*The World Wide Web Consortium*

by Alla Zollers

IS297 Information Institutions
March 15, 2007
Dr. Maack

**Introduction**

Imagine a world where you have to use a special browser in order to access online information outside of the US, or a world where a person that is utilizing a PC would not be able to view the same web pages as a person using a Mac. We could speculate that in such a world, the diversity, popularity, and spectacular growth of the Internet would not have been possible. Only through worldwide standardization of the ways in which web pages are coded, displayed, and accessed has the World Wide Web been able to flourish into the international phenomenon that it is today, and also become a vital part of our lives.

When Tim Berners-Lee was inventing the World Wide Web he was working from the fundamental principle that "once someone somewhere made available a document, database, graphic, sound, video, or screen at some stage in an interactive dialogue, it should be accessible … by anyone with any type of computer, in any country," (Berners-Lee, p. 37). It seems that Tim Berners-Lee understood from the beginning that in order for the World Wide Web to be successful, everyone in the world should be able to contribute to it as well as to access it. So it logically follows that Tim Berners-Lee was also responsible for creating the World Wide Web Consortium (W3C). W3C is an "international consortium where Member organizations, a full-time staff, and the public work together to develop Web standards," and whose mission is, "To lead the World Wide Web to its full potential by developing protocols and guidelines that ensure long-term growth for the Web," (W3C Website).

Since the development of the World Wide Web and subsequently the W3C is inexorably linked with the invention of the Internet, this paper will first provide a brief historical background on the development of both the Internet and the World Wide Web. Then, the paper will discuss the inner workings of the W3C, and conclude by presenting an institutional analysis of the consortium.

## Historical Background

### *Inventing the Internet*

The first conceptual spark towards the eventual creation of the Internet came from Vannevar Bush, who in 1945 published an article in the Atlantic Monthly magazine describing a device called a Memex, which would extend human memory and allow researchers to follow links between microfiche documents (Bush 1945). Then in 1960, J.C.R Licklider, an American computer scientist, articulated the idea of networked computing in his paper called "Man-Computer Symbiosis". In his paper, Licklider stated that,

> "It seems reasonable to envision, for a time 10 or 15 years hence, a 'thinking center' that will incorporate the functions of present-day libraries together with anticipated advances in information storage and retrieval and the symbiotic functions suggested earlier in this paper. The picture readily enlarges itself into a network of such centers, connected to one another by wide-band communication lines and to individual users by leased-wire services. In such a system, the speed of the computers would be balanced, and the cost of the gigantic memories and the sophisticated programs would be divided by the number of users," (1960).

In 1962, Licklider was appointed head of the United States Department of Defense DARPA information processing office, and set up three network terminals to be installed: one for System Development Corporation in Santa Monica, one for Project Genie at the University of California, Berkeley and one for the Multics project SHOPPING at the

Massachusetts Institute of Technology (MIT). Three years later in 1965, Ted Nelson invented “Hypertext”, which provided for the movement away from a linear structure of text towards a structure that allowed different portions of text to be linked to each other. Then in 1969, Robert W. Taylor, the director of the Pentagon's Advanced Research Projects Agency (ARPA) Information Processing Techniques Office, immediately saw the need for inter-networking when he ran into problems accessing Licklider’s three terminals.

> " There was one other trigger that turned me to the ARPAnet. For each of these three terminals, I had three different sets of user commands. So if I was talking online with someone at S.D.C. and I wanted to talk to someone I knew at Berkeley or M.I.T. about this, I had to get up from the S.D.C. terminal, go over and log into the other terminal and get in touch with them.
>
> I said, oh, man, it's obvious what to do: If you have these three terminals, there ought to be one terminal that goes anywhere you want to go where you have interactive computing. That idea is the ARPAnet,” (Markoff 1999).

Subsequently, Taylor initiated the project to build an interconnected network system, and one of the first links to the network was established between the University of California, Los Angeles and the Stanford Research Institute in 1969. The ARPAnet grew rapidly and became the technical core of what would later become the Internet. International collaborations were rare and so European developers were coming up with their own networks and protocols. As time went on, it was clear that something needed to unify the different networks that were being created both nationally and internationally, at which point the Transfer Control Protocol (TCP) and Internet Protocol (IP) were created. These protocols allowed for the safe arrival of information from one computer to another on different and even unreliable networks (Abbate 2000, p.128).

Ultimately, however, the development of the ARAPnet was a military project and continued research had to be justified in military terms. Computer scientists such as Vince Cerf demonstrated that a computer network such as the ARPAnet was a tool that could be utilized for communication in case of a nuclear attack. Because the network did not rely on a central computer, if one or more computers in the network went down, then the information could be routed to other machines in the network and thus communication lines would still remain open. “The design of the Internet made it possible for the networks to operate independently but still communicate,” (Abbate 2000, p. 132). Finally, when Ray Tomlinson invented email in 1971, it quickly became the most popular application on the ARPAnet, further strengthening the communication and resource sharing on the network (Abbate 2000).

*Inventing the World Wide Web*

Only two years after the creation of the TCP/IP protocol, on the other side of the pond at CERN, located northwest of Geneva on the border between Switzerland and France, Tim-Berners Lee was beginning his intellectual journey towards creating the World Wide Web. Tim Berners-Lee would not have been able to create the World Wide Web as we know it today if the other technologies such as TCP/IP and Hypertext were not already available. In Weaving the Web, Berners-Lee (1999) mentioned that many reporters wanted to know when he came up with his idea for the World Wide Web, and were often disappointed at the fact that there was no single moment of epiphany, but rather an intellectual and experiential process that progressed over a period of ten years.

As history shows us, many technological, intellectual and even institutional factors influenced the creation of the Internet and the World Wide Web as we know it today.

Tim Berners-Lee's road to the World Wide Web began in earnest in 1980, when he wrote a system called "Enquire-Within-Upon-Everything". Enquire was a system that Berners-Lee created exclusively for himself, to keep track of the people, experiments, and machines at CERN. "In Enquire, I could type in a page of information about a person, a device, or a program. Each page was a 'node' in the program, a little like an index card. The only way to create a new node was to make a link from an old node," (Berners-Lee, p. 10). Eventually, Berners-Lee was able to compile an entire dataset of people and their associated projects. By the time the database was compiled, Berners-Lee's consulting time with CERN ended and he left the Enquire project behind. When Berners-Lee returned to CERN in 1984, he was hired into the "data acquisition and control group which was responsible for capturing and processing the results of experiments," (Berners-Lee 1999, p. 14). He noticed that physicists from around the world needed to share data, yet physicists had their own machines, languages, and customs.

> "I saw one protagonist after another shot down in flames by indignant researchers because the developers were forcing them to reorganize their work to fit the system. I would have to create a system with common rules that would be acceptable to everyone. This meant as close as possible to no rules at all," (Berners-Lee 1999, p. 15).

Thus, Tim Berners-Lee began building the system that would eventually become the World Wide Web.

In 1989, Berners-Lee wrote "Information Management: A Proposal", and circulated this document around CERN. Although the idea was not well received at

CERN, with the support of Robert Cailliau, he forged ahead. By 1990, Berners-Lee wrote the first browser called “WorldWideWeb”, the first web server “info.cern.ch” and the first web pages which described the World Wide Web Project. Berners-Lee also came up with the main protocols of the World Wide Web. The protocols included a Universal Resource Identifier (URI), what we now know as the Universal Resource Locator (URL); the Hypertext Transfer Protocol (HTTP), as well as the Hypertext Markup Language (HTML). The URI/URL’s provide the address for the web pages; HTTP tells the browser how to decode the webpage; while HTML is used to code the webpage.

Once the World Wide Web was written, Berners-Lee had a difficult time convincing people of the concept. In 1991 at the Hypertext conference, his paper was only accepted for a poster session. However, by 1993 the concept of the Web was becoming more popular as evidenced by the increase in both the number of web servers, which in1993 totaled about fifty, and in the production of new text-only web browsers such as Erswise, Viola, and Midas. At the point, websites were using both the HTTP protocol as well as the gopher protocol, since both protocols were developed around roughly the same time period. The gopher protocol was developed at the University of Minnesota, “and was originally created as an online help system for the university’s computer department,” (Berners-Lee 1999, p. 72), thus the gopher protocol provided access to web pages through hypertext menus presented as a file system.

Then in only a matter of months, two major events would propel the HTTP protocol to become the worldwide standard as well a compel Tim Berners-Lee to begin the World Wide Web Consortium.  First, in the Spring of 1993, the University of Minnesota made a dire error by deciding to reserve the right to ask for a license fee from certain classes of users who wanted to use gopher. “This was an act of treason in the academic and the Internet community,” (Berners-Lee 1999, p. 73). Industry completely abandoned the gopher protocol, and approached Berners-Lee concerned over the future of the HTTP protocol. In order to avoid the same fate as gopher, Berners-Lee quickly petitioned CERN to release the intellectual property rights of the HTTP protocol into the public domain. On April 30, 1993, CERN allowed anyone to use the Web protocol and the code free of charge, and thus the protocol was quickly adopted as the standard for the Web. Then in early 1994, Mosaic, the first graphical browser was released, and the popularity of the web began to increase exponentially. The Mosaic browser later became known as Netscape Navigator.

**The World Wide Web Consortium (W3C)**

The growing popularity of the web and the near disaster over licensing left Berners-Lee “more convinced then ever that some kind of body was needed to oversee the Web’s development,” (Berners-Lee 1999, p. 75). He did not really want a standards body, but rather an organization that would help developers reach consensus on how the Web should operate.

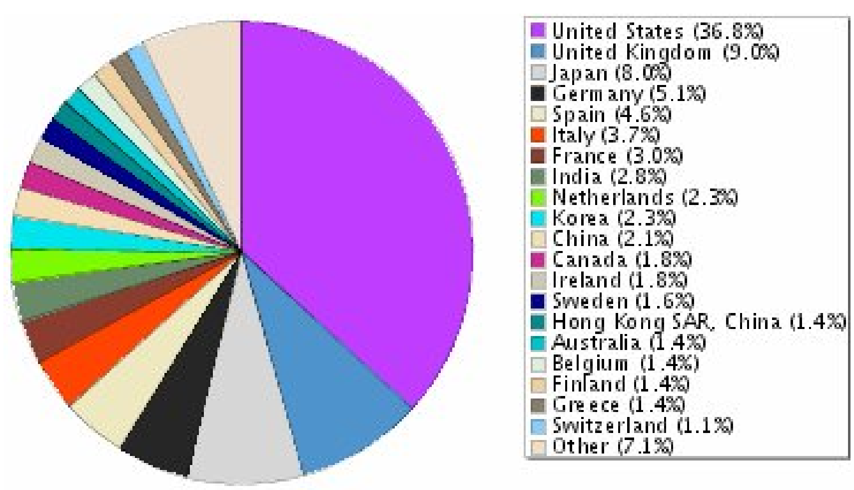
> “Evidence was mounting that ‘the Web’ could splinter into various factions - some commercial, some academic, some free, some not. This would defeat the very purpose of the Web; to be a single, universal, accessible medium for sharing information,” (Berners-Lee, p. 76).

On October 1, 1994, the World Wide Web Consortium opened in the US at MIT and in Europe at CERN. Berners-Lee specifically wanted to have the consortium hosted in both countries because the US was successful at building the Internet, while Europe was successful at creating the Web. Currently, the W3C is hosted in the US at the MIT

Laboratory of Computer Science, in Europe at the ERCIM (European Research Consortium in Informatics and Mathematics), and in Japan at Keio University. Although Berners-Lee could have started a company, or gone to work for a large corporation (and made a significant amount of money), he chose to oversee the W3C because his "primary mission was to make sure that the Web [he] had created continued to evolve," (Berners-Lee, p. 83) in accordance to his vision of the Web being a universal resource that anyone could utilize.

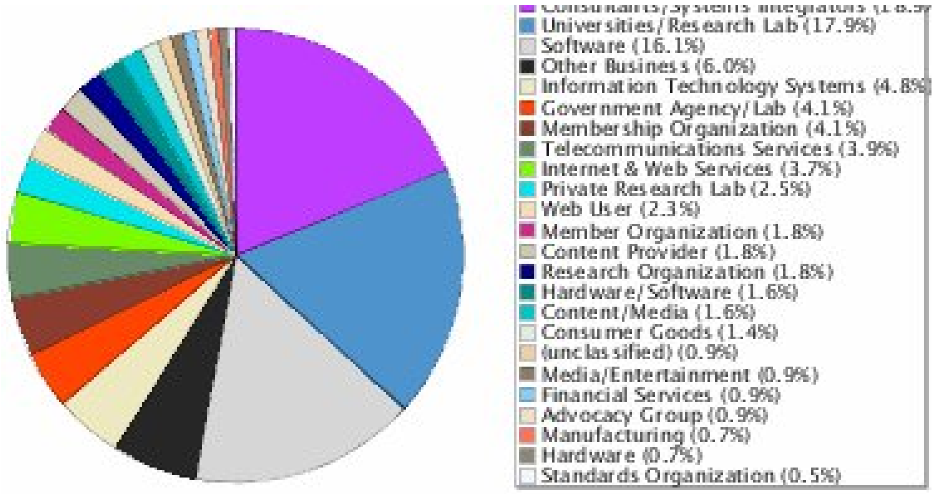
Membership in the W3C is open to any organization: commercial, education, or governmental, for profit or not-for-profit. In 1994, the annual fee for full membership in the US was fifty thousand, today it is close to sixty five thousand; an affiliate membership in the US in1994 cost five thousand, while today it costs around seven thousand. Currently, membership in the W3C is also open to international organizations, so the annual fee varies appropriately by country. Figure 1 and 2 below show the membership distribution by country and organizational type.

**Figure 1. W3C Membership by Country**




(Source: W3C Website)

**Figure 2. W3C Membership by Organization Type**




(Source: W3C Website)

Although initially the W3C did not have a motto, its purpose was always to "lead the Web to its full potential," (Berners-Lee, p. 94). The purpose is realized through the development of protocols that enhance the interoperability of the Web. The protocols come in open technical specifications that are specifically called "recommendations" and not "standards". The terminology of recommendations was chosen over standards in order to reflect that "rough consensus and running code" (Berners-Lee, p. 98), was the level at which the consortium would work. Recommendations as well as the web-like structure of the organization, which did not have hierarchies but only working groups that needed to reach a consensus, freed up the consortium to progress alongside the fast-paced technological developments and not get bogged down in bureaucracy.  "Indeed, the true art of the consortium would be in finding the minimum agreements, or protocols, everybody would need in order to make the Web work across the Internet," (Berners-Lee,

p. 98). On December 14, 1994, the W3C had its first advisory committee meeting, which consisted of one representative from each member organization.

As the consortium matured, it began to codify the process for developing recommendations and the accompanying technology. Currently, the W3C is organized into working groups for technical developments, interest groups for more general work, and coordination groups for communication among related groups. The process for creating recommendations is as follows:

1) Any member draws up a briefing package which identifies an issue which the member wishes the consortium to address. The briefing addresses the technical aspects, market conditions, explains why the consortium should address the issue, and the estimated cost of addressing the issue.

2) The briefing package is distributed to the entire membership, if there is sufficient consensus among the members that this is a viable issue, a new "Activity" is created.

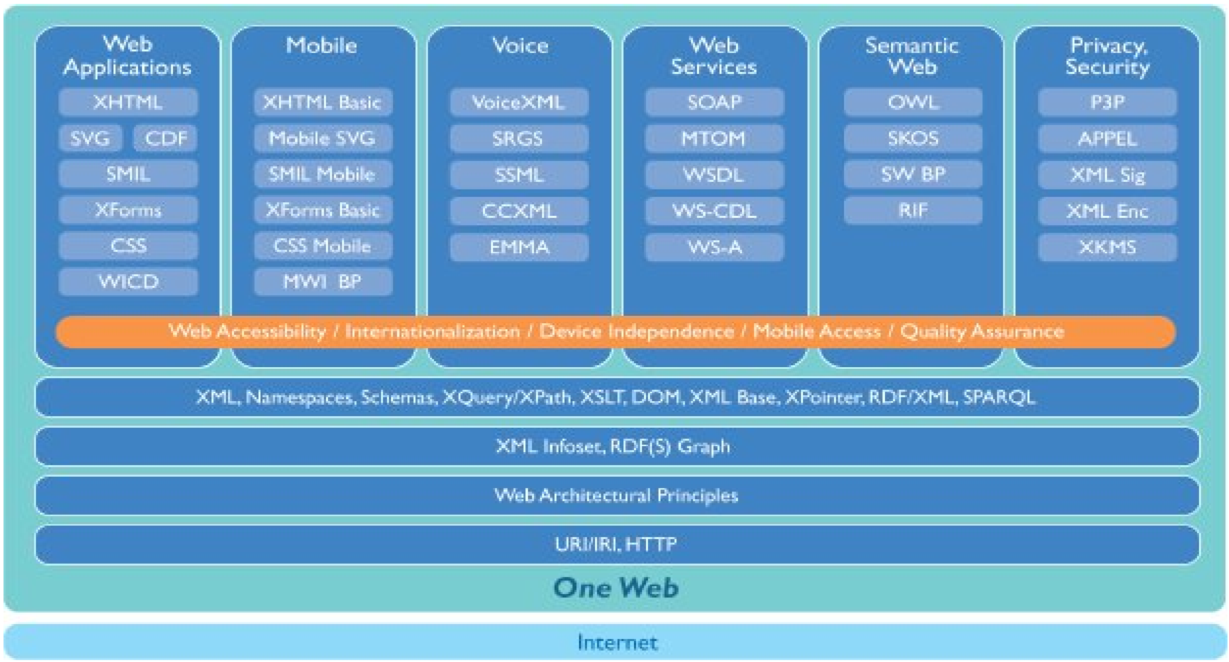
3) W3C Activities are grouped by domains such as Architecture, Interaction, Technology and Society, Ubiquitous Web, and the Web Accessibility Initiative. The working groups in each domain appropriate to the issue consider the technical aspects of the issue as well as the impact on society, and any political questions.

4) The working groups create a specification that is then distributed to wider and wider audiences. Even the public may comment on specifications through the website.

5) Once comments have been compiled, the specification is modified. If a consensus is reached within the consortium, the specification reaches its final phase as a "Proposed Recommendation".

There are currently 94 proposed recommendations from the W3C (W3C Website). Figure 3 below displays the technical areas for which the W3C provides recommendations and technologies.

**Figure 3. World Wide Web Consortium Areas**




(Source: W3C Website)

*The World Wide Web Consortium as an Institution*

From the W3C's inception, Tim Berners-Lee and the members of the consortium have guided the web towards standardization, interoperability, and openness. Without this guidance, our society would not have been able to progress from the Industrial Age toward the Information Age. Globalization would have been hampered as well as the incredible access to information that we have available to us today. If we analyze the W3C using Scott's (2001) three pillars, we will quickly recognize the fact that the consortium is a well established institution which contains regulative, normative, and cognitive aspects.

If one were to pick the dominant aspect of the W3C, it would certainly be regulative. The W3C's main purpose is to create specifications in the form of recommendations. Scott states that "institutions constrain and regularize behavior," through, "rule-setting, monitoring, and sanctioning activities," (p. 51). The recommendations that the W3C produces are in effect rules that govern the ways in which Internet technology should function. Although there is no requirement to follow these recommendations, non-compliance leads to incorrect rending of web pages, inability to connect to the Web, or any other number of technical problems. This is especially evident with Microsoft Windows Internet Explorer, which does not comply with W3C standards. Many web pages render differently or incorrectly on Internet Explorer, yet are displayed as intended on Firefox or Safari. This incompatibility makes it difficult for web designers to create web pages that have identical look and functionality on different browsers. The difficulty faced by designers underscores the need for standardization and interoperability, which the W3C promotes through regulation.

The normative aspect of the W3C is strongly interconnected with the regulative aspect. The standards that the W3C proposes essentially become the preferred methods for interacting with the Web. The recommendations specifically define "how thing should done; they define legitimate means to pursue valued ends," (Scott, p. 55). Additionally, once the W3C recommendations have been sufficiently adopted by the industry, they transform from a regulation to the normal way of doing things. Therefore, W3C recommendations eventually become "normative expectations" (Scott, p. 55), which in turn constrains others from deviating from these expectations for fear of incompatibility, while at the same time empowering the compliant actors with greater access and interoperability.

Finally, the W3C also contains the cognitive aspect, which plays an incredibly important role in our society. According to Scott, the cultural-cognitive elements of institutions are the "shared conceptions that constitute the nature of social reality and the frames through which meaning is made," (p.57). In the case of W3C, the consortium values the social and political ramifications of technologies, and not just the technology itself. As mentioned previously, part of the recommendation process requires members to address the social and political implications of the issue raised. The social and political implications are viewed the through frame of openness, sharing, and collaboration that the W3C promotes. The cognitive role that the institution plays has been instrumental in blocking governmental and private control of the Web, while continuing to uphold Berners-Lee original vision of openness and freedom online.

The cognitive framework of universal access is a constant struggle and the Internet is a contested terrain. This is exemplified by the Network Neutrality debate. The Internet as we know it today allows everyone's data gets pushed through the lines with the same speed, irregardless if it is company data or an individual's webpage, this is called "Network Neutrality". The telephone and cable companies wish to divide the Internet to have two lines, one for fast service and one for regular service, with extra charges for the faster service. This business model would stifle innovation because start-up companies that wish to provide rich multimedia content on their websites such as videos, yet who cannot afford the faster service will quickly fold. A divided network goes against Berners-Lee's vision of an open web that anyone, with any type of computer anywhere, in the world can access and contribute. Subsequently, Berners-Lee, as the inventor of the World Wide Web and the director of the W3C, is slated to testify in Congressional hearings in support of Network Neutrality.

In conclusion, World Wide Web Consortium is an institution that maintains the vision of Tim Berners-Lee and the inventors of the Internet. The W3C provides standards that encourage sharing, compatibility, and interoperability. The institution also upholds the ideals of freedom of access and supports the invention of new Web technologies. Finally, the institution considers the social and political impact of technology, and thus guides us into the future.

**References**


Abbate, J. (2000). *Inventing the Internet*. Cambridge, Mass.: MIT Press.

Berners-Lee, T. (1999). *Weaving the Web*. San Francisco, CA: HarperSanFrancisco.

Bush, V. (1945). As We May Think. *Atlantic Monthly*. Retrieved March 1, 2007 from http://www.theatlantic.com/doc/194507/bush

Licklider, J.C.R.. (1960). Man-Computer Symbiosis. *IRE Transactions on Human Factors in Electronics*, volume HFE-1, pages 4-11. Retrieved March 1, 2007 from http://groups.csail.mit.edu/medg/people/psz/Licklider.html.

Markoff, J. (1999, December 20). An Internet Pioneer Ponders the Next Revolution. *The New York Times*. Retrieved March 1, 2007 from http://partners.nytimes.com/library/tech/99/12/biztech/articles/122099outlook-bobb.html?Partner=Snap

Scott, R. (2001). *Institutions and Organizations*. Thousand Oaks: Sage Publications.

World Wide Web Consortium (W3C Website). http://www.w3.org/. Last accessed on March 9, 2007.