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HISTORY OF THE INTERNET

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Анотація

Стаття присвячена історії глобальної мережі Інтернет. Проаналізовані передумови її виникнення і основні стадії розвитку. Розглянуті її основні принципи, структура і ключові особистості, що стояли біля її витоків.

***Ключові слова**: Інтернет, мережа, комп'ютер, пакет, інформація, протокол, веб.*

Abstract

The article is devoted to the history of the Internet. Analyzed the preconditions of its origin and main stages of development. Considered its basic principles, structure and key personalities which stood at its origins.

***Keywords**: Internet, network, computer, packet, information, protocol, web.*

The Internet has revolutionized the computer and communication world like nothing before. The invention of the telegraph, telephone, radio, and computer set the stage for this unprecedented integration of capabilities. The Internet is a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regarding for geographic location. The Internet represents one of the most successful examples of the benefits of sustained investment and commitment to research and development of information infrastructure.

As you might expect for a technology so expansive and ever-changing, it is impossible to credit the invention of the Internet to a single person. The Internet was the work of dozens of pioneering scientists, programmers and engineers who developed new features and technologies that eventually merged to become the "information superhighway" as we know it today.

Long before the technology existed to actually build the Internet, many scientists had already anticipated the existence of worldwide networks of information. Nikola Tesla toyed with the idea of a "world wireless system" in the early 1900s, and visionary thinkers like Paul Otlet and Vannevar Bush conceived of mechanized, searchable storage systems of books and media in the 1930s and 1940s.

The Soviet Union sent the satellite Sputnik 1 into the space on October 4, 1957. Partially in response, the American government created in 1958 the Advanced Research Project Agency, known today as DARPA—Defense Advanced Research Projects Agency. The agency's specific mission was to prevent technological surprises like the launch of Sputnik, which signaled that the Soviets had beaten the U.S. in the space. The mission statement has evolved over time. Today DARPA's mission is still to prevent technological surprise to the US, but also to create technological surprise for it enemies.

To coordinate such efforts, a rapid way to exchange data between various universities and laboratories was needed. It was J. C. R. Licklider who is largely responsible for the theoretical basis of the Internet, an "Intergalactic Computer Network." He provided his vision or dream of a world-wide network and would later become ARPANET. His idea was to create a network where many different computer systems would be interconnected to one another to quickly exchange data, rather than have individual systems setup, each one connecting to some other individual system.[1]

He thought up the idea after having to deal with three separate systems connecting to computers in Santa Monica, the University of California, Berkeley, and a system at MIT. "For each of these three terminals, I had three different sets of user commands. So if I was talking online with someone at SDC and I wanted to talk to someone I knew at Berkeley or MIT about this, I had to get up from the SDC terminal, go over and log into the other terminal and get in touch with them…. I said, oh man, it's obvious what to do. If you have these three terminals, there ought to be one terminal that goes anywhere you want to go where you have interactive computing. That idea is the ARPANET."[2]

With the threat of a nuclear war, it was necessary to decentralize such a system, so that even if one node was destroyed, there would still be communication between all the other computers. The American engineer

Paul Baran provided the solution to this issue; he designed a decentralized network that also used packet switching as a means for sending and receiving data.

Many others also contributed to the development of an efficient packet switching system including Leonard Kleinrock and Donald Davies. “Packet switching” is basically a method of breaking down all transmitted data—regardless of content, type, or structure—into suitably sized blocks, called packets. So, for instance, if you wanted to access a large file from another system, when you attempted to download it, rather than the entire file being sent in one stream, which would require a constant connection for the duration of the download, it would get broken down into small packets of data, with each packet being individually sent, perhaps taking different paths through the network. The system that downloads the file would then re-assemble the packets back into the original full file. This form of packet switching is still used as the primary means of transferring information to this day on the web.

Over the 1960s, ARPA and the Massachusetts Institute of Technology corroborated to share technology and research information. Ivan Sutherland and Bob Taylor performed a lot of the precursor work to the ARPANET by connecting separate computers via phone network with researchers in Santa Monica, University of California at Berkeley, and MIT. In 1966, Larry Roberts from MIT introduced the ARPANET which would allow computers to be linked over long distances. In 1969, colleges were permitted to become a part of the network nodes with UCLA and Stanford being early adopters. The network was further expanded in 1971 and by 1973 it had a node in London.

On August 29, 1969 the first network switch was sent to UCLA for use and was called an IMP (Interface Message Processor). The first data was moved to the switch from the UCLA host on September 2, 1969. The IMPs were developed by BBN technologies under contract to ARPA with the team led by Frank Heart. The IMPs were designed to function as gateways with the purpose to connect local resources. At each deployment site, the IMPs storage and forward packet switching functions. The devices were connected via modems that were connected through leased phone lines running at an initial speed of 50 kbit/second. The host computers at each location were then connected to the IMPs via serial communication interfaces. The design to implementation of the IMPs was accomplished in 9 months. The first IMPs made use of a Honeywell DDP-516 computer that was configured with 24KB of expandable core memory along with a 16 channel DMC (Direct Multiplex Control) direct memory access unit. The purpose of the DMC was to establish a communications interface between the host computer and the modem.

In the initial deployment of ARPANET there were four IMPs. These were sent to UCLA, Stanford, University of California at Santa Barbara (UCSB), and the University of Utah. The first message transmitted on the ARPANET was sent by UCLA student Charley Kline from Boelter Hall. Under the supervision of Leonard Kleinrock, he transmitted from the SDS Sigma 7 Host computer to the Stanford Research Institute’s SDS 940 Host computer. His message text was intended to be “login” by the system crashed after the letters “lo” were sent. As a result, the first message transmitted on ARPANET was “lo.” Approximately one hour later after recovering from the crash, a full “login” message was sent. The first permanent ARPANET link would be established on November 21, 1969 between UCLA and the Stanford Research Institute. On December 5, 1969 the entire four-node network would be established.

By 1972, the number of computers that were connected to ARPANET had reached twenty-three and it was the term electronic mail (email) was first used, when a computer scientist named Ray Tomlinson implemented an email system in ARPANET using the “@” symbol to differentiate the sender’s name and network name in the email address. Alongside these developments, engineers created more networks, which used different protocols such as X.25 and UUCP. The original protocol for communication used by the ARPANET was the NCP (Network Control Protocol).

In 1974, after many attempts failed, a paper published by Vint Cerf and Bob Kahn also known as “the fathers of the Internet” resulted in the protocol TCP (Transmission Control Protocol), which by 1978 had become TCP/IP (with the IP standing for Internet Protocol). At a high level TCP/IP is essentially a relatively efficient system for making sure the packets of data are sent and ultimately received where they need to go, and in turn assembles in the proper order so that the downloaded data mirrors the original file. So, for instance, if a packet is lost in transmission, TCP is the system that detects this and makes sure the missing packets get re-sent and are successfully received. Developers of applications can then use this system without having to worry about exactly how the underlying network communication works.

ARPANET adopted TCP/IP on January 1, 1983, and researchers began to assemble the “network of networks” that became the modern Internet.

In 1983 Paul Mockapetris proposed a distributed database of internet name and address pairs, now known as the Domain Name System (DNS). This is essentially a distributed “phone book” linking a domain’s name to its IP address allowing you to type in something like todayifoundout.com, instead of the IP address of the website. The distributed version of this system allowed a decentralized approach to this “phone book.” Previously, a central HOSTS.TXT file was maintained at Stanford Research Institute that then could be downloaded and used by other systems. Of course, even by 1983, this was a problem to maintain and there was a growing need for a decentralized approach.

In 1989 Tim Berners-Lee of CERN (European Organization for Nuclear Research) developed a system for distributing information on the Internet and named it the World Wide Web.

What made this system unique from existing systems of the day was the marriage of the hypertext system (linked pages) with the Internet; particularly the marriage of one directional links that didn’t require any action by the owner of the destination page to make it work as with bi-directional hypertext systems of the day. It also provided relatively simple implementations of web servers and web browsers and was a completely open platform. Anyone could contribute and develop their own such systems without paying any royalties. In the process Berners-Lee developed the URL format, hypertext markup language (HTML), and the Hypertext Transfer Protocol (HTTP).

Around this time, one of the most popular alternatives to the web - the Gopher system - announced it would no longer be free to use that effectively killed it with many switching to the World Wide Web. Today the web is so popular that many people often think of it as the Internet, even though this isn’t the case at all. [3]

The web helped popularize the Internet among the public, and served as a crucial step in developing the vast trove of information that most of us now access on a daily basis.

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