Transmission Media Overview

- Transmission Medium: Anything that carries information from a source to a destination.

- Types: Guided (wired) and unguided (wireless).

Guided Media

1. Twisted-Pair Cable

  - Structure: Two insulated copper wires twisted together.

  - Types:

    - Unshielded (UTP): Most common, used in LANs (e.g., 10Base-T).

    - Shielded (STP): Adds metal foil for noise reduction, but bulkier and costlier.

  - Connector: RJ45.

  - Applications: Telephone lines, Ethernet LANs.

2. Coaxial Cable

  - Structure: Central conductor (copper) with insulation, metallic shield, and plastic cover.

  - Connector: BNC.

  - Applications: Cable TV, analog/digital telephone networks, Ethernet LANs.

3. Fiber-Optic Cable

  - Structure: Core of glass/plastic, surrounded by cladding to guide light.

  - Propagation Modes:

    - Multimode: Multiple light beams (Step-index and Graded-index).

    - Single-mode: Single light beam, minimal distortion.

  - Connectors: SC, ST, MT-RJ.

- Applications: Backbone networks, hybrid networks (optical fiber + coax), Ethernet (100Base-FX, 1000Base-X).

- Advantages: High bandwidth, low signal attenuation, immune to electromagnetic interference, lightweight, secure.

- Disadvantages: Costly, unidirectional light, complex installation.

Unguided Media (Wireless)

1. Radio Waves

- Frequency Range: 3 kHz to 1 GHz.

- Characteristics: Omnidirectional, susceptible to interference.

- Applications: AM/FM radio, TV, cordless phones.

2. Microwaves

- Frequency Range: 1 to 300 GHz.

- Characteristics: Unidirectional, requires aligned antennas.

- Applications: Cellular networks, satellite communication, WLANs.

3. Infrared

- Frequency Range: 300 GHz to 400 THz.

- Characteristics: Short-range, cannot penetrate walls, no interference.

- Applications: Remote controls, short-range communication in closed spaces.

Switching Techniques

- Switching: Method to connect multiple devices efficiently in a network.
- Types:
  1. Circuit-Switched Networks:
     - Process: Connection setup, data transfer, teardown.
     - Efficiency: Resources dedicated for the entire connection; not efficient.
     - Delay: Minimal during data transfer; delay occurs during setup and teardown.
     - Application: Traditional telephone networks.
  2. Packet-Switched Networks:
     - Types: Virtual-circuit and Datagram networks.