



# COMPONENTS OF DATA COMMUNICATION

Communication component

Protocol



Protocol



Sender



Message



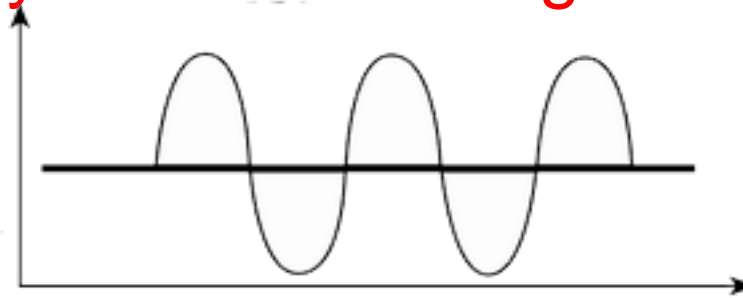
Receiver

Transmission media



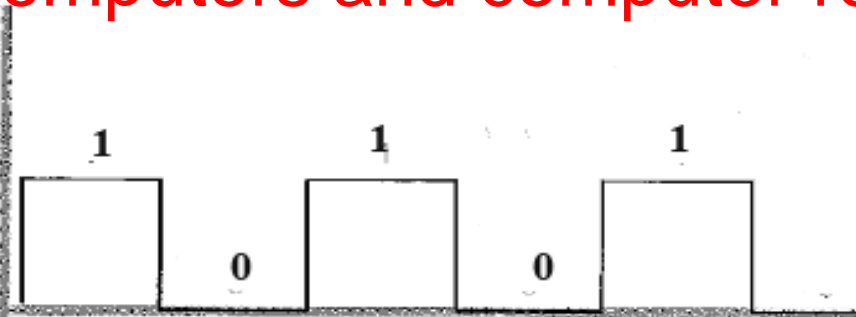
# ANALOG AND DIGITAL TRANSMISSION

- An **analog signal** is one that is continuous with respect to time and may take on any value within a given range of values. Eg Human voice.



Analog Wave Form

- A **digital signal** may take on only a discrete set of values within a given range. Most computers and computer related equipment is digital.



DIGITAL WAVE FORM

# **MODES OF TRANSMISSION**

# MODES OF TRANSMISSION

Data can be transmitted by following two ways : -

- **Simplex** also known as **Transmission**
- **Duplex** also known as **Communication.**

**Duplex** is classified into two formats

- **Half Duplex**
- **Full Duplex**

# MODES OF TRANSMISSION

➤ **Simplex-** It is one way data transmission. e.g pager, radio, T.V.



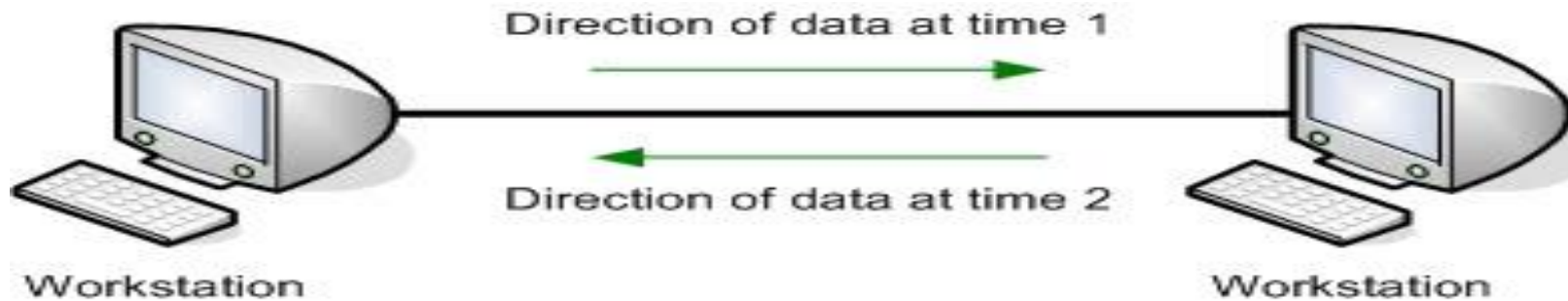
# MODES OF TRANSMISSION

➤ Duplex- It is two way data transmission. e.g WiFi , Li.Fi, Bluetooth.

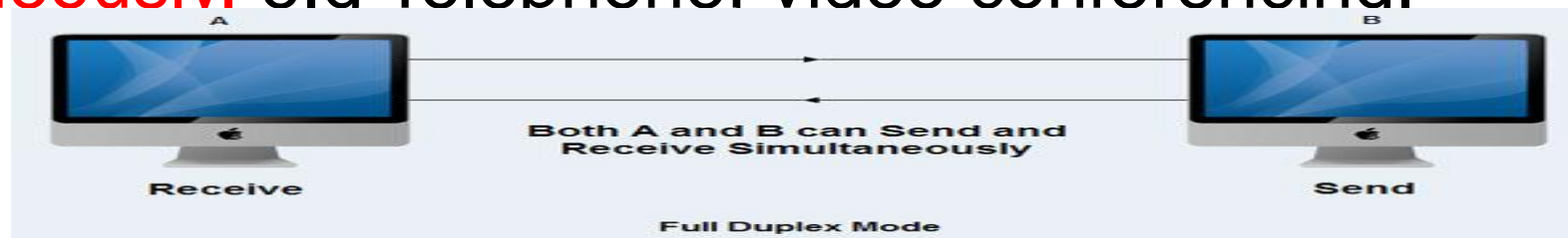


# MODES OF TRANSMISSION

- **Half-Duplex-** In Half- Duplex, each station can both transmit and receive but not at the same time. e.g:- Wireless, Walky-talky



- **Full-Duplex-** In Full-Duplex mode, data can be transmit and receive at the same time. It is a two way data communication simultaneously. e.g Telephone. video conferencing.





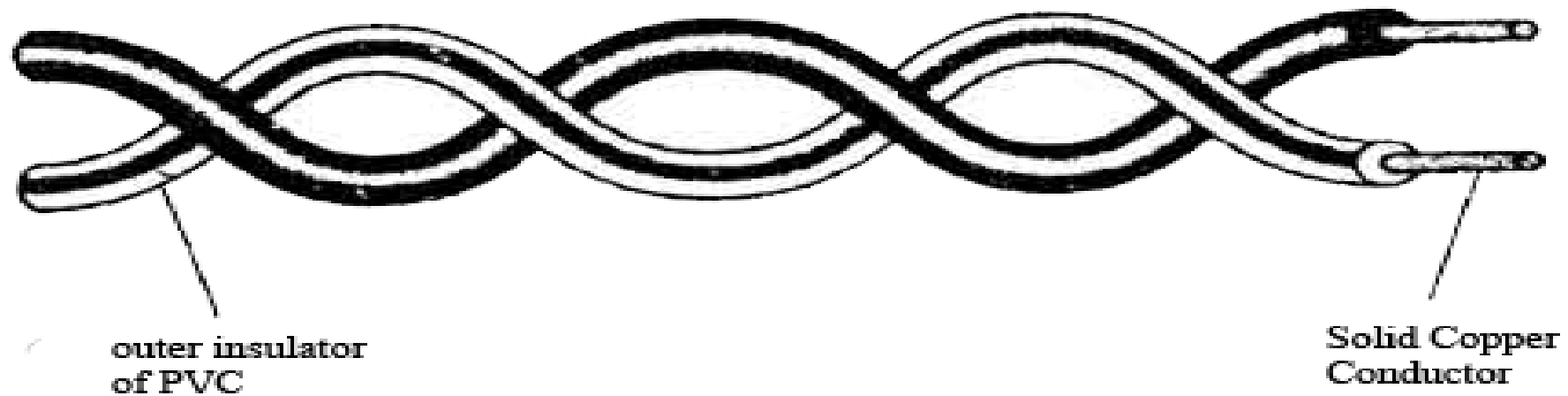
**COMMUNICATION MEDIUM**

# COMMUNICATION MEDIUM

- The most basic hardware is the media through which data is transferred.
- Types of Medium
  1. **Guided Medium OR Wired Medium**
  2. **Un-guided Medium OR Wireless**

# GUIDED MEDIA

- **Twisted pair cable-** A twisted pair consists of insulated conductors that are twisted together. It is used for communication up to distance of 1 K.M and can achieve transfer rate of 1-2 mbps. Twisted pair cable widely used in telephone network.



Twisted Pair Cable

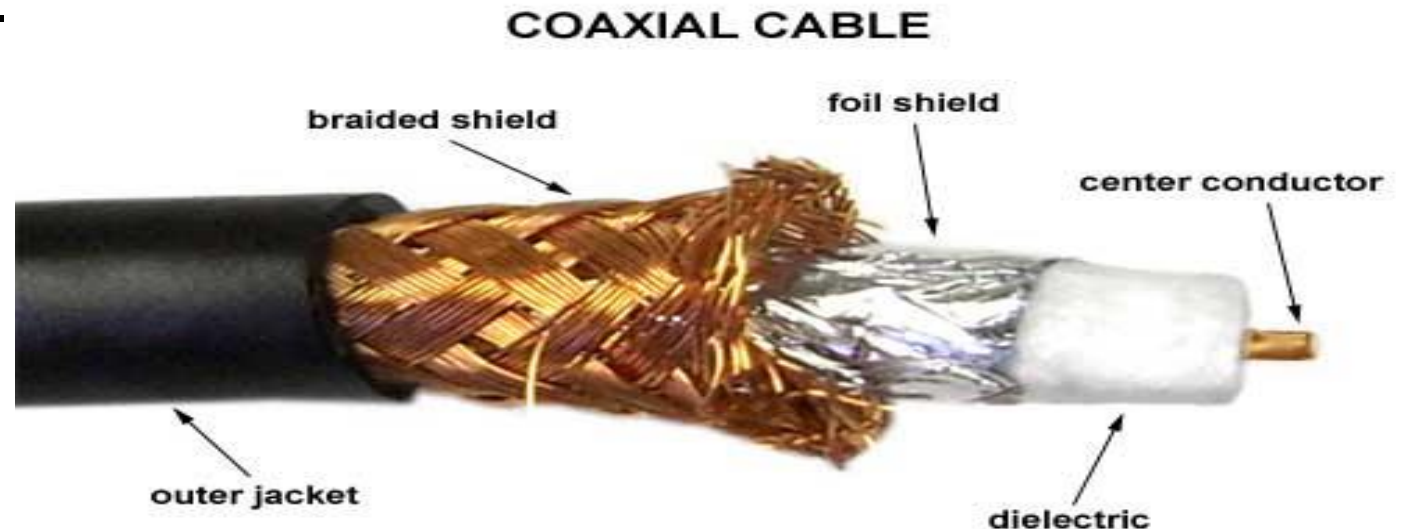
# GUIDED MEDIA

## ➤ Coaxial cable:

A coaxial cable consist of a solid conductor running coaxial inside a solid or braided outer annular conductor. A coaxial cable can be used over a distance about 1 KM and can achieve a transfer rate of up to 100 mbps.

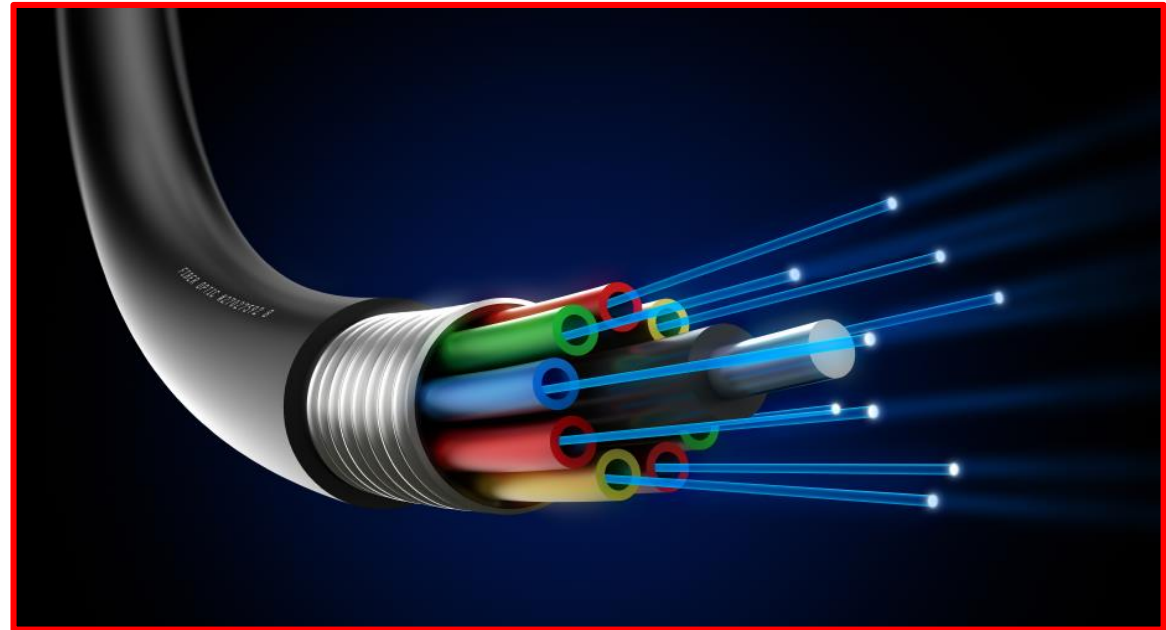
## ➤ Uses of coaxial Cable :-

- used by cable TV operator
- used in high speed broadband.



# GUIDED MEDIA

- Fiber optical cable- A Core fiber optical cable Carries signal in the form of fluctuating light in a glass or fiber .It has very high data transfer rates of about 101.7tbps over 100 mile,1370 different laser in a single pulse.



# UN-GUIDED MEDIA

- **Radio wave , microwave and satellite-** Radiowave, microwave, satellite channels use electromagnetic propagation in open space. It covers large geographical area. These are known as un-guided media.



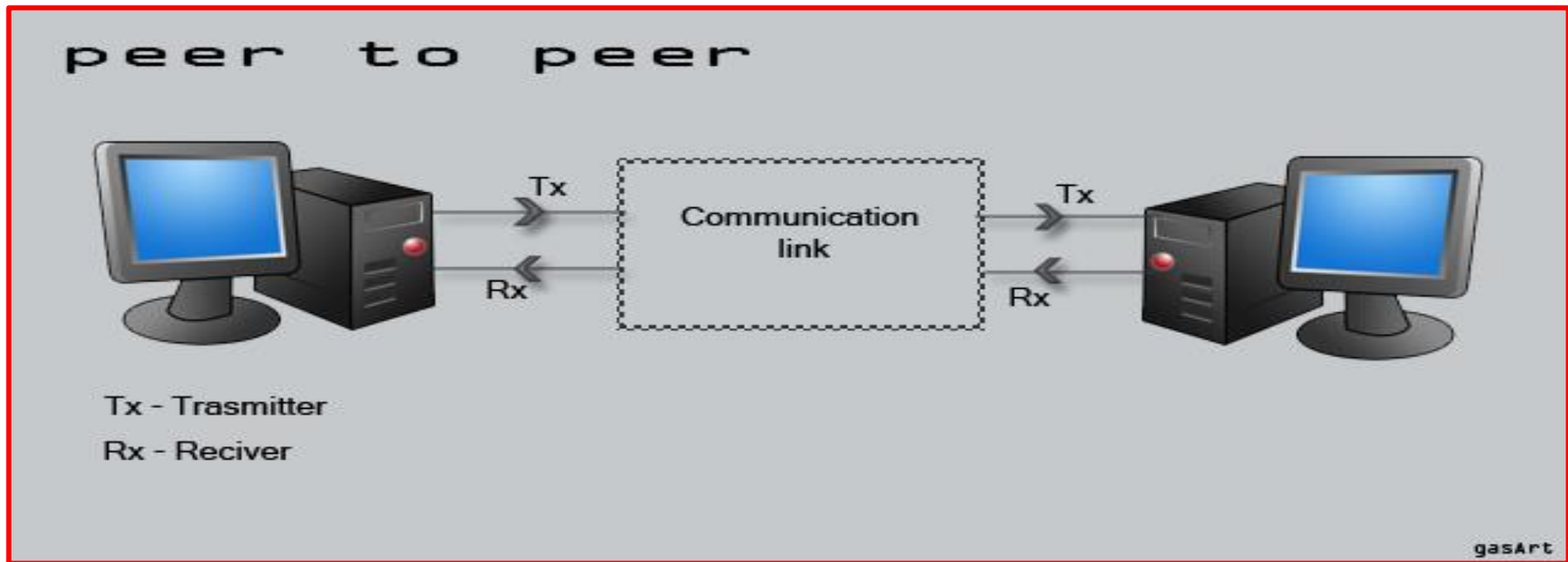
# NETWORK ARCHITECTURE

Network architecture is of two types :

- **Peer to Peer**
- **Client Server**

# NETWORK ARCHITECTURE

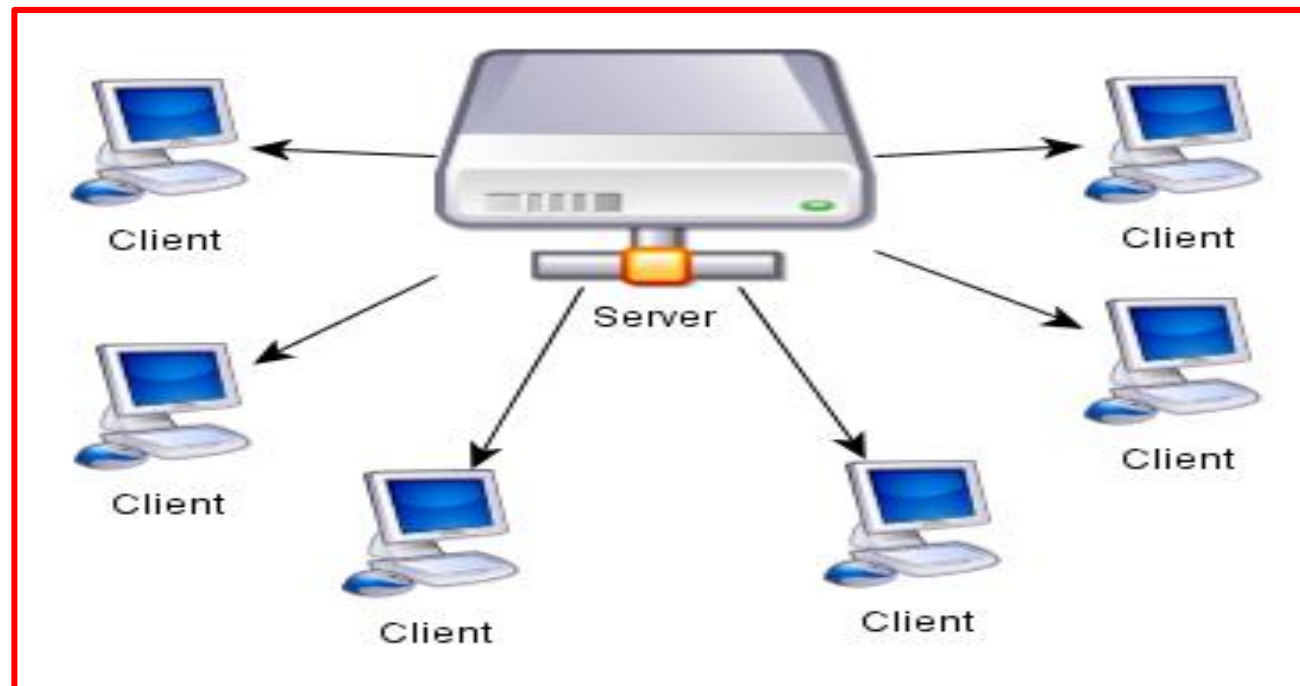
- **Peer to Peer-** It is a type of decentralized and distributed network architecture in which individual nodes in the network (called "peers") act as both suppliers and consumers of resources.
- In contrast to the centralized client–server model where client nodes request access to resources provided by central servers.





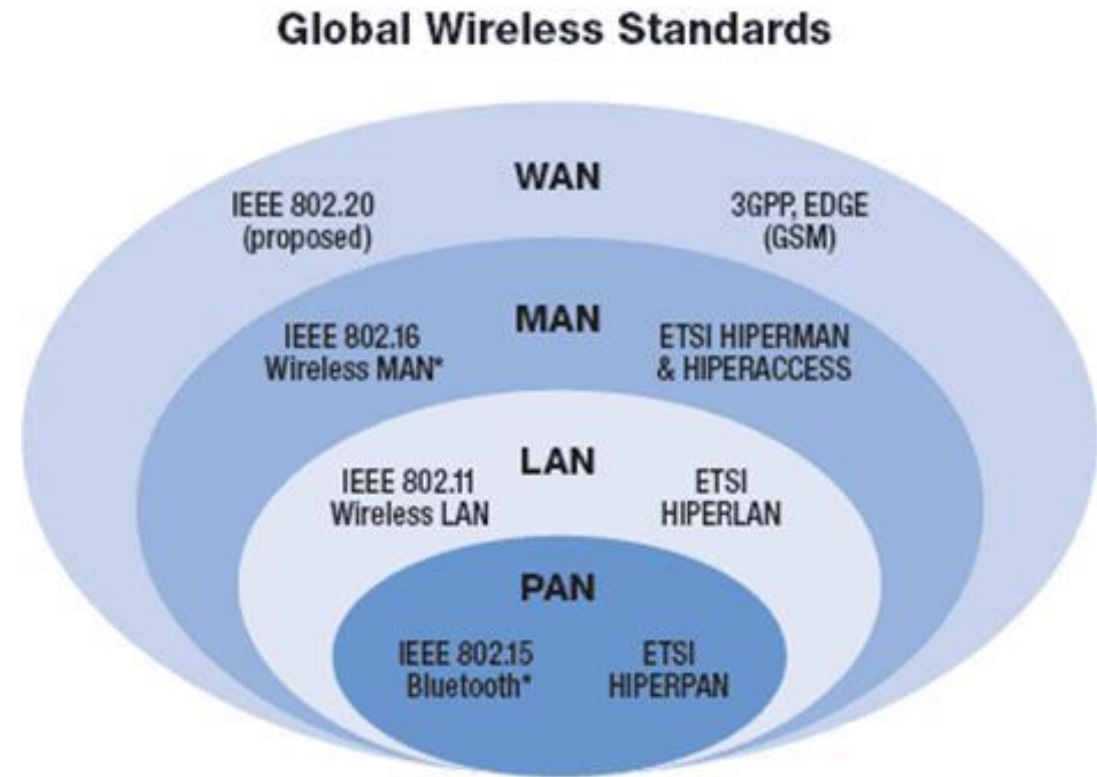
# NETWORK ARCHITECTURE

- **Client Server Architecture-** In communication networks, a node is a connection point. The device used to communicate a data communication network is called workstations.
- These workstation may be terminal, printer ,telephone in other communication devices. A workstation known as terminal, client or slave.



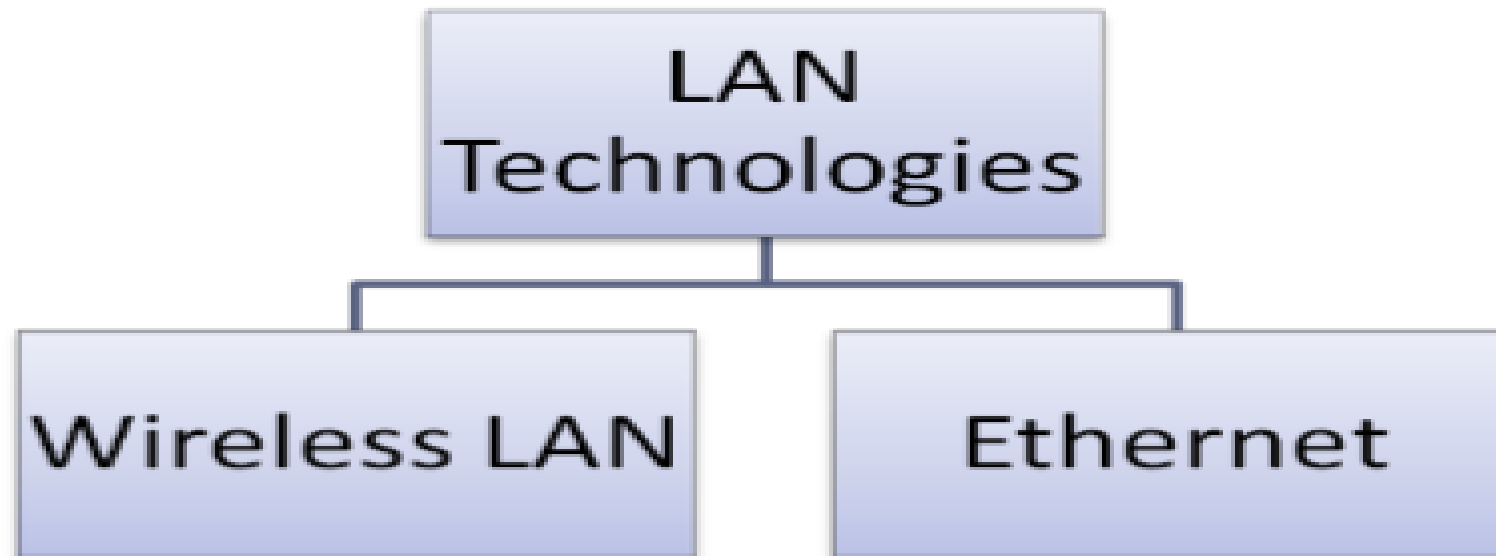
# CLASSIFICATION OF NETWORKS

- **LAN**(Local Area Network)
- **MAN**(Metropolitan Area Network)
- **WAN**(Wide Area Network)
- **PAN** (Personal Area Network)
- **CAN** (Campus Area Network)



# Local Area Network (LAN)

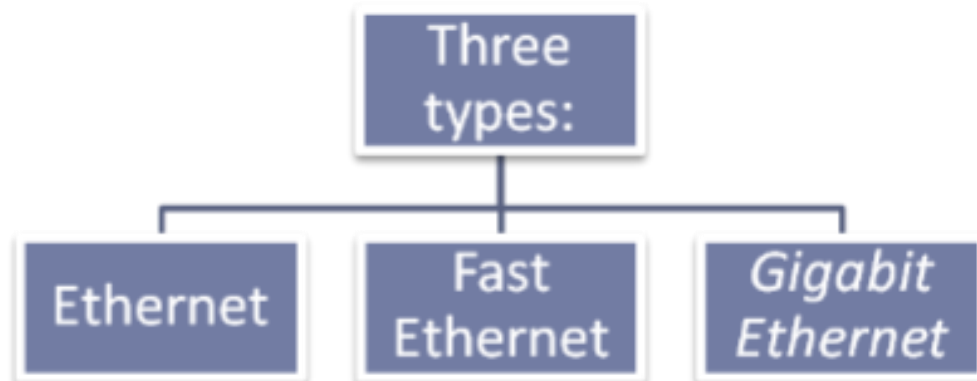
- small geographic area (e.g. room, office)
- controlled by one administrative authority
- usually high speed
- always shared



# COMMUNICATION DEVICES : LAN

## Ethernet

- standardized as IEEE 802.3
- IEEE (Institute of Electrical and Electronics Engineers)
- usually uses twisted pair cable ( CAT6 and CAT5E with RJ-45 Port)



# COMMUNICATION DEVICES : LAN

## Wi-Fi : Wireless fidelity

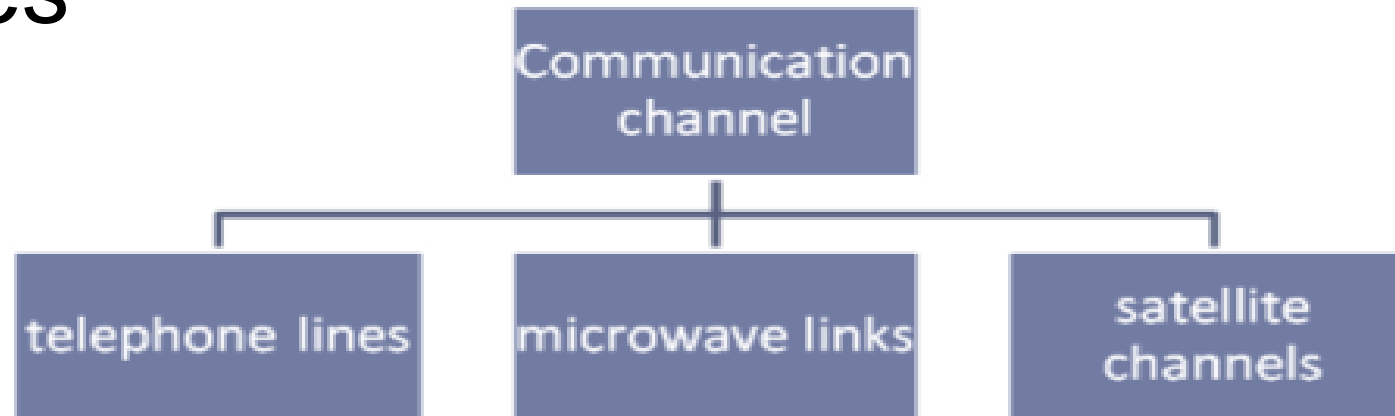
- Radio waves instead of cables
- **Four standards :**  
802.11a, 802.11b, 802.11g and 802.11n



802.11 standard version	RF Band (GHz)	Max Speed (Mbps)	Typical Speed (Mbps)	Approx. Indoor range (m)	Approx. Outdoor range (m)
a	5	54	25	40	100
b	2.4	11	6	70	150
g	2.4	54	25	80	200
n	2.4 or 5	600 (4x4 @	75 (1x1 @ 20	100	250

# Wide Area Network (WAN)

- computer network that covers a broad area
- crosses metropolitan, regional, or national boundaries



# **COMMUNICATION DEVICES**

# COMMUNICATION DEVICES : WAN

## Modem

- **Modem** stands for **Modulator demodulator**.
- Modem is a device which convert digital signals into analog signal and analog signal into digital signal.
- Types Of modem .
  - Internal modem
  - External moden





# COMMUNICATION DEVICES : WAN

## VSAT

- **VSAT** stands for **Very Small Aperture Terminal**
- It is a Satellite-based Wide Area Network (WAN), with centrally managed hub



# ROUTER

- **A router is a device that forwards data packets between computer networks, creating an overlay internetwork.**
- **A router is connected to two or more data lines from different networks.**



Three 10/100/1000 Mbps RJ-45  
Console AUX Management FE



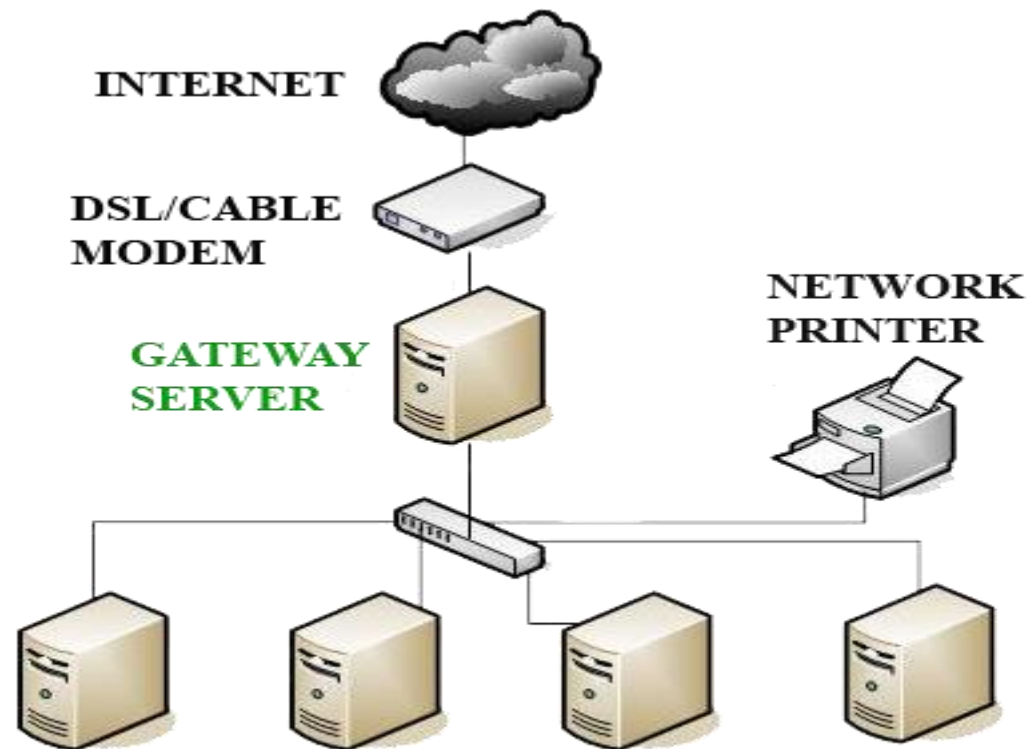
Three SFP Gigabit Ethernet Ports are available

USB

Compact  
Flash

# GATEWAY

- **A gateway is a network point that** acts as an interface to connect two different types of networks
- **It is used for** connecting two dissimilar networks



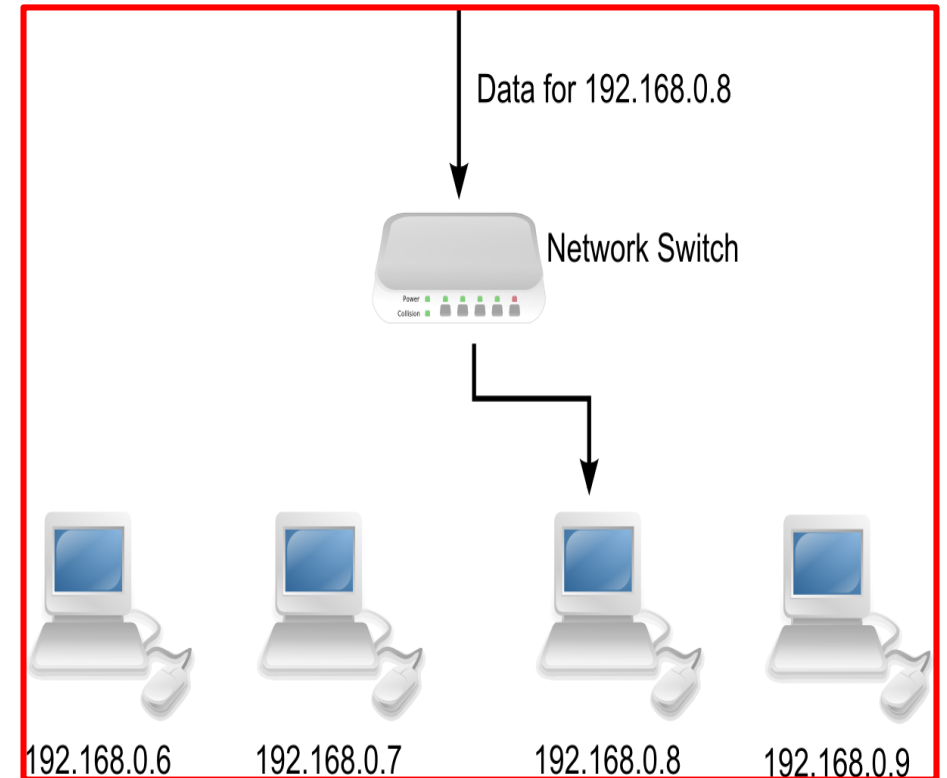
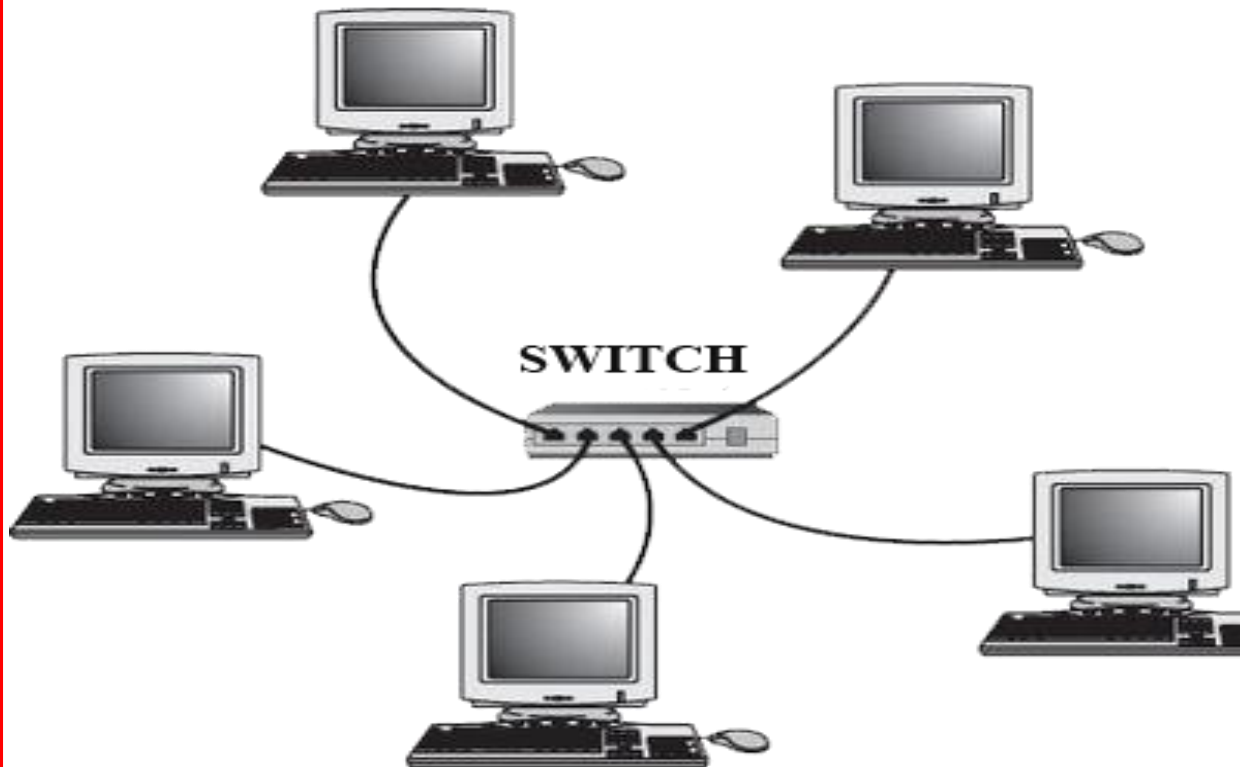
# HUB

- A common connection point for devices in a network. Hubs are commonly used to connect segments of a LAN.
- A **hub** contains multiple ports. When a packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets.



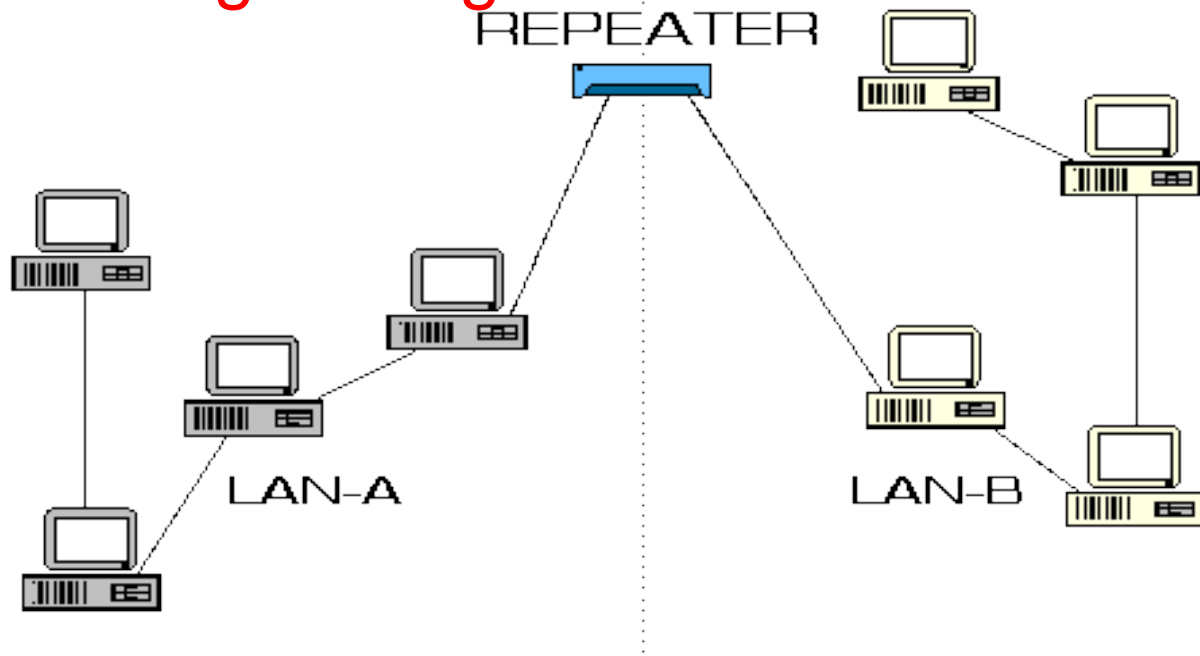
# SWITCH

- A **Network Switch** (sometimes known as a *switching hub*) is a computer networking device that is used to connect many devices together on a computer network.



# REPEATER

- **Network Repeaters** regenerate incoming electrical, wireless or optical signals. With physical media like Ethernet or Wi-Fi, data transmissions can only span a limited distance before the quality of the signal degrades.



# TOPOLOGY

➤ The topology of a network refers to the configuration of cables, computers, and other peripherals.

➤ Types of Topologies

➤ **Star Topology**

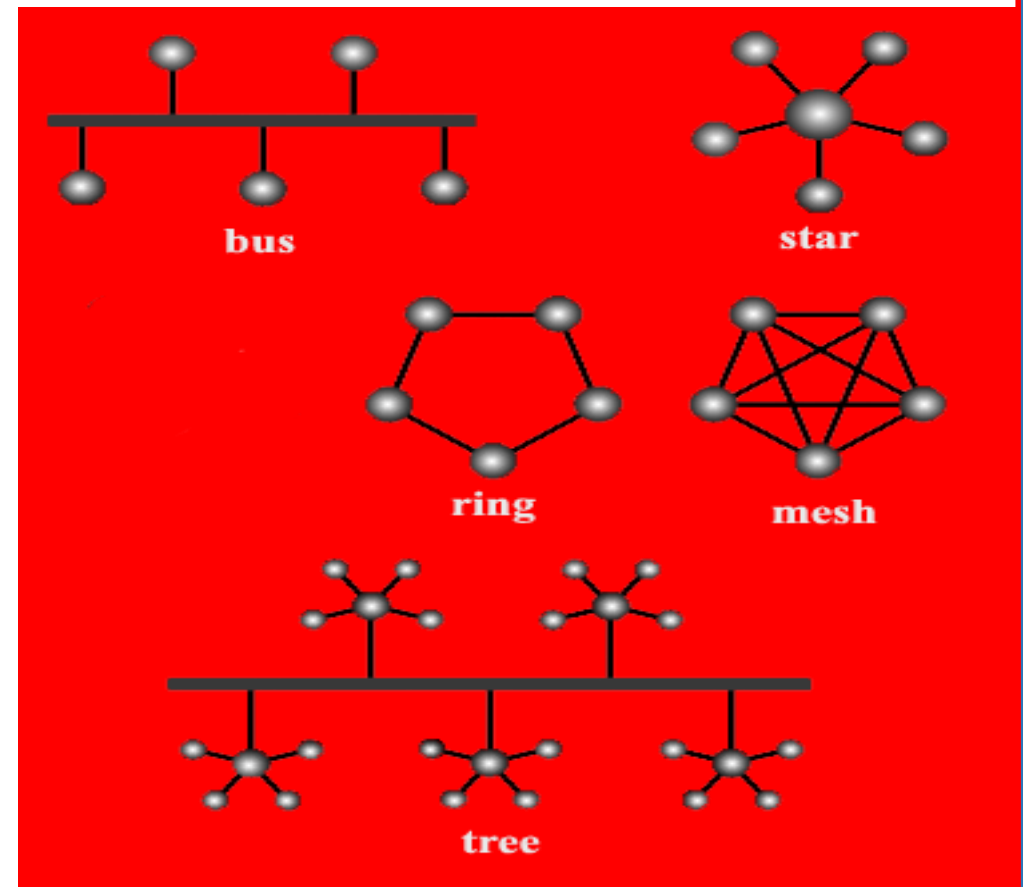
➤ **Ring Topology**

➤ **Bus Topology**

➤ **Mesh Topology**

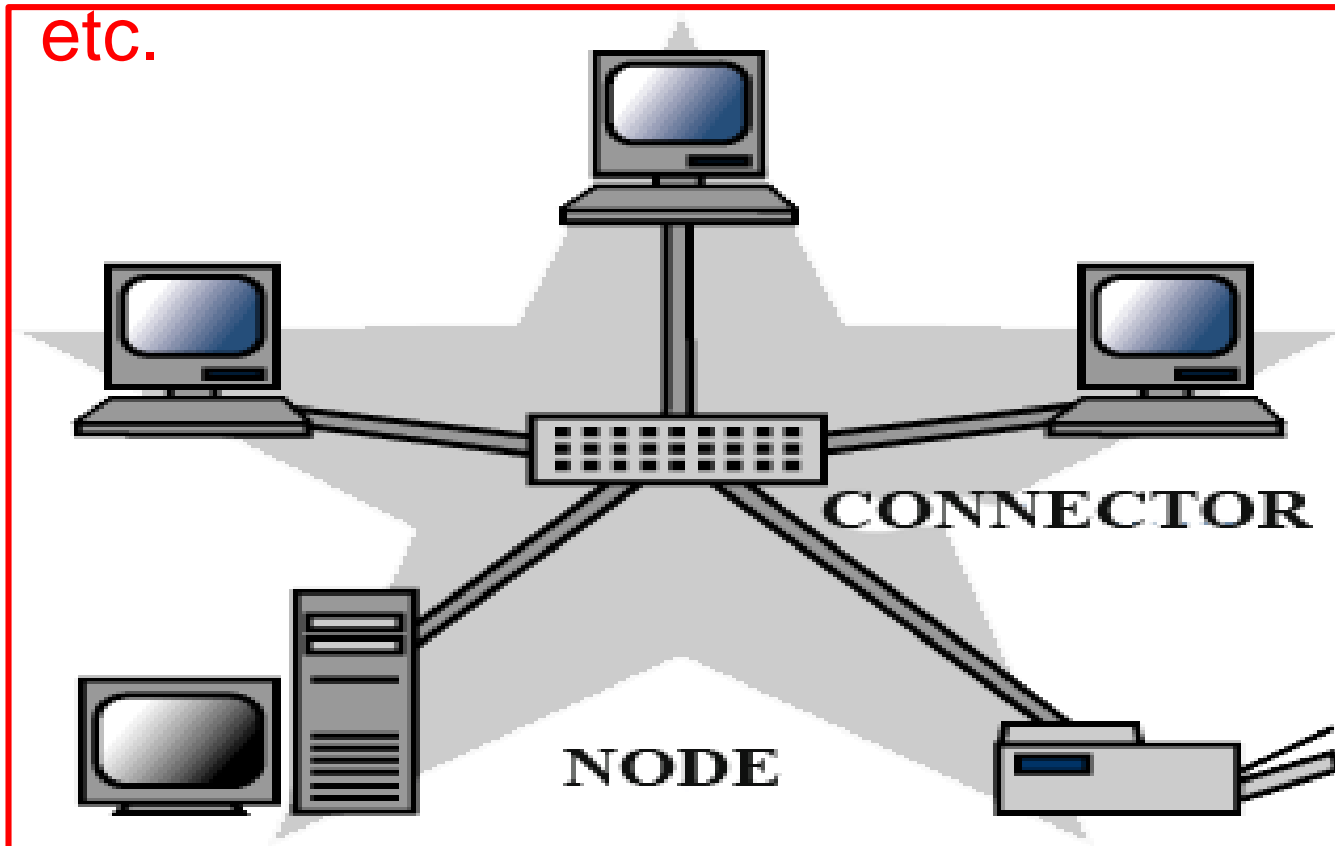
➤ **Tree Topology**

➤ **Hybrid Topology**



# STAR TOPOLOGY

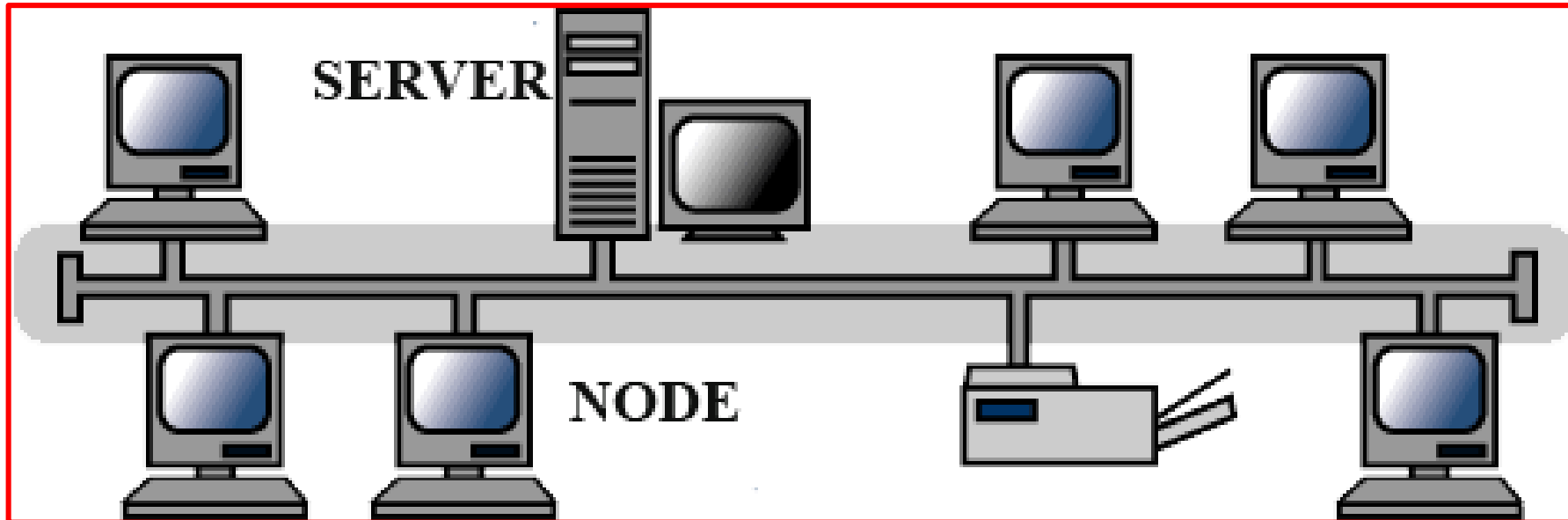
- A **star topology** is designed with each node (file server, workstations, and peripherals) connected directly to a central node hub, switch etc.





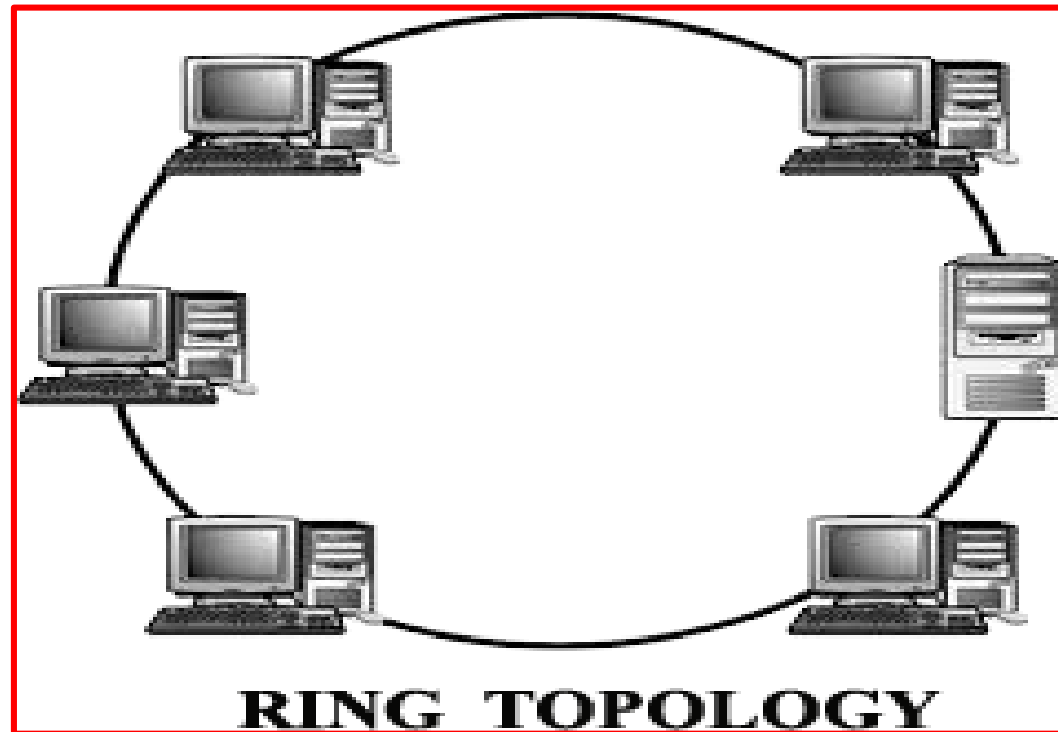
# BUS TOPOLOGY

- A **bus topology** is a type of network setup where each computer and network device is connected to a single cable or backbone.



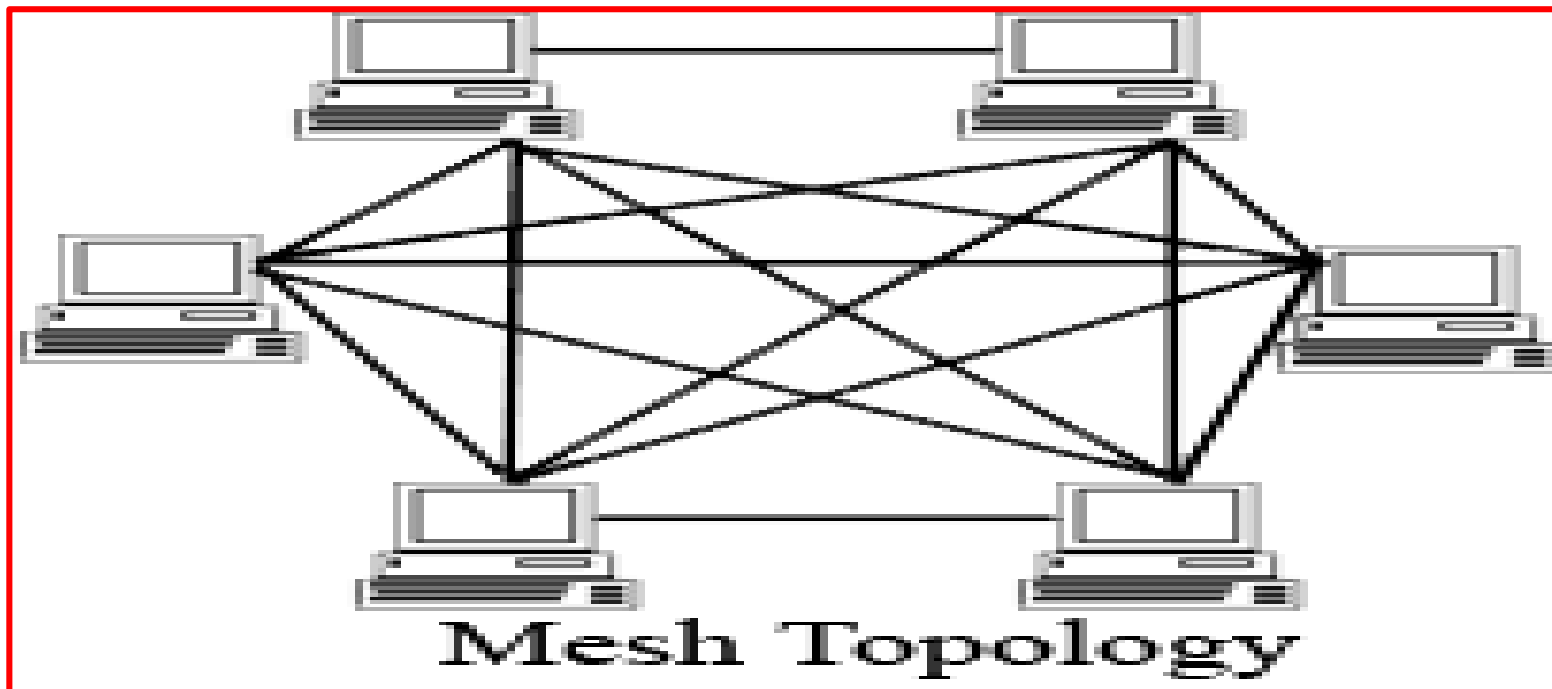
# RING TOPOLOGY

- The **ring topology** is a computer network configuration where each network computer and device are connected to each other forming a large circle (or similar shape).



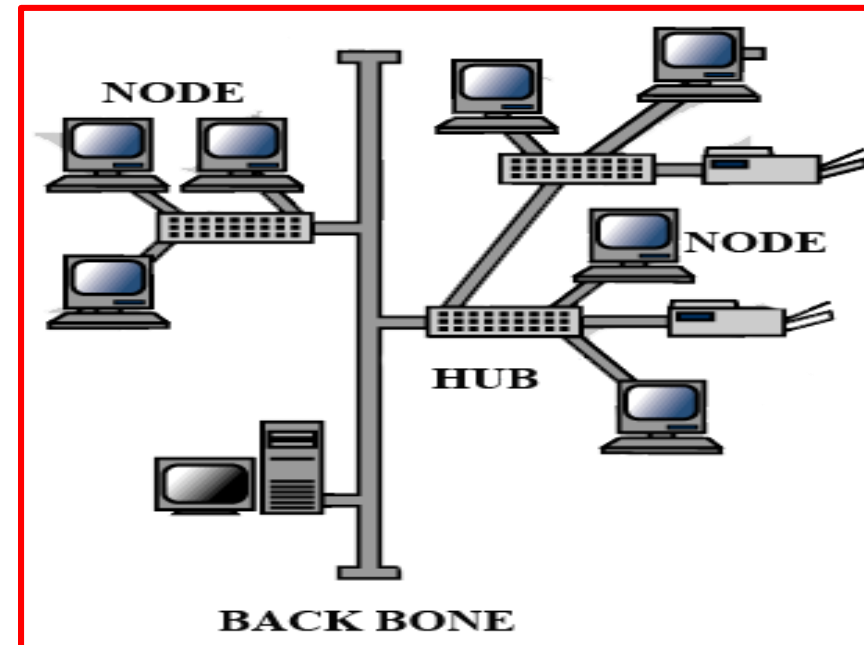
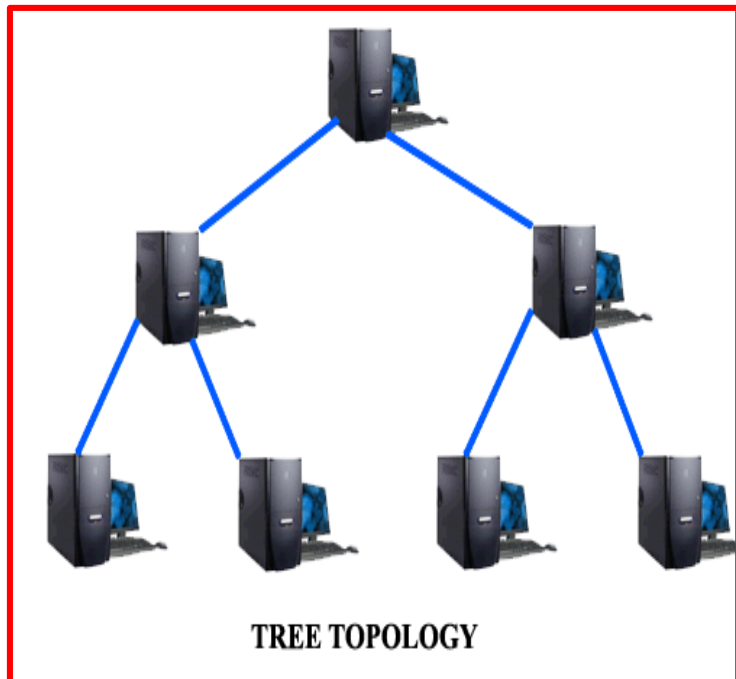
# MESH TOPOLOGY

- A network setup where each computer and network device is interconnected with one another, allowing for most transmissions to be distributed, even if one of the connections go down.



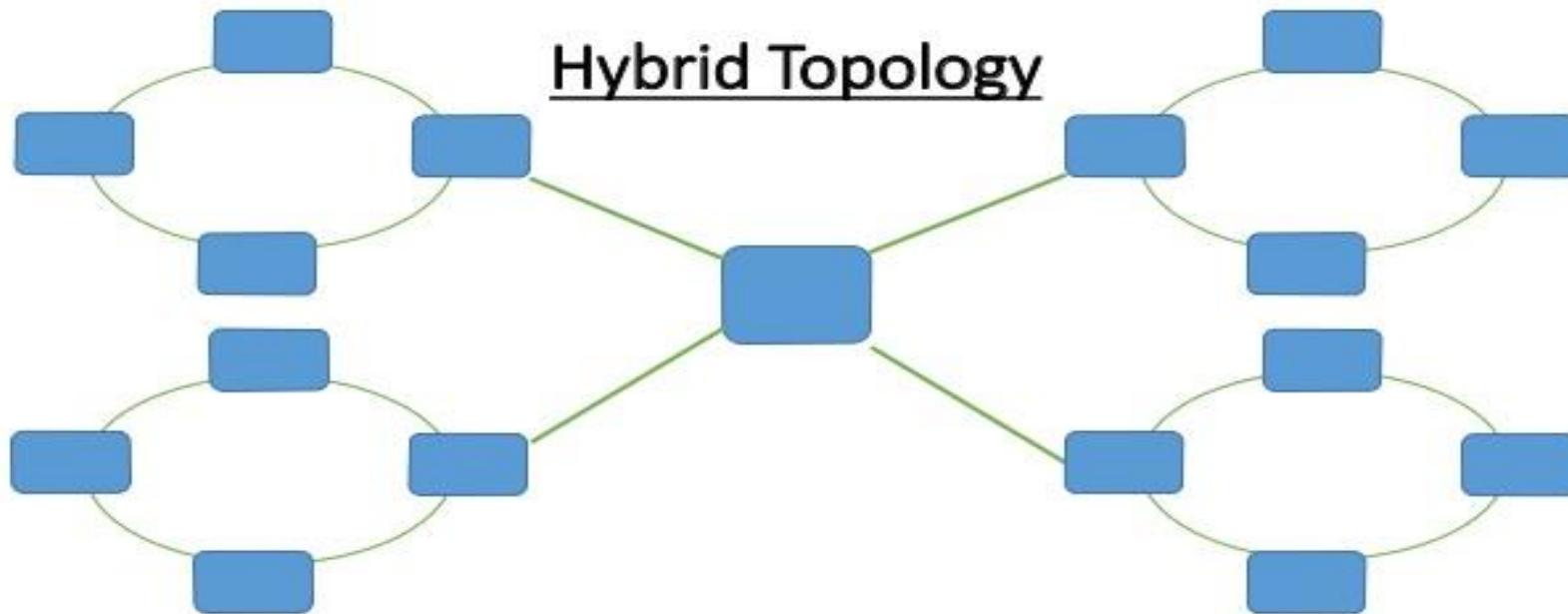
# TREE TOPOLOGY

- This particular type of network topology is based on a hierarchy of nodes.
- The highest level of any tree network consists of a single, 'root' node, this node connected either a single (or, more commonly, multiple) node(s) in the level below by (a) point-to-point link(s).

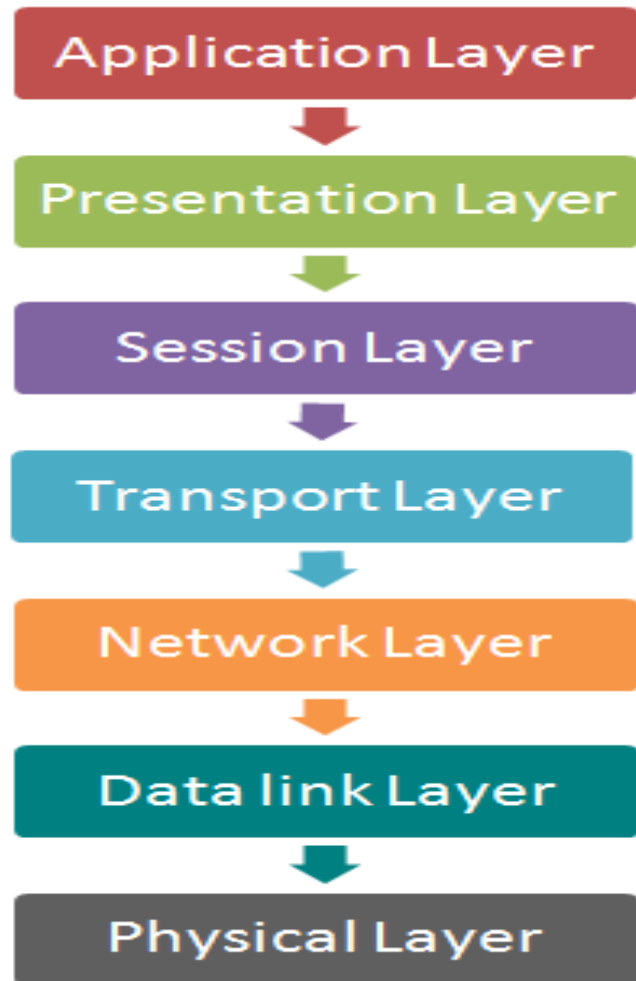


# HYBRID TOPOLOGY

➤ **Hybrid topology** is a computer network that uses a combination of two or more topologies. Whenever two or more topologies are interconnected and they form such a structure where a different property arises.



# ISO-OSI MODEL



OSI  
Reference  
Model

# ISO-OSI MODEL

ISO-OSI(International Standard Organization- Open System Interconnection)

- OSI Model defines a networking framework to implement protocols in seven layers.
- Control is passed from one layer to the next, starting at the application layer in one station, and proceeding to the bottom layer, over the channel to the next station and back up the hierarchy.

# ISO-OSI MODEL

## Physical (Layer 1)

- This layer conveys the bit stream - electrical impulse, light or radio signal through the network at the electrical and mechanical level.
- It provides the hardware means of sending and receiving data on a carrier, including defining cables, cards and physical aspects.
- Hub, Modem, Adapters, USB, NIC, Cables, DSL, ISDN



# ISO-OSI MODEL

## Data Link(Layer 2)

- It furnishes transmission protocol knowledge and management and handles errors in the physical layer, flow control and frame synchronization.
- EXAMPLES
- - PPP, ATM, ARP, BRIDGE, GATEWAY, SWITCH, MAC

## Network (Layer 3)

- This layer provides switching and routing technologies, creating logical paths, known as virtual circuits, for transmitting data from node to node.
- Routing and forwarding are functions of this layer, as well as addressing, internetworking, error handling, congestion control and packet sequencing.
- EXAMPLES -ROUTER, RIP,POP, IP(IPv4, IPv6), ICMP

# ISO-OSI MODEL

## Transport (Layer 4)

- This layer provides transparent transfer of data between end systems, or hosts, and is responsible for end-to-end error recovery and flow control.
- It ensures complete data transfer.
- Protocols - TCP, UDP, SST, SPX

## Session (Layer 5)

- This layer establishes, manages and terminates connections between applications.
- Protocols - SAP, Socks

# ISO-OSI MODEL

## Presentation (Layer 6)

- This layer provides independence from differences in data representation (e.g. encryption) by translating from application to network format, and vice versa.
- It is sometimes called the syntax layer.  
Protocols – ALL FILE EXTENSIONS,

# ISO-OSI MODEL

## Application (Layer 7)

- This layer supports application and end-user processes.
- This layer provides application services for file transfers, e-mail, and other network software services.

Protocols-

- HTTP, FTP, Telnet, DHCP, DNS, SMTP

# TCP/IP MODEL

## TCP/IP(Transmission Control Protocol/ Internet Protocol)

➤ It is based on a four-layer reference model.

TCP/IP	OSI Model	Protocols
Application Layer	Application Layer	DNS, DHCP, FTP, HTTPS, IMAP, LDAP, NTP, POP3, RTP, RTSP, SSH, SIP, SMTP, SNMP, Telnet, TFTP
	Presentation Layer	JPEG, MIDI, MPEG, PICT, TIFF
	Session Layer	NetBIOS, NFS, PAP, SCP, SQL, ZIP
Transport Layer	Transport Layer	TCP, UDP
Internet Layer	Network Layer	ICMP, IGMP, IPsec, IPv4, IPv6, IPX, RIP
Link Layer	Data Link Layer	ARP, ATM, CDP, FDDI, Frame Relay, HDLC, MPLS, PPP, STP, Token Ring
	Physical Layer	Bluetooth, Ethernet, DSL, ISDN, 802.11 Wi-Fi

# DIFFERENT PROTOCOLS USED IN NETWORKING

## DHCP(Dynamic Host Configuration Protocol)-

It is a network protocol that enables a server to automatically assign an IP address to a computer from a defined range of numbers (i.e., a scope) configured for a given network.

## TCP(Transmission Control Protocol)

TCP (Transmission Control Protocol) is a standard that defines how to establish and maintain a network conversation via which application programs can exchange data. TCP is a connection-oriented protocol.

# DIFFERENT PROTOCOLS USED IN NETWORKING

## UDP(USER DATA-GRAM PROTOCOL)-

UDP is a connectionless Internet protocol. Multiple messages are sent as packets in chunks using UDP.

## PPP (Point-to-Point Protocol)-

It is a data link protocol commonly used in establishing a direct connection between two networking nodes. It is used for the communication between two computers using a serial interface, typically a personal computer connected by phone line to a server.

# DIFFERENT PROTOCOLS USED IN NETWORKING

## CSMA/CD(Carrier Sense Multiple Access With Collision Detection)-

- It is a media access control method used most notably in local area networking using early Ethernet technology.
- It uses a carrier sensing scheme in which a collision is entirely avoided.



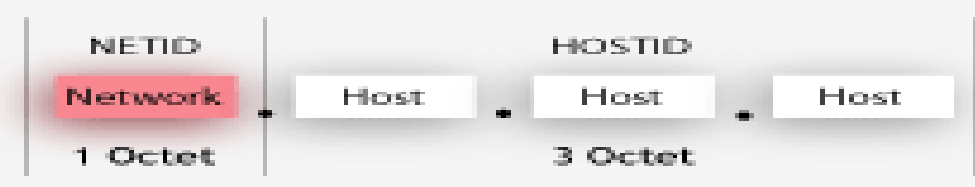
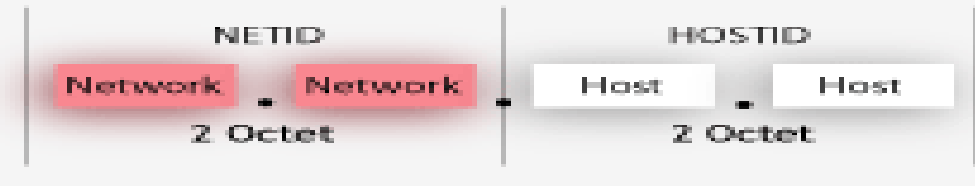
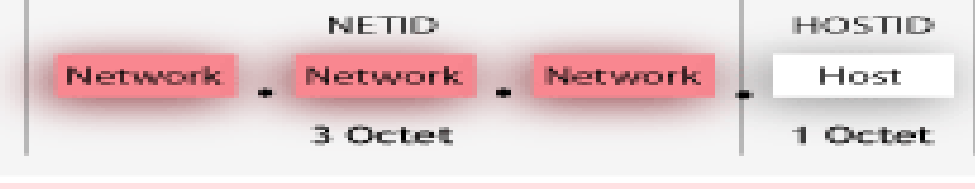


# IP(INTERNET PROTOCOL)

The **Internet protocol suite** is the networking model and a set of communications protocols used for the Internet and similar networks.

## IP Address

An **Internet Protocol address (IP address)** is a numerical label assigned to each device e.g. computer, printer participating in a computer network that uses the Internet Protocol for communication

# IP(INTERNET PROTOCOL)

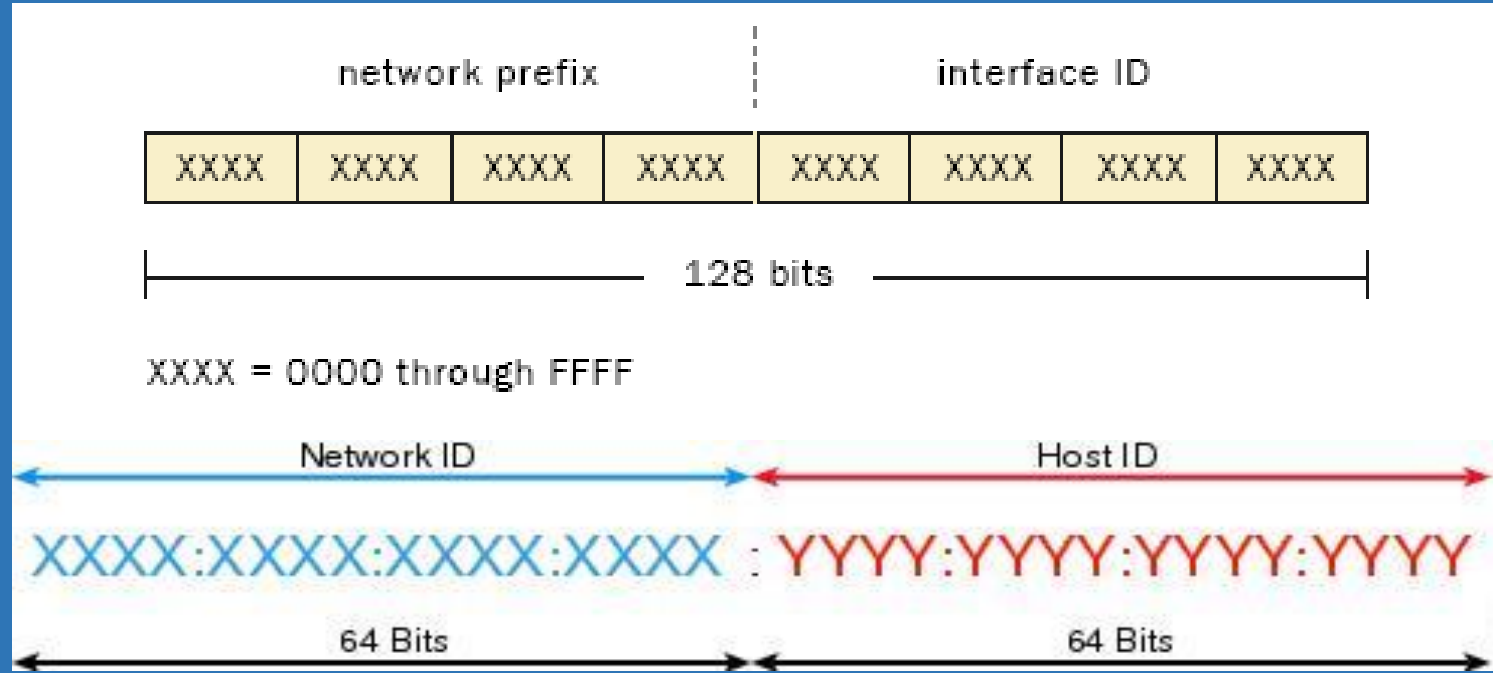
Class	First Octet Range	Default Subnet Mask	Max Hosts	Format
A	1-126	255.0.0.0	16M	 <p>NETID Network 1 Octet</p> <p>HOSTID Host Host Host 3 Octet</p>
B	128-191	255.255.0.0	64K	 <p>NETID Network Network 2 Octet</p> <p>HOSTID Host Host 2 Octet</p>
C	192-223	255.255.255.0	254	 <p>NETID Network Network Network 3 Octet</p> <p>HOSTID Host 1 Octet</p>
D	224-239	N/A	N/A	 <p>Multicast Address</p>
E	240-255	N/A	N/A	 <p>Experimental</p>

# IP(INTERNET PROTOCOL)

## IP Address classes-

- Class A addresses 127.0.0.0 to 127.255.255.255 cannot be used and is reserved for loopback and diagnostic functions.
- Class A, B, C are private IP Addresses.
- Class D is reserved for Multicasting.
- Class E is reserved for Experimental used for research.

# IPv6 (INTERNET PROTOCOL VERSION 6)



# MAC (MEDIA ACCESS CONTROL)

The Media Access Control (MAC) address is a binary number used to uniquely identify computer network adapters. These numbers (sometimes called "hardware addresses" or "physical addresses") are embedded into the network hardware during the manufacturing process, or stored in firmware, and designed to not be modified.

```
C:\Users\sAm>getmac
```

Physical Address	Transport Name
78-0C-B8-8C-80-6B	\Device\Tcpip_{3C69BD09-32BD-4AF2-8FB1-927B75EEF03B}
F8-CA-B8-16-DB-47	Media disconnected
78-0C-B8-8C-80-6F	Media disconnected

```
C:\Users\sAm>
```

# MAC (MEDIA ACCESS CONTROL)

Traditional MAC addresses are 12-digit (6 bytes or 48 bits) hexadecimal numbers. By convention, they are usually written in one of the following three formats:

MM:MM:MM:SS:SS:SS

MM-MM-MM-SS-SS-SS

The leftmost 6 digits (24 bits) called a "prefix" is associated with the adapter manufacturer.



Thank You

shift