# Internet & Network

- Submarine cable map
- Types of networks
- Topologies
- OSI/ TCP/ IP Model
- Network Address

Submarine cable map

A submarine communications cable is a cable laid on the sea bed between land-based stations to carry telecommunication signals across stretches of ocean and sea. The first submarine communications cables laid beginning in the 1850s carried telegraphy traffic, establishing the first instant telecommunications links between continents, such as the first transatlantic telegraph cable which became operational on 16 August 1858.

https://www.submarinecablemap.com/
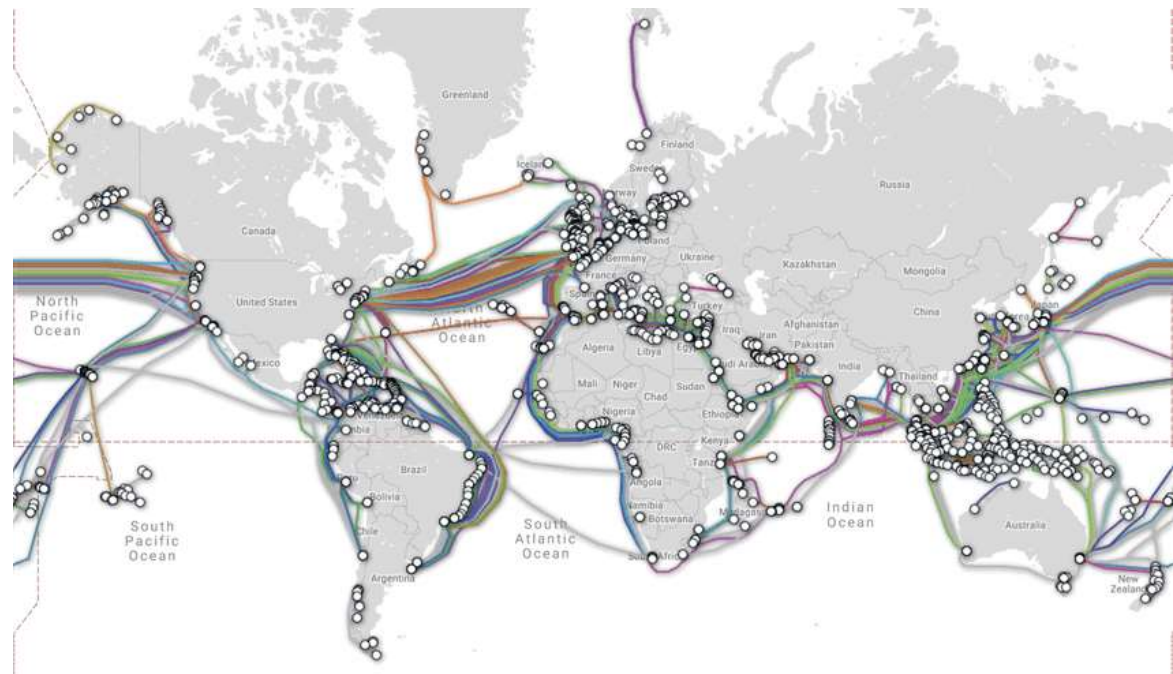
Types of networks

A network consists of two or more computers that are linked in order to share resources (such as printers and CDs), exchange files, or allow electronic communications. The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.
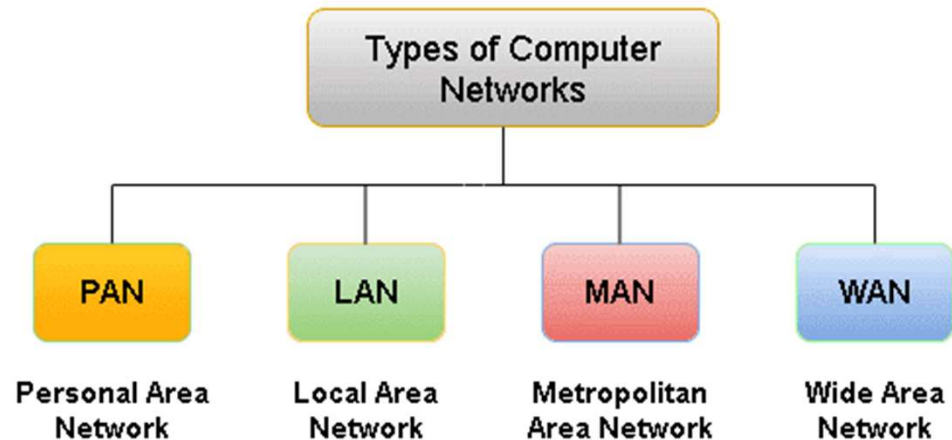
LAN(Local Area Network)

•Local Area Network is a group of computers connected to each other in a small area such as building, office.

•LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.

•It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.

•The data is transferred at an extremely faster rate in Local Area Network.

•Local Area Network provides higher security.
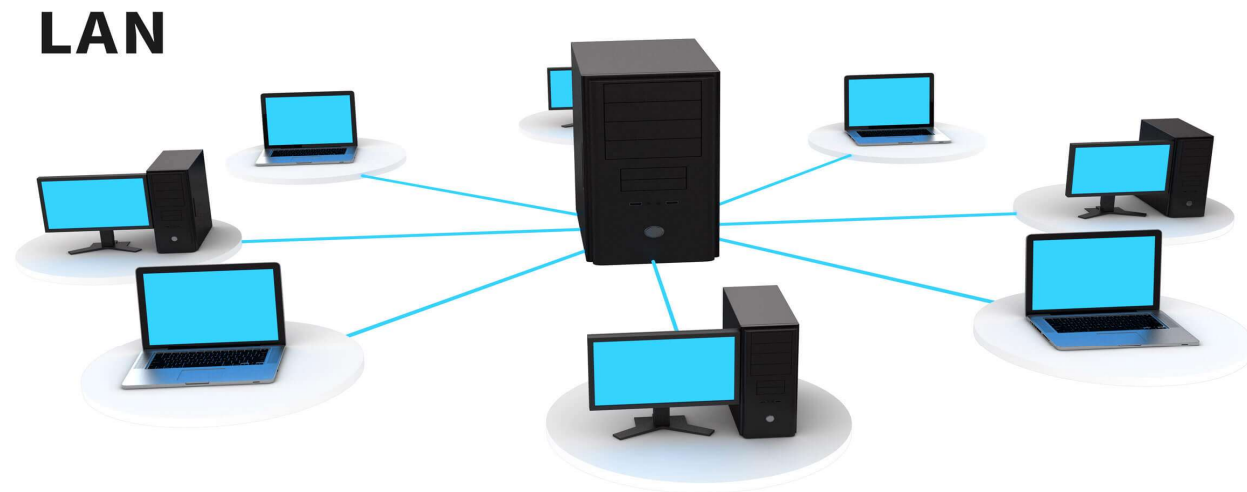
PAN(Personal Area Network)

• Personal Area Network is a network arranged within an individual person, typically within a range of 10 meters.

• Personal Area Network is used for connecting the computer devices of personal use is known as Personal Area Network.

• Thomas Zimmerman was the first research scientist to bring the idea of the Personal Area Network.

• Personal Area Network covers an area of 30 feet.

• Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations.

MAN(Metropolitan Area Network)

A metropolitan area network is a network that covers a larger geographic area by interconnecting a different LAN to form a larger network.

Government agencies use MAN to connect to the citizens and private industries.

In MAN, various LANs are connected to each other through a telephone exchange line.

The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.

It has a higher range than Local Area Network(LAN).
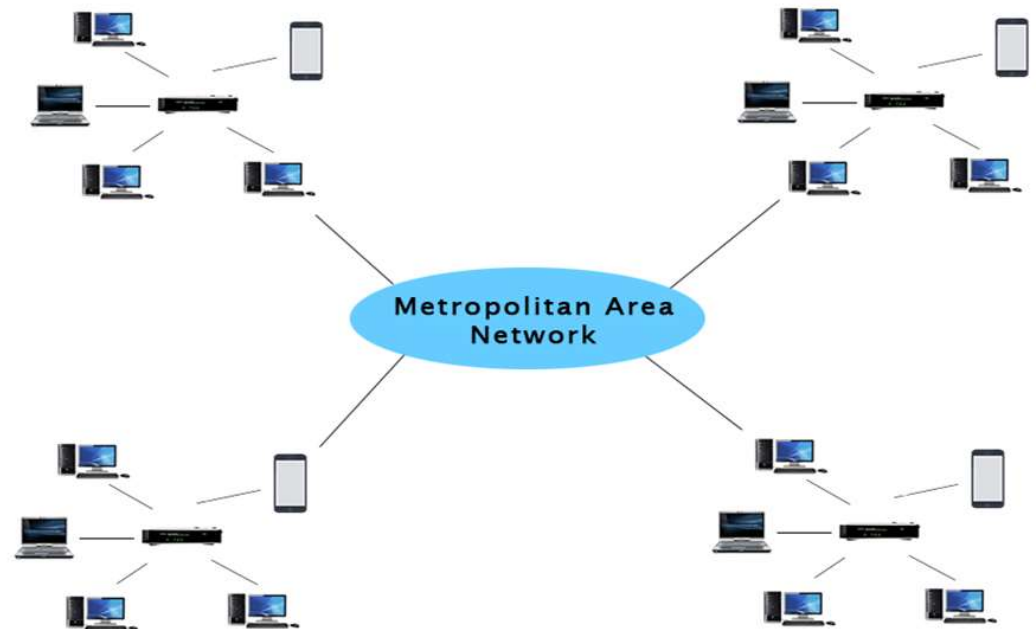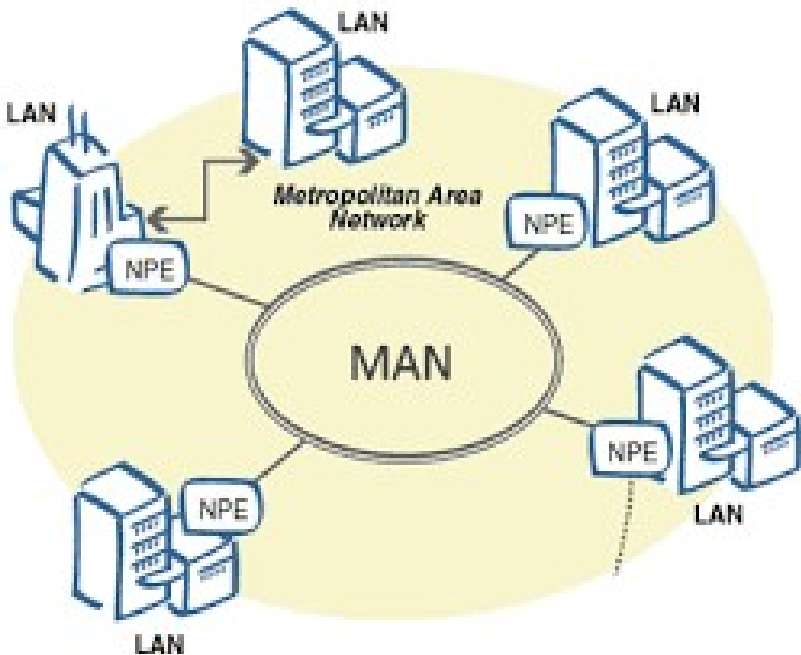
WAN(Wide Area Network)

A Wide Area Network is a network that extends over a large geographical area such as states or countries.
A Wide Area Network is quite bigger network than the LAN.
A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fibre optic cable or satellite links.
The internet is one of the biggest WAN in the world.
A Wide Area Network is widely used in the field of Business, government, and education.
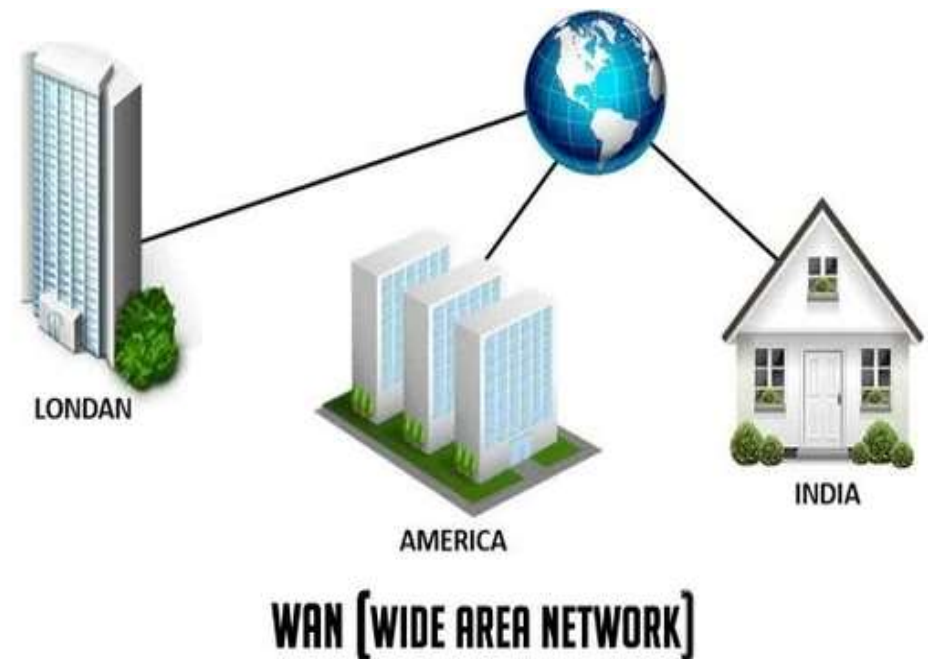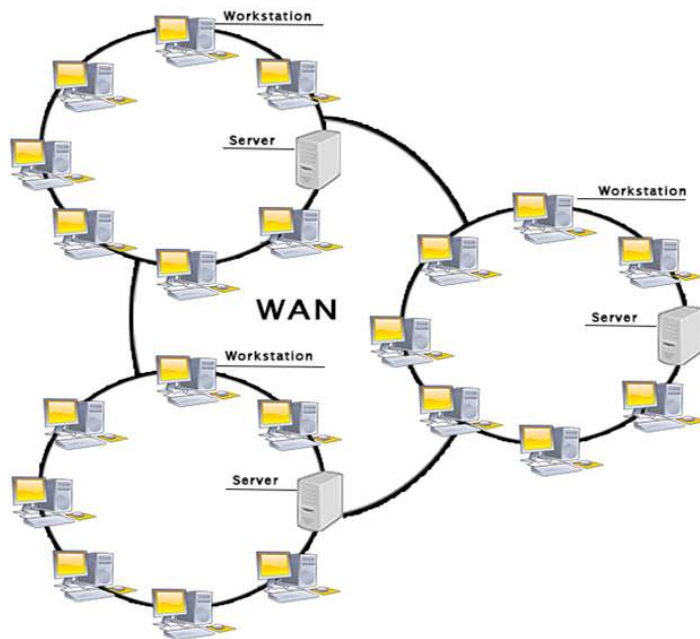
Topologies

A network topology is the physical and logical arrangement of nodes and connections in a network. Nodes usually include devices such as switches, routers and software with switch and router features. Network topologies are often represented as a graph.
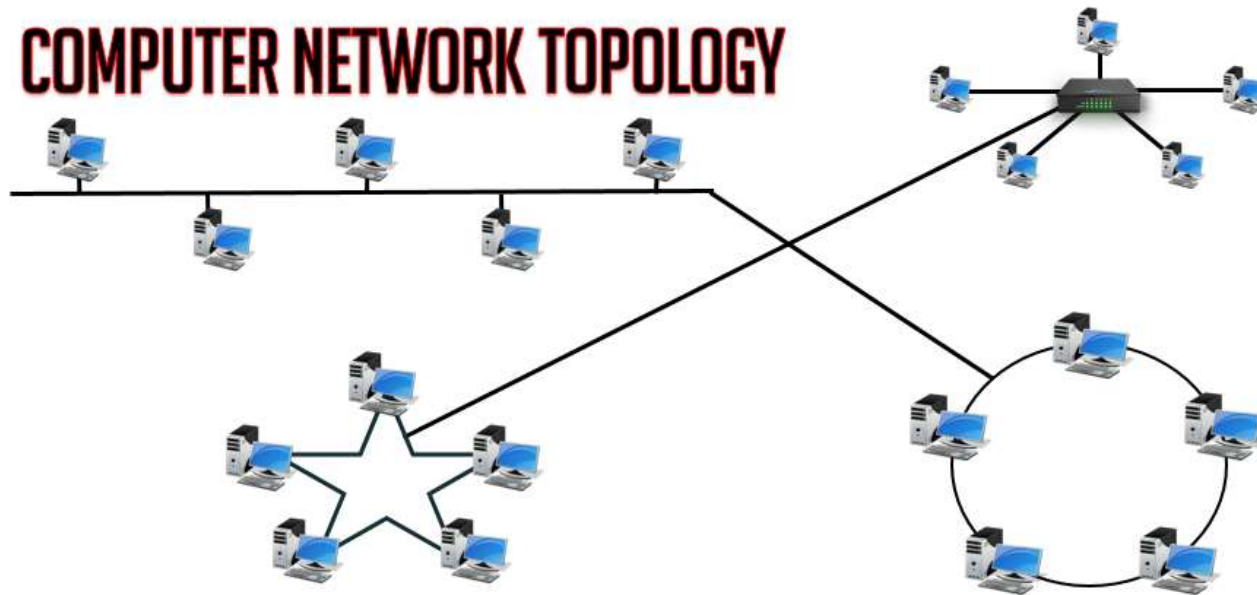
(01)Bus:

- A linear bus topology consists of a main run of cable with a terminator at each end.

- All nodes (file server, workstations, and peripherals) are connected to the linear cable.

Backbone cable

Terminal
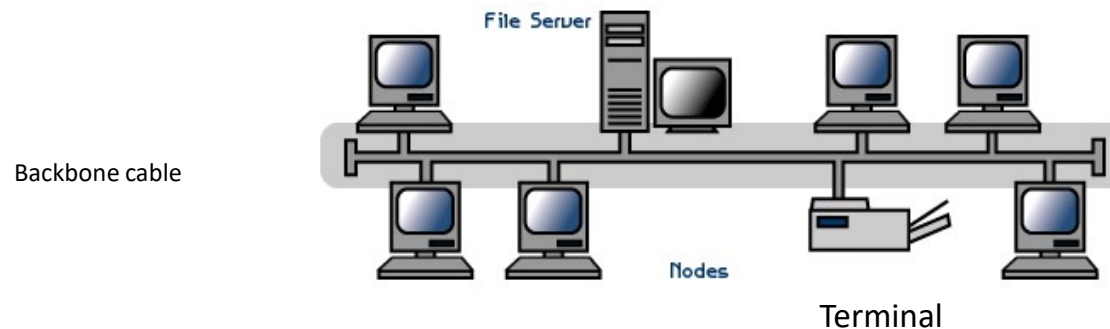
- **It is use T connector:**
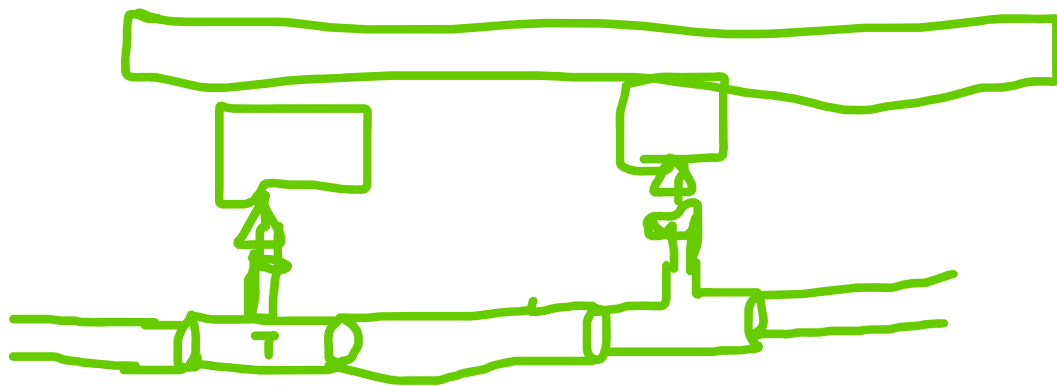
❖Advantages of bus topology:

• Easy to connect a computer or peripheral to a bus.

• Requires less cable length than a star topology.

• Easy to transfer.

❖DISADVANTAGES OF BUS TOPOLOGY:

• if backbone cable is not work properly whole network is shut down.

• Terminators are required at both ends of the backbone cable.

• High collision.

• Always broadcast.

(02) ring:

- Ring topology, pc are connecting like ring.

- In a ring topology network computers are connected by a single loop of cable,

- Ring topology is an active topology because each computer repeats (boosts) the signals.

- If there is a line break, or if you are adding or removing a device anywhere in the ring this will bring down the network.

- Data is sending through token passing method.
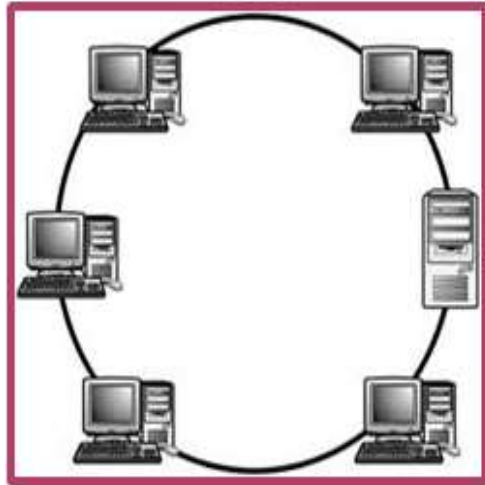
❖Advantages Of ring topology:
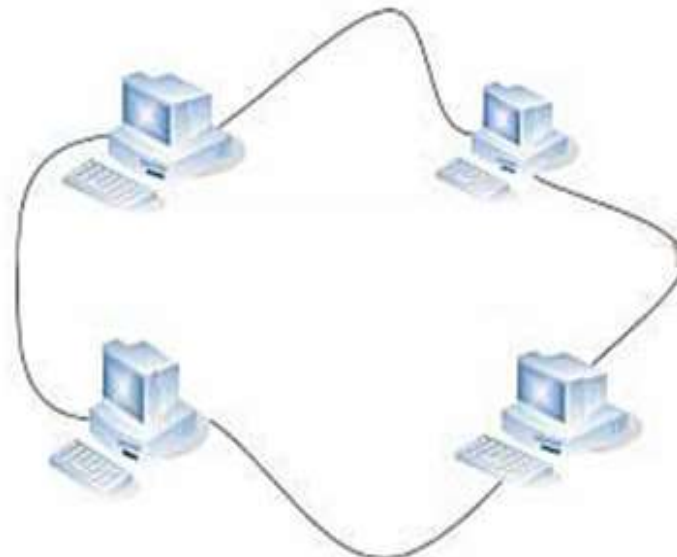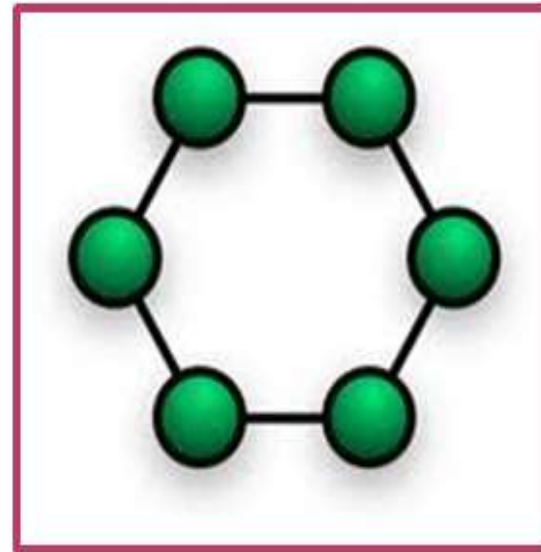
- Easy to connect a computer or peripheral to a bus.

- Requires less cable length than a star topology.

- Essay to transferable.

❖DISADVANTAGES OF RING TOPOLOGY:

- Network shuts down if there is a break in the main cable.

- Minimum two Lan card are required in single pc.

- It is expensive.

- Difficult to troubleshoot.

(03) star topology:

- Star networks are one of the most common computer network topologies.

- A star configuration is simple: Each of several devices has its own cable that connects to a central hub.
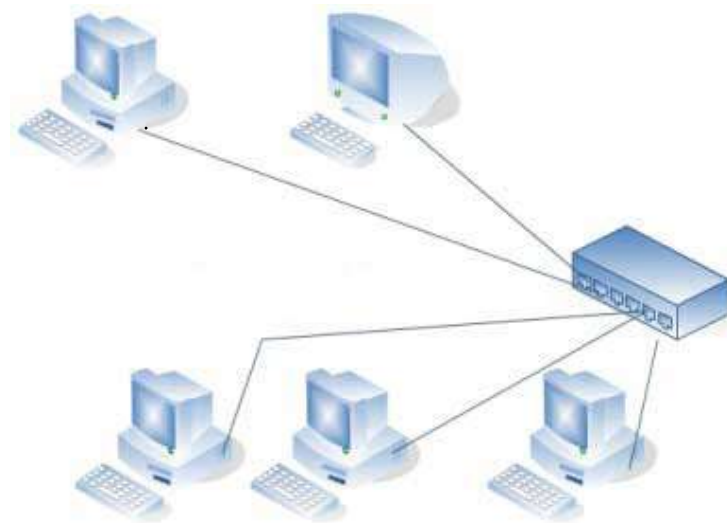
❖Advantages of star topology:

- Data Packets are sent quickly as they do not have to travel through any unnecessary nodes.

- No speed divided.

- Essay to troubleshoot.

❖DISADVANTAGES OF STAR TOPOLOGY:

- Expensive because of additional cabling and central hub / switch require.

- If the centralize device fails the entire system is affected & shuts down.

(04)mesh topology:

- In This topology generally routers are not in use , only computers are connected with every pc .
- All devices are connecting to all devices.
- Multiple path is use for data sending.
- Find cable =N(N-1)/2   N=number of pc
- Suitable for LAN only.
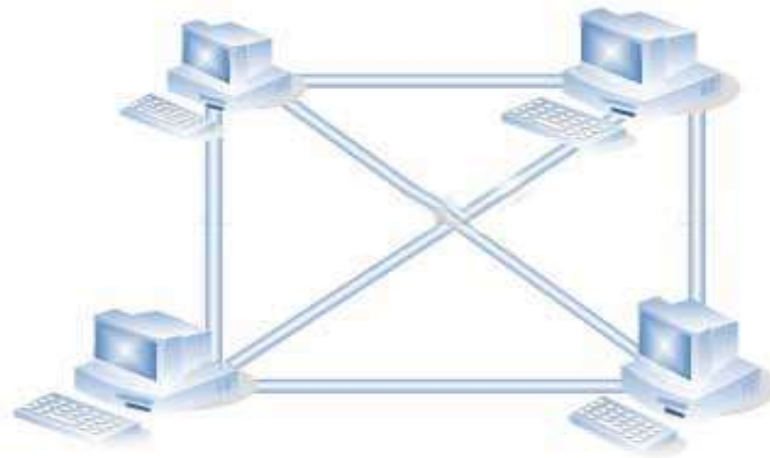
❖Advantages of Mesh topology:

- it is use heavy network.
- Network never stop to work.
- High speed.

❖DISADVANTAGES OF MESH TOPOLOGY:

- Expensive because of additional cabling are require.
- It is hard to manage.
- Its hard to transfer.
- High expensive.

(05)hybrid topology:

- When we are network connecting two or more than two topologies at that time, its called hybrid topology.

- It is hard to manage.

- Internet is work on hybrid topology base.
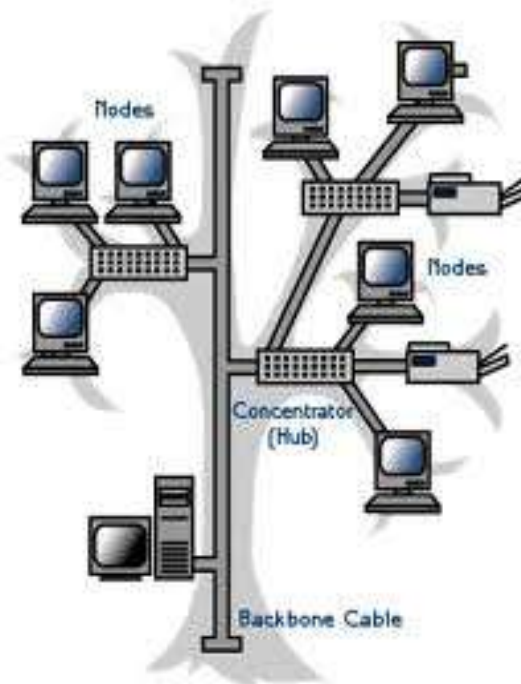
❖Advantages of hybrid topology:

• it is use in heavy network.

• Network never stop to work.

❖DISADVANTAGES OF HYBRID TOPOLOGY:

• Expensive because of additional cabling are require.

• It is hard to manage.

• Its hard to transfer.

• High expensive.

❖ Extra Notes:

- All topologies are batter but depend upon situation.
- topologies are used as situation or base on money and speed.
- Less money – less speed, bus is best.
- High speed and high expenses star is best.
- Temporary base ring is best.

NEWORKING MODELS :-
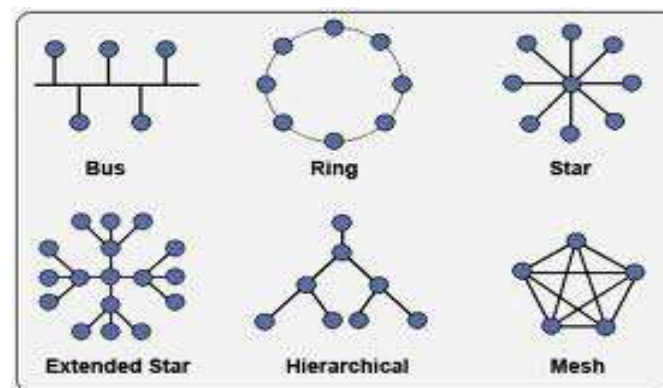
A System Which Describes how data travels. There are mainly two types of Networking Models.

OSI MODEL :-

The Open Systems Interconnection model is a conceptual model that characterizes and standardizes the communication functions of a telecommunication or computing system without regard to its underlying internal structure and technology. This model is categorized into 7 different layers.

Developed by ISO IN THE YEAR 1974

OSI Model

7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data link
1	Physical

1.PHYSICAL LAYER:-

This layer is responsible for converting the
digital data into bit stream. Data Encoding
also takes place here. All the physical
network devices relies on this layer.
It establishes, maintains and deactivates the
physical connection.
It defines the Transmission mode type

**INFRARED, IEEE
INTERFACES ARE THE
MAIN PROTOCOLS**

2. DATA-LINK LAYER:-

This layer is responsible for the error-free
transfer of data frames.
It contains two sub-layers:

**VLAN , VTP , PPTP ARE THE
MAIN PROTOCOLS**

- **Logical Link Control Layer**
  - It identifies the address of the network layer protocol from the header.
  - It also provides flow control.
- **Media Access Control Layer**
  - It is used for transferring the packets over the network

The Physical Layer

0010100010

Sending cable   Bitstream   Receiving cable

APPLICATION LAYER	7	Human-computer interaction layer, where applications can access the network services
PRESENTATION LAYER	6	Ensures that data is in a usable format and is where data encryption occurs
SESSION LAYER	5	Maintains connections and is responsible for controlling ports and sessions
TRANSPORT LAYER	4	Transmits data using transmission protocols including TCP and UDP
NETWORK LAYER	3	Decides which physical path the data will take
DATALINK LAYER	2	Defines the format of data on the network
PHYSICAL LAYER	1	Transmits raw bit stream over the physical medium

The Data Link Layer

Frame Creation → Transport → Transfer frames between network nodes

3.NETWORK LAYER:-

Network layer works for the transmission of data from one host to the other located in different networks. It also takes care of packet routing. The sender & receiver's IP address are placed in the header by the network layer. Path selection and routing takes place here.

IGRP , EIGRP , ICMP IS THE MAIN PROTOCOLS OF NETWORK LAYER

The Network Layer

Packets Creation → Transport → Packets Assembly
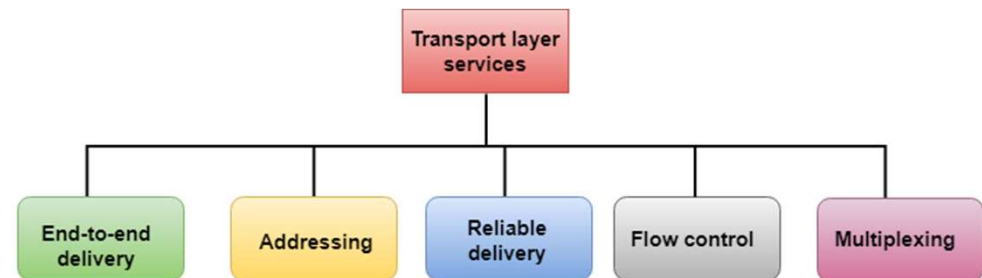
4.TRANSPORT LAYER:-

The Transport layer is a Layer 4 ensures that messages are transmitted in the order in which they are sent and there is no duplication of data. The main responsibility of the transport layer is to transfer the data completely. It receives the data from the upper layer and converts them into smaller units known as segments.

TWO MAIN PROTOCOLS OF THIS LAYER IS TCP (TRANSMISSION CONTROL PROTOCOL) & UDP (USER DATAGRAM PROTOCOL)

Transport Layer

Segmentation → Transport → Reassembly

Transport layer services
- End-to-end delivery
- Addressing
- Reliable delivery
- Flow control
- Multiplexing

5.SESSION LAYER:-

This is the layer responsible for opening and closing communication between the two devices The Session layer is used to establish, maintain and synchronizes the interaction between communicating devices.

RPC , NETBIOS , SMB ARE THE MAIN PROTOCOLS

The Session Layer

Session of communication

6.PRESENTATION LAYER:-

This layer is primarily responsible for preparing data so that it can be used by the application layer; in other words, layer 6 makes the data presentable for applications to consume. The presentation layer is responsible for translation, encryption, and compression of data.

SSL , SSH ARE THE MAIN PROTOCOLS

The Presentation Layer

Encryption   Compression   Translation

7.APPLICATION LAYER:-

This is the only layer that directly interacts with data from the user. Software applications like web browsers and email clients rely on the application layer to initiate communications
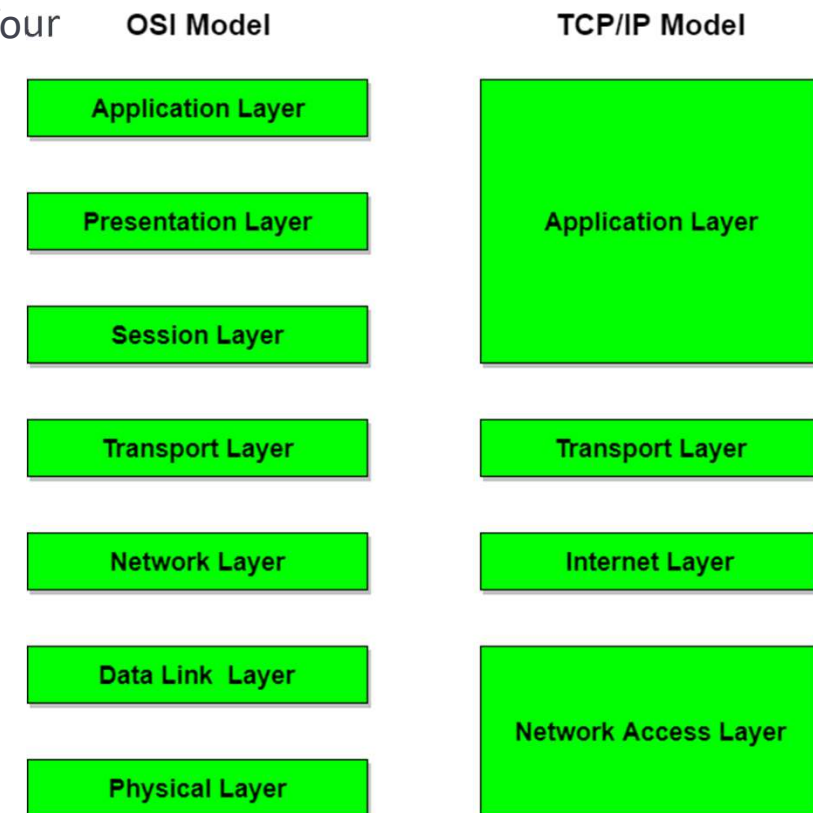
HTTP , HTTPS, DNS ARE THE MAIN PROTOCOLS

Application Layer

Website

APPLICATION LAYER   7   ← Request content

→ Return content in required format →

TCP/IP MODEL :-

It was designed to describe the functions of the communication system by dividing the communication procedure into smaller and simpler components. But when we talk about the TCP/IP model, it was designed and developed by Department of Defense (DoD) in 1960s and is based on standard protocols. It stands for Transmission Control Protocol/Internet Protocol. It contains four layers. The layers are:

1. NETWORK ACCESS/LINK LAYER
2. INTERNET LAYER
3. HOST-TO-HOST/TRANSPORT LAYER
4. PROCESS/APPLICATION LAYER

OSI Model

- Application Layer
- Presentation Layer
- Session Layer
- Transport Layer
- Network Layer
- Data Link Layer
- Physical Layer

TCP/IP Model

- Application Layer
- Transport Layer
- Internet Layer
- Network Access Layer

1. Network Access Layer –

This layer corresponds to the combination of Data Link Layer and Physical Layer of the OSI model. It looks out for hardware addressing and the protocols present in this layer allows for the physical transmission of data.

2. Internet Layer –

This layer parallels the functions of OSI's Network layer. It defines the protocols which are responsible for logical transmission of data over the entire network. The main protocols residing at this layer are : IP , ICMP , ARP

3. Host-to-Host Layer –

This layer is analogous to the transport layer of the OSI model. It is responsible for end-to-end communication and error-free delivery of data. It shields the upper-layer applications from the complexities of data. The two main protocols present in this layer are : TCP & UDP

4. Application Layer –

This layer performs the functions of top three layers of the OSI model: Application, Presentation and Session Layer. It is responsible for node-to-node communication and controls user-interface specifications. Some of the protocols present in this layer are: HTTP, HTTPS, FTP, TFTP, Telnet, SSH, SMTP, SNMP, NTP, DNS, DHCP, NFS, X Window, LPD.

Application

Transport

Internet

Network Interface

COMPARISION BETWEEN OSI & TCP/IP MODEL :-

S.NO.	FACTOR	OSI MODEL	TCP/IP MODEL
1	WORKING TECHNOLOGY	It is an independent standard and generic protocol used as a communication gateway between the network and the end user.	It consists of standard protocols that lead to the development of an internet. It is a communication protocol that provides the connection among the hosts
2	RELIABILITY	OSI MODEL is less reliable	TCP/IP is more reliable
3	PACKET DELIVERY	In OSI model, transport layer provides assurance delivery of packets.	Transport layer in TCP/IP does not provide assurance delivery of packets.
4	PROTOCOL REPLACEMENT	Protocols can be replaced easily in OSI MODEL as technology changes.	Protocols cannot be replaced easily in TCP/IP model.
5	CONNECTECTION	Connection less and connection oriented both services are provided in OSI model.	TCP/IP model network layer only provides connection less services.
6	HEADER SIZE	The minimum size of the OSI header is 5 bytes.	Minimum header size is 20 bytes.

Network Address

A network address is a key networking technology component that facilitates identifying a network node/device and reaching a device over a network. It has several forms, including the Internet Protocol (IP) address, media access control (MAC) address and host address.