



Developing of Telecommunications

Evolution of Telecommunication Technology

- Today's telecommunication technologies have evolved from the earliest smoke signals to almost instant global transmission of large amounts of data.





Early Signaling and Telegraphy

- **Semaphore** - a type of signaling, in which visual cues represent letters or words.
- **Morse code** - the transmission of a series of short and long pulses (dots and dashes) that represented characters.
- **Duplexing** - simultaneously transmitting a signal in both directions along the same wire.
- **Multiplexing** - simultaneously transmitting an indeterminate number of multiple signals over one circuit.

Early Signaling and Telegraphy

- 1856 - Western Union Telegraph Company was founded.
- 1861 – Over two thousand telegraph offices operated across the United States.

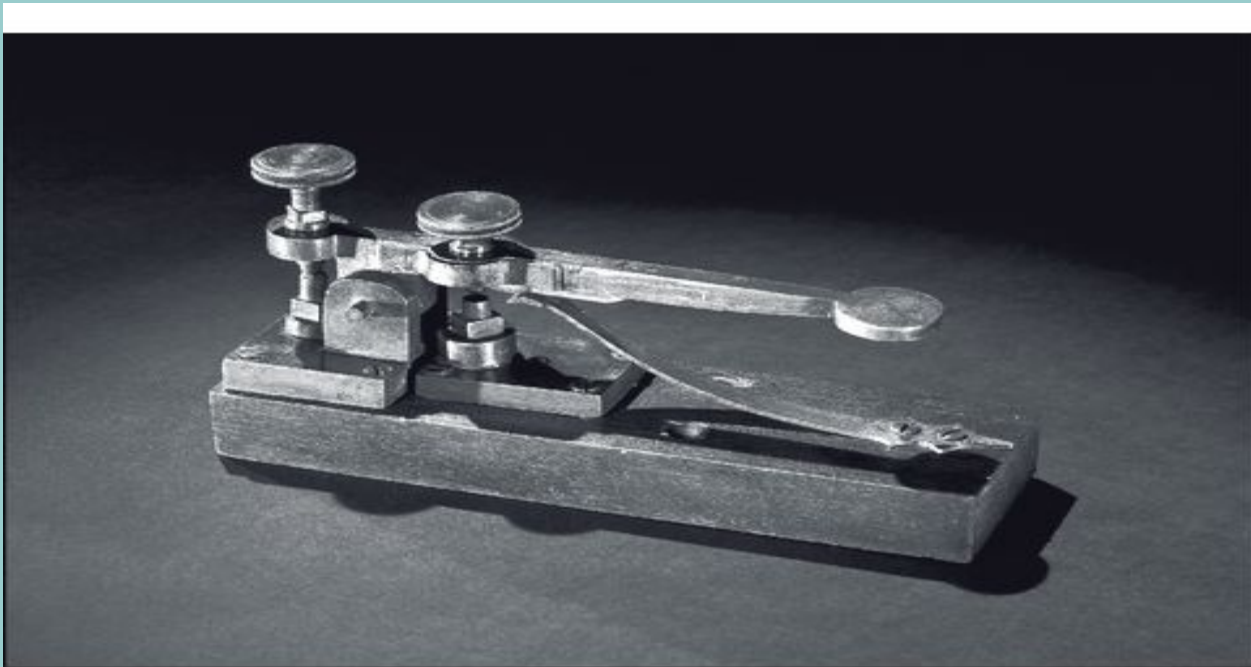


Figure 3-1 Telegraph key used to send Morse's famous telegraph message in 1844

Telephone Technology

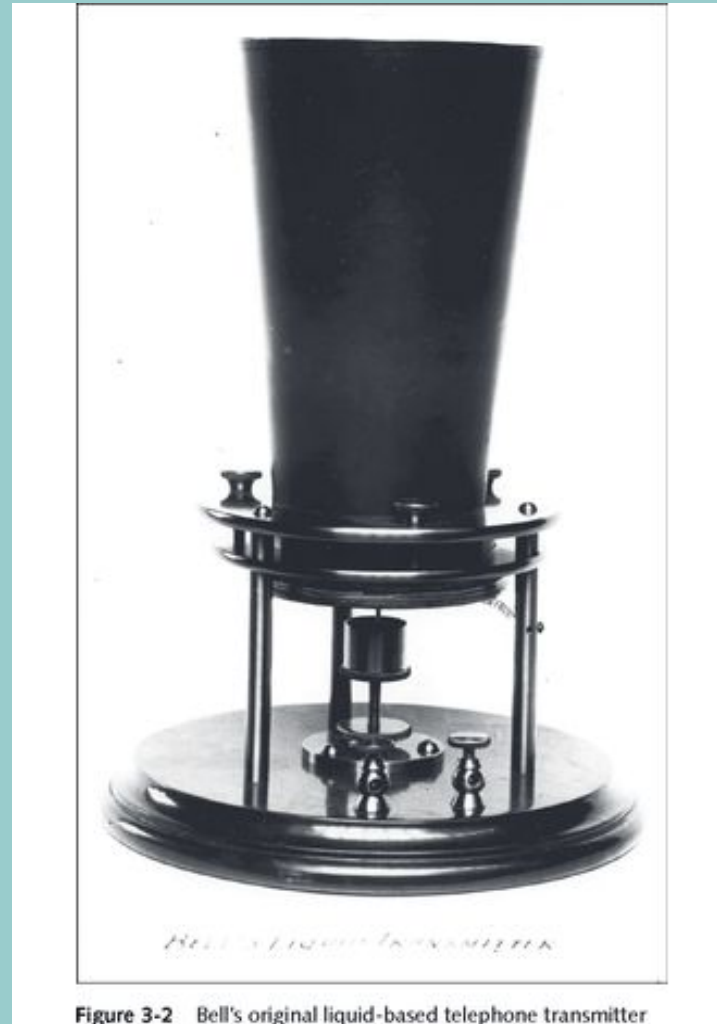


Figure 3-2 Bell's original liquid-based telephone transmitter

Telephone Technology



Figure 3-3 A turn of the century wall-mounted telephone



Infrastructure

- Wires criss-crossing cities and states and terminating in several exchanges or central offices.

Exchange was also known as a switching point because the device used to open and close a circuit is known as a switch.

- Operators would connect the circuits and complete the call for the subscriber.

Subscribers refers to a telephone company customer

Telephone Technology

- 1878- The first telephone exchange opened in New Haven, Connecticut.
- Connected 21 separate lines.



Figure 3-4 A telephone switchboard in 1885



Telephone Technology

- In 1889 Almon Strowger developed the automatic switch called the step-by-step.
- In 1896 he replaced the button-pushing method with a rotary dialer.



Telephone Technology

- In 1913, N.J. Reynolds, a Western Electric engineer, developed a better automatic switch, the **crossbar switch**. It used a grid of horizontal and vertical bars, with electromagnets at their ends. The horizontal bars could rotate up and down to connect to specific vertical bars and thus complete circuits.

Original version could complete 10 simultaneous connections.

By the 1970 a single crossbar could connect 35,000 connections.



Telephone Technology

- In the mid-20th century AT&T integrated electronics into crossbar switches
 - 1965 – first electronic switching system was used

Handled up to 65,000 two-way voice circuits.

Until 1970 all telephone switches depended on a continuous physical connection to complete and maintain the call.

Wireless Technology

- 1894- Italian physicist Guglielmo Marconi a method of transmitting electromagnetic signals through the air.

His invention relied on an induction coil.

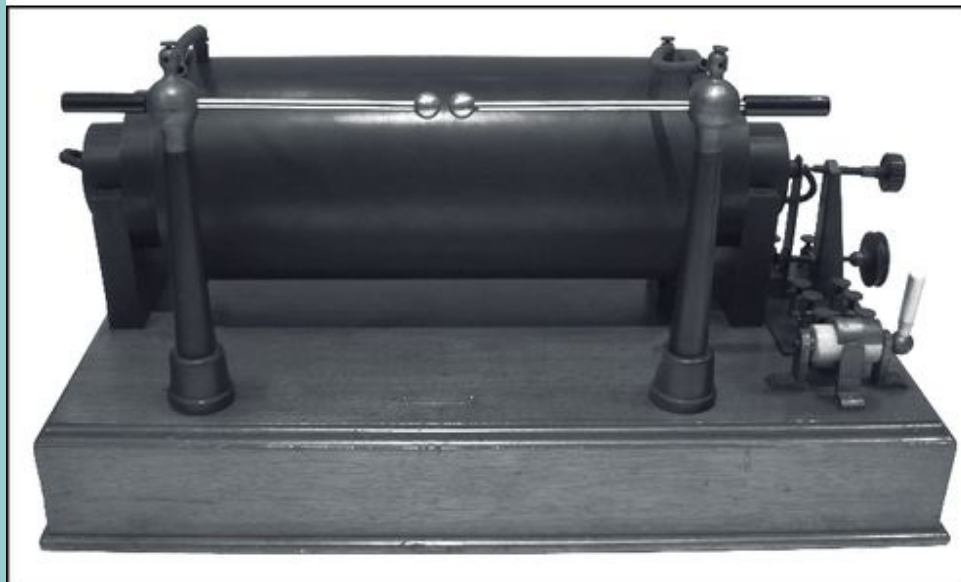


Figure 3-6 Marconi's induction coil radio transmitter



Early Computing

- **1822- Charles Babbage** “father of computing”
- **Computing** - the automatic manipulation of input based on logical instructions.
- **Difference engine** - an English mathematics professor, proposed an automated calculating machine as large as a locomotive and powered by steam.
- Herman Hollerith - used his punch card invention to found the Tabulating Machine company which later became known as International Business Machines (IBM).

Early Computing

- **Electronic Numerical Integrator and Computer (ENIAC)** - a multipurpose computer so large that it required its own 30 foot by 50 foot room.
- ENIAC was first used to assist with ballistics calculations.



Figure 3-8 The ENIAC computer



Early Computing

- **Memory** - in the mid-1940s, a U.S. scientist named Jon Von Neumann designed a computer that was capable of retaining logical instructions for use at any time, even after the computer had been turned off, then on again.
- **UNIVAC (Universal Automatic Computer)** - the first computer designed for business (and not merely scientific purposes), became available in 1951.

Early Computing



Figure 3-9 The UNIVAC computer

Challenging the Monopoly



Figure 3-10 The Hush-a-phone telephone attachment