

## Computer network

A computer network is a group of computer systems and other computing hardware devices that are linked together through communication channels to facilitate communication and resource-sharing among a wide range of users. Computers on a network may be linked through wired or wireless.

### Major components to do networking are

- Software's
  - ▶ NOS
  - ▶ Protocols
- Hardware's
  - ▶ Computers
  - ▶ Hub
  - ▶ Switches
  - ▶ Routers
  - ▶ NIC
  - ▶ Gateway

### Networks are used to:

- ▶ Facilitate communication via email, video conferencing, instant messaging, etc.
- ▶ Enable multiple users to share a single hardware device like a printer or scanner
- ▶ Enable file sharing across the network
- ▶ Allow for the sharing of software or operating programs on remote systems
- ▶ Make information easier to access and maintain among network users

### Advantages of computer N/w (network)

- ▶ **It enhances communication and availability of information.**
- ▶ **It allows for more convenient resource sharing.**
- ▶ **It makes file sharing easier.**
- ▶ **It is highly flexible.**
- ▶ **It boosts storage capacity.**
- ▶ **Backup and Recovery**

### Disadvantages of Computer N/w

- ▶ **It lacks independence.**
- ▶ **It poses security difficulties.**
- ▶ **It allows for more presence of computer viruses and malware.**
- ▶ **Its light policing usage promotes negative acts.**
- ▶ **It requires an expensive set-up.**

### The Networking Enterprises

- ▶ **Intranet**
  - An intranet is a private network that is contained within an enterprise.
  - It may consist of many interlinked local area networks and also use leased lines in the wide area network.
  - The main purpose of an intranet is to share company information and computing resources among employees.
  - An intranet can also be used to facilitate working in groups and for teleconferences.

▶ **Extranet**

- private network that uses Internet technology and the public telecommunication system to securely share part of a business's information or operations with suppliers, vendors, partners, customers, or other businesses.
- An extranet can be viewed as part of a company's intranet that is extended to users outside the company.
- It has also been described as a "state of mind" in which the Internet is perceived as a way to do business with other companies as well as to sell products to customers.

**Types of N/W**

▶ On the basis of area

- LAN
- MAN
- WAN

▶ On the basis of architecture

- Client-server
- Peer to peer

**LAN**

- **LAN or Local Area Network** links network devices in such a way that personal computer and workstations can share data, tools and programs in an a small geographical area.

**MAN**

- **MAN or Metropolitan area Network** covers a larger area than that of a LAN and smaller area as compared to WAN.
- It connects two or more computers that are apart but resides in the same or different cities.

**WAN**

- **WAN or Wide Area Network** is a computer network that spans over a large geographical area.
- A WAN could be a connection of LAN connecting to other LAN's via telephone lines and radio waves.

## Comparison Chart

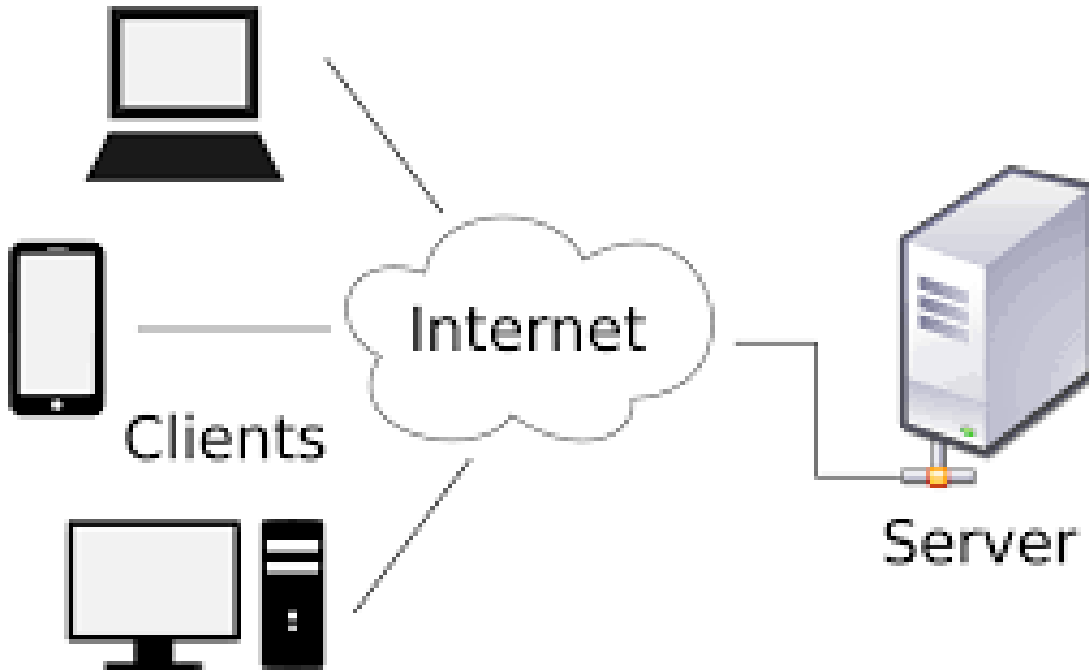
<b>BASIS OF COMPARISON</b>	<b>LAN</b>	<b>MAN</b>	<b>WAN</b>
Expands to	Local Area Network	Metropolitan Area Network	Wide Area Network
Meaning	A network that connects a group of computers in a small geographical area.	It covers relatively large region such as cities, towns.	It spans large locality and connects countries together. Example Internet.
Ownership of Network	Private	Private or Public	Private or Public
Design and maintenance	Easy	Difficult	Difficult

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Propagation Delay	Short	Moderate	Long
Speed	High	Moderate	Low
Fault Tolerance	More Tolerant	Less Tolerant	Less Tolerant
Congestion	Less	More	More
Used for	College, School, Hospital.	Small towns, City.	Country/Continent.
Allows	Single pair of devices to communicate.	Multiple computers can simultaneously interact.	A huge group of computers communicate at the same time.

#### Client/server architecture

- Client/server architecture is a computing model in which multiple components work in strictly defined roles to communicate.
- The server hosts, delivers and manages most of the resources and services to be consumed by the client.
- This type of shared resources architecture has one or more client computers connected to a central server over a network or internet connection.
- In a client/server architecture, the server acts as the producer and the client acts as a consumer.
- The server houses and provides high-end, computing-intensive services to the client on demand.
- These services can include application access, storage, file sharing, printer access and/or direct access to the server's raw computing power.



**Advantages**

- All files are stored in a central location
- Network peripherals are controlled centrally
- Backups and network security is controlled centrally
- Users can access shared data which is centrally controlled

**Disadvantages**

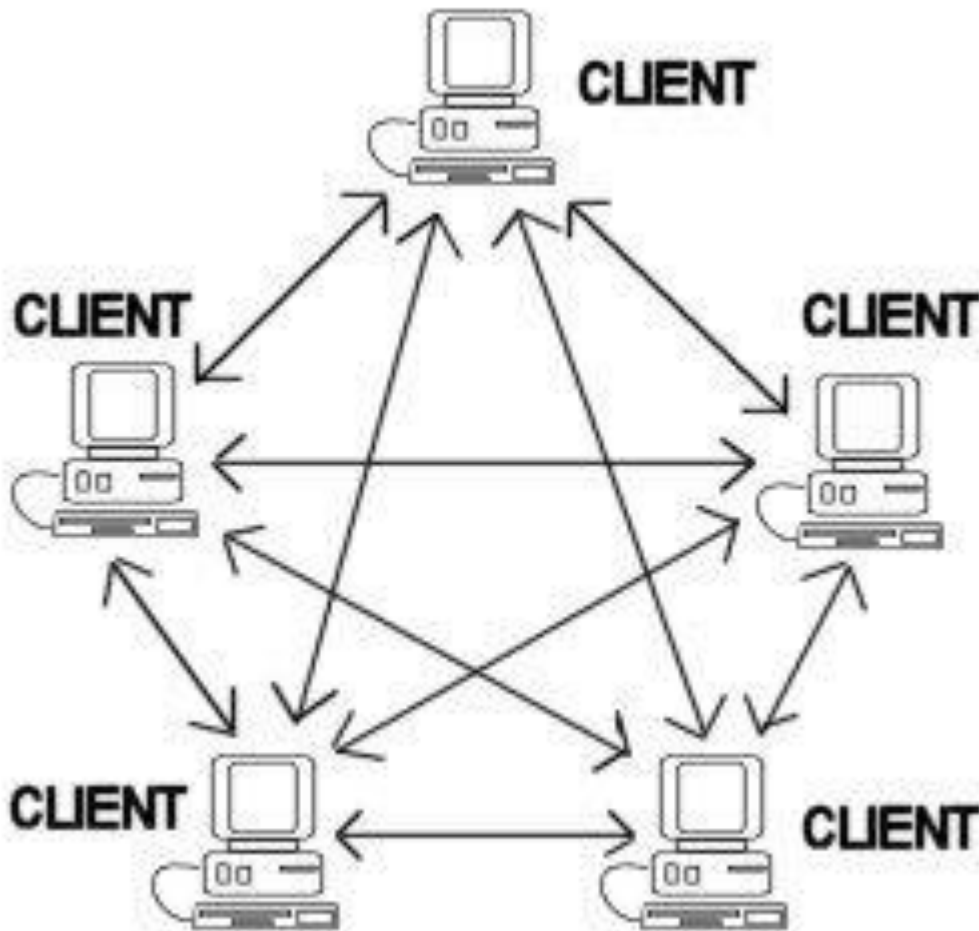
- A specialist network operating system is needed
- The server is expensive to purchase
- Specialist staff such as a network manager is needed
- If server fails a lot of disruption can occur

**Peer to peer network**

- Peer-to-peer architecture (P2P architecture) is a commonly used computer networking architecture in which each workstation, or node, has the same capabilities and responsibilities.
- It is often compared and contrasted to the classic client/server architecture, in which some computers are dedicated to serving others.
- P2P may also be used to refer to a single software program designed so that each instance of the program may act as both client and server, with the same responsibilities and status.
- P2P networks have many applications, but the most common is for content distribution.

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- This includes software publication and distribution, content delivery networks, streaming media and peer casting for multicasting streams, which facilitates on-demand content delivery.
- Other applications involve science, networking, search and communication networks.



### Advantages

- No need for a network operating system
- Does not need an expensive server because individual workstations are used to access the files
- No need for specialist staff such as network technicians because each user sets their own permissions as to which files they are willing to share.
- Much easier to set up than a client-server network - does not need specialist knowledge
- If one computer fails it will not disrupt any other part of the network.

### Disadvantages

- Because each computer might be being accessed by others it can slow down the performance for the user
- Files and folders cannot be centrally backed up

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- Files and resources are not centrally organized into a specific 'shared area'. They are stored on individual computers and might be difficult to locate if the computer's owner doesn't have a logical filing system.
- Ensuring that viruses are not introduced to the network is the responsibility of each individual user
- There is little or no security besides the permissions.

#### Difference b/w client server and peer to peer

S.NO	CLIENT-SERVER NETWORK	PEER-TO-PEER NETWORK
1.	In Client-Server Network, Clients and server are differentiated, Specific server and clients are present.	In Peer-to-Peer Network, Clients and server are not differentiated.
2.	Client-Server Network focuses on information sharing.	While Peer-to-Peer Network focuses on connectivity.
3.	In Client-Server Network, Centralized server is used to store the data.	While in Peer-to-Peer Network, Each peer has its own data.
4.	In Client-Server Network, Server respond the services which is request by Client.	While in Peer-to-Peer Network, Each and every node can do both request and respond for the <u>services.</u>
5.	Client-Server Network are costlier than Peer-to-Peer Network.	While Peer-to-Peer Network are less costlier than Client-Server Network.
6.	Client-Server Network are more stable than Peer-to-Peer Network.	While Peer-to-Peer Network are less stable if number of peer is increase.
7.	Client-Server Network is used for both small and large networks.	While Peer-to-Peer Network is generally suited for small networks with fewer than 10 computers.

#### Network Topologies and it's types

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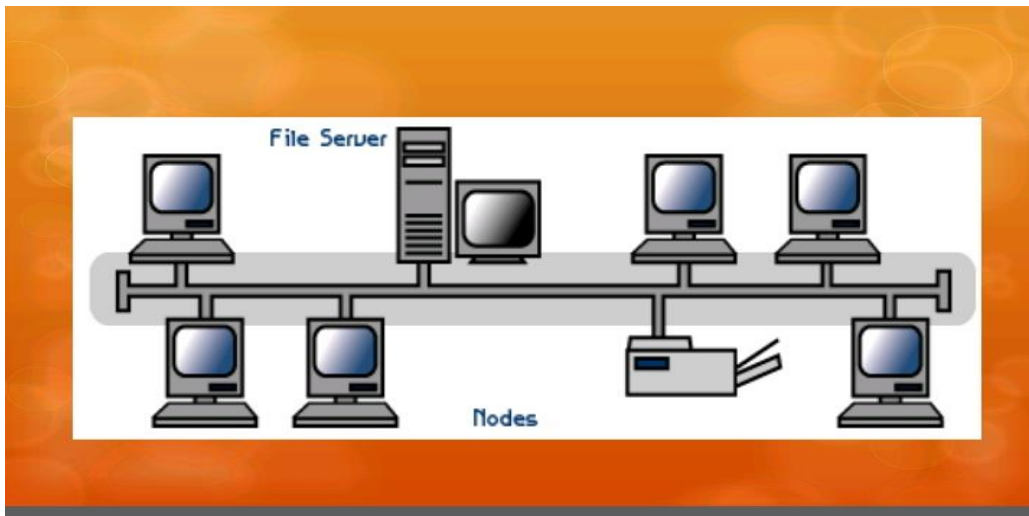
- Computers in a network have to be connected in some logical manner.
- The layout pattern of the interconnections between computer in a network is called network topology.
- You can think of topology as the virtual shape or structure of the network.
- Network topology is also referred to as 'network architecture'.

### Types of Topology

- Bus topology
- Ring topology
- Star topology
- Mesh topology
- Tree topology
- Hybrid topology

### Bus Topology

- In a bus topology all of the computer in a network are attached to a continuous or segment line.
- Bus topology uses one main cable to which all nodes are directly connected.
- The main cable acts as a backbone for the network.
- One of the computer in the network typically acts as the computer server.



#### ADVANTAGE

- It is a simple , reliable and easy to use and understand.
- Low cable requirement for connecting the nodes together.
- Lower cost.

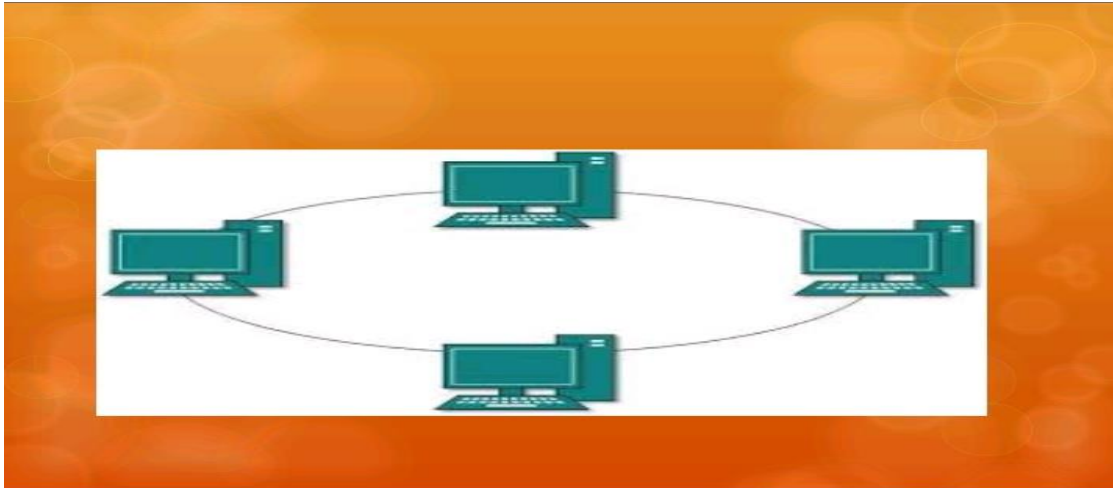
#### DISADVANTAGE

- It is difficult to troubleshoot a bus
- This type of topology is not used for large networks , such as those covering an entire building.
- Heavy network traffic can slow the performance of the bus.
- If the cable breaks the entire network goes down.



### Ring topology

- In this topology the computer in the network are connected in a circular fashion and the data travels in one direction.
- Each computer is directly connected to the next computer , forming a single pathway for singles through the network.
- It provides equal access for all the computer.
- This network need more cables.



### ADVANTAGE

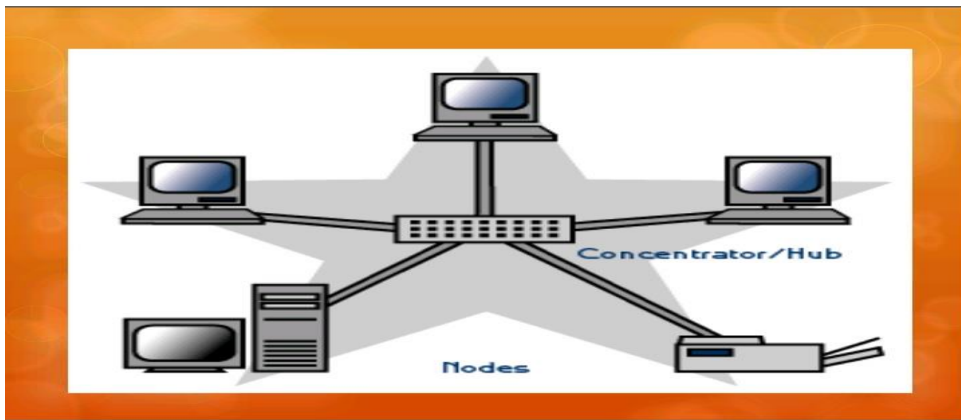
- Every computer has equal access.
- No monopoly in the network.
- This type of network is easy to install and manage.

### DISADVANTAGE

- Adding computer to this type network is more cumbersome .
- If one single computer fails, the entire network goes down.

### STAR TOPOLOGY

- In this topology all the cables , computer run from the central location which is known as hub.
- All the computer has equal access in the network.
- The central hub can be a computer server that manages the network , or
- It can be a much simpler device that only makes the connection between computer over the network possible.



**ADVANTAGE**

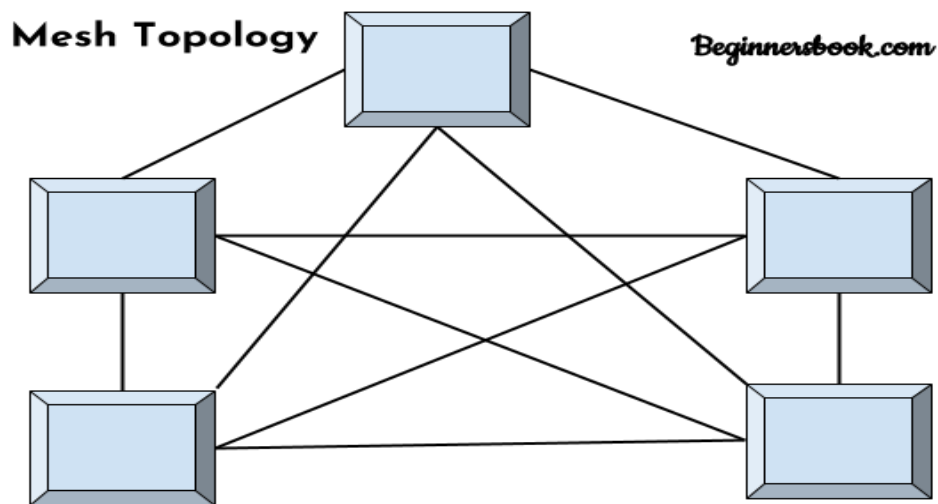
- Easy to add/remove computer from the network.
- Hub in this topology is easy to troubleshoot.
- Single computer failure doesn't interrupt the network.
- The startup cost are low.

**DISADVANTAGE**

- If the hub breaks down, the entire network goes down.
- Expensive as it needs more cables with the increase in the number of computer.

**MESH TOPOLOGY**

- It is a network where computer are connected to each other through intermediate nodes with redundant path.
- Between 2 computers there are multiple nodes which provides alternative path.
- In this topology every nodes has a direct point to point connection to every other nodes.



**ADVANTAGES**

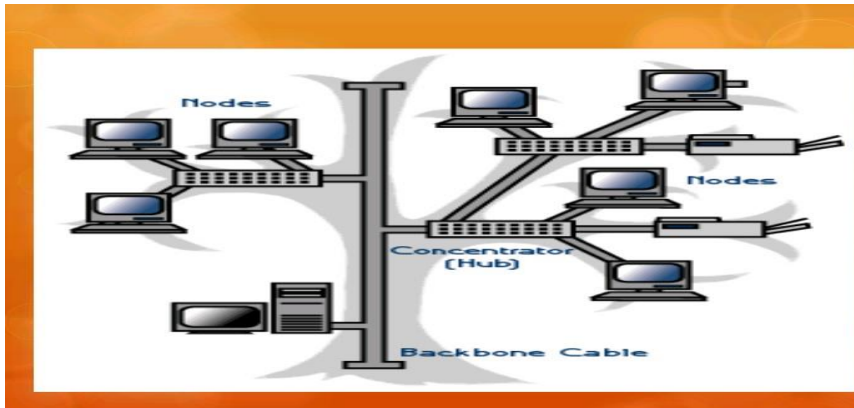
- It provides alternative way to send and receive data.
- It provides redundant path.
- If one computer or cable is break down it does not affect the entire network path.

DISADVANTAGE

- It needs more cabling.
- It is difficult to troubleshoot
- It does not guarantee delivery of data.

**TREE TOPOLOGY**

- In a tree topology each device is connected to its own port or hub just like a star topology.
- The computer are interconnected in hierarchical fashion.
- This topology is a special type of structure in which many connected elements are arranged like the branches of a tree



ADVANTAGE

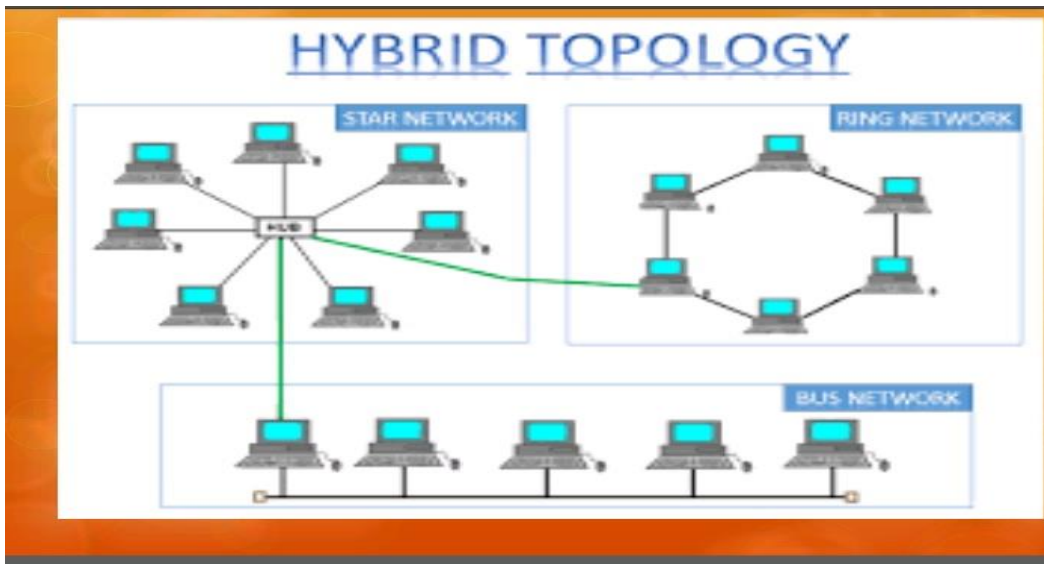
- Expansion of network is possible and easy.
- Error detected and correction is easy.
- If one segment is damaged, other segment are not affected.

DISADVANTAGE

- The entire network is dependent on the root.
- If there is failure in the root, the complete network breaks down.
- As more and more nodes and segments are added, the maintenance become difficult.

**HYBRID TOPOLOGY**

A hybrid topology is a type of network topology that uses two or more other network topologies, including bus topology , mesh topology, ring topology, star topology and tree topology.



**ADVANTAGE**

- It has far better fault tolerance.
- The weakness of the different topology connected are disregarded and only the strengths are taken into consideration.

**DISADVANTAGE**

- High cost.
- Due to the fact that different topologies connect in a hybrid topology , managing the topology gets challenging.

**Devices used in Networking**

**MODEM**

- Modem is a device that directly converts digital signal from a computer or other digital devices into analog form for transmission over analog link i.e telephone line and vice versa.
- MODEM stands for Modulation and Demodulation.
- There are two types of modem used in computer they are as follows:  
Internal modem and External modem.

**NIC**

- It is a Network Interface Card, which connects each computer to the wiring to the network.
- A NIC is a circuit board that fits in one of the computer's expansion slots.
- It provides a port on the back of the computer to connect in the network.

**HUB**

- Hubs are connectivity devices, which contain multiple ports for connecting to network components.
- Hubs connect the computers in a star topology.
- It lies between server and clients computers.

**BRIDGE**

- Bridge connects networks using same communications protocols or similar networks so that information can be passed from one to the other.

**GATEWAY**

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- Gateway connects networks using different communications protocols or dissimilar networks so that information can be passed from one to the other.

### **SWITCH**

- A device that capable of forwarding packets directly to the ports associated with particular network addresses.
- Hubs and switches are almost same but switch is new technology and intelligent compare to hub.

### **REPEATER**

- A device used on communications circuits that decrees distortion by amplifying or regenerating a signals so that it can be transmitted onward in its original strength and form as they pass through a network cable.

### **ROUTER**

- A router is a device that is used to connect different LAN in the network.
- It receives transmitted messages and forwards them their correct destinations over most efficient available route

### **NOS**

- The operating, which can support network environment, is called Network Operating System (NOS).
- For example Windows XP, 2000, server, unix, linux, Novel Netware etc.

### **Network Protocol(Communication Protocol)**

- A set of rules by which computers on the network communicate with each other is known as network protocol.
- The common protocols used on the network are:
  - TCP/IP (Transmission Control Protocol / Internet Protocol)
  - SMTP (Simple Mail Transfer Protocol)
  - FTP (File Transfer Protocol)
  - HTTP (HyperText Transfer Protocol)
  - POP (Post Office Protocol)
  - IPX/SPX (Internet Packet Exchange/Sequential Packet Exchange)
  - NetBEUI (NetBIOS Extended user interface)
  - AppleTalk
  - VOIP(Voice Over Internet Protocol)
  - HTTPs (HyperText Transfer Protocol Secured)
  - UDP(User Datagram Protocol)

### **Mode of communication**

#### **Simplex mode**

- Simplex is one-way data transmission that takes place only from sender to receiver.
- An example of this would be a television that allows the signal to pass in only one direction.
- Computer network connections do not use simplex.

#### **Duplex mode**

- Duplex is two-way data transmission that takes place both directions over a communication channel. Computer use duplex channel.

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- For example if computer A and computer B are connected together than both computer can share data or information.
- From computer A to computer B or computer B to computer A.

### **Types of duplex mode**

- **Half duplex**
  - Half duplex is two way data transmission that takes place in only one direction at a time. Eg walkie Talkie
- **Full duplex**
  - Full duplex is two-way data transmission that takes place in both directions at a time. Eg mobile communication, voice call, video-conferencing etc.