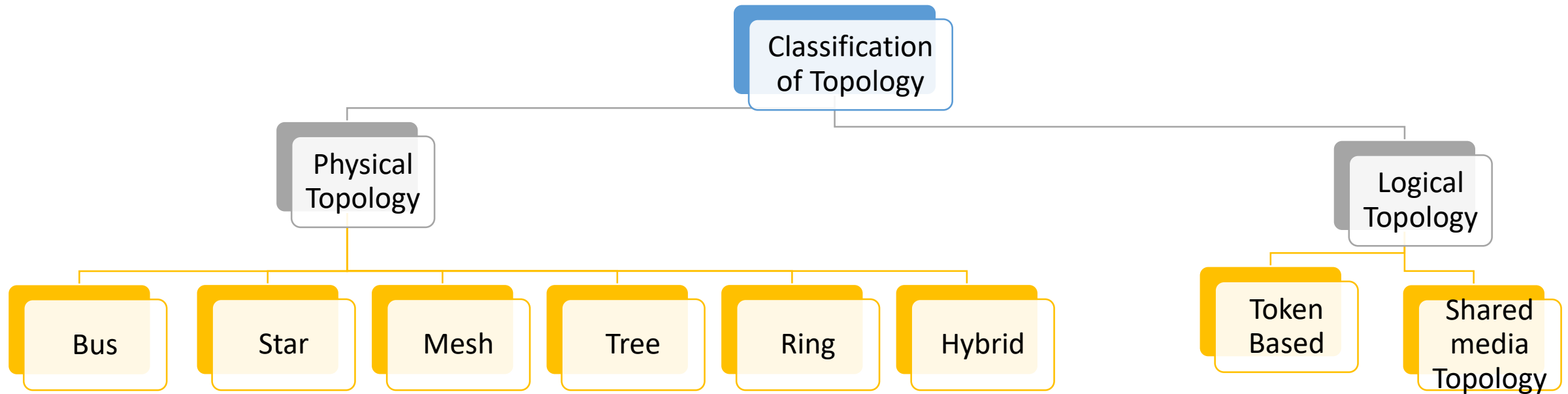# Network Topologies and Network devices

Unit 4

- Topology refers to the way in which the network of computers is connected. Each topology is suited to specific tasks and has its own advantages and disadvantages. The choice of topology is dependent upon type and number of equipment being used, planned applications and rate of data transfer required, response time, and cost.

Classification of Topology

Physical Topology
- Bus
- Star
- Mesh
- Tree
- Ring
- Hybrid

Logical Topology
- Token Based
- Shared media Topology

- **1. Physical Topology:**

❑Physical topology mentions the physical design of a network including the devices, location and cable installation.

❑ A physical topology describes the placement of network nodes and the physical connections between them.

❑This includes the arrangement and location of network nodes and they are connected. Bus topology, star topology, ring topology, tree topology, mesh topology, etc. are the examples of physical topologies.

2. Logical Topology:

❑It is also called as signal topology.

❑Logical topology refers to the nature of the paths the signals follow from node to node.

❑Logical topologies are bound to the network protocols that direct how the data moves across a network. Logical topology refers to the paths that messages take to get from one place on the network to another place. The two most common types of logical topologies are broadcast and token passing.

❑For example, in a logical diagram of your office network, you may show a connection between city A and city B. But in the actual physical network, your data may go through switching points in several other cities as well. The logical path is a high-level representation; the physical path is the actual route.

- **Definition**

- The topology of a network is "the geometric representation of the relationship of all the links and linking devices (nodes) in a network".

- The way of Connecting the computer in a network is called as topology.

- **Selection Criteria**

- Selecting an appropriate topology for your deployment environment depends upon several factors. When you select a topology pattern, consider the following factors:

- 1. Current Hardware.

- 2. Size of the Network.

- 3. Budget Limitations.

- 4. Need for reliability.

- 5. Bandwidth capacity.

- 6. Scalability and Ease installation.

- 7. Ease of Troubleshooting.

Star

hub or switch

Bus

Mesh

Ring
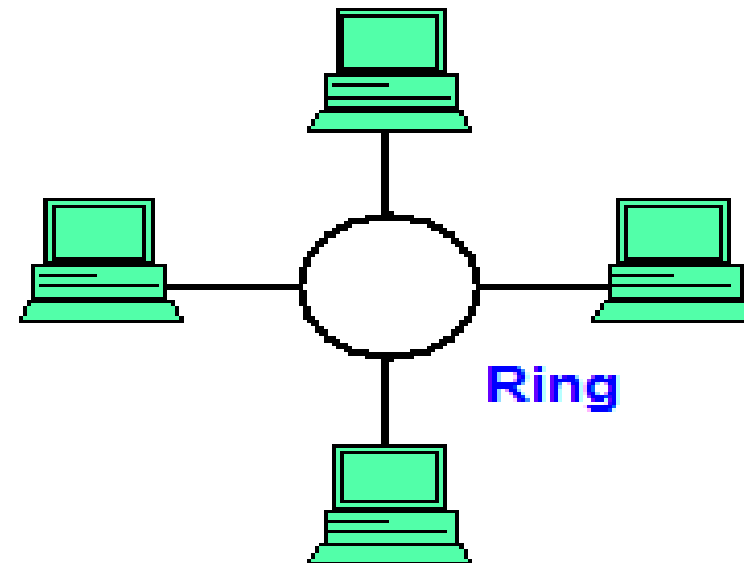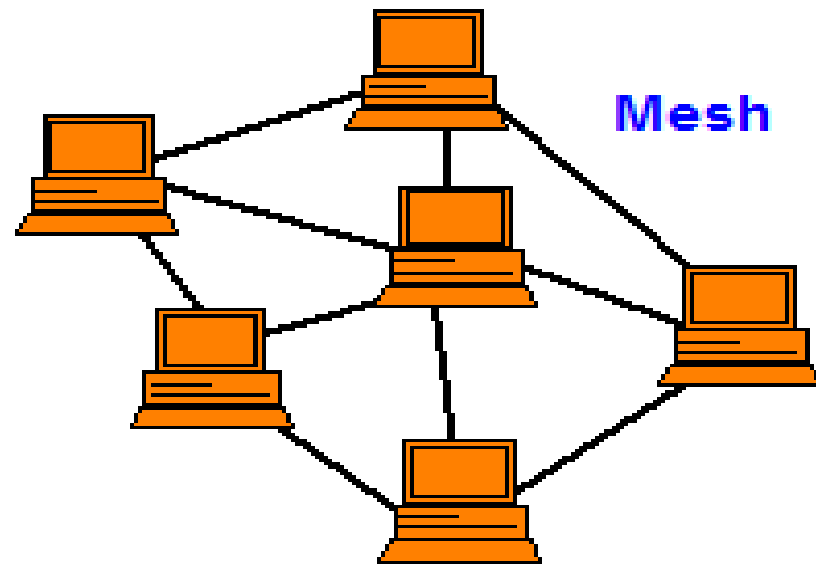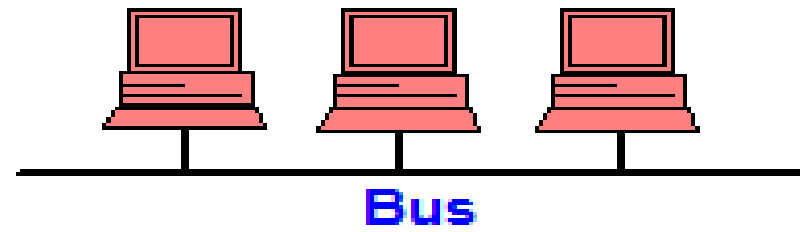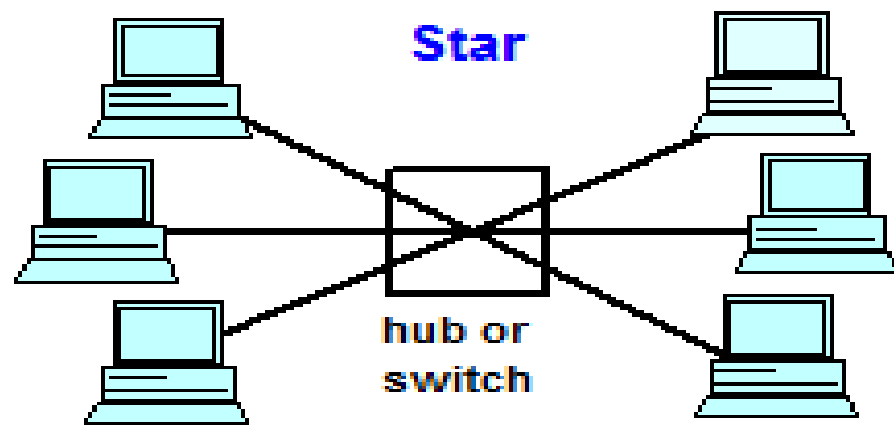
Bus Topologies

➢ In networking, a topology that allows all network nodes to receive the same message through the network cable at the same time is called as bus topology.

➢ In this type of network topology, all the nodes of a network are connected to a common transmission medium having two endpoints.

➢ All the data that travels over the network is transmitted through a common transmission medium known as the bus or the backbone of the network.
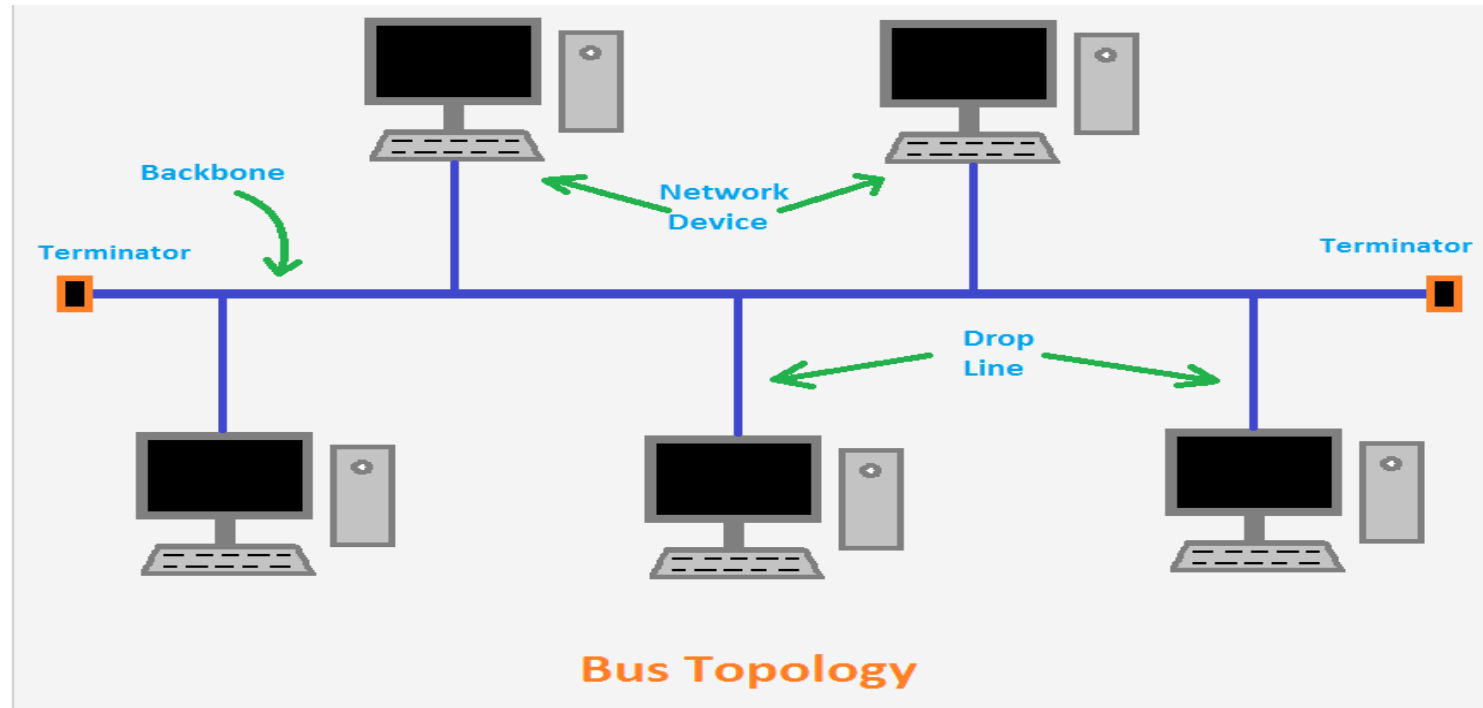
Bus Topology

➢ **Working of Bus Topology:** The central cable is the backbone of the network and is known as Bus (thus the name). Every workstation or node communicates with the other device through this Bus.

➢ A signal from the source is broadcasted and it travels to all workstations connected to bus cable, Although the message is broadcasted but only the intended recipient, whose MAC address or IP address matches, accepts it.

➢ If the MAC/IP address of machine does not match with the intended address, machine discards the signal. A terminator is added at ends of the central cable, to prevent bouncing of signals. A barrel connector can be used to extend it.
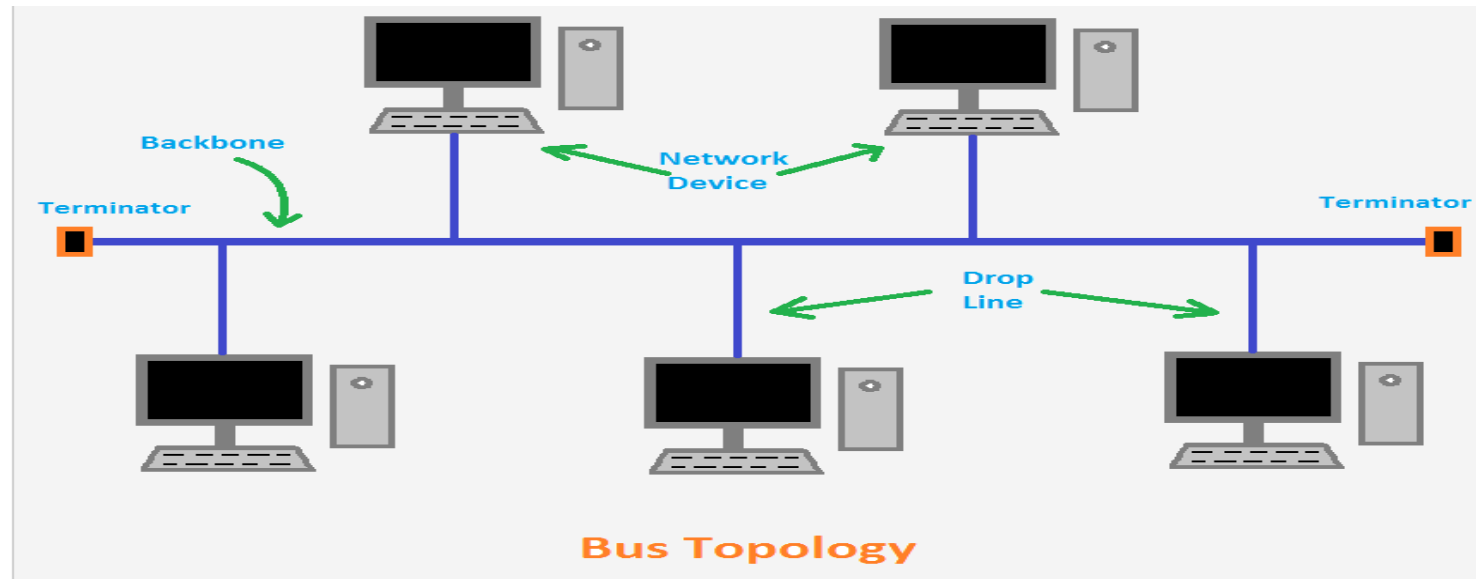
Bus Topology

Features of Bus Topology:
 1. It transmits data only in one direction.
 2. Every device is connected to a single cable in bus topology.

**Advantages of Bus Topology**:
 1. It is cost effective and cabling cost is less than other topologies.
 2. Easy to install and set-up. It is very easy to connect a computer or peripheral to a bus.
 3. Requires less cabling length, so cheaper.
 4. Any one computer or device being down does not affect the others.
 5. Fast as compare to ring topology and sufficient for small network.
 6. Easy to expand joining two cables together.

Disadvantages of Bus Topology:
 1. Cable has a limited length, so it cannot connect a large number of computers.
 2. A fault or break in the bus cable stops all data transmission. Difficult to identify the problem if the entire network shuts down.
 3. Collision may occur.
 4. Terminators are required at both ends of the backbone cable.
 5. If network traffic is heavy or nodes are more the performance of the network decreases.

Ring Topologies

✓ Ring topology is a network topology that is set-up in circular fashion.

✓ It is called ring topology because it forms a ring as each computer is connected to another computer, with the last one connected to the first. Exactly two neighbors for each device.

✓ Each nod in this topology contains repeater. A signal passes node to node, until it reaches its destination. If a node receives a signal intended for another node its repeated regenerates the signal and passes it.
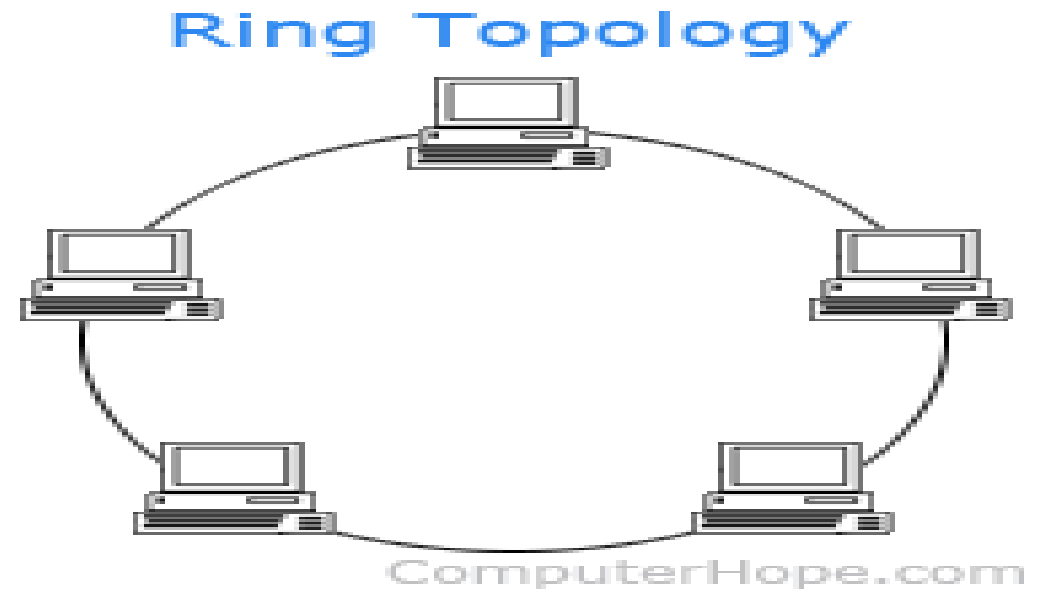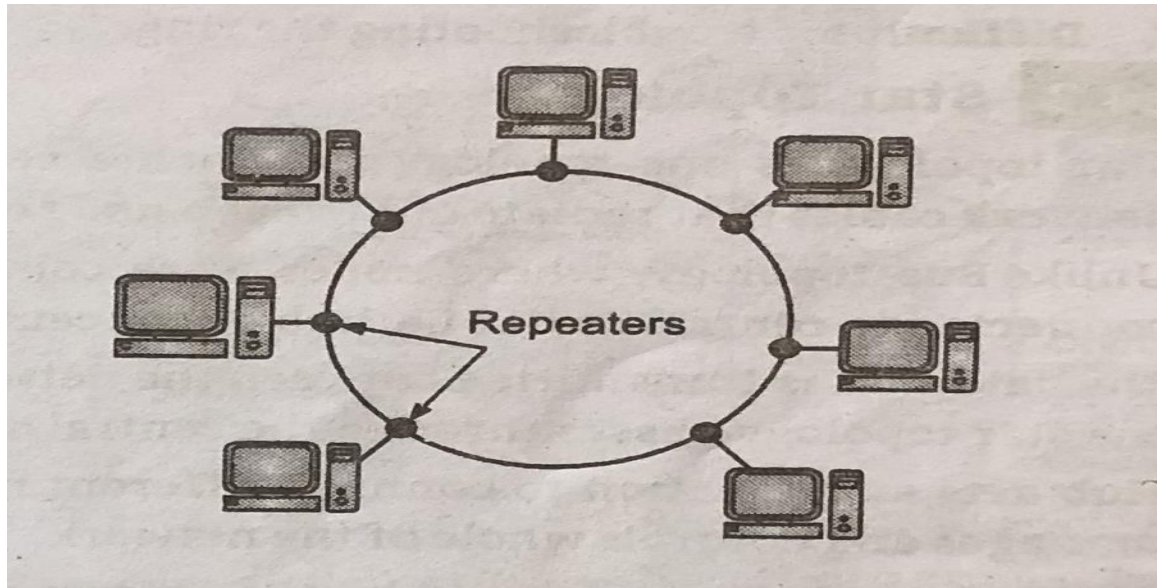
Ring Topologies

Working of Ring Topology:

❑ In ring topology network arrangement, a signal is transferred sequentially using a 'token' from one node to the next.

❑ If a node wants to transmit, it "grabs" the token, attaches data and a destination address to it, and then sends it around the ring. The token travels along the ring until it reaches its destination.

❑ Once, token reaches destination, receiving computer acknowledges receipt with a return message to the sender. The sender then releases the token for the token for use by another computer.

Advantages of Ring Topology:
1. Require less cabling.
2. Less expensive.
3. This type of network topology is very organized. Each node gets to send the data when it receives an empty token.
This helps to reduces chances of collision.
4.Each computer has equal access to resources.
5. Good Communication over long Distance

Disadvantages of Ring Topology:
1. Traffic is unidirectional.
2. Network is highly dependent on the wire which connects different components.
3. Failure of one computer disturbs the whole network.
4. Slow in speed.
5. Adding or deleting the computers disturbs the network activity.
6. Reconfiguration is needed to add one node; whole network must be down first.
7. Difficult for troubleshooting the ring.

Star Topologies

➤ Every node on the network is connected through a central device like hub, switches or routers.

➤ All the data on the star topology passes through the central device before reaching the intended destination.

➤ Hub acts as a junction to connect different nodes present in star network it also manages and control whole of the network.

➤ Hub does not route the data it just passes the signals.

➤ With the help of central device we can add network.
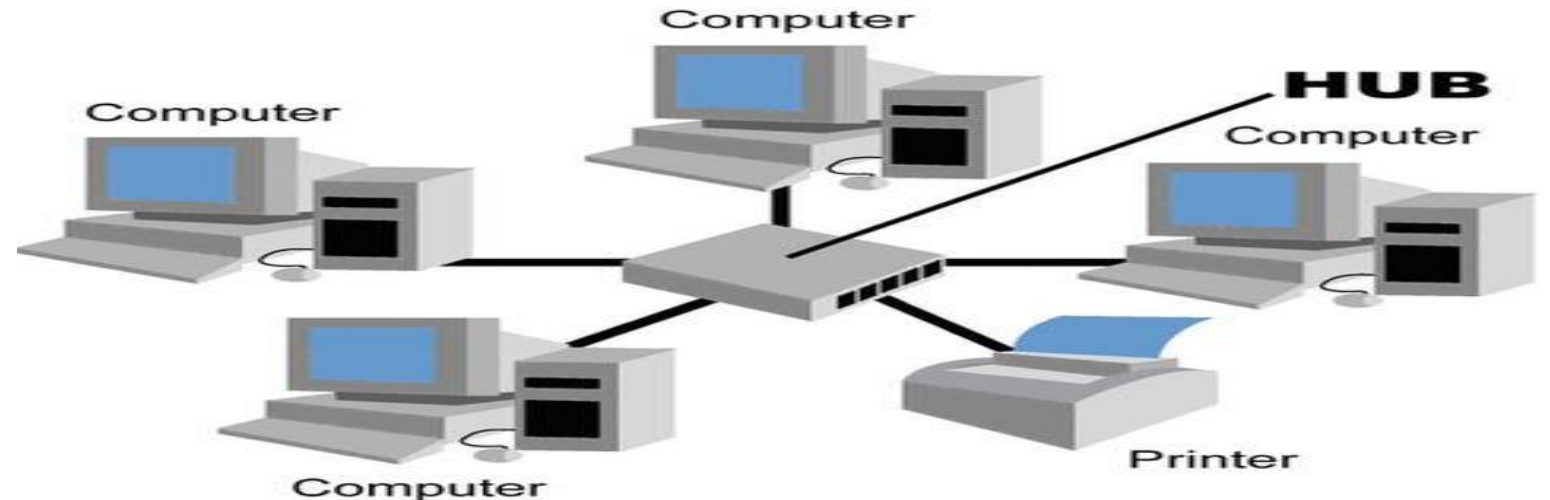
Advantages:
- If one link fails only that link is affected.
- Hub can be upgraded easily.
- Fast as compare to ring topology
- East to install, reconfigure and wire.
- It is east to detect the failure and troubleshoot it.

Disadvantages:
- Central device fail all the network fails.
- Performance is based on hub.
- More Cabling is required than bus topology .
- Performance and as well as number of nodes which can be added in such topology is depended on capacity of central device.

Mesh Topologies

➤ In a mesh network topology, each of the network node, computer and other devices, are interconnected with one another.

➤ In this type of network, each node may send message to destination through multiple paths.

➤ While the data is travelling on the Mesh Network it is automatically configured to reach the destination by taking the shortest route which means the least number of hops.

➤ This type of topology is very expensive as there are many redundant connections, thus it is not mostly used in computer networks. It is commonly used in wireless networks.

Computer

Computer   Computer

Computer   Computer

Computer
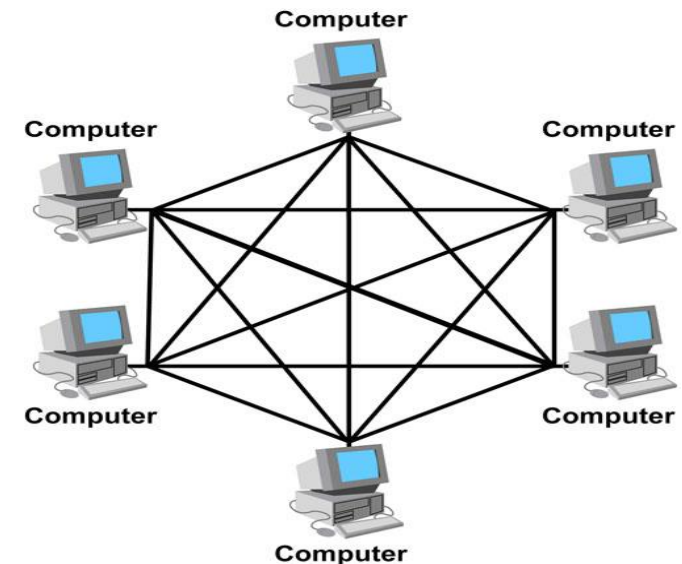
Advantages:

- Mesh topologies is secure because there is a point-to-point link thus unauthorized access is not possible.
- Failure of one link does not affect the other link.
- Eliminate traffic problem.
- Each connection can carry its own data load due to dedicated link.

Disadvantages:

- Bulk of wiring is required.
- Difficult to install.
- Cabling cost is more.
- Setup and maintenance of this topology is very difficult.

Tree Topology:-

➢ As its name implies in this topology devices make a tree structure.

➢ Tree topology integrates the characteristics of star and bus topology.

➢ In tree topology, the number of star networks are connected using Bus.

➢ This main cable seems like a main stem of a tree, and other star networks as the branches. It is also called expanded star topology.

➢ Ethernet protocol is commonly used in this type of topology.

➢ Tree topologies allow for the expansion of an existing network and enable schools to configure a network to meet their need
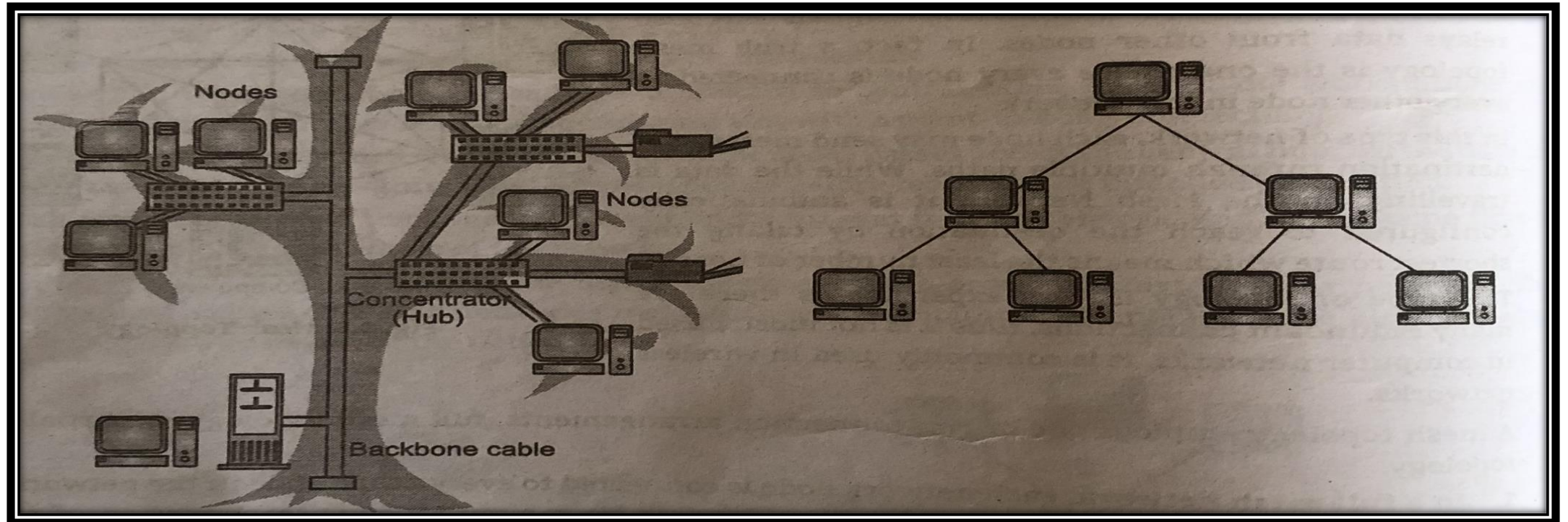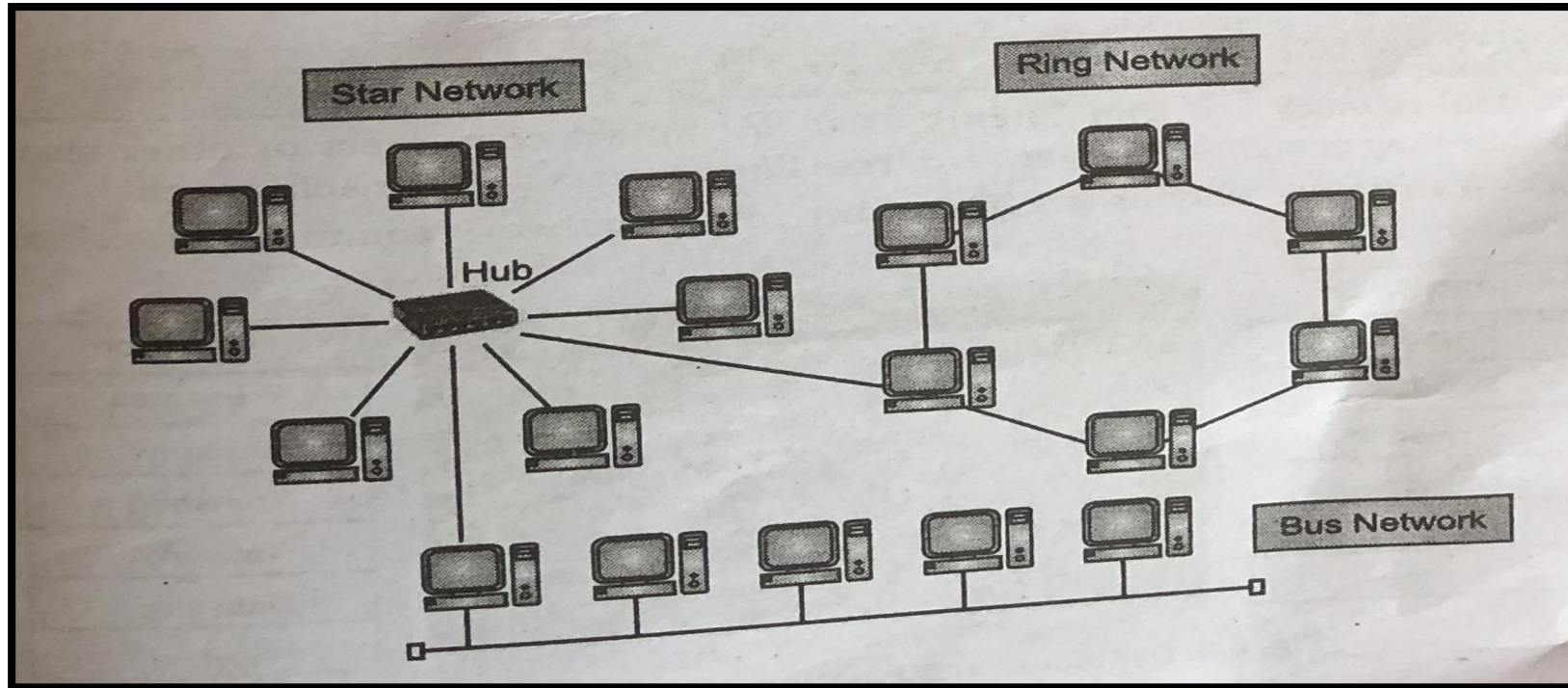
Advantages:

- Easy to install and wire
- Fast as compare to other topologies.
- Eliminates traffic problem.
- Multiple device can transfer data without collision
- Easy to detect faults and to remove parts.

Disadvantages:

- The cabling cost is more.
- Scalability of the network depends on the type of cable used.
- Failure in the central hub brings the entire network to halt.
- As more and more node and segments are added the maintenance become difficult.

Hybrid Topology:-

➢ A combination of two or more different topologies makes for a hybrid topology.

➢ This combination of topologies is done according to the requirements of the organization. In other words, the topology that combines more than one topology is called hybrid topology.

➢ Hybrid topology is used to connect a network that is divided into smaller sections also known as segments.

➢ **Two common examples for hybrid network are star ring network and star bus network.**

➢ 1. A star-ring network consists of two or more star topologies connected using a Multistation Access Unit (MAU) as a centralized hub.

➢ 2. A star-bus network consists of two or more star topologies connected using a bus trunk (the bus trunk serves as the network's backbone).

Advantages:

1. Unlike other networks, fault detection and troubleshooting is easy in this type of topology.
2. It is easy to increase the size of network by adding new components, without disturbing existing architecture.
3. Hybrid network can be designed according to the requirements of the organization and by optimizing the available resources. Special care can be given to nodes where traffic is high a well as where chances of fault are high.
4. Hybrid topology is the combination of two or more topologies, so we can design it in such a war that strengths of constituent topologies are maximized while their weaknesses are neutralized

Disadvantages:

1. One of the biggest drawback of hybrid topology is its design. It's not easy to design this type of architecture and it's a tough job for designers.
2. Configuration and installation process needs to be very efficient
3. The hubs used to connect two distinct networks, are very expensive.
4. As hybrid architectures are usually larger in scale, they require a lot of cables, cooling systems, sophisticate network devices, etc.