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DOT-ORG ENTREPRENEURSHIP: WEAVING A WEB OF TRUST

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La création du World Wide Web Consortium par Tim Berners-Lee en 1994 est l'institutionnalisation d'une communauté de confiance pour éviter la balkanisation des standards principaux du Web. Cette innovation est l'œuvre d'un entrepreneur organisationnel centré sur la coopération sociale. Elle n'évite pourtant pas la mise en place à partir de 2003 d'autres structures de standards, centrées sur la concurrence, qui conviennent aux firmes réalisant des profits sur Internet.

INTRODUCTION

If asked about entrepreneurship in the Information Age, most people would think of successful companies such as Google or Amazon.com[1], or perhaps individuals such as Bill Gates or Steve Jobs. Others might think of failed "dot com" ventures, such as Pets.com, eToys.com, and the like. In all cases, the word entrepreneurship would most likely conjure images of an innovative individual whose objectives were to attract venture capital, Get Big Fast, and, ultimately, compete in the market[2].

Market success or failure, however, are not the only measures by which we can evaluate the significance of entrepreneurial activity. According to Joseph Schumpeter, "the function of entrepreneurs is to reform or revolutionize the pattern of production by exploiting an invention or, more generally, an untried technological possibility"[3]. The establishment of a new business enterprise is only one way to achieve such reform or revolution. A broader Schumpeterian conception of entrepreneurship also includes technological and organizational innovations that, in some cases, are not oriented primarily toward financial gain or market competition. These other innovations may include "policy entrepreneurship" within government bureaucracies, "academic entrepreneurship" in universities, or "social entrepreneurship" that concentrates

[1] See *inter alia* two articles in this journal: W. H. Becker, "The dot.com revolution in historical perspective", and P. Fridenson, "Une entreprise de sélection: Google", *Entreprises et Histoire*, n° 43, juin 2006, p. 34-46 and 47-57.

[2] D. Kirsch and B. Goldfarb, "Small Ideas, Big Ideas, Bad Ideas, Good Ideas: 'Get Big Fast' and Dot Com Venture Creation", in W. Aspray and P. Ceruzzi (eds.), *The Internet and American Business*, Cambridge, MA, The MIT Press, 2008.

[3] J. Schumpeter, *Capitalism, Socialism and Democracy*, New York, Harper Perennial, 1975 [1942], p. 132.

on the creation of social value (as opposed to market value)[4].

As the scope of business history has expanded beyond a Chandlerian focus on individual firms, historians have displayed a growing interest in an institutional form – cooperative standard-setting – that has brought stability to the American style of competitive managerial capitalism. Scholars agree that standardization can bring efficiency and stability to uncertain economic and technological circumstances. However, there are comparatively few studies that examine standardization as a dynamic endeavor that requires the creation of new institutions to sustain it[5].

I want to emphasize this entrepreneurial aspect of standardization in the context of a familiar tool, the World Wide Web. The Web is a clear example of an "untried technological possibility" (to use Schumpeter's phrase) that grew rapidly into one of the seminal inventions of the Information Age. My analysis will consider the Web's inventor, Tim Berners-Lee, as an organizational entrepreneur. After he created the Web in 1989, Berners-Lee's main concern was to foster its growth into a universal medium for sharing information. Unlike many of his Information Age contemporaries, Berners-Lee did not form a start-up company to promote his invention. Instead, he turned his entrepreneurial vision toward the creation of a new standards organization, the World Wide Web Consortium (W3C).

For the first decade after its creation in 1994, the W3C faced many challenges to establish itself as a legitimate and effective steward of technical standards for the Web. To evaluate the relative success of the W3C as an entrepreneurial venture, we need to look in two places: the W3C's position within a broader context of private, public, and non-profit organizations that were active within the nascent Internet economy; and the W3C's development of internal rules and policies that met the expectations of its diverse constituents.

The history of the W3C provides a compelling example of what I refer to as "dot-org entrepreneurship." I define "dot-org entrepreneurship" as an Internet-based, non-proprietary endeavor that is oriented primarily around social cooperation, not market competition. By considering the W3C and dot-org entrepreneurs more generally, we can gain a greater understanding of the diverse forms of entrepreneurship that tend to be overlooked in existing histories of the Information Age.

STANDARDIZATION: EFFICIENCY, POWER, TRUST

In general terms, scholars tend to utilize three concepts – *efficiency*, *power*, and *trust* – when they study the standardization process. Most scholarly appraisals of standardization tend to emphasize the first two concepts, and often neglect the third. Before looking at the specific history of the W3C, it will be helpful to review these concepts briefly, show the benefits of utilizing all three concepts together, and suggest how we can benefit from a critical and in-depth examina-

[4] D. M. Hart, *Forged Consensus: Science, Technology, and Economic Policy in the United States, 1921-1953*, Princeton, Princeton University Press, 1998; W. B. Carlson, "Academic Entrepreneurship and Engineering Education: Dugald C. Jackson and the MIT-GE Cooperative Engineering Course, 1907-1932", *Technology and Culture*, 29, 1988, p. 536-567; and B. Drayton, "Everyone a Changemaker: Social Entrepreneurship's Ultimate Goal", *Innovations: Technology, Governance, Globalization*, 1, 2006, p. 80-96.

[5] Two exceptions are J. Yates and C. N. Murphy, "From Setting National Standards to Coordinating International Standards: The Formation of the ISO", *Business and Economic History On-Line*, 4, 2006; and A. L. Russell, *"Industrial Legislatures": Consensus Standardization in the Second and Third Industrial Revolutions*, Ph.D. dissertation, The Johns Hopkins University, 2007.

tion of the dynamics of the third concept, trust.

A great deal of scholarship on standardization comes from economists and scholars in technical disciplines such as engineering and computer science. These scholars tend to emphasize the correlations between standardization and *efficiency*. Many economic considerations of standardization situate standards within a transaction-cost interpretation, in which standards serve the goals of efficiency by simplifying coordination and hence lowering costs. Standards, to the extent that they are stable embodiments of complex ideas, are vital for *intra-firm* efficiencies (such as mass production and bureaucratic routinization) as well for *inter-firm* efficiencies (such as compatibility among products from different manufacturers)[6].

A second subset of the literature on standardization comes from scholars influenced by a sociological and strategic emphasis on *power*. In these accounts, standardization is not simply a rational, frictionless, or efficiency-seeking endeavor. Instead, the standardization process is a site where competing social groups struggle to exercise control over technology and markets. This emphasis on power is valuable because it shows how standardization – and "standards wars" – became an increasingly vital focus of corporate strategy, and, in many cases, a determinant of market success or failure[7].

A third concept – *trust* – adds further contextual richness to accounts that emphasize efficiency and power in the standardization process. Because it is a fundamentally social activity, standardization cannot occur without at least a minimum level of trust, even between rivals. A number of historians and sociologists of science and technology have examined the dynamics of trust across a range of collaborative activities. During the late nineteenth century, for example, the development of electrical technologies such as the telegraph were contingent upon social and cultural perceptions of moral standing and trustworthiness. Trust – in instruments, institutional practices, theories, and individuals – was a key factor that facilitated the abstraction of scientific and technical knowledge from its localized and particular origins to more general and universal status. Rather than a Machiavellian grab for power, claims of objective expertise came to be essential aspects of moral claims to fairness in democratic societies[8].

The establishment of trust relations in the standardization process, however, should not be romanticized as harmonious and uncontested. Rather than taking the existence of trust as a given, we need to examine more closely the processes by which trust became

[6] See for example P. A. David and S. Greenstein, "The Economics of Compatibility Standards: An Introduction to Recent Research", *Economics of Innovation and New Technology*, 1, 1990, p. 3-41; and C. Antonelli, "Localized Technological Change and the Evolution of Standards as Economic Institutions", *Information Economics and Policy*, 6, 1994, p. 195-216. For historical assessments of standardization and efficiency in the late nineteenth and early twentieth centuries, see D. A. Hounshell, *From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States*, Baltimore, The Johns Hopkins University Press, 1984; and R. Kanigel, *The One Best Way: Frederick Winslow Taylor and the Enigma of Efficiency*, New York, Viking, 1997.

[7] See for example T. McNichol, *AC/DC: The Savage Tale of the First Standards War*, San Francisco, Jossey-Bass, 2006; C. Shapiro and H. Varian, *Information Rules: A Strategic Guide to the Networked Economy*, Boston, Harvard Business School Press, 1998, especially Chapter 9, "Waging a Standards War", p. 261-296; and A. L. Russell, "'Rough Consensus and Running Code' and the Internet-OSI Standards War", *IEEE Annals of the History of Computing*, 28, July-September 2006, p. 48-61.

[8] See for example G. J. N. Gooday, *The Morals of Measurement: Accuracy, Irony, and Trust in Late Victorian Electrical Practice*, New York, Cambridge University Press, 2004; S. Schaffer, "Rayleigh and the Establishment of Electrical Standards", *European Journal of Physics*, 15, 1994, p. 277-285; and T. M. Porter, *Trust in Numbers: the Pursuit of Objectivity in Science and Public Life*, Princeton, Princeton University Press, 1995.

institutionalized in organizations and codified into technical standards. How were institutions and standards constructed as "impartial"? As they constructed their communities of trust, standards engineers needed to create boundaries around their communities. In other words, they needed to identify points of *mistrust*. New standardization efforts could succeed only when their rivals were identified, and when the new project – the entrepreneurial venture – was defined as a critique of and improvement upon rival efforts[9].

As we explore the history of standardization, we should be wary of relying upon any of these three concepts – efficiency, power, and trust – in isolation from the others. Instead, my aim is to illustrate how these three concepts can together inform historical narratives of standardization within dynamic technological and institutional contexts. The remainder of this article, then, provides empirical support for a more abstract pattern of standardization that combines these three concepts: as engineers sought to create efficiencies through standardization, they created new institutions–new communities of trust–that functioned within economic, political, and cultural contexts permeated by mistrust and contests over power.

THE POLITICAL ECONOMY OF CONSORTIA

Before exploring the growth of the W3C as an example of this abstract pattern of standardization, it is important to describe the emergence of standards consortia in the 1980s and the 1990s. Dozens of standards consortia were created during this period to overcome some of the inadequacies of existing standard-setting organizations. As they proliferated, however, the new consortia faced their own problems – most notably the need to establish themselves as legitimate and effective institutions.

Beginning in 1980, American firms in a variety of high-technology industries began to participate in research consortia. Research consortia, blessed by the financial and legal support of the federal government, existed to distribute the costs of research and development in order to create technological and economic advantages for American firms competing in global markets against Japanese and European firms. One of the most prominent of these consortia was SEMATECH, a federally-funded effort created in 1987 to catch up with Japanese dominance in global markets for semiconductor memory chips. As it developed in the late 1980s and early 1990s, SEMATECH took on functions that had traditionally been filled by trade associations, including the distribution of information and "best practices", the establishment of technical standards, and the coordination of basic and applied research and development[10].

By the late 1980s and early 1990s, competing firms in the telecommunications and information technology industries also began to form consortia to coordinate their products and accelerate market development. Like SEMATECH, many of these new consortia developed technical standards and marketing

[9] H. M. Marks, "Trust and Mistrust in the Marketplace: Statistics and Clinical Research, 1945-1960", *History of Science*, 38, 2000, p. 343-355. R. Werle and E. J. Iversen, "Promoting Legitimacy in Technical Standardization", *Science, Technology and Innovation Studies*, 2, 2006, p. 19-39.

[10] Congress of the United States, *The Benefits and Risks of Federal Funding for Sematech*, Washington, DC, Congressional Budget Office, 1997; P. Grindley, D. C. Mowery, and B. Silverman, "SEMATECH and Collaborative Research: Lessons in the Design of High-Technology Consortia", *Journal of Policy Analysis and Management*, 13, 1994, p. 723-758.

[11] S. C. Salop, "Deregulating Self-Regulated ATM Networks", *Economics of Innovation and New Technology*, 1, 1988, p. 85-96; G. Saloner, "The Economics of Computer Interface Standardization: the Case of UNIX", *Economics of Innovation and New Technology*, 1, 1989, p. 135-156.

strategies, for example for the UNIX operating system and automated teller machines in the banking industry[11]. Unlike SEMATECH, however, the new consortia did not attempt to dictate the research and development agendas of their member firms. A second crucial difference between SEMATECH and the new consortia was the absence of direct financial support from the federal government. Instead, federal support for information technology consortia occurred through indirect policy measures, beginning with the National Cooperative Research Act of 1984, that sanctioned cooperative standard-setting so long as participants did not fix prices or engage in other illegal forms of collusive behavior. This Act, along with subsequent legislation passed under the Reagan, Bush, and Clinton Administrations, was intended to enhance American competitiveness in high-tech global markets by permitting cooperation among rival firms[12].

During the 1980s and 1990s, firms in the information technology industry responded to this favorable regulatory climate by creating and joining hundreds of consortia. Some examples include the X/Open Consortium (created in 1984) to set standards for the Unix operating system; CableLabs (created in 1988); the Video Electronic Standards Association (created in 1989); and the Asynchronous Transfer Mode Forum (created in 1991)[13]. There was, ironically, no standard form or set of objectives for these standards consortia; instead, as Lewis Branscomb and Brian Kahin summarized in 1995,

> Consortia come in many flavors. They may be horizontal (among competitors), vertical (between integrators and suppliers), or comprised of firms providing complementary products and services. They may develop specifications, patentable technology, or tools and platforms. They may be structured as stock companies, exclusive non-profit organizations, open trade associations, or ad hoc interest groups[14].

Despite their differences, the very emergence of these diverse consortia was an indication of widespread dissatisfaction with existing standard-setting organizations, such as the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). Beginning as early as the 1920s, ANSI and ISO had developed extensive rules to institutionalize the values of openness, balance, due process, and consensus in the standards process. Although the new consortia mimiced many aspects of ANSI and ISO, many consortia did not bother with rules that ensured balance and due process. Nor did they adhere strictly to the technical aspects of standard-setting; instead, the most effective consortia were attentive to speed and marketing considerations. Carl Cargill, a manager at Sun Microsystems and leading advocate of consortia, candidly emphasized this promotional aspect in his assessment of the rise of consortia: "Many of them [consortia] were designed to be vendor marketing tools, devoted to providing support for specific vendor 'openness' claims"[15].

[12] M. K. Lee and M. K. Lee, "High Technology Consortia: A Panacea for America's Competitiveness Problems?", *Berkeley Technology Law Journal*, 6, 1992, p. 335-372; S. Oksala, "The Changing Standards World: Government Did It, Even Though They Didn't Mean To", *Standards Engineering: The Journal of the Standards Engineering Society*, 52, 2000; A. Updegrove, "A Work in Progress: Government Support for Standard Setting in the United States, 1980-2004", *Consortium Standards Bulletin*, 4, 2005.

[13] For hundreds of additional examples, see A. Updegrove, "The Consortiuminfo.org Standard Setting Organization and Standards List", http://www.consortiuminfo.org/links/.

[14] L. Branscomb and B. Kahin, "Standards Processes and Objectives for the National Information Infrastructure", in B. Kahin and J. Abbate (eds.), *Standards Policy for Information Infrastructure*, Cambridge, MA, The MIT Press, 1995, p. 11-12.

[15] C. F. Cargill, "A Five-Segment Model for Standardization", in B. Kahin and J. Abbate (eds.), *Standards Policy for Information Infrastructure*, *op. cit.*, p. 87. See also R. Hawkins, "The Rise of Consortia in the Information and

However, as consortia proliferated and became a common feature of the information technology industries in the 1990s, significant practical problems came to the fore. First, firms had to devote significant resources to consortia membership and participation. Membership fees ranged anywhere from $5 000 to $60 000, and travel, research, and legal costs presented additional expenses. Since leading firms such as Sun, Microsoft, and IBM participated in multiple consortia, the overall expense for a single firm could quickly reach several millions of dollars – figures that standards engineers struggled to justify to executives who wondered how the investment would pay off. Second, because of the *ad hoc* process through which consortia were created, there existed tremendous potential for consortia to work at cross-purposes, or even produce conflicting or competing specifications – a problem that had haunted past generations of engineers who created new standards organizations as part of an effort to reduce a duplication of effort[16]. A third problem with consortia was that their *ad hoc* and uncoordinated character spawned rules and policies that varied widely from one consortium to another. Some consortia adopted strict policies governing the use of intellectual property and patents within their committees; others failed to define clear rules. This variety forced engineers to consult intellectual property lawyers to clarify their contribution to standards projects – thus adding further costs to the process.

Finally, critics in government, industry, and the standards establishment viewed consortia standards skeptically because consortia did not (by design) adhere to ANSI's procedures for balance, openness, and due process. For these critics, consortia subverted existing mechanisms that made the standards process accountable to regulators and the general public. In some cases, this perceived illegitimacy was not a problem if consortia standards were adopted without controversy in smaller niche markets. In other cases advocates of consortia standards lobbied officials in the legislative and executive branches of the U. S. government to enhance the political and legal legitimacy of standards consortia. Legislation passed in 1984, 1993, 1995, and 2004 that protected standards consortia from prosecution under American antitrust law may be seen as indicators of the success of these lobbying efforts[17].

In sum, although consortia presented quicker alternatives to existing standard-setting institutions, they also had the potential to introduce a new set of legal and practical problems into the standardization process. The history of the World Wide Web Consortium illustrates the various advantages and draw-

Communication Technology Industries: Emerging Implications for Policy", *Telecommunications Policy*, 23, 1999, p. 159-173; M. Weiss and C. F. Cargill, "Consortia in the Standards Development Process", *Journal of the American Society for Information Science*, 43, 1992, p. 559-565.

[16] C. A. Adams, "National Standards Movement–Its Evolution and Future", in D. Reck (ed.), *National Standards in a Modern Economy*, New York, Harper & Brothers, 1954. See also A. L. Russell, *"Industrial Legislatures"..., op. cit.*, especially chapter 2, "From Engineering Standards to American Standards, 1910-1930".

[17] C. F. Cargill, "Consortia Standards: Towards a Re-Definition of a Voluntary Consensus Standards Organization", Subcommittee on Environment, Technology, and Standards, Committee on Science, United States House of Representatives, June 28, 2001. Relevant legislation includes the National Cooperative Research Act of 1984; the National Cooperative Research and Production Act of 1993; the National Technology Transfer and Advancement Act of 1995; and the Standards Development Organization Advancement Act of 2004. Federal rules that govern the inclusion of standards in federal procurement practices are defined in "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities", Office of Management and Budget (OMB) Circular A-119, Revised February 10, 1998.

backs of consortia standards as well as the challenges inherent in creating and maintaining a new standards organization.

AN INSTITUTIONAL HISTORY OF THE WEB

A brief history of the Web, told from an institutional vantage point, gives us some concrete examples of both the promise and peril of the creation of new standards consortia, what I am referring to as dot-org entrepreneurship.

First, it is important to establish the relevance of changing institutional settings in which the Web was developed. The Web's inventor, Tim Berners-Lee, developed his hypertext program as a solution to an institutional problem that plagued his employer. This employer was CERN, an international physics research laboratory located in Geneva. Berners-Lee, having observed how scientists communicated and shared ideas in a non-hierarchical, networked fashion, decided that CERN needed a system for cataloging information that could mimic these physical interactions. He first developed a proposal for a hypertext-based system that he called the WorldWideWeb in 1989, and by the end of 1990 he had set up the first Web server and created a program for browsing and editing hypertext pages. The technical foundations of his Web server and browser software included a language for rendering hypertext pages – the HyperText Markup Language, or HTML – and a protocol for sending hypertext documents over a network – the HyperText Transfer Protocol, or HTTP[18].

Berners-Lee invented the Web at a moment where there was a tremendous interest in experimental online information systems such as archie, WAIS, gopher, Usenet, and a variety of bulletin board systems. The large numbers of programmers active in these online communities were eager to experiment with the Web, and Berners-Lee was equally eager for others to play with it and improve it – to "harness the geeks", as one account put it[19]. However, because the Web's institutional home was at CERN, there was some uncertainty within the broader online community about the terms under which the Web's protocols would be available. Berners-Lee advocated a public release under an open source license, as advocated by the free software crusader Richard Stallman, so that adopters would not have to worry about a time-consuming (or potentially costly) procurement process. In short, an open source license would preserve the freedom to tinker.

Berners-Lee, in an effort that he celebrates as a pivotal event in the Web's history, convinced CERN administrators to agree to an open source, public domain release of the Web's code in April 1993[20]. Once the Web's code was freely available for experimentation, several different Web browsers, such as Midas, Erwise, Viola, and NCSA Mosaic, soon surfaced. While Berners-Lee welcomed this explosion of interest, he also recognized a major problem with this decentralized style of innovation: the technical foundations of the Web would most likely balkanize – or

[18] This section draws primarily on three sources: T. Berners-Lee, *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by its Inventor*, San Francisco, HarperSanFrancisco, 1999; J. Gillies and R. Cailliau, *How the Web Was Born*, New York, Oxford University Press, 2000; and D. Connolly, "A Little History of the World Wide Web", http://www.w3.org/History.html. For an assessment of the Web in the context of similar technologies, see T. Haigh, "Protocols for Profit: Web and Email Technologies as Product and Platform", in W. Aspray and P. Ceruzzi (eds.), *The Internet…*, *op. cit.*

[19] J. Gillies and R. Cailliau, *How the Web Was Born*, *op. cit.*, p. 215.

[20] T. Berners-Lee, *Weaving the Web*, *op. cit.*, p. 73-74. The CERN declaration is available from http://tenyears-www.web.cern.ch/tenyears-www/Welcome.html.

"fork" – absent any institutional effort or mechanism to harmonize them.

As the Web's inventor, Berners-Lee was in a unique position to lead such an institutional initiative. However, CERN administrators were giving very clear signs that they would not provide the resources to support the growth of the Web. Berners-Lee thus faced a fundamental choice about how to best support the growth of his invention.

One obvious option was to create a start-up company. (Marc Andreessen, the programmer behind the NCSA Mosaic browser, was at this time in the process of teaming up with businessman Jim Clark to form Netscape.) As early as 1992, Berners-Lee and his CERN colleague Robert Cailliau contemplated this option, but quickly rejected it for a number of reasons. Of course, a start-up company (they liked the name "Websoft") would be a significant career shift and financial risk. Unlike many of his contemporaries in Silicon Valley, Berners-Lee seemed immune to the temptations of wealth (Cailliau later remarked that Berners-Lee "accepts a much wider range of hotel-room facilities than a CEO would"). More to the point, Berners-Lee was skeptical that this style of entrepreneurship would prevent the balkanization of Web protocols. Berners-Lee also considered other institutional paths – either in academia or as a research scientist in a "large benevolent company". The former option, however, was impractical because he had never earned a Ph.D.; and although Berners-Lee spoke to several companies about the latter option, none seemed to provide a good fit[21].

Instead, Berners-Lee decided that an alternative institutional form – some sort of standardization body – would provide the best means for his primary objective to promote the universality of the Web and sustain its growth. The most obvious venue for standardization was the Internet Engineering Task Force (IETF), a large and respected body that had developed the core Internet protocols. Berners-Lee had already participated in IETF meetings in 1992 and 1993, and pushed the core Web protocols through the IETF standards process. However, Berners-Lee had been discouraged by his experience with the IETF because it forced him to compromise important aspects of his vision for the Web. Moreover, he was anxious to move quickly but was discouraged by delays in the IETF, including some "endless philosophical rat holes down which technical conversations would disappear"[22].

The initial idea for Berners-Lee to create a new standards body emerged during his conversations in 1993 and 1994 with David Gifford and Michael Dertouzos, two faculty members in MIT's Laboratory for Computer Science. When they met in early 1994, Dertouzos, who was the Director of MIT's Laboratory for Computer Science, convinced Berners-Lee that his most promising option for helping the Web grow quickly was to start his own standards consortium. Dertouzos based his suggestion on a prior success: in the late 1980s, he had overseen the creation of the X-Consortium to coordinate the development of X-Window graphical system that, like the Web, was an academic project that grew and attracted interest from a broad and diverse community. After meeting with Dertouzos in February 1994, Berners-Lee agreed to move to MIT to create and direct a consortium to coordinate Web standards[23].

[21] J. Gillies and R. Cailliau, *How the Web Was Born*, *op. cit.*, p. 234; T. Berners-Lee, *Weaving the Web*, *op. cit.*, p. 82-85.

[22] T. Berners-Lee, *Weaving the Web*, *op. cit.*, p. 61-63; T. Berners-Lee, "Universal Resource Identifiers in WWW", RFC 1630, 1994, http://www.ietf.org/rfc/rfc1630.txt; R. Rada, "Consensus Versus Speed", *Communications of the ACM*, 38, 1995, p. 21-23.

[23] T. Berners-Lee, *Weaving the Web*, *op. cit.*, p. 81-82.

Berners-Lee summarized his thought process in his 1999 autobiography:

> Starting a consortium, therefore, represented the best way for me to see the full span of the Web community as it spread into more and more areas. My decision not to turn the Web into my own commercial venture was not any great act of altruism or disdain for money, of which I would later be accused[24].

Instead, Berners-Lee's rejection of turning the Web into a personal commercial venture came from his recognition of the inadequacy of that conventional form of entrepreneurship. Rather than tying the future of the Web to a start-up firm or an existing standards body, Berners-Lee came to see the W3C as a way to leverage his status as the Web's inventor and stay at the heart of the action – hardly an altruistic or selfless gesture, as he openly admitted.

Simply put, creating a new consortium was the best option in his menu of institutional choices. Berners-Lee did not trust any of his other options – CERN, the IETF, or a start-up company – to function as the institutional steward of his vision of a universal Web. So he became a dot-org entrepreneur. By presiding over a new standards consortium as "facilitator of the Web's evolution", Berners-Lee thought he would be best equipped to focus on the Web's proliferation from a "neutral viewpoint", as opposed to the competitive life of corporate employment. It would also allow Berners-Lee to keep a close eye on the Web's development, while at the same time providing a space for the Web to grow without a centralized point of authority or control.

The most pressing task at hand for Berners-Lee the dot-org entrepreneur was to secure institutional support for the W3C. Unlike a start-up company that needs venture capital for sustenance, the W3C needed social capital for legitimacy. Having MIT as the W3C's home was a big step in that direction: MIT was the pre-eminent university in the United States (if not the world) for computer science, with plenty of resources to support the technical and organizational growth of the Web. But their plans for the W3C also called for a second institutional base in Europe – a feature that would prove to be fraught with bureaucratic problems.

At first, Berners-Lee and Dertouzos referred to the new organization as the World Wide Web Organization, or W3O. In addition to its coordinating role for Web protocols, the W3O would also provide free reference material for users around the world–a "truly altruistic organization" in the view of two of Berners-Lee's colleagues[25]. The proposed W3O would consist of two groups, one in the United States (based at MIT) and the other in Europe (funded by the European Union and based at CERN). In addition to these American and European branches, the W3O would also oversee a consortium consisting of industrial firms named the W3C.

For Berners-Lee and his supporters at MIT, such an arrangement would be a palatable political compromise for CERN's European administrators, who were eager to take credit for being the birthplace of the Web yet unwilling to support it through its adolescence. However, CERN's enthusiasm for the enterprise was tempered by the political realities of the initiative, in terms of its support within the European Union as well as CERN's junior status in the Atlantic partnership. As negotiations dragged on through 1994 and into 1995, it became increasingly clear that the French computer science institute INRIA (Institut National de Recherche en Informatique et en Automatique) would

[24] *Ibid.*, p. 85, 89, 99.

[25] J. Gillies and R. Cailliau, *How the Web Was Born*, *op. cit.*, p. 275.

be better suited as the W3C's European host[26]. Somewhere along the way, the idea of a W3O separate from the W3C was dropped, and only the W3C remained. In the fall of 1996, the W3C added a third host institution, the University of Keio in Tokyo, Japan, thus reinforcing the group's global (if not universal) ambitions[27].

With its social capital and institutional foundations secure, the W3C could engage fully with the difficult work of developing common Web standards. The W3C had managed to establish its legitimacy in the eyes of the computer science research community, but had yet to demonstrate its utility for the dozens of commercial firms that were clamoring to hop on the Web bandwagon. Once its founding bureaucratic tussles were settled by early 1995, the defining organizational challenge facing the W3C was to navigate the inherent tension between Berners-Lee's altruistic and research-oriented values and the commercial ambitions of the W3C's corporate membership. In 1999, Dertouzos summarized this struggle by declaring that Berners-Lee's "consistent aim was to ensure that the Web would move forward, flourish, and remain whole, despite the yanks and pulls of all the companies that seemed bent on controlling it"[28].

As the dot-com sensation took flight in the late 1990s, Berners-Lee and the W3C struggled to maintain a viable middle ground between the "yanks and pulls" and charged rhetoric of two opposing constituencies. On one extreme were representatives from high-tech corporations who viewed the Web as a business opportunity; on the other extreme were open source developers who, in many cases, adhered to an anti-corporate ideology. Within these vocal extremes, the vast majority of the W3C's members believed in a less ideological, more practical synthesis of the two opposing perspectives. This group in the middle ground was in many ways representative of Berners-Lee's own views that did not shun commercial representatives on the basis of a supposed moral purity: "universal", after all, is an all-inclusive category. However, Berners-Lee and the W3C "silent majority" also hoped to preserve the open and non-proprietary orientation of the Web's underlying standards. Beyond the ideological and rhetorical appeal of "openness", it also made good business sense to promote the Web as a non-proprietary platform upon which any number of business plans could flourish.

Conflict among these three constituencies occurred in numerous realms, both within and beyond the confines of the W3C. These conflicts included many familiar episodes in the late 1990s, including the "browser wars" between Microsoft and Netscape; battles between proprietary and open source software (manifest in the rivalries between Microsoft products on the one hand and open source products such as Linux and Apache on the other); and questions about who, if anyone, would ensure user privacy in the online era.

The ideological conflict underlying each of these issues, as Lawrence Lessig had summarized in his influential 1999 book *Code and Other Laws of Cyberspace*, was between two visions of the future: one oriented toward liberty and freedom, the other darkened by the forces of control. The core insight of Lessig's brilliant book was his recognition that control could be literally coded into the architecture of cyberspace – hence his pithy slogan "code is law". The architects of control were as likely to come from industrial governments – the "weary giants of

[26] A. Beltran and P. Griset, *Histoire d'un pionnier de l'informatique: 40 ans de recherche à l'INRIA*, Les Ulis, EDP Sciences, 2007.

[27] J. Gillies and R. Cailliau, *How the Web Was Born, op. cit.*, p. 275-305.

[28] M. Dertouzos, foreword to T. Berners-Lee, *Weaving the Web*, *op. cit.*, p. X.

flesh and steel" in John Perry Barlow's defiant phrase – as well as the hordes of dot-com entrepreneurs looking to cash in on the Web[29]. Lessig's contribution was to suggest that code could promote the values of freedom and liberty – but the best way to accomplish this was to adhere to the values of open source.

Within the W3C, this rhetorical and technological struggle between the respective values of dot-org and dot-com came to a head during a few tense months in late 2001 and early 2002. The catalyst was the W3C's decision to create a formal patent policy, a step that the W3C staff took in order to protect their organization from the costs and uncertainties of "submarine patents", proprietary claims that were disclosed only after standards committees had completed their work. In August 2001, a small group of W3C members, including representatives from Microsoft and IBM, worked with the W3C staff to publish a draft policy that compelled participants in the W3C process to declare any relevant patents – thus closing a crucial loophole that had plagued the W3C as well as other standards consortia[30].

The W3C's draft policy, however, did not stop at requiring disclosure. In an effort to appease the W3C members with large patent portfolios, the W3C's policy left room for royalty-generating patents to be included in W3C standards. Although this type of patent policy – known as a reasonable and non-discriminatory, or RAND, license – was common in standards consortia, it was deeply offensive to the open-source community. For this community, embracing software patents was akin to giving in to the forces of control that Lessig and Barlow had warned against. Further, the embrace of royalty-generating patent licenses represented a stunning departure from the Web's tradition and Berners-Lee's publicly stated opposition to software patents.

The response from open source advocates was severe. Within two months of the W3C's release of its draft patent policy, nearly 1000 individuals submitted comments to the W3C to oppose it[31]. Many comments situated the W3C's policy within the broader contexts identified by Lessig, and expressed disappointment with the W3C's decision. For example, Jonathan Zirkle, a government immigration attorney and self-taught programmer, framed his concerns in terms of whether the W3C could maintain its status as a trustworthy steward of the Web:

> We are currently becoming locked in a war over the morality of intellectual property. The web represents all that is good and possible because of freedom. Microsoft and big pharmaceutical represent the other side. You, at W3C, have been placed in a *position of trust*, and it is your responsibility to protect the growth of free exchange fostered by the web. If you allow patents, you will have lost a battle. And perhaps you will have joined forces with Redmond. Make the right choice[32].

In response to the public outcry, the W3C reconsidered its draft policy. By November 2001, the W3C had reversed course and decided to draft a policy that only allowed patents

[29] L. Lessig, *Code and Other Laws of Cyberspace*, New York, Basic Books, 1999; J. P. Barlow, "A Declaration of the Independence of Cyberspace", February 8, 1996, available from http://homes.eff.org/~barlow/Declaration-Final.html.

[30] D. J. Weitzner (ed.), "W3C Patent Policy Framework: W3C Working Draft 16 August 2001", http://www.w3.org/TR/2001/WD-patent-policy-20010816. On submarine patents, see D. D. Clark, "Do Web Standards and Patents Mix?", *Computer*, 35, 2002; and M. A. Lemley, "Intellectual Property Rights and Standard-Setting Organizations", *California Law Review*, 90, 2002, p. 1889-1980.

[31] See the W3C's extensive analysis of the comments, "Public Issues for Patent Policy Framework of 20010816," http://www.w3.org/2001/11/PPF-Public-Issues.html.

[32] J. Zirkle, "rand licensing", September 30, 2001, http://lists.w3.org/Archives/Public/www-patentpolicy-comment/2001Sep/0204.html. Emphasis added.

licensed under royalty-free terms. The W3C turned to efficiency explanations to justify their abrupt shift: a royalty-free process, they explained, would best facilitate widespread development of Web applications and simultaneously would minimize the significant transaction costs associated with licensing negotiations and intellectual property lawyers. Although the practical concerns were paramount for W3C staff, defenders of the ideals of open source claimed victory and concluded that the W3C had averted building "a tollbooth on the Internet"[33].

The W3C's new patent policy (finally released in May 2003) signaled a renewal of its bonds of loyalty and trust with the open source community. It also signaled to patent holders that they should look elsewhere to develop proprietary versions of standards for the Web. As a consequence, the firms in the Internet economy who were interested in creating proprietary protocols looked for new venues to promote their efforts. It became evident that W3C would not be able to function as the sole destination for anyone interested in Web standards. Instead, the W3C became one of several organizations who were competing to create standards that were both timely and authoritative. In a sense, the sequence of events that led to the creation of the W3C had come full circle: the W3C was now part of the establishment, yet another standards body that was either unwilling or unable to move quickly and rapidly enough to keep up with the bleeding edge of markets and technology.

CONCLUSIONS

The market for standards continues to be a crowded and contested organizational field, and viable alternatives to W3C Recommendations exist for important standards for the XML language and for a suite of functions known as Web services. Industry leaders such as Microsoft and IBM have remained as dues-paying W3C Members, but, at the same time, continue to "forum-shop" for alternative venues – competitors to the W3C – that might give them greater control over the terms and pace of standardization[34].

These alternatives include groups such as the Organization for the Advancement of Structured Information Standards (OASIS, www.oasis-open.org), the Institute for Electrical and Electronic Engineers Standards Association (IEEE-SA, standards.ieee.org), the Internet Engineer Task Force (IETF, www.ietf.org) and the Joint Technical Committee of the International Organization for Standardization and International Electrotechnical Commission (ISO/IEC JTC 1, www.jtc1.org)[35]. In areas of overlap, the W3C has established liaison relationships with over three dozen such organizations; but beneath the cordial veneer of these relationships lies a reality of intense jurisdictional competition in a dynamic commercial environment[36]. Moreover, since there are no limits to entry in the standards world, the sector is ripe for future efforts at dot-org

[33] D. J. Weitzner (ed.), "Patent Policy Working Group: Royalty-Free Patent Policy", February 26, 2002, http://www.w3.org/TR/2002/WD-patent-policy-20020226/; B. Perens, "Perspective: The patent threat to the Web", *CNet News.com*, October 7, 2002, http://news.com.com/2010-1071-961018.html.

[34] D. L. Garcia, "Standards for Standard Setting: Contesting the Organizational Field", in S. Bolin (ed.), *The Standards Edge: Dynamic Tension*, Ann Arbor, MI, Sheridan Press, 2004, p. 15-30; S. Lohr, "Setback for Microsoft Ripples Through the World Wide Web", *The New York Times*, September 17, 2003; N. Levitt, "Are Web Services Finally Ready to Deliver?", *IEEE Computer*, 37, November 2004, p. 14-18.

[35] See Andrew Updegrove's website, http://www.consortiuminfo.org/links/, for a list of hundreds of current standards-setting organizations.

[36] I. Jacobs, "W3C Liaisons With Other Organizations", http://www.w3.org/2001/11/StdLiaison.

entrepreneurship that promise to compensate for the inadequacies of existing groups, including the W3C.

This, ultimately, is the Achilles heel of consortia: the success or failure of consortia standards is determined by market demand and acceptance. Within this market for standards, if any participants in the process – whether they be open source programmers or dot-com executives – feel that the W3C (or any other dot-org standards body) is not meeting their needs, they have three options: loyalty, voice, or exit[37]. Although they may not like it, dot-org entrepreneurs are still subject to the market logic of competition. And, despite the W3C's best efforts to build a "Web of Trust," mistrust and uncertainty seem to be an inevitable part of the Web's future.

[37] A. O. Hirschman, *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*, Cambridge, MA, Harvard University Press, 1970.