Open Innovation Learning

Theory building on
open sourcing while private sourcing

David Ing

Open Innovation Learning:
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Foreword

Open Innovation is a topic of scientific interest and economic significance to academic researchers, business practitioners and government policy makers. In 2003, Henry Chesbrough described stories from IBM, Intel and Lucent as innovation case studies of managing innovation processes in technology (Chesbrough, 2003). The changes to progress open innovation were furthered in 2007, beyond innovation processes to focus on business models, with Air Products, IBM and Procter & Gamble as extended cases (Chesbrough, 2007), This research opened up managerial thinkers to the insight that external ideas and technologies can be brought into a company, and that internal knowledge might flow out for alternative uses in other organizations.

Open Innovation Learning is a new framework that aims to build on case studies, but not get stuck in the past. Studying the histories of organizations that have been successful in innovating gives grounding on managerial actions that have worked (or not worked). With rapid changes in technologies and societies, however, looking backwards is not sufficient. Organizations and individuals mutually engage in learning. The learning is not only about the external contexts, but in the relationships between products, services and people within the organization.

In this book, David Ing deepens the history of case studies of innovating over a decade at IBM. Across parallel timelines, three descriptive theories of open innovation learning are developed. Additionally, normative theory is proposed for managers seeing the world of 2020 just over the horizon. In this brief foreword, I will try to cover a bit of the past, present, and future evoked by reading this complex, but important book.

First, a bit about the past. Before there was open innovation, there was Intellectual Property (IP) to be created privately by a sponsoring company, legally protected against infringement, and monetized as a reward for prior investments. The early 20th century largely saw the surge of technological and economic change associated with oil, automobiles and mass production. The 1970s saw the beginnings of a surge with the rise of the computer and the Internet (Perez, 2002). As we enter what is arguably just the

third century of technology-driven innovation firms (e.g. in industries of transportation, chemicals, communications, and information), organizations are evolving their organizational IP strategies. The low barriers to entry and capacity for rapid change in software innovation feed a new fitness function reshaping businesses for competing in a multi-vendor, multi-platform world. Over the past 10 years, there has been incredible growth in the open source community. One report counts 24 million developers working across 67 million repositories (GitHub Inc., 2017). In this book, researchers may gain insight into the phenomenon, with a source of concrete data (as in-depth case studies) in addition to emerging theories (both descriptive and normative) to be further developed.

The case studies in the book are drawn from the author's experiences as an enterprise systems architect at IBM. At the dawn of e-business around 1997, IBM discovered that software products built in-house were not keeping pace with competitors. The IBM investments with the Apache web server in 1998 and the Linux operating system in 2000 proved that supporting carefully selected open standards could disrupt marketplace contests with vendors pushing proprietary offerings. Since those days, IBM has learned there are even more advantages to this strategy. This book traces that story.

Before 2000, from an IP perspective, two types of organizations dominated: (i) *PSo* (Private Sourcing only) businesses, primarily for-profit enterprises seeking to maximize value capture; and (ii) *OSo* (Open Sourcing only) not-for-profit organizations, primarily ecosystems seeking to maximize adoption and growth. Over the next decade, a third way emerged as a hybrid, described as *OSwPS* (Open Sourcing while Private Sourcing). This phenomenon is recounted in great detail in this book, using seven case studies that highlight IBM as a lead originator of *OSwPS* from 2001 to 2011.

During that decade, David Ing had a front row seat to observe, study, and participate in these changes at IBM and in the industry. During this same period, David and I worked together on IBM's *SSME* (Service Science Management and Engineering) initiative, an emerging academic discipline studying service systems as a type of complex socio-technical system. Service systems are noteworthy, in part, due to their wide range of value co-creation mechanisms, as well as their potential for entities to co-elevate their capabilities for collaborating and competing in a rapidly evolving ecology of other service system entities. Service-Dominant logic (S-D logic) refers to these entities as resource integrators, engaging in service for service exchange, and giving rise to markets, the focus of the study of marketing and economics (Vargo and Lusch, 2017).

From a service science and S-D logic perspective, *PSo*, *OSo*, and *OSwPS* organizations can be viewed as three types of service system entities or resource integrators.

The first major contribution of this book is its presentations of three descriptive theories of *OSwPS* organizations. The three descriptive theories are: (i) quality-generating sequencing from an architectural problem-seeking paradigm, (ii) affordance wayfaring from an inhabiting disclosive spaces paradigm, and (ii) anticipatory appreciating from a governing sub-worlds paradigm. Grounding these descriptive theories is the business imperative to create high-quality artifacts (i.e. code) by engaging highly skilled talent (people) across multiple organizations and communities (i.e. ecosystem), and maintaining highly ethical conduct while competing for customers, employees, partners and stakeholders (i.e. incentives for collaborators).

The second major contribution of this book is its presentation of seven case studies drawn from IBM's history as the company transformed more fully into *OSwPS* from *PSo*. The case studies are: (i) integrating development, (ii) microblogging, (iii) blogging, (iv) wikiing, (v) podcasting, (vi) mashing-up, and (vii) co-authoring. Again, grounding these case studies in business imperatives shows a path whereby people (i.e. highly skilled talent) create code while organizations ethically compete for collaborators across a dynamic, innovative ecosystem. After absorbing these case studies and descriptive theories, one is left wondering how will the range of potential case studies continue to evolve in the future?

However, before looking into the future of open innovation learning, next, a bit about the present. Readers interested in IBM's continuing investment in technology communities and projects, as described by IBM itself, can browse "IBM's approach to open technology". Successful collaboration for state-of-the-art open source amongst highly competitive businesses relies on working open governance:

> One thing IBM has learned through all of this is that those communities that strive for inclusiveness and open governance tend to attract the largest ecosystems and most expansive markets. However, not all open source is created equal, and not all communities thrive. There is a broad range of open source, and much of it is not truly open... The reality is that open technology projects managed under open governance — true open governance as we have with organizations such as Apache, Eclipse, OpenStack, Mozilla, and Linux — are demonstrably more successful (by an order of magnitude), have a longer life, and are less risky than those projects that are controlled by a single vendor, or are more restrictive in their governance (T. Moore and Ferris, 2016).

Now we are ready, finally, for a bit about the future. As I write this foreword, I am leading IBM's Cognitive Opentech Group (COG). Cognitive Opentech can be seen as open innovation learning in action. The rise of AI (Artificial Intelligence) and IA (Intelligence Augmentation) will hopefully

lead to not just smarter, but wiser service systems (Spohrer, Bassano, et al., 2017). The legal IP frameworks are now well-established for licensing. However, some companies have been slower to adopt standard practices than others.

AI is acting as a forcing function for companies to work together like never before, to realize the benefits and mitigate the risks of AI. Since 2015, OpenAI was founded as a non-profit research company promoting paths to safe artificial general intelligence, and Partnership on AI was formed as an industry consortium to establish best practices that will benefit people and society.

From the Kubernetes system for containerized applications to the TensorFlow library for dataflow programming, there is a growing realization of the benefits of open source. SystemML is a scalable machine learning system originating from IBM Research that was pledged into the Apache Foundation, now a top-level project with open governance. MxNet is a scalable deep learning framework backed by Microsoft and Amazon that is also on the pathway towards open governance. The ONNX Open Neural Network Exchange sees Microsoft and Facebook collaborating with other industry partners. The Acumos Project, a directory for finding and sharing apps and microservices, has AT&T and Tech Mahindra partnering with the Linux Foundation to create an open marketplace for AI models.

This thriving activity is still just early days for commercial AI. The growth of open AI Leaderboards to measure AI progress shows that open innovation learning is at play with open competition platforms such as Kaggle (acquired by Google in 2017). The opportunities for open source in platform thinking and a world ruled by algorithms are further explored in *WTF? What's the future and why it is up to us* (O'Reilly, 2017).

In sum, this book provides researchers who study open source phenomena a feast of data and theories based on the past, while pointing the way into the future with the concept of open innovation learning. It remains for other scholars to add additional data and case studies from a wider range of organizations, as well as refinements or replacement of the theories presented herein. Nevertheless, this book provides contribution to the field and grows our collective knowledge of open source phenomena, as well as providing a solid foundation for future studies of open innovation learning. From a service science (SSME) perspective, this book illustrates the evolving ecology of service system entities, including their value co-creation mechanisms and capability co-elevation mechanisms around the shared technology resource of open source code and shared talent resource of multi-role skilled people.

Jim Spohrer
San Jose, California, USA
November 2017

Preface

What learning emerges on an organizational journey of open innovation? For those who view learning as an art, there are skills that can be developed whereby the crafts of innovating are elevated with creativity. For those who view learning as a science, accumulating a rich body of data is the first step towards building theories.

Organizational learning can be a long cumulative process, punctuated by periods of rapid change. In a layered theory of change, Stewart Brand writes: "Fast gets all our attention; slow has all the power" (Brand, 1999, p. 34). Positive results from embracing open innovation can certainly draw attention. A capability to sustain open innovation can have longer lasting power.

How should a reader navigate the scholarly exposition in this book? A fast read skimming across the chapters may be most fruitful in surfacing ideas most relevant to personal interests.

A manager with a bias towards action may read the introduction in Chapter 1, and then delve most deeply into the normative theories in Chapter 9. This path serves practitioners who are less interested in history, and more focused on putting theories into practice.

A consultant may jump from the outlines in Chapter 1 to the descriptive theories in Chapters 6, 7, and 8. Establishing a program of measuring progress on organizational learning that sustains open innovation can be based on tracking a variety of indicators over time.

A business historian may be most interested in the cases summarized in Chapter 4, and the contexts described in Chapter 5. These lead into extended histories in Appendices A and B. The shifts associated with the rise of the Internet, e-business and globalization from 2001 to 2011 can be observed from the perspective of individuals who were instrumental in the changes.

A policy advisor may be most drawn to the details of open source licensing grounding the behaviours of open sourcing while private sourcing in Chapter 2. Participating and sharing in a commons can accelerate innovation, but running afoul of intellectual property constraints will bog down

subsequent progress.

A social theorist or business philosopher may appreciate the richness in the extended footnotes embedded in each chapter. Embracing multiple scientific paradigms within a single book calls for deeper explanations of concepts and terms used, and a long list of references for follow through.

For those who are visual learners, the figures and the tables in the book may serve to reduce the cognitive load of reading. When I am in a stand up presentation of content, those are most likely that images that would appear on the projection screen behind me.

This book is being released in both electronic and paper-based forms, simultaneously. For a reference work, the search function and rapid navigation through an ebook is an affordance that sequential physicality does not support.

Open innovation learning is nonlinear. The writing in this book is sympathetic to that orientation.

David Ing
Toronto, Ontario, Canada
November 2017

Acknowledgements

The case studies and context in the book cover a decade from 2001 to 2011. This writing was done much as a shadow, 5 years after the histories had settled into stories that could be related to others.

In that decade, I was an employee of IBM Canada, with formal assignments extending to customer teams residing in the United States. Further, I was an active participant in mutual learning with colleagues globally, collaborating on projects and in communities via online forms, email and real time chat. I am sometimes asked whether this writing includes any confidential data. I assert that there is nothing in this book that 400,000 other IBM employees couldn't also know. Many of their names are now inscribed on these pages, in their contributions towards learning and innovating.

In my assignment to the IBM Advanced Business Institute, Al Barnes provided a home for continuing research after a First-of-a-Kind project was wound down. Stephan Haeckel set me on the course of appreciating systems thinking, as he was completing the *Adaptive Enterprise* book. The teach team of Marianne Kosits, Bob Keiser and Pat Brown showed me the art of guiding customer executives to be slightly uncomfortable with revolutionary ideas in managing business with new technologies, while remaining engaged and enthusiastic for the education they provided. Ian Simmonds at IBM Research Yorktown saw the art in the science in our collaborative inquiries, as experimental tools influenced new ways of working. Taking the *Adaptive Enterprise* framework into practice was a highlight in a client consulting engagement with Michael Karchov, Mike Wittenstein and Brad Long.

Returning back to IBM Global Business Services in Canada, Greg Lowes was a nurturing manager who enculturated practice leaders with the way-out work that I was trying to do. Longtime friend Joe Arteaga again became a colleague and mentor in navigating the practicalities of a consulting business in Canada. The business architecture community leads of Doug McDavid, Martin Gladwell and Dav Bisessar encouraged the formation of the blog at coevolving.com where my writing has continued, a

decade later. During this time, Jim Spohrer welcomed me into the service sciences community, and now the new field of cognitive opentech.

In the assignment to IBM Industry Solutions, Mary Ellen Mulvey and Bill Liebler were creative in transitioning me to a permanent part-time position attempting to balance my day job with the external research. Antonio Fazzalari later buffered me back in the return back to a full-time role. Charlie Matheson and Greg Pizzuti deployed me onto customers in the media and entertainment industry as workflows based on analog media went digital. Alison Olesksiak and Stephen Brickell placed me into collaborative teams with governments looking into smarter cities and the adoption of social media.

In parallel over the decade, my involvement with the systems sciences community offered me a view of larger changes in the world. As a trustee of the International Society for the Systems Sciences, G.A. Swanson extended the longevity of a professional organization founded in the 1950s for subsequent generations to build on prior wisdom. Jennifer Wilby deepened my involvement with the ISSS and the University of Hull. Gary S. Metcalf connected me to the larger international community of systemicists and cyberneticians. David L. Hawk has been a gateway to the dynamics amongst systems thinking luminaries in the 1970s through 1990s, with a sense of humour on the human condition. Continuing collaboration with Minna Takala led me to visit Finland, putting me to work on projects that matter. Kyoichi Jim Kijima and Hiroshi Deguchi led a decade of symposiums on service systems science, affording the richness of in-person knowledge development.

At Aalto University, Eila Järvenpää has been a patient Ph.D. supervisor for a graduate student who has been distracted from completing his studies multiple times. Simo Makkonen was generous in providing initial lodging for an itinerant scholar getting started in Finland. Karlos Artto lent me a deeper appreciation of Finnish culture and customs over many long dinner conversations. Taina Tukiainen showed how a new program at a university of applied sciences could break down barriers between current practice and developing theory. In the earliest days of the Creative Sustainability program, Aija Staffans and Katri-Liisa Pulkkinen molded me into the Finnish style of leading graduate students, as we piloted two new courses on systems thinking. In the later days of the program, Susu Nousala and Tiina Laurila evolved the courses to not only maintain their theoretical richness, but to also be more digestible to learners transforming their mindsets in a matter of months.

Special thanks go to the only person to have endured reading every version of this manuscript: David Hawk. He advised on the writing, as the style progressed from more academic, to more readable, and then more academic again. I have enjoyed multiple visits to Iowa, where time takes a different pace from my normal urban life at home.

In the time that it's taken for this book to culminate, my four sons entered university, graduated, and are in productive careers. Adam, Eric, Noah and Ryan are always enthusiastic and skeptical critics at the dinner table.

Mostly, I dedicate this book to my spouse Diana. In 1984, she met a graduate student dropping out of university in Vancouver, and took a chance to start a new life together in Toronto. In 2017, she's still married to a graduate student who has not yet completed his final degree.

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1. Introduction and outline

Open innovation learning is a set of emerging theories based on cases and contexts of *open sourcing while private sourcing*, from 2001 to 2011.

What is the nature of learning and progressing open innovation over time, for an organization and its members? Open innovation goes beyond just the declaration of an organizational intent. This research work defines the behaviour of open sourcing while private sourcing (*OSwPS*) as new to technologies businesses in 2001, and widespread amongst a wide variety of organizations by 2011. Open sourcing is an open innovation behaviour related to, but distinct from, open source as licensing. Further, open sourcing does not preclude private sourcing.

The research path from data through inductive theory-building and multiparadigm research is drawn in Figure 1.1.

The phenomenon of *OSwPS* can be observed in seven cases involving IBM. These cases occurred in a background macro context of the information technology sector between 2001-2011, in parallel with organizations engaging in conventional Private Sourcing only (*PSo*) businesses, and not-for-profit communities participating in Open Sourcing Only (*OSo*) development. The cases and macro context provided an inductive foundation of theory-building alongside multiparadigm interplay.

Three descriptive theories of *OSwPS* emerged alongside three emerging paradigms: (i) a theory of *quality-generating sequencing* is proposed within the paradigm of architectural problem-solving; (ii) a theory of *affordances wayfaring* is proposed within the paradigm of inhabiting disclosive spaces; and (iii) a theory of *anticipatory appreciating* is proposed within a paradigm of governing subworlds. These three descriptive theories are further extended into multiparadigm research, with concurrent paradigm formation and normative theory building.

The resulting paradigm centers on *co-responsive movement along lines of becoming*, as a derivative of ecological anthropology and material culture studies. The building of three normative theories, associated with three philosophical foundations, is proposed: (i) *innovation learning-for*, towards the intellectual pursuit of episteme; (ii) *innovation learning-by*, towards

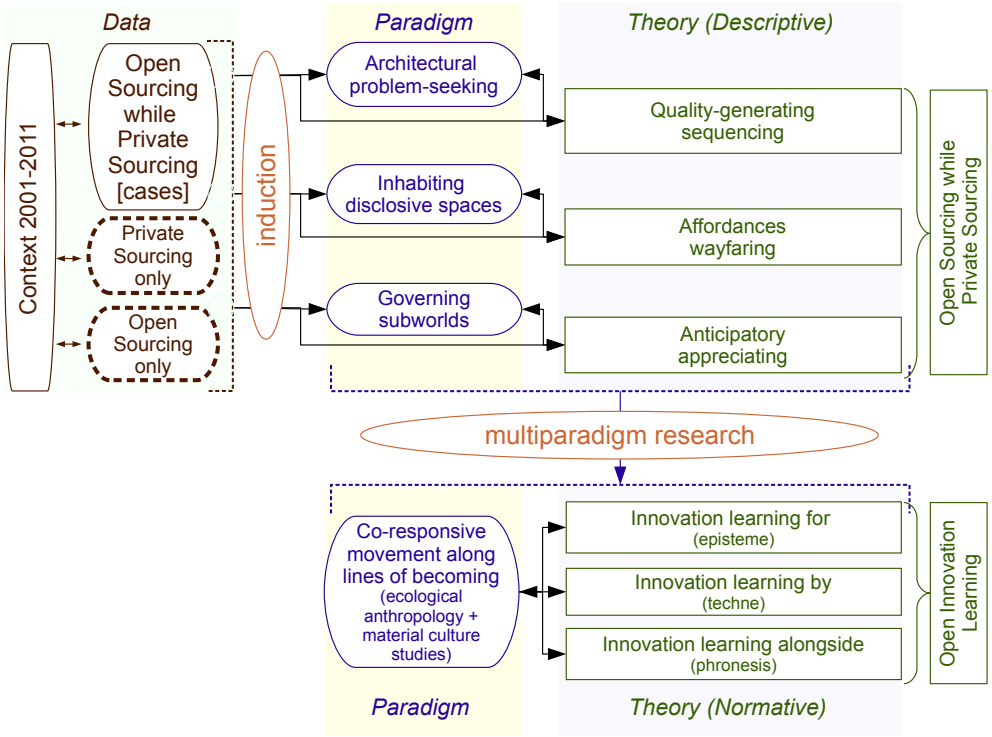


Figure 1.1. Data, paradigms and theories (descriptive, normative)

techne; and (iii) *innovation learning-alongside*, towards phronesis. These three normative theories are the basis of Open Innovation Learning (*OIL*).

1.1 Research contributions towards theory and practice

OIL can be parsed as (open innovation + learning), or as (open + innovation) The former parsing is most compatible with the contemporary research literature.

Open innovation has evolved to become "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for its external use".[1]

Learning is a longitudinal educating of corresponding, through (i) experiencing (attaining like-mindedness in carrying on together), (ii) agencing (acting and undergoing a change in quality of habit) and (iii) tuning attention (i.e. responding to the terrain as it unfolds).[2]

[1] In 2003, open innovation was first described as "a paradigm that assumes firms can and should use external ideas, and internal and external paths to market, as firms look to advance their technology", combining "internal and external ideas into architectures and systems whose requirements are defined by a business model" (Chesbrough, 2003, p. xxiv).

[2] The lifelines of living beings join with each other in a meshwork. In social life, human beings carry alongside one another, answering to each other about variations-in-commoning. "I propose the term *correspondence* to connote their

The research contributions towards theory and practice are shown in Figure 1.2.

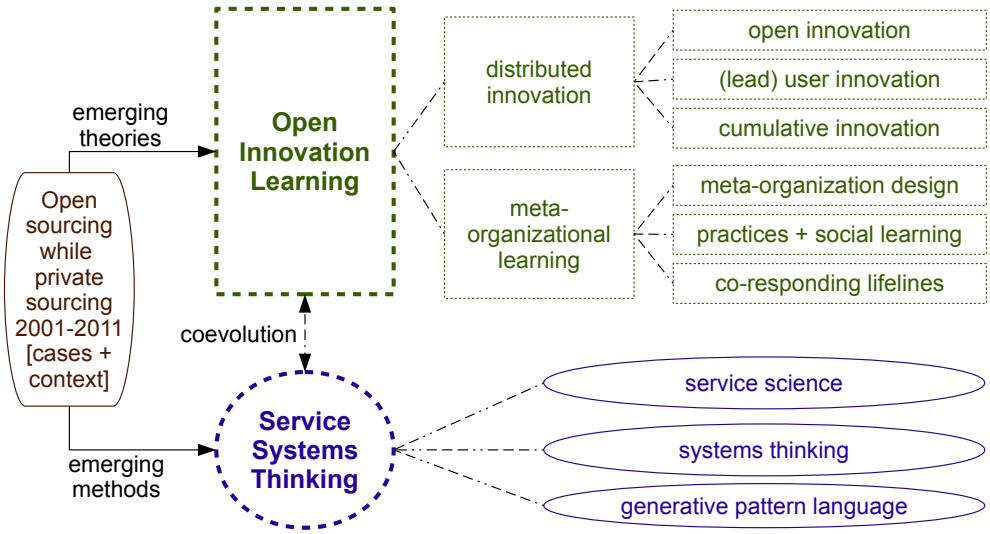


Figure 1.2. Context + cases, emerging theory and emerging methods

The *theoretical contribution* of *OIL* is on emerging theories related to two existing research streams, on (a) distributed innovation, and (b) meta-organizational learning.

Distributed innovation[3] includes (i) *open innovation* (where firms extend from internal creation and commercialization to external sources); (ii) *user innovation* (where users are active participants in creating innovations); and (iii) *cumulative innovation* (where rival firms build upon each other's work).

Meta-organizational learning is proposed as a new label combining aspects of (i) *meta-organization design* (linking networks of firms or individuals not bound by authority based on employment relations, but character-

affiliation. Social life, then, is not the articulation but the correspondence of its constituents" (Ingold, 2017, p. 6). Corresponding occurs as (i) experiencing (habits as movements enacted as undergoing transformations from within); (ii) agencing (midstreaming in between interests going along); and (iii) tuning attention (continual responsiveness to the terrain, the path, and the elements). *Experiencing* conjoins acting and undergoing at the same time, in contrast to *volition* that delivers on intention that the mind places before the acts. *Agencing* is ever forming and transforming from within the action itself, rather than *agency* given in advance of action. *Tuning attention* calls for responsiveness while going along, as compared to *intention* that prepares for movement in advance, and *distraction* where pulls from different directions cause awareness to stall.

[3] A broader view of "distributed innovation" partially resolves a "schism in open innovation definitions". Henry Chesbrough's emphasis on open innovation as a business model, is contrasted with Eric von Hippel's work on "open and distributed innovation" sharing knowledge in a community (Chesbrough, 2016b; Chesbrough, 2016a). The three views of (i) open innovation, (ii) user innovation, and (iii) cumulative innovation, are unified in countering traditions of *vertically integrated innovation* where firms need to control the creation and commercialization of their innovations (J. West and Bogers, 2010).

ized by system level goals);[4] (ii) *practices + social learning* (where practice is an improvisational logic that reflects engagement and sense-making in action, and learning is located in the relationship between a human being in a social world);[5] and (iii) *co-responding lifelines* (with constituents in entangled lines of life, growth and movement, as members carry on alongside one another with counterpoint).[6]

The practical contribution of OIL has concurrently emerged as methods packaged separately as *Service Systems Thinking* (S^2T). S^2T combines aspects of (i) *service science*, (ii) *systems thinking*, and (iii) *generative pattern language*.[7]

---

[4]The more recent definition of meta-organization includes both firms and individuals as agents who are autonomous. The existences of a system level goal doesn't necessarily imply that all agents share it (Gulati, Puranam, and Tushman, 2012, p. 573). This contrasts to earlier definitions where meta-organizations were only organizations-of-organizations assuming the role of associations, different from organizations-of-individuals (Ahrne and Brunsson, 2005, p. 431).

[5]Organizations were originally seen to depend on social learning systems. Social learning was defined "in terms of social *competence* and personal *experience*". Human beings participate in three distinct modes of belonging: *engagement*, *imagination* and *alignment*. Social learning systems were structured by three elements: *communities of practice*, *boundary* processes among these communities, and *identities* shaped by participation (Wenger, 2000). After a decade, "a community of practice can be viewed as a simple social system", and "a complex social system can be viewed as constituted by interrelated communities of practice". Aspiring to build a social discipline of learning would (re-)orienting capabilities towards (i) communities of practice becoming *learning partnerships*; (ii) governance combining *stewardship and emergence*; (iii) transversality to increase the visibility and integration between *vertical and horizontal structures of accountability*; and (iv) participation in *learning citizenship* with the ethics associated with identities travelling through the landscape (Wenger, 2010).

[6]In ecological anthropology, a meshwork of interwoven lines of becoming inverts the conventional image of a network as interacting entities of being. There is a primacy to movement. "Among the Inuit of the Canadian Arctic ..., as soon as a person moves he or she becomes a line. People are known and recognised by the trails they leave behind them .... (Ingold, 2011b, p. 72) "[In] life as in music or painting, in the movement of becoming – the growth of the organism, the unfolding of the melody, the motion of the brush and its trace – points are not joined so much as swept aside and rendered indiscernible by the current as it flows through" (Ingold, 2011a, p. 83). Co-responding departs from the philosophy of Heidegger towards von Uexküll. "Can there be any escape from this shuttling back and forth between enclosure and disclosure, between an ecology of the real and a phenomenology of experience? So long as we suppose that life is fully encompassed in the relations between one thing and another – between the animal and its environment or the being and its world – we are bound to have to begin with a separation, siding either with the environment vis-à-vis its inhabitants or with the being vis-à-vis its world. A more radical alternative, however, would be to reverse Heidegger's priorities: that is, to celebrate the openness inherent in the animal's very captivation by its environment. This is the openness of a life that will not be contained, that overflows any boundaries that might be thrown around it .... [We] can take our cue from von Uexküll, who compares the world of nature to polyphonic music, in which the life of every creature is equivalent to a melody in counterpoint" (Ingold, 2011a, p. 83).

[7]The emerging methods of service systems thinking show up in theory-building dissertation, while being de-emphasized as a separate concern. Presentations and papers track the evolution in the communities of systems engineering (Ing,

1.2 Open sourcing while private sourcing emerged after 2001

Starting from the data, the behaviour of interest is specifically *OSwPS*, which is appreciated in the context of *PSo* and *OSo*. Private sourcing is common amongst commercial businesses. Open sourcing is common amongst not-for-profit organizations and many governments. Contemporaneously conducting open sourcing *while* private sourcing is a way that many years to establish as natural.

The label of *open sourcing* frames ongoing ways that organizations and individuals conduct themselves with others through continually sharing artifacts and practices of mutual benefit. The label of *private sourcing* frames the contrasting and more traditional ways that business organizations and allied partners develop and keep artifacts and practices to themselves. Many customers external to a private sourcing organization are uninterested in internal details about the whys and wherefores about how an offering comes about. Some constituents external to an organization prefer the transparency in open sourcing, both in self interests and mutual interests.

The terms *open sourcing* and *private sourcing*, in this research work, present an opposition that is related to, but independent from, parallel studies in the 2006-2009 period that have subsequently been overlooked. The label *opensourcing* (as a single word) is positioned as an alternative even cheaper than offshore sourcing, reorienting outsourcing research that tends to focus on the customer perspective with supplier's side on development process and projects.[8] The label *open-sourcing* (with a hyphen) has been contrasted with "proprietary source" and "outsourcing", emphasizing business models with a focus on: (i) *product* (with a mechanism of open licenses; and a company motivation to lead with innovative ideas and value-producing innovations); (ii) *community* (with the mechanism of release requirements prioritization with voluntary contributions; and company motivation for resource capture from a larger global resource; and (iii) *process* (with mechanism of managing online-based communication, distributed control and a democratic governance structure; and a

2014c), service engineering (Ing, 2014d), pattern languages of programs (Ing, 2014b), systemic design (Ing, 2014a), pattern languages for social change (Ing, 2015) and urban architecture (Ing, 2016).

[8] *Opensourcing* (as a single word) "is the use of the OSS (Open Source Software) development model as a global sourcing strategy for an organization's software development process" (Ågerfalk and Fitzgerald, 2008, p. 386). Studying the "critical customer and community obligations in a successful opensourcing relationship" isn't suitable based on the theoretical frameworks popular previously used with outsourcing – agency theory, relational exchange theory, and transactional costs theory – so psychological contract theory (PCT) became the basis for understanding the mutual relationships. Interviews on three projects enabled refining the obligations for which (i) the customer, and (ii) the community, must bear responsibility.

company motivation of steering the environment).[9] This distinctive focus of this research work centers an organization and its member individuals (i.e. IBM and IBMers) *learning* the behaviours of *open sourcing*, coming from a commercial context where the behaviours of *private sourcing* have traditionally been dominant.

Open sourcing while private sourcing is an uncommon way of operating. Sequential modes of (i) *OSo*, or (ii) *PSo*, are more common. Simultaneously maintaining credible parallel (i) open sourcing with an active community, while (ii) satisfying customers through private sourcing is complicated. These distinctions are illustrated in the pattern of Table 1.1.

Table 1.1. Behaviours examined

Private Sourcing only (*OSo*)	Open Sourcing only (*PSo*)
Open sourcing while Private Sourcing (*OSwPS*)	

Research based on seven case studies aims to develop an appreciation for this uncommon way of doing business. The cases are drawn from the IBM's engagement in the information technology sector, although the findings are seen as applicable across other industries and segments.

1.3 Open sourcing raises private sourcing as an opposite

The label of *open source* is most readily recognized from software development. An open source license allows free use, modification and sharing. *Open sourcing* is a norm where the resources of system internals, e.g. artifacts and practices, are shared in a community beyond the originators.

Private sourcing is coined as a norm where the resources of system internals are reserved within a privileged group. That reservation typically comes with an expectation of responsibility and authority where an orchestrating organization and its network of aligned partners serves a fee-paying customer base. Continuing revenue streams associated resulting from private sourcing enable ongoing maintenance and enhancements of core offerings for customers.

[9] *Open-sourcing* (with a hyphen) is defined as originating both from (i) the open source movement (in software development), and (ii) the global sourcing strategies and practices of outsourcing. Sourcing is "where something comes from", e.g. outsourcing, insourcing, cosourcing, netsourcing and opensourcing (Shaikh and Cornford, 2008, pp. 7-8). Types of business models described in this research work in section B.5.1 can be categorized emphasizing a demand focus on product, and a supply focus on process. Thirty interviews across case studies at four large global technology companies plus two smaller firms led to the appreciation of open-sourcing mechanism and motivations (Shaikh, 2009). Focusing on two large technology companies, the theme of a strong dialectic between "an atmosphere that allows innovation to thrive" and "need to supervise through different control methods" required substantial efforts by managers (Shaikh and Cornford, 2009, pp. 2-3).

Typically, an organization choose either (i) *OSo*, or (ii) *PSo*. A business enterprise can, however, simultaneously operate with *OSwPS*. Seven case histories from IBM in the period 2001-2011 reveal: (i) activities originally private sourcing becoming disclosed to open sourcing; (ii) activities originally open sourcing becoming enclosed to private sourcing; and (iii) open sourcing and private sourcing conducted contemporaneously and in parallel. The seven cases examined are non-exhaustive, both in the context of this company and the information technology sector. Other examples could additionally be found.

1.3.1 The behaviours coincide with the rising open source movement

A large body of research has already been produced on open source – both in open source licensing, and the operation of open source communities. The participation of for-profit enterprises in open sourcing has been acknowledged, but simultaneous private sourcing has not been examined.

In the decade after 2000, IBM was generally regarded as a successful company. At 2009, it declared "Since the dot-com crash of 2002, we have added $12 billion to IBM's pre-tax profit base, increased our pre-tax margin 2.5 times, quadrupled our earnings per share and more than doubled our free cash flow" (IBM, 2009a, p. 3). In reflecting on the horizon required for the new directions to bear fruit, the company has stated that "A decade ago, we saw change coming. [....] A new computing architecture was taking shape. It was build on pervasive instrumentation and interconnectivity, open standards, unprecedented computing power and advanced analytics" (IBM, 2009a, p. 10). Open standards are part of open sourcing. Most of the profitability and positive cash flow can be attributed to private sourcing of resources in competition with other companies.

Chapter 2 clarifies the behaviours of open sourcing and private sourcing, in the context of the history of the open source movement.

A key question of interest to some parties, "how do I make money by open sourcing?", is **not** a focus in this research study[10]. Entrepreneurs have and will find ways to develop customers and revenue streams to enable viable and profitable businesses. Additionally, the question of "how does private sourcing compete with open sourcing" is largely excluded.

1.3.2 The behaviours have analogies in other domains

Open sourcing and private sourcing are evident in other worlds. There are analogies in the ways that salmon are sourced to consumers. Many diners don't care whether they're eating farmed salmon or wild salmon.

[10] One work that could be informative on the question of financial business models is Chris Anderson, *Free: The Future of a Radical Price*, (C. Anderson, 2009).

Some do. Farmed salmon and wild salmon can be distributed side-by-side in a supermarket. For producers, though, the system for aquafarming is distinct from the system for capturing wild salmon. While there are nothing to preclude a single company from producing both farmed salmon and wild salmon, successes in each business come from different behaviours. These are outlined in Table 1.2.

Table 1.2. Analogies of private sourcing and open sourcing with salmon

Aquafarming as Private Sourcing [cultivating species in pens]	*Capturing Wild Fish* as Open Sourcing [sharing naturally wild fish harvests]
Ocean Ranching as Open Sourcing while Private Sourcing [conforming with aquacultural regulations, and the law of the sea (200 mile exclusive economic zones, and high seas)]	

Aquafarming is analogous to private sourcing. The salmon provider typically operates a freshwater hatchery in which eggs are fertilized and incubated. For the first year, the fry (baby) and parr (juvenile) salmon require diets high in protein and lipids, so the aquafarmer feeds them fishmeal and fish oil. Next, smolts (young salmon) are moved for cultivation into ocean net pens, sea cages, or (less frequently) inland tanks. For about 18 to 24 months, the salmon are fed to a maturity of about 10 pounds. At that size, the aquafarmer seines and harvests the fish.[11] This life cycle is shown in Table 1.3

Table 1.3. Life cycle for salmon in aquafarming (analogous to private sourcing)

Reproduction	*Fry to Parr*	*Smolts to Maturity*	*Harvesting*
Eggs and milt mixed by aquafarmer, incubated to hatching	In fresh water, fry (babies) are fed by aquafarmer, becoming parr (juveniles)	Smolts are moved to salt water net pens, sea cages or inland tanks are fed to maturity	Mature salmon are captured in seine nets and transferred to processing plants

Aquafarmers prefer to breed Atlantic salmon over Pacific salmon. Atlantic salmon are less aggressive, grows faster, and has proven to be less prone to disease. The private sourcing frame applied to aquafarming recognizes each commercial business orchestrating the resources and supplies for the production of seafood.

Capturing wild fish is analogous to open sourcing. Salmon are naturally anadromous: they are born in fresh water, roam freely for most of their lives oceans, and return to their fresh water origins to spawn. At small

[11]The life cycle of a farmed salmon is described by the International Salmon Farmers Association at `http://www.salmonfarming.org/the-cycle-of-salmon/` .

scales on the Pacific coast of Canada and the United States, aboriginal cultures have strong traditions tied with salmon runs. Recreational angling is also an popular seasonal activity today.

Commercial salmon harvesting is regulated by governments (e.g. Alaska, British Columbia, Washington State). Within inshore limits (e.g. 200-mile exclusive economic zones), trolling with small vessels with lines and hooks is permitted. Trolling captures smaller salmon in full vigour, individually handled to command a premium price. On the high seas, purse seining with larger ships are permitted. Nets are set in a circle and drawn closed at the bottom, wrapping hundreds to thousands of fish at a time. On the high seas in international waters, coordination through the United Nations to preclude depletion of the shared resource has been long in coming.[12] This life cycle is shown in Table 1.4.

Table 1.4. Life cycle for salmon in the wild (analogous to open sourcing)

Reproduction	*Fry to Parr*	*Smolts to Maturity*	*Harvesting*
In stream, male salmon stake out gravel bed, female dig a redd, both release gametes, alevin hatch in 3 to 4 months	Fry eat zooplankton in stream, parr eat insects, worms, fish eggs, etc. and then migrate downstream	Smolts adapt gills and kidneys to salt water, and roam in the ocean for 1 to 8 years feeding on small fish, shrimp and squid	Inshore marine trollers capture individuals with lines and hooks; high seas seiners watch for salmon jumping, and capture schools

The open sourcing frame applied to commercial marine fisheries recognizes a variety of parties (including the fish) operating independently and naturally. Nature provides most the resources that enables the fish to breed and live. The human species benefits in harvesting, and should exercise self-control to preclude depleting the fish to extinction.

Ocean ranching is analogous to open sourcing while private sourcing. Like aquafarming, eggs and milt are stripped from from mature salmon, and cultured. Ocean ranchers would release into rivers the fry, and then learned that waiting until the salmon grow to near-smolt size improves their abilities to compete for food. As with wild salmon, the smolts swim downstream, to feed and grow naturally in the ocean. Since salmon ranchers can anticipate the migration patterns of mature salmon, gill netting is a practical way to capture the fish when they return. This life cycle is shown in Table 1.5.

[12] In February 2015, for the first time, representatives agreed that biodiversity loss on the high seas calls for stewarding of international marine habitats (Boyd, 2015). Action has not yet been taken, though.

Table 1.5. Life cycle for ranched salmon (like open sourcing while private sourcing)

Reproduction	*Fry to Parr*	*Smolts to Maturity*	*Harvesting*
Indigenous salmon are caught and stripped of eggs + milt, that are cultured	Fry could be released in rivers, but are usually kept to larger size that competes for food	Smolts swim downstream to ocean remaining for 2 to 5 years, depending on species	Small boats place gill net walls in water, entangling mature fish returning to original rivers

Salmon originating from the hatchery and salmon born in the wild return to the same stream. Estimates that over 90% of returning salmon are now hatchery-born confound statistics on the recovery or decline of wild fish stocks.[13] The frame of open sourcing while private sourcing to ocean ranching recognizes both the private intervention by human beings in the reproduction and early stages of a ranched salmon's life, with the open natural growth in the wilds of the ocean.

Amongst scientists, there has been criticism that fisheries enhancements (which would include salmon ranching) have received only limited research interest. Fisheries science has split into "separate disciplines with divergent concerns and frames of enquiry" including (i) fisheries ecology, focused principally on protecting natural fish populations and communities – analogous to open sourcing; and (ii) aquaculture science, increasing levels of control over the production cycle, and separation from natural systems – analogous to private sourcing. "These paradigms are not only different but they are also diametrically opposed and defined, in part, by rejection of the other" (Lorenzen, 2014, p. 1808). Fisheries scientists have recently been exhorted to follow the lead of practitioners who have driven enhancements through unique opportunities for learning on pragmatic grounds. This is equivalent to the recognition of open sourcing while private sourcing with salmon.

Let's return from this digression to the core domain of interest: business organizations in the information technology sector.

1.4 The method is inductive from case studies into pluralistic paradigm interplay

The data underlying this study is primarily archival, supplemented by interviews and private communications. The open source world benefits

[13] Ranched salmon are genetically identical to those reproduced in the wild, with an advantage of protection to grow larger before release. A study on sulfur isotopes in adult Chinook salmon in one California river has produced some tentative results (R. C. Johnson et al., 2012).

from much of the data about IBM being readily available on the Internet not only in IBM press releases, but also in extensive journalistic reporting of interviews with named company sources. The IBM-internal records sourced for this research were available to every IBM employee in the corporation, as shared openly on the intranet between 2001 and 2011. Interpreting the data has been facilitated by the researcher having a career with IBM from 1985 to 2012. The process orientation of the data is apparent in the observation of events, activities and choices ordered over time.

Processual analysis reveals periods of *OSo*, *PSo*, and *OSwPS*. These play into an inductive appreciation, leading to theory-building. The theories are developed from multiple perspectives, preserved in their pluralistic contexts in a multiparadigm inquiry. The scope of this research has not unified these perspectives, in favour of a paradigm interplay leaving synthesis for subsequent researchers.

Methodological references and reasoning in the study approach are described in Chapter 3.

1.5 Seven case studies over 10 years found micro-level analysis

Case studies are traced in seven contexts, over the period 2001 to 2011. Artifacts and practices are reviewed for:

1. integrating-development;
2. microblogging;
3. blogging;
4. wikiing;
5. podcasting;
6. mashing-up; and
7. coauthoring.

Some of these initiatives were born and developed internally, and never released externally, while others have been developed into offerings. While many researchers tend to limit their focus on the most tangible aspects of the initiatives (e.g. the software code assets produced), this scope of this research study extends to products, services, infrastructure and interpersonal relationships surrounding open source with private source.

The case studies are outlined in Chapter 4, with more extensive histories in Appendix A.

1.6 The cases are placed in background contexts

The cases of open sourcing while private sourcing are micro phenomena situated in broader background contexts of business and technology change.

The time period between 2001 to 2011 started in turbulence with the dot-com bubble, with IBM maintaining steady growth in revenue and profits over the decade. The e-Business revolution initiating commercial use of the Internet in 1997 coincided with the trend towards globalization of markets and economies. The background contexts included:

1. IBM's senior managers, from 2001, advancing strategic bets on future drivers of industry, business, computing and marketplace;
2. IBM employees, since 1996, engaging online with w3 intranet platforms for global knowledge exchanges and social sharing;
3. IBM consultants, from 2004, probing to confirm business priorities through industry-based executive studies; and
4. IBM researchers, from 2004, exploring social changes influencing new organizational and technological opportunities on longer horizon.
5. A world reorienting, from 2001, from regional institutions to open and global network.

The background context fills in some of the activities concurrent with the seven cases studied. The case-by-case behaviours of open sourcing while private sourcing are neither necessary nor sufficient to explain the company's success.

These background contexts are outlined in Chapter 5, with more extensive histories in Appendix B.

1.7 Descriptive theory-building within three paradigms

The combination of seven case studies and five background contexts provide the foundation for inquiry towards building three theories that emerged inductively: (i) quality-generating sequencing; (ii) affordances wayfaring and (iii) anticipatory appreciating. These three theories have been developed alongside three paradigms that also emerged inductively: (i) architectural problem-seeking; (ii) inhabiting disclosive spaces; and (iii) governing subworlds. The methodological relationship between multiple theories and multiple paradigms is described more fully in section 3.4.

1.7.1 Architectural problem-seeking → quality-generating sequencing

The first of three paradigms is based on *architectural problem-seeking,* shaping the structure of the environment and articulating the relations between parts and wholes. Architectural programming, from 1969, has been seen as a problem-seeking inquiry, distinct from design as a problem-solving synthesis of facts. The paradigm, emerging theory and entailments are depicted in Table 1.6.

In this paradigm, *quality* is seen an objective property in both artefactual

Table 1.6. Architectural problem-seeking → Quality-generating sequencing

Paradigm		*Emerging descriptive theory*		*Entailments*
Architectural problem-seeking	→	Quality-generating sequencing	←	• Program envisioning • Program realizing • Program elaborating

and natural things. A program can be ordered so that *generating* positive elaborations unfolds over time (or, alternatively, degenerating negative elaborations result). With structure seen as an arrangement in space, and process seen as an arrangement in time, *sequencing* matters, placing all of the parts in a way that wholeness unfolds.

Program envisioning entails (i.e. could lead to) quality-generating sequencing. *Elevating common standards* is a generative pattern significant for *OSwPS*. Industry leading organizations can work together towards open specifications that may satisfied by a variety of private sourcing implementation.

Program realizing entails quality-generating sequencing. *Doing well by doing good* is a generative pattern significant for *OSwPS*. Outcomes of social acceptance and/or financial success can come from establishing independent foundations that serve commercial and non-commercial interests in a benevolent manner.

Program elaborating entails quality-generating sequencing. *Cultivating perennial platforms* is a generative pattern significant for *OSwPS*. Desirable quality improvements can be generated in a program through internal properties (as autopoiesis) or through external influences (as allopoiesis).

These lead to a hypothesis towards descriptive theory: *Open sourcing while private sourcing* enables quality-generating sequencing through program envisioning, program realizing and program elaborating. This is possible in ways that that neither *open sourcing only* nor *private source only* allow.

The reasoning through paradigm, emerging theory and entailments is described in detail in Chapter 6.

1.7.2 Inhabiting disclosive spaces → affordances wayfaring

The second of three paradigms is based on *inhabiting disclosive spaces*, living in an environment where change is a constant, influenced by external forces and by human beings. Inhabiting a world involves dwelling both in space (e.g. a building) and in time (e.g. a taskscape). A disclosive space is an organized set of practices for dealing with oneself, other people, and things that produce a web of meanings. The paradigm, emerging theory and entailments are depicted in Table 1.7.

In this paradigm, *affordances* are a complementarity of an animal and

Table 1.7. Inhabiting disclosive spaces → Affordances wayfaring

Paradigm		*Emerging descriptive theory*		*Entailments*
Inhabiting disclosive spaces	→	Affordances wayfaring	←	• Enskilling • Equipping • Legitimating

its environment, in which the environment offers, provides or furnishes an invariant meaning or value to the animal. *Wayfinding* is an embodied experience of living not inside places, but through, around, to and from them, from and to places elsewhere.

Enskilling entails affordances wayfaring. *Accessing the smartest people elsewhere* is a generative pattern significant for *OSwPS*. When pioneers explore practices and technologies that are new-to-the-world, establishing features that later are recognized as common sense can come from engaging beyond organizational boundaries.

Equipping entails affordances wayfaring. *Practicising until they can't get it wrong* is a generative pattern significant for *OSwPS*. Bringing commercial resources and formal plans can professionalize a project through would otherwise evolve casually without deadlines or clear purpose.

Legitimating entails affordances wayfaring. *Being on the right side of history* is a generative pattern significant for *OSwPS*. After an episode where a variety of innovators compete and one party emerges with a dominant standard, history gets rewritten by the eventual winner.

These lead to a hypothesis towards descriptive theory: *Open sourcing while private sourcing* enables affordances wayfaring through enskilling, equipping and legitimating. This is possible in ways that that neither *open sourcing only* nor *private source only* allows.

Further reasoning through paradigm, emerging theory and entailments is described in detail in Chapter 7.

1.7.3 Governing subworlds → anticipatory appreciating

The third of three paradigms is based on *governing subworlds*, establishing order amongst organizations and individuals, both through rules of law and expected norms of behaviour in everyday social practices. Governing is an activity where the general manner or specific action through which a social body is guided, steered or regulated. Subworlds are local elaborations of a commonsense world that we share, parts of organized bodies of objects, purposed, skills and practices on the basis of which human activities have meaning or make sense. The paradigm, emerging theory and entailments are depicted in Table 1.8.

In this paradigm, *anticipatory* behaviour in living organisms is exhibited as changes undergoing in the system in the present, caused by events

Table 1.8. Governing subworlds → Anticipatory appreciating

Paradigm		*Emerging descriptive theory*		*Entailments*
Governing subworlds	→	Anticipatory appreciating	←	• Judging material reality • Judging formal value • Judging efficient instrumentality

that have not yet happened, but are entailed to happen in the future. *Appreciating* behaviours in human systems follow a regulative model of norm-seeking, in contrast to a rational model of goal-seeking.

Judging material reality entails anticipatory appreciating. *Finding room for the commercial beyond non-profit institutions* is a generative pattern significant for *OSwPS*. An independent foundation initially backed by a commercial organization becomes becomes relevant beyond academic and voluntary communities only when other industry players take active roles and contribute.

Judging formal value entails anticipatory appreciating. *Growing a bigger pie as better than slicing a smaller pie* is a significant generative pattern for *OSwPS*. Investing to grow a market or establishing a common standard has the promise that society at large can benefit, while the value captured by the driving sponsors is better than taking a reductive position.

Judging efficient instrumentality entails anticipatory appreciating. *Stratifying concierge levels above mainstream excellence* is a generative pattern significant for *OSwPS*. The quality of open sourcing works can be high when "given enough eyeballs, all bugs are shallow", so an offering owner of a commercial variant has to provide features that attract paying customers, who would otherwise choose the non-chargeable alternative.

These lead to a hypothesis towards descriptive theory: *Open sourcing while private sourcing* enables anticipatory appreciating through judging material reality, judging formal value, and judging efficient instrumentality. This is possible in ways that neither *open sourcing only* and *private sourcing only* allows.

Additional reasoning through paradigm, emerging theory and entailments is described in detail in Chapter 8.

1.8 Normative theory building with co-responsive movement

The three paradigms underlying descriptive theory building associated with *OSwPS* are not necessarily exhaustive. With multiparadigm interplay, however, compatibility and conflicts in understanding *OIL* have led to proposing a paradigm of co-responsive movement. With *OSwPS*, *PSo* and *OSo* all concurrently at play, the premise of a relatively static field doesn't

reflect reality. Further, normative interests in innovation and learning should be placed in the current day (of 2017), rather than the historical period of 2001-2011.

For a horizon of 2017-2020, normative theory-building on OIL may be appreciated in (at least) three newly rising situations: (i) polycentric governance, (ii) the Internet of Things, and (iii) cognitive computing. The validity of the theories is likely to be evaluated at a later date on pragmatic grounds, rather than theoretical grounds.

A paradigm of *co-responsive movement along lines of becoming* is proposed, derived from contemporary turns in philosophy associated with (i) ecological anthropology, (concurrent with sociology and psychology); and (ii) material culture studies. Normative theories are then proposed for (i) open innovation learning-for; (ii) open innovation learning-by; and (iii) open innovation learning-alongside.

1.8.1 Open innovation learning-for categorizes enkilling attentionality

Open innovation learning-for comes in three categories for enskilling attentionality: (i) proto-learning, for selecting an alternative in context; (ii) deutero-learning, for changing the set or sequence of alternatives in contextual change; and (iii) trito-learning, for changing systems of alternatives in meta-contextual change.

1.8.2 Open innovation learning-by layers weaving flows in form-giving

Open innovation learning-by weaves flows in form-giving as (i) learning-by-doing, accumulating experience in both organizational and personal senses; (ii) learning-by-making, with artifactual construction and human projects that give an artifact its meaning; and (iii) learning-by-trying, in co-configuration or projects and services in an episodic manner within windows of opportunity.

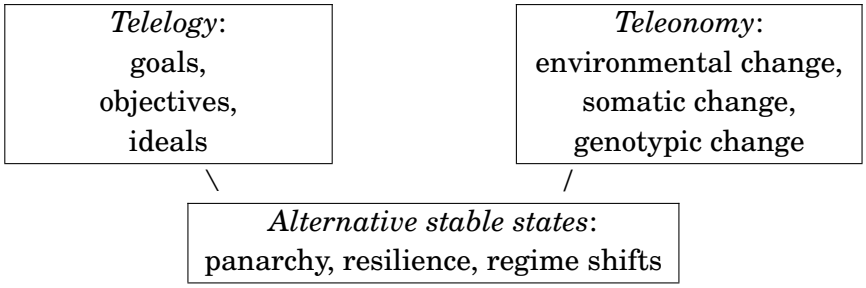
1.8.3 Open innovation learning-alongside respects agencing strands

Open innovation learning-alongside is agencing strands in dialectical distinctions between (i) polyrhythmia entangling eurhythmia, aligning multiple organic repetitions in time; (ii) regenerating entangling preserving, in life cycles of nature, and order in social institutions; and (iii) less-leading-to-more entangling more-leading-to-more, as elaborating organization with a deeper hierarchy, or elaborating structure with a broader structure.

1.8.4 Alternative stable states, teleonomy and teleology

At a philosophical level, the building of normative theories point towards an opportunity for *teleonomy* to learn from *teleology*. A larger context in which to consider these philosophies is in the science of *alternative stable states*, from ecology, shown in Table 1.9.

Table 1.9. Teleonomy learns from teleology



Teleology explains natural phenomena by their end or purpose, which is presumed to be known before action. *Teleonomy* sees goal-directed processes in organisms as owing to the operation of a program (e.g. the genetic sequences of DNA gradually unfold). The panarchy and resilience science literature emphasizes not a single equilibrium, but alternative stable states. While *PSo* and *OSo* may naturally have their own stable states, OSwPS introduces additional possibilities.

Open sourcing while private sourcing was a new way of organizing in 2001. Today, in 2017, *OSwPS* is a reality that some take as commonplace, while others still find it a mystery.

1.9 Study limitations, future research and practical implications

Following inductive methods, this research work is limited by the scope of data collected. The detail centers on IBM as an organizational whole and its individual members, sweeping in associated open sourcing communities and the industry. The activity of theory-building has induced preliminary statements of correlation that could be refined and tested deductively. The emerging philosophical foundations provided alongside the emerging theories are not exhaustive, so the data could be approach from additional directions.

Future research is expected on further development of generative pattern language, in the format proposed for Service Systems Thinking. This is expected to lead outside the scope of *OIL*, and probably will not involve *OSwPS*. Interest has already been expressed in conferences and lectures not only by the pattern language community, but also by the systemic design community.

The practical implications of this research into *OIL* and *OSwPS* are to

highlight alternative ways of conducting business that were unknown in 2001, and still relatively uncommon by 2011. Open innovation, if repeated as an organizational practice more than once, can take years to become natural. The preliminary normative theories in this research work may be validated by the few organizations who choose to stand apart from others in their flock.

2. Behaviours: open sourcing, private sourcing

The label of *open sourcing* is a behaviourally-oriented derivation of the term *open source*. While the word *open* suggests an opposite to *closed*, the label of *private source* is a precise opposite to open source, with early usage in computer science. *Private sourcing* as used here is a derivation of private source.

While private sourcing and open sourcing are new labels, they reflect an overarching choice made in commercial and non-commercial social relations. Private sourcing reserves ideas as trade secrets,[14] typically on a premise that competitive advantage is most important in maintaining economic viability. Open sourcing discloses artifacts and practices, on a premise that gains from participating in industry standards and/or expanding market adoption benefits innovators.

Private sourcing protects trade secrets through non-disclosure or non-compete contracts. The exclusivity in the contracts warrant that confidential information will not be misappropriated, e.g. taken to a competitor for replication. Maintaining a trade secret over a long period is hard. Even without an insider breaching a fiduciary agreement, a mystery may be solved by a diligent outsider conducting reverse-engineering. Analysis of "11 secrets herbs and spices" for the original Kentucky Fried Chicken concludes the recipe only include four spices and no herbs (Poundstone, 1983, p. 20).[15]

[14]Definitions of trade secrecy can be devolved to other scholars. Josh Lerner provides a helpful summary. "The definition of trade secrecy with the widest acceptance is that in the American Law Institute's Restatement of Torts [1939]: 'A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. .... A substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring the information.' Trade secrecy is quite different from other forms of intellectual property protection."

[15]Todd Wilbur, author of Top Secret Recipes, believes that consumer preference for juicy and moist chicken can largely be attributed to the ten-minute pressure cooking process. Trade secrets, as compared to other legal alternatives, have an advantage that they are not subject to expiration.

Filing a *patent* gives up private sourcing in favour of intellectual property protection for defined period of time. The inventor publicly discloses the design for an invention with claims of novelty, usefulness and non-obviousness. If a patent is granted, the inventor may either transfer rights exclusively or grant rights non-exclusively to another party in a license. Infringements on patents lead to lawsuits in court. Patents have a history back to glass-making in Venice in the 1400s, and to industrial revolution machines in the late 1700s in England, France and the United States. Since patents are enforced under national jurisdictions, the World Trade Organization has encouraged harmonization of the term of patents to 20 years of protection.

Copyright recognizes that codified information gets value when it is disclosed. Written works – including books, articles, and software code, has properties different from material goods.

> ... information as a commodity differs from the typical good in that it (1) is not easily divisible or appropriable, (2) is not inherently scarce (though it is often perishable), and (3) may not exhibit increasing returns to use, but often in fact increases in value the more it is used .... Furthermore, unlike other commodities, where are nonrenewable and (with few exceptions) depletable, information is (4) essentially self-regenerative or "feeds on itself" ... so that the identity of a new piece of knowledge immediately creates both the demand and conditions for production of subsequent pieces (Glazer, 1991, p. 3).

The motive behind copyright was originally to enable authors and artists to protect their works immediately, and license republication privileges. Copyright does not protect the original idea or information, but instead the form or manner in which they are reproduced. The rise of the printing press led to regulations in the early 1700s in England, and incorporation directly into the United States Constitution in 1787. Subsequent treaty conventions and trade agreements have led to protection either for a fixed term (e.g. for 50 years from the first showing of a work of photography or cinematography) or beyond the author's death (e.g. 50 years later). Fair use is a doctrine that permits limited use of copyrighted materials without first acquiring permission of the rights holder.

Open sourcing counters the history associated with the idea of trade secrets, private ownership, and exclusive relationships. Mutual sharing based on collaboration presents opportunities for advancements both for society and for businesses. The industrial age pattern of secrecy is strong in western civilization, even permeating education. Collaboration is generally regarded by teachers with suspicion.[16] In the rise of social media,

[16]School work is often graded for each individual, even if the learning comes from collaboration:
... students do not as a rule learn collaboratively in our classrooms. We do

educators have been challenged by questions as to whether homework should or should not be shared.

In the 21st century, private sourcing and open sourcing need not be mutually exclusive. The challenge of private sourcing *while* open sourcing is less in economic or financial reasons, but more in the legitimation and adoption of associated social practices. Businesses and institutions originating from the industrial era are likely to exhibit inertia in their desires to maintain ways that have previously proven successful for them. As they become less relevant and/or viable, their motivation to embrace private sourcing with open sourcing should rise.

This chapter builds an appreciation for the focus on open sourcing while private sourcing in three parts:

1. Legalities: software licensing and the rise of open source
2. Behaviours: norms with open sourcing or private sourcing
3. Precursors: open sourcing and private sourcing prior to 2001

The open source movement was initiated centered on free access and use software artifacts through licensing. As the open source community developed, behaviours gradually became adopted as norms in ways of collaborating. Further success led to the participation of business corporations in open sourcing, complemented with parallel private sourcing activities.

2.1 Legalities: software licensing and the rise of open source

Copyrighting dates back to industrial revolution. The most recent licensing options have been associated with digital content evolving from the 1980s (i.e. GNU from 1984) to the beginning of the 21st century (i.e. Creative Commons CC0 first announced in 2007). This timeframe places the case studies in the period 2001 to 2011 in the middle of evolving legal options. In hindsight, the legal context can be described in a series of subsections:

- Source language and target language
- Copyright, licensing and derivative works
- Private source licensing
- Free/libre reciprocal licensing

not ordinarily recognize collaboration as a valid kind of learning. Traditionally, indeed, collaboration is considered irresponsible; in the extreme, collaboration is the worst possible academic sin, plagiarism. We ordinarily expect a student to talk mainly to the teacher, write to the teacher, and, surely, determine his fate in relation to the teacher, individually. [....] We turn our back on collaboration which does occur in learning, or we penalize it, or we simply refuse to see it. [....] As Durkheim puts it, collaboration is unquestionably "a very rich activity ... periods of creation or renewal occur when men for various reasons are led into a closer relationship with each other, when ... relationship are better maintained and the exchange of ideas most active" (Bruffee, 1973, p. 636).

- Open source permissive licensing
- Open source permissive licensing to free/libre reciprocal projects
- Open source permissive licensing to private source projects

The letter of copyright laws represent the constraints for enforcement rather than exemplary behaviour. The cases demonstrate that parties can espouse offering open source licensing options while not practising the spirit of mutual sharing. As with everyday life, human interactions may be guided by legal contexts, but relatively few conflicts end up in judicial proceedings.

2.1.1 Source language is for humans; target language is for machines

Source language – colloquially called source code – is a set of instructions written in human-readable form. A programming language executes on a computer in one of two ways: (i) using an interpreter, or (ii) using a compiler.

Real-time interpreting of source language was originally the less popular way of using a computer when processing power was expensive. Interactive computing – where a human being types in a command and the computer responds conversationally – first became common at the advent of time-sharing on mainframes, and then common in the paradigm of personal computing. Source language is interpreted in real time and every invocation, as illustrated in Figure 2.1.

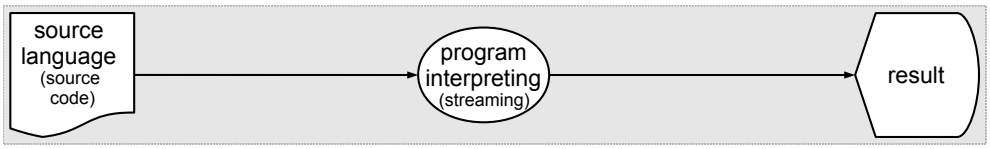


Figure 2.1. Interpreting source language

Interpreting source language in real time and at every invocation requires more computing resources. However, if the instructions are to be executed only once (or a very few times), having human-readable source language reduces the programming effort. Over time, the minimal set of machine commands recognized has become complemented by scripting languages (e.g. REXX, PHP, Javascript). Scripts are human-readable, and can be stored. The rise of virtual machines for programming languages (e.g. the Java Virtual Machine interpreting the Java programming language) came about the same time as the rise of the Internet.

Using a compiler involves two steps: (i) build-time preprocessing where the source language is converted to target language for a specific machine or operating system; and (ii) run-time processing where the target language can be executed again and again, illustrated in Figure 2.2.

The target language artifact (also known as object code) is typically a

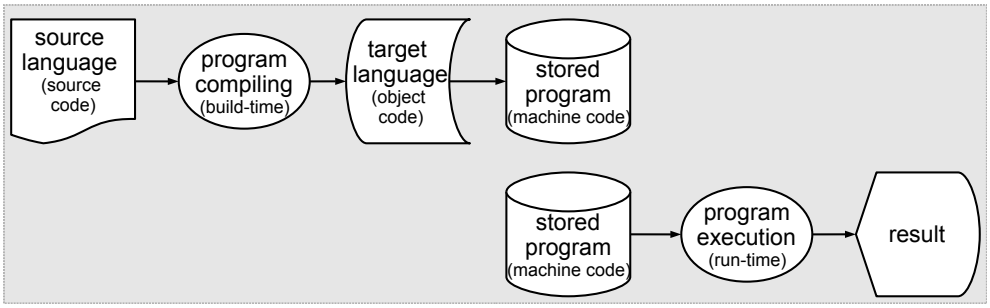


Figure 2.2. Compiling source language into target language

computer program that can be stored and/or redistributed. Distributing object code has the benefits that (i) program execution is more efficient, and (ii) the recipient of the program can immediately put it to use. Object code is rarely modified directly, as few people learn machine-level programming, and logic that is clearly readable in higher-level languages becomes obscured in binary code. When computer power is a precious resource (e.g. transactional volumes are high, or processing bandwidth is low) – centralized compilation to object code is preferred.

The release of source language, as human-readable instructions, enables recipients to directly access and read content as written by the original author(s). In digital form, source language is easy to copy and edit. On the Internet, the guidance of the World Wide Web Consortium (W3C)[17] brought standardization to the online publishing language (HTML),[18] so that practically every web browser features the option to "View Page Source". When modifications or revisions of authored content occur frequently, access to source code reduces effort.

The ideas of source language and target language are as old as writing and mechanization. Musical scores – printed musical notation often known as sheet music – are a form of source language that one or more musician(s) interpret to perform a composer's work. A player piano can execute target language programmed on perforated paper; an electronic synthesizer can execute target language through MIDI (Musical Instrument Digital Interface); a compact disc player can execute target language recorded onto an optical disc.

2.1.2 Copyright can be licensed; derivative work can also be protected

In countries that recognize the Berne Convention[19], any literary or artistic

[17] W3C has a vision of "a web of consumers and authors".

[18] Versions of HyperText Markup Language has been specified by the HTML Working Group .

[19] The Berne Convention was first established in 1886. The treaty has been signed by 168 countries, including the USA in 1989 and China in 1992.

work is copyrighted as soon as it is secured to a fixed medium (e.g. writing or drawing on paper; recorded as an audio or video recording). Official registration with a government office is not required. In 1996, the WIPO Copyright Treat ensured that computer programs were recognized as literary works, and compilations of materials (e.g. databases) were intellectual creations.[20] With automatic copyright as the norm, the primary ways that works transition into the public domain are (i) after the copyright term has passed and/or the author is deceased; or (ii) if government-contracted work is specified specifically in the interest of the country's citizens.

Since 2009, the Creative Commons has provided CC0 tools – as "no rights reserved" – so that authors can waive their copyright interests as place them as completely as possible in the public domain.[21] In addition, the Creative Commons also provides a Public Domain Mark for "no known copyright" to tag or label work that is known to be free of copyright around the world. The Public Domain Mark is typically applied to very old works, and is not recommended for work that is public domain in some jurisdictions but not restricted by copyright in others.[22]

Licensing a copyrighted work can be relative straightforward if the author is known.[23] Remixing a derivative work so that it is recast, transformed or adapted into a new original creative work can earn a new copyright.[24] The most famous derivative work was created in 1919 by Marcel Duchamp. He bought a mass-marketed postcard of the Mona Lisa, added a moustache, goatee and the letters L.H.O.O.Q. Duchamp would create multiple versions of this readymade in differing sizes and different media. In the age of the Internet, this sets up a test model of where new and old elements are comingled, resulting a work that is difficult to dissect. The old layers could still be present underneath, but new layers are added on top. The person that creates the composite could have a new work that would pass the test of originality for copyright (R. H. Stern, 2001).

[20]There are 95 contracting parties to the World Intellectual Property Organization Copyright Treaty. The treaty came into force in the USA in 2002 with the Copyright Directive. In China, the "2002 Measures for Registration of Copyright in Computer Software" removed the prerequisite of registration of software copyright with the government, but primary protection would be given to parties approved by the Copyright Protection Center of China. Canada only ratified the treaty in 2014, as part of a larger Copyright Modernization Act.

[21]CC0 isn't a guarantee that the work will be in the public domain everywhere, since copyright is enforced differently by each country.

[22]Since the length of copyrights can differ across various jurisdictions, a work that is public domain in one country might still have copyright in force in another.

[23]A large proportion of software has "no license declared", which can present challenges for open source community projects to reuse the code (Phipps, 2005). Without an explicit copyright or open source license, the original authorship of the work is a mystery, which leads to a nuisance of tracking down the original author.

[24]Remixing music can be described as "Read/Write" culture where individuals add to the culture and share person-to-person, as compared to "Read/Only" culture where the production is concentrated only amongst professionals (Lessig, 2008).

Merely adding a frame to picture is not sufficient to define creativity in a derivative work, and the doctrine of fair use complicates copyright claims.

For a developer who wants to widely distribute his or her works with others freely over the Internet, automatic copyright creates an overhead burden. Anyone who wants to copy and/or create a derivative of work not in the public domain is legally required to acquire a license to do so. The requirement of licensing persists even if the original author is no longer interested in maintaining the software, and consciously wishes to abandon it. The affirmation obligation of the licensee to obtain copyright permissions on terms that vary country-by-country is at least a nuisance, and at worst a deterrent to innovation.[25]

2.1.3 Private source licensing has each licensees affirm privileges

Prior to the rise of digital content, the focus of legality was more on patents than on copyright. Hardware devices have designs that can be patented. The design was hard-coded into physicality. Copying and/or creating a derivative work of hardware can be seen in the material world. With software, privileges to copy and create derivative work require copyright licensing for the target language on which a machine runs, and/or the source language that computer programmers write.

While the label *open source* has become everyday language, the origins of private source are more obscure and technical. One of the earlier public appearances of *private source*, in opposition to open source (after the 1999 definition) is by IBM in August 2006, at the Linux World Conference.[26]

In computer science, the label of private source has the longer history. In 1975, an article on "source statement libraries" depicts an era when computer programming was moving from punch cards to magnetic storage. The use of the label "private source" as "not available to just any user" is an acknowledgement of the obsolescence of physical records (i.e. statements punched onto paper cards) to electronic storage (i.e. magnetic disk) to which access privileges could be programmed as open or private (I. Flores and Feuerman, 1975).

With automatic copyright, private source licensing has been the norm for almost all commercial businesses. The effects of private source licensing are illustrated in Figure 2.3.

Most consumers don't care about copyright (or patents). Do-it-yourself enthusiasts and commercially-oriented professionals have a deeper interest.

[25]The affirmative act of consent can be designed as self-enforcing, e.g. in the MIT License. See Chapter 6 "Legal Impacts of Open Source and Free Software Licensing" in (St. Laurent, 2004).

[26]"Private source" appears in a press release "IBM Unveils Development Roadmap and Business Strategy for Open Source Beyond Linux" at Linux World Conference and Expo, in San Francisco, August 15, 2006.

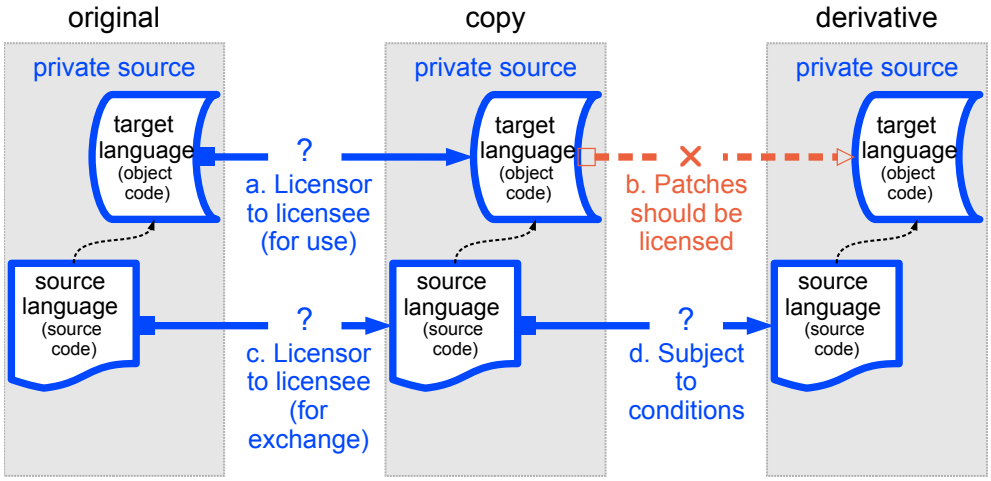


Figure 2.3. Private source licensing

Both source language and target language are subject to copyright. The wording of most copyright declarations places the burden of responsibility on the licensee to seek out the copyright holder to affirm permission to copy.

(a) Copyrighted private source target language is typically embedded in a product or on a medium (e.g. a CDROM). While the product or medium is packaged as a product, the software is actually licensed for use, and not sold. Opening shrink-wrap and/or installing software usually requires accepting copyright conditions on a computer or device. The license may apply to a single copy, or for the purchaser to install on multiple computers.

(b) Projects to patch private source target language with a derivative work are rare. A licensee or third party would likely only do so if the source code were lost, as modifying and maintaining machine code is difficult. Technically, distributing an unauthorized patch breaches copyright. The preferred path would probably be a reverse engineering of firmware, for an alternative free/libre version. Manufacturers of some products (e.g. Canon Powershot cameras, Linksys routers) often look the other way, because the purchasers assume the risk if something goes wrong, and sales are rarely impacted.[27]

(c) Licensing private source language is about the same as with copyright on any creative work, e.g. text or audio/video recordings. Licensing requires explicit communications between the licensor and licensee about the fee in exchange, generally involving a contract advised by lawyers. Licensed software typically includes maintenance. If a software package is essential to the customer, and the financial stability of the provider is

[27]The Canon Hack Development Kit replaces the firmware in some Canon Powershot cameras under a GPL. The DD-WRT project is a Linux-based (GPL) replacement of the firmware for many 802.11 network routers with Broadcom or Atheros chipsets e.g. Linksys.

questionable, some acquisitions will include a clause that requires that source language be put into escrow. If the provider is unable to maintain the software, the third party agent will release the source language for another organization to continue service.

(d) An ongoing project to create and distribute a derivative work of private source language would be subject to negotiated terms and conditions. The derivative work incorporating that private source language would be eligible for a new copyright on modifications. Open source redistribution of the modifications would have little value without access to the original source language.

Private source licensing can be decoupled from ownership. Access to the original source of codified information may be of value to some parties, but not to others. Incorporated businesses can separate control from ownership, creating "powers in trust".[28] Organizations that are responsive to customer needs live up to the social contract that they will act in the interests of their constituents.

2.1.4 Free/libre reciprocal licensing perpetuates defined freedoms

In 1984, Richard Stallman started the GNU software project, based on a philosophy of free software. Free software means that users have four essential freedoms: (i) to run the program, (ii) to study and change the program in source code form, (iii) to redistribute exact copies, and (iv) to distribute modified versions.[29] This project was founded on Stallman's experience in the MIT Artificial Intelligence Lab, after Digital Equipment Corporation discontinued support for the PDP-10. Any software developed on that obsoleted platform became waste.[30]

In 1985, Richard Stallman incorporated the Free Software Foundation (FSF). This led to February 1989 publication of the GNU General Public License, version 1. The GPL is based on copyleft (also called reciprocity, or libre share-alike[31]) conditions, where copies and modified works preserve the license of the original work. In June 1991, the wording of the GPL v1 was revised to the "ordinary" GPL v2, with the legal effect retained.[32] The

[28]The separation of powers of control and ownership are described in (Berle and Means, 1991) in Book 4, Chapter 1, "The Traditional Logic of Property".

[29]The philosophy of GNU Project recognizes that software is different from material objects.

[30]The rise of the GNU Project portrays the first software sharing community.

[31]A copyleft license is a share-alike license in definitions by the Creative Commons. However, if the share-alike license has additional conditions, e.g. for non-commercial use only, that would not be a full copyleft.

[32]From 1989, the name of each software program was named in the license. The 1989 GPL v1 simplified the text by referring to "the program". In the 1991 GPL v2 "the changes made were entirely in phraseology rather than legal effect" (R. Wilson, 2005).

most well-known free software program, Linux, would see Linus Torvalds changing the license for the Linux kernel at v0.12 to GPL in February 1992.[33]

The label of *free* requires some clarification. In English, free has two meanings: free as in *liberty*, and free as in *gratis* (i.e. out of favour or kindness, without charge, cost or pay). Amongst software developers, this distinction is known as "free as in speech", as opposed to "free as in beer", based on an 1999 panel discussion including Eric Raymond, Richard Stallman and Linus Torvalds, describing different philosophies.

> The disagreement, which has since been reported widely as a "rift" in the free software world, has to do with just what the community's goals are. Perhaps the most succinct characterization of the debate would be the following:
>
> *Eric*: I want to live in a world where software doesn't suck.
>
> *Richard*: Any software that isn't free sucks.
>
> *Linus*: I'm interested in free beer.
>
> One group sees free software as a means to an end; the other sees freedom as the end in itself. And a third group – perhaps the majority – would like to drink its beer in peace and wishes the whole debate would go away (Corbet and Coolbaugh, 1999).[34]

Free/libre software has strong *reciprocal (share-alike)* conditions. The implications of reciprocity as copyleft are illustrated in Figure 2.4.

A reciprocal licensing scheme has become known as non-permissive, because subsequent derivative works come with conditions.

(a) Any party can copy free/libre software – both source language and target language – without having to seek a copyright release. If a distributor chooses to make copies for others, the same privileges under which the original was copied can't be denied to downstream parties.

(b) Distributing the target language of a derivative work without its

[33] Linux 1.0 would be released in 1994. Version 2 was released in 1996. Linus Torvalds, in a later interview, said:
"I actually originally released Linux with complete sources under a non-GPL copyright that was actually much more restrictive than the GPL: it required that all sources always be available, and it also didn't allow any money to be exchanged for Linux at all (i.e. not only did I not try to make money off it myself, but I also forbid anybody else to do so). [...]
I changed the copyright to the GPL within roughly half a year: it quickly became evident that my original copyright was so restrictive that it prohibited some entirely valid uses (disk copying services etc - this was before CD-ROM's became really popular). And while I was nervous about the GPL at first, I also wanted to show my appreciation to the gcc C compiler that Linux depended on, which was obviously GPL'd.
Making Linux GPL'd was definitely the best thing I ever did" (Yamagata, 1997).

[34] A more complete history reveals frictions between Richard Stallman's position and the Linus Torvald's pragmatic view, in "Open Source" (Chapter 11) of (S. Williams, 2002).

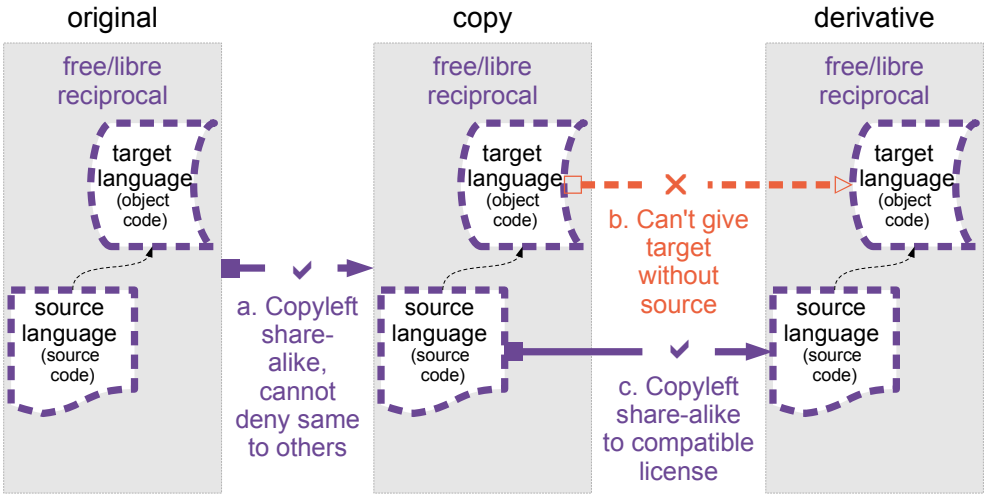


Figure 2.4. Free/libre reciprocal licensing

source language is not permitted. This allows others to study and change the original source, that might be used to create a modified target language for personal or public use.

(c) Redistribution of source language for a derivative work is permitted, as long as the derivative carries either a free software license that is the same or compatible with the original.

While the GPL permits running free/libre software *beside* non-free private source software, the license conditions preclude embedding free/libre reciprocal licensed software *inside* private source software. The rise of the composite applications on the Internet popularized combinations of free/libre software with non-free. This situation was handled in June 1991, at the same time as the release of the GPL v2, with the introduction of the new GNU Library GPL license was introduced.[35] This LGPL was renamed and superseded in February 1999 as the Lesser GPL (LGPL) v2.1.[36] The ordinary GPL restricts use of the library only with free programs (i.e. those with a GPL). The LGPL "permits use of the library in proprietary programs".[37] This is sometimes called a "weak copyleft", because it allows LGPL code to be combined with non-free code. Software developers can now choose to license their works under the less permissive (General) GPL or the more permissive LGPL.

The GPL does not preclude selling free software.[38] If a software de-

[35] Although the Library GPL v2.0 has been superseded by the Lesser GPL v2.1, a historical version of the license remains in force for those who don't relicense.

[36] The LGPL v2.1 preamble encourages using the ordinary GPL v2 rather than the lesser successor..

[37] The GNU Project prefers the ordinary GPL license, describing "Why you shouldn't use the Lesser GPL for your next library".

[38] The GNU Project writes: "Actually, we encourage people who redistribute free software to charge as much as they wish or can. If a license does not permit users to make copies and sell them, it is a nonfree license".

veloper abandons ongoing work, free access to the source code enables motivated parties to do so for themselves, or potentially pay someone else for that service. There are a variety of alternative ways of generating revenue based on free/libre software.[39] A copyright holder also has the option to both (i) release software code to the public under GPL, and then (ii) have customers pay for the same code under different terms. This is called dual licensing, or selling "license extensions". The MySQL software commonly used with web servers followed dual licensing: a development team could either (i) accept the MySQL GPL license and declare its whole project as GPL, or (ii) pay the MySQL owner (i.e. MySQL AB from 2000, Sun Microsystems from 2008, and Oracle Corporation from 2009) licensing fees.[40]

2.1.5 Open source permissive licensing allows relicensing with attribution

At a strategy session in Palo Alto on February 3, 1998, open source emerged as a business-oriented label that superseded some of the philosophical positions adopted by the free software movement.[41] Shortly thereafter, Eric Raymond published *Goodbye, free software; hello, open source* summarizing the findings of the strategy session, with activities underway to register

[39] Since free/libre source language is readily available, alternative business models could include:
"*Support Sellers* of media distribution, branding, training, consulting, customizing and post-sales support;
Loss Leader, where a no-charge product offers a path to a traditional commercial software;
Widget Frosting, for hardware companies enabling software such as driver and interface code;
Accessorizing, distribute booking, computer hardware and other physical items;
Service Enabler, where open-source software gives access to revenue-generating on-line services;
Brand Licensing, which charges others to use its brand names and trademarks in derivatives;
Sell It, Free It, where products start out as traditionally commercial and then are converted open-source;
Software Franchising, combines *Brand Licensing* and *Support Sellers* with geographic franchises" (Hecker, 2000).

[40] Richard Stallman surprised some free software enthusiasts by support selling exceptions to the GNU GPL, specifically in the acquisition of MySQL by Oracle.

[41] The official history, with meeting attendees and followup actions, was published online.
"The strategy session grew from a realization that the Netscape announcement had created a precious window of time within which we might finally be able to get the corporate world to listen to what the hacker community had to teach about the superiority of an open development process.
The conferees decided it was time to dump the moralizing and confrontational attitude that had been associated with *free software* in the past and sell the idea strictly on the same pragmatic, business-case grounds that had motivated Netscape. They brainstormed about tactics and a new label. *Open source*, contributed by Chris Peterson, was the best thing they came up with".

"open source" as a trademark and hold it through Software in the Public Interest.[42]

The Open Source Initiative (OSI), in 1999, derived the Open Source Definition from the Debian Free Software Guidelines.[43] The definition is a 10-point list, with a preamble "Open source doesn't just mean access to the source code".[44]

A sentence from the rationale to point 6 is worth emphasizing: "We want commercial users to join our community, not feel excluded from it". The phrasing is the same in the Debian Free Software Guidelines, but clearer in the Open Source Definition.

Both the Free Software Definition and Open Source Definitions encourages technical interoperability, i.e. one software package should work with the other. By specifying that Free Software is only for gratis, however, social interoperability is limited: software developers can engage in commercial relationships in restricted ways. The Open Source Definition was constructed with social interoperability between non-commercial and commercial parties in mind.[45]

The software community often combines the two philosophies into a single acronym, as FLOSS – free/libre and open source software.[46] However, free/libre and open source are rather different.

The OSI definition recognizes the MIT license and varieties of the BSD

[42]The call to the community was published on February 8, 1998. Software in the Public Interest Inc. was incorporated as a non-profit organization in 1997 in the State of New York.

[43]Bruce Perens is credited for removing the Debian-specific references.

[44]An annotated list gives more detail on reasoning. Here's an abstracted list:
1. Free Distribution ... shall not restrict selling or giving away ... as a component of an aggregate ...;
2. Source code ... Deliberately obfuscated source code is not allowed. ...;
3. Derived works ... must allow modifications ... to be distributed under the same terms ...;
4. Integrity of The Author's Source Code ... derived works ... carry a different name or version number ...;
5. No Discrimination Against Persons or Groups ... export restrictions ... may warn ...;
6. No Discrimination Against Fields of Endeavor ... in a business, or ... genetic research;
7. Distribution of License ... without need for execution of an additional license ...;
8. License Must Not Be Specific to a Product ...same rights as original software distribution;
9. License Must Not Restrict Other Software: ... must not assist all other programs ... open source ...;
10. License Must Be Technology-Neutral: ... (not) predicated on any individual technology .... (Open Source Initiative, 1999)

[45]Bob Sutor distinguishes between *interoperability* where standards do not favour any specific party, as opposed to *intraoperability* where one party becomes central and dominant.

[46]One example of formalization of the FLOSS acronym is the "Free/Libre and Open Source Software: Survey and Study" reported conducted for the European Union. See (International Institute of Infonomics and GmbH, 2002).

license as open source. The FSF recognizes the MIT and BSD licenses as free/libre. Both licenses are permissive, i.e. they grant everyone the rights to copy, derive and distribute.[47] These academic licenses have been described essentially as "gifts" that may be used unencumbered, allowing relicensing of the derivative work under a new license of the developer's choosing (Streicher, 2005).

The GPL and LGPL are recognized as open source licenses within the OSI definition as well as free/libre by the FSF. They are not, however, permissive, as any derivative works have reciprocal (share-alike) restrictions, i.e. relicensing is limited to GPL or LGPL.[48] Free/libre reciprocal licensing is open source, but open source licensing is not necessarily free/libre.

The Apache license is recognized by the OSI. It is permissive, requiring only that the copyright notice and disclaimer be preserved. The effect of open source permissive licensing is illustrated in Figure 2.5.

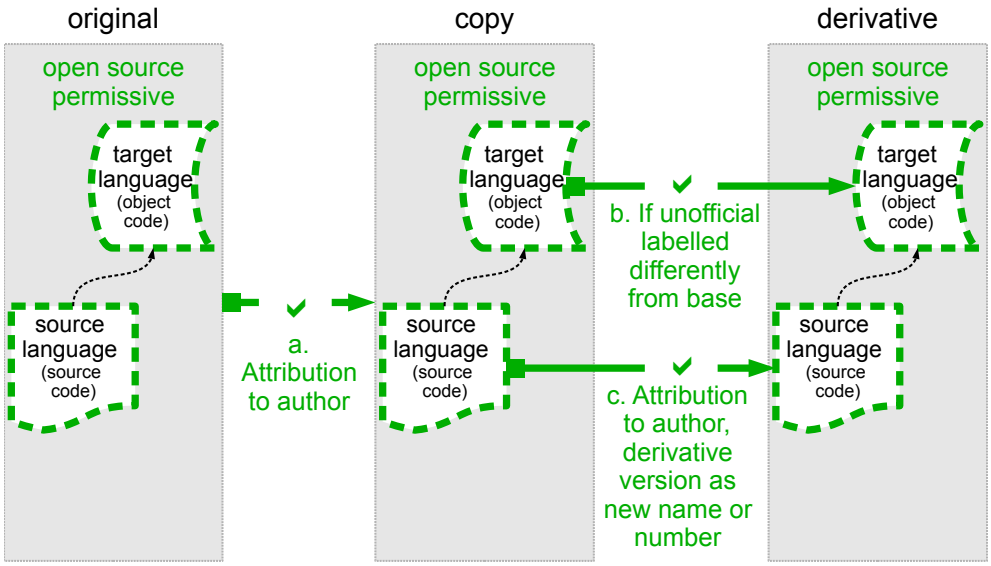


Figure 2.5. Open source permissive licensing

In recent years, the Apache 2.0 license has risen in popularity.[49] Other open source licenses with variants in wording have historically been per-

[47] "A 'permissive' license is simply a non-copyleft open source license — one that guarantees the freedoms to use, modify, and redistribute, but that permits proprietary derivative works". See .

[48] "'Copyleft' refers to licenses that allow derivative works but require them to use the same license as the original work. [....] Copyleft provisions apply only to actual derivatives, that is, cases where an existing copylefted work was modified. Merely distributing a copyleft work alongside a non-copyleft work does not cause the latter to fall under the copyleft terms".

[49] A less restrictive license may or may not be compatible with the one or more of the GNU licenses (as the more restrictive). The Apache v2 license is compatible with the GPL v3, but not GPL v2. The Apache v1 and v1.1 licenses was incompatible with GPL. The Eclipse Public License v1.0 is incompatible with GPL, and was not revised. The Mozilla Public License v1.1 was not compatible with GPL, but improvements in 2.0 would enable a dual license.

missive, but the proliferation of alternative licenses has proven to only benefit the employment of lawyers.

(a) An open source project is permitted to copy open source language and target language, as long as the attribution to the original author is preserved.

Across permissive open source licenses, copying across projects is common. As an example, OpenOffice 4.0 is based on an Apache 2.0 license, with the source code naming components under MIT licenses, Python Software Foundation licenses, Beopen Python licenses, CRNI license, International Components for Unicode licenses from IBM, BSD licenses, public domain licenses ... and many more.[50]

(b) An open source project is permitted to create a derivative target language version, as long as it is labelled differently – e.g. with a different name and/or version number – from the base. This helps subsequent copiers to differentiate between a base target language version, and a modified derivative.

(c) An open source project is permitted to create and distribute a derivative source language version, as long as attribution to original author is preserved, and the derivative version has a new name or number.

An open source permissive license allows relicensing the derivative work under the same or difference license, e.g. OpenOffice 4.0 has "Copyright 2012, 2013 Apache Software Foundation" under the "Apache License Version 2.0, January 2004", so anyone has the permission to copy that, and create a derivative adding "My own name, the current year" as long the original Apache 2.0 copyright is included.[51]

Projects that develop source language with one license while using source language with another language introduces complications. The foundations sponsoring the license terms have worked out the legalities of compatibility.

2.1.6 Open source permissive to free/libre reciprocal: can copy, not derive

Novices in the FLOSS community may think of free/libre and open source

[50] The Apache 1.0 license released in 2000 was revised into Apache 2.0 by 2004.

[51] A FAQ responds to license provisions.
"I've made improvements to the Apache code; May I distribute the modified result? Absolutely – subject to the terms of the Apache license, of course. You can give your modified code away for free, or sell it, or keep it to yourself, or whatever you like. Just remember that the original code is still covered by the Apache license and you must comply with its terms. Even if you change every single line of the Apache code you're using, the result is still based on the Foundation's licensed code. You may distribute the result under a different license, but you need to acknowledge the use of the Foundation's software. To do otherwise would be stealing.
If you think your changes would be found useful by others, though, we do encourage you to submit them to the appropriate Apache project for possible inclusion".

as similar, but the reciprocal and permissive features rule out some combinations. The compatibility of open source permissive licensing on free/libre reciprocal projects is illustrated in Figure 2.6.

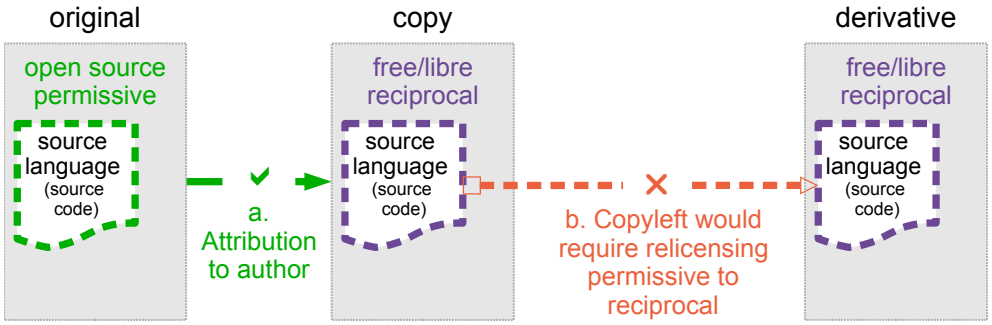


Figure 2.6. Open source permissive licensing on a free/libre reciprocal project

Generally speaking, the constraints on compatibility are due to reciprocity conditions on the free/libre licenses, set by the FSF.

(a) A free/libre reciprocal project may be allowed to embed a copy of permissive open source language. In one likely combination, a GPL v3 project can copy source language that is licensed under Apache 2.0, unchanged.[52] Portions of source language components can be distinctly identified as either open source or free/libre, and packaged together.

(b) A free/libre reciprocal project can not release a derivative work under a GPL or LGPL, as copyleft conflicts with permissive conditions on the open source licensing. An Apache 2.0 license permits relicensing with attribution incompatible with GPL v3.[53]

In practice, this compatibility is workable. Software developers can copy and redistribute code with open source permissive licensing on a free/libre reciprocal project. The can choose to license their contributions as derivatives under one license or the other, e.g. Apache 2.0 or GPL v3. What they can't do is to create a derivative of the whole, which has to

[52] "The Free Software Foundation considers the Apache License, Version 2.0 to be a free software license, compatible with version 3 of the GPL. [. . . .]
Apache 2 software can therefore be included in GPLv3 projects, because the GPLv3 license accepts our software into GPLv3 works" (Apache Software Foundation, 2012).

[53] The Software Freedom Law Center provides guidance on license compatibility: "GPLv3 software cannot be included in Apache projects. The licenses are incompatible in one direction *only*, and it is a result of ASF's licensing philosophy and the GPLv3 authors' interpretation of copyright law.
This licensing incompatibility applies *only* when some Apache project software becomes a derivative work of some GPLv3 software, because then the Apache software would have to be distributed under GPLv3. This would be incompatible with ASF's requirement that all Apache software must be distributed under the Apache License 2.0. [. . . .]
The ASF will not dual-license our software because such licenses make it impossible to determine the conditions under which we have agreed to collaborate on a collective product, and are thus contrary to the Apache spirit of open, collaborative development among individuals, industry, and nonprofit organizations"....

remain as a composite of Apache 2.0 components and GPL v3 components.

2.1.7 Open source permissive to private source: can copy, can derive

Licensing under open source permissive conditions is friendlier to private source copyrights. This is illustrated in Figure 2.7.

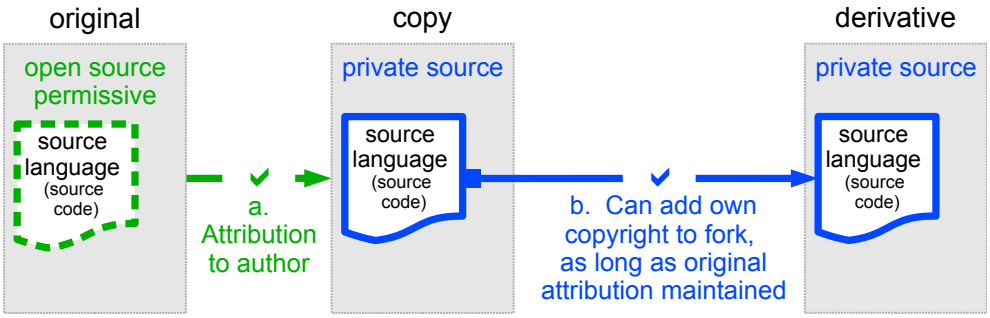


Figure 2.7. Open source permissive licensing on a private source project

A commercial business can package open source permissive language into its products without having to affirm privileges with the copyright holder, or require customers to integrate components on their own.

(a) A private source project that wishes to copy, embed and redistribute permissive open source language is free to do so, as long as attribution to the original author is preserved.

(b) A private source project is permitted to create a derivative work and add its own copyright, as long as attribution to the original author(s) is maintained.

With these options, a project has two non-exclusive licenses for ongoing development and distribution: (i) maintain a private source version; and/or (ii) pledge modifications back to the open source community.

If the project chooses to maintain a private source version, it then assumes all responsibilities for changes not contributed back to the open source community as a fork. Something in the open source language could be broken or incompatible with the private source language. Fixing that might serve only the private source project, and might not be relevant to the open source community. If the open source community has priorities incompatible with the project at hand, a private source version is expedient.

If the project pledges modifications back to the open source community, those contributions would go through processes of external review and release cycles. A healthy open source community is a meritocracy, where contributions from multiple sources are pooled for consideration. When the variety of ways of approaching an issue is fluid, and many parties can contribute expertise, contributing to an open source community can have longer term benefits.

This combination of open source permissive licensing with private source projects sets the legal boundaries in which development occurs. Knowing what *can* be done legally guides, but doesn't dictate what *should* be done.

2.2 Behaviours: norms with open sourcing or private sourcing

The labels of *private sourcing* and *open sourcing* are introduced to highlight ongoing norms that characterize contrasting styles and philosophies of social interaction. These norms go beyond the boundaries of legalities and licensing.

The contrasts in style and philosophy are most popularly portrayed as "The Cathedral and the Bazaar", first presented by Eric Raymond in September 1997 at the O'Reilly Perl Conference.[54] He described "two fundamentally different development styles, the *cathedral* model of most of the commercial world versus the *bazaar* model of the Linux world". Based on his experience with the *fetchmail* project, Raymond listed lessons on motivations and practices that had been successful in the distributed collaboration.[55]

The writing of "The Cathedral and the Bazaar" inspired the management at Netscape,[56] on January 22, 1998, to announce that "Communicator Standard Edition 5.0 source code will be freely available for modification and redistribution".[57] It also led to the Open Source Initiative defining its mission in February 1999.[58]

[54]The history of "The Cathedral and the Bazaar", Netscape's announcement and the strategy session of February 3, 1998 is well-documented. The revision 1.27 note of February 9, 1998 replaces the original phrase "free software" with "open source" (Raymond, 2000).

[55]In July 1999, Eric Raymond appended a chapter "On Management and the Maginot Line", where he reflected on the role of project manager and the new context of "cheap PCs and fast Internet links" with volunteers leading to self-selection and self-organization.

[56]Eric Hahn, executive vice-president and chief technology officer at Netscape, was cited in correspondence in the "Epilog: Netscape Embraces the Bazaar" (Raymond, 2000).

[57]The benefit of giving source code away was to enable (i) development of better software through the integration of enhancements from a broad array of developers; and (ii) broadening of distribution to allow developers to address markets needs not currently addressed by the company. The original announcement by Netscape has been preserved as a record by its successor, the Mozilla Foundation.

[58]The complete mission statement includes the OSI's purpose and activities:
"The Open Source Initiative (OSI) is a non-profit corporation with global scope formed to educate about and advocate for the benefits of open source and to build bridges among different constituencies in the open source community.
Open source is a development method for software that harnesses the power of distributed peer review and transparency of process. The promise of open source is better quality, higher reliability, more flexibility, lower cost, and an end to predatory vendor lock-in
One of our most important activities is as a standards body, maintaining the

The bazaar model is not necessarily better than the cathedral model; they're just different. Private sourcing has norms similar to cathedral building; open sourcing has norms similar to a bazaar setting. Contrasts between the norms are depicted from three perspectives, listed in Table 2.1.

Table 2.1. Norms characterizing private sourcing and open sourcing

Perspective	*Private sourcing*	*Open sourcing*
1. What and where: coalescing	Legitimating "the best way", specification and protocol with black box functionality	Letting "a thousand flowers bloom" with condition-specific tailoring and refactoring
2. When and why: stewarding	Planning timelines and following rules, towards ideal-seeking	Piecemealing change with easy modifiability, towards situated learning
3. Who and how: coordinating	Front stage magicians with backstage crew orchestrated by managers	Independent performers mutually accommodating in networks thickening social capital

These norms were not proscribed; they are inferred inductively from the common sense of the way private sourcing and open sourcing work. Whereas the emphasis on licensing centers on artifacts, an emphasis on sourcing centers on human interactions.

(1) *What and where:* Coalescing a group of people to build and/or use an offering reflects a living identity. Parties will naturally join a fledgling group with investments of time and energy into shared interests, and naturally diminish efforts as the group reaches viability. Any cathedral or bazaar is alive only as long as people maintain or renew it. Continuing coalescing can be described in two ways:

- *Private sourcing* presumes that unity towards "the best way" shapes action. Functionality comes in a plug-and-play "black box" where internal workings can be a mystery. If multiple alternative implementations become available, a specification and/or protocol standard of input and output interfaces can be written. Establishing the legitimacy of an offering may be resolved through "bake-off" contests at points of time when selections are to be decided.
- *Open sourcing* presumes that the variety in letting "a thousand flowers bloom" shapes action. Anyone can get "under the hood" to "tune up the ride" specific to conditions. An easy accessibility to materials

Open Source Definition for the good of the community. The Open Source Initiative Approved License trademark and program creates a nexus of trust around which developers, users, corporations and governments can organize open source cooperation"....

and methods enables offerings to be tailored. Parts can be taken apart and assembled in a variety of refactorings to suit the wants or needs at that time.

With private sourcing, parties coalesce around the idea of "the best way", and suspicion arises when a variety of alternative "best ways" is espoused. With open sourcing, parties coalesce around the idea of letting "a thousand flowers bloom", and suspicion arises when no alternatives or options lead to lock-in. These alternative norms are described in greater detail in section 2.2.1.

(2) *When and why:* Stewarding collective action is associated with norms about when activities and releases are "done", and the reasoning behind that. An offering may evolve slowly or rapidly. Some beneficiaries prefer rigourously tested major upgrades, while other prefer frequent minor updates. Any change to a cathedral or bazaar may be as lauded as an improvement or criticized as unnecessary. The way a community is stewarded may be more structured or more fluid:

- *Private sourcing* tends toward formal planning with timelines. Beneficiaries are encouraged to keep up-to-date with the current release, as superseded features from older releases deprecated and then obsoleted. Roles are defined, with rules set down for authority and accountability. Ideal-seeking, as ongoing improvements towards betterment, are an ongoing pursuit.
- *Open sourcing* tends towards piecemealing changes. Community members work on fixes they need, and improvements as time permits. Individual preferences can be satisfied be constructing an offering to be easy to modify. Learning is situated in technical and social contexts, as each party value and feasibility of implementing a change depends on the local environment.

In private sourcing, joint activities are stewarded towards everyone "staying on plan" and "following the rules". Frustrations arise when a project is "off schedule" or derailed by "scope creep". In open sourcing, joint activities are stewarded through independent contributors "squashing bugs" and building enhancements in response to "feature requests". Frustration arises when "major issues" are ignored by community leaders or when "good work" is repeatedly not acknowledged. These two norms are explored more deeply in section 2.2.2.

(3) *Who and how:* Coordinating action can involve a group that can be more exclusive or more inclusive. The group can directed more consciously or organized more casually. The desire for unity or plurality may evolve. The reality of a cathedral or bazaar may could be an intense effort by a few, or wider participation by many. Coordinating forward motion can be approached in two ways:

- *Private sourcing* can be coordinated like Las Vegas entertainment: a group of renowned magicians astonishes audiences, while a crew

behind the scenes makes the staging work. Impresarios provide the visible hand of managers to preserve the mysteries, clearing obstacles to success.

- *Open sourcing* can be coordinated like the Band Aid musicians: independent performers come together for a specific interest, mutually accommodating each others activities and strengths. The network can thicken social capital as long as individuals participate, with contributions coming in different ways at different times.

In private sourcing, effectively coordinating a group generally involves roles who can anticipate the values of the beneficiaries, and are able to guide collective action productivity. Breakdowns occur when beneficiaries are not effectively served front stage, and they start asking what's happening backstage. In open sourcing, effecting coordinating of the group requires participants to ensure that all have a voice, constructive critic are heard, and alternative directions are considered. Breakdowns occur when the collective fragments, as individuals decide that they're better of working by themselves or joining another group. These norms are further discussed in section 2.2.3.

While open sourcing is commonly associated with software development, Raymond saw the bazaar as a pioneering self-guided community, distributed globally but connected electronically. Global organizations were not new: religious institutions and multinational corporations and religious institutions operate across borders. However, practical decentralized activities connected electronically were new, with the rise of the Internet.[59] Beyond software development, open sourcing holds potential in other spheres.[60]

2.2.1 What + where: "the best way" vs. " a thousand flowers bloom"

Initiatives and projects have an identity (i.e. what) and direction (i.e. where) around which coalescing occurs. Parties amongst both beneficiaries and providers vests time and energy toward something of value to them.

Private sourcing norms are strongly associated with working implemen-

[59] Raymond's insight of volunteerism was added on July 29, 1999, well after the conference presentation, and preceding the publishing of the book:
"... open-source developers are volunteers, self-selected for both interest and ability to contribute to the projects they work on (and this remains generally true even when they are being paid a salary to hack open source)."

[60] In the afterword, Raymond states that he is not without opinions about music, book, hardware and politics. However, he believed in a principle of "one battle at a time".
"I expect the open-source movement to have essentially won its point about software within three to five years (that is, by 2003-2005). Once that is accomplished, and the results have been manifest for a while, they will become part of the background culture of non-programmers. At that point it will become more appropriate to try to leverage open-source insights in wider domains".

tations. *The best way* may be reflected in a "technical standard" or a "best practice" that gradually expands. Attaining a standard may begin with one party establishing a "lowest common denominator", and an espoused direction of improving interoperability over time. This is depicted in Figure 2.8.

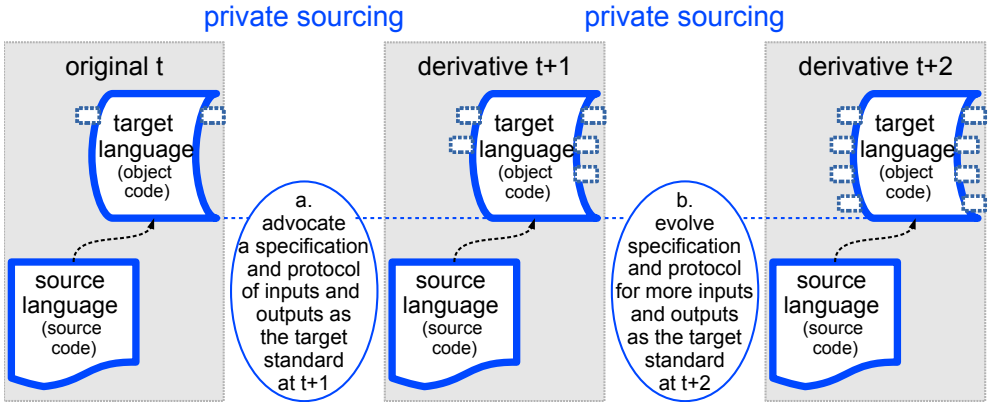


Figure 2.8. What + where: private sourcing "one best way" specifications

Most users typically only care that target language works, and never use source language.

(a) A specification or protocol can be written describing the black box target language interfaces (e.g. from time t where only one input is recognized and only one output is produced, to time t+1 when the derivative can have two inputs and three outputs) .

(b) With demands for greater functionality and/or fewer resource constraints at later points in time, the specification or protocol can be expanded (e.g. at time t+2, four inputs are recognized, and four outputs could be produced). The newest revision of the standard is presumed to be better than the older version, so the prior version(s) (e.g. t, t+1) are no longer maintained and are obsoleted.

Even if a specification is not publicly available, the behaviour of the black box may be replicated: a "clone" with a functionally equivalent target language from source language can be engineered in a clean room.[61] When multiple providers claim the same "best way" functional equivalency, private sourcing maintains trade secrets for a competitive advantage.[62]

Private sourcing tends to coincide with "de facto standards" that become

[61] Clean room design involves creating an independent specification of an existing offering, and then reimplementing without referring to the internals of the original. Physical goods are sometimes reverse engineered by taking an existing product apart, but the legitimacy of a replica would then fall under patent law (for the design) rather than copyright law.

[62] The idea of competitive advantage popularized circa 1979 by Michael Porter has been declared as superseded by disruptive innovation (Denning, 2012) and unhelpful in the creative economy (Denning, 2013).

popular through use.[63] Internet Information Server (IIS) is a good example of a program that has become a de facto standard.[64] First introduced in 1995, the IIS source code is copyrighted and private to Microsoft. IIS has been the second or third most popular web server in the world, following the Apache HTTP Server.

An organization promoting its private sourcing behaviour may claim it's the way to move faster. A standard is not an implementation, and many projects have failed to move from an abstract description to a concrete system. Having a concrete implementation can dissolve speculations about the efficacy of alternative approaches and methods. "The nice things about standards is that you have so many to choose from. Furthermore, if you do not like any of them, you can just wait for next year's model" (Tanenbaum, 2003, p. 235). A specification created after an adoption of a successful implementation may evolve or be superseded by an open industry standard in a later revision.

Open sourcing norms are associated with contributing source language that may be used or remixed in a later version. From these seeds, when *a thousand flowers bloom,*[65] the best derivative for each particular project can be selected. Ways in which source language can be derived is shown in Figure 2.9.

Source language may be associated with one identity, but then show up in alternative combinations.

(a) From the baseline version v, fixes and enhancements are contributed by independent parties. Some of those contributions are selected into the trunk for an integrated update to the source language at v+1 for a new baseline derivative. The other contributions may remain as surplus in unused branches, or deferred for integration into the trunk as a later version.

(b) Some or all of the source language from baseline version v may be refactored with source language from another project or branch to produce a new original w+1. Attribution to the original authors is preserved in copying the source language. The merged result is a new trunk labelled with a different identity (e.g. w+1) so that the reputation of the original trunk (e.g. v+1) is not impacted.

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[63] A fine distinction can be made between standards, industry standards and open standards. An exposition by the IBM Executive Vice President of Innovation and Technology (Donofrio, 2006) expands on the points on "open, collaborative, multidisciplinary and global".

[64] IIS was packaged with Windows NT (IIS 1, 2, 3, 4), 2000 (IIS 5), XP (IIS 5.1, 6), Vista (IIS 7), 7 (IIS 7.5), 8 (IIS 8), 8.1 (IIS 9) and 10 (IIS 10). The specifications for the Internet Server API (ISAPI) Extensions that can be programmed by developers have evolved with each new version.

[65] As in nature, the viability and desirability of a variant depends on the environment in which it is located. "Innovations can grow wild, springing up weed-like despite unfavourable circumstances, but they can also be cultivated, blossoming in greater abundance under favourable conditions" (Kanter, 1988, p. 170).

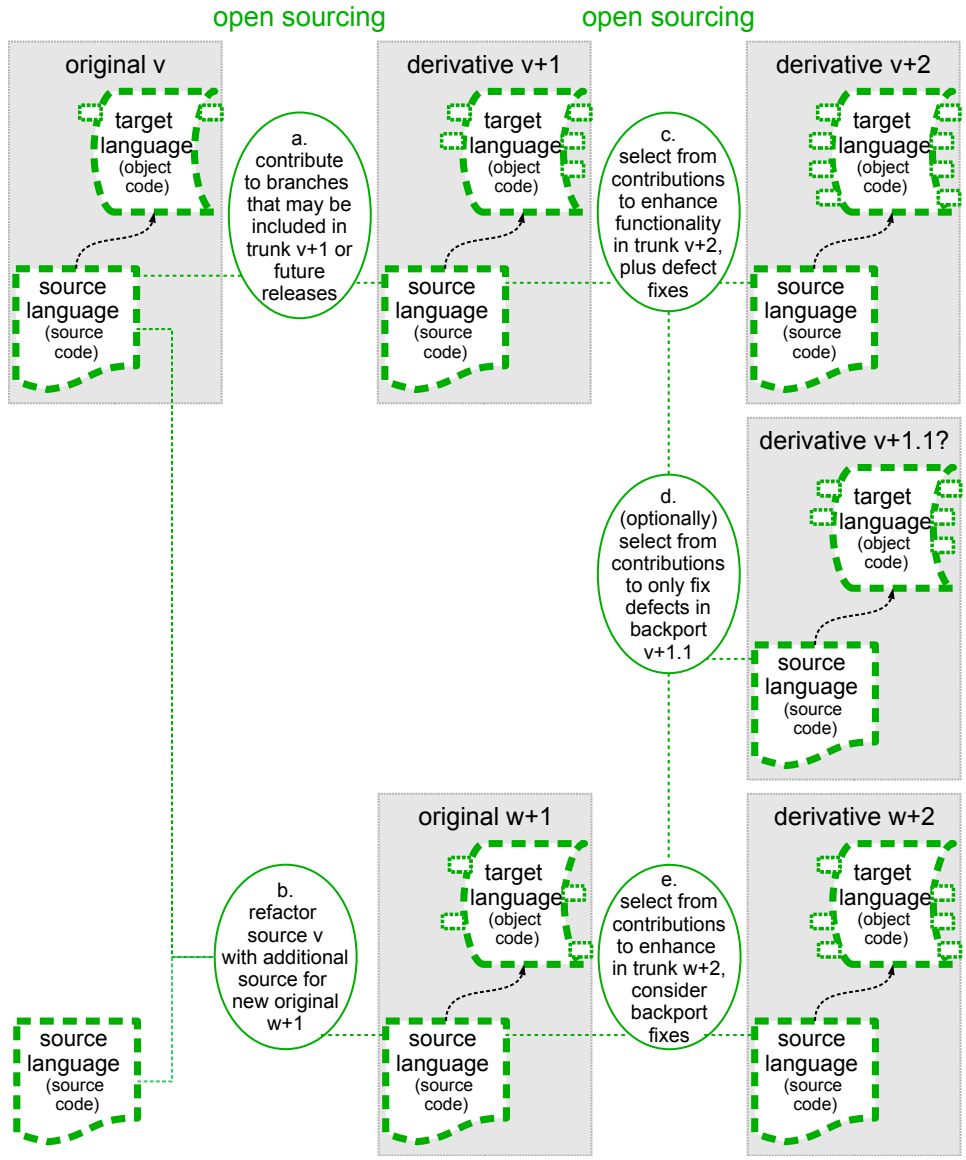

Figure 2.9. What + where: open sourcing “a thousand flowers bloom”

(c) Further enhancements to the functionality to the trunk v+1 can be released as derivative v+2. The source language could incorporate the most recent changes on the immediate predecessor v+1, and possibly features from prior releases (e.g. v).

(d) Optionally, the community may decide to maintain older versions with only defect fixes as a backport to version v+1.1. Some projects may prefer an unenhanced feature set, for a leaner integration and/or better performance on just the basics. The identity of the trunk may be preserved in a variety of versions, and the continuing availability of all prior source language branches enables satisfying both prudent teams who want only the most proven and stable releases, and progressive teams who want enhanced features.

(e) If a new community coalesced around the w+1 fork, they may choose to pursue different features to enhance and release as derivative w+2. They are not precluded from including backported defect fixes from the other project v+1.1. Some members of the community might work on both v+2 and w+2, or the forks might decided to join forces and come back together under one identity.

Open sourcing means that any party can take any or all contributions to a project, and create a derivative that is distributed under a different identity. This is an unconstrained form of innovating, or of retroceding, through individuating.[66]

The spirit and success of open sourcing has been demonstrated in the Apache HTTP Server project since its inception in 1994. It claims to be the most popular web server on the Internet, used on 60% to 70% of web sites.[67] A web site can be built on top of the organization's choice of operating systems: Linux and Windows have been the most popular, and the variety extends to Mac OS/X and OS/2.[68] Multiple versions of the server have simultaneously been under active development.[69]

h When breakthrough innovations lead to many unanswered questions about ends and means, open sourcing enables open assessments of the merits and constraints of contributions to date. Open sourcing may be a better way of working through ill-defined problems.[70]

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[66]Open sourcing is not only as a way of developing software code, but more broadly, a way individuals can make contributions towards common interests:
"Technological innovation is more than the production of improved functionality. In open source projects it is easy to see that striving for the common good is one of the reasons why open source developers commit themselves to a development project. Although the common good is evaluated based on the internal values of the community, even a small contribution can become important when it becomes part of a bigger system. [....]
Innovation, therefore, has its deep roots in the processes of individuation. socialization, and meaning construction. We use language, signs. and tools, and integrate them in our thinking and action. In this sense, human beings are technological beings. Fundamentally, technological change, therefore, relates to questions concerning the way we exist in the world. As technologies and technological change become visible in our everyday life, the foundations of technology also will be increasingly in our focus" (Tuomi, 2002, p. 219).

[67]The Apache Server started as a fork of the NCSA httpd web server, informally in 1994, the 1.0 release in December 1995 (Apache Software Foundation, 2010)..

[68]A survey concluded that about 80% of Apache HTTP Servers are on Linux and Windows (i.e. 64% + 20%), and also that about 80% are on Unix-like platforms (i.e. Linux 64%, 7% FreeBSD, 4% Solaris, 2% AIX, 1% HP-UX) (Temme, 2012).

[69]Version 1.3 was released in 1999, actively maintained for 10 years through 40 revisions, with was declared at end of life in 2010, when only critical security releases would be released. The version 2.0 alpha was released in 2000, with general availability in 2002, and continuing through version 2.4 release in 2012 with continuing incremental improvements.

[70]Objectivity in science often relies on reaching a consensus, whereas innovation may come from outliers:
"Ill-defined problems (like the origin of the moon) are almost defiantly elusive; they seem to defy a common "consensible" formulation .... Because of their widespread consensible nature, well-defined problems seem independent of the personality

Open technical standards and open best practices may, but do not necessarily require, access to source languages. An open technical standard may be established with specifications by an international body (e.g. the ISO crossing national groups), a government agency (e.g. the FDA for food and drugs) or a professional group (e.g. the SAE for automotive and aerospace). An open best practice may be developed with protocols as process frameworks (e.g. by the APQC with benchmarking) or through a clinical research (e.g. evidence-based practice in medicine). Once a baseline has been established, the specification or protocol can evolve with learning. Alternative implementation may satisfy the standard specification and/or protocol minimally or more enthusiastically.

2.2.2 When + why: "timelines + ideals" vs. "piecemealing+ situated"

Collective action has pacing (i.e. when) and rationales (i.e. why) on which stewarding communications and activities happen. The rise of the Internet has made follow-the-sun workflows possible, but keeping order asynchronously is different from working face-to-face.

Private sourcing norms see individuals committing to planning timelines so that individual contributions can be productively meshed into a whole. Defined roles and standard operating procedures are laid down as rules that individuals can follow, so productive collaboration is more likely than internal conflict. A "more perfect union" pursues an ideal with the recognition that improvements can always be made. These ideas appear practically in Figure 2.10.

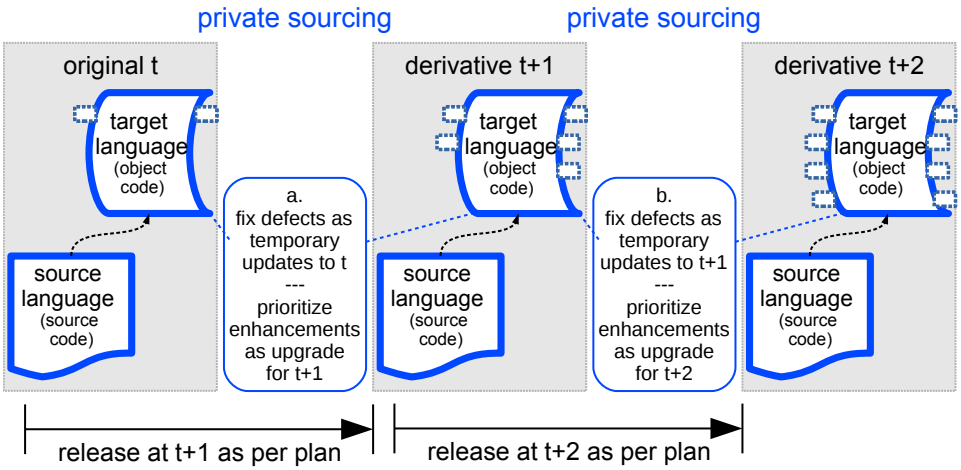

Figure 2.10. When + why: private sourcing planning + rules, ideal-seeking

Major releases of target language are major events scheduled at an-

of their formulators; they appear to be impersonal. Ill-defined problems, on the other hand, appear to be the intensely personal creations of their creators" (Mitroff, 1974, p. 594).

nounced points at time (i.e. at t, t+1, t+2). Temporary fixes may be released to privileged customers for specific issues (i.e. mission critical support for high-severity incidents), or packaged as minor release updates for scheduled maintenance.

Planning defines the lifecycle for the current offering, expectations on features of the future offering(s), and deprecation of prior offerings. As an example, Microsoft IIS versions were timed to coincide with major releases of Windows servers.[71] The typical support period for Windows operating system versions is 5 years in a mainstream support phase when requests for additional features are entertained, followed by 5 years in an extended support phase when security updates will be continued.[72] Customers adopting new releases of an offering will be interested in "plug-and-play" compatibility that reduces migration effort.[73]

Rules that clearly set out terms of engagement and limits on behaviour are formalized with private sourcing. Agreement and consequences can be expressed in written contracts. Customers typically license target language, and may be granted read access to interface specifications, but not the source language. Business partners can sign non-disclosure agreements to view the source language, with the privilege of modifications reserved to a core group. Social translucency[74] is usually sufficient so that parties in a supply chain can "divide and conquer" within their domains of expertise.

Ideal-seeking – towards ends – sets when and why releases are scheduled, as a dance between the willingness-to-pay of customers, and the capacity of resources employed by funders. Idealized design may extend beyond

[71] IIS 1.0 came in 1995 with NT 3.51 SP3; IIS 2.0 came in August 1996 with the NT 4.0 release, IIS 3.0 in Dec. 1996 with NT 4.0 SP2, and IIS 4.0 in May 1997 with NT 4.0 SP3. IIS 5.0 in Dec. 1999 with Windows 2000; IIS 6.0 with in Sept. 2001 with Windows XP Professional; IIS 7.0 in Jan. 2007 with Windows Vista and Windows Server 2008; IIS 7.5 in Oct. 2009 with Windows 7 and Windows Server 2008 R2; and IIS 8.0 in Oct. 2012 with Windows 8 and Windows Server 2012.

[72] The introduction of new features standards is generally reserved for major releases, with cross-version support sometimes offered (e.g. IIS 7 had IIS 6 Compatibility Support that could be turned on).

[73] Compatibility is a vague description that has been refined by Bob Sutor with language on (strong) interoperability and interchangeability.

[74] Social translucency has three properties: (i) visibility, (ii) awareness, and (iii) accountability:
"Why is it that we speak of socially *translucent* systems rather than socially *transparent* systems? Because there is a vital tension between privacy and visibility. What we say and do with another person depends on who, and how many, are watching. Note that privacy is neither good nor bad on its own – it simply supports certain types of behavior and inhibits others. For example, the perceived validity of an election depends crucially on keeping certain of its aspects very private, and other aspects very public. As before, what we are seeing is the impact of awareness and accountability: in the election, it is desirable that the voters not be accountable to others for their votes, but that those who count the votes be accountable to all" (T. Erickson and Kellogg, 2000, pp. 62-63).

the economic to truth, the good, and beauty.[75] The time horizon on shared ends can vary.[76] Practically, a group is unlikely to completely align on ideals, but individuals can share goals with defined planning periods (F. Emery, 1977). Offerings may be stratified (i.e. more features on expensive models, fewer features on basic models) and/or sequenced (i.e. faster and smaller with new models) with technological advances or experience curve declines. When the features of an offering overshoot the wants and needs of the market, an innovator's dilemma may lead to a business model transformation (Christensen and Raynor, 2003).

Open sourcing norms see individuals piecemealing changes, as they can incrementally try out small differences to judge their impacts. Ongoing yourself maintenance leads to a preference for easy modifiability, so that replication is possible through do-it-yourself. The variety of changes leads to situated learning, as the profile of each beneficiary is different. as things out committing to the value of ongoing discovery, and the modifiability of offerings in response to learning. The evolution of branches and released versions is depicted in Figure 2.11.

Some projects believe in releasing small increments frequently, while others are more ambitious with large changes on an "it's ready when it's ready" basis. Since the source language is open for all to copy and derive, any party with more pressing needs is free to select from the body of contributions to make a custom version.

(a) Starting from the same baseline version (e.g. v) of the source language, each contributor adds his or her changes to a branch (e.g. v0.1, v0.2, v0.3). Those additions are all derivatives of the original (e.g. v), but are not necessarily compatible in combination. Individuals who have gained the respect of peers in an open source project are granted roles as committers who will merge contributions into an integrated whole a new version (e.g. v0.1 and v0.2 make it into derivative v+1, but v0.3 doesn't).

(b) Some contributions can be immediately incorporated into the next release (e.g. branch v1.1 v+2); some contributions never reach the mainline version (e.g. branch v1.2); and some contributions may be deferred into a later release (e.g. branch v0.3 doesn't make it into v+1, but does into v+2). The pacing of releases may depend on the complexity of integration, as

[75] In Ackoff's definitions, ideals are worth pursuing but not attainable; objectives are worth pursuing, but beyond the period planned; and goals are achievable with the period planned:
"A purposeful system is one which can produce the same outcome in different ways in the same (internal or external) state, and can produce different outcomes in the same and different states. [....] Human beings are the most familiar example of such systems.
Ideal-seeking systems form an important subclass of purposeful systems" (Ackoff, 1971, p. 666).

[76] An ideal is an end that is unobtainable but worth pursuing. Groups that are ideal-seeking are labelled as purposeful. A goal is obtaining within a planning period. Groups that are goal-seeking but not ideal-seeking are labelled as purposive. See (Ackoff and F. E. Emery, 1972).

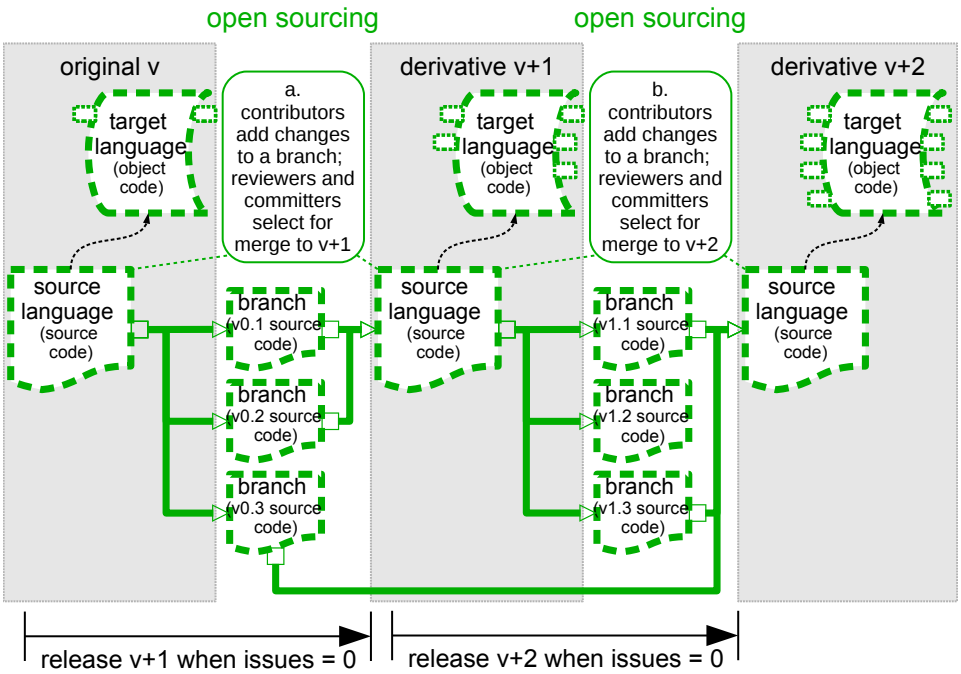

Figure 2.11. When + why: open source piecemealing + modifiability, situated

disruptive changes take longer to accommodate than others.

Piecemealing growth sees progress in small steps, following a notion of organic growth and repair.[77] Parties can independently try out the target language, and if it doesn't suit their purposes, modify some of the source language. Working with source language involves both critical thinking and material production.[78] Related activities could include discovering previously unarticulated preferences, prototyping variants and crafting extensions and improvements. While piecemealing might be an activity that is done by individuals in isolation, open sourcing as a community encourages resharing of derivative works so that others may mutually benefit.

Modifiability of target language is made practical by transparency through

[77] Piecemeal growth is a pattern for built environments described in *The Oregon Experiment*:
"By piecemeal growth we mean growth that goes forward in small steps, where each project spreads out and adapts itself to the twists and turns of function and site .... Piecemeal growth, like participation, is essential to the creation of organic order. ....
For environments ... an organic process of growth and repair must create a gradual sequence of changes, and these changes must be distributed evenly across every level of scale. .... Only then can an environment stay balanced as a whole, in its parts, at every moment of history" (Alexander, Silverstein, et al., 1975, pp. 67-68).

[78] In studies of interaction designers, this combination of critical thinking and material production has become known as critical making, connecting:
"critical thinking, typically understood as conceptually and linguistically based, and physical making," goal-based material work" (Ratto, 2011, p. 253).

to the source language.[79] An issue may be identified by a person who does not have the expertise to change the source language, yet when a bug report is confirmed by many, its priority in the multitudes of defects and incompatibilities that require attention rises. "Given enough eyeballs, all bugs are shallow" (Raymond, 2000). Modifiability with open sourcing can extend the life of an offering, as well as allowing the possibility to rebuild for conditions not originally anticipated.[80] Derivative works created through open sourcing may have modified only slightly, or transformatively.

Situated learning sees the modification of offerings as satisfactory opportunistic improvements in concert with the activities, contexts and cultures at hand. Open sourcing encourages individuals to gain skills through learning-by-doing.[81] Beneficiaries become participants in communities of practice who engage actively, rather than being passive bystanders. Individuals report issues in the context that they (and possibly no one else) are in, and are stepped through diagnosing problems and testing solutions collectively. The productivity of the community depends on a collaborative culture, when novices – often frustrated end users – are guided or mentored by more experienced members sharing knowledge. As with most social endeavours, the greatest amount of energy is expended by a core group, and free riding is frown upon as a social dynamic.

With the freedom for everyone to access and create a derivative of any version of the source language, the official branches coming from the community process could be complemented by a variety of unofficial builds. Joining and participating in the community is voluntary, and leaving to form an alternative community is always an option.

2.2.3 Who + how: "front stage, backstage" vs. "mutually accommodating"

Integrating the work coming from multiple parties requires orchestrators (i.e. who) with effective methods (i.e. how) for coordinating a continuing series of releases. The interactions not only involve the providers of an offering, but also the beneficiaries and funders who may be involved in cocreating the enterprise.

Private sourcing norms may follow the maxim that "laws, like sausages,

[79] A definition of information transparency in B2B exchanges can be generalized for open sourcing:
"Information transparency is defined as the degree of visibility and accessibility of information" (Zhu, 2002, p. 93).

[80] Modifiability "creates new possibilities and new problems for long-settled practices like publication, or the goals and structure of intellectual-property systems, or the definition of finality, lifetime, monumentality, and especially, the identity of a work" (Kelty, 2008, p. 12).

[81] Situated learning occurs in social coparticipation, rather than the transfer of propositional knowledge (Lave and Wenger, 1991).

cease to inspire respect in proportion as we know how they are made".[82] Civilization relies on trust in mutually beneficial exchanges, where parties rely on institutions to serve collective interests.[83] This is depicted in Figure 2.12.

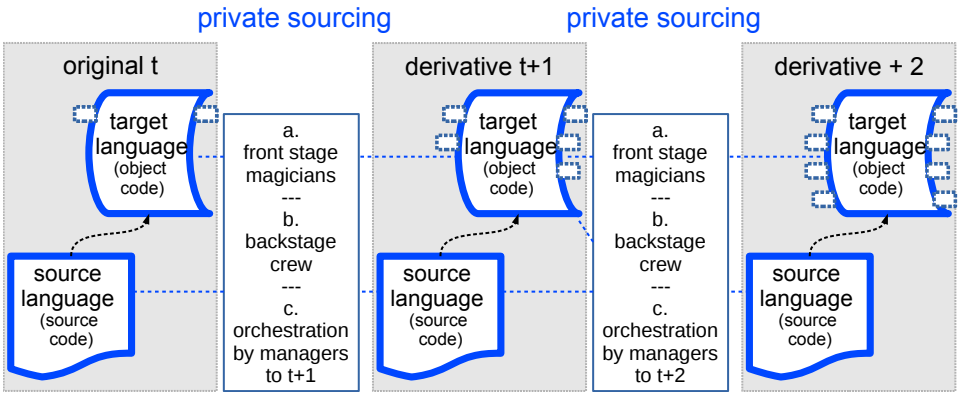

Figure 2.12. Who + how: front stage magicians, back stage crew

Generally, more people are interested in (i) "knowing that" an offering will mostly fulfil their wants and needs, rather than (ii) "knowing how" the offering was designed and constructed.

(a) On the front stage, audience members enjoy being entertained by magicians. Laymen suspend disbelief so as not to be overloaded with "knowing how", as they are boundedly rational.[84] They do need to comprehend how to interact with a man-made system, so interface specifications should be visible.[85] The rise of digital software has led to interface metaphors where devices mimic behaviours familiar in the physical world, e.g. a desktop metaphor has documents that can be stored in folders, a

[82] The maxim on law and sausage is attributed to John Godfrey Saxe in 1869.

[83] Beyond just living together, human beings have evolved to voluntarily enter in mutually beneficial behaviours "in the company of strangers" (Seabright, 2010).

[84] Bounded rationality is one of the "Models of Man" of Herbert Simon from the 1950s into the 1970s.

[85] Parts with visible and invisible internals can interoperate through interface specifications:
"For a modularization to work in practice, the architects must partition the design parameters into two categories: visible information and hidden information. This partition specifies which parameters will interact outside of their module, and how potential interactions across modules will be handled". [....]
"Information hiding begins as an abstraction. But to achieve true information hiding, the initial segregation of ideas must be maintained throughout the whole problem-solving process. This means that as points of interaction across problem boundaries arise, they cannot be dealt with in an ad hoc way. Instead, the interactions must be catalogued and a set of interfaces specified.
An interface is a preestablished way to resolve potential conflicts between interacting parts of a design. it is like a treaty between two or more subelements. To minimize conflict, the terms of these treaties – the detailed interface specifications – need to be set in advance and known to the affected parties. Thus interfaces of a common information set that those working on the design need to assimilate. Interfaces are visible information" (Baldwin and K. B. Clark, 2000, p. 73).

first-person shooter metaphor immerses a player in combat environment, "fly by wire" piloting mediates aircraft through electronics rather than mechanical linkages. These systems emphasize a*bstraction,* an "isomorphic transformation from an interpreted system into the corresponding general system" (François, 1997, p. 17).[86] The internal complexity of a system can be reduced for users through abstraction.[87]

(b) Backstage, there's a crew at work behind the scenes. For any interface specification, there are alternative equivalent ways for implementation.[88] With private sourcing, the original authors have the benefit of source language in the current implementation, as well as for prior unreleased works in progress that were deselected. Outside copyright originators, internals may be authorized selectively (e.g. protected with a password, or not disclosed at all). Internally, a design can be modularized with *information hiding* to separate external interactions from internals.[89] If the copyright holders do not wish to license their creations, or if the original source language has been lost or forgotten, diligent parties may

[86]This encyclopedia definition cites Klir, George (ed.): *Facets of Systems Science*. Plenum Press, New York, 1991, p. 17.

[87]Abstraction is common in software (and other types of) engineering, as a way of modelling concerns:
Abstraction is a technique for managing complexity that is deeply ingrained in human beings. As information processors we are always suppressing details we take to be unimportant; as problem solvers, we instinctively focus on a few manageable parts of a problem at one time. If our abstractions match the true underlying structure of the problem – if we are good carvers, not bad ones – then the analysis of abstractions will lead to a good solution to the problem. In any use, given our limited mental capacities. we have no choice but to work with simplified representations of complicated problems (Baldwin and K. B. Clark, 2000, p. 73).

[88]Component interface specifications, as standards have been described as the most important "open". "[Open] has become associated with software source code, industry standards, developer communities and a variety of licensing models – four distinct phenomena that are often intermingled in indistinct ways. [....] Of the four, open standards are the most critical, because making a choice today shouldn't preclude you from making a different choice tomorrow" (J. Schwartz, 2003).

[89]Partitioning a design with (i) visible information and (ii) hidden information is related to, but different from abstraction:
"The principle of *information hiding* was first put forward in the context of software engineering by David Parnas. However, the principle is perfectly general, and can be usefully applied to any complex system. With respect to software programs, Parnas reasoned that if the details of a particular block of code were consciously "hidden" from other blocks. changes to the block could be made without changing the rest of the system. The goal was then to enumerate and as far as possible restrict the points of interaction between any two modules of a program. The fewer the points of interaction. the easier it would be for subsequent designers to come in and change pans of the code, without having to rewrite the whole program from scratch.
"Information hiding" is closely related to the notion of abstraction defined above: When the complexity of one of the elements crosses a certain threshold, that complexity can be isolated by defining a separate "abstraction" with a simple interface. The abstraction 'hides' the complexity of the element ...." (Baldwin and K. B. Clark, 2000, p. 73)

resort to cracking security features or reverse engineering. Construction of a "clone" hardware and/or software system may result in a variety of compatible substitute legacy systems, as well as a foundation for additional interoperability specifications going forward.

(c) Partially visible to outsiders, the managers orchestrate the resources for performances over defined periods of time. A show may run for months or years at one venue before "going on the road", or a product may available for one season before being revised or superseded. When offerings are working well, front stage visibility is sufficient. Customers reporting issues can be helped by support roles on the front stage that may reach into backstage resources for deeper diagnosis and resolution. When offerings are not working well, the visible hand of managers may be invoked to rework the offering.[90] Internal review processes evaluate either incremental or radical changes that may be unnoticed or appear as "new and improved" features. Small issues may be handled with updates, and recalls to fix life-threatening defects are rare. As an offering wears out or interests move on, current customer may be offered privileges towards upgrades on a new release, for a reduced fee.

Maintaining a private source language while making interfaces to the target language public enables the copyright holder(s) to maintain a larger degree of control. Private sourcing enables repairing defects in features before customers notice that they're needed. It also enables optimization in plans not only for the current offering, but also in future upgrades. Energies can be focused on better serving customers rather than having competitors immediately copying innovations that required major investments. Quality and performance in the end product may be easier to sustain with fewer unpredictabilities to manage. As an example, Microsoft IIS benefited by integrating other private source components that could be coupled with, but not necessarily required, by Internet standards.[91]

Open sourcing norms are may follow the maxim "Alone we can do so little; together we can do so much".[92] This does not mean that every party has to do the same thing. In Figure 2.13, multiple streams of work are shown to coexist.

[90]The modern business enterprise originating in the late nineteenth century has the visible hand of management replacing Adam Smith's invisible hand of market forces (Chandler, 1977).

[91]In 1996, Microsoft segmented the market by licensing NT Workstation prohibiting its use as a server, and charging more for NT Server that included IIS. Both Netscape and O'Reilly advertised that customers could run NT Workstation with their alternative web server products, and would have a more powerful engine than NT Server with IIS, at a lower cost. This additional function of NT Server of NT Workstation was not because the program code had not been included, but instead was hidden. O'Reilly engineers "demonstrated that it was possible to convert NT Workstation to NT Server by changing only a few registry entries" (O'Reilly, 1999).

[92]In the 1920s, Helen Keller, with Anne Sullivan, spoke on the vaudeville circuit saying "We live by each other and for each other".

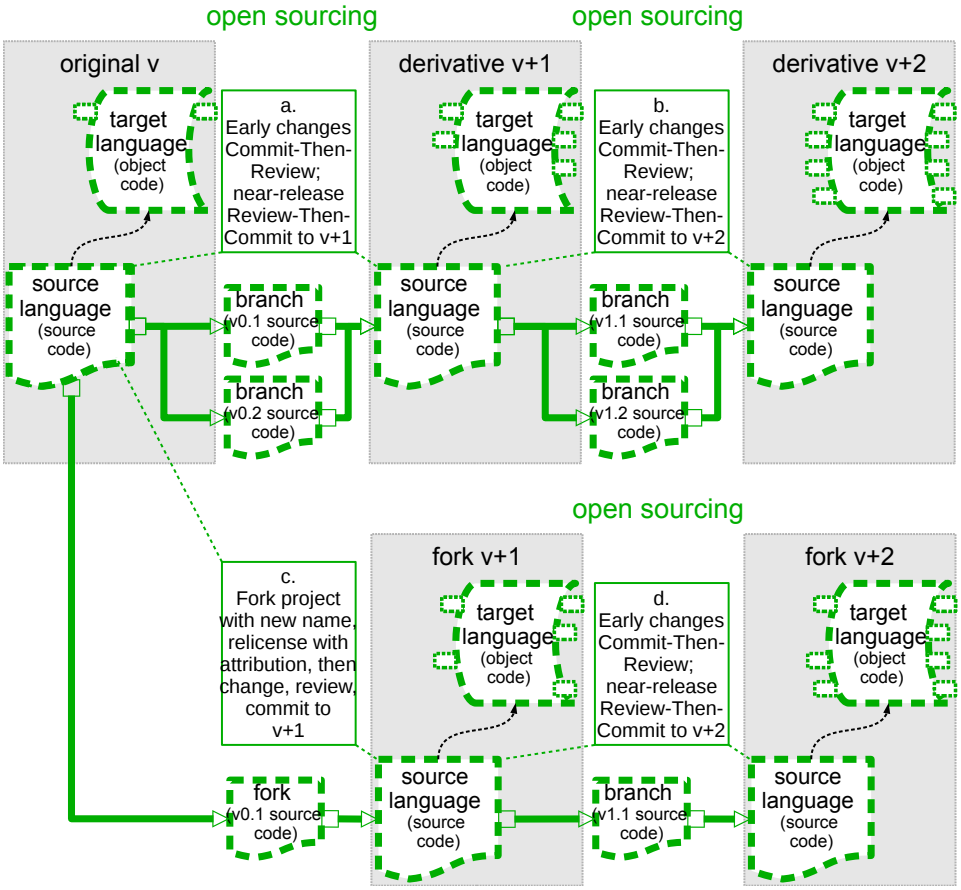

Figure 2.13. Who + how: independent performers mutually accommodating

When open sourcing thrives, many individuals and organizations will join in solidarity as a large community to participate in collective action. The popularity of one successful stream does not mean that alternatives can't also develop. Magnanimous participants are generally happy to see a variety of activities, rather than jealousy in another project.

(a) From a baseline source language (e.g. in the original version v), parties are welcomed to contribute branches that implement alternative future features. These branches (e.g. v0.1, v0.2) may not be compatible with each other, and could actually destabilize an attempted integration. In the Apache HTTP Server project, the contributions are handled differently, depending on the timing in the release cycle.[93]. Early changes are coordinated as *Commit Then Review*, welcoming individuals to add to a wide variety of potential changes from the baseline. As the release date nears, the pattern changes to *Review Then Commit*, as the components making up the formal release (e.g. v+1) go through final testing.

(b) Working towards a next release (e.g. v+2), contributions unused from

[93]In the Apache OpenOffice community, the timing of decision-making as "Commit Then Review" is described as early, and as "Review Then Commit" is described as late

earlier releases (e.g. v+1) may be reconsidered for integration, as well as the fresher additions. In any case, all of the branches are reserved for posterity, so that motivated parties may combine source language parts to create their own target language variants.

(c) If a group decides that it has different priorities not served in the project mainstream, they are welcome to break away in a fork. The forked project has to establish a different identity, either with a different name or a version number so that not it's confused with a continuing mainstream offering.

(d) If the breakaway group has sufficient momentum, they may be able to continue open sourcing in a project with a distinct identity. Compatibility in the code base and licensing may enable some contributions from the forked project to be considered for merging into the original mainstream. If the project does not have sufficient momentum on its own, project members may rejoin to the original mainstream project to influence the direction in later releases.

With open sourcing, contributions are made by *independent performers*. Those performers could be individuals acting on their own behalf, or working for organizations that have pledged to support a specific project. About 400 individuals have contributed code to the Apache HTTP Server project, with the size of the core development group ranging from 8 to 25 per week.[94] The content contributed may or may not be integrated immediately or for a subsequent release, and yet is available for inclusion into other projects.

Rework is done in a *mutually accommodating* manner. Features that are important for one beneficiary are not necessary high on the list for another. Individuals could fix issues only for and by themselves, but contributing revisions to the community enables potential improvements and pooled ongoing maintenance for all. The people open sourcing to any project may come and go, with a group of developers fixing and redesigning the offering according to their expertise and availability.

Open sourcing can thrive in *networks thickening social capital*. Activity densifies networks of social interaction, with generalized reciprocity occurring not only within a single project, but possibly across many related and unrelated contexts. It's not uncommon to see familiar names recur again and again in open sourcing projects.[95] Continuing activity

[94] A core developer has usually contributed for more than 6 months, then becoming nominated for write access to the version control system. The active core developers on any given week range from 4 to 15 (Mockus, Fielding, and Herbsleb, 2000).

[95] Sharing is a norm in open sourcing, where contributions come asynchronously: "Dense networks of social interaction appear to foster sturdy norms of generalized reciprocity --"I'll do this for you now without expecting anything immediately in return, because down the road you (or someone else) will reciprocate my goodwill." Social interaction, in other words, helps to resolve dilemmas of collective action, encouraging people to act in a trustworthy way when they might not otherwise do

has benefits both for each individual and the community as whole, with transparency leading to spillover effects to parties who partake as "free as in beer" non-contributors.[96] While open sourcing in the age of the Internet enables working together asynchronously and at a distance, continuing collaboration can produce thick social capital through weak ties.[97] When open sourcing is formalized, an independent institution may be formed to manage the common pool resource, e.g. the Apache Foundation.[98] The fluid nature of people and skills contributing across projects fits within the bounds of institutional framing (e.g. copyright licensing) but either flourishes or dies depending on the participation within the community.[99]

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so. When economic and political dealing is embedded in dense networks of social interaction, incentives for opportunism and malfeasance are reduced. A society characterized by generalized reciprocity is more efficient than a distrustful society, for the same reason that money is more efficient than barter. Trustworthiness lubricates social life. If we don't have to balance every exchange instantly, we can get a lot more accomplished" (Putnam and Goss, 2002, p. 7).

[96]Open sourcing includes both reciprocal relations and parties benefiting from the externalities:

"We describe social networks and the associated norms of reciprocity as social *capital*, because like physical and human capital (tools and training), social networks create value, both individual and collective, and because we can "invest" in networking. Social networks are, however, not merely investment goods, for they often provide direct consumption value" (Putnam and Goss, 2002, p. 8).

[97]The presumption that social capital requires long-running synchronous interaction may not be true for open sourcing:

"*Thick versus thin social capital*. Some forms of social capital are closely interwoven and multistranded, such as a group of steelworkers who work together every day at the factory, go out for drinks on Saturday, and go to mass every Sunday. There are also very thin, almost invisible filaments of social capital, such as the nodding acquaintance you have with the person you occasionally see waiting in line at the supermarket, or even a chance encounter with another person in an elevator. Even these very casual forms of social connection have been shown experimentally to induce a certain form of reciprocity; merely nodding to a stranger increases the likelihood that he or she will come to your aid if you suddenly are stricken. On the other hand, that tenuous, single-stranded bond is very different from your ties to members of your immediate family, another example of a thick social network. [....]

Granovetter pointed out that weak ties are more important than strong ties when it comes to searching for a job. [....] Weak ties may also be better for knitting a society together and for building broad norms of generalized reciprocity. Strong ties are probably better for other purposes, such as social mobilization and social insurance, although it is fair to add that social science has only begun to parse the effects, positive and negative, of various kinds of social capital" (Putnam and Goss, 2002, pp. 10-11).

[98]Some of the research into common pool resources with natural resources might be transferable into opens sourcing:

"In her case studies of community resource management projects, Elinor Ostrom (1990) observed the following four different conditions conducive to successful resource management: (a) local resource dependence, (b) availability of knowledge about the resource, (c) appropriate rules and procedures (i.e., for exclusion of outsiders and fair distributions), and (d) the presence of a community" (Vugt, 2002, p. 791).

[99]The research on common pool resources has continued to develop into an Institutional Analysis and Development (IAD) framework (Poteete, Janssen, and Ostrom, 2010, p. 40). An alternative view emphasizes the role of community,

To this point in this book, the emphasis has been on establishing a firm appreciation for private sourcing (only) and open sourcing (only) as independent phenomena. With that done, we can focus on the main phenomenon of interest: open sourcing while private sourcing.

2.3 Precursors: open sourcing and private sourcing prior to 2001

Open sourcing and private sourcing have traditionally been viewed as alternative patterns of behaviour for social systems. The cases in Chapter 4 focus on the period from 2001 to 2011, when open sourcing while private sourcing at IBM rose. Prior to that, some precursors were indicated:

- From 1993, open sourcing while private sourcing was encouraged internally at IBM
- From 1998, open sourcing while private sourcing was history-making with IBM contributing to Apache
- In 2000 and 2001, IBM invested $1 billion each year in Linux

Sequential thinking has traditionally been the pattern: (i) private sourcing offerings have been disclosed out to open sourcing projects, and (iii) open sourcing projects have been enclosed into private source offerings. Parallel thinking sees open sourcing and private sourcing as norms that, in hindsight, can contemporaneously complement each other.

2.3.1 From 1993, IBM internal private sourcing proscribed open sourcing

While 1990 was the second most profitable year to date in IBM's history, the company was alarmed by financial losses in 1991 and 1992. Inside IBM, divisions were private sourcing their operations rather than functioning as the whole that customers would see. When Lou Gerstner joined IBM at CEO in 1993, he found inwardly-focuses businesses each protecting their turfs.[100]

where social capital is generated: "Many of these collective action problems are in fact solved by the resource users themselves without recourse to or intervention by external agencies. ... [*Why] are some user-groups able to resolve their collection action problems by themselves, when others are not?*" (Singleton and M. Taylor, 1992, p. 310).

[100]The new chairman saw rampant bureaucracy:
"In IBM's culture of 'no' – a multiphased conflict in which units competed with one another, hid things from one another, and wanted to control access to their territory from other IBMers – the foot soldiers were IBM staff people. Instead of facilitating coordination, they manned the barricades and protected the borders. For example, huge staffs spent countless hours debating and managing transfer pricing terms between IBM units instead of facilitating a seamless transfer of products to customers. Staff units were duplicated at every level of the organization because no managers trusted any cross-unit colleagues to carry out the work. Meetings to decide issues that cut across units were attended by throngs of people, because everyone needed to be present to protect his or her turf.

To dissolve IBM's private sourcing bureaucracy, Gerstner "insisted there would be few rules, codes, or books of procedures". Across the company, he instead prescribed eight principles in September 1993.[101]

In hindsight, the seeds for open sourcing at IBM were foreshadowed in May 1993 – shortly after the announcement of Gerstner as CEO in March of that same year – with a conclusion of his expectations from the customer meeting in Chantilly:

- We would redefine IBM and its priorities starting with the customer.
- We would give our laboratories free rein and deliver open, distributed, user-based solutions.
- We would recommit to quality, be easier to work with, and reestablish a leadership position (but not the old dominance) in the industry.
- Everything at IBM would begin with listening to our customers and delivering the performance they expected (Gerstner, 2002, p. 48).

IBM's interest in open sourcing, as a business enterprise, has been fundamentally driven to (i) strengthen market relevance through continually engaging customers in ongoing relationships including an open sourcing style, and (ii) reduce bureaucracy inside a multinational, multi-divisional enterprise by reasserting customers outside the organization as primary, and the internal organizational structure and processes as secondary.

2.3.2 From 1998, open sourcing Apache while private sourcing WebSphere

In 1997, IBM heralded the rise of business on the Internet as e-business. At the end of that year, the Apache HTTP Server was most popular web platform at more than double the usage of second-place Microsoft IIS.[102]

The Apache Group was originally 8 individuals trading patches on a

The net result of all of this jockeying for position was a very powerful bureaucracy working at all levels of the company – tens of thousands trying to protect the prerogatives, resources, and profits of their units; and thousands more trying to bestow order and standards on the mob" (Gerstner, 2002, p. 195).

[101]The eight principles were: (1) The marketplace is the driving force behind everything we do. (2) At our core, we are a technology company with an overriding commitment to quality. (3) Our primary measures of success are customer satisfaction and shareholder value. (4) We operate as an entrepreneurial organization with a minimum of bureaucracy and a never-ending focus on productivity. (5) We never lose sight of our strategic vision. (6) We think and act with a sense of urgency. (7) Outstanding, dedicated people make it all happen, particularly when they work together as a team. (8) We are sensitive to the needs of all employees and to the communities in which we operate (Gerstner, 2002, pp. 201-202).

[102]At December 1997, shares were: Apache 44.79%; Microsoft-IIS 20.91%; Netscape Enterprise 5.27%; NCSA 4.42%; Stronghold 2.59% (Netcraft, 1997). NCSA HTTPd 1.3 was originally the reference for a newly written Apache HTTP Server "drop-in replacement", and NCSA would cease development at version 1.5 (Red Hat Europe, 1996). Netscape "had stumbled, and needed to be propped up by another in order to survive", acquired by AOL in November 1998 (Zawinski, 1999). By October 2000, the Apache was gaining: Apache 59.675; Microsoft-IIS 20.16%; Netscape-Enterprise 6.74%, with all others below 3% (Netcraft, 2000).

mailing list for the original NCSA HTTPd server developed at the University of Illinois. The first public release (version 0.6.2) came out in April 1995, and version 1.0 was released in December 1995 (Apache Software Foundation, 2001).

The unofficial project spokesman, Bruce Behlendorf was approached by IBM:[103]

> "IBM said, 'We would like to figure out how we can use [Apache] and not get flamed by the Internet community, [how we can] make it sustainable and not just be ripping people off but contributing to the process ....' IBM was saying that this new model for software development was trustworthy and valuable, so let's invest in it and get rid of the one that we are trying to make on our own, which isn't as good" (Friedman, 2005, p. 103).

IBM brokered a relationship with the Apache Group, and provided the legal expertise to incorporate the Apache Software Foundation. Most importantly, the Apache Group got IBM's best engineers working on the project. IBM executive John Swainson said:

> "There was a whole debate going on at the time about open-source, but it was all over the place. We decided we could deal with the Apache guys because they answered our questions. We could hold a meaningful conversation with these guys, and we were able to create the [nonprofit] Apache Software Foundation and work out all the issues". [....]
>
> "When we started working with Apache, there was an apache.org Web site but no formal structure, and business and informal structures don't coexist well". [....]
>
> "The Apache people were not interested in payment of cash. The wanted contribution to the base. Our engineers came to us and said, 'These people who do Apache are good and they are insisting we contribute good people.' At first they rejected some of what we contributed. They said it wasn't up to their standards! The compensation that the community expected was our best contribution" (Friedman, 2005, pp. 103-104).

On June 22, 1998, the Apache Group announced the partnership with IBM, with a technical representative joining the eight original leaders.[104] In

[103]The Apache server had been used by IBM as the platform for the 1996 Summer Olympic Games in Atlanta. IBM's development on web server was focused on Lotus Domino Go, which would require a lot of continuing redevelopment to be compatible with the Apache HTTP Server and Microsoft IIS. The first meeting with Bruce Behlendorf was in spring 1998, with James Barry (the product management for WebSphere, who had joined IBM less than year earlier) and Yen-Ping Shan (chief architect for e-Business Tools) (Leonard, 2000).

[104]In April 1998, the Apache Group had eight core contributors (A. Group, 1998).

a complementary product announcement, IBM released the WebSphere Application Server (WAS) “including packaging the popular Apache HTTP Server” and providing “commercial, enterprise-level support” (IBM, 1998).

Procedurally, customers receive maintenance on the IBM HTTP Server bundled in WAS. In the background, IBM contributes fixes to the Apache HTTP Server project, which theoretically, might be not accepted. Both IBM and Apache have an interest in maintaining a uniform standard, as a proliferation of forked versions would increase the cost of resources without expanding the market.[105]

In a path not chosen, IBM could have instead taken a private sourcing route. By 1996, IBM had HTTP services in the Lotus Notes server, renamed to Domino 4.5 as Internet features were added to the secure document sharing for which that product had been known. Domino may have been used on intranets, but didn’t even register on surveys of the open Internet. In 1999, Microsoft was quoted as saying “You won’t see a lot of Fortune 1,000 customers putting Apache on their Web servers”.[106] The Netscape Enterprise Server was acquired by AOL, in a deal where Sun Microsystems would license the software while AOL bought Sun servers.[107] IBM saw beyond corporate intranets to a larger opportunity on the open Internet with e-business, choosing to pioneer open sourcing while private sourcing with Apache.

The IBM WebSphere platform was designed with transaction processing and message brokering functions that large scale enterprises use in everyday business. Beyond the Apache HTTP Server, the WAS v2.0 extensions released in April 1999 were written in the Java programming language that originated from a competitor, Sun Microsystems, who was also investing in open sourcing (IBM, 2011g).[108]

On that list, Ken Coar was listed as an active member from MeepZor Consulting. At the June 1999 announcement, Ken Coar is listed as an IBM employee (Apache Software Foundation, 1999). On his LinkedIn profile, Ken Coar says he was employed as a “Senior Software Engineer” from August 1998 to February 2009, where he “helped IBM learn to cooperate with open software projects”.

[105] WebSphere Application Server has certified Java application features, whereas an Apache HTTP Server deployment for Java would add the open source Apache Tomcat environment. A no-charge HTTP Server is bundled with IBM WebSphere Application Server. The z/OS version of IBM HTTP Server was initially powered by the (Lotus) Domino Go Webserver, and switched to the Apache HTTP Server in 2003.

[106] Netscape also thought “People in corporate situations have a problem dealing with freeware”. “The corporate motto at both Netscape and Microsoft is to emphasize the "intranet" while downplaying the Internet. Publicly accessible Web servers aren’t where the money is -- the real profits are behind the "firewall" in internal corporate networks” (Leonard, 1997).

[107] AOL announced a stock-for-stock pooling of interest transaction with Netscape in November 1998, and completed the merger in March 1999. “As part of the deal, Sun will pay more than $350 million in fees, plus significant minimum revenue commitments during the next three years. In exchange, AOL will buy Sun hardware and services worth $500 million” (Junnarkar and T. Clark, 1998).

[108] The IBM Announcement Letter ZP99-0256 specifies prerequisite operating

Steve Mills, General Manager of IBM Software Group Strategy and Solutions, recalled the 1997 discussion on considering which web server to choose for IBM's product direction: "the most popular was Apache Web server, and we made a decision to anchor our effort to Apache because it had 47 percent market share". Despite its open sourcing origins, WebSphere is private sourcing product, and is likely will remain that way. "Something of this class of software could never be free", Mills said (Taft, 2008, pp. 2-3).[109]

In January 1998, Mills, sanctioned a team of about 25 employees in Raleigh, NC to leverage the Apache open sourcing into a private sourced WebSphere product. The cycle time from prototype concept to general availability of WebSphere in the second quarter of 1998 was revolutionary, with a subsequent release in third quarter. These releases became foundations for adding transaction monitoring and component broker features for WebSphere Application Server in 2002. By 2004, other IBM software brands were also contributing to WebSphere products. In 2008, WebSphere was developed in 80 locations by 6,000 developers (Taft, 2008).

WebSphere was the first-of-a-kind success for open sourcing with private sourcing. Open sourcing while private sourcing goes beyond technical artifacts to influence both organizational behaviour, and the business model for commercial enterprises.[110] Other initiatives blending open source with private source would not necessarily require the commitment of a corporate officer, thereby providing more insight into volunteerism and emergent adoption into organizational culture.

2.3.3 In 2000 and 2001, IBM each year invested $1 billion in Linux

While the WebSphere v3.0 release in September 1999 was based on the

systems of AIX, Windows NT or Sun Solaris. Linux was not supported in WAS 2.0.

[109]The private sourcing origins of WebSphere did not precluded packaging it with open source components and offering it to developers for gratis. In November 2005, IBM WebSphere Application Server Community Edition v1.0 was announced. With the private source WebSphere core, the open source Apache Tomcat and Geronimo components are pre-integrated and downloadable without charge. Technical support – including learning materials, defect resolution and developer assistance – are offered both free of charge through the online web community, and for fee for expedited handling. This gratis software product provided a low cost of entry for customers and business partners, with an easy migration path to the private source WebSphere solution stack. In the first six months, WebSphere Application Server Community Edition was downloaded more than 250,000 times (Websphere News Desk, 2006).

[110]The ideas of business models and software assets can be decoupled. Open source software extended with proprietary extension has been described as mixed source or hybrid source. This leads to a matrix of base (open and closed) and extensions (open and closed) (Casadesus-Masanell and Llanes, 2009). While software may be designed in a hierarchical system structure, business relationships as social systems do not necessarily need to follow.

open source Apache project, an even larger bet on open sourcing with private sourcing was yet to come.[111]

In the late 1990s, IBM had four product lines, each running a different operating system: (i) the mainframe System/390 line, that ran OS/390 and all of the legacy versions back to the System/370 back into the 1970s; (ii) the AS/400 line for small and intermediate-sized businesses, running OS/400 integrating the DB2 database, starting from 1988; (iii) the RS/6000 line for scientific computing, running the AIX variant of Unix, since 1990; and (iv) the PC Series (since 1994) and Thinkpad line (since 1992) of personal computers running OS/2 and Windows, with lineage back to the original IBM PC in 1981.

The four lines were incompatible. The S/390, AS/400 and RS/6000 lines had hardware built from chip manufacturing up, and the operating systems were developed through private sourcing. The PC Series and Thinkpad lines were built with Intel x86 processors[112], and ran commercial shrink-wrapped Microsoft Windows, OS/2, and AIX/386.[113] Customers loyalty to IBM could have support staff working on four different environments, with a variety of IBM technologies to knit them together.

In 1991, the PowerPC alliance of Apple, IBM and Motorola jointly developed a faster processor line. The Apple Macintosh used PowerPC processors from in the Power Macintosh introduced in 1994, with Mac OS 8.5 in 1998 dropping support for prior 68000-based computers.[114] Microsoft offered Windows NT for PowerPC from 1995 to 1997.

Linux had originally been developed for x86 processors. The MkLinux port of Linux for the PowerPC was started by the Open Software Foundation Research Institute and Apple in 1996. The LinuxPPC project in Germany forked Red Hat Linux in 1996.

By 1998, internal memos at Microsoft showed that Linux was being perceived as a real threat.[115]

In December 2000, IBM announced at a conference that it had invested $1 billion on Linux in 2000, and that spending would grow in 2001. Linux

[111]The WAS v3 announcement letter A99-0839 of September 1999 specified prerequisite operating systems of AIX, Windows NT or Sun Solaris.

[112]IBM manufactured its own PC processors licensed from Intel designs as the 386SLC and the 486SLC from 1991. While Intel has always had a dominant position in x86 processors, the market has been competitive with other manufacturers such as AMD.

[113]OS/2 was codeveloped by IBM and Microsoft from 1985. After the breakup in 1990, IBM continued to develop the operating system up through the OS/2 Warp 4 release in 1996. IBM had a joint venture with Apple from 1991 to 1995 to develop Taligent, that didn't work out. On x86 Point-of-Sale devices from 1986, IBM derived the 4680 and 4690 OS from DR Concurrent DOS 286 and FlexOS.

[114]The PowerPC architecture had some compatibility with the Motorola 68000. The Mac 68K emulator was built in from Mac OS 7 to enable older applications to run.

[115]Eric Raymond leaked portions of Microsoft's internal memos as "The Halloween Documents".

was growing at twice the rate of Windows NT, and IBM had 1500 developers working on it (J. Wilcox, 2000). IBM partnered on its computer hardware with Red Hat, which would provide maintenance and support for is distribution of Linux.[116]

IBM had previously offered AIX/370 for its mainframes since 1998, and AIX/ESA since 1991, neither of received much commercial interest.[117] The announcement of Linux on mainframes in 2000 coincided with the evolution from the 32-bit ESA/390 to the 64-bit z/Architecture.[118] In 1998, work began in the IBM Boeblingen lab in Germany to port Linux to the mainframe, including extending GNU tools.[119] At the end of 1998, CEO Lou Gerstner found that IBM did not have a policy on open sourcing and demanded a strategy.[120] This led to the surfacing of all internal skunk works projects. On December 18, 1999, the kernel patches were released on a Marist College web site.

By January 2002, IBM claimed that it had recouped the $1 billion invested in Linux in 2001, and the internal revenue target for the year was

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[116] WAS v3 was supplemented with a software announcement 200-215 in July 2000, adding Red Hat Linux as a new platform.

[117] AIX/370 was a port of the LOCUS operating system, a commercialization of an ARPA research project at UCLA. AIX/ESA was a port of OSF/1, a reference implementation sponsored by the Open Software Foundation founded in 1988 under the U.S. National Cooperative Research Act of 1984 to create an open standard for Unix. See .

[118] A "Bigfoot" distribution of Linux, started by Lina Vepstats in 1998, was carried out in parallel while the IBM Boeblingen work was still in secret (Courtney, 2000). The change in hardware from 32-bit to 64-bit meant that Bigfoot could be backwards compatible, but would require rewritten for future generations. Since IBM's contribution to Linux was free software, few would be interested in continuing to maintain Bigfoot.

[119] The first Linux kernels for S/390 were compiled on PCs into assembler source programs and then transferred to VM/CMS guests for machine code generation. Application programs written for Linux would have to be recompiled (to big endian from the little endian conventional with other platforms). The changes to Linux written by IBM included 2% of the kernel and 0.5% of the GCC (B. Thomas, 2010). Linux was originally created with GNU tools from the Free Software Foundation, and were licensed under GPL 2. The extensions to the GNU tools done by IBM would have to follow reciprocity clauses, and thus would also be GPL 2.

[120] On Dec. 14, 1998, New York Times reporter John Markoff incorrectly described that the Secure Mailer developed by Wietse Venema as open source prior to joining the company, would be released by IBM:

"...if IBM was endorsing open-source software as a worthwhile strategy, then Gerstner wanted to know about it. [....]

Gerstner started making phone calls. First he called his chief of software, who called his subordinate, who in turn called his. The conference call kept expanding, until it made its way down to the research director who managed Venema. By the end of day, Gerstner had his answer. There was no clear strategy. Or at least there hadn't been up to that point.

'There was that one morning in December of 1998, and by that afternoon the open-source strategy had jumped into the runway,' says Dan Frye, IBM's program director for open source and Linux. 'We talked to everyone in the industry. The answer we came back with was that open source was good for us.'

As a result, Linux got the green light" (Leonard, 2000).

increased by 50%. (Shankl, 2002). Private sourcing was evident in the zSeries mainframe hardware, and the iSeries midrange computers powered by RS64 and then PowerPC processors. Open sourcing was evident in IBM contributing to the Linux project, since the operating system ran on the four evolved product lines: (i) the System z Series mainframes; (ii) the System i Series midrange computers; (iii) the System p Series workstations and servers based on PowerPC processors; and (iv) the System x Series based on Intel processors.

In 2000, IBM was one of the founding sponsors of the Open Software Development Labs, a non-profit organization promoting Linux in the enterprise, becoming the Linux Foundation in 2007.[121] In fall 2013, IBM announced that it would spend another $1 billion over the next five years on Linux and the Power processor, enabling the OpenPower Consortium and strategies for new big data, cloud computing, analytics and datacenter customers (Yegulalp, 2013; Vaughan-Nichols, 2013a).

2.4 Contribution: Focus on open sourcing while private sourcing

The time frame for the research that follows is 2001 to 2011. During this period, IBM gradually made open sourcing while private sourcing a viable way of doing business.

An appreciation of private sourcing only – as strategic management associated with trade secrets and competitive advantage – has drawn on sources such as Sun Tzu[122] and von Clausewitz[123]. While principles of cooperation are not unknown in business[124], open sourcing and the rise of the Internet has drawn attention mostly amongst technologists.

The seven cases in Chapter 4 and contexts in Chapter 5 aim to support the development of theory associated with open sourcing while private sourcing. Chapter 3 takes a brief diversion to describe the methods through which inquiry into the phenomenon is conducted.

[121]The OSDL had founding sponsors of IBM< HP, CA, Intel and NEC, and included Linus Torvalds as an employee. In 2007, the OSDL would merge with the Free Standards Group to become The Linux Foundation.

[122]The *Art of War* dates to the 6th Century B.C., with translations into French in the 18th Century, and into English in the 20th Century.

[123]*On War* was written by von Clausewitz in the 19th Century.

[124]Fans of cooperative strategies may cite Peter Kropotkin, *Mutual Aid: A Factor of Evolution* (1902), or more recent works on coopetition.

3. Research approach: inductive from case studies

The research question of "what is the nature of learning and progressing open innovation over time, for an organization and its members?" has been pursued through study of the relatively short history of open sourcing while private sourcing (*OSwPS*).

Building theories on organizational learning and on innovation generally takes one of two approaches: (i) formulating a priori process theories, which are then tested using coarse-grained longitudinal time series and event history methods; or (ii) plunging deeply into the processes themselves to collect fine-grained qualitative data, and attempting to extract theory from the ground up. This research work follows the latter path, with the philosophy "that to truly understand how and why events play out over time, we examine them directly" (Langley, 1999, p. 691).

The label of open source was coined just before the dawn of the 21st century. Research on the phenomenon has isolated Open Sourcing only (*OSo*) from Private Sourcing only (*PSo*). This research work focused on *OSwPS* is driven by data, towards building theory (Eisenhardt and Graeber, 2007), as shown in Figure 3.1.

The key considerations in the research approach include:

- *data*, as process data over a decade, viewed as multilevel in Appendices A and B (section 3.1);
- *analysis*, as sequencing actions, circumstances and outcomes; replicating theoretically; and appreciating contexts changing, across Chapter 4 and 5 (section 3.2);
- *induction*, as abstracting towards descriptive theory, and generating pattern language, in Chapter 6, 7, and 8 (section 3.3); and
- *metainquiry*, as interplaying differences and similarities across descriptive theories, to further building normative theory emphasizing innovation learning, in Chapter 9 (section 3.4).

The data collected centers on IBM, sweeping in the activities of business partners and industry competitors. As a publicly-traded corporation that has been a part of the Dow Jones 30 since 1979, the large volume of press releases and news reports daily presents challenges in making sense of

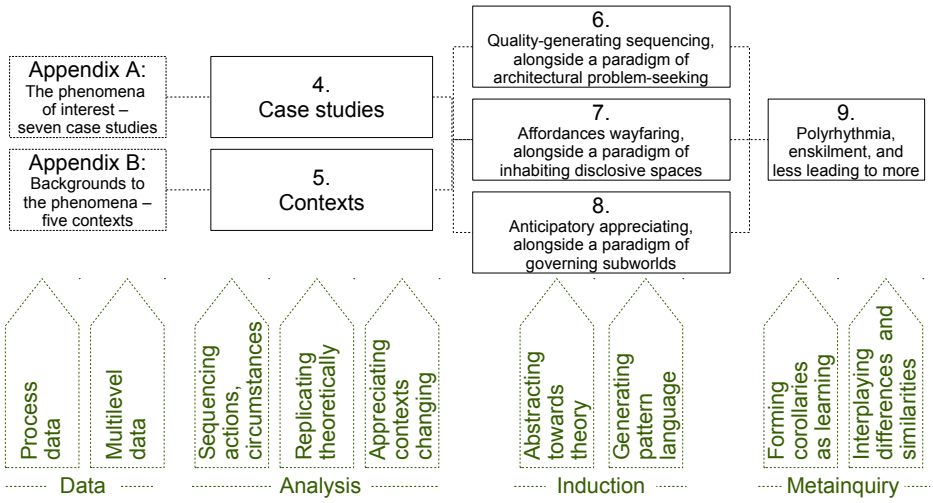

Figure 3.1. Considerations in research approach by chapter

situations, rather than accessing content. With IBM formally declaring works under open sourcing conditions and continually providing guidance, open community members were as close to an equal footing with IBM employees as practical. Competitively sensitive IBM information was not collected for this research. Specifically cited internal use documents used for triangulation were openly available to each and every of the 300,000 to 400,000 on the IBM intranet. The research author was an employee of IBM between 1985 and 2012 on a professional career track, and did not have profile-holding management responsibilities.

3.1 Data: The history of open sourcing while private sourcing is observed as events, activities and choices ordered over time

The data window starts with 2001 as a watershed year, with the January announcement of a plan to invest $1 billion in Linux over the following three years (IBM, 2001, p. 21). Seven case studies in Appendix 1 (reduced to Chapter 4) provide parallel histories through 2011. These cases were selected as significant multi-year initiatives by IBM, where *OSwPS* behaviour progressed. Within that time period, the earliest cases progressed from startup to winddown, while the later cases continued beyond the timebox. Five contexts over all of the case studies are described in Appendix B (reduced to Chapter 5).

The nature of the datasets has driven their handling as (i) process data, as overlapping time series histories; and (ii) multilevel data involving individuals, workgroups and organizations in both corporate and noncommercial contexts. The considerations for process data and multilevel data are described in the following two subsections.

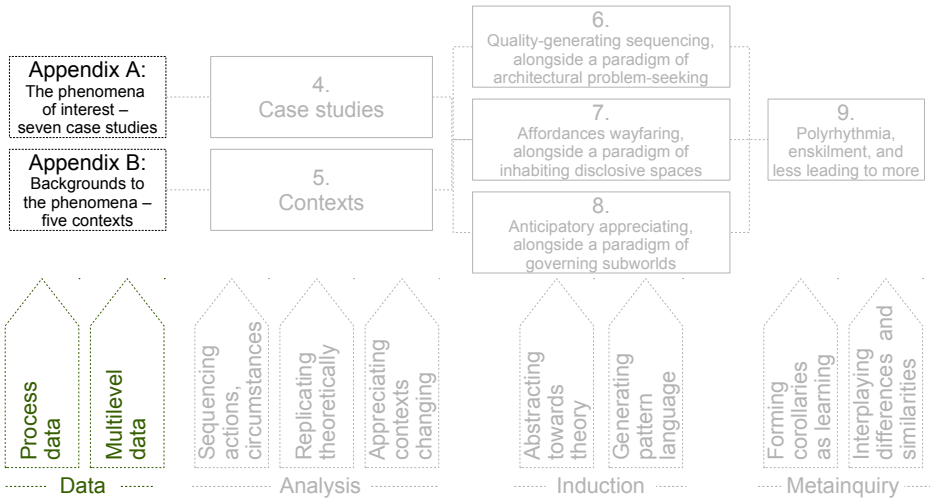

Figure 3.2. Data in Appendices A and B

3.1.1 Process data: Over a decade, ways that open sourcing does and doesn't work with private sourcing were discovered

Insight into evolving phenomena such as organizational learning, innovation and change can be gained through studying data longitudinal over time, rather than as cross-sectional views at a single point in time. When a body of theory is limited and fine-grained qualitative data is available, new theories can be built and later tested with time series and event history methods.

Process data are series of events, activities and choices ordered over time. For researchers, four characteristics that makes them difficult to analyze and manipulate.

> First, they deal mainly with sequences of "events": conceptual entities that researchers are less familiar with. Second, they often involve multiple levels and units of analysis whose boundaries are ambiguous. Third, their temporal embeddedness often varies in terms of precision, duration, and relevance. Finally, despite the primary focus on events, process data tend to be eclectic, drawing in phenomena such as changing relationships, thoughts, feelings, and interpretations (Langley, 1999, p. 692).

The data on *OSwPS* in Appendices A and B follows that list of four characteristics.

On (i) "data composed of events", the most interesting aspects are "stories about what happened and who did what when". Actions and decision made under uncertainty may provide more insight than directions espoused a priori.

On (ii) "data on multiple units and levels of analysis with ambiguous

boundaries", some actions were taken by individuals formally charged with responsibilities and resources, whereas others have relied on guidelines and volunteerism, within and beyond organizational boundaries.

On (iii) "data of variable temporal embeddedness", the sequences of events occurs at irregular periods, and histories recalled retrospectively tend to focus on significant changes. Individuals and groups learned about *OSwPS* not only within the confines of a single case, but across the organization in complementary or peripheral projects and activities.

On (iv) "data that are eclectic", variables and events are intertwined. In the cases that have spanned years, the players – both individuals and organizations – have changed. The cases may include unclear and evolving purposes altered from hands-on learning, factors in the larger organization, or unforeseen external pressures.

A study based on longitudinal data in the real world does not have the benefit of data on "the road not taken". There is, however, a reality of action from conscious choices made by actors immersed in the situation.

3.1.2 Multilevel data: open sourcing while private sourcing coevolved for individuals, teams, corporations and non-profits

The origins for seven case histories on *OSwPS* vary: some started as formally funded corporate initiatives, and others started as voluntary contributions by individuals working on their own time. In an open sourcing style, relatively few people are committed full-time to an exploratory project, yet success is later measured through the widespread adoption of an innovation.

In a multilevel approach, individuals, groups and organizations are embraced simultaneously, with two advantages. Firstly, researchers can avoid significant fallacies associated with single-level empirical research.[125] Secondly, a multilevel perspective opens up new opportunities for theory understanding linkages between levels.

In a business working in *OSwPS* at an organizational level, there will be also be individuals and groups concurrently working in open sourcing only (*OSo*) or in private sourcing only (*PSo*). Further, employees can be active with other parties outside of the company participating in *OSo* and *PSo* communities. An approach that includes data from multiple levels encourages an appreciation of the interdependencies that are simultaneously in

[125]Fallacies include (i) a *cross-level fallacy* in construct validity, whereby individual-level phenomena give rise to higher-level phenomena; (ii) a *contextual fallacy* in internal validity, finding spurious relationships at lower levels while failing to account for higher-level relationships; (iii) an *ecological fallacy* in external validity, incorrectly assuming that a relationship that exists at a higher level exists in the same way at a lower level; and (iv) an *atomistic* fallacy in external validity, incorrectly assuming that a relationship that exists at a lower level exists in the same way at the higher level (Burton-Jones and Gallivan, 2007, p. 660).

play in the real world.

With multilevel process data as the source for study, the next section describes the approach for analysis.

3.2 Analysis: In hindsight, processual abstractions of evolutionary stages of open sourcing while private sourcing can be constructed

With the body of *OSwPS* data defined, analysis has been conducted with three considerations: (i) sequencing actions, circumstances and outcomes longitudinally; (ii) replicating theoretically across multiple case histories, and (iii) appreciating the changing context in the background for the duration of the study.

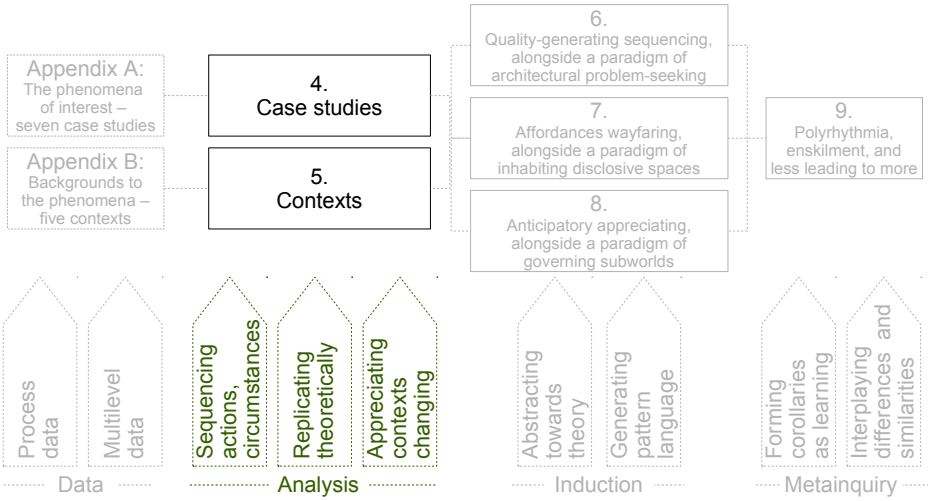

Figure 3.3. Analysis in Chapters 4 and 5

In Chapter 4, key *OSwPS* actions and events are charted for each of seven cases over the 10-year period, lined up with some *OSo* and *PSo* periods. While the emphasis is on in-case longitudinal histories, cross-case learning may influence decisions in sister initiatives and teams. Chapter 5 summarizes changing background contexts, as actors learned from larger trends in the world, particularly as open sourcing became more commonplace.

3.2.1 Sequencing actions and circumstances aims to explain outcomes in the stream of changes within a domain

The states of open sourcing and private sourcing for an initiative or offering are dynamic. The time-based nature leads to an analysis of process. In the context of organization science, a working definition for process is “a sequence of individual and collective events, actions and activities

unfolding over time in context" (Pettigrew, 1997, p. 388). Process thinking "may involve consideration of how and why things – people, organizations, strategies, environments – change, act and evolve over time ... or ... how such 'things' come to be constituted, reproduced, adapted and defined through ongoing processes (Langley, 2007, p. 271). The role of time is more prominent than in cross-sectional models that may assume an equilibrium state, and variance theories that do not take advantage of temporally embedded accounts.

Processual analysis involves more than just the telling of stories in a case history. "The irreducible purpose of a processual analysis remains to account for and explain the why, why and how of the links between context, processes and outcome" (Pettigrew, 1997, p. 340). With the events and chronologies as building blocks, processual analysis includes three factors: (i) "a search for patterns in the process and presumably some attempt to compare the shape, character and incidence of this pattern in case A compared with case B"; (ii) "a quest to find the underlying mechanisms which shape any patterning in the observed processes", and (iii) inductive pattern recognition hand in hand with a deductive component, particularly in the structuring of data sets (Pettigrew, 1997, p. 339).

This process thinking is compatible with the strategy-as-practice perspective "with its focus on strategy as 'something that people do' on micro-level activities and practices. In general, though, process "does not necessarily demand a micro focus and can be applied to temporally evolving phenomena at a variety of different levels (individual, organizational, sector, field), including phenomena related to strategy content issues" (Langley, 2007, p. 272).

3.2.2 Replicating theoretically across multiple case studies infers a business context changing systemically, rather than just situationally

This study on *OSwPS* takes an approach of multiple case studies in *theoretical replication*, which should lead to contrasting results for predictable reasons (Yin, 2003, p. 47). While these cases are centered on a single company, their contexts vary. Some cases involve open sourcing communities external to the company; some emphasize internal employee participation; some cross over from internal to external. Some cases center more on formal roles in developing and delivering product, others engage volunteers. This applies an integrative form of "longitudinal replication" where "temporal brackets ... are constructed in progressions of events and activities separated by identifiable discontinuities in the temporary flow" (Langley et al., 2013, p. 7).

The alternative of multiple case studies for *literal replication* does not lend itself to the time-oriented nature of situations and choices in those

contexts. The aim is for “more robust, generalizable and testable theory (Eisenhardt and Graeber, 2007, p. 27). The learning within the ten years between 2001 and 2011 sees a ramp from *OSwPS* as unconventional way of doing business, to practices acknowledged and adopted in a variety of industries.

3.2.3 Appreciating contexts changing sees individual/workgroup dynamics coevolving with organizational/institutional redefinitions

While the focus of this study on *OSwPS* has been centered on seven case studies, the processes are both shaped and shaped by context.[126]

In a multilevel study the boundaries between inner context (i.e. including individuals and groups within an organization) and outer context (e.g. an organization in its environment) dissolve.[127] Participation in open sourcing communities, and privileged interorganizational sharing of private sourcing content presents contexts that transcends boundaries.[128] Each case has its own context, yet those contexts overlap as learning from one situation in *OSwPS* informs another. The inner context is addressed more in Chapter 4; the outer context follows in Chapter 5.

[126]The importance of context to processual analysis has emphasized: "Thus far I may have underplayed the role of context in a processual analysis. If the process is our stream of analysis, the terrain around the stream which shapes the flow of events and is in turn shaped by them is a necessary part of the process of investigation. However, the interactionist field of analysis occurs not just in a nested context but alongside other processes. Metaphorically we are studying some feature of organisational life not as if it represents one stream in one terrain, but more like a river basin where there may be several streams all flowing into one another, dependent on one another for their life force and shaping and being shaped by varieties of terrain each constraining and enabling in different intensities and ways. This quality of the interactionist field moves us into the form of holistic explanation which is the apotheosis of the processual analysis" (Pettigrew, 1997, p. 340).

[127]An orientation emphasizing practice (i.e. what people do) over teleology (i.e. intent) doesn’t require the same specification of boundary for an *inner context* where the management declares authority and an *outer context* where influence is less direct. “Outer context includes the economic, social, political, competitive and sectoral environments in which the firm is located. Inner context refers to the inner mosaic of the firm; the structural, cultural and political environments which, in consort with the outer context, shape features of the process. Processes are embedded in contexts and can only be studied as such” (Pettigrew, 1997, p. 340).

[128]The distinctions between inner context and outer context are criticized in a chapter on “Pettigrew and contextualism” in (Caldwell, 2006). The introduction of (Pettigrew, 2003, p. 301) quoting being-in-the-world by Heidegger may suggest that distinctions between inner and outer are less important than the basic idea of context.

3.3 Induction: From data towards building theory, open sourcing while private sourcing instances are generalized to hypotheses

This research on *OSwPS* aims at theory-building. In cycles of theory building in management research, communities of scholars cumulatively build valid and reliable theory, at two levels: "the individual research project and the iterative cycles of theory building in which a researchers attempt to build upon each other's work" (Carlile and Christensen, 2005, p. 1). As an early study in this domain, this work is an individual research project.

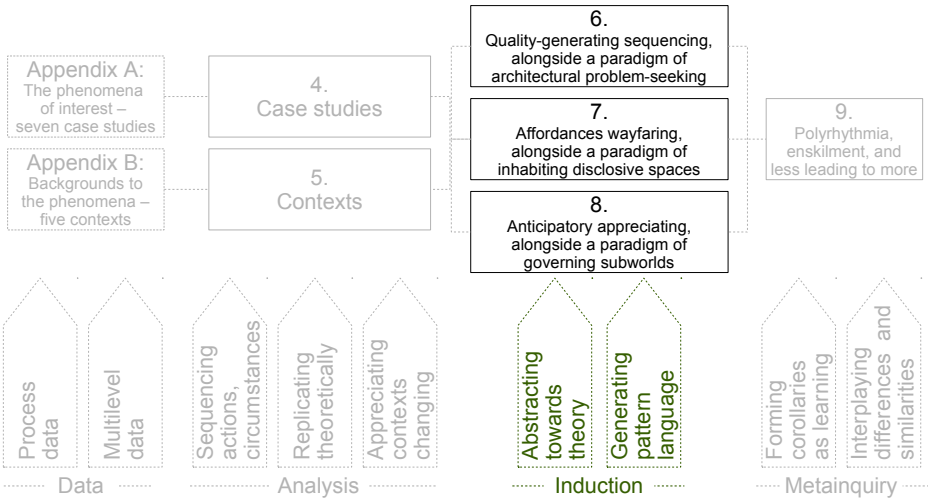

Figure 3.4. Induction in Chapters 6, 7 and 8

Abridging the many in-depth references on methodology, the most visible manifestations in this study of open sourcing are in (i) abstracting from the case studies inductively, and (ii) generating pattern language that may infer theories for future research. These two activities are conducted in three parallel chapters, 6, 7 and 8, coming from contrasting paradigms that will underlie the theories built.

3.3.1 Abstracting towards theory draws from concrete case studies supplemented by descriptions of contemporaneous contexts

In this study on *OSwPS*, inductive reasoning[129] is applied: cases are used

[129]There are three forms for reasoning, originating from Charles Sander Peirce: deduction, induction and abduction (Burch, 2009). "C. S. Peirce's insight was that in any reasoning process you might always deal with three distinct entities: 1. A Rule (a belief about the way the world is structured); 2. A Case (an observed fact that exists in the world); 3. A Result (an expected occurrence, given the application of the Rule in this Case). The way in which you can consider yourself to be reasoning at any one time is determined by where you start in the process

to build theory (i.e. rules as beliefs about the way the world is structured).

"The building of theory occurs in two major stages – the descriptive stage and the normative stage" (Carlile and Christensen, 2005, p. 2). Chapters 6, 7 and 8 center on the former, the descriptive stage. Chapter 9 centers on the latter, the normative stage. The building of descriptive theory involves (i) observing, describing and measuring the phenomena; (ii) categorizing by the *attributes* of the phenomena; to induce (iii) preliminary statements of correlation.[130] The building of normative theory involves (i) observing, describing and measuring the phenomena (as with descriptive theory building); (ii) categorization of the *circumstances* in which we might find ourselves; to induce (iii) statement(s) of causality.

Observation of the phenomenon, as outlined in section 3.1, follows the processual history in seven cases and their containing contexts into descriptions of *constructs*. Categorization defines the attributes of the phenomenon, simplifying and organizing the observations into *frameworks and typologies*. Association defines the relationship between the categories defined, and the outcomes observed, resulting in preliminary *models*.

The result of these three steps leads to assertions – descriptive theory – across the scope of the data collected. Improving the theories from this study of *OSwPS* can then be conducted in subsequent deductive processes,

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and what additional fact you know" (Minto, 1976, pp. 210-211).
The three forms are closely related, and often used in rotation.
Deductive reasoning begins with the rule (e.g. if A then B), presents the case (e.g. A), leading to the result (necessarily B). Deductive reasoning is the pattern conventionally followed in problem solving, leading to a "therefore" conclusion.
Inductive reasoning begins with the case (e.g. A), presents the result (e.g. B), leading to the rule (e.g. if A then probably B).
"Induction defines a group of facts or ideas to be the same kind of thing, and then makes a statement (or inference) about that sameness"(Minto, 1976, pp. 60-61).
Abductive reasoning begins with noticing a result (an expected occurrence), looking for its cause in our knowledge of the structure of the situation (a rule) and testing whether we have found it (a case). This approach is used because the result can't otherwise be explained because (i) the structure doesn't exist (e.g. something new is being invented); (ii) the structure is invisible (i.e. only the results of the structure are available for analysis; or (iii) the structure fails to explain the result (i.e. existing definitions still leave a mystery) (Minto, 1976, p. 210).

[130] Building theory is different from proving theory.
"The central notion is to use cases as the basis from which to develop theory inductively. The theory is emergent in the sense that it is situated in and developed by recognizing patterns of relationships among constructs within and across cases *and* their underlying logical arguments.
Central to building theory from case studies is replication logic (Eisenhardt, 1989). That is, each case serves as a distinct experiment that stands on its own as an analytic unit. Like a series of related laboratory experiments, multiple cases are discrete experiments that serve as replications, contrasts, and extensions to the emerging theory (Yin, 2003). But while laboratory experiments isolate the phenomena from their context, case studies emphasize the rich, real-world context in which the phenomena occur. The theory-building process occurs via recursive cycling among the case data, emerging theory, and later, extant literature" (Eisenhardt and Graeber, 2007, p. 27).

where the models are tested with different sets of data.

The goal of this theory-building – both descriptive and normative – is to primarily to provide knowledge useful to practitioners in business. It aims to improve practices in management, with subsequent deductive work later improving the validity into a practical science.[131]

The applicability of findings beyond the domain in which the data have been collected present opportunities for abduction in putting normative theory-building into practice. Entrepreneurial business people, as well as researchers, may modify and/or extend the models, frameworks and typologies from the pioneering cases in the software business to other industries.[132]

Within the narrow scope of software development, practices in open sourcing and private sourcing are rather well-known and in common use. In the slightly broader scope of technology businesses, the definitions of open sourcing and private sourcing provide within this study will be somewhat unfamiliar in application. In an unbounded scope across the world of business, the interest and applicability in these models has yet to be asked.

3.3.2 Generating pattern language with a paradigm grounds a theory emerging with hypothesizing

In chapters 6, 7 and 8, analysis of the cases is presented in a repeating sequence of (i) paradigm description, (ii) theory emerging with the paradigm, (iii) generative pattern language entailing theory, and (iv) hypothesizing for a theory within the paradigm. This sequence reflects refinement of the data from constructs, through frameworks and typologies, towards models.

[131] Theories can be validated on pragmatic grounds: "[The] success of a theory should be measured by the accuracy with which it can predict outcomes across the entire range of situations in which managers find themselves. Consequently, we are not seeking 'truth' in any absolute, Platonic sense; our standard is practicality and usefulness. If we enable managers to achieve the results they seek, then we will have been successful" (Christensen and Raynor, 2003, p. 27).

[132] In *The Innovators Dilemma*, research into the disk drive industry was extended to mechanical excavators, steel, retailing, motorcycles, accounting software, motor controls, diabetes care, and computers. The real life experimentation by business practitioners will continue to lead the collection of history and testing of theories in other industries. This question is discussed in a footnote (23) in the book.
"Applying any theory to industry after industry cannot prove its applicability because it will always leave managers wondering if there is something different about their current circumstances that renders the theory untrustworthy. A theory can confidently be employed in prediction only when the categories that define its contingencies are clear. Some academic researchers, in a well-intentioned effort not to overstep the validity of what they can defensibly claim and not claim, go to great pains to articulate the 'boundary conditions' within which their findings can he trusted. This is all well and good. But unless they concern themselves with defining what the other circumstances are that lie beyond the 'boundary conditions' of their own study, they circumscribe what they can contribute to a body of useful theory" (Christensen and Raynor, 2003, p. 29).

From the cases, theories have emerged inductively: quality-generating sequencing, in section 6.2; affordances wayfaring in section 7.2; and anticipatory appreciating in section 8.2. Simultaneously, three paradigms in which the theories are further developed have emerged inductively. This follows from a multiparadigm approach to theory-building that may surface inherent and irreconcilable theoretical differences and lead for more comprehensive interplay.[133]

A paradigm is a world view underlying the theories and methodology of a particular scientific subject.[134] Outlining key concepts in a paradigm clarifies the use of words in specific meanings. The paradigm discussed in section 6.1 is architectural problem-seeking; in section 7.1, it is inhabiting disclosive spaces; and in section 8.1, it is governing subworlds.

Within each of the three chapters that follow, a generative pattern language format is used to establish some consistency in the structure of descriptions around theories and paradigms. The pattern language approach has been adapted from its 1960s roots in built environments to today's world of service systems.

In the domain of architecting built environments, a *pattern* was originally defined as an abstract relation (e.g. between solution and problem) that occurs within some conditions (e.g. a range of contexts).[135] Architecture of "unselfconsciously" constructed artifacts of tradition were observed to not suffer from the adaptation, quality and usability failures criticized in the products of rational professionalized design practices.[136] Building on expe-

[133]Traditional approaches to theory building in organizational studies have been criticized "because they are predicated on the tenets of one major paradigm ....or way of understanding organizational phenomena" (Gioia and Pitre, 1990, p. 584). Approaching theory building from three different paradigms enables expanding a "research repertoire by triangulating alternative philosophies of science to gain a richer and more holistic understanding of a complex organizational and managerial problem being investigated" (Bechara and Van de Ven, 2011, p. 344). Thus, in addition to the more traditional theory triangulation within a single paradigm, *philosophical triangulation* "emphases validity on divergent data while providing a way of including, incorporating, and maintaining pluralistic findings or perspectives that may be contradictory or inconsistent" (Joslin and Müller, 2016, p. 1047).

[134]The Oxford English Dictionary defines a paradigm as "a conceptual or methodological model underlying the theories and practices of a science or a discipline at a particular time; (hence) a generally accepted world view", based on (T. S. Kuhn, 1967). Otherwise, the less formal meaning of a pattern or model dates back to 1483.

[135]In its simplest form, "Each pattern is a three-part rule, which expresses a relation between a certain context, a problem, and a solution" (Alexander, 1979, p. 247). In a more complete description, "We see, in summary, that every pattern we define must be formulated in the form of a rule which establishes a relationship between a context, a system of forces which arises in that context, and a configuration which allows those forces to resolve themselves in that context. It has the following generic form:
Context → System of forces → Configuration" (Alexander, 1979, p. 253).

[136]Predating the work on pattern language, Notes on the Synthesis of Form

riences evolving in architectural practice since the 1960s, formalization of a scientific pattern method has been proposed some 50 years later.[137]

The origins of pattern language are rooted in a mathematical sense of *formal language* (as can be compared to natural language).[138] With formal languages, inductive inference that includes both positive data and negative data is more powerful than inference only from positive data.[139]

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counters analytic orientations:
"... as discussed in *Notes*, the notions of analysis and synthesis are badly, and harmfully, construed ...
The main problem lies in separating activities surrounding analysis and synthesis rather than recognizing their duality. [....]
Model, process, context, and artifact are all intertwined aspects of the same system. Artificial separations of models, phases, and roles break these connections. [....]
In *Notes*, Alexander argues that the key to methodological continuity, integration, and unification is to temper, or even replace intensionally [sic] defined models with reliance upon complete, extensionally-described sets of constraints, specific to each design effort" (Lea, 1994, p. 40).

[137]A scientific pattern method has been described, based on the "tracks" of Christopher Alexander.
"Summarizing the key concepts of the elements of pattern method, the following overall picture emerges:
1. *Living systems* are the main concern of the pattern method, whether biological, non-biological ...
2. *Pattern descriptions* support the understanding of systems ...
3. *Pattern languages* are nearly complete collections of patterns. [....]
4. *Judging the quality of living systems and participation*: Patterns are options which have clear effects ...
5. *The practice of unfolding*: The architect modifies his role to become a coach of participation. [....
The pattern method is a scientific method because it arrives at rationally produced a socially useful knowledge which can be verified in the framework of the society. This knowledge is synthetic because it relates to whole systems. Complete control of the processes from outside is considered neither possible nor desirable. [...] The truth as corroboration or falsification of the results depends on the outcomes of the design process being judged by those affected" (Leitner, 2015, pp. 141-142).

[138]Formal languages are artificial constructs required in computer programming, for precision in describing states and changes in information. "A formal language is simply a particular set of strings over some fixed finite alphabet of symbols" (Angluin, 1980, p. 118). Natural languages (e.g. English, French) are spoken, evolving naturally amongst groups of human beings. Formal languages are designed by specialists for specific purposes (e.g. chemistry), as compared to natural languages. This meaning differs from the linguistic distinction between formal language (i.e. grammar and vocabulary used in serious situations with people we don't know) and informal language (used in relaxed situations involving people we know).

[139]Defining a formal language effectively not only specifies the symbols that are included (i.e. positive data), but also the symbols that are excluded (i.e. negative data). Having both positive and negative data deals with the problem of overgeneralization. "If in the course of making guesses the inferring process makes a guess that is overly general, i.e., specifies a language that is a proper superset of the true answer, then with positive and negative data there will eventually be a counterexample to the guess, i.e., a string that is contained in the guessed language but is not a member of the true language. No such specific conflict with the examples will occur in the case of inference from positive data" (Angluin, 1980, p. 118).

In specifying a constructive inference method for a formal language, the grammar should have characterizable results (i.e. correct identification) and efficiency (in a relatively small language that could be produced in polynomial time).[140]

Pattern languages have been proposed as *lingua francas* (i.e. common languages – as multiple *lingua franca*) accessible to all stakeholders in a design process.[141] In a design process with high diversity (e.g. interactive systems involve visual designers, social scientists and technologists), a pattern language that includes both vocabulary and conceptual frameworks brought by disciplines and professionals, can serve as a *lingua franca* for communicating in a more egalitarian way.

In developing a pattern language, induction precedes deduction. Pattern language can be used on empirical studies as representations from which design work is derived.[142] From qualitative data, (i) inductive analysis methods are used to identify patterns, (ii) deductive methods are used to articulate (i.e. structure and format) the patterns into a language; and (iii) comparative methods can be used to extend the contexts in which the pattern language has validity.[143] Pattern language can be generated

[140]The concerns for a pattern language to be generated through efficient and characterizable methods bounds the search to a feasible space. Extending a pattern language may or may not satisfy those bounds (Angluin and C. H. Smith, 1983, p. 261).

[141]As a design method, pattern languages are part of the communicative aspect of design. The end users (or inhabitants of an architecture) sometimes don't have sufficient appreciation of technical issues that will eventually impact them. "[First] programmers, then later designers applied Alexander's patterns and his design politics in practice" (Steenson, 2016, p. 2). The pattern language created by Alexander has four attributes that "make it suitable for generating lingua francas": (i) Alexandrian patterns are embodied as concrete prototypes rather than abstract principles: (ii) Alexandrian patterns are grounded in the social, focusing on interactions between the physical form of the built environment and the way it inhibits or facilitates sorts of behaviours within it; (iii) Alexandrian patterns express values as part of their representational power, in both descriptive and prescriptive uses; and (iv) Alexandrian patterns are amenable to piecemeal use that can later be re-tested, generalized and redefined. A pattern language not aimed strictly at the built environment might be "oriented towards events or situations" (T. Erickson, 2000, pp. 362-364).

[142]Pattern language is neither necessary nor sufficient with ethnographic work, but can be helpful. "It is not the intention behind either the notion of patterns or the development of a pattern language that these should guide *fieldwork* in any way. The patterns we document are drawn from the fieldwork as grossly observable patterns of activity and interaction. The intent behind the construction of these patterns is that they will serve both as a means of *documenting* and *describing* common interactions, and as a vehicle for *communicating* the results of a specific analysis to designers – to be drawn upon and used as a resource for design. The presentation of different patterns of interaction seeks to allow different *general principles* and issues to be presented alongside *specific* material drawn from empirical studies" (D. Martin et al., 2001, p. 41).

[143]A pattern language approach can be applied on ethnographic data as a part of interpretational analysis. The "identification of patterns is largely experience based. .... An inductive analysis method was used to generalize the observations and develop categories to guide further observations". Pattern articulation [sees]

through collaborations amongst people who have tacit knowledge within a target domain.[144] The validity of a pattern language is not testable as the hypothesis of a single pattern, but instead in the network of hypotheses and their interactions as a complex system.[145]

A feature of *pattern language* that is often under-emphasized is the associative network that selectively links patterns to others at (a) larger scale(s) and/or (a) smaller scale(s). Recasting pattern language from its structuralist roots to a more interactionalist philosophy, an alternative format makes containing and contained systems more explicit (Ing, 2016, p. 11). The pattern form proposed for framing service systems thinking is outlined in Table 3.1.

This adaptation sees OSwPS (and infers PSo and OSo) with parties engaged in service systems. The following definitions guide authoring of the pattern.

(i) Pattern label: A service system involves an interaction – minimally between a beneficiary and a provider – and thus can be expressed as a present participle. Attaching an "-ing" suffix to a verb in English changes it to a continuous form. For conciseness, a participial phrase with a noun suffices (and a longer expression draws risks of a dangling participle).

(ii) Voices on issues: A service system introduces human perspectives into a pattern. Voices are heard (or not heard) from archetypal roles of stakeholders. Stakeholders of a service system could include not only beneficiaries, sponsors and funders, but also neighbours and regulatory bodies seeking constraints on impacts (sometimes called externalities). Expressing issues as questions, rather than problem as statements, can

reasoning and interpretation [moving] from general principles and theories to the particular and specific predictions ...." (Schadewitz and Jachna, 2007, p. 16).

[144]For over 20 years, the Hillside Group has conducted meetings where pattern languages are developed by writers guided by shepherds, with eventual reviews in peer-to-peer workshops. An alternative framing of the basic procedure for making a pattern language is a back-and-forth progression through five phases: (i) *pattern mining*, to discover patterns embodied in minds and activities within the target community; (ii) *pattern prototyping*, clarifying what is to be made, and sharing images of work-in-progress; (iii) *pattern writing*, both in text and illustration form; (iv) *language organizing*, reflecting and reconsidering every pattern in relation to other patterns; and (v) *catalogue editing*, forming the pattern language into a sequential work for publishing with table of contents and an explanation of how to read (Iba, Sakamoto, and Miyake, 2011, pp 48-49).

[145]A pattern language, as a complex system, begins as a network of claims which then require validation in its parts and as a whole. In the Alexandrian context-solution form, "a pattern is not just a simple hypothesis (if context then solution) but a network of hypotheses that explain the forces that cause the fitness between context and solution, these hypotheses count for the content as well. Each force tells something about the context and problems, and each force can be falsified empirically. That is, we can test whether all the forces actually exist in a given context and whether all the forces are actually resolved by a given solution. [...] It is important to notice that we can test all the claims and forces empirically, but we cannot do this in isolation. We cannot test a single force or a single design variable ceteris paribus. The reason is that there are interdependencies between the form variables. This is typical for complex systems ..." (Kohls, 2014, p. 140).

Table 3.1. Pattern form (for service systems thinking)

(i) Pattern label	An interaction phrased as a present participle
(ii) Voices on issues (who and what)	Archetypal roles of stakeholders, with concerns and interests posed as questions
(iii) Affording value(s) (how and why)	Objects and/or events that enable modes of practised capacities for independent or mutual action
(iv) Spatio-temporal frames (where and when)	Occasions at which dwelling in issues and affordances are salient and at hand
(v) Containing systems (slower and larger)	Constraining conditions in which the pattern operates, potentially where multi-issue messes are dissolved
(vi) Contained systems (faster and smaller)	Opportunistic conditions which the pattern contains, potentially allowing ad hoc resolving of a specific issue at hand

serve as checklist for determining whether an issue has been dealt with, or at least acknowledged. An issue for a service system could be expressed as a one-to-many relation.

(iii) Affording value(s): Affording an action possibility with value for a service system under specified conditions is neither necessary nor sufficient to resolve an issue. With an affordance, an object or event becomes available for an individual or a group to use in practice.

(iv) Spatio-temporal frames: The when and where of affording value(s) is socially negotiated between a client and a service provider. As an example, a service system that electronically provides an affordance for routing around traffic congestion, consider the when and where of (i) a dedicated GPS navigation device and (ii) a mapping app on a smartphone. For the features of aided routing for either a driver or a pedestrian, the service provider must have already mapped that territory before the client encounters that place. For the driver or pedestrian, a smartphone app normally requires an active wireless Internet service, while the GPS doesn't. A service system providing an "affordance" would presume that a person has eyesight and would not autonomically navigate himself or herself into a ditch.

(v) Containing systems: Authentic systems thinking starts from containing whole.[146] A client of a service system is typically defined as being

[146]This general definition of systems thinking applies to service systems.
"In systems thinking, there are ... three steps:
1. Identify a containing whole (system) of which the thing to be explained is a part.
2. Explain the behavior or property of the containing whole.
3. Then explain the behavior or properties of the thing to be explained in terms of

outside its systems boundaries, and therefore part of the containing whole. In situations where a client is not merely a consumer, but instead a coproducer, the definition of the system changes. "Value co-produced by two or more actors, with and for each other, with and for yet other actors, invites us to rethink organizational structures and managerial arrangements for value creation inherited from the industrial era" (Ramírez, 1999, p. 49).

(vi) *Contained systems*: From panarchy theory, smaller and faster systems can "revolt" to change the system of interest (Gunderson and Holling, 2002). In service systems, this is typically demonstrated by a segment of clients voicing shared concerns resulting in a response by the provider, or exit from that relationship to other alternatives.

As the data for the research is focused on *OSwPS* as a concern, induction has led to three patterns in sections 6.3, 7.3 and 8.3. A *concern* is a matter of interest originating from one or more stakeholders in a system.[147] Concerns can be typed in many ways, e.g. logical concerns vs. physical concerns; simple concerns vs. composite concerns.[148] Concerns are defined to exist in multiplicity, concurrently and in overlapping classifications or dimensions.[149] The *separation of concerns* challenges decomposing matters of interest while composing systems with reduced complexity that facilitate evolution.[150] Within a paradigm, *OSwPS* is regarded as a concern separate from, although related to *OSo* and *PSo*. To gain an appreciation of contrasts with *OSo* and *PSo*, partial patterns have inferred for each of those concerns, without collecting additional data to validate them. This approach leads to 3 full patterns and 6 partial patterns in each of sections 6.3, 7.3 and 8.3. The motivation for this extension is to strengthen the inductive approach of theory building, relying first on the data collected specifically for this study. The subsequent inclusion of complementary data is a process of enfolding that “involves asking what is this similar to, what does it contradict, and why” (Eisenhardt, 1989, p. 544).

In sections 6.4, 7.4 and 8.4, hypotheses are stated formally as emerging propositions that may be deductively tested with datasets in similar or

its **roles(s) or function(s)** within its containing whole.
Note that in this sequence, synthesis precedes analysis" (Ackoff, 1981a, pp. 16-17).

[147] Concern modeling originates in the design of software systems, but is not necessarily restricted to the technical domain (Harrison et al., 2005).

[148] Specifying types of concerns leads to typing of concern relationships, i,.e. kinds of mapping (e.g. logical to physical), subtypes of relationship (e.g. contribution, motivation, admission, implementation), and attributes and properties (e.g. name and description) (Sutton and Rouvellou, 2001).

[149] The multidimensionality of concerns isn’t a problem conceptually, but leads to challenges with implementation, e.g. in object-oriented design (Harrison et al., 2005).

[150] The domination of single dimension of separation in situations of simultaneous overlapping concerns in multiple dimensions is described as a "tyranny of the dominant decomposition" (Tarr et al., 1999).

different businesses.

3.4 Multiparadigm research: Interplay across pluralistic paradigm accommodates multiple worldviews

The building of descriptive theory associated with multiple paradigms is a milestone in researching *OSwPS*. The building of normative theory extends the research with pluralistic contexts through multiparadigm inquiry. This broadens the range of models for alternative views of the same phenomenon. Emerging (an) additional paradigm(s) is neither an exhaustive nor mutually exclusive direction, as distinctions run deep in their underlying philosophies. Rather than synthesizing across paradigms, interplay leaves combinations or exclusions to each reader suited to his or her own purposes.



Figure 3.5. Metainquiry in Chapter 9

The normative theory building completing this research work is in Chapter 9.

3.4.1 Corollaries learning across plural paradigms reflection on the design of underlying inquiring systems

Inquiring systems can be categorized into five ways of knowing: (i) inductive-consensual, (ii) analytic deductive, (iii) multiple realities, (iv) dialectic, and (v) unbounded systems thinking (Mitroff & Linstone, 1993). These correspond to the philosophies of (i) Locke, (ii) Leibniz, (iii) Kant, (iv) Hegel, and (v) Singer (Churchman, 1971). This study on *OSwPS* recognizes multiple realities, and the potential for dialectic. The presentation building descriptive theories each associated with a distinctive paradigm does not

exclude the potential for additional worldviews. This is consistent with the principle of "sweeping in" more knowledge towards unbounded systems thinking.

In prior organizational research, pluralistic contexts have been acknowledged. They may be characterized by features such as multiple objectives, diffuse power and knowledge-based work processes, with some organizations "more pluralistic than others".[151] The decentralization of authority around clusters of customer and assets results in a work life where the combined resources of empowered employees with internal and external parties results in unique rather than universalistic contexts.[152] An organization may attempt to command-and-control policies on open sourcing and/or private sourcing, but collaborative arrangements will be made in one of the many situational horizontal (and interorganizational) contexts.

Pluralism in paradigms has been applied in organizational research is a way of accommodating multiple worldviews.[153] Alternative approaches to inquiry bring different assumptions about (i) ideology, (ii) ontology, and (iii) epistemology. These assumptions are summarized for modern paradigm approaches, multiparadigm approaches and postmodern paradigm approaches in Table 3.2. (Lewis and Kelemen, 2002, p. 254)

As research that has started from an inductive method on a phenomenon, this study on open sourcing while private sourcing follows the goals of a multiparadigm approach, with (i) an accommodating ideology, (ii) a stratified ontology, and (iii) a pluralist epistemology.[154]

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[151]Organizational boundaries are seen as more porous. "As organizations in many industries enter into various forms of collaborative arrangements, as matrices and networks penetrate organizational structures, and as knowledge workers play an increasingly important role in the economy, pluralistic forms of organization are becoming more and more prevalent" (Denis, Langley, and Rouleau, 2007, pp. 179-180).

[152]Knowledge work shifts authority. "When employees become subjects rather than objects in organizations and their own judgments guide their actions *vis-a-vis* the people they deal with in their internal as well as external relationships, the strategic apex no longer exists, neither as a center of information nor as a center of power and authority" (Løwendahl and Revang, 1998, p. 759).

[153]A "paradigm offers coherent assumptions regarding how the world should be studied – assumptions that attract an enduring community of scholars, yet remain sufficiently openended (Lewis and Kelemen, 2002, p. 252).

[154]Why a multiparadigm approach?

"In sum, the primary goals of a multiparadigm approach are twofold: (1) to encourage greater awareness of theoretical alternatives and thereby facilitate discourse and/or inquiry across paradigms, and (2) to foster greater understandings of organizational plurality and paradox.

Multiparadigm researchers apply an *accommodating* ideology, valuing paradigm perspectives for their potential to inform each other toward more encompassing theories. [....] Multiparadigm inquiry strives to respect opposing approaches and juxtapose the partial understandings they inspire. Paradigm lenses may reveal seemingly disparate, but interdependent facets of complex phenomena.

Multiparadigm inquiry promotes a *stratified* ontology, assuming multiple dimensions of reality. Reality is at once 'made' and 'in the making' as advocates examine both entities and processes, rather than collapsing these dimensions. [....]

Table 3.2. Alternative approaches to inquiry (Lewis & Kelemen, 2002)

	Modern	Multiparadigm	Postmodern
Ideology	*Centering* Focus on authorship, promote chosen voices, beliefs and issues Sharpen selective focus	*Accommodating* Value divergent paradigm lenses Explore paradox and plurality	*De-centering* Stress fluctuating and fragmented discourses Accentuate difference and uncertainty
Ontology	*Strong* States of being Entities are distinct, determinant and comprehensive	*Stratified* Multiple dimensions Expose interplay of entities and process	*Weak* Processes of becoming Meaning are indeterminate, in constant flux and transformation
Epistemology	*Restricted* Employ paradigm prescriptions systematically Construct cohesive representations to advance paradigm development	*Pluralist* Apply divergent paradigm lenses Reflect organizational tensions and encourage greater reflexivity	*Eclectic* Use varied methods freely Deconstruct organizational contexts and processes to produce small stores or modest narratives

Building descriptive theory through multiparadigm inquiry takes a multiparadigm research approach. This should be not confused with multiparadigm theory building that attempts to link conflicting paradigm insights.[155] This choice may leave unresolved paradoxes with theoretical

In multiparadigm inquiry, a *pluralist* epistemology 'rejects the notion of a single reference system in which we can establish truth' as bounded rationality binds us within our own learning processes, while allowing us to explore alternatives (Spender, 1998: 235). Advocates assume that paradigm lenses help construct alternative representations, exposing different dimensions of organizational life" (Lewis and Kelemen, 2002, pp. 258-259).

[155]Multiparadigm inquiry can be distinguished into three approaches: (i) multiparadigm reviews, (ii) multiparadigm research, and (iii) metaparadigm theory building. The motives for different approaches can be distinguished.
"Multiparadigm reviews involve recognition of divides and bridges in existing theory (e.g., characterizing paradigms X and Y), whereas multiparadigm research

contradictions and oppositions embedded in complex traditions (M. S. Poole and Ven, 1989, p. 564). In the design of an inquiring system as unbounded systems thinking, this should encourage “sweeping in” of additional knowledge.[156]

3.4.2 Interplaying across multiple paradigms encourages fuller synthesis for future development

Having selected an approach of multiparadigm research, there is a choice of metatheoretical positions that include (i) *paradigm incommensurability*, where each paradigm is developed and applied separately; (ii) *paradigm integration*, assessing and synthesizing a variety of contributions ignoring differences between competing approaches and underlying assumptions; and (iii) *paradigm crossing* in sequential, parallel or bridging approaches. This research on *OSwPS* takes a metatheoretical position of (iv) *paradigm interplay* that “refers to the simultaneous recognition of both contrasts and connections between paradigms and, thus, to both the differences and similarities between paradigms that are emphasized by the parallel and bridging strategies, respectively” (Schultz and Hatch, 1996, p. 534). This enables cross-fertilization across diverse perspectives without demanding integration.[157]

Mixing inductive reasoning with a discussion of paradigms leads to issues of incompleteness. Starting from paradigmatic categories (e.g. sociological theories as functionalist, interpretive, radical humanist and radical structuralist (Burrell and Morgan, 1979)) is deductive. Alternative paradigmatic categories (e.g. by discursive features as normative,

involves using paradigm lenses (X and Y) empirically to collect and analyze data and cultivate their diverse representations of organizational phenomena. Lastly, in metaparadigm theory building, theorists strive to juxtapose and link conflicting paradigm insights (X and Y) within a novel understanding (Z)" (Lewis and Grimes, 1999, p. 673).

[156] As this work progresses from data towards theory, the perspectives within three paradigms can be seen as a beginning, not and end. “The researcher consciously and tenaciously pursues theoretical inconsistencies, rather than dismissing them or resigning them to the "theoretical disagreements" category. Rather than regarding each theory as a self-encapsulating whole, the theorist can play theories off against one another, gaining insights from multiple perspectives and comparative analysis. In this view, theories are not statements of some ultimate "truth" but rather are alternative cuts of a multifaceted reality. Alternative theories give partial views, and the theorist’s task is to sort them out and work out their relationships (M. S. Poole and Ven, 1989, p. 563).

[157] The paradigm boundaries are seen as permeable, so that researchers can jointly emphasize contrasts and connections, moving back and forth while keeping paradigms in tension.
"While paradigm interplay may result in an understanding similar in form to paradox, the approach differs by stressing the interdependent relationship between constitutive oppositions. While the application of paradox in organization theory aims to accept, clarify or resolve contradictions, paradigm interplay preserves the tension between contrasts and connections at the metatheoretical level in order to theorize organizations in new ways" (Schultz and Hatch, 1996, p. 530).

interpretive, critical and dialogic (Deetz, 1996); or by systems approaches as functionalist, interpretivist, emancipatory and postmodern (Jackson, 2000)) have added to lists for consideration for deductive inquiries. This study on open sourcing while private sourcing leans towards an *explanationist view* "acknowledging the use of pragmatic virtues in reasoning and embraces the idea that theoretical explanation indeed plays a role in scientific inference" rather than the *Spartan view* that "rejects pragmatic virtues and accepts truth as the only virtue in scientific inference (Ketokivi and Mantere, 2010, p. 317).

In normative approaches to systems analysis, the term "perspective" has generally been preferred over "paradigm". The *Multiple Perspective Concept* is consistent with principles in the design of an inquiring system that is a metainquiring system.[158] In sociotechnological systems – specifically technology assessments – three perspectives are proposed: a technical perspective (T), an organizational perspective (O), and a personal perspective (P).[159]

Multiple perspectives can be approached from a variety of philosophies and cultures. Based in Chinese philosophy, the WSR approach to interventions view sociotechnical systems as constituted by *wu* (objective existence), *shi* (subjective modeling) and *ren* (intersubjective human relations) (Gu and Zhu, 2000). When the American TOP (T, O, and P perspectives) is compared with the Chinese WSR (*wuli-shili-renli*), the multiperspective systems approaches each map the world and follow with methodological treatments differently, and yet can provide opportunities for mutual learning (Zhu, 2002). In systems research, increased sensitivity to the cultural dimension (e.g. west vs. east) in methodologies has been seen as overlooked in a world of deepening globalization (Zhu, 2010). In addition to the recognition of diversity in groups – as diverse perspectives, diverse

[158]The Multiple Perspective Concept may be seen as a Singerian inquiring system in Churchman's terms (Churchman, 1971):
"It is a metainquiring system (i.e. it includes all the other inquiring systems (data, model, dialectic, etc.);
It is pragmatic, i.e. the truth content is relative to the overall goals and objectives of the inquiry;
No single aspect has any fundamental priority over any of the other aspects;
It takes holistic thinking seriously that it constantly attempts to sweep in new components; it is in fact nonterminating and explicitly concerned about the future
It postulates that the system designer is a fundamental part of the system: his psychology and sociology are inseparable from the system's physical representation" (Linstone, 1981, pp. 299-301)

[159] "The word perspective is used to distinguish how we are looking from what we are looking at (i.e., an element)" (Linstone, 1981, p. 292). Perspectives may be related to roles, but are not necessarily tied to them. "*Any perspective may illuminate any element.* [....] One perspective may be able to offer all three perspectives (T, O, and P) on a problem – the rational analyst's, his organization's, and his own. Or one perspective may dominate his thinking and blind him to others. Perspectives are dynamic; they change over time. Most importantly, *the different perspectives are mutually supportive, not mutually exclusive*" (Linstone, 1981, p. 292).

interpretations, diverse heuristics, and diverse predictive models (Page, 2008) – the "simultanenous localization and globalization driven by information technology inevitably invites a variety of perspectives" (Linstone, 2010, p. 697).

In aspiring to the design of a metainquiring system, care is taken to not overstep its inductive nature with *OSwPS*. The crossing of philosophical distinctions follows the spirit of multiparadigm research and paradigm interplay, yet the perspectives may be neither orthogonal nor complete.

3.5 Summary: Inductive case study leading to metainquiry enables a platform and trajectory for further enrichment and theory-testing

This chapter on research approach has been reflexive with the study on *OSwPS*: starting with multilevel process data, analyzed with multiple processual analyses including changes in the background contexts, induced into descriptive theory and normative theory in the recognition of pluralistic contexts. The magnitude of effort centered on seven case studies has led to the choice of emphasis on the induction from data into propositions as hypotheses, which may serve as a foundation for future deductive research with theory-testing.

The discussion on methods has included approaches from organizational science and the systems sciences. The full impact of the underlying philosophies on methods has been left for other scholars for reconciliation.

In the next chapter, the focus shifts to the seven case studies, from which patterns and inferences are derived.

4. Case studies

The genesis for this research was based on observing: (i) the conventional wisdom of the 20th century that private sourcing only (*PSo*) is the only path to commercial success; (ii) the rise of the Internet coinciding with the founding of the Open Source Initiative in 1998, and some new organizations centering on open sourcing only (OSo); and (iii) a very few pioneers operating at scale with open sourcing while private sourcing (*OSwPS*). While it is not the only company to do so, the first decade of 21st century saw IBM as (i) coming from a heritage in private sourcing, (ii) not only tolerating, but encouraging IBM employees in open sourcing; and (iii) seeing commercial success at global scale with *OSwPS*. How is this so?

This Chapter 4 provides highlights of seven cases, with extended histories narrated in Appendix A. The larger context in which the cases are placed are outlined in Chapter 5, with the extended histories in Appendix B.

4.1 Seven case studies are representative stories over a decade

OSwPS first showed up at IBM with the Apache HTTP Server from 1998, and then Linux on four products lines from 2000. These have proven to not be singleton aberrations, but instead harbingers of change at IBM.

Seven case studies within the period between 2001 and 2011 are reviewed. They relate to technologies that have been both accessible to the general population of IBM employees around the world, and disclosed to the public through formal press releases and less formal channels during that period.[160] This list of cases is non-exhaustive, so more could be uncovered at IBM and across the technology industry at large.

The ordering of cases has been sequenced roughly from earliest to most recent in Figure 4.1: (1) integrating-development (fully detailed in Appendix

[160] In the interest of research replicability and in the spirit of open source, references to externally verifiable sources have been preferred when available. The IBM corporate (w3) intranet includes access to resources around the world, and confidential materials related to near-term launches of products and services have been avoided.

section A.1); (2) microblogging (detailed in A.2); (3) blogging (detailed in A.3); (4) wikiing (detailed in A.4); (5) podcasting (detailed in A.5); (6) mashing-up (detailed in A.6); and (7) coauthoring (detailed in A.7).

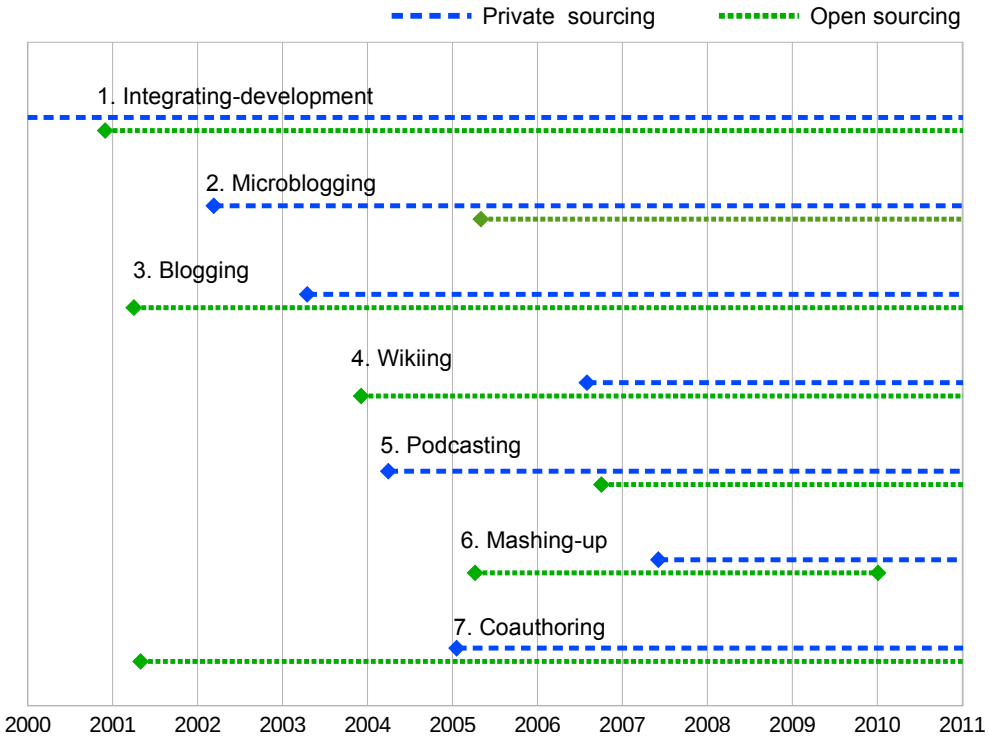

Figure 4.1. Timeline of cases

In some cases, private sourcing in IBM preceded open sourcing; in other cases, the sequence was reversed. The behaviours of the organization and individuals coevolved with technologies that were new, and matured with experience.

4.2 Case: Integrating-development (IDEs)

In the late 1990s, IBM's heritage with multiple platforms – i.e. S/390, AS/400, RS/6000, PCs – meant that computer programs written for one environment could not be easily reused in another. In 1995, IBM first introduced the VisualAge/Smalltalk product, an integrated development environment (IDE) aimed at making object-oriented programming easier on OS/2, Windows and AIX. In 1996, Sun Microsystems released the Java software platform for Solaris, Windows, Mac OS Classic and Linux, including a virtual machine, class libraries and the programming language. The Java Development Kit (JDK) 1.0 was free to download over the Internet, with the source code licensable from Sun. These roots led to the timeline shown in Figure 4.2.

IBM adopted the Java platform as the way to knit together computing

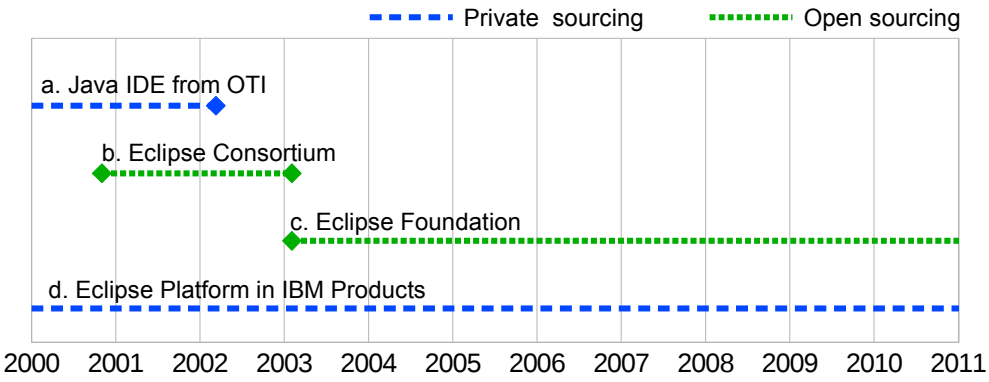

Figure 4.2. Timeline of integrating-development

across its heritage product lines, at the rise of the Internet. This timeline is described more fully in Appendix section A.1.

(a) In summer 1997, IBM introduced the VisualAge for Java product as a commercial private sourcing offering. With the Enterprise Edition, IBM offered a IBM Java Virtual Machine (JVM) for its platforms (i.e. AIX, OS/2, OS/400, OS/390) to complement those available from Sun (e.g. Solaris, Windows, Linux). This Integrated Development Environment was complemented by an early team collaboration system originally developed by Object Technologies International, acquired by IBM in 1996.

(b) In November 2001, IBM joined eight other organizations to form the Eclipse Consortium. This was a landmark community for an open sourcing platform for commercial and non-commercial development on Java. IBM was the leading contributor of software assets and staff resources.

(c) In January 2004, the Eclipse Foundation was reorganized into a not-for-profit corporation, whereby IBM would become but one of 50 member companies. Full-time management would guide the development of open sourcing projects. This has continued as a successful technology community for over a decade.

(d) In 1999, VisualAge Micro Edition, a complete IDE implementation in Java, was released. This became the core of the Eclipse open sourcing platform in 2001, on which WebSphere Studio Application Developer private sourcing product of 2002 was built. That product evolved into Rational Application Developer released in 2004, that has continued as a private sourcing product for over a decade.

With the open sourcing Eclipse Foundation, IBM was a founder and then a voting community member. It has continued as one of its largest contributors, in parallel with others in the industry. Practically all of IBM's commercial private sourcing products since 2001 have been based on Eclipse. This case is the longest-running proof that advancing technology through open sourcing does not have to be incompatible with private sourcing.

4.3 Case: Microblogging (broadcast messaging)

With the benefit of hindsight, micro-blogging – more formally labelled as synchronous broadcast messaging – has been a practice that was waiting for technology to catch up. The Twitter service is commonly understood today, but the company and platform only came about in 2006. There's pre-history for micro-blogging dating back to 2003 in Figure 4.3.

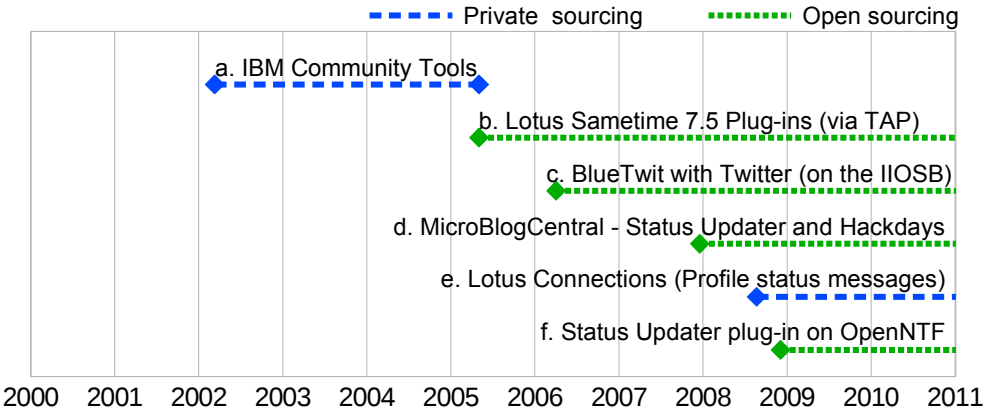

Figure 4.3. Timeline of microblogging

IBMers first experimented with at scale with precursor technologies in private sourcing, and then shared its learning more broadly through open sourcing. Details are described in Appendix section A.2.

(a) In February 2003, the Webahead team integrated some previously experimental technologies in a package called IBM Community Tools (ICT). It included (i) w3alert, (ii) TeamRing, (iii) SkillTap, (iv) FreeJam, (v) Pollcast, built on top of the commercial Lotus Sametime 3.1 offering. ICT was freely available to every IBM employee, but followed a private sourcing style with support through the Webahead team. A version of ICT was made publicly available on the Next Generation Internet (NGI) IBM web site demonstrating the iSeries capability to simultaneously run OS/400, Linux and Windows 2000. Customers downloading ICT had to accept terms that would grant IBM a royalty-free license on derivative works. Multiple patents naming ICT would be filed by Webahead and IBM Research members, and granted.

(b) In March 2006, the ICT product features were migrated onto the Lotus Sametime 7.5 client with the formation of the Technology Adoption Program (TAP) as voluntary approach to try out new technologies. The Sametime Connect 7.5 client was built on the Eclipse platform, so plug-ins to extend functionality could be programmed and added beyond the core development team. IBM employees were able to try out the Sametime 7.5 at low risk in advance of the official availability in August 2006, as they could revert to the fully-supported Sametime 3.1 at any time. Lotus Sametime was a commercial product, yet its plug-in architecture and easy

access to beta code represents an open sourcing style.

(c) In April 2007, IBM employee Ben Hardill released an enterprise microblogging environment called BlueTwit. This was hosted on the IBM Internal Open Source Bazaar (IIOSB) as a side project. Participating employees could learn to tweet to colleagues within a "safe" IBM intranet by downloading plugins for either the Firefox browser or Lotus Sametime Connect. In March 2011, BlueTwit was renamed as IBM Internal Microblogging. It continued to be available, although superseded by the officially-supported Lotus Connections product.

(d) In April 2009, Jessica Wu Ramirez released MicroBlogCentral on *Connections Plug-In Developers* blog hosted on the w3 intranet. The Lotus Connections 2.0 commercial product previously released in June 2008 had evolved to support plug-ins. In December 2008, Marty Moore posted a preview of the status message update feature for the upcoming Lotus Connections 2.5 release targeted for 3Q2009. This feature allowed individuals to leave status messages on their personal profiles as well as on colleagues' profiles. This pattern would have been familiar to anyone on Facebook writing on one's own or a friend's wall. MicroBlogCentral enabling updating the status message from Lotus Notes or Sametime, without opening a browser.

For Hackday 6.5 in June 2009, Brian O'Donovan proposed a "Status Updatr" project. Other participants alerted him to Wu Ramirez's work. O'Donovan extended MicroBlogCentral to three additional services on the w3 intranet: *BlueTwit*, *Fringe*, and *Beehive*.

For Hackday 7 in October 2009, O'Donovan was unable to participate, but four other IBMers joined Wu Ramirez to extend the plug-in. The Status Updatr plug-in continued to be available for all IBM employees on the w3 intranet, and was adapted for use in some customer engagements by IBM Software Services for Lotus.

A Hackday is "is an event where people step outside of the normal scope of work and apply their expertise toward driving new innovations". This originated with a day in June 2006, and has continued as a semi-annual tradition of open sourcing inside IBM.

(e) In August 2009, Lotus Connections 2.5 was released as a commercial offering, upgrading features on the version 1.0 released in July 2007. The upgrade included the status message update feature (described above as similar to the Facebook wall). In addition, microblogging and directed public messages was similar to tweeting on Twitter. The practices that had become common on the open Internet with Facebook and Twitter could now be done within the bounds of a company intranet with an IBM private sourcing offering that integrated individuals' profiles online.

(f) In December 2009, an open source version of the Status Updatr was posted onto the web site of the OpenNTF community, under an Apache License Version 2.0. This was a plug-in that could be used by any indi-

vidual using Lotus Sametime or Lotus Notes, as integration with Lotus Connections. The plug-in was also open to any developer to extend or modify for his or her organization's needs.

While research into broadcast messaging dates back to 2003, the popularity of Facebook and Twitter rose around 2007, IBM employees tried open sourcing experimentation in building and using social software both inside the company, and in their personal lives on the open Internet. Having moved its Lotus offerings to the Eclipse platform, IBM was able to rapidly develop features in private sourcing commercial offerings.

4.4 Case: Blogging (serial web content sharing)

Blogging was recognized as a noun and verb in the 2003 update to the Oxford English Dictionary. While publishing on the World Wide Web has been commonplace since free web hosting in 1995 (e.g. Tripod, Geocities) sharing writing in a serial form was a new idea in 2002. The evolution of blogging is partially described in Figure 4.4.

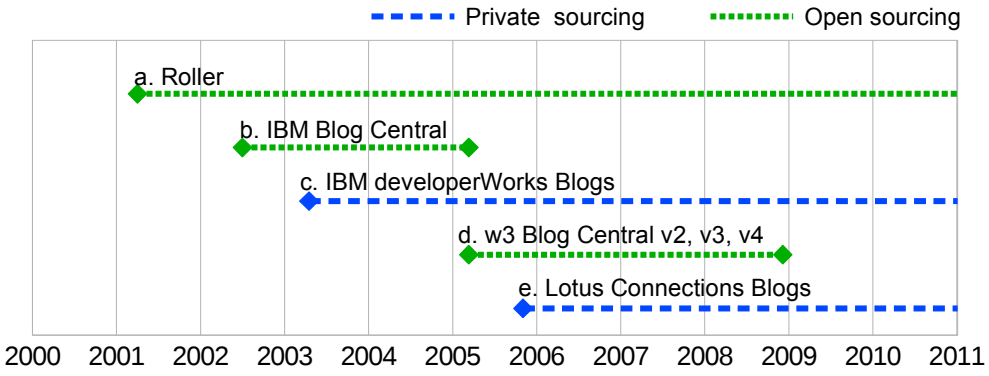

Figure 4.4. Timeline of blogging

For an audience of corporate executives, John Patrick, IBM VP of Internet Technologies, wrote about "Blogging -- The Next Big Thing?" in December 2002. Other IBMers had started blogging independently by September 2001, pioneering increased external presences between 2002 and 2005. More details on the rise of blogging is in Appendix section A.3.

(a) In 2002, Dave Johnson, an independent developer from North Carolina, developed a Java-based blogging platform named Roller. He hosted it on Sourceforge with an open source license, and publicized it with an article on onjava.com. With the Java development community small, some IBM employees downloaded Roller to experiment both for corporate and individual interests.

(b) In November 2003, the Blog Central web site appeared on the IBM w3 intranet. Implementation had begun in July 2003 with a pre-v1.0 release of Roller, customized to integrate with IBM's intranet login and employee

directory lookup.

From fall 2003 through fall 2005, Blog Central was an experiment on w3, supported by system administrators in a "best-efforts" mode. By April 2004, Fast Company magazine reported 500 employees were blogging. By June 2005, over 10% of employees worldwide were blogging.

In January 2006, David Johnson had been hired by Sun. He publicly recognized that Elias Torres, an IBM employee was contributing to the Roller 2.0. This meant that employees from two corporations were both contributing to the open sourcing project.

(c) In April 2004, the IBM developerWorks blogs were launched, with five prominent technical professionals as initial authors. A private sourcing approach was taken by licensing Jive Forums and skinning it to look like a blog, rather than relying on unproven and immature technology. By January 2006, 36 senior technical professionals – all but two from IBM – were blogging on developerWorks.

In March 2006, the content was migrated to a Roller v2.1 platform, and off Jive. By January 2008, 71 bloggers were named on developerWorks.

In 2010, Forrester recognized developerWorks with excellence in "social technologies to advance an organizational or business goal". It "encouraged the growth of the open standards development community" while driving down IBM support costs by $100 million.

(d) On the intranet, w3 Blog Central evolved in an open sourcing style. In March 2006, in parallel with the developerWorks migration, Blog Central v2 was an upgrade to Roller v2.

In May 2007, Blog Central v3 was a migration to the Lotus Connections code base, in advance of the commercial product v1.0 release in June. The evolved platform was acknowledged as being based on Apache Roller. IBM's internal blogging experience was publicized at this time, to encourage other companies to follow suit. In May 2007, members of IBM Research published some preliminary observations on "Blogs at Work". In August 2007, Luis Suarez, who was recognized as a pioneer at IBM with blogging, officially was assigned a role as a "Social Computing Evangelist". Suarez would become a celebrity in his "Life without e-mail" campaign, as his work communications shifted to social collaboration platforms.

By January 2008, 41,000 of 360,000 IBM employees were registered as either authors or commenters. The volume of blog readers could be inferred from a 3-day statistics of over 3 million hits from over 100,000 unique visitors. In March 2009, Blog Central v3 was upgraded to v4.

(e) In March 2009, the technical development community outside IBM was invited to join My developerWorks, blogging on a customized version of the commercial Lotus Connections product.

In December 2009, the private source offering of Lotus Connections 2.5 became the official platform for social computing on the w3 intranet. The content from w3 Blog Central v4 was migrated.

The gradual crossover from open sourcing to private sourcing had started some years earlier. On May 2007, the Lotus Connection v1.0 commercial private sourcing offering was released. The derivation of its blog features from Apache Roller "thrilled" the originator, Dave Johnson, in December 2006. He also stated his disappointment about his employer Sun Microsystems not similarly shipping a distribution, acknowledging Sun did have Roller as the platform under blog.sun.com. Sun would announce Project SocialSite in August 2008, but would never become a viable product. With Sun laying off employees in early 2009, Dave Johnson joined IBM in March on a team unrelated either to Roller or SocialSite.

The success of blogging in a corporate environment often overemphasizes the organization over the individuals. Blogging is rarely the primary job for any individual, just as answering e-mail is not a primary job. Blogging, reading and commenting work on a mutually reinforcing spiral where individuals can easily communicate personal perspective globally with their peers. Within an intranet, uncertainties and cautions can be conveyed on work-in-progress. Open sourcing in a professional context does not need to be independent of private sourcing work, and can improve speed through transparent communications.

4.5 Case: Wikiing (collaborative web content sharing)

Wikipedia became the most popular reference source on the Internet in 2005. The word "wiki" entered the Oxford English Dictionary only in 2007. Collaborating by openly adding and editing content on a web site has a history partially reflected in Figure 4.5.

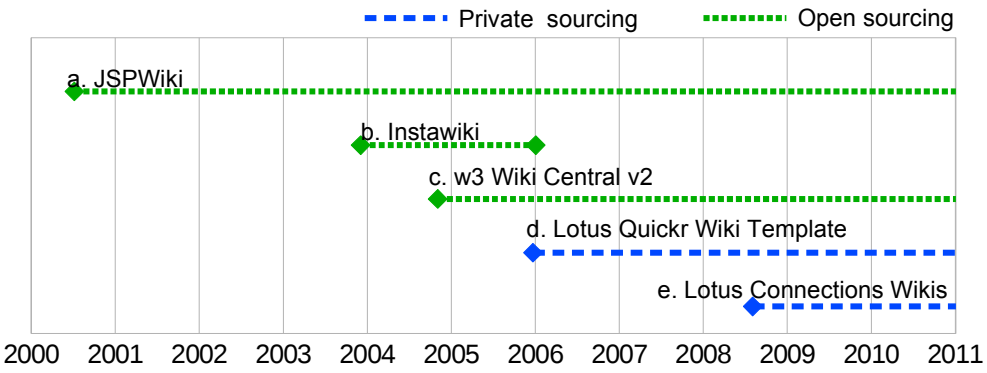

Figure 4.5. Timeline of wikiing

The first wiki was developed in 1995 by Ward Cunningham, to aid sharing amongst the Hillside Group on a Design Patterns Library. A fuller history appears in Appendix section A.4.

(a) In 2001, Janne Jalkanen, a Nokia employee, developed JSPWiki on his own time. This was a Java-based application, eventually licensed

under the Lesser GPL in 2004. By August 2007, the core development team submitted a proposal to be redeveloped as an Apache project. In July 2013, Apache JSPWiki would graduate from incubation.

(b) In December 2004, an IBM employee asked if he could use the Webahead Instawiki installation, rather than installing JSPWiki on a private server as others had done earlier in the year. This started a period of experimentation, where author-editors would negotiate with system administrators about their privileges and authority over content and revisions.

By January 2007, the Webahead team announced that Instawiki would be sunset, although content would be available through the end of the year. Author-editors were encouraged to migrate their writings to a new platform, recoding content and links since wiki markup is not standardized.

(c) By November 2005, the Webahead began to pilot Wiki Central v2 based on the Atlassian Confluence 2.0 product, licensed as commercial open source. By February 2006, Confluence was evaluated as viable. Wiki Central v2 was run in parallel with Instawiki through 2006. With over 20,000 users by April 2006, the Confluence platform was modified for clustering and multiple servers. With the full deployment of Wiki Central v2 in July 2007, the volume increased to 150,000 daily users. Participation represented about 40% of the total workforce.

In December 2009, IBM deployed the commercial Lotus Connections 2.5 on w3. The mature Wiki Central v2 on Confluence would run in parallel with the Connections 2.5 Wiki through 2012, at which point Connections was upgraded to version 4.0

(d) In October 2007, the Lotus Quickr 8.0 commercial offering included a wiki template licenses from SNAPPS became available on the w3 intranet, under the Technology Adoption Program.

With the predecessor Lotus Quickplace 7.0, SNAPPS had offered a wiki template downloadable under a GPL license.

Quickr 8.0 was available either as (i) Quickr for Domino (requiring a Lotus server) or (ii) Quickr for WebSphere Portal. The wiki template was only for the Domino version. Quick continued as a commercial offering until its withdrawal from marketing in 2014.

(e) In August 2009, wiki features became available in the commercial Lotus Connections 2.5 offering. That version was available on the w3 intranet in parallel with Wiki Central v2. By the September 2012 release of Connections 4.0, additional features (e.g. activity streams, mobile device support) would encourage internal wiki uses to choose the newer private sourcing platform.

On the evolution of wiki from its first use in IBM in 2004, the observation of open sourcing of content by author-editors was combined with system administrators learning about how individuals collaborate electronically. While IBMers used other open sourcing platforms internally, the Lotus division was able to observe and advance features used in wikiing. As

an example, wikiing has traditionally been done with simple markup reformatted with an interpreter, whereas Lotus Connections wikis feature WYSIWYG (What You See is What You Get) editors. Private sourcing refined wikiing to encourage adoption by the more typical business professional.

4.6 Case: Podcasting (digital media syndication)

Podcasting is the distribution of episodes of digital media – streaming audio or video – content over the Internet. The BBC selected *podcast* as word of the year for 2005. The timeline for podcasting in the context of a business organization is shown in Figure 4.6.

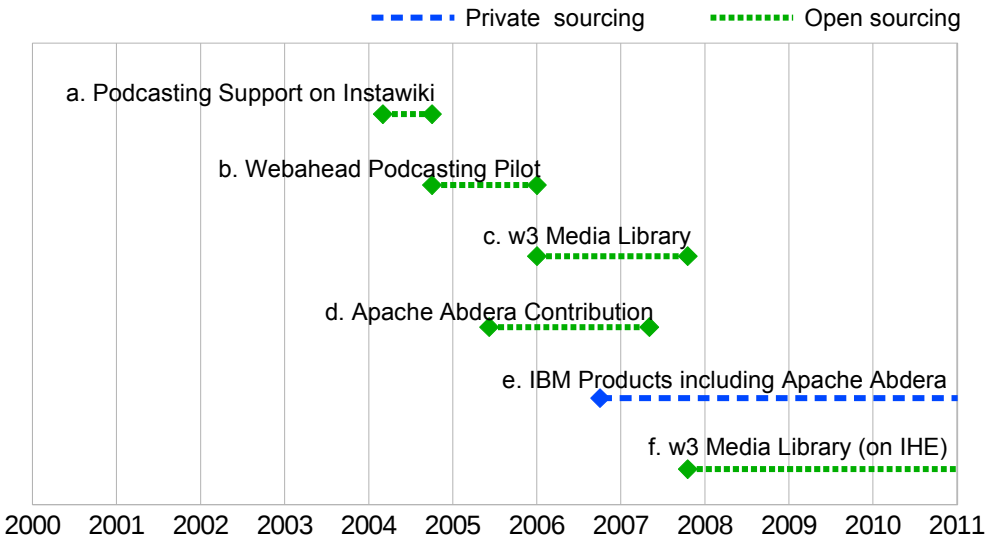

Figure 4.6. Timeline of podcasting

Podcasting rose when three elements were in place: (i) standard protocols on data formats between syndicators and subscribers (i.e. MP3 audio and MPEG4 video; RSS and Atom enclosure specifications); (ii) channels, series or shows by content producers (e.g. blogradio.org, Odeo, iTunes); and (iii) hardware and software platforms (e.g. Creative Zen, Samsung, iRiver, iPod). Part of the evolution for podcasting for corporate applications is described in Appendix section A.5.

(a) In March 2005, the Instawiki pilot code (based on the open sourcing JSPWiki) was extended so that if MP3 audio files were attached to a wiki page, they would appear as XML enclosures in an RSS feed. The feature was demonstrated as viable experiment that contributed to the Wiki Central v2 evaluation, although few content publishers or subscribers used it before the decision to sunset Instawiki was announced in February 2006.

(b) By October 2005, the Webahead Podcasting Pilot was launched. The

design enabled episodes to have two attachments: an audio recording, and a text transcript. IBM employees often have teleconferences where a slide deck is posted electronically for download, and then are bridged with a telephone call-in number. By August 2006, when practice showed that text transcripts were less popular than slide decks, upload constraints were relaxed to allow 50 MB attachments. The pilot became a common way for IBM employees to download teleconference recordings onto mobile devices for playback while travelling.

(c) By May 2007, the w3 Media Library was formally launched, having been announced in January as an upcoming an evolution from the Webahead Podcasting Pilot. While the premise in the pilot had been that employees might search to find content produced by peers, the reality became that most downloads were driven by formal communications of important announcements and education. In addition, the new platform allowed the video content – not just audio recordings – to be uploaded, for viewing either through online streaming or download offline. By January 2008, it was estimated that about half of 360,000 employees at IBM had listened to, or watched content, on the w3 Media Library.

(d) In summer 2006, the internal Webahead group, through the external-facing IBM Software Standards Strategy group, contributed its implementation of Atom to the Apache Foundation. This would form the basis of the Abdera, becoming a top level project in November 2008 and evolving to a 1.0 release by May 2010. Atom was first used for attachments to blogs, but became much more widely applied, e.g. with file management, photo sharing and podcasting. While the Webahead group doesn't have a mission to work outside of the company, advancing an implementation of Atom would benefit the industry at large to converge on an open standard.

(e) Between the June 2006 Abdera contribution and its formal acceptance as a project by the Apache Foundation, IBM incorporated the Atom technology into its private sourcing commercial offerings. Atom features appeared in Lotus Connections 1.0 in November 2007, as well as the Feedsphere library for WebSphere Application Server in December 2007. After Abdera had been released as version 1.0 in May 2010, coevolution of IBM's implementation with the Abdera releases would be acknowledged in the copyright attributions and version histories.

(f) In October 2008, the w3 Media Library remained as an open sourcing project on the IBM intranet, moved to the Innovation Hosting Environment. The software implementation and informal support remained the same, while recognizing the rise of the TAP organization.

Podcasting at IBM originated in 2005, and much was learned through open sourcing with publishers and subscribers in distributing multimedia content. The viability for a branded product offering specifically for podcasting does not seem to have become a market opportunity for IBM, although the company has commercial tools available so that a motivated

organization could implement a project on its own.

4.7 Case: Mashing-up (situational applications)

The idea of mashing-up originates in the remix of digital music circa 2002. With the sophistication of creating content on the World Wide Web rising, a gap for situated software – colloquially mashups – by non-programmers was seen around 2004. The evolution of offerings to enable mashing-up is charted on Figure 4.7.

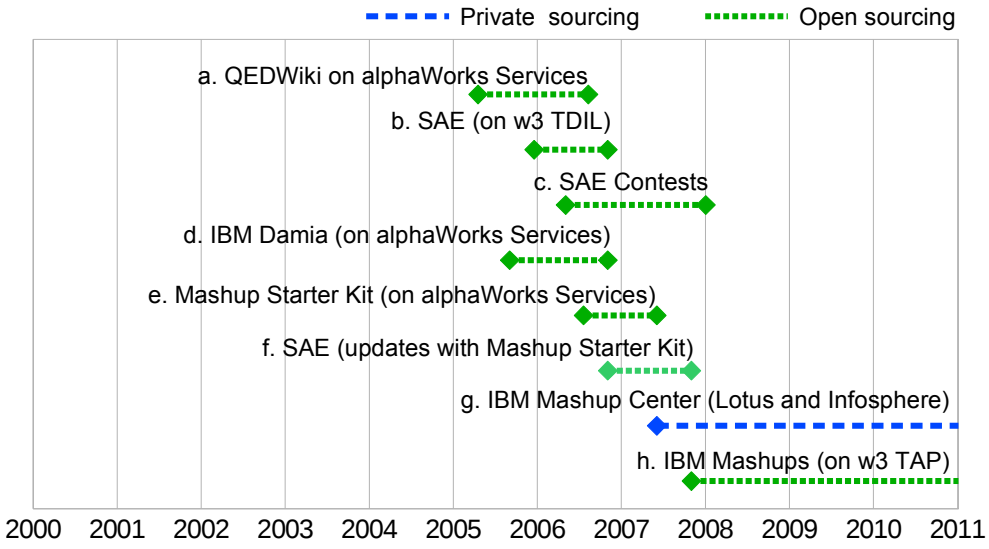

Figure 4.7. Timeline of mashing-up

The launch of Google Maps in February 2005 led to the first mashups on housing and traffic, originally through reverse-engineering of the Maps API until Google published the specifications in June 2005. O'Reilly Media organized the Where 2.0 conference in October 2005. In June 2006, Mashup Camp drew 300 participants in an unconference, followed by the June 2006 Mashup Camp 2 drawing sponsors and 400 people. Yahoo Pipes was introduced in February 2007, and Google Mashup Editor would follow in May 2007. The explorations involving IBM are described more fully in Appendix section A.6.

(a) In April 2006, IBM demonstrated the QEDWiki tool at the Web 2.0 conference, and then at the National Association of Broadcasters (NAB) show. In September 2006, QEDWiki was announced as a software-as-a-service offering on the alphaWorks Services technology hosting, actually becoming available in February 2007. Unlike prior technologies downloadable from alphaWorks, QEDWiki could be used to integrate public web sources on the open Internet, as did Google Pipes and Google Mashup Editor.

(b) In December 2006, IBM Research piloted a "Situational Application

Environment" (SAE) on the Tap Dynamic Infrastructure Lab (TDIL) hosting. The SAE was described as more than "just about mashups", whereby mundane tasks could be automated. This came out of research into "ad hoc programming" compatible with with Clay Shirky's idea of situated software. Other open source components, e.g. OpenKapow robots, were also included in the initial trial.

(c) Around Hackday 3 in May 2007, the CIO Office ran education sessions for an SAE Contest. IBM regular or supplemental employees were eligible to enter. Entries could not be part of a day job assignment. The deadline for submission was June 31, with a prize of $15,000 for first place, $5000 for second place and $2000 for third place. The contest drew 90 entries from 178 participants. Some winning entries were further developed by CIO Office: *IBM Travel Maps*, the *Virtual Team Locator* and the *Bluecard Widget*. Insights from using the SAE were published by the IBM Research team, in the IBM Systems Journal.

(d) In September 2006, at a keynote in the VLDB conference, the VP and CTO of Information Management at IBM hypothesized the need for an "enterprise information mashup fabric" to structure back end data sources so that end user programming could be composed with tools like QEDWiki. In August 2007, IBM (Data Mashup Fabric for Intranet Applications) became available on alphaWorks Services. This was complemented on the QEDWiki web video series on Youtube, with a demonstration of Mashup Hub with DAMIA. In September 2007, A more complete disclosure was presented by IBM Almaden Research at VLDB '07, showing features beyond Yahoo Pipes.

(e) At the July 2007 Mashup Camp, IBM sponsored a Business Mashup Challenge, where an alpha version of Mashup Hub was provided. In August 2007, Info 2.0 was explained in blogs as three parts: (i) DAMIA, (ii) Mashup Hub, and (iii) QEDWiki. In October 2007, the Mashup Starter Kit was previewed and downloadable from alphaWorks in an open sourcing style, with a commercial release projected for 1Q2008.

(f) In November 2007, the Mashup Starter Kit available on alphaWorks was replicated on the IBM intranet. The internal platform name of "Situated Application Environment" was retained.

(g) In June 2008, with some slippage from the projected 1Q2008 date, the commercial IBM Mashup Center v1.0 was announced. It was branded as a combination of complementary products: (i) Lotus Mashups, and (ii) InfoSphere Mashup Hub. Potential customers could try out the Mashup Center on the Lotus Greenworks site, as the alphaWorks Services site was superseded. IBM Mashup Center was upgraded to v2.0 in October 2009 and then v3.0 in November 2010. In May 2010, the offering was withdrawn, with the two components migrated into WebSphere Portal Server and the IBM Web Experience Factory Designer.

(h) In September 2008, the second Situational Applications Contest was

announced with a deadline of January 16, 2009. In October 2008, the SAE was moved from TAP (which had collaboration and review features) to TDIL, recognizing the official support channels available with the IBM Mashup Center program product. The SAE Context deadline was moved up to December 31. The results for the SAE 2008 contest were not publicized as the 2007 contest had been. It's likely that the fiscal year-end coinciding with a slowdown in IBM's business and a Christmas holiday season deterred entries and drew the attention of potential participants away.

By 2010, an article on "What Ever Happened to Enterprise Mashups" cited that the term peaked on search engines in spring 2008 and declined slowly. This was counter to the growth of open APIs that could be consumed. A lack of industry standards was suggested as a problem. The OpenAjax Alliance started in October 2006, with a stable snapshot of OpenAjax Hub in July 2007. IBM contributed SMash in September 2007. OpenAjax Hub v2.0 was approved in July 2009. OpenSocial 1.1 was released with OpenAjax Hub inside in November 2010. In 2011, IBM and the Dojo Foundation announced Maquetta, using the OpenAjax Widgets. Despite the continuing progress, "apathy" from OpenAjax Alliance sponsors were cited.

In September 2009, a competitive Open Mashup Alliance was formed. By spring 2010, no progress beyond the initial EMML v1.0 release was reported.

In retrospect, the idea of mashing-up as a path for non-programmers did not take root, either through open sourcing or private sourcing. Developers have passed on the Dojo technology that included OpenAjax, in favour of the simpler JQuery.

4.8 Case: Coauthoring (collaborative document editing)

While personal computer popularized electronic document editing – as word processing, spreadsheets and slide presentations – the Internet brought a new paradigm of sharing and collaboration. By late 2004, the evolution from the read-mostly client-server Web 1.0 to the read-write network computing Web 2.0 was challenging the premise of a document-centric orientation. While IBM previously had offerings for office productivity (e.g. Lotus SmartSuite was a competitor to Microsoft Office in releases from 1994 to 2002), Web 2.0 presented new opportunities, shown in Figure 4.8.

The legacy of personal computing on documents tends to be blind to Internet presumption that there are many other types and forms of data in the world. At the introduction of Office 2003, the private sourcing activities of Microsoft were having major impacts on its customers. The Word 97 .doc format was revised to Word 97-2003, the Excel spreadsheet format of .xls

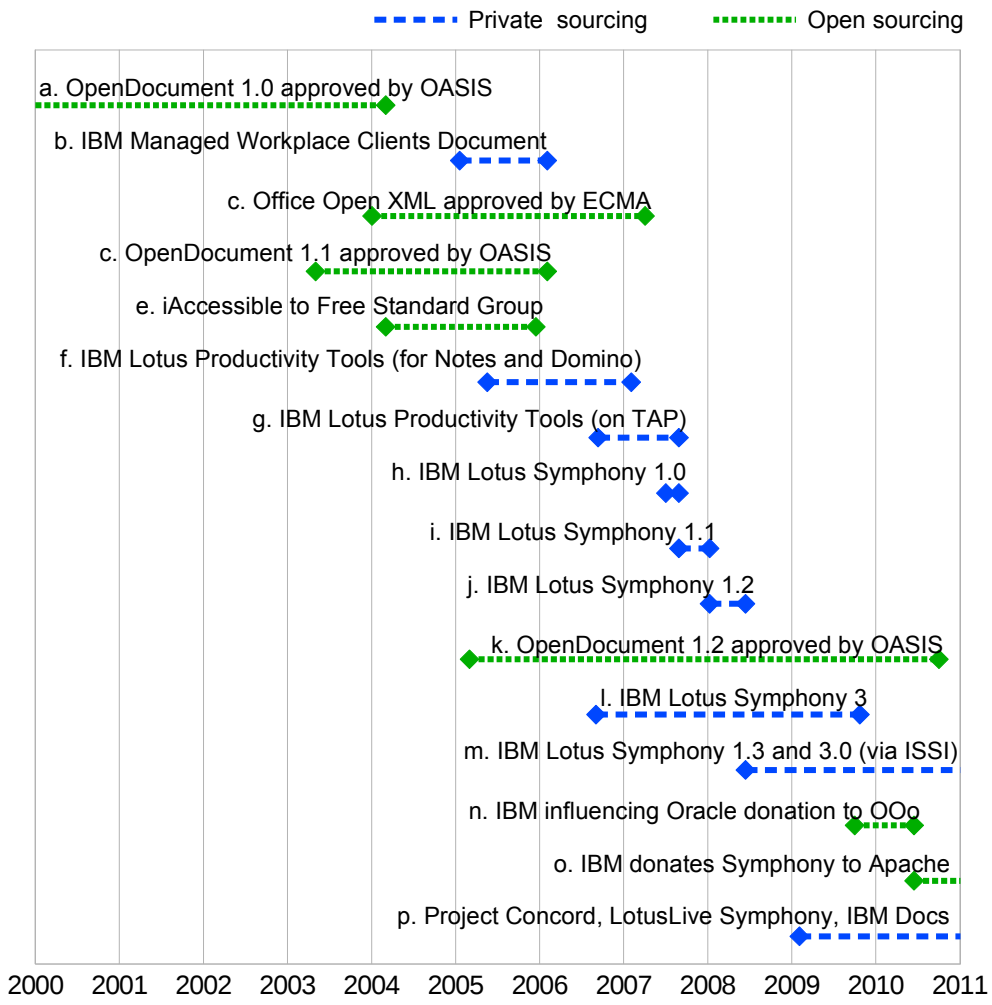

Figure 4.8. Timeline of coauthoring

was revised to Excel 97-2003, and the Powerpoint presentation format of .ppt was revised to Powerpoint 97-2003. Further, in April 2003, Microsoft filed for a patent on "Word-processing documents stored in a single XML file". The movements towards alternatives and open industry standards is detailed in Appendix section A.6.

(a) In March 2005, OpenDocument 1.0 was approved as an OASIS Standard. This specification was led primarily by implementers dating back to the open sourcing of StarOffice by Sun in 1999, leading to OpenOffice 1.0 in April 2002. In November 2002, the OpenOffice.org XML File Format Technical Reference Manual 1.0 was donated by Sun to OASIS. The OpenDocument Technical Committee (TC) initially included Sun, Corel, Arbortext and Boeing. Microsoft declined to send a representative. Major milestones included a first phase to be delivered in March 2004, and a second phase to catch up on development work done in parallel with the first phase. By the March 2005 approval of the ODF v1.0 standard, endorsements by Adobe, IBM and Sun were included.

In May 2004, the IDA II program of the European Commission endorsed the OpenOffice format specification to OASIS. A recommendation to get more industry participation in standardization led to IBM responding that it "welcomed" the invitation, and would reiterate its "commitment to working with governments to promote open computing based on open standards". The OASIS approval would lead to a fast track ISO standardization. The EC committee also requested Microsoft to consider standardization of its XML formats. Microsoft agreed.

In September 2005, Sun changed the licensing for OpenOffice from the dual SISSL and GPL to the more permissive LGPL. In October 2005, OpenOffice 2.0 had ODF 1.0 as its default file format.

ISO standardization of ODF 1.0 started review as ISO/IEC 26300 in October 2005, and was approved in March 2006.

(b) In January 2006, IBM announced the Workplace Managed Client v2.6 commercial program product, featuring the ODF 1.0 file format. This offering was targeted for intranet-attached diskless workstations, where security concerns would preclude copying onto a floppy disk or USB drive. The plan to support ODF had previously been disclosed in May 2004, forking the OOo base. IBM private sourced this fork as a server-managed client, as the greater OpenOffice community was believed to be more interested in the desktop suite.

In January 2007, IBM announced it would discontinue the Workplace line, incorporating the office productivity applications as core in other products, including the new Lotus Quickr offering.

(c) In December 2006, the Office Open XML specification primarily driven by Microsoft would be approved as the ECMA-376 standard. This competitive response to ODF 1.0 was in response to government concerns, and has been regarded with controversy. Microsoft itself would not release a product fully-compliant to the December 2006 OOXML specification until Office 2013. In July 2014, the UK government would reject OOXML in favour of ODF.

In March 2005, the Commonwealth of Massachusetts ETRM 3.0 draft recommended that agencies should evaluate OpenDocument applications, to move away from Microsoft XML Reference Schemas as a non-open specification. In June 2005, Microsoft made documentation on OOXML licensable royalty-free to developers. This was criticized by IBM as disadvantaging anyone outside of Microsoft. In September 2005, the final ETRM 3.5 version excluded OOXML, precluding agencies from the Commonwealth of Massachusetts from upgrading to Microsoft Office 2007, and setting a precedent for other jurisdictions to follow. Political pressures would lead to state executives resigning, and a subsequent senate oversight review.

In December 2006, despite a clear protest where "IBM voted NO today in ECMA on approval for Microsoft's Open XML spec", the ECMA-376 standard was approved. This allowed a fast track for OOXML be approved

as the ISO/IEC DIS 29500 standard in April 2008. This abuse of the standardization process has become a textbook case study, and impugned the credibility of technical and international committees.

(d) In February 2007, ODF 1.1 would be approved as an OASIS standard. ODF 1.0 had some criticisms on accessibility. IBM and Sun co-led an OpenDocument Accessibility Subcommittee, with IBM contributing four additional members. The updates would receive endorsement of the UK Royal National Institute for the Blind, and the National Federation for the Blind in Computer Science.

(e) In December 2006, the Free Standards Group accepted the IAccessible2 APIs for Windows, donated by IBM. These would ease development of accessible applications on Windows as well as other operating systems, as it was originally developed with Sun to for Java and Linux. This would meet the needs laid out by the Commonwealth of Massachusetts for an open standard.

(f) In November 2007, Lotus Notes and Domino 8 was released, including Productivity Tools that would enable editing of documents in ODF, across Windows and Linux. Support for Mac OS/X would come with Lotus Notes 8.5 in January 2009. These commercial offerings were first presented in a May 2006 preview under the Hannover code name, and a managed beta starting November 2006.

(g) In November 2006, a standalone version of the Hannover-based Productivity Tools (i.e. word processing, spreadsheets and presentations, without the e-mail and collaboration features) came onto TAP. License conditions meant that the initial version would be based on the OpenOffice 1.0 code base, rather than the 2.0 released in October 2005. IBM employees were permitted to independently download and use OpenOffice for personal use, but internal distribution by the corporation was prohibited.

In August 2007, the internal beta versions on TAP were removed, and refreshed with “Normandy” code name that would eventually officially labelled as the IBM Lotus Productivity Tools. The development, support and bug reporting followed private sourcing conventions, as developers simultaneously engaged in integrating the desktop tools with the Lotus Notes client versions.

(h) In September 2007, OpenOffice.org announced that IBM was officially joining the community. The Normandy project was renamed IBM Lotus Symphony, with Beta 1 downloadable at no charge on the public IBM web site with a simple online registration. In the first week, the free code was downloaded by 100,000 businesses and consumers. Inside IBM, the intranet site was refreshed, and employees could download at leisure.

In November 2007, Symphony Beta 2 was posted on the TAP intranet site.

Symphony Beta 3 was updated on the public Internet in December 2007, and on the TAP intranet in January 2008. This version improved inter-

nationalization. The VP of Global Workforce and Workplace Enablement encouraged IBM employees to start using IBM Lotus Symphony. This not only would enable moving on from the legacy of Microsoft Office, but also Windows XP to Linux and eventually Mac OS/X. Between October 2007 and January 2008, IBM Research conducted a study where staff were given MacBook Pro laptops to try out while their Windows-based Thinkpads were continued to be used "as a last resort".

In February 2008, Symphony Beta 4 was released on both the public IBM web site on the TAP intranet site. It was positioned as a Developers Release where Eclipse-based plug-ins could be installed.

In May 2008, a Prerelease Candidate for Symphony was posted only to TAP, as bug fixes were being ironed out.

In June 2008, IBM Lotus Symphony 1.0 was released publicly. Complementing the free online moderated support, large enterprises could sign up for Elite Support. By the end of the month, Symphony 1.0 became available for automated installation inside IBM via the ISSS provisioning tool. Instructions on how to uninstall Microsoft Office XP foreshadowed a future date when it be would removed without choice.

In August 2008, IBM Lotus Symphony 1.1 was released, fixing some bugs, reducing the memory footprint and adding a few enhancements.

In November 2008, IBM Lotus Symphony 1.2 was released, improving the spreadsheet, supporting Ubuntu Linux and a Mac OS/X beta.

In June 2009, Symphony 1.3 was released, improving interoperability with Microsoft Office 2007.

The development and release of IBM Lotus Symphony followed a private sourcing style. While IBM provided the software as a free download, the offering had IBM copyrights extending the OpenOffice version 1 code base. Internal employees could download from the TAP intranet site rather than registering on the public IBM web site, with bug reporting channels internally similar to those available externally.

(i) In August 2008, IBM Lotus Notes and Domino 8.0.2 was a maintenance release with Lotus Symphony 1.1 packaged in. This brought the prior Lotus Productivity Tools in line with IBM Lotus Symphony 1.1. in public. Customers who were licensing IBM Lotus Notes would thereby receive support for Lotus Symphony through official channels.

(j) In January 2008, the public beta for the Lotus Notes 8.5 client for Mac OS was announced. The deprecation of the PowerPC platforms at Mac OS 10.5 meant that there was not Notes 8.0 for Mac release, and customers would jump from Notes 7.0 to Notes 8.5. This beta of Notes 8.5 for Mac was ahead of the May 2008 public beta for Windows and Linux clients, as well as Domino 8.5 servers.

In January 2009, Lotus Notes 8.5 with Symphony 1.2.1 was announced for general availability. The threading of development to support multiple operating systems platforms on both clients and servers follows a private

sourcing style.

(k) In September 2011, OpenDocument 1.2 was approved as an OASIS standard. IBM contributed team members to the OpenDocument Formula subcommittee from February 2006, and the OpenDocument Metadata subcommittee from March 2006.

(l) In February 2010, IBM Lotus Symphony 3 beta 2 was publicly released, followed by beta 3 in June and beta 4 in August. In October 2010, IBM Lotus Symphony 3 was formally released. This was an IBM private sourcing offering, downloadable free of charge "rebased on the current OpenOffice.org 3 code stream", supporting the ODF 1.2 OASIS standard that would be approved in September 2011, and published by the ISO in summer 2015.

Since the joining the OpenOffice.org Community in September 2007, IBM had committed "a core team of 35 programmers in China" to the project. In October 2008, OpenOffice 3.0 was released, supporting ODF 1.2 and importing OOXML Transition, plus a native Mac OS/X interface. In November 2008 at the OOo Conference in Beijing, the Director of Lotus Development in IBM China outlined the roadmap whereby the private sourcing Symphony user interface would be built on top of OpenOffice 3.0.

(m) On March 14, 2012, Microsoft Office XP was discontinued on IBM employee computers worldwide, removed with the automated ISSI tool. Lotus Symphony had become a mandatory alternative application installed on all employee computers since September 2009. Microsoft Office 2003 could be installed via ISSI if a manager approved a business case. Employees were still free to install Microsoft products that they had personally licensed, within the policy of the new Bring Your Own Device (BYOD) policy.

The update to Symphony 3 was rolled out in October 2010, with the update to Symphony 3.0.1 after January 2012. By November 2011, authors choosing OpenDocument format could use free mobile viewers for Android and iOS.

This private sourcing activity served to release IBM employees from their dependence on Microsoft Windows, as Linux and Mac OS/X became platforms that could be deployed and maintained on an equal footing.

(n) In May 2011, Oracle announced that it would donate the OpenOffice branding and assets to the Apache Foundation. Lobbying by IBM was reported to have been a contributing factor towards open sourcing. In June 2011, OpenOffice was approved a probationary project by the Apache Incubator.

The founding of OpenOffice.org in 2000 by Sun Microsystems had espoused a foundation modelled on the Apache Software Foundation. This independence never became a reality. In 2005, there was a draft of proposed bylaws the U.S. Team OpenOffice.org, but critical mass in other geographic regions did not develop. Sun had a StarOffice offering based

on OpenOffice, and was the largest contributor by far. The management of projects by Sun employees was criticized as unbalanced for independent developers in 2007. In October 2007, a new fork of OpenOffice named Go-oo (Go-Open Office) was started.

In April 2009, Oracle Corporation bought Sun, after rumours from late 2008 that IBM might be an acquirer. Major layoffs in October 2009 and replacement of all Sun logos with Oracle logos in May 2010 put uncertainty into OpenOffice development. An August 2010 lawsuit with Oracle claiming that Google infringed on Java copyrights originally held by Sun did not endear the company to the open source community.

In September 2010, some of the European leaders of OpenOffice development formed "The Documentation Foundation" and chose *LibreOffice* as their brand going forward. LibreOffice was supported by Linux providers Red Hat, Novell, and Ubuntu.

The April 2011 announcement that Oracle would "move OpenOffice.org to a purely community-based open source project" and no longer offer a commercial version ended Sun's history as an open sourcing champion. The technical resources associated with StarOffice, mostly in Hamburg, Germany, would be laid off ... and IBM would eventually hire many of them.

(o) In June 2011, with the approval of OpenOffice as a podling by the Apache Software Foundation, IBM contributed Lotus Symphony under an Apache 2.0 license.

In June 2007, the introduction of the LGPL 3 permitted inclusion of Apache 2.0 licensed software. OpenOffice 1 had been licensed under SISSL and GPL. OpenOffice 2 had been licensed under LGPL 2.1. Those licenses worked for Sun, as its only derivative work was StarOffice. However, since IBM's derivative work might involve the private sourcing Lotus product line, corporate contributions to open sourcing would not be compatible with LGPL 2.1 or any GPL. OpenOffice 3 was licensed under LGPL 3, so the LibreOffice fork would also have LGPL 3.

The standalone version of Lotus Symphony had over 3 million lines of code where GPL / LGPL dependences had been replaced. With IBM open sourcing Lotus Symphony under an Apache 2.0 license, not only could derivative works be private sourced (e.g. with commercial IBM Lotus offerings), but improvements could also flow into the LibreOffice project under LGPL 3. In May 2012, the LibreOffice team announced that they would rebase the entire project on Apache OpenOffice, encouraging developers to contribute directly under an LGPL 3, rather than through the Apache process.

In May 2012, Apache OpenOffice 3.4 was released, with a "slow merge" of the IBM Symphony features. IBM continued to aid in the transition of the Symphony code base, leading to the release of Apache OpenOffice 4.0 in July 2013.

In December 2014, IBM discontinued support for Lotus Symphony. This marked IBM's exit from desktop office productivity tools, with derivative works subsequently all platformed on the Internet.

(p) In January 2012, IBM Docs, a new set of collaborative web editors, was released as a beta. It had been demonstrated in January 2010 as "Project Concord", and then in January 2011 as "LotusLive Symphony" with "Tech Previews" during the year. In December 2012, the technology became available as IBM SmartCloud Docs (for word processing, spreadsheets and presentations), or packaged with IBM SmartCloud Engage Advanced (including e-mail, blog and wiki).

These private sourcing offers in 2012 can be seen as an evolution from the Managed Workplace Client in 2006. Tracing its history has been complicated by industry standardization initiatives, competitive activity, corporate acquisitions and open source community forks. While the PC generation may think Microsoft Office and the Internet generation may think Google Docs, their shapes have been influenced by interplay of open sourcing with private sourcing for over a decade.

4.9 Open sourcing while private sourcing began circa 2001

This book uses seven cases at IBM for an in-depth appreciation of open sourcing while private sourcing. The announcements by IBM of the relationships with the Apache Group in 1998 and the Linux Foundation in 2000 were precursors of a new way of working. IBM, at the levels of a corporate collective and in individual action, evolved open industry standards and ways of sharing across organizational bounds. The cases show that this behaviour was not a singleton event, but instead a larger movement that defined much of the business in the decade 2001-2011.

IBM is not the only company in the information technology industry that has attempted open sourcing while private sourcing. Sun Microsystems was a leading proponent of open sourcing. Its initiatives included the Solaris variant of Unix with the OpenSolaris alternative;[161] the StarOffice desktop productivity suite with the OpenOffice alternative;[162] and MySQL with a commercial license for commercial distributors and an exception for Free and Open Source Software users.[163] Sun had the misfortune to not

[161] An archive from 2010 on "Why did Sun create the OpenSolaris project?" describing opportunities for collaboration between Sun Microsystems, developers and the user community was removed after the acquisition of the company by Oracle.

[162] Since StarOffice has been renamed Oracle Open Office, web pages describing the former product on sun.com are no longer available. The change of the name occurred around April 2010.

[163] MySQL had an October 9, 2008 commercial license with a FOSS license exception version, specified by Sun Microsystems. The pages have been preserved on the Internet Archive.

survive 2010 as an independent entity, to be acquired by a company that does often antagonizes open source communities. Post-2011, we see many well-known private sourcing commercial companies open sourcing, e.g. Google, Facebook, and Twitter. The first decade of the 21st century saw IBM as a successful company, and many industry observers believe that the entity founded in 1911 could exist in one form or another in another century.

This chapter has focused on detailed initiatives of *OSwPS*. The next chapter looks at the bigger context on which those initiatives occurred.

5. Contexts

The seven cases of open sourcing while private sourcing (*OSwPS*) in the previous chapter were indicative, but not exhaustive, descriptions of behaviours in projects and explorations in day-to-day work. In the period between 2001 and 2011, the context of worlds larger than those specific cases evolved. Many behaviours seen as a remarkable first-of-a-kind innovation at their introductions might melt into the context of learned conventions 3 to 5 years later. The cases describe teams and individuals immersed day-to-day in OSwPS, while the five evolving contexts depicted in Figure 5.1 include parties influencing or influenced by those shifts.

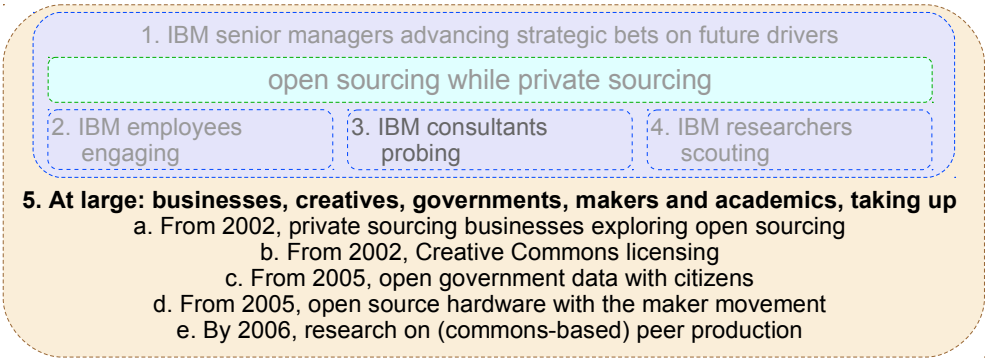

Figure 5.1. Five contexts behind open sourcing while private sourcing

Open sourcing began the decade as new, with a variety of organizations making sense of the possibilities it would bring:

1. IBM's senior managers, from 2001, advancing strategic bets on future drivers of industry, business, computing and marketplace;
2. IBM employees, since 1996, engaging online with w3 intranet platforms for global knowledge exchanges and social sharing;
3. IBM consultants, from 2004, probing to confirm business priorities through industry-based executive studies; and
4. IBM researchers, from 2004, exploring social changes influencing new organizational and technological opportunities on longer horizon.

5. At large, from 2000, businesses, creatives, governments, makers and academics, taking up open sourcing.

In a retrospective view, behaviours of open sourcing while private sourcing were revolutionary early in the decade, and gradually became more normal. The contexts are outlined in this chapter, with details fleshed out fully in Appendix B.

5.1 Context: IBM senior managers, from 2001, advancing strategic bets

In July 2000, Sam Palmisano was named as president and chief operating officer of IBM, and John M. Thompson was named as IBM vice chairman focusing on growth initiatives.[164] In March 2002, Palmisano became Chief Executive Officer of IBM, and chairman of the board at the beginning of 2003.[165] This smooth transition of leadership would continue IBM's transition into a company leading on services and software. The directions set in the IBM 2001 annual report published in April 2002, outlined in Figure 5.2, would be relatively consistent for decade that followed.



Figure 5.2. Context from IBM senior managers advancing strategic bets

For the decade after 2001, IBM senior managers would be relatively consistent in advancing strategic bets on future drivers. They would:

1. Lead the industry by innovating and integrating;
2. Evolve *e-business* from *services-led* to *on demand*;
3. Invest in enterprise systems, integrating middleware and specialized high-value components; and
4. Turn toward open architectures and common standards.

In 1999, e-business had been the galvanizing mission for IBM. Inside the

[164] At the announcement in July 2000, Sam Palmisano at age 48 would play the more operational role, and John M. Thompson at age 57 would continue a strategic role as he had with Lou Gerstner as CEO.

[165] John M. Thompson would retire from IBM in September 2002. After the IBM retirement, Thompson became chairman of the board for Toronto-Dominion Bank Financial Corporation in 2003. Lou Gerstner would retire as CEO of IBM in March 2002, and relinquish his role as IBM chairman at the end of 2002.

2001 annual report, the shift that was foreseen was "that customers are finally driving the direction of the information technology industry". These strategic bets are outlined below, and described more fully in Appendix B.1.

5.1.1 IBM would lead the industry by both innovating and integrating

In 2001, the memory of the dot-bomb collapse in 2000 would be fresh in the minds of industry leaders. The 2001 annual report clarified the first strategic bet for the Palmisano era as simultaneously innovating *and* integrating.

Innovating at IBM would mean transforming not only organizational functions, but entire businesses and industries. The company would lead both with new technologies and with professional services to implement them.

Integrating at IBM would mean embracing the "lifeblood of business" with strategic directions on architectures and standards, as well as concrete hardware and software choices.

Approaching customers while simultaneously innovating and integrating meant that IBM could not ignore the offerings of alternative providers. In addition to traditional private sourcing competitors, it would have to deal with the emerging open sourcing options. Value and growth could be realized through extending open source technologies and standards rather than denying their merits. Details on this strategic bet are described in Appendix B.1.1.

5.1.2 IBM would evolve *e-business* from *services-led* to *on demand*

IBM's 1997 campaign on e-business was "about transforming key business processes with Internet technologies". By 2001, success in e-business resulted in IBM Global Services becoming "the world's largest and most innovative consultancy, systems integrator and strategic outsourcing leader". The 2001 annual report outlined a vision of e-business on demand offerings, where "utility-like delivery of computing" would be acquired on "a pay-for-use basis". This second strategic bet was on *services* not just as professional services, but also on web technology services. After 2006, the industry would recognize virtualization technologies and new business models as *cloud computing*.

In 2002, the IBM e-business on demand model was clarified as three major components: (i) infrastructure on demand of core services (i.e. technologies); (ii) IBM business process on demand (which would evolve into middleware enabled by IBM Business Partners); and (iii) know-how in consulting (i.e. professional services). The speed at which these compo-

nents could be made a reality was layered: (i) the infrastructure would include open sourcing technologies and the evolution of industry standards on a scale of 5 to 10 years; (ii) business processes through business partners would deploy new technologies on a scale of 3 to 5 years; and (iii) consulting with professional services within the company could be ramped up on a scale of 6 months to 2 years. Details on how the 2001 and 2002 annual reports outlined the foundational IBM strategy for the decade are in Appendix B.1.2.

5.1.3 IBM would invest in enterprise systems, integrating middleware, and specialized high-value components

The potential of IBM to create value through advancing technologies, and capture value distinctively against alternatives is highly variable across its wide portfolio of offerings. The decade of 2001-2011 would see IBM divesting business segments where it could not effectively compete, and acquiring emerging technology companies that would accelerate complements in the IBM portfolio.

The focus on enterprise systems would see spinning off the hardware storage business to Hitachi in 2002; the personal systems division in 2004 to Lenovo; and printing systems to Ricoh in 2007. Those lines of businesses may have been core to total solution packages by IBM over the prior two decades, but gradually became peripheral components of lower value.

The third strategic bet saw “infrastructure plus ubiquity” as the new computing model. The Internet was displacing client-server personal computing technology.

The label of *middleware* as technologies for integration was recognized by 2001. The “middle” can be interpreted as the “inter” in Internet. The Gerstner “barbell” strategy had seen IBM’s investments focused on foundational electronic components on one end, and integration services on the other end. In the 1990s, the middle was computer hardware, in the PC-based client-server architecture. In the period 2001-2011, the rise of network-centric distributed computing would see server farm clusters connected to smartphones, videogame consoles and set-top boxes through complicated content delivery networks (CDNs). The IBM WebSphere products would represent a layer above an operating system and below applications, extend open sourcing technologies and standards. Specialization amongst software technologies (e.g. search, authentication, video processing) would evolve, and IBM would lead in developing open standards and new technologies with high value. More on the original vision on this strategic bet from 2001 and 2002 is summarized in Appendix B.1.3.

5.1.4 IBM would turn toward open architectures and commons standards

IBM has a strong history of working with customer user groups, business partners, and standards organizations. In 2001, the strategic bet to participate in "an open playing field" of a new marketplace model of networked organizations would encourage IBM to further cooperate, if not collaborate, with others. This larger context is depicted in Figure 5.3.

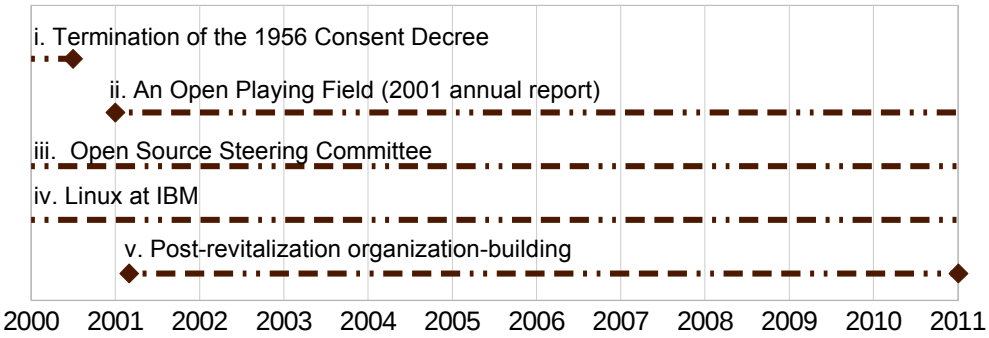

Figure 5.3. IBM turn toward open architecture and common standards

(i) The 1956 consent decree with the U.S. Department of Justice made IBM cautious of anti-trust investigations. The decree was terminated (i) in 1996 for PCs; (ii) in 2000 for midframe computers; and (iii) in 2001 for mainframes. The direction towards open sourcing was away from "the siren call of proprietary control" that IBM now guards against.

(ii) The 2001 declaration of "an open playing field" of open architectures and common standards in the annual report is a watershed shift towards learning to coevolve with customers and other organizations in a different way.

(iii) From 1999, an IBM internal board, the Open Source Steering Committee (OSSC) had been in place to oversee open sourcing activities.

(iv) In early 2000, IBM employees in the pioneering Internet Division were migrated into a new Linux team. IBM demonstrated Linux running on all its hardware platforms at LinuxWorld in February 2000, and then announced it has spent $1 billion on Linux by year-end.

(v) The October 2000 appointment of Sam Palmisano as President and Chief Operating Officer evolved into the March 2002 Chief Executive Office role. Lou Gerstner had presided over instituting greater discipline within IBM from 1993, and transformed IBM into an e-business company from 1997. With a slide of the stock markets with the dot-bomb collapse in 2000-2001, and the attack on the United States on September 11, 2001, a stable institution like IBM was better appreciated. The company was well-positioned for organization-building, both with financial resources and with strong leadership in managerial and technical roles.

The turn towards open architectures and common standards would be a

direction that continue for IBM into the next decade. Details on the early days are reviewed in Appendix B.1.4.

5.1.5 Through 2009, IBM reiterated on open source and open standards

IBM was consistent in maintaining its strategic bet including open source and open standards for eight years, after which it became a normal way of doing business. The reiteration of these themes showed up again and again in annual reports through 2009, as depicted in Figure 5.4.

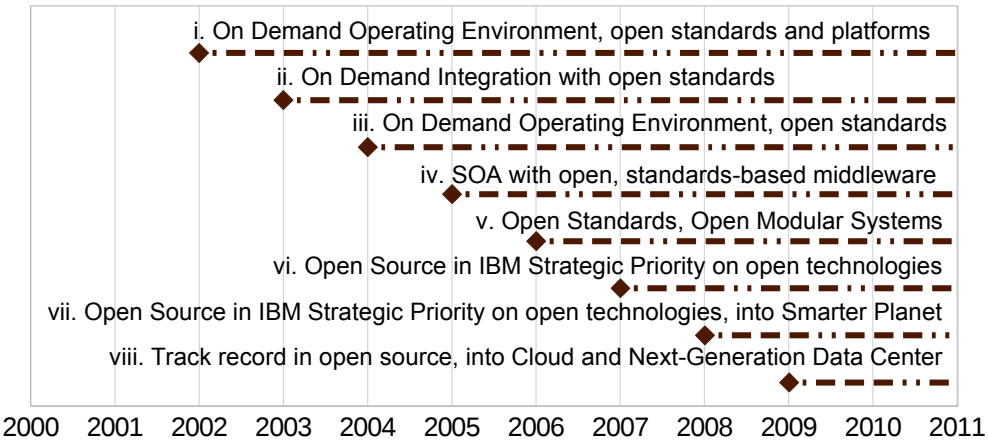

Figure 5.4. IBM annual reports mentioning open source and open standards

(i) In the 2002 Annual Report, the computing model had evolved to become an "On Demand Operating Environment", where IBM would continue to lead open technical standards and platforms.

(ii) In the 2003 Annual Report, the next wave was described as "On Demand Integration" with open standards.

(iii) The 2004 Annual Report reiterated "the architecture and technologies for the On Demand Operating Environment, based on open standards".[166]

(iv In the 2005 Annual Report, the rise of service-oriented architecture (SOA) was built on "open, standards-based middleware".

(v) In 2006, CEO Sam Palmisano wrote about a new business model called the Globally Integrated Enterprise, observing new forms of collaboration including the open source software movement. These open approaches were seen to affect more than just software and IT, and applied more broadly to education, governance and many industries. The language of "open standards" was complemented by the addition of "open, modular systems", expanding from the domain of technology into business processes.

[166]The 2004 fiscal year saw IBM exiting the PC market with an agreement with Lenovo to acquire the Personal Computing Division. Leadership in enterprise-class middleware with open standards was cited.

(vi) By the Annual Report 2007, open sourcing became embedded as core to the IBM strategy. In the first of three strategic priorities, the "focus on open technologies and high value solutions", the direction to continue "to be a leading force in open source solutions to enable its clients to achieve higher levels of interoperability, cost efficiency " was explicit.

(vii) The Annual Report 2008 was released in the wake of the 2007-2008 financial crisis and bear market, and just before the inauguration of U.S. president Barack Obama, repeating the three strategic priorities from 2007. The chairman's letter portrayed confidence with IBM "well positioned to continue delivering strong results". Open sourcing becomes a background context in itself, in the "instrumented, interconnected, intelligent" campaign of Smarter Planet launched in November 2008.

(viii) By the Annual Report 2009, open sourcing was described as part of the "IBM's track record", embedded into two of four investments in the future, in the "Cloud and Next-Generation Data Center" and "Smarter Planet". The annual reports of 2010 and 2011 saw the transition of leadership from Sam Palmisano to Ginny Rometty, with "open source" becoming unremarkable.

From the writing crafted in IBM annual reports, open sourcing can be seen as new in 2001, core by 2006, and a natural part of the way of doing business by 2009. Deeper reading of the IBM annual reports is included in the footnotes to Appendix B.1.5.

5.2 Context: IBM employees, from 1996, engaging globally online

IBM is a multinational corporation with matrixed organizational structure across many lines of business and countries. IBM employees have had a long tradition of communicating not only individual-to-individual, but with collective intelligence mediated in persistent conversations both inside the company, and with the world at large. The evolving context is depicted in Figure 5.5.

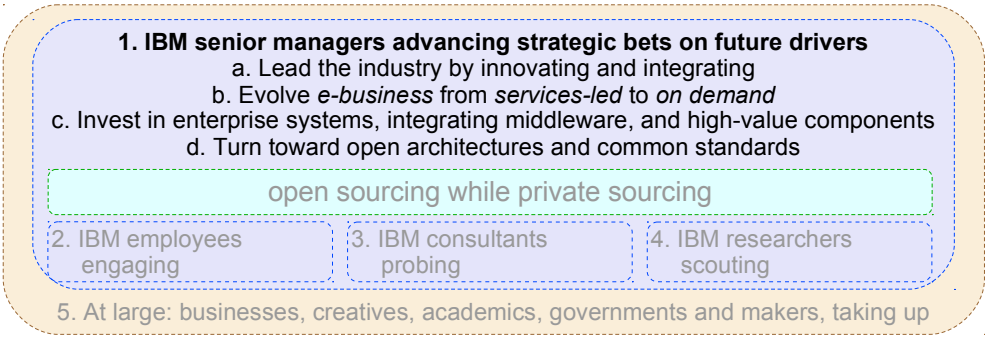

Figure 5.5. Context from IBM employees engaging globally online

Before, during and after the 2001-2011 frame of research, IBM employees

have engaged in online platforms, including: (a) online forums, outlined in section 5.2.1; (b) the w3 intranet, in section 5.2.2 (c) alphaWorks, in section 5.2.3; (d) pooled non-commercial source internally in section 5.2.4; (e) global online Jam events, in section 5.2.5; (f) the Technology Adoption program, in section 5.2.6; (g) Social Computing Guidelines, in section 5.2.7; and (h) the Greater IBM Community in section 5.2.8. The evolving contexts are more fully described in Appendix B.2.

5.2.1 From 1996, IBMers conferenced on IBMPC, then IBM Forums

Inside IBM, employees have long not only had platforms for communications one-to-one (e.g. e-mail), but also many-to-many (online conferencing) in parallel. This has enabled organizational sensemaking on technical and business question at a worldwide scale. As a foundational communications network infrastructure, the slow evolution is depicted in Figure 5.6.

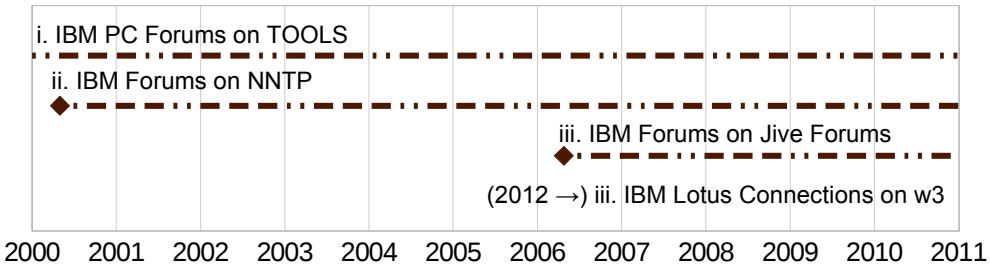

Figure 5.6. IBM employees conferencing worldwide on online forums

Historically, online conferencing dates back to 1981, the same time that business professionals were introduction to PROFS, a precursor of e-mail. A fuller history on conferencing platforms is in Appendix B.2.1.

(i) In October 1981, the IBMPC Forums built on the TOOLS conferencing system on the mainframe (i.e. under the VM operating system) on the internal IBM network (i.e. VNET). The platform came from the IBM Watson Research Centre Yorktown and IBM UK Scientific Centre, to support discussion on the IBM PC that was released in August 1981.

(ii) By 2001, the online conferencing became known as IBM Forums, with infrastructure was moved to an NNTP (Network News Transfer Protocol) application more consistent with the Internet technologies.

(iii) In 2007, application was still mostly funded by IBM Research, with a smaller contribution by the Office of the CIO. The TWE (Total Workplace Experience) Center of Excellence migrated the content to Jive Forums into production.

(iv) In June 2012, the IBM (Lotus) Connections program product was implemented by the Office of the CIO on the w3 intranet, seeded with migration of the complete content from the IBMPC and IBM Forums legacies.

Since 1981, computer conferencing has a consistent way inside IBM that employees could share questions, answers and insights in accumulating persistent conversations. By the early 1990s, practices and platforms such as these would become foundations for organizational learning, and then knowledge management. This ability to easily share perspectives amongst IBM employees, worldwide, has been a consistent background context for further advances in open sourcing.

5.2.2 From 1996, IBMers got connected to the Internet and w3 intranet

For the 2001-2011 period, IBMers could be described as mostly digital natives in their work lives. The history of the Internet and w3 Intranet is depicted in Figure 5.7.



Figure 5.7. IBM employees connecting on the Internet and w3 intranet

Before the rise of the Internet, communications between IBM employees was centralized through mainframe technology. From 1971, 3270 “green screen” terminals enabled e-mail, file sharing and messaging. The 1983 introduction of the PC/XT personal computer evolved the hardware, with 3270 terminal emulated in software. By 1992, mobile workers graduated to a Thinkpad 700C, still with 3270 terminal emulation connected to the mainframe through a modem with the IBM Global Network Dialer. The shift from mainframe to Internet and intranet platforms is detailed in Appendix B.2.2.

(i) In 1994, a “Get Connected” manifesto led by John Patrick and Irving Wladawsky-Berger in the new IBM Internet call for every IBM employee to have an Internet e-mail address. The www.ibm.com web site was launched in May 1994. IBM gained experience on scaling up public Internet sites with the 1995 U.S. Open and Wimbledon tournaments, the 1996 chess match between Gary Kasparov and Deep Blue, and the 1996 summer Olympics in Atlanta. By 1996, IBM was leading corporate enterprises with microsites for ShopIBM, investors, developers, and business partners. Since at least 1997, the e-mail address and phone number of every IBM worldwide has been available on whois.ibm.com.

(ii) The early 1990s saw IBM employees joining the PC revolution with word processing, spreadsheets and presentation tools (e.g. Lotus SmartSuite on OS/2 and Windows 95). In 1996 e-mail and document collaboration moved to Lotus Notes from PROFS, so that Lotus Notes databases became a standard way of sharing documents and discussions, with master

copies on networked servers and local replicas on laptops.

In late 1996, the IBM w3 intranet was rolled out, enabling IBM employees the ability to search on a gradually increasing body of knowledge across the corporation. By 2000, each employee was able to use a single sign on to the w3 intranet, and personalize his or her own homepage. In 2001, IBM employees would rank the w3 intranet equally with co-workers as the most credible or useful source of information, above the news media, executive memos or managers. The rise of open standards with Mozilla Firefox browser introduced in 2003 would gradually improve the functionality on the w3 intranet, as more information-intensive collaboration continued on Lotus Notes. By 2004, the w3 intranet was enhanced with the BluePages expertise locator and employee directory that would immediately show the person and profile of any colleague worldwide.

The technology platforms inside IBM have always enabled open sourcing behaviour. The rise of the Internet and intranet made sharing content easy, with a great leap forward for knowledge gathering through improved web search engines. Organizational knowledge could be decoupled from the minority of original content authors into the larger majority of "lurkers" who reuse the accumulation of wisdom. Knowledge was encouraged to flow freely on the intranet, and non-sensitive information could flow through official channels to the public.

5.2.3 From 1996, IBMers shared emerging technologies on alphaWorks

IBM practices emphasizing quality included development of commercial hardware products have following a stage-gated series of decision reviews separating design from manufacturing. Disclosing product directions to customers can have material impacts on financial projections, and was thus done under non-disclosure agreements. The rapid development of software "on Internet time" with Netscape browser releases in 1995 on the order of weeks led leaders in IBM's Internet Division to say that company development cycles were "taking too long". IBM alphaWorks, charted in Figure 5.8, were seen an alternative path.

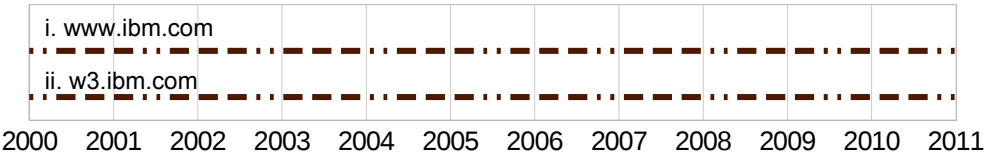

Figure 5.8. IBM employees sharing emerging technologies on alphaWorks

An alpha test (of units or modules of a system) precedes a beta test (of an integrated system). The IBM alphaWorks web site became an "online laboratory" for demonstrations to be available, months before they became official offerings. The history of alphaWorks is detailed in Appendix B.2.3.

(i) In December 1996, alphaWorks was first exhibited at the Internet World convention. In addition to new technologies from IBM Research, non-IBM contributions were also welcomed. While the alphaWorks demonstrations could include visibility to source code, downloads came with a "term and termination clause" whereby developers would agree to delete or destroy the software within 90 days. Success with alphaWorks was declared in the first year, with 28 early-stage technologies attracting 60,000 users to the community, and five products becoming commercialized.

(ii) In 2006, the rise of web-based services led to extending the download site with alphaWorks Services, where developers could connect to service side demonstrations running inside IBM. At the 10th year anniversary of alphaWorks, 700 new technologies had been introduced, from which 129 had been incorporated into an IBM product.

As a community site, alphaWorks has been an open sourcing way for IBM employees to share emerging technologies that may or may not have a clear product plan. At the leading edge of product development, feedback from a wider audience can influence judgements on standards and/or market demand. Having a license that terminates after 90 days is a creative way of releasing unproven technology modules (alphas) before further investment into prerelease products (betas).

5.2.4 From 2000, IBMers have pooled on source code repositories

The number of IBM employees with technical expertise far exceeds those with specific job roles to research, development and support IBM products. While these could be shared individual-to-individual, the company has provided more structured means for widespread distribution. These are charted in Figure 5.9.

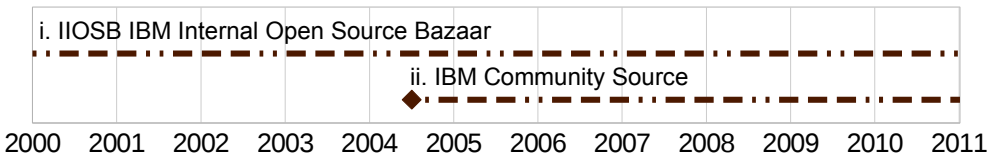

Figure 5.9. IBM employees pooling non-commercial source internally

Formally categorizing software written "on company time", but not originally targeted as customer offerings, clarifies future uses of an asset. More details on the platforms and methods is in Appendix B.2.4.

(i) In May 2000, the IBM Internal Open Source Bazaar (IIOSB) became "a free service to promote Open Source style development internally at IBM" across all employees, funded by the IBM Linux Technology Center. Licensing zones include: (i) IBM Internal; (ii) IBM Internet / Mixed OSS; (iii) Apache / BSD / MIT; (vi) GPL / LGPL; (v) IPL / CPL / EPL;

and (vii) Other (where legal counsel would have to be sought). The first project registered was the "Linux Client for e-business" (C4EB) installer of operating system and applications on computers issued to IBM employees, as an alternative to the Windows XP platform. By May 2010, 1,493 projects were hosted, with 12,865 registered users.

(ii) In 2005, the IBM Community Source repository was opened. This repository was targeted for developers with primary responsibility for development program products across 40 labs in Software Group. While these assets would be recognized externally as copyrighted to IBM, an open sourcing behaviour was encouraged inside the company. With a single repository across the entire company, the ability to easily access a continually evolving body of software components within Software Group was estimated to improve speed to market by 30%. At May 2010, 1,747 projects were hosted on IBM Community Source, with 33,580 registered users.

Having to check copyright licensing can be a drag on open sourcing as a desirable behaviour. Contributing assets to the IIOSB and IBM Community Source clarifies the origins and potential scope of use of company assets for reuse in commercial and non-commercial contexts.

5.2.5 From 2001, IBMers have collaborated on global online *jam* events

IBM coined the term "jam" as an online collaboration event that could be sponsored by leaders to start a movement towards organizational transformation. Jams originated as employee events with voluntary participation in non-anonymous open sourcing of perspectives. They evolved to become facilitations conducted for external parties in non-commercial and then commercial contexts. The progression of jams is shown in Figure 5.10.

When jams were first started in 1999, collaboration over Internet technologies had not been conducted with near-real-time facilitation at the scale of tens of thousands of participants over multiple days. Jams were shown not only to be feasible, but effective. The extended history of jams is detailed in Appendix B.2.5.

(i) The first jam event, World Jam, was scheduled May 21 to 24, 2001, after 9 months of preparation. It ran as 72 hours around-the-clock global event. This experiment, led by the Worldwide Internet Strategies and Program office, tested whether an intranet could be used for culture change. The goal was to surface best practices by employees successful working in the complexity of IBM as a global organization. The web-based platform saw 52,595 unique logons (one-sixth of IBM's 300,000 workforce). In the back channel for topic moderators and facilitators, IBM Researchers coordinated on joint problem solving with the Babble prototype. World Jam was seen as positive in (i) accelerating expertise engagement by

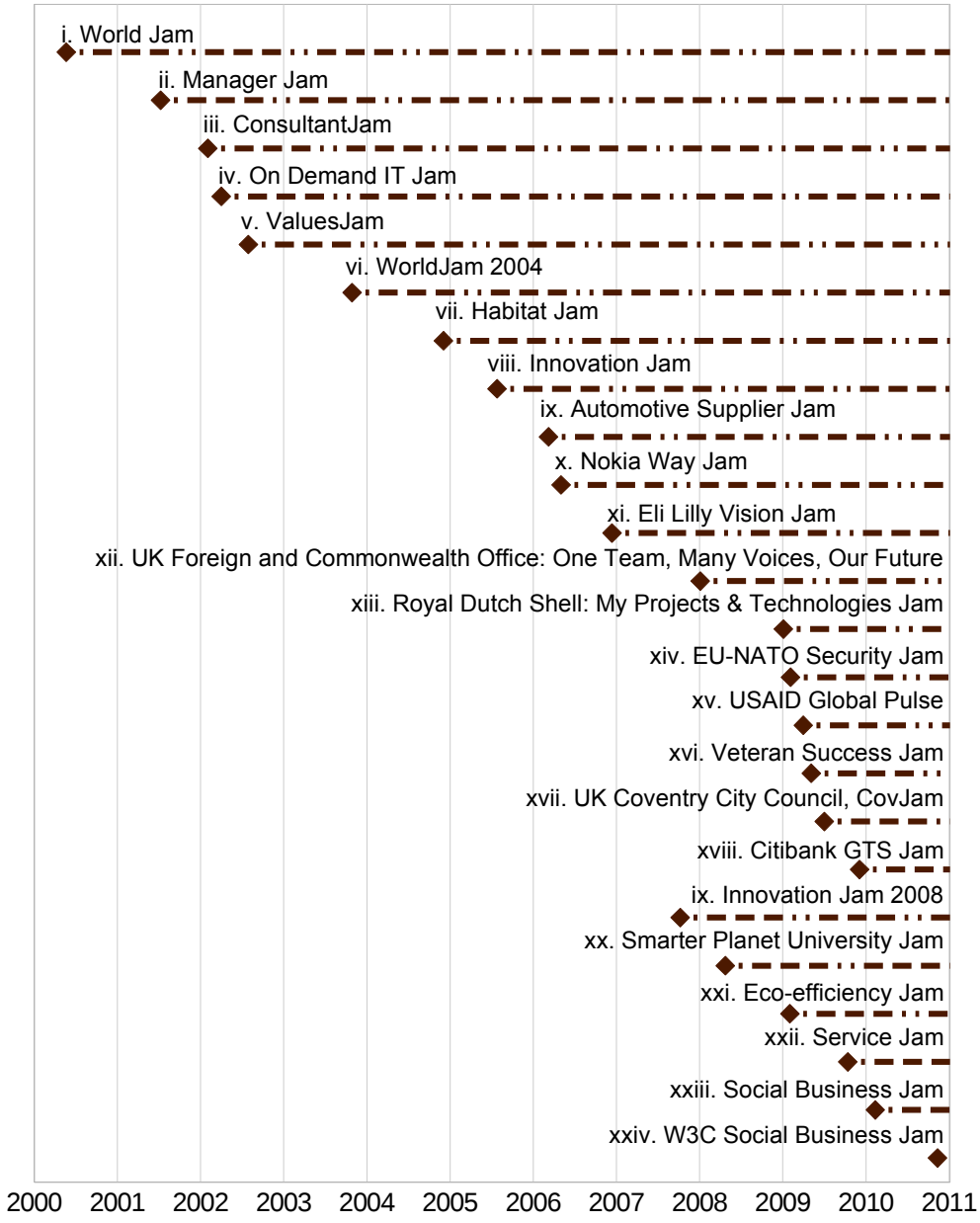

Figure 5.10. IBM employees engaging in Jams

meeting new contacts; (ii) observed trust, in mutual constructive criticism, and (iii) repeatability to engage again in a similar event, having learned new things.

(ii) ManagerJam, on July 9 and 10, 2002, invited 32,000 managers at all levels to join during 48 hours. Topics were focused on grassroots solutions to everyday IBM management challenges. The technology platforms evolved both on the front stage discussion forums, and the back stage facilitation collaboration. Participation rates rose from World Jam, with 25% of the manager population logging in, and 22% posting to the 4554 comments and replies.

(iii) ConsultantJam, in February 2003, was conducted within 45 days of the acquisition of PriceWaterhouseCoopers Consulting. The 30,000 legacy PwCC consultants and over 30,000 legacy IBM Global Services employees had been instructed to not communicate with each other in the lockup period between the acquisition announcement in July 2002, and the completion in October 2002. This event included discussions on the IBM corporate culture, and working together. In 96 hours, 8560 participants discussed 2960 ideas. Text mining and theme analysis was added, with a JamAlyzer technology.

(iv) The On Demand IT Jam in April 2003 followed the "On Demand" strategy by IBM introduced that year. Internet technologies had been proven as successful for adjunct platforms, e.g. e-commerce. At the same time, those Internet technologies had not had changed core operational environments in large enterprises. This Jam was designed to uncover ideas and solutions to transform IBM itself into an on demand business. Internal success could then be replicated with enterprise-scale customers. Over 72 hours, 9793 participants discussed 2963 ideas. Follow through was tracked by formally establishing executive accountabilities for action.

(v) Values Jam, held between July 29 and August 1, 2003, was the landmark event to move massive online collaboration from the tactical to the strategic. By 2002, the company had turned its fortunes around, and was positioned for growth with Sam Palmisano taking the role of CEO. All employees knew the corporate values set in the Basic Beliefs established by Thomas Watson Jr. in 1969. Should new corporate values be set for the 21st century? All employees were invited to discuss what defines IBM and IBMers.

The Values Jam web site saw 1.25 million views over 72 hours, with 22,007 participants writing 9337 posts and replies. IBM executives reviewed the JamAlyzer analysis, pre- and post-jam survey, and raw transcripts. The revised set of corporate values was published on the company intranet in November 2003, leading to 200,000 downloads by employees within 10 days.

(vi) World Jam 2004, in the October a year after Values Jam, followed through to operationalize those findings consistent with the new values. At

levels both of individual employees and executive policy, the focus was identifying actionable ideas to accelerate profitable growth, unleash innovation and drive internal productivity. The volume of participation extended the event by 6 hours to 52 hours, October 26 to 28, 2004. World Jam 2004 resulted in 2.4 million page views, and 56,870 unique participants writing 32,662 posts. From November 30 to December 6, a follow-up "Rate the Ideas" inviting ranking for 191 ideas. Senior management committed to 35 of the top-rated ideas.

(vii) In December 2005, Habitat Jam was an event external to IBM, where the proven Jam technologies and facilitation events techniques were provided. The internet conference was jointed sponsored by the United Nations Human Settlements Program, the Government of Canada, and IBM. In preparation for the third World Urban Forum scheduled for June 2006 in Vancouver, Canada, the Jam technology enabled voices who could not otherwise attend in person to engage. Habitat Jam included 400 organizations from around the world, drawing 39,000 people from 158 countries, including slum dwellers, villagers, architects and planners. The 4000 pages of discussion generated 600 ideas, leading to 70 actionable ideas published in the workbook and CD for the World Urban Forum III.

(viii) The label of *Innovation Jam* for 2006, can be traced to the new corporate value of "innovation that matters", from the 2003 Values Jam. This event expanded participation beyond IBM employees to family members and 67 organizations including business partners, customers, and university researchers. Shifting towards developing a larger set of idea rather than immediate implementation, participants were asked to familiarize themselves with some 25 emerging technologies.

The first phase of Innovation Jam ran between July 24 and 27. Forums focused on (i) Going Places; (ii) Finance & Commerce: (iii) Staying Healthy; and (iv) A Better Planet. Discussions saw 57,000 logging in, and 37,000 posts. The cross-IBM team analyzed these outputs, resulting in 31 "big ideas".

Phase 2 of Innovation Jam, between September 12 to 14, invited participants to flesh out the proposals. Ratings on business impact, market readiness and societal value led to 9000 posts. Further analysis reduced the proposals to 10 finalists. On November 14, 2006, CEO Sam Palmisano announced that IBM would invest $100 million over the next two years to pursue these ten new business, in partnerships with clients and universities. These investments were estimated to have returned $700 million in revenue in the following five years.

From 1999 through 2006, Jams were run primarily as internally-oriented events with non-customer-facing resources. From 2007, Jam became an offering contractable through IBM Global Services.

- (ix) In March 2007, *Automotive Supplier Jam* was the conducted with the Original Equipment Suppliers Association (OESA).

- (x) In May 2007, Nokia had a *Nokia Way Jam*. focused on the question "What does it take to be an Internet company?" as part of shifting Nokia's business and strategy.
- (xi) In December 2007, Eli Lilly had a *Vision Jam* to generate practical ideas through an increased understanding of the company's new vision.
- (xii) In January 2009, the UK Foreign and Commonwealth Office had a jam on *One Team, Many Voices, Our Future*, to model the behaviour for the future organization, to break down divisions between the home office and overseas, career diplomats and civil service.
- (xiii) In early 2010, Royal Dutch Shell Projects and Technologies had a *My P&T Jam* to create an affiliation across a new organization of 8200 globally dispersed employees.
- (xiv) In February 2010, the European Union and NATO had *Security Jam* focused on the changing nature of the 21st century security landscape.
- (xv) In March 2010, USAID and the White House had *USAID Global Pulse* 2010 Jam to share ideas and creative innovation solutions to social issues, informing U.S. foreign assistance and diplomatic strategies.
- (xvi) In May 2010, the American Council on Education and the Kresge Foundation sponsored a Veteran Success Jam, to address issues for returning veterans with colleges, universities and employers
- (xvii) In June-July 2010, the UK Coventry City Council had *CovJam*, to engage in dynamic conversations with constituents about future direction.
- (xviii) In late 2010, Citibank Global Transaction Service had a *GTS Jam*. to enable employees to engage directly with senior management on key initiatives for future growth.

From 2008, IBM Jam events were sponsored by business units, rather than through corporate programs.

(xix) Innovation Jam 2008 was an IBM-sponsored event linked with customer-facing research. The jam followed publication of the IBM CEO Study released in May 2008, where 1100 CEOs shared their visions of the Enterprise of the Future. The four main discussion areas were on: (i) change and adaptation; (ii) customers as partners; and (iv) moving beyond green.

The jam ran from October 5th through 9th. Nearly 90,000 logins generated 32,000 posts. Employees from over 1000 companies across 20 industries included thousands of IBMers, and subject matter experts from Mars Incorporated, Eli Lilly and Company, Citigroup and Boston College. The enterprise of the future was concluded as having to (i) embrace transparency; (ii) increase efficiency; and (iii) adopt corporate stewardship.

(xx) In April 2009, IBM University Programs sponsored a Smarter Planet

University Jam. Nearly 2000 students and faculty from 200 universities in 40 countries joined. The jammers saw the need for new university education around smarter campuses, contributed ideas of how universities could "go green", and saw opportunities in water, healthcare, grid technologies and cities.

(xxi) In January 2010, the Institute for Business Value unit of IBM Global Business Services sponsored the Eco-efficiency Jam. Participants included 1600 leaders, journalists and experts from more than 60 countries. Best practice recommendations included: (i) "green" infrastructures overlayiung the physical with digital; (ii) sustainable solutions promoing resource efficiency; and (iii) intelligent systems using open standards for realtime information.

(xxii) In October 2010, IBM Corporate Citizenship & Corporate Affairs sponsored Service Jam. More than 15,000 people from 119 countries, including presidents, professors and tutors, discussed practices in volunteering, public services, and social entrepreneurship.

(xxiii) In February 2011, IBM Software Group sponsored a Social Business Jam. The event brought together 2700 participants from 80 countries for 72 hours on (i) social business; (ii) participatory organizations; (iii) social media with customers; (iv) IT functions; (v) risks and governance. The jam yielded over 2600 discussion posts and more than 600 tweets. Over 25% of organizations were found to be immature in adopting social business practices.

(xxiv) In November 2011, the World Wide Web Consortium (W3C),hosted the W3C Social Business Jam. IBM provided the minijam platform. Six aspects of social technology were discussed by 1073 unique registrants from 20 different industries. The resulting W3C Social Business Community Group evolved with the W3C launching two groups, and the OpenSocial Foundation integrating into the W3C legal entity.

From an open sourcing perspective, IBM Jams have been revolutionary as large scale participatory events, where individual contributors are not anonymous. While the resources have been provided by IBM on a private sourcing basis, the technology platform could be easily replicated with open source alternatives. The expertise and credibility of such events did, however, benefit by the explicit sponsorship and participation of IBM.

5.2.6 From 2005, IBM early adopters have collaborated on innovations via the Technology Adoption Program

In 2005, the IBM CIO recognized that innovation in the company is not limited to employees in the research and development labs. Individuals could share hobby projects on an Intranet wikis or a personal web space, but structured feedback or ongoing enhancements was absent. This gap led to the Technology Adoption Program (TAP), charted in Figure 5.11.

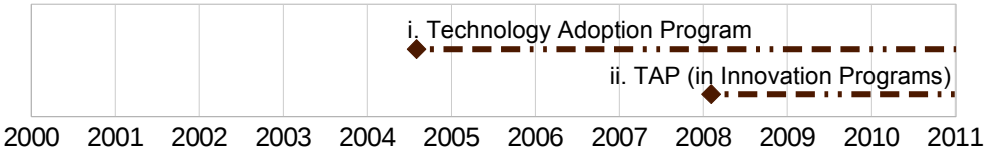

Figure 5.11. IBM employees on Technology Adoption Program

The Office of the CIO, traditionally an operations function, recognized a new role as a innovations sponsor. The program was originally staffed organically, and then later formalized. The projects and participation of employees in these programs is detailed in Appendix B.2.6.

(i) In August 2005, an initial core team of four put a TAP life cycle process into place: (a) an innovation proposal phase of 1 or 2 weeks; (b) an offering phase of 9 months; and (c) graduation to production and/or commercialization, or retirement. The initial projects seeded included a web services client for smartphones, a browser page tagging extension, and a enterprise social bookmarking extension. At the end of 2007, there were 143 TAP offerings, and over 100,000 TAP users in the company.

(ii) In February 2009, the Innovations Programs department became the new home for TAP, in parallel with Biztech (virtual teams for early tenure employees) and Thinkplace Next (an ideation forum originating from IBM Research). By 2010, projects would be more prominent on every employee's personalized intranet home page with the Innovation Carousel featuring offerings associated through social ties.

TAP reflects open sourcing practices at work inside IBM. Employees voluntarily shared tools they personally built to help them in their daily activities, and peers could each install them or not. The Office of the CIO minimally provided a tracking platform with simple platforms.

5.2.7 From 2005, IBMers wikied guidelines and grew social computing

IBM has policies, as does any corporation. Deferring to the situational judgement of its professional workforce, the company has evolved guidelines on which desired and acceptable behaviours are explained. An evolution of guidelines is shown in Figure 5.12.

Guidelines have been part of IBM practices for many decades. The rise of the Internet and social media has resulted in new guidelines originating bottom-up from the experiences of early adopters. Details on the development of these practices appear in Appendix B.2.7.

(i) In 1956, IBM first established Business Conduct Guidelines. Each year, all employees read the revised version, and sign (now electronically) that they have done so.

(ii) Since 1995, the Internet Usage Guidelines primarily oriented towards intranet has been complemented by an Acceptable Use Policy on gateways

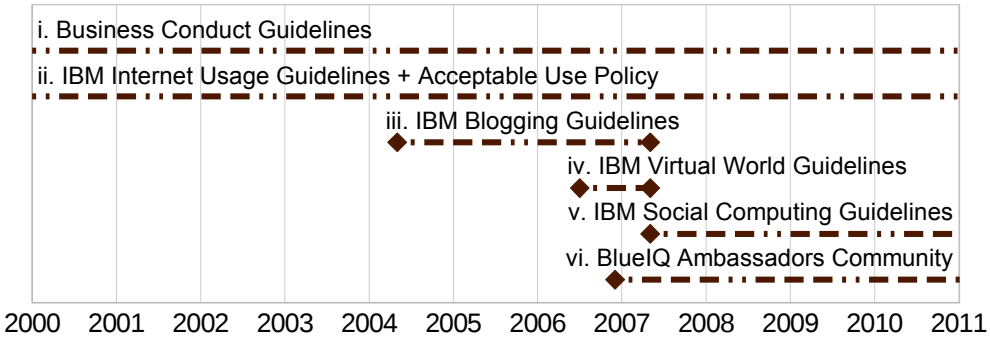

Figure 5.12. IBM employees on social computing guidelines

(e.g. e-mail, Telnet, FTP, Usenet) to the outside world.

(iii) In May 2005, a small group of IBM employees developed a set of core principles on an internal wiki. At that time, almost 9,000 IBMers were blogging on the open Internet, and/or on the w3 Intranet. The practice that that blog authors "are speaking for yourself and not on behalf of IBM" was not a policy imposed by IBM, but instead a "commitment that we have all entered into together". These blogging guidelines were endorsed by the corporation, and promoted on the public IBM web pages. The IBM Blogging Guidelines became an innovation that other institutions came to recognize and emulate.

(iv) In July 2007, increased participation in immersive technologies (e.g. Second Life) led to publishing of the IBM Virtual World Guidelines.

(v) By May 2008, the IBM Social Computing Guidelines emerged from a group working again on a wiki on the w3 intranet, to generalize the prior blogging and virtual world writings. These were published on the public IBM web site, deprecating the earlier blogging and virtual world versions. A subtle evolution of wording was released in 2010.

(vii) At the end of 2007, a BlueIQ Ambassadors Community was formed as a peer-to-peer network of volunteers who would become social software evangelists. To expand beyond early adopters, the larger population of client-facing employees was encouraged to embrace IBM social software in internal and external use. By 2011, the community had grown to 1600 volunteers, coordinated by 9 headcount across the range of job roles, geographies and product lines, sponsored by the Senior VP of IBM Software Group. By the 2011 IBM Centennial, 29,000 IBM experts in social business were made visible on the public IBM web site.

On the learning journey from blogging to social computing, IBM employees were respected on the voices that appeared openly on personal web sites. In fact, the same content was often published both on intranet sites and on personal web domains, both by non-managerial professionals and by executives. The guideline of "Don't forget your day job" reflects maturity and trust that individuals are able to distinguish between information that should preserved as private sourcing, while much can be released as open

sourcing.

5.2.8 From 2006, IBM alumni connect via the Greater IBM Connection

With an employee population around 330,000 at 2006, there were an estimated 800,000 to 1,000,000 former IBMers. Outreach to this group was initiated through the Greater IBM Connection, charted in Figure 5.13.

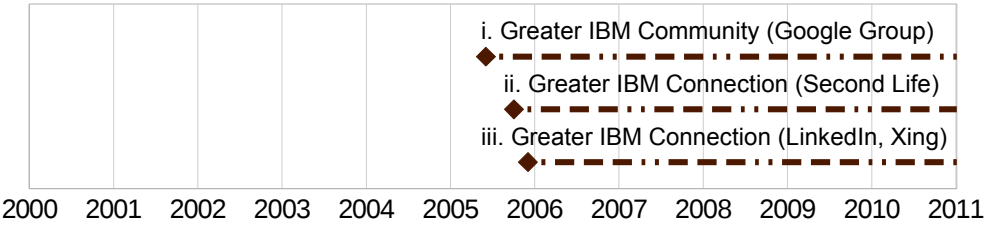

Figure 5.13. IBMers in the Greater IBM Community

Former IBM employees include traditional retirees, professionals active in careers elsewhere after long or short tenures, and interns. With 20 to 25% of professional hires as former employees who can be reboarded rapidly, corporate alumni networks are a good investment. Responses to the outreach to ex-IBMers are described in Appendix B.2.8.

(i) In June 2006, discussions were initiated by IBM U.S. Strategic Communications about forming a Greater IBM group. A team planning and developing the network coalesced on a Google Group and Wordpress blog.

(ii) In October 2006, a virtual block party was held for the Greater IBM Connection in Second Life. Complementing the venue on Almaden Island, alternative meeting technologies with text chat and voice teleconferencing were provided.

(iii) By December 2006, the Greater IBM Connection was on the two largest business social networking sites: Xing and LinkedIn. A site was launched on Facebook in 2007, and a Twitter identiy was created in July 2008.

The endorsement of IBM alumni networks on non-IBM platforms reflects opening up communications beyond the current employment status. While current IBM employees do participate on these online communities, their number is dwarfed by the larger body of ex-IBMers.

The autonomous actions of IBM employees are detailed in Appendix B.2. The style of engagement in an open sourcing style dates back before open source licensing was legally formulated. The online engagement of IBMers in the period 2001-2011 coincides with embracing fluid communications with Internet technologies.

5.3 Context: IBM consultants, from 2004, focused priorities from business leaders through industry-based executive studies

The IBM Institute for Business Value was formed in 2002 within the management consulting unit, with a charter to develop primary research. Amongst the intelligence shared externally with other parties, the IBV studies involving business executives are depicted in Figure 5.14.

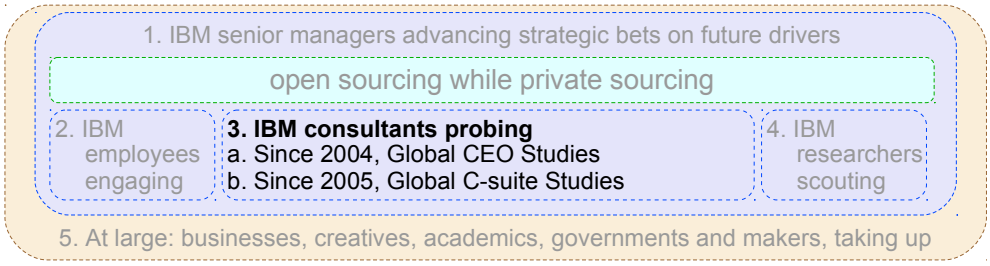

Figure 5.14. Context from IBM consultants probing

Consultants from IBM Business Consulting Services (which would rename to Global Business Services) first engaged Chief Executive Officers with the Global CEO Studies. Subsequently, studies with functional business leaders would lead to the Global C-suite Studies. The history and findings of the studies are more fully described in Appendix B.3.

5.3.1 From 2004, IBM consultants surveyed priorities on innovation and strategic change with Global CEO Studies

IBM consultants interviewed hundreds of executives in the private and public sectors on their views of strategic business issues, funded by IBM corporate. The series of CEO Studies is charted in Figure 5.15.



Figure 5.15. IBM consultants probing with Global CEO Studies

Both business leaders and IBM could benefit by understanding the evolving attitudes and concerns across industries, around the world. The content scope and depth of these studies sponsored by IBM is detailed in Appendix B.3.1.

(i) In early 2004, the first Global CEO Study was published as *Your Turn: CEOs across the world are renewing their organizations for growth. Are*

you? Reporting on interviews with 456 CEOs, the top finding was a shift towards growing revenue, after many years focused on cost containment.

(ii) In March 2006, the second Global CEO Study was published as *Expanding the Innovation Horizon*. Interviews with 765 CEOs found business model innovation a priority higher than expected, and external collaboration with business partners and customers the top source for ideas.

(iii) In April 2008, the third Global CEO Study was titled *Enterprise of the Future*. In interviews with 1130 CEOs, the gap between expected change and ability to manage it tripled since the 2006 study.

(iv) The fourth Global CEO Study released April 2010, titled as *Capitalizing on Complexity*, "sought to understand differences between financial standouts and other organizations". In addition to the interviews with 1541 CEOs in 60 countires and 33 industries, a subset of questions was asked to 3619 students from 100 universities around the world. Findings including 79% of CEOs expecting greater complexity ahead, with 51% doubting their ability to manage it.

(v) The fifth Global CEO Study was published in May 2012 as *Leading Through Connections*, focusing on "interconnected organizations, markets, society government". More than 1709 CEOs across 64 countries found 75% seeking greater collaboration amongst their employees.

This 2012 CEO Study was the last to be prepared and packaged as an independent work, perhaps as a byproduct of the theme of interconnectedness. The CEO perspective would be one part of subsequent C-suite Studies.

5.3.2 From 2005, IBM consultants surveyed functional executives with additional C-suite studies

The Global CEO Studies were complemented by a series of studies with CxOs (i.e. CFO, CHRO, CIO, CSCO, CMO). The approach was similar, as primary research conducted with many face-to-face interviews. The releases of the studies are charted in Figure 5.16.

These studies of functional executives were often compared in alignment to the prior Global CEO Study. Eventually, they were repackaged and renamed as a group, as C-suite studies. Details on methods of inquiry and and findings appear in Appendix B.3.2.

(i) Before the *studies* started in 2004, the IBV conducted a *survey* published in September 2003 as *CFO Survey: Current state and future direction*. Reporting on interviews of 450 CFOs from 35 countries, it foresaw the Chief Financial Officer becoming a Chief Focus Officer, transforming from the role of a "policeman" to becoming a strategic business partner.

(ii) In September 2005, the first CxO study, the Global Human Capital Study, was titled as *The Capability Within*. Interviews with 106 CHROs

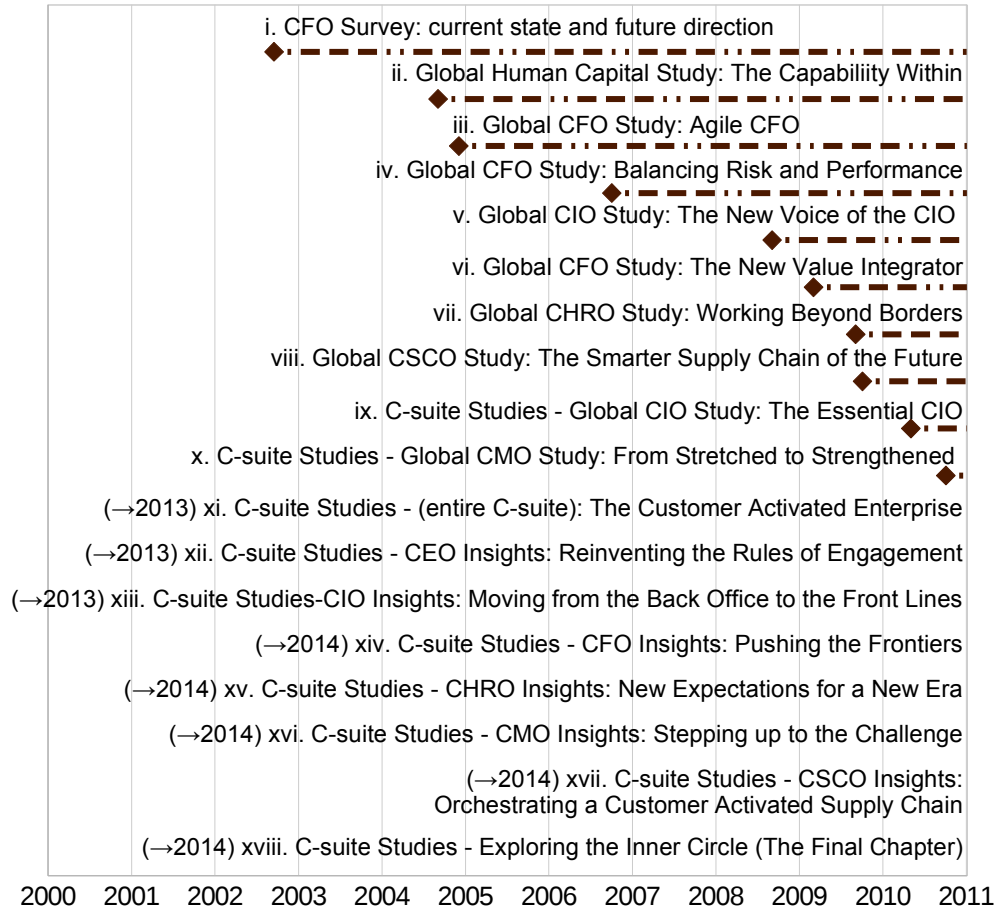

Figure 5.16. IBM consultants probing on C-suite Studies

(Chief Human Resource Officers) confirmed "the findings of the IBM Global CEO Study 2004" in organizational inadequacies to respond to growth and responsiveness priorities set out by their CEOs.

(iii) In December 2005, the Global CFO Study was published as *The Agile CFO: Acting on business insight*. In cooperation with the Economist Intelligence Unit, 889 CFOs were interviewed, with results tracking the 2004 Global CEO Study top agenda items.

(iv) In October 2007, the Global CFO Study was titled *Balancing Risk and Performance with an Integrated Finance Organization*, in coooperation with the Economist Intelligence Unit and Wharton School professors. With a vision of a "globally integrated enterprise", "what does it mean for the Finance discipline"? Findings from 619 in-person interviews and 611 online surveys included most enterprises seeing material risk issues while being unprepared for them.

(v) In September 2009, the first Global CIO Study was titled *The New Voice of the CIO*. The 2598 CIOs in 78 countries were found to spend over half of their time on innovation activities.

(vi) In March 2010, the Global CFO Study was released as *The New*

Value Integrator. Of 1900 CFOs, 75% were interviewed face-to-face by IBM executives, and the remaining surveyed by the Economist Intelligence Unit. With four segments of (a) scorekeepers, (b) constrained advisors, (c) disciplined operators and (d) value integrators, the latter were found to outperform by more than 20 times EBITDA, 49% more revenue and 30% more ROIC.

(vii) In October 2010, the second Global CHRO Study was released, titled *Working Beyond Borders*. Amongst 707 CHROs, the pattern of workforce investment had changed, so that CHROs in growth markets (e.g. China and India) were increasing their workforces in mature markets (i.e. North America and Europe).

(viii) In December 2010, the first Chief Supply Chain Officer Study was titled *The Smarter Supply Chain of the Future*. Responses from 393 executives were compared with "The AMR Research Supply China Top 25 for 2008" on ways to deal with volatility.

(ix) In May 2011, the second Global CIO Study was released, titled *The Essential CIO*. This was the first in the program now called *C-suite Studies*. Amongst 3018 CIOs, plans were highly aligned with 2010 Global CEO Study vision to increase competitiveness.

(x) In October 2011, the first Chief Marketing Officer Study was published, titled *From Stretched to Strengthened*. The 1734 CMO respondents were found to be highly aligned with the 2010 CEO Study on top external forces as markets and technologies.

After 10 years of studies, research has ramped down with a perspective of seeing changes with the benefit of history.

- (xi) In October 2013, the "first study of the entire C-suite" was was titled *The Customer Activated Enterprise*. This combined the cumulative data from 23,000 interviews stretching back to 2003 with meeting with 4183 top executives between February and June 2013. Associated reports were subsequently release.
- (xii) In November 2013, the CEO insights were described in *Reinventing the Rules of Engagement*, placing technology as the biggest driver of change over market forces.
- (xiii) Also in November 2013, The CIO insights were released as *Moving from the Back Office to the Front Lines*.
- (xiv) In February 2014, the evolution of the CFO perspective was released as *Pushing the Frontiers*.
- (xv) In March 2014, the CHRO insights were as *New Expectations for a New Era*.
- (xvi) Also in March 2014, the changing world of the CMO was reported in *Stepping Up to the Challenge*.
- (xvii) In May 2014, the preparations of the future by CSCOs were reported in *Orchestrating a Customer Activated Supply Chain*.
- (xviii) In June 2014, *The Final Chapter* of C-suite Studies was re-

leased as an app downloadable to a tablet or viewable on the web as *Exploring the Inner Circle*. This summarized the ten years, 17 studies, and 23,000 face-to-face executive interviews.

Every company does market research and intelligence work. Most would hire external consultants to conduct the studies, and would make the findings totally private to the company. In the Global CEO and C-suite Studies, IBM consultants took an open learning approach with leaders of commercial, governments and not-for-profit enterprises, and published findings publicly.

5.4 Context: IBM researchers, from 2004, led studies on longer horizon opportunities for social impact

IBM Research, a division of the company with a horizon of five to ten years in the future, has historically focused on advances in technology. Some new domains of focus are depicted in Figure 5.17.



Figure 5.17. Context from IBM researchers scouting

In contrast to consultants in IBM Global Services, the staff in IBM Research typically have a Ph.D. in science, and seldom few receive direct revenue from external customers. Their mandate has been to pursue technological and scientific breakthroughs. The broadening of research domains is described more fully in Appendix B.4.

5.4.1 Since 2004, IBM researchers led the Global Innovation Outlook

Since 2000, IBM Research had annually published a Global Technology Outlook (GTO) for internal use forecasting. The GTO is selectively shared with customers, and the distribution of copies outside of IBM is strictly controlled.

The Global Innovation Outlook (GIO) was started as a complement, with two major differences: (i) discoveries were to be cocreated with parties outside of IBM; and (ii) the opportunities would in aspects of quality of life that could be changed. The studies and work involving researchers are charted in Figure 5.18.

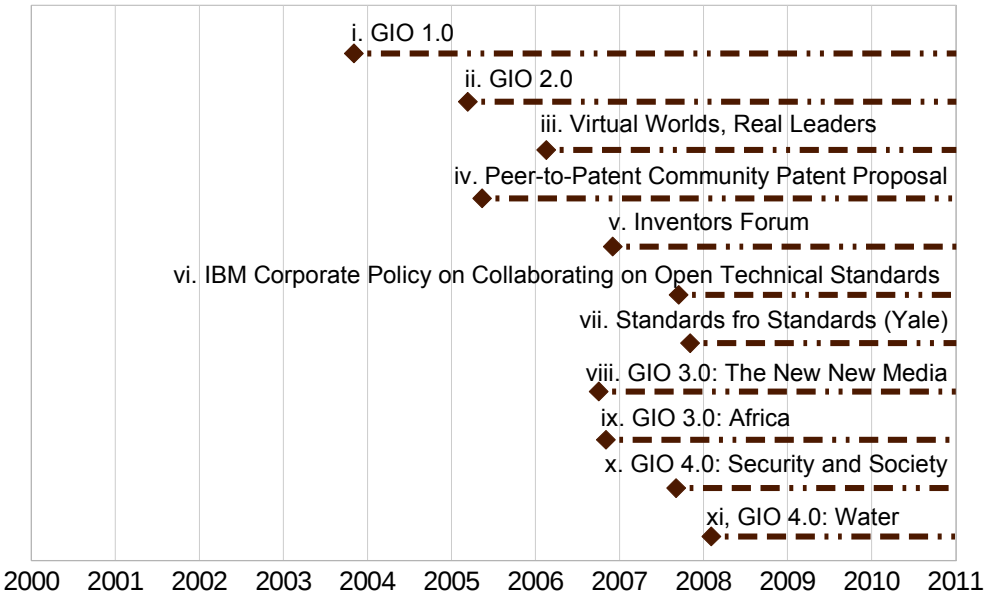

Figure 5.18. IBM researchers scouting on Global Innovation Outlooks

The premises of GIOs included: (a) innovation occurring more rapidly; (b) collaboration across wide disciplines and specialities was required; and (c) intellectual capital was being shared, rather than being hoarded. Breaking from the practice of IBM copyrighted form numbers, the later reports were released under Creative Commons licenses. More details on the GIO appear in Appendix B.4.1.

(i) In November 2004, GIO 1.0 was published. It reported on 10 "deep dive" sessions in New York, Shanghai, Washington DC and Zurich over 24 days across 96 organizations. Three broad societal themes were discussed: (a) healthcare; (b) government and its citizens; and (c) the business of work and life. Themes that emerged were (a) the need for standard ways of exchanging information; (b) the need for open collaboration; and (c) the primary of the individual as a focal point for innovation.

Based on GIO 1.0, the view on innovation evolved so that its nature became described as "global, collaborative, multidisciplinary and global" consistently by IBM executives in 2005. This framing coincides with the accepting of open sourcing while private sourcing at IBM.

(ii) In March 2006, GIO 2.0 was published. Respondents in GIO 1.0 largely prioritized issues related on energy and the environment. This context led to 15 deep dive sessions in fall 2005 on (a) the future of the enterprise; (b) transportation and (c) environment with 178 organizations. Building on the findings of GIO 1.0, some patterns emerged on (a) the power of networks; (b) line of sight shaping decision-making; (c) flipping the equation towards new breakthroughs and advancements. After GIO 2.0, subsequent reports would be in-depth studies on specific topics.

(iii) In February 2007, *Virtual Worlds, Real Leaders* was inspired by GIO

2.0. Leadership in online games was guided by the Sloan Leadership Model from MIT. Given the right tools in the right circumstances, leadership was found to emerge.

(iv) In September 2006, the *Building an IP Marketplace* report was issued. This followed a "Peer to Patent" community proposal led by New York Law School, IBM, and the U.S. Patent and Trademark Office from May 2006, that evolved on a wiki over the summer. Issues raised included (a) patent quality; (b) transparency; (c) integrity; (d) valuation and (e) flexibility. The Peer-to-Patent program officially started in June 2007. Within two years, 2600 individuals registered to become peer reviewers, on 187 patent applications. With the new Obama administration in 2009, David Kappos moved from IBM VP to Director of the USPTO, and Beth Noveck was appointed to lead the Open Government Initiative.

(v) In December 2007, *The Inventors Forum* report was released under a Creative Commons license. Earlier the year, 400 participations had a 12 week online discussion on how smaller enterprises could reform patent quality. Issues identified included (a) lack of education at undergraduate levels; (b) patent offices not exploiting technology; (c) pending patent reform legislation in the U.S. improving quality, but negatively change damage and challenge rules; (d) an emerging "soft IP" system that would facilitate innovation; and (e) effective IP management as assets rather than byproducts.

(vi) In September 2008, IBM published a new corporate policy to formalize company behaviour when collaborating to create open technical standards. The policy followed from the approval of OOXML as the ECMA-376 standard in December 2006, and the ISO/IEC DIS 29500 in April 2008, driven by Microsoft. This led to a call for "standards for standards", since the transparency, fairness and quality was highly variable across international bodies. Over summer 2008, IBM facilitated an online wiki discussion amongst 70 independent experts. Final recommendations were published on the IBM web site, complemented by Japanese and Chinese translations. The new policy could lead to IBM withdrawing from an international standards body – a last resort, in dire circumstances.

(vii) In March 2009, the Information Society Project at Yale Law School presented *Technical Standards Recommendations for the Obama Administration*. The "standards for standards" wiki content originating from IBM was an input into the Standards for Standards Summit at Yale in November 2008. These recommended a national standards strategy, that would contribute to the America Invents Act passed in September 2011.

(viii) In October 2007, the first GIO 3.0 was published as *The New New Media*. Over 60 days, deep dives had been conducted in seven cities to explore the new "media, content, branding and messaging" segment. The primary themes emerging were (a) authenticity through dialogue; (b) digital person ownership; (c) context as king over content; and (d) mobile

platforms bridging the economic divide.

(ix) In November 2007, the second GIO 3.0 report was published, titled *Africa*. GIO meetings brought together 123 ecosystem partners from 24 countries. Eight factors critical to the continent's future were presented: (a) unlocking skills through investment in education realigned to private sector needs; (b) capturing more value locally from resources; (c) raising Internet above the "low access" category; (d) transforming through mobile technologies; (e) tapping the informal economies; (f) mesofinancing women entrepreneurs; (g) redefining risk and collateral to financing; and (h) collaborating with NGOs to stimulate economies.

(x) In September 2008, the first GIO 4.0 report was published on *Security and Society*. From April 2008, six deep dives with 93 organizations surfaced an idea of distributed security with: (a) network effects in adaptive security intelligence; (b) new roles in partnerships of government and business; (c) behavior change through incentives; and (d) informational self-determination balancing security and privacy.

(xi) In February 2009, the second GIO 4.0 report – and last in the GIO reports – was on *Water*. Participants included 122 organizations, across management, business, infrastructure, food and energy. Insights included: (a) data drought, where collecting and sharing could be improved; (b) valuing water could be improved with technologies and disclosures; (c) infrastructure losses due to leaks and vulnerabilities of flooding and storm surge; (d) the balance between water, energy and agriculture; and (e) global awareness was low.

The Global Innovation Outlooks became coupled with the idea to "Let's Build a Smarter Planet" beginning in fall 2008, and the 100 Smarter Cities Forums in 2009. Transorganizational conversations and open sourcing of findings were guided by the orientation towards differences that private enterprise could make.

5.4.2 Since 2005, IBM researchers have led the Services Science, Management, Engineering and Design initiative

In 2002, IBM Research started a Human Sciences Research area with an initial staff of seven. Almaden Services Research would move IBM into leading an emerging interest across universities, businesses and governments, as shown in Figure 5.19.

The idea of a new science of services became more broadly known as Services Science, Management, Engineering and Design. More details are described in Appendix B.4.2.

(i) In September 2004, the idea of service science emerged in a conversation between Henry Chesbrough at U.C. Berkeley with Jim Spohrer at IBM. In July 2006 the ideas became published as "A Research Manifesto for Services Science".



Figure 5.19. IBM researchers leading SSMED

(ii) In October 2006, a Service Science, Management and Engineering (SSME) Summit convened 254 people, representing 21 countries across government, industry and academia. The scholarly community became energized with the formation of a Service Science Section within INFORMS. The first issue of the Service Science journal was published in March 2009.

(iii) In summer 2007, the Services Research and Innovation Institute (SRII) was cofounded by IBM, Oracle, the TPSA and SSPA, with the intent to increase funded service research, development and innovation in industry.

(iv) A July 2007 symposium on Service Science, Management and Engineering at University of Cambridge led to a 2008 discussion document on "Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government".

(v) In July 2008, the first in the Service Science: Research and Innovations in the Service Economy book series was published. Significant additional volumes would be published in 2011, including *The Science of Service Systems*, and the *Handbook of Service Science.*

(vi) In June 2012, the formation of the International Society of Service Innovation Professionals (ISSIP), as a democratically-run non-profit organization, would partially supersede activity in the SRII.

The initiatives all had IBM as a cofounder, but not the long-term administrators of the communities. Just as IBM had been an initiator of the new field of computer science, it was at the founding of service science.

5.5 Context: At large, from 2000, businesses, creatives, academics, governments and makers, taking up open sourcing

Beyond IBM, open sourcing gradually rose as a social behaviour in the world at large, without using that label. Groups taking up the domain are depicted in Figure 5.20.

Open sharing on the Internet reshaped the way that businesses, creatives, governments, makers and academics think about social organizations and

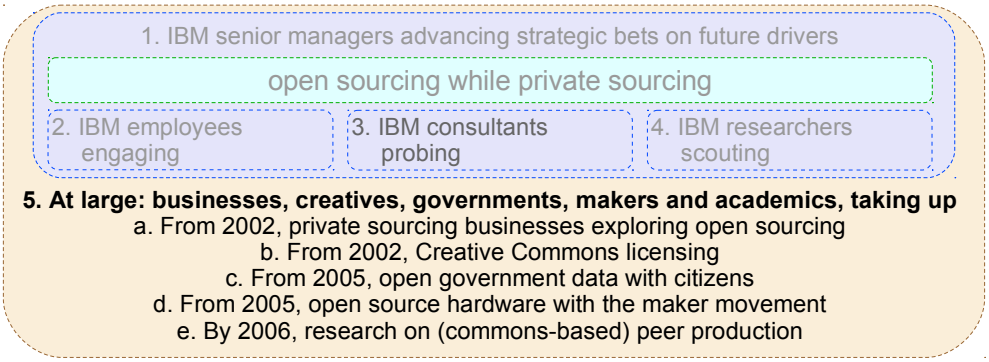

Figure 5.20. Businesses, creatives, governments, makers and academics

interactions. Details on each of the groups appears in Appendix B.5.

5.5.1 From 2000, private sourcing businesses explored commercial options in open sourcing through new communities and institutions

IBM was undoubted a leader in open sourcing with the February 2000 LinuxWorld announcement. Other commercial businesses have followed suit, mostly to lesser extents. Legal considerations, legacy business practices and missing institutions slow adoption. Some landmark events encouraging open sourcing are shown in Figure 5.21.

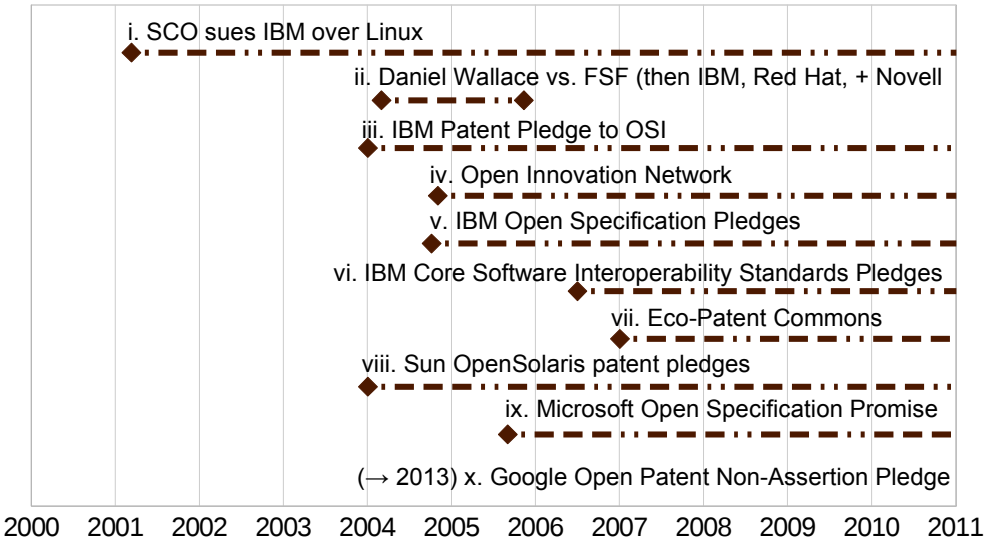

Figure 5.21. Private sourcing businesses exploring open sourcing

Licensing was a legal constraint that was resolved early in the decade. Activities amongst commercial business are described in more detail in Appendix B.5.1.

(i) In March 2003, the Santa Cruz Organization (SCO) filed suits against IBM alleging infringement on Caldera Unixware by IBM's AIX program product. In a related lawsuit, SCO attacked the Free Software Foundation

on the GPL, the license chosen for Linux, as unconstitutional and against antitrust laws. In 2006, these claims were partially vacated. In 2007, the case was administratively closed while SCO was in bankrupcy. In 2013, SCO tried to reopen the case, but the charges were dismissed in 2014.

(ii) Beginning in April 2005, Daniel Wallace filed *pro se* lawsuits in Indiana against the Free Software Foundation, arguing he was barred from competing with Linux because Linux had the unbeatable price of free. In June 2006, he launched a second lawsuit against IBM, Red Hat and Novell as a conspiracy to eliminate competition in the operating system market. These cases were dismissed, and the upheld in the U.S. Court of Appeals in 2006.

(iii) In January 2004, IBM made a pledge to not assert on 500 software patents against anyone meeting the OSI definition of open source. While criticized by Bill Gates as "some new modern-day sort of communism", the proposal to create a patent commons was generally received favourably in the press.

(iv) In November 2005, the Open Innovation Commons (OIN) was founded by IBM, Novell, Philips, Red Hat and Sony. The Commons was chartered to acquire patents and offer them royalty-free, providing they would not be asserted. Initial patents on Linux and web services were contributed. In March 2007, Oracle would license from the OIN. In August 2007, Google joined.

(v) In October 2005, IBM began open specification pledges, independently without partners. The first specifications were on selected open healthcare and education standards on web services, electronic forums and open document formats.

(vi) In July 2007, IBM pledged universal and perpetual access on patents on 150 core software interoperability standards. Implementers would have to reciprocate to also not assert. Additonal pledges were made in July 2009 and December 2011.

(vii) In January 2008, the Eco-Patent Commons were announced by the World Business Council, initiated by IBM during the 2007 GIO conference. Initial founders IBM, Nokia, Pitney Bowes and Sony pledged patents on energy conservation, pollution prevision, environmentally preferable materials, material use reduction and recycling opportunities. Additional corporations joined in 2008 and 2009.

(viii) In January 2005, after IBM had pledge 150 patents, Sun Microsystems pledged 1600 OpenSolaris patents under the CDDL. This was criticized as clumsy in comparison to IBM's approach, with the CDDL incompatible with GPL-licensed Linux.

(ix) In September 2006, Microsoft would declare an "Open Specification Promise". The need to involve legal counsel on each and every patent licensing was criticized as "worse than useless".

(x) In March 2013, Google would announce an "Open Patent Non-Assertation

(OPN) Pledge" to not sue unless first attacked. The first 10 patents on MapReduce would be complemented in August 2013 on cloud technologies, and then 152 patents in August 2014.

Open sourcing as a behaviour can become acceptable within organizations through policy changes. Across organizations, transforming legal constrains requires a bigger vision. By 2008, a new style of government in the Obama administration would make *OSwPS* more acceptable, but still uncommon.

5.5.2 From 2002, Creative Commons has standardized open licensing

Intellectual property licensing has been made simpler, for the layman, with the popularization of Creative Commons (CC) licensing. A concise timeline of some milestones is charted in Figure 5.22.

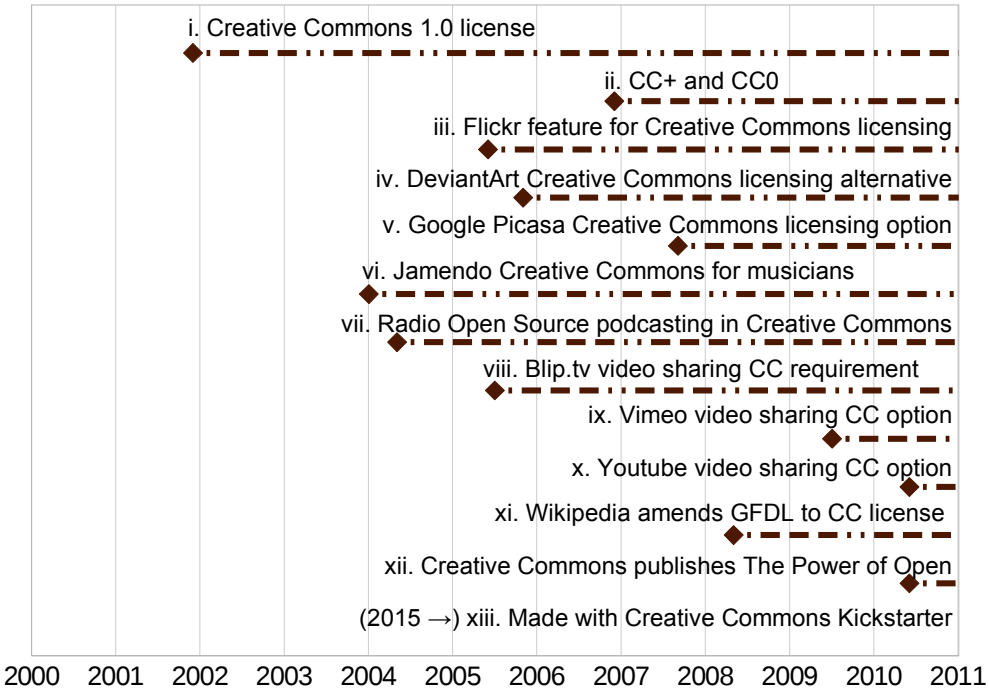

Figure 5.22. Creative Commons licensing

The legal conditions were mostly worked out early in the decade, and gradually refined. A variety of social sharing platforms have encouraged CC licensing. More details can be found in Appendix B.5.2.

(i) The December 2002 release of CC 1.0 enabled individuals and organizations to declare privileges for reuse and/or derivations of works. Otherwise, content is automatically copyrighted, and negotiation is required case-by-case. CC licensing is intended to cover all works beyond software (for which properties of executability are more complicated). The newer versions of CC licenses are refinements due to legal jurisdictions.

(ii) In December 2007, two new licenses were introduced. CC+ extends non-commercial rights to commercial uses, warranties, non-attribution and physical media. CC0 asserts a work has no legal restrictions, or waives rights.

(iii) In June 2004, Flickr added the feature to choose CC licensing on uploading new images, shortly after launching the platform in February 2004. Within the first year, 10 million photos were published under the six CC licenses. By 2009, there were 100 million CC licensed photos.

(iv) In November 2006, DeviantArt added CC licensing for members uploading remixed animations, photographs, web skins, films and literature.

(v) In September 2008, Google added the option to choose a CC license at the release of Picasa 3.0 and Picasa Web Albums.

(vi) In January 2005, Jamendo was launched as a website for musicians to share their music, with CC licensing. Jamendo also enabled listeners to directly donate or sponsor the artists. By October 2010, Jamendo claimed 400,000 tracks of music, from 30,000 artists from 150 countries.

(vii) In May 2005, the first podcasting interview was released on Radio Open Source, under CC licensing. The show followed a history from a 2001 dispute on rebroadcast right by Christopher Lydon on *The Connection*. In November 2013, an agreement was made by WBUR to rebroadcast Radio Open Source podcasts on weekends.

(viii) In July 2006, Blip.tv was the first video sharing site to require all uploaded video content as CC licensed.

(ix) In July 2010, Vimeo launched a new setting to allow adding CC licensing during video uploading.

(x) In June 2011, Youtube announced content owners could market videos with CC-BY licenses upon uploading. In addition, they started a new CC library of 10,000 videos from C-SPAN, Voice of America, Al Jazeera and others.'

(xi) Between May and August 2009, Wikipedia amended its licensing, dualing the original GNU Free Documentation License (GFDL) with CC-BY-SA. After April 2009, the GFDL was deprecated.

(xii) In June 2011, the Creative Commons published *The Power of Open* in 9 languages, featuring exemplars from 400 million works of musics, photos, research findings and college courses.

(xiii) In August 2015, funding of a book *Made with Creative Commons: A Book on Open Business Models* was proposed on Kickstarter. The goal is to begin to answer the question "how do creators make money to sustain what they do when they are letting the world reuse their work?".

Within five years of the launch of Creative Commons licensing in 2002, its adoption has become common. After a decade, businesses are still trying to figure out how to work with it.

5.5.3 From 2005, open government data cooperated with citizens

While governments around the world should be acting in the public interest, much of its data has not been open to citizens. The evolution of governments opening up their databases to citizens is tracked in Figure 5.23.

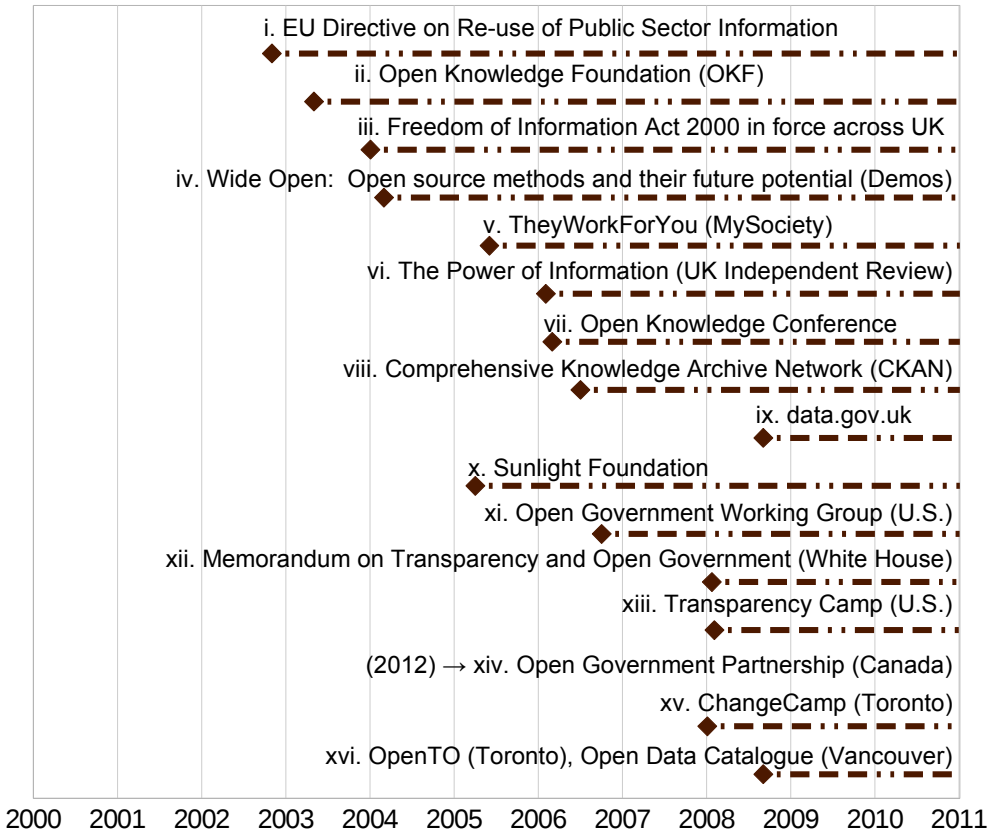

Figure 5.23. Open government data with citizens

Much of the data from government would seem to be mundane (e.g. swimming pool hours, bus schedules). However, policy changes can result in measurements of performance that challenge promises previously made by politicians. Details on the evolution of open government are described in Appendix B.5.3. Principles of "open government data" would be established in December 2007, after some prehistory.

(i) In November 2003, the EU passed a Directive on *Re-use of Public Sector Information*. This established a minimum set of rules to reuse documents across member states. By July 2009, all EU member states would have complied. The UK was one of four to meet the original deadline of July 2005.

(ii) From May 2004, the Open Knowledge Foundation (OKF) in the UK was formed to promote freedom of access to knowledge, promote projects and communities, and campaign again restrictions. Led by Rufus Pollock,

these aims came to focus on open government data.

(iii) In January 2005, the Freedom of Information Act 2000 came in force across the whole UK. Compliance had been staged with the passing in 2000 for England, Wales and North Ireland, and in Scotland in 2002.

(iv) In March 2005, Demos, a cross-party think tank in Britain, published *Wide Open: Open source methods and their future potential*. Three areas inspired by open source ideas were: (a) open knowledge; (b) open team working; and (c) open conversations online.

(v) In June 2006, the mySociety project led by Tom Steinberg would adopt the TheyWorkForYou web site, aggregating content from hansard records to track votes and speeches of MPs.

(vi) In June 2007, *The Power of Information* report was published, presenting recommendations to the Cabinet Office Minister. The independent review was originally chartered by the Strategy unit of Prime Minister Tony Blair. The publication would get caught up decline of the Labour Party, hung parliaments and the eventual 2010 coalition of the Conservative Party with the Liberal Democrats.

(vii) In March 2007, the first Open Knowledge Conference was held in London. Open Knowledge conferences, festivals and meetups have spread most popularly in Europe, with associated events in North America, Asia and Africa.

(viii) In July 2007, the OKF launched an open sourcing Comprehensive Knowledge Archive Network (CKAN) after a year of development. This platform would influence further development both on UK and U.S. projects.

(ix) In September 2009, the Cabinet Office had an early preview of data.gov.uk, inviting developers to give feedback on 1000 datasets from 7 deparments, in a CKAN private beta. In January 2010, the public beta of data.gov.uk was announced. In July 2010, the Cabinet office started promotion with "tell us what datasets you wanted released". In September 2010, all information was relicensed under a UK-wide Open Government License, compatible with CC-BY.

(x) In April 2006 in the United States, the Sunlight Foundation was founded to digitize data, build tools and site, and develop communities. It rose from dissatisfaction from multiple corruption scandals in Washington DC in 2005.

(xi) In October 2007, an Open Government Working Group was convened, with many members of the Sunlight Foundation, to develop eight principles for open government data, complying as (a) complete; (b) primary; (c) timely; (d) accessible; (e) machine processable; (f) non-discriminatory; (g) non-proprietary); and (h) license-free.

(xii) On January 21, 2009, the new Obama administration issued a Memorandum on Transparency and Open Government, outline three principles that government should be: (a) transparent; (b) participatory; and (c) collaborative. Deadlines were given for 45 days, 60 days, 90 days, 120 days, 1

year and 2 years.

(xiii) In February 2009, a TransparencyCamp "unconference" led by the Sunlight Foundation convened in Washington DC. The wiki and artifacts were openly shared on the Internet. TransparencyCamp West was convened in August 2009, followed by a better organized DC event in March 2010. The camps have continued annually, and the Foundation supports local events.

(xiv) In September 2011, the Open Government Partnership was launched with eight founding nations: Brazil, Mexico, Norway, the Phillipines, South Africa, UK and U.S. The Open Government Declaration required a National Action Plan outline two years of commitments. While Canada espoused joining the Open Government Partnership in April 2012, the federal government was criticized in 2014 as failing to drive an open agenda.

(xv) In January 2009, more interest at the municipal level led citizens rallying at ChangeCamp in Toronto.

(xvi) In April 2009, the mayor of the City of Toronto announced the OpenTO initiative would launch in November. In May 2009, the City of Vancouver council endorsed principles of open data for a launch in September.

The idea of open data in government clearly reflects a rise in expectations for open sourcing behaviour. Transparency, participation and collaboration is more difficult in some some jurisdictions than others. In the UK in 2012, Tom Steinberg, a founder of the mySociety project, resigned from advisory roles in Westminister, frustrated "partly due to the dull tribalism". The momentum for open sourcing in government is positive, but it's easy to lapse back into private sourcing.

5.5.4 From 2005, open source hardware rose with the maker movement

The rise of open sourcing in the non-material subworld of software has raised questions about which practices might be transferable into a material subworld of physical objects. The coevolution of initiatives is depicted in Figure 5.24.

The presumptive frameworks of (a) patent law for hardware designs, (b) copyright law for software code, and (c) trademark law for symbols, words and phrases have morphed with the advent of open source hardware. More details are described in Appendix B.5.4.

(i) In October 2004, Eric von Hippel at MIT published *Democratizing Innovation* as a CC-BY-NC-ND ebook. In user-centered innovation, individuals are involved in customizing and/or extending features of products and/or services, either independently or in cooperation with manufacturers. One case study featured a student who would go on to found the *Instructables* web site and community.

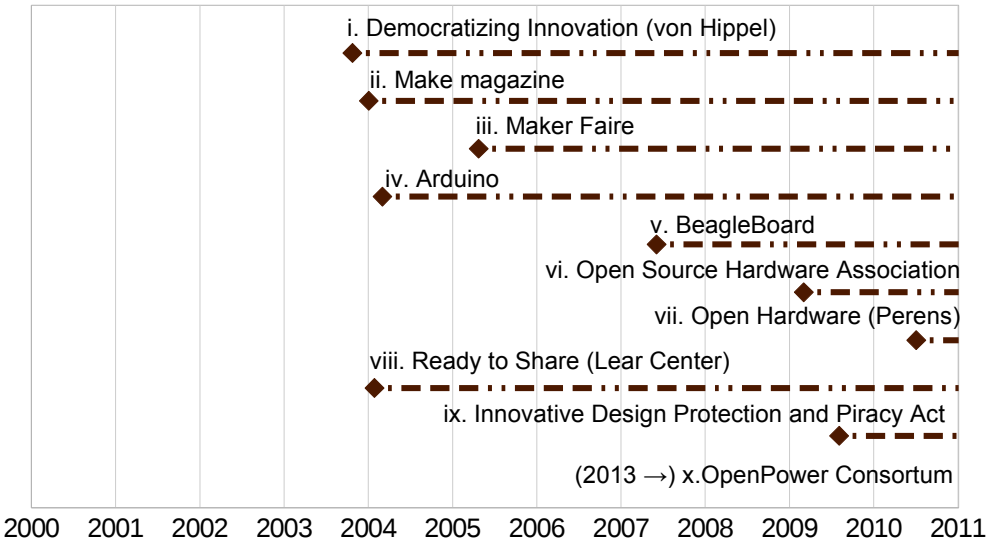

Figure 5.24. Open source hardware and the maker movement

(ii) In January 2005, the first issue of *Make* magazine was published as "Martha Stewart for geeks", both online and hardcopy. The term "maker" was coined by Dale Dougherty as a individuals engaged in learning-by-doing.

(iii) In April 2006, the first Maker Faire in San Mateo attracted 100 exhibiting makers. By 2014, Maker Faires reached 100 events globally, with 530,000 attendees.

(iv) In winter 2005, the low-cost Arduino microcontroller board was included in a class at the Interaction Design Institute Ivrea. It enabled novices to create interactive devices and robots. In comparison to the Stamp platform used since 2002, the Arduino board was cheaper, and components could be added to it. The CAD (Computer Aided Design) files were licensed under Creative Commons, and the Arduino brand was trademarked. Officially trademarked Arduino boards were first produced in Italy. In 2013, Intel introduced the Galileo as an Arduino-certified board based on x86 architecture. By 2014, 1.2 million official Arduino boards are estimated in use, with possibly an equal number of Chinese counterfeits.

(v) In June 2008, the BeagleBoard Rev. B was introduced. BeagleBoard aimed to have the functionality of a desktop machine, as a low-cost, fanless single-board computer. The project was initiated by two employees of Texas Instruments working on their own time, encouraged by the company to build on the OMAP35x family. Digi-Key Electronics backed an evaluation board, built under contract by CircuitCo. Reference manuals and hardware documentation were published as CC-BY-SA. By 2013, four generations of BeagleBoards were released.

(vi) In March 2010, the "Opening Hardware" workshop in New York City coincided with a major Arduino meeting. This meeting led to the founding

of the Open Source Hardware Association (OSHWA). Iterating through an Open Hardware Summit in September 2010, the OSHW Definition 1.0 was released in February 2011. The definition meant sharing the files need to build and modify hardware, i.e. CAD files for mechanicals and schematic and board layouts for circuit boards. In April 2011, a community mark was selected. The OSHWA has been pursuing a certification program.

(vii) In July 2011, a wiki for the Open Hardware Catalog was put in place on openhardware.org by Bruce Perens, one of the originators of the *Open Source Initiative* in 1998. The vision of a self-certification by hardware manufacturers was foreseen in 1998, but the emergence of projects and companies labeling "open source" hardware didn't rise until 2011. On openhardware.org, issues of *Open Source Journal* were published in November 2001 and February 2012. Finding licensing might add restrictions to designs already in the public domain, Perens removed the wiki by February 2014. He interprets that hardware designers should not expect protections unless the work has been patented.

(viii) In January 2005, researchers in the fashion industry conducted a conference at the Lear Center at USC called "Ready to Share". The rise of digitalization, Creative Commons and open sourcing in software and hardware was explored in fashion's traditions of sampling, appropriation and borrowed inspiration. Fashion apparel have historically been "useful articles" in physical fixed expressions not protected by copyright. *Counterfeits* infringe on trademarks, whereas *knockoffs* for mid-market and lower-tier consumers are not customer of elite brands. Fashion design is not seen as an art form that can be copyrighted, but instead a domain where incorporating elements of peers' creative works can accelerate innovation.

(ix) In August 2010, the *Innovative Design Protection and Piracy Prevention Act* was introduced into the U.S. Congress, and died when not enacted. This was revised into the *Innovative Design Protection Act of 2012*, which passed out of the Senate Judiciary Committee, but not enacted. The *Japanese Design Law* covers apparel, but only if no identical of similar design can have existed before. The *EU Community Design System* has a less stringent novelty standard, but it's easy to make a small change and claim as new. In Canada, works of artistic craftsmanship are limited to finished useful items only if fewer than 50 copies are made.

The fashion industry could be portrayed as an industry where open sourcing has been an accepted way of doing business for centuries.

(x) In August 2013, the OpenPower Consortium, founded by IBM, Google, Nvidia, Tyan and Mellanox, would see full open-sourcing in microprocessors. Members would have access not only to IBM CPUs, but all Power-related hardware and software IP, and would be free to choose whoever they wanted to manufacturer customized Power chips they developed.

Open sourcing does not have to be interpreted as applicable only to the domain of computer software. These examples in computer hardware

and fashion design show that innovation may not be discouraged within the laws of a specific jurisdiction, and alternatively may be preempted by voluntary agreements within an industry or consortium.

5.5.5 By 2006, research on (commons-based) peer production crossed over from academia to popularity

Commons-based peer production does not require technology as a base, but is made practical and accelerated by the digital information revolution. Academic researchers have gradually been accumulating experiences that provide a background that informs open sourcing, depicted in Figure 5.25.

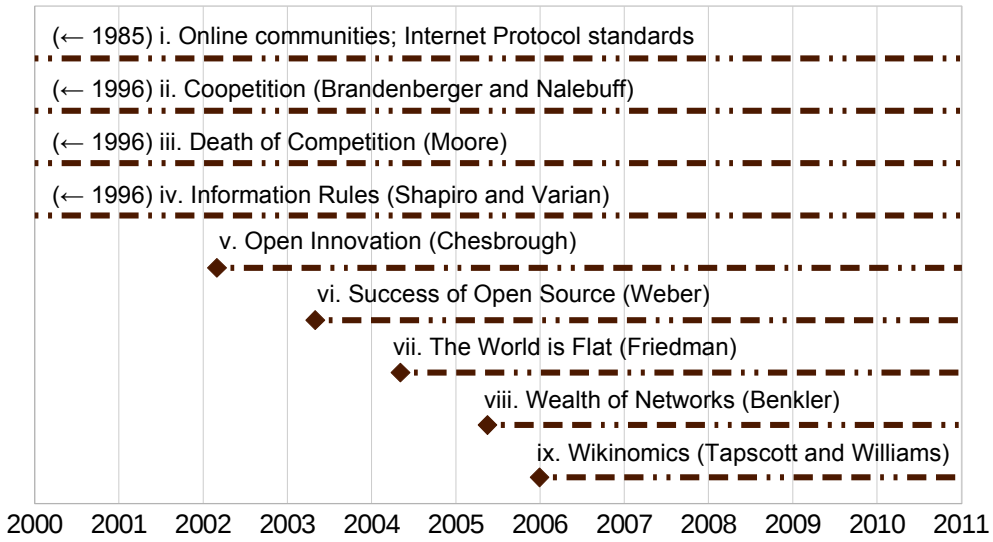

Figure 5.25. Research on (commons-based) peer production

The rise of the Internet at the dawn of the 21st century has shaped social and economic progress. Amongst G7 countries, individuals using the Internet rose from 30% to 40% in 1998, to the top five over 65% by 2006. Publications from practically oriented researchers have gradually become popularized. Details on some key milestones are described in Appendix B.5.5.

(i) Since 1985, online communities have enabled persistent conversations. The *WELL* (Whole Earth 'Lectronic Link) uncovered the tension that "information wants to be free" and "information wants to be expensive". At the first Interop conference in 1985, the adoption of TCP/IP beyond its military roots in 1982 were explored. In 1989, Tim Berners-Lee proposed hypertext, leading to the World Wide Web. In 1996, IBM would promote a campaign on e-business.

(ii) In 1996, *Co-opetition* was published by Brandenburger and Nalebuff. Strategies of cooperation with competitors, in a game theoretic view, were recognized as situations where there could be multiple winners.

(iii) Also in 1996, *The Death of Competition* by Geoffrey Moore described

business ecosystems. Beyond the core business is (a) an extended enterprise of customers, suppliers, standard bodies and complementers; (b) stakeholders in investors, labour unions, government and regulators. The premise was t cahnge from competing on new products to molding new ecosystems.

(iv) In 1999, *Information Rules* by Shapiro and Varian viewed that the "Information Economy" didn't need need a new set of principles. Instead business strategies and public policy should engage in a deeper reading on differential pricing, bundling, signaling, licensing, lock-in and network economics.

(v) In 2003, *Open Innovation* by Henry Chesbrough presented a shift from "closed innovation" where "successful innovation requires control" to a new approach where external ideas and paths to market could be combined with the internal. Closed innovation at Xerox PARC (1970 to 1986) and IBM (1945 to 1980) were compared to open innovation at IBM (after 1993 with Lou Gerstner), Intel Capital and Lucent Ventures Group. This new paradigm leads to a business model where a firm should become an active buyer and seller of intellectual property.

(vi) In 2004, *The Success of Open Source* by Steven Weber traced the history of open source through Unix, the origins of the Internet and the founding of the Free Software Foundation, with case studies ending by 2000. The open source process was hypothesized to have implications with: (a) properity oriented towards stewardship; (b) organizing for distributed innovation; (c) the commons in economic and social life; (d) international economic geography leading to more inequality; (e) shifts in relational structure; and (f) hierarchies managing relationships with networks.

(vii) In 2005, *The World is Flat* by Thomas Friedman popularized the association between globalization and the rise of the Internet. Of ten "flatteners", open sourcing was threaded at least through five: (b) Netscape; (c) workflow software; (d) uploading; (i) informing; and (j) "the steroids" of digital, mobile, personal and virtual. As one of the bestselling books of the decade, *The World is Flat* brought recognition of world changes to the average household.

(viii) In May 2006, *The Wealth of Networks: How Social Production Transforms Markets and Freedom* was published by Yochai Benkler as (i) a hardcover book from Yale University Press and (ii) an online version with CC-BY-NC-SA license. The academic work compares the economics of information production with the Internet, alongside property-based production and market-based production. IBM's embracing of Linux was cited as a business strategy based on nonexclusivity, compared to the prevalent approach of rights-based exclusion by copyright and patent holders. In cooperating with Free Software Foundation and software development community, IBM had to structure a relationship to co-exist in a helpful and non-threatening way. The rise of the institutional ecology of

information production and exchange has required regulatory and policy conditions mediating communications, from shared content down through logical coding and physical technology.

(ix) In December 2006, *Wikinomics: How Mass Collaboration Changes Everything* was published by Don Tapscott and Anthony Williams. The principles of wikinomics included: (a) *being open*, to networking, sharing and self-organization; (b) *peering*, as with Linux and Wikipedia; (c) *sharing*, of intellectual property, computing and knowledge; and (d) *acting globally* to eliminate geographic redundancies. At IBM, a shared infrastructure was cited as creating opportunities to create differentiated value.

In the context of the world outside IBM, open sourcing was seen as commercial opportunity for businesses by 2000, first in the technology sectors. Digital natives embraced open sourcing of personal works by 2002, made easy by Creative Commons licensing. Governments and makers of physical hardware changed their policies towards open sourcing by 2005. With well-researched books on the phenomenon published by 2006, open sourcing can be seen has having become mainstream.

Chapter 4 outlined seven cases of *OSwPS* by IBM, both within the boundaries of the company, and in engagement with external parties. Chapter 5 described evolution on contexts over the decade from 2001 to 2011, that shaped both the behaviours of IBM employees and the world at large. In the three chapters that follow, inquiry is pursued in paradigms of architectural problem seeking, inhabiting disclosive spaces and governing subworlds.

6. Quality-generating sequencing, from a paradigm of architectural problem-seeking

Across and along the seven cases on open sourcing while private sourcing (*OSwPS*) between 2001 and 2011, *quality-generating sequencing* emerges as the first of three theories, coming alongside a paradigm of architectural problem-seeking. This theory-building is based on the seven cases detailed in Appendix A (summarized in Chapter 4) and the five contexts detailed in Appendix B (summarized in Chapter 5).

6.1 A paradigm of architectural problem-seeking can be seen as articulating structure

OSwPS can be oriented philosophically towards shaping the structure of the environment, and articulating the relations between parts and wholes.

Structure[167] can be defined as an arrangement in space, while process is defined as an arrangement in time. Philosophically, mereology[168] is the study of parts and wholes, and morphogenesis[169] is the synthesis of form.

[167] In systems thinking, the most basic relations are function, structure and process. "Briefly, function is contribution of a part to the whole; structure is an arrangement in space; and process is an arrangement in time" (Ing, 2013, p. 520). "*Structure* defines components and their relationships, which in this context is synonymous with input, means and cause. *Function* defines the outcome, or results produced, which is also synonymous with outputs, ends, and effect. *Process* explicitly defines the sequence of activities and the know-how required to produce the outcomes. Structure, function, and process, along with their containing environment, form the interdependent set of variables that define the whole" (Gharajedaghi, 1999, p. 110).

[168] The philosophy behind Christopher Alexander's work can be clarified: "[... in] 'A city is not a tree" (Alexander 1965) ... there are echoes of the earlier preoccupation with the problem of morphogenesis, the synthesis of form, and in particular the mereological relation of parts and wholes, that has been Alexander's focus from the beginning of his career to this day'. (Mehaffy, 2010, p. 62). While the theory of parthood relations dates back to the ancient Greeks, the term "mereology" wasn't formally coined until 1927 (Varzi, 2016).

[169] Morphogenesis is an aspect of developmental biology that has been cross-appropriated into built environments. The succession of form, in beings and things, has some degree of stability over some part of space lasting over some period of time, with some occasional qualitative changes (i.e. an attractor that

Generalizing morphogenesis from a geometric framing to a coevolutionary framing[170] or a network framing[171] benefits from a deeper appreciation of systems theory.

Articulating[172] can mean simultaneously (i) dividing into parts (i.e. decomposition), and (ii) putting together by joints (i.e. integration). With semiotics, architecture can be seen as articulation of spaces[173], with a first articulation as a denotative functional object, and a second articulation as a connotative symbolic object.

Architecture, from a systems perspective, can be seen either as autopoietic[174] (i.e. self-reproducing) or allopoietic[175] (i.e. produced by

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appears or disappears as a catastrophe) leading to a bifurcation (R. Thom, 1975). In a sequence of development that is essentially smooth in character, "each state follows, without breaking structure, from the state before" (Alexander, 2002, p. 23). Dissatisfied with previously offered explanations of emergence from the whole (e.g. mechanical origins of living centers; the principle of least action; non-linear dynamics, biological evolution), a geometric principle of form-creation is proposed, in a principle of unfolding wholeness (Alexander, 2002, pp. 35-44).

[170]A cybernetic reframing from biological systems to anthropological ecologies led Gregory Bateson to maintain "that dilemmas of evolutionary record arise from the survival of the larger system being always dependent on variability and change in its constituent subsystems. As in any communicational system, observers of change of both large and constituent systems constantly find themselves in trouble deciding 'what' is changing" (Harries-Jones, 1995, p. 166). The biological entity and its environment are not separate. "We should not think of the process just as a set of changes in the animal's adaptation to life on the grassy plains but as a *constancy in the relationship* between animals and environment. It is the ecology which survives and slowly evolves. [....] Trouble arises precisely because of the 'logic' of adaptation is a different 'logic' from that of the survival and evolution of the ecological system' (Bateson, 1972b, pp. 338-339).

[171]In an alternative non-reductionist approach, the biological models of morphogenesis can be generalized to morphogenetic networks with three mechanisms of (i) sorting; (ii) differentiation and (iii) differential birth-and-death proceeding in parallel (R. Rosen, 2000).

[172]Articulating comes from the Latin *articulare*. "The word 'articulate' has two conflicting meanings: (1) to divide into parts and (2) to put together by joints. Thus, the word encompasses two opposite concepts: analysis (decomposition) and synthesis (integration)" (Kodama, 1995, p. 145).

[173]The representation of space in four dimensions in insufficient. "A film can represent one or two or three possible paths the observer may take through the space of the building, but the space in actuality is grasped through an infinite number of paths. [....] there is a physical and dynamic element in grasping and evoking the fourth dimension through one's own movement through space" (Zevi, 1957, p. 59). Codes are not just in geometric space, but also as structures of cultural contexts. The second articulation of architecture is as a form of mass communication (Eco, 1997).

[174]Autopoiesis is "the condition of a system able to regenerate itself by self-reproduction of its own elements and of the network of their characteristic interactions. [....] The main characteristic of autopoietic systems is organizational closure" (François, 1997, p. 36).

[175]Allopoiesis is "the production by a network of interrelated component-producing processes of a system, which does not however become able to thereafter reproduce its components or processes. ... [If] the allopoietic system is really to be a system, it must at the same time be autopoietic in order to maintain its identity and coherence. This would be possible if we admit that the boundaries or other

something external to the self). Living systems are defined as autopoietic, self-organizing and self-generating; assembly lines are allopoietic, externally-organizing and externally-generating. A theory of architectural autopoiesis includes order[176] in both the physical and social senses. The societal function of architecture[177] is not just framing, but continuously adapting and reordering. Architecting can be seen as the framing of spatial relations[178], not just physically, but also emotionally.

Problem-seeking[179] establishes a program in which key stakeholders engage in dialogue to defining the scope and nature of a future innovation. Projects that are information-laden and complex rely on systematic data gathering, analysis and traceability to assure accountability in the resulting brief. Architectural programming[180] came to be seen as a problem-

subsystems transform inputs into internally fitting elements ... while producing outputs by an inverse transformation" (François, 1997, p. 24).

[176]An autopoietic system of architecture cross disciplinary lines. "The concept of *order* proposed here – encompassing both social and architectural order – denotes the result of the combined effort of organization and articulation. Architectural order – symbiotic with social order – requires *both* spatial organization and spatio-morphological articulation. While organization establishes objective spatial relations by means of distancing (proximity relations) as well as by means of physically separating and connecting areas of space, articulation operates via the involvement of the user's/participant's perception and comprehension of their designed/built environment. Articulation reflects the phenomenological and the semiological dimensions of architecture. Thus, to the extent to which architecture operates through articulation (rather than mere organization), it also relies on engendering an effective semiosis within the designed/built environment. It is one of the fundamental claims of the theory of architectural autopoiesis that the semiological dimension of architecture is of central importance with respect to architecture's capacity to successfully discharge its unique societal function" (Schumacher, 2011, pp. 371-372),

[177]"Every society needs to utilize articulated spatial relations to frame, order and stabilize social communication. The autopoietic *system of architecture* within modern functionally differentiated society has taken up this societal function: to *frame* social communication, or, more precisely, to continuously adapt and re-order society via contributing to the continuous provision and *innovation of the built environment as a framing system of organized and articulated spatial relations*" (Schumacher, 2011, p. 371).

[178]"Contemporary architectural discourse commonly invokes the term framing. Derivative phrases contrived in education and practise are seemingly inexhaustible: framing the view, framing space, framing an idea, frame of reference, framework, window frame, body frame, space frame. [....] Framing is a primal phenomenon. It shapes an essential spatial experience with the power to divide, connect, fuse, reveal and conceal entities literally or notionally. In the simple but profound act of recognizing, entering and exiting the boundary between, for example, an interior and an exterior, framing emerges in all its architectural and emotional significance. The experience of the frame is both intimate and metaphysical, hinting at shared but intangible dimensions of architecture" (Kim, 2013, p. iii).

[179]The process of architectural programming originated in the 1950s for client engagement in the post-war boom of new elementary schools. "Architectural Analysis" described in 1959 became "Problem Seeking" by 1969 (Schermer, 2015).

[180]"Design is problem-solving; programming is problem-seeking. [....] the aim of programming is to provide a sound basis for effective design. The Statement of the Problem represents the essense and the uniqueness of the project. Furthermore,

seeking inquiry, distinct from design as a problem-solving synthesis of facts. Since "all architecture is design but not all design is architecture"[181], distinctions between the roles of an architect and a designer are sometimes unclear. Searching for sufficient clarity in problem definition[182] can be separated from solving a problem.

Architectural problem-seeking to deal with complexity may be most natural in ordered modes[183], workable in messy modes, and more tenuous for wicked and natural modes. Selecting a focus on one problem over another does not come without consequences. A problem that rises to the top may be self-generated or externally-generated. In comparing architectural problem-seeking to design thinking[184], more emphasis is placed on the divergent than the convergent, and more on analysis rather than on synthesis. Articulating choices can create some problem that are viewed more positively than others (e.g. a small company getting swamped by too much demand is a problem that founders could hope to enjoy). Embarking on an architecture of open sourcing leads to one set of problems, while private sourcing leads to another. Engaging in *OSwPS* introduces complications and/or complexities for organizations and for individuals.

6.2 A theory of quality-generating sequencing emerges alongside architectural problem-seeking

Based on the paradigm described above, the cases on *OSwPS* lead to

it suggests the solution to the problem by defining the main issues and giving direction to the designer" (Peña and Focke, 1969, p. 4).

[181]In the domain of software development, "The code is the truth, but not the whole truth; all architecture is design, but not all design is architecture" (Booch, 2016). In an earlier clarification, "All architecture is design but not all design is architecture. Architecture represents the significant design decisions that shape a system, where significant is measured by cost of change" (Booch, 2006).

[182]"Almost all problem -solving methods include a step for problem definition— stating the problem. But most of the methods lead to confusing duality— finding out what the problem is and trying to solve it at the same time. You can't solve a problem unless you know what it is. What, then, is the main idea behind programming? It's the search for sufficient information to clarify, to understand, and to state the problem. **If programming is problem seeking, then design is problem solving**. These are two distinct processes, requiring different attitudes, even different capabilities" (Peña and Parshall, 2001, p. 15).

[183]Architectural complexity has been described in four modes: (i) wicked complexity of the network, citing Herbert Simon, Horst Rittel and Stafford Beer; (ii) messy complexity of the whole, citing Robert Venturi, Jane Jacobs and Christopher Alexander; and (iii) ordered complexity of the essence, citing Henry Sanoff, William Peña and Wolfgang Preiser; and (iv) natural complexity of the organism, citing John T. Lyle, Janine Benyus, Buckminister Fuller and Gregory Bateson (Bachman, 2008).

[184]Designing thinking is a series of divergent steps (i.e. creating choices) and convergent steps (i.e. making choices), with an interplay of analysis (i.e. breaking problems apart) and synthesis (i.e. putting things together) (T. Brown, 2008).

proposing a theory of quality-generating sequencing.

Quality-generating[185] reaches back into the idea of quality-without-a-name[186], with a view forward into generative codes[187]. Both artefactual and natural things are seen to have objective properties in themselves (i.e. with a nature of autopoiesis), that can be improved with human effort (i.e. with interventions of allopoiesis). A program that is counter to a positive direction could be labelled as quality-degenerating. Within this paradigm, an objective meaning for quality[188] should coincide with a com-

[185]Generating has been chosen as a label for both preserving and extending quality. Some the phenomenon called "life" or "wholeness" observed in artifacts is carried through by nature, and some is done by a person paying attention to it (Alexander, 2002, p. 104). By 2007, the original term of "structure-preserving" published in 2002 had been revised to "wholeness extending". "In Book 2, the term 'structure-preserving transformations' is used throughout. Since its publication, I have adopted the more expressive term 'wholeness-extending' (Alexander, 2007).

[186]The quality without a name "is an objective quality that things like buildings and places can possess that makes them good places or beautiful places. Buildings and towns with this quality are habitable and alive" (Gabriel, 1996, p. 34). Alternative words of *alive*, *whole*, *comfortable*, *free*, *exact*, *egoless* and *external* were proposed by Alexander, but don't help clarify. In the original sense of built environments, a process of order comes out of nothing but ourselves. "There is a central quality which is the root criterion of life and spirit in a man, a town, a building, or a wilderness. This quality is objective and precise, but it cannot be named' (Alexander, 1979, p. ix). In reconsidering a quality without a name in software development, the challenge of separating fact from value (and science from philosophy) in the 17th and 18th centuries was being reversed: "Alexander stepped forward and tried to reverse the separation of fact from value. His program was not only to find patterns that explain the existence of the quality without a name but also to find patterns that generate objects with that quality. Furthermore, the patterns themselves must demonstrate the same quality" (Gabriel, 1996, p. 39).

[187]Towards creating living neighborhoods, generative codes evolved from pattern languages, but were more sophisticated in governing rules of unfolding (Alexander, Schmidt, et al., 2005). The patterns are less oriented towards structure, and more towards process. "Alexander's "generative code' addresses not physical parameters of the built environment, but steps that the participants should take together in laying out and detailing a given structure. Alexander likens it to a recipe, or a medical procedure, in which the steps always follow a logically similar pattern, but the actual actions continuously adapt to the context – the taste and texture of the food in the case of a recipe, or the condition of the patient's tissues in a medical procedure. But in this case, the "recipe" or the "procedure" guides the unfolding of environmental form" (Mehaffy, 2008, p. 69).

[188]A phenomenological view of quality, for the craftsman, occurs in the practice of poiesis. "Until about a hundred years ago, the cultivating and nurturing practices of *poiesis* organized a central way things mattered. The *poietic* style manifested itself, among other places, in the craftsman's skills for bringing things out at their best. [....] This cultivating, craftsman-like, *poietic* understanding of how to bring out meanings at their best was alive and well into the late nineteenth century, but it is under attack in our technological age" (H. L. Dreyfus and S. D. Kelly, 2011, p. 206). This Dreyfus-Kelly view departs from Robert Pirsig and Matthew Crawford (in *Shop Class as Soulcraft*) philosophies, although they also have skill associated with meaning. In a footnote: "xiv. [....] We are sympathetic with all of these writers, but they remain firmly entrenched in the monotheistic philosophical tradition. Pirsig, like Plato, finds an abstract source of meaning in what he calls 'Quality'. Crawford, like Aristotle, reacts by emphasizing the

mon appreciation, either favourable or unfavourable, across casual visitors, inhabitants and craftsmen. In the 1970s, inquiry into the metaphysics of quality followed the popularity of *Zen and the Art of Motorcycle Maintenance.* Approaching the metaphysics of quality with hierarchy theory[189], a distinction can made between *structural quality* as a more static (i.e. horizontal) elaboration of form, and *dynamical quality* as a more dynamic (i.e. vertical) elaboration of organization.

Sequencing a selection of structural components in one way may not give the same result as sequencing in an alternative way. The unfolding of quality or wholeness over time[190] may be related to its composition in a disordered way. There can be a challenge with cross-scale interactions[191] in hierarchical organization. In ecology, process can be seen at three levels: (i) the focal scale on which interest is centered; (ii) the larger and more slowly changing scale in which the focal scale is contained; and (iii) the smaller and faster scale that contains the focal scale. In the structuring of buildings, the layers of longevity in built components were originally described as *shearing layers*.[192] *Slow constrains quick; slow controls quick*.[193] In ordering the layers of civilization, "the fast layers innovate;

hands-on, concrete, socially embedded sources of meaning. We go beyond them both in the details of our treatment of *poietic* skill and also in identifying *poiesis* as one among several ways the world can be".

[189]Hierarchy theory builds on Robert Pirsig' metaphysics with a distinction between *structural* quality and *dynamical* quality. "Structural quality is elaboration of form or relationship such that there is reliable desired function, which is achieved only with difficulty through care. Structural quality is primarily static, is responsible for high-quality day-to-day performance, and is exemplified by Thomas Kuhn's (1962) 'normal science' or Joe Friday's style of detective work. Dynamical quality is an improvement on structural quality, because it denies the premise on which particular structural qualities are based. Dynamical quality is the antithesis of structural quality. It is creative, and so changes the functioning of what is already functioning well in a state of high structural quality. The priest represents structural quality: He is always there to give sermons and offer absolution. In contrast, the prophet shows dynamical quality: Do not expect him to turn up to hear confession when the parishioner needs it; he is too busy turning over tables in the temple" (T. F. H. Allen et al., 2001, p. 478).

[190]Christopher Alexander cites David Bohm's *Wholeness and the Implicate Order* in shaping his work, and had a meeting with Bohm in 1986. On reviewing the conclusion to the four books, "A Modified Structure of the University", Alexander recalls that Bohm "declared that in his view this material was the most interesting. ... somehow he though the conception of matter contained here was the most significant aspect of these books. It came closer, perhaps, to providing a complement to his own views" (Alexander, 2004, p. 336).

[191]Interactions across faster and slower processes and the possibility of regime shifts make forecasting ecological systems challenging. Science can observe slow changes, yet long term thinking is rare (Carpenter, 2002).

[192]Frank Duffy originally distinguished four layers for commercial buildings called (i) shell; (ii) services; (iii) scenery; and (iv) set. Stewart Brand revised and generalized these into six shearing layers of (i) site; (ii) structure; (iii) skin; (iv) services; (v) space plan; and (vi) stuff (Brand, 1994, pp. 13-14).

[193]Shearing layers were cross appropriated from the study of ecosystems by O'Neill, DeAngelis, Waide and Allen: "The insight is this: *'The dynamics of the system will be dominated by the slow components, with the rapid components*

the slow layers stabilize"[194]. "Fast gets all of the attention, slow has all the power"[195]. The label for this framework as evolved to become known as *pace layering thinking*[196].

Quality-strengthening sequencing provides a progressive differentiation of space[197] through a mindful ordering of decisions to be made. The strengthening of quality may be exhibited through the preserving of wholeness[198] across a field of mutually reinforcing centers. For a generative sequence[199], centers have to be laid down in an orderly form. An unfolding[200] that preserves wholeness from one stage to the next may not be known in advanced, so experimenting and/or testing may be done to identify good sequences and preclude backtracking to recover from bad subsequences. Taking a scientific foundation to architecting has led to a position emerging "objective measures of coherence in complex systems,

simply following along'" (Brand, 1994, p. 17).

[194]The layers in the order of civilization, from slower to faster, are: (i) nature; (ii) culture; (iii) governance; (iv) infrastructure; (v) commerce; and (vi) fashion (Brand, 1999, p. 37).

[195]Ecological systems absorb and incorporate shocks through varying change rates and varying scale. "The combination of fast and slow makes the system resilient, along with the way that the differently paced paced parts affect each other. Fast learns, slow remembers. Fast proposes, slow disposes. Fast is discontinuous, slow is continuous. Fast and small instructs slow and big by accrued innovation and occasion revolution. Slow and big controls small and fast by constraint and constancy. Fast gets all our attention, slow has all the power. All durable dynamic systems have this sort of structure; it is what makes them adaptable and robust"(Brand, 1999, p. 34).

[196]A retrospective history on pace layer thinking after 15 years was captured in a conversation between Stewart Brand and Paul Saffo at the Long Now Foundation (Em, 2015).

[197]The pattern language work of Christopher Alexander from the 1970s was further developed in the Nature of Order publications, with "sequences more fecund that patterns" (Quillien, 2007).

[198]Emerging centers help the whole. "... a living wholeness is a structure of STRONG CENTERS, centers existing at many scales, mutually reinforcing each other and forming a field. [....] When a living whole is to be built step by step, it is clear, therefore, that what must be created, throughout the space, are precisely all these centers from which the wholeness gets its strength" (Alexander, 2002, p. 268).

[199]An example of generative sequence is biological morphogenesis. "When an embryo grows, it must grow in a certain order – a preordained order. If the events were to occur in another order (or if artificially altered to force events to occur in another order) the effects would be disastrous. Instead of orderly form, we would get chaos, monsters" (Alexander, Silverstein, et al., 1975, p. 300).

[200]The number of workable sequences is small when compared to all possible sequences. "... sequences which work can be identified experimentally by a well-defined procedure. If one applies a sequence of steps to a given context, and if one then observes the unfolding process, it is possible to identify, unambiguously, whether the process engendered by the sequence at any time contradicts itself – that means, whether one is forced to backtrack, because step B which comes at a certain point in the sequence forces one to undo the results of the previously taken step A. [...] One technique for finding good sequences is to identify bad subsequences, and eliminating all sequences which contain these bad subsequences" (Alexander, 2002, p. 306).

and the unavoidable relationship between structure, fact, and beauty"[201].

6.3 Pattern concerns entailed by quality-generating sequencing include program envisioning, realizing and elaborating

Reflecting across and along the seven case studies from 2001 to 2011 within the paradigm of architectural problem-seeking, some patterns that emerge include (i) program envisioning, (ii) program realizing and (iii) program elaborating. A program is used here in the sense[202] of a set of related measures or activities with a particular long-term aim. A program has a purpose and an organization[203], more than projects it contains, in a context of a portfolio that contains it. A program has an authoritative mandate[204], and may integrate multiple services. In architecture and de-

[201]In response to reviews on manuscripts of *The Nature of Order*, Christopher Alexander responded to criticisms: "I would argue there is no substantial line at all – between the issues of relative coherence of subsystems in a physical-mechanical system, and the more complex distinctions of coherence in an aesthetic entity.... The relative coherence of more complex entities – the relative beauty of one column in a building, versus another, uglier column – is susceptible to precise observation, and can be made a part of science by new kinds of experiments, using the human observer as a measuring instrument" (Alexander, 2003, pp. 8-9).

[202]The Oxford English dictionary provides this more specific definition of program, e.g. a nuclear power program, as a subentry under "a planned series of future events, items or performances". It also includes the computing sense of a program as "coded software instructions", which is not the focus here.

[203]The Project Management Institute defines a project as "a temporary endeavor undertaken to create a unique product, service or result". In managing projects, programs and portfolios, "programs usually represent entities that have a determined purpose, predefined expectations related to the benefits scheme, and an organization, or at least a plan for organizing the effort. A program is set up to produce a specific outcome that may be defined at a high abstraction level of a "vision"' (Artto and P. H. Dietrich, 2007, p. 5). A portfolio of projects can be defined as "as a group of projects that are conducted under the sponsorship or management of a particular organization" that "compete for scarce resources" (Artto and P. H. Dietrich, 2007, p. 4).

[204]In government, both programs and services have outcomes provided to target groups with needs. They are, however, distinct. "A program is a mandate and resources conferred by legislative or administrative authority to achieve outcomes within a jurisdiction and based on a strategy. Programs provide an essential management structure for services. Programs are delivered by services but are not synonymous with a collection of services. Programs provide the rationale for packaging services together into integrated solutions for clients on the demand side and the basis for developing accountability structures, business processes and resources on the supply side" (Government of Ontario Ministry of Government Services, 2010, p. 16).

sign[205], both problem-seeking[206] and problem-solving[207] may be involved in developing a program.

6.3.1 Program envisioning entails quality-generating sequencing

Program envisioning[208] conceives how possibilities could be created for what a system might and should do, amongst alternative formulations and concepts, trade-off considerations, and organizational issues. In quality-generating sequencing, program envisioning layers in early, as a conception that can align or revise ongoing action. Generative patterns of program envisioning are outlined for three concerns in Table 6.1.

[205] Architecture and design involve assessments of goodness of fit. "The ultimate object of design is form" (Alexander, 1964, p. 15). Synthesizing form may happen in two ways: "I shall call a culture unselfconscious if its form-making is learned informally, through imitation and correction. And I shall call a culture selfconscious if its form-making is taught academically, according to explicit rules" (Alexander, 1964, p. 36). Towards improving goodness of fit, conceptual hierarchies (i.e. semi-lattices) can be constructed with graphs (G) of misfits (M) and links (L). "... I shall really be trying to show that for every problem there is one decomposition which is especially proper to it, and that this is usually different from the one in the designer's head. For this reason we shall refer to this special decomposition as the *program* for the problem represented by *G(M,L)*. We call it a program because it provides directions or instructions to the designer, as to which subsets of M are its significant 'pieces' and so which major aspects of the problem he should apply himself to. This program is a reorganization of the way the designer thinks about the problem" (Alexander, 1964, p. 83).

[206] Problem-seeking has been described earlier in the main text of this chapter. It is important to note the publication date of *Notes on the Synthesis of Form* (Alexander, 1964) precedes *Problem-Seeking* (Peña & Focke, 1969) by 5 years.

[207] In the early 1960s, the thinking on architectural programming as evolving, and distinctions between architecture and design were not yet clear. "The word 'program' has occurred a great deal int he recent literature on the psychology of problem solving – the implication throughout being that man's natural way of solving complex problems is to make them easier for himself by means of heuristics which lead to a solution stepwise" (Alexander, 1964, p. 208). In that footnote, citations include Allen Newell, J.C. Shaw and Herbert Simon on the 1959 *General Problem Solver* in computer science; George A. Miller, Eugene Galanter and Karl Pribram on the 1960 *Plans and the Structure of Behavior*; and James March and Herbert Simon on the 1958 *Organizations* that included concepts of bounded rationality and satisficing. The "program" was seen as a source of architectural unity in modern architecture by John Summerson in the 1957 "The Case for a Theory of Modern Architecture".

[208] Envisioning a program can involve systems perspectives and approaches. This definition on program envisioning is based on a 1998 OOPSLA workshop "motivated by an interest in sharing experiences on the relationships between problem domain understanding and creative thinking on formulating systems concepts. We were interested in how different types of thinking and action are involved in developing the conceptual architecture of a system. Particularly, we were concerned with requirements elicitation and generation, organizational design, systems thinking, holonics and cybernetics, object thinking, creativity and imagineering, metaphorical exploration, synectics and analogical reasoning, human communications and dialog-based interaction" (Matthews and Hodgson, 1998).

Table 6.1. Generative patterns of program envisioning in three concerns

Pattern label	(b) Selecting those who want the best	**(a) Elevating common standards**	(c) Levelling the playing field
(i) Voices on issues (who and what)	(a.i) For an enterprise investor, which industry standards are worth backing? while (b.i) For an offering owner, which features enable our entry to be superior to alternatives? while (c.i) For a community adopter, which non-exclusive projects will further anticipated interests?		
(ii) Affording value(s) (how and why)	(b.ii) Engaging the discerning and bourgeois distinctly from the indifferent, to rationally manage scope	**(a.ii) Aligning with and influencing specifications, so future non-conformances are pre-empted**	(c.ii) Following pre-established community processes, so that voices are equally heard on decisions
(iii) Spatio-temporal frames (where and when)	(b.iii) Segmented preferences are distinct and sustained	**(a.iii) Supply of technological improvements is not overshooting demand**	(c.iii) Community offering has credibility to attract peers willing to contribute
(iv) Containing systems	←	**(a.iv) For industry opinion leaders, does the prospective initiative have a future that is credible and viable?**	→
(v) Contained systems	→	**(a.v) For a program adopter, does the open sourcing preempt risks of lock-in from private sourcing?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

Let's focus first on program envisioning with the concern of OSwPS supported by the cases in Chapter 4.

(a) Elevating commons standards is a generative pattern significant across and along all seven cases for the concern of *OSwPS*. While industry leading organizations may aspire to reach a higher level of quality by forging ahead on an independent de facto standard, a common standard may be satisfied by a variety of implementations. This is most clearly demonstrated in the case of *coauthoring*, where the Open Document specification was satisfied with implementations by OpenOffice.org and IBM Lotus, as compared to the Office Open XML Strict specification approved by Oasis in 2005 and satisfied[209] by Microsoft with the release of Office 2013 in January 2013, and LibreOffice 4.3 in August 2014.

(a.i) For an enterprise investor, "which industry standards are worth backing?" is a driving voice on issues. The quality perceived by customers of offerings evolving with common standards includes credibility of the provider, where doubts are cast when features are later deprecated.

(a.ii) Aligning with and influencing specifications, so future non-conformances are pre-empted is an affording value for the enterprise investor. The quality of delivering an offering suffers without participation in industry standards committees, as development teams have to continually catch up to revisions.

(a.iii) Supply of technological improvements is not overshooting demand is a spatio-temporal frame for the pattern. The possibility of improving quality has to matter to stakeholders. While advances in technology may allow a provider to push the feasibility of additional features to an offering, the ability to produce enhancements may be overshooting[210] the wants and needs of customers and stakeholders.

(a.iv) For industry opinion leaders, does the prospective initiative have a future that is credible and viable? is a containing system for the pattern. Whether it's a new offering by an industry player or a new standards

[209]The OOXML specification file with Oasis in 2005 continues to be criticized as a "bogus 'standard' which is basically just an 'open'-looking gown for Microsoft Office (proprietary) formats is now being further distorted in order to cause trouble for people who are not Microsoft customers" (Schestowitz, 2014). With the full adoption of OOXML Strict by Microsoft, "... if you open a purely OOXML-Strict compliant file with Microsoft Office 2013, the file will be declared corrupt. If you open the same one with LibreOffice 4.3, the file will open and you will be able to edit its contents just like with any other format supported by LibreOffice. In other words, *LibreOffice can claim to have a better support of OOXML than Microsoft Office*, despite years of unfulfilled promises, pledges, and never met expectations by Redmond" (Schulz, 2014). See Appendix A.7.4(c) for a fuller history.

[210]Improving quality has a minimal effectiveness when an offering has become a commodity so that switching is nearly costless. "Note that it's overshooting – the more-than-good-enough circumstance – that connects disruption and the phenomenon of commoditization. Disruption and commoditization can be seen as two sides of the same coin. A company that finds itself in more-than-good-enough circumstance simply can't win. Either disruption will steal its markets, or commoditization will steal its profits" (Christensen and Raynor, 2003, p. 152).

organization, there have been many good intentions that have never borne fruit. Whether it's open sourcing, private sourcing or both, bad press may kill a worthwhile idea, but good journalism relies on authoritative sources for facts and opinions.

(a.v) For a program adopter, does the open sourcing preempt risks of lock-in from private sourcing? is a contained system for the pattern. While a customer might prefer to pay for a private sourcing version for reliability and maintainability, having an alternative options mitigates reliance on implemented features available only from a single supplier.

A generative pattern for the concern of *private sourcing only* (*PSo*) can be inferred from the research into *OSwPS*.

(b) Selecting those who want the best is a generative pattern significant for the concern of private sourcing. Unlike public sector programs, the private sector can choose the target audiences that are most profitable to serve. The economics of downward-sloping demand curves means limiting output is correlated with higher prices. Microsoft Office is a commercial product that maintains and enforces copyright.

(b.i) For an offering owner, "which features enable our entry to be superior to alternatives?" is a driving voice on issues. Offerings amongst competitors differentiate on multiple dimensions. The economics of willingness-to-pay amongst funders have to be weighed against cost-to-provide by suppliers.

(b.ii) Engaging the discerning and uncaring for the indifferent, to rationally manage scope, is an affording value for the offering owner. Private enterprise can maintain higher quality offerings by focusing attention on fans, while disregarding deselected customer sets.

(b.iii) Segmented preferences are distinct and sustained is a spatio-temporal frame for the pattern. Parties may choose to exchange species of capital, and free-riding can be precluded.

A generative pattern for the concern of *open sourcing only* (*OSo*) is similarly inferred.

(c) Levelling the playing field is a generative pattern significant for the concern of open sourcing. Participation in the community of a quality-generating offering is not restricted organizationally or economically, as long as licenses and processes are followed. The LibreOffice community formed as a fork of the OpenOffice community, at the threat of control being exerted with the Oracle acquisition of Sun Microsystems.

(c.i) For a community adopter, which non-exclusive projects will further anticipated interests? is a driving voice on issues. Voluntary adoption, membership and contribution to an open sourcing project means that parties can do well by doing good. Collective interests to improve quality need not be incompatible with personal interests.

(c.ii) Following pre-established community processes, so that voices are equally heard on decisions is an affording value for a community adopter. Transparency and predictability are desirable traits that engender partici-

pation on collective pursuits.

(c.iii) Community offering has credibility to attract peers willing to contribute is a spatio-temporal frame for the pattern. Open sourcing communities are living systems, where participation rises and falls as milestones are attained. With maturity, maintenance requires minimal effort, and parties can move on to other challenges.

The three issues around envisioning (i) elevating industry standards, (ii) aiming for superiority amongst the discerning, and (iii) aspiring towards non-exclusivity, incorporate concerns mixed across open sourcing and private sourcing programs. Industry standards can be attained either through voluntary processes, or through de facto adoption through popularization. Superiority may be achieved through a collaboration of the willing, or on a tails of an independent genius. Non-exclusivity may be ruled explicitly, or negotiated case-by-case. The three patterns described are non-exhaustive, and additional ones could be created.

6.3.2 Program realizing entails quality-generating sequencing

Program realizing[211] brings the essential nature[212] of an identity[213] into being. Synthesis can occur in either through a casual (unselfconscious)[214]

[211]Realization is "the achievement of something desired or anticipated" in the Oxford English Dictionary. In a design process, realization of a program first follows an analytical phase of "a tree of sets of requirements" resulting in a diagram, followed secondarily by a "synthetic phase, in which a form is derived from the program" (Alexander, 1964, p. 84). This use of narrow view of realization is acknowledged by Christopher Alexander, owing "the word 'realization' to Louis Kahn, who has used it extensively, and often with a wider meaning"(Alexander, 1964, p. 209), citing a CIAM lecture in 1959.

[212]An essential nature can be described as what "a thing wants to be'. "In making [something] you must consult the laws of nature, and the consultation and approval of nature are absolutely necessary. There you will find, discover, the order of water, the order of wind, the order of light, the order of certain materials. If you think of brick, for instance, and you consult the orders, you consider the nature of brick. This is a natural thing. You say to brick, ;What do you want, brick?' And brick says to you, 'I like an arch.' And you say to brick, 'Look, I want one too, but arches are expensive and I can use a concrete lintel over you, over an opening.' And then you say, 'What do you think of that, brick?' Brick says, 'I like an arch.' It's important, you see, that you honor the material that you use' (L. Kahn, 1973, p. 92).

[213]Beyond built environments, the concept of identity is more general than the concept of form. The earlier intuitions on realization by Louis Kahn from 1957 to 1959 have broader applicability. "By 1960 realization is intimately tied with the notion of form and design. He is conscious that architects rely too much on the actual design on not enough on solving the problem; they do not think enough about what the thing wants to be. Ideally, at the end of the design process, the architect should be left with "the design that he produces as a result of his realization that led to form" (Pedret, 1993, pp. 36-37)).

[214]In a communicative perspective, casual builders lack a variety of experience that brings self-criticality. "The features which distinguish architecturally unselfconscious cultures from selfconscious ones are easy to describe loosely. In the unselfconscious culture there is little thought about architecture or design

or professional (selfconscious) culture. Realization includes the transcendental and feelings[215] coming out of nature, whereas design includes only the measureable. In quality-generating sequencing, a different program may be realized if the order of the constitutive parts changes. Generative patterns of program realizing are outlined for three concerns in Table 6.2.

Again, for program realizing, we'll focus first on the concern of *OSwPS*, supported by the cases in Chapter 4.

(a) Doing well by doing good[216] is a generative pattern significant across and along all seven cases for the concern of *OSwPS* that realizes achieving social acceptance and/or financial success as a result of behaving in a benevolent manner. In the case of *integrating-development*, IBM's cofounding of the Eclipse project and shepherding through formation of the Eclipse Foundation advanced tools available both to commercial and academic institutions. The platform and organization were realized as independent, modular and extensible systems, and enabling reconfiguration to the desirable qualities at hand.

(a.i) For a community contributor, which balance of commons and private interests outweighs independent action? is a driving voice on issues. Open sourcing more can widen adoption and influence standards, while private sourcing more can cater to needs of higher-valuing stakeholders.

(a.ii) Evolving private sourcing extensions, keeping compatibility with open sourcing components is an affording value for a community contributor. Decisions choosing trailblazing versus conforming on specifications can be made over time.

(a.iii) Licensing on derivative open works as permissive is a spatio-

as such. There is a right way to make buildings and a wrong way; but while there may be generally accepted remedies for specific failures, there is no general principles comparable to Alberti's treatises or Le Corbusier's" (Alexander, 1964, p. 33).

[215]Realization was introduced by Louis Kahn in 1957, remaining unclear though 1971 when he acknowledged "realization is unclearly defined, but it impresses you as being in nature. You look for inseparable parts. It doesn't come right away. You don't know what they are" (Pedret, 1993, p. 35-36). "Early on ... *Realization*, is the source of what something wants to be, that is the source of the nature of a thing" (Pedret, 1993, p. 37). "*Realizations* come from an inspired realm – 'from the first feelings of beauty, or the first sens of it, and the wonder that follows'" (Pedret, 1993, p. 40).

[216]The maxim to "do well by doing good" is attributed to Benjamin Franklin, in the *Poor Richard's Almanack* published from 1732 to 1758. "Franklin appears always to have understood the necessity in English North America and its successor regimes of pursuing one's uncommon individual superiority in a way that did not irretrievably offend the common" (Dawidoff, 2000, p. 42). "Poor Richard's proverbs condense a tough, even cynical, knowledge of the world as the context of maxims. They are essays to do well, rather than good, but as usual Franklin reversed the point of his Puritan home culture and codified what they *did*, works not grace, as opposed to what they *said*, grace and works. "Doing good by doing well" may be a better motto than "doing well by doing good". It reverses the Puritan belief and anticipates Madison's thinking, if not his solution. ... It is counsel with the narrative pungency that makes it possible for a body to think it through independently" (Dawidoff, 2000, p. 44).

Table 6.2. Generative patterns of program realizing in three concerns

Pattern label	(b) Aiming high, you may hit a star	**(a) Doing well by doing good**	(c) Raising a barn
(i) Voices on issues (who and what)	(a.i) For a community contributor, which balance of commons and private interests outweighs independent action? while (b.i) For an entrepreneur, which strategic bets will lead to superiority over alternatives? while (c.i) For a community participant, is a project showing momentum and attracting participants?		
(ii) Affording value(s) (how and why)	(b.ii) Focusing efforts consistent with defined scope, preempting wasteful distractions	**(a.ii) Evolving private sourcing extensions, keeping compatibility with open sourcing components**	(c.ii) Welcoming voluntary action by both by the experienced and learners-by-doing so participation grows
(iii) Spatio-temporal frames (where and when)	(b.iii) Confidence by investors on incumbency or reputation	**(a.iii) Licensing on derivative open works as permissive**	(c.iii) Parties (as individuals and/or institutions) are credibly respected as serving common interests
(iv) Containing systems	←	**(a.iv) For an organization integrating systems, is this initiative showing sufficient momentum to deter defecting to alternatives?**	→
(v) Contained systems	→	**(a.v) For a program adopter, are offering interfaces sufficiently accessible and documented to be useful?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

temporal frame for the pattern. Private sourcing based on open source works is practical only when derivative works aren't covered by sharealike conditions.

(a.iv) For an organization integrating systems, is this initiative showing sufficient momentum to deter defecting to alternatives? is a containing system for the pattern. Beyond the initial promise of a worthwhile vision, the reality of market and societal changes and/or practical difficulties may lead to delays, descoping, or unanticipated emergent options unanticipated at the outset.

(a.v) For a program adopter, are offering interfaces sufficiently accessible and documented to be useful? is a contained system for the pattern. Implementers and end users are less concerned with details inside standards or specifications, and just if they deploy reliably with offering interfaces.

A generative pattern for the concern of *PSo* is inferred from behaviours around *OSwPS* activities.

(b) Aiming high, you may hit a star[217] is a generative pattern associated with ambition and purpose. The emphasis on the quality of ends over means correlates with private sourcing.

(b.i) For an entrepreneur, which strategic bets will lead to superiority over alternatives? is a driving voice on issues. Investment involves committing to a program with risks that reward may or may not be realized, against other competitors in the race.

(b.ii) Focusing efforts consistent with defined scope, pre-empting wasteful distractions is an affording value for the entrepreneur. Early market entry may establish a de facto standard long before industry committees can converge on a consensus. Winning in the marketplace can make technical victories irrelevant.

(b.iii) Confidence by investors on incumbency or reputation is a spatio-temporal frame for the pattern. With many opportunities from which to choose, funding on risky programs tends to favour a proven player or a breakthrough innovator.

The generative pattern for the concern of *OSo* can be similarly inferred.

(c) Raising a barn is a generative pattern for volunteers coming together in realizing cooperation amongst neighbours. Reciprocal work bees[218] could occur with regularity and frequency through the agricultural year, including shearing sheep, ploughing the land, picking apples and butchering

[217] Ralph Waldo Emerson is attributed with "Aim high, and you may hit a star". In a lecture to a high school graduating class in 1899, the work to which their lives were to be given should be worth the effort. Variations include on shooting at the moon or sun, and hitting a tree or landing on high ground.

[218] Work bees were an integral part of the farm economy and an important social resource before modernization and industrialization. They were organized around neighbourhoods, which doesn't necessarily follow familial, class, ethnic or gender lines. While neighbourhoods have spatial and temporal dimensions, work bees add community interaction, process and a sense of belonging (C. Wilson, 2001).

livestock. In Finland, *talkoot* cooperation[219] has a tradition as multiple or inter-related events where joint work is unpaid, and rewards would be hospitality and enjoyment of shared work.

(c.i) For a community participant, is a project showing momentum and attracting participants? is a driving voice on issues. Programs heavy on talk and light on producing outputs lose members rapidly. The community has to be perceived as having a future with ongoing updates and revisions, or the volunteer resources will move on to alternatives.

(c.ii) Welcoming voluntary action by both by the experienced and learners-by-doing so participation grows is an affording value for community participants. Novices get access to more senior talent, and leaders help shape the skills of more volunteers.

(c.iii) Parties (as individuals and/or institutions) are credibly respected as serving common interests is a spatio-temporal frame for the pattern. Community members who consistently push an agenda and take more than they give can become shunned.

The three issues around realizing (i) balancing across commons and private interests, (ii) nurturing of strategic bets and (iii) maintaining voluntary momentum, incorporate concerns mixed across open sourcing and private sourcing programs. As time unfolds, the degree to which a program realizes its promise becomes clearer. Reprioritizing concerns can be decided rapidly.

6.3.3 Program elaborating entails quality-generating sequencing

Program elaborating[220] works out in detail, finishes or completes a production. After an initial or subsequent release, changes in scale, scope or speed can be framed with an identity ranging from an incremental fix to a distantly-related descendant. Elaborating a program can produce desirable quality improvements generated through internal properties (as autopoiesis) or through external influences (as allopoiesis). Generative patterns for program elaborating are show for three concerns in Table 6.3.

For program elaborating, the concern of *OSwPS* can be reviewed first, following from the cases in Chapter 4.

[219]Rural cooperation has been proposed as root for a networked society that may evolved into cooperation in the information society in Finland. In 2009, a seminar on alternative economy cultures was held following the Pixelache Festival. Talkoot is characterized with "people getting together for joint work efforts, based on voluntary participation, and collective reward through hospitality and enjoying of the shared work performance" (Paterson, 2010).

[220]The *Oxford English Dictionary* etymologizes elaborating with the Latin root elaborare, to work out or produce by labour, a meaning that has been in use since the 1600. Other definitions include the process of producing or developing from crude materials (in chemistry), and natural production of chemical substances from elements or sources (in physiology).

Table 6.3. Generative patterns of program elaborating in three concerns

Pattern label	(b) Migrating the herd to fresh pastures	**(a) Cultivating perennial platforms**	(c) It's ready when it's ready
(i) Voices on issues (who and what)	(a.i) For a program sponsor, which programs elevate platforms, concurring with emerging standards? while (b.i) For an offering manager, what schedule of maintenance updates and chargeable upgrades extend relevance? while (c.i) For a project participant, what additional tangible evolution is evident, as compared to forks and alternatives?		
(ii) Affording value(s) (how and why)	(b.ii) Deprecating legacy features, allowing optimizing operation for contemporary offerings	**(a.ii) Extending work on an offering architecture, building on prior infrastructure**	(c.ii) Modifying, testing and adopting concrete outputs, so value-in-use is evident
(iii) Spatio-temporal frames (where and when)	(b.iii) Momentum or network lock-in favours incumbency over defection	**(a.iii) Reusing proven experiences more pragmatic than reinvention**	(c.iii) Continuity through a collective identity maintained by a core group
(iv) Containing systems	←	**(a.iv) For an independent open sourcing foundation director, are members actively sponsoring community advancements?**	→
(v) Contained systems	→	**(a.v) For a program adopter, are releases of updates and fixes timely and sufficient?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

(a) Cultivating perennial platforms is a generative pattern significant across and along all seven cases for the concern of *OSwPS*. Private sourcing can be built on top of open sourcing, while open sourcing – by definition – can not be built on top of private sourcing. The case study on *wikiing* shows how a platform of collaborative web content sharing relies on open sourcing. The information content that is shared can be readily migrated, reposted and/or derived from the open Internet onto a private intranet, while the reverse requires taking responsibility consistent with authority. With system internals transparent at a foundational level, a variety of players, both commercial and non-commercial, have a platform above which competitive offerings can be built.

(a.i) For a program sponsor, which programs elevate platforms, concurring with emerging standards? is a driving voice on issues. With open sourcing as a non-chargeable alternative, a private sourcing extension has to exhibit extended quality for selection for the commercial version to be selected beyond the industry reference version.

(a.ii) Extending work on an offering architecture, building on prior infrastructure is an affording value for the program sponsor. The cost of a developing and maintaining quality in a common foundation is borne by contributors to the open sourcing community. Higher value features can be offered as private sourcing.

(a.iii) Reusing proven experiences more pragmatic than reinvention is a spatio-temporal frame for the pattern. Platform adoption is an architectural decision that should not be taken lightly. Reinvention has the potential to lead to new creative directions, but an open sourcing community is normally receptive to reason and dialogue that tends to deter forking.

(a.iv) For an independent open sourcing foundation director, are members actively sponsoring community advancements? is a containing system for the pattern. The governance of an open sourcing community with both corporate and individual members should ensure some fairness on parties both giving to and taking from the community.

(a.v) For a program adopter, are releases of updates and fixes timely and sufficient? is a contained system for the pattern. Under permissive licensing, any party at large can derive existing offerings for their own use, but the attraction of an open sourcing community is the pooling of resources towards formal releases.

The concern of *private sourcing only* has a generative pattern inferred from behaviours around *open sourcing while private sourcing* activities.

(b) Migrating the herd to fresh pastures is a generative pattern for private sourcing only. Commercial businesses maintaining sustainable profitability conventionally seek new customers and improved products and/or services that renew their relevance.

(b.i) For an offering manager, what schedule of maintenance updates and

chargeable upgrades extend relevance? is a driving voice on issues. Most products include warranties and after-sales services that include fixes to remediate defects within a limited period. Economically, the provider may thereafter make maintenance may be available for fee, or advise an upgrade path for a price less than a new purchase.

(b.ii) Deprecating legacy features, allowing optimizing operation for contemporary offerings is an affording value for the offering manager. Performance for a current release may be improved by removing obsolete features, according to end-of-life dates established in advance.

(b.iii) Momentum or network lock-in favours incumbency over defection is a spatio-temporal frame for the pattern. Commercial enterprises tend to rely on repeat business. Customer may prefer the devil they know to the one they don't.

A generative pattern for the concern of *OSo* can be inferred similarly.

(c) It's ready when it's ready is a generative pattern for *OSo*. Official releases are important milestones for open sourcing. Proposals and options may be retained for posterity, but progress requires synchronization points in time acknowledge by all participants. Releases may be planned according to fixed dates or fixed scope, either of which require critical defects to have been closed.

(c.i) For a project participant, what additional tangible evolution is evident, as compared to forks and alternatives? is driving voice on issues. Open sourcing projects relies on the contributions of volunteers, who may move on when their expertise is no longer appreciated.

(c.ii) Modifying, testing and adopting concrete outputs, so value-in-use is evident is an affording value for a project participant. When a defect is suspected, ways of reproducing "I have this problem, too" eliminates the "it works for me" response.

(c.iii) Continuity through a collective identity maintained by a core group is a spatio-temporal frame for the pattern. Community membership is strengthened through solidarity. Dissenters are welcomed to leave, and may fork a current or prior release for their own purposes.

The three issues around elaborating (a) elevating platforms perennially, (b) extending relevant updates and upgrades, and (c) showing additional tangible evolution, incorporate concerns mixed across open sourcing and private sourcing programs. After envisioned programs have been realized, elaborating a system reflects adaptation to environmental conditions and/or the opportunity to continue ratchet up quality.

6.4 Hypothesizing for a theory of quality-generating sequencing

One hypothesis for a descriptive theory for *OSwPS* within the paradigm of architectural problem-seeking can be constructed:

- *Hypothesis*: *Open sourcing while private sourcing* enables quality-generating sequencing through program envisioning, program realizing and program elaborating. This is possible in ways that that neither *open sourcing only* nor *private source only* allow.

The seven cases and the context of IBM between 2001 and 2011 support this hypothesis. Additional hypotheses within this paradigm could be developed. This hypothesis could be tested beyond IBM with contemporary cases, as *OSwPS* has become more commonplace.

7. Affordances wayfaring, from a paradigm of inhabiting disclosive spaces

Across and long the seven cases on open sourcing while private sourcing (*OSwPS*) from 2001 to 2011, *affordances wayfaring* emerges as the second of three theories, coming alongside a paradigm of inhabiting disclosive spaces. This theory-building is based on the seven cases detailed in Appendix A (summarized in Chapter 4) and the five contexts detailed in Appendix B (summarized in Chapter 5).

7.1 A paradigm of inhabiting disclosive spaces can be seen as being-in-the-world with practice theory

OSwPS can be oriented philosophically towards living in an environment where change is a constant, influenced both by external forces and the actions of human beings inhabiting it.

Being-in-the-world[221] is part of a practical holism that views explicit beliefs and hypotheses meaningful only in specific contexts and against a background of shared practices.

Practice theory[222] emphases the social life of human beings in the context

[221]While being-in-the-world originates from Martin Heidegger in the 1920s, the interpretation into the 21st century (H. L. Dreyfus, 1990) emphasizes practices, equipment, locations and the human skill to navigate those. This philosophy is complemented by the philosophy of Pierre Bourdieu .(D. G. Stern, 2003, p. 188-189)

[222]Practice theory, in organizational science, can be situated in three ways: "an empirical focus on how people act in organizational contexts, a theoretical focus on understanding relations between the actions people take and the structures of organizational life, and a philosophical focus on the constitutive role of practices in producing organizational reality" (Feldman and Orlikowski, 2011, p. 1240). In the larger frame of a paradigm, these three ways of studying practice are complementary. A milestone for the more contemporary views of practice theory is labelled as the practice turn in contemporary social theory. "Thinkers once spoke of 'structures', 'systems,' 'meaning,' 'life world,' 'events,' and 'actors' when naming the primary generic social thing. Today, many theorists would accord 'practices' a comparable honor. Varied references to practices await the contemporary academician in diverse disciplines, from philosophy, cultural theory, and history to sociology, anthropology, and science and technology studies" (Schatzki, Knorr-

of the actions of others and themselves leading to reality in which they engage. As opposed to thinking about a social groups or individuals in terms of their intentions, attention is focused on their behaviour. This action-oriented view observes that the "purpose of the system is what it does"[223] as potentially different from the espoused.

A disclosive space[224] is an organized set of practices for dealing with oneself, other people, and things that produce a web of meanings. A community of practice is bound together through a shared style[225]. Most people engage with customary skills, in a style of organized pragmatic activity that interrelate equipment, purposes and identities. Innovators and entrepreneurs have cultivated history-making skills[226] that change the style of a disclosive space.

Inhabiting a world[227] is more than occupying a building. Dwelling[228]

Cetina, and Savigny, 2001, p. 1).

[223]A cybernetic perspective can concur. "According to the cybernetician, the purpose of a system is what it does. This is a basic dictum. It stands for a bald fact, which makes a better starting point in seeking understanding than the familiar attributions of good intentions, prejudices about expectations, moral judgments, or sheer ignorance of circumstances" (Beer, 2002, p. 217).

[224]A disclosive space is related to Heidegger's account of worldhood, with three characteristics: (i) interrelated pieces of equipment used to carry out a specific task; (ii) tasks undertaken to achieve certain purposes; and (ii) the activity enabling those performing it to have identities (Spinosa, F. Flores, and H. L. Dreyfus, 1999, p. 17).

[225]Style constitutes things, people and activities in the way practices fit together. "All our pragmatic activity is organized by a style. Style is our name for the way all the practices ultimately fit together. A common misunderstanding is to see style as one aspect among many of either a human being or human activity, just as we may see the style as one aspect among many of a jacket. Our claim is precisely that a style is not an aspect of things, people or activity, but, rather, constitutes them as what they are" (Spinosa, F. Flores, and H. L. Dreyfus, 1999, p. 19).

[226]The two kinds of skills required for historical disclosing are (i) the ability to able to sense and hold on to disharmonies in one's current disclosive activity; and (ii) the ability to change one's disclosive space on basis of the disharmonious practices (Spinosa, F. Flores, and H. L. Dreyfus, 1999, p. 14-15).

[227]Tim Ingold adds to the dwelling perspective from Martin Heidegger with moving from one place to another through the anthropological studies of wayfinding and navigation: "... in the building perspective ...the earth is presented to humanity as a surface to be occupied rather than a world to be inhabited. [....] I argue that while dwelling in the world entails movement, this movement is not between locations in space but between places in a network of coming and going that I call a region." (Ingold, 2000a, p. 155)

[228]In the essay "Thinking Building Dwelling" (Heidegger, 1971, p. 145), the meaning of dwelling – as a verb – is described as lost to us, now only signifying to remain or to stay in a place. Dwelling can be described as (i) an activity that man performs alongside other activities (e.g. doing business, traveling, lodging); (ii) cherishing and protecting, preserving and taking care for, cultivating, as in the Latin *colelre, cultura*; and (ii) building as the raising of edifices, as in the Latin *aedificare*. Appreciating a beaver dwelling in the dam it constructs for its progeny leads to an "animal-in-its-environment" evolutionary history (Ingold, 2000a, p. 185-186). While dwelling is a way of being at home in the world, that home may not be comfortable or pleasant, and struggles with others in a political ecology may have to be accommodated (Ingold, 2005)).

dissolves distinctions between occupying and building. A task, as labour in a work practice, is carried out in a taskscape[229] temporality, in the way that land is part of the landscape known to those who dwell within.

Do individuals share worlds? Each individual is a separate being, so the way that one experiences being-in-the-world varies. Individuals can share a disclosive space with common practices and compatible webs of meanings. However, open sourcing only (*OSo*) occurs in a disclosive space with a set of practices and meanings, private sourcing only (*PSo*) occurs in another disclosive space, and *OSwPS* can be in yet another disclosive space where the practices and meanings integrate differently. The customary skills in one disclosive space may or not be considered as appropriate in another.

7.2 A theory of affordances wayfaring emerges alongside inhabiting disclosive spaces

Based on the paradigm described above, the cases on *OSwPS* lead to proposing a theory of affordances wayfaring.

Affordances[230] were originally defined as a complementarity of an animal and its environment, in which the environment offers, provides or furnishes an invariant meaning or value to the animal. Shifting the frame from zoology to anthropology, human beings are seen as handy in their environments, and world-forming in disclosing.[231]

Wayfaring[232] is an embodied experience of living not inside places, but

[229] With dwelling as a verb, a taskscape deemphasizes the form in landscape, towards a processual unfolding of embodiment. "Every task takes its meaning from its position within an ensemble of tasks, performed in series or in parallel, and usually by many people working together" (Ingold, 2000d, p. 185).

[230] The theory of affordances originated in ecological psychology (Gibson, 1979). Affordances have been defined as latent cues in natural environments, such as substances, surfaces, objects, and places that hold possibilities for action. In technological words of industrial machines and computer graphical interfaces, designers came to care more about "perceived affordances" of actions that were perceived to be possible rather than truly real (Norman, 1999). Differences about the original ontology (i.e. affordances belonging neither to the environment nor the individual, but instead in the relation between individuals and perception of environments) and technological conventions (i.e. cultural norms that promote some actions and constrain others) lead to the necessity of clarifying the use of the term (Parchoma, 2014).

[231] While animals are seen to live in an environmental niches where the open is furnished with objects, human beings can probe a niche and pick up their affordances. "For Heidegger, ... the space of dwelling is one that the inhabitant has formed around himself by clearing the clutter that would otherwise threaten to overwhelm his existence. The world is rendered habitable not as it is for Gibson, by its partial *en*closure in the form of a niche, but by its partial *dis*closure in the form of a clearing"(Ingold, 2011c, p. 82).

[232] Wayfaring changes the perspective from living at a point of time and space to lines where human beings intersect. "My contention is that lives are led

through, around, to and from them, from and to places elsewhere. A line of travel[233] is an ongoing process of growth and development, or self-renewal. Transporting[234], in contrast to wayfaring, moves the traveller from one location to another location, oriented towards a destination. While wayfaring in a labyrinth (i.e. a unicursal puzzle with a single non-branching path) is attentional in action, navigating in a maze (i.e. a multicursal puzzle with many branches, choices of path and dead-ends) is intentional.[235] These lines characterize the enfoldings of a generative

not inside places but through, around, to and from them, from and to places elsewhere .... I use the term wayfaring to describe the embodied experience of this perambulatory movement. It is as wayfarers, then, that human beings inhabit the earth .... But by the same token, human existence is not fundamentally place-*bound*, as Christopher Tilley ... maintains, but place-*binding*. It unfolds not in places but along paths. Proceeding along a path, every inhabitant lays a trail. Where inhabitants meet, trails are entwined, as the life of each becomes bound up with the other. Every entwining is a knot, and the more that lifelines are entwined, the greater the density of the knot. Places, then, are like knots, and the threads from which they are tied are lines of wayfaring" (Ingold, 2011a, p. 148-149).

[233]A distinction can be made between the knowledge systems of habitation and occupation. "In the first, a way of knowing is itself a path of movement through the world: a wayfarer literally 'knows as he goes' ..., along a line of travel. The second, by contrast, is founded upon a categorical distinction between the mechanics of movement and formation of knowledge, or between locomotion and cognition. Whereas the former cuts from point to point across the world, the latter builds up, from the array of points and materials collected therefrom, into an integrated assembly" (Ingold, 2007b, p. 92).

[234]Wayfaring moves a traveller through a world, while transporting moves the traveller across the world from point to point. "Transport, by contrast, is essentially destination-oriented .... It is not so much a development along a way of life as a carrying across, from location to location, of people and goods in such a way as to leave their basic natures unaffected. For in transport, the traveller does not himself move. Rather he is moved, becoming a passenger in his own body, if not in some vessel that can extend or replace the body's powers of propulsion. While in transit he remains encased within his vessel, drawing for sustenance on his own supplies and holding a predetermined course. Only upon reaching his destination, and when his means of transport comes to a halt, does the traveller begin to move. But this movement, confined within a place, is concentrated on one spot. Thus the very places where the wayfaring inhabitant pauses for rest are, for the transported passenger, sites of occupation. In between sites, he barely skims the surface of the world" (Ingold, 2011a, p. 150).

[235]In a taxonomy of lines, a thread is a filament which can entangled with other threads or suspended between points in three-dimensional space, while a trace is any enduring mark left in or on a solid surface by a continuous movement. Threads may be transformed into traces on surfaces, and traces can be transformed into threads by dissolving a surface. Theseus found his way out of the Labyrinth of Knossos by means of a thread presented to him of Minos' daughter Ariadne. When a maze goes underground, a path becomes a thread rather than a trace (Ingold, 2007a, p. 52-57). Wayfaring should not be confused with wayfinding. Wayfinding is an ability to situate one's current position within a known region, within the historical context of journeys previously made. Feeling a way towards a goal, adjusting movements in response to ongoing perceptual monitoring of surrounds, is an un-maplike way of knowing (Ingold, 2000e, p. 219-220).

past, and a future potential in the present moment.[236]

Combining affordances with wayfaring amongst a group of fellow travellers has the potential to emerge an unfolding over time of collective disclosive spaces. For an individual unfamiliar with an environment, a substance, surface, object or place might not be perceived as an affordance with meaning or value. A companion more familiar with the line of travel may draw attention to a value-rich ecological object, and educate on its potential as an affordance. Additionally, collaboration amongst some pioneers may lead to the creation of new affordances, which could be selectively disclosed to others, or more obviously show up for everyone.

Across social worlds, a material entity may become recognized as a boundary object.[237] A social life for boundary objects may be described in three phases: (i) an origin where locally tailored objects are interpreted similarly within a group; (ii) development of well-structured standards allowing different groups can work together; and (ii) the generation of residual categories (e.g. none of the above) that become inhabited by outsider who may start a new cycle.[238] Depending on the range of the wayfarer, a boundary object may or may not hold the possibility for actions as an affordance.

7.3 Patterns concerns entailed by affordances wayfaring include enskilling, equipping and legitimating

In considering along and across the seven case studies from 2001 to 2011 within the paradigm of inhabiting disclosive spaces, some pattern that emerge include (i) enskilling, (ii) equipping and (iii) legitimating.

[236] Wayfinding has a temporal character, unfolding over time rather than space (Ingold, 2000e, p. 238). "In [a fleeting moment in a never-ending process] is compressed the movement of the past that brought it about, and in the tension of that compression lies the force that will propel it into the future. It is this enfolding of a generative past and a future potential in the present moment, and not the location of that moment in any abstract chronology, which makes it historical" (Ingold, 2011b, p. 232).

[237] The origins of boundary objects comes from information and work requirements leading to organic infrastructures. The word *boundary* was "used to mean a shared space, where that sense of here and there are confounded" between groups. The word *object* was used "in both its computer science and pragmatist sense, as well as in the material sense" as something people can act toward and with. "Its materiality derives from action, not from a sense of prefabricated stuff or 'thing'-ness" (Star, 2010, pp. 602-603). Three components to boundary objects are: (i) interpretive flexibility; (ii) the structure of informatic and work process needs and arrangements; and (iii) the dynamic between ill-structured and more tailored use of the objects.

[238] People (often administrators or regulatory agencies) struggle to (i) control the methods of bridging ill-structured and well-structured aspects; (ii) arrange standards that subtend differences between shared objects and local objects; and (iii) move within and from inhabiting residual categories to form new boundary objects (Star, 2010, p. 613-614).

7.3.1 Enskilling entails affordances wayfaring

Enskilling[239] continually embodies capacities of awareness and response across generations of individuals and group situated in their environments. In unfamiliar environments, affordances may become salient while wayfaring, so unconscious competences may rise in importance for further honing as part of a journey. Generative patterns of enskilling are shown in three concerns in Table 7.1.

For enskilling, let's focus first on *OSwPS*, informed by cases from Chapter 4.

(a) Accessing the smartest people working elsewhere[240] is a generative pattern significant along and across all seven cases for the concern of *OSwPS*. When pioneers explore practices and technologies that are new-to-the-world, establishing features that eventually become common sense may come from sources outside organizational boundaries. This is illustrated in the case study on *blogging*, where conventional ways of online authorship and commenting in serialized form was at first an unusual way of publishing that eventually became popular. Blogging platforms and authors often start in a tentative style, and learn from responses and interaction with their audiences. The behaviour of blogging can be supported through alternative technology platforms, either open sourcing or private sourcing in nature.

(a.i) For an organization leader, what frontiers of knowledge can be nurtured for societal and commercial gains? is a driving issue. Innovations based on science may originate from public universities or private research divisions that publish findings and experiences in academic journals. Many advances are unconstrained from derivative use in applied ways,

[239] A process of enskillment is an "education of attention" (Ingold, 2000b, p. 37). Enskillment sees that know-how can be acquired through by observation (i.e. the active attending to the movements of other others) and imitation (i.e. the aligning of attention to the movement of one's own practical orientation towards the environment). This can be contrasted critically against a process of enculturation, where (i) cultural knowledge takes the form of representations; (ii) the representations are stored in mental containers of a universal psychology for later retrieval; and (iii) enactment cross domains from the mental into the public (Ingold, 2001). The process of enskillment is consistent with Jean Lave's "understanding in practice", where learning in inseparable from from doing, and both are embedded in the context of a practical engagement (or dwelling) in the world. It is counter to "culture of acquisition" counterposed by Lave, where enculturation is seen as learning entailed as internalizations of collective representations of the world (Ingold, 2000c, p. 416).

[240] In 1994, the Java technology was released by Sun Microsystems with open sourcing specifications, so that software developers could build applets that would run in Internet browsers. "The idea behind our Java strategy was that the smartest people in the world don't all work for us. Most of them work for someone else. The trick is to make it worthwhile for the great people outside your company to support your technology. Innovation moves faster when the people elsewhere are working on the problem with you' (Schlender and M. H. Martin, 1995). This has become known as Joy's Law (or at least one of them).

Table 7.1. Generative patterns of enskilling in three concerns

Pattern label	(b) Leaving complexities to specialists	**(a) Accessing the smartest people working elsewhere**	(c) Leaving breadcrumbs for followers
(i) Voices on issues (who and what)	(a.i) For an organization leader, what frontiers of knowledge can be nurtured for societal and commercial gains? while (b.i) For a typical user, are basic functions accessible immediately, with assistance for advanced features available on demand? while (c.i) For a self-reliant tinkerer, can an assembly be deployed, modified and/or repaired without unnatural effort?		
(ii) Affording value(s) (how and why)	(b.ii) Reducing effort through privileges of an offering in exchange for monetary and/or non-monetary compensation	**(a.ii) Seeing history and progress of successes, errors and fixes, so that concerns and defects are acknowledged and prioritized**	(c.ii) Building on the work of others without worrying about future constraints, so that some hard problems are already solved
(iii) Spatio-temporal frames (where and when)	(b.iii) Customers trust the offering provider for quality and satisfaction as long as the relationship continues	**(a.iii) Gradient of expertise is appreciated, and collaboration is not seen as collusion**	(c.iii) Community has benevolent leaders and moderators who include and develop contributing participants
(iv) Containing systems	←	**(a.iv) For participants in a socio-technical system, are additional features of an offering worth updating platforms and practices?**	→
(v) Contained systems	→	**(a.v) For an offering provider, in which activities do we lead, and in which do we only participate?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

yet many discoveries are not commercially viable. Organizations with a reputation of sharing and contributing to public bodies of knowledge will be welcomed more than those who take without giving.

(a.ii) Seeing history and progress of successes, errors and fixes, so that concerns and defects are acknowledged and prioritized is an affording value. Private sourcing providers can hide their mistakes, as relatively few customers will go through the effort of diagnosing and reporting defects. Software users have unfortunately become accustomed to *rebooting* their computers to clear potential interactions between applications, and hoping that they can avoid crashes. When a commercial provider contributes both to open sourcing and private sourcing asset bases, defects that appear in their offering but not the pure open sourced version have to be acknowledged. The commercial provider may offer a revision to open source components, but if they are not accepted by the community, a change to the private sourcing components is the alternative.

(a.iii) Gradient of expertise is appreciated, and collaboration is not seen as collusion are spatio-temporal frames for the pattern. While open sourcing means that anyone can join a project, private sourcing resources often bring more highly-educated and better-trained professionals. Self-funded participants may be suspicious of the motives of corporate developers, but open sourcing somewhat levels the playing field by allowing everyone to examine and criticize contributions. At the same time, the prevailing socio-political environment has to support corporate interests participating the commons, in the context of independent foundations that see many organizations working on shared issues.

(a.iv) For participants in a socio-technical system, are additional features of an offering worth updating platforms and practices? is a containing system for the pattern. Keeping up to date with an evolving system brings the burden of upgrading skills continuously, as technologies and the world changes. Those feeling overburdened may decide newness is not worth the effort, or rely on services to care of details for them.

(a.v) For an offering provider, in which activities do we lead, and in which do we only participate? is a contained system for the pattern. An open sourcing community has many contributors, so participants are free to choose their focuses. A corporate-backed resource may have the time and energy to tackle larger challenges, leaving minor bug fixes to those with shorter time horizons.

A generative pattern for the concern of *PSo* can be inferred from the research into *OSwPS*.

(b) Leaving complexities to specialists is a generative pattern significant for the concern of *PSo*. Much of the time, people don't care or have the time to appreciate the inner working of systems. In 1999, blogger.com was a private sourcing web site from Pyra Labs that enabled authors to publish on the web for free. Since Pyra Labs was acquired by Google in 2003,

the code base still bears a private sourcing copyright. While many open sourcing blog platforms have since become available (e.g. Wordpress since 2003; Movable Type since 2007) many authors are trusting commercial enterprises to continue to provide technologies without charge.

(b.i) For a typical user, are basic functions accessible immediately, with assistance for advanced features available on demand? is a driving issue. Busy people are willing to start off with basic no-charge offerings, recognizing that businesses may be supported by advertising revenue or premium charges for more advanced functionality. They don't mind paying a reasonable fee for services, and may switch providers if further functionality is inadequate.

(b.ii) Reducing effort through privileges of an offering in exchange for monetary and/or non-monetary compensation is an affording value for a customer or client. Members of advanced societies rely on organizations and institutions to extend their capabilities. While cooperation has traditionally been common within families, clans and faith-based communities, commercial businesses exist to fulfill wants and needs of those who prefer to not "do-it-yourself".

(b.iii) Customers trust the offering provider for quality and satisfaction as long as the relationship continues is a spatio-temporal frame for the pattern. Most commercial enterprises rely on repeat business by customers who have enjoyed their products and services. A reputation is fragile, so a significant mistake may lead to customers migrating to alternatives.

A generative pattern for the concern of *OSo* is similarly inferred.

(c) Leaving breadcrumbs for followers is a generative pattern significant for the concern of *OSo*. A history of choices, decisions, and fruitful and fruitless results enables observers to assess the alternatives and options that might recur. Artifacts can be objectified, and communications between participations may provide additional insights into the trajectory that has led to the current state.

(c.i) For a self-reliant tinkerer, can an assembly be deployed, modified and/or repaired without unnatural effort? is a driving issue. Open sourcing should enable motivated parties to copy and derive similar results as the original authors, if sufficient diligence is applied. Open sourcing builds in open sourcing, so communities ensure that foundational tools (e.g. Linux) can be reproduced and recreated from scratch.

(c.ii) Building on the work of others without worrying about future constraints, so that some hard problems are already solved is an affording value for downstream participants. Assets with open source licenses already attached mean that reuse and derivation are permitted within the conditions expressed by the original authors. Distinctions between permissive (non-sharealike) and non-permissive (sharealike) conditions may influence architectural decisions, yet are clear from the outset.

(c.iii) Community has benevolent leaders and moderators who include and

develop contributing participants is a spatio-temporal frame for the pattern. A community of active contributors keeps an open sourcing project alive. If new recruits are not welcomed, or a mutiny occurs, volunteers can easily move onto another community where they're welcomed.

These three issues on (i) encouraging progress at the frontier of knowledge; (ii) deepening expertise through specialization, and (iii) broadening universal accessibility to tools incorporate concerns mixed across open sourcing and private sourcing programs. Having the skills to innovate around offerings, can be a challenge both from the perspectives of providers and of customers. Migrating from a prior way of doing things may be a minor adjustment that is easily accepted, or a drastic change that is reviled and criticized by the community.

7.3.2 Equipping entails affordances wayfaring

Equipping[241] with tools, materials or dwelling, when available in an equipmental whole, enables everyday coping in order to situationally accomplish carry out a function. Generative patterns of equipping are shown in three concerns in Table 7.2.

For equipping, let's again focus on the concern of *OSwPS*, supported by the cases of Chapter 4.

(a) Practicising until they can't get it wrong reflects professionals learning-by-doing as a significant pattern across and along all seven cases for the concern of *OSwPS*. The case of *podcasting* illustrates an organization supporting the distribution of prerecorded audio, video and presentation slides across the full range of employees. Uploading and downloading files has been a feature of computing since its early days, but the advent of the iPod and MP3 players set new expectations that anyone who missed a teleconference should be able to catch up later, practically as simply as dialling in on a telephone. When a project evolves casually without deadlines or clear purpose, wayfaring discloses history-making affordances as "amateurs practice until they get it right".[242] When commercial resources are engaged and plans become formalized, "professionals practice until they can't get it wrong".

(a.i) For an organization leader, does bringing professional resources to a volunteer initiative accelerate a desirable outcome? is a driving issue. Not

[241]Equipment is available (i.e. ready-to-hand), while other entities are occurrent (i.e. present-at-hand) in the Heideggerian philosophy of being-in-the-world. "The basic characteristic of equipment is that it is used for something. 'Equipment is essentially *something-in-order-to*' .... Equipment always refers to other equipment. [....] An 'item' of equipment is what it is only insofar as it refers to other equipment and so fits into a certain way into an 'equipmental whole'" (H. L. Dreyfus, 1990, p. 62).

[242]The distinction between amateur musicians and professional musicians dating back to 1944 sees more than just the payment for performances. "An amateur practises until he can do a thing right, a professional until he can't do it wrong".

Table 7.2. Generative patterns of equipping in three concerns

Pattern label	(b) Organizing with the visible hand of managerial capitalism	**(a) Practicising until they can't get it wrong**	(c) Gathering the volunteer army
(i) Voices on issues (who and what)	(a.i) For an organization leader, does bringing professional resources to a volunteer initiative accelerate a desirable outcome? while (b.i) For an entrepreneur, does capital investment prosper over grassroots alternatives? while (c.i) For a do-it-yourselfer, are processes and materials readily available and/or shared?		
(ii) Affording value(s) (how and why)	(b.ii) Funding from financial backers for acquiring talent and resources so that market wants and needs can be fulfilled	**(a.ii) Accelerating commons initiatives with commercial resources, so that independent investments are reduced**	(c.ii) Tapping pre-cleared assets and methods so that private pursuits can enjoy the fruits of collective wealth
(iii) Spatio-temporal frames (where and when)	(b.iii) Capital can be economically appropriated and deployed distinctively	**(a.iii) Commercial contributions are unencumbered by licensing**	(c.iii) Perquisite tools and equipment are generally available to participants
(iv) Containing systems	←	**(a.iv) For a governing leader, are non-commercial and commercial parties encouraged to participate fairly towards societal benefits?**	→
(v) Contained systems	→	**(a.v) For a business unit leader, does pooling resources with community lead to a surplus above going it alone?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

every project needs to be someone's full-time job. Open sourcing is often done on "hobby" time, where an individual has a pet peeve that he or she solves for personal reasons, and then shares with others. In some cases, the informality amongst a group of volunteers is creative, and having management bring in professional resources can crush the spirit.

(a.ii) Accelerating commons initiatives with commercial resources, so that independent investments are reduced is an affording value for the pattern. Open sourcing can lead to many alternative projects headed in the same general direction, competing for recognition. When one or more commercial organizations begin to contribute to an open project, attention gets drawn so that one project gains momentum and/or features from other initiatives get added to the scope.

(a.iii) Commercial contributions are unencumbered by licensing is a spatio-temporal frame for the pattern. When a private sourcing version is offered in the marketplace, there must be at least one alternative open sourcing alternative that is practically viable. Customers may prefer a reputable private sourcing vendor to the dynamics of multiple open source contributors, but shouldn't feel locked in to only one provider.

(a.iv) For a governing leader, are non-commercial and commercial parties encouraged to participate fairly towards societal benefits? is a containing system for the pattern. At the level of policy-setting, laws and industrial policy should see a role for commercial businesses to work with not-for-profit organization towards advancing societal goals. Encouragement and constraints can be in force at a variety of levels of legislatures, and across jurisdictional boundaries.

(a.v) For a business unit leader, does pooling resources with community lead to a surplus above going it alone? is a contained system for the pattern. A manager in a commercial enterprise has responsibility to the company shareholders, and thus finds himself or herself with a private sourcing offering in competition with an open sourcing alternative where the acquisition price is zero. In order to be compensated for the offering, the value that is captured by the enterprise has to be greater than the cost for the company in employing both private sourcing and open sourcing resources.

A generative pattern for the concern of *PSo* is inferred from behaviours around *OSwPS* activities.

(b) Organizing with the visible hand of managerial capitalism is a generative pattern motivating business enterprise. While projects initiated by volunteers are laudable, professional managers ensure that market opportunities are met with talented people well equipped to serve customers. They can act with speed and decisiveness in the face of competitive tensions and economic pressures.

(b.i) For an entrepreneur, does capital investment prosper over grassroots alternatives? is a driving issue. Many businesses remain as small en-

terprise (e.g. mom-and-pop shops) because scaling up is not economically viable. Some businesses can benefit from entrepreneurs taking financial capital to invest in serving more customers and/or providing a broader range of offerings.

(b.ii) Funding from financial backers for acquiring talent and resources so that market wants and needs can be fulfilled is an affording value for the entrepreneur. Cash flow enables an organization invest in resources and operate to serve its customers. Success leads to greater success, so that wealth is available to expand the business.

(b.iii) Capital can be economically appropriated and deployed distinctively is a spatio-temporal frame for the pattern. An entrepreneur may succeed by bringing together social capital, cultural capital and financial capital in ways that others do not. The business does have to retain some distinction as a differentiation, so that competitors and/or copycats don't steal away all of the customers.

A generative pattern for the concern of *OSo* is similarly inferred.

(c) Gathering the volunteer army is a generative pattern significant for the concern of *OSo*. In addition to bringing their skills and reputations to a community, members usually bring their own tools. The falling price of computer hardware has lowered the barrier of access to tools for software development. In other domains, hardware tools and environments either have to be pocket change for authentic open sourcing, or local collectives (e.g. fab labs) may have emerged as makers pool their resources locally.

(c.i) For a do-it-yourselfer, are processes and materials readily available and/or shared? is a driving issue. Joining and participating in an open source community is based on transparency. Individuals self-assess their qualifications, preparedness and willingness to engage with others. Expectations of members increases with their involvement (e.g. becoming a committer is generally regarded as prestigious).

(c.ii) Tapping pre-cleared assets and methods so that private pursuits can enjoy the fruits of collective wealth is an affording value for the open source community member. Participants can focus on their tasks at hand without having to deal with bureaucracy or contracts. Contributors certify that their donations are authentically created by themselves, or have been obtained with appropriate clearances.

(c.iii) Prerequisite tools and equipment are generally available to participants is a spatio-temporal frame for the pattern. Open sourcing presumes that individuals have access to basic platforms as foundations. Rather than specifying requirements of the latest and highest performing infrastructure, older and cheaper technologies and institutions are accommodated. When newer technologies are required, older versions of open source offerings often have a following until total obsolescence is reached.

These three issues on (i) professional resources on volunteer initiatives; (ii) profitable capital investment, and (iii) ready accessibility to materials

and tools, incorporate concerns mixed across open sourcing and private sourcing programs. Better equipped individuals may have a larger set of tools, materials or dwelling available, so that additional history-making affordances are disclosed. Greater interoperability of additional affordances with the prior equipment customarily available can lead to greater commonality in practices.

7.3.3 Legitimating entails affordances wayfaring

Legitimating[243] objectivizes distinctions over a social space, by lending higher prestige to some identities over others. While species of capital[244] include (i) economic capital (i.e. materials that can be exchanged), (ii) cultural capital (i.e. abilities and talents embodied), and (iii) social capital (i.e. obligations or rights through relationships), those three lead to forming (iv) symbolic capital (i.e. honour, prestige or recognition) that can be converted into advantage in social and/or political spheres. Generative patterns of legitimating are shown in three concerns in Table 7.3.

For legitimating, the concern of *OSwPS* can be reviewed first, following from the cases in Chapter 4.

(a) Being on the right side of history is a generative pattern significant across and along all seven cases for the concern of *OSwPS*. After an episode where a variety of innovators compete and one party emerges as dominant, history gets rewritten as a prescience by the eventual winner. The case of *mashing-up* shows the interplay between developing standards, building technologies, and guiding non-programmers to assemble web content for themselves. Providing early access to product prototypes and hosting competitions to create exemplars for later promotion represent "right ways" to lead in the marketplace towards launching a new class

[243] On the field of power, legitimating species of capital into symbolic capital enables social classes (and individuals) to dominate from more powerful positions. "The objective relations are the relations between positions occupied within the distributions of the resources which are or may become active, effective, like aces in a game of cards, in the competition for the appropriation of scarce goods of which this social universe is the site. According to my empirical investigations, these fundamental powers are economic capital (in its different forms), cultural capital, social capital, and symbolic capital, which is the form that the various species of capital assume when they are perceived and recognized (Bourdieu, 1989, p. 17).

[244] Symbolic capital is accumulated honor and prestige that can serve as a source of power, even as economic capital is ineffective. "In an economy which is defined by the refusal to recognize the 'objective' truth of "economic' practices, that is the law of 'naked self-interest' and egoistic calculation, even 'economic' capital cannot act unless it succeeds in being recognized through a conversion that can render unrecognizable the true principle of its efficacy. Symbolic capital is thus denied capital, recognized as legitimate, that, misconstrued as capital (recognition, acknowledgement, in the sense of gratitude aroused by benefits can be on the foundations of the recognition) which, along with religious capital ... is perhaps the only form of accumulation where economic capital is not recognized" (Bourdieu, 1990, p. 118).

Table 7.3. Generative patterns of legitimating in three concerns

Pattern label	(b) Building a brand with prestige	**(a) Being on the right side of history**	(c) Doing trumps talking
(i) Voices on issues (who and what)	(a.i) For an offering architect, which emerging directions will converge to become standards both for society and our participation? while (b.i) For an offering adopter, does the provider have an identity with value(s) worth affiliating? while (c.i) For a commons contributor, is the collective credible as a living initiative aligned with personal interests?		
(ii) Affording value(s) (how and why)	(b.ii) Enjoying respect gained through customer endorsements to extend profitable patronage in continuing relationships	**(a.ii) Aligning foresight with evolving public specifications so that investments realize into mainstream everyday ways**	(c.ii) Reusing and extending work products proven by others in practice, so that the load is lessened for everyone
(iii) Spatio-temporal frames (where and when)	(b.iii) Markets are complete and efficient, with customers discerning on preferences	**(a.iii) Standards committees are independent and inclusive**	(c.iii) Artifacts are shared in the commons, and constructive criticism is welcomed transparently
(iv) Containing systems	←	**(a.iv) For a market participant, which organizations have reputations with whom association is desirable?**	→
(v) Contained systems	→	**(a.v) For a platform adopter, which standards have an implementation practical for application?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

of offerings. The technologies of mashing-up unfortunately were not as big success due to timing (with a product release in midst of the 2008 financial crisis), so legitimacy could be seen as necessary condition that is not sufficient by itself. The learning and product features were eventually repackaged into other offerings.

(a.i) For an offering architect, which emerging directions will converge to become standards both for society and our participation? is a driving voice on issues. Establishing an open industry standard requires cooperation with customers and amongst competitors, although deliberation tends to slow down progress. Offering leaders have to find ways to release a distinctive product, while embracing the will of the marketplace with "not invented here" innovations.

(a.ii) Aligning foresight with evolving public specifications so that investments realize into mainstream everyday ways is an affording value for the offering architect. Innovating can follow the maxim that "the best way to predict the future is to create it".[245] Participation on industry standard committees while developing a distinctive implementation enables legitimacy on claims of interoperability and clear paths for relevance of offerings in the future.

(a.iii) Standards committees are independent and inclusive is a spatio-temporal frame for the pattern. Ongoing participation in an industry collaboration requires credible governance that maintains neutrality.

(a.iv) For a market participant, which organizations have reputations with whom association is desirable? is a containing system for the pattern. There are a variety of standards organizations at national and international levels, for technologies and practices. Gaining the endorsement of a standards body requires both effort and time. Some bear greater legitimacy than others.

(a.v) For a platform adopter, which standards have an implementation practical for application? is a contained system for the pattern. A community or organization that can claim compliance with a standard has table stakes as a credible alternative. Long term viability and responsiveness to change may influence the reputation on which an implementation is selected.

The concern of *PSo* has a generative pattern inferred from behaviours around *OSwPS* activities.

(b) Building a brand with prestige is a generative pattern for *PSo*. A pursuit of excellence can lead to an innovator forging ahead in a heroic effort that should be rewarded with recognition.

(b.i) For an offering adopter, does the provider have an identity with

[245] Alan Kay is attributed in 1982 to saying the researchers' maxim at Xerox PARC was "The best way to predict the future is to invent it". An earlier version dates back to 1963 by Dennis Gabor, who won a Nobel Prize in Physics for work on holography: "The future cannot be predicted, but futures can be invented".

value(s) worth affiliating? is a driving issue. Customer adoption of an offering is the measure of success. While superior products and lower price can lead customers to narrow a consideration set for transactions, a strong company reputation and admirable history play larger in decisions related to long-term relationships.

(b.ii) Enjoying respect gained through customer endorsements to extend profitable patronage in continuing relationships is an affording value for the offering adopter. A well-reputed company and/or brand will benefit by repeat business. "If you lie down with dogs, you will get up with fleas".[246]

(b.iii) Markets are complete and efficient, with customers discerning on preferences is a spatio-temporal frame for the pattern. For private enterprise to work well, customers are presumed to have easy access to vendor offerings. In addition, customers have to care about differentiating features, beyond product commodities.

A generative pattern for the concern of *OSo* can be inferred similarly.

(c) Doing trumps talking is a generative pattern for *OSo*. Legitimacy is established through verifiable facts and body of work, rather than claims of a future to come. Public access to records enables transparency.

(c.i) For a commons contributor, is the collective credible as a living initiative aligned with personal interests? is a driving voice on issues. Open source communities show their orientations on a variety of philosophies. Attitudes can range from emancipatory to laissez-faire, personal to institutional, simple to sophisticated. Members volunteering in an open source community assume part of the identity shared by peers.

(c.ii) Reusing and extending work products proven by others in practice, so that the load is lessened for everyone is an affording value for the offering adopter. The authenticity in open source works is high, due to transparency. Individuals can self-select to try out and/or adopt stable releases that have been hardened, or less mature actively developed branches with additional features.

(c.iii) Artifacts are shared in the commons, and constructive criticism is welcomed transparently is a spatio-temporal frame for the pattern. A community thrives when mutual respect is shown. Open sourcing protects direct copying, but does not preclude any party from taking an idea and reinventing it elsewhere (e.g. rebuilding in another language or context).

These three issues on (i) backing the eventual industry standard, (ii) building a prestigious organizational identity, and (iii) showing tangible signifiers of progress, incorporate concerns mixed across open sourcing and private sourcing programs. Offerings and organizations embody their identities in continual evolution, with skills, equipment and legitimacy changing to match societal wants and needs and environmental conditions.

[246]The *Oxford Dictionary of Proverbs* dates the Latin "qui cum canibus concumbunt cum publicibus surgent", back to 1573.

7.4 Hypothesizing for a theory of affordance wayfaring

One hypothesis for a descriptive theory for OSwPS within the paradigm of inhabiting disclosive spaces can be constructed:

- *Hypothesis*: *Open sourcing while private sourcing* enables affordances wayfaring through enskilling, equipping and legitimating. This is possible in ways that neither *open sourcing only* nor *private source only* allows.

The seven cases and the context of IBM between 2001 and 2011 support this hypothesis. Additional hypotheses within this paradigm could be developed. This hypothesis could be tested beyond IBM with contemporary cases, as OSwPS has become more commonplace.

8. Anticipatory appreciating, from a paradigm of governing subworlds

Across and along the seven cases on open sourcing while private sourcing (*OSwPS*) from 2001 to 2011, *anticipatory appreciating* emerges as the third of three theories, coming alongside a paradigm of governing subworlds. This theory-building is based on the seven cases detailed in Appendix A (summarized in Chapter 4 and the five contexts detailed in Appendix B (summarized in Chapter 5.

8.1 A paradigm of governing subworlds can be seen as regulating commercial and non-commercial domains

OSwPS can be oriented philosophically towards establishing order amongst organizations and individuals, both through rules of law and expected norms of behaviour in everyday social practices.

Commercial and non-commercial domains operate in parallel in the political economy of everyday life. Behaviours in each domain follows an ethical system, that can be described as "moral syndromes"[247]. The *commercial moral syndrome* sees parties *trading* with each other, voluntarily cooperating towards mutually productive ends, in business transactions and relationships both as individuals on their own behalf, and in for-profit enterprises. Commercial behaviours have a long history in farmers markets, and trading companies where ships sailed from one country to another. The *guardian moral syndrome* sees parties *taking* from each other, where nonprofit activities defend against treachery and corruption. Guardian behaviours have a long history in the armed forces and police, government legislature and courts, and organized religions. The behaviours[248]

[247]These syndromes are presented as theory that can't be proved, only disproved. They manifest as "two moral syndromes as survival systems, worked out by long experience with trading, on one hand, and taking, on the other. [....] [This is an attempt of] systematizing a stratum of behavior that underlies what we conventionally accept as morality". [...] Maybe the syndromes are existential morality ...." (J. Jacobs, 1992, p. 52).

[248]The Commercial Moral Syndrome will see parties: (i) shun force; (ii) come to

found acceptable in one syndrome are unacceptable in the other. Moral conduct[249] is judged coherently within the systems, but not across the systems. Human civilization[250] has relied on both moral systems functioning in parallel, and mutually supporting each other.

Regulating[251] is a systematic (i.e. rule-like or determinate) behaviour of one part of a system that tends to restrict the fluctuations in behaviour of another part of that system. Regulators[252] can occur at different levels of systems and places in a complex system. Order is established and maintained in a system by forces within (i.e. self-organization[253]) or by

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voluntary agreements; (iii) be honest; (iv) collaborate easily with strangers and aliens; (v) compete; (vi) respect contracts; (vii) use initiative and enterprise; (viii) be open to inventiveness and novelty; (ix) be efficient; (x) promote comfort and convenience; (xi) dissent for the sake of the task; (xii) invest for productive purpose; (xiii) be industrious; (xiv) be thrifty; and (xv) be optimistic. The Guardian Moral Syndrome will see parties (i) shun trading; (ii) exert power; (iii) be obedient and disciplined; (iv) adhere to tradition; (v) respect hierarchy; (vi) be loyal; (vii) take vengeance; (viii) deceive for the sake of the task; (ix) make rich use of leisure; (x) be ostentatious; (xi) dispense largesse; (xii) be exclusive; (xiii) show fortitude; (xiv) be fatalistic; (xv) treasure honor (J. Jacobs, 1992, p. 215). These lists are not order in strict opposition with each other, but can be reordered in that way.

[249]A violation of expectations in a moral syndrome can be described as corruption. "[If] the guardian and commercial organizations of a society are corrupt, the society is corrupt .... But if the guardian and commercial organizations respect and adhere to good moral standards, they supply a moral social context ..." (J. Jacobs, 1992, p. 215).

[250]Commercial activities are supported by government. "[The] guardian-commercial symbiosis that combats force, fraud, and unconscionable greed in commercial life – and simultaneously impels guardians to respect private plans, private property, and personal rights. Mutual support of morally contradictory taking and trading; it tames both activities and their derivatives. So perhaps we have a useful definition of civilization: reasonably workable guardian-commercial symbiosis" (J. Jacobs, 1992, p. 214).

[251]Regulation presumes an asymmetry in part. "Regulations translate constraints through appropriate devices, i.e. regulators. They are one of the most general and fundamental feature of systems in their dynamic direction and appear in practically every aspect of nature or constructed ones". Regulation tends to have a broader meaning that control. "Regulation seems more general, as many natural regulations (in ecosystems, in living systems and even in social systems) are automatic. Control implies generally the introduction of a human decider" (François, 1997, p. 295).

[252]Regulators can be globally centralized, or polycentrically distributed. "A completely centralized regulation in a quite complex system faces the problem of time lags .... Moreover, when long communication lines are needed, noise may distort the information .... While a global regulator is still needed in order to maintain the general coherence in the system, regulation may be at least partially decentralized. Local and specific regulators may be set up, in conformity with the heterogeneous character of the system. This leads to a degree of heterarchy, giving autonomy to functional subsystems" (François, 1997, p. 296).

[253]Self-organization is an ability of a system to construct and change its own behaviour or internal organization. "The construction of self-organization is quite different from its maintenance, once the organization is completed. In the first stage, morphogenesis is important, even if the basic template of the system's organization is already present and acting. In the second stage, when the general organization is stabilized, it should possibly be useful to speak of self-reorganization" (François, 1997, p. 308).

forces without (i.e. environmental constraints). The process of regulation is circular[254], with sensing of the system in its environment compared against a standard, leading to a selection from a variety of preprogrammed actions. Systems can naturally regulate themselves; interventions of human regulation[255] can establish policies that guide a system into an alternative state.

Subworlds[256] are local elaborations of a commonsense world that we share. A world[257] is an organized body of objects, purposes, skills and practice on the basis of which human activities have meaning or make sense. Being in a subworld[258] is not exclusive of being in other subworlds. Practices and skills from one subworld can be cross-appropriated into another.

Governing[259] is an activity where the general manner or specific action

[254]A systems engineering description of regulation suffices, and is then extended for human contexts. "An ongoing physical process ... is designed as to change its state in response to signals, and it contains a subsystem ... designed to generate the signals to which the main system will respond. The subsystem derives its signals by collecting information about the state of the main system – about the internal relations that constitute it ... or about the external between its and its surround ... – and comparing this with standards that have somehow been set for these variables. The disparity between the two generates a signal that triggers a change in the main system, sometimes through the medium of a selective mechanism that chooses from a repertory of possible actions" (Vickers, 1965, p. 50).

[255]Institutions can create and enforce policies. "The sole purpose of human intervention is to regulate the relationship of some level more acceptable to those concerned than the inherent logic of the situation would otherwise provide. [...] thus, policy making assumes, expresses, and helps to create a whole system of human 'values'. (Vickers, 1965, p. 43)"

[256]Worlds are not built up from subworlds; the conception is reversed. "Subworlds, like the world of physics, the business world, and the theater world, make sense only against a background of common human concerns. [....] That is, subworlds are not related like isolable physical systems to larger systems they *compose*, but are rather, local elaborations of a whole, which they *presuppose*" (H. L. Dreyfus, S. E. Dreyfus, and Athanasiou, 2000, p. 76).

[257]A world can be differentiated from a universe, which is a totality of objects of a certain kind. "[Note] that we can speak of the sins of the world, but not the sins of the universe. Such worlds as the business world, the child's world, and the world of mathematics are 'modes' of the total system of equipment and practices that Heidegger calls *the* world... [All] 'special worlds' ... are public. There is no such thing as *my* world, if this is taken as some private sphere of experience and meaning, which is self-sufficient and intelligible in itself, and so more fundamental than the shared world and its local modes. Both Husserl and Sartre follow Descartes in beginning with my world and then trying to account for how an isolated subject can give meaning to other minds and *the* shared intersubjective world. Heidegger, on the contrary, thinks that it belongs to the very idea of a world that is shared, so *the* world is always prior to *my* world" (H. L. Dreyfus, 1990, pp. 89-90).

[258]At the grandest level, we all share *the* world, and then beings with common practice may share a subworld. "Worlds can interact, and where several worlds interact without presupposing a common world we speak of local worlds" (Spinosa, F. Flores, and H. L. Dreyfus, 1999, p. 17).

[259]Governing is an inflected form of *governance*. "The Oxford English Dictionary

through which a social body is guided, directed, steered or regulated. Governance[260] is usually oriented towards setting and enforcing bounds. In contrast, *managing*[261] is an activity the general manner or specific action of applying skills or care in the manipulation, use, treatment, or control of things or persons, as in the conduct of an enterprise, operation, etc. Management[262], as a practice is traditionally oriented more to setting direction.

The larger world of business provides a shared context in laws and policies that cross commercial and non-commercial interests. The lines between subworlds are not as distinct as the institutions that might espouse these primary interests. For-profit enterprises might be presumed as primary in the commercial subworld, and not-for-profit organizations as primary in the non-commercial world. Both, however, are social entities where commercial and non-commercial activities take place, and lines become blurred. For-profit enterprises can be active in non-commercial practices, e.g. disaster or wartime assistance, matching charitable donations, and training and apprenticeship programs. Not-for-profit organizations can be active in practices where competitors view them as commercial, e.g. renting buildings or grounds as a landlord, sponsoring lotteries, and reselling secondhand clothes and household items. In these practices, the equipment in the larger world of business is similar, i.e. a provider

(OED) presents governance as derived from the Latin word *gubernare* (to steer, direct, or rule), as well as the Greek *kubernan* (to steer). [....] In this definition, the phrase "social body" tends to rule out governing an individual person or things. Normally, governing involves a group of people, rather than a single person. A thing may have a governor built in, but the operation of a machine normally does not connote a human component as part of its mechanism" (Ing et al., 2003).

[260]Governance tends to be more about constraints and bounds than a specific direction. "The phrasing of this definition in a passive mode – i.e. "is guided, directed, steered or regulated' – suggests an approach of bounding or circumscription rather than direction. The social body may be led informally on a peer-to-peer basis, or through a formal authority charged with resources to enforce conformance. Governability, or the lack thereof, may be observed after principles, policies and rules have been established and communicated" (Ing et al., 2003).

[261]Managing is an inflected form of *management*. "Management is derived from the mid-16th century Proto-Romance *maneggiare*, from a Latin root of *manus* (hand). [....] Its original sense comes from the French, who "encouraged" horses through the use of hands, carrots and sticks to perform in ways that served the trainers, but were not natural for the horses" (Ing et al., 2003).

[262]Managing applies skills and care, in practice. It is "... oriented more towards the model of external control .... In hierarchical form, a manager is a supervisor formally assigned with responsibility to oversee a group of workers. The description is also valid, however, in a context of self-management, where these activities can be distributed across individuals or rotated over time. Management of a team can be shared, with individuals each providing guidance along a different dimension (e.g. a project lead responsible for tracking progress and budget, and a technical lead for ensuring quality). [....] The manager may be considered as a member of the work team, but is 'more equal than others' as higher expectations and responsibilities are placed on the role. In a social network of equals, the person with greater responsibility and authority becomes, by definition, an outsider" (Ing et al., 2003).

of products or services in exchange for consideration in a monetary or non-monetary form. The purpose in a commercial subworld is primarily for monetary gain; the purpose in a non-commercial subworld may have spiritual, recognition or reputational motivations. The identities of individuals tend to be aligned with the institutions that they represent, so that disentanglement generally requires explicit disclaimers that clarify the interests of the individual as independent of the organization.

With a political economy of social interactions, open sourcing and private sourcing are regulated differently as subworlds, following distinct moralities of governing. *OSwPS* then coexists with those two subworlds, as a third type that risks corruption in mixing the commercial and guardian syndromes. Governing *OSwPS* therefore requires an even more delicate setting of regulating and constraining behaviours.

8.2 A theory of anticipatory appreciating emerges alongside governing subworlds

Based on the paradigm described above, the cases on *OSwPS* lead to proposing a theory of anticipatory appreciating.

Appreciating[263] behaviours in human systems follows a regulative model of norm-seeking, in contrast to a rational model of goal-seeking. Regulation can be analyzed with three fields of inquiry[264]: (i) how does the control system derive its information about the state of the main system? (ii) how does it derive the norms with which the state is to be compared; and (iii) how does the signal thus generated cause the selection and initiation of change in the main system? Appreciation[265] precedes regulative action, so

[263]Models of motivation created before the distinguishing of information flows from energy flows are criticized. "The concept of tension reduction, apt enough to the physical relaxation of a creature which had just achieved the 'goal' of satisfying hunger or sex, was carried over in unconscious metaphor to describe the abatement of any mis-matched signal. The concept of goal-seeking, apt enough of a model of behviour in those situations in which effort leads through successful achievement to rest, was generalised as the standard model of human 'rational' behaviour, although most human regulative behavior ... is norm-seeking and, as such, cannot be resolved into goal-seeking, despite the common opinion to the contrary" (Vickers, 1963, p. 274).

[264]The question of "why is he doing that" is seen as misleading. The proper question should be "why is he doing that, rather than something else?" (Vickers, 1963, p. 275).

[265]Appreciative behaviour can be distinguished from regulative behaviour. "The first and second fields of enquiry – the observation of the 'actual' and its comparison with the 'norm' – are indissolubly connected and important in their own right. This combined process I call appreciation. The third field – the choice of action – is separable and may be irrelevant. Appreciation may or may not call for – and if it does, it may or may not evoke – action which may or may not abate an observed discrepancy, action which I will call regulative action. There may be no observed discrepancy; match signals, no less than mis-match signals, are important and ... informative. There may be nothing to be done. The selective mechanism for

that additional regulation may not be required. Policy making involves two segments[266]: (i) an appreciative segment; and (ii) an instrumental segment. In the appreciative segment are two judgements[267]: (a) *reality judgements* of the facts of the state of the system, both internally and in its external relations, either actual or hypothetical, in the past, present or future; and (b) *value judgements* about the significance of the facts to the appreciator or to the body for whom the appreciation is made. In the instrumental segment, (c) *instrumental judgements* (and instrumental hypotheses) on the choice of action becomes executive decisions once they are approved by appreciation. With multiple policy-makers involved with multiple stakeholders, committees commonly engage in deliberation[268] in the cycle of appreciative processes and regulative action. The readiness to distinguish some aspects of the situation and interrelatedness of the judgements are called an *appreciative system*. The current state of a system is called its *setting*, and the setting of several such systems are called an *appreciative field*.

Anticipatory behaviour[269], in living organisms, is exhibited as changes undergoing in the system in the present, caused by events that have not

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action may act at random or may be systematically wrong" (Vickers, 1963, pp. 275-276).

[266]Governing roles should not be focused on solving problems at hand, but instead on ensuring an appropriate context. "[In] institutional behavior, when the object is not to study problem solving but to get a problem solved (or even to find other whether it is soluble within given limits) policymakers well know that the first essential is to present the problem clearly and simply to the problem solver and to hold it constant until he has exhausted his response to i. [....] Nothing is more inimical to the process of solving *executive* problems than to change the specification of the problem or even to suggest that it might be changed" (Vickers, 1965, p. 53).

[267]Reality judgements and value judgements entangle facts and norms. "[They] correspond with those observations of fact and comparison with norm that form the first segment of the regulative cycle, except that the definition of the relevant norm or complex of norms, like the identification of the relevant facts is itself a product of the appreciation. The relation between judgements of fact and of value is close and mutual ..." (Vickers, 1965, p. 54).

[268]When changing regulations is significant, the volume of facts and variety of values may lead to significant documentation. "The deliberations of a single mind are only accessible through reported introspection; but collective deliberations are often more explicit. The agenda which accompany them are often accompanied by supporting papers, statistics, reports, forecasts and so on. Discussion and conclusions are recorded more or less fully in minutes. [...] It occupies much of the time of those committees which occupy scientists, no less than other men, as of cabinets and law courts, boards of directors and university senates" (Vickers, 1963, p. 278).

[269]Causality in the universe is seen as relational. "[What] we commonly think of as causality in this universe is actually a relational matter: the way in which various material 'things' interact is what characterizes the resulting effects, not the material nature of the 'things' themselves. Furthermore, any subsequent scientific study into the material nature of the "hings', which ignores the contextual constraints (relational information) that characterized the interaction, will not explain the causal results ('causality') (J. Rosen and Kineman, 2005, p. 400)).

yet happened, but are entailed to happen in the future. An entailment[270] is a relation of necessity. In the natural system that is part of the external world, our interest is more in causal entailment[271]; in the formal system that is part of the modelling world, our interest is more in inferential entailment. Causal entailment can be interpreted as the "grounds or forms of explanation"[272] necessary for an effect. There are three causal categories[273] which are not themselves entailed, through which an effect can be instantiated through a set of inference rules when applied in a sequence[274]: (i) material causes mapping to initial conditions; (ii)

[270]Robert Rosen uses category theory from mathematics as a foundation for relational biology. "Category theory captures the abstract structural relations among components, and promises to serve as a generic modeling language for both simple and complex systems. Relational diagrams reflect pure 'organization', measured by the density of entailments within them. This concept of organization is completely removed from those concerning disequilibrium, improbability, or entropy common in classical information systems theory. The elements of a relational diagram are devoid of any explicit referents (for example, an explicit representation of time). None of the baggage of dynamical systems need be brought to bear. Thus, relations of the form A $\stackrel{f}{\rightarrow}$ B are the fundamental units of express for Rosen. Each one is called a component, and expresses a form of general entailment – a relation of necessity – from A to B. As such they are uninstantiated, and can represent any kind of relation (for example, ontological or epistemic)" (Joslyn, 1993, p. 396).

[271]Robert Rosen published his work on the modeling relation prior to further development of research into the causal entailments. "Rosen showed clearly in [*Life Itself*] that an invocation to Aristotelian causality may be made in any entailment structure. There are two different realms in which one may speak of entailment: the outer world of causal entailment of phenomena and the inner world of inferential entailment in formalisms. These two realms of entailment are brought into congruence by Rosen's modeling relation, a concept first introduced in Chap. 3 of [*Anticipatory Systems*] (Louie, 2008, p. 291).

[272]Relational biology has cross-appropriated Aristotle's causations. "Aristotle's original Greek term $\alpha\acute{\iota}\tau\iota o\nu$ (*aition*) was translated into the Latin *causa*, a word which might have been appropriate initially, but which had unfortunately diverged into our contemporary notion of 'cause.' The possible semantic equivocation may be avoided if one understands that the original idea had more to do with 'grounds or forms of explanation,' so a more appropriate Latin rendering (in hindsight) would probably have been *explanatio*. It is with this 'grounds or forms of explanation" sense of "cause' that I apply the four Aristotelian causes interchangeably to components of both the causal entailment in natural systems and the inferential entailment in formal systems" (Louie, 2008, p. 293).

[273]In analyzing entailment structures, the fourth Aristotelian category of final cause requires the larger system and reflexivity: "The Aristotelian category of 'final cause', of course, requires more consideration, bringing up as it does issues of teleology, purpose, function, vitalism, and even metming. But in equation 1 we note that the symbol *b* itself has yet to be mapped to an Aristotelian category. This is the way that final cause is introduced, by understanding b as both an effect and reflexively as *itself* a cause: a *final* cause of that which entails it. Thus final causes are *contingent*, dependent on the larger system of which they are a part" (Joslyn, 1993, p. 397).

[274]An effect can be entailed through different structures and/or different processes. "We can see *b* as an *effect* which naturally generates the question 'why *b*?' There are multiple answers depending on the Aristotelian modality of the question, and each answer maps to a classical category for both Aristotle, logical

formal causes mapping to trajectory; and (iii) efficient causes mapping to dynamical equations.

Anticipatory appreciating combines the categories of causal entailment with judgements potentially leading to regulation and/or policy. While living organisms recognize that shared futures are governed both through (i) mechanistic rules[275] and (ii) negotiations-in-contexts, the former has a nature as invariant while the latter is variable in time and space. Since ends (as norms, or as goals) can not effectively be regulated in human systems[276], means (as actions) are constrained either in structures or in processes.

systems, and dynamical systems:

Because	Category	Logic	Dynamics
α	Material	Axioms	Initial conditions
F	Efficient	Inference rules	Dynamical equations
$\vec{F}$	Formal	Algorithm	Trajectory

We note that these causal categories are *independent* of each other, and are themselves not entailed: the same b could be reached with different axioms, different inference rules, and/or a different order of application of those rules" (Joslyn, 1993, pp. 396-397).

[275]Mechanisms have a linear causal structure, whereas organisms are complex systems that can include mechanisms as parts. "Rosen's primary conclusion: mechanisms, the very stuff of existing science, necessarily have very 'impoverished' entailment relations. The class of *simple* systems (those mechanistic, fractionable, reducible, simulable systems with decidedly *linear* entailment structures) is necessarily smaller than the class of *complex* systems with general analytic models. [....] As machines, being synthetic, are the special case, so we arrive at the concept of the *organism* as the proper general case. Organisms have properly analytic models, and their entailment structures can be very rich, containing many loops. An organism cannot therefore be constructed as a machine, but perhaps in the limit of a series of machines (cf. epicycles). But further, organisms contain many *parts* which are machines; indeed they admit to multiple, complementary, individually incomplete mechanistic models" (Joslyn, 1993, p. 397).

[276]Human systems involve both natural systems and formal systems, but unanticipated behaviours can emerge outside of socially-constructed norms and laws. "[When] we attempt to involve final cause in our explanatory scheme, we come to recognize a number of serious weaknesses in classical formalisms. First, since a final cause appears to violate expected causal temporality, being subsequent to its effect, the classical linear flow of time from axioms to theorems is not observed. Second, in classical entailment schemes, entailments themselves are not subject to further entailment. They are always 'given' from 'above', explainable only in term of their final cause, or purpose, never in terms of their efficient cause, or explanation as to how they came about: 'In short, the efficient cause of something inside the system is tied to final cause of something outside the system. [*Life Itself* p. 246]" (Joslyn, 1993, p. 397). The formal system can be entailed with efficient cause; the natural system can be entailed with final cause.

8.3 Patterns concerns entailed by anticipatory appreciating include judging material reality, formal value(s) and efficient instrumentality

Reflecting along and across the case studies from 2001 to 2011 within the paradigm of inhabiting disclosive spaces, some pattern concerns that emerge include judging material reality, judging formal value(s) and judging efficient instrumentality.

8.3.1 Judging material reality entails anticipatory appreciating

Judging material reality through a period of true innovating is an organizational challenge of selecting facts relevant to the current situation. A new *reality* tends to be cocreated psychologically anchored to the past, e.g. podcasting was first thought as a way to narrowcast radio programs, and then was as a way to replay teleconferences, but not as a way to leave voice messages to each other rather than sending email. *Material* effects that are tangible are frequently difficult to separate from hype, with early adopters and fanboys make noise about possibilities that may or may not be actualized. *Judging* occurs both amongst decision-makers who have a knowledgeable appreciation of anticipation of events over which they have some control, and by the uninformed who may jump to conclusions that are totally unfounded. "Technology is anything that was invented after you were born", says Alan Kay[277]. Generative patterns of judging material reality shown in three concerns in Table 8.1.

For judging material reality, let's first focus on the concern of *OSwPS*, supported by the cases in Chapter 4.

(a) Finding room for the commercial beyond non-profit institutions is a generative pattern across and along all seven cases for the concern of *OSwPS*. The case of *integrating development* has the Eclipse technology – consortium – foundation has been success both as a non-commercial initiative, and a platform for developing software and businesses. The Eclipse platform hosted on the eclipse.org web site has continued to evolve for over a decade, with an extensible architecture whereby plug-in packages can be deployed on demand. On the non-commercial side, the Eclipse Foundation cites thousands of universities and research institutes using the platform.[278] IBM has built commercial products for its Rational, Lotus and WebSphere brands. Other companies that have offered commercial products based on Eclipse include Fujitsu, Hewlett-Packard, Hitachi, and

[277] This 1977 version of an Alan Kay quotation was cited by Kevin Kelly. Other variations include "Technology is anything that isn't around when you were born", dating back to a 1996 lecture at UCLA; and "Technology is only technology to people born before it was invented" cited by Don Tapscott in 1998.

[278] At the 10-year anniversary in 2011, the Eclipse Foundation sized the ecosystem also with millions of individuals, and thousands of companies.

Table 8.1. Generative patterns of judging material reality in three concerns

Pattern label	(b) Winning with superiority over competitors	**(a) Finding room for the commercial beyond non-profit institutions**	(c) Sharing and caring in the commons observed
(i) Voices on issues (who and what)	(a.i) For an offering leader, are customers embracing chargeable commercial extensions beyond non-chargeable platforms supported? while b.i) For an offering owner, is a sufficient share of the market choosing our features and pricing over competitors? while c.i) For a community participant, are contributions continuing to be welcomed and considered fairly?		
(ii) Affording value(s) (how and why)	(b.ii) Gaining additionally on a credible market position so that the business grows with new and repeat customers	**(a.ii) Shaping a commons as form emerges, so that commercial participation in the future is ensured**	(c.ii) Preserving privilege perpetually to customize and/or fix any version of an offering, past, present or future so as to maintain self-determination
(iii) Spatio-temporal frames (where and when)	(b.iii) Advantages of intellectual property rights are granted nationally and recognized by treaties and foreign jurisdictions internationally	**(a.iii) (a.iii) Funders see non-zero sum games where societal progress and commercial activity coevolve**	(c.iii) Community has facilitators guiding processes to scope active releases and stabilize less popular prior works
(iv) Containing systems	←	**(a.iv) For governing leaders, what institutions and regulations will allow independent entrepreneurs to advance the standard-of-living within our jurisdiction?**	→
(v) Contained systems	→	**(a.v) For an offering adopter, what is the practicality of moving between commercial and non-profit alternatives?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

SAP.[279] Companies that notably have not participated in Eclipse include Microsoft (with a competitive Visual Studio), Sun Microsystems (preferring the pure Java Netbeans) and Apple (with products built on Objective-C coming from the NeXT acquisition).

(a.i) For an offering leader, are customers embracing chargeable commercial extensions beyond non-chargeable platforms supported? is a driving voice on issues. Open sourcing enables everyone to copy artifacts to package an alternative offering for either commercial or non-commercial pursuits. Even free software (i.e. GNU licenses) permit sellers to charge for something obtainable for free. In the developed world, many consumers are willing to pay for bottled water while that alternative from taps doesn't won't cost them anything.

(a.ii) Shaping a commons as form emerges, so that commercial participation in the future is ensured is an affording value for the offering leader. While open sourcing is conventionally incorporated as an independent non-profit institution, the charter and conduct guidelines are set by the founding members. While an ongoing ability to credibly influence the commons is limited, conditions can be set so that commercial participants are at least not disadvantaged.

(a.iii) Funders see non-zero sum games where societal progress and commercial activity coevolve is a spatio-temporal frame for the pattern. Member activity in *OSwPS* can range from active contribution to passive observation. Participation on parts of commons initiatives can be dialled up or down, depending on interests at the time.

(a.iv) For governing leaders, what institutions and regulations will allow independent entrepreneurs to advance the standard-of-living within our jurisdiction? is a containing system for the pattern. The material reality of commercial and non-commercial interests working together tends to be culturally and politically based within nations. For organizations to operate internationally, enforcing copyright and licensing policies may rely on the background legal and governmental institutions.

(a.v) For an offering adopter, what is the practicality of moving between commercial and non-profit alternatives? is a contained system for the pattern. A customer of a commercial provider may or may not care that an open sourcing version is available, e.g. IBM's WebSphere Application Server has always had Apache counterparts. Having an open sourcing alternative free of licensing restrictions is good for educational purposes, and upgrading to a private sourcing version should be easy. For a business leader, having an option to stay "within the family" can be a better position than losing a customer to a competitor who locks in.

The concern of *private sourcing only* (*PSo*) has a generative pattern inferred from behaviours around *OSwPS* activities.

[279] At April 2004, 45 companies were listed as having "commercial Eclipse-based offerings".

(b) Winning with superiority over competitors is a generative pattern for *PSo*. Business strategy thinking is sometimes influenced by military history of combat. An offering doesn't necessarily have to decimate the playing field, but it does need to be perceived by at least some customers to be better than those from competitors.

(b.i) For an offering owner, is a sufficient share of the market choosing our features and pricing over competitors? is a driving voice on issues. A commercial business has to generate a profit to survive. Having paying customers gives the enterprise cash flow on which resources can be deployed, or reorganized, should economics be unsatisfactory.

(b.ii) Gaining additionally on a credible market position so that the business grows with new and repeat customers is an affording value for the offering owner. Launching a new offering is hard. Word of mouth can lead to success building on success. Retaining customer has a greater return on investment than acquiring new customers.[280]

(b.iii) Advantages of intellectual property rights are granted nationally and recognized by treaties and foreign jurisdictions internationally is a spatio-temporal frame for the pattern. Leading companies are wary of "knock-off" and "copycat" competitors who can reproduce designs that have proven to be desirable in the marketplace. Most copyright infringement enforcements pursued in civil courts rather in criminal courts. Having legal recourse discourages imitations.

A generative pattern for the concern of *open sourcing only (OSo)* is similarly inferred.

(c) Sharing and caring in the commons observed is a generative pattern for the concern of *OSo*. The material reality of active participation across the community has to be live up to the charter promised at its formation. Individuals can be seen acting not only towards their own interest, but helping others who want to help themselves.

(c.i) For a community participant, are contributions continuing to be welcomed and considered fairly? is a driving voice on issues. After an initiative has matured, the volume of changes could slow down. A living community may choose to work on fixed tiers with irregular dates (e.g. the Debian Linux community has a stable release repository in which backports from future versions may be added, with alternatives including oldstable, testing, and unstable), or timeboxed schedules with negotiated scope (e.g. the Ubuntu Linux community has Long Term Support releases every 2 years promising 5 years of updates, and Regular releases every 6 months promising 9 months of updates). With either approach, behaviours following (or not following) processes of reviewing and promoting changes

[280] Raising customer retention rates by 5% could increase the value of an average customer by 25% to 100% (Reichheld and Teal, 1996, p. 33). More generally, this research has been expanded to appreciate the "right customers" with the "right employees", right investors and right measures.

can be observed.

(c.ii) Preserving privilege perpetually to customize and/or fix any version of an offering, past, present or future so as to maintain self-determination is an affording value for a community participant. A community member should understand the conditions of his or her contribution, which doesn't necessarily restrict personal future endeavours, but does grant rights to everyone for copying, reusing and deriving works in prespecified ways. Staying with an older release that could have been deprecated, is not an issue while do-it-yourselfers can build their own fixes.

(c.iii) Community has facilitators guiding processes to scope active releases and stabilize less popular prior works is a spatio-temporal frame for the pattern. Automation can reduce some effort in coordination, but ultimately collaboration amongst human beings is required to decide on future plans. Incorporated open sourcing foundations sometimes have community moderators, but the major of projects operate with committees of volunteers.

The three issues around (i) charging commercial customers, (ii) sufficient market size and (iii) community participation, incorporate concerns across open sourcing and private sourcing programs. Organizations, both commercial and non-profit, are chartered with intents and conditions that may or may not materialise in reality. Judging when or if an initiative deserves its mandate to be extended, stabilized or wound down is complicated decision amongst multiple players.

8.3.2 Judging formal value(s) entails anticipatory appreciating

Judging formal value(s) looks across the shape of adoption while innovating. *Value(s)* are placed on outcomes now practical that were not previously possible, as stakeholders weigh benefits versus associated consequences and costs. *Formal* effects in take-up or rejection across a population in scale (e.g. adoption in numbers as broadly or narrowly), in scope (e.g. adoption for uses as universal or selected) and in speed (e.g. adoption as acceptance rapidly or slowly) can challenge the viability of the initiative on both short horizon and long horizon timeframes. *Judging* is decentralized amongst actors who may change personal predispositions, acquiesce, or resist in preferences to prior ways. "The future has arrived — it's just not evenly distributed yet", says William Gibson.[281] Generative patterns of judging formal value shown in three concerns in Table 8.2.

We can focus first on formal value(s) with the concern of *OSo*, supported by the cases in Chapter 4.

(a) Growing a bigger pie as better than a slicing a smaller pie is a gener-

[281] William Gibson has been cited with this quotation in 1992 by Scott Rosenberg, but claims to have only said something similar in conversation, rather that publishing in a formal written work.

Table 8.2. Generative patterns of judging formal value in three concerns

Pattern label	(b) Supplying a segment of the downward sloping demand curve	**(a) Growing a bigger pie as better than a slicing a smaller pie**	(c) Rising the tide to lift all boats
(i) Voices on issues (who and what)	(a.i) For an industry champion, what investments are commercially viable alongside non-chargeable works in commons? while (b.i) For an offering manager, what target segment of customers can we sustain with products and services? while (c.i) For a community participant, what works are worth preserving in the commons into perpetuity?		
(ii) Affording value(s) (how and why)	(b.ii) Following a disciplined scope with resources and timeline, so that market is engaged tangibly without wasted effort	**(a.ii) Expanding the popularity of an industry platform, so as to gain cofounder position and experience**	(c.ii) Access to artifacts and/or original makers in the community so that experiences and reasoning is shared
(iii) Spatio-temporal frames (where and when)	(b.iii) Funders willing to invest until net cash flow is positive	**(a.iii) Market opportunity is large but specifics are uncertain**	(c.iii) Coalition attracts volunteers sharing contributions, livelihoods to be found in other ways
(iv) Containing systems	←	**(a.iv) For a potential innovator, what untapped wants and needs could be fulfilled by additional offerings using our resources?**	→
(v) Contained systems	→	**(a.v) For an offering manager, of the addition value cocreated, how much can we capture?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

ative pattern significant across and along all seven cases for the concern of *OSwPS*.[282] In the case of integrating development, the Eclipse platform originated from the Java IDE originally developed by OTI prior to its acquisition by IBM. While the technologies at hand in the late 1990s were based on personal computing (e.g. Windows XP would be released in 2001), the Java technology would enable scalability from mainframe computers down into embedded devices such as smartphones (e.g. Siemens in 2001, Nokia in 2002). Building on a virtual machine that would work on a variety of hardware platforms rather than optimizing on a single or few chips is an ambitious direction with a longer horizon.

(a.i) For an industry champion, what investments are commercially viable alongside non-chargeable works in commons? is a driving voice on issues. While all releases of an open sourcing product should be available into perpetuity, a private sourcing counterpart conventionally follows an offering life cycle of pre-release, general availability, maintenance support, upgrades, and withdrawal. Within that cycle, investments have to produce either monetary or strategic benefits over costs.

(a.ii) Expanding the popularity of an industry platform, so as to gain cofounder position and experience is an affording value for the industry champion. If an industry standard is victorious over other approaches in a marketplace, and one company can be seen hands-on to that effort, the victor generally benefits with a halo effect with customers as a winner.

(a.iii) Market opportunity is large but specifics are uncertain is a spatio-temporal frame for the pattern. A new-to-the-world innovation comes with value(s) that are ambiguous before becomes concreting, finding its level after a conventional wisdom emerges. A champion have a vision intuitively "the right thing to do", and adjust practicalities as the shape of the offering becomes more certain.

(a.iv) For a potential innovator, what untapped wants and needs could be fulfilled by additional offerings using our resources? is a containing system for the pattern. In a large enterprise, the overall value(s) may not be within a single initiative, but gained in a synergy across a portfolio of activities spread over a period of time.

(a.v) For an offering manager, of the addition value cocreated, how much can we capture? is a contained system for the pattern. Society at large may have benefited by cooperating amongst companies and the open source community, yet the accountability for an offering is generally placed on the shoulders of an individual. For the private sourcing to continue while open sourcing, value has to be captured for the commercial interests.

A generative pattern for the concern of *PSo* can be inferred from the research into *OSwPS*.

[282]The mindset of a fixed pie of purely win-lose has been well researched by the Harvard Negotiation Project. The alternative is to negotiate to grow the pie for all players.

(b) Supplying a segment of the downward sloping demand curve is a generative pattern for the concern of *PSo*. Economics is generally based on scarcity, and some subset of customers who place a higher value on offering are willing to pay more than the typical party in the world at large.

(b.i) For an offering manager, what target segment of customers can we sustain with products and services? is a driving voice on issues. Appealing to a larger customer set increases revenue by decreasing price and seeking higher volume. However, more sales entail supporting more products and services, and resources of the same quality and/or availability may be limited. Profitability and revenue are related, but not directly coupled.

(b.iii) Funders willing to invest until net cash flow is positive is a spatio-temporal frame for the pattern. The costs to build an offering can accumulate months or years before revenue flows in. Further, cash inflows usually start small before ramping up. Funders of a new offering may be internal to an organization based on surplus generated in other businesses, or externally through venture capital or investment banking. Patience for economic sustainability is generally limited.

A generative pattern for the concern of *OSo* can be inferred similarly.

(c) Rising the tide to lift all boats is a generative pattern for *OSo*. Orienting towards action that furthers value(s) not only for oneself but for others may lead to a community of mutual support. By definition, open sourcing means that everyone should have equal access to the means of production, although the ability of individuals to capitalize will be variable.

*(c.i) For a community participant, what works are worth preserving in the commons into perpetuity?*n is a driving voice on issues. A crisis can bring people together, and may lead to a wealth of donations as reactions. However, not all contributions have equal value, and deserve preservation. Libraries and museums establish deaccession and disposal policies in order to maintain some coherency in their collections.

(c.ii) Access to artifacts and/or original makers in the community so that experiences and reasoning is shared is an affording value for the community participant. Shared source materials removes most needs to "reinvent the wheel". Sometimes, however, deeper insight into the whys and hows leading to the commonplace are revisited for reinvention or innovation. Records of provenance in open sourcing repository eases research or historical reconstruction.

The three issues of (i) benefiting from growing a bigger pie, (ii) sustaining a profitable market segment and (iii) preserving a living commons, incorporate concerns mixed across open sourcing and private sourcing programs. The range of value(s) as either common across a large population or splintered in narrow segments can impact the viability of a mainstream or multiple niche offerings. Establishing value(s) as either positive or negative is not static either within a group or across groups, and may change through parties negotiating.

8.3.3 Judging efficient instrumentality layers into anticipatory appreciating

Judging efficient instrumentality spreads engagement in a period of innovating with participation ranging from passive to active. *Instrumentality* in changing a world is associated with authority and the influence to have others join in a social movement. *Efficient* effects from agency may be attributed to actions by a leader or champion around whom others coalesce. Judging the future impact of conscious action reveals propensity or aversion to risk, as collective activity is rarely a sure thing. "An acre of performance is worth a whole world of promise".[283] Generative patterns of judging efficient instrumentality in three concerns is shown in Table 8.3.

For efficient instrumentality, the concern of *OSwPS* can be reviewed first, following from the cases in Chapter 4.

(a) Stratifying concierge levels above mainstream excellence is a generative pattern across and along all seven cases for the concern of *OSwPS*. The quality of open sourcing works can be high when "given enough eyeballs, all bugs are shallow".[284] A commercial offering has to have features attract to at least some paying customers, who would otherwise choose a non-chargeable alternative. The case of *coauthoring* shows a long history of collaborative document editing, where editors are commonly packaged with operating systems. In the era of personal computing, writers, presenters and bookkeepers paid for Microsoft Office, with no cost alternative of Star Office and then Open Office. With self-service kiosks (e.g. filling out a form at a public terminal at a bank or post office), these types of applications are difficult to maintain. Diskless workstations and then web browsers (with restricted features) replicated the features for organizations with computing security, but the export of documents eventually led to interchange standards (i.e. Open Document Format).

(a.i) For a commercial contributor, what distinctive chargeable features can we develop beyond non-chargeable contributions? is a driving voice on issues. If a commercial organization is unable to make a profit on an offering, it may orchestrate a graceful exit from the market. IBM never charged for downloads of its IBM Symphony, and eventually donated the entire codebase to the Apache Open Office project. Related private sourcing document editors have been embedded in Lotus collaboration products that continued to be profitable.

(a.ii) Offering specialized functions to higher valuing segments, so that needs with greater depth and speed are served is an affording value for the commercial contributor. While the IBM Symphony product was never

[283] The importance of actual conduct and achievement over promise dates back to British historian James Howell in 1655.

[284] Linus' law was coined by Eric S. Raymond as "How many eyeballs tame complexity" (Raymond, 2000).

Table 8.3. Generative patterns of judging efficient instrumentality in concerns

Pattern label	(b) Giving customers what they want	**(a) Stratifying concierge levels above mainstream excellence**	(c) Helping oneself while helping others
(i) Voices on issues (who and what)	(a.i) For a commercial contributor, what distinctive chargeable features can we develop beyond non-chargeable contributions? while (b.i) For an offering manager, with which features are customers resonating? while c.i) For a community participant, what am I contributing as a volunteer to the commons?		
(ii) Affording value(s) (how and why)	(b.ii) Responding to and/or anticipating customer requests so that renewing relationships are predisposed	**(a.ii) Offering specialized functions to higher valuing segments, so that needs with greater depth and speed are served**	(c.ii) Diagnosing and fixing issues independently and/or with community help, so personal priorities are expedited
(iii) Spatio-temporal frames (where and when)	(b.iii) Supplier (brand) preference persists in nonperfect market	**(a.iii) Expertise and/or proficiency is/are on a gradient**	(c.iii) Easy entry to, and exit from, benevolent neutral territory
(iv) Containing systems	←	**(a.iv) For an actor with abilities, what build or buy options are appropriable and non-appropriable?**	→
(v) Contained systems	→	**(a.v) For an offering adopter, what ongoing outcomes are better from a provider than doing it ourselves?**	←
Concern	Private sourcing only	**Open sourcing while private sourcing**	Open sourcing only

chargeable, customers interested in migrating from Microsoft Office could choose to pay for support services. Adopters who don't pay for software generally have some tolerance for defects. Business users who use software dictated by corporate standards are more demanding when they're trying to get a job done.

(a.iii) Expertise and/or proficiency is/are on a gradient is a spatio-temporal frame for the pattern. Adopters of an offering are generally not equally facile with it. When a casual user prefers to rely on assistance of someone more proficient, rather than struggling through himself or herself, there's an opportunity for performing for a fee.

(a.iv) For an actor with abilities, what build or buy options are appropriable and non-appropriable? is a containing system for the pattern. Modern civilization is full of choices on modern conveniences where we delegate some activities to others, and do some other tasks ourselves. In some cases, we embody the resources, and other others, we access them from others.

(a.v) For an offering adopter, what ongoing outcomes are better from a provider than doing it ourselves? is a contained system for the pattern. Opting for a commercial provider leads options open about when and if an adopter will switch to the open sourcing version, which may or may not have fewer features.

A generative pattern for the concern of *PSo* can be inferred from the research into *OSwPS*.

(b) Giving customers what they want is a generative pattern for *PSo*. A commercial organization that has acquired a customer may extend its offerings to retain the business. If the core organization doesn't natively possess the product extensions or complementary services, they may be obtained from an ecosystem partner.

(b.i) For an offering manager, with which features are customers resonating? is a driving voice on issues. The relationship with customers can be a mystery, unless an organization makes the effort to survey for post-purchase satisfaction, and listen for cues. An offering provider can focus on distinctive features.

(b.ii) Responding to and/or anticipating customer requests so that renewing relationships are predisposed is an affording value for the offering manager. Appreciating the preferences of customers precludes defections to competitors. An ideal of knowing the customer better than he or she knows himself opens an opportunity for anticipating latent or future requests.

(b.iii) Supplier (brand) preference persists in nonperfect market is a spatio-temporal frame for the pattern. An offering provider has to have some control over the organization's destiny with the customer. If products and/or services are undifferentiated, an ongoing social relationship could make the difference.

A generative pattern for the concern of *OSo* can be inferred similarly.

(c) Helping oneself while helping others is a generative pattern for *OSo*. Volunteering one's works into the commons presumes that producing them is relatively easy, or that reciprocity in some way is expected.

(c.i) For a community participant, what am I contributing as a volunteer to the commons? is a driving voice on issues. Legitimacy in an open sourcing community is gained through participation. People contribute according to their skills. Reporting a bug or adding to documentation shows respect towards shared interests, as an alternative to contributing nothing.

(c.ii) Diagnosing and fixing issues independently and/or with community help, so personal priorities are expedited is an affording value for the community participant. In an active open sourcing community, channels of communication are generally open so that urgencies can be surfaced. If the problem has potential impact on many, persisting with collective efforts will yield progress.

(c.iii) Easy entry to, and exit from, benevolent neutral territory is a spatio-temporal frame for the pattern. Well-operating open sourcing communities are meritocracies of volunteers. Respect for similarly-minded peers tends to encourage retention, otherwise people move on to other projects.

These three issues on (i) developing distinctive chargeable features, (ii) anticipating customer requests, and (ii) contributing to the commons, incorporate concerns mixed across opening sourcing and private sourcing programs. The decisions that organizations make can and do influence relationships and outcomes.

8.4 Hypothesizing for a theory of anticipatory appreciating

One hypothesis for a descriptive theory for *OSo* within the paradigm of governing subworlds can be constructed:

- *Hypothesis*: *Open sourcing while private sourcing* enables anticipatory appreciating through judging material reality, judging formal value, and judging efficient instrumentality. This is possible in ways that neither *open sourcing only* and *private sourcing only* allows.

The seven cases and the context of IBM between 2001 and 2011 support this hypothesis. Additional hypotheses within this paradigm could be developed.

9. Open innovation learning, with a paradigm of co-responsive movement

Open innovation learning (*OIL*) advances towards application, building normative theory on ways that organizations succeed. Normative theory is "a statement of what causes the outcome of interest, not just what is correlated with it".[285] Descriptive theory orients towards '*is*' propositions; normative theory orients towards '*ought*' propositions.[286] There are multiple ways for organizations to succeed, and science based on historical data and analysis partially contributes towards that.[287] A transition from building descriptive theory to building normative theory is depicted in Figure 9.1, extending the diagram originally shown in Figure 1.1.

Multiparadigm research builds on the insights from chapters 6, 7 and 8, where three descriptive theories alongside three emerging paradigms were proposed. The result is three new normative theories for *OIL* alongside a single new paradigm that may inform organizational decisions and activities in some emerging cases.

Building normative theory extends the boundaries of situations or circumstances under which understanding and prediction under which man-

[285]The leap from descriptive theory to normative theory gives "understanding of causality [that] enables researchers to assert what actions managers ought to take to get the results they need. ... [Normative] theory has much greater predictive power than descriptive theory does. ... [We] cannot judge the value of a theory by whether it is true. The best we can hope for is a body of understanding that asymptotically approaches truth. Hence, the value of a theory is assessed by its predictive power, which is why this article asserts that normative theory is more advanced, and more useful, than descriptive theory" (Christensen, 2006, pp. 42-43).

[286]A turn towards '*ought*' over '*is*' sweeps in decision theory at personal and organizational levels. "It has been well established that a normative proposition – an 'ought' proposition – cannot follow logically from a factual, descriptive proposition – an 'is' proposition. A norm follows only from, or is implied only by, another norm of more general content" (Morgenstern, 1972, p. 710).

[287]Scientific knowledge is espoused as value-free, but its use may not be. "Economists have been admonished time and time again to leave their political and other value judgements out of their theories and outside their classrooms, or at least to make it clear when they are speaking as scientists, and when as citizens, politicians, religious persons, etc." (Morgenstern, 1972, p. 711)

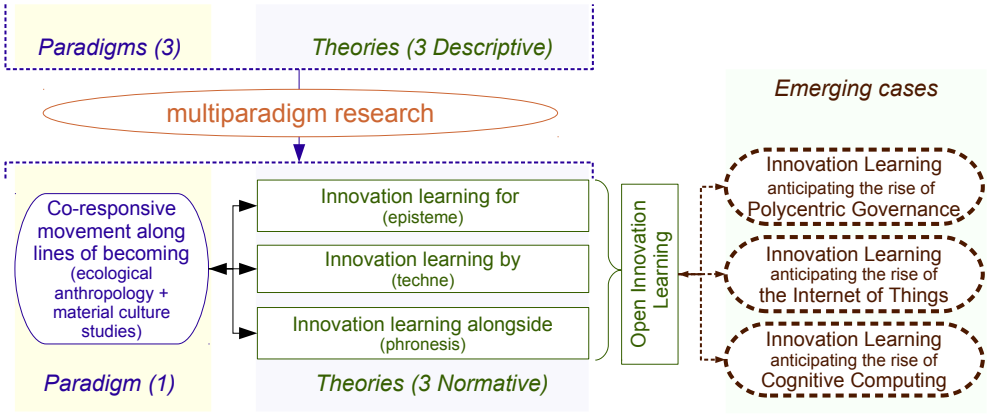

Figure 9.1. Multiparadigm research: paradigm, theory, emerging cases)

agers might apply the research.[288] The relevance of findings here may be reapplied in studies approached by action research, mode 2 (engaged scholarship, collaborative research) or design research.[289]

Jumping forward from the 2001-2011 case studies, *open sourcing while private sourcing* (*OSwPS*) is one way in which *OIL* has become more commonplace by 2016. Commercial companies of the scale of Google, HP, Microsoft and Twitter all contribute to open source communities. IBM has expanded its open sourcing into cloud and cognitive computing strategies where there hadn't been a presence 5 years earlier. Of 400,000 IBM employees, 62,000 have been certified[290] to participate in open sourcing. Open sourcing has also extended more broadly. In 2014, Tesla had declared an open source patent pool[291] on vehicle components, battery charging, energy storage and power optimization.

[288]While categorization in descriptive theory is by the attributes of the phenomena, in normative theory it's by the circumstances in which we might find ourselves. "The relatively accurate, circumstance-contingent predictability of normative theory enables managers to know, in other words, what they *ought* to do. .... We propose that [a] principle defines the salience of category boundaries in management theory. If managers find themselves in a circumstance where they must change actions or organization in order to achieve the outcome of interest, then they have crossed a salient boundary between categories" (Carlile and Christensen, 2005, pp. 7-9).

[289]Researchers have acknowledged that the use of scientific results of management studies is low. "We argue that, in order to advance research on the practical relevance of management studies, it is necessary to move away from the partly ideological and often uncritical and unscientific debate on immediate solutions that the programmatic literature puts forward and toward a more rigorous and systematic research program to investigate how the results of scientific research are utilized in management practice" (Kieser, Nicolai, and Seidl, 2015, p. 144).

[290]IBM employees are not just contributors, but also committers to projects with foundations such as Apache. The IBM Open Cloud Architecture includes Internet-of-Things, web and mobile, runtimes, data and analytics, security, operating environments and DevOps (T. Moore, 2016).

[291]A larger network of charging station for electric vehicles benefits not only car owners, but Tesla and others who align to open sourcing (Buschmann, 2016).

9.1 Emerging cases where open innovation learning is relevant

The salience of *OSwPS* research may be triggered by suggesting some circumstances under which scientific findings have relevance. In 2017-2020, guidance might be appreciated in newly rising situations.

(i) *Innovation Learning with the rise of Polycentric Governance*: Deglobalization is seen as a major shift in the world order, with Brexit and the election of Donald Trump as the U.S. president in 2016.[292] The rise of globalization that had seen multinational organization design progress from ethnocentric to polycentric to geocentric could see a step back towards geocentrism.[293] The normative theory based on *OSwPS* could be helpful in flowing learning in international innovation from the traditional alternative of (i) complete concentration towards (ii) core-periphery concentration, (iii) sequential dispersal, (iv) modularized dispersal, or (v) inclusive dispersal.[294] Leaders should also be aware that *OSwPS* may be used in military as well as commercial ways, counter to prevailing interests.[295]

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[292] On the global agenda by early 2015, the World Economic Forum was surfacing trends. "The path to a de-globalized world [... has ...] many signposts that already point to such a world being well within the boundaries of plausibility. Aren't the three pillars of our global economic commons – open communications, open seas and open skies – beginning to crack?" (Van der Elst, 2015). By late 2016, the Council on Foreign Relations was evoking parallels to protectionism in the 1930s. "... the quick succession of the United Kingdom's vote to leave the European Union and the election of Donald Trump to the U.S. presidency invites comparison to a phenomenon that defined the early 1930s: deglobalization" (Barbieri, 2016).

[293] The shift towards geocentrism has its roots in the 1960s. "The tendency towards ethnocentrism in relations with subsidiaries in the developing countries is marked. Polycentric attitudes develop in consumer goods divisions, and ethnocentrism appear to be greater in industrial product divisions. The agreement is almost unanimous in both U.S.- and European-based international firms that the companies are at various stages on a route towards geocentrism but none have reached this state of affairs" (Perlmutter, 1969, p. 14).

[294] A transnational solution has been posed to combine advantages of globalization with localization, but the way in which such a constellation can be achieved is left open. Five idealized forms have been proposed. "[With] *complete concentration* ... all the involved activities are then conducted in one location. [....] *Core-periphery concentration* ... for innovation projects [... sees that ...] power remains concentrated in the headquarters, while selected subsidiaries are being assigned clearly defined tasks. [....] In *sequential dispersal*, specialised entities serve the whole corporation in their field of expertise [with] the underlying concept of 'centres of excellence' .... [With] *modularised dispersal*, the project is carried through in a dispersed setting at that particular point of time, but as the interfaces are clearly defined beforehand, the division of tasks takes place in a way which enables rather independent work of each participating site. Finally, *inclusive dispersal* refers to ... [various subsidiaries (that may be set up again as in the centre of excellence model) work simultaneously in a project, and while they all have their particular responsibilities and tasks, they are closely interconnected in this organisational constellation" (Mattes, 2015, p. 150-152)(.

[295] Open sourcing of software, as well as hardware, can be seen as a risk to the world order. As one of five factors exacerbating geopolitical risk, "technological innovation exacerbates the risk of conflict. A new arms race is developing in weaponized robotics and artificial intelligence. Cyberspace is now a domain of

(ii) *Innovation Learning with the rise of the Internet of Things*: The Internet of Things (IoT) interweaves the physical world with actuators, sensors and computational element through network connectivity. IoT smart environments, categorized by application domain, include: smart cities; smart homes; smart grid; smart buildings; smart transportation; smart health; and smart industry.[296] While the vision of small ubiquitous connected computers was described in 1993, the IoT was authentically seen as taking root in 2016, with the potential to increase 10-fold to 100-fold over the following 10 years with open peer-production, standards and common practices.[297] With the rapid pace innovation coming from commercial businesses (many funded by venture capital), normative theory from *OSwPS* could provide some guidance for technology organizations.

(iii) *Innovation Learning with the rise of Cognitive Computing*: In late 2015, IBM declared the cognitive business as a new technological era beyond digital business.[298] Computing has been characterized as an evolution from (i) the (mechanical) tabulating era (1900s-1940s), to the (ii) the (digital) programming era (1950s to the present); and (iii) the cognitive era (from 2011, with IBM Watson defeating previous champions on *Jeopardy*). The cognitive era follows from foresight by J.C.R. Licklider in 1960

conflict, and the Arctic and deep oceans are being opened up by remote vehicle access; in each case, there is no established system for policing responsible behaviour. Because research and development of "dual-use" technologies takes place largely in the private sector, they can be weaponized by a wider range of state and non-state actors – for example, the self-proclaimed "Islamic State" has used commercial drones to deliver bombs in Syria, and open-source technology could potentially create devastating biological weapons. Existing counter-proliferation methods and institutions cannot prevent the dissemination of technologies that exist in digital form" (World Economic Forum, 2017, p. 16).

[296]The Internet of Things attracted public attention with the vision of A Smarter Planet where converging digital and physical infrastructures were becoming instrumented, interconnected, and intelligent (Samuel J Palmisano, 2008). "A smart environment is a connected small world where sensor-enabled connected devices work collaboratively to make the lives of humans comfortable. The term smart refers to the ability to autonomously obtain and apply knowledge, and the term environment refers to the surroundings. Therefore, a smart environment is one that is capable of obtaining knowledge and applying it to adapt according to its inhabitants' needs to ameliorate their experience of that environment" (Ahmed et al., 2016, p. 10).

[297]The IoT is seen with both hard and soft parts, a distinction repeated from Usman Haque: "Hard IoT is traditionally understood as a network of electronic gadgets, software, and sensors that are connected so objects can collect and exchange data. In contrast, soft IoT focuses on the value that can be derived from the collection of fluid relationships among people, objects, and spaces". The promise of IoT sees that "its greatest limitation is arguably the lack of open standards, because the IoT's growth will bring many incompatible IoT solutions. Even if standards are used, consumers are hesitant to pay a premium for IoT-enabled devices, particularly if these devices aren't compatible with products and devices they already own" (Cerf and Senges, 2016, p. 81).

[298]In one of many presentations in October 2015, IBM CEO Ginny Rometty expressed ""Digital is the wires, but digital intelligence, or artificial intelligence as some people call it, is about much more than that. This next decade is about how you combine those and become a cognitive business" (Lorenzetti, 2015).

of man-machine symbiosis in cooperative interaction.[299] In the case of the Jeopardy demonstration, the data analytics and statistical reasoning of machines were combined with human qualities of self-directed goals, common sense and ethical values. In December 2015, OpenAI was founded as a non-profit research company by Elon Musk, Sam Altman and Greg Brockman to "create a new type of AI lab, one that would operate outside the control not only of Google, but anyone else".[300] By December 2016, OpenAI and Deepmind Labs (a subsidiary of Google parent Alphabet) both open sourced their deep learning code.[301] The Partnership on AI was founded by Amazon, DeepMind/Google, Facebook, IBM, and Microsoft in September 2016, with Apple joining in January 2017. Organization members will "conduct research, recommend best practices, and publish research under an open license in areas such as ethics, fairness, and inclusivity; transparency, privacy, and interoperability; collaboration between people and AI systems; and the trustworthiness, reliability, and robustness of the technology".[302] Amidst rapidly advancing technologies, cognitive

[299] J.C.R. Licklider saw cognitive computing as an evolution from programmable computing, but didn't know how it would be accomplished (J. E. Kelly, 2015). "Man-computer symbiosis ... will involve very close coupling between the human and the electronic members of the partnership. The main aims are: 1) to let computers facilitate formulative thinking as they now facilitate the solution of formulated problems, and 2) to enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs. In the anticipated symbiotic partnership, men will set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations. Computing machines will do the routinizable work that must be done to prepare the way for insights and decisions in technical and scientific thinking (Licklider, 1960, p. 4).

[300] In establishing a new AI lab focused on deep learning, the first ten scientists would be paid well, but not the astronomical salaries that Google and Facebook offer. "OpenAI is not a charity. Musk's companies could benefit greatly the startup's work, and so could many of the companies backed by Altman's Y Combinator. [...] OpenAI is a research outfit, ... not a consulting firm. [....] The company may not open source everything it produces, though it will aim to share most of its research eventually, either through research papers or Internet services" (Metz, 2016).

[301] "OpenAI released Universe, a software platform that 'lets us train a single [AI] agent on any task a human can complete with a computer'. At the same time, Google parent Alphabet is putting its entire DeepMind Lab training environment codebase on GitHub, helping anyone train their own AI systems" (Dent, 2016). DeepMind defeated the world champion of Go, and is more generally a 3D game-like platform tailored for agent-based AI research. Universe is targeted to allow AI to run a lot of different types of tasks, to develop world knowledge and problem solving strategies that can be reused in a new task.

[302] The Partnership for AI "does not intend to lobby government or other policy-making bodies". The FAQ declares that the organization "will study the potential societal impact of AI systems, and develop and share best practices. We will also create working groups for different sectors, for example healthcare and transportation, allowing us to conduct research on the specific AI applications in these different sectors of the economy. We will also develop educational resources and host open forums to widely disseminate information about the latest topics in the field and support an ongoing public discussion about the technology".

computing will see organizations actively *OSwPS*.

With present challenges such as these – and others where organizations cooperate to advance knowledge collectively, across commercial boundaries – an associated paradigm and theories have emerged.

9.2 Open innovation learning with a paradigm of co-responsive movement sees open sourcing alongside private sourcing

"Innovation learning" is a label that surfaces a normative challenge on the practicality of reaching an aspiration. If an organization is considering a direction of entrepreneurial innovation[303], Schumpeterian innovation[304], disruptive innovation[305], social innovation[306] or any other type of inno-

[303]Being entrepreneurial has been seen less as about personality than about discipline. "Innovation is a specific function of entrepreneurship, whether in an existing business, a public service institution, or a new venture started by a lone individual in the family kitchen. It is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth" (Drucker, 1985, p. 67).

[304]Joseph Schumpeter is often cited as the source for "creative destruction". Scholarly work on innovation sometimes differentiates between early Schumpeter (1934) and older Schumpeter (1942). Early Schumpeter emphasized the disequilibrium effects of innovation – "for practical purposes defined at this stage as the successful introduction of new products and processes" in new combinations of "the introduction of a new product or a new quality of a product, a new method of production, a new market, a new source of supply of raw materials or half-manufactured goods,and finally implementing the new organization of any industry". Later Schumpeter responded to the growing separation between ownership and management, where "the role of entrepreneurial skills is stressed as part of a co-operative entrepreneurship in large companies instead of the 'heroic' creative labour of a single entrepreneur" (Hagedoorn, 1996).

[305]"*Disruptive innovations*, in contrast, don't attempt to bring better products to established customers in existing markets. Rather, they disrupt and redefine that trajectory by introducing products and services that are not as good as currently available products. But disruptive technologies offer other benefits – typically, they are simpler, more convenient, and less expensive products that appeal to new or less-demanding customers" (Christensen and Raynor, 2003, p. 66). While the term "disruptive technology" was originally used 1997 in *The Innovator's Dilemma*, the language was changed to "disruptive innovation" in *The Innovator's Solution,* explained in a footnote. "... many people have equated our use of the term *sustaining innovation* with their preexisting frame of "incremental" innovation, and they have equated the term *disruptive technology* with the words *radical*, *breakthrough*, *out-of-the-box*, or *different*. They then conclude that disruptive ideas (as they define the term) are good and merit investment. We regret that this happens, because our findings relate to a very specific definition of disruptiveness, as stated in our text here. It is for this reason that in this book we have substituted the term *disruptive innovation* for *disruptive technology* – to minimize the chance that readers will twist the concept to fit into what we believe is an incorrect way of categorizing the circumstances".

[306]Social innovation is often contrasted to business innovation. "Social innovation refers to innovative activities and services that are motivated by the goal of meeting a social need and that are predominantly diffused through organizations whose primary purposes are social. Business innovation is generally motivated by profit maximization and diffused through organizations that are primarily

vation, what is the evolutionary path for the behaviour of individuals as members, and the organization as whole? A direction towards innovation requires that a more than a leader merely declaring a strategy in a pattern of communicate-and-hope.[307]

Innovation in organizations requires changes both in practice and process.[308] New knowledge may be best created in single communities of practice, but then formal organizational processes are generally needed to scale up inventions as viable innovations. Process innovation can be directed within an organization through top-down formal specifications of ways that work is coordinated.[309] Innovation on practices typically occurs from bottom-up hands-on work communities, as shared knowledge and common identity coalesce organizational knowledge. Innovation learning has conventionally been focused on changes in behaviour *within* organizations. *OIL* complicates dynamics as changes in behaviour *across* organizations coevolve.

OIL is exemplified in *OSwPS*, in a paradigm drawn at the intersection of (i) ecological anthropology and (ii) material culture studies.

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motivated by profit maximization. There are of course very many borderline cases .... (Mulgan, 2006, p. 146)"

[307]A change in strategic direction is requires a reallocation of resources, beyond communicate-and-hope. "Many decision-makers do not distinguish between the process of decision-making and the context of the decisions they make.... We will use the term *decision* to mean an irrevocable allocation of resources. This is not the typical definition ... Without a concomitant resource commitment, the strategic "decision" to strive for world-class quality becomes a wish or an empty statement of desire. The simple discipline of defining strategic decisions in terms of resource commitments can be profoundly clarifying to both management and subordinates, because it forces identification of specific actions necessary for implementation" (Kusnic and Owen, 1999, p. 227).

[308]A historical perspective sees startup companies having individuals in almost interchangeable roles, then requiring specialization as the organization scales up. "Communities of practice are groups of people whose interdependent practice binds them into a collective of shared knowledge and common identity. Within such tight-knit groups, ideas move with little explicit attention to 'transfer', and practice is coordinated without much formal direction. When people work this way, barriers and boundaries between people and what they do are often insubstantial or irrelevant since a collective endeavor holds them together. [....] But to create growth, you will want to pull this community apart, allowing people to develop particular facets of the community's insights. [....] As soon as this happens, coordination, which is almost implicit within such communities, become a major source of concern between them. [....] While ... division of labor leads to growth, ... specialization leads to specialized knowledge. So each of the communities that develops out of the startup's initial group will begin to develop knowledge along the lines of its own interests" (J. S. Brown and Duguid, 2000, pp. 89-92).

[309]Order-of-magnitude improvements in performance are sought for innovation. "Businesses must be viewed not in terms of functions, divisions, or products, but of key processes. ... [*Process innovation*] combines the adoption of a process view of the business with the application of innovation to key processes. [....] The term process innovation encompasses the envisioning of new work strategies, the actual process design activity, and the implementation of the change in all its complex technological, human and organizational dimensions" (Davenport, 1993, pp. 1-2).

(i) Ecological anthropology studies the organism's exploratory movement through the world.[310] *OIL* can similarly see progress not just as an inwardly focused reflection, but also in ecological approach getting a grip on the larger world.

(ii) Material culture studies focuses on artifacts, that, beyond their physicality, have a history with the human beings with which it has associated.[311] *OIL* not only appreciates individuals and organizations expanding their knowing in mental models and abstract concepts, but also in artifacts of today's physical and digital world.

OSwPS grounds a paradigm of co-responsive movement along lines of becoming, for *OIL*. This dense description can be broken down, with foundations from ecological anthropology and material culture studies.

Movement along lines of becoming is associated with an animic ontology, where "beings do not propel themselves across a ready-made world but rather issue forth through a world-in-formation, along the lines of their relationships".[312] This inverts conventional western thinking in (i) the

[310]Ecological anthropology, as practiced by Tim Ingold, builds on the ecological psychology of J.J. Gibson. "Gibson wanted to know how people come to perceive the environment around them. The majority of psychologists, at least at the time when Gibson was writing, assumed that they did so by constructing representations of the world inside their heads..... The mind, then, was conceived as a kind of data-processing device, akin to a digital computer, and the problem for the psychologist was to figure out how it worked. But Gibson's approach was quite different. It was to throw out the idea, that has been with us since the time of Descartes, of the mind as a distinct organ that is capable of operating upon the bodily data of sense. Perception, Gibson argued, is not the achievement of a mind in a body, but of the organism as a whole in its environment, and is tantamount to the organism's own exploratory movement through the world. If mind is anywhere, then, it is not 'inside the head' rather than 'out there' in the world. To the contrary, it is immanent in the network of sensory pathways that are set up by virtue of the perceiver's immersion in his or her environment. Reading Gibson, I was reminded of the teaching of that notorious maverick of anthropology, Gregory Bateson. The mind, Bateson had always insisted, is not limited by the skin" (Ingold, 2000a, pp. 2-3).

[311]Material culture studies has been criticized as overemphasizing the artifact, and underplaying its association in social life and time. "... in the world of materials, humans figure as much within the context for stones as do stones within the context for humans. And these contexts, far from lying on disparate levels of being, respectively social and natural, are established as overlapping regions of the *same* world. It is not as though this world were one of brute physicality, of mere matter, until people appeared on the scene to give it form and meaning. Stones, too, have histories, forged in ongoing relations with surroundings that may or may not include human beings and much else besides. It is all very well to place stones within the context of human social life and history, but within what context do we place this social life and history if not the ever-unfolding world of materials in which the very being of humans, along with that of the non-humans they encounter, is bound up?' (Ingold, 2011c, p. 31).

[312]An animic ontology is more common among indigenous people than modern western societies. "These peoples are united not in their belief but in a way of being that is alive and open to a world in continuous birth. [....] To its inhabitants this world, embracing both sky and earth, is a source of astonishment but not surprise. There is a difference, here, between being surprised by things, and being astonished by them. Surprise is the currency of experts who trade in plans and

relational constitution of being, and (ii) the primacy of movement.

(i) Instead of representing being at a point in time with an organism inside a circle, and the environment as everything outside, an animic ontology represents a being that is alive as a trail of movement or growth (e.g. a wavy vector over time).[313]

(ii) Instead of occupying the world in a static dwelling, an animic ontology has beings inhabiting the world, "in so doing – in threading their own paths through the meshwork – they contribute to its ever-evolving weave" [....] . And woven into their very texture are the lines of growth and movement of its inhabitants. Every such line, in short, is a way *through* rather than *across"*. [314] Among the Inuit, a person or an animal is recognized as soon as he/she/it moves, becoming a line with a trail behind it. Something that doesn't move is not alive.

This emphasis of movement and lines descends from the ecological ap-

predictions. We are surprised when things do not turn out as predicted, or when their values – as experts are inclined to say – depart from 'what was previously thought'. Only when a result is surprising, or perhaps counterintuitive, are we supposed to take note. What is not surprising is considered of no interest or historical significance. Thus history itself becomes a record of predictive failures. In a world of becoming, however, even the ordinary, the mundane or the intuitive gives cause for astonishment – the kind of astonishment that comes from treasuring every moment, as if, in that moment, we were encountering the world for the first time, sensing its pulse, marvelling at its beauty, and wondering how such a world is possible" (Ingold, 2011f, pp. 63-64).

[313]Process and structure are both basic concepts of systems, and western culture often emphasizes structure as unchanging. "Let us imagine an organism. [... Folding] the organism in on itself such that it is delineated and contained within a perimeter boundary, set off against a surrounding world – an environment – with which it is destined to interact according to its nature. The organism is 'in here', the environment 'out there'. But instead of drawing a circle, I might just as well have drawn a line. In this depiction there is no inside or outside, and no boundary separating the two domains. Rather there is a trail of movement or growth. Every such trail discloses a relation. But the relation is not *between* one thing and another – between the organism 'here' and the environment 'there'. It is rather a trail along which life is lived. Neither beginning here and ending there, nor vice versa, the trail winds through or amidst like the root of a plant or a stream between its banks. Each such trail is but one strand in a tissue of trails that together comprise the texture of the lifeworld. This texture is what I mean when I speak of organisms being constituted within a relational field. It is a field not of interconnected points but of interwoven lines; not a network but a *meshwork*" (Ingold, 2011e, pp. 69-70).

[314]The organism in its environment is not lost in the inversion. [... The] lives of organisms generally extend along not one but multiple trails, issuing from a source. .... Organisms and persons, then, are not so much nodes in a network as knots in a tissue of knots, whose constituent strands, as they become tied up with other strands, in other knots, comprise the meshwork. But what, now, has happened to the environment? Literally, of course, an environment is that which surrounds the organism. But you cannot surround a bundle without drawing a boundary that would enclose it.... What we have been accustomed to calling 'the environment' might, then, be better envisaged as a domain of entanglement. It is within such a tangle of interlaced trails, continually ravelling here and unravelling there, that beings grow or 'issue forth' along the lines of their relationships" (Ingold, 2011e, pp. 70-71).

proach to perception of J.J. Gibson in the concept of affordance, which works more generally for animals, as well as human beings.[315] Interpreting Jakob von Uexküll's subjective universe, human beings are unique as "capable of making their own life activity the object of their attention, and thus of seeing things as they are, as a condition for deliberating about the alternative uses to which they might be".[316] Martin Heidegger was seen to admire von Uexküll in appreciating human beings as unique from other animals, but his world in a space of dwelling sees disclosing (opening up) in ways subtlely different from Gibson's perception of objects.[317] Gilles Deleuze counters Heidegger with an "openness of a life that *will not be contained*", yet living his along "lines of becoming" requires bringing back the environment so that his field is "not of interconnected points but of interwoven lines, not a network but a meshwork".[318] Both anthropologist Gregory Bateson and cognitive scientist Andy Clark see the mind not limited by the body.[319]

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[315]Gibson asserts that "he environment does *not* depend on the organism for its existence". "[Far] from inhering in a relation between a living being and its environment, and pointing both ways, it now seems that the affordance rests unequivocally on the side of the environment and that it points in just one way, towards any potential inhabitant." (Ingold, 2011f, p. 79).

[316]Ingold takes exception with the translation from German of *Umwelt* as "subjective universe", and translates English back to German as *Innenwelt*. "No animal, however, or at least no non-human animal, is in a position to observe the environment from such a standpoint of neutrality. To live, it must already be immersed in its surroundings and committed to the relationships this entails. And in these relationships, the neutrality of objects is inevitably compromised" (Ingold, 2011d, p. 80).

[317]Heidegger sees human beings as different from animals. "The animal in its *Umwelt*, he argued, may be open to its *environment*, but it is closed to the *world*. The human practitioner is unique in inhabiting the world of the open". However, Heidegger's view on objects in the world contrasts to Gibson's. "For Heidegger, to the contrary, the space of dwelling is one that the inhabitant has formed around himself by clearing the clutter that would otherwise threaten to overwhelm his existence. The world is rendered habitable not as it is for Gibson, by its partial *en*closure in the form of a niche, but by its partial *dis*closure in the form of a clearing" (Ingold, 2011d, pp. 81-82).

[318]Deleuze sees every species and every individual as having its own bundle of lines. "Thus in life as in music or painting, in the movement of becoming – the growth of the organism, the unfolding of the melody, the motion of the brush and its trace – points are not joined so much as swept aside and rendered indiscernible by the current as it flows through. .... Life is open-ended: its impulse is not to reach a terminus but to keep on going". To reincorporate the environment, geographer Torsten Hägerstrand "imagined every constituent of the environment – including 'humans, plants, animals and things all at once' – as having a continuous trajectory of becoming" (Ingold, 2011d, p. 83).

[319]The boundary between organization and environment is challenged by perception. "[In] 1970 the anthropologist Gregory Bateson declared ... that the processing loops involved in perception and action are not interior to the creature whose mind we are talking about, whether human or non-human, nor can that creature's activity be understood as the merely mechanical output of one or more cognitive devices located in the head. Rather, such activity has to be understood as one aspect of the unfolding of a total system of relations comprised by the creature's embodied presence in a specific environment. Much more recently, in

Co-responsive movement is a *joining with*, in an ongoing sympathy of living things going along together. Joining with is an "interpenetration of lifelines in the mesh of social life ... in a world where things are continually coming into being through processes of growth and movement" in a generative form when contrary forces of tension and friction are pulled tightly into a knot. This is in contrast with "joining up" as assemblies that can "be a readily *de*composed as composed". "Untying the knot ... is not a disarticulation or decomposition. It does not break things into pieces. It is rather a casting off, whence lines once bound together go their separate ways".[320]

Co-responding "is the process by which beings or things literally answer to one another over time, for example in the exchange of letters or words in conversation, or of gifts, or indeed in holding hands."[321] Members co-responding with each other carry on *alongside* one another over time, answering contrapuntally.[322] A theory of co-responding was foreshadowed in John Dewey's social view of communication, meaning "the attainment of a certain 'like-mindedness', enabling those with different experiences of life, both young and old, to carry on together".[323] This sense of communication is "not about the exchange of information, as communication is often

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his book *Being There*, Andy Clark has made the same point. The mind, Clark tells us, is a 'leaky organ' that refuses to be confined within the skull but mingles shamelessly with the body and the world in the conduct of its operations .... From Bateson to Clark, however, there remains a presumption that whereas the mind leaks, the organism does not. I want to suggest that as a nexus of life and growth within a meshwork of relations, the organism is not limited by the skin. It, too, leaks" (Ingold, 2011d, p. 86).

[320]Joining *up* can more formally be called *interstitial differentiation*. Joining *with* is *exterior articulation*, as in agencement traced to Gilles Deleuze and Felix Guattari, assemblage used by Manuel DeLanda, or compositionism advanced by Bruno Latour (Ingold, 2017, pp. 13-15).

[321]I prefer the more active labels of co-responsive and co-responding, for which Ingold builds a theory of human correspondence. "I propose the term correspondence to connote their affiliation. Social life, then, is not the articulation but the correspondence of its constituents. [....] The sense in which I *do* intend the term differs from this precisely as filiation differs from alliance. It is not transverse, cutting across the duration of social life, but longitudinal, going along with it" (Ingold, 2017, p. 9).

[322]Whereas articulation associates with "*and*", co-responding associates with "*with*". "The distinction between the kinds of work done here with these little words 'and' and 'with' is all-important. The logic of the conjunction is articulatory; that of the preposition differential. The limbs and muscles of the body, the stones and timbers of the cathedral, the voices of choral polyphony or the members of the family: these are not added to but carry on *alongside* one another. Limbs move, stones settle, timbers bind, voices harmonize, and family members get along through the balance of friction and tension in their affects. They are not 'and . . . and ... and' but 'with ... with ... with', not additive but contrapuntal. In answering – or responding – to one another, they co-respond" (Ingold, 2017, p. 14).

[323]Dewey saw life as coproduced with others, socially. "Since no living being can perpetuate itself indefinitely, or in isolation, every particular life is tasked with bringing other lives into being and with sustaining them for however long it takes for the latter, in turn, to engender further life. The continuity of the life process is therefore not individual but social" (Ingold, 2017, p. 14).

understood today; it is rather about forging a concordance".

OIL can be seen as opening up communications, sharing artifacts in common and learning in a larger community.[324] This takes up "an approach that understood how time, movement, and growth were together generative of the forms of living things rather than merely ancillary to their expression".[325]

A paradigm of co-responsive movement along lines of becoming is a foundation for normative theory building on *OIL*. The theories include:

- (i) innovation learning [enskilling attentionality] for;
- (ii) innovation learning [weaving flows in form-giving] by; and
- (iii) innovation learning [agencing strands] alongside.

These three theories aim to advance three primary intellectual virtues: (i) episteme (i.e. science as epistemology), (ii) techne (i.e. craft and technique), and (iii) phronesis (i.e. prudence and common sense).[326] This paradigm complements an ecological perspective on learning "reconceptualised as a process entailing mutually constitutive, epistemic, social and affective relations in which knowledge, identity and agency become collective achievements of whole ecosystems ... [implying] that learning involves a trans-contextual and multimodal process, in which both learners and their social and material environments change".[327]

[324]Ingold's proposal of a theory of human correspondence is cited as concordant with pragmatic philosophy and theory of education. "Dewey was particularly struck by the affinity between the words 'communication', 'community', and 'common'. This, he insisted, is not just an accident of etymology. It rather points to a fundamental condition for the possibility of social life. 'Men live in a community', he wrote, 'in virtue of the things which they have in common; and communication is the way in which they come to possess things in common' (Dewey 1966: 4) (Ingold, 2017, p. 14).

[325]Tim Ingold cites Henri Bergson's *Creative Evolution* (1911) as turning point in his research. "The year was 1983, and I was in the throes of writing a book on the idea of evolution, and on how it had figured in theories of biology, history, and anthropology from the nineteenth century to the present. [....] It turned into a Bergson-inspired critique of the entire legacy of Darwinian historicism in the human sciences" (Ingold, 2014, p. 157).

[326]Colloquially, episteme is "know why", oriented towards research; techne is "know how" oriented towards production with a collective sense of methods; and phronesis is "know when, know where, know whom", with an orientation towards action (Ing, 2013, p. 540).

[327]An ecological approach to education reframes "(a) knowledge co-construction and epistemic agency, (b) the role of (material) knowledge resources in the learning process and (c) the trans-contextuality that characterises learning in today's knowledge society" (Damsa and Jornet, 2016, p. 39). The reconceptualization was based on a case involving groups of computer engineering students enrolled in an undergraduate course in web design and development, working with an external customer.

9.3 Innovation learning [enskilling attentionality] for (episteme)

Innovation learning-for centers on enskilling attentionality. This orientation emphases ecological epistemology.[328]

Attentionality comes habitually, as intentionality comes volitionally: "if going for a walk is volitional, walking itself is habitual".[329] Distraction doesn't pull a pedestrian away from intention along the route, as much as drawing attention towards a manoeuvre to circumvent a potential hazard.[330] Learning, as generating and regenerating knowing[331] both

[328]Ecological epistemology (*EE*) counters constructivism that takes knowledge as a mental construct, regardless of its material base, and idealism that takes knowledge as a representation of reality abstracted and detached from the empirical object. Contemporary theories converging into EE share a common core in "the recognition of the agency of natural processes, objects, and materials. EE encompasses the knowledge emerging from the assumption of symmetry between things and thought, human and nonhuman beings, and historical and natural processes. .... The assumption of symmetry leads to a knowledge no longer 'about' but 'with' the other human and nonhuman beings. From this perspective, EE avoids diluting culture into nature or assimilating nature into culture but seeks to merge the human and natural histories considering all, nonhumans and humans, coresidents, and 'co-citizens' of the same world" (Carvalho, 2016). In the work of Gregory Bateson, EE is also called recursive epistemology. "His writing on this unnamed science was published posthumously. Part of Bateson's thinking about a recursive (ecological) epistemology is published in *Angels Fear* (1987), a book he co-authored with Mary Catherine. Even here much of his argument is implicit. .... [Roger] Donaldson, who is also Gregory Bateson's archivist, recognizes the importance of this unnamed science by devoting a whole section of *A Sacred Unity* to 'ecological epistemology'" (Harries-Jones, 1995, p. 4).

[329]Attention involves continual responsiveness, as the environment intrudes upon intention. "Walking calls for the pedestrian's continual responsiveness to the terrain, the path, and the elements. To respond, he must attend to these things *as he goes along*, joining or participating with them in his own movements. This is what it means to listen, watch, and feel. If attention, in going *for a walk*, interrupts or cuts across movement so as to establish a transverse relation between mind and world (the separation of which is assumed from the outset), in walking it is an animate movement in itself. The key quality that makes a movement attentional lies in its resonance with the movements of the things to which it attends – in its going along with them. Attention, in this sense, is longitudinal" (Ingold, 2017, pp. 19).

[330]The mind extends into the environment, attending beyond the body. "The attentive walker tunes his movement to the terrain as it unfolds around him and beneath his feet, rather than having to stop at intervals to check up on it. Distraction, then, is not the opposite of attention, nor does it set body and mind at cross-purposes. It is rather what happens when attention itself pulls in different directions, leaving the walker in a bind and causing awareness to stall. Our attention can, as we say, be caught or captivated, pulled in one direction or another, or sometimes in several directions at once. [...] Far from taking up a fixed position or standpoint, whence one can check up on what is there, attention continually pulls the walker out of it" (Ingold, 2017, p. 19).

[331]In contrast to a more classical approaches in cognitive science, an anthropological approach builds on phenomenological, ecological and practice-theoretical perspectives on perception and cognition. Criticizing the foundations of cognitive science, "... there must be something wrong with the founding assumptions. These assumptions are, specifically, that knowledge is information, and that human beings are devices for processing it. I shall argue, to the contrary, that our

in individuals and in groups, should not be seen as a *transmission of representations*, but instead as the *educating of attention*. Passing along knowledge from one generation to another is more than writing a recipe into a cookbook to be copied as images into a mind. Novices are guided by tutors not to imitate, but to discover for themselves and improvise, towards becoming skilled practitioners in situated and attentive engagement.[332] While an novice can get thrown off by a minor unanticipated variation, the experienced craftsman couples perception and action that attunes movement to the task at hand at that moment.[333]

Enskilling is an embodying of capacities of awareness and response by environmentally situated agents[334]. In a world of work practices, a task[335] is an any practical operation carried out by a skilled agent in

knowledge consists, in the first place, of skill, and that every human being is a centre of awareness and agency in a field of practice. [....] My critique, therefore, is directed against cognitivism in its 'classical' guise, rather than against its 'emergentist' alternative .... [The[classical perspective remains the dominant one in cognitive psychology; moreover its continued dominance is reinforced by a powerful alliance with evolutionary biology in its modern, neo-Darwinian formulation. Thus to take issue with classical cognitive science is inevitably to call into question some of the founding precepts of neo-Darwinism" (Ingold, 2001, pp. 113-114).

[332]The role of an educator is not to just transmit representations. "The process of learning by guided rediscovery is mostly aptly conveyed by the notion of showing. To show something to someone is to cause it to be made present for person, so that he or she can can apprehend it directly, whether by looking, listening or feeling. Here, the role of the tutor is to set up situations in which the novice is afforded the possibility of such unmediated experience. Placed within a situation of this kind, the novice is instructed to attend particularly to this or that aspect of what can be seen,touched or heard, so as to get the 'feel' of it for him- or herself. Learning, in this sense, is tantamount to an 'education of attention'. I take this phrase from James Gibson .... Gibson's point was that we learn to perceive not by taking on board mental representations or schemata for organising the raw data of bodily sensation, but by a fine-tuning or sensitisation of the entire perceptual system, comprising the brain and peripheral receptor organs along with their neural and muscular linkages, to particular features of the environment" (Ingold, 2001, pp. 141-142).

[333]The repetitive action of a carpenter sawing and a blacksmith hammering shows the craftsman adjusting: "For the novice every stroke is the same, so that the slightest irregularity throws him irretrievably off course. For the accomplished blacksmith or carpenter, by contrast, every stroke is different. The fine-tuning or 'sensory correction' of the craftsman's movement depends, however, on an intimate coupling of perception and action. Thus in sawing, the visual monitoring of the evolving cut, through eyes positioned above to see the wood on either side, continually corrects the alignment of the blade through subtle adjustments of the index finger along the handle of the saw .... Likewise the right hand responds in its oscillations to the sound and fee of the saw as it bites into the grain. This multisensory coupling establishes the dexterity and control that are the hallmarks of skilled practice" (Ingold, 2011h, pp. 58-59).

[334]Coming from a larger way of thinking in anthropology, enskilment extends the research in (communities of) practice. This view can "help us to overcome both an overly rigid division between the works of human beings and those non-human animals and, in the human case, the opposition between the fields of 'art' and 'technology'" (Ingold, 2000b, pp. 5-6).

[335]Tasks have temporality. The productive activity of making useful things

an environment. A taskscape[336] relates tasks to each other, in series and in parallel with other human beings inhabiting technical and social activities. Individually, the lines of our lives[337] assemble our movements, each of us (i) wayfaring on personal trails, (ii) mapping journeys that we can re-enact, and (iii) relating storylines as paths of lived experience. In shared environments, our lines of lives, growths and movements entangle in meshworks[338] of interaction.

Deskilling, through new affordances in technology that mechanize and automate tasks, is a common response by employers challenged to find workers qualified and experienced with a craft. Industrialization routinizes work activities to reduce the variability in outputs, with a consequence of inhibiting enskilment as opportunities to progress learning are reduced.[339] Standardization displaces learning through situated prac-

involves labour. "Like land and value, labour is quantitative and homogeneous, human work shorn of its particularities. [....] How, then, should we describe the practices of work in their concrete particulars? For this purpose I shall adopt the term 'task', defined as any practical operation, carried out by a skilled agent in an environment, as part of his or her normal business of life. In other words, tasks are the constitutive acts of dwelling" (Ingold, 2000f, pp. 194-195).

[336]A taskscape can be compared to a landscape not as a place, but dwelling in the world with motion. "In the landscape, the distance between two places, A and B, is experienced as a journey made, a bodily movement from one place to the other, and the gradually changing vistas along the route" (Ingold, 2000f, p. 191). "Every task takes its meaning from its position within an ensemble of tasks, performed in series or in parallel, and usually by many people working together. [....]. It is to the entire ensemble of tasks, in their mutual interlocking, that I refer by the concept of taskscape. Just as the landscape is an array of related features, so – by analogy – the taskscape is an array of related activities. And as with the landscape, it is qualitative and heterogeneous: we can ask of a taskscape, as of a landscape, what it is like, but not how much of it there is. In short, the taskscape is to labour what the landscape is to land, and indeed what an ensemble of use-values is to value in general" (Ingold, 2000f, p. 195).

[337]The modern world changed our thinking about our lives as points with connections joined up, rather than lines of inhabiting environments. "One the trace of a continuous gesture, the line has been fragmented – under the sway of modernity – into a succession of points or dots. This fragmentation ... has taken place in the related fields of *travel*, where wayfaring is replaced by destination-oriented transport, *mapping*, where the drawn sketch is replaced by the route-plan, and *textuality*, where storytelling is replaced by the pre-composed plot. It has also transformed our understanding of *place*: once a knot tied from multiple and interlaced strands of movement and growth, it now figures as a node in a static network of connectors" (Ingold, 2007b, p. 75).

[338]The term *meshwork* was originally borrowed from Henri Lefebvre (Ingold, 2007, p. 80). It makes adjustments to the ecological approach to perception of J.J. Gibson, biosemiotics from Jakob von Uxekull, being-in-the-world of Martin Heidegger via Hubert Dreyfus, the haeccity of Gilles Deleuze, and embodied presence in environment of Gregory Bateson (Ingold, 2011d, pp. 77-86).

[339]The decline of quality in the British craft of horticulture is associated with few opportunities for learning mastery, and the industrialization of gardening using contractors. "... technical knowledge (e.g. of a Taylorist kind) transforms nature so that it corresponds more closely to the underlying principles of said knowledge. [....] What is perhaps more unsettling is that these gardeners lose touch with nature. They know less and less about plants, soil, weather, and climate, as they increasingly rely on standardized rules of thumb which are not born out of their

tice that progresses novices into mastery, and the ability to deal with the ambiguous is reduced. Hands-on experience, where novices peripherally participate in communities of practice that include experts, can raise the level of skills for all.

Learning "denotes *change* of some kind. To say what kind of change in a delicate matter".[340] The simplest type of learning has been called *Learning Zero*, where "an entity shows minimal change in its response to a repeated item of sensory input".[341] In this sense, there is a category of *innovation learning zero*, where discovery of an error contributes nothing to future skill.[342] Logical categories of learning [for] are depicted in Figure 9.2.

A response that leads to an error can provide information to an organism to change a response when a similar event occurs in the future. Learning Zero would continue to repeat the same error. *Proto-learning* (Learning I), *deutero-learning* (Learning II) and *trito-learning* (Learning III), as described in detail in the sections that follow, correct for errors in different ways. For normative theory in anticipation of frame-breaking world changes (e.g. polycentric governance, the Internet of Things, cognitive computing), the Learning Zero path of not responding to changes in context reduces the likelihood of viability.

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own experience but are acquired as bits of information out of context" Gieser, 2014, p. 147.

[340]Learning, amongst behavioral scientists, was clarified with an application of Russell's Theory of Logical Types. "Change denotes process. But processes are themselves subject to 'change'. The process may accelerate, it may slow down, or it may undergo other types of change such that we shall say that it is now a 'different' process" (Bateson, 1972c, p. 283).

[341]Zero learning is compared to "zero motion" in Newtonian physics. "Phenomena which approach this degree of simplicity occur in various contexts: (a) In experimental settings, when 'learning' is complete and the animal gives approximately 100 per cent correct responses to the repeated stimulus. (b) In cases of habituation, where the animal has ceased to give overt response to what was formerly a disturbing stimulus. (c) In cases where the pattern of the response is minimally determined by experience and maximally determined by genetic factors. (d) In cases where the response is now highly stereo-typed. (e) In simple electronic circuits, where the circuit structure is not itself subject to change resulting from the passage of impulses within the circuit — i.e., where the causal links between 'stimulus' and 'response' are as the engineers say 'soldered in'" (Bateson, 1972c, pp. 283-284).

[342]For innovation learning zero, a player changes its behavior within the present game, but errors aren't resolved in future games. "[He] may base a decision upon probabilistic considerations and then make that move which, in the light of the limited available information, was most probably right. When more information becomes available, he may discover that that move was wrong. [....] By definition, the player used correctly all the available information. He estimated the probabilities correctly and made the move which was most probably correct. The discovery that he was wrong in the particular instance can have no bearing upon future instances. When the same problem returns at a later time, he will correctly go through the same computations and reach the same decision" (Bateson, 1972c, pp. 286-287).

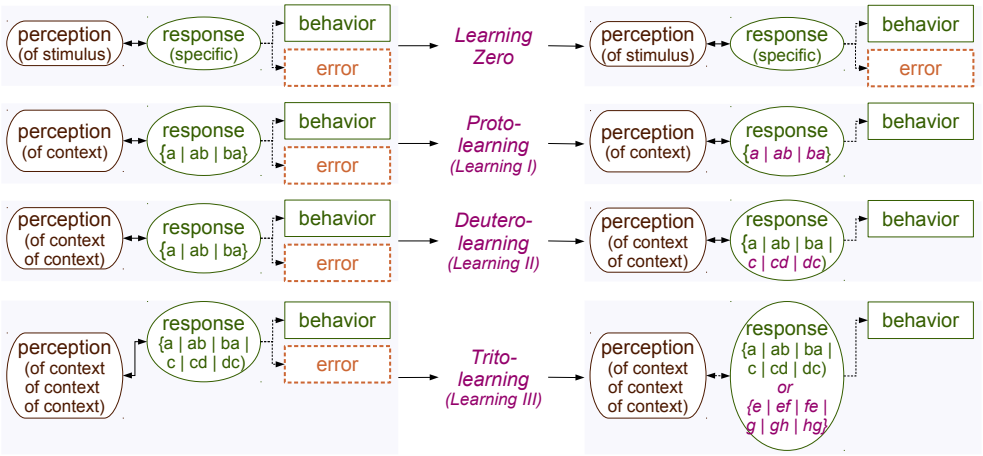

Figure 9.2. Logical categories of learning [for])

9.3.1 Proto-learning is enskilling attentionality for selecting an alternative in context

Proto-learning focuses perception on repeatable context markers, that cumulatively builds on experience.[343] With Learning I, choices are revised within an unchanging set of alternative, as shown in Figure 9.3.



Figure 9.3. Proto-learning (Learning I [for]

If a context is misperceived, selection from pre-established responses may result in an error, rather than an appropriate behaviour. A decision may be made initially based upon probabilistic considerations, and later found to be "wrong". When the same problem returns at a later time, a correct selection from the fixed set of alternatives can be made.

Innovation proto-learning is well suited to routinizing and automating: a recurring context is perceived, and an appropriate response is consistent. The context and set of responses are static and tightly coupled. Institutions that operate as machine bureaucracies, e.g. regulatory and justice systems, evolve slowly in ensuring coherence between perceptions and outcomes.

Open innovation learning that continually sweeps in new contexts and ways of responding chafes with proto-learning. Systems optimizing for proto-learning segment and stratify their incoming contexts, e.g. an inpa-

[343] Organisms change behavior as a result of learning about repeatable contexts. This follows from an "implicit hypothesis that for the organisms which we study, the sequence of life experience, action, etc., is somehow segmented or punctuated into subsequences or 'contexts' which may be equated or differentiated by the organism. [....] In Learning I, every item of perception or behavior may be stimulus or response or *reinforcement* according to how the total sequence of interaction is punctuated" (Bateson, 1972c, p. 292).

tient clinic referring a case to the emergency room, or door-to-door mail delivery streaming large packages to be transported with a truck.

9.3.2 Deutero-learning is enskilling attentionality for changing the set or sequence of alternatives in contextual change

Deutero-learning focuses on first order changes of context, i.e. the perception of the context of the context. For Learning II, the *set* of alternatives from which a choice can be made is revised, as shown in Figure 9.4.

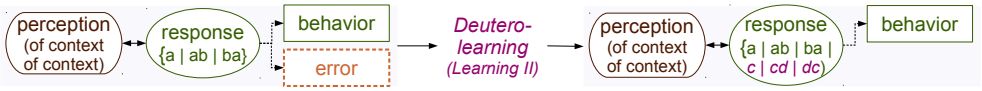

Figure 9.4. Deutero-learning (Learning II [for]

"The external event system contains details which might tell" the decision-maker that the set of alternatives from which to choose is insufficient and will lead to an error.[344] With Learning II, the capability of learning to learn can be measured by the speed at which the decision maker adapts to the new contingency pattern. Learning II describes "changes in the manner in which the stream of action and experience are is segmented or punctuated into contexts together with the changes in use of the context markers".[345]

Deutero-learning has been described as including both single-loop learning and double-loop learning, when applied to individuals within an organization and the organization as a whole.[346] Based on cybernetic feedback,

[344]When the external event system contains details that tell an organism: "(a) from what set of alternatives he should choose his next move; and (b) which member of that set he should choose", the various species of profitable error can be categorized with two orders of error: "The organism may use correctly the information which tells him from what set of alternatives he should choose, but choose the wrong alternative within this set; or ... He ma choose from the wrong set of alternatives. (There is also an interesting class of cases in which the sets of alternatives contain common members. It is then possible for the organism to be "right" but for the wrong reasons. This form of error is inevitably self-reinforcing.)" (Bateson, 1972c, p. 286).

[345]Some care is required in describing the meaning of "learning to learn". "Learning II is adaptive only if the animal happens to be right in its expectation of a given contingency pattern, and in such cases we shall expect to see a measurable learning to learn. It should require fewer trials in the new context to establish 'correct' behavior'. If on the other hand, the animal is wrong in his identification of the later contingency pattern, then we shall expect a delay of Learning I in the new context" (Bateson, 1972c).

[346]In a theory of action perspective, deutero-learning is mixed with organizational learning curves. An example of aircraft manufacturers projecting "the rate at which their organizations will learn to manufacture a new aircraft and base cost estimates on their projections on the rate or organizational learning". In such examples, "however, deutero-learning concentrates on single loop learning; emphasis is on learning for effectiveness rather than on learning to resolve conflicting norms for performance. But the concept of deutero-learning is also relevant to double-loop learning. How, indeed, can organizations learn to become

the first order loop takes ordinary sensory input (e.g. eye, ear, joints) on changes in state, while the second order loop carries information about whether essential variables are or are not driven outside of normal limits (e.g. pain receptors) of changes in field.[347] Memories are built, as the system develops.[348]

A theory of action perspective is not synonymous with deutero-learning. With single-loop learning, "members of the organization respond to changes in the internal and external environments of the organization by detecting errors which they then correct so as to maintain the central features of organizational theory-in-use".[349] The name "double-loop learning" is given "to those sorts of organizational inquiry which resolve incompatible organizational norms by setting new priorities and weightings of norms, or by restructuring the norms themselves together with associated strategies and assumptions".[350]

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better at double-loop learning? How can members of an organization learn to carry out the kinds of inquiry essential to double-loop learning? What are the conditions which enable members to meet the tests of organizational learning? And how can they learn to produce those conditions?" (Argyris and Schön, 1978, pp. 27-28).

[347]Learning loops should be better attributed to Ross Ashby than to Gregory Bateson. In citing Naven (1958), "Bateson borrows a term from W.R. Ashby's *Design for a Brain*" (Argyris and Schön, 1978, p. 337)(.

[348]The appreciation of cybernetics from Ross Ashby derives more clearly in the writing of Gregory Bateson than in that from Argyris & Schon. Drawings derived from Ashby's original help differentiate the environment as changed continuously or discontinuously. "A change in the parameter causes a change in the behaviour (observed) field. This change-in-state-to-change-in-field is a 'step function' – it causes a potentially discontinuous response to the environment – and is of paramount importance .... Each step function must be an independent 'memory' to be available as accumulated learning when past conditions re-occur. The step functions also must be distinguished by a gating mechanism such that the system chooses an appropriate step-function from which to obtain the equilibrium-returning behaviours. Otherwise, the system would not know which 'memory in action' to choose upon repeat of environmental conditions, and would in essence 'forget' what it had learned by way of previous actuation of the second-order loop" (Geoghegan and Pangaro, 2009, p. 158).

[349]A theory of action perspective emphasizes the relationship between individual learning and organization learning. "... in order for organizational learning to occur, learning agents' discoveries, inventions and evaluations must be embedded in organizational memory. They must be encoded in the individual images and the share maps of organizational theory-in-use from which individuals members will subsequently act. If this encoding does not occur, individuals will have learned bu the organization will not have done so" (Argyris and Schön, 1978, p. 19).

[350]Single loop learning and double loop learning are not seen as distinct, in the way that proto-learning and deutero-learning are. "First, it is often impossible, in the real-world context of organizational life, to find inquiry cleanly separated from the uses of power. Inquiry and power-play are often combined. [....] Second, while we have described he kinds of inquiry which are essential to single- and double-loop learning, we have not yet dwelt on the quality of inquiry. [....] Finally, we must point out that the distinction between single- and double-loop learning is less a binary one than might first appear. Organizational theories in use are systemic structures composed of many interconnected parts" (Argyris and Schön,

From the mid-1960s into the 1970s, deutero-learning associated with a theory of action perspective framed the primary concern on organizational effectiveness as "is the organization able to manage change?".[351] In the 21st century, aspects of the Argyris and Schon single- and double-loop learning framework have been criticized as "they neglect the aspects of adaptive behavior, context, and relationship that were central to Bateson's original formulation" for deutero-learning.[352] To reset deutero-learning back to its ecological roots, aspects of organizational learning are proposed for relabelling as *meta-learning* and *planned learning* in order to escape from terminological ambiguities.[353] The philosophical stance of knowledge distinct from action by Argyris and Schon contrasts to the ecological epistemology by Bateson. Batesonian deutero-learning "aims not so much to provide us with facts *about* the world as to enable us to be taught *by* it".[354]

Innovation deutero-learning introduces new responses as capabilities when a change in context is perceived. In comparison to proto-learning where "sticking with the script" is the standard operating procedure, deutero-learning should reward instances of innovating to correct errors of omission. Decision-makers are put into a *double-bind* between be-

1978, pp. 24-25).

[351]The pursuit of organizational effectiveness is based on intentionality, both at the individual and organizational levels. "If what is learned is a new pattern of behavior, then what is the new knowledge associated with that behavior? [....] We distinguish theory-in-use from *espoused theory*, which is the individual's explicit version of his theory of action, advanced for public or personal consumption. Theory-in-use and espoused theory need not be, and often are not, congruent. I would like to advance here the concept of learning as experience-based change in theory-in-use. Although any experience-based change in theory-in-use may be called learning, some kinds of changes in theory-in-use are more important than others" (Schon, 1975, p. 6-7).

[352]In the 21st century reformulation, deutero-learning true to the Batesonian heritage has three characteristics: "First, it is continuous, behavioral-communicative, and largely unconscious. [....] Second, deutero-learning tends to escape explicit steering and organizing. [....] Third, deutero-learning does not necessarily lead to organizational or individual improvement" (Visser, 2007, pp. 660-661).

[353]Argyris and Schon emphasize conflicts in the relationship between knowledge and action. "Learning starts when actual consequences of an action strategy do not correspond with expected consequences. This discrepancy between expectation and result is considered an error and leads to a problematic situation. Learning (single or double loop) involves the detection and correction of error. *Meta-learning* implies that persons reflect on and inquire into the process in which single-loop and double-loop learning take place". "*Planned learning* ... refers to the creation and maintenance of organizational systems, routines, procedures, and structures through which organizational members are induced to meta-learn on a regular basis and in which the results of meta-learning are embedded for future use" (Visser, 2007, pp. 663-664).

[354]Anthropologists are encouraged to get out from behind their books, and attend to discovery. "The world itself becomes a place of study, a university that includes not just professional teachers and registered students, dragooned into their academic departments, but people everywhere, along with all the other creatures with which (or whom) we share our lives and the lands in which we – and they – live" (Ingold, 2013a, p. 2).

havior proven successful in a prior context, and breaking "that pattern to deal with the class of such episodes".[355] Customer-centered service should allow clients to not only select from the posted menu of popular choices available, but also to embrace variants within the capabilities of the organization.

Open innovation learning is entailed by deutero-learning as necessary, but not sufficient. A private sourcing organization shows the condition of necessity in exhibiting deutero-learning: it sees itself not satisfying the changing context of its stakeholders, and then adds a new response to its repertoire. The organization is able to perceive and operate within the contexts that have accumulated in its experience, but would be challenged to cocreate a distinctly different context for itself. Self-awareness of these limits might lead a successful organization to segment contexts for defined units that could spin off resources to pursue incompatible opportunities.

9.3.3 Trito-learning is enskilling attentionality for changing systems of alternatives in meta-contextual change

Trito-learning focuses on second order changes of context, i.e. the perception of the context of the context of the context. For Learning III, the system of *sets* of alternatives from which a choice can be made is revised, as shown in Figure 9.5.

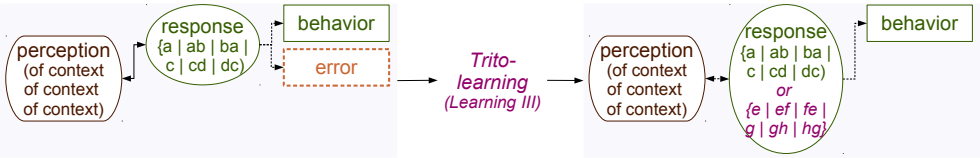

Figure 9.5. Trito-learning (Learning III [for]

"Learning III is likely to be difficult and rare in human beings".[356] Learning II occurs upon the improvements occurring with successive reversal of facts from prior Learning I (i.e. a double-bind).[357] Learning III throws "un-

[355]Research based on training porpoises were at the genesis of understanding transcontextual syndromes. "First, that severe pain and maladjustment can be induced by putting a mammal in the wrong regarding its rules for making sense of an important relationship with another mammal. And second, that if this pathology can be warded off or resisted, the total experience may promote *creativity*" (Bateson, 1972c, p. 278).

[356]Demanding Level III performance in men and mammals is potentially pathogenic. "[It] is claimed that something of the sort does from time to time occur in psychotherapy, religious conversion, and in other sequences in which there is profound reorganization of character" (Bateson, 1972c, p. 301).

[357]True Learning II doesn't' occur with a single reversal of a premise. "It is possible to learn (Learning I) a given premise at a given time and to learn the converse premise at a later time without acquiring the knack of reversal learning. In such a case, there will be no improvement from one reversal to the next. One item of Learning I has simply re-placed another item of Learning I without any achievement of Learning II. If, on the other hand, improvement occurs with

examined premises open to question and change" by resolving contraries generated at level II.[358] Trito-learning may therefore either collapse much of that which had previously been learned, or lead to schizophrenia or psychosis.

In comparison with other conceptualizations of learning, four distinct features are highlighted in trito-learning: (i) skepticism about the instrumental pursuit of Learning III; (ii) emphasis of Learning III as beyond language; (iii) the recursive organization of the levels of learning (as depicted in a hierarchy redrawn at Figure 9.6) (Tosey, Visser, and Saunders, 2012, p. 300), and (iv) the prevalence of risk in Learning III.

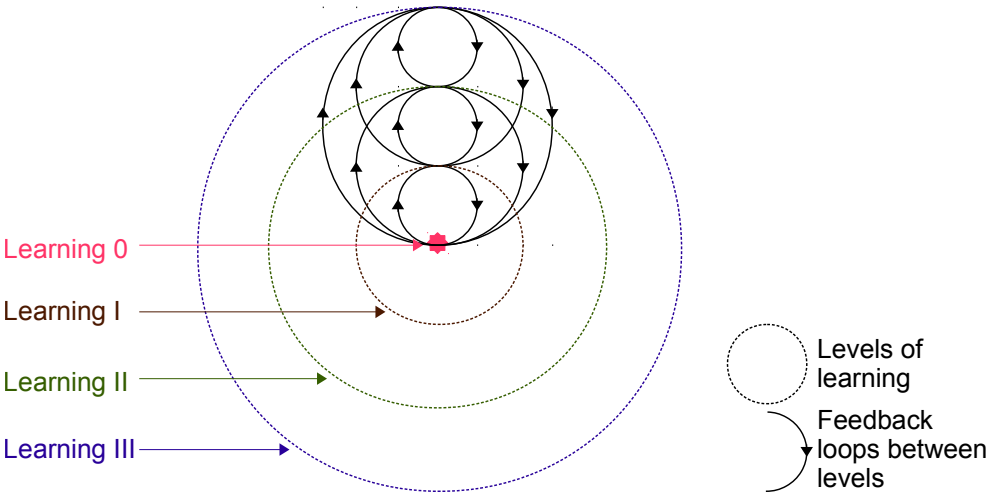

Figure 9.6. Bateson's levels arranged as a recursive hierarchy [Tosey, Vissers and Saunders (2012)]

With recursive feedback loops between Learning I, Learning II and Learning III, the higher order levels are not necessarily more desirable than lower orders.[359] Transformational learning introduces risks that could lead to breakdowns and unintended consequences.

Innovation trito-learning introduces new systems of sets of alternatives responses. A system of changing context X (i.e. ΔX) with the response set {x1, x2, x3} could have new alternatives added, while a contemporaneous system of changing context Y (i.e. ΔY) with response set {y1, y2, y3} adding

successive reversals, this is evidence for Learning II"(Bateson, 1972c, p. 302).

[358]Learning III could lead to either an increase or a decrease in Learning II. "To the degree that a man achieves Learning III, and learns to perceive and act in terms of the contexts of contexts, his 'self' will take on a sort of irrelevance. The concept of 'self' will no longer function as a nodal argument in the punctuation of experience" (Bateson, 1972c, p. 304).

[359]While the learning levels are described as hierarchical, the Western world assumption that more is better is challenged. "Attempts by managers to control and directly effect Learning III may, in an analogous way, result in unintended consequences ... and profound 'organizational unlearning' .... Significantly, calls for transformation led by an enthusiasm for the value of higher levels of learning may underestimate the impact on an organization's ecology" (Tosey, Visser, and Saunders, 2012, p. 300).

alternatives, as well. Private sourcing can be seen as a system of context with a set of responses, while open sourcing is another system of a set of responses. Perceiving (i) private sourcing and (ii) open sourcing not as coupled but both independently changing can be handled as parallel deutero-learning, rather than trito-learning.

Open innovation learning is entailed by trito-learning as sufficient, but not necessary. Since the Batesonian model of learning is hierarchical (or recursive), attaining trito-learning requires the lower level of deutero-learning. Open sourcing while private sourcing requires, by definition, taking successive risks of trito-learning as a series of positive double-binds.[360] Innovation learning could be ascribed to one-way flows (e.g. commercial ventures that privately extend research from public universities); open innovation learning more fully engages in two-way flows where an organization not only responds to changing contexts, but works towards changing those contexts (e.g. participating in advancing open standards while developing private sourcing implementations).

9.3.4 Hypothesizing for a theory of *open innovation learning-for*

A hypothesis for a normative theory for *OIL* within a paradigm of co-responsive movement can be constructed from the three learnings-for:

- Hypothesis: *Open innovation learning-for* layers enskilling attentionality for (iii) changing systems of alternatives in meta-contextual change (trito-learning), over (ii) changing the set or sequence of alternatives in contextual change (deutero-learning), and (i) selecting an alternative response in context (proto-learning).

Testing this normative theory for *OIL* could take place in the three emerging cases outlined earlier. The rise of (i) polycentric governance, (ii) the Internet of Things, and (iii) cognitive computing, each provide salient contexts to which enskilling attentionality on proto-learning, deutero-learning and trito-learning are combined and weighed against each other.

[360] A positive double-bind might offer enlightenment (as cybernetics led to Zen Buddhism), at the risk of a negative-double bind that results in schizophrenia. "Most likely under the influence of Watts, Bateson and his team discussed Zen Buddhism at length in their 'Toward a Theory of Schizophrenia'. While the schizophrenic experience offered a negative double bind, Zen offered a positive double-bind that led in the opposite direction, one that pointed towards Enlightenment. [...] Bateson and his team at Palo Alto had observed that the positive double-bind to be found in the Zen experience was made possible by role of the master, himself an embodiment not of authority but of the experience of passing through itself – yet this was not unique to Eastern philosophies. The bulk of mystical traditions around the globe offered variations of the shaman, a spiritual guide who has undergone the tribulations of 'madness' in order to be able to assist others on their journey. Looking at this esoteric currents, Laing felt that the psychiatry should be approached in the same way – what better guide for the schizophrenic than another who had already passed through the experience?" (E. B. Berger, 2015).

9.4 Innovation learning [weaving flows in form-giving] by (techne)

Innovation learning-by centers on weaving in processes of formation as the flows and transformation of materials in form-giving. Techne is 'know how' – particularly in a collective sense of methods oriented towards productions.[361]

Flows in form-giving gives primacy to making in a social-material-temporal taskscape.[362] This overthrows Aristotle's emphasis on the end product in the creation of form. "Form is the end, death", wrote painter Paul Klee. "Form-giving is life".[363]

Weaving values a *textility in making*, where "the tactile and sensuous knowledge of line and surface that had guided practitioners through their varied and heterogeneous materials, like wayfarers through the terrain".[364] Skilled practice is "a question not of imposing preconceived forms on inert matter but of intervening in the fields of force and currents of material wherein forms are generated".[365] The architectonics of

[361]Techne, as "know-how", is one of three intellectual virtues in philosophy. Episteme is "know why", oriented towards research; phronesis is "know when, know where, know whom", with an orientation towards action (Ing, 2013, p. 540).

[362]A task is "any practical operation, carried out by a skilled agent in an environment, as part of his or her normal business of life. [...] It is to the entire ensemble of tasks, in their mutual interlocking, that I refer by the concept of taskscape. Just as the landscape is an array of related features, so – by analogy – the taskscape is an array of related activities. And as with the landscape, it is qualitative and heterogeneous: we can ask of a taskscape, as of a landscape, what it is like, but not how much of it there is. In short, the taskscape is to labour what the landscape is to land, and indeed what an ensemble of use-values is to value in general" (Ingold, 2000f, p. 195).

[363]Paul Klee insisted that "the processes of genesis and growth that give rise to forms in the world we inhabit are more important than the forms themselves. .... 'Art does not reproduce the visible but makes visible".... It does not, in other words, seek to replicate finished forms that are already settled, whether as images in the mind or as objects in the world. It seeks, rather, to join with those very forces that bring form into being" (Ingold, 2011g, p. 210).

[364]The shift from textility of making to architecture in a hylomorphic model occurred in the mid-fifteenth century. "Until then, as ...in the case of the great medieval cathedral of Chartres, the architect was literally a master among builders, who worked on site, coordinating teams of masons whose task was to cut stones by following the curves of wooden templates and to lay the blocks along lines marked out with string. There was no plan, and the outcome – far from conforming to the dictates of a prior design – better resembled a patchwork quilt .... [Thereafter], architecture was a concern of the mind. [....] 'It is quite possible to project whole forms in the mind without any recourse to the material, by designating and determining a fixed orientation and conjunction for the various lines and angles'" (Ingold, 2011g, p. 211).

[365]The ancient Greek word describing the skill of the practitioner, *tekhne*, is related from Sanskrit words for carpenter, *taksan*. The Latin word for 'to weave', *texere*, comes from the same root. This argument follows Gilles Deleuze and Felix Guattari who "argue that the essential relation, in a world of life, is not between matter and form but between materials and forces". The more dominant hylomorphic reasoning bringing "together form (*morphe*) and matter (*hyle*) comes from Aristotle (Ingold, 2011g, pp. 210-211).

pure form elevates technology into "a system of operational principles". The form of a woven basket "assumes a rigid form, precisely because of its tensile structure".[366] The textility of building encounters "matter in movement, in flux, in variation", leading to a rule of thumb: *follow the materials*.[367] Building is "a process of working with materials and not just *doing* to them, and of bringing form into being rather than merely translating from the virtual to the actual". As building is to dwelling, so making is to weaving".[368]

Learning-by connects learning and practice in the literature of communities of practice, including the development of skills without formal learning or school through participatory work and apprenticeship. Distinctions can then be made between:

- (i) learning-by-doing;
- (ii) learning-by-making; and
- (iii) learning-by-trying.

This perspective follows an *anthropological paradigm of practice-based learning*, with situated learning and distributed cognition.[369]

9.4.1 Learning-by-doing is weaving flows in form-giving in experiencing

Learning-by-doing has largely studied from two perspectives: organizational (sometimes extended to industry or nation), and personal (drawn from social psychology traditionally, and from anthropology more recently).

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[366] Woven baskets "involves the bending and interweaving of fibres that may exert a considerable resistance of their own". From architecture, "the coherence of the basket is based upon the principle of tensegrity, according to which a system can stabilise itself mechanically by distributing and balancing counteracting forces of compression and tension throughout the structure. Significantly, tensegrity structures are common to both artefacts and living organisms, and are encountered in the latter at every level from the cytoskeletal architecture of the cell to the bones, muscles, tendons and ligaments of the whole body ..." (Ingold, 2000d, p. 432-433).

[367] architects, builders and repairmen, in elevating "the people who live in them who, through unremitting effort, shore them up and maintain their integrity in the face of sunshine, wind and rain, the wear and tear inflicted by human occupancy, and the invasions of birds, rodents, insects, arachnids and fungi" (Ingold, 2011g, p. 212).

[368] *Building* and *making* "see the processes of production consumed by their final products, whose origination is attributed not to the improvisatory creativity of labour that works things out as it goes along, but to the novelty of determinate ends conceived in advance". *Dwelling* and *weaving* "prioritise process over product, and to define the activity by the attentiveness of environmental engagement rather than the transitivity of means and ends" (Ingold, 2011b, p. 10).

[369] A central figure in situated learning is Jean Lave, who brought legitimate peripheral participation into the *Institute for Research into Learning* to coevolve with Etienne Wenger into communities of practice. Distributed cognition was described by Ed Hutchins as cognition in the wild with practical activities (e.g. navigating ships) in everyday life outside of laboratories (Hasse, 2014).

Organizational learning-by-doing has been researched in studies on the "improvement curve", including "learning curves", "progress curves" and "experience curves". The seed for this idea originates from an 1936 empirical report on labor production costs associated with producing the same model of aircraft in varying quantities. The factors from the original drawings are simplified in Figure 9.7.

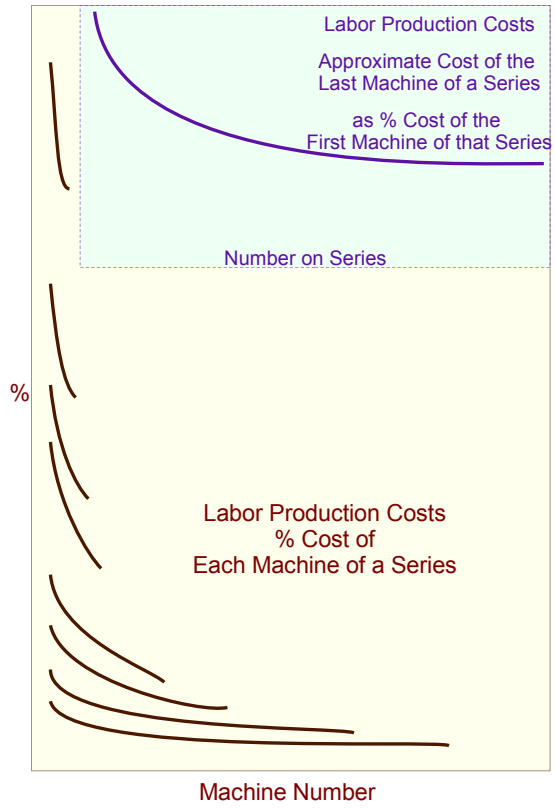

Figure 9.7. Labor cost percentages [Wright (1936)]

The declining number of labor-hours became central to cost planning in the U.S. Air Force during and after World War II.[370] The label "learning-by-doing" was described by Kenneth Arrow in 1962, in dealing with the difficulty of measuring the quantity of knowledge, as it was obviously growing over time. This research attempted to formalize "an endogenous theory of the changes in knowledge which underlie intertemporal and international shifts in production functions".[371] Arrow established two points: (i) "Learning is the product of experience"; and (ii) "Learning can only take place through the attempt to solve a problem and therefore only takes place during activity". This ascribed technical change to the experience gained in the action of production.

Systematic studies of factors contributing to performance improvement associated with production experience are scarce. The major sources of improved efficiency have been proposed as (i) changed contexts of productions; (ii) embodied technical change; and (iii) improved organization and proficiency.[372]

[370]The study of variation of costs with quantity of aircraft production started in 1922. "A curve depicting such variation was worked up empirically from the two or three points which previous production experience of the same model in differing quantities made possible" (Wright, 1936, p. 122).

[371]With an economic orientation, learning-by-doing was examined with implications on (i) wage earners; (ii) profits, the inducement to invest, and the rate of interest; (iii) behaviour under steady growth; and (iv) the divergence between social and private returns Arrow, 1962, pp. 156-157.

[372]The sources of performance improvement have been distinguished in three areas. (1) Changes in the context of production include (i) increases in the rate of

Learning-by-doing, when defined as problem solving, includes trial-and-error – specifically, a process of trial, failure, learning, revision and re-trial. Ill-structured problems are solved by first generating one or more alternative solutions, testing against requirements and constraints, revising and refining into an acceptable result. Under stable use conditions, learning-without-doing is feasible. In changing use environments, learning-without-doing fails when unanticipated and unpredicted field issues arise.[373]

A learning curve where experience is gained in production assumes that knowledge acquired is cumulative and persists through time. Fostering learning (e.g. from one factory shift to another) has been modelled as knowledge acquisition, retention, carry forward (i.e. embedding) and transfer.[374] Organizational forgetting "undoes" learning-by-doing leading to firms become more aggressive rather than less aggressive. A winning firm is able to build advantage by moving down its learning curve, setting up a rival to forget and slide back up its learning curve.[375]

Personal learning-by-doing has been a central concern in the fields of education and pedagogy. The book *Experience and Education* published by John Dewey in 1936 is recognized as a landmark, although the prescriptions for moving from subject matter organization to experiential learning have rarely become institutionalized.

From a cognitive science foundation, Roger Schank writes: "Learning is the accumulation and indexing of cases and thinking is the finding and consideration of an old case to use for decision-making about a new case. Critical to all this is the process of expectation failure and explanation. To make thinking beings, we must encourage explanation, exploration, generalization, and case accumulation".[376] Learning-by-doing has human

production (e.g. lot sizes war time), and (ii) pre-production engineering and planning. (2) Embodied technical change includes (i) changed production equipment, (ii) improved product design, and (iii) improved materials and components. (3) Improved organization and labour proficiency includes (i) management learning on scheduling, coordination and plant layout in changing from job lot to mass production, and (ii) increased skill and proficiency of direct labour (Kemmis and Bell, 2010).

[373]Learning without doing could include templating, that works within specific contexts (Von Hippel and Tyre, 1995).

[374]Transferring knowledge from one work shift to another highlights that knowledge is not uniformly embedded across employees or managers (Epple, Argote, and Murphy, 1996).

[375]The prior economic premise is that learning-by-doing promotes market dominance by shutting out competition. Organization forgetting allows bidirectional movements in competition. "By winning a sale, the firm ensures that it does not slide back up its learning curve even if it forgets. At the same time, by denying its rival a sale, the firm sets up the possibility that its rival will move back up its learning curve if it forgets. Because organizational forgetting reinforces the advantage-building and advantage-defending motives in this way, it can create strong incentives to cut prices so as to win a sale" (Besanko et al., 2010, p. 455).

[376]In comparing the teaching of undergraduate and graduate students, concerns differ: "The graduate students were being forced, both in school and in life, to think for themselves. What method were the undergraduates using for learning?

beings deciding what to do (and understanding what others do) through "*scripts* ... intended to account for the human ability to understand more than was being referred to explicitly in a sentence by explaining the organization of implicit knowledge of the world that one inhabits".[377] Skills are sets of micro-scripts for situations, in which actions culminate in a desired conclusion. In addition to scripts, productive members of societies will have learned three universal processes of (i) communications, (ii) human relations, and (iii) reasoning. "Learning by doing, when one is talking about processes, means inventing for oneself strategies that work within the processes that one is involved in". Scripts may fail when a new situation is encountered, leading to the potential for acquisition of a new case. "People acquire new cases because the old script they were using didn't work all that well".[378]

For the applied behavioral analysis community, learning-by-doing is a scientific principle.[379] "Learning by doing means learning from experiences resulting directly from one's own actions, as contrasted with learning from watching others perform, reading others' instructions or descriptions, or listening to others' instructions or lectures".[380] In contrast with classical psychology where "direct experience" mean mental contact with mental phenomena by introspection, behavioral analysis means "sensory contact with the results of doing". Everyday life show *discovery preferred over instruction*, with trial-and-error often preferred over reading a user's manual, and learning-by-training (doing until the subject exhibits stimulus equivalence) yielding more correct responses than learning-by-instruction. The Renaissance saw *practical experience preferred over book learning* from the Scholastic era, particularly in politics (following Rousseau), language acquisition, and facilitating the asking of good question. Practice means

Basically, they were copying what they were told. The graduate students were, on the other hand, experimenting, hoping to find out what was true by trying things out and attempting to make generalizations about what might hold true in the future" (Schank, 1995).

[377] "Scripts enable people to understand sentences that are less than complete in what they refer to". There are three broad classes of micro-scripts: "A *cognitive micro-script* refers to knowledge about use. [....] A *physical micro-script* refers to knowledge about operations. [....] A *perceptual micro-script* refers to knowledge about observations" (Schank, 1995).

[378] Copying a behaviour that has worked in the past is part of case-based reasoning. "Scripts save processing time and energy. We do what we have done before. The difference between cases and scripts is really just one of the overarching generality and ubiquity of the script" (Schank, 1995).

[379] Behavior analysis is a branch of psychology that seeks to understand the behavior of individuals. As a natural science "behavior analytic explanations of behavior appeal to natural, physical processes (e.g., environmental events, genetics, neural receptors). They do not appeal to metaphysical phenomena (e.g., free will), and they do not explain one behavior by appealing to another behavior".

[380] For behaviorists, learning-by-doing involved direct experience based on actions that the learner actually performs, rather than watching/reading/listening to demonstrations or descriptions of actions (Reese, 2011, p. 1).

"doing", not repetition, in the *practice-theory-practice dialectic* advocated by Karl Marx, Lev Vygotsky and Mao Zedong. Effective practitioners (e.g. medical professionals) *bridge the gap between practice and theory* by basing their procedures not only on direct experience, but also on theoretical principles.[381] The test of truth through *proof upon practice* (or "the proof is in the pudding" challenges scientist with doing concepts operationally, rather than just getting a mechanistic agreement.

The *organizational* and *personal* aspects of learning-by-doing have been brought together in the literature on communities of practice. Learning-by-doing has been developed into a larger theory of situated learning, developed through studies of craft apprenticeship with historical and culturally specific realizations. Legitimate peripheral participation sees "learning as an integral and inseparable part of social practice", more incompassing than "conventional notions of 'learning *in situ*' or 'learning by doing' for which it was used as a rough equivalent".[382] A social learning theory of learning was further developed through study of an insurance claim processors, formalizing concepts on meaning, community, locality and identity.[383]

Innovation learning-by-doing appreciates the accumulation of experience in both the organizational and personal senses. Trial-and-error with innovating has to be experienced first-hand; watching and copying an innovator may replicate behaviours after the fact, but is unlikely to lead to innovation mastery. Innovating is learned through "understanding in practice" rather through a "culture of acquisition".[384]

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[381] Direct experience is necessary, but not sufficient, to reach complete mastery. "Book-learning or theory deals with universals, which are abstract, and practice deals with particulars, which are concrete. Therefore, book-learning is insufficient by itself because it is uninformative about regularly successful practice, which requires knowing and dealing with the relevant particulars of each different person. However, direct experience is also insufficient by itself because although it deals with particulars, life is too short for direct learning of all the particulars that are relevant to successful practice" (Reese, 2011, p. 7).

[382] The learning-by-doing of individuals occurs within a social context with historically and culturally specific circumstances: "... among Vai and Gola tailors in Liberia ... apprentices ... engage in a common, structured pattern of learning experiences, without being taught, examined, or reduced to mechanical copiers of everyday tailoring tasks, and of how they become, with remarkably few exceptions, skilled and respected master tailors" (Lave and Wenger, 1991, p. 30-31).

[383] Insurance claim processors each have their own jobs to do, yet learning happens communally. "The concept of practice connotes doing, but not just doing in and of itself. It is doing in a historical and social context that gives structure and meaning to what we do. In this sense, practice is always social practice" (Wenger, 1999, p. 3).

[384] While math may not be the favoured subject in school, dieters following Weight Watchers diets were motivated to cook with a myriad of measurements and procedures for generating accurate portions until they had internalize the quantities and relations. This contrasts "two theories of learning, characterized as 'the culture of acquisition' and 'understanding in practice'. The first theory proposes that learning is a naturally occurring, specific kind of cognitive functioning, quite separate from engagement in something. [...] Recent research on learning has

Open innovation learning-by-doing opens up the situatedness of practices to a world beyond the bounds of a single organization. This allows individuals to "grow *into* knowledge" rather than having it handed down to us".[385] The role of the facilitator or educational leader should be "to establish the contexts or situations in which we can discover for ourselves much of what they already know, and also perhaps much that they do not". A community of practice should collectively have members with *anticipatory foresight* to guide the less-experienced towards a path of success.[386]

9.4.2 Learning-by-making is weaving flows in form-giving in constructing

Learning-by-making is associated with the constructionism of Seymour Papert, "building relationships between old and new knowledge, in interaction with others, while creating artifacts of social relevance".[387] Research into constructionism in the 1980s and 1990s focused on instructional environments (e.g. assembling LEGO kits, building microworlds with the Logo programming language).

In recent years, the field of *critical making* has emerged with the rise of digital technologies combined with physical microcontrollers (e.g. Arduino).[388] The importance of actually making things draws on three aspects of constructionism: (i) incorporating the emotional dimension of learning, as new understanding is endowed with a positive, affective tone; (ii) using

turned to apprenticeship for theoretical inspiration because it offers a shorthand way of 'saying no' to the theoretical position of "the culture of acquisition". [...] Apprenticeship forms of learning are likely to be based on assumptions that knowing, thinking, and understanding are generated in practice, in situations whose specific characteristics are part of practice as it unfolds" (Lave, 1990).

[385] While a textbook tends to frame a "right" knowledge to be passed on, "... it is wrong to think of learning as the *transmission* of a ready-made body of information, prior to its *application* in particular contexts of practice. On the contrary, we *learn by doing*, in the course of carrying out the tasks of life" (Ingold, 2013a, p. 13).

[386] Models for art and design should be drawn less from horology or architecture, and more from gardening and cooking. Not only seeing the state of things, but sensing where they are going, suggests "a foresight that does not so much connect a preconceived idea to a final object as *go between*, in a direction orthogonal to their connection, following and reconciling the inclinations of alternately pliable and recalcitrant materials" (Ingold, 2013c, p. 70).

[387] Constructionism by Seymour Papert has an allegiance to constructivism by Jean Piaget, but add the learner engaging in constructing a public entity. "While constructivism places a primacy on the development of individual and isolated knowledge structures, constructionism focuses on the connected nature of knowledge with its personal and social dimension" (Kafai, 2005, pp. 35-36).

[388] Collective acts of making involve shared construction, joint conversation, and reflection. "The use of the term *critical making* to describe our work signals a desire to theoretically and pragmatically connect two modes of engagement with the world that are often held separate—critical thinking, typically understood as conceptually and linguistically based, and physical "making," goal-based material work" (Ratto, 2011, p. 253).

transitional objects to connect body knowledge to more abstract understandings; and (iii) encouraging "messing about" in order to overcome a rigid style of work, and allow new perspectives to emerge. Critical making aims "to make concepts more apprehendable, to bring them in ways to the body, not only the brain, and to leverage student and researchers personal experiences to make new connections between the lived space of the body and the conceptual space of scholarly knowledge.

Learning-by-making and creativity can be coupled as *sociomaterial creativity.*[389] This a break from the dominant individual-oriented creativity models in psychology where creativity either (i) originates from an individual's internals sources, or (ii) represents a rebellion against present and existing social structures. A living theory of creativity is based on three sociomaterial conditions: (i) creativity is an everyday phenomenon resulting in continual processes of "making the world", rather than reserved for unique geniuses or historic personalities; (ii) human beings and material tools change constantly "in the making" with constant improvisation, rather than reserving creativity for an intellectual moment, and (iii) we work in contact with, and resistance from the materials in a relational creativity. Sociomaterial creativity sees a generative renewal in improvisation that can be collective, where materialized starts from tradition with emotion and anticipation of the new.

Maker-centered learning has recently been encouraged with the advent of *makerspaces*. These venues share an ethos of multidisciplinary engagement and innovation.[390] Learning arrangements were hybrids of participatory culture with pedagogical structures found in more formal studio-based settings. Learning is embedded in the experience of making. "These spaces value the process involved in making—in tinkering, in figuring things out, in playing with materials and tools".

Innovation learning-by-making emphases the two-sidedness of materiality: (i) the artifactual construction of things, and (ii) human life projects that give an artifact its meaning. [391] Making a novel product or process

[389]Sociomaterial creativity is based more on anthropological approaches to the study of creativity and cultural improvisation, than to mainstream psychology. "That is, creativity is much more social and everyday-like than has hitherto been acknowledged; materiality and artefacts are to be seen as substantial components of creativity in itself" (Tanggaard, 2013, p. 20).

[390]Three cases of makerspaces showed differences in participants, the media for making and project duration, yet exhibited some commonalities. "Unlike these disciplinary places of practice, makerspaces support making in disciplines that are traditionally separate. Sewing occurs alongside electronics; computer programming occurs in the same space as woodworking, welding, electronic music, and bike repair. This blending of traditional and digital skills, arts and engineering creates a learning environment in which there are multiple entry points to participation and leads to innovative combinations, juxtapositions, and uses of disciplinary knowledge and skills" (Sheridan et al., 2014, pp. 526-527).

[391]Materiality brings archaeology and anthropology together. "[We] need a concept of materiality ... in order to understand how particular pieces of stone are

can be labelled as an inventing; making a change in predisposed practices defines the adopting of an innovation. With improvisation seen as an everyday phenomenon, learning-by-making relies partially on the knowledge gained through experience, and partially on discovery at hand of the materials in the process of form-giving.

Open innovation learning-by-making creates novel understanding amongst members of a community of practice, often transcending organizational boundaries. Unencumbered access to materials and knowledge unchains accumulating collective experience in making.[392] An open learning-by-making community coalesces creativity through (i) unimpeded acceptance in joining an interest; (ii) tolerance of a variety of styles and approaches; and (iii) hands-on advancement of skills working with materials.[393]

9.4.3 Learning-by-trying is weaving flows in form-giving in co-configuring

Learning-by-trying appears in the struggle to get configurational technology assembled into a working system: "improvements and modifications have to be made to the constituent components before the configuration can work as an integrated entity".[394] Trying combinations of components involves micro-processes akin to "evolutionary models of speciation", rather than the epidemiological models of population growth where the "diffusion of the same technological entity in essentially unchanged form across a sector or the economy as a whole".[395] Success requires generic knowledge

given form and meaning within specific social and historical contexts". Materiality can 'emphasise the physicality of the material world', yet this physicality embraces the fact 'that it offers possibilities for the human agent'" (Ingold, 2013b, p. 27).

[392]Learning-by-making has a sense of working first-hand on materials. "Neither objects nor services are the currency of critical making. For me, it is the making experience that must be shared. Therefore, critical making is dependent on open design technologies and processes that allow the distribution and sharing of technical work and its results." (Van Abel et al., 2014, p. 202)

[393]This open view of learning-by-make builds on three principles for creative learning communities: (i) immersion in the topic of interest, in traditions and in the subject matter; (ii) experimentation and inquiry learning; and (iii) resistance from the material of interest (Tanggaard, 2014, pp. 110-111).

[394]Learning-by-trying conforms with an engineering systems approach. While there is some similarities with "innovation configurations" research on implementation knowledge, this definition of learning-by-trying focuses on the integrating. "Each configuration is built up from a range of components to meet the very specific requirements of the particular use organization. Configurations therefore demand substantial user input and effort if they are to be at all successful, and such inputs can provide the raw material for significant innovation" (Fleck, 1994, pp. 637-638).

[395]Success in learning-by-trying is at hand when the integration is ready to be experienced, rather than after a long period of experience. Learning-by-doing and learning-by-using "refer to the important incremental improvements that flow from progress up the learning curve (learning by doing) and from progressive modifications to an already functioning technological entity (learning by using). As such, they represent improvements made after a functioning entity is achieved"

embodied in skills and practices gradually formed over a period of time, plus local practical knowledge contingent onto the particulars at hand. Users "constitute the only available repository of the local knowledge component which might be essential for achieving successful implementation". Studies of such new technology implementations (e.g. customizing a specific instance of software) reports high failure rates.

Co-configuration of products and services reorients learning-by-trying less on technology and more on ongoing social interactions. "The work of co-configuration involves building and sustaining a fully-integrated system that can sense, respond and adapt to the individual experience of the customer".[396] A product or service provider is able to reconfigure its organization to respond to customer requests through a *mass customization* design of *dynamic product change* and *stable process change*.[397] Mass customization requires designing a product at least once for each customer.[398] Co-configuration "never results in a 'finished' product, but instead develops a living, growing network between customer, product and company. The capability for a product to continuously adapt reliability to customer needs requires continual learning.[399]

Learning-by-trying can be differentiated as an exploration for new knowledge.[400] Learning constructs (i) *architectural knowledge* in a context of

(Fleck, 1994, p. 638).

[396]Co-configuration is a step beyond four other types of work capability: (i) *craft*, strong in inventing and creating high-priced novel products; (ii) *mass production*, strong in discipline and in achieving value through predictable, standard commodities; (iii) *process enhancement*, strong in thinking and doing with superior quality; and (iv) *mass customization*, strong in modular customization, dominating a market with precision in made-to-order tailored products and services (Victor and Boynton, 1998, pp. 6-14).

[397]Dynamic product change enables organizations to respond to customers making unique and unpredictable demands. Stable process change allows organizations to build flexible platforms of process capabilities, improving know-how incrementally on a continuing basis. "Mass customization is the ability to serve a wide range of customers and meet changing product demands through service or product variety and innovation. Simultaneously, mass customization builds on existing long-term process experience and knowledge. The result is increased efficiencies" (Boynton, Victor, and Pine, 1993, p. 47).

[398]Progress on work capabilities follows a path: (i) craft founded on tacit knowledge generates *articulated knowledge* that can be used in a *development transformation* to mass production; (ii) mass production generates *practical knowledge* that can be used in a *linking transformation* to process enhancement; (iv) process enhancement generates *architectural knowledge* that can be used in a *modularization transformation* to mass customization; (v) mass customization generates *networking knowledge* that can be used in an *integration transformation* to co-configuration (Victor and Boynton, 1998, pp. 195-207).

[399]The value of co-configuration is products and services that "customize themselves not just once, but constantly, in response to what you need and want. .... [The} need for reliability ties in tightly with the need for a precise, dynamic fit between customer needs and product characteristics. ... [The] most successful firms ... focus obsessively on organizational learning" (Victor and Boynton, 1998, pp. 196-197).

[400]Learning-by-trying suggests that a lack of confidence about an outcome. "Pro-

experimentation, with *incremental exploration* of a *given* nature of an object and *given* activity to be mastered; or (ii) *dialogical configuration knowledge* in a *context of transformation*, with *radical exploration* of a *newly* emerging nature of an object and a *new* activity to be mastered.[401] The incremental exploration of Engeström lines up with the mass customization of Victor and Boynton; the radical exploration (also labelled as expansive learning) lines up with co-configuration. Learning-by-trying has two challenges: (i) learning the co-configuration work itself on collaboration and infrastructures; and (ii) learning constantly in ongoing interactions between the user, product/service and producers.[402] Professional practices for *multi-agency working* are characterized by distributed expertise where "*coming to know* the potential networks or 'trails' of colleagues" may be a necessary precursor to success.[403]

Learning-by-trying occurs in an *episodic* manner within *windows of opportunity*, triggered either by discrepant events or by new discoveries on the part of users.[404] This spiky timing of learning contrasts to depictions

cesses of learning may be effectively differentiated along two key dimensions, one representing the given vs. newly emerging nature of the object and activity to be mastered, the other one representing the famous distinction between exploitation of existing knowledge vs. exploration for new knowledge put forward by March (1996)" (Engeström, 2004, p. 13).

[401]Engeström sees the learning-by-trying perspective of James Fleck (1994) as a "traditional zone between incremental exploration and radical, expansive exploration". Incremental exploration is likened to the "learning as structuring" by Donald A. Norman (1982), and "articulation" by Spinosa, Flores and Dreyfus (1997). Radical exploration, on which Engestrom's expansive learning is later developed, is likened to "reconfiguration" in Spinosa, Flores and Dreyfus, with a "great sense of integrity" and "the sense of gaining wider horizons" (Engeström, 2004, pp. 14-15).

[402]Learning in co-configuration settings is accomplished in and between loosely interconnected activity systems distribution over long, discontinuous periods of time . "Co-configuration presents a twofold learning challenge to work organizations. First, co-configuration work itself needs to be learned (learning for co-configuration). In divided multi-activity terrains, expansive learning takes shape as renegotiation and reorganization of collaborative relations and practices, and as creation and implementation of corresponding concepts, tools, rules, and entire infrastructures. Second, within co-configuration work, the organization and its members need to learn constantly from interactions between the user, the product/service, and the producers (learning in co-configuration). Even after the infrastructure is in place, the very nature of ongoing co-configuration work is expansive; the product/service is never finished. These two aspects – learning for and learning in – merge in practice" (Engeström, 2004, pp. 15-16).

[403]Co-configuration involves *boundary-crossing*, which is "predicated not only on knowledge of what other professionals do but why they operate as they do. Thus there is a need to focus on the ways in which professional knowledge, relationships and identities incorporate learning 'who', 'how', 'what', 'why' and 'when' in emergent multi-professional work. Moreover, it is important to explore the dynamic, relational ways in which professional learning and professional practice unfold. This means asking with whom practices are developed, where current practices lead to, where practices have emerged from and around what activities and processes new practices emerge" (Daniels et al., 2007, p. 533).

[404]Learning-by-trying is likely to be most intense with a discontinuous change, e.g. at switching to a new technology and process. "Our research finds that

of the learning curve as continuously improving.[405] Learning-by-trying can be applied to ill-structured problems with problem-solving including "trial and error (or more precisely, trial, failure, learning, revision and re-trial) as a prominent feature".[406] Taking advantage of a disruption, experimentation is "more likely to occur and significant changes more apt to be implemented *immediately* following introduction than at any later time, despite ongoing problems or additional in sights that might be gained over time".[407] Problem discovery, particularly identified by operators in the field at deployment of new technology into the field, has been recognized as a specific form of learning in pattern recognition called either *interference finding* and templating. [408] Both interference finding and templating are described as "a form of pattern recognition".[409] Templating is related

adaptation drops off dramatically after an initial burst of intensive activity .... [This] decline of adaptation is not irreversible, in that later, unexpected events can trigger new spurts of adaptive activity .... Specifically, the initial introduction of technology – as well as subsequent, unexpected events – provide limited but valuable windows of opportunity for experimentation and adaptation" (Tyre and Orlikowski, 1994, p. 99).

[405]Research into the learning curve does attempt to disaggregate the effect of (i) first-order manufacturing process experience "based on repetition and on the associated incremental development of expertise" from (ii) second-order managerial variables related to the acquisition of process knowledge "that transforms the goals of the process by explicit managerial or engineering action to change the technology, the equipment, the processes or human capital in ways that augment capabilities" (Adler and K. B. Clark, 1991, p. 270). The tension between structure and agency in production theory and capability theory can be streamed as structural learning trajectories with (i) learning-by-doing as first-order learning internal to the firm, and (ii) learning-by-using (i.e. learning-by-interacting and learning-by-exporting) as second-order learning external to the firm (Andreoni, 2014).

[406]An empirical study of novel process machines in factory production processes has been framed as learning-by-doing and using-by-using (Von Hippel and Tyre, 1996, p. 2). Here, the label of learning-by-trying is used, which is not language that von Hippel and Tyre had originally used.

[407]If learning is seen as episodic, it's a pity to waste the opportunity of a foreseeable downturn. Behavioral theories "indicate that as organizations, groups, and individuals gain experience, they tend toward increasingly habitual modes of operation' (Tyre and Orlikowski, 1994, pp. 100,104).

[408]There's a small editorial difference in language across subsequent co-authored research papers. In describing "the mechanics of learning by doing" with problem discovery, "problem discovery via 'interference finding'" is preferred (Von Hippel and Tyre, 1996). In describing "how learning by doing is done" with problem identification, "templating the process of problem discovery" is preferred (Von Hippel and Tyre, 1995).

[409]It's possible that *interference finding* could be used in a more descriptive sense, and *templating* in a normative sense. "The interference finding that we observed in our sample of process machine problems occurred when two very different and highly complex patterns, the new machine and the plant context, were brought into close juxtaposition during field use – 'doing'" (Von Hippel and Tyre, 1996, p. 318). In an comparison to Christopher Alexander's 1964 *Notes on the Synthesis of Form*, "Templating is a form of pattern matching which is sensitive to the interferences among object (such as a process machine and a plant environment) that may have very different features or functions. Alexander [2, p. 19] describes the essence of templating when he discusses a means for characterizing the fit

to "a means for characterizing the fit between form and context", which Christopher Alexander labelled as "configuration".[410] Learning-by-trying may not only result issues of fit when a design is deployed in the field, but may also surface pre-existing conditions not originally perceived from a system that has been functioning for some time. Renovators say that "you never know what's behind a wall until you break through".[411]

Innovation learning-by-trying raises the importance of the situated nature of adaptive learning.[412] Physical setting is important in four ways: (i) technical experts and users tend to see different thing in any given setting; (ii) skills that expert problem solvers can apply to a problem depend on where they stand, and the resources available there; (iii) the physical setting affects unwritten rules and assumptions guiding behaviour, including interactions with others; and (iv) problem solvers learn not only in physical settings, but also through alternation between different physical settings. Innovation programs that are hands-on will have the episodic opportunity to more rapidly pivot direction on learning.

Open innovation learning-by-trying as co-configuration requires not only architectural modularity, but also dialogical integration. Trying multiple alternative assemblies presumes access both the physical parts and knowledge networks. Much of commercial business (as well as government-provided services) is designed an asymmetric "Read/Only" culture where production is professionalized and concentrated.[413] A remix culture has "Read/Write" privileges, where multiple parties can engage in co-configuration. That engagement could lead to open standards for cases where interests of a majority of partners are shared, and forked directions for parties with specialized needs.

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between form and context" (Von Hippel and Tyre, 1995, p. 5).

[410]The canonical form for a pattern language for built environments is described in Christopher Alexander's 1979 *The Timeless Way of Building* as Context → System of forces → Configuration. In architecting services systems rather than buildings, a pattern language based on contexts of spatio-temporal frames, containing systems and contained systems may be more appropriate (Ing, 2016).

[411]Learning-before-doing, as simulation and modelling, would be preferred to learning-too-late, as (i) it allows failure; (ii) it speeds up the rate of experimentation; (iii) it allows learning to be closely examined, managed and optimized, and (iv) it supports better decision-making in complex systems (Rejeski, 1998). There are limitations to models and simulations, however, so if the precautionary principle is not invoked, creative ways of learning-by-trying may be possible.

[412]A situated learning orientation takes into account context that may be absent in behavioral models of adaptive learning (e.g. March and Simon, Cyert and March) and cognitive theories (Argyris and Schon) (Tyre and Von Hippel, 1997, p. 71).

[413]"Read/Only" permission only allows a computer user to see, but not change a file. An "increasingly "Read/Only" ("RO") culture [is] less practiced in performance, or amateur creativity, and more comfortable ... with simple consumption". The testimony of John Philip Sousa to U.S. Congress in 1906 reflects concerns. "His fear was not that culture, or the actual quality of the music produced in a culture, would be less. His fear was that people would be less connected to, and hence practiced in, creating that culture" (Lessig, 2008, p. 28,27).

9.4.4 Hypothesizing for a theory of *open innovation learning -by*

A hypothesis for a normative theory for *OIL* with a paradigm of co-responsive movement can be constructed from the three learnings-by:

- Hypothesis: *Open innovation learning-by* layers weaving flows in form-giving through (iii) learning-by-trying, over (ii) learning-by-making, and (i) learning-by-doing

Testing this normative theory for *OIL* could take place in the three emerging cases outlined earlier. The rise of (i) polycentric governance, (ii) the Internet of Things, and (iii) cognitive computing, each provide salient contexts to which weaving flows in form giving through learning-by-doing, learning-by-making and learning-by-trying are combined and weighed against each other.

9.5 Innovation learning [agencing strands] alongside (phronesis)

Innovation learning-alongside respects two (or more) (life)lines as agencing strands alongside each other. Phronesis is 'know when, know where, know whom', appropriately demonstrating an appreciation of the situation at hand, a possible implicit weight of values, and the setting for an appreciative system.[414]

Strands are characteristic of social lives, where animals have a togetherness in moving, encountering and resting in the open. Lives "are social not because they are framed but because they are entwined. All life is social in this sense, since it is fundamentally multistranded, an intertwining of many lines running concurrently".[415] This lineal view sees inhabitants threading themselves through their worlds, each tying up his or her strand with other strands, interweaving their paths in knots.

Agencing is "the potential of undergoing reflexively to transform the doer".[416] A doer generally acts out of habit, but encounters interstitial differentiations where experience of the interval departs from the habit.

[414] Phronesis, as "know when, know where, know whom", is one of three intellectual virtues in philosophy. "Phronesis is often translated as 'prudence' or 'practical common sense'. [....] Phronesis is a sense or a tacit skill for doing the ethically practical rather than a kind of science." (Flyvbjerg, 2006, p. 371)

[415] Society, constituted of persons, can be seen as lines of life coevolving over time. Instead of focusing inwardly, "imagine the social world as a tangle of threads or life-paths, ever ravelling here and unravelling there, within which the task for any being is to improvise a way through, and to keep on going. Lives are bound up *in* the tangle, but are not bound *by* it, since there is no enframing, no external boundary. Thus the self is not fashioned on the rebound but undergoes continual generation along a line of growth" (Ingold 2011b, 221)

[416] *Agencing* is rough translation of the French word *agencement*, with the connotation of "transformative potential of 'doing undergoing', rather than the more confusing translation as "assemblage". Agencing is the "ever forming and transforming from within the action itself" (Ingold, 2017, p. 17).

The agent "is *inside* the process of his or her action", not separate from it. Agencing in-between two strands is a becoming. This is akin to seeing a swimmer in the current of a swift river, and joining that swimmer in the midstream, not interacting with the opposite banks of the river, but going along longitudinally.[417] The parties co-respond to each other, rather than being bounded by the ends set in advance by each.

Learning-alongside couples multiple agents in the joining together in their movements. For deeper insight into what is going on in-between, inquiry can be constructed in a dialectic with positions in opposition to each other. Such an approach extends the technique described with the systems approach and its enemies.

To me, these enemies provide a powerful way of learning about the systems approach, because they enable the rational mind to step outside itself and observe itself (from the vantage point of the enemies) (Churchman, 1979, p. 24).

The enemies of the systems approach were characterized as (i) politics; (ii) morality; (iii) religion; and (iv) aesthetics. Here, in the interest of dialogic inquiry, we can make dialectical distinctions between:

- (i) learning-alongside of *polyrhythmia* entangling *eurhythmia*;
- (ii) learning-alongside of *regenerating* entangling *preserving*; and
- (iii) learning-alongside of *less-leading-to-more* entangling *more-leading-to-more*.

This perspective builds on an ecological anthropological theory of human co-responding.[418]

9.5.1 Learning-alongside is agencing strands of *polyrhythmia* entangling *eurhythmia*

Polyrhythmia and *eurhythmia* are appreciated by living beings founded on the experience and knowledge of the living body, depicted in Table 9.1.

Table 9.1. Polyrhythmia entangling eurhythmia

Learning alongside		
Polyrhythmia	–	Eurhythmia

Polyrhythmia is an alignment of multiple organic repetitions in time and space, beyond metrics of mechanical regularity. Within polyrhythmia are three fundamental concepts:

[417] Each agent joins in "interests, in interaction, is like an oscillation between two points". With both parties swimming "in a fluid medium, always at risk of going under, you have no option but to keep on going, in a direction orthogonal to that of the line connecting the banks on either side" (Ingold, 2017, p. 17).

[418] The enlarged perspective of dialectic over dialogic spins off from the theory of human correspondence with three essential principles: (i) of habit (rather than volition); 'agencing' (rather than agency); and attentionality (rather than intentionality) (Ingold, 2017).

- *isorhythmia*, the equality of rhythms, in an identity of temporalities;
- *eurhythmia*, an association of heterogeneous rhythms, as normal in a healthy living body; and
- *arrhythmia*, a breaking apart of rhythms, altering and bypassing synchronization.

Isorhythmia is present in symphonic and orchestral music[419], but otherwise is rare. Eurhythmia is present in living bodies as diverse rhythms in a metastable equilibrium[420] unified with the environment. Arrhythmia appears as functional disruption than can manifest into illness and progress into morbid and fatal disorder.

Rhythm is "a pattern of movement, characterized by the recurrence at a regular frequency of some pulse in a process or system"[421]. Rhythm exists in the natural world[422], and perceiving rhythms are fundamental to the human experience. The sciences and the arts can both engage with rhythm[423], in a unity of the perception of immediate experiences,

[419]Polyrhymia manifests differently in music and in living bodies: "... iso- and eurythmia are mutually exclusive. There are few isorhythmias, rhythmic equalities or equivalences, except of a higher order. On the other hand, eurhythmias abound; every time there is an organism, organisation, life (living bodies)" (Lefebrve, 2004a, p. 67).

[420]Eurhythmia is not just within a body, but includes the world. "The eu-rhythmic body, composed of diverse rhythms – each organ, each function, having its own – keeps them in **metastable** equilibrium, which is always understood and often recovered, with the exception of disturbances (arrhythmia) that sooner or later becomes illness (the pathological state). But the surroundings of bodies, be they in nature or a social setting, are also *bundles*, *bouquets*, *garlands* of rhythms, to which it is necessary to listen in order to grasp the natural or produced ensembles. The rhythmanalyst will not be obliged to *jump* from the inside to the outside of observed *bodies*; he should come listen to them as a whole, and unify them by taking his own rhythms as a reference; by integrating the outside with the inside and vice versa" (Lefebrve, 2004d, p. 20).

[421]In systems theory, rhythm is an under-researched topic. "Rhythms are ebbs and rises in periodic phenomena. They are generally a synchronous response (in phase or out of phase) to some other rhythm at a more embracing level. They can be simple or complex and are observable on the whole scale of phenomena, from nuclear physics to cosmic ones. They are also present in ecology, economy and in social evolution. They should thus be considered as a general family of isomorphic features in systems" (François, 1997, p. 302).

[422]Rhythms exist in nature without organisms perceiving them; although experiencing art is human. "Interaction of environment with organism is the source, direct, or indirect, of all experience and from the environment come those checks, resistances, furtherances, equilibria, which, when they meet with the energies of the organism in appropriate ways, constitute form. The first characteristic of the environing world that makes possible the existence of artistic from is rhythm. There is rhythm in nature before poetry, painting, architecture and music exist. Were it no so, rhythm as an essential property of form would be merely superimposed upon material, not an operation through which material effects its own culmination in experience" (Dewey, 1934a, p. 147).

[423]Rhythm can provide a unity of the arts with the sciences. "Today the rhythms which physical science celebrates are obvious only to thought, not to perception in immediate experience. They are presented in symbols which signify nothing in sense-perception. They make natural rhythms manifest only to those who have undergone long and severe discipline. Yet a common interest in rhythm is still

and in symbolic form that can be internalized by others. Live creatures experiencing rhythm enjoy the order of repetition, but also demand variety as a stimulus[424]. Rhythm is present both in experiencing music (i.e. in time) and in experiencing colours (in space)[425].

Philosophically, rhythm can be a foundation for moving from the dyadic (i.e. two terms) to the triadic[426] (i.e. three terms). In a dialectical analysis of music as melody-harmony-rhythm, rhythm has been de-emphasized[427]. Rhythm is understood within the body of any human (or creature) and in music, and has been proposed for an understanding of space-time-energy[428]. Where there is a place, a time, and an expenditure of energy,

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the tie which holds together science and art in kinship. [...] Because rhythm is a universal scheme of existence, underlying all realization in order of change, it pervades all the arts, literary, musical plastic and architectural, as well as the dance" (Dewey, 1934a, p. 150).

[424]Differentiation can be made between the art product (as physical and potential) and the work of arts (as active and experienced). "Mechanical recurrence is that of material units. Esthetic recurrence is that of relationships that sum up and carry forward. Recurring units as such call attention to themselves as isolated parts, and thus away from the whole. Hence they lessen esthetic effect. Recurring relationships serve to define and delimit parts, giving them individuality of their own. But they also connect; the individual entitles they mark off demand, because of the relations, association and interactions with other individuals. Thus the parts vitally serve in the construction of an expanded whole" (Dewey, 1934b, p. 166).

[425]While we experience music and colours initially through perception, reflections can be integrated. "We see intervals and directions in pictures and we hear distances and volumes in music. If movement alone were perceived in music and rest along in painting, music would be wholly without structure and picture nothing but dry bones" (Dewey, 1934b, p. 184).

[426]Triadic analysis was understood by Hegel and Marx in the scheme thesis-antithesis-synthesis. "The intellectual procedure characterised by the **duel** [*le duel*] (duality) has its place here: with oppositions grasped in their relations, but also each of itself. It was necessary to set up the list of oppositions and dualities that enter into analysis by rejecting first the old comparison of **dialogue** (**two** voices) and **dialectic** (**three** terms). Even from the Marxist standpoint there were confusions; much was staked on the two-term opposition b*ourgeoisie-proleteriat*, at the expense of the third term: the soil, agricultural property and production, peasants, predominantly agricultural colonies" (Lefebrve, 2004c, p. 11).

[427]The study of mathematics does not lead to understanding the experience in rhythm, only the metric. "Rhythm in and of itself, not music in general, as believed Douglas Hofstadter in Gödel, Escher, Bach, in which he gave a good deal of room to melody and harmony – and little to rhythms. [....] To the extent that the study of rhythm is inspired by music (and not just by poetry, by walking or running, etc.) it is closer to Schumann than to Bach. This does not explain the tension and kinship between mathematical thought and musical creations, but it does shift the question" (Lefebrve, 2004c, p. 14).

[428]The analysis of rhythm was proposed as triadic, and only tentatively generalized. "Rhythm is easily grasped whenever the body makes a sign; but it is conceived with difficulty. Why? It is neither a substance of a thing. Nor is it a simple relation between two or more elements, for example subject and object, or the relative and the absolute. Doesn't its concept go beyond these relations: *substantial-relational*? It has these two aspects, but does not reduce itself to them. The concept implies more. What? Perhaps **energy**, a highly general concept.

rhythm provides an inductive framework[429] with (i) repetition; (ii) linear and cyclical processes; and (iii) birth-to-end life cycles.

In 2016, an essay in The Philosophers' Magazine asked "Why do philosophers have no rhythm?"[430], pointing out that the western classical canon emphasizes the tonal over the rhythmic. An edited volume on "The Aesthetics of Rhythm" based on a 2014 workshop supported by the British Society of Aesthetics is forthcoming.[431]

Eurhythmia may include higher order rhythms that dynamically adapt a system to naturally change with its environment, and/or interventions that will enfold health.[432] In wellness, the diverse rhythms can normalize each other towards an everyday state of health.[433]

Polyrhythmia is demonstrated socially in the music of the rock band, *The Police*. The renowned trio of drummer Stewart Copeland, bassist Sting and guitarist formed in 1977, and stopped touring after an exhausting

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An energy is employed, unfolds in a time and a space (a space-time). Isn't all expenditure of energy accomplished in accordance with a rhythm?" (Lefebrve, 2004b, pp. 64-65)

[429]Beyond mechanisms, there are rhythms in the everyday. "Everywhere where there is interaction between a place, a time and an expenditure of energy, there is **rhythm**. Therefore: (a) repetition (of movements, gestures, actions, situations, difference); (b) interferences of linear processes and cyclical processes; (c) birth, growth, peak and then decline and end. This supplies the framework for analyses of the *particular*, therefore *real* and *concrete* cases that feature in music, history and the lives of individuals or groups" (Lefebrve, 2004c, p. 15).

[430]The philosophy of music to date is criticized as (i) isolated from other art forms, and (ii) focusing on sounds over the whole experience. "The first assumption is that any rigorous inquiry into music should start by deliberately ignoring music's connections to singing, dance, social rituals and religious ceremony; only then is one in a position to discover what is essential to it. [....] Rhythm, with its foregrounding of movement and dance, puts this "music alone" axiom under pressure. But the second (and much more widespread) assumption is that music is a matter of sounds – that musical experience is, at base, a rarefied kind of hearing. In my work, I argue that central aspects of rhythmic experience, such as the experience of the "beat", are deeply multimodal" (J. Judge, 2016).

[431]The Aesthetics of Rhythm workshop was held June 28-29, 2014 at Durham University, hosted by Andy Hamilton and Max Paddison. There were 15 workshop participants, and 15 in the audience .

[432]For a human body, education and acupuncture could be seen as programs to improve health naturally. "Intervention through rhythm (which already takes place, though only empirically, for example, in sporting and military training) has a goal, an objective: to strengthen or re-establish eurhythmia. It seems that certain oriental practices come close to these procedures, more than medical treatments. Rhythmanalytic therapy would be preventative rather than curative, announcing, observing and classifying the pathological state" (Lefebrve, 2004a, p. 68).

[433]Eurhythmia includes a wide range of patterns that would not be assessed as illness. "Rhythms unite with one another in the state of health, in normal (which to say normed!) everydayness; when they are discordant, there is suffering, a pathological state (of which arrhythmia is generally, at the same time, symptom, cause and effect). The discordance of rhythms brings previously eurhythmic organisations towards fatal disorder. **Polyrhythmia analyses itself**. A fundamental forecast: sooner or later the analysis succeeds in isolating from within the organised whole a particular movement and its rhythm" (Lefebrve, 2004c, p. 16).

1983-1984 Synchronicity world tour.[434] For the 2007-2008 world tour, the band reformed as a trio with greater maturity, making history both musically and economically.[435]

The Police fused progressive rock styles with reggae beats, playing in sophisticated rhythms that neither punk bands nor rock bands find natural. Most groups struggle to be isorhythmic and coherent on a unified pulse. The 1978 hit song "Roxanne" originally written as a bossa nova[436] became a hybrid of tango and reggae in a rhythmic ambiguity. *The Police* were able to mesh in rhythm, seeking a groove that is "in the pocket"[437]. Simultaneously dealing with a variety rhythms surfaces metric conflict[438]. Sophisticated rhythmic interplay[439] is uncommon in garage bands, however, and requires a higher level of expertise.

Any amateur musicians who attempt to replicate the feeling and technique of *The Police* readily discover how intricate and difficult the arrangements really are. The *polyrhythmia* of a band playing a bass behind the

[434]World tours in 1983-1984 finally exhausted the band. Recutting songs in 1986 for a Greatest Hits recording started with Stewart Copeland breaking a collarbone falling off a horse, and the band disagreeing on arrangements (Fricke, 2007).

[435]In 2008-2008, The Police sold 3,300,912 tickets in 146 headlining shows for $358,825,665 gross, in addition to appearing at five festivals (Waddell, 2008). At that time, it was the third highest grossing tour of all time, following the Rolling Stones 2005-2007 Bigger Bang tour, and the U2 2005-2007 Vertigo tour.

[436]Punk musicians felt kinship with reggae of the marginalized West Indians, in a common struggle against upper classes where bossa nova had been enjoyed in the 1960s. "In short, reggae was cool. On the other hand, Brazilian styles, like bossa nova, were not cool" (A. J. West, 2015).

[437]When a drummer plays "in the pocket", that musician is consistently executing a slight backbeat delay. "The optimum snare-drum offset that we call the 'pocket' may well be that precise rhythmic position that maximizes the accentual effect of a delay without upsetting the ongoing sense of pulse. This involves the balance of two opposing forces: the force of regularity that resists delay, and the backbeat accentuation that demands delay" (Iyer, 2002, p. 406).

[438]The Police originally fused reggae with punk into their idiolect, shown in an analysis of "The Bed's Too Big". "Although it is composed of otherwise standard reggae devices, what makes this particular groove special is the metric conflict created by the bass and drums against the guitar skank. If we were to listen to the bass riff alone without the other instruments, we naturally would expect that the riff begins each time on the downbeat. [.... However,] the bass riff actually begins on the second beat of the measure; the rim shots, likewise, seem to have been displaced by one quarter note compared to the corresponding rhythmic feature on the guitar" (Spicer, 2010, p. 133).

[439]Punk musicians do not center on expertise as did The Police. From the guitarist's perspective, "For us it was the blending of rock and reggae and punk, and using the spaces that reggae provides to find a fresh approach to playing as a three-piece, rather than just banging out heavy power chords all night long ... (Summers, quoted in Goldsmith 2007)". From the bass player and drummer, "Very few of the new bands had the finesse to be able to play reggae, with its complex rhythmic counterpoint that seems to turn traditional pop drumming on its head. This, and the predominance of the bass in the music, allowed Stewart and me to explore subtle areas of interplay that were rarely touched by less experienced outfits (Sting 2003)" (Hesselink, 2014, pp. 72-73).

beat (i.e. microtiming as late) as drums are ahead of the beat (i.e. microtiming as early) with guitar and vocals are layered generally leads to rushing or dragging perceived as arrhythmia[440]

Innovation learning of polyrhythmia alongside eurhymthia challenges the balancing of "what is inside the head" with "what the head is inside".[441] Philosophical perspectives on time contrast *event* time (as subjective) with *clock* time (as objective), and alternatively more formally as *chronos* and *kairos*.[442] Progress includes the unfolding of life both inwardly and outwardly.[443]

Open innovation learning of polyrhythmia alongside eurhythmia characterizes open sourcing while private sourcing is a rhythmic construction[444] that was new in 2001, becoming commonplace as a style by 2011. Open sourcing operates with a rhythm that is different from private sourcing. The organization that is successfully open sourcing while private sourcing has to maintain a polyrhythmic proficiency. This appreciation of polyrhyth-

[440]Fletcher: "Were you rushing or were you dragging?" Andrew: "I don't know". In the movie *Whiplash*, the drummer is challenged by the instructor for not keeping the tempo for the stage band in the performance of a rhythmically difficult composition (Chazelle, 2014).

[441]The stimulus-response model of behavioral psychology with an ecological approach to perception has been described as a challenge: "ask not what's inside your head, but what your head's inside of" (Mace, 1977).

[442]Chronos and kairos have been recognized since ancient Greek philosophers. "*Chronos* is 'the chronological, serial time of succession. . .time measured by the chronometer not by purpose' ... it is typically used to measure the timing or duration of some action. . In contrast, *kairos*, named after the Greek god of opportunity, refers to 'the human and living time of intentions and goals ... the time not of measurement but of human activity, of opportunity' .... While rhetoricians have always seen chronos as objective and quantitative, they have long debated the status of kairotic time. Some believe it is given and independent of the actor, ... Increasingly, however, rhetoricians has suggested the kairos is shaped by the actor ... (Orlikowski and J. Yates, 2002, p. 686)

[443]An organism develops structure both internally, and externally. "... the vital genesis of bios proceeds. Its progressive steps crystalize in a multiple *motio*. Hence, it crystalizes in 'time,' which lends it a 'moment' of fulfillment, the measure of the step onward in the process of growth or decline. Each constructive advance of individualizing life (e.g., the opening of the petals of a flower, the rise of the sap of a tree in early spring, the cross-pollination of flowering plum trees effected by insects,...) is a result of a bundle of results—of numerous operations and processes, each of them crystalizing segments of time that flow together to work a change, a transformation, a moment of constructive progress. Advance is not the effect of a single cause, nor does it singlehandedly contribute or effectuate another change. On the contrary, each occurrence in the course of bios' unfolding is significant in various inward/outward radiating directions (*inwardly*, the opening of a flower is a phase preparatory to fruition; *outwardly*, it is the opening of a source of nectar that nourishes bees, wasps, hummingbirds, etc.)" (Tymieniecka, 2009, pp. 205-206).

[444]The unique sound of The Police was produced by a creative tension between rock/punk and reggae. "Punk is rhythmically explicit because it saturates the rhythmic texture with eight-beat timekeeping. Reggae, by contrast, is rhythmically implicit, because the most consistent rhythms are all afterbeats. The other rhythm lines, especially the bass, move freely, creating a rhythmic fabric of unparalleled lightness. (Campbell and Brody 1999)" (Hesselink, 2014, p. 72).

mia could be a promising first step on a trajectory from the science sciences towards an aesthetics for systems.

9.5.2 Learning alongside is agencing strands of *regenerating* entangling *preserving*

Regenerating and *preserving* are concerns of continuity in the natural and artifactual material world that may be influenced by human activity[445], depicted in Table 9.2.

Table 9.2. Regenerating entangling preserving

Learning alongside		
Regenerating	–	Preserving

In both living and non-living contexts, the distinctions may be more precisely described as *regenerating as nature* and *preserving of form*. These concerns can be related to evolution of philosophy from (i) the wilderness preservation of Ralph Waldo Emerson and Henry David Thoreau, popularized by John Muir; (ii) resource management articulated by Gifford Pinchot with private conservation organizations such as the Sierra Club, and (iii) the ecosystem management and sustainable development of Aldo Leopold.[446] Muir advocated preservation, writing of the beauty, the physical and mental promotion, and spiritual redemption associated with lengthy wilderness sojourns.[447] Pinchot criticised preservationists as "locking up" resources, and led conservationists take a scientific approach to the development of natural resources, and a fair distribution of benefits through regulated markets.[448] Leopold saw conservation as "harmony-with-nature" in sustainable development with "the initiation of human economic activity that does not significantly compromise ecological health and integrity; and ideally economic activity that might positively

[445]The concern of human impact on earth's geology and ecosystems in the 21st century has been labelled the anthropocene.

[446]Wilderness preservationists following John Muir were opposed to the resourcists following Gifford Pinchot. Aldo Leopold started a member of the Pinchot camp, gradually moving over to the Muir camp, but then advocated a third philosophy of human harmony with nature (Callicott, 1994).

[447]John Muir wrote recommendations that led U.S. Congress writing a bill to establish Yosemite National Park in 1890. Muir promoted the vision of Thoreau, that "each town should have a park, or rather a primitive forest, of five hundred or a thousand acres ... where a stick should never be cut – nor for the navy, nor to make wagons, but to stand and decay for higher uses – a common possession forever, for instruction and recreation" (Callicott, 1994, p. 11).

[448]Gifford Pinchot was the first chief of the U.S. Forest Service from 1905 to 1910, eventually becoming the Governor of Pennsylvania 1923-1927 and 1931-1935. Pinchot followed a utilitarian creed of "the greatest good for the greatest number for the longest time", where conservation standing for development as a systematic exploitation of natural resources (Callicott, 1994, p. 11).

enhance it".[449] In order for wilderness area to remain viable, ecosystem management may require invasive procedures (e.g. prescribed burns) to maintain the mix of species that compose them.

Preserving of form in the global world order – across natural systems and human systems – requires maintaining relations in governance of amplifiers of choice associated with the market economy and development of technology.[450] When governance fails to maintain a system within some critical limits with stability, enablements and constraints can spin off into an irreversible change towards disorder. In a bureaucratic organization, preservation of form sees "the protection or preservation of the premises of decision, including those supporting the control of the decision system, and not simply to the preservation of the organization's structural arrangements, although these are interrelated".[451] The appearance of rationality amongst decision makers as symbolic use rather than instrumental use supports bureaucratic control with risk aversion.

Regenerating as nature is related to distinctions between making and growing. Human beings "produce society in order to live – and in doing so, 'create history'".[452] Five kind of materiality can be distinguished, "depending upon the manner and extent to which human beings are implicated in their formation", as shown in Table 9.3.

The five kinds of materiality include: (i) that part of nature which is wholly untouched by human activity; (ii) the part that has been changed on account of the presence of humans, but indirectly and unintentionally; (iii) the part that has been intentionally transformed by human beings and that depends upon their attention and energy for its reproduction; (iv) the

[449]The term "ecological livelihood" is suggested as a label less liable to misinterpretation and misappropriation than "sustainable development". "Leopold had in mind changes far more radical than, say, building more energy-efficient tract houses and automobiles. He was proposing, rather, a veritable revolution in the way we human beings inhabit and use the natural environment" (Callicott, 1994, p. 12). Aldo Leopold worked in the U.S. Forest Service, including developing a comprehensive management plan for the Grand Canyon in 1924, before becoming a professor at the University of Wisconsin, Madison, in 1933.

[450]While increasing political regulation is required to maintain a society sustainable across generations, the trend has been in the opposite direction. "The power to veto of vested interest and militant subgroups, the cultivation of what is individual and diverse rather than what is shared and unreal assumptions about what is possible, thwart the capacity of governments in the affluent, high consumption states to tackle the daunting issues of managing limitations, reducing expectations and promoting satiable rather than insatiable human wants" (Blunden, 2000, p. 245).

[451]Orienting towards the *preservation of form* as "preservation of the norms of the organization", is characterized by only single-loop learning (at the exclusion of double-loop learning) (Lovell and Turner, 1988, p. 416-417).

[452]Maurice Godelier "means that the designs and purposes of human action upon the natural environment – action that yields a return in the form of the wherewithal for subsistence – have their source in the domain of social relations, a domain of mental realities ('representations, judgements, principles of thought') that stands over and above the sheer materiality of nature" (Ingold, 2000c, p. 78).

Table 9.3. Kinds of materiality and implications in formation

#	Kinds of materiality (part of nature)	Distinctions in production
1	Wholly untouched by human activity	Wild
2	Changed on account of the presence of humans	Wild [hunting, gathering, nurturing animals (wild pigs)]
3	Intentionally transformed by human beings and that depends upon their attention and energy for its reproduction	Cultivation of domesticated [growing, gardening, raising animals (midwifing births), artificial selection]
4	Materials that have been fashioned into instruments such as tools and weapons	Making [tools, services]
5	The built environment	Making [products]

part that comprises materials that have been fashioned into instruments such as tools and weapons; and (v) the part we conventionally call the "built environment" (e.g. houses, monuments).

In the middle kinds of materiality, two themes emerge. Firstly, people do not "literally make plants and animals, but rather establishes the environmental conditions for their growth and development". Secondly, "growing plants and raising animals are not so different, in principle, from bringing up children". The difference between growing plants, raiding animals and bringing up children is in the relative scope of human involvement in establishing the conditions for growth. There is a "temporal interlocking of the life-cycles of humans, animals and plants, and their relative durations".[453] While the orthodox Western view extends making from inanimate things to animate beings, growing can be extended in the reverse direction from animate to inanimate.

The temporal interlocking of life-cycles between human beings and nature shows up in the "second life of trees" in the traditional regenerative practices of foresters in a mountainous region of Japan.[454]

[453]The conventional appreciation of growing things has a sense of time that making underemphasizes. "The lives of domestic animals tend to be somewhat shorter than those of human beings, but not so short as to be of a different order of magnitude. There is thus a sense in which people and their domestic animals grow older together, and in which their respective life-histories are intertwined as mutually constitutive strands of a single process. The lives of plants, by contrast, can range from the very short to the very long indeed, from a few months to many centuries" (Ingold, 2000c, p. 86).

[454]Regenerative timber forestry in the Kii Peninsula included villagers earning a living through planting, weeding, branch-cutting, felling, transporting and sawmilling. "However, the trees in the forest have never been simply an economic resource to the people in the village. To the trees are attached a rich set of ideas, beliefs and associations. They are a site of spirits and a source of supernatural

> The traditional practice was this — that the forester would plant, and grow, and look after the trees for generations. Something like 30 years went from the conifers, so you planted the tree, you attended, you looked after it to make sure things well with it. And once a suitable period had elapsed you would cut it down. And then having cut it down, you would use those trees to make timbers for your house. And then, so, during the first 30 years of the growth of the tree, you're looking after the tree. In the next 30 years the tree has become a house timber and it's looking after you. You and your family living inside the house. And they call this the second life of trees.
>
> So, the *first life* is when the tree is growing in the ground, and when and you're looking after it. The *second life* is when the tree is in your house and it's looking after you. That also lasts about 30 years during which time you've planted a new set of trees. They'll be harvested and they'll replace the old timbers as they begin to go rotten.
>
> Perhaps, by that stage — and so that way — you've got a perfect interlocking of tree lasting and human lasting — that is, tree life cycles, and human life cycles — that are kind of in phase with one another, and carrying on indefinitely through time.
>
> That was all fine, until the conservationists came along and said you can't cut those trees! These trees are part of nature! We need to preserve nature! So they denied the trees the possibility of their second life. They just stood there getting older and older in the ground, until they eventually drew out, as conifers do, sort of died down. They died on their legs, and died in their roots, and became dead trees standing in the ground.
>
> And the foresters didn't have the raw materials to build and restore their houses. So what happens now is we have ancient trees and concrete houses, in the name of preservation, and thinking of sustainability in terms of the preservation of form, rather than the continuation of life cycles. (Ingold, 2016, 35m55s - 38m12s)

A challenge in sustainability (and conservation, more precisely) is an orientation towards steady states, rather than with movement. Conservationists often think more in terms of projecting the past into the future, whereas an alternative way of thinking about the future is anticipating the regenerating of nature.

Innovation learning of regenerating alongside preserving leads to the cross-appropriation of understandings of the world across domains. Preserving our civilization dates back to ancient times, with enduring built environments displacing nomadic shelters, and the industrial revolution of the 19th century advancing technologies to augment manual labour.

existence, as well as symbolic medium for human life" (Knight, 1998, p. 198).

Regenerating underlies much of biomimcry as "innovation inspired by nature", where the biology of living things is mimed by human beings.[455]

Open innovation learning of regenerating alongside preserving appreciates that some phenomena have life cycles with circularity, while others are rare or singular anomalies that serendipitously emerge. Open sourcing projects that welcome the injection of capital and resources from commercial partners can gain produce the critical mass of vitality. Private sourcing derivatives and forks may eventually lapse into neglect due to unfavourable revenue-cost trends, yet open sourcing projects may see new generations through self-sustaining community interests.

9.5.3 Learning alongside is agencing strands of *less-leading-to-more* entangling *more-leading-to-more*

Less-leading-to-more and *more-leading-to-less* are two prospective mindsets for moving an innovation forward, as depicted in Table 9.4.

Table 9.4. Less-leading-to-more entangling more-leading-to-more

Learning alongside		
Less-leading-to-more	–	More-leading-to-more

The emphasis of "leading-to" adds a dimension of foresight in time. A layman might describe less-leading-to-more as "working smarter", as compared to "more-leading-to-more" that "builds on success" through linear scaling.

The more popular "less-is-more" phrase comes from two related fields: rhetoric, and architecture.

From rhetoric in the 16th century, *meiosis*[456] has been an understatement, frequently ironic, a figure of speech by which something is intentionally presented as smaller or less important than it really is. As meiosis in 1855, less is more was published in a Robert Browning poem "Andrea del Sarto (called The Faultless Painter)"[457], a monologue from a technically

[455] Learning from nature is an orientation that contrasts from dominating nature. "Unlike the Industrial Revolution, the Biomimicry Revolution introduces an era based not on what we can *extract* from nature, but on what we can *learn* from her. [....] The biomimics are discovering what works in the natural world, and more important, what lasts" (Benyus, 1997, p. 2-3).

[456] The use of meiosis in rhetoric dates back to 1550 as *miosis*, "diminutio, when greate matters are made lyghte of by worde" and 1577 *meiosie*, "when we use a less word for a greater, to make the matter much less than it is". The use of meiosis in biology only dates back to 1905, says the Oxford English Dictionary Online.

[457] Andrea del Sarto had become famous for frescos painted 1509-1514 in Florence. "During this period he married Lucrezia del Fede, a widow, who served as a model for a number of his pictures. In 1518, Andrea was invited by Francis I of France to come to the court at Fontainebleau. The next year Francis gave him money to be used in the purchase of pictures in Florence for the palace of Fontainebleau, and Andrea left France on this commission. According to Vasari, through Lucrecia's

gifted artist to his unfaithful wife. Andrea produced paintings with "no sketches first, no studies" to support her lifestyle, while dreaming of ascending to "the heaven" of superior contemporaries Raphael, Michelangelo and Leonardo DaVinci. Andrea recognized "there burns a truer light of God in them".

In architecture, the original inspiration for *less-is-more* came to Mies van der Rohe under the supervision of Peter Behrens[458] during the construction of the AEG Turbine Factory in 1907-1910. In contrast to his early work in the decorative arts focused on organic allusions, uniqueness, craft and patronage by the elite, Behrens moved into a style of architecture and design[459] that could be generalized for the middle class and modernized into industrial manufacturing. Form was simplified in shapes of spheres, cubes, cylinders and hexagons, exploiting the attributes of the new industrial materials of glass, steel and reinforced concrete. When Mies designed the west courtyard elevation of the Turbine Factory, he created drawings of what could be done. Behrens said "less is more", so that Mies contributed little beyond the determinants of the technical form. Mies eventually reappropriated the phrase[460] to emphasize a style where features beyond essential functions were eliminated. From 1904 to 1924, Mies was shaped by the philosophy of critical realism of Alois Riehl[461],

persuasion Andrea used the king's money to build himself a house in Florence, never daring to return to France, and in effect destroying 'the eminence he had attained with so much labour' (Lancashire, 2009).

[458]Behrens as an important modernist artist, teacher and polemicist in Germany, attracting Mies van der Rohe, Walter Gropius and Le Corbusier by 1907 to his studio at the industrial electrical company AEG (Mertins, 2014, p. 32).

[459]As the artistic director for AEG, Behrens became the first designer of a comprehensive corporate identity. He extended "the ethos of total art into the design of industrial buildings, products and graphic material – this is across the entire range of material culture for industrial society. In designing products (lamps, kettles, fans), advertising, factories and workers' housing, Behrens did not wish to lower architecture to the everyday, but rather enoble ordinary objects to the lofty level of art" (Mertins, 2014, p. 35).

[460]Behrens originally would have referred to "less is more" as the newest construction technology of glass enclosed steel frames enabled a light, yet monumental expression. "In pointing out that he used the phrase differently, Mies was referring to his later efforts to reduce and distill buildings and their components into simple forms in which art and technics (geometry and matter) were achieved in a more persuasive tectonic expression than Behrens had achieved" (Mertins, 2014, p. 36).

[461]While Mies is known for steel and glass buildings, the Riehl House included a garden, incorporated into the sloping lawn and woodland. The Riehls treated Mies like a son. "Riehl directed him towards key works in philosophy and cultural theory, and introduced him to any of their authors in person. [....] The dualities bound together in the form of the house – open and closed, block and frame – are indicative not of a metaphysical worldview, but of a critical philosophy that promoted a philosophical way of life, asking questions and probing the limits of knowledge, including self-knowledge. Riehl followed Kant's critique of metaphysics and adopted his pursuit of an alternative mode of philosophy as inquiry into the objective conditions of subjective knowledge" (Mertins, 2014, p. 26).

for whom Mies had designed an ascetic country home in 1907. Mies' quest for "great form" gradually departed from the style of Behrens[462], embracing nature on the site, and three-dimensionality. Mies returned in 1911 to work with Behrens, and then left in 1912 as a competitor in architecting the Kröller-Müller Villa. Siting a house in front of, rather than in, the woods, the studies of Karl Friedrich Schinkel[463] and Frank Lloyd Wright[464] were a larger influence. In 1912, Mies saw the Stock Exchange in Amsterdam architected by Hendrik Petrus Berlage[465] with the attributes of "monumental form".

Less-is-more, manifested as modernism, has been criticized as choosing simplification over unity[466] through the exclusion of parts. Complexities in architecture include[467] the variety of goals, and ambiguity of experi-

[462]The difference between the styles of Mies and Behrens is cited into two projects. "Mies' Bismarck Monument is ... distinguished from Behren's architecture in its relationship to site and to nature. [...] Instead of Behren's opposition of culture and nature, Mies offers continuity, clarification and transformation. Instead of understanding geometry as a sign of transcendent consciousness imposed on matter from above, here it appears from below, as a property of matter, rendered visible through the science of stereotomy and the art of cutting stone. Riehl's monastic teachings may clearly be discerned in this, emphasizing the unity of the physical and psychic, body and soul, as well as the unity of matter and energy. [....] Another crucial difference between Bies and Behrens is evident in their respective conception and handling of space. Siting the Riehl House to one side of the lot gave priority to the space for the garden with its view to the landscape, using the building to mediate the relationship between the occupant and the setting" (Mertins, 2014, pp. 37-40).

[463]Schinkel had designed the Pavilion at Charlottenburg Palace in 1824. Schinkel had a self-professed goal to create "an architecture at once 'complete in and of itself' and tied to the environment both formally and experientially, thus 'making visible the maximum number of connections' between the world of man and the world of nature" (Mertins, 2014, p. 44).

[464]The Kröller-Müller Villa did have a neoclassical rather than prairie style. "As with Wright, the house is conceived as an organism, the parts of which relate freely, functionally and formally to a larger whole. In Behrens' hands such an approach produced a compact and static amalgam of differentiated parts, but with Wright the result was more open and mobile with the site, its irregularity unified through consistent materials and strong horizontal datums" (Mertins, 2014, p. 49).

[465]Berlage emphasized the objective value of geometry and proportion. "Behrens understood 'great' form as pre-given and transcendent, applied as if from above; Berlage's 'monumental' for was materialist in its fullest sense – constructed from unformed matter, arising from below through the act of fabrication, which was contingent to a moment in time and the modes of production that defined it" (Mertins, 2014, p. 51).

[466]Modern architecture was described as having a puritanically moral language. "I have referred to a special obligation toward the whole because the whole is difficult to achieve. And I have emphasized the goal of unity rather than simplification in an art 'whose ... truth [is] in its totality'. It is the difficult unity through inclusion rather than the easy unity through exclusion" (Venturi, 1966, p. 88), with embedded citation to August Hescher, *The Public Happiness*, 1962.

[467]Form and function are interdependent. "First, the medium of architecture must be re-examined if the increased scope of our architecture as well as the complexity of its goals is to be expressed. Simplified or superficially complex forms will not work. [....] Second, the growing complexity of our functional problems

ences. A "difficult whole"[468] embraces a multiplicity of parts that are inconsistent, and potentially in exploits or resolves duality in a whole, in a way that simplification does not. Contradictions include (i) "both-and" phenomena (e.g. closed yet open, simple outside yet complex inside); (ii) double-functioning elements (e.g. multifunctional buildings or rooms with generic purpose rather than separation and specialization at all scales); and (iii) accommodation of inconsistencies in the order (e.g. breaking up orderliness as a strength, rather than a weakness); and (iv) adapting to contradictions (e.g. compromising in disintegration of a prototype). Modernism maintains consistency in order, in points, lines and planes.

More-is-more implicitly opposes the polemic of "less is more". To move the dialectic positions forward, the pursuit of "more" – as an increase in the quantity of output or in the quality that is valued – may be correlated with changes in scale (i.e. larger or smaller), scope (i.e. broader or narrower) and/or speed (i.e. faster or slower, with potentially higher order acceleration or deceleration). The effects of these changes are not monotonically linear (i.e. a relation that can be graphed as a straight line continuously rising or falling). The effects may not only be nonlinear, and could also change as the mix of conditions change. In a highly interconnected and complex world, the convention wisdom that "bigger is better"[469] may mislead. Seeing a system as generative, there are conditions when *more-leads-to-more*, and conditions when *more-leads-to-less*.

When *more-leading-to-more* precedes *more-leading-to-less* over time – a curve that seems like a frown when drawn – the nonlinearity is concave[470]. When *more-leading-to-less* precedes *more-leading-to-more* over time – a

must be acknowledged. I refer, of course, to those programs, unique in our times, which are complex because of their scope ... [Although] the means involved in the program and structure of buildings are far simpler and less sophisticated technologically than almost any engineering project, the purpose is more complex and often inherently ambiguous" (Venturi, 1966, p. 19).

[468]Attaining wholeness at multiple scales was seen as a challenge. "The difficult whole in an architecture of complexity and contradiction includes multiplicity and diversity of elements in relationships that are inconsistent or among the weaker kinds perceptually. [....] If the program or structure dictates a combination of two elements within any of the varying scales of a building, this is an architecture which exploits the duality, and more or less resolves dualities into a whole. Our recent architecture has suppressed dualities" (Venturi, 1966, p. 88).

[469]Global interconnectedness have made paradoxes more central. "The patterns 'more is more' and 'less is less' are the primary ones that have governed our thinking about was and most phenomena in our civilization for so long. The first one is the old familiar line of thinking 'bigger is better'. The second one is also just as familiar: 'weakness leads to weakness'. [....] For the world that functioned as a machine, 'bigger is better' was appropriate. Bigger inputs into the machines (more resources, money, etc.) did lead to bigger desirable outputs (more products, greater productivity, quality of life, etc.). Increasingly today, we find exactly the reverse on every front and level of our society" (Mitroff, 1986a, pp. 326-327).

[470]Another mnemonic for remembering concavity is that the drawing looks like a there's a cave under the line. The smile and frown descriptions add a dimension of human value to the story (Taleb, 2012, pp. 271-272).

curve that seems like a smile when drawn – the nonlinearity is convex. These can both be labelled as *convexity effects*, with the shape of a "smile" as *positive convexity effects* and the shape of a "frown" as *negative convexity effects*. In human exchanges, convexity effects[471] lead to some parties gaining, and some parties losing. If a party invests in a variation with positive convexity, there is more upside than downside. A variation with negative convexity is hurt more by "Black Swan events"[472] due to the occurrence of unexpected outcome that comes with great harm.

Diminishing returns to resources[473] that are well understood in economics can be cross-appropriated to understanding systems more generally. Changes in an ecology[474] may manifest as (i) increasing complicatedness or (ii) increasing complexity. Increasing complicatedness is a replication of parts within an existing level, as an elaboration of structure. Increasing complexity is a change in type, as an elaboration of organization with a deeper hierarchy. Choosing to deepen the hierarchy can lead to greater efficiencies, but requires resources (i) to fuel the reorganization, and (ii)

[471]Convexity effects is a label chosen to include both convexity and concavity. "Why does asymmetry map to convexity or concavity? Simply, if for a given variation you have more upside than downside and you draw the curve, it will be convex; the opposite for the concave. [....] [The] convex likes volatility. If you earn more than you lose from fluctuations, you want a lot of fluctuations" (Taleb, 2012, p. 272).

[472]A *Black Swan* is a large-scale unpredictable and irregular event of massive consequence – unpredicted by an observer. That observer becomes surprised and harmed by a Black Swan event. "*Why is the Concave Hurt by Black Swan Events?* [....] The more concave an exposure, the more harm from the unexpected, and disproportionately so. So very large deviations have a disproportionately larger and larger effect" (Taleb, 2012, p. 273).

[473]Problems with diminishing returns can lead to sociopolitical collapse. "Average and marginal returns are well known in economic theory to follow convex trajectories as the resource is consumed. [....] The diminishing return on average return for resource extraction is intuitive, with moves from poor extraction technology, to adequate technology, and finally to depletion of the resource. Marginal return relates more directly to the decisions as to when to quit, and reflects how much extra resource the society acquires for increases in effort. Marginal return is a higher derivative of average return. When the marginal return is flat, extra effort yields only what extra effort yielded in the immediate past. At that point, even though the actual amount of resource captured increases, extraction is a losing proposition. Societies often go beyond the break-even point on marginal return, because the decision maker has a vested interest in conservative behavior' (Timothy F. H. Allen, Tainter, and Hoekstra, 1999, p. 405).

[474]The complexity described by Tainter in *The Collapse of Complex Societies* is split. "One process of elaboration is of structure. The cost of maintaining an ever more elaborate infrastructure continuously increases as successively harder problems are solved. The other elaboration is of organization. It too is associated with expenditure of resources, in that more highly organized societies cost a lot more to run. It is worthwhile keeping the cost of structural elaboration separate from the cost of organization. The process of structural elaboration is local and is always in the context of a pattern of organization that persists for a given cycle of structural elaboration. A given contextual level of organization itself has a cost that is relatively constant, even over the period of time that structural maintenance costs increase dramatically (Timothy F. H. Allen, Tainter, and Hoekstra, 1999, p. 406).

maintain the overhead of that new level of organization. Decomplexifying a hierarchy into a flatter structure more responsive to local variety is often a challenge, as (i) resources are again required to fuel the reorganization, and (ii) a decentralized or distributed organization may not be viable against a global competitor. Complexified organizations can benefit from high gain resources if they are available,[475] but complicatified (i.e. decomplexified) organizations may enjoy greater sustainability by falling back on low gain resources available locally.

More-leading-to-more is generally associated with a transforming to, and the maintaining of, complexification. When a system becomes unsustainable or is headed towards collapse, continuing on the prior *more-leading-to-more* trajectory fails with a *more-leading-to-less* taking over.[476] The alternative choice of *less-leading-to-more* may come with a transitional cost associated with reorganization, for the potential sustainability at a lower level of overhead in the longer term. Efficiency is a siren's call on a shorter horizon for complexifying; sustainability is a disciplinary foresight on a longer horizon for complicatifying.

Complexity is full of contradictions and paradoxes. Switching from a *more-leading-to-more* history in favour of a *less-leading-to-more* future depends on the context. Three approaches suggest different contexts: (i) schismogenesis; (ii) messes (also known as problematiques); and (iii) wicked problems.

Schismogenesis[477] was originally observed as regenerative or "vicious" circles amongst a community where parties acted in two groups, each one stimulating the other. Schismogenic sequences were classified as (i) *symmetrical schismogenesis*, where mutually promoting actions of each group were essentially similar (e.g. in competition or rivalry); or (ii) *com-*

[475] High gain resources and low gain resources may be available at different points in time. "The decline of high or low gain cycles leads to either extinction of some sort or a switch to the other type of gain. High gain systems use readymade resources, and are so called because the return on effort of gathering the resource is high. Under a high gain regime, something other than the system at hand previously concentrated the resource. Therefore in the right situation the resource is ready for the taking without much need for refining what is gathered. But that right situation does not last because, once the hot spots of resource are dissipated, high gain systems either disappear or they must become low gain. Low gain systems use lower quality resources. Under low gain the resource is so low quality as to require the system to extensively gather much raw material and then refine it. The process of refinement increases the quality of what has been captured so that it becomes high enough quality to be ready for use. High and low gain systems both require fuel of high quality: high gain systems just take it, while low gain systems must make it" (Timothy F. H. Allen, P. C. Allen, et al., 2009, p. 586).

[476] Complex phenomena have issues and paradoxes to be dealt with in four principal categories. Emphasizing each category as generative, the original labels have been slightly modified from (i) more is or leads to less; (ii) less is or leads to more; (iii) more is or leads to more; and (iv) less is or leads to less (Mitroff, 1986b, p. 55).

[477] Research into schismogenesis originated with the Iatmul culture in Bali first published in 1936, and more fully developed in 1949 (Bateson, 1972a).

plementary schismogenesis, where mutually promoting actions of each group were dissimilar but mutually appropriate (e.g. dominant-submissive, exhibitionist-spectator). Modeling interactions as a Von Neumannian game (i.e. competitive game theory) was found to be inappropriate, as (i) players learn and incorporate rules in their character; (ii) value scales are neither simple nor monotone; (iii) games are infinite, and not a tabula rasa at each play; and (iv) players could exit by economic death or boredom. Describing the system qualitatively would look to follow the regenerative (*more-leading-to-more*) and degenerative (*more-leading-to-less*) causal loops of processes and acts.

Managing a mess[478] (i.e. a problematique, as a system of problem) could lead to an intervention where problems are resolved (satisficing), solving (optimizing) or dissolving (removing the problem, in the environment). An approach of *less-leading-to-more* would most likely be associated with dissolving a mess.

A wicked problem[479], by definition, can not be solved, just re-solved over and over again. An approach of *less-leading-to-more* could be implemented, that could be linked to another issue or consequence at a later time.

Innovation learning of less-leading-to-more alongside more-leading-to-more weighs the risks gains and costs associated with reorganizing. If the current design orientation is more-leading-to-more, a rearchitecting to less-leading-to-more could incur short-term transition vagaries with an infrastructural shift. The option of "don't mess with success" may rub against a reality where alternatives and competitors don't feel constrained by legacy systems.

[478]A problem is defined as a situation that satisfies three conditions: "First, a decision-making individual or group has alternative courses of action available; second, the choice made can have a significant effect; and third, the decision-maker has some doubt as to which alternative should be selected. There are three kinds of things that can be done about problems – they can be *resolved*, *solved*, or *dissolved*. [....] To *resolve* a problem is to select a course of action that yields an outcome that is good enough, and that *satisfices* (satisfies and suffices). [....] To solve a problem is to select a course of action that is believed to yield the best possible outcome, that optimizes. [....] To dissolve a problem is to change the nature and/or the environment, of the entity in which it is imbedded so as to remove the problem" (Ackoff, 1981b, pp. 20-21).

[479]Planners were warned to be alert to at least 10 distinguishing properties of wicked problems. (1) There is no definitive formulation of a wicked problem. (2) Wicked problems have no stopping rule. (3) Solutions to wicked problems are not true-or-false, but good-or-bad. (4) There is no immediate and no ultimate test of a solution to a wicked problem. (5) Every solution to a wick problem is a "one-shot opportunity"; because there is not opportunity to learn by trial-and-error, every attempt counts significantly. (6) Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that maybe incorporated into the plan. (7) Every wicked problem is essentially unique. (8) Every wicked problem can be considered to be a symptom of another problem. (9) The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution. (10) The planner has no right to be wrong (Rittel and Webber, 1973).

Open innovation learning of less-leading-to-more alongside more-leading-to-more expands the field of possible reorganizations to collaborations with other organizations. With regulations deterring undisclosed collusions, participating in open sourcing projects can constructively elevate the quality of resources available to all, while enabling each party to capitalize on private sourcing for specific customer sets or stakeholders. Foundations and committees enabling the crossover from open sourcing to private sourcing are minimally skeletal to maintain low overhead.

9.5.4 Hypothesizing for a theory of *open innovation learning-alongside*

A hypothesis for a normative theory for *OIL* with a paradigm of co-responsive movement can be constructed from the three learnings-alongside:

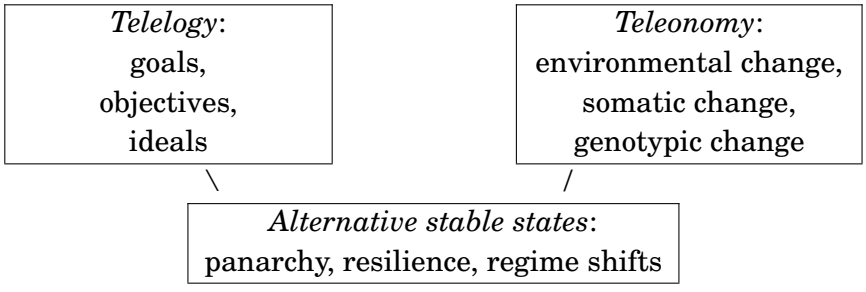
- Hypothesis: *Open innovation learning-alongside* couples agencing strands of (i) polyrhythmia entangling eurhythmia, over (ii) regenerating entangling preserving, and (i) less-leading-to-more entangling more-leading-to-more.

Testing this normative theory for *OIL* could take place in the three emerging cases outlined earlier. The rise of (i) polycentric governance, (ii) the Internet of Things, and (iii) cognitive computing, each provide salient contexts to which agencing strands of polyrhythmia entangling eurhythmia, regenerating entangling preserving, and less-leading-to-more entangling more-leading-to-more are combined and weighed against each other.

9.6 Philosophy of alternative stable states: teleonomy meets teleology

Building a normative theory of *OIL* portends becoming in nature, in the way that child-rearing attempts to be place young learners on the right path: enfolding seeds for development may or may not later unfold as fruit. Becoming preceding being. Philosophically, there's an opportunity for teleonomy to learn from teleology. A larger context in which to consider these philosophies is in the science of alternative stable states, from ecology, shown in Table 9.5.

Table 9.5. Teleonomy learns from teleology



Teleology is the branch of philosophy that explains natural phenomena by their end or purpose. Of Aristotle's four causes[480], it emphasizes final cause. Human systems can be described at teleological[481], with purposeful systems as ideal-seeking and purposive systems as goal-seeking, recognizing human will. In the study of organizations as systems, choices can be made on different outcomes on a variety of time horizons[482]: (i) a goal is a preferred outcome within a specified time period; (ii) an objective is a preferred outcome obtainable in a longer time period; and (iii) an ideal cannot be obtained within any time period, but is worth pursuing. From the perspective of living systems, however, teleology has been criticized[483] for an inference that the end design of an organism at some future time can be foreseen in advance.

Theories of biological evolution recognize three types of change[484]: (i) environmental change; (ii) somatic (cellular) change; and (iii) genotypic change. recognizes both generational and adaptive change in response to the environment. These three types are illustrated in an example of a person accustomed to sea level atmospheres being moved up to high altitudes, resulting in an elevated heart rate and panting. An environmental change would see the person descending from altitude, so that symptoms of stress would immediately reverse. A somatic change would see the person's body acclimatizing to the thinner atmosphere, with mul-

[480]Aristotle offered four explanations of *why* in four causes: (i) material cause (that out of which); (ii) the formal cause (the account of what it-is-to-be); (iii) the efficient cause (the primary source of change or rest; and (iv) the final cause (the end, that for the sake of which a thing is done".

[481]Human systems can have purpose, whereas machines can be programmed for function (Ackoff and F. E. Emery, 1972). Individuals can be purposeful in pursuing ideals; groups can be purposive in pursuing a joint goal (F. Emery, 1977).

[482]In a more formal specification, "A *purposeful system* is one which can produce the same outcome in different ways in the same (internal or external) state and can produce different outcomes in the same and different state. Thus a purposeful system is one which can change its goals under constant conditions; it selects ends as well as means and thus displays will" (Ackoff, 1971, p. 666). In a more practical reinterpretation, the "specified time period" can be a fiscal planning cycle (e.g. annual plans) (Ackoff, 1981a).

[483]Causality in biology can suffers either from a mechanistic interpretation, or a vitalistic theory. Neither describes life beyond physical and chemical phenomena. "Thinkers from Aristotle to the present have been challenged by the apparent contradiction between a mechanistic interpretation of natural processes and the seemingly purposive sequence of events in organic growth, reproduction, and animal behavior. Such a rational thinker as Bernard (1885) has stated ... 'We admit that the life phenomena are attached to physicochemical manifestations, but it is true that the essential is not explained thereby; for no fortuitous coming together of physicochemical phenomena constructs each organism after a plan and a fixed design (which are foreseen in advance) and arouses the admirable subordination and harmonious agreement of the acts of life .... Determinism can never by [anything] but physicochemical determinism. The vital force and life belong to the metaphysical world" (Mayr, 1988a, pp. 29-30).

[484]Towards a general theory of evolution, there is resistance against Lamarckian inheritance, where somatic changes or changes in environments could led to genotypic change (Bateson, 1963, p. 529).

tiple organs attaining homoeostasis by responding to or increasing the overall flexibility of the organism. A genotypic change could occur over generations of people[485] living at high altitudes, where natural selection assimilates acquired characteristics.

Teleonomy has been defined specifically for goal-directed processes in organisms. *A teleonomic process or behavior is one which owes its goal-directedness to the operation of a program*[486]. Goal direction is implied, but with a dynamic process rather than a static condition. The program may originate through lucky macromutation, a slow process of gradual selection, or even through individual learning or condition as in open programs. A *program* might be defined as *coded or prearranged information that controls a process (or behavior) leading it toward a given end*[487]. Teleonomic processes can be controlled by closed programs (e.g. in the DNA of the genotype) or open programs (e.g. incorporating additional information acquired through learning, conditioning, or experiences).

A theory of alternative stable states has been developed in ecology, from two heritage research streams[488]. Ecologists often take advantage of studying lakes that are geographically proximate: one lake may have settled into a flourishing stable state with a vigourous population of fish and vegetation, while another lake nearby has settled into a dead stable state in a poverty trap of low oxygen (i.e. hypoxia) and hypertrophication (e.g. oversupply of phosphates or sewage). Stable states are commonly depicted with ball-in-cup diagrams, where (at least) two basins are available in which the ball can rest. A small perturbation may move the ball within the basin, retaining its current stable state. A large perturbation may move the ball out into another basin, into a new stable state. Having become stable in the new state, a reverse perturbation may or may not result in a return to the original stable state.

[485]Genotypic change through natural selection requires decimation of the population who are not sufficiently somatically flexible in the new environment. If the conditions present unpredictability and often (e.g. 2 to 3 generations), somatic change is more economical to biology (Bateson, 1963, pp. 535-537).

[486]In his earlier 1961 writing, Mayr had proposed a definition that restricted "the term teleological rigidly to systems operating on the basis of a program, a code of information". He later modified the definition to permit better operational definition to consider activities, i.e. processes (like growth) and active behaviors (Mayr, 1988b, p. 45).

[487]The term program is taken from information theory, where a computer may act purposively when given appropriate instructions. The program contains not only the blueprint, but also the instructions on how to use information in the blueprint (Mayr, 1988b, p. 49).

[488]Empirical support for the idea of alternative stable states has captured since the 1970s. Two contexts were brought together in a new theoretical development: (i) from population ecology, the environment is regarded as fixed, and the community organizes within a variety of stable configurations; and (ii) from ecosystem ecology, changes in the environment effect the state of the community. Both contexts can be described in terms of resilience and hysteresis (Beisner, Haydon, and Cuddington, 2003).

The research stream from community ecology focuses on changes in state variables (e.g. population densities). As an example in fish population, there may be one stable state where harvesting is supported by a high birth rate, and then an alternative stable state where harvesting is not supported due to the dominant death rate. There's a boundary middle ground where the state is not stable. In another example where there are multiple species in a lake, there may be one stable state where two species coexist, and then another stable state where one population outcompetes the other. In a ball-in-cup depiction, the community moves from one basin to another, with intermediate positions leading the ball away from that middle ground.

The research stream from ecosystem ecology has focused on changes to the parameters governing interactions within an ecosystem. As an example in Africa, both woodlands and grassy open savannahs are stable states[489]. Woodlands are not eliminated by herbivore grazers, but can be destroyed by humans and/or high densities of elephants, leading to an almost irreversible loss of forests. The landscape (as the environment) is considered to be constant, and parameters of the living biota change (e.g. birth rates, death rates, carrying capacity). In a ball-in-cup depiction, the landscape on which the ball sits alters, so the ball moves.

The theory of alternative stable states is a foundation for panarchy and resilience science. In panarchy, social ecological systems exist and function at multiple scales of time, space and social organization in nested hierarchies. Resilience science is associated with adaptive capacity in the ecosystem to deal (or not deal) with changes in the environment. With alternative stable states, research into regime shifts – as large, abrupt, persistent changes in the structure and function of system – is being conducted on a wide variety of domains.

Private sourcing can be seen as the dominant regime for business in the 20th century, with a variety of organizations competing to establish primacy in one of many stable states. Open sourcing rose only in the late 1990s, as a regime initially independent of commercial interests, operating in a stable state with a relatively low level of energy. *OSwPS* in the first decade of the 21st century created a new landscape with injections of enterprise-scale resources, that organizations could choose to embrace or to reject.

The nature in teleonomy battles with human interventions in teleology. *OSwPS* may have been most prominent with IBM as a pioneer, but after 2011 has become a not-uncommon way of working. Timing is everything. More formally, the ancient Greek poet Hesiod, wrote[490] "Observe

[489]In addition to the example of woodlands and savannahs as stable states, shifts in lakes, coral reefs, deserts and oceans have been observed (Scheffer et al., 2001).

[490]This translation of Hesiod (circa 750-650 B.C.) at line 694 in Works and Days may not be the preferred scholarly interpretation, but a popular one entering

due measure, for right timing is in all things the most important factor". Organizations may choose to extend their heritage of private sourcing only (*PSo*), or to include open sourcing in their practices by its associated changes in governance. Leaders and policy makers can choose between protecting the past from the future[491], or protecting the future from the past.

Barlett's Familiar Quotations by 1968. Another translation by Hugh G. Evelyn-White in 1914 reads "Observe due measure: and proportion is best in all things".

[491]Tim O'Reilly criticizes companies that initially created value for a whole ecosystem of industry players, but then fail to continue to create value. "Policy makers need to focus on protecting the future from the past, rather than protecting the past from the future. Most of the policy that we see is oriented towards protecting incumbents, because of course they have the loudest voices . . . " (O'Reilly, 2012, 40m05s).

A. The phenomena of interest – seven case studies

Detailed histories of the cases highlighted in Chapter 4 follow in the next seven sections.

A.1 Case: Integrating-development (IDEs)

The first case study centers on productivity in software development. Developing software is one of the purer forms of knowledge work, with pressures to maintain delivery speed and quality in a competitive marketplace. Improving the practice of software development can involve better tools, better trained individuals and/or better enablement of collective work. IBM was founder of the community now governed by the Eclipse Foundation, participating in both open sourcing and private sourcing activities.

Through the 1990s, software development was shifted from personal computing and client-server computing towards Internet technologies [in subsection A.1.1]. IBM purchased a company in 1996 leading to a private sourcing Java Integrated Development Environment (IDE) in 1998 [in subsection A.1.2]. The IDE was offered as open sourcing in the formation of the Eclipse Consortium in 2001 [in subsection A.1.3]. The consortium was reorganized into the not-for-profit Eclipse Foundation in 2004 [in subsection A.1.4]. Eclipse has become the core to many of the strategic private sourcing software assets offered as commercial offerings by IBM [in subsection A.1.5]. Eclipse continues to have bright prospects for both open sourcing and private sourcing [in subsection A.1.6]

The Eclipse initiative has generally been regarded as an exemplar of ways in which the open sourcing community can work together with commercial businesses.

A.1.1 Context: In the mid-1990s, software development tools were coupled to target platforms

In the development of computer software, programming application logic is only part of the job. Computer applications are developed on top of software platforms with application programming interfaces (APIs) to interoperate with other routines (e.g. graphical user interfaces, mathematical libraries), data structures (e.g. query, transactional and storage engines) and protocols (e.g. synchronous or asynchronous calls to other programs and/or devices). The productivity of software developers can be improved through abstraction, i.e. not programming at the level of machine code, but instead taking advantage of APIs. The rise of client-server computing in the early 1990s and network computing over the Internet in the late 1990s coincided with software developers shifting from APIs provided by an operating system to an abstract layer called middleware. Having middleware between application software and the operating system allows programmers to connect alternative software components that provide similar functions. As an example, while SQL (Structured Query Language) is common across relational databases, the specific implementation by each software vendor has nuances from which each programmer could be shielded.

IBM has had an ongoing interest in interoperability across the variety of computer platforms, as (i) customers typically have a legacy of technology from multiple vendors and sources, and (ii) IBM has a heritage of offering multiple hardware and operating systems platforms as options to customers. Few companies have the luxury of developing their information technologies de novo or performing "rip and replace" by decommissioning old systems with new ones. Reducing the backlog of application development drives an interest in productivity of software developers, with the rise of integrated development environments (IDEs). In the mid-1990s, two camps emerged: one around Microsoft technologies (e.g. Visual Studio, COM and .NET) and one around Java technologies encouraged by IBM and Sun. IBM's interest in IDEs was motivated by the potential for a common platform.

> This landscape actually contained two worlds: one centered on tools that enabled Microsoft's directions on runtime execution support, the other focused on a more open industry approach centered on the Java platform. Confident that a more open approach to IT was the best way to ensure its customer's long-term success, IBM saw Java development tooling as key to enabling growth in the open community. So its goal at the time was to bring developers closer to Java-based middleware.
>
> We wanted to establish a common platform for all IBM develop-

> ment products to avoid duplicating the most common elements of infrastructure. This would allow customers using multiple tools built by different parts of IBM to have a more integrated experience as they switched from one tool to another. We envisioned the customer's complete development environment to be composed of a heterogeneous combination of tools from IBM, the customer's custom toolbox, and third-party tools. This heterogeneous, but compatible, tool environment was the inception of a software tools ecosystem (Cernosek, 2005).

At the foundation of this revolution was Java, originating not from IBM but from Sun Microsystems. Evolving from the Oak object-oriented programming language targeted for distributed mobile devices, Sun Microsystems released Java 1.0 on the Internet in January 1995 (Bank, 1995). IBM first starting working with Java on internationalization in 1996, through the Taligent team that was down the street from Sun's offices (Werner, 1999). With the rise of e-business, IBM adopted and invested heavily in the open approach with Java. IBM licensed the Java Virtual Machine (JVM) source code from Sun.[1] By 1997, it created an IBM JVM, and ported it to the IBM operating systems (i.e. AIX, OS/2, OS/400, OS/390) and Microsoft Windows.

Built on top of a runtime engine, the Eclipse Platform is written in Java with a plug-in architecture that includes a manifest, extension points and extensions to extension points (Des Rivières and Wiegand, 2004). Architecturally, the IBM Network Computing Framework for e-business announced in April 1997 was implemented on three tiers – client, application server, and data/transaction server (Gottschalk, 1998). An implementation of IBM's Enterprise Server for Java specification into the WebSphere Application Server product (Bayeh, 1998). For Independent Software Vendors (ISVs), the San Francisco framework provided a distributed object-oriented infrastructure and common business objects mostly built in Java (Rubin, Christ, and Bohrer, 1998).

A.1.2 (a) Private sourcing: Java IDE from OTI

The evolution to Java was associated with the movement by most in the information technology industry – including IBM – towards object tech-

[1] The distribution of IBM JVM was originally restricted to platforms where Sun didn't compete. This is explained in a developerWorks response in August 2010: "Unfortunately you can get hold of the JDK only as part of another IBM product (say, WebSphere or any Rational) that you purchased. Our licensing agreement with Sun/Oracle forbids us from providing direct downloads of the IBM JDK on any platforms that Oracle/Sun also support (namely Windows and Linux). If you look at the Java downloads section of the developerWorks website, you'll only find SDKs for AIX, z/OS and Linux on System p/z, since those are IBM owned platforms that Oracle doesn't support."

nologies. Object technologies were seen as a way to improve development productivity, reduce maintenance effort and provide greater consistency throughout the software life cycle (Radin, 1996). Wasted effort from incommensurability amongst method approaches led to cooperation by technology leaders (i.e. Booch, Rumbaugh, and Jacobsen joining forces in 1994 and 1995) towards unity. In 1997, the Unified Modeling Language led to standardization in model elements, notation and guidelines, while supporting flexibility in programming languages, tools and process (O. M. Group, 2000).

IBM's lead product in object technologies was the VisualAge Smalltalk product, introduced in 1994. This product was often complemented by Envy/Developer group collaboration tool from Object Technologies International (OTI) (Steinman and B. Yates, 1992). OTI was one of the pioneers with the Smalltalk language, having emerging from university research at Carleton University since 1984 (D. A. Thomas, 1985). IBM acquired OTI in 1996 as a wholly owned subsidiary.[2] With this expertise, IBM introduced the VisualAge for Java product – an alternative to coding directly in the Java Development Toolkit – in summer 1997 (Chamberland, Lymer, and Ryman, 1998). VisualAge for Java was an Integrated Development Environment in built on a Smalltalk virtual machine. In 1999, a related product with a Java virtual machine was introduced as VisualAge Micro Edition, targeted at embedded devices (Wolfe, 1999).[3]

While object technologies are taken for granted in the 21st century, they represented a major paradigm shift in the 1990s. The object technology community included commercially-funded researchers, academics and independent software engineering experts in a small and influential network. While IBM was producing private sourcing products, the tools were targeted both at enterprise customers for in-house development and independent vendors who might extend the platform. Interpersonal relationships developed over many years, through venues such as the OOPSLA conferences sponsored by the ACM.[4]

A.1.3 (b) Open sourcing: Eclipse Consortium

By 1999, IDEs for personal computing and client-server had matured, but the tools in common use in embedded devices (e.g. mobile phones,

[2] "OTI was acquired by IBM in 1996, and operated as a wholly owned subsidiary for seven years. In 2003, OTI transitioned to become a full part of IBM with the formation of the new IBM Ottawa Software Lab."

[3] In the transition from Smalltalk to Java, "OTI developed what was called the UVM (or Universal Virtual Machine) which could execute both Smalltalk and Java byte-codes, and used Smalltalk to implement the Java primitive functions which were implemented in C in the Sun JVM"(DeNatale, 2008).

[4] OOPSLA – Object-Oriented Programming, Systems, Languages and Applications – was seeded in 1985, and continues as a major event.

personal digital assistants (PDAs), television set-top boxes) were still nascent. Software for embedded devices is generally coded on personal workstations with an emulator, with programs subsequently transferred to the physical hardware for execution.

> In 1999, in addition to the variety of IDEs jerry-rigged out of a combination of command line interfaces and various Microsoft and Unix windowing kludges, three offered the potential of becoming the de facto industry IDE: Integrated System's Prisim+ [sic], Wind River's Tornado and IBM's VisualAge Micro Edition. [...] By 2004, everything had changed. IBM open-sourced Visual Age Micro Edition as Eclipse, Wind River acquired ISI and abandoned further development [sic] its TCL backplane in favor of Eclipse (Cole, 2009).[5]

The movement towards standardization would not only consolidate effort in the domain of resource-constrained embedded devices, but also in personal computers connecting to servers in the emerging Internet. "Scaling up" from embedded devices – constrained in connectivity, working memory and persistent storage – is simpler than "scaling down" from more powerful computing environments by stripping out functions. In networks of computers and intelligent devices, compatibility in protocols and interfaces requires bilateral or multilateral coordination.

In a world of networked computing, success relies on cooperation with other technology developers. IBM was a key driver in the formation of the Eclipse Consortium in 2001.

> We knew that a vibrant ecosystem of third parties would be critical for achieving broad adoption of Eclipse. But business partners were initially reluctant to invest in our (as yet unproven) platform. So in November 2001, we decided to adopt the open source licensing and operating model for this technology to increase exposure and accelerate adoption. IBM, along with eight other organizations, established the Eclipse consortium and eclipse.org. Initial members included (then-partners) Rational Software and TogetherSoft, as well as competitors WebGain and Borland. Membership in the consortium required only a bona fide (but non-enforced) commitment to

[5] While pRISM+, Tornado and VA Micro Edition might have been used to achieve the same end, they presumed different technologies: "What all three had in common was an easy to use 'software backplane' into which developers with a minimum of programming effort could plug the various tools needed to do code development quickly and efficiently on each vendor's RTOS [DI's note: real-time operating system]. ISI used the Common Object Request Broker Architecture (CORBA) as its common API. Wind River used an object module format built around the very C-like Tool Command Language (TCL). Somewhere in the middle in terms of complexity and ease of use was IBM's VisualAge which used a Java-based object-oriented software backplane" A holdout continuing on a private sourcing approach until 2009 was Texas Instruments (Cole, 2009)).

> Eclipse to use it internally, to promote it, and to ship a product based on it.
>
> The consortium's operating principles assumed that the open source community would control the code and the commercial consortium would drive 'marketing' and commercial relations. This was a new and interesting application of the open source model. It was still based on an open, free platform, but that base would be complemented by commercial companies encouraged to create for-profit tools built on top of it. Most of the committers and contributors to Eclipse came from a short list of the commercial vendors, with IBM being the largest contributor of both content and financial and staff resources (Cernosek, 2005).

The formation of a consortium decoupled the creation and maintenance of products (i.e. software assets) from extensions, redistribution and application of derivative offerings. This consortium, as a newly formed industry organization, relied on the largesse and goodwill of corporations.

> Industry leaders Borland, IBM, MERANT, QNX Software Systems, Rational Software, Red Hat, SuSE, TogetherSoft and Webgain formed the initial eclipse.org Board of Stewards in November 2001. By the end of 2003, this initial consortium had grown to over 80 members [6]

The Eclipse Consortium served as a common ground on which organizations could collaborate and mutually learn about working in open sourcing. IBM granted its contributions of software code to the open sourcing community under the IBM Public License, meeting the requirements of the Open Source Initiative[7]. Borland released its database product under the Interbase Public License.[8] QNX manages three types of licenses for (i) commercial developers, (ii) partners, and (iii) end users.[9] In May 2001, the IBM Public License was superseded by the Common Public License, so that parties other than IBM could apply those terms and conditions.[10]

[6]The Eclipse Consortium is noted as a progenitor of the Eclipse Foundation.

[7]The IBM Public License is published on the Internet (IBM 1999), and recognized and reproduced by the Open Source Initiative.

[8]The Interbase Public License was for a relational database product that has been spun off to Embarcadero Technologies.

[9]The three QNX developer licenses are: "(1) the QNX Commercial Software License Agreement ("CSLA"), for commercial developers; (2) the QNX Partner Software License Agreement (PSLA"), for members of the QNX eco-system; and (3) the Non-Commercial End User License Agreement ("NCEULA"), for non-commercial developers, including evaluators, hobbyists, students and academic faculty members".

[10]The Common Public License encouraged licensors to consider uniformity, as variety in licensing terms tend to benefit lawyers more than licensees. In the FAQ published June 1, 2002, "The CPL was written to generalize the usage terms of the IPL so that any open source originator could use the terms found in the IPL . Thus, the CPL is suitable to be used by all."

Colloquially, Eclipse has become commonly used as a label not only for the Eclipse platform (i.e. Integrated Development Environment) and the library of software code, but also the organization stewarding the open sourcing community, and the eclipse.org web site.

A.1.4 (c) Open sourcing: Eclipse Foundation

In the two years following the formation of the Eclipse Consortium, membership had grown to 80 members.[11] Adoption of the Eclipse platform at academic institutions was encouraged by the granting of Eclipse Fellowships sponsored by IBM, initially to 9 universities in 2002, and subsequently 270 researchers between 2003-2006.[12]

With IBM was a founding member and continuing strong contributor, the independence of the Eclipse initiative continued to raise skepticism by some parties. In cooperation with the other stewards of the consortium, IBM guided the organizational definition through a transformation.

> By 2003, the first major releases of Eclipse were well-received and were getting strong adoption by developers. But industry analysts told us that the marketplace perceived Eclipse as an IBM-controlled effort. Users were confused about what Eclipse really was. This perception left major vendors reluctant to make a strategic commitment to Eclipse while it was under IBM control. If we wanted to see more serious commitment from other vendors, Eclipse had to be perceived as more independent – more decoupled from IBM.
>
> So we began talking to others about how a more independent concern could take control of Eclipse so as to eliminate this perception. Working with these companies, we helped formulate and create the Eclipse Foundation. We then announced the new foundation, just in time for EclipseCon 2004, as a not-for-profit organization with its own independent, paid professional staff, supported by dues from member companies (Cernosek, 2005).

[11] The figure of 80 members at the end of 2003 is cited in the Eclipse history. In a press release at the end of 2002, the membership of 30 is listed: "The thirteen new member companies and organization that have joined the Eclipse Consortium since September include: AltoWeb, Catalyst Systems, Flashline, Hewlett Packard, ETRI (the Korean information technology research institute), MKS Software, Oracle, Parasoft, SAP, SlickEdit, Teamstudio, Timesys and OMG, the Object Management Group. They join members: Fujitsu, Hitachi, Ltd., Instantiations, Inc., MontaVista Software, Scapa Technologies Limited, Serena Software, Sybase, Telelogic, Trans-Enterprise Integration Corp. and founding members Borland, IBM, MERANT, QNX Software Systems, Rational Software, RedHat, SuSE, and TogetherSoft in providing ongoing support for Eclipse open-source projects."

[12] In 2002, the first 9 nine Eclipse Fellowships at Oregon Health and Science University, University of Aarhus, Queensland University of Technology, Monash University, Carleton University, University of British Columbia, University of Washington, Ecoles des Mines de Nantes, and Northeastern University, Boston, MA, USA. Between 2003-2006, 270 awards were granted.

On February 2, 2004, the Eclipse Consortium was reorganized into the not-for-profit Eclipse Foundation.

> The Eclipse Board of Stewards today announced Eclipse's reorganization into a not-for-profit corporation. Originally a consortium that formed when IBM released the Eclipse Platform into Open Source, Eclipse is now an independent body that will drive the platform's evolution to benefit the providers of software development offerings and end-users. All technology and source code provided to this fast-growing ecosystem will remain openly available and royalty-free.
>
> With this change, a full-time Eclipse management organization is being established to engage with commercial developers and consumers, academic and research institutions, standards bodies, tool interoperability groups and individual developers, plus coordinate Open Source projects. To maintain a reliable and accessible development roadmap, a set of councils – Requirements , Architecture and Planning – will guide the development done by Eclipse Open Source projects. With the support of over 50 member companies, Eclipse already hosts 4 major Open Source projects that include 19 subprojects (Eclipse Foundation, 2004).

In addition to change in the organizational form, the maturity of the Eclipse initiative from 2004 can be seen in three ways: (i) the cooperative relationships amongst parties; (ii) the quantity of artifacts it produces; and (iii) the services it provides.

Eclipse has four types of memberships for organizations, and one for individuals: (i) "*Associate Members* are organizations that participate in, and want to show support for, the Eclipse ecosystem". (ii) "*Solutions Members* are organizations that view Eclipse as an important part of their corporate and product strategy and offer products and services based on, or with, Eclipse. These organizations want to participate in the development of the Eclipse ecosystem". (iii) "*Enterprise Members* are organizations that rely heavily on Eclipse technology as a platform for their internal development projects and/or act strategically building products and services built on, or with, Eclipse. These organizations want to influence and participate in the development of the Eclipse ecosystem". (iv) "*Strategic Members* are organizations that view Eclipse as a strategic platform and are investing developer and other resources to further develop the Eclipse technology". (v) "*Committer Members* are individuals that are the core developers of the Eclipse projects and can commit changes to project source code" [13]. At 2010, the membership pages list 75 associate members, 77 solutions

[13]The membership structure for the Eclipse Foundation is similar that from the Eclipse Consortium. "Solutions Members were previously known as 'Add-In Providers'".

members, 3 enterprise members (Cisco, Motorola and Research In Motion), and 14 strategic members (including IBM). Committers, who have write access to the repositories and content on the Eclipse Foundation's web site, are nominated by other committers on a project. Additional privileges as a Committer Member includes eligibility to vote for Committer Representatives on the Eclipse Board of Directors.

At the end of 2003, the repository of open sourcing artifacts had a strong track record of growth. The Eclipse platform had advanced from release 1.0 to release 3.0. In addition, 17 open technology projects on tools, research and development and web application-oriented tools were hosted on the web site. Over 18 million download requests had been served in the first two years of operation (Eclipse Consortium, 2003).

The Eclipse Foundation provides four services: (i) IT infrastructure; (ii) intellectual property management; (iii) development community support; and (iv) ecosystem development. *IT infrastructure* includes code repositories, databases, mailing lists and newsgroups, download site and web site. *Intellectual property management* includes (i) due diligence in ensuring contributions under the Eclipse Public License, and (ii) approvals of all contributions originally developed outside the Eclipse development process for inclusion into an Eclipse process. The Eclipse Public License announced in 2004 was evolved from the Common Public License with the agreement steward changed from IBM to the Eclipse Foundation.[14] *Development community support* coordinates the release train for participating projects with integration testing to surface cross-project issues before final release, and assists new project startups. *Ecosystem development* encourages commercial products based on the Eclipse platform, training and services providers, and cooperative marketing events such as conferences.[15]

The formation of the Eclipse Foundation as an independent not-for-profit entity and the establishment of the Eclipse Public License clarified organization in the open sourcing community. Eclipse is, however, not the only camp in the open sourcing world. Sun Microsystems – the originator of Java – is conspicuous in its absence from Eclipse.

While Java was at the foundations of the inception of the Eclipse Consortium, open sourcing means different things to different people. In order to strengthen its portfolio, Sun Microsystems acquired the Netbeans tool company in 1999, and released the software under the Sun Public License (as a variant of the Mozilla Public License) in June 2000.[16] In "An Open

[14]The Eclipse Public License also handled some rewording to address concerns about the way the Common Public License handled possible patent litigations.

[15]The services provided by the Eclipse Foundation are further detailed.

[16]The history of Netbeans and the Sun Public Licensing at Netbeans.org is described by (Fox, 2001). Since January 2007, the Netbeans licenses were changed to a combination of the Common Development and Distribution License (as recognized by the Open Source Initiative) and GNU General Public License version 2.1 and GNU Public License version 2.

Letter to the Eclipse Membership" in January 2004, Sun declared its choice to not transition to the Eclipse platform, in favour of its own Integrated Development Environment based on Netbeans. This was positioned not as opposition to the Eclipse organization, but an alternative path in the interest of competition and diversity.

> Competition and technical diversity are not equivalent to fragmentation, as some would define it. In the process of your [Eclipse organization's] achievement, you've shown that competition and diversity have in fact helped win over more developers and software vendors to the Java platform, and further demonstrated its staying power and value. Technical diversity is always beneficial when it's aligned with accepted standards. And, regarding alternative GUI technologies, Sun is even working to ensure effective standards-based interoperability there as well (Sun Microsystems, 2004).

The choice to not merge code bases is not inconsistent with the open sourcing spirit, and the pledge towards standards-based interoperability reflects an attitude of cooperation. This alternative path underscores the position that commercial enterprises – i.e. with IBM and Sun as examples – can simultaneously pursue open sourcing and commercial approaches in different ways.

In a reflection from 2005, IBM lauded the transition from Eclipse Consortium to Eclipse Foundation.

> The move has been a success. The new and independent Eclipse Foundation shipped Eclipse 3.0, and soon afterwards, Eclipse 3.1; both were received with even higher degrees of interest and adoption rates than the prior version. Soon afterwards, Eclipse 3.1 was released to resounding interest. We've seen dramatic growth in membership at all levels, and a deeper commitment by all independent tools vendors and most platform vendors. The Eclipse Foundation and its members made a number of announcements at EclipseCon 2005, including the emergence of powerful Eclipse projects such as Rich Client Platform, Web Tools Platform, Data Tools Platform, Business Intelligence Reporting Tool, and a dramatically reduced level of fragmentation in our efforts.
>
> We've seen exciting levels of growth in Eclipse commitment and support. There are now twelve strategic developer member companies, each of whom commits at least eight full-time developers and up to $250,000 annually to the Eclipse foundation. The Eclipse Foundation also has four strategic consumers who also make a similar economic commitment. There are sixty-nine companies serving as add-in providers, and another thirteen associate member companies. If you peruse the software industry, you'll find hundreds of commer-

cial plug-ins and products for Eclipse. Eclipse is now the industry's major non-Microsoft software tool platform (Cernosek, 2005).

While IBM benefits from cooperation within the Eclipse Foundation and continues as a strategic member, it is only one of many parties who continue to guide its direction. This open sourcing community would not have come into being without IBM's initial support, yet needed its independence in order to sustain credibility. The Eclipse foundation hosts open sourcing assets on a phublic web site, communicates is services and missions in an open sourcing style, and encourages memberships according to the needs and resources available to organizations and individuals. Eclipse is a leading example of open sourcing working in both business and wider social contexts.

A.1.5 (d) Private sourcing: Eclipse Platform in IBM Products

In 1999, VisualAge Micro Edition was the Java-based IDE originally targeted for mobile devices. This became the foundation not only for open sourcing Eclipse, but the private sourcing IBM products. In December 2002, the IBM WebSphere Studio Application Developer built on Eclipse replaced the VisualAge for Java product.[17] After IBM acquired Rational Software in 2003, the product would evolve into the Rational Application Developer in 2004 and subsequently-related software development products.[18] Software offerings from the Rational brand are clearly are clearly private sourcing products that are licensed to customers under an International Program License Agreement (IPLA).[19] The use of the Eclipse platform at IBM is strong within the Rational brand, and has been extended to other brands (e.g. WebSphere, Tivoli, Lotus).[20] When IBM acquires a company to expand its software portfolio, products are often

[17] WebSphere Studio Application Developer v5.0 was the first release on Eclipse, offered as an upgrade to VisualAge for Java in Announcement Letter 202-330 on December 3, 2002.

[18] In the FAQ, Rational Software Development Platform takes "advantage of the Eclipse Modeling Foundation, the Hyades test foundation, and other Eclipse features" that "allows you the broadest integration of both IBM and best-of-breed third party tools throughout the lifecycle"; "provides an open, modular framework for the entire development team", "improves productivity and team cohesion", and "provides consistent, simplified, seamless user experience across products for each member of the development team".

[19] IBM software licenses are founded on the IPLA, and may be extended upon negotiation.

[20] Rational brand products based on Eclipse include Rational Software Modeller, Rational Software Architect, Rational Application Developer, Rational Web Developer, Rational PurifyPlus, Rational Functional Tester, Rational Manual Tester, Rational Performance Tester. In other brands, WebSphere (Business Integration Modeller and Monitor) and Tivoli (Configuration Manager, Monitoring) were earliest in adoption (Cernosek, 2005). In recent years, the foundation of Eclipse in products from the Lotus brand (e.g. Lotus Notes, Lotus Symphony) has been prominent.

extended, migrated, or replatformed onto Eclipse.[21]

The Eclipse platform and Java environment are so much at the core of IBM's development activities as to be nearly invisible. A search on "eclipse" at the Jobs at IBM web site brings up pages of opportunities for full time and student positions, across IBM divisions around the world.[22] The IBM developerWorks site has its own section on Java technology, with pointers to standards (i.e. at jcp.org for the Java Community Process that develops Java Specification Requests), online discussion forums, events, and training.[23] At IBM alphaWorks, where IBM releases emerging technologies to developers, the Eclipse platform is common.[24] In 2010, IBM was simultaneously encouraging an Enterprise Generation Language (EGL) both as a private sourcing product and proposing an open sourcing project at the Eclipse Foundation.[25]

Cooperation in the Eclipse Foundation with other companies can result in arrangements amongst selected parties for mutual benefit. As an example, Actuate was a founder and co-leader of the Eclipse BIRT (Business Intelligence and Reporting Tools) open sourcing project.[26] In parallel with software assets under the Eclipse Public License, Actuate offers commercial products under the Actuate Software License and Services Agreement.[27] The basic BIRT Reports Designers is downloadable at no charge from the Actuate web site, with Designer Professional and BIRT iServer as upgrade products under the commercial license.[28] The plug-in structure of the Eclipse platform enables open sourcing components to interoperate with Actuate-licensed (and IBM-licensed) components. IBM and Actuate are partners in marketing to financial services customers, on

[21]As an example, IBM acquired Telelogic in 2008, and has gradually been migrating its products to the Eclipse platform. Telelogic has a history of membership in the Eclipse Foundation, and had acquired other software companies who had not initially developed on the Eclipse platform.

[22]On August 1, 2010, Jobs at IBM were listed for IBM Software Group, IBM Global Business Services, IBM Systems and Technology Group and IBM Research, in the United States, Canada, UK, China, Taiwan, Ireland, France, Brazil, Argentina and Romania.

[23]The Java technology section of IBM developerWorks is at the same level as a section on Open Source.

[24]A search on "eclipse" at the IBM alphaWorks site in August 2010 brought up three projects.

[25]IBM has technical descriptions of Rational Business Developer product, with an online community. The proposal for an EGL development project is at the Eclipse Foundation.

[26]Contributions from Actuate to the Eclipse Foundation have been notable since 2004.

[27]The Actuate licenses are described as "shrinkwrap".

[28]While creating reports is a common basic business activity, extended features such as the development of interactive data visualizations and/or distribution of reports inside and outside a firewall are likely to benefit from more than volunteer support. Actuate has a portfolio of BIRT products.

integration and support on IBM middleware, and on IBM servers.[29]

A.1.6 Prospects: Eclipse is a popular foundation for both open sourcing and private sourcing software development continuing with momentum

The Eclipse story is an exemplar of how companies can work together with an open sourcing community. The assets are readily available for access, distribution and reuse with minimal bureaucracy. Over nearly a decade, the commitment by IBM and other organizations has been strong.

A.1.6.1 The Eclipse community has a repository of vital open sourcing assets that continue to grow

The list of projects hosted by the Eclipse Foundation is readily available on the Internet.[30] A project can originate from any community member, with a few rising to industry-shaping significance.

- The *Eclipse Platform* was a founding project at 2001, evolving to become the Rich Client Platform in June 2004.[31] Subprojects include JDT (Java Development Tools), PDE (plug-in Development Environment), and e4 (a next-generation platform for pervasive, component-based applications and tools).
- The *Eclipse Tools Project* also started in 2001 includes programming compilers and editors, performance tools, debuggers and test tools.[32] When the project was chartered, there were three focuses: (i) Language Integrated Development Environments (e.g. C/C++ (CDT), COBOL and ADJT); (ii) Development Tools Productivity; and (iii) Graphical User Interface Frameworks (e.g. GEF).
- The *Eclipse Technology Project*, with newsgroup postings dating from 2002, encapsulates research, incubators and educational activities that will come to a natural end, either in just the publishing of research results, or incorporation into another top-level project.[33] It has included experimental tools (e.g. dynamic languages, voice tools) and industry vertical emphases (e.g. financial markets, health care).
- The *Test and Performance Tools Project* started in 2004 signalled a community interest in software quality.[34] Tools enable a universal

[29] IBM typically extends its reach with business partners through cooperative agreements. Actuate similarly declares its interests.

[30] Eclipse projects are listed at `http://www.eclipse.org/projects/` .

[31] The Rich Client Platform is described at `http://wiki.eclipse.org/index.php/Rich_Client_Platform` . The Eclipse IDE from 2001 was superseded by the OSGi service platform with Eclipse v3.0 in June 2004.

[32] The Eclipse Tools project takes advantage of extensibility in the IDE / Rich Client Platform. Commits for the CDT project can be seen back to December 2001 on the Eclipse Dashboard.

[33] The Eclipse Technology Project hosts an assortment of projects that come and go.

[34] The Test and Performance Tools Project spans the entire test and performance

platform for monitoring, testing, tracing and profiling.

- The *Business Intelligence and Reporting Tools (BIRT)* project has provided core reporting features such as layout, data access and scripting since 2005.[35] These simplify presentation features (e.g. charting) in Java-based applications.
- The *Eclipse Web Tools Platform Project* started in 2004 produced release 1.0 in 2005.[36] It includes editors, wizards to simply development (e.g. an AJAX user interface framework, distributed persistence and logging).
- The *Eclipse Modeling Project* provides a unified set of frameworks, tools and standards implementations that encourage both concrete (visible) relationships and abstract (logical) relationships.[37] It includes the Eclipse Modeling Framework from 2004, incorporated with the Graphical Modeling Framework and Textual Modeling framework in 2006.
- The *Device Software Development Platform* started in 2006 addresses the needs in the embedded market segment (e.g. mobile smartphones).[38] With a variety of manufacturers building hardwire devices in a variety of forms, a universal framework removes the effort of porting software from one model or brand to another.
- The *Data Tools Platform* started in 2007 simplifies programming interfaces to data-centric systems.[39] Abstracting data source drivers, reading from and writing to relational or object databases can take advantage of a standard framework.

This list of projects is not exhaustive. Other projects (e.g. the Eclipse RunTime Project started 2008) have not yet sufficient history to be judged as successes. The dynamic nature of technologies and participating Eclipse members presents an ever-changing list of interests.

A.1.6.2 Contributions to the Eclipse community by IBM and other companies continues to increase

As of 2010, the Eclipse Project Dash has recognized 1227 committers since it began collecting information in 2001. While casual users can suggest changes to existing software code, committers make tentative changes permanent. In Table A.1, while IBM is recognized as one of the

life cycle, from early testing to production application monitoring.

[35]BIRT provides foundations for data access, data transforms, business logic and presentation.

[36]The Web Tools Platform extends development beyond a single platform to network-enabled interoperable programs.

[37]The Eclipse Modeling Framework enables rich descriptions of current and future systems.

[38]The Device Software Development Platform supports both target management (i.e. same software code for multiple device forms) and a client platform (i.e. footprint reduced to constrained memory and storage).

[39]The Data Tools Platform was spearheaded by Sybase, Actuate and IBM.

largest contributors to Eclipse, commits by individuals and other strategic members have shifted the balance over a decade.[40]

The Eclipse platform is at the core of products by IBM, HP and QNX (Des Rivières and Wiegand, 2004), and Motorola (Yang and Jiang, 2007).

The volunteerism in the open sourcing community dwarfs the number of salaried positions in the Eclipse Foundation. In support of ongoing operations, the Eclipse Foundation lists a staff of 18.[41]

The ongoing interest by companies in Eclipse is illustrated in the sponsorship of EclipseCon in March 2010.[42] Gold sponsors included Cisco, SAP, Red Hat, Sonatype, Intel, Oracle and IBM. Silver sponsors included Actuate, Xored, Amazon, Research in Motion, BSI, Agitar Technologies, Instantiations, Microsoft, Google and Soyatec.

A.2 Case: Microblogging (broadcast messaging)

Improved connectivity on the Internet, standards-based interoperability and friendlier web interfaces in the first decade of the 2000s have given business people new options with ways to communicate. The features of convenience in e-mail found through 1980s and 1990s evolved into burdens and pressures with social and organizational pressures for point-to-point communications. IBM Research saw that:

> ... email can be seen as a victim of its own success – users increasingly suffer from overload and interruptions as well as use email in a manner for which it was not intended. [....] People are overwhelmed by the volume of new email they receive each day. They report spending increasing amounts of time simply managing their email.[43]

In this wake, social computing has been on the rise. IBM Research has described social computing as "concerned with the intersection of social behavior and computational systems".[44] Forrester Research sees the

[40] Statistics on software code presumably do not include other contributions outside of the version control software, e.g. documentation changes.

[41] Staff titles at the Eclipse Foundation include labels such as intellectual property, marketing, community support, ecosystem development, and IT infrastructure.

[42] EclipseCon 2010 sponsors are listed on the main page. A more official list dates back to 2004.

[43] The "Reinventing Email" project is outlined in a brief. Problems and frustrations with e-mail are interconnected through (i) the lack of context, in the relationship between messages (and reply as only one dimension); (ii) co-opted overloading, as e-mail is used for information management, task management, contact management, record keeping and file transfer; and (iii) keeping track of too many things. See (Kerr and E. Wilcox, 2004).

[44] The meaning of social computing by IBM Research is expanded with the term used in two ways: "In the weaker sense of the term, social computing has to do with supporting any sort of social behavior in or through computational systems. This means that software needs to be designed so that it supports things like

Table A.1. Activity on Eclipse.org

Year	Active Committers	Commits	Lines of Code	Companies most active with commits
2001	85	184,059	6,287,799	IBM 85%; individual 5%
2002	93	297,189	12,896,821	IBM 84%; individual 7%; QNX 1%
2003	135	349,409	19,239,164	IBM 73%; individual 14%; QNX 1%
2004	191	609,605	31,100,185	IBM 63%; individual 17%; EclipseSource 3%; Springsource 3%; QNX 1%
2005	331	1,043,188	46,006,936	IBM 57%; individual 25%; Sonatype 5%; Actuate 3%
2006	427	932,557	33,958,896	IBM 50%; individual 29%; Actuate 5%; Oracle 3%; Tasktop 35; Intel 2%; RedHat 1%
2007	557	1,300,157	35,640,791	individual 38%; IBM 33%; Oracle 5%; RedHat 3%; Actuate 3%; OBEO 2%; Tasktop 2%; Innoopract 2%; Intel 2%; Borland 2%
2008	623	1,876,024	59,831,513	individual 47%; IBM 25%; Oracle 5%; Inatalio2%; RedHat 2%; Actutate 2%; itemisAG 2%; Borland 1%; Innoopract 1%; Tasktop 1%
2009	574	1,682,938	50,584,221	IBM 23%; individual 23%; Intalio 18%; Oracle 5%; itemisAG 5%; SOPERAGmbH 3%; Soyatec 2%; Actuate 2%; OBEO 2%; Thales 2%; Innoopract 1%

impact of social computing as "a social structure in which technology puts power in communities, not institutions".[45] .

Broadcast messaging rose as a method of communications with the Internet became more popular.

In broadcast messaging, users broadcast messages to topics. Other users listen on those topics and can choose to act on messages or not. The message is essentially a request for interaction from some or all of the recipients. That request for interaction can be something like a request to chat or answer a poll (Jania, 2003, p. 40).

Broadcast messaging is in the same class of communication applications as microblogging, as well as collaborative web sharing (wikis) [in section A.4], blogging (serial web content sharing) [in section A.5], and podcasting (digital media syndication) [in section A.6]. As new technologies, development coevolves as explorations through joint learning with emerging user groups and communities. Innovation in new social computing products arrive hand in hand with new services and infrastructure that ease collaboration, with extensions to social networks online of contacts and new acquaintances. An open sourcing style facilitates rapid learning, while commercial funding facilitates (re-)development.

Broadcast messaging and microblogging are easier to describe in hindsight than from the situational wins, losses and learning that occur during discovery of practical uses. The perspective of the social computing cases in this study on open sourcing with private sourcing are centered on the interests with business customers (i.e. IBM provides technologies to corporate clients) within a larger context of the social media of individuals and consumers (e.g. as communications amongst friends and family and/or entertainment change the nature of interaction). Broadcast messaging and microblogging are forms of one-to-many near-synchronous interpersonal Internet messaging, as alternatives to e-mail [in subsection A.2.1]. Internal to IBM, broadcast messaging was a feature of the private sourcing IBM Community Tools [in subsection A.2.2]. This learning evolved into open sourcing plug-ins with the Lotus Sametime product [in subsection A.2.3]. The rise of Twitter led to an open sourcing release of BlueTwit [in subsection A.2.4]. Posting messages to profiles was simplified by the MicroBlogCentral plugin developed in the open sourcing Hackdays [in

persistent identity, reputation, conversation, and the creation and maintenance of social norms. Used in this sense, social computing includes email, blogs, social networking system, online commerce, and systems generally referred to under the rubrics of "social software" and "web 2.0. In the stronger sense of the term, social computing has to do with supporting "computations" that are carried out by groups of people, an idea that has been popularized in James Surowiecki's book, *The Wisdom of Crowds*. Examples of social computing in this sense include Collaborative Filtering, Online Auctions, Prediction Market, Recommender Systems, Collective Content Creation systems, and verification games".

[45] Social Computing was described in a reportby Forrester Research in 2006

subsection A.2.5] , as IBM internally moved to the corporate infrastructure to the private sourcing Lotus Connections (Profiles status messages) [in subsection A.2.6]. / The MicroBlogCentral plugin developed internally at IBM became open sourcing to the OpenNTF community as a Status Updater plugin [in subsection A.2.7]

In hindsight, the practice of microblogging – commonly known as *tweeting* on twitter.com – rose before the behaviour was explained. The main intentions within Twitter communities were found to be (i) daily chatter about what people are doing (as the largest and most common use); (ii) conversations (as comments or replies to posts); (iii) sharing information and or URLs; and (iv) reporting news on current events (Java et al., 2007). In the business context, microblogging is seen as a type of informal communication that has (a) relational benefits that (i) build person perceptions of each other, (ii) develop common ground, and sustain a feeling of connectedness, and (b) personal benefits towards one's personal interests and goals (Zhao and Rosson, 2009).

Communicating is not independent of relationship. Friends tend to mutually follow each others' messages, while more highly connected individuals exhibit an "asymmetric follow" pattern with more readers following them than those individuals follow (Governor, 2008; O'Reilly, 2009a). Readers have learned to prune their subscriptions in order to blunt the tsunami of messages that arrive daily. Microblogging to a selected audience (e.g. private tweets that can be read only with the authorization of the author) is technologically possible, but reflects less than an open (sourcing) spirit. The ability to send and receive messages in the largest broadcast area possible relies on the adoption of standards – in technology, and in behaviours – in common, if not open, ways.

A.2.1 Context: One-to-many near-synchronous interpersonal messaging

Synchronous broadcast messaging – where one person can send to many people – was a new technology at the dawn of the 21st century. This approach to communication can be viewed amongst other communication alternatives, some familiar and some not-so-familiar.

E-mail, since the definition of a Simple Mail Transfer Protocol (SMTP) standard by IETF RFC 821 in 1982, was designed as a one-to-one communications method, with potential negotiation to add additional recipients.[46] The flood of e-mail (i.e. asynchronous messages) into electronic in-boxes has led to many business professionals to seek other options. The syn-

[46]The RFC (Request for Comments) 821 on SMTP by Jonathan B. Postel was dated August 1982. "The SMTP design is based on the following model of communication: as the result of a user mail request, the sender-SMTP establishes a two-way transmission channel to a receiver-SMTP. The receiver-SMTP may be either the ultimate destination or an intermediate."

chronous multi-user Internet Relay Chat protocol has typically been used only by technical professionals, at a fraction of the wider adoption by e-mail users.[47]

The lack of standards across instant messaging providers did not match the evolution of browsers and HTML with the rise of the Internet in the late 1990s through early 2000s. Software providers (e.g. AOL, MSN) favoured their privately-developed protocols towards business models that might encourage stickiness to online communities within their own domains. The IETF formed the Instant Messaging and Presence Protocol (IMPP) Working Group in 1998 that specified a minimal feature set, but progress halted in 2001 on reaching a consensus (Hildebrand, 2003). In 2002, an XMPP (Extensible Messaging and Presence Protocol) Working Group was approved by the Internet Engineering Steering Group, and the Jabber Software Foundation contributed its base Jabber protocols. Formalization of the protocols in 2003 led to the approval of proposes standards in early 2004.[48] The credibility of XMPP was increased by the introduction of Google Talk to use the protocol across Google clients in 2005, and then opening up public server-to-server access in 2006.[49] Facebook similarly opened up Facebook Chat for XMPP in February 2010.[50] The endorsement of these standards supported definition of RFC 6120 and RFC 6121 in March 2011.[51] Work on standards for the XMPP protocol continue with drafts on internationalization and extensions for multi-user chat.

In business contexts, synchronous messaging was little used before 2000. In a 24-month study of the introduction of the technology in three business organizations, a three-stage *Instant Messaging Maturity Model* was proposed: (i) an early stage with socially-based spread of the technology (i.e. as a critical mass of users build, non-users feel pressure to also adopt) and low-risk networking (i.e. with well-known team members and with friends); (ii) a maturity phase with gradual increases in skills (chat behaviors) and higher-stake chats (i.e. with managers as partners); and (iii) then a hypothesized later stage of visibility concerns (i.e. privacy control) and interruption management (Muller et al., 2003). In a telephone survey of 912 office employees in 2006, instant messaging was found to simultaneously promote more frequent communications and reduce interruptions (Garrett and Danziger, 2008). Scalability in communications can become a concern.

[47] Jaarko Oikarinen, the founder of IRC, cites its birthday as August 1988. This was formalized in May 1993 as an experimental protocol for the Internet Community.

[48] The Jabber Software Foundation evolved into the XMPP Standards Foundation. The proposed standard for XMPP as RFC 6121 was dated March 2011.

[49] Google described XMPP for Google Talk in December 2005, and then federation to public XMPP networks in January 2006.

[50] Facebook Chat was announced in April 2008. The feature to open up to XMPP clients was announced in February 2008.

[51] In March 2011, the IETF published RFC 6120 for the XMPP Core, and RFC 6121 for XMPP Instant Messaging and Presence.

In experiments with 220 subjects, groups of four or fewer members working on a task with equivocality found productivity and satisfaction with voice communications, while groups of seven or more had similar productivity with higher satisfaction using chat (Lober, Schwabe, and Grimm, 2007).

The label of "synchronous broadcast messaging" was characterized as an emerging "communications mediated communications system" that had emerged about 2003, and flourished over three years (Weisz, T. Erickson, and Kellogg, 2006). IBM Community Tools had become popular, but was not officially supported. The researchers were aware of only two other systems that combined broadcast with synchronous group chat: (i) the Zephyr Help Instance, with questions and answers seen by all users subscribed to a channel on Project Athena workstations at MIT since 1993 (Ackerman and Palen, 1996), and (ii) ReachOut, for asking questions to be answered by people matching a profile, piloted within IBM in 2002 (Ribak, Jacovi, and Soroka, 2002). Over the decade, more "community-based question and answer systems" emerged, such as Yahoo Answers (answers.yahoo.com), Live QnA (qna.live.com), Twitter Answers (www.mosio.com/twitter), Google Answers (closed 2006) and mimir (a market-based experiment deployed among Microsoft interns) (Hsieh and Counts, 2009).

In the context of open sourcing with private sourcing, the history of broadcast messaging in IBM can be traced through IBM Community Tools (in subsection A.2.2), Lotus Sametime 7.5 Plug-ins (in subsection A.2.3), BlueTwit with Twitter (in subsection A.2.4), Lotus Connections (Profiles status messages) (in subsection A.2.5), Status Updater plug-in (in subsection A.2.6) and Lotus Connections Notification plug-in for Sametime (in subsection A.2.7).

A.2.2 (a) Private sourcing: IBM Community Tools (via the Webahead team)

Originally an Internet hosting technology founded in 1994 within IBM Software Group (i.e. the development lab serving external customers), the Webahead team eventually migrated to Office of the CIO (supporting internal customers). While the Webahead team had a mission to enable rapid prototyping of emerging technologies, it did not provide a support channel for early adopters or application owners (Alkalay et al., 2009). The Webahead technologies and organization have a relationship with their users as private sourcing. While IBM employees were able to sample and test out new technologies, their influence on directions and decisions would have been rather limited.

The Webahead team – a 20-person team within the 100,000-person IT department at IBM – started experimenting with instant messaging technologies in 1997 (Kirsner, 2000). These included both individual-to-individual communications, and broadcast messaging.

IBM Community Tools was announced on March 10, 2003, as an integration of some previously experimental technologies.[52] It included five applications for broadcast messaging:

1. w3alert: enabling the broadcast of informational messages to a community, with an optional URL for more information;
2. TeamRing: sharing web presentations, by sending out invitations with a broadcast of the URL for viewing;
3. SkillTap: requests for help or information to a community, with responses subsequently searchable in a FAQ database through Question Search;
4. FreeJam: a just-in-time chat room, with topic based on prior broadcasts; and
5. Pollcast: multiple choice polls, with results tabulated and graphed in real time.

The internal deployment had 20,000 users per month on average, and 6,000 peak simultaneous users across 53 countries. Of the 1021 communities open to all, 437 communities had more than 100 members. The user base was 80% in technical job roles, so the typical office professional would have been the exception at this stage of maturity. A version of ICT was made available for free download outside of IBM on the Next Generation Internet (NGI), demonstrating an iSeries simultaneously running one OS/400 partition, two SuSE Linux partitions and one Win2000 partition. An external party downloading the application would accept terms including not using ICT for commercial purposes, and granting IBM a royalty-free license on derivative works (Jania, 2003). ICT was built on top of Sametime 3.1 and Lotus Domino 6.[53]

Multiple patents included members of the Webahead team, such as "Just-in-time publishing via a publish/subscribe messaging system using a subscribe-event model" was filed in 2004 and granted in 2008 (E. P. Stewart, Stokes, and Meulen, 2008). Multiple patents also including members of IBM Research, such as "System and method for targeted message delivery and subscription", naming "IBM Community Tools with Broadcast Suite" as exemplary, was filed 2005 and granted in 2007 (Bellamy et al., 2007).

Placing this project into a categorization of open sourcing or private sourcing, IBM Community Tools conforms as private sourcing. The development

[52] On March 10, 2003, the announcement read:
a. The Shotgun Suite is now Broadcast Suite (gasp, big change).
b. BlueINQ? Not so much - now it is Question Search.
c. QuickPoll is now PollCast.
d. and of course, Ginie is now IBM Community Tools!

[53] Lotus Sametime 3.1 (released July 2003) was independent of the Lotus Domino 6.0 server (released September 2002). In 2003, ICT would have been built on those releases. Internally, IBM employees continued to run Sametime 3.1 to get ICT features well after Sametime 6.5.1 was released. Eventually, the ICT features were incorporated into Sametime and Domino 7.5.1 release in April 2007 (Hutchins, Goodman, and Rooney, 2010, p. 28).

and support was done entirely by the Webahead team.

A.2.3 (b) Open sourcing: Lotus Sametime 7.5 Plug-ins (via the Technology Adoption Program)

The successful adoption of IBM Community Tools led to changes in both the technology and the organization. Instead of a standalone application running directly on the operating system, the product features were migrated to become plug-ins on the IBM Lotus Sametime product included in the workstation platform common to all IBM employees worldwide.

With Sametime 3.1 first released commercially in 2003, the follow-on instant messaging product was long anticipated. The Lotus Notes business unit executive published screen shots of the Sametime Connect 7.5 client following the Lotusphere demonstrations in January 2006 (Brill, 2006b), and the beta was available by April (Brill, 2006a). The official announcement of Lotus Connect 7.5 would be in August 2006, with a launch event in September (Brill, 2006c).

As an evolution to the best-efforts support by the Webahead team, the Technology Adoption Program was formed as an open, voluntary approach to try out and assess new technologies. The migration was announced on the IBM intranet in May 2006.[54] The Lotus Connect 7.5 beta version was available via TAP. Any employee who wanted to try out the new

[54]IBM forums were typically communications amongst technical professionals. The news on the w3 intranet undergoes more formal review and approval procedures. On May 2006, the article "Get ready for a new instant messaging platform for IBMers" was posted.
True or false: The IBM Community Tools (ICT) pilot is being replaced by the Sametime 7.5 Connect pilot on TAP
Answer: True. The migration of users off IBM Community Tools (ICT) will be completed by November 17. The recommended new tool / pilot experience is Sametime 7.5 Connect on TAP. [. . . .]
Lotus listened when IBMers and clients said they wanted a richer experience for IBM's Sametime Connect tool. Emoticons, broadcast messaging, and voice over ip (Voicejam) fit the bill - and those features offered a competitive edge in the market. Additionally, 130,000 IBMers were using other, unsupported instant messaging tools they felt offered a better user experience than Sametime 3.1 Connect. Something had to be done, but what?
Rather than develop and release to the marketplace an instant messaging tool they 'thought' IBMers and our clients might like - Lotus first made a prototype available that users could test. This allowed IBMers and clients to identify the things that added the most value, collaboratively shaping the tool that launched as Sametime 7.5.
A highly successful Technology Adoption Program (TAP) early deployment effort was conducted (with over 60,000 participants!).
The result is a wonderful new Sametime Connect that has much of the experience that users expect. For example, if you are used to ICT and its menus, you won't need to alter your usual mouse and click behavior. If you're used to NotesBuddy, and you love your emoticons, you can import your emoticons into Sametime Connect 7.5 using the palette editor. These are just a few features waiting for you. Try it today. [. . . .]
Sunset announcement at `http://w3.webahead.ibm.com/ict/download.htm`

version 7.5 features could do so at low risk, it could be installed beside the fully-supported version 3.1, easily switching back and forth between the two. The combination of open sourcing technology with an open sourcing community inside IBM can be seen as a switch from private sourcing to open sourcing.

In technology, IBM employees who were using IBM Community Tools to access their technical communities also logged in to the Lotus Sametime 3.1 product connecting to all IBMers. The Lotus Sametime product, as with many IBM products, was developed with the Eclipse platform as its foundation. The shift from Sametime 3.1 to version 7.5 coincided with a redesign of the product to the plug-in architecture familiar in Eclipse. Plug-ins may originate as part of the shipped product, or as a module written by a third party (Attardo et al., 2007). The source code is open for all to read, although relatively few people would either bother to do so, or to have an appreciation. The IBM Community Tools code was the foundation for rewritten code of similar features in Lotus Sametime plug-ins.

Placing this project into a categorization of open sourcing or private sourcing, the Lotus Sametime 7.5 Plugins conform as open sourcing. These plugins were written in the Java programming language, in which the interpreted source code is provided so that any one who had access could modify it. Further, the Technology Adoption Program provided routes for interaction and feedback so that improvements could be contributed and reviewed for inclusion in updates and upgrades.

A.2.4 (c) Open sourcing: BlueTwit with Twitter (on the IIOSB)

While IBM Sametime was become the application of choice inside the intranet, Twitter was on the rise outside. An IBM employee, Ben Hardill, created an enterprise microblogging environment called BlueTwit as a side project released first in April 2007, so that IBMers could experiment with microblogging with less-than-public visibility. The source code for this was hosted on the IBM Internal Open Source Bazaar (IIOSB).

The idea of writing BlueTwit came to Hardill after he had been reading a blog post written by a colleague that attracted a lot of comments about what could be done with a microblogging technology. In addition, Hardill had been looking for a project to develop his Java J2EE skills. The motivations do construct a microblogging service behind the firewall (i.e. accessible only inside the IBM intranet) included: (i) accessibility to existing services private to IBM, e.g. enterprise directory services, and search and tagging systems; (ii) the opportunity to enable social networking research; (iii) the pre-empting of accidental releases of confidential information; and (iv) allowing people to get used to the conception of microblogging "before joining the big bad scary world". The BlueTwit server was constructed on a J2EE stack (i.e. IBM Java 5, WebSphere 6.1, DB2 9.5 and Linux

Fedora Core 8). Web services accessible within the intranet included Nova Services (accessing the BluePages enterprise directory), the TAP Google Maps corporate proxy, Bluecards (for small in-page pop-ups showing BluePages information as mouseover events, and BlueFaces profile photos (Hardill, 2009).

Users could download the BlueTwit plugins (for either the Firefox browser or Lotus Sametime) that would access the BlueTwit server. In a sidebar, posts to either BlueTwit or Twitter services, or both, could be created. Hardill found use cases including (i) calls for help e.g. "how do I do" and "where do I find"; (ii) news sharing and link posting; (iii) debate; (iv) conversations as asynchronous and low overhead chats; (v) group notifications, e.g. team milestones; (vi) status tracking, and (vii) location updates.

Between 2007 to 2009, the total registered user base grew to 3000. Over 10,000 posts per month were written from over 500 unique users (Hardill, 2009).

The parallel evolution of BlueTwit and Twitter enabled research into the behaviour of microbloggers inside the workplace, in comparison to the larger world. In a four-month a study was done of the 19,067 posts of 34 users using both tools. Categorizing the types of posts, BlueTwit was used more to broadcast information and less to directed posts addressed to an individual, as compared to Twitter. Motivations for microblogging on the intranet included (i) preserving confidentiality on company-specific topics; (ii) conversation and help from colleagues, akin to "family conversation"; (iii) real-time information and sharing, including links to news posted on internal URLs; (iv) enhancing personal reputation through visibility; (v) feeling connected – especially for mobile workers – through familiarity on both work and personal topics (Ehrlich and Shami, 2010).

Developed in 2007, BlueTwit is an IBM internal-only micro-blogging tool, similar to Twitter. Referred to as 'social networking' or 'web 2.0,' BlueTwit allows all employees to register at no cost to their department and experiment with microblogging within the safety of IBM's firewall. The source code for BlueTwit was shared on the IBM Internal Open Source Bazaar (IIOSB).

On March 14, 2011, BlueTwit was renamed as to IBM Internal Microblogging. While the site continues to be available, comments by TAP participants suggest that the technology had been superseded (i.e. features in Lotus Connections were better).[55] IBM Internal Microblogging was still in operation in 2012, perhaps due to its minimal computing needs.

Placing this project into a categorization of open sourcing or private sourcing, BlueTwit is open sourcing. The source code was written by an IBM employee on his own time, and shared openly with the company. BlueTwit

[55]On March 14, 2011, Ryan Hutton posted "Microblogging: It's time to start tweeting", announcing the relabelling of BlueTwit to IBM Internal Microblogging. In fall 2012, posts continued to appear.

adopters were employees curious about the microblogging technology who took the opportunity to learn-by-doing, and were neither encouraged nor discouraged by management to try it out. The IIOSB and infrastructural resources to enable BlueTwit, and similar projects, has been seen as minimal ongoing investment by the company towards encouraging emergent innovation.

A.2.5 (d) Open sourcing: MicroBlogCentral – Status Updater plug-in and Hackdays

With release of Lotus Connections 2.0 in June 2008, the product architecture evolved to support plug-ins (Minassian, 2008). While this commercial product is offered as private sourcing, plug-ins are open sourcing scripts that can be built on top. The Status Updater for microblogs was an open sourcing project inside IBM that became available to the public.

On December 15, 2008, Marty Moore posted a preview of the upcoming feature to update a status message on Lotus Connections 2.5 when the product would ship in 3Q2009.[56] On April 15, 2009, a version of MicroBlogCentral, written by Jessica Wu Ramirez, was announced on the *Connections Plug-In Developers* blog on the w3 intranet.

> *Why install MicroBlogCentral?*
> - Update your connections status from [Lotus] Notes or Sametime without opening a browser.
> - Easily see messages on your own board, your network contacts updates, or updates from anyone in the system.
> - See and add comments to status messages and board postings.
> - Click on a person's name to see their board.[57]

While a plug-in may have been designed and developed within an IBM lab, its value has a premise that the customer must have licensed a commercial IBM product. While downloads of the plug-in were welcomed, technical support was limited to responses as comments to the blog post. Further development and distribution of the plug-in would progress based on the open sourcing spirit in IBM Hackdays, and voluntary leadership by Brian O'Donovan, a second-level manager with IBM in Dublin.

The idea of a Hackday at IBM was inspired in 2006, by the fourth Hackday event at Yahoo! The success of the first three Yahoo! Hackday

[56] The status update feature was not in the Lotus Connections 2.0 product, but would resonate with Facebook users.

[57] Jessica Wu Ramirez, a software developer working in the Lotus Software Lab, confirmed in a Sametime chat on September 17 that she had written the MicroBlogCentral sometime before that April 15, 2009 blog date. The plugin had been previously available amongst the Connections Plug-In Developers community, and open to the IBM intranet at large, but had not been widely publicized. As a development to a commercial product, it had not been posted to Technology Adoption Program.

in Santa Clara (December 2005, March 2006) and Bangalore (April 2006) led to the coordination of worldwide events in Santa Clara (July 15, 2006), Bangalore (July 4, 2006), London (July 6, 2006). Outcomes from these efforts are emergent.

> Hack Day at Yahoo! has minimal rules:
> - Take something from idea to prototype in a day
> - Demo it at the end of the day, in two minutes or less (usually less)
>
> [. . .] Hack Day is by hackers, for hackers. The ideas are theirs, the teams are self-determined, and no technologies are proscribed. I don't even know what people are building until they get up to do their demos at the end of the day (Dickerson, 2006).

The Yahoo event was surfaced in an IBM internal blog by Kelly Smith wondering if it should be submitted as a Thinkplace idea to be shepherded through a formal review process for innovation investment. In discussion, however, John Rooney pointed out that IBM already had all of the infrastructural tools in place, so all that was required was picking a date and self-organizing.[58] With 2 weeks, the first Hackday was scheduled in a half-day event on June 30, 2006.[59] It had 57 entries, 54 unique teams (including multiple submissions) and 64 IBM participants produced results, categorized as 37 programs, 16 ideas and 4 designs. The second Hackday in December 2006 was also scheduled as an internal IBM event, with prospects in the future for collaboration with external parties (K. Smith, 2006a; K. Smith, 2006b). From 2006 through 2008, as shown in Table A.2, the number of projects and participants continue to grow (O'Donovan, 2009b).

Table A.2. The growth of Hackday from HD1 through HD6 (O'Donovan 2009b)

Hackday	Date	Projects	Participants
HD1	1-Jun-2006	59	64
HD2	1-Dec-2006	20	30
HD3	18-May-2007	70	88
HD4	12-Oct-2007	129	161
HD5	25-Apr-2008	353	433
HD6	24-Oct-2008	449	552

For Hackday 6.5 on June 26, 2009, Brian O'Donovan proposed a "Status Updatr" as a potential project. Other participants enlightened him on the MicroBlogCentral plugin by Jessica Wu Ramirez. In addition to

[58]The original blog post by Kelly Smith titled "Mashup or Shut Up" was posted on June 16, 2006. That blog post was discussed on the open Internet on August 17, 2009 in an interview of Kelly Smith by Valerie Skinner titled "Yin Meets Yang".

[59]The first Hackday was coordinated by individuals signing up and reporting their activities on a wiki.

enabling Notes and Sametime users to post to Lotus Connections Profiles, Sametime and Twitter at the same time, O'Donovan found the technology designed with extensibility in mind. For Hackday 6.5, he was able to extend MicroBlogCentral to three additional services on the w3 intranet: *BlueTwit*, *Fringe*, and *Beehive* (O'Donovan, 2009a). For Hackday 7 in October 2009, Ramirez (in the U.S.) and O'Donovan (in Ireland) posted a request for volunteers to enhance the MicroBlogCentral plugin.[60] In the end, O'Donovan was unavailable on Hackday 7, but four other IBMers joined Wu Ramirez to extend the plug-in.[61] The MicroBlogCentral / Status Updater plugin has continued to be available to all employees on the IBM intranet, and supported by comments posted to the Connections Plug-In Developers community. The asset has been adapted for use in customer engagements by IBM Software Services for Lotus.[62]

Inside IBM, while the origins of Hackday has traditionally been technical, the idea was expanded more widely for the 24-hour HackDay X on October 11-12, 2012.

> *What is a 'HackDay?'*
>
> A HackDay is an event where people step outside of the normal scope of work and apply their expertise toward driving new innovations. While historically focused on technical solutions, IBM's Social Business HackDay will go beyond the creation of software code to include work processes, collaborative models and anything else you feel could improve and accelerate IBM's transformation to a social business. It's also a great opportunity to help shape how IBM continues to integrate social business capabilities into how we work and drive innovation that matters for our company and the world.
>
> *Who should participate in HackDay?*
>
> Every IBMer should feel they have an opportunity to participate in HackDay. From working on prototypes of your own ideas to submitting ideas for others to work on, every IBMer has something to contribute — whether or not you consider yourself to be 'technical.' You will also have the opportunity to vote on ideas and prototypes once HackDay ends.
>
> *I still don't get it. What is a 'hack?'*
>
> Simply put, a hack is anything that makes things better. You create and use hacks without even knowing it.[63]

[60] A list of "teams looking for people" for Hackday 7, including the Microblog Central project, was posted on the wiki.

[61] Jessica Wu Ramirez gave credit to Emil Varga, Varun Lingaraju, Erika Flint and Vinay Thykkuttathil for working on the plug-in on Hackday 7, published as "Hackday 7: Team Microblog" on October 9, 2009.

[62] On Dec. 4, 2009, Hunter R. Medney blogged about "Changes made to MicroBlogCentral for customer environment", and shared the file for download on the IBM intranet.

[63] Hackday X was announced on the company-wide intranet news in Sept. 2012.

This could be seen a form of voluntary innovation, encouraged by management. Hackday X for 2012 was given a social media focus by CEO Ginni Rometty (O'Donovan, 2012).

Placing this project into a categorization of open sourcing or private sourcing, the MicroBlogCentral - Status Updater plug-in is open sourcing. The architecture of plugins is as scripts that are visible to be modified, and the Hackday context reflects the voluntary contributions of individuals towards shared interests.

A.2.6 Private sourcing: Lotus Connections (Profiles status messages)

Lotus Connections 1.0 was released as a commercial product from IBM on July 19, 2007. It offered five Web 2.0-based components: (i) activities, as collaborative task coordination and tracking; (ii) communities, as shared discussions amongst people with common interests; (iii) social bookmarking (Dogear), as personal storing of URLs with tags in public visibility; (iv) profiles, as an online directory of persons and their web activities; and (iv) blogs, as individuals and groups publishing content onto public electronic places.[64] These five features were evolved in Lotus Connections 2.0, announced June 10, 2008.[65]

Lotus Connections 2.5 was released as a commercial product on August 19, 2009. Major new features included (i) files, as an online place to share personal documents with revision updates; (ii) wikis, as places to collaboratively edit content; and (iii) status messages on personal and colleagues' profiles, as microblogging and directed public messages.[66] Lotus Connections was primarily designed for a web browser interface, or could be integrated into a desktop environment (e.g. with Lotus Sametime).[67]

Inside IBM, planning for technical support of Lotus Connections 2.5 began on June 6, 2009. The Profiles feature was deployed on December 4, 2009.[68] The IBM CIO created three functional towers in the *Global Workforce and Web Processes Enablement* organization:

- The *Innovate* tower deployed Lotus Connections 2.5 on the TAP (Technology Adoption Program) platform, informally supported by the Lotus Development team on a best efforts basis. Code drops were deployed as needed.

[64] Lotus Connections 1.0 was announced on on July 19, 2007 .

[65] Lotus Connections 2.0, was released with Announcement Letter ENUSZP08-0277 on June 10, 2008.

[66] Lotus Connections 2.5 appeared with Announcement Letter ENUS209-210 on August 15, 2009.

[67] The common Eclipse platform foundation for Lotus Connections and Lotus Sametime made integration simpler (J. Erickson, 2008). Third parties could also use documented APIs, e.g. Glue for Lotus Connections.

[68] The project plan for Lotus Connections 2.5 implementation inside IBM was tracked on the intranet.

- The *Transform* tower rehosted the application on ODW (On Demand Workplace), formally supported by the CIO with dedicated 24x5 resources, and dedicated technical support and server monitoring. Code drops were deployed on an established schedule.
- The *Run* tower was scheduled for a production platform, 12 to 18 months later. The support would then be transferred to the IBM Help Desk.[69]

The transition from the *Innovate* (TAP) platform to the *Transform* (CIO) platform by December 2009 marked the point at which the nearly 400,000 IBM employees would have access to new Lotus Connections 2.5 features.

Within the Collaboration Platform Initiative established in 2008, Lotus Connections 2.5 Profiles was targeted as the new Bluepages, upgrading from the heritage mainframe-based employee directory.[70] The organizational change to introduce the IBM Social Computing Environment to both the extranet and intranet environments was developed in late 2008, with executive approvals in January and February 2009.[71] The direction to shift IBM's web persona from content-centric to people-centric represents a long-term strategy of the company.

In comparison to the synchronous application-oriented synchronous IBM Community Tools and BlueTwit, the status update feature in Lotus Connections is more asynchronous and web-oriented. The microblogging/status message feature on the profile appears with a prompt "What are you working on right now?". Status messages can be viewed on the home page (like a Facebook Newsfeed) or on a board (similar to the Facebook Wall). Comments can be added onto anyone's board, so that questions and answers (Q&As) have become part of the social networking service. In a 17-month study begin in 2009 with 22647 distinct users, 309,925 messages with 191,752 threads were reduced to 17,508 threads with questions (i.e. with question marks at the end of sentences). Leading types of question types were found to be (i) information seeking ("is there?", 40%); (ii) rhetorical (27%); (iii) solution ("how do I?", 10%); and (iv) invitation ("are you coming?", 10%) (J. Thom et al., 2011).

Placing this project into a categorization of open sourcing or private sourcing, Lotus Connections 2.5 is private sourcing. An infrastructure to support 400,000 employees requires planning and commitment of resources to be effective in large-scale adoption. User may sometimes look to peers for help or guidance, but the provision of formal support channels ensure that requests and questions are efficiently handled, with concerns and bugs methodically registered for subsequent consideration and action.

[69] Deployment updates for Lotus Connections 2.5 were published on the intranet.
[70] The Profiles feature was only one part of the larger Collaboration Platform Initiative.
[71] Executive presentations at the IBM vice-president level dated 1/30/2009 and 2/23/2009 appeared on TAP .

A.2.7 (f) Open sourcing: Status Updater plug-in on OpenNTF

While the MicroBlogCentral - Status Updater audience was internal to IBM, there is an external group at OpenNTF, as "the Open Source Community for Lotus Notes Domino". OpenNTF was initiated in 2002 by IBM, becoming the OpenNTF Alliance in 2009 conforming with an Apache License (Heidloff and Castledine, 2009). At 2009, there ware 60,000 users registered to download code from 250 open sourcing projects.

In December 2009, an open sourcing version of the Status Updater was posted to the web site of OpenNTF (Heidloff, 2009). Following the conditions of an Apache License Version 2.0, the release became available for users outside of IBM without charge, and to developers to modify or extend under open sourcing conditions (J. Ramirez, O'Donovan, and Varga, 2009).

Placing this project into a categorization of open sourcing or private sourcing, the Status Updater plug-in on OpenNTF is open sourcing. The boundaries of open sourcing grew from an internal IBM project into a formally licensed project available to the world.

A.2.8 Prospects: Features of broadcast messaging from 2003 became popularized as micro-blogging by 2006

Interactive electronic communications relies on standards: e-mail had SMTP in 1982, and instant messaging had XMPP in 1998. Broadcast messaging, in 2003, was seen as an extension of instant messaging. The publishing of Twitter technology interfaces in 2006 (Stone, 2006), and subsequent spin-off into its own company in 2007 (Lennon, 2009) represents a watershed period in micro-blogging. The history of the evolving technologies illustrates how a variety of approaches can concurrently emerge, with only one or a few approaches gaining traction in popularity.

In comparison to the original visions for broadcast messaging, although Twitter is socially translucent (i.e. providing visibility into individuals' networks, thoughts and movements), it does not support real-time awareness (i.e. showing immediate availability of other parties) (J. Erickson, 2008). Micro-blogging can be seen as coevolving in two contexts: inside organizations with privileged visibility (e.g. Lotus Connections status messages) and on public platforms (e.g. Twitter).

Pure open sourcing micro-blogging platforms (e.g. Diaspora*[72]) have not become as popular as technologies with well-documents APIs (Application Programming Interfaces). Micro-blog subscribers openly contribute their

[72]The Diaspora* project started as a crowdsourced project by NYU students in 2010 developed a distributed open source technology project that has not reached the popularity of Twitter. In 2012, the project assets were handed over to an open sourcing community. In 2013, infrastructure support was received from the Free Software Support Network.

content, as the underlying platforms look for ways to remain commercially viable. The variety of ways to electronically communicate to an open audience is wide, so individuals can choose the platform that mostly closely matches their style and ethics.

A.3 Case: Blogging (serial web content sharing)

The word "blog" was recognized as both a noun and verb in Oxford English Dictionary as a 2003 update.[73] As a noun, as blog is "a personal website or web page on which an individual records opinions, links to other sites, etc. on a regular basis", and as a verb, to blog is to "add new material to or regularly update a blog".[74]

In 2003, a weblog – not even yet formally shortened to be called a "blog" – was described technically as "a hierarchy of text, images, media objects and data, arranged chronologically, that can be viewed in an HTML browser" (Winer, 2003b). However, of greater importance is that blogs have "the unedited voice of a person", where individuals:

> ... are writing about their own experience. And if there's editing it hasn't interfered with the style of the writing. The personalities of the writers come through. That is the essential element of weblog writing, and almost all the other elements can be missing, and the rules can be violated, imho, as long as the voice of a person comes through, it's a weblog.

This distinction is important in the relation between individuals and organizations. Executives and officers in an enterprise are in authority to speak on matters on behalf of a company. Only employees with approved media training had generally been approved to speak to the media. The advent of blogs obliterated communications channels so that individuals were empowered to express their views directly to the world. This represented a revolution whereby organized could choose to encourage or discourage open sourcing communications from employees either as only personal viewpoints, or as disclosures of private sourcing content to the benefit of readers.

A.3.1 Context: Personal web pages

The first web site is credited to Tim Berners-Lee in 1991, in the description of the World Wide Web project (Hiskey, 2010). While individuals could then construct personal (or family) web sites, the registration of a domain name, coding of HTML and upload of files via FTP requires technical skills.

[73] "Blog" was featured on "The OED Today" for March 2003.
[74] A definition for "blog" appears on the OED online.

The advent of free web-based hosting services for personal web sites came with the formation of 1995 launches of Tripod – acquired by Lycos in 1998 – and Geocities – acquired by Yahoo in 1999 (Zucherman, 2009; Manjoo, 2009). Free web hosting encouraged the publishing of personal content on the Internet, but the page-oriented structure was more prevalent than date-oriented (or diary-oriented) publishing. It wasn't until 1999 that weblog technology emerged on the Internet, with the advent of LiveJournal and Blogger (from Pyra Labs) (Boyer, 2011; Rosenberg, 2010).

Beyond web publishing on personal content, the rise of blogging for business content can be seen to rise between mid-2003 through 2005. Of course, there were individuals publishing on the Internet prior to the advent of the term "blogging".

One pioneer was John Patrick, who was the IBM Vice President of Internet Technologies from 1995 through to his retirement after 35 years of service at the end of December 2001. Having been a leader with IBM through the e-business era, he published a book, *Net Attitude*, in April 2001 and founded an independent company called Attitude LLC where he could continue his relationship with IBM as an advisor.[75] Patrick had a corporate web site at ibm.com/patrick "created in 1995 as a way to share my presentations about The Future of the Internet with people who inquired after I made a speech or who saw a reference to me in the press".[76] The patrickweb.com domain was registered personally by John Patrick in April 1998, but his "reflections" were originally published at ibm.com/patrickweb on a Lotus Internotes platform assisted by Mary Keough .[77] In July 2002, Patrick wrote that he was consolidating his "various websites into one place" and "as part of this there will also be a single weblog", based on a the open sourcing Greymatter server.[78] The content would be preserved in migrations from Graymatter to Radio Userland in June 2002, then

[75]In early 2002, John Patrick posted an Irving Wladawsky-Berger letter on the post-IBM career relationship. "... on December 31, 2001, after 35 years with IBM, John will indeed assume a new status. He will step down from his responsibilities as vice president, Internet Technology, making a transition to another stage in his career as he founds a new company called Attitude LLC. At the same time, he will continue his relationship with IBM as an advisor, carrying on his many industry relationships on behalf of IBM and speaking out to customers and the industry about his vision of the Internet. So we will still see John around IBM, sharing the invaluable insights that have meant so much to us for so long."

[76]Even after John Patrick's retirement from IBM at the end of 2001, the web pages at ibm.com/patrick were available for some years. The linkages from patrickweb.com to ibm.com/patrick from early 2002 have been preserved.

[77]The original registration date for patrickweb.com can be readily verified as April 20, 1998. The "History of this site" originally written on September 24, 1998 has been preserved on the Wordpress platform, but would have originally been written on Lotus Internotes.

[78]The "weblog moved" post by John Patrick on July 12, 2012 is preserved on the Internet Archive. This lists "Blogging Technology by" Noah Grey at Greysoft. The 2002 pages said "Greymatter is the original open source weblogging and journal software", and the product was withdrawn by the end of 2008,.

Movable Type in July 2003, and then to Wordpress in June 2010.[79]

In December 2002, John Patrick wrote about "Blogging – The Next Big Thing?", on a list of five other technologies including autonomic computing, grid computing, web services and WiFi.[80] In June 2003 meetings with Chief Technology Officers, WiFi proved to be a familiar term, but blogging was entirely foreign.

> During the past week, I had the pleasure of meeting with quite a few senior executives — mostly CIO's — of major corporations. They were all familiar to varying degrees with WiFi but not one had even heard of blogging. One said, "blobbing?". This is not surprising. CIO's have a lot on their plate. Cut IT spending. Get systems integrated. Support wireless. Improve security. Do more with less. Although I strongly believe enterprises do need blogging (see Site Redesign), it is understandable that CIO's think they need blogging like they need a hole in the head. Once I explain what blogging is all about, the typical response from people is that they are already in "information overload" to how could they possibly take on reading or writing a blog? (Patrick, 2003)

In November 2003, John Patrick was interviewed by Marcia Stepanek of CIO Insight. He described blogs as a form of knowledge management.

> *Patrick*: Today, employees have their intranets, but the intranet is the data dumpster. Everything is there but you can't find what you want. Much of the content is old and no longer relevant. What employees want is a current view on a topic. They want to find what the experts are thinking so they can leverage that experience. Corporate blogs will become the source. Companies will also use blogging to share their news and views with their customers and suppliers. IBM already has nearly 100 blog feeds of ibm.com news unique to countries around the world. IBM is embracing blogging in various ways, including participating in the development and evolution of the standards for blogging to ensure that it can continue to flourish for all.
>
> *Stepanek*: Why should CIOs see this as part of their management strategy?
>
> *Patrick*: The goal is to improve the leveraging of the expertise

[79] The move from Greymatter to "Experimenting with Radio Userland" started in June 2002. The migration to Movable Type in July 2003 was motivated much by the plug-in architecture. A reflection on the history of Patrick's blogging (and platforms) was written on March 27, 2005. The shift to Wordpress is noted as "Change of address: patrickWeb blog has moved" on June 1, 2010.

[80] The original thinking on "The Next Big Thing" was based on an interview by Jeffrey Rayport in December 2001. Patrick later wrote about being challenged to explain the significance of blogging at December 2002.

> within the department and across the corporation. If a company has 10,000 people, and if they can be only 1 percent more effective, that's 100 people. And that's a lot of money. It's a productivity play.
>
> You could call it knowledge management, but that's sort of a hackneyed term, and a lot of people, as soon as they hear KM, they immediately tune out. Actually, I think KM is going to come back again. It never left, it really is important. It's just never been able to work very effectively. Some people have said it was overhyped, but I say it was underdelivered. Nobody argued with the potential of it, it's just that it didn't really happen. Why? For the most part, it was based on the idea of imposed collaboration: Making it work required centralized control over the knowledge and the sharing of it. It's a good theory, but it simply hasn't worked. A lot of companies made people fill out skills profiles, on the theory that when someone, say, needs help with a Linux server installation, they can go into the KM database and find out who the experts are in the company. The problem was that the best experts wouldn't cooperate and considered it beneath them, and at the other extreme, people who worried about getting laid off would be happy to expose their skills, which may or may not be that great.
>
> So where does blogging fit in? It's a way to energize the expertise from the bottom – in other words, to allow people who want to share, who are good at sharing, who know who the experts are, who talk to the experts or who may, in fact, be one of those experts, to participate more fully. We all know somebody in our organization who knows everything that's going on. "Just ask Sally. She'll know." There's always a Sally, and those are the people who become the bloggers. And such people write a blog about, say, customer relationship management, and they're taking the time to find the experts and the links to leverage, to magnify what they're writing about. And from those links people can be led to information and see things in a context they might not have considered before (Patrick and Stepanek, 2003).

A bottom-up approach would look for people who were already blogging, and encouraging their behaviour as exemplars. Similar to John Patrick's experience, they would have tried a variety of technologies and writing styles, and gained experience on establishing a voice. In their personal time, IBMers experimented with web technologies during that period of transition from web pages to blogging.

In September 2001, Andy Piper, an IBMer with the Hursley Park Lab in the UK, started blogging.[81] This personal blog has continued with a mix of "photography, technology and life". His blogging would foreshadow

[81] Andy Piper hosted his blog first on Blogger in Sept. 2001, and then migrated to Wordpress in March 2006.

the Eightbar blog was started in September 2005 as a joint blog which has included 12 members of the IBM Hursley Park Lab.[82] Although the blog is "guided by the IBM Social Computing Guidelines", it is "not an official IBM blog".[83] Andy Piper contributed to this blog in beginning in 2006 by cross-posting content from his personal blog. The Eightbar blog represents increased permeability of the membrane between individual professional activities and official IBM corporate communications. The Eightbar bloggers had a clear understanding of publicly-appropriate content and sensitive material not cleared for disclosure. This group was recognized in the social media of 2008 as "a really strong grassroots-led innovation story".[84]

In December 2002, Ed Brill, a marketing manager for the Lotus Domino products, started a blog at edbrill.com using Movable Type on Volker Weber's server. In April 2003, he migrated to a Domino blog template by Steve Castledine hosted on a Lotus Notes server provided by PSC Group.[85] The first year of blogging emphasized content on countries visited, airlines flow, and personal experiences.

> I've generally left anything IBM/Lotus-related out of this year in review, by design. As much as many of you read this site primarily to find information related to Lotus, IBM, and the collaboration market, what has made the last 12 months energizing has been sharing in human interaction. I look forward to more of the same in the next year. [86]

Since Ed Brill also writes for "official" IBM blogs in parallel with his personal blog, he can channel different content to different venues.

In the period between 2003 and 2006, other IBM employees experimenting with the Internet also had personal web sites which eventually evolved onto the blogging platform that we know today.

In 1998, David Ing, an IBMer from Canada, wrote digests of for the

[82]The first entries on the Eightbar blog in Sept. 2005 were by Darren Shaw and Roo Reynolds.

[83]The about page said: "We're a group of techie/creative people working in and around IBM's Hursley Park Lab in the UK. We have regular technical community meetings, well more like a cup of tea and a chat really, about all kinds of cool stuff. One of the things we talked about is that although there are lots of cool people and projects going on in Hursley, we never really let anyone know about them. So, we decided to try and record some of the stuff that goes on here in an unofficial blog: eightbar."

[84]James Governor, an industry analyst watching IBM, has said its innovation is "is great at top down, but bottom up, not so much", in "My Team Of The Year Award: IBM EightBar, Hursley Labs" published Dec. 18, 2008.

[85]The content was originally published by Ed Brill for December 2002. This content was migrated to Lotus Notes Domino as described in "Welcome to my new home" on April 3, 2003.

[86]Ed Brill wrote "A year of blogging in review" on December 12, 2003.

International Society of the Systems Sciences,[87] and then posted academic content on the Systemic Business Community from 2000.[88] Experimentation with a personal blog started in October 2005.[89] A professional collaborative blog was also created in January 2006 with two other IBMers, Doug McDavid and Martin Gladwell, falling dormant around May 2006, and then wound down in November 2006.[90] The coevolving.com blog was restarted with professional content on systems thinking and information technologies, as an individual persona in December 2006.[91]

In November 2001, as a student, Sacha Chua started a diary using Emacs Planner and Emacs Wiki Mode. [92] In March 2006, she became a researcher for one day per week in the IBM Toronto lab, while she was completing her master's degree at the University of Toronto.[93] After graduation, Sacha joined IBM as a consultant in October 2007.[94] In November 2007, she pulled all of the content over to Wordpress, and by September 2008 ended her use of Emacs.[95] As a blogger inside IBM, her notoriety was increased when she started contributing "Hello, Monday" comics to the main w3 Intranet page.[96] Sacha Chua's content has been a mixture of personal reflections on life and technology.

Outside of IBM, the most prominent executive to write a blog was Jonathan Schwartz, CEO Sun Microsystems, on sun.com starting on June 28, 2004.[97] For IBM, the most prominent blogger has been Irving Wladawsky-Berger, Vice-President of Technology Strategy and Innovation, on the irvingwb.com domain beginning April 2005.[98]

[87]The "Rough Transcriptions of Plenary Sessions (and some Paper Sessions) at the ISSS 1998 Conference" is part of the history at isss.org.

[88]Digests on the "Breaking the Code of Change II, Rotman School of Management, University of Toronto" from August 2000 are still online.

[89]The content originally written on the Pivot Log software was migrated in form to Wordpress.

[90]As a collaboration, the Coevolving Innovations blog content first started in January 2006, and wound down in Nov. 2006.

[91]The professional blog content was separated from personal content on Dec. 3, 2006, after an extended family member expressed interest in seeing only family pictures.

[92]Sacha Chua's first entry on "Playing with planner (linux, emacs)" was posted on Nov. 2, 2001.

[93]Sacha Chua blogged about "Off to IBM early" as a researcher at IBM in March 2006 .

[94]Full time employment for Sacha Chua at IBM was noted as "The first day of work" in October 2007.

[95]The migration from Emacs to Wordpress was in Nov. 2007. The last entry using Emacs Planner was on Sept. 18, 2008.

[96]A hand-drawn comic was to be posted every third Monday, reported as "'Hello, Monday!' comic series launched on IBM intranet home page; now I'm a comic artist!" on August 22, 2011.

[97]Jonathan Schwartz's blogging in 2004 is preserved on the Internet Archive. The whole blog was deleted from sun.com in July 2011, as Oracle acquired Sun Microsystems.

[98]Irving Wladawsky-Berger's first blog post from May 2005 is still online. He

While the official "birth" of blogging could be dated earlier, the early majority of authors, their content, and the blogging platform all simultaneously evolved from mid-2003 to 2005.

A.3.2 (a) Open sourcing: Roller

Blogging by manually writing HTML and uploading web pages is feasible, if care is taken to maintain web links in a date sequence. However, a platform written with features – specifically simplifying the management of posts, feeds and commenting – opens up authorship to a much larger audience.

In 2001 – with the context of blogger.com having been offered only as a hosted service since 1999, and Movable Type introducing its commercial private sourcing software from 2001 – a blogging package that would be available under open source licensing for self-hosting would have been an innovation. On web application servers, the most popular scripts are written in PHP for a LAMP (Linux Apache MySQL PHP) stack. On enterprise web application servers, the Java programming language is often preferred over PHP scripts.

Starting in 2001 as a project extending open source Java under a variety of open source licenses (e.g. BSD, Apache, Sun), Dave Johnson, a developer in Chapel Hill, NC, developed the Roller software as a hobby on nights and weekends.[99] He publicized the open source blogging package in April 2002 in an article on "Building an Open Source J2EE Weblogger" on onjava.com (D. Johnson, 2002). The Roller project was first hosted on Sourceforge between 2002 and 2004. [100]

Prior to the July 2003 experimentation and customizations for IBM Blog Central (described in the next section), the development of a Java-based blog platform would not go unnoticed by IBM. With IBM encouraging the rise of the Java and the Eclipse platform, open sourcing would lead to employees downloading and trying out Roller, both for corporate and individual interests.

By October 2003, 2000 blogs were being hosted on the Jroller.com, a free service started a FreeRoller by Anthony Eden in 2002, transitioned and rebranded by Javalobby (D. Johnson, 2004b). By June 2004, blogs.sun.com was running Roller, and Chief Operating Officer Jonathan Schwartz was noted for authoring on the platform (D. Johnson, 2004a).

In August 2004, Johnson was hired by Sun Microsystems to deploy and evangelize blogging, thereby funding open sourcing development of Roller

retired from IBM in 2007.

[99] Dave Johnson was employed by HAHT Software around 2001-2002 when he first developed Roller (D. Johnson, 2009b).

[100] Activity on the now "Former home of Roller Weblogger" dates back to July 2002 with the release of Roller Weblogger v0.9.3, with the last published release of v0.9.8 in August 2004.

with the milestone release of v1.0 on January 17, 2005. (Shankland, 2004).

In March 2005, a proposal was made to migrate Roller to an Apache license. By January 2006, Roller had been accepted as an incubator project by the Apache Foundation. The progression to become fully supported with an Apache open source license largely rests on legal questions (e.g. the GNU LGPL) rather than technical questions (Taft, 2006).

Dave Johnson was swept up in the January 2009 layoffs from Sun, where he had been able to focus on full-time on Roller, and the development of a Project SocialSite that was never completed. From March 2009 to July 2011, Johnson was employed by IBM in the Rational Software brand, so that Roller was not directly funded and again became a hobby project.[101]

Roller was clearly started as an open sourcing project under open sourcing licensing with a community of independent developers, and continues that way today under the Apache Foundation.

A.3.3 (b) Open sourcing: IBM Blog Central

IBM Blog Central has become an exemplar of pioneering with blogging inside corporations. While the practice of blogging and its supporting technologies are commonplace today, these ideas were unknown to business leaders in 2002, and only experimental in period between 2003 and 2005.

In a November 2003 interview, John Patrick – having been retired from IBM for 2 years, yet still serving as an advisor – foreshadowed a direction for blogging internally at IBM.

> *Stepanek*: How might a corporation use blogs?
>
> *Patrick*: Create a blog central, which might be company.com/blogcentral. On that Web page can be a list of the blogs of the experts or the representatives of those experts organized by subjects important to the company—metallurgy and Linux and CRM and so forth. They might find relevant information or links to other resources they didn't know about. And, sure, you might have found it on Google, but you might not have, because the relationship between the problem you're working on and the Web page that's got the answer wasn't obvious.
>
> Some have asked whether there's a role for customers, and there probably is a role for both intranet and extranet blogging. But I think there's a danger that companies might try to invoke some rules to try to edit them, overregulate, overcontrol or sanitize them. Imagine how unread something would be, for example, if Bill Jones, the vice president of consumer safety, writes a blog on something that admonishes people to be careful about something. First, it's corporate-speak more often than not, and second, everybody knows Bill Jones

[101] Roller was in the foundation of the Connections product in the Lotus brand, but Johnson was working in the Rational brand on Jazz and OSLC. He announced "Joining IBM" on March 12, 2009, and described the first impressions on April 30.

> can't find the on-off button on his laptop, so you know there's no way he actually wrote the stuff himself. Blogs, to be credible, must not be overcontrolled, public relations documents. They're best if they're from the grassroots of the organization (Patrick and Stepanek, 2003).

In November 2003, the Blog Central collaborative software appeared on the IBM intranet.[102] Implementation had begun in July 2003 with a pre-v1.0 release of Roller, customized to support integration with IBM's internal systems (e.g. intranet login, employee directory).[103]

From fall 2003 through fall 2005, Blog Central was an experiment where system administrators were in a "best-efforts" mode to support the platform, while learning about the technology. In March 2004, Mark Irvine posted to the IBM Forums asking about "The Future of Blog Central".[104]

> Just wondering what are the long term plans for Blog Central? I'm interested in using blogging within my department, and it's something we're looking at using a lot. But should I start to rely on Blog Central? Maybe things will just fizzle out (in my department I mean), but if it takes off, and we start to get used to using Blog Central, what assurances do we have that it's safe? Will it be stable. Already I've noticed it's sometimes unavailable for short periods.
>
> I have a few other questions:
>
> What about my data, what if I use Blog central for a couple of months, then decide I want to move to another system. Will I be able to get my data exported into some useful format that I can take to another system.
>
> What if I want more than one blog? For example, I may have a specific blog I use for support information for an application. I would also like to start a blog on the blogging project within the department. From there I could link to other blogs as others in the department start to get involved.
>
> What about a blog where more than one person can post? A team blog if you like? Is that possible, or is it being considered?
>
> What software does Blog Central use? Is it available if we want to change it in ways that Blog Central doesn't want to?

[102] The debut of Blog Central was verified by John Rooney, the Workplace Technology and Intranet Operations Manager at IBM during the 2003 launch. "Blog Central launch was November 2003...that was internal on w3.".

[103] The integration work for the first version of Blog Central started July 2003 (Roach et al., 2006), predating the January 2005 v1.0 release of Roller. James Snell and Bill Higgins responded to an incorrect inference by James Governor on June 15, 2005 that IBM was forking Roller in "Note to IBM and Sun: Why not collaborate on OSS, Get over it?"

[104] The Mark Irvine thread about "The Future for Blog Central" started on March 10, 2004.

> It's a great tool btw! very interested to see where this project goes.[105]

On that IBM Forum thread, Elias Torres responded transparently about the experimental nature of Blog Central in 2004, and the thinking at that time about the blogging features that could be supported. He provided some assurance that written contributions by employees would be preserved if the technology proved to not work out.

> Mark,
>
> Thanks for your questions. We really want you and your department to give this a try and we think you should. However, we want you to understand that currently this is supported by only a handful of individuals here at WebAhead and the support and availability is as best as we can provide it.
>
> w3's John Rooney is the 'owner' of this 'pilot' and he is working the real plan for the future of Blog Central, you may redirect some of these questions directly to him, if you wish. Some of the features that you are requesting have been discussed, but we have not had time to implement them, especially the team blog concept. If you would like to blog about different subjects, categories should do that for you. One of the main drives for weblogs is that it can become a centralized repository of your thoughts, and we don't like the idea of multiple blogs because it would create a lot of isolated data set that would not benefit the whole company through a unified dashboard/search/directory for Blog Central (whenever this actually works, not at the moment).
>
> Regarding the data entered into your weblog, I promise everyone using Blog Central to make available a complete dump of their data in some basic XML format in the case this pilot goes nowhere. Regarding changing the application and what it does, I'm not sure this is possible at the moment. Several developers are interested in helping with the development, but no major progress has occurred there. But you can modify your look completely through the use of Page Templates available in your configuration section of your weblog.
>
> To Everyone: keep using this forum or the wiki for comments/questions regarding Blog Central.

By April 2004, Fast Company reported that 500 employees had joined as early adopters, as they learned to contribute content in an open sourcing style.

Internal blogs are more integrated into a worker's regular daily

[105]The IBM Forums on the w3 intranet were eventually migrated to a Lotus Connections foundation, where the exchange between Mark Irvine and Elias Torres could be found.

> communications. IBM began blogging in December, and by February, some 500 employees in more than 30 countries were using it to discuss software development projects and business strategies. And while blogs' inherently open, anarchic nature may be unsettling, Mike Wing, IBM's vice president of intranet strategy, believes their simplicity and informality could give them an edge. 'It may be an easy, comfortable medium for people to be given permission to publish what they feel like publishing,' he says (McGregor, 2004).

In early 2004, Blog Central didn't even have its own IBM Forum, instead relying on the general Webahead forum and the wiki as places to share questions and answers on the experiment.[106] Through 2004, and even into late 2005, there were periodic questions posted to the forum about the Blog Central response time, or the blog server being down.[107]

In a January 2005 university presentation on "Why is IBM Blogging", a cycle of contributing, learning and continuing to engage was described (Borremans, 2005b). By March 2005, the number of bloggers inside IBM was in the thousands.

> At this moment we have about 2800 internal weblogs (on a total worldwide population of about 330,000 IBM'ers.) with about 12700 entries. About 200 blogs have more than 10 posts on them... (Borremans, 2005a)

By June 2005, over 10% of IBM employees worldwide were blogging.

> Through the central blog dashboard at the intranet W3, IBMers now can find more than 3,600 blogs written by their co-workers. As of June 13 there were 3,612 internal blogs with 30,429 posts. Internal blogging is still at a stage of testing and trying at IBM but the number of blogs is growing rapidly – and they are appreciated, with everything from water cooler talk to discussions about IBM's business

[106] On February 17, 2004, David Chess asked:
"I dunno if this is the right place to report it, but `http://blogs.webahead.ibm.com/` is currently giving 'Internal Server Error' (as are all the other URLs on that host that I've tried)."
... to which Elias Torres responded ...
"There's no forum for Blog Central. We are monitoring this forum for Blog Central related questions/comments. We are also watching the Wiki for comments posted there. The reason we have not been actively answering questions or wiki comments is because of our involvement with several other projects in WebAhead and we are not dedicated full-time to Blog Central,although is very dear to us."

[107] Without an official support channel, messages to the IBM Forum were a reliable and responsive way of communicating to system administrators and other bloggers. A typical message looked like this one by David Chess on March 25, 2004:
"Just in case no one's reported this (and assuming it's not just me, and I don't think it is) Blog Central has been broken since sometime yesterday. The Dashboard gives a huge Java exception trace, the individual weblogs and RSS feeds that I try don't seem to return any data, etc. DC"

strategies. (Wackå, 2005)

On September 9, 2005, Dave Johnson acknowledged that IBMers were helping to develop the Roller 2.0 release, and named Elias Torres as a committer on September 15, 2009.[108]

In January 2006, Dave Johnson noted that Elias Torres had contributed the Weblog Tags proposal in the Roller 2.0 release,[109] This acknowledged that a Sun employee (Dave Johnson) and an IBM employee (Elias Torres) were both contributing to an open sourcing project as part of their day jobs while the technology and user base were both evolving.

The first version of IBM Blog Central, from November 2003 through March 2006, is an exemplar to be classified as open sourcing for this research study: the software product was licensed as open sourcing; the services to install, maintain and improve the system were not the full-time activity of the majority of developers or author contributors; and everyone appreciated the pioneering nature of blogging. The story of IBM Blog Central is one of success, which is not necessarily the case for all innovations.

A.3.4 (c) Private sourcing: IBM developerWorks Blogs

In 1999, IBM launched the developerWorks portal web site as a free resource for developers, in support of open standards and cross-platform development (Gonzalez, 1999). In addition to extending the alphaWorks site that provided developers with free access to early IBM source code, conversations could be carried out on forums.

On April 15, 2004, the editor-in-chief of developerWorks, Michael O'Connell, wrote the first blog post on the IBM web site visible to the world, as "Welcome to the new developerWorks blogs".[110] At the launch were announced four additional blog authors: Grady Booch, Simon Johnston, James Snell and Doug Tidwell.[111] All of these bloggers were IBM technical professionals.

The first version of developerWorks was implemented not on a blog platform, but on Jive Forums, with a skin that made the web page look like a

[108]"IBM helping with Roller" foreshadowed Blog Central going directly to Roller 2.0. "Elias Torres joins the Roller team" brought the committer count up to seven.

[109]The contribution by Elias Torres an IBMer was noted for Roller 2.0.

[110]This content of this first blog post on the new developerWorks by Michael O'Connell is a migration onto the Lotus Connections platform as of April 2009. The original look of the page is preserved on the Internet Archive.

[111]In 2004, Grady Booch was an IBM Fellow and Chief Scientist for Software Engineering at the IBM Watson Research Center. Simon Johnston was a Senior Technical Staff Member in the Office of Chief Technology Officer for Rational Software. James Snell was an architect in the IBM Emerging Technologies Group. Doug Tidwell was serving a technology evangelist in IBM's University Relations group. With Michael O'Connell, the five were listed as founding developerWorks bloggers.

blog.[112] With developerWorks visible to the world, the risks of customizing an interface on a commercially mature Jive Forums (i.e. v3.2) product would have assessed lower than modifying an unsupported immature open sourcing Roller (i.e. v0.9.8 with slow progress until v1.0 at January 2005).

By January 2006, 36 bloggers were named on developerWorks.[113] Of the 36, 34 were IBM employees, and two were IBM friends: Wayne Beaton (who had joined the Eclipse Foundation, transitioned out of IBM) and Amy Wohl (an information industry analyst). At this time, the bloggers were still primarily technical professionals – some with notable senior titles such as Chief Architect or Distinguished Engineer – with three exceptions of executives: Jim Spohrer, Director of Almaden Services Research; Bob Sutor, Vice President of Standards and Open Source for IBM; and Bob Zurek, Director of Advanced Technologies with IBM Integration Solutions.

In March 2006, with the releases of Roller v2.0 in November 2005 and v2.1 in March 2006, the developerWorks blog was moved off Jive Forums. Bill Higgins appreciated a new "preview" feature so that misspelling and grammar mistakes could be corrected before publishing.[114] James Snell saw that his original content had been migrated from Jive Forums over to Roller v2, and that Atom feeds, tagging and uploads had become supported.[115]

By January 2008, 71 bloggers were named on developerWorks.[116] Of the 71, all were IBM employees except for Rick Hightower (an independent mentor and trainer on Java programming and frameworks). All of the prior IBM executives on developerWorks blogs in 2008 were still listed,

[112]Nick Poore confirmed (on Feb. 1, 2014) that Jive Forums was the foundation for developerWorks in 2004, saying "we used jive forums. we created a forum in jive then skinned it to look like a blog". Although Jive Forums was available as open sourcing, Poore additionally clarified that the interfaces were sufficiently well documented that reading the original source was not required: "all the UI back then was jsp files so just used java API in jsp very easy. No source needed".

[113]The bloggers on developerWorks in January 2006 listed sorted alphabetically by last name is preserved on the Internet Archive.

[114]On March 12, 2006, Bill Higgins wrote that "This blog is now on Roller, and I have no idea of how to use it", saying that he would see Dave Johnson at the next Raleigh Blogger's Meetup.

[115]While RSS feeds have been a de facto foundation for blogging, Atom was a standard developed by an industry committee. James Snell wrote about the "New Blog Infrastructure":
"DeveloperWorks is in the process of migrating their external weblogs over to a Roller 2.x based platform. My blog was one of the first to be converted. There are several cool new features. First... Atom feeds! If you're currently reading this blog via the RSS feed, I would encourage you to switch over to the Atom feed. New subscribers should automatically pick up the Atom feed from this point forward. Second... tagging! I can now assign arbitrary tags to each post. No more static, stale categories. Third, file uploads and podcasting support. If I ever decide to start podcasting, or if I want to share a screencast or whatever, it's easy as a few clicks. Four... smileys ;-) .... This will be fun. Roller rocks".

[116]Many of the earlier developerWorks bloggers continued, with the 2008 list archived as the "developerWorks community" sorted alphabetically by first name.

joined by Sandy Carter, Vice President, SOA & WebSphere Marketing, Strategy and Channels.

In 2010, "for excellence in effective use of social technologies to advance an organizational or business goal" since 1999 in the business-to-business category, Forrester Research recognized IBM developerWorks with a Groundswell award. IBM said that "developerWorks has both encouraged the growth of the open standards development community while driving down IBM support costs. The net result of the following activities is over $100M in annual support savings" (IBM developerWorks, 2010).

For this research study, the IBM developerWorks blog have been categorized as private sourcing. The technology was selected and implemented by management priorities in a conventional way. The bloggers were all IBM employees and executives who are predisposed to speak on IBM directions in a favourable way – and not to speak in unfavourable ways. Whether the underlying platform was or was not open sourcing software, the general style was private sourcing.

A.3.5 (d) Open sourcing: w3 Blog Central v2, v3, v4

From 2006 to 2009, the Blog Central internal to IBM continued to operate in an open sourcing style, as blogging was encouraged not as a novelty, but as a new way of working.

Approaching March 2006 – in parallel the migration of developerWorks – Blog Central was migrated to Roller v2. On March 10, 2006, James Snell posted an internal blog entry describing the new functional blogging features on the w3 intranet.[117] The IBM High Performance On Demand Solutions organization later described the enhancements as (i) the upgrade to Roller v2 with WebSphere Application Server (instead of Tomcat) and DB2 Universal Database (instead of MySQL); (ii) advanced search capabilities of Blog Central content with WebSphere Omnifind; and (iii) a Data Feeder to Search application that would extract new and updated blog content to be pushed over for search on the w3 intranet (Roach et al., 2006).

On May 31, 2007, Elias Torres announced that the new version of Blog Central was being launched.[118] This was a migration to the Lotus Con-

[117] In "An End and a Beginning" on March 10, 2006, James Snell wrote:
"This weekend marks the end of the IBM internal blogging pilot that has been running for the past two years. The service is being replaced with 'BlogCentral version 2', a Roller 2.x based infrastructure that will offer greater functionality, support for podcasting, group blogs, tagging, and lots of other goodies... including, Atom feeds! All of the content from the pilot system is being rolled over to the new system. Cool stuff.
p.s. the near future may see some changes to my developerWorks blog as well. stay tuned!"

[118] Compatibility between the prior and new versions of blog central could have been expected as relatively small, as "the new version of BlogCentral ... is based on Lotus Connection product which is based on Apache Roller (the original code base for all of the previous versions of BC)". The announcement of "BlogCentral

nections code base (with v1.0 officially released on June 29, 2007), acknowledged as being based on Apache Roller. Issues with the installation were tracked on a ticketing system. This release became known as Blog Central v3.

In May 2007, members of IBM Research reported on "Work-in-Progress" on "BlogCentral: The Role of Internal Blogs at Work", with some preliminary observations:

1. Blogs may rely on or solicit social interaction to collaboratively produce knowledge.
2. Personal opinions and non-job-related stories may be used as a way of attracting readers and building rapport.
3. Some blogs focus on sharing expertise and may facilitate transfer of tacit knowledge.
4. Blogs may be used as repositories for externally gathered knowledge (Huh et al., 2007).

That early research report observed that blogs could and were changing organization communications. At that time, the research was still positioned as discovery, with more conclusive findings some years away.

Organizational collaboration through blogging (and other social software) was encouraged by showcasing enthusiasts demonstrating exemplary behaviours. One such person was Luis Suarez, who was active internally on Blog Central since 2003 and started blogging on the public Internet in April 2005.[119] On the public blog at elsua.net, he first wrote about his experimentations with new web technologies available to the informed consumer (e.g. Opera Browser, Wordpress publishing, Flickr image archives) that complemented tools available only to employees on the IBM intranet. From 1999 to 2006, he was an educational specialist with IBM Netherlands. In March 2004, taking advantage of IBM's mobility programs, he continued his job while physically moving his residence to Gran Canaria.[120]

In January 2006, Luis Suarez was assigned to a new role as a Knowledge Management consultant inside IBM Global Business Services, on the Learning and Knowledge team focused on community building. With that new role inside IBM, he also extended his external persona by writing also as "elsua: The Knowledge Management Blog" on IT Toolbox, publishing

launched today" appeared on May 31, 2007.

[119]Luis Suarez started as a contractor to IBM in January 1997 in the role of a customer support representative on mainframes, then on PCs (with OS/2 and Windows 3.1). In November 1999, he became a full-time IBM employee, taking a larger role in training. On April 15, 2005, the first "Welcome to LSR!" post appeared on Blogsome (a free Wordpress hosting service). The web domain elsua.net was registered on October 4, 2005, and the Wordpress content migrated shortly thereafter. A retrospective on ten years with IBM was posted in January 2012.

[120]Luis Suarez has an entire category of his blog on Gran Canaria, and reflects on March 17, 2004 seven years later.

content both on that site and cross-posting to his personal site.[121] In March 2006 at the IBM Technical Leadership Conference in Madrid, the advocacy of personal and organizational initiative towards social software was demonstrated in his presentation on "Personal Knowledge Management".[122]

In May 2007, at the IBM Technology Leadership Conference with 2200 IBMers at Euro Disney Paris, Luis Suarez led one of the five sessions on Social Computing, initially nervous about mistargeting the audience, but then discovering many colleagues attending and participating in his presentation.[123] In June 2007 at the 12th annual AQPC Conference on Knowledge Management in Houston, in a panel of IBMers on "Communities: Hotbeds of Innovation at IBM" chaired by Alice Dunlap-Kraft: Luis Suarez presented "Collaboration Technologies" and Mary Ellen Sullivan described the "IBM Global Innovation Community: Case Study".[124] In July 2007, the IBM Academy of Technology Conference in Somers, NY had the theme of "Collaboration 2.0", where Luis Suarez participated but content was not released publicly.

On September 25, 2007, the pioneering work in blogging both inside and outside of the company by Luis Suarez led to his moving from a knowledge management role in the regional IBM Global Services organization over to a "Social Computing Evangelist" role in the worldwide IBM Global Technical Sales team.[125]

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[121]The original description for Luis Suarez starting his blogging at IT Toolbox in January 2006 is noted on elsua.net and replicated from ittoolbox.com.

[122]The content of the "Personal Knowledge Management" presentation on social technologies is complemented with reporting of the irony of poor Internet infrastructure at the hotel deterring communications.

[123]For TLE 2007, the Euro Disney hotel was criticized for not providing sufficient wireless Internet access. Luis Suarez was discouraged by poor attendance at a lunch roundtable on Social Computing, and then eventually energized by the attendees at his presentation. The experience of attending the event is blogged in six posts.

[124]The presentation slides for the AQPC 2007 conference are online at slideshare.net. Luis Suarez reported with ten blog posts on the conference.

[125]Luis Suarez described the move to the worldwide Software Group team:
"... as of the 1st of November 2007 ... I will ... join IBM's Software Global Technical Sales team with Dale Rebhorn and working very closely as well with Gina Poole (IBM Software Group, Marketing VP, Social Software Programs and Enablement) and her team.
I am incredibly excited about this particular job move, because it would allow me to do on a full time basis what I have been doing, for most of the time, out of my own private time, which is basically help knowledge workers, whether they are part of my immediate teams or not, or elsewhere, including business partners and customers, embrace and adopt social software in order to collaborate much more effectively with other knowledge workers.
I guess my new title would probably not change much from the one I have at the moment: Knowledge Manager, Community Builder and Social Computing Evangelist. Except that perhaps this time around the focus would be more on evangelising on social computing and helping a bunch of teams and communities out there embrace social software".

Within enterprises, social computing has the possibility to resolve challenges of e-mail overload. Research from the IBM Remail project found: (i) workers feel overwhelmed by e-mail, from the average user getting 24 messages per day to high-volume users getting several hundred; (ii) e-mail inboxes used to manage tasks are insufficient to preclude when "things fall through the cracks" as messages get lost among newly arriving mail; and (iii) responsiveness is a problem, with 27% of messages perceived to "require" immediate attention (Gruen et al., 2004). The adoption of social software as an alternative to e-mail would not only be a change in technology, but also a change in communication practices.

A January 2008 interview hinted at the revolutionary idea that social computing and blogging would take a higher priority over e-mail.

> *Peter Andrews:* One of your theses, which you put into practice, is making blogging, rather than face-to-face meetings or e-mail, the center of your worklife. [. . . .]
>
> *Luis Suarez:* [. . . .] Blogging has changed my working life in such a way that e-mail is the last thing I check in my usual morning catch-up. And when I look through it I always try to find content from those e-mails that would be bloggable and blog it. One of the things I keep trying to tell people is that if you want to be an effective blogger and get the job done, (the) first thing to do is to stop using e-mail. Instead, make use of social software and, especially, blogging. Nowadays, the amount of e-mail I get is no way the same number I used to get a few years ago. People know where to find me, and e-mail is not the first place I check :-) (Peter Andrews and Suarez, 2007)

During this new assignment as a "Social Computing Evangelist", Luis Suarez gained notoriety across the industry and the mainstream press on "giving up on e-mail". On February 15, 2008, he reported that he had started an experiment whereby he would divert most of his conversations into social computing and social software tools.

> I have been telling people I will no longer be responding to e-mails, because the more I respond, the more I get. I am sure you have seen and been through that already!
>
> So have I given up on all incoming e-mails as such? No, I wish I could, but there is one single scenario that I cannot ignore and that will force me to continue making use of e-mail as a communication tool ... to engage on a private conversation where information of a sensitive nature gets exchanged. Of course, in that case, that conversation is still going to be carried out through e-mail & it would be the only time that I would be responding back.
>
> I have been using quite often Lotus Sametime 8.0 (With some of its lovely social networking capabilities I will cover one of these days),

> Blog Central (i.e. blogs), Wiki Central (i.e. wikis), Lotus Connections (With blogs, Dogear, Activities, Profiles, Communities), Lotus Quickr, Fringe, Cattail, BlueTwit (An internal Twitter clone), Media Library, Beehive, Atlas, etc. etc. (And not counting the external social software tools I use on a regular basis!)[126]

"Giving up on e-mail" became newsworthy in mainstream media. At nine months, Luis Suarez gave a presentation on "Thinking Outside the Inbox" at the O'Reilly Web 2.0 Expo Europe (Suarez, 2008).[127] This led to a CBC Radio interview broadcast on Canadian airways and available for download over the Internet (Young, 2009).

By January 2008, blogging had become a way for collaboration-oriented IBM employees to share their knowledge. Of 360,000 employees worldwide, 41,000 had registered so that they could contribute either as authors or commenters. Of 11,000 blog authors, about 13% were posting regularly. Since blogs had been integrated into the IBM intranet search, the number of content readers could be inferred from a 3-day statistic of over 3 million hits and over 100,000 unique visitors.[128]

Through 2009, Blog Central platformed on the Roller software was maintained. On March 23, 2009, Blog Central v3 was upgraded to v4.[129]

For this research study, Blog Central – from v2 through v4 – is categorized as open sourcing. The community of authors and comments were learning about blogging, contributing their time towards improving organi-

[126]The shift to "giving up on e-mail" was announced by Luis Suarez on Feb. 14, 2008 as "A Refreshing New Way of Collaborating and Sharing Knowledge – Giving up on e-mail! (Part I)".

[127]At the Web 2.0 Europe conference, Luis Suarez had prepublished his slides, and spoke without them. The third day of the conference was reported on Oct. 31 2008 as "Web 2.0 Expo In Berlin – Day 3 Highlights".

[128]James Snell reported statistics for the first three days of January 2008 on his January 4, 2008 blog as "Growth":
"Quick note: IBM's internal blogging environment currently has 95k+ entries, 94k+ comments, 41k+ registered users, 11k+ Blogs (about 13% of which are considered "active"), 20k+ distinct tags, and 6k+ ratings on entries (entry rating has only been around since June of 2007). On average, there are just under 150 new entries posted to about 115 blogs per day. The number of comments per day fluctuate between 80-230 per day. A range of between 200-400 tags are used each day. Update: in the first three days of January, the server access logs show 109,439 unique visitors, 3,265,739 hits, and 61.37 GB of data transferred".

[129]The last upgrade of Blog Central from v3 to v4 with continuing support via the Technology Adoption Program was announced by Brett Ashwood on the IBM Forums:
Brett Ashwood | Blogs Outage | Mar 23 2009
"As posted by the Blogs Central Dev team last week, Blogs central v3 is currently being upgraded to v4 today. Scheduled outage is 3/23 until tomorrow the 24th - we'll try our best to have it available before then. We'll post status here as to our progress, and as always, we appreciate your patience during this upgrade.
https://w3.tap.ibm.com/weblogs is up and operational! Search and other features are working - please post any issues or bugs you come across and we will address them in a timely manner. Thanks you again for your patience, Innovation Systems team"

zational communications voluntarily. Only a few would have had "social computing" in their job descriptions, and practically none had a full-time position enabling blogging. The technology evolved at the same time as the practices.

A.3.6 (e) Private sourcing: Lotus Connections Blogs

While IBM had deployed wiki technology internally since 2003, and had employees with experience writing and hosting their content on open source platforms, the Software Group division did not have a commercial product that included blogging features until 2007. The Lotus Connections 1.0 product announced May 2007 featured blogs, as well as profiles, bookmarking, and communities (with forums) (IBM, 2007i). Within the IBM organization, however, employees developing commercial program products in the Software Group division operate in under a completely separate set of structures and practices formally unrelated to the internal office of CIO responsible. Since IBM prefers the Java software platform for building technologies, the influence of the open sourcing work on Roller should not be surprising. The association between the Roller product and the Lotus Connections product was foreshadowed in late 2006, with functionality and user interface conventions that would have been obvious to anyone who used both the open sourcing and commercial versions.

In November 2006, IBM Project Ventura was leaked in a public blog post by Redmonk analyst Michael Coté and then retracted on IBM's request.[130] The content was reblogged on December 1, 2006 by on personal blogs by IBMers Luis Suarez, James Snell, Elias Torres and Andy Piper – none of whom was involved in the release of IBM program products to customers.[131] Based on pre-announcement of product in development, Dave Johnson – the original inventor and leader of the Roller project, saw IBM's move as positive.

> ... at an analyst conference last week IBM announced a new server-side product suite called Ventura that includes blogging, social bookmarking and social networking. Ventura is Java EE-based, runs on WebSphere (with DB2 or Oracle) and the blog server component is based on Apache Roller (incubating) 3.1. That's the very same version of Roller that we're currently running at blogs.sun.com.
>
> So how do I feel about it? I'm thrilled to see IBM contributing to, building on and supporting the Roller project. No matter how you cut it, that's good news for Roller users including those at blogs.sun.com who are already benefiting from IBM's contributions (e.g. tagging

[130] The comments on Project Ventura were written on the Coté blog on redmonk.com before being taken down.

[131] Luis Suarez shared the parallel blogging on Project Venture by other bloggers on elsua.net.

> support in 3.1). Of course to be honest, I'm also a little disappointed that Sun isn't shipping and supporting a Roller distribution – that's always been one of my goals. Sun has put heck of a lot of engineering time into Roller, helped to grow the community in the Apache incubator and benefited greatly via blogs.sun.com – it sure would be nice to share those benefits with our customers by offering service and support (D. Johnson, 2006).

Dave Johnson "thrilled" perspective of December 2006 can be placed in the context of his career changes and Roller's progress. Dave Johnson had been an employee of Sun Microsystems since August 2004, and Roller had been accepted as an open sourcing project by the Apache Foundation in January 2006. Although the open sourcing Roller platform was prominently featured on Sun Microsystems public web site, the company would not even acknowledge how blogging technology might play in a commercial context until the announcement of Project SocialSite, associated with the OpenSocial API by Google in November 2007.[132] At May 2008, on the Roller blog, Dave Johnson wrote that he had been cleared by Sun to demonstrate Project SocialSite, but not about commercial product plans.

> As promised, here's some more information about the talk I and my co-speaker Jamey Wood are giving tomorrow at CommunityOne ....
>
> Below is the official title and blurb.
>
> **Turn your Web Application into an OpenSocial container**
>
> [....]
>
> Perhaps a better title would have been, '**make your webapps social with Project SocialSite**' but we didn't have permission to talk about our project until very recently. Now, we're ready to talk about the Project SocialSite widgets and web services and how you can use them to add Social Networking features to your existing Java, PHP and Ruby webapps. We're not ready to talk about product plans, features or schedules but we are ready to demonstrate our work in Netbeans, MediaWiki, Portal, Roller and possibly some other apps as the JavaOne week progresses (D. Johnson, 2008).

Project SocialSite would be formally be announced on August 8, 2008 by Dave Johnson on the Sun Microsystems blog. The code was classified as an open source project hosted on java.net – a community web site sponsored by Sun – under the CDDL/GPL license. SocialSite would never become

[132] While developing an independent blog platform could be done by any motivated programmer, blogging as a way of sharing relies not only on being able to link from one web site to another, but also managing identities and authentications so that a single individual doesn't have fragmented personas across the Internet. OpenSocial was announced as "a set of common APIs for building social applications across the web – for developers of social applications and for websites that want to add social features" (Google, 2007).

a viable project. Dave Johnson was one of the employees released in the January 2009 layoffs from Sun. He joined IBM in March 2009 in an assignment unrelated either to Roller or to SocialSite. The changes at Sun Microsystems, in hindsight, were related to corporate stress later disclosed as a November 2008 initial approach by IBM about a merger with Sun, through to the April 2009 acquisition by Oracle that was to be approved by shareholders in July 2009.[133] On March 27, 2009, Dave Johnson announced that Sun had agreed to contribute the code to the Apache Foundation (D. Johnson, 2009a). While SocialSite was registered to the Apache incubator as a project in May 2009, lack of activity on the project led to its retirement in October 2010.[134]

While IBM is cited to have made contributions to the open sourcing Roller project, this work came through the Office of the CIO and directly from Software Group. In January 2007, Dave Johnson blogged about IBM contributions to the Roller project.[135] The contributor, Elias Torres, was working on Blog Central, not the Lotus Connections product. Since these contributions would have been adopted within the Apache-sanctioned project, the benefits would have available to everyone subscribed to updates to the open source. The Software Group developers would have visibility to the changes in the Roller code, but inclusion or exclusion of Apache licensed materials into the Lotus Connections program product would be based on IBM development processes and the code base already established.

Prior to the May 2007 announcement of Lotus Connections, IBM employees outside of Software Group product development would not have even known the name of a new program product for collaboration. The primary platform for blogging internally on the w3 intranet would continue to be Blog Central for some years. In fact, the wiki functionality available as Wiki Central on the w3 intranet was notable in its absence in the Lotus Connections 1.0 release. Pragmatically-oriented employees enjoying the benefits of Blog Central for day-to-day internal work would not totally ignore the blogging features of Lotus Connections. IBM benefits by referencing its own use of commercially-available program products, as one of

[133] In proxy filings by Sun in June 2009, the initial contact in November 2006 by IBM to Sun CEO Jonathan Schwartz also led to approaching a "Party B" – rumoured to be Hewlett-Packard – in December 2008, subsequent to the eventual acquisition by Oracle (Handy, 2009).

[134] Although the open source software licensing of SocialSite code would have made migration to an Apache project simpler, the contribution of ongoing resources after Sun had been acquired by Oracle makes viability improbable. The 2010 retirement shows up on the SocialSite Project Incubation Status page.

[135] While the resources who support applications as support IBM inside IBM as a business are distinct from resources dedicated to developing program products for external customer, most journalistic reports don't differentiate. Dave Johnson posted on Jan. 30 2007 about "IBM Roller development update and iBatis vs. JPA":
"Elias posted some good news about some upcoming IBM contributions to Roller. We're discussing how best to get them into Roller now".

the world's largest organizations employing enterprise-scale applications. From the formal announcement product announcement date though to the internal migration off Blog Central, the pilot use of Lotus Connections on the w3 intranet would be managed through the Technology Adoption Program (TAP) (Chow et al., 2007).

While Lotus Connections is a commercial, private sourcing package, IBM employees had privileged access (as compared to external customers) to provide feature requests to Lotus product management. On July 27, 2007, Gia Lyons blogged about the availability of a new "cubscout" feature request site. Entering feature requests would require registering for a new web site (i.e. authentication wasn't integrated with Bluepages), although Suzanne Livingstone pointed out that viewing feature requests (e.g. seeing the features most requested) didn't require registration.[136]

From 2007 through 2009, most IBM employees working in their normal courses of activities on the w3 intranet used Blog Central rather than Lotus Connections on the Technology Adoption Program. Lotus Connections versions 1.0, 2.0 and then 2.5 were deployed on TAP, with employees providing feedback. With Blog Central built directly on the open sourcing Roller platform and Lotus Connections derived from that heritage, migration of the rich legacy of writings since 2003 to a new platform would be a large, but relatively low risk data migration project.

On December 3, 2009, Lotus Connections 2.5 became the official software platform for social computing on the w3 intranet. The legacy blog content was migrated, and Connections would become the new place for collaboration, going forward. In addition to the promotion of the launch internally, the recognition of IBM itself having moved over to its premiere collaboration product was blogged to the public by Luis Suarez as historic.[137]

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[136]The visibility of the Lotus feature request site on the IBM intranet demonstrates a willingness to collaborate inside the company, with relatively low bureaucracy. Gia Lyons, a social software evangelist on the Lotus product sales team, blogged, and received comment responses:
Lotus Connections Feature Request Site | Gia Lyons | 12 July 2007
"Feel free to use this feature request site. Product Management is actively watching it. The stuff with the most votes gets more attention. I think it's great that they are listening, don't you?
And I don't wanna hearing ANY complaining about how this is not tied into Bluepages (must register a new set of creds to use), how it's not in Notes (get over it), or how it's not whatever else that might irritate you. C'mon. Try something new".
Comments
1 Meng Mao 11 July 2007
"Nice. I'll use this to shoot down all the features I don't want. jk. I'll probably really go for dashboard and collaborative writing".
2 Suzanne Livingston 20 July 2007
"Thanks Gia! If you go to this view - http://cubscout.lotus.com/pligg/live_published.php - you can see the ones with the most votes".
3 Gia Lyons 20 July 2007
"Nice! Ones with the most votes... cool!"

[137]The switch over from Blog Central to Lotus Connections 2.5 was publicized

On March 2, 2009, IBM developerWorks introduced blogging to the world of technical developers with My developerWorks, built on the Lotus Connections Blogs.[138] IBM announced "the transformation of developerWorks into a professional network and knowledge base that connects the developer community worldwide" (IBM developerWorks, 2009). In comparison to the rising social media platforms – e.g. Facebook and LinkedIn – the press described My developerWorks as the "world's geekiest social network" (O'Dell, 2009). The technological challenge of customizing the IBM Lotus Connections product for developerWorks would later be presented at the 2010 LotusSphere conference.[139]

For this research study, Lotus Connections Blog is classified as private sourcing not only as a commercial product, but also in the style in which the social computing infrastructure of Roller was replaced for both Blog Central and the developerWorks blogs. While some personalization features are available to authors, the design, development and deployments followed standard corporate practices. Open sourcing contributed to learning about blogging at the infancy of the technology and practice, which then stabilized into predictable patterns by 2009.

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as "Validating Social Computing by Living an Historic Moment at IBM" by Luis Suarez on Dec. 3, 2009:
"Version 2.5 was just that quantum leap we were all waiting for all along...
So for the last few months we have been using that version in TAP, which is, as you may have imagined, a pilot environment that serves more the purpose of a playground area to explore the potential of what the tool can do to help improve the way we collaborate and share knowledge with our peers. But always with a purpose. The purpose that one day it would leave TAP, continue to grow further and reach that full production environment that serves as perhaps *the* most prevalent validation point that social software for the enterprise is here to stay.
Well, today is that historical moment. I am very pleased (And incredibly excited!) to share with you folks out there that overnight Lotus Connections on TAP was successfully migrated into IBM's full production environment within the IBM Intranet. And everything has gone very smooth. The performance has been amazing all along and, like I said, this is just a new beginning for all of us IBMers. This move into that full production environment means that from here onwards IBM's 500k employee population will be using Lotus Connections as their strategic knowledge sharing and collaboration tool. As far as I know, that is the largest deployment of enterprise social software behind a corporate firewall. And along with the recent announcement that the instance of Lotus Connections on http://ibm.com/communities has moved to version 2.5 in a production environment as well we are witnessing very exciting times on what's still to come, indeed!"

[138]Bob Leah, the Manager of developerWorks Advanced Design, wrote the first blog post on March 2, 2009 of "Welcome to My developerWorks!". My developerWorks featured "personalized profile, custom home page (My Home), feeds, tags, bookmarks, blogs, groups, forums, and activities.

[139]Nick Poore captured a photograph just before starting the presentation at Lotusphere 2010. Of ten customizations to the IBM Lotus Connections produce, three were specifically related to the blog: (i) migration of legacy blogs, (ii) custom themes, and (iii) mirroring external blogs (Poore and J. Allen, 2010).

A.3.7 Prospects: Blogging is an individual open sourcing expression that organizations can cultivate

Looking back from 2014, blogging starting from 2001 was an innovation: it permitted (i) individuals to have a web presence to "react, respond and provoke" as much as any commercially-funded vendor on the Internet; (ii) development of a web community as a social space, more than the purely publishing, information or commercial agendas to date; and (iii) disruption in "who gets to speak, how we speak, and who is in authority" in a communications revolution (Weinberger, 2014). This personal perspective is the one associated with any individual who comes to be known as a *blogger*.

From an organizational perspective at IBM, blogs have been seen as a way to enable global collaboration.

> BlogCentral is a worldwide phenomenon at IBM, as illustrated by the business region distribution .... Combined globalization and increased economic pressures were instrumental in worldwide adoption because all regions had equal access to the technology. Little if any local resources were required to take advantage of BlogCentral from any IBM office worldwide. Feedback on the effectiveness of blogs and efficiency gains were likewise not limited to any region. Globally distributed satisfaction surveys were analyzed by region, providing strong quantified evidence that internal blogs generate great value throughout a global environment (Azua, 2009).

Much of the learning about blogging inside IBM came from employees who not only became known as leaders inside the company, but also in external and public contexts. In 2011, IBM Benelux constructed an entire web site around "Outside the Inbox", based on the "Life Without eMail" work of Luis Suarez.[140] In April 2013, Luis Suarez moved from the position funded by the external sales team into an internal role with the Office of the CIO of IBM.[141] Continuing progress on "Life Without eMail" was reported on Suarez's personal blog 5 years and 6 years after his beginning.[142] – (Newcomer Challenging for King Email's Crown)" on July 17, 2013.

From the perspective of open sourcing and private sourcing, the technology platform is part of blogging, but not all of it. Dave Johnson continues

[140]The website at outsidetheinbox.eu was registered in 2011 by Ogilvy Amsterdam, and featured a video of Luis Suarez in Gran Canaria.

[141]The job role and responsibilities for Luis Suarez bridged both "Lead Social Business Enabler - IBM's w3 and www Connections" as the IBM Connections product was a commercial offering also used by IBM internally. The job change was announced on April 22, 2013 as "Lead Social Business Enabler for IBM's w3 and www Connections – Job Role and Responsibilities".

[142]Continuing reports included "Life Without eMail – 5th Year Progress Report – The Community, The Movement" on May 6, 2013 ; "Life Without eMail – Year 6, Weeks 1 to 20 – (Back to Basics)" on June 15, 2013; and "Life Without eMail – Year 6, Weeks 21 to 24

to lead Roller as an open sourcing project at Apache, but progress isn't active as he would like. In April 2012, he wrote:

> These days, Roller isn't really thriving as an open source project. Wordpress became the de facto standard blogging package and then micro-blogging took over the world. There are only a couple of active committers and most recent contributions have come via student contributions. Though IBM, Oracle and other companies still use it heavily, they do not contribute back to the project (D. Johnson, 2012).

The content contributed to corporate blogs remains with the organization even when employees leave the business. Some individuals blog both in public contexts and inside their companies, some blog only on intranets, and others blog only on extranets. Both IBM and the blogging authors benefited by adopting the new technology. Blogging continues as a practice that is a normal way of communicating in both organizational and public contexts.

A.4 Case: Wikiiing (collaborative web content sharing)

With Wikipedia becoming one of the top-ten web sites after 2007, the wiki technology has become commonly understood by laymen.[143] The word "wiki" entered the Oxford English Dictionary only in 2007, acknowledging references back to the 1990s.[144] A wiki is "a website or database developed collaboratively by a community of users, allowing any user to add and edit content".[145] Before the 2005 landmark when Wikipedia became the most popular reference source on the Internet, the way that wiki technology had been applied was specialized to researchers in pattern language community and small groups studying computer supported collaborative work. Large scale collaborative web sharing in the wiki way was neither familiar in the larger public realm nor within goal-oriented organizational settings.

The Internet was designed as between computer networks. The rise of the browser as a human interface to the worldwide web has been described as "Web 1.0" with the Netscape browser an archetype. In 2005, "Web 2.0" was seen as a turning point for the worldwide web with:

[143] Alexa ranked Wikipedia entering as #10 most popular in 2007, rising consistently to be #6 behind Google, Facebook, Youtube and Yahoo.

[144] Graeme Diamond, Principal Editor of New Words for the Oxford English Dictionary commented in March 2007 on "wiki *n*." "This joins a small but distinguished group of words which are directly or ultimately borrowings into English from Hawaiian. It has been suggested that in some ways the OED itself resembles a wiki: its long tradition of working on collaborative principles means it has welcomed the contribution of information and quotation evidence from the public for over 150 years".

[145] The word "wiki" is recognized as a noun at Oxford Dictionaries Online.

- (i) the web as platform, with seamless cooperation between two or more websites using web services;
- (ii) the harnessing of collective intelligence, where network effects from user peer contributions make up the largest part of web site content;
- (iii) the owning or hosting of core data encourages an authoritative single source, e.g. of location, identity, calendaring of public events, product identifiers and namespaces;
- (iv) business models shift so that software is delivered as a service rather than as a product, with operations becoming a core competency and users treated as co-developers;
- (v) simple, lightweight programming models dominate complex web service stacks engineered for highest reliability; and
- (vi) software not limited to the PC platform, but accessible across multiple devices; and
- (v) rich user experiences beyond simple text browsing to interactivity (O'Reilly, 2005a).

The idea of collaborative editing through a wiki has grown into a new mind-set exemplified by Wikipedia[146], and described as Wikinomics (Tapscott and A. D. Williams, 2006).

A.4.1 Context: Wiki as simple web sharing

The first wiki was developed by Ward Cunningham in 1995, as a tool for rapid sharing amongst the Hillside Group in the development of a Design Patterns Library.[147] It was called the Wiki Wiki Web, or a wiki wiki for short.[148] In the Hawaiian language, wiki means hurry, hasten, quick, fast, or swift.[149] The original wiki was governed by a group of volunteers that come and go, with unstructured content that could be altered or deleted by anyone.[150] Ward Cunningham writes: "When volunteers tire and depart, others take their place. I remain amazed that this works without mechanically enforced authority. Possibly it works because there is no mechanically enforced authority".[151]

[146]Wikipedia was launched in 2001, with the Wikimedia Foundation established in 2003.

[147]The history of the first wiki is described at c2.com. A description of the Design Patterns Library – for software patterns and pattern languages – is at the Hillside Group.

[148]The label of Wiki Wiki Web soon came to be abbreviated to a wiki.

[149]The definition for wiki, from the M.K Pukui and S. H. Elbert, *Hawaiian Dictionary*, University of Hawaii Press (1986) appears as part of the *Polynesian Lexicon Project Online*.

[150]The C2 wiki is so easy to change, there's no bragging rights to hacking it.

[151]While the first entry on "Why Wiki Works" was posted by Ward Cunningham, the rest of the page has the contributions of others, some attributed and some not attributed.

Without a technological enforcement of authentication and security, wikis are designed to preserve the history of edits, so that vandalism and disputed content can be undone. As compared to the hierarchy of editorial roles in Wikipedia, the style of the original wiki was looser.

> The following are the norms for this wiki:
> - unattributed viewpoints
> - original research
> - fussing, noise, fun, actual and inactual advances
> - thread mode, jokes, and transclusions
> - content shamelessly ripped off from other forums, possibly without attribution
> - signed works by WikiAuthors
> - unsigned works by actual authors
>
> Nothing here needs to be chronically cleansed of any potential for dissent![152]

The wiki way was never seen as the only way of presenting content. In a comparison of usage patterns for alternatives, "thread mode" – chronological writing where additional content requires sequentiality to make sense – was seen as difficult for this technology.[153]

There is over 100 wiki platforms to choose from. In contrast to the original C2 wiki written by Ward Cunningham in the Perl programming language, alternatives vary in their development foundations.[154] In addition, since the specific wiki markup to format the text for presentation varied, the Wiki Markup Standard Workshop at WikiSym2006 led to development of a Wiki Creole.[155]

There is also philosophical views on how wiki is used on computer-support cooperative work. Ward Cunningham sees wiki content as always unfinished, encouraging opportunities for continuous learning:

> One person asked me once, he said wikis are pretty neat, but do they have to be so ugly? The answer is yes, basically they do. If you make it beautiful, then anyone who can't match your beauty is closed out of the conversation (Cunningham, 2012).

In the period from 2001 to 2011, the wiki technology and the way it was used coevolved.

[152] Contributors to Wikipedia who have been savaged by editors undoing content are likely to appreciate why the wiki way has a different spirit.
[153] Breaking the pattern of sequentiality is advised . Humility says that collaboration issues with the wiki technology are present in other platform alternatives.
[154] Wikimatrix lists the most popular programming languages for wiki as PHP (40), Java (28), C (27) and Perl (14).
[155] WikiCreole was started in 2006 to map out the variety of markup syntaxes. The project was stabilized in 2007.

A.4.2 (a) Open sourcing: JSPWiki

JSPWiki was a wiki technology started as an open sourcing project by Janne Jalkanen in 2001, developed as a J2EE (Java 2 Platform, Enterprise Edition) application.[156] Jalkanen was a Nokia employee at the advent of JSPWiki, who developed the technology on his own time. Originally written under a GPL license, the Jalkanen, as "benevolent dictator" changed to license to Lesser GPL in 2004 so that JSPWiki contributors could more easily embed their own code.[157]

Within increasing popularity, further shifts away from a "benevolent dictator" role by Jalkanen began. In August 2007, the core development team of JSPWiki submitted a proposal for the technology to be further developed as an Apache project.

> JSPWiki code base is old, and it needs some refactoring. This refactoring includes things like moving to Java 5, fixing the metadata engine, replacing the backend with something scalable, and in general removing all the cruft that has been accumulated over time. This requires that we break compatibility with existing plugins and other components. Not badly, but to some degree.
>
> Also, JSPWiki as an open source software project is growing slowly but steadily. However, the wiki world is moving rapidly, and wikis have been adopted widely. JSPWiki has become a tool for a great many companies, who are relying on it in their daily business. This is a lot for a hobby project lead by a 'benevolent dictator' -model. Therefore, it is time for JSPWiki to mature to a 'real' open source software project to be a serious contender in the wiki world.
>
> To accomplish both of these goals needs a major shift in how JSPWiki is managed and who 'owns' it, in a sense. Therefore, we (the people who have been committing source code) think that Apache would be a good choice, and have decided that we will try to submit JSPWiki into the Apache incubation process, with the goal of graduating as a top-level project (Jalkanen et al., 2007).

On July 17, 2013, the project graduated to become Apache JSPWiki, a top-level project.[158]

[156] JSPWiki progressd from v1.0 through v1.6.2 in 2001.

[157] Following a benevolent dictator style in 2004, Janne Jalkanen made the license change autonomously. A minor history of discussion subsequently appears as the "JSP Wiki License Discussion".

[158] The legacy JSPWiki site has been preserved, with the announcement of the project status as graduating from incubation.

A.4.3 (b) Open sourcing: Instawiki

In 2004, the IBM Webahead team installed JSPWiki on an intranet server as Instawiki. In December 2004, an IBM employee asked on the internal forum if he could use the Webahead Instawiki, rather than installing a wiki on his own private server. The response from the Webahead team was positive, marking the beginning of an experimental phase.[159]

Through having authors creating and revising content on Instawiki, the use of the technology and product functionality coevolved. Since wikis preserve the original history of edits and revisions, conventions on system administration performed by authors and by named systems administrators were gradually negotiated. Philosophically, unwanted revisions (e.g. duplicate pages, or graffiti) can be reverted by author-editors, rather than deleted. From a system administrator's perspective, however, unwanted revisions represent wasted space that might be freed for other more productive content. In June 2005, as an interim negotiation on a minimal level of support, a daily procedure to expunge any pages with [DELETEME] on its contents was discussed and implemented.[160]

---

[159] Bill Krebs asked, on Dec. 2, 2004, "Can I use webahead's instawiki", and received a response:
I'm working on setting up a wiki for my project. Though I've setup wiki engines on my machine I prefer to avoid hosting on my test box because it's not an official server.
"I noticed at http://w3.webahead.ibm.com/inksling/collaborate.htm you can 'Create your own wiki'. It gives you an 'instawiki' url. (It's based on JSPWiki and has the W3 theme). I've created some pages for my site. I like it because it's hosted at webahead, and doesn't even say 'pilot' in the url.
Technically it does 95% of what I need (though FindPage (search.jsp) and UserPreferences don't seem to function).
Is this too good to be true? Is this a pilot that could vanish, or is it something I can use?
Thanks! Bill"
. . . to which Konrad Lagarde replied ..
"InstaWiki is still just an experiment at this point. Feel free to use it and give us your feedback.
Konrad Lagarde, Webahead"

[160] The minimal level of support is discussed in a thread started by Soobaek Jang on June 1, 2005 , in the "WikiCentral - Daily Refresh and Delete Page function":
"As of June 1, 2005,
– Daily refresh on WikiCentral at 3AM EST. This means RSS Feeds will be generated once its refresh is done. Notes that RSS Feeds get only generated once a day.
– [DELETEME] function enabled. With daily refresh, it will delete all pages with [DELETEME] on its content. NOTES that any page contain [DELETEME] on any line itself will be deleted and NOT be recoverable. So be sure type something else on the same line with [DELETEME] if you don't want your page to be deleted but want to mention about [DELETEME].
Thanks".
On a question from Xavier Verges about this delete function, Soobaek Jang responded:
"Hi Xavier, I guess I didn't read your post carefully on Thursday night, sorry.
Yes, once a page is deleted, it is NOT recoverable. In that sense, yes it is aggres-

The experimental status of Instawiki as a minimally supported technology continued through 2005, with messages to the forum periodically appearing about the wiki server being down.

In January 2007, the Webahead team announced that Instawiki would be sunset. Archiving of the data would be available only within 2007. While the basic text could be migrated to a different wiki technology, the lack of standards in wiki markup meant that links between pages would be broken, and content would have to be migrated page-by-page. By June 2008, all of the data was gone.[161]

Placing this project into a categorization of open sourcing or private sourcing, Instawiki is open sourcing. In addition to being based on open source technology, the minimal support organization and mediated interaction between author-editors and administrators reflect a style common in open source communities.

A.4.4 (c) Open sourcing: w3 Wiki Central v2

Through 2005, while the Webahead team was learning about the use of wiki through Instawiki, alternatives were reviewed and evaluated. While wiki technologies have a history back to 1995, enterprise scale companies – like IBM at 300,000 employees – had not experienced more than experimentation. Enterprise wikis (e.g. Atlassian Confluence, Jotspot Wiki, Socialtext Enterprise) include technical support with their products, unlike purely open sourcing platforms (e.g. MediaWiki).[162] IBM would not have a branded commercial enterprise wiki product until 2009, with Lotus Connections 2.5.

By November 2005, the Webahead team was piloting Wiki Central v2 based on the Atlassian Confluence product. This coincided with the release of Atlassian Confluence 2.0 in the same month.[163] The Confluence product, with an open sourcing commercial license for unlimited use and a fixed annual maintenance fee, was easy to cost-justify for a company the size

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sive.
However, as I explained before, many people have asked me to have this enabled. I totally understand your concern and that is something we (our team) should keep in mind.
I am thinking maybe something like this would work.
Only restricted pages can be deleted. Pages which are open to public can NOT be deleted.
What do you think?"

[161] Although the content of Instawiki has been eradicated, discussion about it's demise was migrated from the IBM Forums to Connections Forums. Soobaek Jang posted "InstaWiki has been sunset" on June 22, 2007.

[162] In a comparison with other enterprise wikis, Atlassian Confluence was not only ranked the top product, but was the only one that provided source code upon licensing. See (R. Anderson, 2006)

[163] The original numbering of Confluence 1.5 was renamed Confluence 2.0, in a blog post by Atlassian architect Charles Miller on October 23, 2005. The official product announcement followed in November 18, 2005.

of IBM.[164] By February 2006, an evaluation had been completed, and Atlassian Confluence was chosen as the platform for Wiki Central v2, to supersede JSPWiki for Instawiki.[165]

Both Instawiki and WikiCentral v2 ran in parallel during 2006. On the forums, the Webahead team responded to questions about how to transfer wiki pages from Instawiki to Wiki Central v2.[166] Implementation of a new Wiki Central v2, while Instawiki had been matured over the year prior, was not straightforward. Messages about WikiCentral v2 being down through December 2005 surfaced discussions by frustrated author-editors on "Not losing your info on a web application".

In February 2006, there were multiple announcements on the forum about attempts to upgrade the Wiki Central v2 with the Confluence software. This proved to be more difficult than expected, due to ensuring alignment of the levels across software modules, as well as databases (e.g. using IBM DB2 instead the more common open source MySQL). Author-editors expressed frustrations, with the Webahead team responding that Wiki Central was effectively still a beta test, rather than a production system. Despite these issues, uptake was still positive, with a report on February 28, 2006 that "As of 4:00PM GMT - 5 Monday, we had 10739 users, 1244 instances of wikis and 11486 pages".[167] By April 16, 2006, "WCV2 reached over 20,000 users, with over 23,025 comprising 2062 instances of wikis... and growing".[168] On June 30, 2006, an integrated dashboard was implemented, so that a second instances of a wiki server could be added, to remove some load from the initial server instance.[169]

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[164] In 2005, a commercial license of Confluence with an unlimited number of users cost $8000, with an annual maintenance fee of $4000 after the first year.

[165] Soobaek Jang said, on Feb. 13, 2006, about alternative technologies:
"The research and requirements for Wikis and Blogs are found at `http://instawiki.webahead.ibm.com/pilot/wiki/Wiki.jsp?page=Main&wiki=BlogsWikisForums` and `http://instawiki.webahead.ibm.com/pilot/wiki/Wiki.jsp?page=WikiRequirements&wiki=BlogsWikisForums` . This information was used to determine that Confluence should be used as the Webahead wiki engine". (The pages with those requirements were not preserved after the sunsetting of Instawiki after 2007).

[166] Soobaek Jang responded on Nov. 22, 2005 to a question on how to "transfer wiki pages":
"Hi Manmohan, I believe you already know, but to help others who wonder.
History/Versions for WikiCentral
* We started with Single instance of Wiki at WikiCentral
* Multiple wiki instances was enabled with InstaWiki
* This new wiki for WikiCentral v2 at http://w3ki.webahead.ibm.com
So we encourage user to start using new wiki engine at `http://w3ki.webahead.ibm.com`"

[167] On February 28, 2006, Kelly Samardak reported the system as stable, but caution was to be applied for a week before "tweaking it further", in an update on "Wiki Central v2 Performance" on February 28, 2006.

[168] The shared experience, both sweet and bitter was expressed by Kelly Samardak as "20,000 users can't be wrong: Wiki Central V2 hits a milestone!".

[169] While the conventional architectural design would have installed the second

"Empirical evidence on wiki success" from data gathered on Wiki Central v2 between 2006 and 2008 was published by an IBM vice-president.

> The original success criterion of the project was to have 20 percent of technical employees participate in the new wiki and blog services. By mid-year 2006, the IBM wiki and blog services had been deployed to a subset of early adopters. These new wiki and blog services were called WikiCentral and BlogCentral. Following enthusiastic initial feedback, a full deployment plan was implemented in 2007.
>
> Remarkably, WikiCentral took nearly everyone by surprise as it quickly surpassed 150,000 users in daily volume across all wikis in just one year. Total page views per month ... reflect this massive adoption. This participation rate, which represented approximately 40 percent of the total workforce, was startling to say the least, and happily far surpassed our most optimistic predictions. These were people who might or might not have collaborated before, but within a year more than 150,000 of them were working together using a wiki.
>
> These results provided initial evidence that wikis are for real and potentially represent one of the most important productivity tools in the history of IBM. Traffic volume on IBM wikis nearly doubled in July 2008 when compared with July 2007.... (Azua, 2009)

The success of Wiki Central v2 beginning from 2006 would extend well into 2012. IBM deployed its own Lotus Connections 2.5 product internally in December 2009.[170] However, the mature Wiki Central v2 on the Atlassian Confluence product would run in parallel with new intranet version of Lotus Connections through 2012.[171] At the end of December 2012, learning about migration from Confluence Wikis to Lotus Connections 4.0 was published on IBM developerWorks.[172]

Placing this project into a categorization of open sourcing or private sourcing, Wiki Central v2 is open sourcing. In addition to the source code for Atlassian Confluence being available, the evolution and internal support of the product through the Webahead team was organic. While

server in the same cluster as the first, the Confluence product did not support clustering in June 2006. The concern about future protection of URL links was discussed in "WikiCentral v3 - Our current activities + Migration".

[170]Luis Suarez noted the milestone where IBM graduated Lotus Connection 2.5 from the Technology Adoption Program into production on December 3, 2009 as "Validating Social Computing by Living an Historic Moment at IBM".

[171]Officially, Atlassian declared Confluence 2.1 at end of life on April 15, 2011, and would have encouraged upgrading to version 3 or 4 for continuing maintenance. With Lotus Connections v3 released in November 2010 and v4 in September 2012, IBM employees would have an alternative platform under official support. Leaving Wiki Central v2 unmaintained on an intranet would be a relatively low risk for hacking.

[172]The product functionality of Lotus Connections wiki would have matured from version 2.5 to 4.0, making migration more practical. Migration experiences were published as "Migrating Confluence Wikis to Connections 4.0 Wikis".

the support requirements for scaling volumes up to enterprise level led to more formal support channels, wikis themselves are inherently open sourcing in their content and management.

A.4.5 (d) Private sourcing: Lotus Quickr Wiki Template

Lotus Quickr was a packaged program product announced by IBM from version 8.0 on July 30, 2007 through version 8.2 announced June 19, 2009.[173] In October 2007, Quickr 8.0 was offered on the Technology Adoption Program.[174] By November, IBM employees were trying it out.[175]

Lotus Quickr evolved out of Lotus Quickplace. Lotus Quickplace was "a collaborative application that people would be able to use in a self-service manner for more ad hoc or ephemeral application", packaged in "a product that would allow non-technical people to create a space of their own in the network" (Kosheff, Shore, and Estrada, 1999). Evolved from a browser-enabled version of the Teamroom template in Lotus Notes Domino and repackaged with a stripped-down version of Domino, Quickplace was positioned as a collaboration tool for customers not interested in Domino (i.e. Microsoft Outlook accounts) (Beckhardt, 2006). The IBM Lotus brand released version Quickplace 1.0 in 1999, through to version 7.0 in October 2005.[176]

Neither Lotus Quickr, nor its predecessor Lotus Quickplace, included a wiki. Since Quickplace 7, SNAPPS (an IBM Business Partner) offered a wiki template downloadable as open sourcing under a GPL license[177]. For Quickr 8, IBM licensed the wiki templates from Snapps to be included as

[173] Quickr Version 8.1 released April 8, 2008 would be a supported product by IBM through September 30, 2014, detailed in the IBM Software support lifecycle.

[174] The w3 intranet Quickplace forum was renamed as the Quickr forum:
"Announcement: We will be renaming this forum to Quickr next week!" | A. L. Widmer | Oct 23 2007
"We have requested this change at the forum administrators and they will be making the change next week! I don't think anything will change in terms of accessing the forum, including bookmarks, etc.
Amy Widmer, Lotus Services Quickr Community Leader"

[175] On the Quickr forum, progress was reported:
John H. Mason | How do I invite, manage users of Quickr space? | Nov 19 2007
"I've built several Quickr places for potential use in IBM's new Innovation Discovery program for clients.
And I've tried both the Domino and Java flavors, as well as one on Lotus Greenhouse".

[176] Quickplace Version 7 released in October 2005 would be a supported product by IBM through April 30, 2010, detailed in the IBM Software support lifecycle.

[177] The base files for the wiki templates for Quickplace 7 were updated December 20, 2006 with the following description:
"SNAPPS is pleased to offer IBM Lotus QuickPlace™ customers a series of free, open-source templates for QuickPlace 7! In our role as the official IBM Design Partner for QuickPlace, we have worked closely with IBM to provide you with an enhanced experience, new Web 2.0 functionality, and immediate benefits for new and existing QuickPlace installations".

part of the base product.[178]

Unlike Quickplace, which had been built only on a Domino foundation, Quickr 8 was released as two products: Quickr for Domino, which requires a Lotus Domino server as a prerequisite, and Quickr for WebSphere Portal, which bundled in WebSphere Portal Server. The "SNAPPS templates are for Domino only", and "there is no way to move content from one version to the other" (V. Weber, 2007)).

Lotus Quickr was withdrawn from marketing by IBM effective February 11, 2014.

Placing this project into a categorization of open sourcing or private sourcing, Quickr is private sourcing. Although the wiki templates were open source and the platform was made available on the Technology Adoption Program, Lotus Quickr was packaged and maintained in a private sourcing style. The capability for author-editors to largely control their own content, independently of systems administrators, was a major feature for Quickr. However, extending or changing those features would have been channelled through normal product support structures.

A.4.6 (e) Private sourcing: Lotus Connections Wikis

IBM Connections is a commercial program product with a variety of Web 2.0 features. At the version 1.0 announcement in May 2007, features included profiles, blogs, bookmarking, and communities (with forums) but not wikis (IBM, 2007i). It was not until version 2.5 in August 2009 that wikis were included (IBM, 2009b). Lotus Connections wiki would support WYSIWYG (What You See is What You Get) editing, in addition to the rudimentary wiki markup that goes back to the original wiki origins in 1995. This feature would be appealing to business professionals more accustomed to document editing (e.g. as with Microsoft Word), yet in a collaborative web environment where other team members could easily share authoring and editing.

IBMers were encouraged to use Lotus Connections, but the volume of internally-generated content on Wiki Central v2 (Atlassian Confluence) tended to deter adoption. A new WYSIWYG interface was introduced with Atlassian Confluence 4.0 in 2011.[179] Rather than upgrading on a third party platform, the collaboration on wiki would shift the internal IBM

[178]The maintenance and support of the templates for Quickplace and Quickr by SNAPPS continued through the product lifecycle.
. . . way back in in 2006, SNAPPS built blog and wiki templates for then-named Quickplace 7.0. And, after we reprogrammed those and optimized them for translation, IBM licensed them from us for use in the 2007 Quickr 8.0 release. They're still there 4.5 years later, based on the original design and using the same rendering engine (8.2), made to work on an 8.5.1 server (Novak, 2011).

[179]Confluence 4.0 was announced as "one the most significant updates to Confluence since its initial release in 2004", "with a brand new WYSIWYG editor and wide-ranging user interface improvements".

resources from Wiki Central v2 towards the commercial Lotus Connections product. Author-editors would gradually migrate to the richer Lotus Connections wiki features. Placing this project into a categorization of open sourcing or private sourcing, Lotus Connections Wiki is private sourcing. The wiki feature is part of a larger product, deployed and supported as would any commercial product.

A.4.7 Prospects: Adopting an open sourcing wiki is easy; maintaining the content and linking with other information requires resources

In the content of open sourcing with private sourcing, wiki platforms present a rich context. The content on a wiki is dynamically edited by author-editors, who shape the platform. Those author-editors may be contributors towards organizational purposes. The artifacts of an evolving wiki are preserved as a series of collective revisions that may become institutionalized as "conventional wisdom", even after the author-editors have left the organization.

Administration of a wiki system, as it continues to grow, represents a challenge for open sourcing contributors. The automation of some procedures can improve efficiencies, but maintenance is often a thankless task. Apart from a few individuals who benefit by patronage, most contributors to an open sourcing project rely on a livelihood that is not funded within the community. Specialization of tasks makes private sourcing, beginning at foundational infrastructural levels, an attractive alternative. Ensuring reliability, availability and serviceability of the platform sometimes conflicts with the grander purposes of an endeavour, e.g. the collective knowledge development.

Migrating wiki content from one platform to another (or potentially even from one release to another) can be a challenge. The lack of standardization on wiki markup, and the way that revision histories are stored results in a loss of fidelity as content is transferred. At the point that an institution takes over revising content without the full participation of the network of original author-editors, the authenticity of content diminishes.

Dynamic open source wiki content often evolves into a static form private sourcing publication, e.g. a book. If the wiki content has been developed by a single or small number of author-editors, and an official release is named as a milestone, then a static resource becomes a reference. If the wiki content continues to evolve, the static resource may become superseded and/or irrelevant. Dissolution of the original team of author-editors may or may not result in sanctioning of the joint work. When the author-editors choose to remove the historical work-in-progress and leave only a static resource, then the wiki content becomes private sourcing, losing the open sourcing potential for recreation and/or redevelopment.

A.5 Case: Podcasting (digital media syndication)

While *blog* was declared by Merriam-Webster as the word of the year for 2004 (BBC, 2004), *podcast* was the word of the year for 2005 (BBC, 2005). A podcast is an episodic series of rich media – typically audio or video multimedia content – distributed via web syndication for playback on portable music players. The etymology of "pod" comes from the introduction of the iPod, and "casting" comes from broadcasting. The rich media generally means content as interviews, news, presentations and speeches, although the technology is equally applicable to performances of musical or theatrical productions.

From an organizational perspective, the rich media content of audio and video represents an opportunity for communications beyond written text. Teleconferences can be recorded for subsequent replay, and meetings can be captured for sharing with an audience larger than could practically be convened in person. With free digital audio editing tools on personal computing platforms (e.g. Audacity has been available since 2000), any participant in a meeting could become an editor and publisher. In the context of an company intranet, the viability of a podcasting service was experimental (and may not have become popularized to today).

A.5.1 Context: Podcasting followed from extending the specifications for web content syndication

For podcasting and subscriptions of digital audio and video to become mainstream, many elements needed to be in place.

- Firstly, standard protocols on data formats between syndicators and subscribers needed to be established. The idea of extending existing protocols was in discussion in 2001, and the specification was established by 2003.
- Secondly, content producers needed to produce a channel, series or shows that audiences could follow. While production professionals could also choose this path for distribution, personal computing tools have made independent recording and post-production easier.
- Thirdly, the hardware and software platforms to scale up syndications and subscriptions needed to be put in place. Places where syndicators and subscribers could "meet" emerged around 2005. While computers are general purpose devices that will playback multimedia, the rise of MP3 portable music players was a natural path for mobile listening.

Podcasting has been adopted more rapidly on the open Internet than in organizational settings.

A.5.1.1 The specification for RSS enclosures in 2002 sparked podcasting

Sharing digital audio and video files has always been a basic feature of

the Internet. The FTP (File Transfer Protocol) can be executed on any command line terminal, although even the technically-astute commonly use an application program (e.g. Filezilla) with a graphical user interface to download (and upload) files from one computer to another. For listeners who preferred to not be chained to their computers, portable music players before 2006 required that files be downloaded on a personal computer and then transferred to the device.

The MP3 specification was endorsed as a standard for audio recordings by the Motion Pictures Expert Group in 1993 (Ewing, 2007). While the first MP3 Portable Music Player was introduced in 1998, and the first mobile phone with an MP3 player dates to 2000, direct connection between the Internet and a mobile device wasn't possible until 2006 with the Archos 4-series (Ødegård, 2008; Temple, 2006).

In March 2001, Dave Winer – a developer working on the RSS specification – reported on a conversation with former MTV VJ Adam Curry about the annoyance of the "click-wait system" to download and play rich media, with the possibility of a "no click-wait" where the download could be performed in advance when a computing device was idle, for immediate playing if the streaming news feature could be extended to multimedia payloads (Winer, 2001).

The RSS (Really Simple Syndication) 0.93 specification from 2000 that supported enclosures for audio files was updated to version 2.0 in fall 2002 (Winer, 2003a)(. In July 2003, the license for the RSS 2.0 specification was transferred open source to the Berkman Center for Internet and Society at Harvard Law School.

In July 2005, Atom 1.0 was introduced as an alternative specification developed by a standards committee, featuring support of multiple enclosures (Snell, 2005a). Under RSS, each feed entry could be hyperlinked only to a single file, e.g. one audio file or one video file. Under Atom, each feed entry could be hyperlinked to an unlimited number of files. The difference would be show up in implementation. A web site with RSS will typically have one feed just for audio files and another feed just for video files. A web site with Atom could have single feed for a series of events that could contain multiple audio and video files, as well as other rich content such as slide presentations. When a podcasting channel publishes a feed where entries have only one media file enclosed, RSS and Atom are functionally equivalent.

The RSS specification to enclose a single media hyperlink has a different philosophy from the Atom specification that enables multiple media hyperlinks. The design of the Atom specification has been criticized as potentially confusing, as each audio or video media file way then have a publishing date different from the feed entry as a whole (Winer, 2004). In practice, both RSS and Atom coexist as continuing standards on the web today. A web site that offers feeds following both RSS and Atom

specifications will have been implemented with a single enclosure for each feed entry, following the lowest-common-denominator simplicity of RSS. A web site that offers only feeds following the Atom specification can enable event-oriented feed entries, where all related rich media – audio, video, presentations, et al. – are associated together.

A.5.1.2 Podcast content on the Internet started in 2003, leading to commercial broadcasters experimenting in 2004

The creation of the first podcast content is attributed to Christopher Lydon, a longtime public television and radio personality, in an interview of Dave Winer in July 2003, following from a dispute between the journalist and his management about rebroadcast rights over the Internet (Doyle, 2003). Lydon chose to free his content to become an independent broadcaster over the Internet, with the launch of BlogRadio.org in October 2003 (Doyle, 2005). Blogging of audio, as an alternative to publishing written content, was a new way of communicating.

At the first Bloggercon in October 2003, audioblogging was demonstrated as the capability to automatically download MP3 enclosures to iTunes (Marks, 2005). This fulfilled the vision of "no click-wait" onto portable audio players. The facility to subscribe to multiple podcasting channels, and select content from the Internet to be downloaded to a computer for transfer to a mobile device (i.e. MP3 player or iPod) was made easier through the advent of media aggregators, e.g. iPodder, first released September 2004 (iPodder, 2004).

In August 2004, former MTV VJ Adam Curry started an Internet marketing company that was the first commercial enterprise centered on podcasting. He codeveloped the iPodder subscription client, and broadcast daily recordings as a proof of concept for the technology. This practice was immediately adopted by numerous independent podcasters, as noted in became noted in October 2004 by the New York Times (Farivar, 2004), and in February 2005 by USA Today (Achido, 2005). The late 2004 experiments by the British Broadcasting Corporation, the Canadian Broadcasting Corporation and National Public Radio would eventually become an everyday content distribution channel (Newitz, 2005).

A.5.1.3 In 2005, podcasting communities of publishers and subscribers had not become popularized

With the technical standards having been established in late 2003, any syndicating podcasters and subscribing audience members in 2004 could easily be labelled as pioneers. Just as blogging codeveloped authors and readers, podcasting would require the codevelopment of speakers and listeners.

The label of *audioblog* dates back to 2001, in the "click-wait" download-

able mode.[180] In 2002, the audio posting of a voicemail message became available on the Internet as an Audioblogger extension to Blogger, but few people listened to such content. The syndication and subscription features of *podcasting* required the RSS specification to move beyond early adopters to non-technical audiences. In early 2005, the idea of creating a subscription series of audio recordings bubbled amongst technology thought leaders, with Odeo emerging as a "podcasting" hub (Evan Williams, 2005). As a business, Odeo would later be considered a failure (Gannes, 2006a).

The popularity of podcasting relates less to the availability of content provided on servers, and more on the ease of use enabled to subscribers on handheld devices. On the Apple iPod Classic, computer files could be transferred and stored on the device in "disk mode" through iTunes. On Portable Music Players – commonly known as MP3 devices – connected to a personal computer via the USB (Universal Serial Bus), files could be transferred via the MSC (Mass Storage device Class) protocol. These were technical, rather than simple, ways in which audio content could become playable on a portable device.

The prospect of commercial distribution of content led to software to simplify managing rich media content. In April 2003, Apple launched the iTunes Music Store, with the upgrade to iTunes 4 software (Apple Inc., 2003). In September 2004, Microsoft announced extension of PTP (Picture Transfer Protocol) to become MTP (Media Transfer Protocol) (Microsoft, 2004a) on new Portable Media Centers to be produced by Creative Zen, Samsung and iRiver (Microsoft, 2004b) that included Windows Media DRM (Digital Rights Management).[181] While the iPod and MP3 players are miniature computers, their ability to store and replay podcasts would be subject to enforcement of copyrighted materials.

The complication of an intermediate computer to stage downloaded audio files or CD rips awaited the feature of WiFi connectivity on the handheld device. In 2006, the first WiFi Portable Music Player was introduced by Archos (Ødegård, 2008). It was not until 2007 that the announcement of (i) the iPod Touch made Internet connectivity a feature (Apple Inc., 2007a), and (ii) the iTunes WiFi Music Store made downloading without an intermediate staging computer practical (Apple Inc., 2007b).

Music enthusiasts in 2005 would have followed these advances in handheld technologies. For business purposes on a corporate intranet, podcasting was an entirely new, and unproven idea.

[180] Wordspy cites Jish.vox as the earliest mention. "If the audioblog focuses on voice content, it's also called a *voiceblog* or *voxblog*. If the audioblog focuses mostly on music, it's also called an *MP3 blog* or a *musicblog*. If the audioblogger syndicates his or her content using RSS, it becomes a podcast."

[181] While MSC would the transfer of any computer file for playback, MTP content in which digital rights protection had been enabled would have restricted playback. See a comparison of "MTP vs. MSC (UMS)" by Dave McLauchlan on June 13, 2006 at the Anything But iPod forum.

A.5.2 (a) Open sourcing: Podcasting Support on Instawiki

The first mention of podcasting inside IBM was an announcement on a forum page in March 2005. Instawiki already supported RSS for basic text entries. The Instawiki pilot code was extended so that if MP3 files were attached to a wiki page, they would show up with an XML enclosure in the RSS feed.[182] A PodcastTesting wiki page was created, and feedback was requested for formalization not only on a wiki platform, but potentially also a blog platform in the future. While Instawiki was based on the open sourcing JSPWiki, the implementation of the RSS enclosure feature on the IBM intranet slightly predates the official release of the RSS enclosure feature to the open sourcing community at large.[183] This activity demonstrates IBM employees actively experimenting with podcasting technology, and contributing back to open sourcing developers outside of the company. The decision to sunset Instawiki in February 2006 represents an end to this experimentation with podcasting, with the knowledge gained feeding into the Wiki Central v2 evaluation that started in November 2005.

For this research study, these baby steps are categorized as open sourcing. IBM employees who had recorded MP3 audio could attach them to wiki pages, and they would show up as a syndication in an RSS feed on the w3 intranet. Followers could subscribe to the RSS feeds in an offline reader (e.g. RSSOwl[184]) and would be easily linked to updates. Only a few IBMers would have been subscribers and even fewer would have been publishers, as the idea of podcasting had not yet become popular. However, the facility to publish and subscribe podcasts was as available inside IBM as it was on the open Internet in 2005.

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[182] Judith Warren wrote “Podcasting comes to Wiki Central” on March 29, 2005: "We now have rudimentary Podcasting support available on Wiki Central. The way it works is quite simple – just attach a mp3 file to any given Wiki page. The appropriate XML enclosure is automatically generated in the RSS feed to flag the mp3 as a Podcast.
If you’d like to see how this all looks check out `http://instawiki.webahead.ibm.com/pilot/wiki/Wiki.jsp?page=Main&wiki=PodcastTesting`, then try pointing your favorite Podcast client at `http://instawiki.webahead.ibm.com/pilot/wiki/feeds/PodcastTesting/index.xml`.
The Podcasts currently posted on the PodcastTesting page came from Kirsten Graham, who is looking into Podcasting webcasts for the BCS community.
We’re looking at putting something a bit more polished in place over time to support Podcasting from both Wikis and Blogs, so feedback would be greatly appreciated".

[183] The application of RSS enclosures wasn’t really appreciated at the time, so extending the RSS implementation must have been a relatively small task (Jalkanen, 2005).

[184] RSSOwl is an open source feed aggregator based on Java, that runs on Windows, Mac and Linux. RSS and Atom support was discussed from Sept. 25 2005 on “Public Preview of RSSOwl 1.2 available”.

A.5.3 (b) Open sourcing: Webahead Podcasting Pilot

By October 2005, the Webahead team had launched a podcasting pilot, as a platform independent of the wiki and blog technologies. With the potential for IBM employees to start new podcast series, dialogue between employees and developers were conducted on internal forums.[185]

One of the key developers of the Webahead Podcasting Pilot was Josh Woods. His story as a rising technology star was featured internally on the intranet news: from placing as a world finalist in the 2003 ACM International Collegiate Programming Context 2003, he was accepted into an Extreme Blue internship in 2004 and then became a full-time employee assigned to the Webahead team.[186] From 2005 to 2007, Woods was a software engineer on the Webahead team, working on the Webahead Podcast Pilot, as well as the Webahead Widgets initiative.[187] As "something fun to do", Woods participated in the Hackday 1 in July 2006 to create a "Feeder" widget enabling the embedding of RSS or Atom feeds onto any static web page.[188]

As IBM employees tried out the Podcasting Pilot, the internal forums became the place where Woods would update on progress and changes, and respond to questions. In August 2006, the growth in volume of data in the Podcasting Pilot led to a temporary outage as the Podcasting Pilot was moved to a new disk array.[189]

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[185] Helen Broadie wrote about "Podcasting suggestion: RSS feed for new podcasters" on Oct. 12, 2005:
"Well done for the new podcasting pilot guys (at `http://podcast.webahead.ibm.com/index.do` for anyone who hasn't seen it).
So that we don't have to keep coming back to the page with the list of podcasts on to see if there are any new ones, could have an RSS feed of all the different podcasters so that if new people start up we'd get informed?"
... to receive a response from Soobaek Jang:
"Thanks for using podcast and suggestion Helen, Yes, that's on our plan as well".

[186] At the time of the 2006 ACM International Collegiate Programming Contest, the story of Joshua Woods for the 2004 event was featured as "The competition of a lifetime", published April 10, 2006. "As a member of the Webahead team, Josh is now responsible for some of the company's cutting-edge technologies including the Webahead Podcasting Pilot and Ajax Widgets".

[187] As part of the Webahead Widgets initiative to provide reusable Ajax components for the IBM w3 Intranet, Josh Woods self-reported on his blog (i) developing the Livespell widget for spell checking of existing web applications using IBM's Languageware technology and jFrost dictionary engine in February 2006; (ii) developing the Bluecard widget to display an employee's Bluepages business card when hovering over a name on a browser page, in March 2006; and (iii) creating a "Pulse" polling widget" for embedding web polls on blogs or web pages, in April 2006.

[188] While Woods was part of the Webahead team, choosing the build the Feeder widget for Hackday would have been more a personal preference than an organizational directive. He said "it just seemed like something fun to do" on "Hack Day Result: Feed displayer widget" posted on July 1, 2006.

[189] Josh Woods wrote on August 3, 2006:
"At some point in the next few weeks – tentatively the week of 8/14/06 – the

In use, the way in which IBM employees wanted to use podcasting emerged. Over a geographically decentralized workforce, teleconferences with a presentation slide deck and a voice conference are common. In more organized meetings, a textual transcript or even a video conference might be available sometime later. If calls were scheduled regularly on a weekly or monthly basis, a podcast containing artifacts from the call could be published for subscribers to follow-up asynchronously. By August 2006, questions arose about the implemented constraint on the Podcasting Pilot of two attachments per episode, with a 50 MB maximum for the recording and 5MB maximum for a transcript. If a teleconference was supplemented by both a presentation slide deck and transcript, only one could be hosted on the Podcasting Pilot site.[190] For the pilot, Wood responded that the two

Podcasting Pilot will be placed into a read only mode. The length of the read only window is currently unknown, but will be announced at a later date. During this time, you will not be able to add/remove/edit any podcast data, but users will still be able to download episodes, browser the site, etc.
The reason for needing to place the site into this mode is that we need to move the site to different hardware. This requires transferring all of the data to a new disk array, which will take a decent amount of time given the sheer volume of data. By doing this, we will ensure that there are no issues with content being out of synch once migration to the new server is complete.
Sorry for any inconvenience, and please contact me with any questions".

[190]The learning about wants and needs and technical constraints was negotiated in an online discussion:
Teresa Allgood asked . . .
"I'd like to use Podcast for a series of calls, but I am afraid that the size limitations might prove to be 'limiting' and I'd also like to post 3 files – audio mp3, presentation ppt and transcript doc. Are there any plans to increase the size of the attachments? Are there plans to allow more than 2 files to be attached?"
. . . to which Joshua Wood responded . . .
"Hello, How big of file are you thinking of uploading? Typically, 50MB with audio allows for a very long call if a proper encoding quality is selected. Feel free to contact me on this issue though, as we can probably figure out a way to make an exception, especially if you happen to be uploading a large video.
As for the two file maximum, there are no plans to alter this in the near future. If we allowed more than one 'episode' file, this would kind of break the concept of a 'podcast' as a 'feed' of data - as the clients that read RSS feeds don't have a concept of 'these 2 files are related' unfortunately.
One work around is to post the presentation ppt online, and then link to the powerpoint in the description. The other is to include it as an episode with the same name and a caption like (Presentation). The only issue is iTunes will not download non-media files. However, most of the other feed readers download anything".
. . . to which Daphne Ruby enjoined the discussion . . .
"Hello, I am fine with the 50 MB limit, my issue is the 5 MB limit on the transcript file. Can you leave the 50 MB total limit, but lift the 5 MB limit on the transcript file so I can post my MP3 and ppt files separately. If I zip the MP3 and ppt together, then iTunes doesn't work properly. Thanks! Daphne"
...and Josh Wood responded . . .
"Hello, Next time I make an update to the site I will change the transcript limit to be 50MB as well".
. . . and finally Teresa Allgood closed with . . .
"I could follow your first work-around [One work around is to post the presentation ppt online, and then link to the powerpoint in the description.], but that requires the subscriber to look at another site to get the presentation.

attachment constraint would remain in place, although he could relieve the transcript maximum constraint to 50 MB as well. The evolution of the RSS single enclosure design and Atom multiple enclosure design would show up in the implementation of the standards, e.g. iTunes would not recognize a presentation as an attachment. Workarounds were discussed in the forums, and the way to immediately deal with additional attachments was left to individuals to decide.

By November 2006, another outage for the Podcasting Pilot was scheduled to migrate the application to a different server farm. In addition, the home page was being updated with a news header, to keep the community updated on progress.[191] With teleconferences and web conferences an everyday occurrence inside IBM, podcasting became a common way for people to catch up to events missed due to tight calendars. While audio conference replays over mobile phone lines had been the common way to listen to missed meetings, podcasting provided an alternative medium for less urgent topics that might be appreciated while on a long drive".

For this research study, the Webahead Podcasting Pilot is categorized as open sourcing. The adoption of the technology both by publishers and subscribers was uncertain when the platform was initiated. The experience, feedback and questions on the pilot where communicated on the internal forums. Early adopters voluntarily tried out the new technology, and found business uses that were not necessarily common in consumer contexts on the open Internet. This pilot was seen as a success, providing a direction for follow-on initiatives.

A.5.4 (c) Open sourcing: w3 Media Library

The Podcasting Pilot had been initiated by the Webahead team. At the end of 2006, the project was moved to the IBM internal Technology Adoption Program, with a new name: the w3 Media Library. The experiment from 2005 would be funded for rollout to a larger audience, preserving the content from the Podcasting Pilot as the starter for the next generation.

The second workaround [include it as an episode with the same name and a caption like (Presentation). The only issue is iTunes will not download non-media files. However, most of the other feed readers download anything.] seems to me like it would be breaking the episode concept since I am saying it is another episode when it isn't.
I do not want to break the concept of a 'podcast' as a 'feed' of data. I just want to include the 3 related files in one episode: the mp3, the transcript and the supporting presentation. Please consider adding a third file that is for PPTs".

[191] On November 14, 2006, Josh Woods alerted subscribers on the forum to expect an interruption in service the next day (and subsequently reported a smooth upgrade, afterwards):
"There will be a brief outage (scheduled at under 45 minutes) as we deploy new code and migrate the application to a different server farm.
The major change is allowing an alerts section at the top of the main page, which we will be very actively using in the upcoming weeks to alert you of very exciting changes which you will soon be seeing".

Publishers were asked to participate in the transition by updating web addresses that might have been embedded in blogs or wikis, and to report bugs in a new Technology Adoption Program system.[192]

In a January 2007 interview published on the w3 Media Library, the evolution from the Podcasting Pilot was explained.[193] The pilot had focused on the basic functions of uploading an audio recording and generating a feed. As IBMers became familiar with the technology, they wanted to be able to provide referral web links to others, with one-click playback inside a browser, rather waiting for a download into an offline player. The original premise that more search features would be required as overturned with the discovery that IBM employees would be driven to the web site by formal communications, i.e. pointing to a playback of a meeting. To develop the community, ratings as thumbs-up or thumbs-down could encourage the audience to listen or watch recordings of interest. Ways to customize feeds with description management would be explored. The w3 Media Library was a replatforming to enable these new features, as well as additional requests that might emerge through more learning.

An April 2007 interview of the w3 Media Library developers described the original Podcasting Pilot as oriented only towards audio, where the new platform would include support for video and other types of attachments.[194] Josh Woods was named as continuing in the role as the primary contact in the transition.

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[192]The migration to the w3 Media library was reported to have begun, on Dec. 6, 2006:
"As of 1:00P EST the transition from the Podcasting Pilot to the w3 Media Library has officially begun! We are busy importing all of your content in to the new site, as well as getting everything else ready for you to use. We hope to finish the import by 5:00P EST, but the integrity of your data is our top priority, so the time may vary.
From this day forward, the Podcasting Pilot will never display any new content or updates to existing content. The current site will be maintained until traffic dies down to help ease the transition by providing links for episodes and series so that you update all of your bookmark, as well as your direct links and mailings that refer to podcast.webahead.ibm.com URLs. We know it's a bit of work, but doing so will lead to less confusion in the long run. Once traffic to the Podcasting Pilot drops off to a minimal level, that application will be sunset and the transition will be complete!
We hope you are as excited about the new application as we are. For the Webahead w3 Media Library team, it's a culmination of a tremendous amount of work and a lot of long hours. As with any new applications there will be bugs, so we invite you to submit them to our bugzilla database or post in our forum.
As always, we appreciate your patronage, patience, and enthusiasm as we continue to try and evolve,
The Webahead w3 Media Library Team"

[193]Brian Goodman, Manager of Webahead Development, was interviewed by Lynn Busby in a "w3 Media Library"presentation and downloadable MP3 interview, published on January 4, 2007.

[194]An audio interview of Michael Lipton and Ramya Nagarajan as "Spotlight on the Innovator: IBM Media Library developers!" was published on April 17, 2007, when the w3 Media Library was relatively new.

By May 2007, the transition to the w3 Media Library was complete. The Webahead Podcasting Pilot was officially designated as sunset, with web links redirecting to the new site.[195]

Ways in which the w3 Media Library might be extended by the wider IBM community continued. In Hackday 4 on October 15, 2007, Josh Woods led a 30-minute session of a technical rundown of available APIs and usage for the w3 Media Library.[196]

The search functionality for the w3 Media Library was not implemented within the library itself, but instead by customizing separate products (i.e. Coremetrics) to be more aware of the rich content and metadata. On February 25, 2008, the search servers associated with the w3 Media Library were migrated to a new cluster.[197] Features such as web site tracking were referred to search engine product team.[198]

In January 2008, George Falkner reported the 14,000 media files posted online with 36,000 tags, 4.5 million downloads had been done by 165,000 unique users. With IBM having about 360,000 employees worldwide at that time, this meant that over half of employees had listened or watched content from the w3 Media Library at some time. [199]

For this research study, the w3 Media Library is categorized as open sourcing. The publishing of audio and video content rarely involved individuals specifically with a multimedia production job role, but instead became an everyday way of communicating amongst global teams. The improved browser interface empowered individuals to create and manage their own podcast series and episodes in a self-service procedure. Sim-

[195]On May 9, 2007, the podcast.webahead.ibm.com officially set for sunset on May 18:
"On Friday, May 18th we will be sunsetting the old podcast.webahead.ibm.com site. For the last six months this site has been in a read only mode redirecting visitors to the new IBM Media Library site. Since we've already moved all the content over, there is no reason to maintain the old Podcasting Pilot site.
At present, only a small number of requests (typically for feeds - which are redirected to the new site) come to podcast.webahead. If you still link to podcast.webahead please update your links to refer to w3.webahead.ibm.com/medialibrary".

[196]The Hackday 4 session slots were published on a wiki.

[197]The enhanced search functions were the only feature of the w3 Media Library to change. This was announced by J.W. Redman as "[Search Outage] Monday, February 25th on Media Library".

[198]Following the style of a Service Oriented Architecture, a feature such as search would call a separate product rather than replicating the functions over again. On March 4, 2008, Ed Eaton asked:
"In regards to the w3 Media Library, is there a way to track how many people have viewed, accessed,and/or completed a hosted media file? I apologize if this question has been answered already."
. . . to which Lynne Hansman responded . . .
"Ed, We use Coremetrics tool for our website tracking and are confirming if it also works for the Media Library. IBM has a worldwide Coremetrics license that your team would need to get access to. Lynne"

[199]In addition to the podcasting, George Falkner also externally reported on blogging and wiki activity.

plicity in the design of the software was important, as learning from peers filled in beyond the basic online how-tos available. Product support continued to be responsive in internal forums, with a small team of technical staff who would answer questions.

The efforts of Josh Woods were recognized both inside the company, and externally through social media in the progression of his career.[200] After his work with the Webahead team, Woods roles as a software engineer in the development of the Lotus Connections product 2007 to 2011.

A.5.5 (d) Open sourcing: Apache Abdera Contribution

In summer 2006, the Webahead group, through the IBM Software Standards Strategy group, contributed its implementation of Atom to the Apache Foundation as an open sourcing contribution.

> *InfoQ:* What is Abdera?
>
> *James Snell*: Abdera is an open source implementation of the Atom Syndication Format and Atom Publishing Protocol. It began life as a project within IBM's WebAhead group and was donated to the Apache Incubator in June 2006. Since then, it has evolved into the most comprehensive open-source, Java-based implementation of the Atom standards (Tikov, 2008).

The contribution entered the Apache incubator on June 6, 2006, became a top-level project on November 25, 2008, and was reached the 1.0 release on May 2, 2010.[201]

While RSS was designed as a simple syndication system for feeds, the experiences on a broader range of applications were incorporated into the Atom standard. Podcasting was specifically a named use for Atom, but the enclosed content could applied more widely.

> *InfoQ*: Everyone knows Atom and AtomPub are just for weblogs. Right? Why would anyone care about them outside of this domain?
>
> *James Snell*: While Atom and AtomPub certainly began life as a way of syndicating and publishing Weblog content, it has proven useful for a much broader range of applications. I've seen Atom being used for contacts, calendaring, file management, discussion forums, profiles, bookmarks, wikis, photo sharing, podcasting, distribution of Common Alerting Protocol alerts, and many other cases. Atom is relevant to any application that involves publishing and managing collections of content of any type (Tikov, 2008).

[200] Tracing back from his beginnings with the ACM Collegiate Programming Context, Josh Woods was interviewed on "IBM Software Engineer and 2003 Contestant Offers World Finals Tips and Career Advice".

[201] The ongoing history of the Apache Abdera project is at `http://abdera.apache.org/` . At the end of 2012, v 1.1.3 was released.

The Atom standard was important to the Webahead team, not only for the Wiki Central and Blog Central projects, but also the w3 Media Library. The original vision of podcasting might have had just one audio enclosure, but the uses of that emerged were largely on meetings that could have multiple enclosures for video, audio, presentation slides, transcripts and other information. The Webahead initiative was formed as an internally-facing team implementing new technologies to improve the productivity of IBM employees, and not a customer-facing team that would develop products for customers. Through the IBM Software Standards Strategy group, a practical implementation of the emerging Atom standard was disclosed into open source.

For this research study, the contribution to the Apache Abdera project is categorized as open sourcing. While the Webahead team primarily works with the open community inside IBM, this contribution extends to the open community that is public. The appropriate corporate team was involved to facilitate that contribution, so that IBM commercial product developers could benefit as much as competitive companies.

A.5.6 (e) Private sourcing: IBM Products including Apache Abdera

By 2007, the Apache Abdera implementation had been included into products commercially offered by IBM Software Group.

> *InfoQ*: What do ... you use Abdera for?
>
> *James Snell*: Within IBM, Abdera is used by components of the Lotus Connections and Lotus Quickr suites to enable Atom Publishing Protocol support. Abdera is also shipped within the WebSphere Web 2.0 Feature Pack. Internally, Abdera is used in a broad variety of applications (Tikov, 2008).

By October 2007, the Lotus Quickr team collaboration product had embedded Apache Abdera. Technical instructions on how Atom could be accessed as a REST service were published on developerWorks web site (Gopalraj, D. Carr, and Melahn, 2007). While the Lotus Quickr product did not specifically have a podcasting module, a developer outside of IBM would have access to the APIs (Application Programming Interfaces) to do so.

In November 2007, the new Lotus Connections product became available. This social collaboration product included a blog supporting the Atom 1.0 specification[202]. This would have enabled the original functionality

[202]At the release of Lotus Connections 1.0 at May 2007, blogs were featured but Atom was not specifically mentioned. The version 1.0.2 announcement in November 2007 highlights Atom (IBM, 2007i). By version 2.0 in 2008, the documentation had caught up, with a reference in "Blogs Atom entry types" to "Media link content" (IBM Support, 2008).

available in the Webahead Podcasting Pilot, but not the richer functionality in the w3 Media Library.

In December 2007, the WebSphere Application Server product was extended with a WebSphere Feature Pack for Web 2.0 (IBM Support, 2007). This feature pack included Apache Abdera as the "Feedsphere" library (Connolly et al., 2008). Should an IBM customer ever want to build their own version of the w3 Media Library, this could be the foundation on which to do so.

For this research study, the embedding of Apache Abdera technology into Lotus Quickr, Lotus Connections and WebSphere Application Server are categorized as private sourcing. These are all commercial program products with licensing fees, for which IBM would provide defect support and fixes. Changes to the embedded code might or might not be recontributed back to the community, as temporary fixes for a single customer could potentially have side effects undesirable to others.

A.5.7 (f) Open sourcing: w3 Media Library (on the Innovation Hosting Environment)

On October 16, 2008, the w3 Media Library was moved to the Innovation Hosting Environment.[203] For users of the system, this meant only that web addresses of w3.webahead.ibm.com/medialibrary would be redirected to w3.tap.ibm.com/medialibrary. The software implementation did not change, and the support paths remained informal.

For this research study, the w3 Media Library remains categorized as open sourcing. The Innovation Hosting Environment is an evolution of how IBM internally deploys software on hardware servers that has not fundamentally changed the way that the w3 Media Library works.

A.5.8 Prospects: Digital media syndication shapes and is shaped by communication patterns in an organization

The evolution of communications interactions and Internet technologies that became the w3 Media Library at IBM is a success that could be

[203] First scheduled for Sept. 30, 2008, the outage for migration was rescheduled to Oct. 8 and then reported as successful Brett Ashwood:
"We would like to make you aware of some changes that are going to be happening to improve Media Library. As previously announced, Media Library will undergo an outage in order to optimize the distribution of our hosting resources and provide you with additional capabilities and improved system availability. During this time, the Media Library application will be moved into the Innovation Hosting Environment (IHE), and all Media Library content will be unavailable.
[. . . .]
After the outage is completed, all Media Library URLs that begin with w3.webahead.ibm.com/medialibrary will be automatically redirected to w3.tap.ibm.com/medialibrary. Please begin using this new URL format immediately after the outage".

replicated in other organizations, but may not be similarly adopted. The communications technology most used in organizations has traditionally been e-mail, which individuals "push" messages to each other, resulting in a burden where both active and passive recipients have to clear their inboxes. Podcasting is implicitly a "pull" technology – as are blogs and wikis – where audiences can choose to prioritize or deprioritize their subscriptions. Unlike blogs or wikis that can be read in a few seconds or minutes, however, audio and video playbacks require partial or full attention for large fractions or a multitude of hours.

In business, the predecessor to podcasting has most frequently been teleconference audio playbacks. Teleconferences work well for small teams within a local geographic region, and can be scaled up to continental scope with 1-800 toll-free numbers. Including participants across multiple continents is generally accommodated with dial-in numbers that are not toll-free. Playback to a worldwide audience over the telephone is a greater challenge, as carriers orient regionally rather than globally. For a teleconference operator, the option to produce a download audio file has been a simple workaround, leaving distribution of that content to be dealt with by the host's administration team.

At IBM, podcasting became a way for sharing audio and video not only from leaders to the workforce, but also from individuals immersed in a community of practice to a broader audience in the large community of interest. Commonly, a few core individuals may be active on developing a product, establishing a standard or formalizing a method. Peripheral parties who could be impacted by changes in direction might begin as passive listeners, but then evolve into active participants. Expertise is not limited by job descriptions and current assignments. By following rich content such as audio and video recordings, a larger number of knowledge workers can benefit in hearing the nuances in how certain directs were chosen, why decisions were made, and what futures might be in store. Podcasting at IBM represents one of the ways that the globally-integrated enterprise was manifested.

In the period between 2005 and 2008, outside of businesses, peer-to-peer sharing of rich media was just starting. In 2003, Christopher Lydon is credited for the first audio podcast, with the second podcast by IT Conversations eventually developing into the Conversations Network.[204] Independent podcast aggregators including iPodder and Podcast Alley started in 2004, with commercial vendors Libsyn starting in 2004 and Podbean in 2006.[205] In June 2005, podcasting was enabled on iPods with

[204] IT Conversations was started by Doug Kaye and Phil Windley in September 2003, and ended with the Conversations Network ceasing operations in 2012, transferring all of its content to the Internet Archive.

[205] The domain name registration for ipodder.org dates back to September 2004, and for podcastalley.com back to November 2004. Libsyn claims to be the world's largest podcasting network, starting from 2004. Podbean was incorporated in

upgraded iTunes software.[206] Vimeo was founded in November 2005, and acquired by IAC in August 2006 (Gannes, 2007). Youtube was founded in February 2005, and acquired by Google in October 2006 (Cloud, 2006; Gannes, 2006b; Google, 2006). SlideShare launched in October 2006, eventually to be acquired by LinkedIn in May 2012 (Arrington 2014; Rao 2014). The features of audio podcasting, video podcasting and slide sharing were composited in a single application inside IBM.

Yet, a commercial intranet media library product has not emerged from IBM. This disparity between internal uses and external commercialization can be explained by the ability to gain similar functionality of sharing rich media content through means. File sharing, in the style of Dropbox or Sharepoint, is a simpler, and less sophisticated way without feeds. Extending a blog or wiki, as was done in the early days of the Webahead Podcasting Pilot would generate feeds, and search functionality could be architected outside of those packages.[207] The technology is insufficient for podcasting, though. Communities of active publishers and subscribers thrive through the sharing of content. The predisposition for podcasting in large organizational contexts may reflect the degree of rich horizontal peer-to-peer knowledge sharing, as compared to vertical communications up and down management lines.

A.6 Case: Mashing-up (situational applications)

While the term "mash up" could be dated back to 1859, it was rarely used before 1994 when the sense was "a fusion of disparate musical elements".[208] By 2002, musical mashups became easy, as digital technology enabled splicing one musical track with another. One of the signals of the idea crossing over into Internet technologies is the naming of the Mashable web site for news on digital technology businesses founded in 2005.[209] The entry for "Mashup (web application hybrid)" first appeared on Wikipedia in September 2005.[210]

Delaware in 2006.

[206] iTunes 4.9 enabled catching podcasts on iPods in June 2005.

[207] In the world of open source media blogging became featured in Roller 5.0 at the May 2013 release. Roller was the original foundation for the IBM Lotus Connections blog.

[208] The Oxford English Dictionary cites a rare use in 1859 in a play where a person "speaks a mash up of Indian, French and Mexican". In 1994, the musical sense is cited in a description of Jungle as a "frantic, weirdly fragmented mash-up of eerie samples, dub bass lines, jittering snare drums, ragga chat and soul vocals".

[209] Mashable started as a technology blog, and has become one of the most popular web sites on the Internet. See John Halliday, "How Mashable turned Pete Cashmore from internet playboy to CNN target", March 12, 2012.

[210] The entry at `https://en.wikipedia.org/wiki/Mashup_(web_application_hybrid)` was noted by Pete Cashmore on September 19, 2005.

Around the same time, Clay Shirky was seeing an opportunity, where, instead of technologists delivering software for others, groups of users could create personal web applications as situated software.

> Part of the future I believe I'm seeing is a change in the software ecosystem which, for the moment, I'm calling situated software. This is software designed in and for a particular social situation or context. This way of making software is in contrast with what I'll call the Web School (the paradigm I learned to program in), where scalability, generality, and completeness were the key virtues. [. . . .]
>
> Situated software isn't a technological strategy so much as an attitude about closeness of fit between software and its group of users, and a refusal to embrace scale, generality or completeness as unqualified virtues. Seen in this light, the obsession with personalization of Web School software is an apology for the obvious truth – most web applications are impersonal by design, as they are built for a generic user. Allowing the user to customize the interface of a Web site might make it more useful, but it doesn't make it any more personal than the ATM putting your name on the screen while it spits out your money.
>
> Situated software, by contrast, doesn't need to be personalized – it is personal from its inception (Shirky, 2004).

The advent of the personal computer led to business professionals manually copying or downloading data from disparate computers, for indexing or cross-tabulating manually. With the rise of data continuously streaming over the Internet, this procedure of capturing and processing periodically is inefficient. Amongst database programmers, the routines to automate ETL – extracting, transforming and loading of – data are well known. For spreadsheet-literate power users, could there be a simple way to mash up multiple data sources on the web?

A.6.1 Context: organization were beginning to publish open web service APIs

The first mashups that became popularized followed the launch of Google Maps in February 2005. By reverse engineering the Maps API, Paul Rademacher overlaid Craigslist housing ad locations onto Google Maps at housingmaps.com, and married Yahoo traffic data with Google Maps for an anti-gridlock site. Adrian Holovatsky created chicagocrime.org whereby individuals could customize views on crime down to neighbourhoods. In October 2005, O'Reilly Media had convened the Where 2.0 Conference in San Francisco, featuring these innovators as speakers (Singel, 2005). On June 30, 2005, Google published official APIs so that reverse-engineering was no longer required. Yahoo and Microsoft quickly followed (Roush,

2005).

In December 2005, with the rise of standard APIs (Application Programming Interfaces) whereby data from a variety of sources could readily be accessed, Dave Berlind suggested an alternative view of "Web 2.0" centered not on individual computers, but instead as mashups on an "uncomputer" network.[211] Following a conversation with Mary Hodder, Berlind announced an "unconference" called Mashup Camp at the Computer History Museum in Mountain View, California, for February 2006 based on the self-organizing format that had proven successful at BloggerCon 2004 (Berlind, 2005c; Hodder, 2005). Ross Mayfield helped to create a wiki site with online registration, and progress was reported on blogs (Berlind, 2006b; Hodder, 2006). The conference attracted about 300 top web technologists and ran well using an Open Space Technology method (Berlind, 2006a).[212]

This led to a subsequent Mashup Camp 2 that was similarly organized for Mountain View in June 2006 with a slight larger attendance of 400, with sponsorship from companies such as Microsoft and Adobe (M. Johnson, 2006; Thorpe, 2006).[213] These mashups were created by computer programmers, with expertise in languages such as C#, Perl, Python and PHP (O'Grady, 2006b).

While this excitement was generating bottom-up in the technical community, an analyst in January 2006 lamented that large enterprise vendors were talking about service oriented architecture (SOA), but not recognizing mashups (O'Grady, 2006a). Enterprises were starting to look at intranet process management based on SOA as Business Process Management, but mashups were showing that data sources on the open Internet could also be incorporated (Kemsley, 2006). While an IBM executive suggested an opportunity for Enterprise Mashup Services, an advisory and educational consultant saw mashups as (i) only a small part of SOA as other rich Internet applications were being (re-)structured that way, (ii) still in the "techie" domain beyond even power business users, and (iii) ungoverned

[211] While APIs on computers had a long history, open APIs on the web were new. Berlind described:
"The computer that we've come to know and love is quickly becoming a thing of the past (thus, the 'uncomputer') and quickly taking its place (and drawing developers in droves) is a new collection of APIs (this time Internet-based ones) and database interfaces being offered by outfits like Google, Yahoo, Microsoft, Salesforce.com, eBay, Technorati, and Amazon (as well as smaller private enterprises, governments, and other businesses).
Whereas the old collections of APIs (the operating systems) were the platforms upon which the most exciting and innovative application development took place, the new collection is where the action is at, spawning a whole new compelling breed of applications. Barely a day goes by where some new mashup – the creative merger of one or more of these APIs with each other and/or with a public or private database – doesn't appear on the Web" (Berlind, 2005e).

[212] The attendee list for the Mashup Camp in February 2006 is preserved with 300 names.

[213] The list for Mashup Camp 2 in June 2006 is preserved with 354 names, with a note that 46 people didn't want to appear on the list.

so as to introduce risk to business process that otherwise follow corporate policies (Zurek, 2006; McKenrick, 2006).

By summer 2006, the vision of mashups had broadened beyond the first map-oriented applications. Four genres of mashups were described:

- *mashing mashups*: things and activities, annotated with locations;
- *video and photo mashups*: collages associating image metadata of subject and location combined with social network graphs or song lyrics;
- *search and shopping mashups*: comparing product technology features or comparing prices; and
- *news mashups*: personalized newspapers assembled from syndicated news feeds, filtered to personalized topics.

The technologies required included (i) a three-tier architecture (i.e. API/-content provider, mashup hosting site and a client web browser); (ii) Ajax (Asynchronous Javascript + XML), web protocols for communicating with remote services (i.e. SOAP and REST), and (iii) web content (formatted most richly as RDF with the semantic web, commonly as either RSS or Atom, or minimally through screen-scraping human-readable data not originally intended for machine-readable reusability). Technical challenges included data integration issues including semantic meaning and data quality, and immaturity in Ajax web development components. Social challenges included implicit or explicit intellectual property questions from third party data providers, as well as established standards and protocols (Merrill, 2006).

For 2006, the creation of mashup technologies remained the domain of programmers. From the first API launched in June 2005 on ProgrammableWeb, December 2006 had 348 APIs and 1350 mashups listed (Hinchcliffe, 2006; Musser, 2006). In 2007, web mashup platforms targeted to non-technical professionals we introduced by Yahoo, Google and Microsoft.

For non-technical users, Yahoo Pipes was introduced in February 2007 as a free "hosted service that lets you remix feeds and create new data mashups in a visual programming environment" (Yahoo Pipes Team, 2007). Yahoo Pipes was heralded as "a milestone in the history of the internet", as "a first step towards ... creating a programmable web for everyone", although while it "opens up mashup programming to the non-programmer, it's not entirely for the faint of heart" (O'Reilly, 2007). The usability of Yahoo Pipes was rough, and enhancements would be added for years to come.

In May 2007, the Google Mashup Editor would follow (McDonald, 2007). Unlike the strong visual programming orientation of Yahoo Pipes, each project within Google Mashup Editor could be scripted with Google Mashup Language (GML).

Also in May 2007, Microsoft announced a private beta launch of Popfly, a

mashup application developed in Silverlight, a browser-based rich Internet application environment (Cubrilovic, 2007). The mashup technology was seen as a turn for Microsoft towards web applications, but was also criticized as less about data sharing in Web 2.0 than really getting into the mashup game (Markoff, 2008).

These free web offerings were predated by IBM in 2006 with technologies made available on alphaWorks Services, and alphaWorks.

A.6.2 (a) Open sourcing: QEDWiki on alphaWorks Services

On April 16, 2006 at the Web 2.0 Expo in San Francisco, Rod Smith, IBM's vice-president of emerging technology, presented "Mashing Up Business Value with Web 2.0" including an introduction to the new QEDWiki tool (R. Smith, 2006b; Barbosa, 2007). In the week following, a "Resource Utilization Monitor" was demonstrated at the National Association of Broadcasters show in Las Vegas, featuring QEDWiki integrated with the Media Hub enterprise service bus. By April 26, the press was reporting on an interview on the emerging technology.

> The idea behind QEDWiki, which stands for quick and easily done wiki, is that businesspeople can create their own Web pages by dragging and dropping components onto a pallet, Smith said.
>
> For example, a businessperson could build a 'dashboard' to see how weather is affecting sales at retail outlets. By aggregating information from public Web sites, such as mapping and weather services, he or she could assemble a very useful, if simple, content-driven application, Smith said. [. . . .]
>
> QEDWiki is targeted at people who want to make Web applications without the aid of professional programmers. It uses Ajax scripting and a wiki on a server to collect and share information, such as RSS and Atom feeds (LaMonica, 2006).

In a keynote talk at the NY PHP Conference on May 15, 2015, Smith presented on "Enterprise Mashups: An Industry Case Study" (R. Smith, 2006a). The IBM press reported on this conference presentation, promoting that the new "IBM Enterprise Mashup" technology would allow for creation of a custom application in five minutes (Becker, 2006). The press release referenced an Ajax Toolkit Framework on the alphaWorks site, predating release of QEDWiki itself.

By July 17, 2006, IBM was demonstrating QEDWiki with an example in retail industry where the inventory in hardware store branches were combined with local weather, and another in insurance industry where the policyholder ACORD records allowed phone numbers to be matched up to regional maps (Evans, 2006). After a teleconference presentation in August (Boyles, 2006; IBM, 2006f), the QEDWiki ACORD presentation

received wider notoriety with a release on Youtube on November 8 (Barnes, 2006).

At the 10 year celebration of alphaWorks on September 26, 2006, QEDWiki was announced as a software-as-a-service offering that would come soon on the new alphaWorks Services minisite (Kerner, 2006). In contrast to all of the prior alphaWorks offerings that were downloadable code, the alphaWorks Services would be accessible either via a browser or a web service call, responding to requests made over the Internet.

On February 7, 2007, QEDWiki became available as a hosted technology on the alphaWorks Services site as a free preview (IBM, 2007n). Individuals could register at no charge, and feedback from using the technology was encouraged.[214] While QEDWiki was hosted, the foundational technologies were described so that potential future implementers could be assured that popular web platforms running PHP would be supported.[215] Not only was

[214] While QEDWiki enabled mashups, it was positioned for more than that:
What is QEDWiki?
QEDWiki is a browser-based assembly canvas used to create simple mash-ups. A mash-up maker is an assembly environment in which the creator of a mash-up uses software components (or services) made available by content providers. QEDWiki is a unique Wiki framework in that it provides both Web users and developers with a single Web application framework for hosting and developing a broad range of Web 2.0 applications. QEDWiki can be used for a wide variety of Web applications, including, but not limited to, the following:
– Web content management for a typical collection of Wiki pages
– traditional form processing for database-oriented CRUD (Create/Read/Update/Delete) applications
– document-based collaboration
– rich interactive applications that bind together disparate services
– situational applications (or mash-ups).
QEDWiki also provides Web application developers with a flexible and extensible framework to enable do-it-yourself (DIY) rapid prototyping. Business users can quickly prototype and build ad hoc applications without depending on software engineers. QEDWiki provides mash-up enablers (programmers) with a framework for building reusable, tag-based commands. These commands (or widgets) can then be used by business users who wish to create their own Web applications.
In the spirit of Web 2.0, the technology community is invited to actively collaborate and participate in the development and direction of this emerging technology. Your feedback, comments, and suggestions are welcomed and encouraged (IBM 2007a).

[215] QEDWiki would run on any Apache (or WebSphere) web server:
How does it work?
QEDWiki is a lightweight mash-up maker written in PHP 5 and hosted on a LAMP, WAMP, or MAMP stack. A mash-up assembler will use QEDWiki to create a personalized, ad hoc Web application or mash-up by assembling a collection of widgets on a page, wiring them together to define the behavior of the mash-up application, and then possibly sharing the mash-up with others. Mash-up enablers provide QEDWiki with a collection of widgets that provide application domain- or information-specific functionality. These widgets are represented within QEDWiki as PHP scripts.
When a user renders a page within a QEDWiki workspace, the QEDWiki framework processes the widgets on the server side and then generates a DHTML page that is sent to the browser for client-side processing. The framework includes a rich AJAX-enabled MVC (Model-View-Controller) architecture so that each wiki page is a rich, interactive application for end users (IBM, 2007o).

QEDWiki designed to be easy for non-technical professionals assemble and wire their own mashups, but design of the platform encouraged sharing with others. [216]

With the technology launch, an "Introduction to QEDWiki" was published on Youtube (Barnes, 2007a).

For this research study, the initial QEDWiki release on alphaWorks Services is categorized as open sourcing. IBM provided the hosted application free of charge for anyone to use, on the open Internet, available with a simple registration. The alphaWorks web site had been, for over ten years, a place where advanced technologies were distributed for customer testing and feedback.

A.6.3 (b) Open sourcing: SAE (Situational Applications Environment on w3 TDIL)

While demonstrations of QEDWiki had been shown to public audiences by the IBM emerging technologies team since spring 2006, few people would be hands-on with the technology until the alphaWorks Services release in February 2007. QEDWiki was the most visible part to show off a mashup, but it required open APIs available from which to pull data.

In comparison to the estimated 3 million professional programmers in American workplaces in 2006, 12 million people "did programming" at work, and 50 million people used spreadsheets and databases (also potentially programming). Beyond professional programmers, end user programming with Internet technologies has not yet caught on in the same way that the personal computing revolution had.

> In spite of all this research, programming is still out of reach of most people. It is still too difficult, and involves concepts such as abstraction, iteration, conditions, and recursion, that are foreign to people. Is it possible to make what we have called a "gentle-slope system", where everyone can start programming with little effort, and learn incrementally as needed? Can the barriers to learning EUP systems be low enough so that the power of customizing the

[216] While QEDWiki was packaged with some standard widgets, library sharing would provide value specific to each organization.
QEDWiki attempts to make use of the social and collaborative aspects of Web 2.0 by enabling the following basic actions:
– Assembly: Subject matter experts who may not be programmers can create Web applications to address just-in-time ad hoc situational needs; they can also integrate data and mark-up using widgets to create new utilities.
– Wiring: Users can bind rich content from disparate sources to create new ways to view information; they can also add behavior and relationships to disparate widgets to create a rich interactive application experience.
– Sharing: QEDWiki can be used to quickly promote a mash-up for use by others and to enable multi-user collaboration on the development of a mash-up (IBM, 2007o).

> computations can be accessible to everyone? How can systems help the end-user programmer be more productive and produce more reliable code? Can artificial intelligence technologies be effectively applied to customize systems to do what users want? These and many other questions are open for future research (Myers, Ko, and Burnett, 2006).

IBM had been conducting primary research into "ad hoc development", conducting 790 web-based interviews and making successful contact with 25,000 respondents. Ad hoc development was defining as "occuring when a person automates or facilitates a particular business function, process, or activity by producing a software application" that: (i) often incorporates other software; (ii) occurs under the radar; (iii) is built for the situation at hand; (iv) is developed in the most efficient, quick-and-dirty manner possible; (v) can be performed by people without extensive, sophisticated computer skills; and (vi) is developed using tools and components that do not require significant IT knowledge (Cherbakov et al., 2007, p. 748).

The idea of "ad hoc development", in the context of the emergence of easily accessible open web services became known at IBM as "situational applications". The term was directly derived from Clay Shirky's earlier vision of "situated software".

> The new breed of situational applications (SAs), often developed by amateur programmers in an iterative and collaborative way, shortens the traditional edit-compile-test-run development life cycle. SAs have the potential to solve immediate business challenges in a cost-effective way, capturing the part of IT that directly impacts end users and addressing the areas that were previously unaffordable or of lower priority. [....]
>
> Clay Shirky's essay titled 'Situated Software' ... describes a type of software that 'is designed for use by a specific social group, rather than for a generic set of 'users'. He argues that 'most software built for large numbers of users or designed to last indefinitely fails at both goals anyway.'
>
> The loosely accepted term situational applications describes applications built to address a particular situation, problem, or challenge. The development life cycle of these types of applications is quite different from the traditional IT-developed, SOA-based solution. SAs are usually built by casual programmers using short, iterative development life cycles that often are measured in days or weeks, not months or years. As the requirements of a small team using the application change, the SA often continues to evolve to accommodate these changes. Significant changes in requirements may lead to an abandonment of the used application altogether; in some cases it's just easier to develop a new one than to update the one in use

(Cherbakov et al., 2007).

The bigger picture of "situational applications" would have to include not only easily accessible open web services, but also other data sources not originally intended for web consumption.

The experience with the "Situational Application Environment" piloted on the IBM intranet beginning December 2006 has been well documented by the IBM Research team leading the pilot (Cherbakov et al. 2007). The first publicizing occurred on December 16, 2006, when Andy Bravery led a one-hour orientation session with the theme "situational application environment - it's not just about mashups" to introduce the SAE as part of Hackday 2.[217] IBM professionals routinely are on the w3 intranet and Internet, and likely repeated mundane tasks that could be automated. When provided with appropriate tools, power uses might be inclined to mash up a situated application rather than repeated downloading and collating data.

The Situated Applications Environment officially came online on the TDIL (TAP Dynamic Infrastructure Lab) hosting environment on Dec. 30, 2006.[218] This availability presented an opportunity for technical enthusiasts to try out end user programming on an intranet platform".

> Three applications and 27 consumables were included in the initial release; within the first two months, the community had helped swell these numbers to 28 applications and some 60 consumables, with the numbers rising to 137 applications and more than 100 consumables by the end of the seventh month (Cherbakov et al., 2007, p. 753).

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[217]The announcement of the second event was made on the Hackday blog:
"In early 2007 we will be launching the Situational Application Environment (SAE) on the IBM intranet. The SAE is designed to provide a structure and eco-system to stimulate the creation, usage and sharing of situational applications (IBM's preferred term for mashups) within the company, and is being used as a 'Living Lab' through which Software Group, Global Services and other parts of the organization will be able to observe and learn about this rapidly emerging style of application development. It is also hoped that direct business benefit will be gained as individuals and departments across the organization start to use situational application seriously to solve day-to-day business problems. Andy will introduce the various elements of the SAE that will be available at launch, and talk about some of the planned enhancements that will follow in early 2007 including some of the tooling that is currently under development. This will be one of the first chances to see the SAE before it appears on TAP shortly and the demonstration will also include a look at some example situational applications and consumable services that have been developed as part of this project.
The aim is to stimulate your interest and hope that as many of you as possible will use HackDay to create cool stuff that we can showcase in the SAE at the earliest opportunity".

[218]The official announcement of SAE was made on the forum:
Luba Cherbakov | The SAE is live | Dec 30 2006
"We made it! We even have several situational applications and consumables already registered in the catalog. Check them out and let us know what you think.

While growth of the SAE was entirely organic for the first two months, increased participation was later encouraged by promotion through contests, described below in A.6.4.

The SAE not only provided IBM platforms for trial, but also other open sourcing components such as OpenKapow robots.[219] Just as IBM was providing open sourcing versions of some products under development, so did other vendors.[220] Adding optional components to the SAE would allow IBMers to try out and compare – just as customers would – product features that might or might not be relevant.[221]

For this research study, the launch of the Situational Applications Environment on the w3 intranet is classified as open sourcing. In addition to the typical IT support staff required to maintain the hosting, this project was unique in the participation of IBM Research staff who initiated and guided the technology direction. The applications created were, however, by IBMers who volunteered their time and energies beyond the primary roles in their day jobs. In that respect, they fit the profile of "ad hoc devel-

[219] With OpenKapow was installed on the SAE server, education was scheduled.
A.J.F. Bravery | Kapow Tooling Education session, Tues 25th Sept. | Sep 19 2007
All, Here is the detail of the Kapow Education session we are running next week. The session will focus on the use of Kapow tooling to create data feeds for use in mashups, through using the Kapow Trial FeedServer in the SAE
"Please let me ... know if you will be attending. If you are aware of others who might be interested in joining the session please forward these details on to them. If you cannot attend this time, then please let me know your interest in a follow-up session so we can organise this if there is the demand".

[220] Kapow Software, another company targeting Enterprise Mashups, offered open source robots for data sources not already provisioned as web services.
What is openkapow?
Openkapow.com is an open service platform, this means that you can build your own services (called robots) and run them from openkapow.com, all for free. These robots access web sites and allows you to use data, functionality and even the user interface of other web sites in a whole new way. No longer are you limited by what public APIs or RSS feeds that are available, instead you can build your own in minutes. You can then use those services from within your own mashups, code, Yahoo! Pipes, Google Gadgets etc.
What is an openkapow robot?
A robot in openkapow is a small program that automates what a person can do in a browser. This includes navigating web sites by clicking on links and submitting forms, extracting data from a site and much more. Robots are created in the development environment RoboMaker without any programming and robots are then hosted and run on openkapow's servers. The behavior of a robot can be affected by input values (for example the username and password to used to log in to a password protected site) and the robot produces an output (for example the current rate of a specific stock) (Software, 2007).

[221] As it turned out, openkapow robots were not popular, and the trial was removed in 6 months.
A. J. F. Bravery | Ending of the Kapow Trial | Mar 26 2008
After 6 months of observation, we have decided to end the trial of the Kapow Robosuite tooling on the SAE.
Unfortunately there has not been enough interest from the community to make it worthwhile to continue.
Thank you to those who did take part in the trial and helped us evaluate this tooling.

opment" enthusiasts who were building situational applications primarily driven by individual, rather than organizational, motivations.

A.6.4 (c) Open sourcing: SAE Contests (on w3 TDIL)

On May 2, 2007, an SAE Contest for IBM employees was announced by the CIO Office.[222] Education sessions would be run around Hackday 3, May 7 to 17.[223] Entries by IBM regular or supplemental employees and coop students would be accepted , but the entry could not be part of a day job assignment. Properly licensed code could be reused, with attribution credited to the original authors.[224] The deadline for submission would be July 31, although teams were encouraged to publicize work-in-progress

[222]The SAE contest was announced online on TAP:
Announcement: To build awareness and momentum around the Situational Applications Environment and to encourage adoption of situational applications in IBM, Maria Azua, VP of Technology and Innovation in the CIO Office, is announcing the Situational Applications Contest! This contest will foster a collaborative community around grass-roots computing and Web 2.0 innovation.
The Challenge: Create a compelling web application, a plugin or a Notes composite application to demonstrate how to address every day business problems with Web 2.0 technologies and techniques. Reuse any openly available internal and external RSS and Atom feeds, REST and SOAP style web services. Style your application using AJAX. Use Project Zero, PHP, Ruby or any other programming language of your choice. Employ mashup makers - QEDWiki, Luana, ADIEU; Ruby on Rails web application framework, Yahoo! pipes, OpenKapow robots or any type of platform or tool. Make components of your solution reusable by others. Script, scrape, shred, snip, mash, map, visualize...reuse, share, expose... and have some fun doing it!

[223]The SAE Contest was independent of Hackday, but could ride on its promotion:
May 7th to May 17th - OPTIONAL Participate in our sister-event HackDay3's education sessions. Check out the full schedule as well as the information on how to join and participate in the sessions at http://w4.ibm.com/hackday. All sessions will be podcast, some vidcast and put into the w3 Media Library. The w3 Media Library already has sessions from HackDay2.

[224]Final results of the contest would be the property of IBM, publicized on w3.
Contest Rules
1. In order to qualify, an entry needs to demonstrate use of one or more Web 2.0 techniques and technologies and must demonstrate how one or more sources of content are used in creative ways to benefit users.
2. The entry must be submitted before the deadline 12 pm, EST. on July 31, as timestamped by the SAE.
3. The contest is open to individuals or teams who are regular or supplemental employees, or co-op students.
4. The entry may not be part of your DAY JOB assignment.
5. The application must be accessible via a single URL, or employ simple standard installation techniques such as those for browser or sametime plugins. Entries that use Notes must include an installation wizard.
6. The solution can reuse acceptably licensed code. In the SAE entry, you must give credit to the original author(s). Plagiarized entries will not be considered.
7. The judges and the contest administration team members are not eligible.
8. If the winning entries are submitted by more than one individual, the cash prizes will be divided equally among the participants who submit the winning entries.
9. All entries will become the property of IBM and shared by the SAE community.

in the hopes of gaining feedback that would strengthen their final entries. On August 17, the winners would be announced, with prizes of $15,000 for first place, $5000 for second place, and $2000 for third place.

The contest drew 90 entries from 178 participants.[225] First prize was awarded to Jan Pieper, a research engineer at IBM Almaden with day job

[225]The 90 entries in 2007 were mentioned in the 2008 contest announcement. The 178 participants were listed by Philip Bender on October 8, 2007, in the article "SAE Contest Winners".

SAE Contest winners

It's not business as usual for IBMers who entered the Situational Applications Environment Contest, sponsored by Maria Azua, VP Technology and Innovation. They took up the challenge to use Web 2.0 technologies and techniques in creating web applications, plug-ins or Notes composite applications that address everyday business problems.

Jan Pieper was one of the 178 participants. He recognized that as virtual teams span the world, keeping track of relationships and expertise is complicated. His solution, TeamAnalytics, offers a simple and visual answer. With TeamAnalytics, just enter your team members Notes addresses and this solution will "slice and dice" through bluepages data like department number and work location to build a visual hierarchy of your logical team . The application also provides visualization of 'Timezone Pain' for better scheduling of meetings with a far-flung team. His efforts brought Jan the $15,000 first prize.

Choosing other winners wasn't easy because the judges were impressed by many entries. As a result, they awarded three prizes each in the 2nd and 3rd place categories.

Santosh S Kumar, a great Innovator in the Software Group in India, won a 2nd place award with Reporting Composite Application on Notes. It provides graphical reports from Notes, integrates Eclipse and Notes Storage Format and offers the ability to create reports over Domino Data Source. His efforts got him $5,000 as second prize.

Any IBMer on the road will appreciate TravelFusion, a 2nd place winner. Described by its creators as a 'Swiss Army knife for road warriors,' this mash-up integrates 10 data streams to provide such info as local weather, meal limits, and directions to lodging and IBM locations. It's the brainchild of Brian Olore and Matt Starr, who will share a $5,000 award.

Google Gadgets on Composite Applications, another 2nd place winner, adds Google Gadgets to the palette of Lotus Notes 8's Composite Application. With this entry, it's easy to have a weather forecast, currency converter and Wikipedia search in the same window. A pair of IBMers from the Dublin Software Lab, Brian O'Gorman and Katherine Sewell, share the credit - and the prize money.

The Expertise Finder, a 3rd place winner, mashes together the Fringe Contacts service and the Nova Locator and EmployeeMapper services to find subject matter experts near a given location in US. It runs within the Project Zero framework and is written in Groovy, Java and Javascript. Daniel L Turkenkopf netted a $2,500 prize for his work.

In England, Jamie Caffrey, Bharat Bedi, and Stuart Crump put their heads together for the Universal Information Framework for Sametime 7.5.1. This is a live information dashboard which receives information from numerous different sources. Information is pushed out to the user dynamically as it changes. Users can then interact back with it to provide such real-time information as stock quotes, sports scores or monitoring remote locations. They share the award for their 3rd place.

A handful of employees in the Software Group in Germany Sebastian Nelke, Michael Baessler, Andrea Elias, Thomas Hampp and Thilo Goetz – grew tired of searching for background information when reading Web pages. Their solution Braindrops SmartTouch is another 3rd place winner. It identifies potential topics of interest in a text, accesses available information sources about a topic and

responsibilities in multimedia technologies, for his creation of TeamAnalytics application that mapped virtual team including a "Timezone Pain" for scheduling meetings. Judges were so impressed that three prizes were awarded for second place and three prizes were awarded for third place.

Some of these winning entries would be further developed by the Office of the CIO. The *IBM Travel Maps* application combined the recommended hotel list provided by the Online Travel Reservations self-service booking system with information locating IBM facilities (provided by Real Estate Operations), airports and rental car locations as a trip-planning aid. The *Virtual Team Locator* application visually mapped the location of client executives and sales representatives on a customer account team, and showed who might be immediately available by their instant messaging status. The *Bluecard Widget* combined the Bluepages corporate directory with the skills database and current projects, so that hovering over an employee's name on any intranet web page would have surface a thumbnail photograph and an abbreviated profile (Cherbakov et al., 2007, p. 752-754).

After eight months of use, the Situational Application Environment surfaced a variety of insights: (i) access to third party data sources could generate unexpected workloads on their servers, so that caching and refreshing a secondary source might be preferred; (ii) improved access would turn up data that needed to be tidied up, calling for a feedback loop to the data owners; (iii) the expectation of "quick and dirty" situational applications that would first lead the end user to meet an immediate need that would require later redevelopment by professionals outside the initial users; (iv) acceptable inefficiencies of slow execution times for the original situation might lead to complaints amongst a broader audience; (v) the initial hosting where developers had root access (i.e. administration privileges) and a personal choice of tools might not be practical when rolled out to a larger community; and (vi) different lines of business would have different interests in applications due to their situations (Cherbakov et al., 2007, p. 756-759).

For this research study, the 2007 contest that continued the Situational Applications Environment on the w3 intranet is classified as open sourcing. Although each individual might develop a situated application for personal productivity reasons, the results could easily be shared across the community. Promotion of the SAE through a contest is a unique way to gain attention, that doesn't necessarily detract from cooperating and sharing.

A.6.5 (d) Open sourcing: IBM DAMIA (on alphaWorks Services)

While QEDWiki was a potential solution for end user programming as a front end composition technology, back end data sources have not tradition-

seamlessly enriches the text with the found information using Ajax technology. For more information concerning this article, please contact Bender, Philip J.

ally been structured for such purposes. In September 2006, at a keynote at the VLDB conference, the need for an "enterprise information mashup fabric" was hypothesized.

> Currently the state-of-the-art in enterprises around information composition is federation and other integration technologies. These scale well, and are well worth the upfront investment for enterprise class, long-lived applications. However, there are many information composition tasks that are not currently well served by these architectures. The needs of *Situational Applications* (i.e. applications that come together for solving some immediate business problems) are one such set of tasks. Augmenting structured data with unstructured information is another such task (Jhingran, 2006).

Information that was incomplete, from the IT perspective, could be augmented in personal application, e.g. a spreadsheet with only the first names of employees could be joined with the official employee directory by the end user himself or herself. In this way, unstructured data was given semantics to match up to the structured data managed by the IT department.

At the June 2007 IBM announcements of "Info 2.0" mentioning only Lotus (collaboration) and WebSphere (Internet) technologies without complementary InfoSphere (database) products, the work in progress on an information fabric layer was resurfaced less formally as ongoing development by a member of the IBM Office of the CTO (Cooney, 2007). An analyst's sharp observation on "Can You Have Info 2.0 Without XML Syndication?" (Gotta, 2007) surfaced a preannouncement of upcoming mashup fabric technology by an IBM Research project leader as a comment on that blog.

> Info 2.0 will be having XML analytics through its DAMIA component. DAMIA (Data Mashup Fabric for Intranet Applications) is a technology invented by IBM Research for augmenting, merging (correlating), sorting, grouping, transforming, and aggregating generic XML feeds (i.e., XML documents with a repeating element. Atom is a special case of an XML feed with 'entry' as repeating element, RSS is a special case of an XML feed with 'item' as repeating element.). In a typical scenario, a user of DAMIA specifies a data flow over XML feeds through a browser-based GUI Editor. The resulting feed produced by DAMIA data can then be formatted and syndicated in various ways, e.g., RSS, Atom, or generic XML feeds (Markl, 2007).

A few weeks later, on August 5, 2007, the QEDWiki web video series on Youtube was extended with a demonstration of Mashup Hub, with DAMIA used to filter, sort and publish an RSS feed from an Excel spreadsheet combined with XML (Barnes, 2007c).

IBM DAMIA became available on the alphaWorks Services web site on August 9, 2007.

> What is IBM DAMIA?
>
> Through a Web-based interface, IBM DAMIA provides easy-to-use tools that developers and IT users alike can use to quickly assemble data feeds from the Internet and a variety of enterprise data sources. The benefits of this service include the ability to aggregate and transform a wide variety of data or content feeds, which can be used in enterprise mashups.
>
> DAMIA lets you do the following:
>
> - Import XML, Atom, and RSS feeds.
> - Assemble feeds from both the Internet and from Excel spreadsheets; database support is coming soon.
> - Import data from local files in XML format and Excel spreadsheets.
> - Aggregate and transform a wide variety of data or content feeds into new syndication services.
>
> When building a complete Web application that provides a user interface, additional tools or technologies are required in order to display the data feed provided by DAMIA. Mashup makers, such as QEDWiki, and feed readers that consume Atom and RSS can be used as the presentation layer in the enterprise Web application (IBM, 2007j).

While mashup technologies such as Yahoo Pipes had focused on data available on the open Internet accessible with web service calls, DAMIA recognized that business professionals largely work with Excel spreadsheets, and any other personal productivity tools might be exportable in XML format. DAMIA provided a facility whereby these personal data sources could be hosted in an intranet, and managed as feeds through a graphical interface.[226]

A more complete disclosure of the internals of DAMIA was presented by

[226] Spreadsheets are structured forms, so interpreting Excel on the web rather than on a personal computer is a relatively simple technical task.

How does it work?

DAMIA is composed of the following:

– a browser-based Web application for assembling, modifying and previewing mashups

– services for handling storage and retrieval of data feeds created within the enterprise as well as on the Internet. In addition to creating data feeds from various sources, DAMIA can publish information such as Excel spreadsheets or XML documents in mashup formats.

– a repository for sharing and storing feeds or information created by DAMIA

– services for managing feeds and information about mashups; search capabilities; and tools for tagging and rating mashups.

Platform requirements

Firefox 1.5 or above is required (IBM, 2007j).

the IBM Almaden Research team at VLDB '07 in Vienna around September 23. The way in which DAMIA extended mashup beyond the data streams typically managed by an IT department was compared to the format of the sources presumed by Yahoo Pipes.

> To our knowledge, the only other similar service is Yahoo Pipes . Pipes allows for the specification of a data flow graph to combine data feeds, which can be RSS or Atom or RDF. Pipes focuses on merging feeds or on enhancing existing feeds by transforming them via web service calls (e.g., language translation, location extraction).
>
> DAMIA goes beyond Yahoo Pipes in several ways: (1) DAMIA has a principled data model of tuples of sequences of XML, which is more general than Yahoo Pipes. (2) DAMIA's focus on enterprise data allows for ingestion of a larger set of data sources such as Notes, Excel, XML, as well as data from emerging information marketplaces like StrikeIron. (3) DAMIA's data model allows for generic joins of web data sources (Altinel et al., 2007).

The architecture of DAMIA was described in five parts: (i) the user interface, a browser-based editor where the data sources were represented as boxes that could be connected with edges in a drag-and-drop style; (ii) the execution engine, where data flows could be filtered, fused, sorted and grouped, in iterative sequences, or in constructs of sequences of sequences; (iii) storage services where Excel spreadsheets or XML documents could be shared with others; (iv) directory services to manage resources and mashups; and (v) scalability services to index and cache mashup resources. DAMIA was written in PHP to run on a common LAMP (Linux, Apache, MySQL, PHP) server.

Open research challenges still being explored included (i) how enterprise data would be ingested, given the variety of sources, formats and authentication models; (ii) how entities that might be the same data represented in different ways could be resolved, potentially through a "folksonomy" so that a data source already catalogued would not be duplicated again; (iii) how streaming data might be better managed, as RSS and Atom updates are "pushed" when published, while mashups typically "pull" data for reporting and dashboarding; (iv) how the catalog of mashup applications and data sources might be searched; (v) how the lineage of data sources could be provided so that the reliability of the composite could be assessed, and (vi) how uncertainty in inexact mashup results might be reported probabilistically.

For this research study, the provisioning of DAMIA on alphaWorks Services is classified as open sourcing. While DAMIA was described by IBM Research as "A Data Mashup Fabric for Intranet Applications", it was provided on the open Internet to be usable by any party who chose to register. The platform was constructed on open sourcing technologies (i.e.

PHP on LAMP), with ongoing developments presented and published at academic conferences, with ongoing uncertainties and future directions reported.

A.6.6 (e) Open sourcing: Mashup Startup Kit (on alphaWorks)

From February 2007, QEDWiki had been available as a public web service from alphaWorks Services. From August 2007, DAMIA had been similarly been available from alphaWorks Services. The targeting of situational applications from IBM – as distinct from Yahoo Pipes, Google Mashups or Microsoft Popfly – was creating mashups on an intranet. This would require that a customer organization would have to host its own mashup servers to have access to private data sources.

Mashup Camp 3 was held in Boston on January 17-18, 2007, with 250 attendees and without an official IBM organization presence (Zelenka, 2007; Berlind and Gold, 2007b). For Mashup Camp 4 on July 19-20, 2007, again at the Computer History Museum in Mountain View, CA, 315 attendees registered, and sustaining sponsorships came IBM and Google (Berlind and Gold, 2007c). IBM led organization of a Business Mashup Challenge, where an alpha version of Mashup Hub was provided as a host for one type of submission.[227] This meant that anyone who was active in mashup technologies would have had an open preview of IBM Mashup Hub.

On blogs in advance of the official product announcement, the three pieces of Info 2.0 were described on August 11, 2007: (i) DAMIA, "dealing with mixing and mashing of information"; (ii) Mashup Hub, "for managing all feeds and enterprise connectivities" [sic]; and (iii) QEDWiki "a lightweight assembly tool", all demonstrated in the Youtube video that

[227] IBM provided Mashup Hub and QEDWiki to Mashup Camp 4 on a temporary domain of sitapps.net. Two submission types were accepted:
1. **Mashup Consumables**: IBM's Mashup Hub provides support for creating, publishing and discovering data components pertinent to a mashup. Mashup Assemblers can use Mashup Makers, such as IBM's QEDWiki, to build new mashups using components stored on the Mashup Hub. These components, referred to as Mashup Consumables, can be one of the following:
– Atom Feeds for local data sources
– Relational Database Query Results
– XML Documents (DB2 pureXML™)
– Microsoft Excel Work Book
– Microsoft Access Query Results
– RSS feeds for remote content providers
– RSS feeds for remote content aggregation servers (such as Dapper Dapps, Yahoo Pipes)
– QEDWiki Widgets
2. **Workspaces**: IBM's QEDWiki Mashup Maker enables a Mashup Assembler to assemble and wire Widgets on a Wiki page to create a web application. The resulting Wiki Page is referred to as a Situational Application or mashup. A QEDWiki Workspace is a Wiki Page that is the parent of one or more Wiki Pages (Berlind and Gold, 2007a).

had been published on April 5, 2007 (Jhingran, 2007). On August 23, a seven-part Youtube video on "Making Mashups with Info 2.0" was released (Barnes, 2007b). In September 2007, the "Web 2.0 Goes to Work Conferences" showing these technologies were held in Raleigh, NC, and Austin, TX were highlighted for a broader audience on Youtube (Barnes, 2007d).

On October 9, 2007, IBM officially announced a preview of the Mashup Starter Kit as and application downloadable from alphaWorks, with a projected commercial version to be released in 1Q2008 (IBM, 2007d).[228]

For this research study, the evolution of technologies that became introduced as the Mashup Starter Kit on alphaWorks is categorized as open sourcing. IBM executives were unusually forthcoming about Mashup Hub prior to its official announcement, including provisioning of the platforms at a conference where the entire mashup community was sure to attend. Providing a downloadable version of the entire Mashup Starter Kit on alphaWorks in October 2007, months ahead of the program product availability in 1Q2008 is counter to the standard processes inside IBM.

A.6.7 (f) Open sourcing: SAE (updates with the Mashup Starter Kit)

With Mashup Starter Kit openly available to the public on alphaWorks, the November 1, 2007 announcement to replicate the same technology on IBM intranet was a matter of course.[229] The internal platform name of the "Situated Application Environment" was retained, although the official names for program products had now been formally established. The applications constructed on the prior pre-announcement platforms were

[228]The three-part product mix was simplified by bundling DAMIA into IBM Mashup Hub. The description for the Mashup Starter Kit on the alphaWorks site only mentions IBM QEDWiki and Mashup Hub.
IBM Mashup Starter Kit consists of two technologies: IBM Mashup Hub and QEDWiki. IBM Mashup Hub is a mashup server that stores information feeds (such as in RSS, ATOM, or XML formats) in order to enable reuse and collaboration. Mashup Hub can also merge, transform, filter, annotate, or publish information in new formats. From there, the newly-enhanced QEDWiki serves as the user interface and allows non-IT users to 'mash' information from any data source in order to create a single view of disparate sets of information in minutes (IBM, 2007d).

[229]The w3 platform were brought up to date with the alphaWorks version:
Andy Bravery | "IBM Mashup Starter Kit sandbox added to SAE | Nov. 1, 2007
"The IBM Mashup Starter Kit bundles up QEDWiki, Mashup Hub and DAMIA into one integrated toolset an runtime environment for Mashup developers and users alike. We now have sandboxes for this on the SAE.
The QEDWiki Service can be accessed at `http://sae01.adtech.internet.ibm.com/ibmmsk/qed/wiki_web_app/`
The Mashup Hub Service can be accessed at `http://sae01.adtech.internet.ibm.com/ibmmsk/mashuphub/client/`
We will soon be enabling the QEDExplorer to be able to pull assets directly from the SAE catalog into the QED palette.
Please experiment with this new tool set and don't forget to register your creations back in the SAE!"

evolved onto the same technologies as were now public.

For this research study, the continuation of the Situational Applications Environment on the w3 intranet with the alphaWorks version is classified as open sourcing. Prior to the official release of an IBM program product, the primary source of feedback on applying the technologies had been the business professionals inside IBM who had access to all of the components on the w3 intranet. With the entire product set now downloadable on the alphaWorks site for installation onto customer intranets, parallel channels of communication to product developers would emerge.

A.6.8 A(g) Private sourcing: IBM Mashup Center (Lotus Mashups and InfoSphere MashupHub)

The first release of program products slipped from the original expected data in 1Q2008. In June 2008, IBM announced IBM Mashup Center v1.0, composed of two complementary products that would also be available separately from each brand: (i) Lotus Mashups with the visual user interface to wire up widgets and/or feeds to create representations including tables and charts, and (ii) InfoSphere MashupHub to create remix, and manage web feeds as merged or transformed datasets (IBM, 2008h).

At the time of announcement, an online community for IBM Mashup Center, publicly accessible to anyone interested in the technology, was initiated on the Lotus web domain as a wiki.

> This community is for you to learn about IBM® Mashup® Center™, contribute to its knowledge base, and collaborate with others. It contains articles on installing, administering, deploying, and using IBM Mashup Center, including tutorials for new users. We invite you to create new articles on these topics, or to expand our content to include troubleshooting and best practices.
>
> **About IBM Mashup Center**
>
> IBM Mashup Center is made up of two components - Lotus Mashups and InfoSphere MashupHub. Used together, these components let you create your own widgets, mix and match widgets to create new mashups, and store widgets and mashups in a catalog to share with others (IBM, 2008l).

From its inception, the wiki contained a structured lesson plan with modules on how Lotus Mashups could be used, and best practices from IBM jStart Engagements. The NSF extension of the URL showed that IBM was employing its own Lotus products on the open Internet.

For purely technical audiences, there were “getting started” and “in-depth” articles focused more on the InfoSphere MashupHub published on developerWorks (Singh, 2008a; Singh, 2008b). For business-oriented audiences, a white paper on “the business case for enterprise mashups”

described the “long tail” where situational applications were not well suited to the economics of formal development processes (Carrier et al., 2008).

Implementation-oriented audiences were provided with a case study where the IBM Emerging Technologies Client Engagement team (jStart) worked with Boeing to create a Usable Airport Search Mashup that would combine information from the Department of Defense, Department of Homeland Security and Department of Transportation to locate airfields during disaster relief situation that were open and had sufficient runway length for landing (IBM, 2008b). The case study was made more visual with a web video published on Youtube (Barnes, 2008).

With the release of a program product with official technical support, the alphaWorks project was ended.[230] If a customer of IBM Mashup Center had previously been piloting with the alphaWorks version, the IBM software support channels would certainly help with migration to new code.

As an alternative to the web services previously hosted on the alphaWorks Services site, parties could try out Mashup Center on the Lotus Greenhouse site. This became available at the same time that Mashup Center became a program product, with a webcast scheduled to step through some basics (IBM, 2008g; Guidera, 2008).

In October 2009, v2.0 of IBM Mashup Center was announced, complemented with a new analytics product, IBM Cognos 8 Mashup Service (IBM, 2009c). The product manager created a web video of Cognos 8 Mashup Service with Google Maps, and later reposted it to Youtube (W. Williams, 2010a; W. Williams, 2010b).

In November 2010, IBM Mashup Center evolved to v3.0, integrating with additional IT security products and SOA service registries (IBM, 2010c).

In December 2010, some of the Mashup Integration features of IBM Mashup Center (from the Lotus Mashups component) became available as part of the WebSphere Portal 6.1.5 feature pack .

In May 2012, IBM Mashup Center was withdrawn as a program product (IBM, 2012b). Paths to replacement products were immediately available. The Lotus Mashups component was migrated into the WebSphere Portal Server. The InfoSphere MashupHub was migrated into the IBM Web Experience Factory Designer.

For this research study, IBM Mashup Center is categorized as private sourcing. After the program product had been officially released, the primary support channels for fixes and updates were put into place. The decision to integrate with other products, and eventually to migrate the

[230] With an official support channel for IBM Software issuing fixes, the version available on alphaWorks would rapidly become obsolete.
Update: August 7, 2008
"On Aug 26, 2008, IBM Mashup Starter Kit will no longer be available. The technology will be replaced by IBM Mashup Center, which is available both as an IBM hosted service and as a product for purchase" (IBM, 2008l).

component features across various brand offerings was based on the economics of market opportunities and ongoing support. IBM Mashup Center was packaged as a combination of collaboration software (traditionally branded as Lotus) and information management software (traditionally branded as InfoSphere). As the use of web mashups matured, rationalization of the product offering lines led to rebranding.

A.6.9 (h) Open sourcing: IBM Mashups (on w3 TAP)

On September 22, 2008, the second Situational Applications Contest was announced.[231] The prizes were at the same level as in 2007, with an amendment that multiple second and third places were explicitly recognized.[232] The timeline encouraged participation in Hackday 6 on October 26, and early entries could be awarded with a trip to present at LotusSphere in Orlando in January 2009.[233] The contest rules for 2008 were

[231]The results for 2007 were recapped in the announcement on TAP for 2008.
"In 2007, Maria Azua, VP of Technology and Innovation in the CIO Office ran a highly successful Situational Applications Contest which attracted over 90 entries involving 178 team members globally from which 7 prize winners were eventually selected by our panel of distinguished judges. The contest not only yielded some great tools, which can still be browsed in the Situational Applications Environment, but also gave us some valuable insight into the types of technologies and techniques the IBM community were using at the time to build their mashups.
In the year that has passed since the 2007 contest closed, there have been many exciting developments in the situational applications space particularly around IBM's product offerings which means that mashup builders now have a range of tools available which support standard approaches to accessing enterprise data and building user interfaces.
The 2008 contest encourages innovators to try out these tools to create their winning entries".

[232]In 2007, the SAE Contest originally specified a second and third prize, but awarded three of each. The announcement continued:
"The IBM CIO Technology & Innovation team, in collaboration with the SWG WebSphere Technology Institute and Lotus teams, are launching this year's contest to find the best mashup that our IBM internal community can produce using the products and technologies that IBM has in situational application space.
The winning entries will be the mashups which, in the judges' opinion, show the most valuable and innovative uses of IBM mash-up technology, as shared with the internal community through the w3 Situational Applications Environment.
The first prize is a cool $15,000, with runner-up prizes of $5,000 and $2,000 for the teams who are able to build working situational applications that show business value, innovative ideas and customer applicability as well as show IBM technology at it's best - oh, and that indefinable 'wow' factor too. [....]
There will be only one First Prize, but multiple Second and Third Places may be awarded".

[233]The last day to submit entries of Jan. 16, 2009 from the entry conditions was later revised to Dec. 31, 2008:
"October 24, 2008: Take part in HackDay 6. Extra credit will be given to entries that were entered and workable on HackDay.
October 31, 2008: Last day to submit Lotus product-based entries to the WPLC contest to be in with a chance of winning a trip to LotusSphere 2009 in Orlando!
January 16th, 2009: Last day to submit your entry to the SA Contest 2008 [....]

practically the same as for 2007, with entries eligible from employees and co-op students that were not part of the day job.[234]

On October 29, 2008, "big changes" were announced for the SAE, with an expectation of completion by the end of 2008.[235] While TAP (the Technology Adoption Program) web site had been the primary place for new applications since 2005, the Situational Application Environment was implemented as a separate subdomain on the w3 intranet, although the hardware infrastructure was provided by TDIL (the Tap Dynamic Infras-

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1st Quarter, 2009: Judging takes place. Top entries may be called to present their work in more detail to the judging panel.
March 2009: Prize winners informed and publicly announced on w3".

[234]Any differences between contest rules for 2008 as compared to 2007 would require word by word matching.
1. In order to qualify, an entry needs to use as it's majority component a recognized IBM mashup product or technology. In this case, 'technology' is meant to cover emerging frameworks or components that are not yet official IBM products but are coming through Research, SWG Emerging Technology or CIO Innovation channels.
2. To be considered, the entry must be registered in the w3 Situational Applications Environment before the deadline 12 pm, EST. on December 31, 2008, as shown by the SAE timestamp.
3. The contest is open to individuals or teams who are regular or supplemental employees, or co-op students.
4. The entry may not be part of your DAY JOB assignment.
5. The application must be accessible via a single URL, or employ simple standard installation techniques such as those for browser. Entries that use Notes must include an installation wizard or a simple install script.
6. The solution can reuse acceptably licensed code. In the SAE entry, you must give credit to the original author(s). Plagiarized entries will not be considered.
7. The judges and the contest administration team members are not eligible.
8. If the winning entries are submitted by more than one individual, the cash prizes will be divided equally among the participants who submit the winning entries.
9. All entries will become the property of IBM and shared by the SAE community.

[235]At the infrastructural level, SAE was moved into TAP .
Andy Bravery | Big changes are coming for the SAE | Oct 29 2008
In recognition of feedback from users and observance of user behavior over the last year or so, we have been working on a consolidation effort that will merge the SAE with TAP to give innovators, early adopters and business users looking to IBM innovations for an edge just one place to go to.
SAE assets will sit alongside TAP offerings in one repository and be referred to simply as 'innovations'. The SAE mashup tooling and construction zone facilities will become part of the TAP site, and situational application owners will be able to call on the TAP program, should they wish, to help get community feedback on their mashups.
When this change happens, the existing SAE and Innovators Library websites will be sunsetted – some functions of Innovators Library, such as sharing stories, will not be replaced as they have not been heavily used.
The SAE wishlist will also disappear in favour of a new hook up with ThinkPlace that will be launched in 2009.
If you have any comments or questions about this migration, which we hope to launch before the end of 2008, then please reply to this post.
This announcement does not affect the 2008 Situational Applications Contest which remains open until 31st December, though there will be some changes to the entry submission procedures forced by these changes. Check out the contest wiki page for details as they emerge.

tructure Lab). The separate subdomain meant that the collaboration and review features available to every other package on TAP were not available on SAE. With the underlying platform now the official IBM Mashup Center program product rather than offerings on alphaWorks enabled by IBM Research, a change in the way SAE was internally managed was due. Existing situational applications could easily be migrated from the old infrastructure to the new infrastructure. The only expected impact was that the entry cutoff date for the SAE contest originally set for January 16, 2009, was now reset for December 31, 2008.

The results for the SAE 2008 contest were not publicized as were the 2007 results.[236] Perhaps the timing of the contest deterred entrants to dedicate volunteer time towards the effort. While the first run of the contest was announced on May 2 with a submission deadline of July 31, the second run was announced on September 22 with a deadline of December 31. The fourth quarter is not only the fiscal year-end for IBM, as well as many of its customers, but also includes the Christmas holiday season. Maybe the first 90 entries from 2007 had exhausted the imagination of volunteers. A slowdown in IBM's business would draw attention away from discretionary programs.[237]

After the migration to TAP, Mashup Center was updated to v1.1.0.1 on April 29, 2009. On January 15, 2010, TAP upgraded the software to v2.0.

For this research study, the maturing of IBM Mashup Center onto w3 TAP is categorized as private sourcing. The situational applications that had previously been contributed were preserved, and new contributions were still encouraged. The initial excitement of a promising new technology may have passed, but the community was still open to the interested.

A.6.10 Prospects: Programmers create web mashups, but situational applications remain ad hoc

On September 1, 2010, Adam DuVander asked "What Ever Happened to Enterprise Mashups?" citing a Google Trends tracking finding the term peaking in spring 2008, followed by a slow decline (DuVander, 2010). This decline in the term "enterprise mashups" would seem counter to the ongoing growth of open APIs available to be consumed. By the end of 2010, 2647 open APIs were listed in the ProgrammableWeb directory, with the top five types as social (149), Internet (112), mapping (130), search (83) and mobile (74) (DuVander, 2011). This trend would continue to 5000 APIs listed by February 2012, with the rise of 231 government open data

[236] A search on the w3 Intranet did not surface a formal news announcement in 2009 for SAE 2008, only the SAE 2007 results.

[237] The turndown in the IT business would seem to correlate with headlines about employee resource actions at IBM (P. Thibodeau, 2009; Lohr, 2009).

sources, and 104 from Twitter (DuVander, 2012). DuVander hypothesized that perhaps enterprise mashups were still occurring, but invisible to the public as internal to companies, or perhaps the term had gone out of vogue. A similar query on "open data" on Google Trends shows a continuous rise since 2008.

At the January 2008 Lotusphere conference, an IBM presentation included challenges in five areas: (i) the lack of an industry-wide agreement on a widget standard, towards which IBM was work on an OpenAJAX specification on openajax.org; (ii) concerns around mashing trusted internal with non-trusted external APIs; (iii) the challenge of creating mashable data before mashing could be done, requiring the IT department to make enterprise data available as feeds; (iv) cultural issues with skepticism around end user development, the IT department allowing mashups, and millennials demanding the capability; and (v) intellectual property and policy issues for managing, monitoring and potentially monetizing third party data sources (Carrier et al., 2008).

Outside of enterprises, the technology enabling mashups has either been superseded by alternative approaches, or plateaued. In January 2009, Google announced that its Mashup Editor would be discontinued in six months, and recommended migrating to application to Google App Engine where they had "factored most of their learning" (Tholomé, 2009).[238] In July 2009, Microsoft announced that they would be discontinuing Popfly, with an analyst suggesting that the company's focus on mashups for enterprises would be based on Sharepoint (Bradley, 2009).[239]

In contrast to these two other services introduced in the same year of 2007, Yahoo Pipes continues to be available. In July 2009, the 24 feature releases were cited, and the commitment to the Yahoo Open Strategy was reiterated (Yahoo Pipes Team, 2009). In August 2011, Yahoo Pipes was upgraded to v2.0 (Yahoo Pipes Team, 2011), and maintenance has continued with a release of v2.0.10 in February 2012 (Yahoo Pipes Team, 2012). The longevity of Yahoo Pipes may be associated with its close relationship with the YQL technology employed inside Yahoo.[240]

[238] Google announced the end of Google Notebooks, Google Catalogs, Dodgeball, Google Video, Google Mashup Editor, and Jaiku at the same time as its first layoffs in January 2009 (Kincaid, 2009a).

[239] A manager of the Popfly project at Microsoft described the learning gained during the beta, cited the economic downturn leading to record layoffs in July 2009, and then assured that everyone on the Popfly team had been reassigned to other projects (Montgomery, 2009).

[240] Nick O'Neill was blogging about the influence of Pipes on two new technologies, Zapier and IFTTT, and received the following response from Pasha Sadri:
"Hi. I am the creator of Pipes (along with the rest of the awesome team: Jonathan Trevor, Daniel Raffel and Ed ho). Pipes was meant to be open platform that grows with the web. It is great to see it live up to some of that potential and keep popping up after all these years.
Pipes has a close cousin called YQL that is used extensively inside Yahoo!
Pipes itself could go much further. It is complicated" (Sadri, 2012).

The challenge of developing industry standards for mashups was approached by two groups, both of which have only seen limited success.

The OpenAjax Alliance had its first official face-to-face meeting in Santa Clara, CA, on October 5-6, 2006 (Ferraiolo, 2006a). Fifty people attended, representing 30 member organizations (Ferraiolo, 2006b). Jon Ferraiolo was seconded from IBM to serve in an alliance operations role.[241] A steering committee was elected for two year terms by two vendors (IBM, Zimbra) and two standards foundations (Dojo, Eclipse), and one year terms by three vendors (Nexaweb, Tibco, Zen).[242] By December 2006, 21 additional members had joined the alliance (Ferraiolo, 2006c). In March 2007, Microsoft and Google joined (Ferraiolo, 2007a).

While Ajax was seen as a way of improving the experience, the motivations for the alliance were explained as longer term.

> Beyond better user interfaces for existing applications, AJAX enables new classes of applications that fall under the umbrella term Web 2.0 that also fit into a Service Oriented Architecture (SOA). Among the next-generation applications that will power the enterprise and the Internet of the future are the following:
>
> - Users as co-developers: New AJAX-powered environments, such as application wikis, are empowering users to create their own customized mashups including personalized dashboards and situational composite applications.
> - Collaboration: AJAX technologies are typically the centerpiece of Web 2.0 information collection and sharing environments that harness the collective intelligence of disparate communities.
> - Software above the level of a single device: Web 2.0 is accelerating the movement from installable desktop applications to Web-based applications, thereby leveraging the advantages of networks and information sharing.
> - Cross-device applications and mobility: Simultaneous with the adoption of Web 2.0 is the growing proliferation of Web-capable mobile devices. AJAX technologies enable Web 2.0 applications across both large-screen desktops and small-screen mobile devices (Ferraiolo, 2007d).

By July 2007, a stable snapshot of OpenAjax Hub became available (Ferraiolo, 2007c), to be formally approved in January 2008 (Ferraiolo, 2008).

In September 2007, IBM contributed "SMash (secure mashups)" to the OpenAjax Alliance. "SMash is a set of technique and open source

[241] In his self-introduction at the October meeting, Jon Ferraiolo said that he had only joined IBM 5 months earlier, having previously been at Adobe. He was "solely dedicated to help with OpenAJAX Alliance" although employed by IBM, in a separation of "church vs state".

[242] John Crupi, from Jackbe, who would later be instrumental in the Open Mashup Alliance, was at the inauguration of the Open Ajax Alliance.

JavaScript that runs in today's browsers (without extensions or plugins) and enables secure handling of 3rd party mashup components" (Ferraiolo, 2007b). Continuing work on the OpenAjax Hub saw renaming for v1.1 to v2.0 in March 2009 (Ferraiolo, 2009a), and then completion and final approval by July 2009 (Ferraiolo, 2009b). Major products including OpenAjax Hub included the September 2009 release of IBM Mashup Hub 2.0 and October 2009 release of Tibco Pagebus 2.0 (Ferraiolo, 2009c).

In May 2010, OpenAjax Metadata 1.0 was completed and approved (Ferraiolo, 2010a). Working across industry standards, OpenSocial 1.1 was released with OpenAjax Hub inside in November 2010 (Ferraiolo, 2010b). In 2011, IBM and the Dojo Foundation announced Maqetta, an HTML5 authoring tool using the OpenAjax Widgets, which were part of the OpenAjax Metadata 1.0 specification (Ferraiolo, 2011).

In October 2008, despite all of the progress on industry standards and reference implementations, "apathy" for the OpenAjax Alliance work surfaced.

> The 2008 Open Ajax Alliance InteropFest a project set up in June to promote compatibility demonstrations for AJAX tools, libraries, and 'mashup' editors has so far failed to attract participants. [. . . .]
>
> This summer the Alliance experienced a similar wave of apathy when it received a poor response to a call for votes on AJAX features developers would most like to see organizations such as Microsoft, Mozilla, and Google add to their browser software (Manchester, 2008).

In September 2009, the Open Mashup Alliance announced its formation, to develop an Enterprise Mashup Markup Language (EMML), based on a Creative Commons licensed contribution from Jackbe.

> Acknowledging the tendency in the IT space to form industry organizations for a multitude of tasks, John Crupi, CTO of JackBe, stressed OMA was different. 'This is a little different because this isn't just a bunch of companies and vendors getting together saying we want to promote the goodness and happiness of mashups,' Crupi said. The difference is the contribution of EMML to the effort, he said. Developed by JackBe, EMML is a domain-specific language based on XML for building and running enterprise mashups (Krill, 2009).

While an analyst recognized the Open Mashup Alliance as a vendor-driven standards approach, it did not vendors beyond Jackbe actually implementing technology.

> Although there are no other mashup standards at the moment, do not expect widespread support for EMML to materialize in the near term. At present, only JackBe is implementing EMML. Support from a megavendor would increase its importance (Knipp, Valdes, and Bradley, 2009).

By spring 2010, news updates about the Open Mashup Alliance had ceased, and no progress beyond the initial EMML v1.0 release was reported.[243]

Despite the fact that the OpenAjax Alliance actually produced tangible results, the Open Ajax Hub and OpenAjax Metadata specification have been passed over by developers, in favour of jQuery.

It appears OpenAjax tried to bring an enterprise application integration (EAI) solution to a problem that didn't – and likely won't ever – exist. So it's no surprise to discover that references to and activity from OpenAjax are nearly zero since 2009. Given the statistics showing the rise of JQuery – both as a percentage of site usage and developer usage – to the top of the JavaScript library heap, it appears that at least the prediction that "one toolkit will become the standard—whether through a standards body or by de facto adoption" was accurate (MacVittie, 2011).

While IBM, Eclipse and Adobe had tools that supported the Open Ajax Metadata specification, most developers were not working on large scale applications where a hub and integration method of interoperability was necessary. Web developers more concerned with simplicity in development and speedy browser performance chose jQuery over Ajax.[244]

While Yahoo Pipes has continued to carry the banner for "mashups" and "situational applications", some new approaches and technologies for "end user programming" have emerged. With venture capital funding, IFTTT (If This Then That) was founded in 2010 (Crunchbase, 2014a) and Zapier was founded in 2011 (Crunchbase, 2014b). In an alternative approach, the implementation of federated wiki now enables dynamic content through plugins (Cunningham, 2013).

The practices of web mashups and situational applications depend on the level of expertise of the individual, since the use of the programs have primarily been seen as persona. Technologies come and go, and are largely driven by dynamics between technical developers and vendors of tools who

[243]The microblog at http://twitter.com/openmashup had posts only from September 2009 to April 2010. The website at openmashup.org never had news beyond the initial 2009 inauguration. The openmashup.org domain ceased when Jackbe was acquired by Software AG in August 2013.

[244]In 2011, 64% of websites were using jQuery, and 53% of developers were choosing jQuery over the 3% choosing the Ajax-based Dojo.
"The focus of the OpenAjax interoperability efforts appears to be on a hub / integration method of interoperability, one that is certainly not in line with reality. While certainly developers may at times combine JavaScript libraries to build the rich, interactive interfaces demanded by consumers of a Web 2.0 application, this is the exception and not the rule and the pub/sub basis of OpenAjax which implements a secondary event-driven framework seems overkill. Conflicts between libraries, performance issues with load-times dragged down by the inclusion of multiple files and simplicity tend to drive developers to a single library when possible (which is most of the time). It appears, simply, that the OpenAJAX Alliance – driven perhaps by active members for whom solutions providing integration and hub-based interoperability is typical (IBM, BEA (now Oracle), Microsoft and other enterprise heavyweights – has chosen a target in another field; one on which developers today are just not playing" (MacVittie, 2011).

support them.

A.7 Case: Coauthoring (collaborative document editing)

Electronic documents – edited as word processing, spreadsheets and slide presentations – became everyday office artifacts through the personal computing revolution. While the first office suite came bundled with the Apple Lisa in 1983, Microsoft Office 1.0 was announced as a packaging of Word, Excel and Powerpoint in 1990 (Dilger, 2007a). ClarisWorks was released in 1990, and Lotus SmartSuite came in 1994 (Dilger, 2007c; Dilger, 2007b). These were all developed as personal productivity tools, where one individual might do most of the work, or multiple people would work in parallel for a single editor to merge all of the content.

In the personal computing paradigm, the typical procedure for collaboration is for one author to compose on his or her desktop, save the changes, and then email to the next person for revisions. The Internet made file sharing easier, so that the file could be uploaded to a centralized place where many people could download it for revision. The advent of wiki comes from a different paradigm, however, where multiple people would concurrently have access to the current version of a document, with permissions in place to make edits. Following the style of the original C2 wiki, when one person edits a document, it locks out others from also doing so until control is relinquished.

Expectations on collaborative editing were elevated in June 2003, when the Hydra collaborative text editor showed a practical implementation on Apple OS/X, where multiple authors could simultaneously edit one file together in real time. The group of German students who won an Apple Design Award, creatively extended Apple's Rendezvous zero-configuration networking technology (Cohen, 2003; Apple Inc., 2003). The product was subsequently renamed SubEthaEdit, and TheCodingMonkeys company was formed to support it (Story, 2003).[245] SubEthaEdit is, however, a line-oriented editor targeted at software developers, rather than a word processor as used in typical office situations.

The period around 2005 saw the rise of a shift from personal computing to collaboration on the Internet. Google was already being seen as an emerging threat to the Microsoft Office legacy, in an article reported in *Fortune* magazine.

> Today Google isn't just a hugely successful search engine; it has morphed into a software company and is emerging as a major threat to Microsoft's dominance. You can use Google software with any Internet browser to search the web and your desktop for just about

[245] Apple renamed the Rendezvous technology as Bonjour in May 2005.

> anything; send and store up to two gigabytes of e-mail via Gmail (Hotmail, Microsoft's rival free e-mail service, offers 250 megabytes, a fraction of that); manage, edit, and send digital photographs using Google's Picasa software, easily the best PC photo software out there; and, through Google's Blogger, create, post online, and print formatted documents–all without applications from Microsoft. [. . . .]
>
> . . . the idea that Google will one day marginalize Microsoft's operating system and bypass Windows applications is already starting to become reality. The most paranoid people at Microsoft even think 'Google Office' is inevitable (Vogelstein, 2005).

Collaborative document editing was not a linear step from personal computing. Advances in personal productivity suites were overshooting the needs of the typical office worker. In 2005, Microsoft claimed 600 million Office users, although analysts estimated that 30% were still running Office 97, having skipped Office 2000 and Office XP, and resisting upgrading to Office 2003 (Clarke, 2005). The release of Office 2003 by Microsoft was complemented by the introduction of a collaboration storage feature in Windows Sharepoint Services, if organizations would upgrade to current version (Richardson, 2006). While Lotus Notes was designed as a collaboration platform in 1999, prior to the company being acquired by IBM in 1995, the groupware features were exercised by only a fraction of the 120 million users accustomed to point-to-point e-mail (Arthur, 2006).

The typical business professional is more comfortable with word processing features than coding HTML scripts common on the world wide web. Collaboration on spreadsheets and presentations introduced complexities beyond the functions possible in an Internet browser. With a legacy of personal computing documents dating back to the popularization of the graphical user interface from 1990, moving forward on collaborative document editing would require ensuring compatibility or interoperability with legacy formats.

A.7.1 Context: The battle on collaborative document editing was part a larger war on the "web as platform"

By late 2004, forward-oriented technologist were considering how the Internet was evolving from "Web 1.0" to "Web 2.0". In contrast to a Web 1.0 perspective of each computer as a platform as an independent part of the Internet, the Web 2.0 perspective had the "web as platform" with the focus on interactions and relations between the computers.

> . . . at the first Web 2.0 conference, in October 2004, John Battelle and I listed a preliminary set of principles in our opening talk. The first of those principles was 'The web as platform.' Yet that was also a rallying cry of Web 1.0 darling Netscape, which went down

> in flames after a heated battle with Microsoft. What's more, two of our initial Web 1.0 exemplars, DoubleClick and Akamai, were both pioneers in treating the web as a platform. People don't often think of it as 'web services', but in fact, ad serving was the first widely deployed web service, and the first widely deployed 'mashup' (to use another term that has gained currency of late). Every banner ad is served as a seamless cooperation between two websites, delivering an integrated page to a reader on yet another computer. Akamai also treats the network as the platform, and at a deeper level of the stack, building a transparent caching and content delivery network that eases bandwidth congestion (O'Reilly, 2005b).

The way in which the computers would interact with each other was through web services, in a Service Oriented Architecture (SOA).[246] Across the great variety of operating systems and applications, information from one computer would have to be intelligible to the other.[247] The requirement of intelligibility led to the philosophy that the XML standard would be a first step where the information would be readable not only by computers, but also by human beings.[248] Organizationally, the idea of Service

[246]The appreciation of SOA was expressed in an interview with Gary Edwards, a member of the OpenDocument Technical Committee:
Mad Penguin: What does SOA mean?
Gary Edwards: It means you can finally connect legacy information systems to everything else, and do so with an efficiency and resulting flow of information that is beyond your wildest dreams. When you write new business applications, you're able to write them against this new horizontal visibility of not just your information resources and transaction process, but including valuable services from trading partners, customers, and other web based information services (like Google and eBay). SOA itself is just a collection of best "Open Internet" practices shaped into an easy to follow blueprint. It's important to understand that the methods and protocols used in creating an SOA solution for connecting disparate information systems are always Open Internet based. So they always involve Open XML technologies. And more often than not, remaining compliant with Open Standards is the best way to improve the participation ratios of an SOA and achieve the broadest horizon of information visibility (Einfeldt, 2006).

[247]The first step towards SOA was to enable information to be available in an XML format.
Mad Penguin: In other words, for the newbies out there, it's a way of getting different computer systems to talk to each other?
Gary Edwards: Yeah, but this is way beyond the promise of client/server. How do we get disparate systems to digitally connect, exchange, and interact the way we need them to? At OpenStack we have one rule of thumb, "first, get everything into XML, and then get it back again". If you can't write XML connectors or work with XML web services, you can't take that first SOA step. The next step of course is setting up a XML universal transformation layer, and an XML Hub that you can create portals, application services, and rich web applications from. The XML hub synchronizes workflows, transaction processing flows, and information flows to the disparate back end (black box) legacy systems – using the universal transformation layer as the connectivity buffer (Einfeldt, 2006).

[248]XML is a structure where data is given semantics, e.g. a number and some characters can be recognized as information as a street address.
Mad Penguin: What it is about XML that allows this to happen? Why is it so

Oriented Architecture can be seen as an enterprise perspective rather than a departmental or functional perspective. The personal computer revolution enabled productivity at an individual level, but created challenges in sharing information across a workgroup. The original way of sharing data amongst personal computers was by passing around floppy disks. As more data become stored on fixed hard drives, personal computers would be networked together in a client-server architecture. That client-server architecture would lead to departmental silos which could be internally productive, but less than effective for the larger enterprise.

> The last great architecture before the Internet came along was client-server based information systems. The tradition of information systems was that of departmentalization, and client/server architectures were the final champion of boundary based business process – transaction process systems. The model for this is simple enough. Each department in a corporation traditionally had their own information system. They would have business applications written for the business processes that they were involved in. These systems didn't talk to each other. But since they were dedicated systems, there really wasn't a need to pursue something deemed impossible. And priced accordingly. If you're the management of a corporation, there was no way of digitally getting all the information into one place. Or digitally passing information from one system to others. There was no way of running reports across the disparate systems, unless of course you standardized on a single vendor platform where at least you could use SQL (Standard Query Language) to run against your databases. Unless your bank account was bottomless, you had to wait for the quarterly reports to come out before you found out what was going on.
>
> When you hook the systems together, you also take out the barriers to the information flow. In freeing the information flow, you enable

magical?
Gary Edwards: Well, first of all, XML is readable by both humans and machines. Plus XML is extensible, so that it can be used to make adaptations to almost anything out there. Since it's readable by humans, people can come in and figure out what was done. What is this system doing that I need to understand? Then there's the real magic; the transformational qualities of XML.
Legacy systems usually provide information that's locked into an application-bound binary file format. Either the keeper of these systems provide you with a description of the inherent schema defining the structure of that information, or you work it out with the vendor. Much of the time though these information structures have been painstakingly reverse engineered so that the files can be worked with. This is why writing XML connectors is still an art. Once you transform that information into XML, it becomes a common layer within a business that any other system can grab and then transform it back to their business processing systems. You only need write your connections once. After that the information flow from that legacy system can be re-purposed endlessly. Once in the universal transformation layer, the information is 100% fluid and interoperable (Einfeldt, 2006).

> management to re-engineer the various business processes without having to rip out and replace the legacy systems. The re-engineering occurs at a higher level. Decision making and workflow routing is implemented in new applications not based on the vendor limits of the back end systems, but based entirely on the needs of a changing business. The applications and the back end databases and transaction processing centers are still doing work they way they always have. It's just that we're able to move the information into an XML file format which is useful to all the other information systems through that XML transformation process (Einfeldt, 2006).

From the perspective of an enterprise architect, documents created by an individual on a personal computer to be shared with other people should also be accessible. In the Web 1.0 view of the Internet through only a browser, the only information that would be accessible would be that either created or transformed into HTML, where semantics would be lost (e.g. a street address becomes only numbers and characters). In the Web 2.0 view of the Internet, there is no reason that a word processing document, spreadsheet or presentation should be less accessible than data stored in a relational database. A personal computing perspective on documents tends to be blind to the reality that it's part of a larger world of the information ever created in the world. This is reflected in the orientation of Microsoft, a company synonymous with personal computing, as compared with industry standards technical committees oriented towards information systems dating back to the era of mainframes.

> **Gary Edwards**: When Microsoft talks about "legacy," they're usually talking about the legacy of Microsoft Office 2000 and MS Office XP 2003. The truth is that MS Office has had a long history, but over the past 25 years, we've seen many versions of word processing and spread sheets and presentation systems other than Microsoft Office's history.
>
> When the Open Document Technical Committee talks about legacy systems, we're talking about at least 30 years of legacy information systems that cross an incredible spectrum of information and file format types. Boeing is an excellent example, and ODF TC member Doug Alberg was a most important driver in the first 18 months of ODF TC work, a period I always refer to as the "universal transformation layer" period because interoperability with legacy information systems was our primary concern. So during that period the legacy needs of large publishing and content management systems like Stellent, Documentum, and Arbortext drove the specification work. It really had very little to do with the ideals of an application independent desktop productivity file format.
>
> Enterprise publishing systems have to deal with 50 years of legacy

> data. Microsoft's consolidation is very young by comparison, having only to deal with the transition from MS Office 2000 to MS Office XP 2003 (Einfeldt, 2006).

For Internet technologists, the information contained within word processing, spreadsheet and presentation documents should be as accessible as any other forms. An OpenDocument Fellowship emerged consistent with this perspective.[249] Microsoft had not previously demonstrated such a history of cooperation.

At the introduction of Office 2003, Microsoft retained the specifications of the file formats as private sourcing. The .doc format used in Word 97 was revised into another .doc format as Word 97-2003. Similarly, the .xls format used in Excel 97 was revised into Excel 97-2003, and the .ppt format used Powerpoint 97 was revised into Powerpoint 97-2003. Since the binary data formats were tied to the newer software, recipients who had not upgraded would have to rely on the sender to "save as" the older format. For word processing, Microsoft provided RTF (Revisable Text Format) specifications, but these would also require senders to "save as" that format.[250].

On April 30, 2003, Microsoft formally filed for a patent for "Word-processing document stored in a single XML file".[251] Following a period of "fruitful discussions with the Danish government", Microsoft announced royalty-free licensing for WordProcessingML in November 2003, with the intent for SpreadsheetML for December (Cover, 2003).[252] These actions placed a legal chill not only on other potential providers of alternative document editing programs, as well as a caution by organizations concerned by being locked in to Microsoft products.

For documenting editing to advanced as an cloud computing application on the Internet, parallel development would have to be done on both the file formats and personal computing applications. Thus, advances in the Open Document Format and Open Office XML are landmarks that anchor

[249]The OpenDocument Fellowship was founded in October 2005, as a group intersecting the OpenOffice and OASIS initiatives.

[250]Microsoft Office file format as complicated, as they were originally designed to be fast on the earlier personal computers, and weren't designed for interoperability (Spolsky, 2008). Microsoft .doc files are in a binary format unreadable without the appropriate Word program, whereas RFT is plain text marked up with formatting commands. The Word RTF specification 1.7 was first published in August 2003 (Microsoft, 2003). See forum discussions at April 2004 on the "Difference between word doc files and RTF files?", and at November 2004 on "RTF versus DOC - what's the difference? (Word2003/SP1)"

[251]European Patent 1376387 A3 has a priority date of June 28, 2002, and a publication date of December 28, 2005. A request for examination was filed on May 3, 2006, and designation fees paid on September 6, 2006. By May 4, 2011, the patent application was deemed to have been withdrawn.

[252]An XML Reference Schema for Powerpoint was not offered by Microsoft at the end of 2003, or into 2004.

the development of applications on all platforms. The rise of tablets (e.g. iPad in 2010, Android tablets in 2011) and low power subnotebooks (e.g. Chromebooks in 2011, Ultrabooks in 2012) would later benefit by the establishment of industry standards. Since IBM doesn't participate directly in consumer markets, tablets or subnotebooks, those offerings are beyond the scope of this research study.

A.7.2 (a) Open sourcing: OpenDocument 1.0 approved as an OASIS Standard on Mar. 1, 2005

The standardization work in XML and OpenDocument format dates back to the acquisition of Star Division by Sun Microsystems. In 1999, to encourage sales of the Sun Ray (codenamed Corona) thin client that would be announced that September, the source code of StarOffice became available under Sun Community Source License (Shankl, 1999). The 200 Star Division developers were offered transfers to join Sun, working not only on "classic" Linux and Windows desktop versions of Star Office, but also the server-centric StarPortal version which would provision the Sun Ray thin clients. The intent to migrate to XML file formats and contribute to the Ecma standards group was surfaced at the time of acquisition. StarOffice 5.2 was released by Sun in June 2000 (Dobbins, 2000).

In October 2000, the OpenOffice.org site was established by Sun, with an XML community project set up to define the specification of an XML file format through an open community effort (OASIS, 2008). The StarOffice source code became available under dual licensing, of the GNU General Public License (GPL) and the Sun Industry Standard Source License (SISSL) (Cover, 2000). Drafts of the StarOffice XML File Format Technical Reference Manual were available to used in building OpenOffice 1.0 and StarOffice v6.0.[253]

On April 30, 2002, OpenOffice 1.0 for Linux, Solaris and Windows 95 became available as a free download from the OpenOffice.org community web site in 25 national languages (B. Smith and Geisler, 2002). On May 15, 2002, Sun announced StarOffice 6.0 for Linux, Solaris and Windows 95 at a price where enterprises could expect to save 75% in license fees, as well as continued support of the freely downloadable OpenOffice version (Sun Microsystems, 2002c).[254] StarOffice 6.0, as commercial product in

[253]The StarOffice XML File Format working draft 7 was available by October 2000, and draft 9 by December 2000 (Cover, 2008). The default file extensions for XML-based documents were .sxw (for the Writer word processor), .sxc (for the Calc spreadsheet), .sxd (for the Draw illustrator), .sxi for the Impress presentation), .sxm (for the Math formatter), and .sxg (for the Writer global document) (OpenOffice.org, 2000).

[254]While enterprise licensing were far below retail prices, the difference in pricing was substantial:
StarOffice 6.0 retails for $76 per copy, and each copy can be used on up to five PCs. Microsoft Office XP Standard, which has application features comparable to

comparison to the free OpenOffice 1.0, included licensed third party technologies as well as installation, documentation and 24x7 web support.[255]

Import and export from Microsoft Office files were available in OpenOffice 1.0, although all macros might not be translated correctly (Computer Weekly, 2002). The StarOffice 6.0 documentation cited compatibility with StarOffice 5.2, with a feature to set a default file format for text, spreadsheet, presentation and drawing documents and formulas (Sun Microsystems, 2002a). A new document converter would process files in batches from the binary StarOffice and Microsoft Office to the new StarOffice XML format, and produce a log file that could be inspected. Details on Microsoft Office interoperability included enhancements to import and export filters, including OLE objects, frames and charts in Office 97/2000. Casual users of Microsoft Office 97/2000 preferring to not pay licensing feeds could switch to OpenOffice 1.0, relying on support in online forums, and manually upgrading to minor releases.[256] Power users of Microsoft Office 97/2000 writing macros and editing OLE objects between spreadsheets and word processing preferring vendor 24/7 support by Sun Microsystems might see value in paying for StarOffice 6.0.

In July 2002, the OpenOffice.org XML File Format Technical Reference Manual 1.0 was published (Cover, 2008).[257] This became a donation by Sun to OASIS at the formation of the Open Office XML Format Technical Committee in November 2002.

StarOffice, retails for $479, and each copy can be used on only one PC.
Microsoft's volume licensing program can cut the cost of the XP Standard version to $297 to $377 per copy, according to Stamford, Conn.-based research firm Gartner Inc. StarOffice 6.0 prices drop to $50 per copy for 150 or more copies and to $25 each for more than 10,000 copies (Weiss, 2002).

[255]Sun said that it decided to charge for StarOffice 6.0 "to provide increased services and support that will expand the reach of its office productivity suite" and assure "Sun's commitment to the on-going development of StarOffice software":
Q. What are the differences between StarOffice 6.0 software and the OpenOffice.org 1.0?
A. StarOffice 6.0 software is a commercial product aimed at organizations and consumers while OpenOffice.org 1.0 is aimed at users of free software, independent developers and the open source community. StarOffice includes licensed-in, third-party technology such as:
Spellchecker and thesaurus; Database component (Software AG Adabas D); Select fonts including Windows metrically equivalent fonts and Asian language fonts; Select filters, including WordPerfect filters and Asian word processor filters; Integration of additional templates and extensive clipart gallery.
In addition to product differences, StarOffice offers:
Updates/upgrades on CD; Sun installation and user documentation; 24x7 Web based support for enterprises and consumers; Help desk support; Warranties and indemnification guarantee Training; Professional services for migration and deployment (Sun Microsystems, 2002b).

[256]OpenOffice 1.0.1 was released July 17, 2002; 1.02 on January 20, 2003; and 1.03 on April 10, 2003 (OpenOffice.org, 2003b).

[257]The official Version 1 of the OpenOffice.org XML File Format Technical Reference Manual was published in July 2002. The Version 2 published in December 2002 includes some corrections, removal of deprecated and unused element descriptions and a chapter about dialogs was added.

> Sun is also going to donate the XML file format specification utilized in the OpenOffice.org 1.0 project to the new OASIS technical committee as an input. 'The way these standards committees work is they take an initial input, which is then evolved. This file format is a suitable starting point as its pure XML and fully specified by an open-source group,' [Simon] Phipps [chief technology evangelist at Sun] said (Galli, 2002).

The invitation to join the OASIS Open Office XML Format Technical Committee (which evolved to become known as the OpenDocument TC) was sent out to mailing lists on November 4, 2002, with requirements for individuals to file an intent to participate by December 1, and attend the first meeting on December 16 (Best, 2002). Sun, Corel, Arbortext and Boeing were amongst the first to join. Microsoft, although already a corporate member of OASIS, declined to send an individual as a representative.[258] Following the OASIS TC process, the charter with statement of purpose, list of deliverables, and schedule proposed at November 4, 2002 was revised on December 16, 2002, April 8, 2004, November 8, 2004 and January 19, 2005. The revisions reflected a first phase to be delivered on March 20, 2004, and then an extension into the second phase to reflect development work that may have happened in parallel to the committee producing their deliverables (OpenDocument TC, 2005).

Closing Phase 1, the Open Office Specification 1.0 Draft 12 was unanimously approved on March 20, 2004 (OpenDocument TC, 2004). In December 2004, the second committee draft was approved, leading to a renaming from the "OASIS Open Office Specification" to "OASIS Open Document Format for Office Applications (OpenDocument)", and renaming of the committee in January 2005. In February 2005, the third file format specification draft included public reviews was approved as a committee draft. This would lead to the OpenDocument Format (ODF) being

[258] One of the goals of the group was "to free corporate data from proprietary file formats so they can be accessed for years to come, no matter what office software a company is using": [....]
Corel, which makes the word processing software Word Perfect, is also an initial member of the technical committee, and said it could benefit from such a standard. Other members include content management software maker Arbortext and Boeing. Boeing has a stake in office document standards as it is bound by government regulations to create and archive an immense amount of data, such as manuals." [....]
Microsoft, which dominates the office software market with its Office suite, is a member of OASIS. Microsoft is aware of the technical committee but will not initially take part, a spokesman from a Microsoft outside public relations firm said in an e-mail message Wednesday. The company has announced recently that the next version of its Office suite, Office 11, will be heavily reliant on XML.
Microsoft already supports an XML-based technology being developed by the World Wide Web Consortium, called XSD, the spokesman wrote. 'What this means is that anything the OASIS group comes up with that's based on XSD 1.0 will already work with Office 11,' he wrote in the e-mail message (M. Berger, 2002).

approved as an OASIS standard in March 2005 (OASIS, 2008).

In September 2003, Sun released StarOffice 7 (Sun Microsystems, 2003), based on the evolving OpenOffice code base and OpenOffice XML. The timing was positioned against the release of Microsoft Office 2003, which was in last stages of beta testing.[259] Unlike the preceding Microsoft Office XP version, the 2003 release would not run on Windows 98 or Windows NT 4.0 operating systems, driving a need to potentially upgrade the hardware platform as well as the software. StarOffice 7.0 was positioned as a direct alternative to Microsoft Office, at one-tenth of the purchase price, and one-quarter the cost of ownership.[260] For enterprise customer that were interested in the Sun Java Desktop system that ran on the Sun Ray Ultra-Thin Client, the company offered a 50% discount on existing Windows or Linux Desktops. For everyone, StarOffice 7.0 was available on a free 90-day trial.

On November 1, 2003, OpenOffice 1.1 was released (OpenOffice.org, 2003a), with extended the features supporting the OpenOffice XML format. In addition to the original Linux and Solaris platforms supported, Windows 98 and Mac OS X were added, with ports for many other Unix variants in progress. Filters for Microsoft Office 2003 XML Wrapped documents were included. Over 60 language localization projects were cited.

In simultaneity with the work underway in the Open Office XML TC, a second OASIS technical committee, composed by the user community in governments, had formed. This one included Microsoft as well as Sun. The e-Government Technical Committee would have recommendations

[259] Microsoft Office 11 beta 1 was released on October 22, 2002 (Microsoft, 2002). Early reviews confirmed that Windows XP (which was first released in 2001) or Windows 2000 would be a prerequisite. "Is there any benefit to using XML over Office's native data formats? For an individual, no, there's no real benefit, and if anything, the resulting files will often be much bigger than their native Office document equivalents. But like many of the features in Office 11, support for XML was added for the benefit of big companies, which will likely be using XML-based services and back-end data stores that work with XML. In such cases, using XML on the desktop will make it easier to move data between a company's many systems" (Thurrott, 2002). Office 2003 beta 2 would ship in May 2003 to over 500,000 testers (Thurrott, 2003). The official launch of the product was on October 21, 2003 (Ballmer, 2003).

[260] StarOffice 7 promised a perpetual license, compared to a Microsoft upgrade every 2 to 3 years:
"Sun's licensing arrangement is user-based, not machine-based, meaning that each user can install StarOffice 7 on up to five machines without additional fees. And Sun's license is perpetual - you don't need to renew every two or three years like Microsoft. [....]
Your IT people may counter, well, we'll need to retrain our users, and we'll need to do document conversion and migration - all of which costs time and money. But usability studies have shown that users familiar with MS Office experience less than a second's delay when using similar features in StarOffice. And the Danish government recently published an open source study that compared StarOffice and OpenOffice to Microsoft XP and Office 2000. The conclusion - StarOffice was three to four times less expensive per desktop than MS Office". (Sun Microsystems, 2003)

that would drive the OpenDocument TC.

In December 2002, the OASIS interoperability consortium announced an e-Government Technical Committee to identify and organize plans for the development of new standards. The group would "coordinate input from governments on emerging technologies, such as ebXML and Web services, to ensure that existing specifications are not developed solely for the benefit of the private sector" with special emphasis on "EU countries working to deliver aspects of the eEurope 2005 plan". Members included " representatives from the Danish Ministry of Science, Technology and Innovation, Ontario Government Canada, United Kingdom Ministry of Defense, United Kingdom Office of e-Envoy, United States General Services Administration, and United States Department of Navy, as well as developers from Baltimore Technologies, BEA Systems, Booz, Allen & Hamilton, Commerce One, Drake Certivo, Entrust, Fujitsu, Logistics Management Institute, Microsoft, Novell, Republica, SAP, Sun Microsystems, TSO, webMethods, and others" (Geyer, 2002). The first meeting would be held at the XML 2002 conference in Baltimore on December 13, 2002.

In May 2004, the IDA (Interchange of Data between Administrations) II program of the European Commission tabled recommendations. While acknowledging the interoperability of OpenOffice.Org and WordML formats, the IDA program endorsed the OpenOffice format submission to OASIS, while cautioning against applications that did not respect equal opportunities to markets.

> Because of its specific role in society, the public sector must avoid that a specific product is forced on anyone interacting with it electronically. Conversely, any document format that does not discriminate against market actors and that can be implemented across platforms should be encouraged.
>
> Likewise, the public sector should avoid any format that does not safeguard equal opportunities to market actors to implement format-processing applications, especially where this might impose product selection on the side of citizens or businesses. In this respect standardisation initiatives will ensure not only a fair and competitive market but will also help safeguard the interoperability of implementing solutions whilst preserving competition and innovation. Therefore, the submission of the OpenOffice.Org format to the Organization for the Advancement of Structured Information Standards (OASIS) in order to adopt it as the OASIS Open Office Standard should be welcomed (Telematics between Administrations Committee, 2004).

The European Commission contracted Valoris to prepare an assessment of Open Documents Formats (Valoris, 2003). The TAC then made nine specific recommendations, that:

1. The OASIS Technical Committee considers whether there is a need

and opportunity for extending the emerging OASIS Open Document Format to allow for custom-defined schemas;

Custom-designed schemas specific to industries including ACORD (insurance), XBRL (finance), HL7 (healthcare) and SF424 (eGovernment). Microsoft's direction was to embed them within documents, whereas an enterprise Service Oriented Architecture would look to access them from other databases or sources.

2. Industry actors not currently involved with the OASIS Open Document Format consider participating in the standardisation process in order to encourage a wider industry consensus around the format;

Up to May 2004, the Open Document Format had been driven primarily by Sun. IBM had been active in OASIS since the formalization of the organization in July 1999, following its inception as SGML Open in 1993, but had not formally sent representatives to either the Open Office XML TC or the eGovernment TC.[261] In response to the recommendations, IBM responded that the company "welcomed" it, and reiterated its "commitment to working with governments to promote open computing based on open standards".[262]

3. Submission of the emerging OASIS Open Document Format to an official standardisation organisation such as ISO is considered;

After the OpenDocument v1.0 Specification was approved as an OASIS standard, in March 2005, it would be eligible for fast-track approval as an ISO standard.

4. Microsoft considers issuing a public commitment to publish and provide non-discriminatory access to future versions of its WordML specifications;
5. Microsoft should consider the merits of submitting XML formats to

[261] In July 1999, OASIS "announced the election of a new board of directors led by Simon Nicholson (Chrystal Software) as chairperson and Bill Smith (Sun Microsystems) as president. Jonathan Parsons (Xyvision Enterprise Solutions) serves as vice president/secretary/treasurer and Bob Sutor (IBM) as chief strategy officer. Norbert Mikula (DataChannel) serves as chief technical officer and leads the technical track. Mary McRae (DMSi) serves as chief marketing officer and leads the marketing track. Alan Hester (Xerox) serves as director and liaison to the CGM-Open affiliate consortium" (Walker, 1999).

[262] While IBM had not directly participated in the Technical Committee, it was already following the file formats:

"It is essential that public sector documents be available in a commonly used open file format so as to avoid use of closed, proprietary formats which result in "vendor lock-in" and the imposition of a single technology choice on citizens, enterprises and other organisations seeking to exchange documents with public administrations".

The ongoing work on open file formats in OASIS is an excellent step forward in efforts to develop a file format which meets the requirements outlined above. IBM follows closely the activities of the Open Office XML Format Technical Committee in OASIS and has informed OASIS that we intend to join the relevant technical committee. Indeed, we already offer products (IBM Workplace Client Technology) which conform with the current draft specifications developed within the OASIS TC" (Norsworthy, 2004).

an international standards body of their choice;

6. Microsoft assesses the possibility of excluding non-XML formatted components from WordML documents;

In response to these three points, Microsoft said that it agreed with the recommendations, and expanded on their perspective (Sinofsky, 2004). The WordProcessingML specifications were posted on the Microsoft web site. On submitting to an international standards body, they made a distinction between open licensing and formal standards.[263] On excluding non-XML formatted components, Microsoft said that they would "vigourously pursue the work of documenting those elements", but then detailed in writing the fundamental disagreements with the direction that the TAC had recommended.[264]

7. Industry is encouraged to provide filters that allow documents based on the WordML specifications and the emerging OASIS Open Document Format to be read and written to other applications whilst maintaining a maximum degree of faithfulness to content, structure and presentation. These filters should be made available for all products;
8. Industry is encouraged to provide the appropriate tools and services to allow the public sector to consider feasibility and costs of a transformation of its documents to XML-based formats;
9. The public sector is encouraged to provide its information through several formats. Where by choice or circumstance only a single revisable document format can be used this should be for a format around which there is industry consensus, as demonstrated by the format's adoption as a standard.

These last three recommendations set the expectation for software providers and public sector customers that multiple standards (i.e. WordML and

[263] Since Microsoft had been part of the OASIS e-Government Technical Group since 2002, the recommendation towards "an international standards body of their choice" a challenge in seeking standardization with OASIS. Microsoft responded: "... we believe that open and royalty-free licensing programs have a role to play alongside formal standards efforts in helping achieve our mutual goals relating to interoperability. [....] To the extent that XML Schemas evolve, we believe that it is important to continue backward compatibility with past versions of Office. Our licensing program enables us to meet these expectations" (Sinofsky, 2004).

[264] Microsoft's perspective appears to be document-centric, as compared to a service-oriented architecture approach.
"... I wish to reiterate a point that we made in connection with our original dialogue with the TAC some months ago. Microsoft does not believe that it would be reasonable to entirely exclude all non-XML formatted components from XML formatted documents. We would observe, in particular, that government and their citizens may need to incorporate media images, video and audio clips, "heavy" objects such as ActiveX controls and Java programs, and other compiled code in XML formatted documents. We also believe the proposed OASIS document format would allow for the incorporation of such elements as well. While the XML specification does not advocate the inclusion of such elements, it is so flexible that it allows authors of XML documents to include these sorts of elements" (Sinofsky, 2004).

OASIS Open Document Format) could both continue to evolve, and filters should be provided to translate from one to the other.

While the two Technical Committees at OASIS were continuing to meet, OpenOffice and StarOffice evolved.

Development of OpenOffice based on Open Office XML would continue incrementally from version 1.1. released on September 2, 2003, through to OpenOffice 1.1.4, released on December 22, 2004, as shown in Figure A.1(Gerard, 2013).

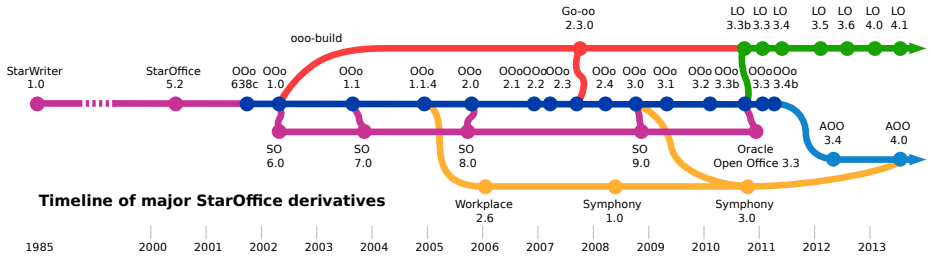

Figure A.1. StarOffice major derivatives (Gerard 2013)

On May 1, 2005, with participation on the technical committee by Adobe, IBM and Sun, the Open Document Format for Office Applications (OpenDocument) v1.0 Specification was approved as an OASIS Standard (Brauer and Oppermann, 2005).[265] Since OASIS is recognized as a standards by ISO, the OpenDocument 1.0 specification was eligible for fast track approval.[266] ISO/IEC 26300 started review on October 1, 2005, and was approved unanimously by the ISO/IEC JTC 1 on March 1, 2006 (Secretariat, 2006).[267]

[265] On March 27, 2005, Nathaniel Borenstein sent a formal statement to the OASIS Office mailing list: "IBM Corporation certifies that it is successfully using the Open Document Format for Office Applications (OpenDocument) 1.0 specification consistently with the OASIS IPR Policy".

[266] In the 6-stage process, specifications already approved by another standards body may enter at stage 4:
International Standards are developed by ISO technical committees (TC) and subcommittees (SC) by a six-step process: Stage 1: Proposal stage ; Stage 2: Preparatory stage ; Stage 3: Committee stage ; Stage 4: Enquiry stage ; Stage 5: Approval stage ; Stage 6: Publication stage . [. . .]
If a document with a certain degree of maturity is available at the start of a standardization project, for example a standard developed by another organization, it is possible to omit certain stages. In the so-called 'Fast-track procedure', a document is submitted directly for approval as a draft International Standard (DIS) to the ISO member bodies (stage 4) or, if the document has been developed by an international standardizing body recognized by the ISO Council, as a final draft International Standard (FDIS, stage 5), without passing through the previous stages (ISO, 2007a).

[267] Of the 32 member bodies voting, none cast negative votes (meeting a requirement of <= 25%), and 23 cast votes in favour out of 23 (meeting a requirement >= 66.66%). Eight of the votes were approvals with comments, suggesting small revisions in the text (Secretariat, 2006).

In August 2003, the "StarOffice / OpenOffice.org Q Product Concept" became public, with a targeted 18-month cycles for releases (Hoeger, 2003). This would lead to the announcement of the OpenOffice 2.0 public beta on March 4, 2005, implementing the OASIS OpenDocument XML file format (OpenOffice.org, 2005b).

For commercial software developers, OpenOffice 1.1.4 would be the last release available under a permissive license. While the version OpenOffice version 1 code was licensed under a dual GPL and SISSL (Sun license), Sun announced a "license simplification" initiative on September 2, 2005.

> **Why has Sun decided to make the change?**
> Sun wants to help with the reduction of open source licenses in use as suggested by the Open Source Initiative (OSI) License Proliferation Committee.
>
> **What does this mean for OpenOffice.org?**
> All OpenOffice.org source code and binaries (executable files) up to and including OpenOffice.org 2 Beta 2 are licensed under both the LGPL and SISSL. Effective 2 September 2005, all code in the 2.0 codeline will be licensed exclusively under the LGPL. All future versions of OpenOffice.org, beyond OpenOffice.org 2 Beta 2, will thus be released under the LGPL only. The change in licensing implicitly affects all languages and platforms in which OpenOffice.org is distributed (OpenOffice.org, 2005a).

Since the GPL is a restrictive license, any commercial development based on OpenOffice code after version 1.1.4 would have to be done openly with the community. IBM was active with communities working with the permissive Apache license (and the prior Apache-like Eclipse license).[268]

Thus, OpenOffice 1.1.4 would be a foundation for IBM Workplace products in 2006, and the IBM Lotus Symphony products in 2007.[269]

[268] IBM senior vice-president for software Steve Mills was interviewed about license proliferation:
What about the call for the GPL?
I guess this was HP's thing [on Tuesday]: Everybody should adopt GPL. Well that's never going to happen. There are multiple viable popular sets of terms out there. ... You can net this down to two major camps. One is a GPL license, which is very prescriptive in terms of what it means to package things with GPL and the obligation to deliver open-source for anything that is literally packaged with a GPL-licensed product. We use the Apache license as an example, [and] there are many derivatives of that license. That's actually the more common licensing type for open-source in the industry. Our license looks very similar, as do other licenses. That license does not carry the same restriction on delivering everything. So if you have code that incorporates that license into a product, you're not obligated to deliver everything else in the product as open-source.
Didn't the IBM-created Eclipse project have its own licensing model?
It's an Apache-like model. It's not a GPL-like model (Sliwa, 2005).

[269] An analyst incorrectly concludes that there might have been "a private agreement" with Sun where IBM "had no obligation to release back to the community" under the SISSL in 2005, but then in 2008 used "OpenOffice version 3.x code

OpenOffice 1.1.5 was released on September 14, 2005, with security patches, and import (but not export) of OpenDocument files (OpenOffice.org, 2005d).

OpenOffice 2.0, which had OpenDocument version 1 as the default file format, was released on October 10, 2005. This would be the foundation for StarOffice 8, which was announced on October 8, 2005, as the "first commercial office suite using the Open Document Format for Office Applications, the OASIS open standard that makes sharing files easier"(Sun Microsystems, 2005a).

For this research study, the OASIS standardization of OpenDocument 1.0, and subsequent approval as ISO/IEC 26300 is classified as open sourcing. The international standards bodies are transparent and diligent in their processes. The OASIS Open Office XML Format Technical Committee formed in 2002 was driven primarily by Sun, with IBM focused on other OASIS activities. At the request of the eGovernment TC in May 2004, IBM became involved with the OpenDocument TC, following through to the approval in May 2005.

A.7.3 (b) Private sourcing: IBM Managed Workplace Client Documents (fork of OpenOffice 2)

The IBM Lotus Workplace was an intranet-oriented collaboration product line first introduced in 2003 (McCarrick, 2003). The Lotus Notes product, first released in 1989, was originally designed in a client-server architecture, i.e. a client interface program installed on a personal computer would connect to application server shared by a floor or building of workers. With the rise of web browsers – e.g. Internet Explorer 6 came out in August 2001, and Firefox 1.0 was released November 2004 – the desirability and need for platform-specific client applications came into question. Lotus Workplace was described as the "next generation of Lotus products", initially including e-mail, directories and instant messaging; team collaboration with discussion forums, document sharing and web conferences for line presentations, and web content management.

When Lotus Workspace v2.0 was announced in March 2004, the product was extended to include a rich client: a Java-based program built on the Eclipse technology, that would download from an intranet server through the browser (Woods, 2004). The rich client would provide functionality beyond the capabilities available with browser technology in 2004, and portable Java runtimes would preclude the need for client versions specific to each operating system (i.e. Windows, Mac and Linux desktops could all

in future releases of Lotus Symphony; this suggested that the code had been relicensed to IBM under a private agreement with Sun" (Hillesley, 2011). While OpenOffice 2 was covered by LGPL v2.1, OpenOffice 3 was released under the more permissive LGPL v3.0 that allowed Apache 2.0 licensed code to be included (OpenOffice.org, 2011b).

be supported equally).[270]

On January 17, 2006, Workplace Managed Client v2.6 was announced (IBM, 2006g). This version featured OpenDocument 1.0, so that word processing documents, spreadsheets and presentations could be edited on any intranet-attached workstation without having the application program permanently installed (Boernig et al., 2006).[271] This product was targeted at workstation security conditions where documents could be edited and mailed with an audit trail, but not copied onto a floppy disk or a USB flash drive. This managed client with a rich Java-based application would be a practical solution until browsers fully supported HTML5, a standard that wouldn't become officially approved until 2014.[272]

The major of office environments do not have such stringent security needs, however. Diskless workstations are rarer than personal computers. Few enterprises with a large installed base of Lotus Notes clients would be motivated to move to a IBM Lotus Workplace product that provided a lower level of function.

The plan for using OpenOffice 1.0 as a foundation for Lotus Workplace Client predates its release nearly two years later. Workplace Client was "based on OpenOffice and [IBM] disclosed that back when Workplace was announced in May 2004" (Berlind, 2005a). IBM initially pursued an Eclipse-based office productivity suite for editing documents over the Internet, while OpenOffice was primarily targeted at editing on personal computers. Efforts to merge the forked code base from IBM into the OpenOffice mainstream would probably not be of great interest to the OpenOffice community. "IBM forked from the original OO.o base (and changed the code) so contributing back isn't really viable. We have a different strategy than OO.o, and we believe these editors have more value as components in a server managed client framework, rather than a desktop suite" (Berlind, 2005b).

At Lotusphere in January 2007, the Lotus Workplace line was announced for discontinuation. The innovations of office productivity applications delivered on browsers and download rich clients would be incorporated into the core Lotus products, and the developers redeployed. At the same time, a new Lotus Quickr product for team collaboration was announced

[270]The release notes for IBM Lotus Workplace 2.0.1 include information regarding non-IBM software. "The Program includes portions of code from the OpenOffice.org project. The source code version of the original OpenOffice.org code is available under the terms of this Sun Industry Standards Source License version (SISSL) at http://www.openoffice.org."

[271]The target specification was ODF Version 1.0 (Weiss 2005). Version 1.0 was endorsed by OASIS in 2005, and the release of the product would be in advance of ISO/IEC approval in 2006.

[272]The w3 recommendation to endorse HTML5 was received on October 28, 2014. Prior to finally establishing HTML5 as a standard, browsers will have varying levels of support for all features. As an example, see Shivaji Babar, "Top 6 HTML5 challenges", February 13, 2014.

(DeJean, 2007). The official withdrawal from marketing was set for the end of 2007 (IBM, 2007p).

For this research study, IBM Workplace Managed Client Documents is classified as private sourcing. This was part of an IBM program product produced for commercial sale, with IBM support channels. The package included code from the Open Office project, but unembedding that work from the larger whole would have been difficult.

A.7.4 (c) Open sourcing: Office Open XML approved as ECMA-376 on Dec. 7 2006

The activities leading up to the approval of the OpenDocument format as an OASIS standard in 2005 led to a flurry of activity by Microsoft, as a competitive threat.

For this research study, Microsoft's activities in getting approval on Office Open XML (OOXML) through standard bodies and implementing the specification in program products has too many details be chronologically reviewed concisely. The focus here will be on IBM's actions, based on government activities in international standard bodies.

From the perspective of the European Commission in 2014, there have been three versions of implementations of the OOXML standard (ISO/IEC 29500) by Microsoft:

> ... ('ECMA', 'Transitional' and 'Strict') that are not compatible with each other. Although the 'ECMA' and 'Transitional' versions are outdated – 'Transitional' had only been accepted as a temporary solution to give the software vendor time to implement 'Strict' in its products – they both continue to be used in practice. This is because older versions of the vendor's office suite (MS Office) cannot read or write OOXML Strict and are unlikely ever to gain such abilities (Fellner, 2014).

If a specification were truly an open standard, implementations by a variety of software developers should have emerged over time. The OpenDocument format had software developers evolving their code as specifications were negotiated within the community, so that standards were met within months or a year. While the ECMA-376 Edition 1 specification approved in December 2006 would be fully enabled in the Office 2007 for Windows (released in November 2006) and Office 2008 for Mac (released in January 2008), the Office 2010 could not create documents following the ECMA-376 Edition 2 specification.

> ... there are two editions of the ECMA-376 standard. There is also an edition of the Open XML standard published by the ISO.
>
> The ISO/IEC 29500 version of the Open XML standard specifies two varieties of Open XML files: Strict and Transitional. Transi-

> tional ISO/IEC 29500 is almost identical to first edition of ECMA-376. Edition 2 of the ECMA-376 standard is identical to the Strict version of ISO 29500.
>
> The 2007 Microsoft Office system reads and writes files that comply with the ECMA-376 Edition 1 standard. Office 2010 reads files conformant to ECMA-376 Edition 1, reads and writes files conformant to ISO/IEC 29500 Transitional, and reads files conformant to ISO/IEC 29500 Strict (Microsoft, 2011b).

Microsoft's challenge of meeting the strict specification on which it was the primary driver surfaces in detailing "the differentiation between normative and informative text".

If meeting the ISO/IEC 29500 Strict standard was so difficult for Microsoft, how would any organization with fewer resources be able to rise to that? The implementation of the Office products was not independent of the Windows operating system.

With OOXML as a heterogeneous and ambiguous standard, and with Microsoft holding the threads and not updating old software versions, every software developer has to deal with a growing set of separate implementations, software versions and different OOXML 'flavours'. This creates a complexity of problems, with each combination behaving slightly differently on operating systems ranging from Windows XP to Windows 8, with their various sub-versions, patch levels and service packs. Free software developers trying to fix office interoperability issues must not only grapple with the OOXML variations but also test their fixes over a wide variety of operating systems, Office versions, documents and implementations. This would not be necessary with a single, unambiguous and open ISO standard (Fellner, 2014).

In 2013, Microsoft would finally support the Open XML format that they had specified seven years early, as well as the ODF and PDF formats standardized by international bodies, shown in Table A.3 (Vaughan-Nichols, 2012).

> The battle was largely over Microsoft's desire to control "open" document standards. In the end, both ODF and Open XML were recognized as standards. Today, ODF is the default format in the main open-source office suites: LibreOffice and OpenOffice. Ironically, it's taken Microsoft more than six years to fully support its own 4,000 plus pages of the Open XML standard , never mind PDF and ODF.
>
> As [Andrew] Updegrove wrote, "Famously, however, after expending such great effort to secure adoption of Open XML as a global standard, Microsoft itself did not fully implement that standard in its next release of Office, in 2007. Or its next. Or its next, although the ability to open and edit (but not save) documents in the ISO/IEC approved version of Open XML (which Microsoft called 'Strict Open XML') was added to Office 10. Instead, it implemented what it called

Table A.3. Document file formats and Microsoft Office version capabilities

	Office 2003	Office 2007	Office 2010	Office 2013
Binary format (.doc, .xls, .ppt)	Open, Edit, Save	Open, Edit, Save	Open, Edit, Save	Open, Edit, Save
Transitional Open XML	Open, Edit, Save	Open, Edit, Save	Open, Edit, Save	Open, Edit, Save
Strict Open XML			Open, Edit	Open, Edit, Save
ODF 1.1		Open, Edit, Save	Open, Edit, Save	Open, Edit
ODF 1.2				Open, Edit, Save
PDF		Save	Save	Open, "Edit", Save

> 'Transitional Open XML,' which it said was more useful for working with legacy documents created using Office."
>
> Of course, "This was something of an embarrassment, because one reason that Microsoft had given for the necessity of ISO/IEC approving a second document standard was to facilitate working with the "billions and billions of documents" that had already been created in Office. Implementers of Open XML as actually approved by ISO/IEC therefore would not be able to achieve this goal" (Vaughan-Nichols, 2012).

In July 2014, the UK government rejected Microsoft's lobbying towards not adopting a single standard, promoting OOXML in addition to ODF (Glick, 2014). In selecting PDF/A or HTML for viewing government documents, and ODF for sharing or collaborating on government documents, the UK Cabinet Office set a pace that not only Microsoft, but also Google Docs, will have to heed (Vaughan-Nichols, 2014). The action to move to a single standard by the UK government came almost a decade after the landmark of a failure in the Commonwealth of Massachusetts to do so.

January 2005 was the landmark beginning of the battle for standardization of OOXML. At that point, the Commonwealth of Massachusetts extended their 2004 work on Open Standards policy to *Open Formats* as "specifications for systems developed by an open community and affirmed by a standards body", with XML as an example (Kriss, 2005).

In March, the review draft Version 3.0 of the Enterprise Technical Reference Model (ETRM) was released by the Information Technology Division (ITD), seeking comments by April 1 (Commonwealth of Massachusetts, 2005b)(Commonwealth of Massachusetts 2005b). In the open formats required, XML was named, with relevant standards bodies recognized

as the IETF, ISO, OASIS and W3C (Commonwealth of Massachusetts, 2005a). The open formats recognized RTF 1.7, plain text, HTML 4.0.1, and PDF 1.5, with OpenDocument v1.0 under review at OASIS. With a migration strategy that "Agencies should evaluate office applications that support the OpenDocument specification to migrate from applications that use proprietary document formats", the Microsoft 2003 XML Reference Schemas were named as a (non-open) specification.[273]

On June 1, 2005, the Microsoft announced Office Open XML Formats that would be available in products going forward, as beyond the possibilities for Office 2003.[274] The documentation was made available royalty-free to third-party developers, so that data created using Microsoft applications could more easily accessed.[275] This immediately led to challenges about what an "open" standard meant for Microsoft, as compared to other work ongoing in the industry.

For Sun, continuing collaboration and cross-organization committee work was associate with a perspective that "An open standard is one which, when

[273]Prior to publishing the ETRM v3.0, the ITD had directly engaged with vendors:
In summer 2004, the ITD began negotiations with Microsoft with the goal of making Office XML more open. The advantage of Office XML was that it worked well with all Microsoft applications. However, the license had legal restrictions that ODF did not have. Furthermore, the code of Office XML had some proprietary codes. Despite these concerns, the ITD included Office XML under the list of Open Data Formats in ETRM version 3.0 (Dedeke, 2012, p. 13).

[274]While Office 2003 had XML schemas, the Microsoft press release in June 2005 is the first mention of "open" in formats:
PressPass: So what's new about the Microsoft Office XML Open Formats?
Sinofsky: The Microsoft Office XML Open Formats introduce significantly enhanced XML formats for Microsoft Word and Excel, and the first XML format for Microsoft PowerPoint. The formats use consistent, application-specific XML markup and are completely based on XML and use industry-standard ZIP-compression technology.
The new formats improve file and data management, data recovery, and interoperability with line-of-business systems beyond what's possible with Office 2003 binary files. And any program that supports XML – it doesn't have to be part of Office or even from Microsoft – can access and work with data in the new file format. Because the information is stored in XML, customers can use standard transformations to extract or repurpose the file data.
PressPass: Why is Microsoft doing this?
Sinofsky: The short answer is because these capabilities – improved file and data management, improved interoperability, and a published file-format specification – are exactly what customers have asked us for (Sinofsky, 2005).

[275]Since royalty-free licenses were granted by Microsoft, third party developers would have to trust the company not to revoke them:
Microsoft Office Open XML Formats are fully documented file formats with a royalty-free license. Anyone can integrate them directly into their servers, applications and business processes, without financial consideration to Microsoft. The open, royalty-free license will help ensure that third-party developers can easily integrate the file formats with their tools, enabling them to build solutions that provide universal access to Microsoft Office-based data without needing Microsoft Office applications and authoring tools (Microsoft, 2005).

it changes, no-one is surprised by the changes".[276]

For IBM, the OASIS OpenDocument format saw multiple organizations in 2005 already showing early implementations, whereas OOXML was not really "open", so that anyone outside of Microsoft would be disadvantaged in complying to the specification.

These are some of the characteristics of a real open document format in 2005:

- it is supported by multiple applications with demonstrated interoperability
- it is preferably produced but at least maintained by a standards group with representation from many companies, organizations, and individuals,
- is therefore not under the control of a single vendor who can change the format and the licensing at its whim, and
- is available on a royalty-free basis and has no restrictions that might limit its use for any reason in any software, be it customer-unique code, a vendor product or open source (Sutor, 2005b).

Microsoft acknowledged sublicensing, in requiring that users of the Office Open XML reference schemas to provide attribution according the OOXML royalty-free agreement. The idea that someone might create and edit documents in an OOXML format without a Microsoft product would be someone else's problem.[277]

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[276] While Office Open XML was documented and royalty-free, Microsoft's prior behaviour had been to make changes autonomously:
An open standard is one which, when it changes, no-one is surprised by the changes. Admittedly I'm not surprised when Microsoft repeatedly and apparently arbitrarily changes its interfaces and formats and jerks developers around but I meant 'not surprised' in the sense that the change process was open to involvement and contribution by all, not in that way. The OASIS process by which OpenDocument was defined is such a process and indeed Microsoft, being an OASIS member, did visit and could have easily steered the format to suit their legacy needs - the format is in fact vendor-neutral. Instead they chose to read the overview and then re-implement it. Jean Paoli's comment 'Sun standardized their own. We could have used a format from others and shoehorned in functionality, but our design needs to be different' reeks of NIH and lock-in when you take that fact into account (Phipps, 2005).

[277] Microsoft was to provide forward compatibility from Microsoft 2003 to the 2007 version, and would encourage upgrading rather than worrying about backward compatibility. The group product manager wrote on his blog:
The questions I've heard are:
1. Are the licenses compatible with Open Source projects?
2. Specifically are they compatible with the GPL?
3. Is there a guarantee that Microsoft won't change the license out from under people? How accessible will these formats be 100 years from now? [....]
The Microsoft license says that you (developer) can write a program that can read and write the Office XML reference schemas, but you need to give Microsoft credit somewhere in your program simply stating that you've used our schemas. What's wrong with that? I don't see that as some super onerous restriction that should cause people to reject the license. I would say the same about the sublicensing issue. If the license is free and it's available to anyone in the world, then what is the big deal? Once you write a program under the license, you are clearly covered.

Over summer 2005, the ITD hosted public forums to discuss issues about Office XML. In the working draft, OOXML was removed.[278] At the Open Data Format Forum on June 15, 2005, an executive statement was required to clarify the criteria by which openness would be defined:

> ... Eric [Kriss, Secretary of the Executive Office of Administration and Finance] stated that the test for openness in data formats would henceforth include three elements:
>
> - It must be published and subject to peer review
> - It must be subject to joint stewardship
> - It must have no or absolutely minimal legal restrictions attached to it (Dedeke, 2012, p. 13).

At that meeting, the Microsoft representative asked how the company could be put back into the ETRM. The secretary reiterated that definition of an open data format.[279] On September 12, 2006, Microsoft made on Open

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[....]
The license actually is perpetual. Take a look, its right here: http://www.microsoft.com/mscorp/ip/format/xmlpatentlicense.asp. It says so right in the license grant and it is confirmed in the Q&A on the site. The Q&A is here: `http://www.microsoft.com/Office/xml/faq.mspx`
I don't really understand the point about it being changed at any time. If you accept the license, then you have a deal. Microsoft can't come back later and say the deal is different. I don't see any restrictions in this license on distribution of programs created under this license. [....]
So, the answers to those questions listed above are:
1. Yes we work with a large number of open source licenses (but not all).
2. No, the GPL does not allow for the attribution and sub-licensing restrictions that the MS Office Open XML Formats licensing asks for.
3. Yes the licenses are perpetual and you don't need to worry about them changing out from under you. The files you save will be freely accessible forever (B. Jones, 2005).

[278]Leading to a new revision of the ETRM, the working draft evolved:
After the online posting of the draft, the ITD deleted Office XML from the draft to diffuse negative feedback from the external stakeholders. In an effort to alleviate the fears expressed about Office XML, the ITD's Architecture Council hosted several public forums on the issue. Representatives from companies such as IBM, Sun, Adobe, Microsoft and OASIS participated in the forums. There was a consensus amongst participants that the "openness" criterion for data formats was a continuum; nevertheless, they concluded that the licensing terms and nature of Office XML reference schema did not meet the emerging criteria of openness.

[279]Public meetings with government typically have open records of proceedings, in the interest of transparency:
Stuart McKee, who represented Microsoft at the meeting, made the following comment: "We do have some concerns that we are now not on the list, and, in fact, I think you stood before this body and talked us being on the list. So, I guess the question is how does this policy evolve over time, what could we expect when we are on the list, off the list, can we get on the list?"
In response to the inquiry, Eric [Kriss] said the following: "If you dropped the patent entirely, if you were to publish the standard and then make provisions for future changes to that standard to be part of a joint stewardship that is no longer solely controlled by Microsoft Corporation, then we would be delighted to begin a true technical comparison of your standard with the open document standard and go from there" (Dedeke, 2012, p. 13).

Specification Promise, in which it pledged to not assert "Necessary Claims" against the OOXML specification and implementations, and Microsoft implementations of OpenDocument format.[280]

The ETRM version 3.5 was posted for public review for comments for 11 days. A significant number of critical comments came from advocates of persons with disabilities, as the implementations of ODF did not yet support their needs (Commonwealth of Massachusetts, 2005d). The final ETRM version 3.5 was published on September 21, 2005, excluding OOXML (Commonwealth of Massachusetts, 2005c). This decision would preclude the Commonwealth of Massachusetts from upgrading to Microsoft Office 2007, setting a precedent for other states and governments to follow (Waters, 2005).

The implementation of OpenDocument in the Commonwealth of Massachusetts would not become a reality. Pressure led Secretary Eric Kriss and ITD Director and Peter Quinn to resign. A Senate Committee on Post Audit and Oversight commenced in October 2005, publishing a final report in June 2006 (Travaglini et al., 2006). Major issues included accessibility for workers with disabilities, costs, and statutory authority on public records. Louis Gutierrez, who had previously been the CIO between 1996 and 1998, assumed Peter Quinn's role in an appointment in February 2006. Gutierrez resigned in October 2006 when it became clear that the state legislature would let the IT investment program lapse by not approving the bond bill (Rosencrance and Sliwa, 2006).[281]

The Massachusetts ETRM, as might other jurisdictions, recognized the IETF, ISO, OASIS and W3C as international standards bodies. The ISO fast-track process similar to the OASIS endorsement of OpenDocument is also offered to as courtesy to others standards agencies. Microsoft chose to

[280]The Microsoft Open Specification Promise asserts Microsoft's intellectual property, at the same time that it espouses that it will not assert claims:
"Microsoft irrevocably promises not to assert any Microsoft Necessary Claims against you for making, using, selling, offering for sale, importing or distributing any implementation to the extent it conforms to a Covered Specification ("Covered Implementation"), subject to the following . . . " (Microsoft, 2006c)

[281]In a 2007 interview, Gutierrez detailed the extent to which Microsoft was influencing government policy:
What did you find most bothersome about what Microsoft did? This was the first time I had ever seen a vendor involved in efforts to re-charter the central IT agency, and I find that troubling.
You mean they weren't just attacking a policy, they were attacking the agency that had developed the policy? It went to that next level.
Did your experience sour you on Microsoft? I think, to be entirely fair, large corporations have many personalities, all at the same time, and I do think that there are individuals of character that together I worked through a year with. There is this whole theater of me keeping Brian Burke, [Microsoft's Northeast] government affairs specialist, out of my office. That was theater for saying that this type of activity must stop. What I'm concerned about with Microsoft is just that there are portions of the organization, and possibly very endorsed portions of the organization, that have lost a sense of right relation with governments and with government customers (Sliwa, 2007).

work with the European Computer Manufacturers Association (Ecma) with an initial submission of a 1900-page OOXML specification.. In December 2005, Ecma announced a Microsoft cosponsored Technical Committee 45 (TC45) "to produce a formal standard for office productivity applications that is fully compatible with the Office Open XML Formats, submitted by Microsoft" (Ecma International, 2005). The other companies joining Ecma TC45 included Apple, Barclays Capital, BP, the British Library, Essilor, Intel, NextPage, Statoil ASA and Toshiba.

IBM, as a member of Ecma, could attend TC45 meetings. However, doubts about even IBM being able to influence the specification were raised.

> 'Given the charter, it's not clear what anyone other than Microsoft is going to be doing on this committee,' [Bob Sutor, IBM's vice president of standards and open source] said ....
>
> Sutor said Microsoft was trying to have its document formats 'rubber-stamped' as standards by Ecma. He said it doesn't appear that the committee, which has Microsoft representatives as co-chairs, can be influenced by companies other than Microsoft (LaMonica, 2005).

Microsoft's choice of Ecma as a standard body was raised with suspicions. In a satirical view of "How to Write a Standard (If You Must)", a cookbook for an organization finding themselves "in the awkward position of coming up short in the standards department" described the situation with Ecma.[282]

[282]Initially drafted as "The Anti-Patterns of Open Standards Development", a tongue-in-cheek description was more entertaining.
Standards writing, as generally practiced, is a multilateral, deliberative process where multiple points of view are considered and discussed, where consensus is reached and then documented. This must be avoided at all costs. [....]
Start with a complete product implementation. This makes the entire process much faster since there is no time wasted discussing such abstract, heady things as interoperability, reuse, generality, elegance, etc. [....]
Shop around for the best standards development organization (SDO), one that knows how to get the job done quickly. Evaluation criteria include:
1. A proven ability to approve standards quickly. You are not interested in advancing the state of the art here. You want fast-in-fast-out-stamp-my-ticket processing so you can get on with your business.
2. A membership model that effectively exclude individual experts and open source projects from the process.
3. A demonstrated competency in maintaining needed secrecy when developing sensitive standards.
4. The right to make FastTrack submissions to ISO
Ecma International approved the DVD-RAM, DVD-R, DVD+R, DVD-RW and DVD+RW standards. Although some falsely claim that these overlapping standards have confused consumers, it is clear that having these multiple formats has given manufacturers ample opportunity for upselling multi-format DVD players and burners. With a single format, where is the upsell? Ecma clearly understands the purpose of standards and can be relied upon.
Once you are in an SDO and are ready to create your Technical Committee, be

In comparison, IBM preferred to work with OASIS, as a more "open" standards body than Ecma. The emphasis on e-business standards at OASIS were more appropriate than the programming languages, hardware and media standards, as compared in Table A.4 (Weir, 2006).

Table A.4. Comparison of OASIS and Ecma

	OASIS	Ecma
Allows individual members	Yes	No
Mailing lists viewable by the public	Yes	No
Meeting agendas and minutes publication	Yes	Only report of face-to-face meeting
Received public comments are viewable	Yes	No

The OpenDocument format approved as an OASIS and then ISO standard, completed a review of 706 pages in 867 days. The "complete "review of the OOXML draft 1.4 of 5419 pages in 254 days strained credibility, as the length of the document would practically suggest commenting and revising should have taken years.

By the final vote by TC45, the quantity of effort was tallied: 9422 different items to document, 6000 pages of documentation, 128 hours of face-to-face meetings, and 66 hours of live meeting discussions (B. Jones, 2006). One negative vote was clear: "IBM voted NO today in ECMA on approval for Microsoft's Open XML spec" (Sutor, 2006). Nonetheless, on December 7, 2006, Ecma announced that Office Open XML has been approved the ECMA 376 standard, including submission to the ISO/IEC JTC 1 process (Ecma International, 2006).

On December 12, 2006, ECMA-376 was submitted to the ISO/IEC JTC (Ngo, 2006) with licensing conditions reiterating the Microsoft Open Specification Promise (Microsoft, 2006a).

Following fast track procedures, the ISO process has national standards bodies in each member country resolve on motions as (i) approval, (ii) approval, with comments, (iii) abstention (which carried no positive or negative weight), (iv) disapproval, with comments (which would revise to become an approval should the comments be resolved), or (v) disapproval. Suspicions became raised in some countries when new organizations would suddenly join the national standards bodies to vote with approvals These were suspected to largely be Microsoft business partners encouraged to stuff the ballot box.

By July 13, 2007, voting at some national standard bodies was scheduled to end. The U.S. technical committee INCITS V1 failed to gain the neces-

sure to carefully consider the topics of membership and charter. Of course, you'll want to assemble a team of willing partners. Loyalty can be obtained in many ways. Your consigliari may have some ideas (Weir, 2006).

sary two-thirds "approval, with comments" minimum to endorse OOXML (Weir, 2007). In Italy, the Uninfo committee that had historically had 5 members mushroomed to 83 voters – surprising, since admission to the JTC1 cost 2000 Euros each – yet the two-thirds majority was not achieved (Updegrove, 2007). In Portugal, IBM and Sun representatives were denied access to the meeting room with the claim that only 20 seats were available, and the two-thirds majority was still not met (P. Jones, 2007c).

On September 4, 2007, the ISO ballot to publish ISO/IEC DIS 29500 failed to get the required level of two-thirds positive and less than one-quarter votes by national bodies (ISO 2007b). A ballot resolution meeting to discuss comments (so that disapprovals with comments could be changed) was scheduled for February 25-29, 2008 (ISO, 2008).[283] At that event, when it was apparent that all comments could not be reviewed individually, meeting attendees agreed to group the modifications into 43 resolutions. This direction was to move forward, despite objections that only a small number of Ecma responses to comments were discussed, and that OOXML should never have been accepted for a fast-track process.[284]

[283] With only 41 of 104 countries participating in JTC1, the competence to appreciate the technical specification would later be questioned.
The five-month ballot process ended on 2 September and was open to the IEC and ISO national member bodies from 104 countries, including 41 that are participating members of the joint ISO/IEC technical committee, JTC 1, Information technology.
Approval requires at least 2/3 (i.e. 66.66 %) of the votes cast by national bodies participating in ISO/IEC JTC 1 to be positive; and no more than 1/4 (i.e. 25 %) of the total number of national body votes cast negative. Neither of these criteria were achieved, with 53 % of votes cast by national bodies participating in ISO/IEC JTC 1 being positive and 26 % of national votes cast being negative (ISO, 2007b).

[284] Ecma had to answer to comments from the September vote, leading to 1000 responses in 2300 pages:
Participants say that only a small portion of the ECMA responses were actually discussed during the BRM. When time ran out, the rest of the responses were simply approved without any review at all. This was done out of necessity because the alternative would be to abandon the important technical recommendations made in the unreviewed ECMA responses. The end result is that ISO members participating in the OOXML voting process were given very little opportunity to refine and expand on ECMA's fixes for OOXML's problems. Although some individuals who have been involved in the process—even some in the ODF camp—have expressed strong support for ECMA's efforts on OOXML, others—like Google and IBM—say that too many deficiencies still remain.
Some of the more vocal critics contend that the lack of time for adequate review of the ECMA responses is evidence that OOXML isn't an appropriate candidate for fast-track approval. One such critic was one of Canada's representatives at the BRM, Tim Bray—director of web technologies for Sun Microsystems (which backs the competing OpenDocument format) and one of the co-editors of W3C's XML specification. 'The process was complete, utter, unadulterated bullshit. I'm not an ISO expert, but whatever their 'Fast Track' process was designed for, it sure wasn't this. You just can't revise six thousand pages of deeply complex specification-ware in the time that was provided for the process,' wrote Bray in a blog entry. 'As the time grew short there was some real heartbreak as we ran out of time to take up proposals; some of them, in my opinion, things that would really have helped the quality of the draft.' (R. Paul, 2008c)

The national member bodies were then given 30 days, to March 29, 2008, to consider whether their votes would be changed.

On April 2008, it was announced that ISO/IEC DIS 29500 had received the necessary votes for approval as an international standard (ISO, 2008).[285] In July, the national bodies of India, Brazil, Venezuela and South Africa appealed to the ISO Technical Management Board to have the OOXML approval overturned, due to the irregular process (R. Paul, 2008a), but the appeal did not have sufficient support to proceed (R. Paul, 2008b).

For this research study, the Office Open XML standardization into ECMA 376 and subsequently ISO/IEC 29500 is categorized as private sourcing. While standards bodies are perceived as open, this history of conflicts shows the relations between vendors, national bodies and an international committees dysfunctional, and possibly manipulated. IBM, Sun and Adobe tried to surface issues to national standards bodies and governments, but got tied up in international bureaucratic processes. The Ecma standardization process is not transparent, and the ISO unfortunately lost some credibility allowing its fast-track process to be misused.

A.7.5 (d) Open sourcing: OpenDocument 1.1 approved as an OASIS Standard on Feb. 1, 2007

At the May 2004 TAC recommendations that 'industry actors not currently involved with the OASIS Open Document Format consider participating in the standardisation process'(Telematics between Administrations Committee, 2004), the IBM response was that the company 'welcomed' it (Norsworthy, 2004). One area where the OpenDocument specification could be improved was on accessibility.

On November 13, 2005, Peter Korn, an Accessibility Architect at Sun, posted a detailed assessment of the background in the Commonwealth of Massachusetts, the implications for OpenDocument, as well as the potential impact of the change in Microsoft Office 12 (i.e. Office 2007) which had a completely new interface (Korn, 2005). Unlike Unix Gnome, the Java platform or Mac OS X that offered accessibility infrastructure at the platform level, Microsoft Windows provided an inadequate Microsoft Active Accessibility interface at the operating system level. This led to Assistive Technology vendors patching the operating system and re-engineering applications such as Microsoft Office to give accessibility features. With a

[285]The ballot resolution meeting in February was unprecedented, and a small number of vote changes tipped the balance:
Approval required at least 2/3 (i.e. 66.66 %) of the votes cast by national bodies participating in the joint technical committee ISO/IEC JTC 1, Information technology, to be positive; and no more than 1/4 (i.e. 25 %) of the total number of ISO/IEC national body votes cast to be negative. These criteria have now been met with 75 % of the JTC 1 participating member votes cast positive and 14 % of the total of national member body votes cast negative (ISO, 2008).

large investment by one Windows screen reader company, Microsoft Office could be perceived as "accessible", not because of the work of Microsoft, but by the third party Freedom Scientific. For users with major visual impairments, OpenOffice.org would work well on the Gnome Linux platform, but not on Microsoft Windows. For users who interact with a computer via speech recognition, OpenOffice.org was not well supported on Microsoft Windows by IBM Viavoice or Dragon Naturally speaking, and there was no real end user speech recognition application yet on Unix.

In November 2005, the IBM Vice-President of Open Source and Standards committed IBM to stepping up to the requirement:

> Accessibility is an important global issue and, in the case I've spent so much time discussing in this blog, whether it's for whatever is needed in the ODF specification or for applications that support ODF (indeed, there seems to have been some confusion between accessibility issues with the standards vs software that implements the standard). That's why one of the action items from last week's ODF Summit was to start an accessibility technical subcommittee in OASIS. The goal is not to just 'meet minimum,' but over time to create something which is effectively state-of-the-art, and use the open, global community process to make that happen. As some of you also know, we're implementing ODF in our Lotus Workplace productivity tools (for those of you in Copenhagen who were at my talk last night, it was prerelease of that which I used to show the ODF-based presentation).
>
> Here's our statement regarding accessibility and this product:
>
> IBM's Workplace productivity tools available through Workplace Managed Client including word processing, spreadsheet and presentation editors are currently planned to be fully accessible on a Windows platform by 2007. Additionally, these productivity tools are currently planned to be fully accessible on a Linux platform by 2008 (Sutor, 2005c).

IBM's direction was to develop its program products in parallel with the evolving standard under the auspices of OASIS. An OpenDocument Accessibility Subcommittee was formed, co-chaired by Richard Schwerdtfeger from IBM, and Peter Korn from Sun (OASIS, 2005). At the charter, the purposes were: (i) ongoing review of the OpenDocument specification for accessibility, both to discover potential accessibility issues and to improve the usability and functionality of creating, reading, and editing office documents for people with disabilities; and (ii) to provide accessibility related feedback to the OpenDocument Technical Committee and implementers of the OpenDocument specification. The subcommittee had four other

official members, all from IBM.[286] The open invitation to join the mailing list on January 9, 2006 led to regularly weekly meetings starting January 26, bringing in additional parties.[287] Activity continued within the subcommittee with regular e-mails through 2009.

On February 1, 2007, OpenDocument v.1.1 was approved as an OASIS standard.[288] The addition of accessibility features on top of v1.0 led to endorsements on the press release from the UK Royal National Institute for the Blind, and National Federation for the Blind in Computer Science (Geyer, 2007)). Engineers at OpenOffice reported that "we did not submit ODF 1.1 to ISO, because it is considered to be a minor update to ODF 1.0 only, and we were working already on ODF 1.2 at the time ODF 1.1 was approved" (P. Judge, 2008). For the record, the ISO officially published the updates in 2012 (ISO, 2012).[289]

For this research study, the OpenDocument v1.1 standardization by OASIS is categorized as open sourcing. IBM committed resources towards improving accessibility, in collaboration with a variety of other corporate and institutional partners. The communications and recommendations of the subcommittee are openly documented on the Internet, and still visible today.

A.7.6 (e) Open sourcing: IAccessible2 accepted by Free Standard Group on Dec. 14, 2006

In response to concerns about providing assistive technologies for people with disabilities, IBM announced development and donation of the IAccessible2 as an open standard for Windows, DHTML, AJAX and WAI-ARIA that all could freely use.

> The new application program interfaces, designed for Windows and dubbed IAccessible2, have been accepted by the Free Standards Group, which will develop and maintain it as an open standard, available for all to use. Freedom Scientific, GW Micro, IBM, Mozilla Project, Oracle, SAP, and Sun Microsystems are the first to back the technology, and will be involved in developing it as an industry standard, or use it in products with which they are associated. [....]
>
> IAccessible2 complements a proprietary application program interface, called Microsoft Active Accessibility (MSAA), and therefore lets

[286] Working with the two co-chairs from IBM and Sun were: Chieko Asakawa, Mingfei Jia, Hironobu Takagi and Rob Weir.

[287] Nathaniel Borenstein sent out the initial invitation on the OASIS mailing list.

[288] Notification of the approval of OpenDocument v1.1 was sent on the e-mail list to the Technical Committee by Mary McRae on February 1, 2007, following the January 2 official submission and call for vote on January 16.

[289] In the relationship between OASIS and the ISO, it is OASIS that maintains updates to the standard. With the original specification for OpenDocument v1.1 online at February 1, 2007, some errata were officially corrected in 2013.

> companies continue to benefit from their Windows investments. IAccessible2 is based on open technology that IBM originally developed with Sun to make Java and Linux accessible to those with disabilities. Once implemented on Windows, it will be easier to adapt individual applications for accessibility on other operating systems, potentially creating business opportunities for multi-platform application developers.
>
> This effort was accelerated by the need to produce accessible productivity software based on the OpenDocument Format (ODF) to meet the needs of municipalities such as the Commonwealth of Massachusetts, which has mandated the use of open standards such as ODF. The technology makes browsers such as Firefox, and formats such as ODF used in open source productivity suites like OpenOffice.org or commercial messaging environments such as IBM Workplace relate more automatically and more fully to assistive technologies such as JAWS, MAGic or Windows Eyes.
>
> This work was performed by IBM engineers across two continents involving IBM Lotus engineers in Beijing and Boston, as well as accessibility experts in IBM's Emerging Technologies group and in IBM Research, many of whom have developed assistive technologies and performed work to make Java, Linux, Firefox, and Rich Internet Applications more accessible. The work was validated by Freedom Scientific and GW Micro, both of which worked closely with IBM developers. Both Freedom Scientific and GW Micro will support IAccessible2 in products designed for blind and low-vision users (IBM, 2006j).

The development project originally "was named Missouri as the State of Massachusetts laid down the gauntlet in front of IBM to 'show me' an accessible solution for ODF in 2007" (Schwerdtfeger, 2006).

This technology would ensure that accessibility features, from that point on, would be available at a level above the operating system (e.g. Windows, Linux), but below an application level (e.g. Lotus Productivity Tools, Lotus Notes, IBM Symphony). While IBM would have its own implementation embedded into its program products, the IAccessible2 open standard would encourage interoperability across other application programs and web browsers used by a disabled person.

For this research study, the IAccessible2 development and donation to the Free Standards Group is categorized as open sourcing. While other software companies might focus on a specific operating system or application, this technology would benefit disabled people with features beyond any single implementation.

A.7.7 (f) Private sourcing: IBM Lotus Productivity Tools (for Lotus Notes and Domino 8, and Quickr Connectors)

On May 16, 2006 at the Deutsche Notes Users Group, IBM presented a preview of Lotus Hannover development (which would eventually be released as Notes Domino 8) featuring a complete new interface building on the Eclipse technology (IBM, 2006i; IBM, 2006h; Lombardi, 2006). In the new Notes 8 rich client interface, Productivity Tools of word processing, spreadsheets and presentations would edit files in the OpenDocument format approved as an ISO standard earlier in the month. These Productivity Tools for Notes Domino 8 were said to be the same as those already available in the IBM Workplace Managed Client. The Notes 8 client and therefore the productivity tools were projected as available for testing on Windows and Linux platforms in a public beta in the fall.

On July 10, 2006, IBM became a cross-platform desktop provider by announcing availability of Lotus Notes on Linux, a release of the Notes 7 client that run on a workstation with an operating system other than Windows (IBM, 2006e). IBM Business Partners were offered "Migrate to the Penguin" rewards for switching customers from Microsoft Exchange to IBM Lotus Notes. This Notes 7 announcement was surprise to the industry watching for Notes 8, as "the beginning of a concerted effort on the part of companies like IBM and Novell to challenge Windows for a piece of the corporate desktop" (McAllister, 2006).

By November 7, 2006, the "managed beta" version of Lotus Notes and Domino 8 (with the prior codename of Hannover acknowledged) was released to selected customers and business partners for initial assessment (Raven, 2006). Experience on this private beta would determine the when a version for testing would be released to a broader audience.

On March 7, 2007, the first public beta of Lotus Notes Domino 8 became available to external parties. It was recognized as " first Notes managed client to be built on Lotus Expeditor (formerly called the Workplace Client Technology) and Eclipse, which lets Notes 8 act as a client for XML-based services, composite applications that combine such services, and applications that incorporate XML-based interfaces" (Fontana, 2007). Available both for Windows and Linux desktops, the combination of the Productivity Editors, embedded instant messaging and presence awareness and ability to create composite "enterprise mashups" could be compared against recent announcements by Microsoft on "unified communications"

On August 8, 2007, Lotus Notes and Domino 8 was announced as generally available, after two years of development, and testing by more than 25,000 businesses (IBM, 2007g). The Productivity Tools bundled with Lotus Notes 8 client enable editing of documents in Open Document Format (ODF). At the same time, Lotus Quickr 8 was released as " team collaboration software that includes IBM's first commercially available

wiki and integration with everyday office applications from Lotus and Microsoft" (IBM, 2007e). The Quickr Connectors, a shortcut could be added to either Microsoft Office of the Lotus Notes 8 Productivity Tools so that documents can be shared from a personal computer into an online collaboration environment. Both Lotus products therefore enabled both (i) online collaborative editing of documents (i.e. a wiki that resided on the web, but not on the personal computer), or (ii) offline rich editing on a personal computer (e.g. with Microsoft Office, or the Lotus Notes 8 Productivity Tools) of a file retained online.

For this research study, the IBM Lotus Productivity Tools on Lotus Notes and Domino 8 are classified as private sourcing. The primary motivation for this technology was not as an independent product, but as part of a larger strategy for an integrated workplace desktop with Lotus Notes Domino 8. While IBM was engaged in open standards work with OASIS, the source code was not released to the public.

A.7.8 (g) Private sourcing: IBM Lotus Productivity Tools (on TAP)

IBM, internally, is the world's largest installed user of Lotus Notes Domino, for e-mail, document management and collaboration. It also had one of the largest installations of Windows XP, on almost 400,000 desktops in 2004 (Evers, 2004).[290] Like many Microsoft customers, IBM would continue to maintain Windows XP to pass over Vista operating system announced in 2005, and eventually migrate to Windows 7 release in 2009.[291] To communicate with customers using the de facto standard word processing, spreadsheets and presentations, IBM paid for a worldwide site license for Microsoft Office XP. Microsoft offered mainstream support for Office XP through July 11, 2006, and then extended support (for only security-related bugs) through July 12, 2011 (Microsoft, 2011a).

For business professionals using Lotus Notes client desktops, the Productivity Tools would enable word processing, spreadsheets and presentations without Microsoft Office, and potentially even without the Microsoft Windows operating system. Since every IBM employee was already using Notes 7 for e-mail, an upgrade to Notes 8 could obviate a need the Mi-

[290] Although IBM sold the personal computer division to Lenovo in 2004, Thinkpads and Lenovo towers were the standard workstations for its employees for many years after that. The management of desktop software was controlled through the IBM Standard Software Installer (ISSI), for which U.S Patent 6928481 B1, "Method, apparatus and program to optimize the network distribution of digital information based on hierarchical grouping of server topology and code distribution" was filed in 2000.

[291] A "Save XP" petition to extend sales of the product beyond February 1, 2008, led to sales continuing through June 30 (Gruman, 2009). Fixes would continue to be provided through April 8, 2014, 12 years after Microsoft XP was released (Microsoft, 2014).

crosoft Office. If IBM as a worldwide company were able to move away from Microsoft Office, this change could serve as an exemplar for other enterprises.

On October 27, 2006 on the IBM intranet, a new forum was created for a "TAP offering, Hannover-based Productivity Editors", as a central place for feedback, general discussion and support.[292] When asked about the scope of the TAP offering, the response was the Productivity Suite would be "standalone", without the requirement of installing the full Hannover client.[293] By November 8, the TAP web page was available so that the Productivity Tools were available for download.[294]

Since the Productivity Tools on TAP complied with the OpenDocument 1.0 format, a question arose as to why IBM would pursue such an activity, when some might see it as a duplication of the OpenOffice work. Following the licensing conditions in place in November 2006, individuals independently downloading and using OpenOffice for personal use was permitted, while internal distribution and deployment by the corporation would involve legal negotiations.[295] The IT guidelines for all IBM em-

[292]A technology advocate in the Office of CIO started moderating a new forrm:
Barbara Mathers | Please create forums.biz.technology-adoption-program.hannover-productivity-editors | Oct 26, 2006
Description: This forum is intended for innovators and early adopters to discuss a TAP offering, Hannover-based Productivity Editors, and the various components of the offering. The team wish to gather specific feedback from IBMers to determine if the technology meets people's needs and will be using the CIO Technology Adoption Program offering to do so. This web-based forum is the central place for feedback, general discussion and support.
The IBM productivity tools are the next generation of office suite tools developed by Lotus. The document editors are ODF-compliant and Microsoft Office-compatible, and include a word processor, a spreadsheet editor, and a presentation tool. Help us pilot test this new release which is packed with usability enhancements and new features.

[293]Ed Markham remarked on the anticipated Hannover release on the forum.
Barb Mathers | Hear that? | Nov 2 2006
"Well remember that the pilot for the Hannover-based productivity editors is actually focused on one specific component of Hannover...the productivity suite within the context of a 'standalone' experience. This means that there is no dependency on installing the full Hannover client to get the editors. (Hannover is the next version of the full Notes client.)
However, the productivity suite is also included as part of the overall Hannover client, so those who participate in the full Hannover pilot will get these same editors through that installation. The Hannover client pilot will be starting soon on TAP though...watch the main TAP page for the announcement of that".

[294] The location for the Productivity Tools were revealed on the forum:
Feng Li Wang | Where are the downloads? | Nov 8 2006
"Pls first access the TAP page of Hannover based IBM productivity tools by following link,
Then, pls select the 'Get started with the IBM productivity tools' to start the download. You can also click the link of 'IBM productivity tools install instructions' underneath to get more info about the installation".

[295]Questions about licensing of OpenOffice arose in response to Mike Rubin:
Walter B. Farrell | Why are we doing this? | Nov 10 2006
">There are legal reasons we can not move to Open Office

ployees allowed the download and use of open source software for personal productive on corporate-owned machines, delegating the responsibility to individuals".

With OpenOffice 2.0 having been released about a year earlier, in October 2005, questions about compatibility of the Productivity Tools that version emerged. The official response came that the development would be based on the OpenOffice 1.0 level, not the 2.0 level.[296] IBM employees voluntarily downloaded the Productivity Tools, tried them out, and reported a variety of issues in late 2006 and early 2007.

Within TAP, the M4 version of the Productivity Tools were embedded into the Lotus Notes 8 beta released into public beta by March 17, 2007.[297] The standalone M4 version was released on the TAP web site a few days later. In June, the M5 version of Productivity Tools were bundled with

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Are you saying: (a) there are legal reasons that prevent IBMers from using OpenOffice.org? or (b) there are legal reasons that prevent Hannover from making use of OpenOffice.org? or (c) something else? I hope it's not (a), as I suspect there are a fair number of IBMers already using OpenOffice.org on their machines".
. . . to which Mike Rubin responded . . .
"Yes, unfortunately it is both option 'a' and option 'b', which prohibits IBM as a corporation from internal distribution and deployment of Open Office. Individuals may download Open Office as long as they follow the ITCS 300 guidelines (under section 2.1.1 Copyright and intellectual property).

[296] Since OpenOffice 2.0 was licensed only under GPL, and OpenOffice up to 1.1.4 was dual licensed under GPL and the permissive SISSL, reusing the code could raise intellectual property questions. This was discussed on the forum:
Martijn Tijhuis | Running on OpenOffice code? " Nov 7 2006
"The earlier productivity tools that came with IWP ran on OOo code 1.1 right? Does this Hannover version run 2.0? Or is it totally different?"
Jian Hong Cheng | Nov 17 2006 | in response to Martijn Tijhuis
"Yes. The Editors in Hannover are also OO 1.1 based,not relate to OO2.0."
Daniel DeGroff | Nov 17 2006 | in response to Jian Hong Cheng
"yes, I noticed in the EULA while installing Notes 8 that it lists OpenOffice 1.1 From my experience with OO 1.x - the M$ compatibility was much poorer than OO 2.x - so is IBM building their own code on the top of OO or will we move to the 2.x codebase at some point?
Or, if you told me - would you have to kill me? wink"
Jian Hong Cheng | Nov 20 2006 | in response to Daniel DeGroff
"We have no plan to move our code base to OO2.x for legal issues. Thanks."

[297] The Productivity Tools version in testing externally was cached internally.
Yin, Da Li | IBM Productivity Tools M4 Beta is available! | Mar 14 2007
"Notes 8 is available on the website. The productivity tools has been also be updated to M4 bata [sic] in this bundle. Stability is improved in this version. Also, some problems posted in this forum before has been fixed. You can download it from betapage."
Walter B. Farrell | Mar 15 2007 | in response to Yin, Da Li
"The link you gave is to the public berta [sic], not to the IBM M4 Beta. IBMers should wait until they can get M4, which has IBM customizations, from ISSI via TAP and the Early Adopters web site."
Yin, Da Li | Mar 19 2007 | in response to Walter B. Farrell
"Maybe this name is not formal enough. Whatsoever, the productivity tools code integrated into that Public Beta is actually M4. So I called it 'M4'."
Walter B. Farrell | Mar 19 2007 | in response to Yin, Da Li
"And in any case, IBMers can get the IBM-customized Hannover M4 now, using the links from the Early Adopter pages."

Lotus Notes 8 Beta3.[298] Again the update of the standalone version was managed by the IBM CIO's office through TAP. Questions were asked about problems described in the forum, on performance, and on compatibility with Microsoft Word. Since Notes 8 was soon to enter General Availability (GA), no new features were added to M5. All reported bugs leading to freezes and crashes had been fixed. Performance had been generally improved at the level of the Eclipse platform, and specific performance improvements for the presentation tools were scheduled for the next version."

On August 23, 2007, the internal beta versions were removed by TAP, to be refreshed with official IBM Lotus Productivity Tools.[299] Significantly,

[298]The Standalone Productivity Tools were not available unbundled to external testers:
Yin, Da Li | IBM Productivity Tools M5 is ready | Jun 4 2007
"The M5 of IBM productivity tools are bundled with Lotus Notes8 Beta3. They can be got at betapage. Please update the IBM productivity tools on your machine and try the new version!"
Seth Erlebacher | Jun 4 2007 | in response to Yin, Da Li
"Is there a way to get the M5 release of the productivity tools without going to Notes 8 Beta?"
Yin, Da Li | Jun 5 2007 | in response to Seth Erlebacher
"What you want is just CIO version of IBM productivity tools. We have the plan to make it. But I don't know when and how it is publicly released. If it's available, I'll notify on this forum."
Todd W. Arnold | Jun 4 2007 | in response to Yin, Da Li
"Can you summarize what has been changed and improved from the beta to this M5 version? In particular, I'd like to see comments on what has been done to address the problems people have described in this forum. Has anything been done to improve performance? To improve compatibility with MS Word?"
Yin, Da Li | Jun 6 2007 | in response to Todd W. Arnold
"To keep the quality of coming eGA of Notes8, we add no new features. Our work in M5 is mainly around fixing existing defects and improving stability.
To improve stability, all reproducible freezing and crash problems are fixed. I remember someone said his PT froze when loading a long document. We opened SPR and fixed for him. Of course it's only one case in the stability campaign.
About performance, startup speed is improved in M5 because we made optimization on infrastructure. Also text painting performance is improved in Word Processor. Performance team are working to improve the loading performance of presentation editor for the next version.

[299]The plans to release the Normandy development as a no charge rebranded Lotus Symphony product was kept under tight covers, and a surprise to everyone, including IBM employees:
John A. Walicki | Refreshed IBM Lotus Productivity Tools now available on TAP | Aug 22 2007
"The IBM Lotus Productivity Tools are the next generation of office suite tools developed by Lotus. The Lotus Documents, Lotus Spreadsheets and Lotus Presentations are open standards compliant, so you can create and read documents in the OpenDocument format. You can also open and save documents in other file formats, such as SmartSuite and Microsoft Office. Help us pilot test this new release, code named Normandy, which is packed with usability enhancements and new features. If you have Notes 8 installed it includes the IBM Lotus Productivity Tools and you do not need to install both. Download the IBM Lotus Productivity Tools from TAP."
Walter B. Farrell | Aug 23 2007 | in response to John A. Walicki
"I have Notes 8, but I prefer not to use the productivity tools in an embedded

the release was given a formal code name of "Normandy". This version of the IBM Lotus Productivity Tools could be installed on client desktops (either on Windows or Linux) alongside the Lotus Notes 8 client, and OpenOffice 2.0. This standalone packaging of Lotus Documents, Lotus Spreadsheets and Lotus Presentations was not announced separately from the Lotus Notes Domino 8 product. The public disposition of "Normandy" – as a product that would be officially released by IBM – would be a mystery until only a few weeks later.

For this research study, the IBM Lotus Productivity Tools on TAP are classified as private sourcing. With TAP, the Productivity Tools were available as standalone package for ease in gaining feedback from IBM employees who would voluntarily contribute their time for testing and submitting bugs. For external customers and business partners who participated in the Lotus Notes Domino 8 beta, the Productivity Tools were always bundled into the desktop client.

In the month that followed, the world would be surprised at the release of an OpenDocument-compliant alternative to OpenOffice.

A.7.9 (h) Private sourcing: IBM Lotus Symphony 1 (on TAP, and public beta)

On September 10, 2007, OpenOffice.org announced that IBM was officially joining the community. "IBM will be making initial code contributions that it has been developing as part of its Lotus Notes product, including accessibility enhancements, and will be making ongoing contributions to the feature richness and code quality of OpenOffice.org. Besides working with the community on the free productivity suite's software, IBM will also leverage OpenOffice.org technology in its products" (OpenOffice.org, 2007).

On September 18, 2007, IBM announced "IBM Lotus Symphony, a suite of free software tools for creating and sharing documents, spreadsheets and presentations" (IBM, 2007f). In a future that would bridge personal computing with the Internet, "the no-charge IBM Lotus Symphony software integrates editor functionality into everyday desktop and business

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fashion, and would prefer to use them outside of the Notes application. I have not found a way to do that when I install them with Notes, so I stopped installing them with Notes. Is there a way to run them outside of Notes if installed with Notes? And if I install them stand-alone from the link you provided, will they run outside of Notes when I start them? Do they properly coexist with OpenOffice.org 2.1? I need that to get database support."
John A. Walicki | Aug 23 2007 | in response to Walter B. Farrell
"If you have the disk space, the standalone editors are completely independent of the Notes 8 implementation. They should be able to coexist side by side. They should also coexist side by side with OpenOffice.
I think the only side-effect will be which application is registered to open the ODF file associations by default. The last editor to be installed will be the default. So install them in the order you want; OpenOffice, Notes 8 or the IBM Lotus Productivity Tools."

applications". The Beta 1 version was downloadable from the IBM web site with a simple online registration. In the FAQ, the documents, spreadsheet and presentation applications in Lotus Symphony in Windows and Linux were described to have the same functionality as the IBM Productivity Tools delivered in Lotus Notes v.8, but with different names. In the first week, 100,000 registered business and consumer users downloaded the free code (IBM, 2007k).

Inside IBM, the download Beta 1 site for employees was renamed from the Normandy code name to Symphony on the September 18 announcement date.[300] The contents on the internal download site weren't as polished as the public Internet page, with an extra file included that reflected the prior historic name.

By November 5, 2007, the Beta 2 version of Symphony became available, on the official TAP site.[301] Performance was noticed as better. Employees

[300]The September 2007 announcement of no charge software was a surprise to employees as much as to the public. The intranet download site wouldn't require employees to register in the same way as the general public on the external Internet. A notification appeared on an internal forum:
John A. Walicki | IBM Lotus Symphony now available internally | Sep 18 2007
"I'm working on refreshing the TAP page but I've posted the IBM LotusSymphony code for Windows and Linux at normandy.
Tomorrow I will likely move them to symphony."
Walter B. Farrell | Re: IBM Lotus Symphony now available internally | Sep 19 2007
"Thanks. Can you tell us the differences between Symphony and Normandy? Is one later code than the other?"
Derek Burt | Re: IBM Lotus Symphony now available internally | Sep 19 2007
"There is no difference other than the branding."
Albert T. Wong | Re: IBM Lotus Symphony now available internally | Sep 19 2007
"There are two different files in the folder. Which one should I pick?"
John A. Walicki | Re: IBM Lotus Symphony now available internally | Sep 19 2007
"Pick the Symphony installer dated Tuesday 9/18. The Normandy installer is from August.
The only difference is branding and Lotus shaved off some of the unused Lotus Expeditor components which made the install bundle smaller."

[301]The Technology Adoption Program has channels for reporting bugs, but employees were still referred to the submit comments on the public web site, even if they downloaded the software from the intranet site.
John A. Walicki | IBM Lotus Symphony Beta2 is now available on TAP | Nov 5 2007
"IBM Lotus Symphony Beta2 is now available on TAP. The Windows and Linux binaries are updated. You can download it from the TAP Download tab.
The Lotus Symphony team is interested in your feedback."
Mike Brown | Re: IBM Lotus Symphony Beta2 is now available on TAP | Nov 6 2007
"And very nice it is too. Much snappier performance than with Beta 1 on the Win XP version.
Are these speed improvements in Eclipse/Expiditor framework? And if so, can we expect to see a similar speed-up in the Notes 8.0.1 client?"
John A. Walicki | Re: IBM Lotus Symphony Beta2 is now available on TAP | Nov 6 2007
" Yes, On Linux, the Notes 8.0.1 Beta1 shaves 10 seconds off of cold start time. Its

were requested to provide feedback to developers, using the same web sites as the external public.

On December 18, 2007 on the external public web site, an initial Beta 3 version was posted with English language support, with the promise of translated menus in 24 languages within a few weeks. Some changes from the prior release included: more properties on the sidebar; autosave; presentation export to HTML or JPG; and improved performance and accessibility support in the Windows installer.[302] The web site now allowed visitors to leave comments, for which there many callouts for a Mac OS/X version to complement the Windows and Linux versions.

On January 2, 2008, the Beta 3 version was updated on the TAP site.[303] With more formal internal publicity of IBM Lotus Symphony and a projected launch date in mid-2008, the VP of Global Workforce and Workplace Enablement included a more personal message.

> Take a moment to download and begin using IBM Lotus Symphony. [. . . .]
>
> **Memo from Carol Sormilic**
>
> Dear team,
>
> I would like to ask our center of excellence to set a good example and start using the Productivity Tools (IBM Lotus Symphony Documents, IBM Lotus Symphony Spreadsheets, and IBM Lotus Symphony Presentations) in place of Word, Excel, and PowerPoint. They are installed with Notes 8 or available standalone as Lotus Symphony (see below). It's really up to us to take the lead on adopting the editors and demonstrating to others within IBM and in the industry that there is an alternative to Office on the desktop. Our team experts are John Walicki, Simon Cooper and Kenny Parciasepe and are great resource of information in you need help. It would be great for them to get input/feedback from you as you start migrating to these tools so that we can be aware of what the broader population may experience as they migrate, and to also see if there are any areas that we may need to address through communications, etc. I am sure this team is up to the challenge....[304]

This request to employees by an IBM executive signalled that IBM was

much snappier."

[302]The changes to Beta 3 were explainedby Yin Da Li, Symphony Level 3 Support Team Lead.

[303]Symphony Beta 3 was at the same address as Beta 2:
John A. Walicki | IBM Lotus Symphony Beta3 is now available on TAP | Jan 2 2008
"IBM Lotus Symphony Beta3 is now available on TAP. The Windows and Linux binaries are updated. You can download it from the TAP Download tab.
Read about the new capabilities of Lotus Symphony Beta3 here."

[304]Beta 3 on TAP on Jan. 16, 2008 would encourage IBMers to adopt Lotus Symphony, for the multiple national languages feature.

serious about moving forward from the legacy of Microsoft Office and the Windows XP operating system. An alternative to the mainstream Windows operating system included an Open Client for Linux, with version 1 released in November 2005 and version 2 released in June 2006 (IBM, 2007h; Sutor, 2008a; Ing, 2008). Employees sufficiently frustrated with Microsoft products provided on the Client for e-business (C4EB) had the option to move to an alternative operating system. On the Open Client for Linux, the Lotus Notes desktop client functioned the same as did on Windows computers, enabling e-mail and collaboration. In web browsers, Firefox was the corporate standard, not Internet Explorer. Microsoft Office was a legacy de facto standard for word processing, presentations and spreadsheets for which a native version on the Linux platform was not offered.[305] If IBM, as a corporation, could move away from Microsoft Windows XP and Microsoft Office, the transition would serve as a case study that opened possibilities at other organizations.

A Linux desktop environment is more popular amongst technical professionals. Another alternative to Microsoft Windows was also rising: Apple Mac OS/X. Some IBM employees were bringing their personal Mac laptops to work, and using them side-by-side their IBM-issued Thinkpads with the Windows Client for e-Business platform. The potential to move off Windows to Mac OS/X, not only within IBM, but also with enterprise customers, was not fully appreciated.

Between October 2007 and January 2008, IBM Research conducted a pilot study where staff were distributed MacBook Pro laptops, and were asked to use their standard Windows-based Thinkpads "as a last resort for applications not working yet on the Mac" (Dilger, 2008). Of the 22 users, 86% decided to keep the Mac laptop and obtain VMWare Fusion licences to run Windows applications when necessary. This finding would foreshadow the rise of Mac laptops in the public, and in businesses. The rise of Internet browsers was making the choice of an underlying operating system less relevant. Microsoft Office was the major application tying most computer users to the Windows operating system. The cross-platform varieties of Lotus Symphony, OpenOffice and StarOffice would further the vision of Internet interoperability.

On February 1, 2008, Symphony Beta 4 was released on the public IBM web site. This was positioned as a Developers Release, where Eclipse-based plugins could easily be installed for either standalone or composite applications.[306] Developers outside of IBM were thus provided the opportunity to easy build applications by extending the Eclipse platform, in the

[305] Microsoft Office XP actually runs quite well in the WINE emulator on Linux, but later upgraded versions would require reverse engineering and years of reporting bugs to similarly run smoothly.

[306] By Symphony Beta 4, the responses from IBM were not coming from development managers, but instead from technical specialists.

parallel with IBM's products now centered on Eclipse. With more than 400,000 people having downloaded the English version of IBM Lotus Symphony, Datamation named the yet-to-be-formally-released word processor as Product of the Year (Harvey, 2008).

On February 3, 2008, Beta 4 was released inside IBM on TAP. By now supporting plugins, this version moved the product from a standalone productivity suite into a package so that data could be integrated into other Lotus collaboration tools such as the Quickr, Unyte, and Connections platforms that were used daily by IBM employees.[307] Technical enthusiasts could extend, customize and share their plugins inside the company.

The Prerelease Candidate for Symphony was posted to TAP on May 11, 2008. New features were not being added, and improvements were mostly bug fixes.[308] The internal release of the Symphony 1.0 General Availability product was released internally on TAP on May 30, 2008.[309]

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[307] Plugins inside w3 were to encourage development of composite applications:
John A. Walicki | IBM Lotus Symphony Beta4 now provide plugin support | Feb 3 2008
"IBM Lotus Symphony Beta4 can be customized with plugins to extend the user interface with new capabilities and move data between Symphony and other applications. IBM plugins are coming for: Quickr, Unyte, Connections, Websphere Translation Server. The Symphony SDK includes API's for different developer communities; Java developers on Eclipse/Expeditor, Notes developers using LotusScript or OpenOffice developers.
Beta 3 previously introduced support for 23 languages in the user interface. You can now enjoy Lotus Symphony in your language of choice.
The Windows and Linux binaries are updated on TAP. You can download it from the TAP Download tab.
Read about the new capabilities of Lotus Symphony Beta4 here."

[308] Widespread use by IBMers reduced need for a public test release:
John A. Walicki | Symphony 1 PreRelease Candidate now available on TAP | May 11 2008
"The Lotus development team has implemented a wide variety of quality improvements to Symphony based on community feedback (both internal and external). Several hundred bugs have been resolved in this new release.
Symphony now includes the following new features: - High performance startup optimization with Java process being preloaded. [....] - Page Slider in Presentation Editor; - Validity List function in Spreadsheet Editor; - Default File Type Association setting for Open Document Type during Installation; - Silent Install; - Preference page now allows the user to select either the embedded or the system browser to open URL in document.
Download the Windows or Linux version from TAP.
Open Client users will be able to install this new release via IBM Easy Update on Tuesday."

[309] Symphony 1.0 code was locked by May 30, but IBM formally announces products on Tuesdays (i.e. June 3):
John A. Walicki | Symphony 1 GA is now available on TAP | May 30 2008
"Our internal deployment of Symphony begins today.
The Symphony 1 GA release for Windows and Linux is now available for download from TAP. Windows ISSI packages are being created and will be available in mid June.
Visit the Symphony TAP Offering for details.
There have been significant improvements since Beta 4:
Performance enhancements: - Provided performance optimization options for

On June 3, 2008, the general availability of IBM Lotus Symphony was announced as "a suite of free, ODF-based software tools (IBM, 2008i). Nearly one million beta users were cited. In addition to the free online, moderated support, IBM also announced IBM Elite Support for Symphony for unlimited remote support of large enterprises. A company of 20,000 employees could save $8 million in software license fees or $4 million in software renewal fees. While the direct competition was Sun StarOffice 8 (first released September 2005) and StarOffice 9 (to be released November 2008), the largest target would be Microsoft Office (particularly to customers who skipped Office 2007 released November 2006, anticipating further changes in the Office 2010 yet in the making).

By June 30, 2008, Symphony 1.0 was available for automated installation from ISSI, so that distribution and maintenance fixes could be scheduled and applied at a time convenient to the employee.[310] This was complemented with reiterations of the IBM CIO's official policy in architecture and standards, moving towards a preference for IBM Lotus Symphony.[311]

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starting up; - Critical crash and freezing issues are fixed; - Significant performance improvement following areas: - ODP files save performance; - Presentation page painting performance; - Creating a new document.
Interoperability with MS Office documents: - Added file format support for Microsoft PowerPoint .pps files, user can open and playback .pps files in Presentations; - Improved support for Chart rendering function.
Interoperability with OpenOffice.org and SmartSuite documents
Usability enhancements in Presentations, Spreadsheets, and Documents
Programmability: - The toolkit is enriched with more samples, and a general "hello world" plugin; - Extension points are enriched with the enablement of 3rd party contribution to root node of Preference settings; - Developers' Guide and Developers' Tutorial are updated; - Java API doc, developers' guide, and developers' tutorial in toolkit are translated to multiple languages.
Online Help: - Provided translation for 24 more languages;
Website: - The website is fully compliant with accessibility requirements; - Added Translated content for User Tutorials, Toolbar Reference Cards, Keyboard Reference Cards, FAQs, Demo scripts, Installation Guide, and Release Notes"

[310]Power users might download and manually install products, but official support channels presumed applications managed by ISSI:
John A. Walicki | Symphony 1 GA is now available for download from ISSI | Jun 30 2008
"You can now install Symphony 1 GA from ISSI. The ISSI software distribution global infrastructure will speed your installation of Symphony 1 GA."

[311]Inside IBM, uninstalling Microsoft Office on installing Lotus Symphony was announced on June 20, 2008:
IBM INTERNAL USAGE POLICY
"Open standards is at the heart of IBM's strategy and IBM Lotus Symphony supports this strategy in two key ways. First, IBM Lotus Symphony support Open Document Format (ODF) ISO26300 as well as support for Microsoft Office and Lotus SmartSuite formats. Second, IBM Lotus Symphony supports multiple client platforms (Windows, Linux, Mac) and has tight integration with the Lotus messaging and collaboration software portfolio. IBM CIO's official policy can be found on the Architecture and Standards home page.
FREQUENTLY ASKED QUESTIONS
Q: Is Lotus Symphony supported by the IBM help desk?
A: Yes.
Q: Can I use OpenOffice? Is Lotus Symphony compatible with OpenOffice?

Symphony was fully supported by the internal help desk, whereas the acceptable alternative of OpenOffice would have to rely on Internet community support. Instructions on how to uninstall Microsoft Office XP foreshadowed a future date when it would be removed without choice. ISSI included the no-charge Office Viewers available from Microsoft so that legacy documents could be viewed faithfully. Customer-facing employees with a need to have the current level of Microsoft Office products to work with clients could always petition for an exception, leading to automated installation from a restricted list on ISSI."}

On August 29, 2008, IBM Lotus Symphony 1.1 was released (Head, 2008). In addition to bug fixes, the memory footprint was reduced, and a variety of small feature enhancements were added. On November 4, 2008, IBM Lotus Symphony 1.2 was released, with spreadsheet improvements, Ubuntu support, and a Mac OS/X beta (IBM Lotus Symphony, 2008). The June 11, 2009 release of IBM Lotus Symphony 1.3 improved interoperability with Microsoft Office 2007 (IBM Lotus Symphony, 2009).

For this research study, IBM Lotus Symphony 1 is categorized as private sourcing. While employees were provided with internal sources by which the product could be provisioned, support processes followed conventional help desk procedures, and product feedback followed the structured path to formal channels.

A.7.10 (i) Private sourcing: IBM Lotus Symphony 1.1 for Lotus Notes and Domino 8.0.2

On August 26, 2008, IBM Lotus Notes and Domino 8.0.2 was released with the "Lotus Symphony office productivity tools" included (IBM, 2008d). This was a maintenance release, updating the feature from "IBM Lotus Productivity Tools" specifically to "Lotus Symphony", which would have been at version 1.1.

For this research study, IBM Lotus Notes and Domino 8.0.2 with Lotus Symphony 1.1 is categorized as private sourcing. This was an evolution of an existing program product, realigning the branding with the Lotus

A. Yes, OpenOffice can be used at IBM. Both Lotus Symphony and OpenOffice support the Open Document Format (ODF) standard. However, IBM Lotus Symphony is IBM's preferred editor as it has integration with the Lotus messaging and collaboration software portfolio [. . . .]
Q: Should I use Lotus Symphony in Lotus Notes 8.0.1 or the standalone version?
A: If you have a desktop capable of running Lotus Notes 8.0.1, we recommend that you run the integrated version. However, if this is not possible, we recommend that you run the standalone version. [. . . .]
Q: How do I uninstall Microsoft Office?
A: Use the ISSI package. Go to IBM Standard Software Installer (ISSI) and look for Microsoft Office Uninstall w/ Microsoft Viewers install. For more information visit the SocialBlue - Uninstall Microsoft Office Challenge
Q: Where can I get the free Microsoft Office file viewers?
A: IBM Standard Software Installer (ISSI)."

Symphony no-charge product freely downloadable over the Internet.

A.7.11 (j) Private sourcing: IBM Lotus Symphony 1.2.1 for Lotus Notes 8.5

While Lotus Notes and Domino 8 were released on August 2007, development of a native client for Mac OS lagged. A native client for Lotus Notes 7 had been available in the transition of Mac OS 10.4.9 when both the Power PC and Intel processors were supported. Beyond Mac OS 10.5, the support of only Intel processors would lead to a deprecation of the PowerPC platforms (IBM Support, 2012). This discontinuity would lead to no Lotus Notes 8.0 native client release for Mac OS, so that customers on that platform would jump from 7.0 to 8.5.

On January 19, 2008, the public beta for the Lotus Notes 8.5 client for the Mac OS was announced (while the Windows and Linux clients were still at version 8.0.1) (Lordan, 2008). There would be two versions to test for Mac OS: the basic client (evolved from the Notes 7 version), and the standard client (based on the new Eclipse Rich Client Platform).[312] The Lotus Notes 8.5 beta clients would work with Domino 8.0 servers.

On May 29, 2008, the public beta for Lotus Notes and Domino 8.5 (i.e. Lotus clients on Windows, Linux and Mac OS, and Domino servers on Windows and Linux) was announced (Kenney, 2008).

On January 6, 2009, at the MacWorld Expo, Lotus Notes 8.5 with Symphony 1.2.1 was announced for general availability (Brill, 2009).

For this research study, IBM Lotus Notes and Domino 8.5 with Lotus Symphony 1.2.1 is categorized as private sourcing. To placate customers using Mac OS/X, the Lotus Notes 8.5 client beta was released ahead of the other platforms. IBM Lotus Notes and Domino 8.5 would become significant program products with much success.

A.7.12 (k) Open sourcing: OpenDocument 1.2 approved as an OASIS Standard on September 29, 2011

Following the approval of OpenDocument 1.1 as a standard by OASIS and the ISO, additional features continued to evolve. This work was done collaboratively in subcommittees of the OASIS OpenDocument Technical Committee.[313]

[312] The Notes 8.5 Basic Configuration and Standard Configuration clients would be available on Windows, Linux and Mac OS/X. The Domino 8.5 Designer and Domino 8.5 Administrator would only be available with the standard (Eclipse RCP) client on Windows (IBM Support, 2009).

[313] Additional subcommittees have been formed. The OpenDocument Accessibility Subcommittee was formed in January 2006. Its work has already been described in the standardization of OpenDocument 1.1. The OpenDocument Requirements Subcommittee focused on post-ODF 1.2 specifications, beginning August 2008, putting its influence beyond the timeframe for this research study.

The OpenDocument Formula subcommittee started February 2006.[314] This subcommittee worked on a specification for recalculated formulas (e.g., spreadsheet formulas) in office documents. While OpenDocument already supported the inclusion of arbitrary formula languages for spreadsheet documents, this subcommittee focused on defining an application independent (and possibly restricted) formula language. The official roster listed three members from IBM, two from Microsoft and two individuals.[315] The subcommittee mailing list shows activity through early 2011.

The OpenDocument Metadata subcommittee started in March 2006.[316] The work of this subcommittee was to collect use cases where metadata is passed or stored along with OpenDocument documents, to classify them, and to derive a set of requirements for future versions of OpenDocument. The official roster listed two members from IBM, and two independent individuals.[317] The subcommittee mailing list shows activity through the end of 2008.

The new work on the OASIS standard in ODF 1.2 included:

- Addition of Spreadsheet formula language (OpenFormula)
- Digital signatures
- RDF XML/RDFa capabilities (semantic web)
- Native tables in presentation slides
- Redrafting of conformance language as well as other changes to conform to ISO/IEC Directives, Part 2.
- Many editorial issues resolved (Weir, 2011a).

In the evolution of implementations with standards working their way through OASIS and the ISO, "ODF vendors for the most part tend to offer anticipatory support for the latest OASIS ODF version".

On September 30, 2011, OpenDocument 1.2 was approved as an OASIS standard (Ensign, 2011). As of September 17, 2014, the ODF 1.2 version of the OpenDocument Format was passed a 3-month Publicly Available Specification ballot at the ISO (Weir, 2014) and entered the publication stage in May 2015.

For this research study, IBM's participation in OpenDocument 1.2 standardization through OASIS is categorized as open sourcing. Reviews through by multiple organizations and individuals across multiple coun-

The OpenDocument Advanced Document Collaboration Subcommittee focused on change tracking markup began in December 2010, also beyond the timeframe for this research study.

[314] David Wheeler of the OpenDocument Foundation set the kickoff teleconference on March 2, 2006. One of the early artifacts was a digest of a conversation with Dan Bricklin, the inventor of the original spreadsheet, Visicalc.

[315] Members of the OpenDocument Formula Subcommittee from IBM were Mingfei Jia, Rob Weir and Helen Yue.

[316] Patrick Durasau, an individual who was chairman of INCITS/V1 for the ISO, led the first organization meeting on April 13, 2006.

[317] Members of the OpenDocument Metadata Subcommittee from IBM were Mingfei Jia and Rob Weir.

tries were transparent and methodical.

With OASIS, the standardization of specifications lag implementations. The OpenDocument 1.1 specification approved February 2007 would be the native file format for OpenOffice 2 releases from October 2005 to September 2009.

A.7.13 (l) Private sourcing: IBM Lotus Symphony 3 (fork of OOo 3)

From 2006 to 2010, IBM document editing products – Managed Workplace Client, Lotus Productivity Tools, Lotus Symphony 1 – were a fork of the OpenOffice code base. Lotus Symphony 1.x and OpenOffice 2.x coevolved, each complying with the OpenDocument 1.1 specifications that had addressed accessibility concerns in v1.0.[318]

In September 2007, IBM officially joined the OpenOffice.org community (OpenOffice.org, 2007). IBM committed to "dedicate a core team of 35 programmers in China to the OpenOffice project", plus more people added as needed around the world (Weiss, 2007). Through 2008 and 2009, the OpenOffice 3.0 development project was largely driven by Sun Microsystems employees, largely out of Hamburg, Germany, where StarOffice development had been centered. By the end of 2007, Beijing was cited as "the second hot-spot for the development of OpenOffice.org and several derived products" with the IBM Lotus Symphony team and Redflag 2000 head office[319] leading a proposal to host the "first OpenOffice.org Conference outside of Europe".[320]

Development on OpenOffice 3 had already been ongoing in 2007, well before a formal timetable for release was set. By February 2008, the feature freeze for OOo 3.0 was set by the GullFOSS (OpenOffice Engineering) team at Sun (Timm, 2008). On May 7, 2008, the OOo 3.0 public beta was

[318]The initial version numbering doesn't match, because OpenOffice 1.0 had OpenOffice.org XML formats that IBM Lotus Symphony never supported. To align version numbers with OpenOffice 2.0, the first release of IBM Lotus Symphony would have had to be named v2.0. This alternative numbering could have introduced more confusion, as an elapsed continuation of the historical Lotus Symphony for DOS integrated office package from the late 1980s.

[319]Redflag 2000 was founded by the Chinese Academy of Science in 2000, releasing a OpenOffice distribution supporting the Uniform Office Format (UOF) alternative to Microsoft Office in 2002, first making code contributions to OOo in 2006 (Dong and Junge, 2011). In 2007, Redflag 2000 had 50 developers (Diedrich, 2007). The company became a member of OASIS in 2007, release RedOffice 4.0 in 2008, and RedOffice 5.0 in 2010. In February 2014, employees were terminated after government subsidies were not released (Wan, 2014).

[320]By 2007, Beijing had a strong OOo community: "Redflag 2000, IBM, Sun Microsystems, Intel and Novell have together more than 150 engineers in Beijing working on OpenOffice.org and their derived products". Don Harbison, a member of the IBM's open standards team serving as the liaison to OOo officially endorsed the proposal (Hongjuan and Junge, 2008). Of 913 ballots from OOo members, Beijing was awarded the 2008 conference with 597 votes (OpenOffice.org, 2008b).

announced (OpenOffice.org, 2008a). New core features included Mac OS X support, ODF 1.2 support, Microsoft Office 2007 import filters, Solver, Chart enhancements, native tables in Impress and enhanced XML support.

OpenOffice.org would release version 3.0 on October 13, 2008.[321] In addition to supporting ODF 1.2 and importing OOXML Transitional, OOo 3.0 would have a native Mac OS/X interface.[322]

On November 5, 2008, in a keynote address at the OOo Conference in Beijing, Michael Karasick, reviewed the evolution of Symphony to version 1.2.1, supported on Ubuntu Linux 8.0.4 and in the public beta for Mac OS/X.

> Karasick also pointed forward to the Symphony roadmap for 2009, when future generations of Symphony will be developed entirely on the ODF 1.2 and OpenOffice 3.0 software code base, bringing it in line with the newest OO technology. This advance will also enable seamless interoperability with Microsoft Office 2007 file formats and support Visual Basic macros next year. IBM plans to deliver more than 60 new features to Symphony in 2009, building it into a versatile tool for work while pledging to keep it free on the Web for all. By synchronizing Symphony's user interface with the underlying OpenOffice 3.0 code base, IBM expects the upcoming wave of planned contributions to make a significant impact to the OpenOffice developer community and its users throughout 2009 and beyond. [...]
>
> IBM Lotus Symphony is based on OpenOffice code, with IBM enhancements that allow new capabilities through Eclipse plug-ins and incorporate some of the OpenOffice 3.0 code. Plug-ins extend the power of the individual to accomplish more varied tasks with Symphony than they could otherwise accomplish with alternatives like Microsoft Office (IBM, 2008e).

While the OpenOffice product had been architected as a integrated application, IBM's use of the Eclipse platform on Symphony enabled developers to build plug-ins that would enable adding new capabilities, accessing additional data sources and customizing the user interface.[323]

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[321] The download popularity on the first day release of OpenOffice 3.0 would lead to crashing the web site (G. Kelly, 2008).

[322] OpenOffice 1.x and 2.x for Mac were ports of the published OOo code using X11 windowing system from Unix, result in slightly rough interfaces (compared to the native Mac OS/X Aqua theme). In 2007, Sun contributed some engineers to help with porting, and switched from writing to the Carbon APIs (which were better for Mac OS 8 and 9 over Unix) to Cocoa APIs (native on Mac OS/X).

[323] At August 28, 2008, some of the plugins were: Frameweb to import and export data from spreadsheets; Diff, to compare two documents; Sidenote, to temporarily store data in a sidebar; Toolbox, to collect links frequently used; Xforms, to embed structured data into a document; Omnifind Yahoo, to search the web from a document keyword; Exporting Presentation to Flash, as an additional converter; Rebranding to customize the user interface to a specific organization; Hyperion

On February 4, 2010, IBM Lotus Symphony 3 beta 2 was publicly released, "rebased on the current OpenOffice.org 3 code stream" and supporting OpenDocument format 1.2 (Boulton, 2010). Beta 3 was released in June, and beta 4 in August (McIntyre, 2010a; McIntyre, 2010b). On October 21, 2010, IBM Lotus Symphony 3 was formally released (Brill, 2010a).

For this research study, IBM Lotus Symphony 3 is categorized as private sourcing. The product was a fork of the open sourcing OpenOffice 3 code base. While the resulting product was made available as a free download at no charge, it was licensed as an IBM program product, and had formal defect support channels and plans.

A.7.14 (m) Private sourcing: IBM Lotus Symphony 1.3 and 3.0 (via ISSI)

The Symphony product had become available on the public IBM web site since September 2007, and on internal TAP site in January 2008. IBM Lotus Symphony 1.3 was formally released on June 11, 2009 (IBM Lotus Symphony, 2009). With this application now mature, the IBM Office of CIO was ready to begin migrating employees off Microsoft Office and towards a product based on OpenDocument format.

The standard personal computing desktop used by IBM employees worldwide is deployed and managed through ISSI (IBM Standard Software Installer). In September 2009, Lotus Symphony became a mandatory application to be installed on all employee computers (Postinett, 2009; Wuelfing, 2009). Within 10 days, Lotus Symphony 1.3 was installed through ISSI onto 330,000 computer desktops out of an employee population of 360,000. Prior to this change, Microsoft Office XP had been part of the standard desktop of an IBM employee. Microsoft Office XP, originally released on May 5, 2001, ended mainstream support on July 11, 2006, and would end Extended Support on July 21, 2011 (Microsoft, 2006b).[324] Employees who already had Microsoft Office XP installed on their workstations would be permitted to continue to use the product. A new computer issued to an employee would, however, not include Microsoft Office XP. Employees with a continuing need for Microsoft-specific features could use the License Request Tool in ISSI to request Microsoft Office 2003, documenting a business case to his or her management to unlock an automated

Essbase Spreadsheet, to display multidimensional data; Sendmail, to include the current document as an e-mail attachment; Database Connection to exchange between a relational database and a spreadsheet; Scanning, for multi-keyword search; Websphere Translation Server, for machine translation of text; Quickr Connector; and Forum Support (IBM Lotus Symphony, 2008).

[324] From Microsoft, mainstream support includes receiving requests "to change product design and features", "security updates" and complimentary no-charge support. Extended support includes only "security updates", and "paid support". After the transition, new product features are not included.

installation. An employee might also opt to manually install OpenOffice (with version 3.1 released in May 2009 and version 3.2 in February 2010) which supported OpenDocument format.

Removing a reliance on the Microsoft Office XP suite would also have removed a reliance on the Microsoft XP operating system. Standardizing on OpenDocument format with either Lotus Symphony or OpenOffice in 2009 would allow employees the freedom to chose their workstation platform based on Windows, Mac OS or Linux, and still have their computer deployed and maintained by ISSI.[325]

Since IBM was an enterprise customer that extensively used the IBM Lotus Notes 8.5 client, the integration with Symphony could provide some conveniences through the Eclipse plug-in architecture. In 2010, TAP made finding and enabling these options easier with a "Lotus Symphony Widgets and Plugins Chest".[326] The TAP offering complemented Symphony.

The upgrade to Symphony 3 rolled out shortly after the public release in October 2010, and the update to Symphony 3.0.1 after January 2012.[327] Employees choosing OpenDocument format could benefit by free features such as the Symphony ODF Mobile Viewer for Android and for iOS Novem-

[325] In a forum responding to platform choices at IBM, Andy Piper wrote on July 2, 2010: "Speaking as an individual, I'm free to choose and use Windows, OS X, or Linux. ISSI is still there on Windows and there are distribution mechanisms for the other platforms too".

[326] Some of plug-ins catalogued on TAP were available on the public IBM web site, while others were of more specific interest only to IBM employees:
TAP Wrap Up Review: Lotus Symphony Widgets and Plugins Chest | Karen L. Welty | Oct 27 2010
"After hearing user requests to improve, and help improve the experience with Lotus Symphony 1.3 and Vienna', innovator Paul Bastide, (IT Specialist, Lotus Symphony - Technical Enablement Specialist) decided that it was time for change and created the Lotus Symphony Widgets and Plugins Chest. The goal was to make features of Lotus Symphony that a person could build upon more visible! This addresses pain points which the lay user accepts, rather than complains about as a problem. Some of to date widgets and plug-ins within this collection include:
Side by side document compare - Compare documents side by side; IBM corporate Template - Corporate templates and features plug-in; IBM Wiki Commons Image Plug-in - Insert images from Wiki Commons; IBM DB2 Plug-in - Query DB2 and return data; Color Picker for Lotus Symphony- Enables you to find the RFB value from the active screen; PDF Export Widget - Quick Button to export to PDF (one of my personal favorites!); Simple BluePages Plug-in; And much more!
Paul Bastide, innovator and catalyst for the TAP innovation and has asked that it remain in TAP while he continues to evolve and enhance it with new features, widgets and plug-ins. Check out the innovation page here; your feedback and request for new features, plug-ins, widgets are welcome!"

[327] ISSI updates occur mostly unnoticed, with few incidents after extensive testing. Since IBM employees often work at a customer site or a home office, deployment can be deferred until the laptop connects to a a high-bandwidth connection in an IBM office.
D. Pearson | Symphony 3.0.1 Now Available On Public Website | Jan 18, 2012
"All – If you can't wait for Symphony 3.0.1 to be made available via ISSI etc ... you can download today by visiting our public website. If you want to know what has changed / what's new – see Release Notes."

ber 2011.[328]

On March 14, 2012, the discontinuation of Microsoft Office XP via ISSI was announced on the Symphony blog on the w3 Intranet.[329] For the majority of IBM employees, Symphony would become the office suite of choice on Windows, Mac OS and Linux. Site licenses for Microsoft Office deployments would become a way of the past, as ISSI could track the applications installed on each personal computer to produce a corporate inventory of software assets. Employees were still allowed to install instances of Microsoft products they had personally purchased, and the support for BYOD (Bring Your Own Device) as an alternative to working with the corporate-provided laptop had policies defined.

For this research study, IBM Lotus Symphony 1.3 and 3 deployed via ISSI is categorized as private sourcing. IBM's position on office productivity tools following open standards presented an exemplar that could be followed by other enterprise customers. The encouragement of automated installation of Symphony 1.3 and withdrawal of Office XP preloads in

[328]With tablets becoming more popular, a viewer would enable IBM employees to not have to carry their laptops to customer sites:
D. Pearson | Symphony ODF Mobile Viewer Posted To Android Market | Nov 21 2011
"The IBM Lotus Symphony Mobile Viewer for Android is now posted into the Android market.
Works with all ODF content - docs, sheets, presentations
The iOS Mobile Viewers should be in the iTunes App Store within the next week
Enjoy happy"

[329]IBM employees were not surprised by the corporate shift to Symphony, as the plans and motivation had been announced years earlier.
John A. Walicki | MS Office 2000 - MS Office XP Removal EzUpdate Rule now active | Mar 14 2012
"There is an EzUpdate rule now active that will remove MS Office 2000 / MS Office XP from your system. In November 2011, we communicated via a targeted memo to MS Office 2000 / MS Office XP users that this rule would be activated in 1Q2012.
If you have MS Office 2003, you will not be affected by the EzUpdate rule. You can continue to use MS Office 2003. However, if you have MS Office 2000 or MS Office XP, we want you to upgrade to MS Office 2003 (available on ISSI) or remove those outdated versions.
We're trying to sunset the insecure versions of MS Office 2000 and MS Office XP. Microsoft dropped support for MS Office 2000 in July 2010. They dropped support for MS Office XP in July 2011. There are unpatched security vulnerabilities in these old versions of MS Office. Macro viruses can attack them and spread malware within IBM. It is no longer acceptable from an IT Security perspective to allow you to continue to use the old versions of MS Office. Its time to remove this software from IBM workstations.
We want you to preferably migrate to Lotus Symphony 3.0. Anyone still running MS Office 2000 or MS Office XP will find that Symphony offers far more functionality than those old versions.
Alternately, only if your business case requires it, you can install MS Office 2003 from ISSI.
Microsoft Office 2003 (Software License Management or License Request Tool Users only) Standard Edition with SP3
We prefer that you use Symphony, but to be really clear, we're not taking MS Office 2003 away from anyone."

September 2009, the upgrade to Symphony 3 in late 2010, and removal of Office XP in March 2012 was a smooth plan and implementation.

A.7.15 (n) Open sourcing: IBM influences Oracle donation of OpenOffice to Apache

When OpenOffice.org was founded in 2000, the original vision was that there would be an independent foundation set up to govern community processes. The original announcement by Sun said "OpenOffice.org will be governed by the OpenOffice.org Foundation, which initially will be modeled on the Apache Software Foundation. OpenOffice.org Foundation's board will consist of members from the open sourcing community, the OpenOffice.org community, and commercial vendors, with Sun Microsystems as an equal member" (Cover, 2000). In February 2005, a "draft of proposed bylaws for the US version of Team OpenOffice.org" was shared on the council listserv, but critical mass with other geographic regions did not build (Suarez-Potts, 2005). The independent foundation would release contributors from having to assign joint copyright to Sun.[330] In November 2005, a birds-of-a-feather session at OooCon "Imagining an OpenOffice.org Foundation" was convened, but little immediate action followed (OpenOffice.org, 2005c).

IBM's joining OpenOffice.org in 2007 resurfaced some questions about a foundation independent from Sun (Weiss and Lai, 2007)}. With the commitment of a lab of 35 IBM employees in China, IBM's contributions would be significant in comparison to the resources from Sun. IBM cited its prior experience with Apache and Eclipse as a potential direction for OOo.[331]

[330] The Chair and Secretary of the OpenOffice.org Community Council was interviewed on a direction and challenges with forming an independent foundation: "The foundation has an appeal simply because OpenOffice.org would not be dependent upon a single sponsoring company, it would be rather dependent upon a consortium and on anonymous contributions, and so on. I'm sure it has some appeal to Sun, too, which would not have to disproportionately bear the cost of development: others would also participate. The problem is intellectual property, that is, OpenOffice.org's. At present, Sun holds copyright and contributors sign a joint copyright assignment form that jointly assigns copyright to Sun, but for a foundation to work, it would have to hold it. For what it's worth, I'm actively raising the idea of a foundation at this year's OpenOffice.org Conference, OooCon" (Chalifour, 2005).

[331] Official statements from IBM followed the OooCon 2007:
'We think that there's a broad-based consensus that some governance and structural changes are in order that would make the OpenOffice project more attractive to others,' Doug Heintzman, director of strategy for IBM's Lotus Software, said in an interview last week. 'It's no secret that this has been an issue for us for some time, and we haven't viewed OpenOffice.org as being as healthy as it might be in this respect.'
Besides committing 35 China developers to OpenOffice.org, IBM plans to make its voice heard – immediately and loudly. IBM will 'work within the leadership structure that exists,' said Sean Poulley, vice president of business and strategy in IBM's Lotus Software division. 'But we will take our rightful leadership position

In practice, the independent foundation did not come to fruition in the way promised in the charter, as Sun Microsystems' parallel interest in StarOffice saw them providing the majority of resources to the project. While Sun's leadership in managing the complexity of the OpenOffice technology might have been appreciated by StarOffice customers, less-than-fully-engaged volunteer developers might perceive bureaucracy in accepting their contributions. With the rising popularity of OpenOffice by 2008, friction within the OpenOffice community began to rise. The acceptance of contributions and passing through Quality Assurance was one point of friction:

> **[Roy Schestowitz]**: *How receptive has Sun been to contributions from the outside, based on your experience?*
>
> **[Charles-H. Schulz]**: I think this deserves both a simple and a complex answer. The simple answer is that Sun has built a fully open source — even Free Software — project though OpenOffice.org. By this I mean that contributions, code contributions among others are tested and integrated in the software we release. The source code is out there, the binaries as well, development process is done by collaboration through mailing lists and wiki, CVS (and now SVN).
>
> Going more into details, Sun has the technical leadership in the OpenOffice.org project. I personally don't have a problem with that. What this means is that sometimes, patches are refused on purely technical merit. Whether those decisions are technically debatable

in the community along with Sun and others.'
In e-mailed comments, Heintzman said his criticisms about the situation have been made openly.
"We think that Open Office has quite a bit of potential and would love to see it move to the independent foundation that was promised in the press release back when Sun originally announced OpenOffice,' he said. 'We think that there are plenty of existing models of communities, [such as] Apache and Eclipse, that we can look to as models of open governance, copyright aggregation and licensing regimes that would make the code much more relevant to a much larger set of potential contributors and implementers of the technology....
'Obviously, by joining we do believe that the organization is important and has potential,' he wrote. 'I think that new voices at the table, including IBM's, will help the organization become more efficient and relevant to a greater audience.... Our primary reason for joining was to contribute to the community and leverage the work that the community produces.... I think it is true there are many areas worthy of improvement and I sincerely hope we can work on those.... I hope the story coming out of Barcelona isn't a dysfunctional community story, but rather a [story about a] potentially significant and meaningful community with considerable potential that has lots of room for improvement...."
. . . Erwin Tenhumberg, community development and marketing manager for OpenOffice.org and a Sun employee in its Hamburg, Germany office where OpenOffice / StarOffice development is centered, acknowledged the criticism.
"There's a long tradition at Sun of not paying attention to outside contributors because there weren't many for a long time,' said Tenhumberg, who estimated that 90 percent of the programming in OpenOffice 2.0, the last major release from two years ago, was done by Sun employees'. (Weiss and Lai, 2007)

might perhaps be the case sometimes. But generally speaking there is no problem. It is – I believe – quite easy to find both corporate and independent contributors who submitted patches, code or anything you can find in the way of contributions who were able to do so without any difficulty, provided they were following the guidelines and that their contributions were technically acceptable. That being said, OpenOffice.org has a very, very complex code base. This in turn causes a problem that is often overlooked: you need to study the code and the architecture, and thus devote a significant amount of your time doing so before efficiently contributing to OpenOffice.org. That's why we always find it hard to recruit engineering resources: you don't contribute code with your left foot when you're patching OpenOffice.org. But I agree that everything should be done in order to lower the barriers of participation to our project.

[**RS**]: What role does QA play in the lifecycle of OOo development?

[**CS**]: Since we're developing an end-user software suite we cannot tolerate leaving our software at a low level of quality. Of course, there are always bugs and we have ramped up our QA teams and resources significantly over time. QA gets to register the builds, test them at various levels according to the development, localization and QA processes. It also approves and decides whether the builds should be released or not. So to answer your question directly: QA and the QA project play a central role in our development and release process. By the way, it should perhaps be noted that independent contributors outnumber Sun engineers by 10 to 1 inside the QA project (Schestowitz, 2009).

Through the development of OpenOffice 2.0 through the release of version 3.0 in October 2008, Sun Microsystems was the dominant contributor, with the volume of code well in plurality over all other organizations combined. While contributions from unfunded volunteer developers were welcomed, coordinating large teams of developers across multiple OpenOffice projects and managing expectations would lead to decisive milestones on fixed timelines. Contributions therefore might or might be accepted into the next scheduled release, potentially leading to duplicated activities would the deselected could feel that he or she had wasted effort.[332]

[332]Kohei Yoshida started working on a Solver for Calc in 2004. He continued to post his activities to the online issue page and mailing lists, yet was surprised when a project was announced for a student for Google Summer of Code 2005 when he had not yet posted his code. With an unsuccessful summer completion, Yoshida was asked to contribute his code to the ooo-build fork of OpenOffice. As technical questions arose, he then got busy with his first IT job. Yoshida was then challenged to write a specification firstly, and the code secondly. Upon getting a job with Novell, Yoshida was asked to change his license to LGPL, which he did. At the announcement of projects for OpenOffice 3.0, he was surprised to see a new project for Calc Solver, and was frustrated to again not see his work acknowledged (Yoshida, 2007).

For fixes that were stalled in OpenOffice development, a maintenance patch set emerged as *ooo-build*. In October 2007, ooo-build became an official fork of OpenOffice named as Go-oo (Go-Open Office), by including a Calc Solver not part of the official OOo plans (Meeks, 2007). Since the source code for the OpenOffice products were available as open source, some communities could choose to incorporate their preferred changes, over the choices made under the Sun-managed mainstream. In particular, some Linux distributions (e.g. Debian, Ubuntu, Xandros) would add on fixes and features that were not on the mainstream OOo distribution by using ooo-build (James, 2007). Resources to package OpenOffice into a Linux distribution were normally associated with the Linux community (e.g. Debian, Ubuntu) rather than the OOo team (e.g. Linux, Windows, Mac OS). The total number of people working on OpenOffice in 2007 was estimated at about 100 full-time equivalents, mostly from Sun, with Novell as a second, then Google, and Red Hat (with one full-time person), complemented with part-timers. As example outside the OOo development team, while Ubuntu was a major player in Linux who included OpenOffice in its distribution, the person responsible for packaging was a part-timer. Go-oo would make the activities of maintaining a package for a distribution easier.

The OpenOffice community noticed that the number of contributions by Sun started to decline steadily by spring 2008, and the number of independent volunteers was not increasing (Meeks, 2008). In summer 2008, rumours that Sun might drop out of OpenOffice.org development strengthened (Proschofsky, 2008). On the other hand, 2008 could also been seen as a successful year for OpenOffice.org development, with 900 child work spaces integrated into the code, 4300 issues (features, enhancements, bug fixes) dealt with, and 12750 reported issues demonstrating a healthy community (Hillesley, 2009).

For the company, 2008 was a tough year from Sun Microsystems (Vance, 2008). In an effort to improve its image, the Sun had a one-for-four reverse stock split in November 2007, but 11 months later, the stock price had fallen to the same per-share level. Declining sales of Unix servers led to multi-billion dollar financial losses for Sun at the end of 2008. Pressure for immediate action would have come from the Memphis investment firm known for activism that had bought 20% of the company. Company morale was reported as poor. A plan revealed Nov. 14, 2008, to lay off 15% to 18% of 33,500 Sun employees started with the first 1300 in January 2009 (Preimesberger, 2009).

With rumours of an acquisition swirling at then end of 2008, reporters were able to confirm negotiations with IBM as a potential buyer by March 2009 (Karnitschnig, Bulkeley, and Scheck, 2008). For some weeks, newsworthy leaks on negotiations and alternative suitors were reported. On April 20, 2009, Oracle announced that they had a definitive agreement

to acquire Sun Microsystems (Oracle Corporation, 2009). Without an independent foundation, the future for OOo under Oracle was unclear. While OOo operated on a budget of $92,000USD in 2008 and $79,000USD in 2009, the Mozilla Foundation had $75 million in revenue in 2007, and the Linux foundation received $5 million per year from corporate sponsors in addition to the contributed development and marketing resources (Lai, 2009).

Through the turbulent years of 2008 to 2010, pressure to reduce resources provided to OOo would come first from Sun's management, and then from Oracle's management. In October 2009, while the acquisition was being held up by European regulators, another 3000 Sun employees were laid off (Kincaid, 2009b). At the release of the OpenOffice 3.2.1 Release Candidate 2 on May 26, 2010, all of the Sun logos were replaced by Oracle logos.[333] By June 2010, the original January disclosure by Oracle of plans to lay off 1000 ex-Sun employees was raised financially from $325 million to somewhere between $675 million to $825, drawing questions about how the number of people to be terminated might have been lowballed (Preimesberger, 2010). In the fluid labour markets of Silicon Valley, far more ex-Sun employees may have chosen to left Oracle voluntarily, at the rate of "30 to 40 people per week" (Bort, 2012).

On September 28, 2010, "The Document Foundation" emerged in a surprise announcement, led by an initial steering group composed of European leaders in the OpenOffice development community.[334] "Oracle, who acquired OpenOffice.org assets as a result of its acquisition of Sun Microsystems, has been invited to become a member of the new Foundation, and donate the brand the community has grown during the past ten years. Pending this decision, the brand 'LibreOffice' has been chosen for the software going forward" (The Document Foundation, 2010a). The LibreOffice beta was supported by Linux providers Red Hat, Novell and Ubuntu (Vaughan-Nichols, 2010b). At the October 14 OOo council meeting, members of The Document Foundation were asked to "resign their offices, so as to remove the apparent conflict of interest their current representational roles produce' (Vaughan-Nichols, 2010a).

At the ODF Plugfest in Brussels on October 13, 2010, Oracle said that it was committed to continuing to support OpenOffice.org, with the release of OOo 3.21 and OOo 3.3 beta (Oracle Corporation, 2010a). On December 15, it released Oracle OpenOffice (renamed from StarOffice) 3.3, as well

[333] The OpenOffice logos were also refreshed with 3.2.1.

[334] The initial steering committee included exclusively European residents: André Schnabel (Germany), Caolán McNamara (Germany), Charles-H. Schulz (France), Florian Effenberger (Germany), Sophie Gautier (France), Italo Vignoli (Italy), Olivier Hallot (Portugal), and Thorsten Behrens (Germany). The list of deputies included additional countries: Christoph Noack (Germany), Claudio Filho (Brazil), Cor Nouws (Netherlands), Davide Dozza (Italy), Leif Lyngby Lodahl (Denmark), and Michael Meeks (United States) (The Document Foundation, 2010b).

as Oracle Cloud Office (Oracle Corporation, 2010b). This latter "web and mobile office suite" would never even have been demonstrated to the press.

Oracle had recently made its reputation of working poorly with open source communities worse. In August 2010, the open source community was shocked to hear that Oracle was suing Google, claiming that the Android operating system infringed on copyrights on Java (Niccolai, 2010). In developing Java, Google had included a Java-compatible technology called Dalvik built in a "clean room", without using any Sun technology or intellectual property.[335]

In December 2010, Oracle angered the open source community by refusing to provide a technology compatibility kit to the Apache Software Foundation for their open source implementation of Java. This led to Apache resigning from the Java Community Process executive committee.[336]

On April 15, 2011, Oracle announced "its intention to move OpenOffice.org to a purely community-based open source project and to no longer offer a commercial version of Open Office" (Undheim, 2011). While this change might superficially be viewed as positive, the deeper implications would be that Oracle would be that StarOffice-derivative products would not longer be supported, and technical resources would be laid off.

On May 31, 2011, Oracle announced that it would donate the OpenOffice branding and assets to the Apache Software Foundation. This was understood as a result of lobbying by IBM (Vaughan-Nichols, 2011b). While some perceived this as a snub to The Document Foundation, Oracle had previously demonstrated that working with foundations experienced working with enterprises (Kanaracus, 2011a). IBM's experience with the Apache Foundation and its processes in web services had been positive, blogged the IBM VP of Standards and Open Source:

> Though I had earlier heard of the Apache HTTP Server project, I really started learning about Apache about 10 years ago when IBM and others helped start projects related to XML and web services. That is, I discovered that Apache was a very significant organization

[335] In May 2012, federal judge William Alsup ruled that the Java APIs that Oracle was trying to assert can't be copyrighted (Mullin, 2012). In May 2014, a three-judge panel in Washington DC overturned the lower court decision, remanding the case back to district courts (Rosenblatt, 2014). In November 2014, the Electronic Freedom Foundation filed an amicus brief on behalf of 77 computer scientists (including five Turing Award winners, four National Medal of Technology winners, and numerous fellows of the ACM, IEEE and AAAS) that the justices should review the "disastrous appellate court decision" (Electronic Freedom Foundation, 2014). In 2014, Dalvik (which does just-in-time compilation) would be replaced by ART (Android Runtime, which does ahead-of-time compilation) in the Android 5.0 Lollipop release (Frumansanu, 2014).

[336] IBM moved over to the Oracle OpenJDK project when bylaws were changed to give it more control and influence, and left the Apache Harmony project (Kanaracus, 2011b).

> for creating open source software implementing open standards.
>
> In some sense, the value of a standard is proportional to the number of people who use it. An Apache implementation of a standard means that software, be it open source or proprietary, can start using the standard quickly and reliably. An Apache implementation of a standard immediately increases the value of the standard (Sutor, 2011).

On June 13, 2011, OpenOffice was approved as a podling (probationary project) by the Apache Incubator Project Management Committee (Ruby, 2011).

For this research study, the Apache OpenOffice formation and contribution by IBM is categorized as open sourcing. While Sun Microsystems may originally have had the intent to form an independent OpenOffice.org community at its inception in 2000, the change in governance did not occur until issues arose through the acquisition of Sun by Oracle. The forking by The Document Foundation into LibreOffice unbundled the dual licensing at the inception in 2000: LibreOffice is licensed under the more restrictive LGPL and Apache OpenOffice is licensed under the more permissive Apache license. While free software advocates might have preferred a single foundation working on single code base, the standardization of ODF 1.2 ensures interoperability across products that faithfully implement the specification.

A.7.16 (o) Open sourcing: IBM donates Symphony to Apache and contributes to OpenOffice 4

The way that a commercial company participates in the open sourcing community is constrained by licensing concerns. Any project is likely to include components licensed under a variety of licenses. A permissive license does not require that future generations of the work remain free, whereas a more protective license comes with share-alike requirements so that derivatives do remain free. Thus, a derivative work under a permissive license may be rebased under a difference license, whereas a derivative work under a protective license must retain the same license.

While the LGPL 2.1 continues to be a license that can be chosen, the introduction of the LGPL 3.0 opened some new opportunities. Combining (i) a work under a more permissive license with (ii) a work with a more restrictive license, leads to (iii) a derivative result that has to follow the more restrictive terms, as show in Figure A.2 (Wheeler, 2007).

The LGPL 2.1, originating from February 1999, recognized only the MIT/X11 and BSD-new licenses as legitimately open source.[337] The

[337] The LGPL license was revised to v2.1 in February 1999. The Apache License was revised to v2.0 in January 2004.

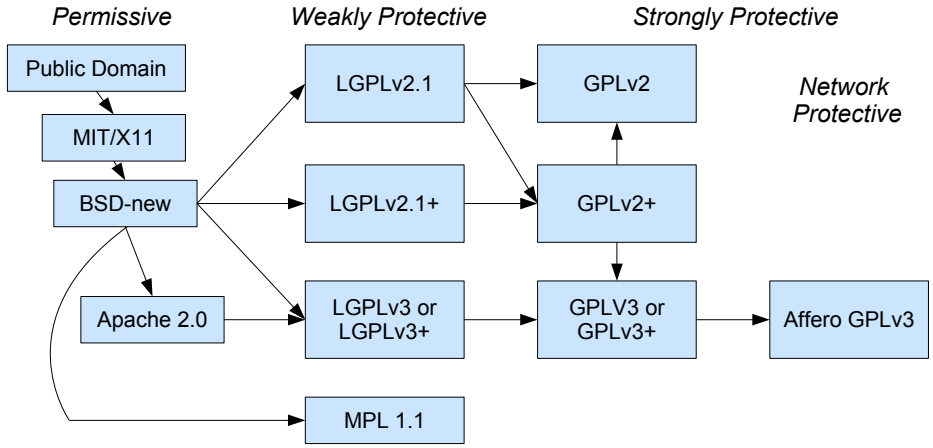

Figure A.2. Free-Libre / Open Source Licenses (Wheeler 2007)

introduction of the LGPL 3 in June 2007 additionally recognized Apache 2.0 as legitimately open sourcing.

While works licensed with the Apache license could be combined with works under LGPL 3, the reverse is not true, in an interpretation by the Apache Software Foundation:

> The Free Software Foundation considers the Apache License, Version 2.0 to be a free software license, compatible with version 3 of the GPL. The Software Freedom Law Center provides practical advice for developers about including permissively licensed source.
>
> Apache 2 software can therefore be included in GPLv3 projects, because the GPLv3 license accepts our software into GPLv3 works. However, GPLv3 software cannot be included in Apache projects. The licenses are incompatible in one direction only, and it is a result of ASF's licensing philosophy and the GPLv3 authors' interpretation of copyright law.
>
> This licensing incompatibility applies only when some Apache project software becomes a derivative work of some GPLv3 software, because then the Apache software would have to be distributed under GPLv3. This would be incompatible with ASF's requirement that all Apache software must be distributed under the Apache License 2.0.
>
> We avoid GPLv3 software because merely linking to it is considered by the GPLv3 authors to create a derivative work. We want to honor their license. Unless GPLv3 licensors relax this interpretation of their own license regarding linking, our licensing philosophies are fundamentally incompatible. This is an identical issue for both GPLv2 and GPLv3 (Apache Software Foundation, 2012).

IBM was a founding member of the Apache Software Foundation at its inception in 1999, and would have had a voice in crafting the Apache

Software License 2.0 in 2004. In order for any company to offer a private sourcing version of a work for which there was a free software counterpart, the Apache 2.0 license would be a practical choice.[338]

OpenOffice 1 and 2 were licensed under a LGPL 2.1.[339] From the June 2008 release of the beta, OpenOffice 3.0 was licensed under the LGPL v.3.0.[340] Sun's only derivative work from OpenOffice was StarOffice. IBM's derivative works from OpenOffice included the entire Lotus product line, which had been explicitly private sourcing. If IBM were to offer a commercial version of software products derived from open sourcing works,

[338]Enforcing software licenses are not only an arena for commercial providers, but also the Free Software Foundation.
... organizations that use open source software and also develop and distribute their own proprietary software, can find themselves in trouble due to the viral nature (copyleft) of some open source licenses. If one of your employees or contractors inadvertently includes some copyleft code in your proprietary product, then you could be required by that license to make the source code for your entire product freely available to the public. [....]
A subset of open source licenses, generally called 'permissive' licenses, are much more friendly for corporate use. These licenses include the MIT and BSD licenses, as well as the Apache Software License 2.0 that we use for Apache OpenOffice. Like other open source licenses, the Apache License explicitly allows you to copy and redistribute the covered product, without any license fees or royalties. But because it is a permissive license, it also allows you to prepare and distribute derivative products, without requiring you to make your own source code public (Apache OpenOffice, 2012a).

[339]The LGPL was preferred over the GPL, as use of the object code would not be restricted in the same way as the source code:
"7. **Why is the LGPL license being used?**
As a member of the GPL license family, the GNU LGPL or 'Lesser General Public License' will be used for the OpenOffice.org source code. The LGPL has all of the restrictions of the GPL except that you may use the code at compile time without the derivative work becoming a GPL work. This allows the use of the code in proprietary works. The LGPL license is completely compatible with the GPL license. [....]
12. **What is the essential difference between the GPL and the LGPL?**
When code licensed under the GPL is combined or linked with any other code, that code must also then be licensed under the GPL. In effect, this license demands that any code combined with GPL'd code falls under the GPL itself.
Code licensed under the LGPL can be dynamically or statically linked to any other code, regardless of its license, as long as users are allowed to run debuggers on the combined program. In effect, this license recognizes kind of a boundary between the LGPL'd code and the code that is linked to it."

[340]The change in licensing from LGPL v.2.1 to v.3.0 occurred while IBM was involved with the OpenOffice community.
"1. **Which licenses does the OpenOffice.org project use?**
Effective OpenOffice.org 3.0 Beta, OpenOffice.org will use the GNU Lesser General Public License v.3 (LGPL). Prior versions use v. 2.1. For the 1.x codeline, OpenOffice.org used as well the Sun Industry Standard Source License (SISSL). [....]
2. **Why is OpenOffice.org adopting the LGPL v.3?**
The switch to LGPL v3 was discussed by the OpenOffice.org project leads and was identified as a good step by the majority of the project leads. By switching to the LGPL v3, OpenOffice.org and Sun show a strong commitment to the LGPL and GPL version and open source in general. Version 3 has the advantage of being clearer in different aspects and offering better patent protection."

those original works could not be licensed under LGPL or GPL.[341]

At the creation of The Document Foundation in September 2010, the OpenOffice 3.3 code was forked to become the LibreOffice 3.3 release on January 25, 2011 (The Document Foundation, 2011)(e LibreOffice 3.3 continued to bear the LGPL 3 that OpenOffice 3.3 had.

LibreOffice 4.0, at its release in February 2013, would retain the LGPL 3 for Linux distributions, and change to a dual license of the LGPL 3 and Mozilla Public License (MPL) Version 2 for other platforms.[342] On January 3, 2012, the MPL 2 had been released, which recognized the mixing of free and non-free software in a larger work.[343] While the more restrictive MPL

[341]Google similarly chose the Apache license over GPL for the Android operating system:
"Although the underlying Linux kernel is licensed under version 2 of the Free Software Foundation's General Public License (GPLv2), much of the user-space software infrastructure that will make up the Open Handset Alliance's platform will be distributed under version 2 of the Apache Software License (ASL). [. . . .] Permissive licenses like the ASL and BSD license are preferred by many companies because such licenses make it possible to use open-source software code without having to turn proprietary enhancements back over to the open source software community. These licenses encourage commercial adoption of open-source software because they make it possible for companies to profit from investing in enhancements made to existing open-source software solutions" (R. Paul, 2007).

[342]While accepting works licensed under Apache 2.0 into LGPL 3 is feasible, n:
Instead of using Apache 2, they'll be using a dual licensed approach with LGPL 3.0 and the Mozilla Public License (MPL) Version 2.0.
The Document Foundation is doing this for two reasons. First, it will make it easier to 'incorporate any useful improvements' from Apache 2.0-licensed OpenOffice code into LibreOffice.
Second, they believe that the MPL licensing will provide 'some advantages around attracting commercial vendors, distribution in both Apple and Microsoft app-stores, and as our Android and iPhone ports advance in tablets and mobile devices.' In short, this is a move to help make future tablet versions of LibreOffice, due out in late 2013/early 2014 more compatible with Android, iOS and Windows Phone 8 app. store restrictions.
On Linux, however, LibreOffice will continue to be under the LPGLv3. 'As the migration continues, and for the foreseeable future on free-software platforms we will continue to distribute our binaries under the LGPLv3 - in addition to the existing mix of external component licenses.' (Vaughan-Nichols, 2013b).

[343]The MPL 2 is recognized as a free software license by the Free Software Foundation. It has, however, the feature of appreciating a *larger work*:
"Our solution was the second sentence of MPL 2.0 Section 3.3:
> If the Larger Work is a combination of Covered Software with a work governed by a Secondary License, and the Covered Software is not Incompatible Software, You may additionally distribute such Covered Software under the terms of that Secondary License, so that the recipient of the Larger Work may, at their option, further distribute the Covered Software under the terms of either this License or that Secondary License.
This clause permits someone to combine MPL and GPL ('Secondary License') code, and distribute that combination (the 'Larger Work') under the other license, but with two key features that help keep code under the MPL for as long as possible:
1. First, the Larger Work must be 'a combination of Covered Software with a work governed by a Secondary License.' So you can't just say 'I really prefer GPL' – you must combine with another, existing GPL work. Compare this to a traditional dual-license, which does not require you to combine – you can just roll out of bed and say 'I've decided to be GPL-only.'

2 license could apply to the whole of the larger work, each of the parts (e.g. licensed as Apache 2.0) could retain their permissive features. In May 2012, the LibreOffice team announced that they would "rebase our codebase on top of the code that has been released under the Apache License by Oracle. This will allow us to incorporate any useful improvements that are made available under that license from time to time".[344] While developers could contribute their code to Apache OpenOffice that could make it eligible to also be included into LibreOffice, the community was advised: "There is no guarantee that your code will make it across, and as the code bases continue to diverge the work required to do this will increase. If you want your code in LibreOffice, the best way to do that is to contribute it directly there".

The May 31, 2011 announcement by Oracle of the donation of OpenOffice to the Apache Software Foundation initiated the legal foundations for IBM to move forward. On June 13, 2011, with the approval of OpenOffice as a podling at Apache, IBM's participation the OpenOffice community was given a fresh start (Weir, 2011b; Vaughan-Nichols, 2011a). The standalone version of Lotus Symphony – over 3 million lines of code where GPL/LGPL dependences had already been replaced – were contributed under an Apache 2.0 license. The updated IAccessible2 work for assistive technologies and VBA macro support for Microsoft Office interoperability would be new features. In addition, IBM would propose a new ODF Toolkit of Java libraries for lightweight server-based document processing applications as an incubation project at Apache.

While the source files were physically migrated within 4 months, the audit of Intellectual Property review and clearance process for a clear Apache 2.0 license would require deprecating or finding replacements for third party code modules not included in the original Oracle Software Grant (Harbison, 2011). The OpenOffice 3.4 beta 1 was in progress, having

2. Second, you can 'additionally distribute' under GPL. In other words, you must also comply with MPL, and must make available to your recipients under both MPL and GPL. Someone downstream from you can 'at their option, further distribute' under GPL-only or MPL-only – as required by GPL – but you don't have that option. This ensures that one distribution is done under both licenses, and those changes therefore have at least some opportunity to be merged back into the upstream release. Again, this is superior to the dual-license, which can't guarantee any releases under a compatible license.
These clauses give us the best of both worlds. The interests of MPL users are protected by ensuring that it is only used when necessary, and that at least one initial distribution must be under the MPL – and therefore can be integrated back into the original project. At the same time, GPL users are protected by ensuring that there is still a useful path for reuse in GPL projects when that is necessary and makes sense" (Villa, 2011).

[344]While the rebasing might lead to a conclusion that LibreOffice is "powered by Apache", "only around 6% of the files in the Apache project have any code change beyond changing the license headers". The LibreOffice code base is quite large, and the majority of functions had been proven through use, so the changes added by Apache Office would initially be incremental.

been released on April 12, 2011 (OpenOffice.org, 2011a). There were two alternative approaches to merging the OpenOffice code with the Symphony code: (i) make Symphony (which had been based on OOo 3.0) the new code base, and merge back in the improvements made to OpenOffice 3.4; or (ii) make OpenOffice 3.4 the code base, and merge in features from Symphony. The former would require reviews that would take longer, and would be more disruptive to non-IBM developers. The latter would be slower to take advantage of Symphony features, and would require deeper involvement from the IBM Symphony team (Weir, 2013b). The second "slow merge" path was chosen, leading to the release of Apache OpenOffice 3.4 on May 8, 2012 (Apache OpenOffice, 2012b).

Of the 26 members of the OpenOffice Project Management Committee, 8 were IBMers, include 5 developers who had been working with OpenOffice and StarOffice with Sun.[345]

Apache OpenOffice 4.0 was released on July 23, 2013 (Weir, 2013a).[346] The sidebar functionality from Symphony was migrated to OpenOffice 4.0, and interoperability with Microsoft Office was improved (Apache Openoffice, 2013).

On December 4, 2014, IBM discontinued support for Lotus Symphony (IBM, 2014e).

For this research study, the donation of Symphony to Apache and the contributions of resources leading to OpenOffice 4 is categorized as open sourcing. When Oracle was no longer interested in developing OpenOffice, IBM hired some of the employees from the StarOffice team in Germany. In addition, some of the resources from IBM Symphony team in Beijing were assigned to help in the merging with OpenOffice.

A.7.17 (p) Private sourcing: Project Concord, LotusLive Symphony, IBM Docs

At the Lotusphere conference in January 2010, IBM demonstrated "Project Concord, a set of collaborative web editors that will be part of the new LotusLive Labs in Q2 2010" (Brill, 2010b) The demonstration included "collaborative document editing, contextual commenting, smart tables, and task and attention management", working with "installed editors (e.g. Symphony), browser users, and even mobile users".

At Lotusphere in January 2011, Project Concord was unveiled as LotusLive Symphony with Tech Preview 2 available at greenhouse.lotus.com

[345] IBM employees on the OpenOffice PMC included Donald P. Harbison, Yong Lin Ma, and Rob Weir. Previous Sun employees in Germany hired by IBM in September 2011 included Andre Fischer, Armin Le Grand, Herbert Dürr, Jürgen Schmidt and Oliver-Rainer Wittmann.

[346] The challenge of moving Symphony features to OpenOffice 4 continued: "... there was no beta for AOO 4.0. We've focused more on formal QA than ad-hoc 'testing' by end users. But we are discussing whether or not to have a public beta for AOO 4.1" (Weir, 2013c).

(Brill, 2011a). By August 2011, LotusLive Symphony Tech Preview 3 was released, with improved functionality in presentations (Perrin, 2011; Brill, 2011b). In January 2012, LotusLive Symphony became renamed as IBM Docs with an official beta, complemented by document storage features in IBM SmartCloud Engage (Brill, 2012a). In September 2012, beta 2 of IBM Docs was available on Lotus Greenhouse (Brill, 2012b).

In December 2012, the IBM Docs technology became available as part of the SmartCloud for Social Business line, packaged as a monthly per-seat offering either as IBM SmartCloud Docs (at $3 per user per month) or part of IBM SmartCloud Engage Advanced (at $10 per user month, including e-mail, blog and wiki features).

For this research study, IBM Docs (renamed from LotusLive Symphony and the code name Project Concord) is categorized as private sourcing. While the underlying code base was clearly related to prior work on Lotus Symphony, based on OpenOffice 3, the user interface was migrated from personal computers to web browsers (potentially on tablets), and collaborative real-time co-editing features were added. Releases were managed through a tech preview and then official beta, before general availability as a program product.

A.7.18 Prospects: Collaborative document authoring continues to evolve from legacy personal computing with emerging web standards

IBM's primary interest in collaborative document authoring has been primarily to enable better sharing of Internet documents on enterprise intranets. The path starting from IBM Managed Workplace Client Documents released in January 2006 through IBM Docs released in January 2012 led dealing with a legacy of standards with a heritage back into personal computing document formats. The mindset of personal computing for documents would dominate for many years, until the rise of browser-based editing (e.g. with Google Chrome betas introduced in September 2008), tablets (e.g. with the iPad introduced April 2010), and cloud-connected thin client laptops (e.g. Chromebooks introduced June 2011).

Coauthoring was introduced by Microsoft in Office 2010, with a central server either as Sharepoint 2010 on an intranet, or with Skydrive as a public cloud (Webb, 2010).

Google Docs and Sheets were first introduced as a beta in October 2006, as derivations of Writely and Google Spreadsheets (Mazzon, 2006). The native file formats has not been publicly disclosed, with access to data provided via APIs.[347] By August 2007, "87% of Google employees worldwide used Docs & Spreadsheets in the past week and 96% have used it in the

[347]The Google Docs APIs were first released in August 2007, with sample for coding in Java and Python. . The Google Documents Lits API v1 and v2 were deprecated on April 20, 2012, in favour of Google Drive.

past month. Googlers have created and shared more than 370,000 documents and spreadsheets and they create more than 3,000 new ones each day" (Norton, 2007). With initial support to import and export .doc and .xls formats, as well as ODF 1.1 .odt and .ods format, the OOXML Transitional .docx and .xlsx formats were added on June 1, 2009 (Sabharwal, 2009). "Google Cloud Connect for Microsoft Office", a free plugin offered to enable simultaneous editing amongst author on Windows computers only, was announced in February 2011 and discontinued in April 2013 (Sinha, 2011; Google, 2013). To enable native editing of .docx and .xlsx formats on Chromebooks, Google acquired Quickbooks in June 2012 (Gruman, 2012). Quickbooks apps for Android and iOS was announced in September 2013 (A. Warren, 2013). The announcement of mobile apps for Docs, Sheet and Slides for Android and iOS announced in April 2014 (Levee, 2014), led to retirement of the Quickbooks brand in June 2014 (I. Paul, 2014). In June 2014, Google Docs enabled native editing of .docx files in a browser, without conversions on upload and download (Ravenscraft, 2014).

Microsoft entered the cloud productivity market with the introduction of Office 365 in July 2011 (Schonfeld, 2011) . The introduction of Microsoft Office 2013 in January 2013, combined with a Skydrive cloud account, enabled coediting by multiple authors simultaneously from Windows computers, as long as they are not both working on the same paragraph (Arar, 2013).

Document editing on personal computers is now a mature technology, with a small minority of authors that use more than a fraction of features available from affordable or free products. Realtime coediting over the Internet is a new technology that has been adopted by pioneers that could take decades to become mainstream.

The decision by the UK government to require OpenDocument format led an expectation that Google Docs might support ODF 1.2 by mid-2015 (Phipps, 2014).

A.8 Summary: Open sourcing has coevolved with private sourcing, as new ways of collaborating are uncovered

While emerging technologies have been at the core of the seven preceding case studies, there is more to operating in open sourcing with private sourcing than just software code and legalities of licensing. Voluntary participation, cross-organizational committees and industry standardization all show a way of working. A larger context to examine these follows in Chapter 5.

B. Backgrounds to the phenomena: five contexts

In Appendix A, open sourcing while private sourcing was described as a phenomenon in seven cases. Over a decade, these cases had sometimes sequential and sometimes nearly contemporaneous events were learnings in one could influence another. In addition, the individuals involved in depth in one case might be an influencer or participants in another. In this Appendix, five overarching background contexts are described as the background for open sourcing while private sourcing between 2001 and 2011:

1. IBM's senior managers, from 2001, advancing strategic bets on future drivers of industry, business, computing and marketplace;
2. IBM employees, since 1996, engaging online with w3 intranet platforms for global knowledge exchanges and social sharing;
3. IBM consultants, from 2004, probing to confirm business priorities through industry-based executive studies;
4. IBM researchers, from 2004, exploring social changes influencing new organizational and technological opportunities on longer horizon; and
5. At large, from 2000, businesses, creatives, governments, makers and academics, taking up open sourcing.

These contexts coincided with an atmosphere of positivity and collaborative teaming amongst IBMers for a decade. More detail is provided in each of the sections following.

B.1 IBM senior managers, from 2001, advancing strategic bets

The *network-centric computing* vision presented by IBM CEO Lou Gerstner did not get the attention of Wall Street analysts in 1994, nor did it resonate at Comdex presentations in 1995 (IBM, 2011b). When the idea was refined less technically and enterprise customer started to appreciate what the Internet might do, *e-business* became the galvanizing mission for IBM in 1999.

> We infused it into everything – not just our advertising, product planning, research agendas, and customer meetings, but throughout our communications and operations – from my e-mails, broadcasts, and town hall visits to the way in which we measured our internal transformation. It provided a powerful context for all of our businesses. It gave us both a marketplace-based mission and a new ground for our own behaviors and operating practices – in other words, culture.
>
> Most important, it was outward-facing. We were no longer focused on turning ourselves around. We were focused on setting the industry agenda again. We shifted the internal discussion from "What do we want to be" to "What do we want to do" (Gerstner, 2002, p. 320).

The e-business vision not only presented a future for enterprise-scale customers, but for the ways that IBM itself would change (Sager, 1999). In business and the Internet, the "real revolution" would be when "big business turns e-business" (Economist, 1999).

In 2000 and 2001, the confidence in Internet-based businesses shifted from buoyant to shaken. The NASDAQ index peaked in March 2000, and the *dot-com* bubble burst into a *dot-bomb* shakeout of new e-commerce startups (Madslien, 2010; Economist, 2000). At March 2001, the NASDAQ market had lost 60% of its value, and NYSE, European and Japanese markets had fallen to lows of 2 to 3 years earlier (BBC News, 2001). After the terrorist attacks of 9/11, stocks fell further (Ulick, 2001).

The IBM 2001 annual report, published in April 2002, reflects much of the context for the industry in the prior decade. The cover was a letter by outgoing CEO Louis Gerstner that acknowledged recent challenges, yet foreshadowed a future with even greater change for the industry:

> I want to use this occasion to offer a perspective on what lies ahead for our industry. To many observers today, its future is unclear, following perhaps the worst year in its history. A lot of people chalk that up to the recession and the "dot-com bubble." They seem to believe that when the economies of the world recover, life in the information technology industry will get back to normal.
>
> In my view, nothing could be further from the truth.
>
> Louis V. Gerstner (IBM, 2001)

Inside the annual report, the shift that was foreseen was "that customers are finally driving the direction of the information technology industry".

IBM's direction, looking forward, was described as a "handful of strategic bets on the future drivers of industry".[348]

1. The New Industry Model: *Innovate or Integrate*

[348]The "IBM Strategy, New Models for the Future" direction was also excerpted from the Chairman's Letter of IBM's 2001 annual report, pp 3-7, for emphasis in a standalone strategy decument.

2. The New Business Model: *Services-Led*
3. The New Computing Model: *Infrastructure Plus Ubiquity*
4. The New Marketplace Model: *An Open Playing Field*

Prior to 2001, IBM has participated in the rise of the Internet, and in open standards. The execution of the strategic bets would be left in March 2002 to the new CEO Sam Palmisano, as Lou Gerstner stepped down (Kirkpatrick, 2002). This 2002 formal statement of strategy set a foundation for strategies that included open sourcing while private sourcing. The implications of each of the four drivers is described below.

B.1.1 IBM would lead the industry by both innovating and integrating

The IBM 2001 annual report saw industry survival as *either* innovating *or* integrating, but industry leadership as *both* innovating *and* integrating. This was the first strategic bet on the future drivers of the information technology industry.

Innovation that in the 1960s and 1970s had come from vertically integrated technologies companies ...

> ... had given way by the early 1990s to a dizzying array of "pure play" companies (specialists in PC, databases, application software and the like). This explosion of entrepreneurial and technical creativity was, on the one hand, a testament to our industry's enduring power. [...]
>
> As I/T moves out of the back office and into the executive suite, value and growth in our industry are driven less than they used to be by technical innovation or product excellence, as necessary as those remain. (IBM, 2001, p.3)

IBM could approach executive suite leaders with a message of innovating for value and growth, whereas niche companies would approach functional managers with the promise of technical innovation or product excellence.

The fragmentation of technologies and initiatives led to the need for integration work to be contracted with professional services companies. With technology and services coming from two different sources, the weight of transformation had to be borne by customers.

> What matters most today is the ability to integrate technology into the lifeblood of business. The people who help customers apply technology to transform their businesses have increasing influence over everything from architecture and standards to hardware and software choices and partners (IBM, 2001, p. 3).

IBM's strengths had traditionally been as a full-service, one-stop provider. The strategy going forward would be for IBM both to innovate and to

integrate, both in the technological and organizational senses.

One way in which IBM would simultaneously innovate and integrate is by open sourcing while private sourcing. *Innovating* through open sourcing features divergent and convergent phases, but often lacks the credibility to break through to enterprise scale implementations. Private sourcing appeals to a customer preferring predictability and low risk in the technologies that the organization practically adopts and maintains. IBM could make open sourcing credible, complementing its traditional private sourcing offerings. *Integrating* the mix of open sourcing and private sourcing components would be a responsibility that IBM would take on, for enterprise scale companies. Working with industry committees on open standards would allow customers the possibility of alternative providers, allying fears of technology lock-in. Both innovating and integrating restored an emphasis on the business value of technology, counter to the leaps of faith leading to dot-com crash.

B.1.2 IBM would evolve *e-business* from *services-led* to *on demand*

The IBM vision of e-business was essentially the adoption of Internet technologies inside enterprise-scale organizations. The heritage of IBM relied on revenue streams from the 1980s on mainframe computing, and from the 1990s on client-server systems. In 2001, the success in professional services was heralded with IBM Global Services as "the world's largest and most innovative consultancy, systems integrator and strategic outsourcing leader". However, the 2001 annual report foreshadowed the shift from selling hardware, software and IT services with a further disruption of:

> ... utility-like delivery of computing – from applications, to processing, to storage. We see the beginnings of this trend in Web hosting and our own "e-business on demand" offerings, where customers don't buy computers, but acquire computing services over the Net, on a pay-for-use basis IBM, 2001, p. 3.

This second strategic bet represented a new business model, not just in professional services, but web technology services between machines (via machine-readable formats, e.g. XML and JSON). This vision of e-business evolving to computing as a utility would require development of virtualization technology and new business models that would be known as *cloud computing* after 2006.

In 2002, the IBM messaging on e-business shifted to an *e-business on demand* model described with three major components:

- IBM infrastructure on demand of core services (i.e. processing, storage and bandwidth);
- IBM business process on demand: pre-integrated software from IBM

and IBM Business Partners encompassing horizontal and vertical business processes; and

- Know-how: worldwide consulting support from IBM and IBM Business Partners to ensure best practices integral to every solution (Services, 2002).

For customers to migrate from in-house provisioning of computing resources, implementations by a variety of information technology providers would have to coevolve with emerging industry standards. This would be a race of open sourcing while private sourcing, where the value of a reliable utility would be challenged with disruptive innovations. The "service-led" vision of e-business on demand was organizationally positioned at IBM Global Service (and in the Strategic Outsourcing unit, in particular) as well as the extended IBM business partner community. The evolution of transforming an organization from product orientation towards a services and software business would continue through to the IBM CEO following Sam Palmisano in 2012, Ginny Rometty.

B.1.3 IBM would invest in enterprise systems, integrating middleware, and specialized high-value components

Under Lou Gerstner, IBM's investments had followed a "barbell" pattern: the highest value was seen in early electronic components parts and later services; lower value would come in the middle computer manufacturing parts. This led to IBM entering joint partnerships to develop and produce PowerPC chips for Apple Macs and Sony Playstations.[349]

> Gerstner ... sketches his vision on the easel in his office: a vertical barbell. The big weight at the bottom is components. At the top end is services. The skinny bar in the middle is everything else: PCs, servers, network gear.
>
> Profits are moving to the ends of the barbell, Gerstner says. The companies in the middle? "They're becoming assemblers. The value is being pulled down to the people who have the real underlying assets." Look at Intel and its 23% aftertax margin: "They're at the bottom of the chain–and they make all the money."
>
> The barbell is especially tough on IBM. In the one market it still dominates – mainframes – prices drop so fast that IBM had to sell twice the horsepower in the first half to muster a 10% rise in revenue. IBM's services business is booming ..., but profit margins are lower than in hardware (Lyons, 1999).

The barbell pattern would lead IBM to de-emphasize some industry segments to the point of effectively exiting them. As examples, IBM left

[349] A history of chip–making at IBM published March 30, 2014 was titled "POWER to the people".

enterprise application software to companies like SAP and left networking hardware to companies like Cisco, while providing customers with middleware software to integrate across information systems.

In the 2001 annual report, the third strategic bet as on "a new computing model: infrastructure plus ubiquity". The rise of the Internet would see computing workloads moving back to the industrial-scale server technologies. Mobile phones, videogame consoles and television set-top boxes would soon decline in price within the reach of consumers. The pervasive computing trend that would become the Internet-of-Things would take hold a decade later.

By 2002, e-business was getting traction as a trend. It was a vision moving away from client-server computing based on personal computers that relied on private sourcing connections to specific server hubs. It was a vision moving towards *network-centric distributed computing* where intelligent devices and computers could connect in a variety of ways through middleware based on open standards.

> This meant that, on one end of the scale, the workload was moving back to the infrastructure – to industrial-strength servers, storage, databases and transaction-management systems. On the client end, it has spawned a proliferation of network-connected devices of all kinds: PDAs, cell phones, videogame systems, set-top boxes and beyond – to the whole pervasive-computing world of embedded components in everything from household appliances, to medical devices, to cars. And tying it all together was an emerging category of software with a wonderfully descriptive name, which hardly anybody had heard of five years ago – middleware IBM, 2001, p. 4.

In the decade 2001-2011, the technologies of an e-business on demand vision would include (i) virtualization and cloud computing platforms, where operating systems would run on software emulators across private and public domains rather than bare metal physical machines, (ii) new devices with embedded technologies, such as smartphones and tablets; and (iii) middleware in a service oriented architecture that rationalized application functions into reusable and more manageable web service components.

IBM would continue to focus on being a provider to businesses rather than to end consumers. As the technology evolved, the company would have to simultaneously advance its investments in private sourcing, while participating with open source communities on evolving standards.

B.1.4 IBM would turn toward open architectures and common standards

Until its termination in 1996, IBM leadership was conscious of a 1956

consent decree with the U.S. Department of Justice (Passell, 1994; Justice, 1996). The decree, a settlement so that an anti-trust investigation would be ceased, required IBM to sell its machines as well as to lease them, and to continue to provide services and parts for computers no longer owned by IBM. The provisions were terminated for (i) personal computers and workstations by January 1996, (ii) midframe computers (e.g. AS/400 products) by 2000, and (iii) mainframe computers (e.g. S/390 products) by 2001. The weight of the consent degree, said Lou Gerstner in his outgoing chairman's statement in the 2001 annual report, had IBM "so acutely aware of the siren call of proprietary control that we have learned to resist it".

The fourth strategic bet on "an open playing field", in a networked world of computing. Private sourcing would not be the only way IBM would deal with customers. Participating through open sourcing would enable both IBM and other technology providers to have interoperable platforms for the benefit of its clientele.

> In a customer-driven world, open architectures and common standards are inevitable.
>
> Today, we are focusing all our technical expertise and marketing energy – previously devoted to creating and marketing self-sufficient systems – toward reimagining and rebuilding them for open platforms. We now share our emerging software products with the developer community; license our technology and patents; and champion common standards at all levels, from Linux, to Java, to Web services. Most important of all was the work we undertook to open up our technical architectures. Absolutely every piece of IBM hardware and software today is a fundamentally different beast (and a more socialized one) than it was ten years ago IBM, 2001, p. 7.

IBM already had a strong history of working with industry standards groups, and customer councils. The alignments reflected IBM's strong installed base of heritage IBM offering lines (e.g. the z/Architecture mainframes, iSeries midrange servers, pSeries Power Unix servers, xSeries Intel-based servers) targeted for different conditions and purposes. Under Gerstner's reign, the feasibility of installing the same IBM software product across the variety of platforms improved. In the age of the Internet, however, the popularity of Linux and Unix servers would lead to an interoperable open sourcing orientation.

Evolving from the e-business vision centered on the Internet towards a broader open source perspective had been in discussion by IBM's leaders, since 1999:

> In March 1999, a report was prepared summarizing our findings and presented to the Corporate Technology Council, a management group

> that governs key IBM strategy and business decisions. It was well-received although a number of questions were raised, particularly about business considerations, which involved more homework and analysis. Ultimately, a small group was set up within the IBM Software Group organization to oversee IBM's open source activities, formalize the goals, create educational materials and provide training, and manage the day-to-day aspects of our activities. This included making sure that appropriate approvals were granted before any IBM team externally participated in an open-source activity and that team members received appropriate education (Capek et al., 2005, p. 253).

The Open Source Steering Committee (OSSC), an IBM internal board, was formed to oversee open-sourcing activities and review all planned external uses of open source.

> Since their establishment during 1999, IBM's strategic goals for open source have remained consistent. They are:
>
> - To support rapid adoption of open standards by facilitating easy access to high quality open-source implementations of open standards in order to speed industry adoption. A primary goal is to encourage open-source implementation of open standards and thus use open source as a way to support our business and strategic goals.
> - To use open source as a business tool by keeping the platform open and taking advantage of new business opportunities. By creating more open opportunities, we encourage choice and flexibility in responding to customers' needs in typically heterogeneous environments.
> - To enhance IBM mind share, creating a preference for IBM brands by associating them with successful OSS projects and building relationships with a broad spectrum of developers. We contribute to key OSS projects that are functionally connected with some of our key products. The joint participation of commercial developers and independent OSS developers creates a synergy that enhances the open-computing "ecosystem."
>
> To summarize these goals, IBM views open source as a tool or technique to be used, where it makes sense to do so, to enhance our business and that of our customers (Capek et al., 2005, pp. 253-254).

At the beginning of 2000, resources from the pioneering Internet division were migrated into a new Linux team (Wladawsky-Berger, 2006). In February 2000, IBM made a variety of announcements in a keynote presentation at LinuxWorld, and then demonstrated Linux running on "everything from laptops to an IBM S/390 mainframe" (Orzech, 2000). In

December 2000, IBM announced that it had spent $1 billion on Linux that year, "and you can expect that to grow in 2001" (J. Wilcox, 2000).

In the elevation of Sam Palmisano from president to CEO in 2002, IBM was well-positioned for organizational-building. Under Lou Gerstner, the company had been revitalized. IBM was financially strong, and seen as a leader in a information technology sector with many dot-bomb collapses. Further, the attacks on the United States on September 11, 2001 would predispose the world to prefer a stable institutions like IBM. The evolution of both the business direction and stronger leaders at all levels of the company were in place to engage open sourcing as a complement to the tradition of private sourcing.

B.1.5 Through 2009, IBM reiterated on open source and open standards

In the eight years following Palmisano becoming CEO, themes from the IBM 2001 annual report would be repeated again and again.

In the 2002 Annual Report, the computing model had evolved to become an “On Demand Operating Environment”, where IBM would continue to lead open technical standards and platforms.[350]

In the 2003 Annual Report, the next wave was described as “On Demand Integration” with open standards.[351]

The 2004 Annual Report reiterated “the architecture and technologies for the On Demand Operating Environment, based on open standards”.[352]

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[350]The 2002 fiscal year saw the acquisition of PriceWaterhouseCoopers Consulting and Rational Software.. As part of “Leadership on Demand”, “Computing must be built on open technical standards and platforms, which is why IBM will continue to be a leader of the open standards movement – a leader in Linux, Web services and other emerging technical standards. Applications must be developed from this new, open model, which is why we acquired Rational; it gives software developers a compelling alternative to proprietary approaches” (IBM, 2002, p. 16).

[351]The pattern of disaggregation in the IT industry, after two decides, had turned to re-integrating: “On demand integration is also why we’ve placed a huge bet on standards, from the Internet protocols and Linux to grid computing and Web services. Without open technical interfaces and agreed-upon standards, even integration within a single enterprise would remain a gargantuan task. And forget about integration with the other companies, business processes, applications, pervasive computing devices, laws, regulations, customs and cultures that make up the ever-more-global marketplace of the 21st century. An IT company’s position on open standards – not just its rhetoric, but its actions – is a clear indicator of whether it faces forward or backward, is serving the needs of clients or protecting its market position” (IBM, 2003a, p. 7).

[352]The 2004 fiscal year saw IBM exiting the PC market with an agreement with Lenovo to acquire the Personal Computing Division. Leadership in enterprise-class middleware was cited: “An important differentiator for our software business is that it is entirely built on open standards, supporting a wide variety of hardware platforms and applications. This gives our clients flexibility and choice, and makes it easy for them to integrate their infrastructure and business operations” (IBM, 2004a, p. 5).

In the 2005 Annual Report, the rise of service-oriented architecture (SOA) was built on "open, standards-based middleware".[353]

In 2006, CEO Sam Palmisano wrote about a new business model beyond the multinational corporation, as the Globally Integrated Enterprise, observed "within IBM and among our clients". As part of the systemic change:

> New forms of collaboration are everywhere: from increasingly complex intercompany production networks to the open-source software movement, which has helped transform the traditional model of innovation. Today, innovation is not led by lone inventors in their garrets but is the product of a collaborative process that also combines technological and marketing expertise. And such open approaches affect far more than software and IT: they also apply to education, governance, and many industries (Samuel J. Palmisano, 2006).

In the Annual Report 2006, the language of "open standards" was complemented by the addition of "open, modular systems", expanding from the domain of technology into the broader domain of business processes. [354]

By the Annual Report 2007, open sourcing had become a behaviour that IBM had practised for some time, and would continue. The IBM Strategy was explicitly described as delivering value through three strategic priorities: (i) focus on open technologies and high value solutions, where:

> The company continues to be a leading force in open source solutions to enable its clients to achieve higher levels of interoperability, cost efficiency;

(ii) deliver integration and innovation to customers; and (iii) become the premier globally integrated enterprise (IBM, 2007b, p. 18). "Open standards" and "open source" were phrases used over and over again in the detailed Management Discussion.[355]

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[353]In fiscal 2005, "more than half of our software revenue came from strategic middleware products vs. the slower growth host or legacy platforms. [....] Companies are seeking to dissolve barriers that impede the flow of information within the enterprise by deploying open, standards-based middleware to integrate their IT systems and to maximize digital assets in all their forms" (IBM, 2005a, p.4).

[354]The Globally Integrated Enterprise was moving away from the dominance in vertical integration towards horizontal integration: "In the world of software, we are witnessing a shift toward new architectures and the componentization of applications. This new model, inherently networked and based upon open standards, enables different business designs and the horizontal integration of business processes. Within the enterprise, its main impact is occurring at the level of middleware" (IBM, 2006a, p. 4).

[355]In the Management Discussion on IBM Strategy, under the "Focus on Open Technologies and High-Value Solutions", "The company continues to be a leading force in open source solutions to enable its clients to achieve higher levels of interoperability, cost efficiency and quality (IBM, 2007b, p. 18). One of the Key

In November 2008, the primary leadership message from CEO Sam Palmisano shifted to "A Smarter Planet", as the Globally Integrated Enterprise was having a broader impact on society. Potential was seen in "infusing intelligence into the way the world literally works – the systems and processes that enable physical goods to be developed, manufactured, bought and sold... services to be delivered... everything from people and money to oil, water and electrons to move... and billions of people to work and live". The possibilities were being made, as "First, our world is becoming instrumented", "Second, our world is becoming interconnected", and "Third, all things are becoming intelligent". This meant that "digital and physical infrastructures of the world are converging" (Samuel J Palmisano, 2008).

The IBM Annual Report 2008 acknowledged that "the global economy is experiencing profound disruption".[356] The chairman's letter from Sam Palmisano described IBM was "well positioned to continue delivering strong results" and "positioned to lead in the new era that lies on the other side of the present crisis". The emergence of a "new computing model" described in 2001 was amended to include "a new platform for global economy and society", in a world that was increasingly instrumented, interconnected and intelligent.[357] The three strategic priorities in the 2008 report were worded identically to 2007.

By the Annual Report 2009, open source was described as part of the "IBM's track record" in positioning of new areas for growth.[358] Investments were then focused on four high-potential opportunities: (i) growth markets; (ii) analytics; (iii) cloud and next-generation data center; and (iv) Smarter Planet. Open source was explicitly linked to the third investment, and implicitly to the fourth.

The 2010 annual report celebrated IBM's centennial in June 2011. Looking towards its "second century", the IBM business model "based on con-

Business Drivers listed was "Open Standards" (IBM, 2007b, p. 22).

[356]The IBM Annual Report 2008 was published in February 2009, after the financial crisis of 2007-2008 and the bear market decline in U.S. stocks. The Dow-Jones index peak at 14,164.53 on October 9, 2007, and had slid to 7,949.09 by January 20, 2009, the inauguration date for U.S. president Barack Obama.

[357]In 2008, the prior computing model described in 2001 of client-server was continuing to evolve with the Smarter Planet themes: "This new model, which was replacing the PC-based, client/server approach, was networked, modular and open. Just as important, it was no longer confined to IT systems alone. Increasingly, the digital infrastructure of the world was merging with the physical infrastructure of the world. And that was creating a new platform for the global economy and society" (IBM, 2008a, p. 2).

[358]In the 2009 Annual Report, four high-potential areas for growth were described. In the third, "Cloud and Next Generation Data Center": "And because of IBM's track record of integrating new technology paradigms like open source and the Internet into the enterprise, we have earned the trust of clients and the industry to bring reliability and security to what is new" (IBM, 2009a, p. 7). The other three area for growth were (i) Growth Markets, (ii) Analytics, and (iv) Smarter Planet.

tinuous forward motion" included "a commitment to research" "pioneering breakthroughs, advancing technologies and helping define open standards" (IBM, 2010a, p. 14). In the 2011 annual report, with Ginny Rometty as President and CEO, and Sam Palmisano as Chairman of the Board, "open standards" and "open source" were so ingrained into the company that they only merited mentioning in the management discussion (IBM, 2011a, pp. 23-24).

From the writing crafted in IBM annual reports, open source and open standards could be seen as new in 2001, core by 2006, and a natural part of the way of doing business by 2009.

B.2 IBM employees, from 1996, engaging globally online

IBM has appreciated operating as a multinational corporation since the founding of the World Trade organization in 1949 (IBM 2011c). Beyond ethnocentric and polycentric designs, geocentric organizations involve "a collaborative effort between subsidiaries and headquarters to establish universal standards and permissive local variations, to make key allocational decisions on new products, new plants, new laboratories (Perlmutter, 1969, p. 13).

> Jacques Maisonrouge, the French-born president of IBM World Trade [from 1967, and member of the IBM board of directors from 1983 until his retirement in 1984], understands the geocentric concept and its benefits. He wrote recently:
>
> "The first step to a geocentric organization is when a corporation, faced with the choice of whether to grow and expand or decline, realizes the need to mobilize its resources on a world scale. It will sooner or later have to face the issue that the home country does not have a monopoly of either men or ideas ...."
>
> "I strongly believe that the future belongs to geocentric companies .... What is of fundamental importance is the attitude of the company's top management. If it is dedicated to 'geocentrism', good international management will be possible. If not, the best men of different nations will soon understand that they do not belong to the 'race des seigneurs' and will leave the business" (Perlmutter, 1969). .

One way in which employees can interact with their peers on a worldwide basis is online through information and communications technologies (ICT). Beyond point-to-point e-mail transmissions, IBM has had a long history in online platforms for open engagement amongst its employees on a world scale. Some of the platforms have included (i) online forums, in section B.2.1; (ii) the w3 intranet, in section B.2.2; (ii) alphaWorks, in section B.2.3; (iii) pooled non-commercial source internally in section B.2.4; (iv) Jams,

described in section B.2.5; (v) the Technology Adoption program, in section B.2.6; (vi) Social Computing Guidelines, in section subsection B.2.7; and (vii) the Greater IBM Community in section B.2.8.

B.2.1 From 1996, IBMers conferenced on IBMPC, then IBM Forums

IBM began online computer conferencing in the age of the mainframe, predating the advent of the Internet.[359] In October 1981, the IBMPC Forums were initiated as a modification of the TOOLS file sharing technology on the mainframe (i.e. under the VM operating system) on the internal IBM network (i.e. VNET) (Chess and Cowlishaw, 1987). TOOLS maintained a persistent record of files with contributions added as "appends", so that the content could be read as a temporal transcript of conversations between participants. The IBMPC Forum was a platform developed by scientists from IBM Watson Research Center Yorktown and the IBM UK Scientific Centre to support discussion about the IBMPC that was introduced in August 1981. By 1990, IBMPC had 1500 active conferences, over 1000 contributions a day from over 10,000 contributors around the world, and readers on the order of 100,000 IBMers (Foulger, 1990).

In 2001, the online conferencing became known as IBM Forums, with infrastructure was moved to an NNTP (Network News Transfer Protocol) application more consistent with the Internet technologies.[360] Despite having become the worldwide online platform of choice for over 20 years, the IBM Forum were still primarily operated by IBM Research, rather than the office of the CIO.[361]

By 2007, 23,000 unique authors contributed 188,000 posts, with an average of 14,980 posts per month. The application was moved from IBM

[359] IBM describes itself as a Networked Business Place since the 1960s. PROFS (the Professional Office System), released in 1981, was designed to replace the typewriter with 3270 terminals attached to a mainframe running VM/CMS. It provided the ability for business professionals to send and receive notes (which become known as e-mail) and messages (a precursor of instant messaging), maintain calendars, schedule meetings and conference rooms, and store and retrieve documents.

[360] General information and history on IBM Forums is published on IBM's internal Bluepedia.

[361] Even with the change in platform in 2007, the IBM Forums were primarily run by IBM Research. On a forum, Bob Easton wrote:
"All forums, those currently on an NNTP based system, and those on the webahead pilot service will be moving to a web-facing service next Monday, 4/24.
As for "pilot" mode, the NNTP forums are (I think) IBM's longest running pilot. They are approaching their fifth birthday mid May. The upcoming change in service leaves us still in pilot mode. We'll remain in pilot status at least until early 2007, maybe longer.
It comes down to what the CIO can afford to fund. There are very many good projects competing for the pot of CIO money. We get a little bit from CIO for the forums. The Research division donates the rest, about three times what CIO contributes."

Research into the TWE (Total Workplace Experience) Center of Excellence production support with a customization of Jive Forums 5.05 onto a zLinux server with four Websphere Application Servers and a DB2 server in 2007.[362]

On June 2, 2012, the complete content from the IBMPC and IBM Forums legacies were migrated to an intranet installation of the IBM (Lotus) Connections program product.

While many companies have struggled with communicating over national boundaries, the IBM Forums were an everyday part of the internal open sourcing culture for IBM employees since the 1980s. Questions or observations as a starter for a thread sparked responses and clarifications where engaged IBM employees could think together. The original form of communications was more rudimentary than today's Internet technologies enable, but the knowledge captured in text has endured since its beginning, beyond generations of IBMers who have retired or left the company.

B.2.2 From 1996, IBMers got connected to the Internet and w3 intranet

On their desks, IBM employees would graduate from 3270 terminals first introduced in 1971, through the PC/XT in 1983, the PC/AT in 1984, the PS/2 in 1987 (with the OS/2 operating system). By 1993, virtual offices had become common for customer-facing employees and consultants.[363] Mobile workers graduated to laptops with a Thinkpad 700C laptop from 1992, a Thinkpad 755C from 1994, a Thinkpad 600 from 1998 and a Thinkpad T20 by 2000. IBM employees in the field became accustomed to connecting to each other electronically through the IBM Global Network Dialer, which became the AT&T Network Dialer after the 1998 acquisition and outsourcing deal.

After the 1994 Winter Olympics in Lillehammer, Irving Wladawsky-Berger and John Patrick were shown by David Grossman that Sun Microsystems were publishing IBM's raw data feeds, and presenting them in a way that IBM was not (Hamel, 2000). This led to development of a primitive corporate intranet, and the "Get Connected" manifesto of six ways IBM could leverage the web:

1. Replace paper communications with e-mail.
2. Give every employee an e-mail address.
3. Make top executives available to customers and investors on-line.
4. Build a home page to better communicate with customers.

[362] Usage statistics for the Total Workplace Experience were published at the 2007 year end.

[363] Non-territorial offices were first introduced in IBM Japan in 1989. By 1993, 5000 IBMers in the UK and Canada had chosen to participate. An estimated 10,000 employees in the United States were estimated to become mobile workers by the end of 1993 (Flanagan, 1993).

5. Print a Web address on everything, and put all marketing on-line.
6. Use the home page for e-commerce.

This led to the launch ofe www.ibm.com on May 24, 1994 (Ransdell, 1997). In 1995, a cross-IBM Internet Division drawing from the software and services business units was formed (Wladawsky-Berger, 2005). IBM gained experience with public Internet sites for the 1995 U.S. Open and Wimbledon tennis tournaments, the 1996 chess match between Gary Kasparov and Deep Blue, and the 1996 summer Olympics in Atlanta. By at least 1996, a ShopIBM link has been on the IBM web site, was as paths to a variety of product support paths.[364] Microsites for investors, developers and IBM business partners were also available by late 1996. As early as 1997, the complete directory of every IBM employee has been accessible on the Internet at whois.ibm.com.[365]

In the first half of the 1990s, IBM employees used a combination of PC-based productivity tools (e.g. Lotus SmartSuite on OS/2 and Windows 95) and mainframe-based collaboration (i.e. PROFS on 3270 emulators to VM/CMS).[366] In 1996, e-mail and document collaboration moved to Lotus Notes from PROFS.[367] Lotus Notes databases became a standard way of sharing documents and discussions, with master copies on networked servers and local replicas on laptops.

In late 1996, the IBM w3 intranet was rolled out. In the following year, the web search would handle 2 million hits per day (IBM 2008a).[368] By 2001, IBM employees would rank the w3 intranet equally with co-workers as the most credible or useful source of information, above the news media, executive memos or managers (Stellin, 2001).

Starting with 8000 intranet sites, 11 million web pages and 5600 domain names, the company standardized and integrated its IT systems so that the organizational boundaries for information sources became transparent (Smeaton, 2002). In 2000, the capability for each employee to personalize

[364]The first capture by Internet Archive of ibm.com is in October 1996. Linking through to Products shows a ShopIBM link on the IBM web page as early as December 1996.

[365]The e-mail address and phone number for every employee in IBM directory has been available on the open internet at whois.ibm.com since at least April 1997.

[366]In 1994, Lotus SmartSuite 2.1 included AmiPro, Freelance Graphics and 1-2-3. Lotus was an important partner to IBM through the OS/2 Warp introduction in 1994, and OS/2 Warp 4 in 1996. Some employees would use Windows 95, and others would use OS/2, until IBM standardized on Windows XP software platform in 2002.

[367]IBM acquired Lotus Development Corporation in 1995. Lotus Domino 4.5, released in December 1995, would be the collaboration platform for IBM for some years. Lotus Notes Client 4.5 could be purchased independently for Windows, and was bundled with the OS/2 Warp operating system. The Lotus Notes Client 4.6 for Windows had integration with Internet Explorer and ActiveX that wasn't relevant for OS/2 clients.

[368]The subdomain w3.ibm.com was used as a mirror of the www.ibm.com site in 1995, before becoming the label for the corporate intranet (Costello, 2006).

his or her homepage to prioritize the most common job role needs (e.g. managing projects, employees, or teams) was added. By 2004, redesign of the enterprise portal refined tabs for (i) home, (ii) work, (iii) career and (iv) life. The BluePages expertise locator and employee directory was enhanced to show information on mouseover, improving the immediacy to connect to colleagues (Pernice, M. Schwartz, and Nielsen, 2006).

The functionality of the w3 intranet has followed the rise of open standards, with IBM Websphere portal technology on servers. Desktops based on the Client for e-Business (C4EB) first relied on Internet Explorer 6 bundled with the Windows XP operating system. IBM was a strong supporter of the Mozilla Firefox browser introduced in 2003, and made that the preferred browser for the company.[369] Employees would continue to use, everyday, both a browser and the Lotus Notes version 8.5.1 " fat client" released in 2009. New mobile applications for smartphones would gradually adopt more standards (e.g. HTML5), but intensive knowledge work continues to be better on a computer with a physical keyboard.

The w3 intranet home page is the portal into the company for each and every of IBM's 300,000-some employees. The portal does not host all of the context, but accesses all of the information sources indexed within the company. While much of the information would be official announcements by company executives, the search engines would crawl every forum back to the IBMPC days, and include wiki and blog pages as those new technologies developed.

B.2.3 From 1996, IBMers shared emerging technologies on alphaWorks

IBM has had a long history in emphasizing quality.[370] The development of commercial products at IBM has traditionally followed a structured Integrated Product Development (IPD) process with stage-gated decision reviews (Grzinich, Thompson, and Sentovich, 1997).[371] Before a prod-

[369] Internet Explorer 6 with difficult to completely replace, as browser standards took time to evolve. IE6 continued to be the workaround platform for submitting expenses, for years after Firefox became the default browser. Richer functionality on the intranet was enabled through Java applets, prior to a move to HTML5 beginning in 2009, with final standardization in 2014.

[370] In 1981, CEO John Opel cited IBM as the top-ranked U.S. company with a reputation for offering high-quality products and services, by 82% of managers surveyed, 7% above the #2 company. As way to not only maintain, but improve, on that in the future, Opel appointed a corporate vice-president to coordinate quality programs.

[371] In an executive brief, the IPD is described by IBM:
"Integrated Product Development (IPD) ... is a management system designed to optimize the development and delivery of successful products and offerings. It consists of six phases (concept, plan, develop, quality, launch and life cycle) with periodic checkpoints that are predicated on fact-based decision making. The cornerstone of IPD is team-based management involving the representation and active participation of all relevant functions. Completed accessibility checklists

uct plan could be created, the concept would first have to be completely specified. This practice is consistent with the 1960s IBM hardware development process that separated the design team from the manufacturing team, with the release of specification documentation.[372] In the rise of agile practices in software development, the gates evolved to become known as alpha test (of units or modules within a system) and beta test (an initial test of an integrated system).[373] For software releases, the rapid pace for new features on "Internet time" was exemplified in the development of the Netscape browser from 1994 through to its open sourcing in January 2008, when beta versions were being released bimonthly or quarterly (B. Wilson, 2000).[374]

In the IBM Internet Division, there was a frustration that "there was a new class of applications possible that were a lot less industrial strength, more user-friendly using Web front ends, browsers and things like that", with a recognition that "development cycles were all geared to back-end commercial applications ... taking too long" (Wladawsky-Berger, R. Smith, and G. Poole, 2006). The idea came that "maybe what we need is to put out alpha versions of our stuff out there. Maybe what we need is alphaWorks" (IBM alphaworks, 2006).

alphaWorks was first exhibited at the Fall Internet World '96 in December 1996. It was intended as an "online laboratory" and "web site that demos new Web technologies months before they become products or services" (Toporek, 1997). In addition to technologies developed by IBM Research,

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are required at key phases of the development process and accessibility verification is integrated into testing and validation procedures."

[372]Before the rise of agile practices in software development, hardware development relied on specifications communicated formally through documentation: "Before a product could be shipped, procedures in place at the time required successful completion of three levels of reliability testing designated as product tests, A, B, and C. Completion of A test was normally required before a product could be announced; it verified that the product built by the development group met design objectives. Completion of B test was required for release of the product to manufacturing; it demonstrated that the documentation supplied to manufacturing by the development group adequately specified the product. Completion of C test was required before a product could be shipped; it demonstrated that manufactured hardware performed as specified" (Pugh, L. R. Johnson, and Palmer, 1991).

[373]The beta version of a software release is not field tested: "... to beta-test is to test a pre-release (potentially unreliable) version of a piece of software by making it available to selected (or self-selected) customers and users. This term derives from early 1960s terminology for product cycle checkpoints, first used at IBM but later standard throughout the industry. Alpha Test was the unit, module, or component test phase; Beta Test was initial system test. These themselves came from earlier A- and B-tests for hardware" (Raymond, 2003).

[374]Development "in Internet time" would be later noted as the "End of the Software Release Cycle" (O'Reilly, 2005b). With a new social networking application such as Flickr, where "until you put it in front of very large numbers of real people, you don't really know", a style to "release products early and often, like perpetual beta" would emerge (Fallows, 2005). Google would raise eyebrows with web-based applications labelled as a beta version beyond two years, in pattern that would eventually be known as a "constant beta" (Festa, 2005).

non-IBM technologies were welcomed on the site. These offerings were deemed insufficiently mature to be labelled as beta versions. The alphaWorks license agreement included a "term and termination" clause: the license "will terminate ninety (90) days after the date on which you receive the Software. Upon such termination you will delete or destroy all copies of the Software".

In its first year, the web site hosted 28 early-stage technologies attracting 60,000 users to the community. From those, five products became commercialized that year (Ransdell, 1997).

In June 2006, IBM complemented the alphaWorks download site with a new alphaWorks Services site (Kerner, 2006). This would enable the addition of web-based services, such as browser-based development tools. After 10 years of operating, alphaWorks claimed to have introduced almost 700 new technologies, 129 of which found their way into IBM products.

alphaWorks became a way in which IBM researchers could interact directly with university faculty and students. By 2008, many downloadable technologies were offered to the academic community with more open terms and evaluation periods (Bridgwater, 2008). The graduation path from alphaWorks has been developerWorks, where a broader audience could engagement with the technology. In 2008, over 200 technologies were available for download, and 40% of the assets posted on the alphaWorks web site had been incorporated into IBM products.

The design of alphaWorks as a community site enables both IBMers and non-IBMers to share and try out technologies that may or may not become products and/or standards. Alternative paths of graduation or termination within a short-horizon encourage limits investment and resources in dead ends, while providing a stage on which early implementations can be sampled.

B.2.4 From 2000, IBMers have pooled on source repositories

The IBM Internal Open Source Bazaar (IIOSB) is "a free service to promote Open Source style development internally at IBM"[375]. The project with the earliest registration date, of May 3, 2000, is "Linux Client for e-business" (C4EB), that has enabled a standard installation of operating system and applications on computers issued to IBM employees, as an alternative to the Windows XP platform.

The IIOSB was first implemented on the IBM intranet in 2000, based on the Gforge software developed by VA Linux Systems at the foundation of Sourceforge on the Internet (McMillan, 2000).

The IIOSB was originally developed, and continues to be funded by the IBM Linux Technology Center. This place allows IBM employees to create projects where they could share code they have written, that might also

[375]All employees on the IBM intranet have open access to the IIOSB.

include open source code (e.g. under a GPL, LGPL, Apache, BSD, IPL or CPL license) and internal use source code with others in the company. Only non-confidential materials were to be hosted in the IIOSB, with confidential materials to be moved to the IBM Community Source server (which later evolved into the IBM Community Development Platform, also called CSNext). Ownership of the source code written by IBMers posted to the IIOSB is copyrighted to IBM, while third-party copyrights and licenses (e.g. GPL, LGPL, Apache, BSD, CPL, etc.) are respected and retained. Registration on the IIOSB reinforced the licensing terms and conditions with an explicit agreement to be electronically signed within a month.[376] Links point to the online education on the IBM Open Source Participation Guidelines that describe the spirit in which open source is to be interpreted.[377]

The repository is partitioned into licensing zones, with project counts as at May 2010:

- IBM Internal zone, for 750 projects with no plans to externalize the source code, or an unknown disposition, with a potential for release either as an IBM product or open source;
- IBM Internal / Mixed OSS zone for 381 projects with no plans to externalize the source code, embedding Open Source Software that could be used only internally;
- Apache / BSD / MIT zone for projects covered under an Apache Software License (43), a BSD License (11) or an MIT License (13) that might eventually be released externally following an approval process;
- GPL / LGPL zone for source code covered under the GNU General Public License (146) or the GNU Lesser General Public License (20) that might eventually be released externally following an approval process;
- IPL / CPL / EPL zone for projects using the IBM Public License (58), the Common Public License (58) and Eclipse Public License (5), that might be released externally following an approval process; and the
- Other License zone for the miscellany in which legal counsel would have to be sought.

At May 2010, 1,493 projects were hosted, with 12,865 registered users. The IIOSB listed 425 projects by development status: 49 were in planning, 49 in pre-alpha, 64 in alpha, 118 in beta, 129 in production/stable, 4 in mature, 3 in moved, and 9 in end of life.[378]

[376] The terms and conditions for the IIOSB are published as a FAQ on the IBM intranet.

[377] The IBM Open Source Participation Guidelines published on the IBM intranet has seven sections to be read by all employees, with an eighth section specific to IBM Global Services employees who have more direct interactions with customers daily.

[378] As a self-service repository, code snippets on the IIOSB can be contributed

Benefits of the internal community source model are seen as two-sided. Producers (i.e. authors) get improved collaboration, broader testing and tuning, and more developers using their code. Consumers (i.e. beneficiaries) get faster access to company capabilities, the ability to tune an existing investment to a unique specification, and broader testing and tuning (Sabbah and Frye, 2005, p. 16).

In 2005, the IIOSB community open to any IBM employee was complemented by the IBM Community Source repository[379]. "The IBM Community Source web site is the place internally to practice open source behavior with IBM product code". The motivation for these professional developers was easier collaboration, leading to increased efficiency and a speed to market improvement of 30% (Graham, 2005). In contrast to the IIOSB, IBM Community Source targets employees of the Software Group division of programmers across 40 labs. The assets "are not open source" in licensing, but are open sourcing in behaviour. Community source "represents a shift in the traditional development model ... that is required to realize the component model of building IBM products"[380]. At May 2010, 1,747 projects were hosted, with 33,580 registered users.

Both the IIOSB and IBM Community Source are programs where procedures for categorizing open source assets are rigourously managed. This provides clarity for reuse of the contents in a variety of contexts, for both non-commercial and commercial reuses.

B.2.5 From 2001, IBMers have collaborated on global online *jam* events

In IBM, a jam is a massive online collaboration whereby participants meet around the globe, around the clock for three days (IBM, 2004d, p. 41). Leaders can use a jam to "start a movement" in an organizational transformation.[381]

In 1999, employee opinion surveys uncovered that intranet was a more useful, credible and reliable source of information than both managers and coworkers. This raised a question as to whether an intranet could be used for culture change (Wing, 2005b). The pragmatic core for a jam was to capture best practices from individuals on clever, common sense ways to get work done and produce value in spite of the complexity of operating in

without a development plan.

[379]The IBM Community Source site is found on the IBM Intranet at https://cs.opensource.ibm.com/.

[380]The "Guide to Community Source Contributions" provided direction for Software Group employees about assets on the IBM Intranet.

[381]The Road to a Smarter Enterprise includes a successful transformation in six steps: (i) start a movement; (ii) establish clear transformation governance; (iii) transformation requires a data-driven discussion; (iv) radically simplify business processes; (v) invest in transformative innovation; (vi) embody creative leadership (IBM, 2010d).

such a large, diverse and complex enterprise at IBM.

> "It was a best practices surfacing effort," says Mike Wing, IBM's director of worldwide intranet strategy and programs. "It was not a suggestion box or a free-form chat. This was not to propose things that management should do. This was very much E to E – employee to employee. We chose topics deliberately so that the ideas that they generated would be things people could go implement, not things that required large capital expenditures or policy decisions.
>
> "We didn't necessarily want the executives who were responsible for X, Y, or Z topic [to respond to problems]," he adds, "because we precisely wanted to come at things from some unusual angles, encouraging people who would bring a different intellectual frame of reference to the topic" (Andelman, 2001).

After nine months of preparation, World Jam was scheduled May 21 to 24, 2001, 72 hours around-the-clock (Feder, 2001). The web-based platform was intended as a medium to help IBM employees talk with and help each other, shaping a different kind of computer mediated communication while striving to provide mutual awareness. The World Jam process had three stages:

1. *Drawing people in*, with headline articles on the main intranet page, and e-mail through managers and from the CEO, leading to a description of the World Jam concept and a list of the fora;
2. *Choosing where to go*, with ten forum topics divided into five areas (new relationships, new ideas; travelling without a map; managing an e-worklife; managing the matrix (or in spite of it); talent and quality), of which three topics were related to individuals within the company, and seven were related to working within and around company issues; and
3. *Participating in one of the fora*, contributing to an asynchronous conversation thread and rating posts for usefulness, overseen by a team of 3 to 4 moderators on duty 24 hours per day would nominate ideas to be voted on for the list of 10 Great Ideas.

Over the three days, there were 52,595 unique logons (one-sixth of IBM's 300,000 workforce), 1700 posting at least once, totalling 6048 postings (Halverson et al., 2001). Topic moderators had assembled a "board of advisors" to provide reference materials and participate online. Moderators and facilitators communicated through an IBM Research prototype, Babble, to engage on joint problem solving on a back channel (J. C. Thomas, 2001).

Findings from the WorldJam research were positive in three ways: (i) the event accelerated expertise engagement, with 2000 new contacts met; (ii) participants had trust, with 68% observing constructive criticism of each other; and (iii) repeatability, as 85% said they would engage again in

a similar event and 62% said they learned new things (Kellogg, 2005).[382]

Following this success, other jams for IBM employees were planned: ManagerJam in July 2002; ConsultantJam in February 2003; On Demand IT Jam in April 2003; ValuesJam in July 2003; and WorldJam 2004 (Wing, 2005a).

ManagerJam was scheduled on July 9 and 10, 2002, for 48 hours. The central idea was to invite 32,000 managers at all levels worldwide to offer practical grassroots solutions to everyday IBM management challenges (Dorsett, Fontaine, and O'Driscoll, 2002). Forum topics included (i) translating strategy into results; (ii) building careers; (iii) fostering innovation; (iv) managing performance; (v) the human face; and (vi) the new customer landscape. JSP servlets were used to integrate the discussion forums were hosted on an NNTP server, and the message ratings on a DB2 server. The project and facilitation team used a TeamRoom Plus online collaboration environment (Millen and Fontaine, 2003). During the event, 8123 managers (25% of the population) participated, with 22% posting (more than double that in WorldJam 2001) to the 4554 comments and replies.

ConsultantJam, in February 2003, was conducted within 45 days of 30,000 PriceWaterhouseCoopers consultants coming on board following the company acquisition by IBM. Conversations included what does it mean to be an IBMer, what does PwC bring to the table, what's best and what doesn't work in our cultures, what can we learn from each other, and how can we work with each other. The event ran for 96 hours, involving 8560 participants discussing 2960 ideas, with a JamAlzyer real-time text mining and theme analysis (Wing, 2005a; Birkinshaw and Crainer, 2007).

The On Demand IT Jam in April 2003 was designed to uncover ideas and solutions to further IBM's on demand transformation. The four forum topics were: (i) business transformation enablement, how the way business is done could be changes; (ii) development environment, leveraging on demand technologies; (iii) operating environment, changing data centers; and (iv) e-business on demand for employees, changing the way work was done. Over 72 hours, 9793 participants discussed 2963 ideas, and established management accountabilities for follow-up (Wing, 2005a).

Values Jam, held between July 29 to August 1, 2003, for 72 hours, was a landmark for the company. With Lou Gerstner as CEO from 1993 to 2002, the focus in the company was to survive and turns its fortune around. When Sam Palmisano took over as CEO in April 2002, it was the first time in since the early 1990s that IBM grew more than the IT industry.[383]

[382]Wendy Kellogg acknowledges jams as related to an earlier ideas on jamming. "Jamming , of course, is a kind of conversation .... That sense of possibility, of spontaneous dialogue, is a crucial element in the creative culture (Kao, 1996). World Jam could be seen as an approach to "knowledge arbitrage" enabling practices from one individual to be transferred to someone not directly connected socially in the enterprise (Kao, 1993).

[383]In 2001, "For the first time in nearly a decade, the information technology

Having been an IBM employee for 30 years, he believed that the Basic Beliefs – originally established by Thomas Watson Jr. in 1969 – could continue to be a foundation for the company, but that a discussion on a new set of corporate values should include which aspects were worth preserving and which aspect would need change in the new century.[384] Research involving 300 senior executives and then a survey of over 1000 employees developed propositions that could be discussed across the whole company (Samuel J. Palmisano, Hemp, and T. A. Stewart, 2004).

Values Jam invited all employees to discuss what defines IBM and IBMers. The four forums initiated discussions on (i) *Company Values* (i.e. Do company values exist? What would a company look like that truly lived is beliefs?); (ii) *A First Draft* (i.e. Consider "1. Commitment to the customer; 2. Excellence through innovation; 3. Integrity that earns trust". Is there a nuance missing?) (iii) *A Company's Impact* (i.e. Is there something about our company that makes a unique contribution to the world?); and (iv) *The Gold Standard* (i.e. When is IBM at its best)? Moderators, with the help of text mining, surfaced emergent themes and updated links on the home page to point specifically at hot topics.

After 72 hours and 1.25 million views of the Values Jam web site, 22,007 participants had written 9337 posts and replies. Executives then reviewed the JamAlyzer e-classifier analysis, pre- and post-jam survey and read the raw transcripts. The revised set of new corporate values became: (i) Dedication to every client's success; (ii) Innovation that matters – for our company and for the world; and (iii) Trust and personal responsibility in all relationships. These were published on the company intranet in November 2003, leading to 200,000 downloads by employees within ten days. This led to floods of posting on the intranet, and a thousand e-mails sent directly to Palmisano. A lot of the reactions were positive towards the new values, but said that the company wasn't close to actually living them.

World Jam 2004, in October, came out of the responses to the Values Jam in 2003. The intent of this jam was to tease out what could be

industry shrank. Yet, measured in constant currency, IBM 's revenue was up 1 percent. That's a modest increase, to be sure – but it was the first time since the early 1990s that IBM outperformed the industry" (IBM, 2001, p. 46). Gross margins improved, and cash flow remained strong.

[384]The Basic Beliefs of 1914 from Thomas Watson Sr. were: (i) respect for the individual, (ii) the best customer services; and (iii) the pursuit of excellence. The interpretation had drifted over time:
"Unfortunately, over the decades, Watson's Basic Beliefs became distorted and took on a life of their own."Respect for the individual" became entitlement: not fair work for all, not a chance to speak out, but a guaranteed job and culture-dictated promotions. "The pursuit of excellence" became arrogance: We stopped listening to our markets,to our customers, to each other. We were so successful for so long that we could never see another point of view. And when the market shifted, we almost went out of business" (Samuel J. Palmisano, Hemp, and T. A. Stewart, 2004, pp. 62-63).

done operationally, both in the daily work of individual employees, and at the policy level. The focus was to identify actionable ideas to accelerate profitable growth, unleash innovation and drive internal productivity, consistent with the new IBM values (Wing, 2005a). Six discussion forums were moderated by 18 senior executives. On the value of *client success* were forums on "Making IBM Work for Each Client" (i.e. How can we make IBM easier to do business with?); and "Delivery Excellence" (i.e. How can we get better at delivering what the customer expects, and more)? On the value of *innovation that matters*, were forums on "For the World" (i.e. How can we see and seize new growth opportunities?); and "For our Company" (i.e. Where and how can we innovate on IBM itself)? On the value of *trust and personal responsibility* were forums on "Managers" (i.e. What do our strategies and values imply for the job of the first-line manage?); and "Every IBMer" (i.e. What do our values imply for each of us – in our jobs, and an in our careers)?

For 52 hours (including a 6-hour extension) between October 26 to 28, 2004, with 2.4 million page views, 56,870 unique participants wrote 32,662 posts. The results were analyzed, based on priority and impact to the business, distilled in 191 ideas across each of the six discussion forums. A "Rate the Ideas" follow-up web site became active for 7 days between November 30 to December 6, inviting every employee to log in and individually rank the 191 ideas. Senior management then committed to 35 of the top-rated ideas. There was overwhelming support for two ideas: (i) an employee survey on people manager effectiveness; and (ii) consolidation of alignment of back-office sales support functions. Three major categories emerged from 26 of the top rated ideas: (i) lowering the center of gravity, improving cross-unit integration for client success; (ii) helping my manager to become a better manager; and (iii) enabling innovation and growth.

The success of jams internally at IBM, and the publicity in the business press, led to events for external parties.

Habitat Jam, in December 2005, was the first event external to IBM using the Jam technologies and facilitation techniques. This internet conference was jointly sponsored by the United Nations Human Settlements Programme (UN-Habitat), the Government of Canada and IBM (Debbe Kennedy, 2006). The approach was to use Jam technology an inherently global medium to drive ideas to action, in preparation for the third session of the World Urban Forum scheduled for June 2006 in Vancouver, Canada. The promise was to have a truly democratic event, where people who would not otherwise engage in a United Nations event could join the discussion. The participation of 400 organizations around the world drew in 39,000 people from 158 countries. Real slum dwellers and villagers joined architects, planners and activities in discussions, sometimes employing translators and screen reading technologies. Discussion was channelled into seven forums: (i-ii) Improving the lives of people living in slums; (iii) Sustainable

access to water in our cities; (iv) Environmental sustainability in our cities; (v) Finance and governance in our cities; (vi) Safety and governance in our cities; (vii) Humanity: the future of our cities. The jam resulted in 4000 pages of discussion and ideas leading to the generation of 600 ideas. From that output, 70 actionable ideas were chosen, research and summarized into a workbook and CD for the World Urban Forum III (IBM, 2006l).

In 2006, Innovation Jam was a significant shift from prior events, in breadth and scale. In addition to IBM employees, participants invited included family members, and represented from 67 organizations spanning business partners, customers and university researchers.[385] Weighting more towards developing ideas better over immediate commercialization, the jam formula was broadened to incorporate major market trends as well as internal inputs.[386] Unlike prior jams that did not require advance preparation, participants were asked to familiarize themselves with some 25 emerging technologies, in six broad groupings of (i) embedded intelligence; (ii) extracting insight; (iii) global collaboration for individuals; (iv) global collaboration for companies; (v) practical supercomputer; and (vi) intelligent information technology systems (Gryc et al., 2009; Bjelland and R. C. Wood, 2008, p. 34).

Between July 24 and 27, the first phase of Innovation Jam ran for 72 hours with forums on (i) *Going Places*, transforming travel, transportation, recreation and entertainment; (ii) *Finance & Commerce*, the changing nature of global business and commerce; (iii) *Staying Healthy*, the science

[385]Some of the organizations participating were: Air Canada, Bank of America, Beijing Futong, Bharti, Boeing, CenterPoint Energy, China E-Port, China Southern Airlines, Circuit City, Citibank Singapore, City Furniture, Datatrend Technologies, Digital China, DVLA, Embraer, Fuji Xerox, Gap, Hakuhodo, Honda, Hsin Chu Transportation, Hydro, Hoplon Infotainment, Logix, Maybank, Metro Group, Microstrategies, NDMA, Nestle, NIBCO, Ogilvy & Mather, Pacific Coast Producers, Parcelhouse, Petrobas, Pfizer, Profi, Ranbaxy Labs, RJS Software, Royal Dutch Shell plc, Samsung, Service Canada, Shoppers' Stop; Sirius Computer Solutions, Silverlake, Sun Life Financial, Telstra, Total System Services, Threshold Entertainment, UBench, UPS, TV Globo, Verizon, Walt Disney Company, Xcel Energy, Dublin Institute of Advanced Studies, Duke University Health System, IIT Bombay, MIT Media Labs, North Carolina State University, Stanford University, Tel Aviv University, Trinity College of Dublin, University College of Dublin, University of Manchester, University of Warwick, Catholic Charities, The Nature Conservancy, World Urban Forum, and IBM.

[386]Palmisano has visited IBM Research in May 2006, but though there could be better integration with activities in the rest of the company. David Yaun, VP, Corporate Communications said ""Take the crown jewels, describe them in a simple way, put them against a backdrop of what's happening in the world and not only invite IBMers in there , but invite clients and business partners, as well. Eventually we also decided to invite IBMers' family members". Ed Bevan, VP, Communications at IBM Research, said "Previously, jams had largely been discussions of things about which you might have opinions or strong feelings. You could comment intelligently based solely on your experience of working with the company, trying to build concrete, business solution innovations together. To do that, we were saying, we need a common base of knowledge" (Birkinshaw and Crainer, 2007, p. 70).

and business of well-being; and (iv) *A Better Planet*, balancing economic and environmental priorities. This led to 57,000 people logging in, and 37,000 posts.

In the five weeks that followed, a multidisciplinary cross-IBM team analyzed the Phase 1 outputs, resulting in 31 "big ideas".[387] These 31 big ideas became the focus for refinement in the Innovation Jam Phase 2, September 12-14. Participants were asked to flesh out the proposals, and rate each one on business impact, market readiness and societal value, leading to 9000 posts.

The output from Phase 2 was analyzed by the cross-IBM team, working up specific proposals around 10 finalists.[388] On November 14, 2006, Palmisano announced that IBM would invest $100 million over the next two years to pursue these ten new businesses, partnering with multiple clients and universities to bring the ideas to market quickly (IBM, 2006k). Five years later, those ten new businesses were estimated to have returned $700 million to IBM in revenue (L. Cleaver and Euchner, 2011, p. 17).

By 2007, the IBM Jam Program Office within the Office of the CIO had organized to facilitate jams for customers as Jam Consulting Services, contractable through IBM Global Services (L. Cleaver, 2009).

- In March 2007, *Automotive Supplier Jam* was the conducted with the Original Equipment Suppliers Association (OESA) (IBM, 2007s; Guerrera, 2007).
- In May 2007, Nokia had a *Nokia Way Jam*. focused on the question "What does it take to be an Internet company?" as part of shifting Nokia's business and strategy.
- In December 2007, Eli Lilly had a *Vision Jam* to generate practical ideas through an increased understanding of the company's new vision.
- In January 2009, the UK Foreign and Commonwealth Office had a jam on *One Team, Many Voices, Our Future*, to model the behaviour for the future organization, to break down divisions between the home office and overseas, career diplomats and civil service.
- In early 2010, Royal Dutch Shell Projects and Technologies had a *My*

[387] Some "big ideas" from the Innovation Jam Phase 1 that didn't pass Phase 2 included: rail travel for the 21st century; advanced safecars; the truly mobile office; remote healthlink; practical solar power systems; cellular wallets; biometric intelligent passport; smart business building blocks; advance traffic insight; e-Ceipts; digital entertainment supply chain; smart hospitals; retail healthcare solutions; digital memory saver; cool blue data centers; water filtration using carbon nanotubes; predictive water management; sustainable healthcare in emerging economies; bite-sized services for globalizing SMBs; smart-eyes, smart-insights; advanced energy modelling and discovery Gryc et al., 2009, p. 37.

[388] The ten finalists from Innovation Jam 2006 were: 3-D Internet; big green innovations; branchless banking; digital me; electronic health record system; smart healthcare payment system; integrated mass transit information system; intelligent utility network; realtime translation services; and simplified business engines (Gryc et al., 2009, p. 25).

P&T Jam to create an affiliation across a new organization of 8200 globally dispersed employees.

- In February 2010, the European Union and NATO had a *Security Jam* focused on the changing nature of the 21st century security landscape.
- In March 2010, USAID and the White House had *USAID Global Pulse* 2010 Jam to share ideas and creative innovation solutions to social issues, informing U.S. foreign assistance and diplomatic strategies.
- In June-July 2010, the UK Coventry City Council had *CovJam*, to engage in dynamic conversations with constituents about future direction.
- In late 2010, Citibank Global Transaction Service had a *GTS Jam*. to enable employees to engage directly with senior management on key initiatives for future growth.

In addition, the American Council on Education and the Kresge Foundation sponsored a Veteran Success Jam in May 2010, to address issues for returning veterans with colleges, universities and employers.[389]

Innovation Jam 2008 was an IBM-sponsored event with an external emphasis. The jam was structured to follow findings from the IBM CEO Study released in May 2008, where 1100 CEOs shared their visions of the Enterprise of the Future (IBM GBS, 2008). The four main discussion areas would be: (i) built for change – adapting to thrive; (ii) customers as partners – the new intelligence; (iii) globally integrated – navigating to a flat, smart world; and (iv) the planet and its people – moving well beyond green.

The jam ran for 90 hours from October 5th through 9th. Nearly 90,000 logins generated 32,000 posts. Employees from over 1000 companies across 20 industries included thousands of IBMers, and subject matter experts from Mars Incorporated, Eli Lilly and Company, Citigroup and Boston College. Jammers read 1.5 million pages, with an average jammer reading 76 pages and spending just under 2 hours participating (IBM GBS, 2008).

Jammers concluded that the enterprise of the future has to do three things: (i) embrace a new level of *transparency* for itself and across the systems we are seeking to make smarter, allowing customers and partners to engage more intimately, and on a variety of levels; (ii) increase *efficiency* in every aspect of its business operations, eliminate waste, and employ new and powerful monitoring and measuring techniques to make better business decisions; and (iii) adopt corporate *stewardship* as a core business function, working closely with the public sector to build

[389]The Veteran Success Jam was not a reference in the IBM Jam Consulting Services list. The project itself cited using IBM's Jam technology (American Council on Education, 2010).

sustainable business practices that will improve global living conditions and drive positive social change.

In April 2009, IBM University Programs sponsored a Smarter Planet University Jam. Nearly 2000 students and faculty from 200 universities in 40 countries participated with IBMers and IBM business partners. The jammers saw the need for a new model of university education around smarter campuses, contributed 100 examples and ideas of how universities could "go green", and identified a variety of opportunities in water, healthcare, grid technologies and cities (IBM, 2009d).

In January 2010, the Institute for Business Value unit of IBM Global Business Services sponsored the Eco-efficiency Jam. Eco-efficiency "is about embedding sustainability and resource conservation in every facet of an organization" with government regulations and incentives. Participants included 1600 leaders, journalists and experts from more than 60 countries. Three best practice recommendations emerged: (i) "green" infrastructures would overlay the physical infrastructure with digital intelligence; (ii) sustainable solutions would promote resource efficiency while reducing the environmental and social impact of operations; and (iii) intelligent systems would use open standards for realtime information on infrastructure (IBM IBV, 2010).

In October 2010, IBM Corporate Citizenship & Corporate Affairs sponsored Service Jam. More than 15,000 people from 119 countries – including former U.S. presidents, German professors and South African tutors – discussed practices that "elevate the effectiveness and impact of volunteering, public services, social entrepreneurship and other forms of service". The four key systems of service that presented the greatest challenge and held the most opportunity were: (i) service learning; (ii) volunteer management; (iii) partnership; and (iv) measuring impact (IBM, 2010g).

In February 2011, IBM Software Group sponsored a Social Business Jam. The event brought together 2700 participants from 80 countries for 72 hours on five major themes: (i) building the social business of the future; (ii) developing participatory organizations through social adoption; (iii) using social media to understand and engage with customers; (iv) determining what social means for IT functions; (v) identifying risks and establishing governance. The jam yielded over 2600 discussion posts and more than 600 tweets. These led to a series of insights. Over 25% of organizations had low levels of adoption of social business practices, as ways of calculating returns-on-investment, and the need for cultural change required by the human resources function were a concern. Social technologies raised issues in the changing role of middle managers, inclusiveness of lurkers who don't contribute, reconciling personal openness with business privacy, and the importance of soft infrastructure (i.e. people, processes and problem solving). Engaging customer with social technologies was seen as shifting from a vendor model to a service provider model, at the

risk of overwhelming the business with the wealth of information. The IT function would need to respond more quickly since social tools were rapidly released as consumer applications, on smartphones and tablets previously unsupported. Risks had not yet been identified, nor governance in place, for social business, with the content streaming in from a new variety of sources, and employees interacting directly with customers in a mix of professional and personal spheres (IBM Software Group, 2011).

In November 2011, the World Wide Web Consortium (W3C), an international community that develops open standards to ensure the long-term growth of the web, hosted the W3C Social Business Jam (W3C, 2011). For this technically sophisticated audience, IBM provided the platform for a minijam.[390] Six aspects of social technology were covered: (i) identity management for social; (ii) mobile and social; (iii) information management; (iv) business process meets social; (v) seamless integration of social; (vi) metrics for social business. The jam had 1073 unique registrants attending, from 20 different industries.[391] On the day of the jam, each of those six topics had posted times with hosts and special guests.[392] The primary recommendation from the Jam was to "form a W3C Social Business Community Group in order to develop a number of customer-driven strategic use-cases for standardizing the Social Web". These activities evolved with the W3C launching its Social Web Activity in July 2014 with two groups:

> The Social Web Working Group, which defines the technical standards and APIs to facilitate access to social functionality as part of the Open Web Platform.
>
> The Social Interest Group, which coordinates messaging around social at the W3C and is formulating a broad strategy to enable social business and federation (I. Jacobs, 2014).

In December 2014, the OpenSocial Foundation transferred its specifications and assets to the W3C, moving its standards work there and integrating into the W3C legal entity.[393]

Jams started as massively collaborative internal IBM events in 2001 with World Jam, became externalized in 2005 with Habitat Jam, was

[390] The minijam page for the W3C Social Business Jam was hosted by IBM on the collaborationjam.com domain.

[391] In the registrant pool, 57% classified their employer as a "large organization", 20% as a "medium organization", 12% as a "small organization", and 11% as self-employed.

[392] In Eastern Time, hosted discussions for the W3C Social Business Jam ran from 4 a.m. to 8 p.m., presumably to cover time zones from Europe through to Silicon Valley. Across the six topics, there were 16 hosts and 13 special guests.

[393] OpenSocial was a public specification for social network applications, started in 2007 by Google and Myspace. It was seen as a cross-platform open specification alternative to the Facebook Platform, a private sourcing set of services, tools and products.

offered commercially in 2007 through Jam Consulting Services, and was used for external studies starting with 2008. The collaboration has always had an open sourcing style with individuals able to voice their views at a peer-to-peer level. The scale of planning, operating and reporting on such a large enterprise has followed a private sourcing style with committed resources managed on a worldwide schedule.

B.2.6 From 2005, IBM early adopters have collaborated on innovations via TAP

In 2005, the IBM CIO (Chief Information Officer) recognized that, outside of research and development labs, innovation can happen anywhere in the enterprise. While labs have resources to progress work from the design phase into a feature for an offering, individuals without mandate within their job roles have not similarly had access to such infrastructure, resulting in potential innovations that go undeveloped, forgotten and/or unrealized. The Technology Adoption Program (TAP) was designed to nurture self-selecting innovators dispersed across the enterprise. This required a shift of the role of the CIO from an operations manager to become an innovations manager (Chow et al., 2007, p. 640-641).

The Technology Adoption Program was launched in August 2005.[394] TAP began as a two-page proposal by Sandesh Bhat, Director of Technology and Innovation in the Office of the CIO, with an idea "What if 30,000 employees were always running the n+1 version of the w3/Intranet?".[395] The first projects mentioned were CEWL (Client for Enterprise Web Services for Blackberry smartphones), Tommy! (a Firefox extension that would augment person-identifiers with tagging) and Dogear (a Firefox extension for enterprise social bookmarking).[396] These, and subsequent other projects, have been described as a crowdsourcing in intra-enterprise communities: instead of the responsibility for early adoption development to a specific employee, volunteers donate their time to provide feedback (Alkalay et al., 2009, p. 3). Even projects with negative feedback were seen to provide value.[397]

[394] On the biz.technology-adoption-program forum, the site URL was announced as http://w3.tap.ibm.com on August 8, 2005.

[395] At the fifth anniversary of TAP, the original Director of Technology Innovation and Web programs within the Office of the CIO was recognized by Tom Immelt | "TAP Anniversary Blog Series: Sandesh Bhat, The creator of TAP" | April 14, 2010.

[396] *Tommy (can you hear me)*, developed by Helder Luz, cooperated in the development of the API for Fringe Contacts from IBM Research (Farrell and Lau, 2006). Dogear was a project on enterprise social bookmarking led by IBM Research (Millen, Feinberg, and Kerr, 2005).

[397] Santosh Bhat reflected on three tools that were successful due to TAP: Dogear, Sametime and MyHelp:
"MyHelp was an interesting story as it showed that the team was dedicated to an unbiased representation of the satisfaction a tool had with it's adopters. MyHelp

The staff assigned to TAP was relatively small, starting in 2005 with an initial core team of four. IBM management consciously allowed TAP to evolve organically, responsive primarily to community priorities rather than corporate constraints. In 2007, staff was added to manage the large number of TAP offerings, the emphasis shifted towards accelerating the rate of graduation from early adopters to production support organizations. At the close of 2007, there were 143 TAP offerings and over registered 100,000 TAP users – about 28% of IBM's total worldwide workforce (Alkalay et al., 2009).

The life cycle process for a TAP offering was structured as three major phases:

1. In an innovation proposal phase of 1 or 2 weeks, the TAP web application would include (i) an offering proposal submission, (ii) proposal review; (iii) completion of a boarding questionnaire; (iv) proposal evaluation; (v) the boarding welcome call to understand how the TAP team might help; and (vi) early adoption and prototype deployment, including promotion through TAP channels.
2. In the offering time phase of about 9 months, assessment and evaluation from early adopters, both through active data collection (e.g. surveys, defect tracking) and passive data collection would track usage, interests (as buzz or hype), level of satisfaction, and potential innovation value.
3. At graduation, some offerings would be (i) returned to development for refinement and a second round through TAP; (ii) retired, or (iii) movement to a production environment, e.g. product development through IBM Software Group, asset commercialization through IBM Global Business Services or IBM Technology Services, alphaWorks or the internal Applications Hosting Environment (AHE).

The TAP community was seen as early adopters releasing trial offerings to other early adopters, so a bounded offering time would be sufficient to assess adoption or lack of interest.

In February 2009, TAP was organizationally moved into a new Innovation Programs department, that also managed BizTech and Thinkplace Next.[398] Biztech was a program focused on forming virtual teams of early

faced a lot of scrutiny by the adopters as it received a lot of negative feedback. The innovation team wanted the TAP team to remove the negative comments, but what is the point of having an innovation on TAP if you want to avoid negative feedback. TAP has thrived on negative feedback as a growing mechanism for tools to learn about their faults. In the end the tool and the team, would benefit as the finalized product would have few errors, which is completely true for the current MyHelp application, which every employees' ThinkPad uses."

[398]The announcement was made by Christopher E. Wyble on February 13, 2009: "As IBM is constantly changing TAP has found a new home in the Innovation Programs department! Innovations Program is an excellent place for TAP to continue to grow and provide innovations that will help IBMers work more efficiently Innovation Programs is being headed by Jane Harper and Mary Keough.

tenure employees of one-to-five years. A project sponsor would back a day-per-week effort for nine-to-twelve months. Results expected could include cost savings, project improvements, or the launch of a new technology (Alkalay et al., 2009). Thinkplace was an ideation management forum originally developed by IBM research. Ideas could be suggested, commented upon, rated, sorted and routed. Thinkplace Next was an evolution of the Thinkplace collaborative tool, combined with social networking tools, i.e. Beehive (a social networking site) and Small Blue (a social network analysis tool) (Majchrzak, Cherbakov, and Ives, 2009).

TAP continued to evolve, with an aim to embed innovation into every employee's workday. By 2010, the Innovation Carousel would enable three types of projects from TAP to be selected to appear on each employee's personalized intranet home page. Social networking features would go beyond the need to search on TAP for projects of interest, but would surface what colleagues with close social ties were following.[399]

The style of open sourcing style of collaboration in TAP was not only encouraged by the Office of the CIO, but also tracked by IBM Research to learn about new ways of working over the Internet. In 2011, the experiences gained from TAP were directed credited in the development of the private sourcing commercial Lotus Connections offering (Naone, 2011).

B.2.7 From 2005, IBMers wikied guidelines and grew social computing

Since 1956, IBM has had Business Conduct Guidelines in place, describing

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We will be working alongside two other great programs, BizTech and ThinkPlace Next! Both programs share commonalities with TAP and we are excited to begin working to cultivate fresh and exciting innovations! The cooperation between TAP, BizTech, and ThinkPlace Next will now be able to utilize common resources to provide an excellent communications method for all IBMers within these groups to network."

[399]TAP was gradually becoming less of a standalone place, and more integrated into the w3 intranet. On April 27, 2010, Tom Immelt interviewed Dave Newbold: "Dave's goal has been to make the TAP site a consumption-based environment where the user can feel satisfied and comfortable every time they visit the TAP site. [....] This has been a large focus of the new website. Tom asked Dave to comment on two key new features ...

1. Innovation Carousel: Based upon your w3 information, you will be able to have three types of innovations appear on your homepage when you first visit w3.tap.ibm.com (logged in). You are free to navigate the section (like a carousel) to quickly flip through various innovations. You also have the freedom of changing these carousels at any time in your profile settings.
2. Social Networking on TAP: You can now see what innovations other members of your internal community have found valuable. Unfortunately this is at a very basic level, and as the infrastructure becomes more sophisticated we can more easily correlate certain innovations to a certain user-base. For now the system depends upon the early adopter to download innovations, rate them, tag the page, and suggest innovations".

appropriate behaviour for IBM employees.[400] Since 1995, employees has followed IBM Internet Usage Guidelines, including an Acceptable Use Policy on the gateways from the intranet to outside world (Patrick and Trio, 1995).

By May 2005, the rapid rise of blogging by IBM employees on the open Internet, plus on the intranet – "to just shy of 9,000 registered users spanning 65 countries, 3,097 individual blogs, 1,358 of which are considered active, with a total of 26,203 entries and comments" in just 18 months – led to IBMers bloggers coming up with their own core principles. Developed over ten days on an internal wiki, "this isn't a policy that IBM is imposing upon us – it is a commitment that we all have entered into together". (Snell, 2005b).

The IBM Blogging Guidelines were posted on the public IBM web pages, and led to other enterprises reflecting on their attitudes towards social interaction over the Internet.[401] It recognized that employees are individuals, and "You must make it clear that you are speaking for yourself and not on behalf of IBM". The detailed discussion reiterated that "IBM supports open dialogue and the exchange of ideas". At the same time, it cautioned to "Don't forget your day job. You should make sure that blogging does not interfere with your job or commitments to customers." In addition to the guidelines, a directory of "IBMers' blogs" on the open Internet was provided.

In July 2007, the rise of immersive technologies (e.g. Second Life) led to publishing of the IBM Virtual World Guidelines (Reynolds, 2007). By May 2008, a group again working on a wiki on the intranet generalized the prior writings in the IBM Social Computing Guidelines (Piper, 2008). The revision was published on the public IBM web site, deprecating the earlier works. In 2010, these guidelines were subtlely evolved.[402]

At the end of 2007, the IBM Social Software Enablement Program formed a *BlueIQ Ambassadors Community* as a peer-to-peer network of volunteers who would be come social software evangelists. On the community intranet web site was a description of aims:

> BlueIQ Ambassadors are social software enthusiasts who help IBM individual employees, teams and communities with using social software. We seek to build a worldwide community of social software evangelists who are passionate and want to learn more about social

[400] The Business Conduct Guidelines was a principal action by IBM, in response to the consent degree with the United States government (A. B. Cleaver, 1992).

[401] A version of the original Blogging Guidelines from 2005 is preserved on the Internet Archive.

[402] In comparing versions of the guidelines on archive.org between 2009 and 2010, most changes were just tighter editing. The section on "IBM"s business performance" was expanded considerably to "IBM's business performance and other sensitive subjects". A new paragraph, third from the bottom, added "Adopt a warm, open and approachable tone".

> networking, and who can volunteer their time and talent to energize and enable every IBM employee in order for him/her to benefit from using social software, both internally and externally (Tuutti, 2010, pp. 34-35).

Beyond the early adopters, the goals of enabling client-facing employees to (i) leverage the collective intelligence of IBM, (ii) improve productivity, and (iii) serve clients more effectively attracted the sponsorship of the Senior VP of IBM Software Group. To support the global IBM base of 400,000 IBM employees across the wide range of job roles, geographies and product lines, 9 people were funded to operate the program (Murray and R. Shah, 2010). The purpose of the initiative, described on the intranet wiki site, was to:

- Showcase for the business benefits of IBM social software, in both internal and external use, to help employees learn about it, get productive with it, connect to communities with it, and share it with other users, clients, partners, and press.
- Operate as a living lab filled with the latest social software tools and programs, education and advice, marketing materials, and success stories.
- Offer a starting point for quickly and easily making the most of social software – and sharing best practices and success stories – as an individual, member of a collaborative team, or member of a social-networking community, or BlueIQ ambassador (Tuutti, 2010, p. 34).

By 2011, the BlueIQ Ambassador committee grew to 1600 volunteers. They had held 160 events to educate each other on how to collaborate, and then 50 events to engage other IBMers. The ambassadors are credited with spreading the philosophy and practices of social business, growing from 11% of the sales force in 2009 to over 40% in 2011. Over 66% of sales roles were estimated to be using the environment (R. Shah, Murray, and Overly, 2011).

Leading up to the 2011 IBM Centennial Program, the Senior VP of IBM Marketing and Communications sponsored the Social Business @ IBM program starting in 2010. This made visible 29,000 IBM experts on the external IBM web site, extending the BlueIQ program (R. Shah, Murray, and Overly, 2011). The crossover to IBM's commercial offerings was complemented by a web site and publication on how Social Business could be a game changer, with references on how additional enterprises had effectively networked their people (Hassell et al., 2011).

In hindsight, the progress on Enterprise Social Strategy has been traced from 2003 to 2009, summarized in Table B.1. Four stages of maturity have been mapped over five periods (Emerick, 2013).

The years 2003 to 2009 were a stage of *ad-hoc experimentation and discovery*. It started with no engagement, a lack of cultural readiness,

Table B.1. Enterprise social strategy (adapted from (Emerick 2013))

	Maturity stages				
	Ad-hoc experimentation / Discovery (2003-2009)		Sponsored exploration (2009-2010)	Business unit engagement (2011-2012)	Enterprise engagement (2012-2013)
Characteristics	No engagement Lack of cultural readiness Restricted (i.e. legal, regulated industry)	Limited complexity Free tools / tools evaluation Experimental People working in their spare time	Stovepiped investments Decisions by BU functions Ownership disputes	Business targets for social Comms or marketing straining to scale Growing effort to coordinate Some data integration	Business process focus Enterprise standards and best practices Data integrated into business processes Cost efficiency imperative Investment sharing
Leadership	Management skeptical of business value	Taking steps to build skills and culture	No overarching vision, underdeveloped coordination	Successful transformation of major enterprise processes	Strong overarching vision and culture, good governance, digital initiatives generating measurable business value
Business Value	Brand becoming irrelevant to increasingly social society, unable to control risk, no influence over earned media.	Some improved customer understanding Some brand surveillance, cost reduction	Improved customer insight, new customer touchpoints, predictive modeling	Strengthened productivity through worker enablement, increased employee engagement, enhanced customer acquisition	Socially modified business models, open innovation, top line growth, new revenue streams

legal restrictions, skeptical management and an inability to control risks to business value. By the end of period, people in their spare time had tried the free tools, leadership saw that skills and culture should be built, and customers began to have a some understanding that an enterprise social strategy should be pursued.

The years 2003 to 2009 were a stage of *ad-hoc experimentation and discovery*. It started with no engagement, a lack of cultural readiness, legal restrictions, skeptical management and an inability to control risks to business value. By the end of period, people in their spare time had tried the free tools, leadership saw that skills and culture should be built, and customers began to have a some understanding that an enterprise social strategy should be pursused.

By 2009 to 2010, *sponsored exploration* saw some decisions autonomously make by business unit functions, in the absence of an enterprise vision and coordination. Ways in which customers could interact with the enterprise improved.

In 2011-2012, *business unit engagement* saw social business targets emerging, with leaders transforming some major processes. Productivity amongst enabled workers strengthened, and impacts on customers was noticed.

Only by 2012-2013 did an *enterprise engagement* occur. Focuses on social business with business processes, standards and data were tracked for cost efficiency and investment sharing. A strong vision and governance guided digital initiatives with a promise of generating business value. A modification of the business model towards open innovation would produce growth and new revenue streams.

The six years from 2003 to 2009 can be seen as individuals and communities learning open sourcing within a private sourcing context. Expanding this to the enterprise level would take about 4 years from 2009 to 2013. Social business would be largely a formalization of way of interacting that had informally developed slowly from a grassroots level.

B.2.8 From 2006, IBM alumni connect via the Greater IBM Connection

In June 2006, a Google Group was formed by IBM U.S. Strategic Communications to open discussions on forming a Greater IBM group. Complemented by a Wordpress blog, this initiative was:

> ... part of our larger strategy to build a community of IBM veterans, whether retired or still working, as a global innovation community. The goal is nothing less than to reimagine what several hundred thousand IBMers beyond the company's active workforce can accomplish by having more interaction with the company and current IBMers.

A virtual team was formed to plan, develop and drive the success of an IBM alumni network:

> There are an estimated 800,000 to a million former IBMers worldwide. They include traditional retirees; long-term employees who've pursued other opportunities; people who spent a few years with the company and have long careers ahead of them elsewhere; even former interns.
>
> The "Greater IBM Community" is new model for lifelong affiliation that encompasses individuals in all of these categories, as well as the company itself and our intersecting circles of friends, colleagues, business partners, clients and advocates (Goodson, 2006).

At that time, a variety of motives for a corporate alumni network were cited: 20 to 25% of professional hires are former employees, they're more productive on reboarding, they stay for longer the second time, and the recruitment cost of 20% to 30 of an annual salary can be saved. [403] Generation Y young adults expecting high employee turnover in the 21st century often stay connected to their networks.

In October 2006, a virtual block party was held for the Greater IBM Connection in Second Life. On Almaden Island, 43 attendees joined from 11 countries (Greater IBM, 2006). In addition to the Second Life virtual online meeting room where groups could communicate via text chat, a teleconference line for voice was also provided (Mariacher, 2006).

By December 2006, the Greater IBM Connection was on the two largest business social networking web sites: Xing and LinkedIn (Suarez, 2006). A site was launched on Facebook in 2007, and a Twitter identity was created in July 2008.

In December 2008, a virtual holiday party was held in Second Life for the Greater IBM Connection (Debbe Kennedy, 2008).

By 2012, the online community had 135.000 members. The benefits of participating in the Greater IBM Connection were found to be (i) staying connected for former colleagues; (ii) finding job opportunities, with an interest in rehiring; (iii) keep abreast of thought leadership and initiatives coming from IBM (Swenson, 2012).

The Greater IBM Connection has been cited as an example of a new network driven approach to human resources where former employees may have opportunities to consult on projects, mentor, or participate in engagement or development events (Kwan, 2013).

[403] At Deloitte Consulting, one if five experienced hires is a former employee. At Ernst & Young, it's one in four. When the alumni return, they are more productive and stay longer the second time. The recruitment cost of 20% to 30% of an annual salary is saved. (Von Bergen, 2006). The Procter & Gamble Alumni Network has 10,000 members worldwide. The Microsoft Alumni Network founded independently and approved by Microsoft to use its name, has 6000 members. Microsoft finds 20% of alumni return to the company (O'Sullivan, 2005).

B.3 IBM consultants, from 2004, focused priorities from business leaders through industry-based executive studies

The IBM Institute for Business Value formed in 2002, within IBM Business Consulting Services, with a charter to develop primary research.[404] Towards anticipating issues that top business leaders were facing, a series of global executive studies prioritized themes towards which IBM could coalesce its resources and position its offerings. The primary research began with the Global CEO Study in 2004, complemented from 2005 with functional leaders to be known as Global C-suite Studies. Outside IBM, the global executive studies showed that IBM was listening across a broad range of customers, and provided a platform for discussion with business leaders. Inside IBM, the global executive studies set contexts through which leaders and employees could assess their alignment with marketplace changes. All of these studies were funded by IBM at the corporate level, and involved hundreds of interviews with executives in the public and private sector.

B.3.1 From 2004, IBM consultants surveyed priorities on innovation and strategic change with Global CEO Studies

In early 2004, the first Global CEO Study was published with the title *Your Turn: CEOs across the world are renewing their organizations for growth. Are you?* It reported on interviews with 456 CEOs "to understand current strategic issues, ambitions and concerns affecting the world's CEOs" (IBM, 2004e, p. 7). Key findings included that (i) four of five CEOs believed that revenue growth was the most important path to boosting financial performance, following some years emphasizing cost containment; (ii) customer responsiveness as high on their agendas, while rating their ability to respond to changing market conditions and risks low; and (iii) growth and differentiation comes through people, but deficiencies in skills – both inside organizations and across the wider labour force – call for re-education and retention, with a need for managerial leadership.

In March 2006, the second Global CEO Study was titled *Expanding the Innovation Horizon*. It reported on interviews with 765 CEOs – 80% face-to-face – to capture views on innovation. Innovation was defined as "using new ideas or applying current thinking in fundamentally different ways to effect significant change" (IBM, 2006c, p. 3). Findings included

[404]The IBV, in 2002, evolved from personnel combining two prior initiatives funded by IBM. The Institute for Knowledge Management (IKM) was founded in 1999 as a consortium of businesses and researchers, during the rise of organizational learning and collaborative technologies. The e-Business Innovation Institute (eBII) was formed after the mid-2001 acquisition of Mainspring Inc., a small business strategy consulting group that carried out primary research. Both the IKM and eBII were contained within IBM Business Consulting Services, working closely with the Strategy & Change practice.

that (i) business model innovation was much higher on CEO's priority lists than expected, although not negating the need for innovation in products, services, markets and operations; (ii) external collaboration with business partners and customers ranked as the top source for innovative ideas, much above research and development, with an admission that organizations were not collaborating enough; and (iii) innovation has to be fostered by the CEO, orchestrating teams, rewarding individuals and better integrating business and technologies.

In April 2008, the third Global CEO Study was titled *Enterprise of the Future*. It reported on interviews with 1130 CEOs, more than 95% face to face, on the enterprise of the future (IBM, 2008k). Findings included (i) eight of 10 CEOs bombarded by change, with gap between expected change and ability to manage it tripling since the 2006 study; (ii) more demanding customer not as a threat, but as an opportunity to differentiate; (iii) two-thirds of CEOs adapting their business models, with 40% changing to be more collaborative; (iv) aggressive movement towards global business designs, changing capabilities and partnering more extensively; and (v) financial outperformers making bolder plays.

In April 2010, the fourth Global CEO Study was titled *Capitalizing on Complexity*. With three prior studies as a foundation, this edition "also sought to understand differences between financial standouts and other organizations" (IBM, 2010b). It reported on interviews with 1541 CEOs in 60 countries and 33 industries. In addition, a subset of the questions was also asked to 3619 students from 100 major universities around the world, to "provide insight into the views of future leaders". Findings included that (i) 79% of CEOs expected greater complexity ahead, but 51% doubted their ability to manage it; (ii) 60% said embodying creative leadership would the most important leadership attribute over the next five years, with 52% mentioning integrity; (iii) 88% planned to get closer to their customers, reinventing relationships to the co-create products and services, and integrate customers into core processes; (iv) 61% of standouts intended to build operating dexterity by simplifying operations as compared to 47% of others, with an expectation of 20% more future revenue to come from new sources.

In May 2012, the fifth Global CEO Study was titled *Leading Through Connections*. The focus was on "the complexity of increasingly interconnected organizations, markets, societies and governments", also called "the connected economy". It reported on more than 1709 CEOs across 64 countries (IBM, 2012a). Findings included that (i) 75% of CEOs seeking collaboration as the number one trait in their employees; (ii) 70% investing in customer insights, above operations, competitive intelligence, financial analysis and risk management; and (iii) more than half partnering extensively to drive innovation.

Subsequent CEO Studies were not packaged independently, but inte-

grated with the C-suite.

B.3.2 From 2005, IBM consultants surveyed functional executives with additional C-suite studies

Before the global executive *studies* started in 2004, the Institute for Business published a *survey* published in September 2003, titled *CFO Survey: Current state and future direction*. It reported on interviews with 450 CFOs from 35 countries, representing global enterprises with average annual revenues of US$8.4 billion (IBM, 2003b). From the past 5 to 7 years, CFOs saw organizations shifting to a "new, more efficient and effective model", including three transformations: (i) from a role from "policeman" to a strategic business partner; (ii) from a cost base from 3% to 1% of revenue; and (iii) from activity focus of transaction processing to decision support and control. The model of the future, for an on-demand world, would see (i) the emergence of a Chief Focus Officer proactively driving business model design and portfolio configuration; (ii) responsive business management architectures; (iii) resilient governance structures; (iv) competitive cost structures across the finance network; and (v) becoming integrators of process, technology and people.

In September 2005, the Global Human Capital Study was titled *The Capability Within*. It reported on interviews with 106 CHROs (Chief Human Resource Officers) in 320 organizations were interviewed, ranging in size from 1200 employees to over 25,0000 (IBM, 2005f). The study confirmed "the findings of the IBM Global CEO Study 2004", with fewer than half of participants seeing their organization as "adequately equipped to respond to the growth and responsiveness priorities set out by their CEOs". Findings included (i) CHROs describing their businesses as "cycling downhill" in either "maturing" or "declining" markets, where HR strategies originally in place to drive growth shifted to institutionalizing and consolidation of processes; (ii) the question for talent seen as a buy-build balance, where higher investments in development of middle managers had higher profits per FTE (full-time equivalent) at a risk of enabling higher voluntary turnover of staff; (iii) the challenge of retaining people in a fast-moving world saw more than 50% of CHROs believing their organizations were "doing alright" with work/life programs and flexible hours, fewer than 50% adopting a relaxed dress code, and only 30% of organizations implementing child-friendly policies; (iv) organizations falling short on knowing which areas need to be measured, with only 25% measuring return on investment in human capital, and few incorporating human capital measures into their leadership rewards; and (v) significant differences across regional geographies challenging a unified corporate culture, with the Asia-Pacific region having advantages in cheap labor and Latin America volatile in layoffs and a relatively young workforce.

In December 2005, the Global CFO Study was titled *The Agile CFO: Acting on business insight*. In cooperation with Economist Intelligence Unit, 889 CFOs were interviewed (IBM, 2005e). Responses from the CFOs top areas of importance of performance, growth and risk were thought to track with the 2004 Global CEO Study top agenda items of growth and responsiveness. The most effective finance organizations were addressing issues of (i) structural complexity and (ii) fragmented information.

In October 2007, the Global CFO Study was titled *Balancing Risk and Performance with an Integrated Finance Organization,* in cooperation with the Economist Intelligence Unit and Wharton School professors. The preface by Mark Loughridge, CFO of IBM, cited the Palmisano 2006 "vision for the 21st century successor to the multinational corporation, the globally integrated enterprise", and asked "what does it mean for the Finance discipline?" to enable this innovation (IBM, 2007c). The primary survey instrument as delivered to 1200 CFOs in 79 countries, with 619 surveys in person and 611 via an online survey tool. Findings included that (i) 62% of enterprises with revenue over US$5 billion had material risk issues in the prior three years with 42% saying they were not prepared for it, and 46% of enterprises with revenues under US$5 billion had a major risk event and 39% were not well prepared; (ii) IFOs (Integrated Finance Organizations) had been adopted by only 1 in 7 enterprises over US$1 billion in revenue, yet their revenue growth rate of 18% over five years was almost double those of non-IFOs at 10%; (iii) 69% of finance executives believed that greater integration was an imperative to achieve, yet no significant progress had been made in the past 3 years; and (iv) risk management was immature, with only 42% doing historic comparisons, 32% setting specific risk thresholds and 29% creating risk-adjusted forecasts and plans. A roadmap to mature into an IFO was proposed.

In September 2009, the first Global CIO Study was titled *The New Voice of the CIO*. Participants included 2598 CIOs in 78 countries and 19 industries (IBM, 2009c). CIOs were found to spend (i) 55% of their time on activities that spur innovation, including generating buy-in for innovative plans, implementing new technologies and managing non-technology business issues; and (ii) 45% of their time on managing the ongoing technology environment, including reducing IT costs, mitigating enterprise risks and leveraging automation to lower costs elsewhere in the business. At any time, a CIO could be described as (i) an insightful visionary and able pragmatist; (ii) a savvy value creator and relentless cost cutter; and (iii) a collaborative business leader and an inspiring IT manager. The three seemingly opposing mindsets would see the CIO lead initiatives to (i) make innovation real; (ii) raise the ROI of IT; and (iii) expand business impact.

In March 2010, the Global CFO Study was titled *The New Value Integrator*. Participants included more than 1900 CFOs from 81 countries and

32 industries, 75% interviewed face-to-face by IBM executives, and the remaining surveyed by the Economist Intelligence Unit (IBM, 2010e). Two primary capabilities were identified: (i) *finance efficiency*, as the degree of process and data commonality across Finance; and (ii) *business insight*, as the maturity level of Finance talent, technology and analytical capabilities dedicated to providing optimization, planning and forward-looking insights. This led to four segments: (a) *scorekeepers*, with low efficiency and low insight, primarily focused on reporting results and ensuring regulatory compliance, struggling with speed and consistency because of insufficient standards and automation; (b) *constrained advisors*, with low efficiency and high insight, developing strong analytical capabilities but working with incomplete and inconsistent information requiring reconciliation and manual intervention; (c) *disciplined operators*, with high efficiency and low insight, competent in financial control and reporting activities in a highly automated, efficient manner, but lacking the capabilities to provide cross-functional analyses and assist with strategic operational decisions; and (d) *value integrators*, with high efficiency and high insight, with heightened interest in using technology to improve data accuracy, streamline information delivery and developing a richer base of information and deeper insights. Value integrators were found to outperform all other enterprises with more than 20 times EBITDA, 49% more revenue, and 30% more ROIC.

In October 2010, the second Global CHRO Study was released, titled *Working Beyond Borders*. Participants included 707 CHROs, with almost 600 interviewed face-to-face (IBM, 2010h). The report found that the rationale behind workforce investment had changed. The traditional pattern of companies in mature markets seeking operational efficiency through headcount growth in emerging economies had changed, with CHROs in growth markets (e.g. China and India) increasing their workforce presence in North America, Western Europe and other mature markets. This shift led to three new requirements: (i) *cultivating creative leaders* who could provide direction, motivate, reward and drive results from an increasingly dispersed and diverse customer base; (ii) *mobilizing for speed and creativity* through simplifying processes and providing fast, adaptive workforce solutions; and (iii) *capitalizing on collective intelligence*, tapping into an institutional knowledge with new ways to connect people both internally and externally.

In December 2010, the first Chief Supply Chain Officer Study was titled *The Smarter Supply Chain of the Future*. Participants included 393 executives located in 25 countries serving 29 industries. They were compared to top supply chains, with 17 listed in "The AMR Research Supply Chain Top 25 for 2008" (IBM, 2010f). Chief Supply Chain Officers were dealing with volatility through coping with (i) *cost containment*, keeping up with frenetic shocks of wage inflation, spikes in commodity prices and sudden credit freezes; (ii) *visibility*, with organizational silos too busy to

share information or not believing that collaborative decision-making is important; (iii) *risk*, with 69% of respondents formally monitoring risk, but only 31% managing performance and risk together; (iv) *customer intimacy*, with 80% of respondents designing products jointly with suppliers, but only 68% doing so with customers; and (v) *globalization*, with issues reported in unreliable delivery (65%), longer lead times (61%) and poor quality (61%), while nearly 40% reported improved margins through increased sales increases rather than greater efficiency.

In May 2011, the second Global CIO Study was released, titled *The Essential CIO*. This was the first in the program now called C-suite Studies. Participants included 3018 CIOs, spanning 71 countries and 18 industries (IBM, 2011d). Aligning with the 2010 Global CEO Study vision to increase competitiveness, plans were cited by CIOs with 83% including business intelligence and analytics, 74% including mobility solutions, and 68% including virtualization, 60% including cloud computing – a 45% jump since the 2009 study – and 60% including business process management. Four distinct CIO Mandates were identified, based primarily on how each organization views the role of IT: (i) the mandate to *leverage*, where IT was a provider of fundamental technology services, and operations were being streamlined for greater organizational effectiveness; (ii) the mandate to *expand*, where the CIO led IT operations that help expand organizational capabilities by refining business processes and enhancing enterprise-wide collaboration; (iii) the mandate to *transform*, where IT would provide industry-specific solutions to the value chain, enhancing relationships with customers, citizens, partners and internal clients; and (iv) the mandate to *pioneer*, where IT was a critical enabler, radically re-engineering products, markets and business models.

In October 2011, the first Chief Marketing Officer Study was published, titled *From Stretched to Strengthened*. Participants included 1734 CMOs in 19 industries and 64 countries, interviewed face-to-face. Respondents included 48 of the top 100 brands listed in Interbrand rankings (IBM, 2011e). Compared to the 2010 CEO Study, CMOs were aligned on the top external forces affecting their organizations, as (i) market factors and (ii) technology factors. Four challenges were seen as pervasive, universal game changers: (i) *the data explosion*, with 70% of CMOs not fully prepared to deal with the impact; (ii) *social media* as completely different tool from traditional channels; (iii) *proliferation of channels* and device choices; and (iv) *shifting consumer demographics*, with 63% seeing a significant impact on the marketing function while only 37% prepared to deal with the shift. Outperforming organizations addressed these challenges differently from other CMOs. The three areas where marketing needed to improve were: (i) delivering value to empowered customers; (ii) fostering lasting connections; and (iii) capturing value and measuring the results of their efforts.

The most intensive research in C-suite Studies appears to have ramped

down after the ten-year period ending 2013.[405] In October 2013, "the first study of the entire C-suite" was titled *The Customer Activated Enterprise*. This cumulated the data from 23,000 interviews stretching back to 2003 (IBM, 2013c). The combined study cited meeting with 4183 top executives – 884 CEOs, 576 CFOs, 342 CHROs, 1656 CIOs, 524 CMOs and 201 CSCOs – between February and June 2013. Separate reports for each of six executive roles were created:

- The CEO insights released in November 2013 were described in *Reinventing the Rules of Engagement*. While CEOs since 2004 had consistently identified market forces as the biggest driver of change, they placed technology at the top of the list for the first time in 2012 (IBM, 2013b).
- The CIO insights were released in November 2013 in *Moving from the Back Office to the Front Lines* (IBM, 2013a).
- The evolution of the CFO perspective was released in February 2014 in *Pushing the Frontiers* (IBM, 2014d).
- The CHRO insights were released in March 2014 in *New Expectations for a New Era* (IBM, 2014b).
- The changing world of the CMO was reported in March 2014 in *Stepping Up to the Challenge* (IBM, 2014f).
- The ways that the CSCOs were preparing for the future were reported in May 2014 in *Orchestrating a Customer Activated Supply Chain* (IBM, 2014c).

The Final Chapter was released not as a hardcopy publication, but an app in June 2014 downloadable to a tablet or viewable on the web as *Exploring the Inner Circle* (IBM, 2014a). This summarized the ten years, 17 studies, and 23,000 face-to-face executive interviews.

The program of understanding customer executive perspectives from 2003 through 2013 represents a significant investment by a private company to guide not only its own interests, but also to openly share in potential future directions together.

B.4 IBM researchers, from 2004, led studies on longer horizon opportunities for social impact

IBM set up an independent research division in 1956, having temporarily set up the Watson Scientific Computing Laboratory at Columbia University in 1945 (IBM, 2011e). It is now a worldwide organization with the most recent locations in the China Research Laboratory in 1995, the India

[405]The most recent C-suite studies, from the 2012 CEO report back to the 2009 CSCO report, have been downloadable from `http://www-935.ibm.com/services/c-suite/series-download.html`. Copies of earlier reports are no longer officially available, but their wide distribution has made some softcopies accessible on industry organization and academic sites.

Research Laboratory in 1998, IBM Research Ireland and IBM Research Australia in 2011, and IBM Research Africa in 2013. IBM Research Division continues to provide "a dynamic mix of long-range scientific research with work that feeds cutting-edge innovations to the company's business units".

IBM Research has always had a longer horizon of five to ten years, as compared to hardware and product divisions with development plans of three to five years, and the sales and distribution division looking out one to three years. IBM has always had strong ties with universities, dating back hosting the first meeting of the precursor to the Association for Computing Machinery (ACM) at Columbia University in September 1947.[406] With the rise of the Internet, the Faculty Portal and a Student Portal hosted by IBM University Programs would expand into the IBM Academic Initiatives in 2003.[407] With business success by the early 2000s, the Research division invested in two further initiatives that opened up the company to a broader range of stakeholders, starting (i) the Global Innovation Outlook, and (ii) the Service Science, Management, Engineering and Design.

B.4.1 Since 2004, IBM researchers led the Global Innovation Outlook

IBM Research has, since 2000, annually published a Global Technology Outlook for internal use as part of its forecasting processes, based on trends that might be disruptive or harbingers of change.[408] In 2004,

[406] The space for the first meeting was organized by Wallace Eckert, the founder and director of the Watson Lab at Columbia University.

[407] The IBM Faculty Portal and IBM Student Portal go back earlier than 2001, when the Internet Archive starting crawling the web. "The IBM Academic Initiative is an innovative program offering a wide range of technology education benefits from free to fee that can scale to meet the goals of most colleges and universities. IBM will work with schools – that support open standards and seek to use open source and IBM technologies for teaching purposes – both directly and virtually via the Web." (IBM, 2004c).

[408] GTO briefings were not release openly, requiring specific approvals for briefings by named individuals. The GTO in 2004 described: (i) power limiting microprocessor frequencies; (ii) breakthroughs in stochastic analysis and optimization methods; (ii) people proxies become first class programming constructs; (iv) pervasive connectivity over Internet broadband; (v) legislative and regulatory compliance becoming mainstream in enterprise IT systems; (iv) the architecture of business leading to models become reusable assets. The 2005 GTO saw: (i) radical changes in semiconductor technology and the shift from scaling up to scaling out; (ii) more flexible enterprise solution assembly with components in service-oriented architectures; (iii) the shift value networks towards a service economy: (iv) the rise of speech technology, particularly in serving customers; (v) the rise of metadata in both structured and unstructured forms, complemented by search and analytics; (vi) business decision dynamics with stochastic analytics and secure federation containment. In the 2008 GTO the top five trends were: (i) core computer architectures; (ii) Internet scale data centers; (ii) community- and informatiion-centric web platforms; (iv) real world aware collection and analysis; and (v) enterprise mobile. In 2010, the GTO six chapters included: (i) evidence-

as a complement the Global Innovation Outlook was initiated with two differences: (i) for interdisciplinary collaboration, viewpoints of clients, partners (both academic and business), through leaders and proponents of change were to be included; and (ii) the scope would be aspects of where quality of life could be changed over a horizon of five to ten years, with disciplines and specialties might then be brought with innovation to break on them as a subsequent consideration (IBM, 2004b, pp. 8-9).

The Global Innovation Outlook would release reports from 2004 to 2008. In hindsight, there would be distinct focus each year:

- GIO 1.0 focused on healthcare, government and work-life balance;
- GIO 2.0 focused on future of the enterprise, environment and transportation;
- GIO 3.0 focused on media and content, and on Africa; and
- GIO 4.0 focused on security and society, and water and oceans.

In contrast to the typical IBM process, the reports were issued without form numbers, and later editions carried Creative Commons licenses.[409] IBM sponsored the dialogues on innovation, business transformation and societal progress, in collaboration with a global ecosystem of experts.

The motive for the Global Innovation Outlook program described that, it was "not just our understanding of innovation that needs adjusting", but that "innovation itself is changing in at least three major ways" in the 21st century:

> *one*: It is occurring more rapidly – barriers of geography and access have come down, enabling shorter cycles from invention to market saturation.
>
> *two*: It requires wider collaboration across disciplines and specialties – where until recently, people hunkering down in a garage could create a new technology that would sweep the world, many challenges are now too complex to be solved by individual pockets of brilliance, let alone brilliant individuals. Combinations of technologies, expertise, business models and policies will now drive innovation.
>
> *three*: The concept of intellectual property is being reexamined in the light of these collaborative demands. Increasingly, entities that treat intellectual assets more like capital – something to be invested,

centric medicine and payment-for-outcomes in healthcare; (ii) model orchestration orchestrating the smarter planet; (ii) new development models, tools and methods transforming the software industry; (iv) tools and services to identify, improve and operate legacy; (v) convergence of IT and wireless infrastructures; and (vi) hardware-software codesign for workload-optimized systems. The 2011 GTO included (i) socially synergetic enterprise solutions; (ii) petascale analytics appliances and ecosystem; (iii) natural resources transformation and management; (iv) the Internet of Things; and (v) advances in technology that will create a new class of systems that can learn.

[409]The reports were previously readily downloadable from the public IBM web site. The resource link page is preserved on the Internet Archive.

> spread, even shared to reap a return, not tightly controlled and hoarded – will find the clearest paths to success (IBM, 2004b, p. 5).

While IBM leaders thought that IBM had excellent methods for examining technology and business trends, the company had no single integrated view of innovation. Two challenges were: (i) working across disciplines outside the company's borders; and (ii) the "invent first, apply second" bias that had crept into modern thinking. Developing the GIO thus led to two major goals:

> FIRST, extend the integration of our business insight and technology expertise beyond our company's borders to include the best thinkers from academia, our clients and partners, and other leaders in areas critical to innovation.
>
> SECOND, follow a different path to discovery: begin with several areas critical to society over the next five to ten years, then consider implications for businesses and other integral components of society, finally considering what technologies or solutions might need to be developed (IBM, 2004b, p. 9).

In addition, the process to produce the GIO "would be quick and spontaneous, and would maneuver around the boundaries of normal business practice", conditions under which innovation thrives.

In 2004, GIO 1.0 GIO convened 10 "deep dive" sessions in New York, Shanghai, Washington D.C. and Zurich over 24 days. Three broad societal themes were discussed: (i) healthcare; (ii) government and its citizens; and (iii) the business of work and life. From 96 organizations, 100 ecosystem members discussed with 100 IBMers, complemented by 25 additional interviews with global thought leaders. In the report released in November 2014, three consistent themes emerged from the wide range of ideas: (i) the need for *standard ways of exchanging information* between members of each ecosystem (and across ecosystems); (ii) the need for more *open collaboration* between ecosystem members (even at times, among competitors); and (ii) the *primacy of the individual* as a focal point for innovation (IBM, 2004b, p. 14).

On *healthcare*, three areas emerged that held significant promise for innovation:

- integrated health records;
- the implications of new delivery models designed to meet the needs of underserved populations; and
- implications of a deeper understanding of ourselves (IBM, 2004b, p. 24).

On *government and its citizens*, significant ways the relationship would evolve were noted as inevitable:

- Governments will have to become more efficient and integrated across

agencies and ministries.
- Governments will become subject to new kinds of influence and pressure due to novel uses of communications technology – "they will not be able to escape the bloggers," said one participant.
- Governments will compete and cooperate with each other more on the basis of virtual factors (skills, expertise, infrastructure and productivity) than on simple, traditional geographic advantages.
- In some ways, governments may behave more like businesses (tying plans to budgets and strictly measuring results and return on investment to society), but in others, they will need to remember what makes them fundamentally different: they cannot pick and choose "clients," since they should act on behalf of all their citizens (IBM, 2004b, p. 41).

On *the business of work and life*, the redefinition of work by the factory through the industrial revolution as "industrial indenture" was being reshaped by knowledge workers:

- *Finding the off switch an always on world* reflected "a return to earlier, pre-industrial models where work performed at home (in the fields, at the hearth) was not thought of as something entirely distinct from life". This changes the ways that a workforce is managed, as well potentially portending a trickle-up into larger structures of society.
- *For workers, work becomes academic*, as "First, workers will no longer be able to rely on expertise (including university degrees) earned early in life to keep them at the front of the skills queue. Second, it will be unlikely that universities and other educational institutions trying to keep abreast of the dynamic nature of work will be able to do so". This could lead to tighter collaboration between academia and industry, or even "a time when leading companies join the ranks of universities in being accredited to offer advanced degrees".
- *Corporate culture catches up to the knowledge age*, where retirement programs that "pressure knowledge workers to leave at a set age with no accommodation for an ongoing association may be wasting their best assets" and a "normalizing culture that allows interaction and collaboration" across cultural differences that are "national, ethnic, linguistic, educational, expertise- or skill-related" (IBM, 2004b, pp. 55-67).

The 2004 report closed by saying the exploration paving the way for change was not a conclusion, but a way to "stimulate concrete action". Projects sparked by GIO 1.0 had already started.

Building on that first outlook, the view on innovation evolved, so that:

> ...innovation is no longer invention in search of purpose, no longer the domain of a solitary genius looking to take the world by storm. Instead, innovation is increasingly:

> *Global*. The widespread adoption of networked technologies and open standards is removing barriers of geography and accessibility. Anyone and everyone can participate in the innovation economy.
>
> *Multidisciplinary*. Because the challenges before us are more complex, innovation now requires a diverse mix of talent and expertise.
>
> *Collaborative and open*. More and more, innovation results from people working together in new and integrated ways. Within this collaborative environment, notions of intellectual property are being re-examined. And those entities that view intellectual assets as "capital" to be invested and leveraged – rather than "property" to be owned and protected – will likely reap the greatest returns (IBM, 2006d, p. 2).

This theme of innovation as "open, collaborative, multidisciplinary and global" would be consistently presented by IBM executive leaders beginning in 2005, both internally and externally.[410] The pattern of open sourcing while private sourcing is implicit in a world where innovation is open, collaborative, multidisciplinary and global.

Looking to produce a second Global Innovation Outlook, a survey of the contributors to the first GIO some direction: 90% of respondents "suggested that issues related to the environment and energy would benefit most from a GIO-style investigation". Keeping with the focus on near-term potential for technology and business innovation, the challenge of massive urbanization trends in the developing world and stresses on existing infrastructure surfaced (IBM, 2006d, pp. 48-49). The 15 deep dive sessions conducted in fall 2005 would focus on (i) the future of the enterprise, (ii) transportation and (iii) the environment. Participants included 248 thought leaders from 33 countries and 178 organizations.

In March 2006, the GIO 2.0 report was released. The patterns from GIO 1.0 – the need for standards, the trend towards open IP and collaboration, and primacy of the individual continued to resonate. In addition, some new patterns emerged:

- *The power of networks*, with the "evolution of social structures" transcending physical and geographic borders; a unifying notion of "the endeavor" in a common set of interests, goals or values that could redefine "the enterprise", "employer" and "employee"; a "collaborative, contribution-based" environment where the traditional enterprise could shift to orchestration and facilitation of endeavors; "reputation capital" as a kind of accumulated trust, in a standard of accountability that enables diverse people to strike partnerships; and a "complex set of causes and effects" as boundaries dissolve and more

[410] Consideration in contrast to an alternative view was blogged as "Innovation as open, collaborative, multidisciplinary, global" | June 13, 2008.

fluid relationships form.

- *Line of sight shaping* "decision making" as whether understanding and anticipating the full consequences of one's actions might inspire "different choices", with opportunities capitalizing on advances in computer power, networked infrastructure and data intelligence.
- *Flipping the equation*, applying intellectual energy into the areas opposite of current focuses for new breakthroughs and advancements, requiring "moving beyond 'either/or' thinking" (IBM, 2006d, pp. 9-12).

The patterns were tied to the *Innovation that Matters* message in 2006, that would broaden the dialogue beyond *On Demand*.

On *the future of the enterprise*, the idea of a joint endeavor or undertaking could change leadership and managing and motivating global talent. Insights included:

- *Forget about free enterprise. Think enterprise-free:* where the endeavor was described as the glue between individuals or entities, relegating the traditional organization to orchestration and facilitation, likened to the fluidity in the Hollywood studio system in rotating rosters of affiliated talent, each an "aggregation of specialized entities".
- *Talking 'bout my reputation*: where brand promise is challenged to maintain integrity across workers and partners, and "reputation capital" of non-affiliated contributors might adopt a currency with a "trustmark".
- *A small world after all*, where highly-specialized businesses of 25, 10 or even five employees can conduct business on a global scale, and large businesses may emulate "smaller is often better" tailoring of products and services.
- *Success will depend on how well you play the game – literally*, where "studying the qualities of leaders" has suggested that the next generation of leaders could be the outliers at the "polar opposite from command and control management systems" in massively multiplayer online games (MMOGs) where "the connective tissues of this collaboration" is the normalizing culture, and "flexible contextual learning models" allow people to develop new skills as needed.
- *Rewriting the employer-employee 'contract'*, inventing the exchange of value with reward systems "beyond stock options, bonuses and retirement plans", with disaggregation where "social networks could provide a stabilizing force" to reduce individual elements of risk, and "mobility for a common set of employees" such as retirees.
- *Insight as a mindset, not a department*, where the best ideas from around the world are exchanged dynamically, such as "sensing hubs" in emerging markets to seek out innovation components and ready receivers for existing ideas (IBM, 2006d, pp. 14-23).

On *transportation*, eased geopolitical borders enabled people and freight

to move greater distances with more frequency, but one they get there, congestion on streets and ports was seen as taking a toll. Insights included:

- *Grow, but with flow*, would see cities or regions dealing with congestion, noting that "mobility increases market areas", expanding options for access to goods, competitive advantage, attracting new business investment and a higher-caliber workforce.
- *Headlights into the system,* with sensing and computing devices to reduce vehicular congestion through "more holistic approaches to understanding and managing urban traffic flows" with the challenge of "are individuals willing to cede such control?", particularly in developing economies.
- *Playing 'leapfrog' to move forward*, with emerging economies rejecting existing paradigms to embrace new approach to manage the boom in personal vehicles, e.g. alternative-energy cars or car-sharing, where a rising "middle class is spiking demand".
- *New paths for public transportation*, in better coordination and integration across different modes of public transit, including smart cards as "a common currency", "integrating the information" to push out to riders via mobile devices or street-side kiosks, and "swarms of smaller, more mobile, more flexible vehicles" that could dynamically re-reroute themselves based on need.
- *Services on the go*, with connected vehicles in "a new breed of services", including embedded technologies, and services that "fundamentally change the relationship" among drivers, passengers, manufacturers and third-party service providers.
- *Shoring up shipping* to eliminate paper documents associated with customs policies, manual processed and increased global trade with "standardization and integration", an "traffic management as a huge differentiator" for economic advantage in ports (IBM, 2006d, pp. 24-35).

On *the environment*, a world could be imagined where environmental protection and economic prosperity are not only compatible but simultaneously attainable.

- *All's well that ends well* found that back end decomposition could provide the richest opportunities for breakthrough thinking by "flipping the equation" to explore innovative new ingredients, products and processes.
- *The reverse supply network* extended the idea of "reverse supply chains" with the possibility of massive waste reduction through new collaborative relationship to send use components and manufacturing by-products back and forth to one another.
- *Regulation: innovation's friend or foe* was seen by some as driving innovation around product composition and decomposition, while others thought "regulation may actually impede innovation" by en-

couraging manufacturers to simply comply with minimal standards rather than rewarding exemplary performance.

- *From trash to treasure* considered that landfills might be view instead as "above-ground mines" to recover copper and metal alloys.
- *Seeing is behaving* with individuals and businesses having a clearer and continual "line of sight" into the consequences of their actions about energy and natural resource consumption.
- *Mighty micropower* through small-scale energy sources such as wind and solar, often considered "the best energy solution for rural areas".
- *Troubled waters?* found GIO participants across the board concurring that water is possible the number one issue of concern to the world's population in 21st century, with the role of the private sector helping by contributing to waste and misuse of available resources (IBM, 2006d, pp. 36-47).

The GIO 2.0 report of 2006 would be the last integrated document published. Subsequent reports would be issued as in-depth studies on specific topics.

One freestanding complementary GIO 2.0 report would be released in February 2007: *Virtual Worlds, Real Leaders.* Inspired by findings from GIO 2.0 published in 2006, IBM sponsored a study led by Byron Reeves of Stanford University and Seriosity Inc., and Thomas Malone, at the MIT Sloan School, on "whether real business lessons can be learned from observing leadership on online games (IBM, 2007t). The model selected to guide the analysis was the Sloan Leadership Model, that breaks leadership qualities and action into four parts: (i) visioning; (ii) sense-making; (iii) relating; and (iv) inventing.[411] Then a team from the IBM Institute for Business Value built on the research to survey IBM's Virtual Universe Community. Given the right tools in the right circumstances, leadership can emerge. The study found:

> Online gaming environments facilitate leadership through:
>
> 1. Project-oriented organization
> 2. Multiple real-time sources of information upon which to make decisions
> 3. Transparent skills and competencies among co-players
> 4. Transparent incentive systems
> 5. Multiple and purpose-specific communications mediums (IBM, 2007t, p. 17).

The iterative nature of online games presents many opportunities to lead. While there is an overriding goal for the group, a series of "raids" or

[411]The Sloan Leadership Model is credited to Deborah Ancona, Thomas Malone, Wanda Orlikowski and Peter Senge. Cited articles included "In Praise of the Incomplete Leader" on distributed leadership, in *Harvard Business Review,* February 2007.

missions spreads around leadership with no expectation of permanence in the leadership role. Tools can make leadership easier, with skills and competency levels of a member of the guild readily apparent, and real-time risk assessment tools with visible "incentive systems". Finally, guild leaders would mediate conflict and maintain relationships as a natural part of their roles.

Three GIO-inspired works would have direct policy implications: (i) Peer-to-Patent Project, leading to the *Building an IP Marketplace* GIO 2.0 report; (ii) *The Inventors' Forum* for smaller enterprises; and (iii) the Standards for Standards wiki collaboration.

Independent of the main GIO 2.0 themes, a "Peer to Patent" Community Patent Proposal was co-led by the New York Law School, IBM, and the U.S. Patent and Trademark Office (USPTO) in 2006.[412]

One of the challenges of working across open sourcing and private sourcing was that the USPTO was challenged in recognizing open source software as a prior art in applications for patents.[413]

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[412]IBM's leadership in the Peer to Patent Community has been subsequently documented:
"Although many solely attribute Beth Noveck of New York Law School with developing the Peer to Patent project, the project actually originated as a close collaboration between Noveck, IBM, and the USPTO, directed to improving the quality of examination of software patents filed with the USPTO. Schecter drove the corporate involvement and sponsorship for the project. Corporate involvement was critical in the early stages of the Peer to Patent project as the project was entirely funded by corporate sponsorship and foundation grants during the first pilot period from 2007–2009. Noveck provided leadership for the project and also provided law students to help in their spare time, and USPTO Technology Center Director, Jack Harvey, offered his Technology Center 2100 (Computer Architecture, Software, and Information Security) and his time for the project" (Bestor and Hamp, 2010, p. 19).

[413]Open source developers see patents as "chilling effect" in getting tied up in legal proceedings around their work. The Open Source Development Labs (OSDL) – the sponsor of Linux Torvalds and Linux, that would become the Linux Foundation – wrote:
"We want to see fewer poor quality patents. We also wish to help people defend themselves against bad patents. Our strategy to achieve this is simple; Help the USPTO use Open Source as prior art."
"OSDL supports the USPTO's drive to improve the quality of software patents. The goal is to reduce the number of poor quality patents that issue by increasing accessibility to Open Source Software code and documentation that can be used as prior art during the patent examination process. For the Open Source community and many others, this means a reduction in the number of software patents that can be used to threaten software developers and users, and a resulting increase in innovation."
"Three specific patent quality initiatives have been identified as a result of collaboration among the USPTO, IBM, OSDL and others in the Open Source community and software industry. Those patent quality initiatives are:
1. Open Source Software as Prior Art (the subject of this website)
2. Community patent review
3. Patent quality index
This website and related wiki and mailing lists provide a central location for information and exchanges of ideas on the Open Source Software as Prior Art Initiative" (OSDL, 2006).

Bringing together the open source development community with the USPTO was controversial, because many developers thought "patents were evil".[414]

At a meeting on May 12, 2006, a proposal to develop the Peer to Patent Project on a wiki was tabled.[415] IBM continued discussions with USPTO subsequently, lead to IBM making some patent applications in progress available for the pilot:

> In a private meeting with the USPTO (after the public meeting), we brainstormed out a list of some of the items that need to be addressed for the pilot. Those include advisory/steering committee, technology infrastructure, communications plan (announcement, education, code of conduct, etc), patentee consent to have certain published patent applications commented on by third parties, participants to review and comment on published patent applications, incentives to participate, USPTO rule changes that might be required, and more. Consensus seemed to be that 200-300 published patent applications would be needed for the pilot. IBM announced during the public meeting that we would consent to make some of our published patent apps available for the pilot. We hope that others will also contribute some of their own published patent apps, technical support, engineers to help provide comments, funding, etc. (Schecter, 2006)

The work on a wiki in May and June 2006 evolved into a *Building an IP Marketplace* report issued in September 2006 as part of the GIO series. The ties between the nature of innovation and intellectual property was described in the foreword:

> The very nature of innovation is changing as economic activity shifts from physical to intellectual assets. Products of the mind are often patented, making patents a key currency in the 21st century knowledge-based economy. Many of the world's patent systems were developed decades or even centuries ago to promote invention of physical goods, and have not evolved to include mechanisms needed to

[414] The open source community was obviously more comfortable with collaboration tools such as wiki than the USPTO.
"Schecter stated that one reason Technology Center 2100 was chosen was because the open source software community is more skeptical about patents than are inventors in other technology areas, and thus the Peer to Patent project provided the open source community with an opportunity to get involved and do something about the perceived lack of patent quality in the software arts. Additionally, Schecter stated that the open source community was already quite familiar with using collaborative online tools. Thus, they represented a natural starting point for a project that relied heavily on collaborative tools" (Bestor and Hamp, 2010, p. 19).

[415] The "Peer to Patent" Community Patent Proposal Wiki from 2006 is preserved on the Internet Archive. The presentation materials from the May 12, 2006 public briefings by Beth Noveck were downloadable from cairns.typepad.com.

> support this expanded role.
>
> While emphasis on patenting proprietary invention continues to intensify, so does the adoption of open standards and collaborative business models. Organizations endeavor to find the ideal balance on this continuum of innovation (IBM, 2006b, p. 1).

The debate on the wiki led to a "collaboratively written manifesto" that "establishes the foundations of a functioning marketplace for the creation, ownership, licensing and equitable exchange of intellectual property".

On behalf of the contributors across institutions – and published under Creative Commons licensing – the GIO special report prescribed:

> In order for innovation to flourish in a global knowledge- based economy, a new set of principles guiding the creation, ownership and equitable exchange of intellectual goods should include the following tenets:
>
> 1. Inventors file *quality patent* applications for novel and non-obvious inventions of certain scope.
> 2. Patent ownership is *transparent*.
> 3. Market participants act with *integrity*.
> 4. IP *value* is fairly established based on the dynamics of an open market.
> 5. Market infrastructure provides *flexibility* to support differing forms of innovation.
> 6. Realistic introductory levels of global consistency exist for all of the above (IBM, 2006b, p. 6-7).

Towards developing global consistency, the report released in September 2006 detailed issues and paths forward on five areas:

- *Patent quality* could be improved by making searches for prior art easier, reducing the instances in which a patent is granted for ideas that are neither new nor distinct from prior work.
- *Transparency* in the true identity of the rights holders, whether the patent is subject of legal conflict or dispute, and the terms under which the patent might be licensed could speed up further innovation.
- *Integrity* would preclude manipulative behaviours that might damage the brand or reputation of a business, or cause difficulty in business relationships could deter "trolls" that produce neither products nor services, and have not customers.
- *Valuation* through tools that would help determine the fair price of viable knowledge assets don't exist for IP investments in the same way that they do in the financial industry.
- *Flexibility* in accommodating the intangible assets of software, services and business methods haven't kept up with open software standards, where royalty-free licenses of inventions are required, but

then derivatives are patented in some jurisdictions but not others. While the GIO 2.0 report captured the collective view of the contributors, IBM independently spoke to the press on the corporate position:

> According to Ari Fishkind, spokesperson for IBM Technology and Intellectual Property, these are the core tenets of IBM's new initiative:
>
> 1. Patent applicants should be responsible for the quality and clarity of their applications,
> 2. patent applications should be available for public examination,
> 3. patent ownership should be transparent and easily discernible, and
> 4. pure business methods patents without technical merit should not be patentable. [. . . .]
>
> "The patent policy we announced is a broad framework for everything related to how we handle intellectual property. The common denominator is that in many cases, we will exceed what the law requires," said Fishkind. "Some aspects of our policy are the notions of transparency and quality. Allowing the USPTO [U.S. Patent and Trademark Office] to publish all of our patents, and allowing other community members to provide detailed feedback about our patents, will exemplify our drive for transparency and quality in the industry" (Dames, 2006).

Since IBM has had a long record of annually being the world's largest grantee of patents, the weight of these reforms are significant.

The Peer-to-Patent program officially started in June 2007. In the first year to 2008, there were "over 2000 registered users and 173 items of prior art submitted on 40 applications by participants from 140 countries" (Patent Innovations, 2008). By the second year to 2009, 2600 people had registered to become peer reviewers, with 187 participating patent applications (Patent Innovations, 2009). Applications had "been submitted by GE, HP, IBM, Intel, Microsoft, Cisco, Disney, eBay, Novell, Red Hat, Sun, Xerox, and Yahoo, as well as by smaller firms and individuals"(Schecter, 2009). While the goals of the program were overachieved, the economic downturn led to the USPTO placing a moratorium on extending the pilot past June 2009, until a full evaluation of the impact could be assessed. A full report was subsequently written (Patent Innovations, 2012). Of more practical significance, however, was the June 2009 nomination by the Obama administration of David Kappos, the VP and Intellectual Property at IBM (and an early proponent of Peer-to-Patent) for Under Secretary of Commerce for Intellectual Property and Director of the USPTO (Noveck, 2009). In addition, Beth Noveck was appointed by Obama to lead the Open Government Initiative (Hansell, 2009).

In January 2007, IBM announced that it would "develop and host the *Inventors' Forum*, an online initiative to share and debate ideas on how

smaller enterprises view patent systems and can contribute to reform efforts such as improved patent quality" (IBM, 2007q). While U.S. Small Business Administration reported that small companies earn nearly 15 times the number of patents per employee as large enterprises, small companies were seen to lack the resources to obtain a patent, maintain ownership, and then convert the patent into marketable products and services.

In December 2007, *The Inventors Forum* report was released as part of the GIO series, under a Creative Commons license. More than 400 participants – smaller companies and their larger partners, attorneys and IP experts, government officials, economists and academics – conversed over 12 weeks (IBM, 2007q). The group identified a number of issues, including:

- *Education*, at university engineering and technical undergraduate levels, did not focus future inventors and business leaders on patents and intellectual property management, further exacerbated by small businesses lacking in-house IP counsel.
- *Patent offices* could better exploit technology to help small businesses navigate the complexity of global patent systems more cost effectively.
- The *patent reform* legislation pending in the U.S. Congress was viewed positively in improving patent quality and aligning the U.S. with other countries, but sometimes negatively on ways that rule changes could award damages and the challenging of patents after they had been granted.
- A "*Soft IP*" system where a patent owner voluntarily foregoes injunctions and accepts some form of compensation for permitting the use of the patented invention would facilitate innovation on complex systems leveraging multiple inventions.
- *Effective IP management* where patents and IP are strategic business assets rather than byproducts of other activities (IBM, 2007q, p. 6-7).

The conversation began with an emphasis on the ways smaller entities could work more effectively with patent offices and legislators. As the dialogue shifted to areas for improvements that would effect the most significant change, the benefits were considered for the system and its participants as a whole.

In 2008, a similar wiki-based collaborative report was used to establish "standards for standards". This did not officially appear as GIO report – probably because the GIO initiative was winding down by late 2008 – but did have an influence both on IBM policy and recommendations into the White House.

This collaboration occurred subsequent to the approval of OOXML as the ECMA-376 standard in December 2006, and the ISO/IEC DIS 29500

standard in April 2008, driven by Microsoft.[416] Some of the issues were expressed in a blog post by Bob Sutor, IBM VP of Open Source and Standards on "Standards and Quality" in August 2007. In independent assessments of quality, comparisons to *Consumers Reports* ratings from an independent nonprofit organization, Amazon product ratings from purchasers, and home inspectors ranking the current state of a house under consideration were drawn.

> We have nothing like this for standards.
>
> What would it possibly mean for something to be a "one star standard" versus something that is a "five star standard"?
>
> We have folks who do standards compliance testing for a business, but this is not evaluating the quality of the standards themselves. I will note that we do have the Web Services Interoperability Organization which looks at existing standards and best practices in using them, and then recommends both profiles for deploying the standards well and future changes to the standards that will improve them.
>
> We have thousands of standards and no clear way to decide which of them are good and which are not. Instead, we more of less go by the organizations that create the standards, whether we are actually required to implement them (say, by law or customer requirements), or if the market leaders use them.
>
> I'm going to tackle the issue of quality and standards organizations in a future entry, but let me say that
>
> - Standards organizations are not all equal in quality, though it doesn't seem that everyone knows that.
> - A given standards organization can produce two standards of wildly divergent quality.
> - In my opinion, the key measurement of a standards organization is not the quantity of standards produced but the quality of standards produced.
>
> As a disclaimer, I'm very aware that when IBM is involved in the creation of standard, we probably want people to use that. The same goes for everybody else.
>
> In some cases there may be only one standard for a particular purpose. Do we just accept that or can we apply some set of metrics to it to help the maintainers evolve it into something better? (Sutor, 2007)

In April 2008, the OOXML standardization by the ISO led to an opinion that something needed to be done.

> When I was in Geneva in February, I found myself saying some-

[416] The case of OOXML standardization is described more fully in section A.7.4 (c) Open sourcing: Office Open XML approved as ECMA-376 on Dec. 7 2006"

> thing like the following to those who asked me how I thought the OOXML/DIS 29500 vote was going to turn out.
>
> "If the ballot fails, we will have seen that a historic change has occurred. If it passes, we will see that historic change is needed."
>
> Evidently, we're in the latter case. In spite of having significant problems and intellectual property gaps, enough countries have changed their votes from the September ballot to allow the specification to move forward into the publication preparation phase with JTC1 (ISO/IEC).
>
> So is that it? Of course not. The process of international standards making has been laid bare for all to examine. [. . . .]
>
> While fully cognizant of these current results, I'm energized to take the bigger fight for openness to the next level with the thousands of individuals who are now convinced that the standards system needs fixing, and soon. I hope you'll take part (Sutor, 2008b).

In summer 2008, IBM facilitated an online wiki conversation on whether standards setting bodies have kept pace with commercial, social legal and political realities, and how transparency, fairness and quality could be improved in standards. Participants included 70 independent forward-thinking experts. The online forum was divided into five topics: (i) transparency and accountability; (ii) standards quality and creation; (iii) policy and society; (iv) intellectual property; and (v) rating and accreditation. By the end of the wiki conversation, suggestions had been made on (i) government; (ii) standards development organizations; (iii) standards community; (iv) quasi-government and non-governmental agencies; (v) international organizations; (vi) intellectual property; and (vii) academia (IBM, 2008m). The wiki recommendations were published on the IBM web site, complemented with translations into Japanese and Chinese.

In September 2008, learning from the discussion on the wiki, IBM announced a new corporate policy to formalize the company's behaviour when collaborating to create open technical standards.

> The tenets of IBM's new policy are to:
>
> - Begin or end participation in standards bodies based on the quality and openness of their processes, membership rules, and intellectual property policies.
> - Encourage emerging and developed economies to both adopt open global standards and to participate in the creation of those standards.
> - Advance governance rules within standards bodies that ensure technology decisions, votes, and dispute resolutions are made fairly by independent participants, protected from undue influence.
> - Collaborate with standards bodies and developer communities to

ensure that open software interoperability standards are freely available and implementable.
- Help drive the creation of clear, simple and consistent intellectual property policies for standards organizations, thereby enabling standards developers and implementers to make informed technical and business decisions (IBM, 2008f).

This new policy could lead to IBM withdrawing from a standards body. It was interpreted by the press as "intended to pressure organizations such as the ISO and ECMA, an industry-led standards organization, into rethinking their procedures" (Kirk, 2008). In response to the publicity, Bob Sutor blogged:

> With this principle, IBM is saying that it will increasingly look more closely at issues like the openness and transparency of a standards organization, as well as the modernness and consistency of the processes and intellectual property rules. IBM did so before, but it will do more in the future. IBM will sharpen and communicate its criteria to those involved in a cooperative manner (Sutor, 2008b).

Withdrawing from a standards body would be a last resort, if the situation became dire.

In November 2008, the wiki recommendations became an input into the Standards for Standards Summit at Yale Law School. The day's discussion was divided into three working groups: (i) Standards and the role of Government; (ii) Quality and Creation of Standards; and (iii) Standards and Intellectual Property (Yale Information Society Project, 2008). The working groups each summarized current problems, drafted recommendations to the Obama administration, and suggested some next steps.

In March 2009, the Information Society Project at Yale Law School presented *Technical Standards Recommendations for the Obama Administration*. Perceived as consistent with the technology policy directions of the Obama administration, they recommended:

1. Develop a Government Open Standards Strategy.
2. Form a United States Standards Advisory Council.
3. Strengthen International Standards Collaboration.
4. Encourage the Formation of a Global Multi-stakeholder Standards Advocacy Group (Yale Information Society Project, 2009).

These actions would represent a national standards strategy, enabling both economic innovation, and a connected democracy focused on openness, transparency, and direct civic engagement. These activities would contribute, in part, to the America Invents Act, passed in September 2011 marked "the most extensive and important update to the U.S patent system

in nearly 60 years".[417]

The research for GIO 3.0 started in 2007. [418] Two reports would be released within the year: one focused on media and content, and the other focused on Africa.

In October 2007, the first GIO 3.0 report was titled *The New New Media*. The sentiment was to explore opportunities for innovation in the "newly amorphous market segment of "media, content, branding and messaging"" – beyond traditional view of the media industry. Over 60 days, deep dives were conducted in seven cities: Helsinki, London, Los Angeles, Mumbai, New York, Seoul and Shanghai (IBM, 2007r). Seven themes emerged, the first four as primary.

- *Authenticity: Viral anti-marketing, brand loyalty and listening without fear*. Companies face a challenge of "walking the fine line of viral marketing" in delivering their brand messages. Authenticity comes not from a monologue, but through dialogue, particularly with "the voice of youth". Beyond recognition, more substantial forms of compensation may be needed in "the currency of contribution".
- *The Digital Persona: Who should own your online identity?* As media producers and advertisers in the digital age aim for personalization in an elusive "market of one", consumers may want to take back control of their personal information.
- *Context is King: In the age of free content, the future (and the money) is in the context*. As the value of content content – e.g. a newspaper article, movie, song, or piece of market research – diminishes, the value of context, as the "when", "where" and "how" that adds value to a piece of content, becomes a target for data analytics.
- *Going Mobile: Can wireless communications bridge the digital and economic divides?* Affordable mobile platforms has become way for the urban poor to connect to the Internet with a simpler "iconic literacy", and the infrastructure is easier to build.
- *Content Bill of Rights: Universal standards for content usage rights could save the digital media business.* Usage rights, e.g. for digital music, could be attached to the a piece of content rather than the device used to consume it, or the mechanism used to deliver it.
- *Regional Spotlight: China: With the eyes of the world upon it, China aims to tell its story*. Not only will the volume of Chinese language content on the Internet increase, but a widespread sense in China

[417] The Intellectual Property @ IBM blog, says "IBM has supported patent reform since the moment the legislation was first introduced over five years ago". The company commended "balanced, common-sense legislation that will lead to significant improvements to our patent system, which has not kept pace with dramatic changes in technology and innovation over the last half century" (IBM, 2011c).

[418] GIO 3.0 started as three topics: (i) Media and Content; (ii) Africa, and (iii) Security and Society (Wladawsky-Berger, 2007). In reality, that last topic would take longer to report, and would emerge as GIO 4.0.

that content should have educational and cultural value could challenge the Hollywood culture coming from the United States.

- *Virtual Uncertainty: The impact of virtual worlds on the business landscape.* The 3D Internet could be to the Internet what silent movies were to Hollywood, with early experiences seeming to be less about consumerism and more about expressionism.

The topics of media, content and messaging had important regional differences apparent during the GIO process: in Shanghai, the need for content to be of both educational and cultural value surfaced; in New York, the deep dive went into topics of piracy and the impact on the established media industry; and in Mumbai, there was optimism about the role that India will play in the future of content creation and distribution.

In November 2007, the second GIO 3.0 report was released titled *Africa*. The GIO meetings brought together 123 ecosystem partners from 24 countries, with deep dives in Atlanta, Beijing, Cape Town, Dakar, Lisbon, Nairobi and Paris (IBM, 2007a). Africa represents 1/7 of the planet's population, with 43% under the age of 15. While China and giant multinational firms poured were pouring billions into Africa, the African nations have colonial legacies that could be instructive for the future. Eight factors critical to the continent's future were presented:

- *Skills: Unlocking a powerful 21st-century work force in Africa demands the engagement of the private sector*. The education system may not have had significant investment in nearly 40 years, so reform and overhaul to realign to the needs of the private sector are needed, and many students want to learn to start their own businesses to employ other Africans.
- *Value Chain: African are beginning to capture more value from the continent's vast resources*. Ghana has invested in cocoa-processing facilities, Rwanda rebuilt infrastructure to deliver high-end specialty coffee, Botswana and Namibia are cutting and polishing diamonds, Uganda is producing T-shirts from local organic cotton, Mauritius is becoming an offshore banking center.
- *Infrastructure: Internet access and communications technology will spark the African services economy.* Only Mauritius ranks in the top 70 countries in ICT access, with the vast majority of Africa in the "low-access" category, in anticipation of East African Submarine Cable Systems (EaSSy) [completed in 2010].
- *Wireless: Mobile technology is transforming Africa in unforeseen ways*. The boom from 10 million wireless subscribers in 2003 to 200 million in 2007, has led to the M-Pesa money-transfer service in Kenya, and Motorola using wind turbines and photo-voltaic cells to power base stations throughout Namibia.
- *Informal economies: Tapping the economic power of Africa's thriving informal sector*. Shadow markets and the traditional sector

that account of almost 3/4 of non-agricultural employment in sub-Saharan Africa, and unregulated economic activity that constitute as much as 40% of GDP in some African nations has been described as a poverty trap without job protection or employee benefits, which don't contribute taxes that could be used in critical infrastructure improvement projects.

- *Women: Women are the driving force behind Africa's entrepreneurial spirit*. While accounting for more than 60% of the rural labour force and contributing up to 80% of food production, female entrepreneurs still find it difficult to obtain the "mesofinancing" they need to grow their businesses.
- *Finance: Access to capital hinges on new definitions of risk and collateral.* Few Africans are landowners or have assets or credit, and there are few traditional lenders, with microfinance a revolution, while small to medium sized enterprises don't have the mesofinancing to grow their businesses.
- *Non-Governmental Organizations: Is foreign aid helping or hurting African economies?* NGOs providing free money demonstrated little in economic stimulation, and collaboration between NGOs and private enterprises in Africa was in its early stages.

IBM had already been doing business in Africa for more than half a century, and the reality of global integration was changing the way the company thought about opportunities for growth and progress.

In September 2008, the first of the GIO 4.0 series was published on *Security and Society*. Starting in April 2008, six deep dives with participants from 93 organizations were conducted in Moscow, Berlin, Taipei, Tokyo, Vancouver and Chicago. The conversations were on security as a foundation of society, with recent trends in globalization, interdependence and digital technologies creating opportunities in business models and lifestyles, also with associated criminal elements and other destabilizing forces (IBM, 2008j). The idea of distributed security emerged from the conversations:

- *The Network Effect: Tapping into the power of distributed security*. The harmfulness of a single treat is exponentially proportional to the number of people exposed to it, so "to fight a network, you need a network". Adaptive security intelligence could be moved out to the edges of the network in "distributed security", through "community-based security" where groups with common interests police themselves, "wireless watchdogs" enable citizens to record audio and video of suspicious activities, and "the secure supply chain" would see transparency from start to finish so that each link in the chain could shoulder a proportionate load.
- *The New Roles: How governments and businesses must adapt to the new security reality*. Security is not seen "solely as a government

enterprise", so partnerships of "good security, good business" enables economic globalization while political systems are still nationalistic and oriented towards domestic affairs; prosecuting international crimes of a digital nature is "the legal vacuum" where cyber criminals have little fear for consequences, where lobbying for legislation on digital crime could be aided by education from the private sector; and "built-in security" is embedded in products and services, with careful consideration of convenience and cost to consumers.

- *Best Behavior: Using incentives to change bad habits*. Marketing security could be "strictly business", as manufacturers ensure the products on store shelves are legitimate, and not counterfeit, soft incentives against negative work-related events preempt "the threat within" of insider attacks; any ways to alter security behavior for the better becomes a "convenient truth" through biometric data or prescreening.
- *Getting to Know You: The evolving relationship between security and privacy*. "Informational self-determination" sees the information communicated about an individual in online world no different from the physical world, where "cancelable biometrics" might enable a "master token" to be enrolled as an identifier that might be reissued if stolen or compromised; "peer-to-peer based online rating systems" enable a "reputation reconnaissance" for trusting parties; and "data tethering" enables an identity "reclamation project" to track who is using a personal record.

The movement towards distributed security tends to focus less on hardening perimeters and securing boundaries, and more on resiliency as an ability to absorb and respond to attacks.

In February 2009, the last of the GIO 4.0 series – and the last of the GIO reports – was on *Water*. This study involved participants from 122 organizations, across management, business, infrastructure, food and energy (IBM, 2009e). Human beings have "survived knowing very little about out water systems. We have always known where to find it and how to use it, but we never gained an intimate understanding of how to preserve or sustain these systems" (IBM, 2009e, p. 5). In addition to relying on water for simple sustenance, "We generated power from it. We transport people and goods through it. We grow our crops with it. And we use it to cultivate medicine and manufacture products. In fact, every time a good is bought or sold there is a virtual exchange of water", with embodied water (IBM, 2009e, p. 3)). The study led to insights in five areas:

- *Data Drought: Informing a new era of water management*. There is a lack of understanding about water, even to "the scientists, academics, businesspeople and policymakers who study water for a living". "Measuring the oceans" has been done with ambitious projects,

e.g. the Global Ocean Observing System (GOOS), but the programs are "big, international and expensive" with governments "only in power for about four years", so the private sector could be involved with revenue-generating, self-sustaining business models. "Sharing the wealth" could collect and coordinate data on water that already has been collected, e.g. in the Beverage Industry Environment Roundtable. "Making data pay" could help narrow the gap between corporate strategy and social good, e.g. SmartBay Galway, where a steady stream of real-time data on water quality, aquaculture, chemical content, wave energy and tidal movement supports both policy decisions and industry around Ireland.

- *The Business of Water: Valuing the world's most precious commodity*. The economics of water can be complex and confounding to business people. In "the paradox of value", there are costs associated with procuring, distributing and treating water, the resource itself has no price, so that issues of wastefulness, pollution and scarcity are not mitigated by a monetary incentive. Technologies focus on increasing the supply of water, leaving an opportunity for "adventure capital" to develop the opportunity to decrease demand, through smarter water systems. For "industry and water", public companies could son be required to disclose water efficiency in their annual reports.
- *The Infrastructure Imperative: Managing water for the next generation*. Water infrastructure is easily ignored, with 15% to 35% loss to leaks in cities, and it's three times more expensive to build and maintain than electricity infrastructure. In "urban outfitting", retrofitting infrastructure should see electricity, telephone, gas and water utilities working in concert and sharing costs. Leak detection and automatic repair of water pipes could "sense and respond" retrofitting infrastructure, as has been done in the oil and gas industry for years. With half of the world's population living in low-lying coastal areas and cities vulnerable to river flooding and storm surge, "climate proofing" has been a strategy where the Netherlands has led, as a country.
- *Food, Energy and Water: Understanding a delicate global balance.* Water, energy and agriculture should be appreciated from a broader perspective, e.g. integrated resource management. With global agriculture wasting nearly 60% of the water it uses, "more crop per drop" encourages framers to match their crops to their climate at a local level. There are huge opportunities in "ocean source" for energy and aquaculture, but we must be careful not to change the chemistry of the ocean. With no global market and little international exchange of water, "think globally, act locally" would require a shift in practices and governance at the regional level.
- *Perception is Reality: Building global water awareness.* With a

> hypothetical question of "If you had $10 billion to invest in any water-related startup, what would it be?", the answer from participants was a "massive public relations effort", as people think that water is cheap and abundant. To draw attention to the trade of water embodied in products, "virtual water" has been proposed as a basic measurement. Increasing the accountability of a nation, business or individual for responsible water use, "water footprints" could track water consumed during production and manufacturing and the supply chain.

The release of this final GIO report, became coupled with the idea to "Let's Build a Smarter Planet" that begin in fall 2008. In 2009, the Smarter Cities campaign would be initiated, with 100 Smarter Cities Forums run around the world.[419]

The Global Innovation Outlooks enabled IBM to engage in conversations across national borders, with governments, not-for-profit organizations, and commercial businesses. The topics were guided not altruistically, but with an orientation towards the differences that private enterprise could make. In hindsight ...

> ... the GIO was never a philanthropic endeavor. If fact, it was not even part of IBM's community engagement strategy. The GIO was a business program, expected to identify real business opportunities that led to real profit. It just so happens that IBM has always believed that addressing the most pressing needs of society are where opportunity has always been found. As our former CEO, Thomas Watson, Jr. said, "Corporations prosper only to the extent that they satisfy human needs... Profit is only the scoring system... The end is better living for us all" (Briody, 2010).

The time horizons beyond 3 to 5 years reflects the scale of challenge that IBM could take on, where only a very few global multinational businesses could even aspire.

B.4.2 Since 2005, IBM researchers have led the Services Science, Management, Engineering and Design initiative

In 2002, the idea of a Human Sciences Research area in IBM Research became realized as Almaden Services Research with an initial staff of seven (Spohrer and Motahari-Nezhad, 2015). In September 2004:

> Jim Spohrer, who was starting up the IBM Research Service Research department, was on the line with Henry Chesbrough, a professor of business and innovation at the University of California at Berkeley. Spohrer complained to Chesbrough that he was having trouble find-

[419] The "Let's Build a Smarter Planet" campaign was linked to the November 6, 2008 speech by Sam Palmisano at the *Council for Foreign Relations*, driven by instrumentation, interconnectedness and intelligence.

> ing job candidates who had the right mix of knowledge, including computer science, engineering, management and social science.
>
> Chesbrough pointed out that in the 1940s and '50s IBM had boosted the development of computer science as a discipline by donating computers to universities and then helping them create curricula for teaching students how to use the machines. "IBM started computer science. You should start service science," Chesbrough told Spohrer. The two men were so excited at the prospect that they immediately dialed in Paul Horn, then director of IBM Research, who blessed the idea (IBM, 2011f).

By July 2006, the ideas had been published in "A Research Manifesto for Services Science" (Chesbrough and Spohrer, 2006). In October 2006, a Service Science, Management and Engineering (SSME) Summit included 254 people, representing 21 countries across government, industry and academia (IBM Almaden Services Research, 2006). The community seemed to be developing from five clusters of intellectual impetus: (i) operations research / mathematics / optimization; (ii) industrial engineering / systems engineering; (iii) computer science / information technology / information management; (iv) process formalization / physics / complexity; and (v) business / organizational sciences / social sciences. Themes identified across the presentations and discussions included: (i) aspects of services include social interaction and relationship management; (ii) multidisciplinarity as expertise that can bridge across science, engineering, social science, management and ethics; (iii) challenges for high education in silos and tenure processes within a single discipline; and acceleration factors for higher education, where there are already establish centers of study and development of new programs.

In 2007, the scholarly community was energized with the formation of a Service Science Section within INFORMS.[420] The first issue of the Service Science journal was published in March 2009.[421]

In summer 2007, "a consortium of technology companies, government agencies and universities dedicated to fostering advancements in service research" named The Services Research and Innovation Initiative was announced (SRII, 2007). "Co-founded by IBM, Oracle, the Technology Professional Services Association (TPSA), and the Service & Support Professionals Association (SSPA), SRII was formed to increase the amount of funded service research, development and innovation in the technology industry". "Members include Association For Services Management International (AFSMI), Cisco, EMC, HP, Microsoft, Sun Microsystems,

[420]The founding officers for the Service Science Section at INFORMS were Robin Qiu (Penn State University), Fugee Tsung (Hong Kong University of Science and Technology), and Gregory R. Heim (Texas A&M University).

[421]The first issue of Service Science, volume 1, number 1, was released in March 2009.

Unisys, and Xerox. Academic participants include top researchers from UCLA; Cranfield School of Management; Indian Institute of Management, Bangalore, India; Wharton School of Business; Arizona State University; University of Maryland; and University of California Silicon Valley Center at Santa Cruz. Government and research institutions include the European Commission and the Fraunhofer Institute in Germany".

A July 2007 symposium on Service Science, Management and Engineering at University of Cambridge led to a 2008 discussion document on "Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government" (IfM and IBM, 2008). This report made recommendations for education to enable graduates to become T-shaped professionals; for research to establish service system and value proposition as foundational concepts; for business to establish employment policies and career paths for T-shaped professionals; and for government to promote service innovation and provide funding for SSME education and research.

By 2008, a new book series, *Service Science: Research and Innovations in the Service Economy*, had been established with Springer Science. Proceedings from the SSME Summit were published in July 2008 as *Service Science, Management and Engineering: Education for the 21st Century*. Significant additional volumes were published in 2011, including *The Science of Service Systems*, and the *Handbook of Service Science.*[422]

For IBM, service science research was cited as having significant internal impact. "By creating reusable software assets, improving business processes and automating elements of services with software, the company improved the pre-tax profit margins for its services business from 6.7 percent in 2005, to 14.1 percent in 2009" (IBM, 2011f).

In June 2012, the SRII would be partially superseded by the International Society of Service Innovation Professionals (ISSIP) as a "democratically-run non-profit organization" where individual and institutional members work together to expand career options for service innovators while impacting business and society through new and improved service innovations.[423] The initial board of directors included representatives from IBM, Cisco, HP, San Jose State University, and Virginia Tech. By the end of 2014, ISSIP would report 675 individual members, across dozens of major companies and 150 universities across 40 countries.[424]

[422]Books, published and forthcoming, are part of the *Springer Service Science Series*.

[423]Many of the key figures who had started the SRII found its balance weighting too much towards technology companies, and shifted their emphasis more towards individuals participating in regional and international Special Interest Groups.

[424]The membership statistics were reported at the change of a new president for ISSIP at the beginning of 2015. Materials from Board of Directors Meetings are posted on issip.org.

B.5 At large, from 2000, businesses, creatives, academics, governments and makers, taking up open sourcing

Laymen not immersed in information technology commonly associate *open source* with technology. The term became formalized when the Open Source Initiative was founded in 1998, and received greater notoriety only beginning in 2000 when IBM made major investments in the Linux project.[425] The IT industry had presumed that the norms of "lock-in, network effects, de facto standards" were the only way to compete in the IT industry.[426] *Open sourcing*, as a social behaviour – by IBM and by a variety of other companies – shifted thinking that commercial propositions with customers didn't have to only be private sourcing.

Beyond IBM, open sourcing coincidentally rose as a social behaviour with new Internet technologies. The new phenomenon of an openly editable encyclopedia in Wikipedia challenged ideas about the public sharing of knowledge, particularly around the formation of the non-profit Wikipedia Foundation at 2003.

A brief history of open sourcing behaviours by organizations and by

[425] In 2007, Dan Frye, vice-president of IBM Open Systems Development, was interviewed about 1988:
"*Frye*: .. in 1998 ... in corporate, ... we were debating new things IBM should worry about and the conversation of Linux came up. So we started exploring. And it turned out, even in 1998, that IBM customers were beginning to demand IBM solutions around Linux. They were asking, "When would our servers support it? When would our software support it? When would we be able to provide service and support?" So really from day one, it was not IBM looking into a crystal ball and deciding that open source was the wave of the future, it really was the marketplace knocking on the door and saying we're beginning to deploy Linux, we're beginning to deploy open source solutions, we want IBM products to work with it."
"So we did a short series of strategy. We looked closely at Linux; we looked closely at open source. And it was almost immediate that ... you know, a realization at the highest levels of the corporation was, this was good for us. This was good for our customers to provide choice. This was good for the market. And so we adopted a strategy within, really within the first three months after we started looking at Linux and open source that, yes, IBM would help make Linux better and IBM had nothing to fear from open source. In fact, open source provided another way not the only way but another way to provide innovation – another way to set open standards. And we've had a happy marriage ever since" (Frye, 2007).

[426] In 2005, Dan McGrath, IBM Director of Corporate Strategy was interviewed on the shift to open sourcing:
"Louis Gerstner, IBM's CEO in the 1990s, ... thought IBM had the wrong attitude toward its customers and challenged the company to reconceive its business models. Gerstner reportedly observed to key IBM insiders: 'This is the only industry where competitors don't regularly agree on standards to enable greater value for customers.' To which IBM executives responded: 'Let us explain about lock-in, network effects, de facto standards and the five ways to play.' Gerstner's reaction was: 'That's interesting ... let me get this straight ... you're telling me the strategy is to lock-in our customers and then gouge them on price.' Gerstner insisted that this was not what IBM should be about, and he set out to change IBM's business models and internal culture to create a more customer-centric business environment" (Samuelson, 2006, p. 23).

individuals follows, to complete the background for changes impacting the period of research between 2001 and 2011.

B.5.1 From 2000, private sourcing businesses explored commercial options in open sourcing through new communities and institutions

The open source movement has benefited from corporate contributions that are "free as in liberty" as well as "free as in gratis". The February 2000 LinuxWorld announcement World about IBM's investments into Linux was a landmark.

By 2002, key leading companies open sourcing software included IBM, Hewlett-Packard, Compaq, SAP, Computer Associates, Hitachi, Sun Microsystems and Cadence Design Systems (International Institute of Infonomics and GmbH, 2002, p. 12-15). By 2005, in a study of 50 projects, 99% of vendor investments went into a "money-driven cluster" of 18 projects, with the remainder as as volunteered effort from employees in a "community-driven cluster" of 32 projects. The motivated vendors in the "money-driven cluster" included IBM (estimated revenue of $4.5 billion related to open source software), Hewlett-Packard (estimated $2.9 billion), Oracle (estimated $1.2 billion) and Red Hat (estimated $280 million) (Iansiti and Richards, 2006).

By 2011, industry analysts estimate that 80% of all commercial software solutions could involve elements of open source.[427]

The resources put into open sourcing by corporate businesses are not insignificant. In the Linux project, the estimated development value of Linux release 2.6.30 in 2008 was over €1 billion, with an estimated annual R&D of €228 million (Garcia-Garcia and Alonso de Magdaleno, 2010). The Eclipse Foundation doesn't provide hard numbers, but estimates that its ecosystem generates in the range of a billion dollars.[428]

The rise of open sourcing in business has been marked by (a) the contributing of assets to open source organizations, and (b) the exploring of business models to enable open sourcing into private sourcing commercial offerings.

(a) One way of measuring contributions by organizations to open source communities is as assets counted as lines of code (Asay, 2009). As of 2009, the Linux kernel had received 1.4 million lines of code from Red Hat, and 725 thousand from IBM.[429] Sun had contributed 6.5 million lines of code

[427] The romance of geeks and hackers in open source is giving way to corporate-funded projects, says Brian Prentice, "Open Source's Dying Narrative".

[428] The impact is described with "Eclipse: The billion-dollar baby?: Eclipse's Milinkovich talks up the Eclipse ecosystem", *InfoWorld*, September 18, 2006.

[429] Since 2008, the Linux Foundation has regularly published statistics on "Who Writes Linux". In 2009, Linux 2.6.30 had 11.6 million lines of code. Sponsors of changes included Red Hat at 12.3%, IBM at 7.6%, Novell at 7.6% and Intel at 5.3% (Kroah-Hartman, Corbet, and McPherson, 2009). In 2012, Linux 3.2 had 15

to Java, 2 million lines of code to Solaris, and 10 million lines of code to OpenOffice. On Eclipse, IBM had contributed 12.5 million lines of code. Google estimated 10 million lines of code for Android, and 2 million lines of code for Chrome.

In digital artifacts, only 15% of the content released by open source developers is computer source code. There's four times as much content released as scripts, markup language files, graphics images and documentation.[430] Beyond the donations of artifacts, organizations commit resources to ensure vitality in the open source movement.

Another way of measuring contributions is through the assignment of human resources. In 2007, 31% of administrators and users of 409 Sourceforge.net project declared that one or more firms were somehow involved. In 68% of the cases, firms supported non-development activities (e.g. testing, animating, forums, documentation, financial and logistic support), and 30% contributed code) (Capra et al., 2009). In 2009, 48% of Eclipse developers were allowed by their companies to use software and contribute back to open source communities, up from 37% in 2007 (Eclipse Foundation, 2009, p. 18).

Sponsorship of organizations independent of single vendor control has enabled open sourcing to grow. The Linux Foundation lists Fujitsu, Hitachi, IBM, Intel, NEC, and Oracle as platinum members; AMD, Cisco, ETRI, Google, HP, Motorola, NetApp, Nokia and Novell as gold members; and 44 additional companies as silver members.[431] The Eclipse Foundation lists Cisco, Motorola and Blackberry as enterprise members; Actuate, Brox, CA, Cloudsmith, Genitec, IBM, Innoopract, Itemis, Nokia, Obeo, Oracle, SAP, Sonatype, and Sopera as strategic members; and 72 organizations as solution members; and 71 organizations as associate members.[432]

All of these contributions demonstrate ongoing open sourcing behaviour while the sponsoring organizations have simultaneously pursued private sourcing initiatives commercially. The simultaneity positions an organization to benefit by being on the "right side" of platform decisions endorsed as an open standard, while not restricting private sourcing extensions as features attractive to the customers they target and serve.

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million lines of code. Sponsors of changes included Red Hat at 11.9%, Novell at 6.4%, Intel at 6.2% and IBM at 6.1% (Corbet, Kroah-Hartman, and McPherson, 2012).

[430] Black Duck Software crawls the Internet to find open source development projects, putting findings into a knowledge base that includes 170,000 open source projects on 4,000 unique web sites.

[431] Both platinum and gold members "engage in or support the production, manufacture, use, sale or standardization of Linux or other open source-based technologies", with annual membership dues of $500,000 or $100,000.

[432] Enterprise members "rely heavily on Eclipse technology"; strategic members "view Eclipse as a strategic platform and are investing developer and other resources"; solution members "offer products and services based on, or with, Eclipse"; and associate members "want to show support for, the Eclipse ecosystem".

(b) While small scale open sourcing can be viable through individuals volunteering personal time and effort, ongoing large scale open sourcing occurs only through injections of capital. Governments sometimes redistribute wealth towards open sourcing (e.g. university research) to influence regional policy, with private sourcing antithetical to transparent political processes.[433] Free enterprises can redistribute wealth into open sourcing while creating greater wealth through private sourcing to a selected customer set. Industry collaboration in open sourcing projects can be structured so that organizations can still compete on independently funded private sourcing complements.

A three-way categorization of business models associated with software products sees (i) pure open source models; (ii) hybrid open source/commercial licensing models; and (iii) embedded open source.[434]

More generally, the Open Source Definition has always recognized – if not encouraged – the benefits of commercial development and motivations with entrepreneurism. Silicon Valley is a hotbed for startup companies initially funded with venture capital, with a promise of business models with eventual financial viability. An offering could include open sourcing in some elements of software, services and/or hardware, while private sourcing in others. When open sourcing while private sourcing was new

[433]Russell Ackoff makes a distinction between wealth redistribution and wealth creation:
" ... I treat government as distinct from suppliers for two reasons. First it has some control over the behavior of the firm; other suppliers do not. Second, the goods and services that government provides does not normally become the property of the firm even thought it uses them."
"... from society's point of view, an obvious function of corporations is to *produce wealth*. What is not so obvious is that corporations also have the social function of *distributing wealth*. They do so in a number of ways, including compensating employees for work, paying suppliers for goods and services they provide, providing dividends to shareholders, paying taxes and interest on money, borrowed, and so on" (Ackoff, 1994, p. 40).

[434]The phrase "embedded open source" used in the sense of a "business model" should be disambiguated from the use in a technical platform, i.e. open source software as firmware in an embedded device, e.g. mobile smartphones. The three-way categorization orients towards a software business:
(i) Pure open source models "use only open source software licenses and generate their revenue via services, support (both ad hoc and subscription-based), customisation, and training".
(ii) Hybrid open source/commercial licensing models with either "dual licensing strategies that see proprietary licenses used for ISV and SI partners, as well as wary corporate clients", or an "Open-Core approach, making additional services, features and functionality available to paying customers using SaaS [Software as a Service) or proprietary licensing".
"The term "Open-Core" ... describe[s] the use of proprietary extensions around an open source core, ... [separating] community users from commercial customers enabling vendors to focus on the needs of each".
(iii) Embedded open source models "[see] open source code embedded in a larger proprietary product – be it hardware or software. Prime examples of the software approach are IBM's use of Apache within WebSphere and Actuate's use of BIRT within the Actuate 10 portfolio" (Aslett, 2009)

in 2004, seven alternative strategies enabling sustainable business models were frequently cited:

1. An *optimization* strategy: In layered a software stack, commodity layers enable optimization where pricing power can be applied in interdependent and/or application layers (e.g. Oracle).
2. A *dual license* strategy: Free use for software with some limitations, with fees for more features and/or commercial distribution rights (e.g. MySQL).
3. A *subscription* strategy: Charge for maintenance, entitling configuration support, updates and upgrades (e.g. Novell, Red Hat, SpikeSource, SourceLabs, JBoss, Sun, Zend).
4. A *consulting* strategy: Make money on the customization of enterprise solutions, where implementation costs are 70% of commercial fees (e.g. 10X, SpikeSource, SourceLabs, JBoss)
5. A *patronage* strategy: Drive standards adoption to crack entrenched markets with a commoditized layer, and then offer value higher up in the stack (e.g. IBM. HP, Intel)
6. A *hosted* strategy: Rather than selling software, provide software services using GPL software without being subject to redistribution restrictions (e.g. eBay, Amazon, Salesforce.com, Google).
7. An *embedded* strategy: Extend hardware platforms with an open operating system, accelerating delivery at a lower cost (Neoteris, Tivo, IBM) (Koenig, 2004).

In a 2005 IBM-internal study, an eighth was added: an *onramp / loss leader* strategy: gaining a strong affinity between open source and commercial software options. This strategy was observed for IBM, CA and Sun.[435]

In the *subscription* strategy, the *consulting* strategy and the *hosted* strategy, customers choose to pay a vendor for complements to the software rather than to do it themselves. These reflect that software only has value when packaged with other components, and that a vendor may gain economies of expertise as a provider to multiple customers. If we look at similes where vendors cook meals for people who might otherwise cook for themselves, (i) some vendors serve meals-on-wheels, (ii) some offer cooking classes where the student prepares food, and (iii) some have restaurants with everyday recipes and ingredients (e.g. a bacon and egg breakfast).

In the *dual license* strategy and the *onramp / loss leader* strategy, some customers choose to directly pay for software that they might otherwise get for free. The *dual license* strategy is a value-based customer segmentation. Lightweight users might not place a higher value on one provider over another (e.g. a student learning about how a relational database works, or a small business with few transactions). When an application becomes

[435] IBM Software Group, "OSS Middleware TT Assessment" (Internal Study), May 18, 2005.

mission-critical and resource intensive, the paid option may be an economical alternative to obtain features that optimize performance. In the *onramp / loss leader* strategy, sunk costs are relevant. A customer may want the advantage of working with a specific vendor in the longer term, but is insignificant in its current state. That customer might choose a free version with limitations (e.g. a "community edition") while in startup mode, then migrating to a paid version (e.g. an "extended edition") when revenue flows become sustainable. The transition from the free version to the paid version is a simple matter of a changed license key, and no effort is wasted.

The trend towards open sourcing requires companies to adjust their private sourcing strategies in the long term, if not in the short term. Three ways in which managers and practitioners might adapt have been suggested: (1) since open sourcing moves appropriability from code secrecy (i.e. private sourcing) to licensing, larger efforts could be placed on patenting algorithms that have superior performance;[436] (2) mixing open sourcing components with private sourcing assets and investments could be an attractive packaging that enables profitability; and (3) hardware manufacturers could bundling open sourcing software, while specialized software suppliers change their value propositions or target customers (Fosfuri, Giarratana, and Luzzi, 2008, p. 302-303). A larger perspective would suggest that the space for open sourcing while private sourcing is a non-zero-sum game, if the market opportunity is reframed from just information technologies to larger social and economic realms.

Companies with large portfolios of software patents have been key participants in open sourcing projects. However, not all companies are equally enthralled with the potential to commercialize open sourcing. Open source alternatives can be seen as a cannibalization threat, with a potential to devalue a brand name and reputation for quality. Commoditization in one technology may or may not be offset from complementaries (e.g. software for gratis could be bundled with hardware or services for fee) (Fosfuri, Giarratana, and Luzzi, 2008, p. 301-302). Open sourcing is a new phenomenon that has to coexist in a legacy of private sourcing. Companies working together have faced court challenges charging collusion and antitrust.

In March 2003, the Santa Cruz Organization (SCO) filed suits against IBM, alleging that IBM had incorporated some of its code (from the private sourcing Caldera derivative of AT&T Unix Unixware acquired by Novell,

[436] Patenting may be done not only to gain licensing revenue, but also as a prior art defence against trolls. While IBM was the largest recipient of patents for most of the years between 1995 and 2015, "IBM tends to be a more of a defensive player with patents than an aggressive seeker of royalties from other companies." "It's also frequently willing to cross-license patents to other companies, particularly technology partners and allies, to ward off the claims of its rivals." "It's doubtful that many of IBM's patents become much of a profit center." (Babcock, 2015).

into IBM's private sourcing AIX product) into the Linux project (Shankland, 2003). In a related lawsuit, SCO also attacked the Free Software Foundation (FSF) on the GPL – the license chosen by Linus Torvalds for Linux – as unconstitutional under the Intellectual Property Clause, and in violation of federal antitrust laws (Ake, 2007). In 2006, Judge Brooke Wells granted, in part, IBM's motion to limit SCO's claims due to lack of specificity (P. Jones, 2006b). The trial date later that year was vacated pending the resolution of a lawsuit of SCO v. Novell. In 2007, Judge Dale Kimball ruled that Novell owned the original Unixware copyright (P. Jones, 2007a). Novell stated that it didn't "believe that there is Unix in Linux" and the company was "not interested in suing people over Linux", seeing no value in legal proceedings against IBM (Montalbano, 2007). With SCO in Chapter 11 bankruptcy, the case was then administratively closed (P. Jones, 2007b). In 2013, SCO secured approval to reopen the case against IBM. At the end of 2014. Judge David Nuffer dismissed the charges, ruling that IBM had licensed the source code from Novell, and SCO was bound by the Novell judgement (Sharwood, 2014).

Beginning in April 2005, Daniel Wallace filed *pro se* (i.e. without legal counsel) lawsuits in Indiana, against the Free Software Foundation. The complaint was amended four times, based on mistakes leading to dismissal by Judge John Daniel Tinder.[437] In June 2006, a second lawsuit was launched against IBM, Red Hat and Novell.[438]

> The plaintiff in the case, Daniel Wallace, has wanted to compete with Linux by offering a derivative work or by writing an operating system from the ground up. He argued that he has been barred from doing so, while Linux and its derivatives can be obtained at no charge. He asserted that IBM, Red Hat and Novell have conspired to eliminate competition in the operating-system market by making Linux available at an "unbeatable" price: free.
>
> The court found Wallace's theory to be "faulty substantively." The decision pointed out that "the goal of antitrust law is to use rivalry to keep prices low for consumers' benefit." Here, the court concluded that Wallace sought to employ "antitrust law to drive prices up," which would "turn (antitrust law) on its head" (Sinrod, 2006).

Later in 2006, Wallace filed with the U.S. Court of Appeals. The three-judge panel upheld the decision by the lower court (Broache, 2006).

These landmark decisions have become precedents on the findings that open sourcing can be beneficial to society, and not in conflict with the principles on which antitrust laws were founded.

[437] The final dismissal of Wallace v. FSF in March 2006 led to a judgement that the plaintiff would have to pay the legal costs for the FSF (P. Jones, 2006a).

[438] Wallace "alleged a scheme of naked per se horizontal price-fixing among competitors" (P. Jones, 2005c).

With open sourcing changing the legal landscape, IBM proactively (i) made intellectual property pledges and (ii) encouraged other industry leaders to follow suit in commons. The difference between a patent pledge and a patent commons has been contrasted:

> A patent pledge can take various forms but it is basically a public commitment from a patent owner not to sue one or more parties for infringement, typically, in support of a specific usage. This is usually done by companies like IBM in support of specific technologies, standards, or particular industry trends, such as the open source with the goal to facilitate adoption of a specific technology, standard, or software.
>
> Wikipedia defines commons as a word "used in the sense of any sets of resources that a community recognizes as being accessible to any member of that community." In the case of patent commons, the resources made accessible are patents. Like patent pledges, patent commons are typically created in support of a specific goal. The major difference between patent pledges and patent commons is that while pledges can be done unilaterally, commons by nature require the creation of a community, a set of identified intellectual property owners who agree to respect the rules set by the community (Lehors, 2009b).

Towards protecting both contributor and users using assets declared in the commons, legacy procedures for intellectual property ownership could be adapted.

At LinuxWorld in August 2004, "IBM pledged not to assert any of its patents against the Linux kernel" (IBM, 2005b). In January 2005, that pledge was made concrete by naming 500 IBM software patents as open access "to any individual, community, or company working on or using software that meets the Open Source Initiative (OSI) definition of open source software now or in the future".[439] That pledge was intended "to form the basis of an industry-wide "patent commons" in which patents are used to establish a platform for further innovations in areas of broad interest to information technology developers and users".[440] In addition

[439]The patent pledges of January 2005 were specifically related to information technologies:
"The patents included in this pledge relate to many aspects of software innovation. Several of the patents cover dynamic linking processes for operating systems. Another patent is valuable to file-export protocols. In total, the pledged patents cover a wide breadth, including patents on important interoperability features of operating systems and databases, as well as internet, user interface, and language processing technologies" (IBM, 2005b). Patent numbers were named in "IBM Statement of Non-Assertion of Named Patents Against OSS".

[440]The formal document describing the patents included categories of Interfacing; Storage Management; Multi-Processing; Data Processing Programming; Human Interfacing, Database and Database Handling; Image Processing and Video

to fostering continued innovation, the pledged patents would "contribute to open standards and broader interoperability between applications by providing open source developers with a solid base of innovation they can use and share". The proposal to create a patent comments was widely covered in the press.

While criticism from some notable individuals ranged from "too little" to "too much"– e.g. Bruce Perens counting the pledge small relevant to the total IBM portfolio (Bednarz, 2005), to Bill Gates describing "some new modern-day sort of communists" (Paul Andrews, 2005) – the proposal was generally well-received (B. Jones, 2005). While copyright and patent systems were originally developed to protect innovation and invention, those were increasingly becoming a detriment to scientific, technological and creative advancements.[441]

In November 2005, the Open Innovation Network (OIN) was founded as a patent commons by IBM, Novell, Philips, Red Hat and Sony, with a charter to acquire patents and offer them royalty-free, provided those patents would not be asserted (P. Jones, 2005a). In addition to the Linux-related content, initial assets also included web service patents from Commerce One, a subsidiary of Novell that had filed for bankruptcy court protection in 2004. In March 2007, Oracle would license patents from the OIN, protecting components in MySQL and PostgreSQL that compete with Oracle's database products (Shankland, 2007).[442] In August 2007, Google also joined the OIN, as Linux is core to its search engine, web indexing and analysis (Babcock, 2007).

In late 2005, IBM started pledging technology specifications, acting unilaterally without partners. An open source analyst explained this as a way of removing bureaucracy for industry standards committees.[443]

Technology; Human Language Processing; Compression, Encryption and Access Control; Software Development and Object Technology; Internet, eCommerce and Industry Specific; Networking and Network Management; and Miscellaneous (IBM, 2005c).

[441] A summary of key points about the patent commons was published by Michelle Delio, as "Patently Open Source", *Technology Review,* January 12, 2005. The original article on *Technology Review* has been removed from the publisher, despite the independent investigation by Carrie Lozano verifying the Bruce Sunstein statements.

[442] MySQL AB was acquired by Sun Microsystems in 2008. Oracle would acquire Sun Microsystems in 2010.

[443] IBM's independent patent pledges on interoperability standards removes legalities on implementation:

"Software patents are generally problematic, but those which encumber technology standards can be especially so. When companies come together to form standards bodies, they have often agreed that implementations of the standard would be able to license any patents required, under so-called reasonable and non-discriminatory (RAND) terms. ... RAND terms have been used to lock out smaller companies from implementing patented standards along the way. Free and open source implementations are usually locked out, because 'reasonable' terms almost always include royalties. [....]"

"This has led some organizations, notably the World Wide Web Consortium (w3c),

Anyone – whether commercial or non-commercial, open sourcing or private sourcing – is free to implement a listed standards, without having to research relevant patents and document conditions on royalty-free licenses,. This effectively separated interface specifications as open sourcing, while putting IBM on the same footing as everyone else for private sourcing implementations (released under either commercial or non-commercial conditions). These pledges included patent shields, implying that anyone attacking IBM on a patent would be met with a counterattack by IBM on its rather extensive patent portfolio. The overall effect would be to reduce the need for legal counsel for all.

In October 2005, the first specifications pledged by IBM were selected open healthcare and educational software standards built around web services, electronic forums and open document formats (IBM, 2005d). While that year had seen a lot of issues around open documents standards and interoperability, little work had been done on industry verticals. In a federated healthcare system, medical information encumbered by proprietary formats controlled be a vendor can slow down integration. IBM named 20 working groups and technical committees in 6 established healthcare and education standards organizations that have done little work on web services and security. In a forward looking announcement, "if these designated groups build their next generation of healthcare and education standards on web services, electronic forms, and open document standards, and they do so within rules of maintaining compatibility and interoperability, then IBM will not assert any of our patents on implementers of these new healthcare and education standards" (Sutor, 2005a). The intent would be to promote to use of core underlying standards into a collection of next generation frameworks, as a global initiative and not just specific to North America. The IBM pledge preceded a report on "Ending the Document Game: Connecting and Transforming Your Healthcare Through Information Technology", where stories (e.g. filling out contact and insurance information seven times) were presented the U.S. Congress by the

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to move to an agreement that patents required to implement their standards be licensed on a royalty-free basis. This simplifies things, but requires some amount of bureaucracy as standards participants need to list relevant patents and create documents that state the nature of the royalty-free license."

"IBM's move circumvents all of that, by pledging not to assert patent claims against any implementation of the listed standards. The pledge not only covers free implementations, but competitive, commercial, closed source versions as well. The patents themselves do not need to be researched or listed as the pledge covers any that IBM has. It should be noted that this only applies to implementing the standards listed; IBM is not giving carte blanche to use their patented technology." [....]

"Because it is a pledge – not a license or agreement – projects or organizations that want to be covered by it need do nothing. There is no paperwork to file or license text to comply with. They will need to refrain from engaging their patent lawyers to attack others implementing the standards; this should be a constraint that most free software projects can live with (Edge, 2007).

federal Commission on Systemic Interoperability.[444]

In July 2007, IBM pledged universal and perpetual access to patents on 150 core software interoperability standards (IBM, 2007i). Motivations were clarified on a page of Frequently Asked Questions.[445] The royalty-free non-assert pledge has conditions that the implementer has to reciprocate to also not assert. Like an open source license, no communication to IBM is required. The motive for the pledge was explained as encouraging broad adoption of open specifications for software interoperability, which could see multiple organizations offering a variety of implementations. The list of 150 patents cited on the IBM public web pages included a broad assortment of XML-based technologies.[446] Subsequently, additional pledges were made in July 2009 and December 2011.[447]

[444]The Commission on Systemic Interoperability was chaired by Scott Wallace, chief of the National Alliance for Health Information Technology (Van, 2005). The report and recommendations were posted on endingthedocumentgame.gov.

[445]The 2007 pledge on interoperability specifications also clarifies the intent on the 2005 pledge on healthcare and educational standards.

"*What is the Interoperability Specifications Pledge?* IBM is committing not to assert its patent claims that are required to implement the listed open specifications as long as the implementer reciprocates. The royalty-free non-assert promotes accessibility to and success of the listed specifications in a manner that is convenient and beneficial to implementers, industries, and entities that are networked around and rely on the listed specifications."

"*How does the Interoperability Specifications Pledge work?* You don't have to do anything to activate the Interoperability Specifications Pledge. No terms to negotiate, no payment, no signature, no notice to IBM. Unless you assert patent claims against a listed specification(s), the Interoperability Specifications Pledge is there."

"*Why is IBM making this Pledge?* IBM is making this Pledge to encourage broad adoption of open specifications for software interoperability. Broad implementation of these specifications can dramatically improve our customers' ability to communicate data within and between their enterprises." [....]

"*How does the Pledge benefit consumers, users, and implementers?* This Pledge simplifies use of these specifications by removing the requirement to obtain a license from IBM. The Pledge applies unless a party asserts Necessary Claims against other customers, users, or implementers. The philosophy is not just to protect IBM, but to protect all users of these open specifications. IBM intends to help keep the listed open specifications open and available to consumers, users and implementers (even if they are competitors of IBM) by covering the aggregate list, not just one spec at a time." [....]

"*How will this affect Open Source implementations using these specifications?* Open source software distributors will find the Interoperability Specifications Pledge much friendlier to their needs since all of the downstream recipients of their implementations will be able to benefit from the Interoperability Specifications Pledge, individually, without having to depend on the distributor for a license, or needing to contact IBM to obtain one" (IBM, 2007l).

[446]The list of covered specifications includes SAML, XHTML and HTML, SAML, BPEL, DISelect, DITA, XACML, XML, ODF, OWL, RDF, WAI-ARIA, SCA, SOAP, SPARQL, SSML, SCXML, UDDI, VoiceXML, Web Servcies Security, WSDL, WSDM, WS-I, WS-Policy, WSRP, XML, XPath, Xquery, XSL and XSLT (IBM, 2007m).

[447]The July 9, 2009 specifications pledged included technologies on CMIS, SCA, SDO, WS Federation Language, Xforms and XML; the December 12, 2011 specifications pledged included BPMN, DRDA, MQTT, OSIMM< RIF, SOA, S-RAMP,

In January 2008, the World Business Council for Sustainable Development announced the Eco-Patent Commons. This had been initiated by IBM, who sought a neutral host, following the 2007 Global Innovation Outlook conference.[448] The initial founders were IBM, Nokia, Pitney Bowes and Sony, each pledging environmentally responsible patents to the public domain. Examples of environmental benefits expected for pledged patents included:

- energy conservation or improved energy or fuel efficiency ;
- pollution prevention (source reduction, waste reduction) ;
- use of environmentally preferable materials or substances;
- water or materials use reduction ; and
- increased recycling opportunity (IBM, 2008c).

The number of members gradually grew: Bosch, DuPont and Xerox joined in September 2008; Ricoh and Taisei joined in March 2009, and Dow Chemical and Fui Xerox joined in October 2009. Examples of pledged patents include:

- transforming old mobile phones into new products, e.g. digital cameras or other electronic devices (from Nokia);
- converting certain non-recyclable plastics into beneficial fertilizer (from DuPont); and
- substituting a toxic solvent used in quantum computing with a mixture of alcohol and water (from IBM) (Lehors, 2009b).

By 2009, over 100 patents had been pledged.[449]

IBM was not the only corporation to make patent pledges. It may, however, have been the company that was least criticized in its legal approach.

In January 2005, shortly after IBM's pledge of 150 patents, Sun Microsystems pledged 1600 patents (Sun Microsystems, 2005b). This gave open source developers free access to Sun OpenSolaris related patents under the CDDL. A journalist asking Jonathan Schwartz why Sun "wouldn't do what IBM did" got a response that he couldn't "justify to his shareholders opening up all of their IP" (P. Jones, 2005b). This criticized as "clumsy dodging" with patents "only for signed-up licensees of the CDDL", which wouldn't apply to using the patents on Linux (under GPL), or any other open source licenses.[450] In a headline suggesting "patent use would be

Web Services and XDBX.

[448] IBM preferred that the eco patent commons not "be just an IBM thing" (Lehors, 2009a).

[449] A full set of eco-patent commons pledges is searchable and downloadable from ecopatentcommons.org.

[450] On the official developerWorks (not personal) blog, Bob Sutor encouraged Sun towards all OSI licenses:
"They are only making them available under CDDL, which really means today for those who work on OpenSolaris. If you want to use these on Linux, YOU ARE OUT OF LUCK. Maybe there is a general patent pledge somewhere, but I can't

okay beyond Solaris project", the head of Sun Solaris marketing responded that "Clearly we have no intention of suing open-source developers," and added, "We haven't put together a fancy pledge on our Web site" to that effect (Shankland, 2005). A deeper analysis seeing the incompatibility of CDDL-licensed OpenSolaris and GPL-licensed Linux meant "Sun prevented its nemeses Red Hat and IBM from implementing those patents in Linux in a way that's harmful to Sun (especially considering the damage that Linux has already done to Sun)" (Berlind, 2005d). By 2007, the conditions hadn't changed.[451]

In September 2006, Microsoft would declare an "Open Specification Promise" (Microsoft, 2006c). This promise was criticized as "worse than useless", as Microsoft explicitly reserved the right to change the terms at any time in the future.[452] This did not mean that Microsoft would not work with open source communities – cooperation on the Apache POI (Java API for Microsoft Documents) project was cited – but did mean that legal counsel would have to be involved in each and every patent licensing (Oliver, 2008).

In March 2013, Google would announce an "Open Patent Non-Assertion (OPN) Pledge, whereby the company promised "not to sue any user, distributor or developer of open-source software on specified patents, unless first attacked" (C. Warren, 2013). The first 10 patents released focused on MapReduce, a programming model for handling large datasets.[453] In

find it."
So Sun has made things more open (this is goodness!), but by restricting things to CDDL they have not gone the whole ten yards to support the open source use of these. This is a shame, because it was a good opportunity to do so" (Sutor, 2005d).

[451]The rumour that OpenSolaris might be dual licensed under CDDL and GPLv3 was squashed (Green, 2007). The non-assert pledge on OpenSolaris for CDDL might have been more easily handled by extending to all OSI-recognized licenses, although changing the OpenSolaris licensing would have resulted in the same effect.

[452]Microsoft's patent promise did not enable open source developers beyond hobbyists:
"A careful examination of Microsoft's Patent Pledge for Non-Compensated Developers reveals that it has little value. The patent covenant only applies to software that you develop at home and keep for yourself; the promises don't extend to others when you distribute. You cannot pass the rights to your downstream recipients, even to the maintainers of larger projects on which your contribution is built."
"Further, to qualify for the pledge, a developer must remain unpaid for her work. Experience has shown that many FOSS developers eventually expand their work into for-profit consulting. Others are hired by companies that allow or encourage" (B. M. Kuhn, 2006).

[453]By 2013, Google had already been active in open sourcing with technologies such as Hadoop.
"There are a variety of OSS copyright licenses and licensing organizations that provide for the responsible allocation of patent rights, emphasizing defensive use only. The Apache License 2.0 and the Open Invention Network are leading examples."
"The OPN Pledge is designed to supplement existing OSS licensing alternatives, providing patent holders who care about reducing threats to OSS a more robust

August 2013, Google would pledge 79 additional patents associated with cloud and big data, have acquired them from IBM and CA Technologies (Lardinois, 2013). In August 2014, Google would pledge another 152 patents associated with back-end technologies, encryption and prefetching, and XML parsing and validation (Lardinois, 2014).

From 2001 through 2007, open sourcing while private sourcing by corporations could be seen as pioneering, within the constraints of legal system, particularly in the United States. By 2008, with several legal challenges flattened and a new style of government encouraged by a newly elected Obama administration, open sourcing while private sourcing became an acceptable, albeit uncommon way of doing business.

B.5.2 From 2002, Creative Commons has standardized open licensing

While some altruistic individuals are willing to participate in open sourcing without concerns about ownership or liability, the pragmatic are more cautious. From the December 2002 release of the Creative Commons 1.0 license, individuals and organizations have been able to easily declare ways in which others are privileged to reuse and/or derive content without having to engage in a case-by-case negotiation.[454] Copyright licensing in a broader range of domains was formalized, inspired from the experiences in the open source movement.[455]

> [The] cc licence is not designed for software, but, rather, for other kinds of creative works: websites, texts, courseware (these are all considered literature), music, film, photography, etc.[456]

The original conditions of "some rights reserved" were expressed in combinations in four dimensions:

> *Attribution* [by]: You let others copy, distribute, display, and perform your copyrighted work – and derivative works based upon it – but only if they give credit the way you request.
>
> *Share Alike* [sa]: You allow others to distribute derivative works only under a license identical to the license that governs your work.
>
> *Non-Commercial* [nc]: You let others copy, distribute, display, and perform your work – and derivative works based upon it – but for

defensive capability against incoming patent aggression. It is a response to recent developments in the patent marketplace, whereby companies that increasingly seek the benefits of OSS in their own businesses nonetheless launch attacks against open source products and platforms as it suits their fancy".

[454]The history of the Creative Commons starts with the 2001 founding.

[455]The Creative Commons cites the Free/Libre Open Source Software (FLOSS) popularization from a June 2001 letter to the European Commission, combining terms from the Free Software Foundation and Open Source Initiative.

[456]Creative Commons license enables a choice in a spectrum of licenses.

non-commercial purposes only.

No Derivative Works [nd]: You let others copy, distribute, display, and perform only verbatim copies of your work, not derivative works based upon it.[457]

Six combinations of these conditions describe increasing strengths of copyright assertion, abbreviated as (i) BY, (ii) BY-SA, (iii) BY-ND, (iv) BY-ND, (v) BY-ND-SA and (vi) BY-NC-ND.[458] For each work released, a content creator can override the standard copyright terms in a jurisdiction by declaring a Creative Commons license. Enabling the wide variety of license choices tends to follow the philosophy of choice by the Open Source Initiative.[459]

In December 2007, two additional legal tools were announced: CC+ (i.e. CC Plus) and CC0 (i.e. CC Zero).

> CC+ is a protocol to enable a simple way for users to get rights beyond the rights granted by a CC license. For example, a Creative Commons license might offer noncommercial rights. With CC+, the license can also provide a link to enter into transactions beyond access to noncommercial rights – most obviously commercial rights,

[457] In a reflexive reference, the Creative Commons conditions are licensed under a Creative Commons Attribution license.

[458] The spirit of the four conditions and six licenses stabilized around 2004 with the release of CC Version 2.0 . Minor tweaks were made in 2005 with Version 2.5, and in 2007 with Version 3.0, to work through compatibility issues with other licenses (e.g. clarifications with Debian and MIT).
The (i) Attribution license requires explicit crediting of the original creation. “Creative Commons licenses are not an alternative to copyright. They work alongside copyright, so you can modify your copyright terms to best suit your needs”.1 In tradition, copyright could be asserted on any work as soon as the ink was affixed to the paper. This minimal condition signals to the reader that the author is concerned about his or her intellectual property.
The (ii) Attribution Share Alike license enables commercial use and extensions of the work, and binds downstream derivatives. These conditions are most comparable to open source software licenses, in spirit.
The (iii) Attribution No Derivatives license allows for redistribution only in original form.
The (iv) Attribution Non-Commercial license removes for-profit uses, while allowing some latitude for downstream derivatives.
The (v) Attribution Non-Commercial Share Alike license is popular in the digital remix culture of mashups and fanzines.
The (vi) Attribution Non-Commercial No Derivatives license, often called the “free advertising” license, asserts the interest in protection on Internet distribution, allowing downloads, and sharing only if links back to the original source are provided.

[459] The OSI direction has been to recognize, by the FSF definition, both “free” and “non-free”:
“Free software’s success is built upon an ethical position. CC sets no such standard.”
“Creative Commons licenses are designed to give artists choice. Lessig personally describes how Creative Commons, "gives creators the freedom to choose how their works are used." This is not freedom in the sense that the term is used in Free Software” (Hill, 2005).

> but also services of use such as warranty and ability to use without attribution, or even access to physical media. [....]
>
> CC0 is a protocol that enables people to either (a) ASSERT that a work has no legal restrictions attached to it, or (b) WAIVE any rights associated with a work so it has no legal restrictions attached to it, and (c) SIGN the assertion or waiver (Steuer, 2007).

The CC+ license was developed in cooperation with commercial rights agencies and some pioneering CC-enabled businesses. The CC0 license is similar to the public domain dedication, enabling a future platform for reputation systems to judge the reliability of a copyright status depending on the certifier.

Refinements of the Creative Commons licences has continued, with version 4.0 initially launched in September 2011, published in November 2013. Considerations for porting into a variety of jurisdictions continued into Q2 2014.[460]

The Creative Commons has advanced the letters of the law in defining *remix* or *read/write culture*, in contrast to a *permission* or *read-only culture* (Lessig, 2008). Licensing is a parallel activity whereby the lawyers have been catching up to the practices exhibited in open source communities.[461]

The rise of digital photography has led to a domain where new licensing for content has become popular. Photographers capture more images digitally than they did with film cameras, and the Internet can making sharing privately, with friends or family, or the public, easy.[462] Organizing digital images on a web platform can make finding a specific photograph easier not only for the non-creators, but also for the photographer himself or herself.[463]

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[460]Since copyright laws are in expressed in a variety of languages in a variety of countries, the declaration of a Creative Commons license may be subject to porting to a specific jurisdiction. In November 2013, the version 4.0 CC license was released to reduce the need to "port" a generic license to laws local to a jurisdiction, enabling ready-to-use around-the-world licenses.

[461]The conditions for sharing of software works can be more clearly specified by domain-specific licenses such as the GPL or licenses recognized by the Open Software Initiative:
"... Creative Commons licences are broader in scope ... in that they allow for peer-distribution without the accompany requirement of authorizing peer-production, i.e. derivative works, mandated by open-source licences. As such, when used in connection to the Creative Commons licences, the term open-source more correctly refers to a methodology used to encourage innovation through the sharing of resources".

[462]In a six-month study in 2000, when digital cameras were relatively uncommon, subjects (aged 24 to 38) took 200 to 1000 (with an average about 500) photographs, compared to their prior non-digital accumulated collection of 300 to 3000 (with an average of about 1000) pictures (Rodden and K. R. Wood, 2003). This means that when digital cameras were relatively expensive – and camera phones didn't yet exist – people were averaging about 1 to 5 photos per day!

[463]People presumably use cameras because they want to be able to retrieve the images later. In a study of 18 parents, the value of long-retrieval of family

Flickr launched as a web-based image hosting platform in February 2004. In June 2004, Flickr announced the feature to choose a Creative Commons license on uploading new images, either as a batch, or per-photo (Butterfield, 2004). With the rise of blogging, hosting images on Flickr was an easy way of managing digital photographs. Within the first year, 10 million photographs were published under the six Creative Commons licences. Yahoo acquired the company in March 2005. After 5 years, in 2009, there were 100 million photographs, free to download, print and distribute (Thorne, 2009). Most photographs were licensed restrictively – with 33% BY-NC-ND, and 29% BY-NC-SA – yet 24% (i.e. 24 million photos) allow commercial use with minimal restrictions. Case law has demonstrated that Creative Commons licenses on Flickr images has been enforced in a variety of jurisdictions.[464] In March 2015, Flickr added options to tag works no longer in copyright as Public Domain, or complete copyright releases under CC0 (Vaidyanathan, 2015).

Creating and sharing derivative works of digital images can complicate their licensing. In November 2006, DeviantArt included Creative Commons licensing as an alternative to traditional copyright, as part of the normal workflow of uploading artistic content to its web site (Ellwood, 2006). Founded in 2000, members "deviate" animations, photographs, web skins, films and literature and share them on the web.

In July 2004, Google acquired Picasa as an image organizer and viewer. With the September 2008 announcement of Picasa 3.0 and Picasa Web Albums, Google announced the option to choose one of the six CC licenses on each image, and/or set the "Photo Usage and Licensing" as a default (Benenson, 2008; Horowitz, 2008).

Sharing digital images through blogging has become even more popular with "retweeting" or "liking". Creative Commons licensing by the original photographer legalizes the conditions for resharing the content. Technically, the terms of service for each web hosting service often restrict sharing to only that provider, and not other web services. While rarely enforced, normal practices in resharing content in social media could frequently represent violations of copyright that are not enforced.[465]

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pictures was high (i.e. around 4.7 on a scale of 5). On experiments of 71 retrieval tasks – finding birthdays, family trips, first pictures of a child, etc. – 61% were successful, taking about 2.5 minutes each. On the 39% of unsuccessful retrievals, subjects gave up after about 4 minutes (Whittaker, Bergman, and Clough, 2010). This effectively means that, on average, nearly 40% of the digital photos taken last year are lost, and considerable persistence is needed for them to be refound.

[464]The Creative Commons cites Curry v. Audax in a 2006 copyright violation in the Netherlands; in Avi Re'uveni v. Mapa Inc. in 2009 in Israel; and Gerlach vs. DVU in 2010 in Germany.

[465]In 2011, Photobucket signed an agreement with Twitter that extended its licensing with subscribers, so that tweeted photographs tweeted would preserve copyright. One month earlier, licensing had become an issue with Twitpic, who had to revise its terms of service. By terms of service agreements, without a CC license, Flickr photos can only be shared on Yahoo sites, and Photobucket allows

Sharing music over the Internet has had a legal chill since the 2001 enforcement of the Digital Millennium Copyright Act (DMCA) on Napster.[466] This could be resolved by separating Creative Commons licensed digital music from the traditional commercial channels of distribution.

In January 2005, Jamendo was launched as a website for musicians, complementing peer-to-peer networks (e.g. eMule, BitTorrent and Kazaa) with a legal service allowing artists to choose one of the Creative Commons licenses for their works.[467] Jamendo also proposed a system of direct and voluntary compensation from listeners to the artists, in the form of donations or sponsorship, passing through 90% to 100% of the payment (Roelants, 2005). By December 2006, the web site had listed 2000 albums (Zimmer, 2006). The company received first round venture capital funding in July 2007, which was bought out in April 2008.[468] By October 2010, Jamendo claimed that the web site had 400,000 tracks of free music, with 30,000 artists from 150 countries, with additional licensing for film, television, public places and games (Jamendo Team, 2013).

Spoken word podcasting saw some early adopters of Creative Commons licensing. On May 3, 2005, the first podcasting interview was released, based on a collaboration between two fellows of the Berkman Center for Internet & Society: radio journalist Christopher Lydon and software developer Dave Winer (Walsh, 2011).[469] The founding of Radio Open Source followed a history of a 2001 dispute on rebroadcast rights on Lydon's prior show, *The Connection*.[470] Production on the podcast show has continued with Creative Commons licensing, with audio content preserved since 2005 on the Internet. In November 2013, an agreement was made by WBUR to rebroadcast Radio Open Source podcasts on weekends (J. P. Kahn, 2013).

Video sharing web sites were slower in working through copyright options, as the popularity of camera phones rose.

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other users to "copy, print, or display ... without limitation" (Gill, 2011).

[466]Non-infringing sharing of content was recognized as one way of using Napster, which led to a finding that Napster should be responsible for differentiating between the copyrighted music shared without permission and the files where the original creators intended for open sourcing (Douglas, 2004).

[467]Sylvain Zimmer had started the project as LesAutres.org in March 2004 while still a student, and then evolved the name to PeerMajor in July-August 2004 after moving to Luxembourg. Pierre Gérard and Laurent Kratz became cofounders after the name of Jamendo (combining "jam session" with "crescendo").

[468]In July 2007, Mangrove Capital Partners invested series A funding into Jamendo, becoming the majority shareholder. In April 2010, MusicMatic acquired that stake, and integrated Jamendo into its broadcasting networks of audio and video content in retail outlet chains.

[469]The first show of Radio Open Source on May 30, 2005 was titled "Web 2.0".

[470]From 1994 to 2001, Christopher Lydon was the host on *The Connection*, broadcast on WBUR. When WBUR moved into syndication, questions about the rights of the on-air personality and the rights of the public radio broadcaster led to a a breakdown (Dan Kennedy, 2001). WBUR replaced Lydon with temporarily with Bob Oakes, and then Dick Gordon through 2005 when the program was cancelled.

Blip.tv, since the early days of its beta test in July 2006, was first in requiring all video content uploaded to its web site be licensed as Creative Commons.[471] This feature on blip.tv was a major differentiator amongst video sharing web sites for many years. Blip.tv made downloading video content easy for remixing, whereas alternatives would not do similarly for many years.[472]

In July 2010, Vimeo announced that they were "launching a new Settings option that allows you to add one of several Creative Commons licenses to your videos" (Verdugo, 2010). They re-emphasized a "golden rule" that "you may not upload content that you did not create yourself", and that permissions could not be granted for others to use.

In June 2011, Youtube announced that content owners could market their videos with Creative Commons CC-BY licenses upon uploading the videos (Peterson, 2011). Additionally, they started a new Creative Commons library of 10,000 videos from C-SPAN, Voice of America, Al Jazeera and others. This was described as "a big deal" for remix culture, as Creative Commons-licensed videos became readily available to Youtube's video editor for mashing up with other clips and synchronizing with music. The Youtube product manager describe it "as if all the Creative Commons videos were part of your personal library" (Roettgers, 2011).

The sharing of text had a legacy in GNU licences (e.g. documentation), that eventually was updated for larger scale collaboration. Between May and August 2009, Wikipedia amended the licensing on its web sites to enable dual licensing under the original GFDL (GNU Free Documentation License) and a new Creative Commons CC-BY-SA. This was started in December 2007, with a request from the Wikipedia Foundation to the Free Software Foundation to provide a migration path in the GFDL 1.3 license. The Wikipedia founder, Jimmy Wales, said Creative Commons licensing might have been preferred if it had been available when the web site was first launched.

[471] Blip.tv required Creative Commons licensing from the beginning: "All user-generated content will be uploaded onto the site under a Creative Commons License (see http://www.creativecommons.org/) or on an all rights reserved basis" (Blip Networks, Inc., 2006).

[472] Google Video, launched in January 2005, was first positioned as a search engine, and then an online video store with (i) commercial tv shows; (ii) psuedo-commerical content; and (iii) amateur user-submitted material (Pogue, 2006). The free download of the "Life Wasted" video by Pearl Jam for one week in May 2006 (before becoming available for sale) shows that Google Video had supported CC licensing. Just prior to the Youtube acquisition by Google in November 2006, Lawrence Lessig called Youtube a "fake sharing site, that "igives you tools to make seem as if there's sharing, but all tools drive traffic and control back to a single site" (Lessig, 2006b). Joi Ito concurred, and cautioned against a "Bubble 2.0 on top of Web 2.0" where the platform would be for greedy people, in the short term (Ito, 2006). Nicholas Carr saw Web 2.0 as a system of exploitation rather than a system of emancipation (N. Carr, 2006). Lessig responded that he saw Youtube as a "hero" in the hybrid economy (between commercial and sharing economies), where "those who follow Web 2.0 values are likely to profit most" (Lessig, 2006a).

> When I started Wikipedia, Creative Commons did not exist. The Free Documentation License was the first license that demonstrated well how the principles of the free software movement could be applied to other kinds of works. However, it is designed for a specific category of works: software documentation. The CC-BY-SA license is a more generic license that meets the needs of Wikipedia today, and I'm very grateful that the FSF has allowed this change to happen. Switching to CC-BY-SA will also allow content from our projects to be freely mixed with CC-BY-SA content. It's a critically necessary change for the future of Wikimedia (Wikimedia Foundation, 2009).

The Free Software Foundation released GFDL 1.3 in November 2008.[473] After the May passage of the dual licensing vote by the Wikimedia Foundation, the FSF gave permission to transition from the GFDL by August 1, 2009.[474] After that date, all content on Wikipedia was to be licensed as Creative Commons CC-BY-SA.

By June 2011, the total number of CC-licensed works on the Internet was estimated at 400 million works "from music and photos, to research findings and entire college courses" (Creative Commons Corporation, 2011). Stories of success were related in an online book, *The Power of Open*, in 9 languages. TED Talks has had free and open distribution of its videos since June 2006 with a CC BY-NC-ND license. British photographer Jonathan Worth followed Cory Doctorow's example of giving his book away and making money from it, with an experiment of CC BY licensing of free high-resolution copies online while selling exclusive signed prints.[475]

[473]The November 3, 2008 update of GFDL to 1.3 was specifically in response to the request by the Wikimedia Foundation, as progress on the GFDL v2 was still in progress (Free Software Foundation, 2008).

[474]The FSF put a strict timeframe on the transition from FSDL to Creative Commons:

"*What is the purpose of the two different dates in section 11? Why did you choose those specific dates?*"

"Section 11 imposes two deadlines on licensees. First, if a work was originally published somewhere other than a public wiki, you can only use it under CC-BY-SA 3.0 if it was added to a wiki before November 1, 2008. We do not want to grant people this permission for any and all works released under the FDL. We also do not want people gaming the system by adding FDLed materials to a wiki, and then using them under CC-BY-SA afterwards. Choosing a deadline that has already passed unambiguously prevents this."

"Second, this permission is no longer available after August 1, 2009. We don't want this to become a general permission to switch between licenses: the community will be much better off if each wiki makes its own decision about which license it would rather use, and sticks with that. This deadline ensures that outcome, while still offering all wiki maintainers ample time to make their decision" (Free Software Foundation, 2008).

[475]In the original experiential, Jonathan Worth licensed some photographs to Cory Doctorow under a CC BY-SA license. He marked up the images on Flickr, which became popular. When Doctorow released his book with the image on the cover, Worth produced 111 copies of the image and sold them on a sliding scaling, where higher numbers were cheaper (Doctorow, 2009).

Nina Paley released her 2008 animated movie "Sita Sings the Blues" under CC BY-SA, claiming that she has a higher profile, doesn't spend anything on promotion, and fans buy merchandise. The Open University chose CC licenses on its new OpenLearn website in 2005, preempting £100,000 in legal fees. Khan Academy has licensed its videos under the BY-NC-SA license since 2004, and has received funding from the Bill & Melinda Gates Foundation. The Public Library of Science (PloS) has published with CC BY license since 2003, and has open access journals recognized as having impact. A total of 30 stories were published in the book.

The sharing of content – as information, ideas, or creative works – has been defined in four ways:

> *Pay to view sharing* is making content available to paying customers. (e.g., paywalls).
>
> *Read only sharing* is granting free access to read content. (for the vast majority of content published, this is the type of sharing involved).
>
> *Copy only sharing* is giving other people the right to actually move and share you content around the web.
>
> *Remix sharing* means giving other people rights to remix and build upon your content (Pearson, 2015).

The Internet has made sharing easy with (i) the abundant information and creative works online; (ii) free copies of even locked-up content easy to find; and (iii) people going beyond just consuming to participate in creating culture. Thus, Creative Commons licences have been used (i) as a publicity vehicle; (ii) to build community; (iii) to leverage outside ideas; (iv) for the social good; and (v) new kinds of "open" companies with transparency and participative work culture. By 2014, the number of Creative Commons-licensed works is estimated at 882 million.[476] The presentation of ideas has led to the August 2015 Kickstarter funding of a book *Made with Creative Commons: A Book on Open Business Models* (Stacey, 2015). The project has a goal to begin to answer the question "how do creators make money to sustain what they do when they are letting the world reuse their work?" (Creative Commons, 2015).

B.5.3 From 2005, open government data cooperated with citizens

Transparency of government and public access to information are not new ideas. Readily sourcing of evolving digital datasets through open interfaces so that that information can be analyzed, contextualized and mashed up has advanced at various rates in a variety of jurisdictions worldwide.

[476]The number of CC-licensed works now merits its own subdomain.

In December 2007, 30 American open government advocates met for a weekend to create a list of *Open Government Data Principles*.[477] Resulting the meeting were 8 principles and 3 principles requesting open comment:[478]

> Government data shall be considered open if it is made public in a way that complies with the principles below:
>
> 1. *Complete*: All public data is made available. Public data is data that is not subject to valid privacy, security or privilege limitations.
> 2. *Primary*: Data is as collected at the source, with the highest possible level of granularity, not in aggregate or modified forms.
> 3. *Timely*: Data is made available as quickly as necessary to preserve the value of the data.
> 4. *Accessible*: Data is available to the widest range of users for the widest range of purposes.
> 5. *Machine processable*: Data is reasonably structured to allow automated processing.
> 6. *Non-discriminatory*: Data is available to anyone, with no requirement of registration.
> 7. *Non-proprietary*: Data is available in a format over which no entity has exclusive control.
> 8. *License-free*: Data is not subject to any copyright, patent, trademark or trade secret regulation. Reasonable privacy, security and privilege restrictions may be allowed.
>
> Compliance must be reviewable.
>
> **Definitions**
>
> 1. "public" means:
>
>   The Open Government Data principles do not address what data should be public and open. Privacy, security, and other concerns may legally (and rightly) prevent data sets from being shared with the public. Rather, these principles specify the conditions public data should meet to be considered "open."
>
> 2. "data" means:

[477] The meeting was organized by Tim O'Reilly (of O'Reilly Media) and Carl Malamud (a public domain advocate who incorporated Public.Resource.Org as a nonprofit public benefit corporation in April 2007). The meeting additionally drew individuals from the Sunlight Foundation, EveryBlock, Stamen Design, GovTrack.US, Stanford University, MapLight.Org, outside.in, Institute for Money, My Society, Participatory Politics, Google, Berkman, NewCo, MetaWeb, Yahoo, New Organizing Institute, Question Copyright, Metavid, UC Berkeley, EFF, Metasocial Web, Omidyar Network and the Open Library.

[478] Comments on open government data principles were received on a Google Group.

> Electronically stored information or recordings. Examples include documents, databases of contracts, transcripts of hearings, and audio/visual recordings of events.
>
> While non-electronic information resources, such as physical artifacts, are not subject to the Open Government Data principles, it is always encouraged that such resources be made available electronically to the extent feasible.

3. "reviewable" means:

> A contact person must be designated to respond to people trying to use the data.
>
> A contact person must be designated to respond to complaints about violations of the principles.
>
> An administrative or judicial court must have the jurisdiction to review whether the agency has applied these principles appropriately.[479]

These 2007 principles have since been adopted, to a greater or less degree, across jurisdictions at the federal, regional and municipal levels. By October 2013, the Open Data Barometer would rank the UK as the most advanced country for open data readiness, implementation and impact, scoring above the USA. Sweden, New Zealand, Denmark and Norway, as shown in Table B.2. The leading developing country was Kenya (21st), ranking higher than rich countries such as Ireland (29th) and Belgium (31st).

The Open Data Barometer is structured in three sub-indices: (i) *readiness*, identifying how far a country has in the places the political, social and economic foundations for realizing the potential benefits of open data; (ii) *implementation*, identifying the extent to which government has published a range of key datasets to support innovation, accountability and more improved social policy; and (iii) *emerging impacts*, identify the extend to which open data has been seen to lead to positive political, social and environment, and economic change.

While the UK scored the highest in readiness and implementation, the United States scored highest in impact. Sampling was conducted in 77 countries. Much of emphasis in the report was on on appreciating regional (i.e. continental) trends, and recognizing the strong relationship between levels on the Human Development Index and the diffusion of open government data policy and practice. Most countries had open government data initiatives at a national level, with a few exceptions leading with cities (e.g. the Edo State ahead of Nigeria as a country).

[479]The Open Government Data Principles were originally posted on a wiki, now archived. The content was "dewikified" onto a static public.resource.org page.

Table B.2. Open Data Barometer, Top Global Ranking, from (Davies 2013)

Rank	Country	Readiness Sub-Index	Implementation Sub-Index	Impact Sub-Index	ODB Overall
1	United Kingdom	100.00	100.00	79.91	100.00
2	United States	95.26	86.67	100.00	93.38
3	Sweden	95.20	83.14	71.95	85.75
4	New Zealand	81.88	65.49	88.81	74.34
5	Norway	91.88	70.98	46.15	71.86
5	Denmark	83.54	70.20	55.73	71.78
7	Australia	87.88	64.71	51.19	67.68
8	Canada	79.11	63.92	51.59	65.87
9	Germany	74.50	63.14	53.81	65.01
10	France	79.39	64.31	39.07	63.92
10	Netherlands	85.92	67.06	21.42	63.66

With the focus of this book on the period between 2001 and 2011, an outline of progress in the leading two countries follow: the United Kingdom, and the United States. The UK evolved partially coinciding with a 2003 directive from the European Union culminating in 2010 action plan by Prime Minister David Cameron.[480] The U.S. activity was led by citizen dissatisfaction on scandals from 2005 through to the Obama administration taking office in 2009.

In the UK, policy changes would originate first from outside the country, with grassroots level activities from citizens associated with academic institutions.

In November 2003, the EU passed a Directive on the *Re-use of Public Sector Information* (PSI). It established "a minimum set of rules governing the re-use and the practical means of facilitating re-use of existing documents held by public sector bodies of the Member States" (Parliament, 2003). The general principle was that "these documents shall be re-usable for commercial or non-commercial purposes", and "where possible, documents shall be made available through electronic means". By July 2009, all member states had implemented the Directive, although only four met the original deadline of July 2005 (European Commission, 2009). The UK was one of those four (Cabinet Office, 2005). The commission would open 18 infringement cases against member states, and the European Court of Justice would deliver 4 judgements for failure to implement the Directive.[481] The 2009 report assessed that "progress had been made",

[480] A UK Open Data Timeline by Tim Davies, charts updates to April 2014, with numeric data from Google Docs. This work was first released in June 2010.

[481] Infringement cases involved "non-communication of implementation initially

but implementation in member states was “uneven”.

From May 2004, the incorporation of the Open Knowledge Foundation in the UK was led by Rufus Pollock, an economist at the University of Cambridge.[482] While initial initiatives at December 2004 did not focus on open government data, the original purpose would eventually include that as well:

> The Foundation exists to promote the openness of all forms of knowledge. We work in three particular areas:
>
> 1. To promote freedom of access, creation and dissemination of knowledge.
> 2. To develop, support and promote projects, communities and tools that foster and facilitate the creation, access to and dissemination of knowledge.
> 3. To campaign against restrictions both legal and non-legal on the creation, access to and dissemination of knowledge.[483]

The costs of computing and the Internet was seen as an opportunity for a knowledge society, while the trend was threats of strengthening of intellectual property law.[484]

In January 2005, the Freedom of Information Act 2000 came into force across the whole United Kingdom. This act of parliament originated as

regarded BE, CZ, DE, GR, ES, IT, CY, LV, LT, LU, MT, NL, AT, PT and HU, and non-conformity of national implementing measures with the Directive currently concerns IT, PL and SE”. Judgements for failure to implement the Directive were filed on “AT, BE, ES and LU” (European Commission, 2009).

[482]The legal status of the Open Knowledge Foundation as a not-for-profit organization incorporated in 2004 is preserved on the Internet Archive.

[483]Initial projects of the OKF included (i) KnowledgeForge, and digital-based open knowledge community; (ii) the Information Accessibility Initiative, working against obstacles created by closed formats in physical accessibility and social accessibility; (iii) Friends of the Creative Domain, supporting the BBC’s efforts to make an open Creative Archive; and (iv) What is To Be Done, addressing the most pressing issues facing society, politics, economics, science and environment in the 21st Century.

[484]The rise of new technologies was why the OKF was formed:
“... while the rise of the ’knowledge economy’ provides a unique opportunity it has also given rise to new threats. Just as technological developments have permitted the ’open source’ revolution in software so we now stand upon the threshold of an analogous revolution for knowledge.”
“*The Threat:* ... While the importance of property rights for incentivizing knowledge creation is acknowledged, the current situation shows a large deviation from the correct balance between openness and proprietarization. [....] Recent years have witnessed a major strengthening of intellectual property laws at a time when trends in technology (see below) would have suggested that the opposite should occur.”
“*The Opportunity:* With the Computer and Communications Revolution ... not only that more powerful and complex hardware and software tools are available for knowledge creation, but that knowledge, in its widest sense, becomes comparatively more important - the development of the ’knowledge economy’ and ’information society’”.

a white paper in 1997, with a schedule of compliance around timelines in different jurisdictions. The 2000 UK Act applied to public bodies in England, Wales and North Ireland. The Scottish Act, with almost identical requirements, was passed in 2002.

In March 2005, Demos, a cross-party think tank in Britain, published *Wide Open: Open source methods and their future potential* (Mulgan, Steinberg, and Salem, 2005). They suggested three broad categories of activity observed in projects inspired by open source ideas, at least partially transferable to non-software areas: (i) *open knowledge*, projects where knowledge is provided freely, shaped, vetted and used by a wide community of participants; (ii) *open team working*, projects that merge semi-open teams rooted in organizations in loose communities of interest; and (iii) *open conversations* with online with more participants than before.

In 2003, the mySociety project, led by Tom Steinberg, revived the UK Citizens Online Democracy (UKCOD) originally founded in 1996.[485] In June 2006, the TheyWorkForYou web site– aggregating content from Hansard records in the House of Commons, House of Lords, Scottish Parliament and North Ireland Assembly to track votes and speeches of Members of Parliament since 2004 – was adopted by mySociety.

In February 2007, an independent review was chartered "to explore new developments in the use of citizen- and state-generated information in the UK, and to present an analysis and recommendations to the Cabinet Office Minister as part of the Policy Review" (Mayo and Steinberg, 2007). This was supported by the Strategy Unit of Prime Minister Tony Blair, with Tom Steinberg of mySociety as the primary author, and with Ed Mayo of the National Consumer Council in a rapid review. The final report of *The Power of Information* was published in June 2007, with 15 recommendations.

June 2007 was also the month when the Labour Party leadership would transition from Tony Blair to Gordon Brown in an uncontested election. The popularity of the Labour Party would decline in the recession of 2008, and the party saw a catastrophic loss of seats in the 2010 general election. With the Conservative Party having the largest number of seats in a hung parliament, a coalition between the Labour Party and the Liberal Democrats was insufficient to rule, and Gordon Brown resigned. In May 2010, the government would change to coalition of the Conservative Party led by David Cameron and the Liberal Democrats led by Nick Clegg.

In an open sourcing mode, the Open Knowledge Foundation would develop the ideas and infrastructure for the Comprehensive Knowledge Archive Network (CKAN), which would become the foundations for the data.gov.uk initiative, and subsequently data.gov in the United States In September 2006, the OKF would publish version 1.0 of the Open Knowl-

[485]The beginning and annual reports mySociety in the UK are charted in a history.

edge Definition.[486] A work is defined as open "if its manner of distribution satisfies" conditions on (i) access; (ii) redistribution; (iii) reuse; (iv) absence of technological restriction; (v) attribution; (vi) integrity; (vi) no discrimination against persons or groups; (viii) no discrimination against fields of endeavor; (ix) distribution of license; (x) license must not be specific to a package; and (xi) license must not restrict the distribution of other works. Licenses conformant with the open knowledge definition include the MIT Database License; the Creative Commons Attribution License (cc-by) and Attribution Share-Alike License (cc-by-sa); the GNU Free Documentation License (GFDL); and the UK PSI (Public Sector Information) Click-Use License. Features that would make a license non-conformant licenses include no-derivatives and non-commercial clauses. In October 2014, the Open Definition would be revised in version 2 in simpler language: "Open data and content can be freely used, modified, and shared by anyone for any purpose".[487] The revision was in review for year prior to release, with "input from experts involved in open access, open culture, open data, open education, open government, open source and wiki communities".

OKCon 2007, the first Open Knowledge Conference, was held in London in March 2007, with panels on open media, open geodata and open scientific and civic information.[488] OKCon 2008 was held one year later, on the theme "Applications, Tools and Services".[489] OKCon 2009 in March 2009 focused on "open knowledge and development" and on "the semantic web and open data".[490] Subsequent conferences have spread to other geographies.[491]

In July 2007, the OKF announced the launch of an open sourcing Comprehensive Knowledge Archive Network (CKAN) after a year of prior development (Pollock, 2007a). CKAN is a registry of open knowledge packages and products, a place to search for resources as well as registering them.[492] CKAN did not replace local technologies, and recommended

[486]The web site infrastructure under The Open Knowledge Definition has evolved since its first version 1.0.

[487]The major change in content was "a clear separation of the definition of an open license from an open work (with the latter depending on the former)" (Pollock, 2014). The principles were rewritten into three key areas: (i) open license; (ii) access; and (iii) open format.

[488]The annual Open Knowledge Conference first organized on a wiki since 2007, with formal announcements on an event page.at . OKCon 2007 convened at Limehouse Town Hall in London on March 17, 2007. The very first event, under a different meeting name, was the World Summit on Free Information Infrastructures, held in London on October 1 and 2, 2005 .

[489]OKCon 2008 met at the London School of Economics on March 15, 2008. Three main sessions focused on 'Transport and Environment', 'Visualization and Analysis' and 'Education and Academia'.

[490]OKCon 2009 met at University College London on March 28, 2008.

[491]An open source tracking of Open Knowledge events appear on lanyrd.com.

[492]"CKAN is a registry or catalogue system for datasets or other "knowledge" resources. CKAN aims to make it easy to find, share and reuse open content and

"side by side" integration with existing public data platforms.[493]

In September 2009, the Cabinet Office announced an early preview of data.gov.uk, inviting the developer community to give feedback on 1000 existing data sets from 7 departments (J. Taylor, 2009). The backend repository for data.gov.uk was CKAN technology private beta, with the packages promised to show up on the CKAN main web site when it would become public (Pollock, 2009).

In January 2010, the public beta of data.gov.uk was announced (Data.gov.uk Team 2010). Improvements over the four months included more datasets, plus online browsing of data and tags, a wiki, and a forum (powered by Drupal). The OKF was a subcontractor the primary contractor, initially the National Archives and then the Central Office of Information (CKAN, 2011).

In May 2010, Prime Minister David Cameron announced a radical plan to open up government data to the public, establishing a Public Service Transparency Board under Minister of the Cabinet Office Francis Maude, and appointing Tom Steinberg as one of the UK's leading experts on data transparency (Cameron, 2010).

In July 2010, the Cabinet Office promoted populating data.gov.uk, with an article to "Tell us which datasets you want released".[494]

In September 2010, the information covered by Crown copyright and database rights was relicensed under a new UK-wide Open Government License. From version 1, this new license was aligned to be compatible with the Creative Commons Attribution license.[495]

In May 2011, the Cabinet Office appointed Beth Noveck as an advisor on open source policy making, based on her experience in the U.S. She was to complement (i) Tom Steinberg; (ii) Tim Kelsey (seconded from McKinsey to direct national policy on transparency, becoming the full-time Executive Director of Transparency and Open Data in January 2012); and (iii) Martha Lane Fox (an Internet entrepreneur previously appointed in 2009 as the digital inclusion champion towards bringing poorer families

data, especially in ways that are machine automatable".

[493]One of the challenges with knowledge, as defined by the OKF, is componentization. "*Componentization* is the process of *atomizing* (breaking down) resources into separate reusable *packages* that can be easily recombined (Pollock, 2007b). The challenge of getting a resource complete with all of its dependencies has been resolved in Linux distributions, e.g. Debian, with the apt packaging manager (Pollock and D. Dietrich, 2009b). With CKAN, the datapkg module takes care of the dependencies, and the metadata is registered on CKAN (Pollock and D. Dietrich, 2009a). In addition to piloting CKAN in beta on data.gov.uk, work on internationalization (i18n) and decentralization was progressing concurrently in Germany.

[494]The announcement included publishing of the procurement spend by English local authorities and the Department of Health on gov.uk.

[495]Version 2 of the Open Government License was specifically named as compatible with the Creative Commons Attribution License 4.0 and the Open Data Commons Attribution License.

online) (Osborne, 2011).

The OKF worked on data.gov.uk for its first two years. In early 2010, the Open Government Data web site, wiki and mailing list was started by the Open Knowledge Foundation. The initial vision was "mapping out open government data initiatives from around the world".[496] By fall 2010, CKAN internationally included instances from governments and institutions in the UK, Norway, the Netherlands, Helsinki and the International Aid Transparency Initiative; and from communities operating at national, provincial and municipal levels.[497] "In early 2012 the UK government took its CKAN work in-house, but they continue to work closely with the CKAN team and make regular code contributions back to CKAN" (CKAN, 2013). By the relaunch of data.gov.uk in June 2012, the CKAN web interface was found to be providing a better web interface, and those functions were migrated from the Drupal modules (Acuna, 2012).

Americans came to open government digital data from a different direction. In 2005, dissatisfaction with multiple corruption scandals in Washington D.C. combined with the rise of social media brought together citizen interested in a more open and accountable government.[498]

In April 2006, the Sunlight Foundation was founded, with three priorities: "digitizing data, building tools and the sites for easy access to it, and developing communities to support and help carry on its work" (Sunlight Foundation, 2010). The name of the group reflects the dissatisfaction with government transparency at that time.

> Publicity is justly commended as a remedy for social and industrial diseases. Sunlight is said to be the best of disinfectants; electric light

[496] The initial home page preserved on the Internet Archive shows activity starting in early 2010 on the wiki.

[497] The initial CKAN communities were listed from the UK, Canada, Germany, Norway, Hungary, France, Austria, Italy, the Netherlands, Slovenia, Colorado, IATI, New Zealand, Belgium, and Spain.

[498] In October 2005, the Bush administration was described as having " the flavor of the early stages of Nixon's Watergate scandal":
"At present, Tom "The Hammer" DeLay, the House majority leader, has been doubly indicted for conspiracy and corruption; Bill Frist, the Senate majority leader, is under investigation for insider trading; Jack Abramoff, a powerful, Republican-connected lobbyist with ties to DeLay, is under criminal investigation by a Senate committee, several government agencies and the state of Florida; David Safavian, Bush's chief of procurement for the Office of Management and Budget (OMB), is under arrest for obstructing an investigation of Abramoff; and the head of the Food and Drug Administration, Lester Craw ford, has been forced to quit after two months for failing to report his wife's sizeable holdings in pharmaceutical industry stock".
"In addition, reporter Judith Miller of the New York Times has testified before a grand jury investigating the exposure of Valerie Plame as a CIA agent. Plame was exposed by the Bush group in retaliation for her husband's exposure of administration lies about weapons of mass destruction. Miller's testimony concerned conversations with Vice President Dick Cheney's key aide, Lewis "Scooter" Libby. The affair raises the question of the involvement of Deputy White House Chief of Staff Karl Rove, Cheney and possibly George W. Bush himself" (Goldstein, 2005).

> the most efficient policeman (Brandeis, 1914, p. 92).[499]

This group was instrumental in convening an Open Government Working Group meeting in October 2007, to develop the list of eight principles for open government data (Malamud, 2007).

These citizen-led activities shaped the guidelines under which development by government managers progressed. The Federal Web Managers Council is an interagency group that collaborates to improve the online delivery of U.S. government information and services, sponsored by the GSA's Office of Citizen Services.[500] In June 2008, the implementation guidelines on publishing data were updated in response, and citizen feedback on updates based on the Open Government Data Principles were incorporated (Tauberer 2008).

On January 21, 2009 – the first day in office for a new administration – the White House issued a *Memorandum on Transparency and Open Government*, outlining three principles: (i) government should be transparent; (ii) government should be participatory; and (iii) government should be collaborative. The president directed the CTO, in coordination with the director of the OMB and administrator of General Services for recommendations for an Open Government Directive within 120 days (Obama, 2009).[501] Beth Noveck was appointed as Director of the White House Open Government Initiative in January 2009.[502] In analysis by citizens, this memorandum listed deadlines for 45 days, 60 days, 90 days, 120 days, 1 year and 2 years (Schuman, 2009).

The energy from the new administration sparked public collaborations. In February 2009, a TransparencyCamp meeting – an "unconference" inviting government representatives, technologists, developers, NGOs, wonks and activists led by the Sunlight Foundation – convened in Washington D.C.[503] Presentations, notes and audio recordings were shared on a wiki openly on the Internet, with videos following soon after.[504] A TransparencyCamp West was convened in August 2009, with a better-organized web

[499]This quotation on sunlight is part of the writings by Louis D. Brandeis in *Other People's Money*, Chapter 5.

[500]The Federal Web Manager Council, its goals and sponsorship were described at us.gov.

[501]The Open Government Milestones for the first 120 days have been preserved as history on the Internet Archive .

[502]President Barack Obama issued a memorandum to the heads of executive departments and agencies on "Transparency adn Open Government", directing the Chief Technology Office, Director of the OMB and Administrator of General Services to coordinate development of an Open Government Directive within 120 days (Obama, 2009).

[503]The announcement and invitations to the first Transparency Camp were managed in social media style on eventbrite.com.

[504]The first Transparency Camp event details, including sponsorship details, were posted on barcamp.org, with artifacts following.

site and microblogging.[505] This series matured with a March 2010 event in a larger DC venue, and video recordings following.[506] TransparencyCamp has become an annual event, with strong support for local communities to host their own.[507]

In addition to individuals immersed in face-to-face meetings, efforts for understanding the importance of open government data has been targeted to the larger audiences. Joshua Tauberer has described Open Data as "Civic Capital", reducing costs in the redistribution of government information and strengthening governance through educating citizens and reducing the need for government regulation (Tauberer, 2009b). In the business media, Tim O'Reilly projected a "Government 2.0" whereby government becomes "an open platform that allows people inside and outside" to innovate, in the similar way that "Web 2.0" has reshaped business models in old media and software companies (O'Reilly, 2009b).

Inside the U.S. government, the policy setting has trickled down to work towards changing practices. Beginning November 2009, monthly inter-agency collaborative events have been organized as an Open Government Directive Workshop Series, each hosted by a different agency. Online social media tools visible to the public have been used to coordinate these events, with presentations and notes available for public viewing.[508] }

The White House formally directed executive departments and agencies, on December 8, 2009, to take steps towards the goal of creating a more open government, including (i) publishing government information online; (ii) improving the quality of government information; (iii) creating and institutionalizing a culture of open government; and creating an enabling policy framework for open government (Orszag, 2009).

Evaluation of the U.S. government activities towards a more open government have generally been favourable. A review of the Open Government Directive of December 8, 2009 found that it addressed "early all of the open government data principles that have been put forward, and even [added] two of its own: being pro-active about data release and creating accountability by designating an official responsible for data quality" (Tauberer, 2009a).

In an April 2010 audit of Open Government Plans, findings scored 6 agencies as "strong", 16 as in the "middle ground", and 5 with "weak plans" (OpenTheGovernment.org, 2010). On a multi-year time horizon, progress was being made, and the public visibility of activities towards open government through periodic reviews would help to maintain momentum.

[505] The second Transparency Camp event saw the launch of the web site at http://transparencycamp.org , and the use of Twitter with a hashtag of #TCamp09.
[506] The 2010 videos have been posted on transparencycamp.org, and a microblogging stream was encouraged with a Twitter hashtag of #TCamp2010.
[507] A history of TransparencyCamps has been written.is maintained.
[508] Presentations from the Open Government Directive Workshops have been compiled as part of the OpenGov Playbook.

At the international level, the *Open Government Partnership* "is a multilateral initiative that aims to secure concrete commitments from governments to promote transparency, empower citizens, fight corruption, and harness new technologies to strengthen governance".[509] . The partnership launched on September 20, 2011, with eight founding governments (Brazil, Indonesia, Mexico, Norway, the Philippines, South Africa, the United Kingdom and the United States) endorsing the *Open Government Declaration*.[510] To be accepted, "OGP participating countries will co-create a National Action Plan (NAP) with civil society. Action plans should cover a two-year period and consist of a set of commitments that advance transparency, accountability, participation and/or technological innovation". By 2013, 57 additional governments had joined the Partnership.[511]

The uptake of open government data as an idea rose circa 2007-2009, in a variety of jurisdictions.[512] Citizen engagement, as distinct from official government pronouncements, sometimes more difficult to discern.

As an example, the Canadian government espoused joining the Open Government Partnership in April 2012 (Lithwick and M.-O. Thibodeau, 2012). Within Canada, democracy advocates criticized the Conservative government in failing to meet the requirements of a National Action Plan.[513] In April 2014, a Progress Report on Canada for 2012-2013 was

[509]The Open Government Partnership described its purpose and membership at its founding in September 2011, looking forward to the first meeting in March 2012.

[510]The Open Government Declaration is coupled with U.N. activities: "As members of the Open Government Partnership, committed to the principles enshrined in the Universal Declaration of Human Rights, the UN Convention against Corruption, and other applicable international instruments related to human rights and good governance".

[511]The United Nations Division for Public Administration and Development Management (DPADM) has been conducting research on Open Government Data since 2010..

[512]The Annual International Conference on Digital Government Research sees a rise in the top of open government data from 2006 through 2008. An archive of the proceedings is linked from interaction-design.org. One bellwether is a 2006 paper by Peter Muhlberger on "Should e-government design for citizen participation?: stealth democracy and deliberation".

[513]The federal government in Canada has been criticized for lack of transparency:
"The Conservatives committed to taking positive steps forward in three areas (what OGP calls Grand Challenges): 1. increasing public integrity; 2. improving public services, and; 3. effectively managing public resources."
"However, the Conservatives' Action Plan focuses only on making currently available information available online through open data systems, does not contain any measures to increase public integrity or increase accountability for mismanagement of public resources, and tries to claim credit for open government and public consultation initiatives the Liberals implemented years ago. And given the Conservatives' recent multibillion dollar F-35 fighter jet and prison spending boondoggles, and G8 summit spending scandal, it couldn't be easier for them to more effectively manage public resources."
"In all these ways, the Conservatives' Action Plan violates the Open Government Partnership (OGP) requirements set out in the Open Government Declaration that all countries are required to sign." (Sommers, 2012)

issued (Francoli, 2014a). While the government of Canada had a highlight in adopting an Open Government License, the report criticized a lack of ambition in driving an open agenda. [514] This could be interpreted as accepting the licensing of open source, while skirting the adopting of behaviours associated with open sourcing. This led to the federal government conducting consultations for a second Action Plan on Open Government, and recognizing multi-jurisdictionality (Francoli, 2014b).

At the municipal level in Canada, citizen activity was better welcomed by local governments. ChangeCamp was initiated in January 2009 in Toronto, and has spread to other Canadian cities.[515] In April 2009, the mayor of the City of Toronto announced the OpenTO initiative, with an official launch in November 2009.[516] In May 2009, the City of Vancouver council endorsed principles of open data, standards and source, with an official launch in September 2009.[517]

In the UK in 2012, Tom Steinberg resigned after 5 years of advisory roles in Westminister, frustrated "partly due to the dull tribalism". He publicly posted policy papers written for both Tory and Labour politicians and analysts, expressing regret at the way his name was being used (Steinberg, 2012).

The progress in government on open sourcing licensing, around the world, can be evaluated as great. The progress in government on open sourcing, as a behaviour, is highly variable.

B.5.4 From 2005, open source hardware rose with the maker movement

While open sourcing originated with non-material artifacts, the impact on the material world of physical objects was beginning to gain traction by 2007. Physicality can create issues in a mix of property domains:

- hardware designs can fall under patent law;
- software code can fall under copyright law; and
- symbols, words and phrases identifying a source of goods or services can fall under trademark (or service mark) law.

The traditional pure private sourcing style would see enforcement of (i) patents on a hardware design; (ii) copyrights on software code; and (iii)

[514] In the Independent Reporting Mechanism report, Francoli said "Civil society didn't really see Canada's commitments as being overly ambitious. They tended to see them more as technological solutions" (Cline, 2014).

[515] With a web site at http://changecamp.ca , the focus has been on local governments, often applying pressure to the federal government to respond to the trend towards urbanization in Canada.

[516] The announcement of OpenTO data by Mayor David Miller was made at the Mesh 2009 conference.

[517] The City of Vancouver released its Open Data Catalogue at `http://data.vancouver.ca/` . Coverage by the news media included a CBC report.

trademarks on distribution.[518] Open sourcing while private sourcing may change those positions, to (i) pledging non-assertion of patent rights on hardware designs and (ii) publishing open source licenses on software code, while (iii) operating commercially and pursuing infringements of trademarks on packaging and delivery of products, and/or service marks on the identification of the offering.

Two domains where open sourcing while private sourcing received notoriety have been in (i) the maker movement, centered particularly around the popularization of the Arduino ecosystem, and (ii) fashion apparel, where intellectual property protection has been relatively uncommon.

A label of *maker* resonates with many who exhibit behaviours of *democratizing innovation* (Hippel, 2005).[519] These ideas contrast to the role-partitioned thinking where (i) users provide needs; and (ii) manufacturers develop product and services (in the style this book calls private sourcing). In *user-centered innovation*, individuals are involved in customizing and/or extending functions, attributes or features of products and services. The involvement can occur either independently of the manufacturer, or in cooperation.[520] Beyond open sourcing software, the development of physical products in kitesurfing by an MIT student (Saul Griffith at Zero Prestige) in 2001 became an early foundational case study for von Hippel. In 2005, Eric Wilhelm would partner with Saul Griffith to cofound Squid Labs (an engineering design firm), and then spin off four companies, including *Instructables*. Instructables has become "the world's biggest show and tell" on offering free step-by-step instructions on how to make things (McCluskey, 2008).

The rise of the *maker movement* coincides with Dale Dougherty coining the term.[521] Dougherty proposed *Make* magazine – pitched as "Martha Stewart for geeks" – and launched the first issue in January 2005 as not only a web site, but also a physical publication with few advertisers at a $15 cover price (McCracken, 2015). The term "maker" was a vague way of describing the target audience of individuals with a sense of curiosity, adventure and intellectual engagement in learning-by-doing. In April 2006,

[518]The language and implementation of patents and trademarks varies across jurisdictions. As an example, a patent infringement may be based on "first marketing" or "first sale, and/or on "primary use" or "secondary use".

[519]The eBook version of *Democratizing Innovation* under Creative Commons licensing showed up on the web in October 2004, while the physical commercial printed versions by MIT Press were avaialble in Feburary 2005.

[520]In a package perspective, an offering as an output for a customer to acquire enables independence from the manufacturer; an offering as an input for a customer enables better collaboration (R. Ramirez and Wallin, 2000).

[521]Dougerty was a cofounder with Tim O'Reilly of O'Reilly Media in 1978, and the first editor of their computing trade books. In 1993, he developed the first commercial web site, the Global Network Navigator. In 2003, he coined the term "Web 2.0" (for Internet services with extensive user action), which became registered as a service mark for O'Reilly Media for arranging conferences (Espinosa, 2014).

the first Maker Faire at the San Mateo County Event Center attracted 100 exhibiting makers. In 2006, the second Maker Faire was held in May in San Mateo, and in October in 2007.[522] In 2010, two new Maker Faires were started in Detroit and New York City (Hague, 2014). By 2014, Maker Faires reached 100 events globally, with 530,000 attendees (Faire, 2014). The White House would host a mini Maker Faire on June 18, 2014.

In winter 2005, the low-cost Arduino microcontroller board was introduced as a tool for students of Massimo Banzi at the Interaction Design Institute Ivrea (IDII) (Kushner, 2011). A microcontroller board, when combined with a programming language, enables novices to to create interactive devices and robots with motors, sensors, lights and sounds. Prior to 2002, the most popular platform had been the Stamp, manufactured by Parallel Inc. The Stamp was programmable with a dialect of BASIC on Windows-based personal computers. The IDII students were challenged to design interactive prototypes, with about 30 days to learn electronics. The Stamp had obstacles including a $100 hardware cost, an underpowered processor for the projects they proposed, and the lack of programming tools on the Mac computers they preferred.[523] One student, Hernando Barragán, wrote a new prototyping platform in 2003 called Wiring, including both a user-friend Integrated Development Environment (IDE) and a ready-to-use circuit board.[524] To complement that software, a core product team of five targeted a $30 budget.[525] The first implementation saw 300 blank printed circuit boards given to IDII students, with a directive to look up assembly instructions online.[526] By 2005, the first simple prototype board was created, eventually given the Arduino name by Banzi.

The Arduino project was apprehensive of the IDII running out of operating funds, and decided to ensure that the assets would remain as accessible as possible. The design of the board, as CAD (computer aided design) files, was licensed under Creative Commons. Components could be added onto

[522]Maker Media was spun off from O'Reilly Media in 2013.

[523]MacBS2 was provided as a private source freeware tool for Mac OS/X 10.4 Tiger by Murat M. Koner from 2002, with the challenge of losing compatibility as Apple moved OS/X from PowerPC to Intel processors. The code was maintained through OS/X 10.6 Snow Leopard, but broke under 10.7 Lion.

[524]The Wiring programming language has a C++ style, inspired by the Processing programming language that follows a Java style. Processing was written at MIT by Casey Reas and Ben Fry, as a descendant of the Design by Numbers project led by John Maeda. Processing (first labelled as Proce55ing) was released in 2001 licensed as GPL and LGPL.

[525]The core team is cited as Massimo Banzi and David Cuartielles (codesigners at IDII), David Mellis (software based on Wiring), Tom Igoe (ITP New York, advisor), and Gianluca Martino (manufacturing and hardware design).

[526]The Wiring ATmega128 boards used in the Strangely Familiar physical computing class in autumn 2004. Arduino forked that design and source code for a cheapter Atmega8 controller. The view of Hernando Barragán is written as "The Untold History of Arduino".

the basic board, and lots of input and output pins were provided.[527]

While Arduino counterfeits (i.e. illegally copies of the trademark) exist, Arduino-compatible clones can follow the specifications with a wide variety of features and costs.[528] Arduino LLC was founded in the United States, with Massimon Banzi as CEO. Production of officially trademarked Arduino board continued with Smart Projects SRL in Italy, under Gianluca Martino.

In 2013, Intel introduced the Galileo, an Arduino-certified development board based on the Intel x86 architecture.

By 2014, there were an estimated 1.2 million official Arduino boards in use, and possibly an equal number of Chinese counterfeit copies claiming "Made in Italy" (Orsini, 2014). By March 2015, there was a split of the five original cofounders, with Smart Projects SRL ceasing royalties payments and a new CEO Frederico Musto renaming the company Arduino SRL (Banzi, 2015). The trademark for Arduino in Italy was granted in 2010, and funding for manufacturing had been personally assumed by Gianluca Martino and Daniela Antonietti at Smart Projects, with much competition from counterfeits (Elliot Williams, 2015)(. Courts in the United States, Switzerland and Italy have sided with Smart Projects (now Arduino SRL) on their use of trademarks. In May 2015, Arduino LLC announced that Arduino-branded boards would be manufactured outside of Italy, by Adafruit in the United States (Senese, 2015). Further, in June 2015, Arduino LLC launched the Genuino brand to be manufactured by a longtime partner, Seeed Studio in Shenzhen, for distribution in China (Dougherty, 2015).

By 2008, the maker movement had become validated as a "big idea" that had gained recognition over the past three years.[529] Not only were Make and Craft magazines successful, but online sites such as Instructables and Etsy were receiving notice in the business press (O'Reilly 2008).

[527]Terms around Arduino components vary. The original design files in Eagle CAD are licensed as CC-BY-SA. The Java environment is released under GPL, and the C/C++ microcontroller libraries are under LGPL. The Arduino brand was trademarked, enabling alternative implementations to be developed commercially, while retaining a distinct identity. The original Arduino Uno became eventually complemented by the more powerful Mega board, the smaller Nano board, the waterproof LilyPad, and a net-enabled Arduino Ethernet.

[528]By 2008, Arduino-compatible boards had become available (Torrone, 2008). In 2012, a list of "10 favourite Ardiuino-compatible clones and derivatives" included designs at lower cost, different collaborators, countries of manufacture, size, connectivity and performance. (Torrone, 2012).

[529]Dale Dougherty described three characteristics of "big ideas" for O'Reilly Media: "A big idea, he said:
- Has a significant impact on the market
- Is not just our idea (i.e. it matters to a lot of people, and helps them to frame what they do)
- It shapes the opportunity (O'Reilly, 2008).
The influence of O'Reilly in snaping commercialization of the Internet, open source software and Web 2.0 were successful reframings of key breakthroughs.

The definition of "open source hardware" or "open hardware" has continued to be a challenge. By 2008, the practice of designing, sharing, distributing and modifying hardware designs over the Internet by makers was common. Sharing blueprints and sketches to make furniture and machinery predates the open source movement by centuries. The difference in open sourcing hardware was articulated by Eric von Hippel:

> Most products are designed in software first. So you're designing and simulating on the computer, and in the last step you turn it into hardware. If you think of open-source software as an information good, then open-source hardware is also an information good until the very last stage (Greene, 2008).

Practically, debates on the definition center around whether the CAD (Computer-Assisted Design) files are or are not available under a Creative Commons license. For microcontroller boards, Arduino set the pace with CAD files licensed under Creative Commons, software licensed as open source, and identity protected by trademarking. Single-board computers have not been so cleanly defined.[530]

From 2008, the BeagleBoard community has been following the spirit of open sourcing. The BeagleBoard was introduced as "low-cost, fan-less single-board computer based on Texas Instruments' OMAP35x device family, with all of the expandability of today's desktop machines, but without the bulk, expense, or noise".[531] Texas Instruments was encouraging "open source as a means to drive innovation, ultimately enabling our customers to create market-leading devices".[532] The company funded a "small dreams" project to fabricate a prototype printed circuit board and host a web site, on the requests of employees Jason Kridner and Gerald Coley who were volunteering their time.[533] An evaluation board was backed by Digi-Key Electronics, and manufactured under contract by CircuitCo.[534] The goal was not to make the Beagleboard a consumer product, but enable makers to experiment with building an embedded system that might be later be put into production by a manufacturer that Texas Instruments sup-

[530] Arduino is designed as a microcontroller board, i.e. with interfaces to the physical world. A single-board computer typically deals with information, and only a limited number of physical ports.

[531] At June 2008, the Rev. B boards did not yet support the USB EHCI port nor linux-omap git tree. Broader distribution was expected when Rev. C boards became available.

[532] The OMAP Linux Community was a resource for developers working on Texas Instruments processors.

[533] In Texas Instruments, Kridner was working as a community manager and in usability; Coley was a hardware design and QA engineer. The Beagle idea is described in a brief.

[534] The Evaluation Board offered by Digikey. The manufacturing of the Beagleboard is listed as a CircuitCo product.

plies.[535] Reference manuals and hardware documentation were provided first on the beagleboard.org web site under a Creative Commons license, and then on Github.[536] In the five years up to 2013, four generations of BeagleBoards were released (Erives, 2013).

For a while there would be two major initiatives that would take different stances on open sourcing and hardware: the Open Source Hardware Association at oshwa.org; and the Open Hardware project at openhardware.org, led by Bruce Perens.

The Open Source Hardware Association originated in early 2010 with a Creative Commons fellow trying to turn a project of open source hardware modules into a company.[537] Sharing the questions, they convened an "Opening Hardware" workshop in New York City in March 2010. The timing coincided with a major Arduino meeting in New York City, bringing together many stakeholders.[538] The norms of practices in open source hardware were discussed, leading to eventual publishing of the Open Source Hardware (OSHW) Definition 0.1.

Iteration on the OSHW Definition continued through the first Open Hardware Summit in September 2010. The OSHW Definition 1.0 was released in February 2011.

> Open-source hardware means sharing the files needed to build *and* modify your hardware. As the open-source hardware definition explains, that means the version of the files that you would prefer for making changes to the design, not an intermediate or obfuscated version. For mechanical stuff, this means the original CAD files. For circuit boards, it's the original schematic and board layout files (Mellis, 2012).

In April 2011, a community mark selected as the symbol of abidance by the OSHW Definition. The gear logo unfortunately led to trademark infringement suit by the Open Source Initiative (OSI) in August 2012, who were concerned about confusion amongst consumers (A. Shah, 2012). In April 2013, the U.S. Patent and Trademark Office rejected an application

[535]The Beagleboard has been criticized as impractical for small-scale production by an individual consumer, as the BGA (Ball Gate Array) processor solders the processor directly on the board rather than plugging into a socket. The Raspberry PI (released in 2012 for a lower-cost educational market) is similarly criticized, plus the Broadcom processors are not available for sale in small quantitites. The OLINIXUNO targets an industrial grade single board computer as Open Source Hardware.

[536]Since 2008, the beagleboard.org web site has been licensed as CC-BY-SA. In 2011, the files were additionally posted at `https://github.com/CircuitCo`.

[537]Ayah Bdeir, advancing her littleBits hardware, consulted with her Creative Commons advisor, John Wilbanks, leading to Opening Hardware workshop (Mota, 2013).

[538]Organizations represented included Bug Labs, Chumby, Wired Magazine and DIY Drones, Arduino, SparkFun, MakerBot, Adafruit, Make magazine, MIT, the Open Prosthetics project and Parallax (Mota, 2013).

for the trademark of "Open Source Hardware" as it was "merely descriptive" and not distinctive (R. Wilson, 2013). In September 2015, the OSHWA reiterated its pursuit of a certification program, despite issues in licensing (Weinberg, 2015).

In September 2007, Bruce Perens reactivated the openhardware.org web site.[539] In 1998, the original vision was for an "Open Hardware Certification Program" as a self-certification by hardware manufacturers.[540] While there was little interest in self-certification in the early 2000s, the emergence of several projects and companies (including Arduino, Adafruit and Sparkfun) using the label of "open source" led Perens to host a placeholder page until July 2011, when a wiki for an Open Hardware Catalog was put into place.[541] Two issues of *Open Source Journal* were published, in November 2011, and then in February 2012. In the process of encourage open hardware, Perens found that his activities may have have actually worsened the freedoms[542] that he was promoting:

> Open Hardware [is] backwards in a way. [....] Patents apply to hardware designs, but most Open Hardware designers never pursue a patent on their designs. What then do they license to others?
>
> It turns out that we have a group of people at CERN, and one of my favorite lawyers and Yahoo, and even me, trying to add restrictions to something that is, for the most part, already in the public domain. And it came to me that this was backwards, and that we could be working against our own interest that way. [....]
>
> The problem is that when we start licensing things that are ac-

[539] Bruce Perens had registered the openhardware.org web domain in 1999 for SPI (Software in the Public Interest, Inc.), in the year following the registration of opensource.org (Perens, 1999). The domain name was not renewed, and came into the possession of a third party. In 2007, Perens found the domain name again available, and re-registered ownership under Perens LLC "rather than leaving it for others to drop the ball" (Mota, 2013).

[540] The original supporters and description of the Open Hardware Certification Program from 1998 are preserved on the Internet Archive::
"By certifying a hardware device as *Open*, the manufacturer makes a set of promises about the availability of documentation for programming the device-driver interface of a specific hardware device. While the certification does not guarantee that a device driver is available for a specific device and operating system, it does guarantee that anyone who wants to write one can get the information necessary to do so".

[541] Between 2007 and 2011, openhardware.org had no activity. By July 2011, a new web site was started at wiki.openhardware.org.

[542] The constitution of the Open Hardware project stated its reason-for-being to support, assist and promote an idea:
"That idea is the creation and distribution of physical or electronic designs that are under licenses that meet all three of the requirements of:
- The Open Hardware Definition 1.1
- The Open Source Definition (As applied to hardware rather than software. The Open Hardware Definition is essentially a hardware translation of this document.)
- The Four Freedoms of the Free Software Foundation. (As applied to hardware rather than software)".

> tually in the public domain, we create norms that the courts take seriously. And they start enforcing licenses on things that could not be licensed before. We really can write new law when what we do gets to a court case, and we want to be careful what law that is. If we were responsible for taking hardware designs from public domain to copyrighted status, we'd be shooting ourselves in the foot.
>
> So, for a while I was uncomfortable with my own Open Hardware evangelism. Was I doing the right thing? I think I've worked out the right path now and will be warning the community about this issue. [. . .]
>
> We also have a bunch of people who use "CC BY-NC" licenses on their designs and then call it Open Source Hardware! Funny how eager they are to call it "Open Source" and then they don't even follow the rules of Open Source. Open Source includes the right to use in any way. If it's "no commercial use allowed" like CC BY-NC, it's not Open Source (Perens, 2014).

By February 2014, the openhardware.org wiki had been removed and replaced by a placeholder web page.

In 2015, Bruce Perens reiterated his legal interpretation that open source licenses work for software copyrights, but hardware designers should not expect protections unless the work has been patented.

> Open Hardware licenses don't work. So go ahead and make Open Hardware, but be aware of the fact that it's essentially public-domain. Making the licenses work would be worse, because we'd also lose the right to implement designs we read about, etc. So, keep in mind that no matter what license you put on a schematic, *copyright does not protect it* and anyone can manufacture it with impunity unless you have a *patent* (Perens, 2015).

For a party that owns an entire copyright for software, Perens advised that he continues to be "a big fan of dual-licensing, using one of the more restrictive Free Software licenses like the Affero GPL 3 and a commercial-license for those who would rather pay than be open".

In January 2005, researchers in the fashion industry conducted a conference at the Lear Center at USC called "Ready to Share". It inquired into whether technological developments – digitalization, cheap and easy replicability (as demonstrated with the Creative Commons) represented a compelling model for creative industries to follow. While open sourcing in software and hardware was seen as enabling some forms of "crowdsourcing", the fashion industry embraces sampling, appropriation and borrowed inspiration.

The scope of works of applied art eligible for copyright are described as rather limited. Works of art (e.g. music, sculpture) can be defined

as property, and protected by copyright. Useful articles (e.g. perfume, culinary creations) are free to copy as utilitarian, and not protected under intellectual property law. Figure B.1 reveals a secondary dimension of tangibility: idea and/or digital manifestations versus physical fixed expressions. Fashion design is utilitarian, like open source code, but is expressed in a fixed physical form.

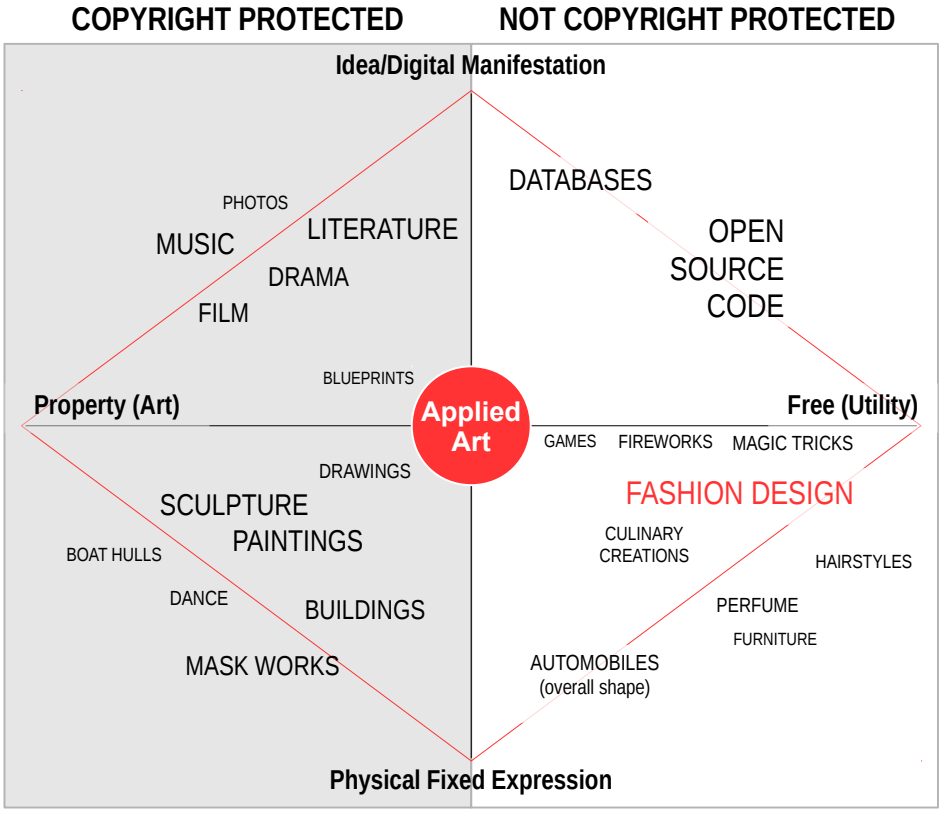

Figure B.1. Fashion design produces apparel as "useful articles" in physical fixed expressions (from Blakley 2010a)

The open, participatory culture on the Internet and in digital media has been theorized by Claude Levi-Strauss description of a “recombinant creative process as *bricolage*, a concept that refers to the constant mixing and morphing of incongruous ’found’ elements into a new synthesis” (Bollier and Racine, 2006). Fashion is seen as having a distinctive “ecology of creativity”, constantly expressing shifting cultural moods, social demographics and personal identities.

> The ecology of creativity in fashion features an open design commons, limited copyright protection, a focus on marketing and branding, and competitive markets that reward innovation and speed. Intellectual property rights are not unimportant in this regime, to be sure, but neither do they obstruct new sorts of creativity and competition.

> Businesses still enjoy proprietary advantages – their brand name and reputation – but no one is allowed to privatize and lock up design itself. Fashion recognizes that pleasing a diverse, constantly changing consumer base in a timely way is the key to a profitable bottom line, and that staying one step ahead of fickle style trends that last months, not years, is imperative to success (Bollier and Racine, 2006, p. 11).

Originality in fashion is built around "an ethic of *homage*, the respectful referencing and imitation of other people's creativity", with talent framed in recognized lineage of tradition. Separating "imitation" from "originality" is a challenge for copyright law. If a "derivative" rendition attracts an independent following, the value of "originality" diminishes. While *counterfeits* – "that falsely bears the label of another designer even though no license has been paid" are legally prosecuted, *knockoffs* "that may be almost identical to a brand-name dress, but it does not purport to be anything but what it is" have been embraced with cheaper production technologies, faster logistics and shorter fashion cycles. Elite designers can charge a premium of perceived superiority and "originality", while imitators cater to mid-market and lower-tier consumers who are not customers of elite brands.

While fashion may borrow from art and vintage styles, its interdependence with culture has led to street fashion from urban hip-hop pioneers. The culture of appropriating, modifying and sharing materials over the Internet is seen to resemble that of fashion: both innovators and imitators draw on the building blocks of the past through bricolage.

Copyright has not generally been granted to apparel, because articles of clothing are considered "useful articles" rather than works of art. Design patents may be granted for ornamental designs, but clothing rarely meets the criteria of novelty and nonobviousness.

> Fashion ... challenges the idea often reflexively accepted by policymakers and courts that "more rights" automatically ensure "more creativity" and less rights will choke it. In the fashion industry, the absence of rights actually may feed the creative process. Fashion designers are free to borrow, imitate, revive, recombine, transform and share design elements without paying royalties or worrying about infringing intellectual property rights. Of course, fashion designers are not the only creators who draw on previous works in order to create (Cox and Jenkins, 2006, p. 17).

The dominant business model in fashion is a counterexample that challenges other creative industries that rely on preventing unauthorized or unpaid uses of content.

The music industry has been strong on enforcing intellectual property law that is supposed to encourage innovation, prevent theft and reward artists.

However, it's possible that an innovative musician could be delayed from sharing his work, and forced to make it more derivative and less original.

> In the fashion industry, sampling, derivation and reappropriation all are accepted and common forms of creative innovation. Indeed, the creative process today is almost wholly reliant on forms of reuse and has deftly avoided the kind of fracas the music industry faces over intellectual property protections. However, there still are powerful institutions that help navigate the murky waters that separate legitimate influence from theft. Without the "thick" copyright protection afforded to the music industry, fashion depends more heavily on social regulation and a primitive but highly functional watchdog – shame (Sinnreich and Gluck, 2006, p. 6).

In the music industry, the high cost of doing business and low success rates has made an industry with concentrated ownership structures and vertically integrated business organizations risk-averse. The fashion industry has resisted corporate consolidation on the same scale.

The elevation of fashion design to an art form is partially based on the lack of qualification for copyright protection (Blakley, 2010). Whereas music, film, photography, writing, sculpting and graphic design can be copyrighted as art, fashion design can incorporate elements of peers' creative works to enable greater creative possibilities and accelerate innovation.

The *Innovative Design Protection and Piracy Prevention Act* was introduced into the U.S. Congress in August 2010, and died when not enacted.[543] This bill proposed to extend copyright protection to fashion designs for three years. Previous bills had been introduced with the support of the Council of Fashion Designers of America and the 2010 bill had the additional support of the larger American Apparel and Footware Association.[544] The bill was criticized as hurting the fashion industry more than helping it.

> Historically, fashion designers have been denied copyright protection because the courts decided long ago that utilitarian articles should not be protected by copyright. Otherwise, a handful of designers would own the seminal building blocks of our clothing. Every time a new blouse would be made, licensing fees would need to be paid to the supposed originator of that particular sleeve or collar.
>
> Although this bill tries to get around that problem by making the overall design, not elements of the design, protectable, once any

[543]The Innovative Design Protection and Piracy Prevention Act S. 2728 in the 111th Congress, was sponsored by Senator Charles Schumer from New York.

[544]The preceding bills included (i) the Design Piracy Act, H.R. 2033 in the 110th Congress, was sponsored by William Delahunt from Massachusetts; (ii) to amend title 17, united State Code, to provide protection for fashion design H.R. 5055 in the 109th Congress by Bob Goodlatte, Representative from Virginia.

> design is owned by someone, it has a chilling effect on other designers who intend to tap into the same trend. Supporters of the bill say the copyright period for fashion designs would only be three years. . . but three years is an *eternity* in the fast-changing world of global fashion. Now that this final version of the bill has eliminated a searchable registry of protected designs, I'm not sure how designers will be able to figure out what they are not allowed to make. And according to law professors Kal Raustiala and Chris Sprigman, manufacturers and retailers could also be held liable for any copies they sold (Blakley, 2010).

The Japanese Design Law covers apparel, but only if no identical or similar design can have existed before. In the EU Community Design System, apparel with a less stringent novelty standard, but it's too easy to make a small change to a registered design and claim it as new. In Canada, works of artistic craftsmanship are limited to finished useful articles only if fewer than fifty copies are made (Daogoo, 2012). The Innovative Design Protection Act of 2012 passed out of the Senate Judiciary Committee, but not enacted, and was yet to be introduced in the 113th Congress.[545]

The fashion industry could be portrayed as an industry where open sourcing as a behaviour has been an accepted way of doing business for decades. Legislation towards enacting intellectual property protection could see private sourcing introduced as a legality. The enforceability of copyright on apparel would probably lead to precedent-setting cases ending up in court for many years.

In August 2013, full open-sourcing in microprocessors would see the OpenPower Consortium founded by IBM, Google, Nvidia, Tyan and Mellanox (King, 2013). In comparison to Power.org founded in 2004, the consortium would have "full access not only to IBM CPUs, but also to the entire gamut of Power-related hardware and software IP. Additionally, Consortium members [are] free to choose who they like, including IBM, to manufacture the customized Power chips they develop".[546]

[545]The Innovative Design Protection Act of 2012, S.3523 in the 112th Congress, was sponsored by Senator Charles Schumer from New York, and not enacted.

[546]From 2004, Power.org would have IBM as the dominant manufacturer, with Freescale building a small number of specialty chips for embedded devices. The initiative was launch as "an independent group of hardware design, manufacturing, and developer companies that support Power Architecture technology and meet to collaborate on specifications and standards to spur development of Power Architecture-based products and solutions" (Harris, 2006). Microprocessor design and manufacturing had traditionally been centered on a private sourcing enterprise, e.g. Intel, Motorola, National Semiconductor, AMD. With Power.org, a variety of microprocessors came under a common flag: the POWER chips in IBM midrange computers, PowerPC chips in the Apple Power Mac G5 line, the Nintendo GameCube and Wii, and Microsoft Xbox 360; and the Cell BE in the Sony Playstation 3. (Apple announced that it would switch from PowerPC microprocessors to Intel architecture in January 2006, with the launch of the Imac, Mac Mini, MacBook and MacBook Pro. The Power Mac G5 tower would

These evolving contexts in computer hardware and fashion design illustrate that open sourcing is practical outside of the domain of software. Legal contexts, varying by jurisdiction, can be intricate and discouraging to those who don't read law. The opportunity to accelerate innovation through open sourcing has been recognized, however. Enterprises and individuals who are diligent may find their business contexts less constrained than their thinking.

B.5.5 By 2006, research on (commons-based) peer production crossed over from academia to popularity

The rise of the Internet as an everyday phenomenon was evident by 2006. Amongst G7 countries, the percentage of individuals using the Internet had risen in 1998 from a range of 30% to 4%, to 2006 range of 72% to 38%.[547] In the leading countries, Finland and Korea, use of the Internet has surpassed 65% of individuals by 2003, reaching almost 80% by 2006. The general trend towards adoption of the Internet is shown in Figure B.2.

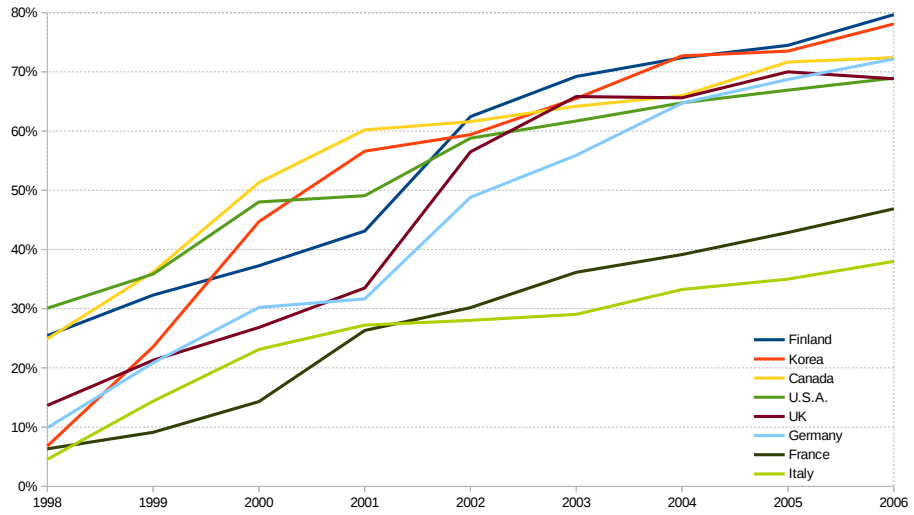

Figure B.2. Percentage of individuals using the Internet (ITU)

Increased use of the Internet enabled the rise of open sourcing, not only with infrastructural projects such as the Apache server and Linux

be replaced by the Mac Pro line in August 2006. The PowerPC microprocessor would be supported in Mac OS/X until the release of v10.6 Snow Leopard in August 2009). The original vision was "based loosely on the Linux® model" with a not-for-profit organization had a cadre of insiders are responsible for maintaining a stable instruction set architecture (ISA), on which the wider community can base systems, code, cores, and so on" (Power Architecture Editors, 2007).

[547] The International Telecommunications Union tracks "Percentage of individuals using the Internet" by country in an interactive graphic.

operating systems, but also participatory communities such as Wikipedia. The phenomenon was popularized as *peer production* in 2006, with the books by Donald Tapscott and Yochai Benkler.

The ideas of open sourcing and peer production were preceded by leading thinkers seeing a digital information revolution ahead, for some decades.

From 1985, the WELL (Whole Earth 'Lectronic Link) was one of the original online communities. Participation on persistent discussions changed the way the people could communicate at a distance. The value and distinctions between data, information and knowledge began to become apparent.

> Information wants to be free because it has become so cheap to distribute, copy, and recombine – too cheap to meter. It wants to be expensive because it can be immeasurably valuable to the recipient. That tension will not go away (Brand, 1989, p. 202).

TCP/IP – the protocol standards for the Internet – would be declared as the standard for all military computer networking in 1982. The first Interop conference in 1985 started the focus on broader adoption of TCP/IP. The proposal for use of hypertext in the World Wide Web was introduced by Tim Berners Lee in 1989. IBM would promote a campaign on e-business in 1996.

In 1996, the publication of *Co-opetition* introduced a game theoretic view of business, where strategies of cooperation could be recognized "as big a factor in business success as competition" (Brandenburger and Nalebuff, 1996, p. 264). Co-opetition sees that "there are both win-win and win-lose elements in relationships" with customers, suppliers, complementers and competitors. A framework of Players, Added Values, Rules and Tactics was proposed as ways to link to a bigger game. In the cases presented, defeating a competitor sometimes seen as the best strategy, but in other times the best strategy had multiple winners.

Also in 1996, *The Death of Competition* extended Gregory Bateson's ideas on coevolution to describe business ecosystems (J. F. Moore, 1996, pp. 9-21). Beyond a core business is (i) an extended enterprise including direct customers; customer of the customers; suppliers of the suppliers; standards bodies; and suppliers of complementary products and services; and (ii) the broader stakeholders in investors and owners, trade associations and labor unions; government agencies, other regulatory organizations; and competing organizations.[548] The premises of the ecosystem strategy include: (i)

[548] After providing a definition of a biological ecosystem, a definition of a business ecosystem is provided:
"**Business ecosystem**. An economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organizations also include suppliers, lead producers, competitors and other stakeholders. Over

the collapse of traditional industries change the way of competing from molding new products to molding new ecosystems; (ii) the new communities exist to bring innovations – as entirely new outcomes – to customers; (iii) the scope of what is contained in the ecosystem – from comprehensive to narrow – is a central strategic decision; and (iv) competitive advantage comes from knowing when and how to build ecosystems. Development of the ecosystem was seen in four stages: (i) pioneering; (ii) expansion, (iii) authority; and (iv) renewal. The automobile industry, with American manufacturers challenged by a rising alternative ecosystem from Japan in the 1970s, was seen as orienting towards new open ecosystems.[549]

In 1999, *Information Rules* took the view that "The Information Economy" did not need a new set of principles to guide business strategy and public policy, but instead required a deeper reading of "the literature on differential pricing bundling, signaling, licensing, lock-in [and] network economics" (Shapiro and Varian, 1999, p. x). With the cost of producing information high and cost of reproducing information cheap, *pricing* could be personalized to the individual, or based on group identity through third-degree price discrimination. *Versioning* could be a strategy to offer information products across a variety of market segments, either by tailoring to different customers, or designing to accentuate needs of different customer so that they self-select the one most aligned with the value they expect to receive. *Rights management* of content could be published with digital technology taking advantage of (i) lower distribution costs to give away free samples while charging for the convenience in repeat view, selling similar but not identical products; or selling complements; or (ii) lower distribution costs to maximize the value of intellectual property, rather than just protecting it for the sake of protection. Recognizing *lock-in* enables (i) buyers to bargain hard during initial negotiations, emphasizing their influence as a customer, and (ii) sellers utilizing key principles of investing in an installed customer base, entrenching so that customers become more committed over time, and leveraging the value by selling complementary products and access to these customers to other suppliers. The *economies of networks* in the information economy has displaced economies of scale in the industrial economy, leading to positive feedback

time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over tie, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles" (J. F. Moore, 1996, p. 26).

[549]Three cases were presented for leading open ecosystems: (i) Chrysler became a "lean orchestrator" as a systems engineer and systems integrator; (ii) Ford consolidated worldwide aggregate volumes with manufacturing and development resources; and (iii) Tolyota appeared to roping functionality back in from suppliers, investing in mechanical engineering, development of individual and team skills, and diffusing knowledge across its suppliers (J. F. Moore, 1996, pp. 97-98).

with a trade-off of openness versus control. *Cooperation and compatibility* in network markets can see the game change through open standards, as alliances are assembled in formal bodies. These changes would have an impact on information policy both in companies, and the government authorities that regulate them.

In 2003, *Open Innovation* was presented as a shift from the paradigm of closed innovation saying that "successful innovation requires control" to a new approach "that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology" (Chesbrough, 2003, pp. xx–xxiv). The achievements and limits of closed innovation at Xerox PARC (1970 to 1986) and IBM (1945 to 1980) were compared to open innovation with IBM (after 1993 with Lou Gerstner and the rise of the Internet), Intel Capital (investing in its close suppliers), and Lucent Ventures Group (commercializing prior Bell Labs technologies beyond the needs of the core Lucent business). The Open Innovation paradigm leads to a business model where the firm should become both an active buyer and seller of intellectual property.[550]

In 2004, *The Success of Open Source* analyzed the rise of this particular kind of software as an experiment around a distinctive notion of property:

> Open source is an experiment in building a political economy – that is a system of sustainable value creation and a set of governance mechanisms. In this case, it is a governance system that holds together a community of producers around this counterintuitive notion of property rights as distribution. It is also a political economy that taps into a broad range of human motivations and relies on a creative and evolving set of organizational structures to coordinate behaviour. What would a broader version of this political economy look like? (S. Weber, 2004, p. 1)

The writing first traces the history of open source through Unix and the origins of the Internet, through proliferating standards, and the founding of the Free Software Foundation. The invention by Linus Torvalds and the rise of Linux is described with two ideal types for the division of labour:

[550]The focus on IP (intellectual property) management further developed by 2007 to include open source business models: (i) selling installation, service and support with the software; (ii) versioning the software, with the free version as an entry-level offering, and other, more advanced versions as value-added offerings; (iii) integrating the software with other parts of the customer's IT infrastructure; and (iv) providing proprietary complements to open source software (Chesbrough, 2007, p. 43). This narrower view of open sourcing and private sourcing is further emphasized by observing that the "emergence [of open source software] ironically has coincided with the the emergence of stronger intellectual properties protection for patents and other IP" (Chesbrough, 2007, p. 48). In a broader perspective on open sourcing while private source, licensing is related to, but independent of, information hiding on other dimension of offerings.

the hierarchy, described by Harlin Mills as breaking up separate teams to manage discrete pieces, and Frederick Brooks in a conceptual integrity, with a master plan, separating architecture and implementation;[551] and (ii) the open source process where the key element is "voluntary participation and voluntary selection of tasks".[552] Open source matured as a model of production following a crisis in incompatible Unix forks; the evolution of Linux 1991-1994; the transformation of NCSA Mosaic in 1994 to the Apache server in 1995, and the IBM's role in the founding of the Apache Group in 1998; and Red Hat and VA Linux IPOs in 1999.

The microfoundations of open source was explained in four ways: (i) individual motivations; (ii) economic logic of the collective good; (iii) coordination, and its sustainment; and (iv) complexity managed with technology and governance institutions. The macro-organization of open source was explained with (i) the coordination of contributions of specialized knowledge on a focal point with neither authoritative command nor a price mechanism, i.e. through individual incentives, cultural norms and leadership practices; and (ii) complexity managed through technical design, sanctioning, license as social structure and formal governance structures. Business models with open source through 2000 were seen as experiments,[553] and legal structures were still wrangling with copyright law, the GPL and the DMCA.

With the case studies mostly ending by 2000,[554] the open source process was hypothesized to have implications on (i) rethinking property oriented more towards stewardship or guardianship rather than exclusion; (ii) organizing for distributed innovation, rather than just division of labour; (iii) the commons in economic and social life, with the potential for a deadweight loss from a "tragedy of the anticommons"; (iv) development in

[551] Fred Brooks' vision was "talking about Reims, not Chartres. In fact, most European cathedrals are a mishmash of architectural designs and styles, built at different times according to the aesthetic of their designers. Norman transepts may abut a Gothic nave" (S. Weber, 2004, p. 60)(.

[552] Building on Eric Raymond's analysis, the essence of the open source process is offered as eight general principles: 1. Make it interesting and make sure it happens. 2. Scratch an itch. 3. Minimize how many times you have to reinvent the wheel. 4. Solve problems through parallel work processes whenever possible. 5. Leverage the law of large numbers. 6. Document what you do. 7. Release eary and release often. 8. Talk a lot (S. Weber, 2004, pp. 72-82).
Collaboration is initially described with three important aspects of behaviour: (i) technology is an enabler, with sharing over the Internet; (ii) licensing schemes as social structure that (a) enables users access to source code, (b) passes rights to use to the user, and (c) constraints further restriction on other users; and (iii) architecture tracks organization, where technical rationality is necessary by not sufficient (S. Weber, 2004, pp. 82-88).

[553] Examples cited within the frame of 1993 to 2000 include Bitkeeper, Red hat, Apple, IBM and Sun Microsystems (S. Weber, 2004, pp. 197-207).

[554] While The Success of Open Source was published in 2004, the case studyies would seem to taper off by the end of 2004. A Google Book search sees 30 mentions of 2000, 21 mentions of 2001, 12 mentions of 2002, and 6 mentions of 2003.

international economic geography potentially leading to even more drastic inequality; (v) power shifts with changes in relational power; and (vi) how hierarchically structured organizations will manage relationships with networks.

In 2005, *The World is Flat* popularized the association between globalization and the rise of the Internet (Friedman, 2005). The idea of a level playing field was described in terms of ten flatteners. Open sourcing, as a behaviour, was threaded through at least five of the flatteners – e.g. (ii) Netscape, (iii) workflow software, (iv) uploading, (ix) informing, and (x) "the steroids" of digital, mobile, personal and virtual – with the phenomenon embedded in the larger context of world changes in society and political economy.[555] As one of the best-selling books amongst business readers in the decade, *The World is Flat* represents a milestone in bringing the average household into a recognition about how much the world had changed over the prior decade.

By 2o06, true insight into the open sourcing phenomenon was accumulated into two works: the more academic *The Wealth of Networks*, speaking to shapers of policy, and the popularized book *Wikinomics* targeted for a broad audience. Both of these publications represent accumulation of the changes associated with open sourcing as a phenomenon, by respected researchers. Insights into history, and potential changes in practices and institutions were described.

The 2006 book *The Wealth of Networks* is subtitled *How Social Production Transforms Markets and Freedom*. The title can be wryly be compared to the *The Wealth of Nations* published by Adam Smith in 1776. The work was both private sourcing in its parallel release under the author's copyright as a hardcover edition by Yale University Press, and open sourcing in the online version and wiki licensed under Creative Commons BY-NC-SA license. Social production and exchange, enabled through (i) economies centered on information production, and (ii) communications interconnected pervasively (i.e. the Internet) was seen as having the promise "to play a much larger role, alongside property- and market-based production" than before (Benkler, 2006, p. 3).

With the premise that information production is not as dependent on property rights and markets as the obsession with "intellectual property" might suggest, nine ideal-type information production strategies were

[555]The open sourcing stories in *The World is Flat* are mostly centered in the chapter on "uploading", with "the community developed software movement" (i.e. Apache and IBM), "Wikipedia" and "blogging / podcasting". The ten flatteners, in brief, were: (i) Collapse of the Berlin Wall in 1989 and ability of individuals to create content and connect to each other with Windows-based personal computers; (ii) Netscape in 1995; (iii) workflow software with industry standards and technologies; (iv) uploading; (v) outsourcing; (vi) offshoring; (vii) supply chaining; (viii) insourcing; (ix) informing with search engines such as Google, and with Wikipedia; and (ix) "the steroids" of wireless, Voice over Internet Protocol, file sharing and personal digital devices (Friedman, 2005).

described, as in Table B.3

Table B.3. Ideal Type Information Production Strategies, from (Benkler 2006)

Cost Minimization / Benefit Acquisition	Public Domain	Intrafirm	Barter / Sharing
Rights-based exclusion (make money by exercising exclusive rights)	*Romantic Maximizers* (authors, composers sell to publishers)	*Mickey* (reuses inventory for derivative works)	*RCA* (companies hold blocking patents, in pools)
Nonexclusion – Market (make money from information production, not exercising exclusive rights	*Scholarly Lawyers* (write articles to get clients; bands give music free and charge for performances; software customization, advice, training)	*Know-how* (firms that have cheaper or better production processes due to research, lower cost or higher quality)	*Learning Networks* (share information with similar organizations, e.g. newswires, professional engineering societies)
Nonexclusion – Nonmarket	*Joe Einstein* (give away information for free, in return for status, reputation or other motivations).	*Los Alamos* (share in-house information, public goods on government funding)	*Limited sharing networks* (release paper to selected peers for review before publication)

IBM is described with “an excellent example of a business strategy based on nonexclusivity”. With the largest number of patents obtained from 1993 to 2004, the revenues from “intellectual property” transfer, licensing and royalties declined from 2000 to 2003, at the same time that “Linux-related services” grew at a higher rate (Benkler, 2006, pp. 46-47). Open sourcing while private sourcing is described at “the interface of social production and market-based businesses”:

> IBM is effectively relying for its inputs on a loosely defined cloud of people who are engaged in productive social relations. It is making the judgment that the probability that a sufficiently good product will emerge out of this cloud is high enough that it can undertake a

> contractual obligation to its clients, even though no one in the cloud is specifically contractually committed to it to produce the specific inputs the firm needs in the timeframe it needs it. [. . . .]
>
> The presence of a formalized enforceable contract, for outputs in which the supplier can claim and transfer a property right, may change the probability of the desired outcome, but not the fact that in entering its own contract with its clients, the company is making a prediction about the required availability of necessary inputs in time. When the company turns instead to the cloud of social production for its inputs, it is making a similar prediction. [. . . .]
>
> In the case of companies like IBM or Red Hat, this means, at least partly, paying employees to participate in the open source development projects. But managing this relationship is tricky. The firms must do so without seeking to, or even seeming to seek to, take over the project; for to take over the project in order to steer it more "predictably" toward the firm's needs is to kill the goose that lays the golden eggs (Benkler, 2006, p. 124).

This positioning had led to IBM contributing patents (e.g. around Linux) to the Free Software Foundation, or openly licensing with the software development community to extend a patent shield. With its size, IBM has "had to structure their relationship to the peer-production processes that they co-exist with in a helpful and non-threatening way". This is often meant "support without attempting to assume 'leadership' of the project" (Benkler, 2006, p. 125). With other companies (e.g. Meetup, del.icio.us, Flickr), the emergence of social production has meant "focusing on serving the demand of active users for platforms and tools that are much more loosely designed, late-binding – that is, optimized only at the moment of use and not in advance – variable in their uses, and oriented toward providing users with new, flexible platforms for relationships" (Benkler, 2006, p. 126).

Looking forward for development in human development, the nonmarket nonproprietary modalities are expected to change the industrial organization of related information industries in the sectors of (i) software, (ii) scientific publication; (iii) agricultural biotech; and (iv) biomed / health.[556] New commons-based approaches for development require policy-making institutions (e.g. patent offices, international intellectual property organizations) to evolve.

[556]Benkler frames human development in terms of the Human Development Index, beginning with the Human Development Report initiated in 1990. In contrast to production-oriented economic measures, "the HDI tries to capture the capacity of people to live long and health lives, to be knowledgeable, and to have material resources sufficient to provide a decent standard of living. It does so by combining three major components: life expectancy at birth, adult literacy and school enrollment, and GDP per capita" (Benkler, 2006, p. 310).

These changes are occurring as social ties are effected not just thickening with preexisting relations with friends, family and neighbours, but also in loose relationships in virtual communities.[557]

The institutional ecology of information production and exchange in the digital economy includes many regulatory and policy elements across a variety of industries. The basic functions in mediated human communications can be mapped in physical, logical and content layers, as in Table B.4.

The physical layer refers to material things used to connect human beings to each other. The logical layer includes algorithms, standards and ways of translating from human meaning to machine language and back. The content layer is humanly understandable statements and utterances. The policy debate in each layer challenges whether sufficient institutional space is left for social-economic practices of network information product to emerge (Benkler, 2006, pp. 391-396). Enclosure is associated with private sourcing behaviour; openness is associated with open sourcing behaviour.

The 2006 book *Wikinomics* was subtitled *How Mass Collaboration Changes Everything* (Tapscott and A. D. Williams, 2006). It was written in parallel with a private $4 million research program in 2004-2005, exploring "how new technology and collaborative models change business designs and competitive dynamics".[558] Wikinomics is described as a "new mode of innovation and value creation ... called "peer production" or peering – which describes what happens when masses of people and firms collaborate openly to drive innovation and growth in their industries".[559]

The principles of Wikinomics included: (i) *being open*, (where traditional companies were closed to networking, sharing, and encouraging self-organization), particularly with standards; (ii) *peering*, as with Linux and Wikipedia; (iii) *sharing*, of intellectual property, computing power, bandwidth, content, and scientific knowledge; and (iv) *acting globally*, not just thinking globally, but also eliminating geographic redundancies with planetary capabilities.

The new mode of production was characterized by Wikipedia and IBM with the Apache Server and then Linux. Tapscott and Williams describe

[557]The rise of social software is cited, with the research of Mark Granovetter, Robert Putnam, Manuel Castells, Barry Wellman, and Clay Shirky (Benkler, 2006, pp. 361-375)).

[558]The "Information Technology and Competitive Advantage" syndicated investigation by New Paradigm Learning, of which Tapscott is a principal. In a 2004 interview, the motivation for the research was explained: "The stimulus for the project was the recent confusion regarding IT competitiveness as reflected in Nicholas Carr's article that was published in Harvard Business Review, and is now a book" Ubiquity, 2004.

[559]Tapscott & Williams credit Yochai Benkler for the term "peer production", citing the publication In Yale Law Journal 2002-2003. "Thoughout the book, we use peer production and mass collaboration interchangeably" (Tapscott and A. D. Williams, 2006, pp. 11, 297).

Table B.4. Overview of the Institutional Ecology, from (Benkler 2006)

	Enclosure	Openness
Physical Transport	• Broadband (with FCC) • DMCA ISP liability • Municipal broadband barred by states	• Open wireless networks • Municipal broadband initiatives
Physical Devices	• CBDPTA (regulated "trusted systems") • Operator-controlled mobile phones	• Standardization • Fiercely competitive market in commodity components
Logical Transmission protocols	• Privatized DNS/ICANN	• TCP/IP • IETF • p2p networks
Logical Software	• DMCA anticircumvention: Proprietary OS; Web browser Software patents	• Free software • W3C • P2P software widely used • Social acceptability of hacking copy protection
Content	• Copyright expansion • Contractual enclosure • Trademark dilution • Database protection • Linking and trespass to chattels • International "harmonization" to maximal exclusive rights regime	• Increased sharing practices and licensing • Musicians distribute freely • Creative Commons publishing • Social disdain for copyright • Jurisdictional arbitrage • Developing nations with free information ecology

The World is Flat as "otherwise helpful", but criticize Thomas Friedman as "not seeing the forest for the trees" (Tapscott and A. D. Williams, 2006, p. 91)). They see public goods (e.g. open source software) and business as compatible, as "without the commons there could be no private enterprise".[560] At IBM, Joel Crawley sees the shared infrastructure "does not decrease opportunities to create differentiated value, it increases them". The key benefit of peer production for business are listed as (i) harnessing external talent; (ii) keeping up with users; (iii) boosting demand for complementary offerings; (iv) reducing costs; (v) shifting the locus of competition; (vi) taking the friction out of collaboration; and (vii) developing social capital (Tapscott and A. D. Williams, 2006, p. 93-95).

For managers, Wikinomics design principles are prescribed: (i) taking cues from your lead users; (ii) building critical mass; (iii) supplying an infrastructure for collaboration; (iv) take your time to get the structures and governance right; (v) make sure all participants can harvest some value; (vi) abide by community norms; (vii) let the process evolve; and (viii) hone your collaborative mind (Tapscott and A. D. Williams, 2006, p. 286-289).

By 2007, the idea of open sourcing had become a mainstream topic in businesses of all scales. Other publications would deepen the histories of successes in the software industry and postulate parallel possibilities in other domains.[561] Questions would shift from *why*, to *how*.

B.6 Summary: Open sourcing behaviour maturing over a decade

While the focus of this book has been on open sourcing while private sourcing in seven specific cases, the larger trends in the decade 2001-2011 were an inescapable context for IBM. Inside the company, the spirit of "open, collaborative, multidisciplinary, global" came from software development practices that changed the way the business worked as a whole. In a coevolutionary path, the Creative Commons, commons-based peer production, open government data and open source hardware emerged as related ideas

[560] The argument that investments in commons takes away from private enteriprise is criticized. "As Linus Torvalds aptly put it, 'That's like saying that public roadworks take away from the private commerical sector.' Even if public ownership of key aspects of the transportation network forecloses opportunities for private profit, the gains to the rest of the economy make these losses look miniscule" (Tapscott and A. D. Williams, 2006, p. 91)).

[561] The combination of open sourcing with commercial business would be addressed in *Free: The Future of a Radical Price*. Beyond the domain of software, "free" business models have been categorized into (i) direct cross-subsidies, where one feature is "given away" while other is "sold"; (ii) three-party or "two-sided" markets, where one customer class subsidizes another, and (iii) *freemium*, where some customers subsidize others (C. Anderson, 2009, pp. 251-254). In addition, there are non-monetary markets (e.g. associated with the attention economy, reputation economics, gifting) where exchanges don't directly involve money.

that have become part of contemporary society.

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