

COMPUTER NETWORKING

A Computer network is a connection of two or more computers via communication devices in order to share data and resources (printer, software, hard disk etc.). Computers on a network are called nodes or hosts.

Types of computer network

Local area network (LAN): This is a kind of network that involves connecting computers and other devices within a limited geographical local such as a building, school, or home. A Wireless LAN (WLAN) is similar to a LAN but uses wireless medium for connection.

Metropolitan Area Network (MAN): This network generally expands throughout a city such as cable TV. MAN can help an organization to connect all of its offices in a city.

Wide Area Network (WAN): This network covers a wide geographical area such as a country or even the world. Most WANs consist of two or more LANs that are connected by routers. Communication channels can include telephone systems, fiber optics, satellites, microwave etc. The largest WAN is the internet. Other variations include Personal Area Network (PAN), Campus Area Network (CAN), Home Area Network (HAN) etc.

Network architecture

Peer-to-peer: In this network, the computers connected together are called peers and each handles its security. Peer-to-peer networks are designed to satisfy the networking needs of home networks or of small companies that do not want to spend a lot of money on a dedicated server but still want to have the capability to share information or devices.

Client/Server: Computers (clients) are connected to a server. The server takes responsibility of storing clients' data and managing other computers (clients) in the network.

Network topology

Topology is the arrangement of nodes (computers) and other devices within a network. Topology can either be:

Physical topology: this is the actual layout of the computers and other connected devices.

Logical topology: this describes the logical pathway signal flow as it passes among the network nodes. It defines the way data passes among the nodes.

Types of topology

Bus topology: A bus topology uses one cable as a main trunk (or backbone) to connect all of the systems together. Both ends of the shared channel have line terminator. The data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.



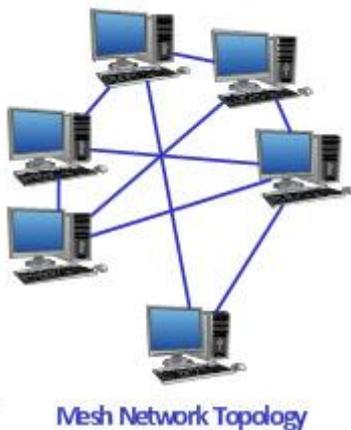
Star topology: In star topology, all computers are connected to a centralized device called a hub or a switch. All data that is transferred from one computer to the other must pass through the hub/switch.



Ring topology: In ring topology, each host machine connects to exactly two other machines, creating a circular network structure. When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts.



Mesh topology: In this type of topology, a host is connected to one or multiple hosts. This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection with few hosts only.



The other variation is the tree which a hybrid topology.

Click [here](#) for advantages and disadvantages of the network topologies

Transmission medium

- **Wired medium (guided medium):** physical cables (coaxial, twisted pairs, fiber optic cables).
- **Wireless medium (unguided medium):** infrared (IrDA), Wi-Fi, Bluetooth, Li-Fi, Satellite, Microwave

Twisted pair (TP) cables

Characteristics

- A twisted pair cable consists of two insulating copper wires arranged in a regular spiral pattern.

- A number of these pairs are bundled together into a cable by wrapping them into a tough protective sheath.
- Twisting decreases crosstalk interference between adjacent pairs in the cable
- Susceptible to interference and noise because of its easy coupling with electromagnetic fields.
- The standard connector is RJ45 (Register Jack 45)
- Most common in the telephone network
- Can either be Unshielded Twisted Pair (UTP) and Shielded Twisted Pair (STP)

Coaxial cable

Characteristics

- It consist of hollow outer cylindrical conductor that surround only a single inner wire conductor
- A single coaxial cable has a diameter of from 1 to 2.5cm
- Can be used over long distances
- Less susceptible to interference and crosstalk than TP.
- More expensive than twisted pair cable
- Connectors include BNC, BNC-T
- Used in Television distribution – cable TV, long distance telephone lines – NITEL wire, LAN – bus topology

Fiber optics

Characteristics

- Made up of glass or plastic and transmit signals in form of light.
- Glass or plastic core is surrounded by a cladding of less dense glass or plastic
- Can be single mode or multi-mode
- Outer jacket is made of Teflon or Polyvinylchloride (PVC)
- Best in terms of performance – can span longer distance and very low attenuation
- Immune to electromagnetic interference (it's not made of copper wire)
- Connectors include Subscriber channel (SC) connector, Straight –tip (ST) connector, MT-RJ connector

- They are used in long distance telecommunication link, found in backbone network and LAN.

Wireless Media

- **Infrared (IrDA):** This type of transmission is used for communication over short distances between sender and receiver that are within the line of sight.
- **Bluetooth:** Bluetooth technology uses radio waves to connect mobile devices such as phones, PDAs, computer etc. It has a limited transmission range of 10 meters.
- **Wi-Fi (Wireless Fidelity):** This is a technology that uses radio waves to provide high speed wireless connection between electronic devices based on the IEEE 802.11x standards.
- **Li-Fi (Light-Fidelity):** LI-Fi is a form of visible light communication system that uses common household LED (light emitting diode) light bulbs to enable data transfer, boasting speeds of up to 224 gigabits per second.
- **Microwave:** microwave signals are sent through space in the form of electromagnetic waves. Just like radio signals, they also must be sent in straight lines from one microwave station to another. To avoid interference, most microwave stations are built on mountain tops or placed on top of buildings.
- **Satellite:** communication satellites are placed in orbit 22300 feet above the earth surface. This allows the satellite to maintain a constant position above one point on the earth surface by rotating at the same speed as the earth.

Networking devices

- **Modem** (modulator-demodulator) – allows the computer to transmit data over analog telephone lines.
- **Network Interface Card (NIC)** – enables and controls the sending and receiving of data between the computers in a network.
- **Gateway:** A software or hardware that link two different types of network that use different protocols.
- **Bridges:** A bridge allows different networks to communicate with each other. However, in all connections with another network, the data packets that pass

between the networks must be in the same format. Because of this disadvantage, most modern networks use routers, instead of bridges.

- **Wireless Access Point (WAP)**- a device that connects wireless communication devices together to create a wireless network.
- **Switch** – an intelligent layer 2 networking device, that forwards data based on MAC (Media Access Control) address. Forward directly to the destination. One broadcast domain, multiple collision domain
- **Hub** – a layer one device used to connect many computers within a network. One broadcast domain, one collision domain.
- **Repeater** – repeats signals that are tending towards attenuation.
- **Router:** A router connects multiple networks and determines the fastest available path to send packets of data to their destination. though it is similar to bridges in by their basic function, routers have several advantages over a bridge because it manages data packets by:
 - Deciding where it is going and the best route to take
 - Deciding whether it should be transmitted or not
 - Formatting it so that it can be accessed by the receiving network.

Benefits of networking

- Information sharing- authorized users can access the computers on the network to share information and data. May include special database, blogs, fax, FTP, internet telephony, IM, chat rooms
- Hardware sharing – printer or scanner can be shared on a network.
- Software sharing – software can be installed on a server, all users can access the program on the central location.
- Collaborative environment – shared environment enables users to work together on group projects using capabilities of diverse equipment and software

Disadvantages

- Vulnerability to unauthorized access- hackers can access and steal or delete data
- Malicious code - networked computers are more vulnerable to virus, worms, spyware than stand-alone computer
- Network fault- problems to networking equipment can result in loss of data

- Setup and management cost - setting up a network requires investing in hardware and software and maintenance of the network requires the care and attention of IT professional.