A History of Computer Networking Technology

Lawrence Harold Hardy
Denver Public Schools, USA

INTRODUCTION

The computer has influenced the very fabric of modern society. As a stand-alone machine, it has proven itself a practical and highly efficient tool for education, commerce, science, and medicine. When attached to a network—the Internet for example—it becomes the nexus of opportunity, transforming our lives in ways that are both problematic and astonishing. Computer networks are the source for vast amounts of knowledge, which can predict the weather, identify organ donors and recipients, or analyze the complexity of the human genome (Shindler, 2002).

The linking of ideas across an information highway satisfies a primordial hunger humans have to belong and to communicate**.** Early civilizations, to satisfy this desire, created information highways of carrier pigeons (Palmer, 2006). The history of computer networking begins in the 19th century with the invention of the telegraph, the telephone, and the radiotelegraph.

The first communications information highway based on electricity was created with the deployment of the telegraph. The telegraph itself is no more than an electromagnet connected to a battery, connected to a switch, connected to wire (Derfler & Freed, 2002). The telegraph operates very straightforwardly. To send a message (electric current), the telegrapher rapidly opens and closes the telegraph switch. The receiving telegraph uses the electric current to create a magnetic field, which causes an observable mechanical event (Calvert, 2004).

The first commercial telegraph was patented in Great Britain by Charles Wheatstone and William Cooke in 1837 (The Institution of Engineering and Technology, 2007). The Cooke-Wheatstone Telegraph required six wires and five magnetic needles. Messages were created when combinations of the needles were deflected left or right to indicate letters (Derfler & Freed, 2002).

Almost simultaneous to the Cooke-Wheatstone Telegraph was the Samuel F. B. Morse Telegraph in the United States in 1837 (Calvert, 2004). In comparison, the Morse Telegraph was decidedly different from its European counterpart. First, it was much simpler than the Cooke-Wheatstone Telegraph: to transmit messages, it used one wire instead of six. Second, it used a code and a sounder to send and receive messages instead of deflected needles (Derfler & Freed, 2002). The simplicity of the Morse Telegraph made it the worldwide standard.

The next major change in telegraphy occurred because of the efforts of French inventor Emile Baudot. Baudot's first innovation replaced the telegrapher's key with a typewriter like keyboard. His second innovation replaced the dots and dashes of Morse code with a five-unit or five-bit code—similar to American standard code for information interchange (ASCII) or extended binary coded decimal interchange code (EBCDIC)—he developed. Unlike Morse code, which relied upon a series of dots and dashes, each letter in the Baudot code contained a combination of five electrical pulses. Eventually all major telegraph companies converted to Baudot code, which eliminated the need for a skilled Morse code telegrapher (Derfler & Freed, 2002). Finally, Baudot, in 1894, invented a distributor which allowed his printing telegraph to multiplex its signals; as many as eight machines could send simultaneous messages over one telegraph circuit (Britannica Concise Encyclopedia , 2006). The Baudot printing telegraph paved the way for the Teletype and Telex (Derfler & Freed, 2002).

The second forerunner of modern computer networking was the telephone. It was a significant advancement over the telegraph for it personalized telecommunications, bringing the voices and emotions of the sender to the receiver. Unlike its predecessor the telegraph, telephone networks created virtual circuit to connect telephones to one another (Shindler, 2002).

Legend credits Alexander Graham Bell as the inventor of the telephone in 1876. He was not. Bell was the first to patent the telephone. Historians credit Italian-American scientist Antonio Meucci as the inventor of the telephone. Meucci began working on his design for

a talking telegraph in 1849 and filed a caveat for his design in 1871 but was unable to finance commercial development. In 2002, the United States House of Representatives passed a resolution recognizing his accomplishment to telecommunications (Library of Congress, 2007).

The telephone was a serendipitous discovery; it came about because of Bell's failure at creating a harmonic telegraph (Library of Congress, 2000). Convention defines a telephone as an electronic device, which transforms sound into electronic signals for transmission then electronically converts the signals into sound for receiving.

Any recapping of the telegraph and telephone histories would be incomplete without recounting the contributions of Thomas Edison. Edison made major contributions to each science. For the telegraph Edison was able to, in 1873, create a printing telegraph that printed messages in plain text instead Morse code. Edison, in 1874, invented a multiplexing telegraph, which permitted simultaneous messages over one telegraphic circuit.

His improvement to the telephone proved just as important. First, Edison extended the distance to an almost limitless Bell transmitted and received voice signal (Microsoft Corporation, 2007). Second, Edison invented a carbon-based transmitter and receiver to capture voices electronically (Derfler & Freed, 2002). Carbon-based telephones are the staple of modern telephones (PBS, 2000).

The seminal foundation for wireless computer networks is the radiotelegraph, invented by Guglielmo Marconi of Italy in 1895. When the Italian government showed little interest in radio telegraphy, Marconi took his invention to Great Britain. In Great Britain, Marconi demonstrated the effectiveness of the radiotelegraph by sending messages first across the English Channel. Then in 1901, he successfully sent a message 2,100 miles across the Atlantic Ocean from Cornwall to Newfoundland. In 1932, Marconi demonstrated the world's first cellular telephone at Vatican City (NobelPrize.Org, 2007).

BACKGROUND

A modern computer network is an interconnection between two or more computers sharing resources and information. Computers on a network sometimes called nodes. Fiber optics, various cooper cabling implementations, or radio may connect the computers on a network. Computer networks are classified by their complexity, starting with the least complex, the local area network (LAN). The LAN is surpassed in complexity by the metropolitan area network (MAN), which in turn is surpassed by the wide area network (WAN). The LAN is the basic component of the two larger networks. A MAN may span several city blocks or a metropolitan area, while a WAN covers a larger geographical area, a state for example. The most popular WAN in the Internet (Lammle, 2004).

Computer networking developed in the United States during the Cold War. The Defense Department (DOD) wanted to create a communications network that would survive a nuclear war. The Advanced Research Projects Agency (ARPA) spearheaded efforts to connect DOD computers to the computers of major universities and research facilities. The DOD initiative created to artifacts of ARPAnet and transmission control protocol/Internet protocol (TCP/IP). ARPAnet is the Internet predecessor. TCP/IP is the engine that drove ARPAnet (Kozierok, 2005; Palmer, 2006).

TCP/IP is a connection-oriented protocol that provides full duplex data transmission (two-way transmission). TCP/IP is noted for its reliability and data integrity. It is the standard for the Internet and most LANs. TCP/IP is a packet switching technology that provides distinct advantages over the previous circuit switching technology. First, packet switching establishes logical routes instead of physical routes. Consequently, successful data transmission increases, because of the of multiple pathways availabile (Shindler, 2002).

Another project DOD sponsored through the auspices Palo Alto Research Center (PARC) was the development Ethernet in 1973. Essentially, Ethernet defines the data link layer sublayer of the media access control of the open system interconnection (OSI) reference model for devices connected in close proximity as described by IEEE's 802.3. Ethernet permits only one network data transmission at a time to diminish transmission corruption. To facilitate this approach, Ethernet uses carrier sense multiple access with collision detection (CSMA/CD) as a method of controlling data transmission (Derfler & Freed, 2002; Walters, 2001).

Members of PARC, in concert with the University of Hawaii, developed the first wireless network, ALOHAnet in 1970. ALOHAnet is significant because its core technologies are the basis for Ethernet and wireless networking (Wikipedia, 2007).

Related Content

Brain Neuron Network Extraction and Analysis of Live Mice from Imaging Videos

Ruichi Yu, Jui-Hsin (Larry) Lai, Shun-Xuan Wangand Ching-Yung Lin (2017). *International Journal of Multimedia Data Engineering and Management (pp. 1-20).*

www.irma-international.org/article/brain-neuron-network-extraction-and-analysis-of-live-mice-from-imaging-videos/182648

Online Video Summarization Based on Local Features

Javier Iparraguirreand Claudio A. Delrieux (2014). *International Journal of Multimedia Data Engineering and Management (pp. 41-53).*

www.irma-international.org/article/online-video-summarization-based-on-local-features/113306

Evaluation of Implementation of Gamification, Game-Based Learning, and Active Methodologies to the Flipped Classroom Model

María-Mercedes Rojas-de-Gracia, Ana Esteban, María J. Bentabol, María Dolores Rodríguez-Ruiz, Amparo Bentabol, Ana Paula Lopes, Filomena Soares, María M. Muñoz, Mariano Soler-Portaand Rocío Caña-Palma (2022). *Online Distance Learning Course Design and Multimedia in E-Learning (pp. 142-164).*

www.irma-international.org/chapter/evaluation-of-implementation-of-gamification-game-based-learning-and-active-methodologies-to-the-flipped-classroom-model/299835

From Single to Multiplayer Mobile Bluetooth Gaming

Daniel C. Doolan, Kevin Duggan, Sabin Tabircaand Laurence T. Yang (2009). *Handbook of Research on Mobile Multimedia, Second Edition (pp. 584-594).*

www.irma-international.org/chapter/single-multiplayer-mobile-bluetooth-gaming/21030

Fast Caption Alignment for Automatic Indexing of Audio

Allan Knightand Kevin Almeroth (2010). *International Journal of Multimedia Data Engineering and Management (pp. 1-17).*

www.irma-international.org/article/fast-caption-alignment-automatic-indexing/43745