

Ch-5

Network topologies & network
devices

Syllabus

Unit - V Network Topologies And Network Devices

5.1 Network Computing Model: Peer To Peer, Client Server

5.2 Network Topologies: Introduction, Definition, Selection criteria, Types of Topology- Star ,Mesh, Tree, Hybrid

5.3 Network Connecting Devices: Switch, Router, Repeater, Bridge, Gateways and Modem

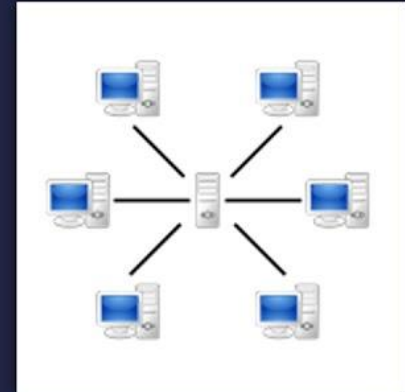
5.1 network computing model

- A network computing model is a way to represent how objects and their relationships are connected in a network. Some examples of network computing models include client-server, peer-to-peer, and distributed computing.
- A Computer Network model is made up of three primary components: A sender, A recipient, and A carrier.

Peer-to-peer network & client-server network

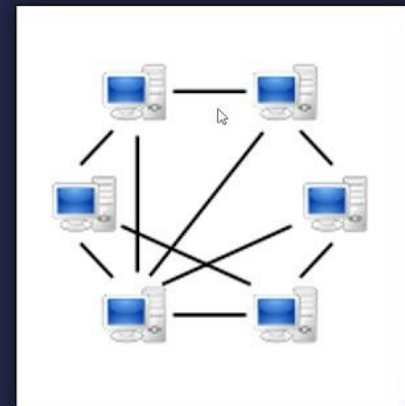
Client-Server network

- Every device either a **client** or **server**.
- A client establishes a connection with the server over the network.
- Servers can backup and store data centrally, though they can be expensive and difficult to run.

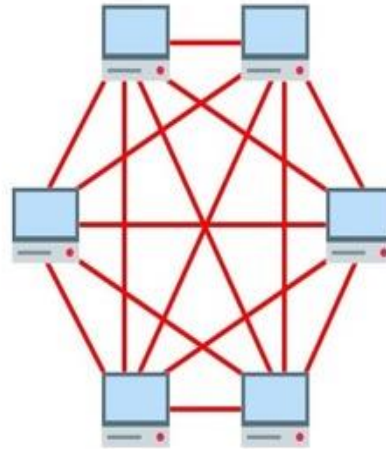
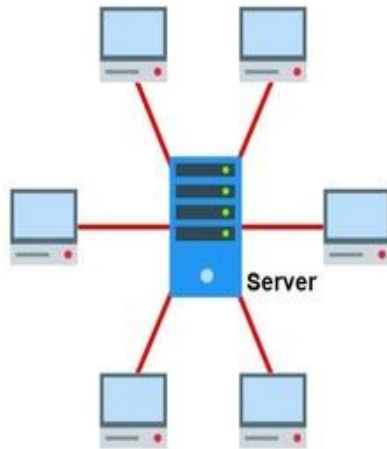


Peer-to-Peer network

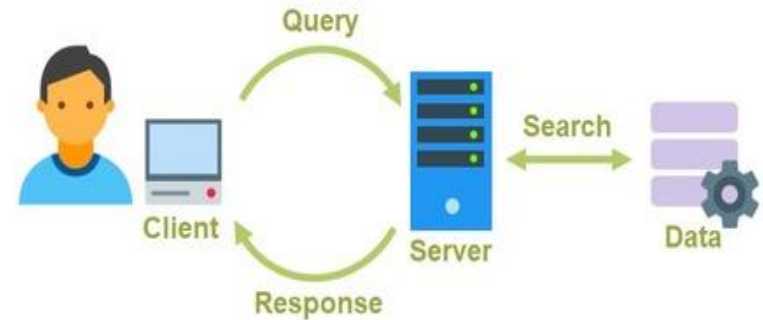
- This network configuration has **no central server**.



Client-server architecture Peer-to-peer architecture



How the client-server network works



Client server	Peer-to-peer
User IDs, passwords and access levels centrally controlled	Files and programs stored on individual computers
Used in many small, medium-size and large organisations	Suitable for a home computer network
Can be expensive to set up and to manage	Cheap to set up and maintain
Backup is centralised and usually automated	Each computer on the network can act as both client and server
No access to other users' files	Can be used for sharing of music and streaming coverage of live events

5.2 Network Topologies

- A network topology refers to the arrangement of devices and connections within a computer network, essentially describing how devices are linked together to facilitate data transmission; common topologies include star, mesh, tree, and hybrid, each with distinct advantages and disadvantages based on factors like scalability, reliability, and cost, which should be considered when selecting the most suitable topology for a given network scenario.
- Network topology is the way devices are connected in a network. It defines how these components are connected and how data transfer between the network.
Understanding the different types of network topologies can help in choosing the right design for a specific network.

What is Network Topology?

A computer network is a collection of two or more computers which are connected together to share information and resources.



Types Of Topology

Based on geographical area covered

Local Area Network (LAN)

Metropolitan Area Network (MAN)

Wide Area Network (WAN)

Based on Architecture

Bus Topology

Star Topology

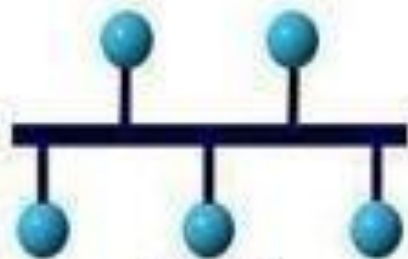
Ring Topology

Tree Topology

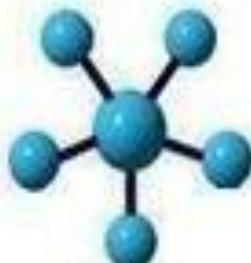
Mesh Topology

Hybrid Topology

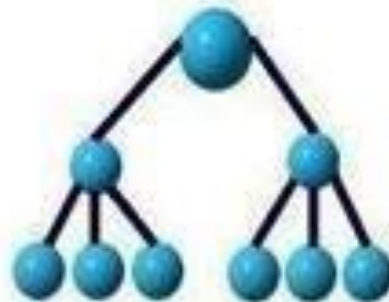
Network Topology's



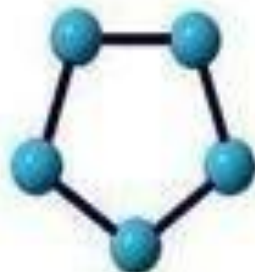
Bus



Star



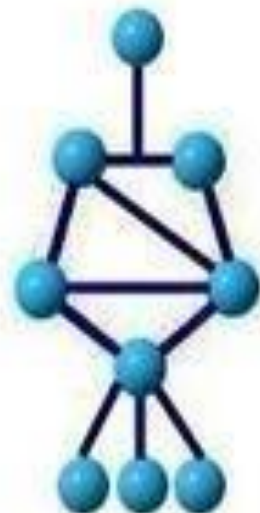
Tree



Ring



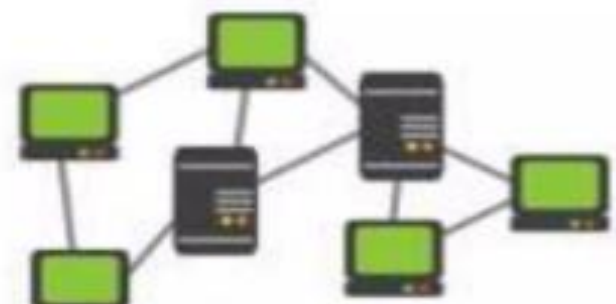
Mesh



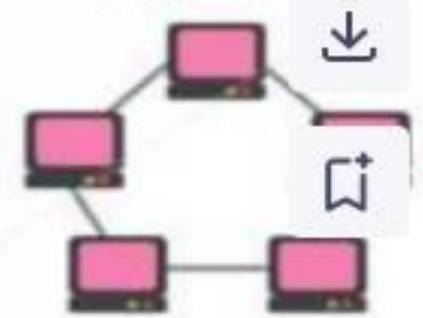
Hybrid



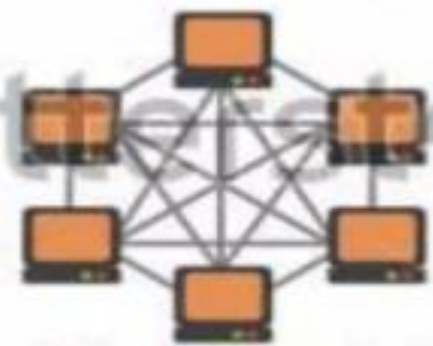
Star



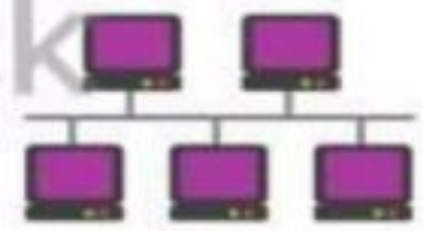
Mesh



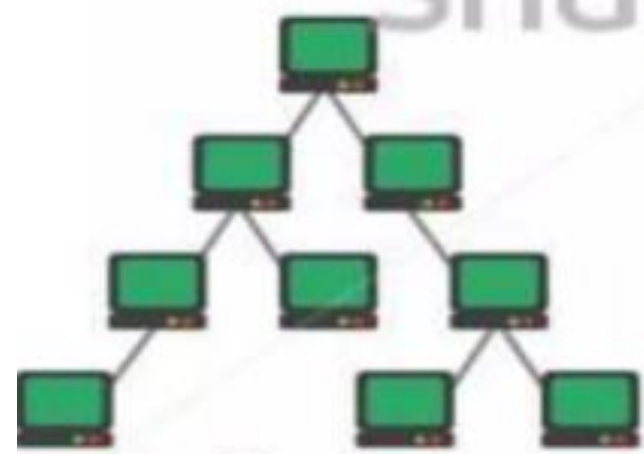
Ring



Fully Connected



Bus



Tree



Line

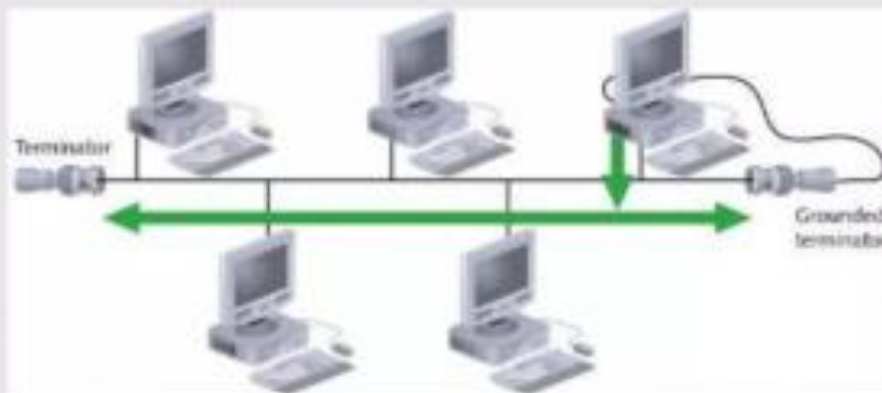
Bus Topology

A **Bus topology** consists of a single cable—called a **bus**—connecting all nodes on a network without intervening connectivity devices



Advantages of Bus Topology

- Works well for small networks.
- Relatively inexpensive to implement.
- Easy to expand joining two cables together.
- Used in small network.



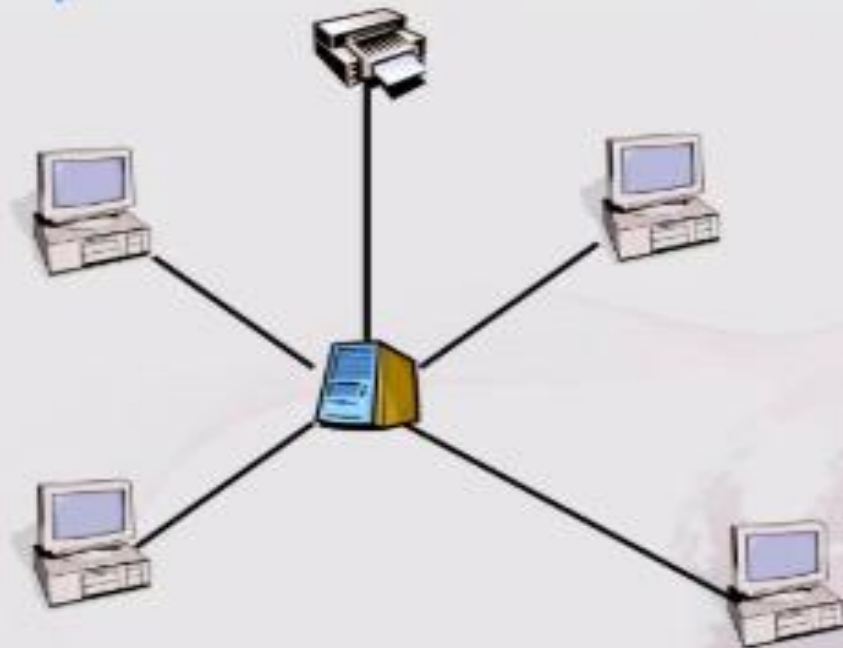
Disadvantages of Bus Topology

- Management costs can be high
- Cables fails then whole network fails.
- Cables has a limited length.



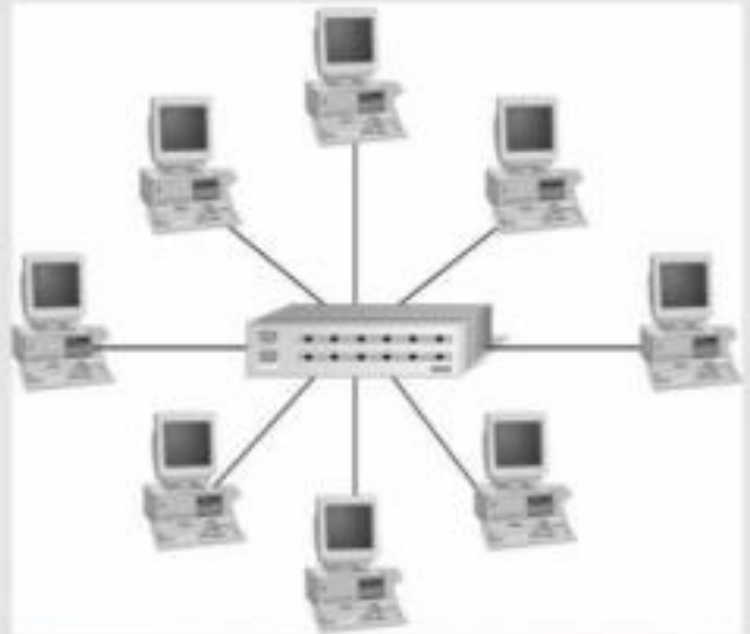
Star Topology

A star network is designed with each node (file server, workstation, peripheral) connected directly to a central network hub or server.



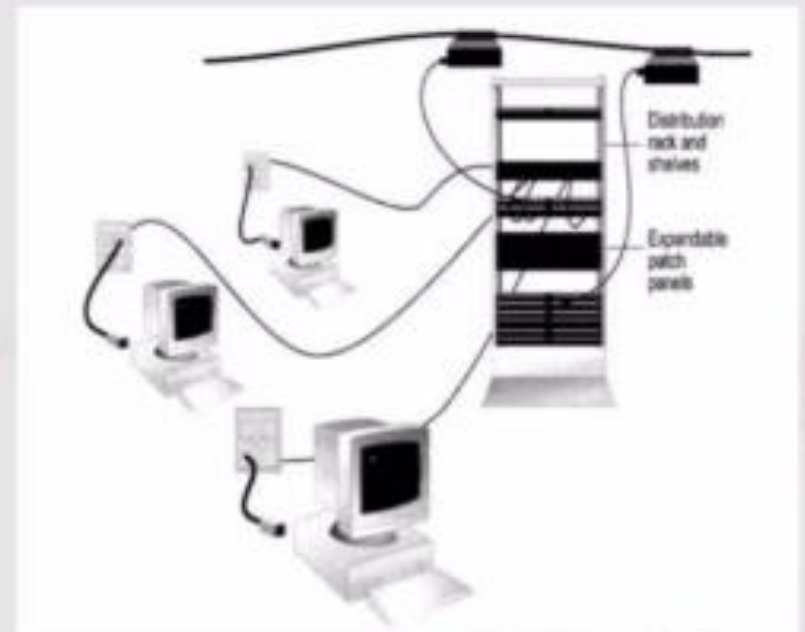
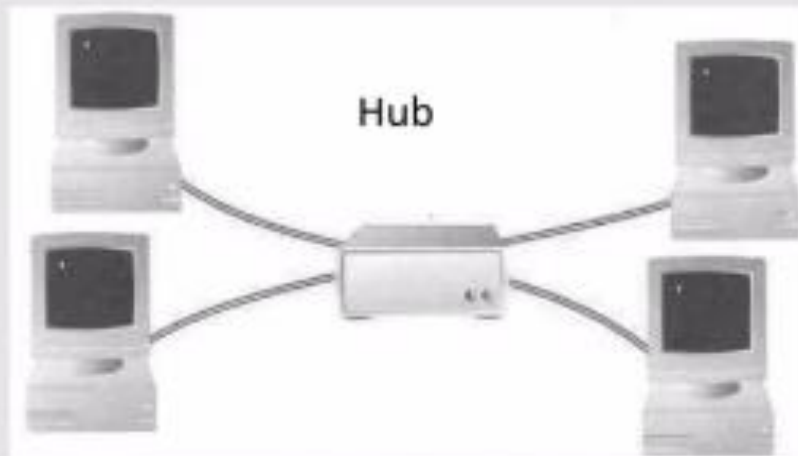
Advantages of Star Topology

- Good option for modern networks
- Low startup costs
- Easy to manage
- Offers opportunities for expansion
- Most popular topology in use wide variety of equipment available



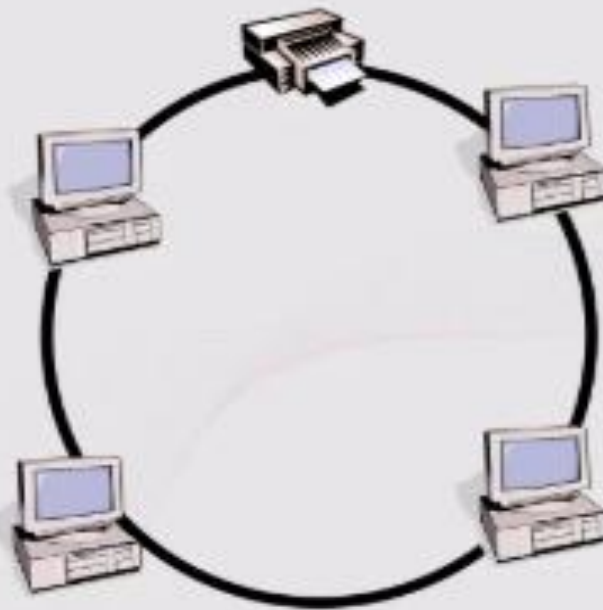
Disadvantages of Star Topology

- Hub is a single point of failure
- Requires more cable than the bus
- Cost of installation is high.



Ring topology

A ring network is one where all workstations and other devices are connected in a continuous loop. There is no central server.



Advantages of Ring Topology

- Easier to manage; easier to locate a defective node or cable problem
- Well-suited for transmitting signals over long distances on a LAN
- Handles high-volume network traffic



Disadvantages of Ring Topology

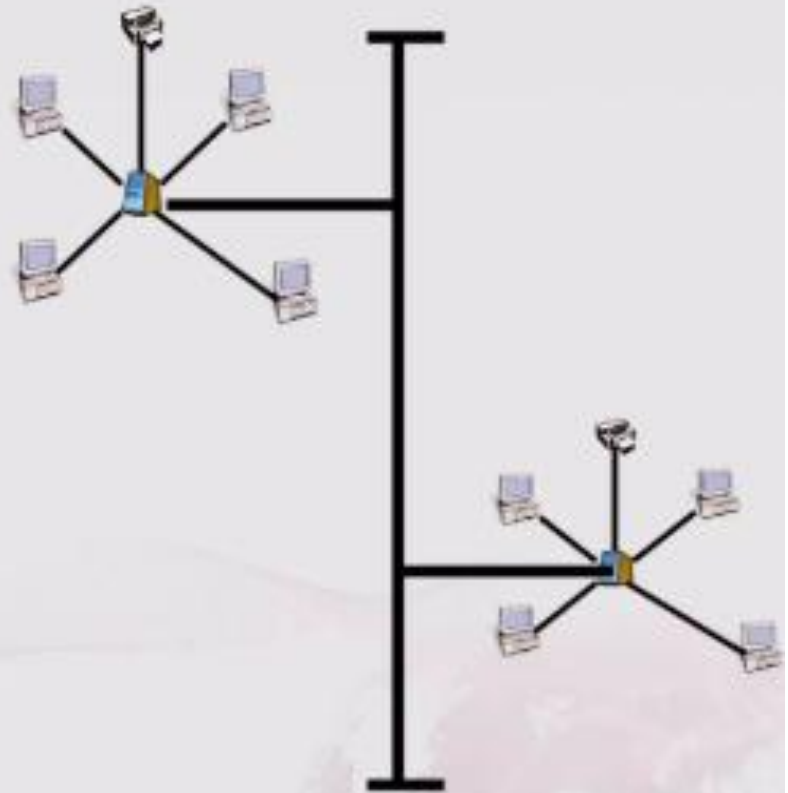


- Expensive
- Requires more cable and network equipment at the start
- Not used as widely as bus topology
 - Fewer equipment options
 - Fewer options for expansion to high-speed communication



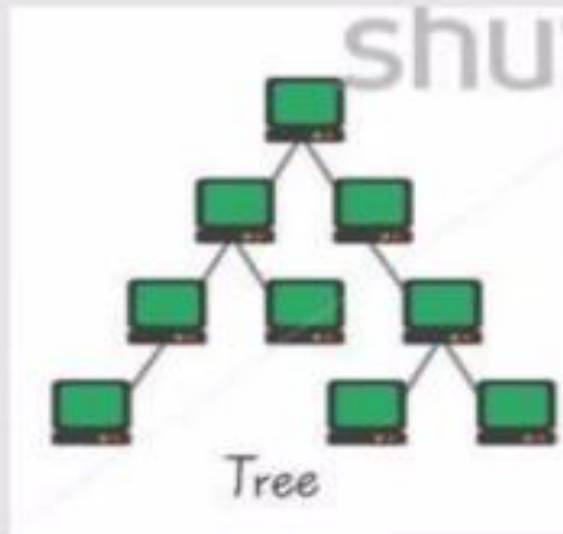
Tree topology

- It has a root node and all other nodes are connected to it forming a hierarchy. It is also called Hierarchical Topology.



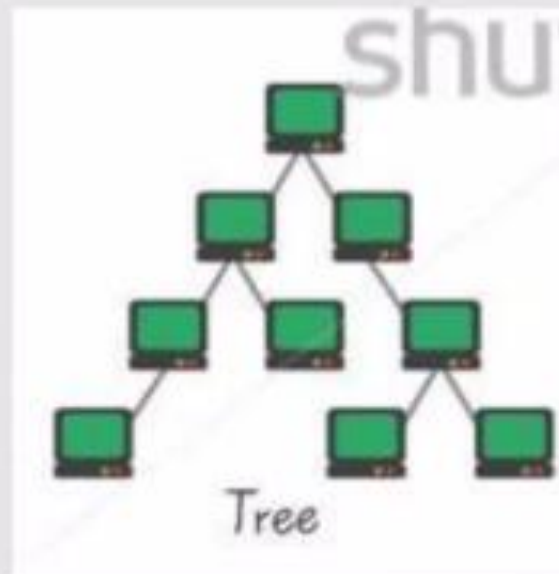
Advantages Of Tree Topology

- Extension of Bus and Star Topology.
- Expansion of nodes is possible and easy.
- Easily managed and maintained.



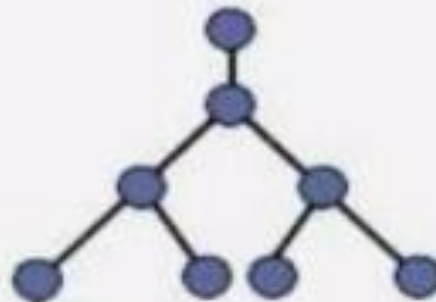
Advantages Of Tree Topology

- Extension of Bus and Star Topology.
- Expansion of nodes is possible and easy.
- Easily managed and maintained.



Disadvantages Of Tree Topology

- Heavily cabled.
- Costly.
- If more nodes are added maintenance is difficult.
- Central hub fails, network fails.

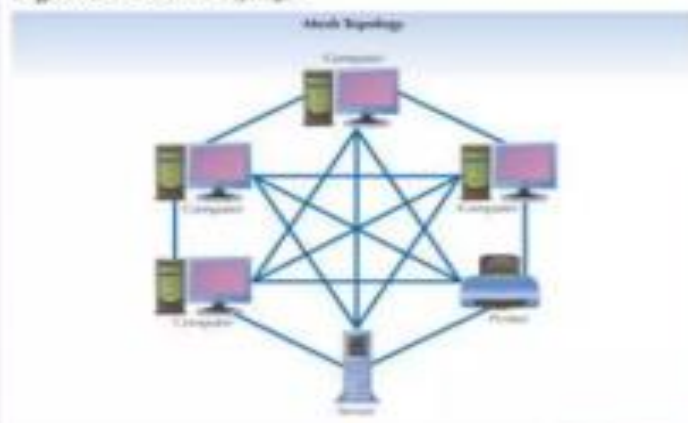


Hierarchical

Mesh Topology

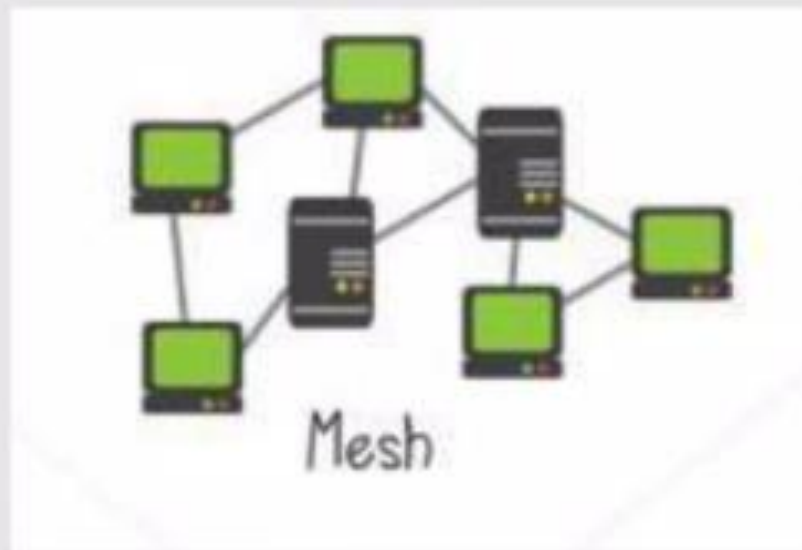
It is a point-to-point connection to other nodes or devices. Traffic is carried only between two devices or nodes to which it is connected. Mesh has $n(n-2)/2$ physical channels to link n devices.

Figure 5.5d Network Topologies



Advantages Of Mesh Topology

- Each connection can carry its own data load.
- Fault is diagnosed easily.
- Provide security and privacy.

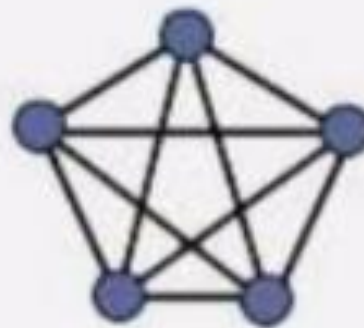


Disadvantage of mesh topology

- Installation and configuration is difficult.
- Cabling cost is more.
- Bulk wiring is required.



Mesh Network
Topology

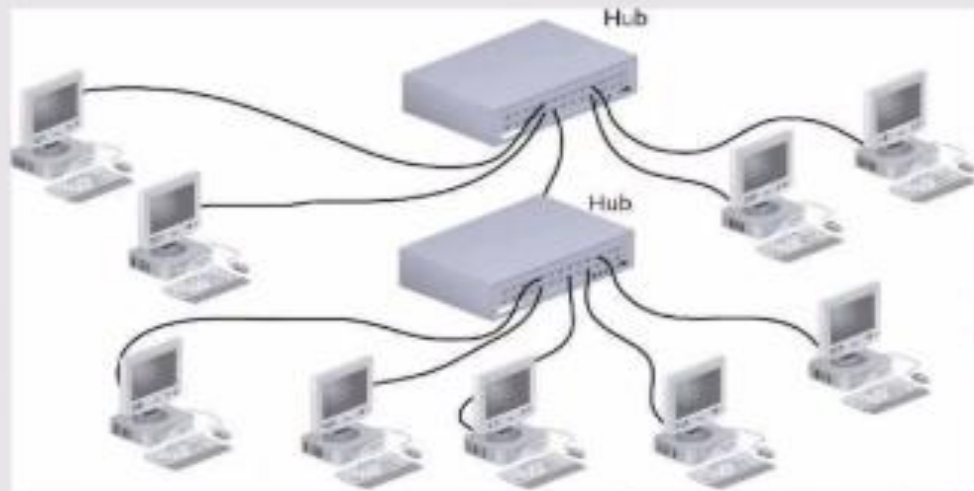


Mesh

Hybrid Topology

It is the mixture of two or more topologies. Therefore it is called Hybrid topology. A hybrid topology combines characteristics of linear bus and star and/or ring topologies.

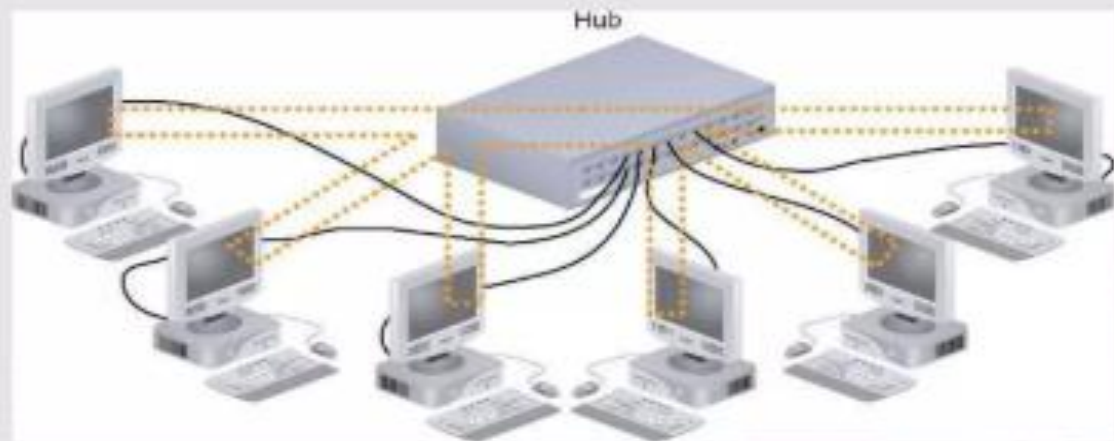
Star-Wired Bus



Advantages of hybrid topology

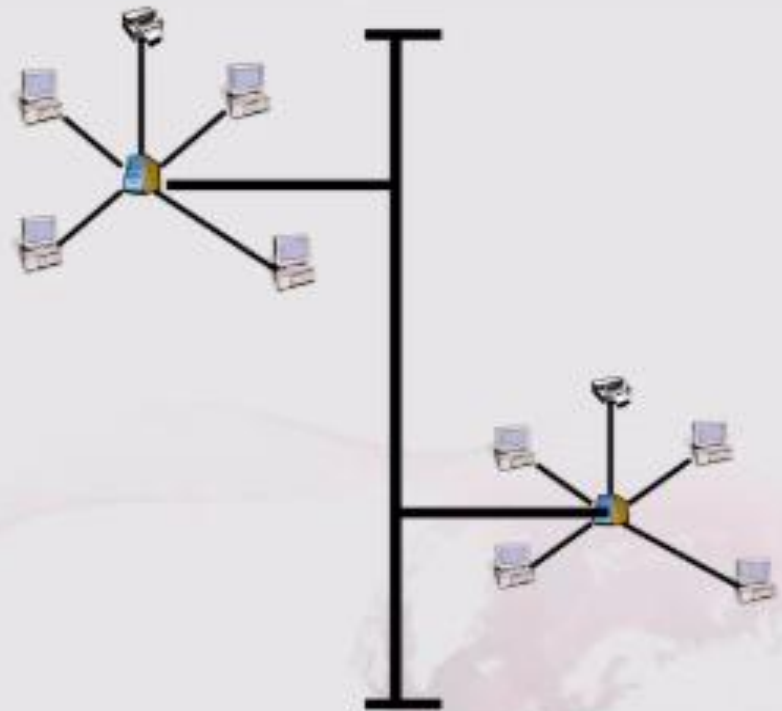
- Reliable as error detecting and trouble shooting is easy.
- Effective.
- Scalable as size can be increased easily.
- Flexible.

Star-Wired Ring



Disadvantages Of Hybrid Topology

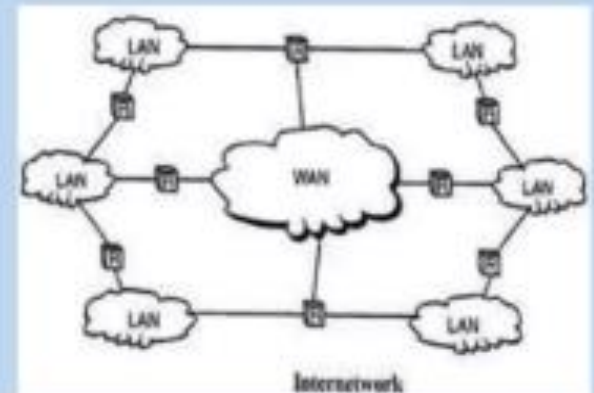
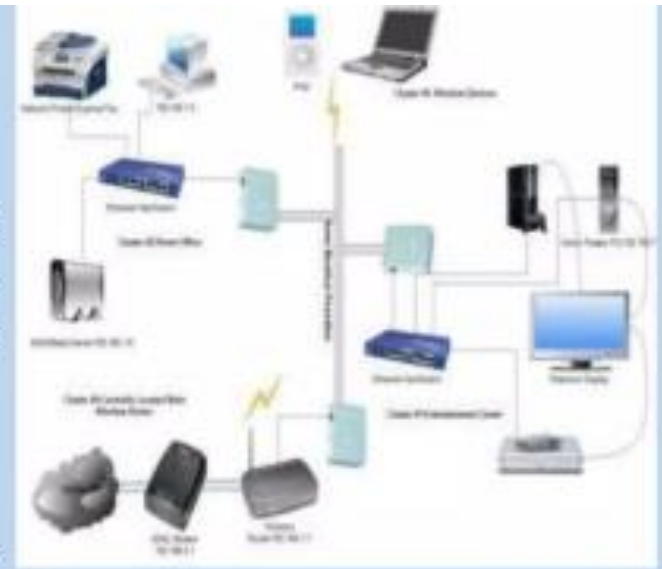
- Complex in design.
- Costly.



5.3 Network Connecting Devices: Switch, Router, Repeater, Bridge, Gateways and Modem

INTRODUCTION

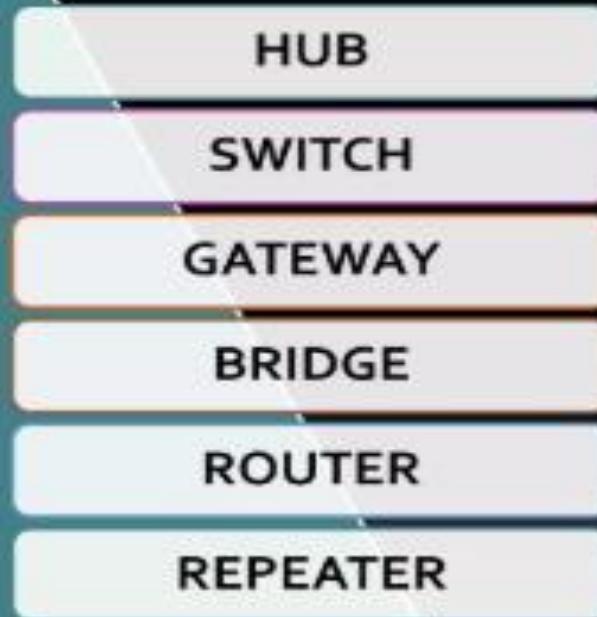
- **NETWORKING:** Devices that help the network to be linked to each other, with the objective of sharing data and/or hardwares or software.
- **INTERNETWORKING:** When two or more networks or subnets connected to each other for communication between hosts on different types of network then it forms internetwork.



Networking Devices

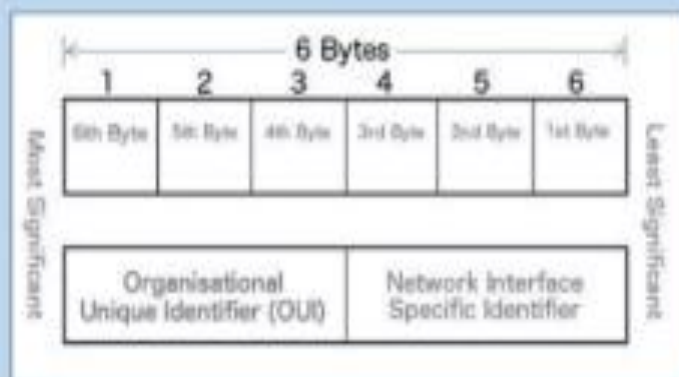
Network devices are components used to connect computers or other electronic devices together so that they can share files or resources like printers or fax machines.

Different Networking Devices



MAC Address

- A network interface card (NIC) is that is attached to each computer on the network.
- The NIC manufacturer assigns a unique physical address to each NIC card this address is called as Media Access Control Address (MAC address).
- It consists of 6 bytes each byte is separated by ':', first three bytes are *manufacturer-id* and last three bytes are the *card number* assigned by manufacturer to each card.



IP Address

- Every network follow some rule for communication, such set of rules are called PROTOCOLS.
- Common protocol and used by internet is Transmission control protocol/Internet protocol(TCP/IP).
- Each computer on a TCP/IP network has a unique identification number called IP address. Its older version is 32 bit long (IPv4 address) and newer version is 128 bit(IPv6).

IPv4 address in dotted-decimal notation

172 . 16 . 254 . 1

10101100.00010000.11111110.00000001

8 bits

32 bits (4 bytes)

An IPv6 address

(in hexadecimal)

2001:0D88:AC10:FE01:0000:0000:0000:0000

2001:0DB8:AC10:FE01:: Zeroes can be omitted

[illegible]

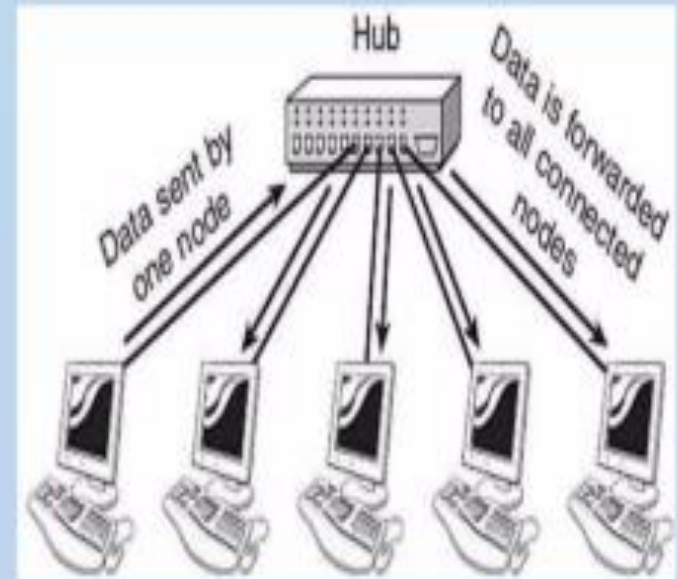
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# Hub

- Connects two or more devices without having to connect to each other directly.
- Uses twisted pair cables.
- Forward the data it received from a connected device to all other connected devices.
- It is also known as Dumb Switch.
- It is cheaper than the switch.

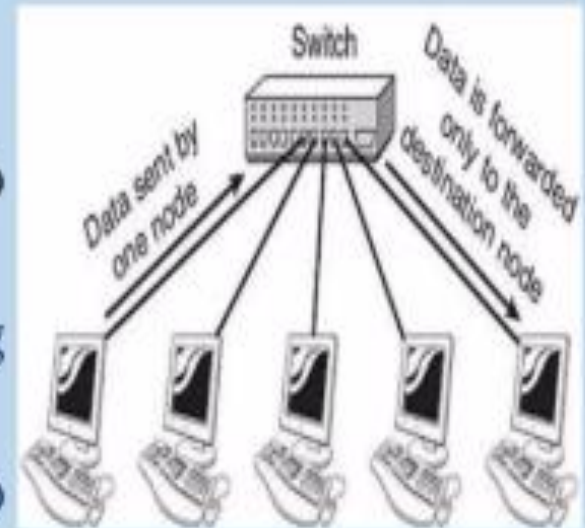


netgear.com



# Switch

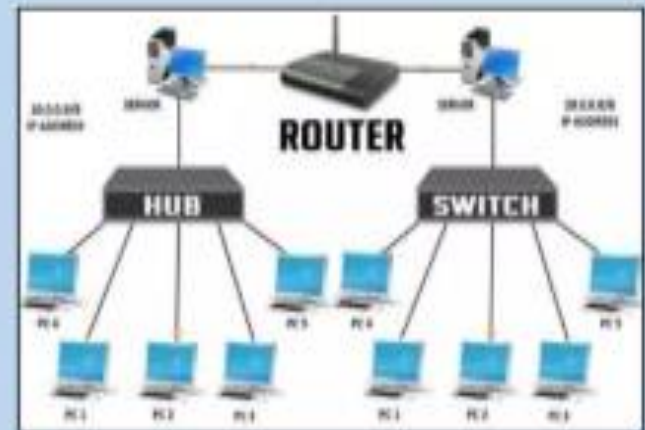
- It connects different computer and sub-networks to one network.
- It transfers data to the specific computer using packet switching technique.
- It uses MAC address of the destination computer to deliver packet on the network.





# Routers

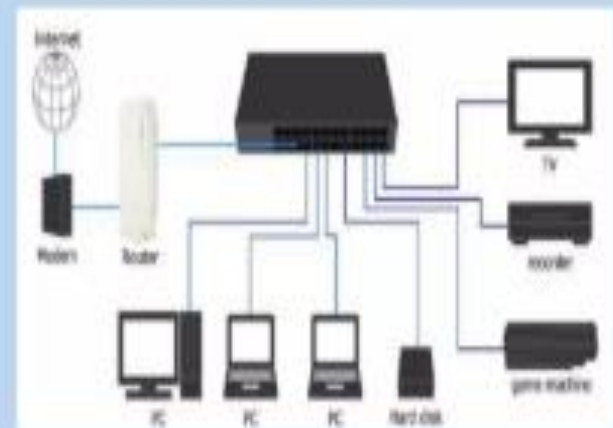
- It is used to connect multiple networks irrespective of their protocol.
- It handles data packets with their IP address.
- It identifies the destination with the packet header and using best route ,the message is forwarded to the next device in the network.



# Types of Routers

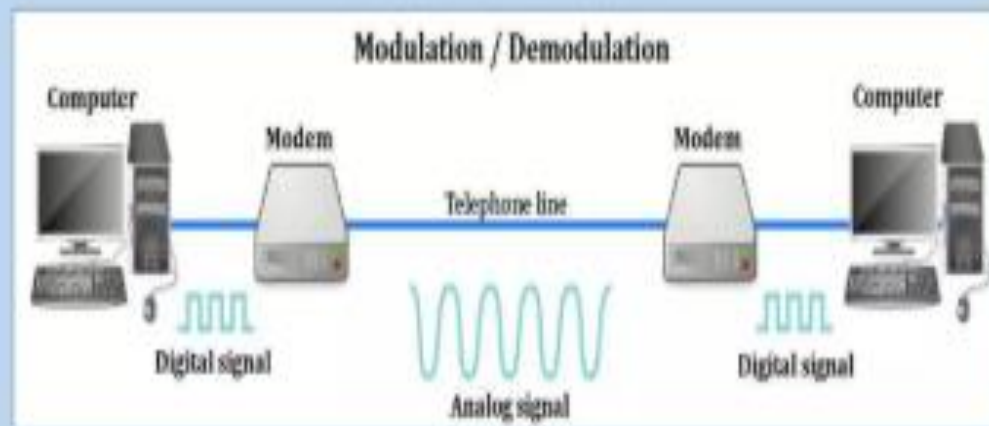


- **Broadband Routers:** It is used to connect computers or to internet. To connect internet through phone and Voice over IP technology (VOIP), we need broadband routers.
- **Wireless Routers:** They create wireless signals in our home and office, so any pc in the range can be connected through the network and can use internet.
- **Edge Routers:** It is placed at the border of ISP network to connect various BGP(Border gateway Protocol).
- **Core Router:** It is used as backbone of LAN network spread in large area.



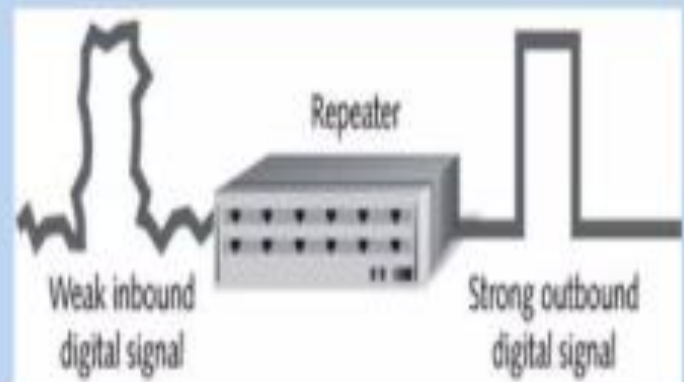
# Modem

- A modem is a device used to connect and communicate with other computers via phone line.
- **Modulation/Demodulation:** process of sending data on a wave(analog) is modulation. (Conversion of digital signal into analog signal) and vice versa.
- Two types of modems are : **Internal modem**(Fix inside the CPU ),  
**External modem**( connected externally to the computer).



# Repeater

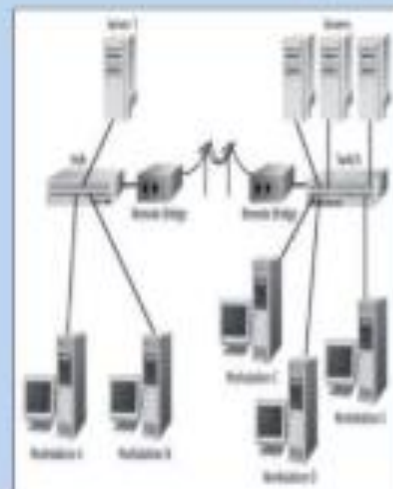
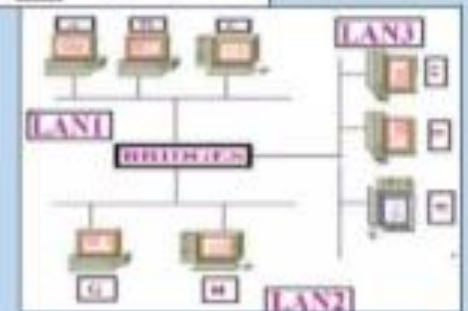
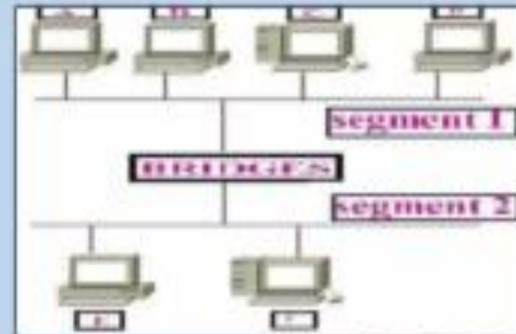
- A repeater is a network device that amplifies and restores signals for long-distance transmission.
- Required when the network is weakened or distorted over a long distance.
- Repeater ensures the delivery of the packet over the chances of weak signals.
- Two types of Repeater: **Amplifier** (amplifies all incoming signals both signals and noise), **Signal Repeaters** (collects the inbound packet and retransmit the packet as it was with source).





# Types of Bridges

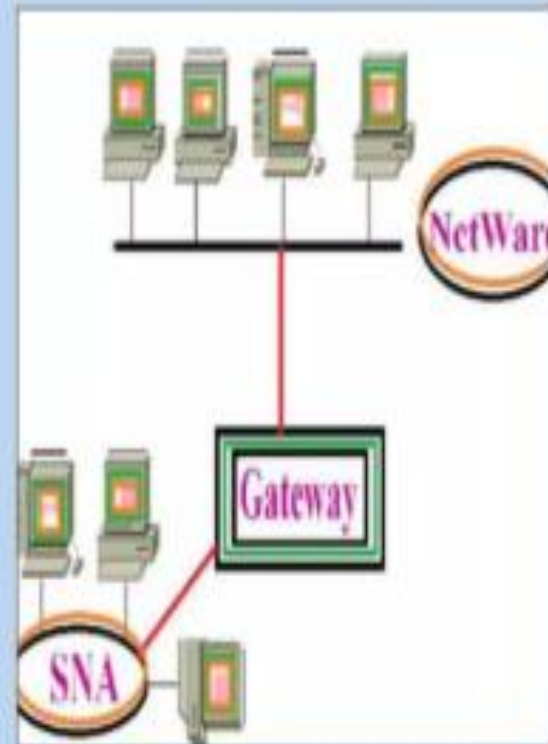
- **Local bridge:** Connects network segments of the same type and at the same location.
- **Translation bridge:** Connects network segments at the same location that use different media or different protocol.
- **Remote bridge:** Connects network segment at remote locations, using a wide area network (WAN) link.



# Gateways



- It is a device that connects at the highest level of network and used to connect dissimilar networks.
- A gateway converts Ethernet traffic from the LAN to SNA(System Network Architecture)i.e. networking standard developed by IBM, for mainframe and minicomputers.
- It is a node which servers as an entrance to another network.
- It acts as a **proxy server**(a machine that is not a server but appears as a server) and a **firewall**(a system designed to prevent unauthorized access to or from a private network).



*Thank  
you*





