From ENIAC To Real-Time Access On The Web: A Technological Revolution In 50 Short Years

Author: Eugene Garfield

Fifty years ago, a revolutionary technology was developed at the Moore School of Engineering and Science at the University of Pennsylvania. On Feb. 14, 1946, John W. Mauchly and J. Presper Eckert, Jr., threw the switch on the first large-scale, general-purpose, electronic digital computer that they had constructed-ENIAC (the Electronic Numerical Integrator and Computer).

The project grew out of a 1943 military contract to calculate the trajectories of artillery shells. Yet ENIAC had flexible capabilities as a general-purpose computer to solve a wide range of calculations and complex data analyses. This distinguished it from earlier automated calculating machines designed for single problem-solving applications.

Those of us accustomed to compact desktop computers might marvel at ENIAC's technical specifications. It took up 3,000 cubic feet, weighed 30 tons, used 18,000 vacuum tubes and 70,000 resistors, required more than 170 kilowatts of power, and had a random access memory capacity of about 1,000 information bits. The typical desktop computer of today has 1,000 times as much processing power as ENIAC, and millions of times more storage capacity. Indeed, Vice President Al Gore, honorary chairman of ENIAC's 50th anniversary celebration on Valentine's Day at Penn, pointed out that the microprocessor in a simple musical Valentine's card nearly equals ENIAC's computing power.

The celebration brought to mind my own personal encounters with Mauchly. We first met in Baltimore in 1951, after Calvin Mooers (who coined the term "information retrieval" while a graduate student at the Massachusetts Institute of Technology) mentioned to him the Welch Medical Library Indexing Project at Johns Hopkins University, with which I was involved. Mauchly was fascinated with our work on the machine indexing of scientific literature.

Little did I know that in a few years I would move to Philadelphia, where Mauchly and I maintained frequent contact until his death in 1980. At Penn, I pursued my doctorate while also establishing the Institute for Scientific Information. My dissertation topic involved computerized translation of chemical nomenclature into molecular formulas. This required using the UNIVAC I, a direct descendant of ENIAC. In the 1960s, I introduced the first course on information retrieval at the Moore School. I take great pride in being affiliated with an institution that has played such a pioneering role in developing the digital computer and the many technologies it has enabled, including the Internet. Gore was right on target when he said at Penn that ENIAC sparked the information age.

As I reported in the January 8 issue of The Scientist (page 11), our newspaper has been on the Net at the AT&T server since late 1992. Starting with the first issue of this year, our Web edition is located, appropriately, at the Penn library (www.the-scientist.library.upenn.edu.). The Penn site archives all Web issues of The Scientist from June 1995 onward. In the three months since this site became active, it has averaged 60,000 accesses per month and about 2,000 daily hits. Significantly, more than 20 percent of these originate from foreign users.

By June, we expect to increase The Scientist's foreign Web presence by establishing mirror sites around the world to help reduce local communications costs. We are also entering into agreements with commercial sites, such as the London, U.K.-based BioMedNet . . (http://www.cursci.co.uk), to reach a wider international audience, provide users with flexibility in their interface choices, and enable advertisers to provide useful information to interested readers.

We have also implemented a truly "real-time" archiving strategy for our Web site. Anyone who uses Internet hotlinks is well aware of the inherent delay in moving from one URL to another. Most aficionados would admit that real-time searching on the Internet is a misnomer, and that delayed access is the norm. But on The Scientist's Web site, all cross-references to articles published since June 1995 can indeed be retrieved immediately. And in cases in which older articles from our AT&T Gopher archive are cited, each is stored "live" on our Web site for immediate, real-time retrieval. I believe other electronic publishers will adopt this strategy until the speed and capacity of communication channels increase sufficiently to obviate this strategy. However, one must keep in mind the "impatience factor" of Web users-that is, no matter how fast technology can connect or cross-connect to information sources, users' expectations will increase exponentially with communications technology advances.

Not a month goes by that has not seen some changes in the electronic edition of The Scientist. Such evolutionary improvements are not unexpected in a new and revolutionary communications medium. We encourage your feedback on our Web site and any suggestions you may have for improvements. We also welcome the interest of foreign institutions in hosting mirror sites of The Scientist. Please feel free to contact us at 75057.230@compuserve.com. We'll get back to you as soon as possible-but probably not in "real time." For that, just try the telephone!