NSF's place in the history of the Web and Digital Government

Lawrence E. Brandt
Program Manager for Digital Government
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This short article recounts one of NSF's biggest successes in the development of research-based software, its impact and commercialization, and its transition into NSF's Digital Government Research Program.

In the early 1990s, NSF's Supercomputer Centers Program of NSF's Computer and Information Sciences and Engineering Directorate (CISE) began providing small supplemental funding (typically no more than $40-60,000 per year) to their four Centers under NSF's Research Experience for Undergraduates (REU) initiative. REU is a cross-directorate program to provide opportunities for undergraduates to work directly in research settings as part of the research team. At NSF's National Center for Supercomputing Applications (directed by Larry Smarr), the Centers Program focused its REU supplemental funding on NCSA's software development group (NCSA/SDG), under the management of Joseph Hardin.

In 1992, NCSA/SDG discovered the work of Tim Berners-Lee of the European high-energy research center CERN, who developed the initial vision and protocols (text only) for the World Wide Web. NCSA/SDG immediately began to work on their own software and Web server, adding many features to increase the Web's capabilities and attractiveness; primary among these was the ability to display (or play) multi-media information. NCSA's software was christened Mosaic, and it was first released in early 1993, running only on the Unix platform. At that time, Marc Andreesen was an undergraduate member of the NCSA/SDG, and received support from NSF's REU funding. Marc is generally thought of as the primary developer of Mosaic, but in fact was not the individual who brought the Web to the attention of NCSA/SDG. Clearly a natural leader, though, he was soon at the focus of the NCSA/SDG Web development team.

Mosaic, even in those early days, was a sensation. NCSA/SDG was soon inundated by demands for greater stability, features, licensing, etc. In late 1993, Mosaic for Windows and the Macintosh was released – this really created a tidal wave.

Joseph Hardin and I discussed the problem of Mosaic's increasing popularity. I agreed to accept and review a proposal from NCSA/SDG. The proposal requested $1M annually for 3 years; the merit review of the proposal was positive. However, aside from special funding such as REU, the Centers Program's entire budget of over $40M was tied up in the operational costs of the Centers – very little of the budget was available for discretionary activities, and funds to support a $1M/year project were simply unavailable within the Program.

Word of Mosaic spread quickly throughout the Federal agencies, though, especially those with traditional research interests, such as NASA, NSF, and the National Library of

Medicine. I began to demonstrate the software as requested by various government organizations; one of these was Vice President Gore's National Performance Review team. Two NPR staffers from the Nuclear Regulatory Commission (Janet Thot-Thompson and Neil Thompson) and I began to discuss how we might find funding to respond to NCSA/SDG's proposal; we decided to raise the funding in $100,000 chunks from interested NSF programs, NRC, and other Federal Agencies. Soon the NSF/NCSA Federal World-Wide Web Consortium was born, consisting of a number of Memoranda of Understanding and fund transfers from interested Federal agencies to NSF. By 1994, the Consortium was in place, and during the next three years had as many as a dozen agencies participated at one time, with a total of over $3M raised; perhaps 25% of this amount came from NSF.

The Consortium served as part of NSF's oversight process for NCSA's work; the agencies provided interesting data, user experience, and other drivers for the software development, adding such things as public/private key security elements and HTML protocol additions to support access by disabled persons. A considerable amount of time was spent by NCSA staff in visiting agencies, understanding their missions and interests, and providing training.

As the Consortium entered its second year, some of the more technical agencies dropped out, but by that time other supporting agencies which were not IT research-oriented had joined, such as the Dept. of Housing and Urban Development, the Bureau of the Census, the Bureau of Labor Statistics, the Defense Technical Information Center, CIA, and others. In 1995, to respond to the need for Federal training and education, the Consortium created the first annual Federal Webmasters Workshop, with an attendance of about 800 at NIH's new Natcher Conference Center. As the Web matured and became commonplace within agencies, the interest was more on the use of the Web in production Federal agency missions, using commercial software than on research. In 1999, the Consortium handed off the workshop to a set of agencies, headed by the General Services Administration. Now, 6 years after its original formation, the Consortium has been re-focused into an energetic group of about a dozen agencies who are collaborating in the broadest sense with the NSF's Digital Government program and its 25 research projects, as well as with each other.

The technology transfer associated with the Mosaic software suite is an interesting story in itself. Netscape was started by Mark Andreesen and Jim Clark. Marc recruited many of the Mosaic development team from NCSA to join him at Netscape; an especially high-bandwidth form of tech transfer. The Mosaic web browser software was licensed to a small number of companies, and finally a master license was signed with Spyglass, Inc., a small company in Illinois formed in part by former NCSA software developers. Spyglass in turn licensed the software to Microsoft; if you open a version of Microsoft's Internet Explorer, and pull down the Help menu, you can click on the item called About Internet Explorer, where you will see language explaining Explorer's genesis at NCSA. Finally, and perhaps of even greater impact, is the NCSA web server software. This software was turned over to a group of software developers around the world in 1996. Features were added and changes made, and the software was released as no-cost open-source, under

the new name of Apache. The Apache server software is still free and still being enhanced, and has remained the most commonly used web server software on the internet. Recently, Mosaic was named the product which has most shaped today's networking industry by Network Computing magazine; the Apache server was rated number six (see the full article at http://www.networkcomputing.com/1119/1119f1intro.html).

The success of the Mosaic experience was not lost on NSF. In 1997, the CISE Directorate began to realize that the Mosaic model could be generalized, and the question was posed to the research community: could a successful IT research program be based on the issues and data surrounding government information services and applications? A workshop was chaired by Herbert Schorr, Director of USC's Information Sciences Institute and Salvatore Stolfo of Columbia University's Computer Science Dept. In December 1997 a report was issued entitled "Towards the Digital Government of the 21st Century" (which can be found at http://www.isi.edu/nsf). In response, NSF established a program in Digital Government Research; the first set of proposals was received in July 1998. The Digital Government Research program is now in its third year, with a portfolio of 25 research grants and partnerships with over 20 government agencies which has leveraged NSF's funding by about 40%. Details on these grants and other aspects of digital government can be found at http://www.digitalgovernment.org

Now, the concept of digital government is broadly accepted, by Congress, by both presidential candidates, and by government agencies at all levels. NSF can take great satisfaction in its seminal and innovative role in this revolution.