Transmission Medium

1. **Guided(Wired Media):**
    a. **Twisted Pair:** Two insulated copper wires twisted together to reduce electrical interference called crosstalk. Used for internal telephone wiring and short range LAN's.

    Advantage: Easy to install. Low weight and Less Expensive

    Disadvantage: High Attenuation and Noise, Low bandwidth so not suitable for broadband applications.

    b. **Co-Axial Cable:** A copper wire surrounded by insulating material, which is encased by conducting braided mesh. Conducting mesh is enclosed in a protective plastic sheet. Used for cable television networks.

    Advantage: higher bandwidth and better data transmission characteristics than Twisted Pair Cable. It can be used for broadband applications.

    Disadvantage: Expensive than Twisted Pair Cable

    c. **Optical Fiber:** Glass fibers are used as media to transmit the data in the form of light waves. The glass fibers are covered in plastic jackets. At the transmitting end of optical fiber, the laser or light emitting diodes are used and the receiving end has detectors to detect the signal.

    Advantage: Immune to electrical and magnetic interference, High transmission Capacity, Used for broadband applications.

    Disadvantage: Expensive, difficult to connect and install.

d. **Ethernet Cable:** LAN Architecture by Xerox corp. in association with DEC & Intel .It is used to directly connect two network devices such as modems, routers and adapters. It transmits data a very high speed using Ethernet protocol. It is commonly used for temporarily networking two devices in the absence of a network router, switch or hub. Computers that are part of Ethernet, have to install a special card called Ethernet Card. It has connections for Co-axial (BNC), twisted (RJ 45) or optical Fiber (AUI)

Summary of Cable Types

Characteristics	Twisted-Pair	Coaxial	Fiber-Optic	Wireless
Cost	Least	More	Expensive	Most Expensive
Maximum Length	100 meters	185 meters - 500 meters	>10 miles	2 miles
Transmission Rates	10 Mbps - 100 Mbps	10 Mbps	100 Mbps or more	10 Mbps

2. **Unguided (Wireless Media)**

a. **Microwaves:** Wireless media that uses microwaves to transmit data. Microwaves travel in straight line and cannot penetrate the metal structure. Sender and receiver require to be within line of sight. Microwave transmission can be terrestrial or through satellite. In case of terrestrial microwave high towers are installed with transmitter is accurately aligned in the direction of receiver on the other tower. Satellite microwave is used for long distance transmission. The earth station sends the signal to the satellite, which transmits it back to another earth station.

Advantage: Cheaper, Ease of communication over oceans and difficult terrains.
Disadvantage: Insecure communication, Limited bandwidth allocation, Propagation is affected by weather conditions like rain/ thunderstorm.

b. **Radiowaves:** Radio frequencies are available to business, private citizens for carrying voice signals over 10 miles of distance. Radio waves are omni directional and can penetrate solid walls or buildings easily. It has a transmitter and receiver both having antennas.
   Advantage: Cheaper, Ease of communication over difficult terrains.
   Disadvantage: Insecure communication, Limited bandwidth allocation, Propagation is affected by weather conditions like rain/ thunderstorm.

c. **Satellite :** It is a special case of microwave, It is used for long distance transmission. The earth station sends the signal to the satellite, which transmits it back to another earth station after amplifying it.
   Advantage: Large area coverage, Can be used for intercontinental communication
   Disadvantage: High investment cost , overcrowding of bandwidths.

d. **Infrared:** Short range communication 300 GHz to 400 THz (approx. 5 meters) e.g. TV Remote, cordless phones. It cannot penetrate solid walls or obstacles. It is only line of sight communication so only two devices can communicate at a time.

e. **Laser**: Highest most electromagnetic spectrum which can be used for data transmission is light or optical signaling. This is achieved by means of LASER. Laser works as Tx (transmitter) and photo-detectors works as Rx (receiver). Lasers cannot penetrate obstacles such as walls, rain, and thick fog.

f. **Bluetooth**: It is a wireless technology for creating personal networks operational within a range of 10 meters. It uses 2.4 GHz unlicensed band. It is used to create a PAN to transfer data between personal devices.