Channels

- A communication channel, or channel, refers either to a physical transmission medium such as a wire, or to a logical connection over a multiplexed medium such as a radio channel.
- A channel is used to convey an information signal, for example a digital bit stream, from one or several senders to one or several receivers.
- A channel has a certain capacity for transmitting information, often measured by its bandwidth in Hz or its data rate in bits per second.

Channels

- Transmission media (channels) are classified as one of the following:
  - Guided (or bounded)—waves are guided along a solid medium such as a transmission line.
  - Wireless (or unguided)—transmission and reception are achieved by means of an antenna.
- Guided transmission media -- the waves are guided along a physical path
  - phone lines, twisted pair cables, coaxial cables, and optical fibers
- Wireless transmission media -- transmission of data without the use of physical means to define the path it takes.
  - microwave, radio or infrared

Channels

- A transmission may be simplex, half-duplex, or full-duplex.
  - In simplex transmission, signals are transmitted in only one direction; one station is a transmitter and the other is the receiver.
  - In the half-duplex operation, both stations may transmit, but only one at a time.
  - In full duplex operation, both stations may transmit simultaneously. In the latter case, the medium is carrying signals in both directions at same time.

Phone Lines

- A telephone line or telephone circuit is a single-user circuit on a telephone communication system.
- Refers to the physical wire or other signaling medium connecting the user's telephone apparatus to the telecommunications network.
- Typically made of copper (sometimes aluminium) and were carried in balanced pairs on poles above the ground, and later as twisted pair cables.

Twisted pair cables

- Twisted pair cabling is a type of wiring in which two conductors (the forward and return conductors of a single circuit) are twisted together for the purposes of canceling out electromagnetic interference (EMI) from external sources.
- It was invented by Alexander Graham Bell.
- The twisted pair can be shielded on unshielded (UTP).

Unshielded twisted pair (UTP)

- UTP cable is the most common cable used in computer networking.
- Modern Ethernet, the most common data networking standard, utilizes UTP cables.
- Twisted pair cabling is often used in data networks for short and medium length connections because of its relatively lower costs compared to optical fiber and coaxial cable.

Common cable categories

Category	Type	Applications
Cat1		Telephone and modem lines
Cat2		Older terminal systems,
Cat3	UTP	10BASE-T and 100BASE-T4 -- Ethernet
Cat4	UTP	16 Mbit/s – Token Ring
Cat5	UTP	100BASE-TX & 1000BASE-T -- Ethernet
Cat5e	UTP	100BASE-TX & 1000BASE-T -- Ethernet
Cat6	UTP	1000BASE-T -- Ethernet
Cat6e		Not a standard; a cable maker's own label.
Cat6a		10GBASE-T -- Ethernet
Cat7		Telephone,CCTV, 1000BASE-TX in the same cable.10GBASE-T -- Ethernet.
Cat7a		Telephone,CATV, 1000BASE-TX in the same cable.10GBASE-T -- Ethernet.
Cat8		Under development, no applications yet.

Twisted pair cables

- A solid core cable uses one solid wire per conductor.
  - Is supposed to be used for permanently installed runs.
  - More prone to failure if repeatedly flexed.
- Stranded conductor uses multiple wires wrapped around each other in each conductor.
  - For connections from wall-ports to end devices.
  - Generally more expensive than solid core.

Twisted pair cables

- Advantages
  - It is a thin, flexible cable that is easy to string between walls.
  - More lines can be run through the same wiring ducts.
  - UTP costs less per meter/foot than any other type of LAN cable.
  - Electrical noise going into or coming from the cable can be prevented.
  - Cross-talk is minimized.

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Twisted pair cables

- Disadvantages
  - Twisted pair's susceptibility to electromagnetic interference greatly depends on the pair twisting schemes staying intact during the installation – resulting in stringent requirements for maximum pulling tension as well as minimum bend radius – which makes the installation practices an important part of ensuring the cable's performance.
  - In video applications twisted pair cabling can introduce signaling delays known as skew causing ghosting and color defects. Can be prevented by changing cable lengths at the ends.

Coaxial cable

- Coaxial cable, or coax, is an electrical cable with an inner conductor surrounded by a flexible, tubular insulating layer, surrounded by a tubular conducting shield.
- The term coaxial comes from the inner conductor and the outer shield sharing the same geometric axis.
- Coaxial cable was invented by English engineer and mathematician Oliver Heaviside, who patented the design in 1880.

Coaxial Cable

- Coaxial cable is used as a transmission line for radio frequency signals.
  - Applications include feedlines connecting radio transmitters and receivers with their antennas, computer network (Internet) connections, and distributing cable television signals.
- In an ideal coaxial cable the electromagnetic field carrying the signal exists only in the space between the inner and outer conductors.
  - This allows coaxial cable runs to be installed next to metal objects such as gutters without the power losses that occur in other types of transmission lines.
  - Coaxial cable also provides protection of the signal from external electromagnetic interference.

Fiber-optic communication

- Fiber-optic communication is a method of transmitting information from one place to another by sending pulses of light through an optical fiber.
  - The light forms an electromagnetic carrier wave that is modulated to carry information.
  - First developed in the 1970s, fiber-optic communication systems played a major role in the advent of the Information Age.
  - Because of its advantages over electrical transmission, optical fibers have largely replaced copper wire communications in core networks in the developed world.

Optical Fiber

- Is a flexible, transparent fiber made of very pure glass (silica) not much wider than a human hair that acts as a waveguide, or "light pipe", to transmit light between the two ends of the fiber.
- Typically consists of a transparent core surrounded by a transparent cladding material with a lower index of refraction.
  - Light is kept in the core by total internal reflection.

Optical Fiber

- Fibers that support many propagation paths or transverse modes are called multi-mode fibers (MMF), while those that only support a single mode are called single-mode fibers (SMF).
  - Multi-mode fibers generally have a larger core diameter, and are used for short-distance communication links and for applications where high power must be transmitted.
  - Single-mode fibers are used for most communication links longer than 1,050 meters (3,440 ft).

Optical fiber cable

- An optical fiber cable is a cable containing one or more optical fibers.
- The optical fiber elements are typically individually coated with plastic layers and contained in a protective tube suitable for the environment where the cable will be deployed.
- Optical cables send data at 182,000 km/s, resulting in 5.5 ms of latency for each 1000 km. Thus the round-trip delay time is around 11 ms.