Ten years of the World Wide Web

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As the new millennium gets underway, there are many anniversaries that could and probably should be marked. The 20th century was packed with tumultuous events that changed the world, including two World Wars and the Russian revolution. Alongside such great happenings, the commemoration of the invention of a system to aid the reading of electronic documents may seem a little out of place. But the creation in 1991 of what became known as the World Wide Web was a technical innovation that has profound social, economic and political implications.

As with all historic events, the World Wide Web has its own pre-history—in the formation of the Internet itself. Though these two terms have become essentially synonymous, they are in fact very different things.

Today the Internet is regarded as a positive sign of human progress, uniting peoples of all countries and generally making the world a smaller place. Paradoxically, the origins of the Internet are to be found not in an effort to unite the world, but as a defensive mechanism of the most powerful imperialist country, the USA, against its principal rival at the time, the Soviet Union.

The precursor of the Internet was the ARPANET, launched in 1969 by the US Department of Defense (DoD). In 1957, the USSR launched the Sputnik, the first artificial earth satellite. Fearful that the Soviet advance in space technology may translated into a military advantage, the DoD formed the Advance Research Projects Agency (ARPA), with a remit of establishing a US lead in science and technology applicable to the US military.

Much of the first decade of ARPA's existence was taken up with researching the possibilities for large-scale information exchange and international communications. It was not until 1967 that the first discussion on the design of the ARPANET took place at Ann Arbor University in Michigan. In August of the following year a request for proposals for ARPANET was sent out, and responses were received in September. The University of California Los Angeles (UCLA) was awarded the contract for the Network Measurement Centre, where the monitoring of the new network would be carried out. A commercial company, Bolt Beranak and Newman (BBN), was awarded the contract to build Interface Message Processors (IMPs), which would carry the messages between computers connected to the ARPANET.

When the ARPANET was commissioned in 1969 it consisted of just four nodes, each of which comprised of a computer with only 12k (kilobytes - one kilobyte is approximately the information contained on a page of text) of memory. They were connected via a line with a speed of 50kbs (kilobytes per second) provided by AT&T.

(By way of a comparison, an entry-level computer today has 128Mb (megabytes or 1,000 kilobytes) of memory. Today connections of up to 2Mbs are not uncommon in US households, with the use of cable modems and high-speed fibre optics connections such as DSL.)

Node 1 of ARPANET was the UCLA, which went live on September 2, 1969. On October 1, Node 2 was connected at the Stanford Research Institute (SRI), to be followed by the University of California Santa Barbara (UCSB) on November 1 and the University of Utah in December.

With the addition of the SRI computer (or host) to the network in October 1969, the first Host-to-Host message ever sent on the Internet was instigated from UCLA. The privilege fell to Leonard Kleinrock, whose leadership at UCLA had been a primary factor in its choice as the first ever ARPANET node. Kleinrock is attributed with having developed the basic principles of packet switching [1] that provide the fundamental underpinning for today's Internet. One commentator described Kleinrock as "arguably the world's leading authority and researcher in the field of computer network modelling, analysis and design and a father of the Internet." [2]

By 1971, there were 15 nodes connected to ARPANET. That year BBN had begun to use the cheaper Honeywell 316 computers as IMPs, but the IMP configuration itself was beginning to show limitations, as it permitted only four host connections. To cater for the new demand, BBN developed a Terminal IMP, or TIP, that supported up to 64 terminals.

The 1970s was a decade of technological advance in both the software and hardware that came to make up today's Internet. It is not possible here to go through every twist and turn of this development. There are many such histories available on the Internet [3]. A few to note are:

* 1972—The creation of the first email management program to list, selectively read, file forward and respond to messages. In March, the email program for ARPANET had been modified to use the now ubiquitous @ sign.

* 1973—Bob Metcalfe presented his Harvard PhD thesis outlining the idea for Ethernet. The concept was tested on Xerox PARC's computers and is today a basic component in the vast majority of office or home networks. The same year the number of ARPANET users was estimated at 2,000, with email comprising 75 percent of all ARPANET traffic.

* 1975—A satellite link was established across two oceans, to Hawaii and the UK to run the first tests of TCP (Transmission Control Protocol) by Stanford, BBN and UCL.

At the end of the decade, Tom Trunscott, Jim Ellis and Steve Bellovin established USENET using the Unix-to-Unix Copy Protocol (UUCP) between Duke University in North Carolina and the University of North Carolina. What originally consisted of discussion forums for technical issues has today grown into hundreds of thousands of newsgroups covering every imaginable topic.

The 1980s saw the creation of a number of commercial networks that were linked to ARPANET. Here we can trace the growth of the network from that of a specialist medium for the US military, to a broad-based academic and commercial network.

A significant development in widening the user base of ARPANET was the development of the “Name Server” at the University of Wisconsin. With this it was no longer necessary for a user to know the exact path a message had to follow to reach another system. Simply by typing in a system's registered name the Name Server would locate it on the network.

In the early 1980s the Internet grew both numerically and geographically. In 1983, Stuttgart, Germany and Korea were connected. The Movement Information Net (MINET) started early that year in Europe was then connected to the ARPANET in September. In 1983 desktop workstations emerged, with many running the Berkeley UNIX operating system that included Internet Protocol (IP) networking software.

Consequently, networking needs switched from having a single, large time-sharing computer connected to the Internet at each site, to requiring entire local networks be hooked into the system. The modern definition of the Internet as a "network of networks" had its birth in this period.

Concerned at the security implications of the widespread use of the ARPANET, the US military split off a section of the network, known as MILNET and integrated it with the Defense Data Network created the previous year. MILNET took 68 of the 113 existing nodes.

By 1984, the ARPANET had over 1,000 hosts, rising to 10,000 in 1987 and 100,000 in 1989, before it ceased to exist a year later.

If the 1970s was the decade in which the basic technologies of the Internet were established, and the 1980s saw its emergence as an indispensable tool within the world of academia and research, then the 1990s herald the emergence of the Internet as a tool for mass communication.

With the opening of the last decade of the 20th century, there were a number of developments that secured the future of the Internet as a mass medium. One of the most significant must be the emergence of the commercial Internet Service Provider (ISP). In 1990, world.sdt.com [4] became the first commercial provider of Internet dial-up access. This meant that for the first time, users other than those in academic or business institutions with Internet access could connect to the Net.

The global reach of the Internet continued to grow with Argentina, Austria, Belgium, Chile, Greece, India, Ireland, Korea, Spain and Switzerland connecting in 1990. The following year saw the first connection from Brazil at a speed of 9.6Kbs.

Alongside the emergence of wider public access to the Internet and improvements in the infrastructure, (the Internet backbone was upgraded to carry 44.736Mbps in 1990) there were also significant software advances that did much to broaden the appeal of the Net.

In 1991, two software standards were released that were both designed to make the navigation of the Internet easier.

The first was Gopher [5] developed by Paul Lindner and Mark P. McCahill from the University of Minnesota. The Gopher system enabled documents to be listed in a readable, hierarchical method that was relatively easy to navigate. But Gopher lacked a central ingredient that was to make the World Wide Web so popular—hyperlinks.

The concept of establishing active links between documents as a means of presenting information was first spoken of by scientist Vannevar Bush in an article in *Atlantic Monthly* in 1945. [6] He wrote about a photo-mechanical device called Memex, short for memory extension, which could make and follow links between documents on microfiche—"a future device for individual use, which is a sort of mechanized private file and library... in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility".

Ted Nelson first coined the term “hypertext”, which is today widely used in the language of the Internet, in 1965. Long before the emergence of the World Wide Web, Nelson had pursued the idea of a global hypertext system as the so-called Xanadu project. But the Xanadu project was stifled from the beginning by Nelson's desire to make a profit and the system never saw the light of day.

In contrast, the World Wide Web emerged as a free and open medium that was not bound by the fetters of intellectual property rights.

Though the World Wide Web can be legitimately thought of as the realisation of Vannevar Bush's vision, it goes far beyond it. While Bush spoke of the Memex system as a device capable of holding private files, books, records etc., what Tim Berners-Lee developed could be more accurately described as a “virtual Memex”. Using the Internet as its underlying foundation, the World Wide Web allows the data to be stored on any Internet connected machine and accessed from any other.

Today the World Wide Web comprises over 34.7 million registered domain names in 190 countries, and global access to the Internet reached 407.1 million in December 2000. It has become virtually impossible to keep track of the number of individual web sites, as users can easily add their own content at very little cost.

The original proposals for the World Wide Web were presented to the European Organisation for Nuclear Research (CERN) by Berners-Lee in 1989 and were further refined with the assistance of Robert Cailliau in 1990. By 1991 they were able to release a software system that included a browser/editor, an information server and a library implementing the essential functions to allow developers to build their own software programmes.

The 1991 release was to the high-energy physics community who had access to the CERN programme library. This meant that a whole range of universities and research laboratories could begin to use the system and, more importantly, contribute towards its development. It was released on the Internet a little later, firstly to the community working on hypertext systems and then more generally. By the beginning of 1993 there were around 50 known information servers.

The software system released by Berners-Lee and Cailliau would initially run only on computers using the high-end and expensive NeXTStep operating system. Though this was clearly the start of the World Wide Web, its birth is more commonly traced to 1995 when Marc Andreesen and Eric Bina developed the first publicly available browser for the National Center for Supercomputing Applications. Andreesen later went on to form the Netscape company and the original Mosaic browser was transformed into Netscape Navigator.

Berners-Lee has secured himself a place in history through the system he developed. Probably of more importance even than the software system he wrote is the devotion to open standards that has dominated Berners-Lee's work from the beginning.

As the director of a body known as the World Wide Web Consortium, or W3C, Berners-Lee brings together such commercial giants as Microsoft, Netscape, Sun, Apple, IBM and 155 others in an attempt to ensure agreement on open technical standards as the software underlying the World Wide Web rapidly evolves. In an interview with *Time* magazine in May 1997, Berners-Lee said his nightmare was a Web that "becomes more than one Web, so that you need 16 different browsers, depending on what you're looking at." According to the interviewer he "especially loathes those BEST VIEWED WITH ACME BROWSER signs on Websites." [7]

With a few deviations, the open standards of the World Wide Web have been pretty much maintained. This has certainly conflicted with the commercial interests of the industry leaders, as the ongoing browser war between Microsoft and Netscape testifies. (We have written elsewhere on the role of Microsoft in particular in attempting to subvert the open character of the Internet to ensure that its own "standards" prevail. [8])

Despite such attempts however, it is today easier than ever for someone not only to access a wide variety of material on the Internet, but also to make their own content available.

At the beginning of the 21st century there can be no doubt that the Internet has already profoundly changed the way in which we live. However, the emergence of a communications system that facilitates the unhindered exchange of ideas between peoples spread across the planet will have profound social implications.

People are getting online at a far greater rate than those taking up television when it emerged as a mass technology, or radio before that. The high Internet take-up rate is bound up with a factor that makes this medium unique. The arrival of the TV set did not mean that everyone could then start to make television programs; it emerged under the strict control of the state or commercial media giants. Thanks to the open standards on which the World Wide Web is based it emerged from the beginning not as a passive but an interactive medium. The personal

computer was not simply the receiver through which a user could access the Internet but a production facility enabling the individual's creative efforts to be accessed by all others online.

To be sure, there is much on the Internet that is of little value or is even downright undesirable. But this cannot be blamed upon the medium. The Internet and the World Wide Web does not exist in a vacuum. It is a product of the society in which it exists and cannot escape the shallowness and superficiality that one finds in other walks of life.

The success of the *World Socialist Web Site*, launched in February 1998, is testimony to the fact there is an interest in more serious and critical material. Thanks to the emergence of the World Wide Web a decade ago, it is possible for a global audience to find it.

This does not mean that there is any cause for complacency. As Internet access begins to shift from those who mainly go online using a desktop computer, to mobile phones and other portable devices, the primary purpose of the Internet will also change. Under commercial pressures the Internet is being transformed from an information super-highway into a giant electronic shopping mall. Paralleling this development, ownership and control of the Internet are being concentrated in ever fewer hands.

The recently ratified merger between America Online (AOL) and Time Warner creates the fourth largest company in the US, as measured by stock value. Worth $342 billion, it trails only Microsoft, General Electric and computer networking manufacturer Cisco Systems. The new company brings together the world's largest Internet provider with the largest media monopoly in the US. Time Warner controls magazines with a combined circulation of 130 million, CNN and other cable television networks as well as Warner Brothers studio and Warner Music. AOL owns the second most used web browser, Netscape.

As deals are struck between the cable companies, Internet Service Providers, and content providers, new users will increasingly find that they access the Internet through a closed portal. When searching for information, users will be offered a selection based upon commercial arrangements between companies. Independent sources of information will still be out there but will become increasingly difficult to find.

Neither has it gone unnoticed by the powers that be that recent protests, such as against the World Trade Organisation conference in Seattle last year, have taken on a global character and were organised largely through agitation on the Internet. In response, the security forces of the leading capitalist nations are in almost constant session, elaborating new ways in which to monitor, censor and if possible restrict access to this medium.

It would be taking things too far, however, to argue as some have that such dangers signify the end of the World Wide Web as a democratic medium. Closed portals notwithstanding, it will still be possible, only more difficult, to find information if one so desires. Moreover a computer network that was designed to withstand a nuclear attack is not too easily closed down. An individual computer or host may be targeted for censorship and even shut down, but the Internet continues to function and the information can be accessed elsewhere on mirror sites.

Footnotes

[1] Packet switching refers to the way in which messages are divided into short packets of information before being sent across the network. Each packet is transmitted individually and can even follow different routes to its destination, where they are recompiled into the original message.

[2] *Leonard Kleinrock's Personal History/Biography: The Birth of the Internet* http://millennium.cs.ucla.edu/LK/Inet/birth.html

[3] A good place to begin is the *Internet & World Wide Web History* on Linkscan at:
http://www.elsop.com/wrc/h_web.htm

[4] The home page of the first ever public ISP can be found at:
http://world.std.com/

[5] An example of a gopher site can be found at:
gopher://gopher.quux.org/11/%09%09%2B

[6] *As we may think* by Vannevar Bush can be read at:
http://www.theatlantic.com/unbound/flashbks/computer/bushf.htm

[7] See, *The man who invented the Web*, at:
http://www.time.com/time/magazine/1997/dom/970519/tech.the_man_who_i.html

[8] See the *WSWS* article "A glimpse behind the veil of business secrets: Microsoft lawsuit reveals predatory corporate practices" at:
http://www.wsws.org/articles/2000/may2000/micr-m23.shtml