

Telecommunications and Networking

1. **Telecommunication** involves sending messages for the purpose of communication. Telecommunications is a general term for a vast array of technologies that send information over distances. Mobile phones, land lines, satellite phones and voice over Internet protocol (VoIP) are all telephony technologies -- just one field of telecommunications. Radio, television and networks are a few more examples of telecommunication.

A complete, single telecommunications circuit consists of two stations, each equipped with a transmitter and a receiver. The transmitter and receiver at any station may be combined into a single device called a transceiver. The medium of signal transmission can be electrical wire or cable (also known as "copper"), optical fiber or electromagnetic fields. The free-space transmission and reception of data by means of electromagnetic fields is called wireless.

The simplest form of telecommunications takes place between two stations. However, it is common for multiple transmitting and receiving stations to exchange data among themselves. Such an arrangement is called a telecommunications network. The Internet is the largest example. On a smaller scale, examples include:

- Corporate and academic wide-area networks (WANs)
- Telephone networks
- Police and fire communications systems
- Taxicab dispatch networks
- Groups of amateur radio operators

Data is conveyed in a telecommunications circuit by means of an electrical signal called the carrier or carrier wave. In order for a carrier to convey information, some form of modulation is required. The mode of modulation can be broadly categorized as either analog or digital. In analog modulation, some aspect of the carrier is varied in a continuous fashion. The oldest form of analog modulation is amplitude modulation (AM), still used in radio broadcasting at some frequencies. Digital modulation actually predates analog modulation; the earliest form was Morse code. During the 1900s, dozens of new forms of modulation were developed and deployed, particularly during the so-called "digital revolution" when the use of computers among ordinary citizens became widespread.

In some contexts, a broadcast network, consisting of a single transmitting station and multiple receive-only stations, is considered a form of telecommunications. Radio and television broadcasting are the most common examples.

Telecommunications and broadcasting worldwide are overseen by the International Telecommunication Union (ITU), an agency of the United Nations (UN) with headquarters in Geneva, Switzerland. Most countries have their own agencies that enforce telecommunications regulations formulated by their governments. In the United States, that agency is the Federal Communications Commission (FCC).

While most people associate telecommunications with modern technologies, the strict definition of the term encompasses primitive and even ancient forms of telecommunication. Among these is the use of smoke signals as a kind of visual telegraph. Puffs of smoke were time-released by smothering a fire with a blanket, then quickly removing and replacing the blanket. Widely used by the American Indians, smoke signals could communicate short messages over long distances, assuming a clear line of sight.

Other forms of early telecommunications include relay fires or beacons. Used for mostly in warfare, relay fires required a handful of men posted along a range of hilltops, with the last man closest to the area where troop movement was expected. When armies were spotted in the distance, he would light a bonfire. The fire could be seen from a good distance away by the next man in the relay, who would in turn light his own bonfire, and so the fires were lit in succession along the range, creating an effective telecommunications signal that traveled back over several miles in a relatively short period of time. Finally, the last man in the relay would light a beacon to signal his army below that the opponent was en-route.

The arrangement of a ship's flags and semaphores were other forms of telecommunications. A semaphore was a mechanical device atop a tower with paddle-like blades or flags. The device would be set in a specific position to communicate information.

Throughout the 19th century, telecommunications devices became more sophisticated with the advent of electricity, leading to the telegraph, Morse code, and signal lamps. A signal lamp, the optical version of the telegraph, is a powerful lamp with shutters that block the light in long or short durations to translate to the

dots and dashes of Morse code. A heliograph is another optical telegraph -- a mirror used to reflect light to mimic a signal lamp.

In the 20th century, telecommunications reached beyond our planet. In June 1969, the world watched and listened as astronauts walked on the moon. Twenty years later, in August 1989, we would see pictures of Neptune arrive back from the Voyager 2 spacecraft, riding radio waves that traveled over roughly three billion miles (4.8 billion km) to reach us in a matter of a few hours.

Strides in telecommunications have changed the world immeasurably. While pockets of humankind were once isolated from each other, people now have multiple ways to see and hear what is occurring on the other side of the world in real time. Satellite technology, television, the Internet and telephony keep the globe connected in a humming buzz of interactive voices and pictures. In short, telecommunications has come a long way from smoke signals.

1.2 The Function of Telecommunication What Are the Types of Communication Networks?

Types

Telecommunication can take place over the telephone, mobile devices, the Internet, through the radio or other electronic instrument. It also involves a variety of mediums including voice, video or Internet transactions. Those in the medical field can even assist in the performance of telesurgery on patients thousands of miles away through telecommunication devices.

Significance

Computer networking, or a web of computers transferring information back and forth, has allowed telecommunications to progress. Without the engineering principle that connected multiple computers over an extended distance, telecommunication would be improbable, and in some cases impossible.

Potential

According to Vinton G. Cerf, senior vice president of the data services division of MCI telecommunications division, the Internet has doubled in size every year since 1988. It is truly a global infrastructure and one of the first infrastructures to grow so rapidly in less than a decade.

1.3 History Telecommunication

Telecommunication is communication at a distance by technological means, particularly through electrical signals or electromagnetic waves. The word is often used in its plural form, telecommunications, because it involves many different technologies.

Early means of communicating over a distance included visual signals, such as beacons, smoke signals, semaphore telegraphs, signal flags, and optical heliographs. Other examples of pre-modern long-distance communication included audio messages such as coded drumbeats, lung-blown horns, and loud whistles. Modern technologies for long-distance communication usually involve electrical and electromagnetic technologies, such as telegraph, telephone, and teleprinter, networks, radio, microwave transmission, fiber optics, and communications satellites.

A revolution in wireless communication began in the first decade of the 20th century with the pioneering developments in radio communications by Guglielmo Marconi, who won the Nobel Prize in Physics in 1909. Other highly notable pioneering inventors and developers in the field of electrical and electronic telecommunications include Charles Wheatstone and Samuel Morse (telegraph), Alexander Graham Bell (telephone), Edwin Armstrong, and Lee de Forest (radio), as well as John Logie Baird and Philo Farnsworth (television).

The world's effective capacity to exchange information through two-way telecommunication networks grew from 281 petabytes of (optimally compressed) information in 1986, to 471 petabytes in 1993, to 2.2 (optimally compressed) exabytes in 2000, and to 65 (optimally compressed) exabytes in 2007. This is the informational equivalent of two newspaper pages per person per day in 1986, and six entire newspapers per person per day by 2007. Given this growth, telecommunications play an increasingly important role in the world economy and the global telecommunications industry was about a \$4.7 trillion sector in 2012. The service revenue of the global telecommunications industry was estimated to be \$1.5 trillion in 2010, corresponding to 2.4% of the world's gross domestic product (GDP).

The word telecommunication was adapted from the French. It is a compound of the Greek prefix tele- (τηλε-), meaning "distant", and the Latin *communicare*, meaning "to share". The French word *télécommunication* was first invented in the French

Grande Ecole "Telecom ParisTech" formerly known as "Ecole nationale supérieure des télécommunications" in 1904 by the French engineer and novelist Édouard Estaunié.

History

Greek hydraulic semaphore systems were used as early as the 4th century BC. The hydraulic semaphores, which worked with water filled vessels and visual signals, functioned as optical telegraphs. However, they could only utilize a very limited range of pre-determined messages, and as with all such optical telegraphs could only be deployed during good visibility conditions.

During the Middle Ages, chains of beacons were commonly used on hilltops as a means of relaying a signal. Beacon chains suffered the drawback that they could only pass a single bit of information, so the meaning of the message such as "the enemy has been sighted" had to be agreed upon in advance. One notable instance of their use was during the Spanish Armada, when a beacon chain relayed a signal from Plymouth to London that signaled the arrival of the Spanish warships.

Systems since the Middle Ages

A replica of one of Chappe's semaphore towers in Nalbach, Germany
In 1792, Claude Chappe, a French engineer, built the first fixed visual telegraphy system (or semaphore line) between Lille and Paris. However semaphore systems suffered from the need for skilled operators, and expensive towers at intervals of 10–30 kilometers (6–20 mi). As a result of competition from the electrical telegraph, Europe's last commercial semaphore line in Sweden was abandoned in 1880.

Telegraph and telephone History of the telephone

Experiments on communication with electricity, initially unsuccessful, started in about 1726. Scientists of including Laplace, Ampère, and Gauss were involved. A practical electrical telegraph was proposed in January 1837 by William Fothergill Cooke, who considered it an improvement on the existing "electromagnetic telegraph"; an improved five-needle, six-wire system developed in partnership with Charles Wheatstone entered commercial use in 1838. Early telegraphs used several wires connected to a number of indicator needles.

Businessman Samuel F.B. Morse and physicist Joseph Henry of the United States developed their own, simpler version of the electrical telegraph, independently. Morse successfully demonstrated this system on 2 September 1837. Morse's most important technical contribution to this telegraph was the simple and highly

efficient Morse Code co-developed with his associate Alfred Vail, which was an important advance over Wheatstone's more complicated and expensive system, and required just two wires. The communications efficiency of the Morse Code preceded that of the Huffman code in digital communications by over 100 years, but Morse and Vail developed the code purely empirically, with shorter codes for more frequent letters.

The first permanent transatlantic telegraph cable was successfully completed on 27 July 1866, allowing transatlantic electrical communication for the first time. An earlier transatlantic cable had operated for a few months in 1859, and among other things, it carried messages of greeting back and forth between President James Buchanan of the United States and Queen Victoria of the United Kingdom.

However that first transatlantic cable soon failed, and the project to lay a replacement line was delayed for five years by the American Civil War. The first transatlantic telephone cable (which incorporated hundreds of electronic amplifiers) was not operational until 1956, only six years before the first commercial telecommunications satellite, Telstar, was launched into space.

The conventional telephone now in use worldwide was first patented by Alexander Graham Bell in March 1876. That first patent by Bell was the master patent of the telephone, from which all other patents for electric telephone devices and features flowed. Credit for the invention of the electric telephone has been frequently disputed, and new controversies over the issue have arisen from time-to-time. As with other great inventions such as radio, television, the light bulb, and the digital computer, there were several inventors who did pioneering experimental work on voice transmission over a wire, who then improved on each other's ideas. However, the key innovators were Alexander Graham Bell and Gardiner Greene Hubbard, who created the first telephone company, the Bell Telephone Company in the United States, which later evolved into American Telephone & Telegraph (AT&T), at times the world's largest phone company.

The first commercial telephone services were set up in 1878 and 1879 on both sides of the Atlantic in the cities of New Haven, Connecticut, and London, England.