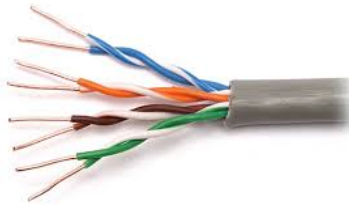


TRANSMISSION MEDIA, PROTOCOLS, CLASSIFICATION AND NETWORK TOPOLOGIES

Transmission media

- **Transmission media** are the physical or wireless channels that allow data transfer over a network.
- They are essential to establish communication between network devices.
 - Guided (wired) types:
 - **Twisted pair:** two copper wires twisted to reduce interference.



- **Coaxial cable:** a single central conductor surrounded by an insulator and a metal mesh.



- **Fiber optics:** glass or plastic filaments that use light to transmit data.



- Unguided (wireless) types:
 - **Radiofrequency:** communication through radio waves.
 - **Microwaves:** communication using high-frequency electromagnetic waves (used by satellite television).
 - **Infrared:** used in short-range devices such as remote controls.
- Characteristics or factors affecting the performance of transmission media:
 - **Bandwidth:** maximum data transfer capacity.
 - **Transmission speed:** how fast data is transferred.
 - **Interference and noise:** can affect signal quality.

Communication protocols

- **Communication protocols** are a set of rules that govern how data is transmitted over a network.
- They allow devices to communicate in an orderly and secure manner.
- Common protocols:
 - **TCP/IP:** main internet protocol, guarantees reliable data transmission.
 - **HTTP/HTTPS:** used for web browsing.
 - **FTP:** file transfer protocol (deprecated because it is insecure, SSH is now used).
 - **SMTP/POP3/IMAP:** email protocols.

Network classification

- Classification according to geographical scope:
 - **PAN:** personal network, nearby devices (infrared, bluetooth, controls, sensors, portable devices, printers).
 - **LAN:** local network in a limited area (office, home). It is controlled by a router or a switch.
 - **CAN:** campus area network (government, university, business).
 - **MAN:** network that spans a city or region.
 - **WAN:** network that connects large geographical distances (cities between cities, countries).

NOTE: the Internet is the largest type of network.

NOTE: router and modem may be combined into a single unit called a “gateway” or “hub”.

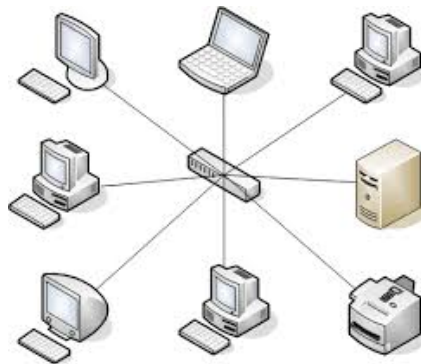
NOTE: ISP = Internet Service Provider.

NOTE: layer 2 in the OSI model works with a MAC address.

- Classification according to administration:
 - **Private networks:** access controlled by an organization.
 - **Public networks:** open to general access, such as the internet.
- Classification according to topology (physical or logical structure):
 - **Star:** a central node connects all devices.
 - **Bus:** all devices share a single channel.
 - **Ring:** devices are connected in a closed chain (serves as backups).
 - **Mesh:** all devices are connected to each other (they are very expensive but robust).

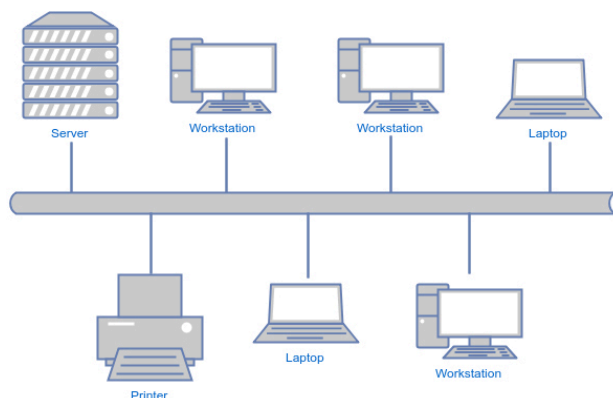
Network topologies

- **Network topology** defines how devices are organized and connected on a network.
- It can be physical (how they physically connect) or logical (how data flows).
- **Star topology:**
 - A central node (e.g. switch) connects all devices.
 - Advantages: easy to manage, failures in individual devices do not affect the network.
 - Disadvantages: If the central node fails, the entire network becomes inoperative.



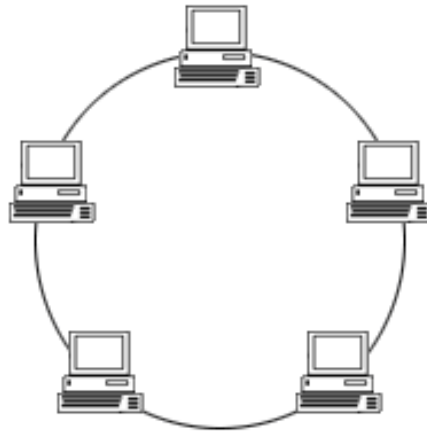
NOTE: cascading of star switches (up to 4 stars max.)

- **Bus topology:**
 - All devices share a single communication channel.
 - Advantages: simplicity and low cost.
 - Disadvantages: problems with data collisions and lower scalability.



- **Ring topology:**

- The devices are connected forming a closed loop.
- Advantages: unidirectional data flow that minimizes collisions.
- Disadvantages: a failure in one device can disrupt the entire network.



NOTE: applies the FIFO method; 2 network cards required; They are physically secure, not wirelessly; redundant system.