

World Wide Web

This section focuses on the role of governmental institutions and universities in the development of code. The first part discusses the creation of the first web browser and libwww, which became the foundation of later web browsers and servers. The second part describes the development of the first mainstream web browser, NCSA Mosaic.

Libwww

The origins of the World Wide Web (WWW or web) occurred at the Conseil Européen pour la Recherche Nucleaire (CERN). This is a laboratory for particle physics funded by twenty European countries. Tim Berners-Lee conceived of the web in 1989 at CERN as a way of connecting information resources for the particle physics community (Gillies & Cailliau, 2000). He envisioned the web as a networked environment, which used hypertext links to connect disparate information sources. For example, the web at CERN allowed access to the telephone book, conference information, a remote library system, and help files through a uniform addressing system (Berners-Lee, 1999; Quittner & Slatalla, 1998).

Berners-Lee initially followed CERN's "buy, don't build" motto by asking firms selling hypertext programs to incorporate his web concept. These firms were not interested. They did not find the appeal of the web compelling, despite the ease of adding Internet access to their products (Berners-Lee, 1999). So Berners-Lee began creating the software and standards for the web on his own as an informal project within CERN. Over the next few years, CERN would spend over twenty man-years on the development of the web (Gillies & Cailliau, 2000).

By 1991, Berners-Lee and Robert Cailliau developed a web browser and server for the Next operating system. To increase the web's popularity, the web browser and server code were freely available to the public. Berners-Lee announced this on Internet newsgroups such as alt.hypertext. These actions broadened the audience from a small group of high-energy physicists to the broader academic community. In turn, the academic community sent reports on problems along with requests for enhancements to Berners-Lee (Berners-Lee, 1999).

In the summer of 1991, Richard Stallman visited CERN and talked about the Free Software Foundation (FSF). The FSF was based around the development of free software with programmers largely volunteering their labor (Gillies & Cailliau, 2000). Berners-Lee did not have a staff inside CERN and recognized that this community of volunteers could help design web browsers for other popular computer operating systems such as Unix (Berners-Lee, 1999). Berners-Lee began publicly touting the development of web browsers as good projects for university students. As a result, students from Helsinki University wrote Erwise, the first web browser for a Unix operating system (Berners-Lee, 1999).

To further encourage the development of the web, Berners-Lee asked his CERN-provided programmer to develop the individual pieces or bricks of code, which other programmers could build upon. Berners-Lee further required the code be rewritten in C, a common language for portable code, even though it meant rewriting the code from his original web browser (Berners-Lee, 1999). These pieces, named libwww, became the foundation of many web applications including web browsers and web servers. Their

portability allowed these pieces to be used with different computer operating systems (Gillies & Cailliau, 2000).

Libwww was available to the public as public domain software (Berners-Lee, 1983). Berners-Lee considered releasing libwww under the FSF's GPL license. However, there were rumors that large companies, such as IBM, would not use the web if there was any kind of licensing issue. This came on the heels of the Gopher internet technology, which was widely abandoned when the University of Minnesota began requiring licenses for commercial use (Berners-Lee, 1999). Berners-Lee decided to release the code into the public domain, thus placing no restrictions on its use. This strategy worked, and within a year there were multiple browsers for Unix systems, and browsers were appearing for Macintosh and Windows operating systems (Gillies & Cailliau, 2000).

Berners-Lee's motivation was to persuade the computing community to adopt the web. He believed the web would be extraordinarily valuable to society. He did not act for his own financial gain. In fact, at several junctures, Berners-Lee decided to remain the benevolent father of the web. He put his vision of the web ahead of personal financial gain (Berners-Lee, 1999). Today, Berners-Lee is the head of the World Wide Web Consortium, which is dedicated to developing open standards to unlock the full potential of the web.

NCSA Mosaic

The next major step in the growth of the web occurred at the National Center for Supercomputing Applications (NCSA) at the University of Illinois at Urbana-Champaign. In the early 1990s, NCSA was working on visual and collaborative software to allow scientists to share data for networks in an easily comprehensive 3-D form (Andrews,

1997). In the fall of 1992, Marc Andreessen worked for Ping Fu on visualization projects at NCSA. Ping Fu asked Andreessen to write a graphical interface for a browser. He replied, “What’s a browser?” She then showed him an early hypermedia system with links. She asked him to develop a tool that would allow people to download software by just clicking on a button. Andreessen replied, “Isn’t that hard code FTP?” She answered, “Marc [Andreessen], you can do something more intelligent than that!” (Gillies & Cailliau, 2000, p. 238).

Later on November 10, 1992, Andreessen watched a demonstration of the web by NCSA staff member Dave Thompson. Thompson thought the web might be an innovative solution for the online collaboration project (Deutschman, 1997). Andreessen was inspired by this demonstration and begin investigating the web through the www-talk newsgroup hosted by CERN.

A few days later, the first public release of Midas, an early web browser, was announced on www-talk. Andreessen was one of the first to download it. He then emailed Tony Johnson the author of Midas. He began by explaining who he was and what NCSA was. He then suggested possible improvements such as “What You See Is What You Get” (WYSIWYG) hypertext editing, inclusion of graphics and animations, and scientific data files. He also proceeded to give Johnson a long list of problems with the code that he found. A few hours later, Andreessen emailed Johnson asking him if he was planning to add other Internet services such as FTP and gopher. Over the next few days, Johnson received a number of emails from Andreessen about fixes and possible improvements. But in the end, Johnson did not want to collaborate with NCSA and he wrote Andreessen, “Well, I’m not sure I want to change everything, I’m happy with it the way it is” (Gillies

& Cailliau, 2000, p. 225). Johnson's rationale was that he was "first and foremost a physicist", and not a computer programmer (Gillies & Cailliau, 2000, p. 225).

Next, Andreessen introduced NCSA staff member Eric Bina to the web, and they began discussing the potential of the web. They recognized that the existing web browsers were limited and not easy to use. Their first project was to write a better web browser. Bina's and Andreessen's manager, Joseph Hardin, understood the significance of the project and approved the project (Naughton, 2000).

Andreessen and Bina began developing a web browser based upon CERN's libwww code (Clark, 1999). They also followed the web standards set by Berners-Lee. They started writing code in December 1992 and by January 1993 they came up with a workable beta version called NCSA Mosaic. The name Mosaic was suppose to represent the idea that the web is a single picture made up of many parts, a mosaic, of Internet services such as the hypertext transfer protocol (http), file transmission protocol (ftp), gopher, and the usenet news protocol.

The web browser project initially met with little excitement within NCSA. However, the Internet community began widely using the beta version of the web browser, as indicated by the number of downloads for the browser from NCSA's server. The popularity of the web browser led to NCSA formally approving the project, and allowing the Windows and Macintosh programmers to work full time on the project. In November 1993, NCSA Mosaic was available as version 1.0 for the Unix, Windows, and Macintosh operating systems (Gillies & Cailliau, 2000).

The design of NCSA Mosaic was basically the work of two people, Bina and Andreessen. But there were many people who contributed to the development.

Andreessen enhanced the web browser based on comments he received through discussions in public forums. Andreessen was one of the top participants in www-talk during 1993 when we was developing and refining NCSA Mosaic. According to Berners-Lee, what made NCSA Mosaic great was Andreessen made “it very easy to install, and he supported it by fixing bugs via email any time night or day. You’d send him a bug [problem] report and then two hours later he’d mail you a fix” (Gillies & Cailliau, 2000, p. 240). According to Berners-Lee, Andreessen was cultivating good customer relations with his rapid fixing and new enhancements. This was in sharp contrast to other student efforts (Berners-Lee, 1999). This customer support led to NCSA Mosaic becoming the most widely used web browser in 1993 (Gillies & Cailliau, 2000).

There were three important design features in NCSA Mosaic (Andreessen & Bina, 1994). The first was that NCSA Mosaic was designed to be accessible and easy to use. Andreessen has stated that “the Net was at least ten years behind the mainstream computer industry” when he was at the University of Illinois (Naughton, 2000, p. 241). Andreessen goes on to provide as an example the situation he was hired to improve. The lack of point and click software for FTP meant that people had to type in addresses by hand and remember the directory location of the FTP archives. Andreessen designed NCSA Mosaic as an easy to use navigational tool for browsing the web and linking together video images, graphics, audio, and text. He strove to make the program intuitive for people who were use to running ordinary applications such as word processors (Quittner & Slatalla, 1998).

The second significant design feature was the lack of publishing features. The original web browser designed by Berners-Lee allowed people to write, edit, and publish

web pages. Instead of a browser, it was a browser/editor. In this browser/editor, it was as easy to compose pages, as it was to read pages. According to Berners-Lee, “my vision was a system in which sharing what you knew or thought should be as easy as learning what someone else knew” (1999, p. 33). In fact, Berners-Lee was uncomfortable with NCSA Mosaic, because of its emphasis on presentation, and the absence of functionality to allow people to easily write pages.

The third significant design decision was the inclusion of images in web pages. To accomplish this, Andreessen had to add the capability into the web browser’s code and add a new tag to the HTML standard for writing web pages. Andreessen added this capability in his the first version and announced it on www-talk. This announcement of multimedia capabilities led to controversy. Deciding how to introduce multimedia and what the appropriate standards should be was still undergoing discussion in the web community. However, the popularity of NCSA Mosaic led to the new tag becoming a de facto addition to the HTML standard (Moody, 2001). Berners-Lee did not like this approach because this could lead to others adding their own tags resulting in a fragmented HTML standard.

In the beginning, the management structure for NCSA Mosaic was loose at best. According to Andreessen, the team consisted of a loose confederation of people with no real management. Programmers would work late at night and talk over pizza. However, this changed as NCSA Mosaic’s popularity grew (Allison, 1995). Once NCSA officially took over there were formal meetings, sometimes with over forty people. The original cadre of programmers was no longer independent and had to follow new management guidelines. Moreover, the programmers did not respect the management’s decision-

making capability. They did not think the management had the adequate ability or foresight to develop NCSA Mosaic (Naughton, 2000).

Besides the new layers of management, Andreessen and the other programmers were perturbed about the highly political academic environment. This was highlighted when the *New York Times* featured NCSA Mosaic in an article in December 1993. While Andreessen and Bina were both interviewed, the *New York Times* used a photo of NCSA director Larry Smarr and the Project Coordinator Joseph Hardin, instead of a group photo of the programmers. This incensed the programming team. Chris Wilson recalls:

at that point I just wanted to get out of NCSA and find something new to do
Some of the management decisions there were getting harder to deal with. There were rebellions breaking out all over, evidenced by the fact that the entire team left shortly after I did. (Andrews, 1997)

The source of the rebellion was the insistence by NCSA to give the institution credit for NCSA Mosaic instead of the original programming team.

The University of Illinois acted similarly as NCSA. The university did not encourage the original programmers of NCSA Mosaic to commercialize their program. Instead, the university asserted ownership over the NCSA Mosaic web browser. While the university continued to support further development of NCSA Mosaic for public use (Clark, 1999), the license for the NCSA Mosaic source code limited its use to “academic institutions and United States government agencies for internal use” (Moody, 2001, p. 186). The rights for commercial use of the source code of NCSA Mosaic were initially licensed to about a dozen companies. By mid 1994, the university licensed all future

commercial licensing rights for NCSA Mosaic to Spyglass. In all, these licenses and royalties earned the University of Illinois seven million dollars. However, by the end of 1996, the popularity of commercial Internet browsers led NCSA to abandon its development of the NCSA Mosaic browser. Nevertheless, the most popular web browser available, Microsoft's Internet Explorer (MSIE), stems from NCSA Mosaic. An acknowledgment can still be found within the application under About Internet Explorer.

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