Educational Hypermedia and the World Wide Web

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Ralph Abraham considers the use of the World Wide Web (WWW) to publish hypermedia in educational environments.

There are currently over 2 million hosts and 20 million people on the Internet, and the numbers are growing rapidly. A large portion of this growth (estimated at 40 percent) is now attributed to the WWW, the World Wide Web. In this article, we consider the use of the WWW to publish hypermedia in educational environments.

Internet history

Beginning with the interconnection of machines at four universities (including two campuses of the University of California) in 1969 under the name Arpanet, the Internet has grown by leaps and bounds and is now a network of networks of phenomenal proportions. Critical milestones in the growth of the Internet include the advent of the TCP/IP standard for data packet transmission, the incorporation of these protocols in the UNIX operating system, and the development of Ethernet technology. Today, the emergence of the WWW is driving the explosion of the Internet.

Five steps in the evolution of the WWW

I personally experienced the creation of the WWW in five key steps:

•UNIX in the 1970s. Through the good fortune of working at a campus of the University of California, I received the gift of UNIX early in its history. I soon learned to use UNIX utilities to move, copy, and remove files, to change directories, to edit text, to send e-mail with the UNIX mail command, and to write and compile programs in C.

•The Internet in 1980. When my campus joined the Internet, I learned to roam the world with native UNIX tools, using telnet, or rlogin, to log in to a remote machine, and ftp to send and receive files. My professional activities globalized, with creative cooperation extended around the world electronically, primarily by using mail and ftp.

•Anonymous ftp in the late 1980s. Using the UNIX command ftp requires having an account (or at least the password of an account) on a remote machine, as well as one on your own local machine. Its use essentially amounts to logging in to both of these accounts, and then transferring a file with the ftp commands *get* and *put*. In the long run, this is a terrific inconvenience, as I must tell each of my coworkers or correspondents the password to an account on my machine, on which I want them to be able to put or get files. As a natural evolution, people began to have special accounts for this purpose called anonymous ftp accounts, which required no password. And thus was born a most useful convention, leading to an almost catastrophic increase in Internet traffic. Anonymous ftp still requires knowledge of the ftp command language to see what files are available, to change directories, and to get or put the files of interest.

•Gopher in 1990. Next, we frequently discovered new tools on the Internet such as gopher in 1990, and wais in 1991. It appeared that the Internet was a chaos of unbridled creativity! Clever programmers, both professional and amateur, were making all kinds of new tools and distributing them freely over the Internet via ftp. The gopher system replaces anonymous ftp as a means of getting files with a simple menu selection interface. The wais system provides an index of files available in the gopher network. Again, a tremendous increase in Internet traffic resulted from this innovation.

•The WWW in 1993. Suddenly, the WWW burst forth as a new world within the Internet of hypertext, hypermedia, and multimedia opportunity with its first graphics browser, Mosaic. Mosaic improves on gopher by merging its menus into text, thus creating hypertext.

Four levels of Internet citizenship

It will simplify matters enormously to quantify the on-ramp of the Internet in four steps.

•Have modem will travel. People with a PC, a modem, and an Internet provider are at this level. This may sound like CompuServe, but it is not. CompuServe provides an e-mail link to the Internet but no file access to Internet servers. They provide their own forums, but no access to Internet news. Real Internet providers offer Level 1 access to the full functionality of the UNIX operating system, including mail, telnet, ftp, and gopher, as programs run on their remote machine.

•SLIP me up, Scotty. At this level, one has all of the above plus SLIP or PPP. This software, running on the provider's host, permits one to run programs locally which substitute for the klunkier UNIX utilities, mail, ftp, gopher, telnet, and wais. Currently, this is an elite frontier to which the flood of recent Internet access books is devoted.

•Jacked-in to the WWW. At this

level, one has all of the above plus a WWW Browser and multimedia displayers for bit-mapped images, digital video, and digital audio. You can browse the full multimedia wealth of the Web, discovering an essentially infinite database spanning the entire globe. You can view, but not provide, such information to others.

•Totally WWWebbed. All of the above plus the ability to provide one's own hypertext, images, sounds, and videos. This represents full citizenship in the cybernautic universe.

A miniature WWW FAQ

A curious and valuable feature of the Internet, common in Newsgroups, is the FAQ, or list of Frequently Asked Questions with answers. Here is a minimal FAQ for the WWW: the top eight questions.

•**Why call it the World Wide Web?**
Well, the Internet looks like a worldwide web. But I am not sure how this name got attached to the social organism called the WWW, which is now self-organizing within the Internet. Perhaps it was just a synonym not yet claimed.

•**What is the WWW?**
The WWW is currently estimated to include about 100,000 browsers and 5,000 server sites, with no comprehensive, up-to-date index. We may compare this to the telephone system of a medium-sized city in which you must call every store to inquire for help in locating another store, because there is no directory assistance. Eventually this situation may be rectified, but meanwhile the chaos can lead to some amazing discoveries. One can actually find almost everything ohe wants within about a dozen jumps. Getting started is the hard part. After a month of browsing, what will you have found? A personal and totally unique universe of interactive information.

•**What is unique to the WWW?**
Recently, gopher connected us to menus of plain text and multimedia files, which we could transfer to our own computers. Now WWW browsers give us hypertext instead of menus and

automatically display the files, in addition to transferring them to our machine.

•**Who is on the WWW?**
WWW sites include a large proportion of the governments, universities, science establishments, libraries, and large businesses of the world, as well as thousands of small businesses and individuals. Each site, of course, publishes a limited amount of information. Larger institutions have larger hard disks to devote to publication on the WWW. Considering the federal fact books and tables of contents of magazines and journals at libraries found on

the WWW, it could be regarded as t' world's largest encyclopedia. The WWW is undergoing continuous revision, which makes accurate indexing impossible. It cannot be trusted to be accurate like an authoritative printed book. Further, it has interactive environments as well as encyclopedic d.... and has a life of its own.

•**What is on the WWW?**
The World Wide Web is a simple invention, yet a gigantic innovation. i consists of three parts which extend beyond the ftp and gopher of Level 2

•a new concept, the hypermedia browser;

•a new standard for hypertext files, HTML; and

•loose conventions for multimedia file types (image, sound, video).

•What is a browser?

A browser displays hypertext files. The elevator bar (or scroll bar) represents the length of the entire file, so the height of the elevator itself is adjusted to indicate the portion of the file currently visible in a scrolling window. The first browser was created by Tim Berners-Lee at CERN in Geneva in 1989. The first graphical browser, Mosaic, was developed by Marc Andreeasen at the National Center for Supercomputing Applications (NCSA) during 1992 and released in January 1993. Mosaic launches other programs to use image, sound and movie files.

•What is hypertext?

Hypertext is familiar to many PC users through HyperCard and other similar programs. This is a text file with some words, symbols, or phrases identified by a change of font or color as hot links. After moving the mouse cursor to a hot link, a click of the mouse button initiates a jump of the mouse cursor to a different location in the file or to a different file. The HTML format is a standard way of indicating hot links and their destinations, or anchors. Inline graphics are also supported: an image may appear on the page in the middle of the text. These images may also be hot; that is, clicking them results in a jump to another file. This standard format for hypertext (HTML) provides the second piece needed to build the World Wide Web.

•What are the file types of the WWW?

The file formats chosen will evolve over time, but the most common are:

•hypertext: *.html (displayed by browsers such as Mosaic);

•bit mapped images: *.gif or *.jpg (inline or launched);

•digital audio: *.snd or *.au (launched); and

•digital video: *.mpg or *.mov (launched).
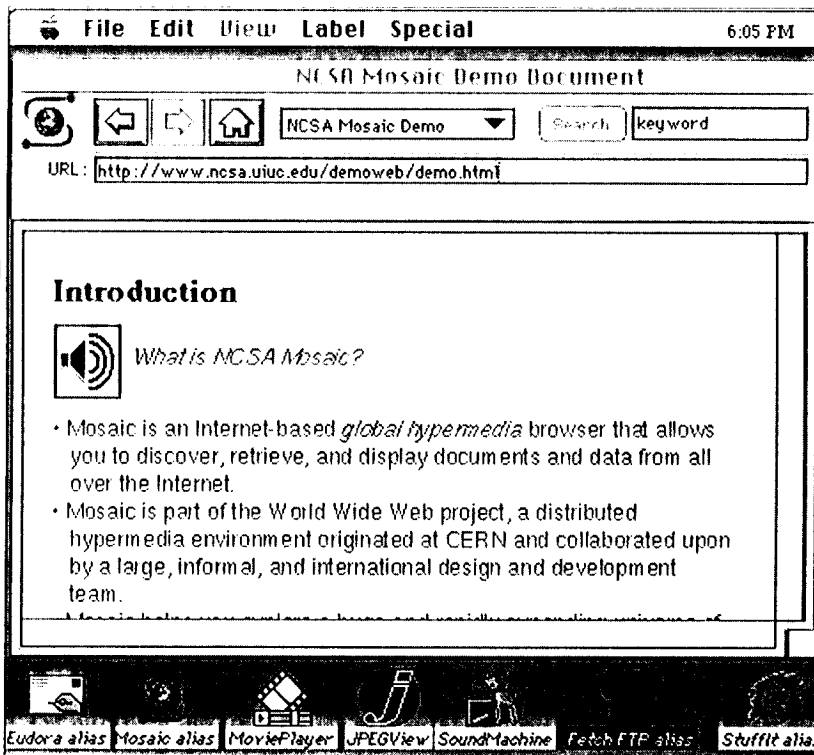
Multimedia in the classroom

At UC Santa Cruz, I have been projecting multimedia and computer-based materials in specially equipped classrooms for six years. Each year, I have experimented with different combina-

The NCSA Mosaic browser for World Wide Web.

tions of hardware and software, with disappointing results. My first real success was in 1993, using the technology of the WWW. I was able to prepare materials in my office and project them in the classroom without the necessity of carrying a portable hard disk, or struggling with ftp just before classtime. This requires Level 4 citizenship. In fact, the advantage of Level 4 citizenship in the Internet is the opportunity to publish your own text, hypertext, and multimedia materials electronically, where they may be indexed, found, and accessed by anyone in the world who is on Level 3. In an educational context, this means that

the teacher may make available, to all students and colleagues, hypermedia courseware, either locally produced or found anywhere on the enormous WWW. Furthermore, in a classroom equipped with a video projector, computer, and Internet connection, all this courseware may accessed within a lecture.

The growth continues

The explosive growth of the WWW is a crucial, revolutionary event in our cultural history. The WWW brings an enormous new freedom of information into homes and schools, and requires very little effort or cost. In the educational sphere alone, it provides a new track, whether within or without our established school system. And its future is up to us.

Ralph H. Abraham has co-authored a book on the World Wide Web, The Web Empowerment Book, by Ralph H. Abraham, Frank Jas, and Will Russell, published by Telos/Springer-Verlag, Santa Clara, Calif. ¶ ▪:::