

Computer Network(CSC 503)

Shilpa Ingoley

Lecture 5

Type of Connection

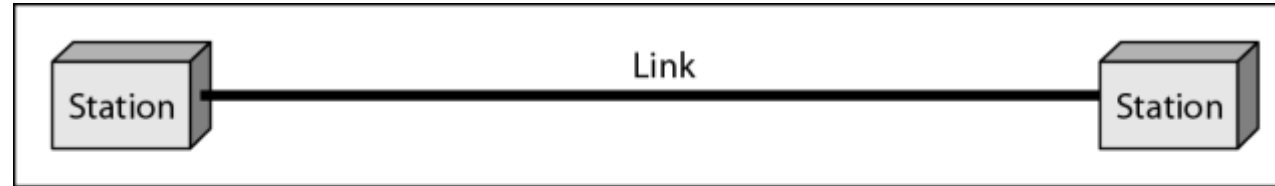
- **Point-to-point**

- Dedicated link between two devices
- The entire capacity of the channel is reserved
- Ex) Microwave link, TV remote control

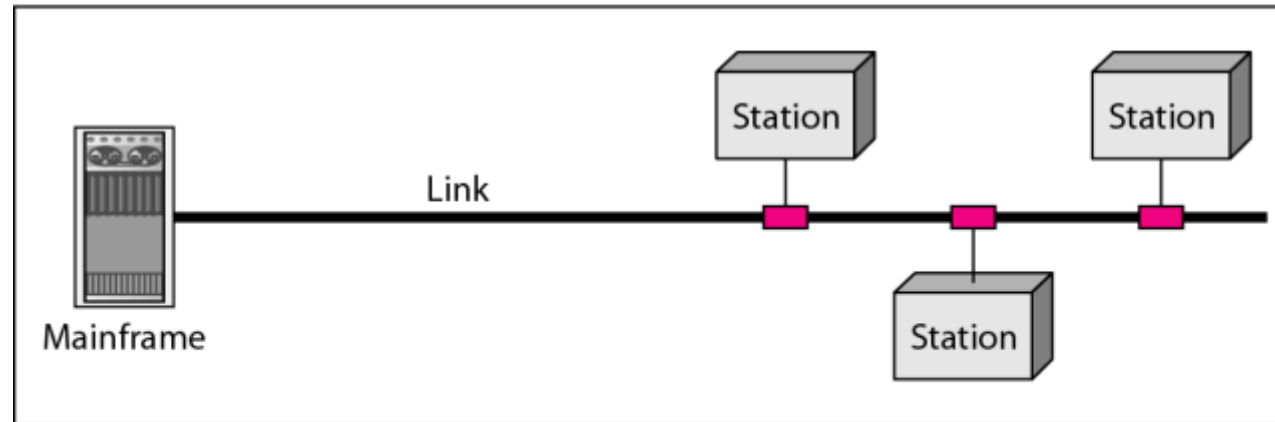
- **Multipoint**

- More than two devices share a single link
- Capacity of the channel is either
 - *Spatially shared*: Devices can use the link simultaneously
 - *Timeshare*: Users take turns

Type of Connection



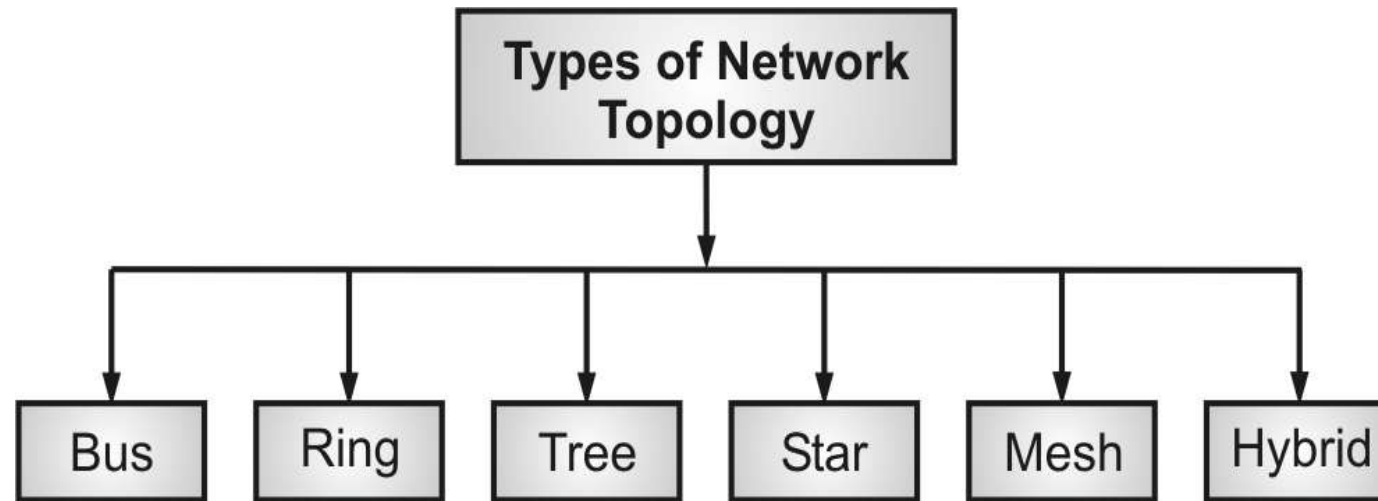
a. Point-to-point



b. Multipoint

Physical Topology

- The term *physical topology* refers to the way in which a network is laid out physically.
- Two or more devices connect to a link; two or more links form a topology.



Network Topology

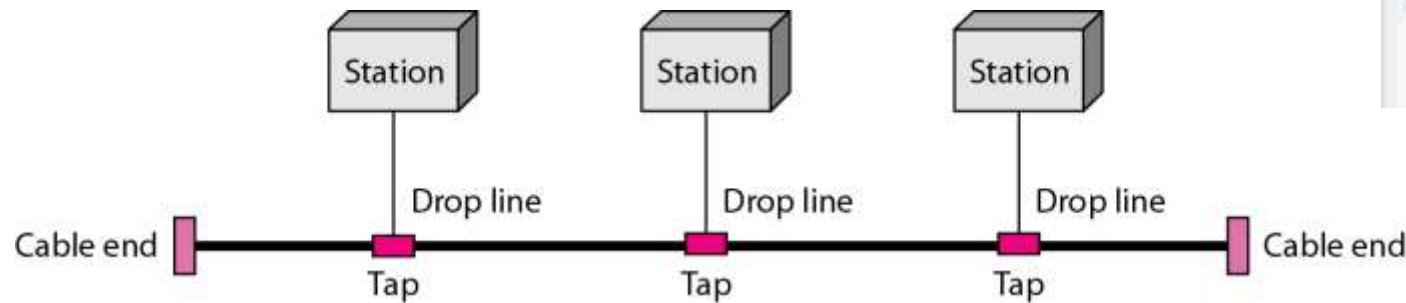
The pattern of interconnection of nodes in a network is called the TOPOLOGY.

Factors to be considered for selection of the choice of topology:

1. **Cost** : For a network to be cost effective, one would try to minimize installation cost
2. **Flexibility**: he topology should allow for easy reconfiguration of the network. This involves moving existing nodes and adding new ones.
3. **Reliability** :The topology chosen for the network can help by allowing the location of the fault to be detected and to provide some means of isolating it.
4. **Ease of installation**
5. **Ease of maintenance**
6. **Cable fault tolerance**

Bus Topology

- One long cable that links all nodes
- tap, drop line, cable end
- limit on the # of devices, distance between nodes
- Advantages: Easy installation, cheap
- Disadvantages: Difficult reconfiguration, no fault isolation, a fault or break in the bus stops all transmission



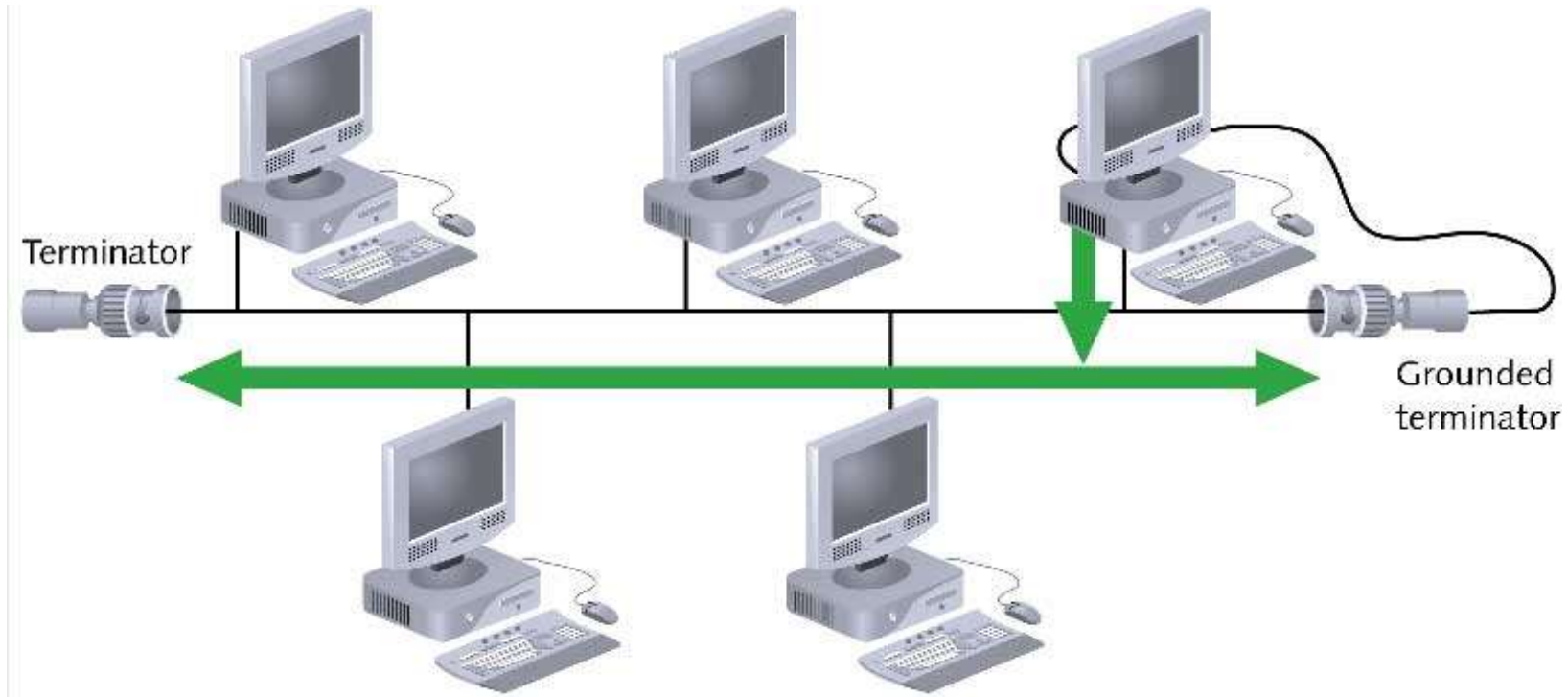
The Bus Topology

This consists of a single length of the transmission medium (normally coaxial cable) onto which the various nodes are attached.

Advantages of the Linear Topology

- 1.Short cable length and simple wiring layout:** Because there is a single common data path connecting all nodes, the linear topology allows a very short cable length to be used. This decreases the installation cost, and also leads to a simple, easy to maintain wiring layout.
- 2. Easy to extend:** Additional nodes can be connected to an existing bus network at any point along its length. More extensive additions can be achieved by adding extra segments connected by a repeater.

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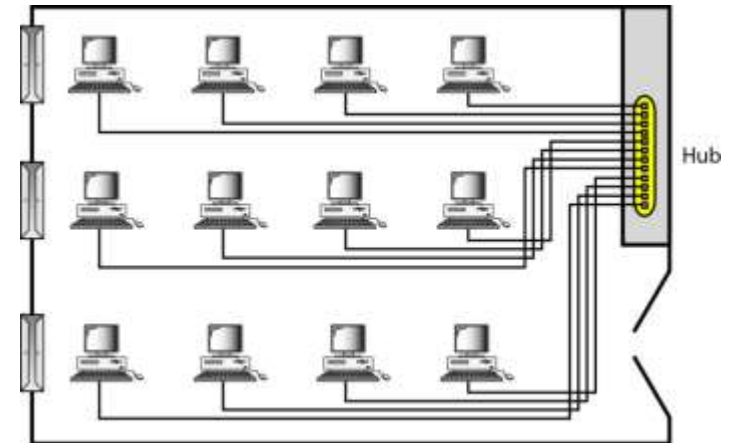
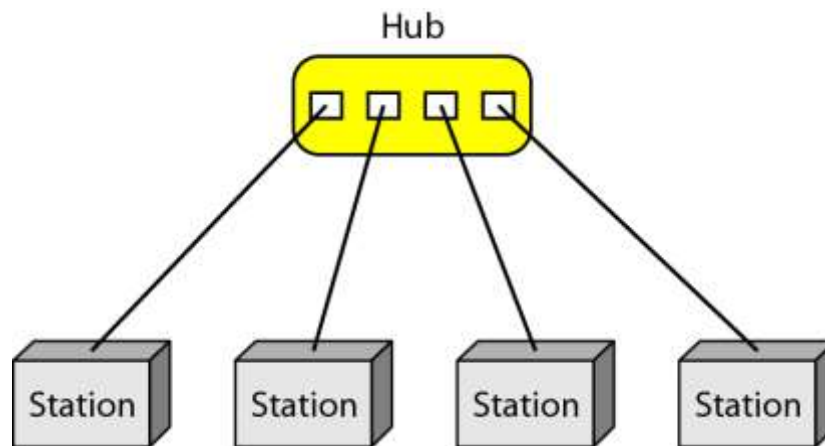


Disadvantages of the Bus (Linear) Topology

- 1. Fault diagnosis is difficult:** Although simplicity of the bus topology means that there is very little to go wrong, fault detection is not simple. Detection of a fault may have to be performed from many points in the network.
- 2. Fault isolation is difficult:** In the star topology, a defective node can easily be isolated from the network by removing its connection at the centre. If a node is faulty on the bus, it must be rectified at the point where the node is connected to the network.
- 3. Nodes must be intelligent:** Each node on the network is directly connected to the central bus. This means that some way of deciding who can use the network at any given time must be performed in each node.
- 4. A main cable/Bus break can disable the entire network**

Star Topology

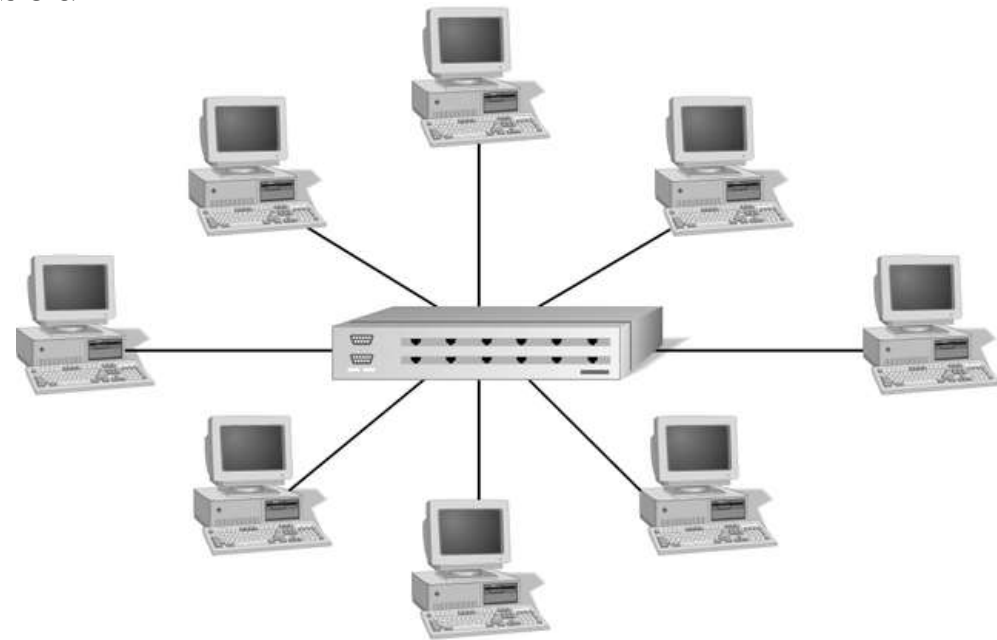
- Dedicated point-to-point link *only to* a central controller, called a **hub**
- Hub acts as an exchange: No direct traffic between devices
- Advantages: Less expensive, robust
- Disadvantages: dependency of the whole on one single point, the hub



Star Topology

This topology consists of a central node to which all other nodes are connected by a single path. It is the topology used in most existing information networks involving data processing or voice communications.

In case of network expansion star is used



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Advantages of the Star Topology

1. **Ease of service:** The star topology has a number of concentration points (where connections are joined). These provide for easy reconfiguration of the network.
2. **One device per connection:** Connection points in any network are inherently prone to failure in the star topology, failure of a single connection typically involves disconnecting one node from an otherwise fully functional network.
3. **Centralized control/problem diagnosis :** Faults are easily detected and isolated. Easy to disconnect failing nodes from the system.
4. **Simple access protocols:** Any given connection in a star network involves only the central node. In this situation, contention for who has control of the medium for the transmission purposes is easily solved. Thus in a star network, access protocols are very simple.

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Disadvantages of the Star Topology.

1.Long cable length: Because each node is directly connected to the centre, the star topology necessitates a large quantity of cable.

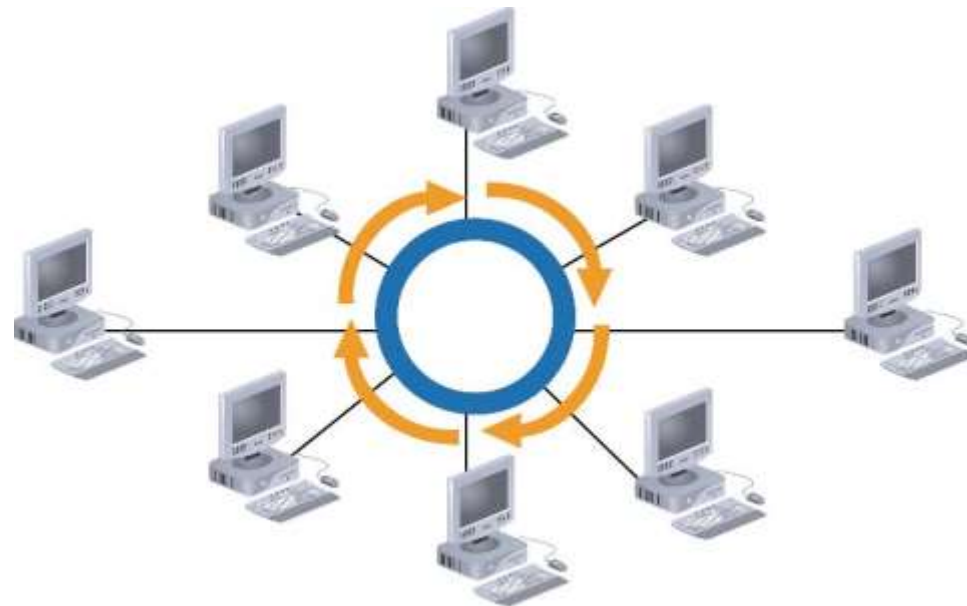
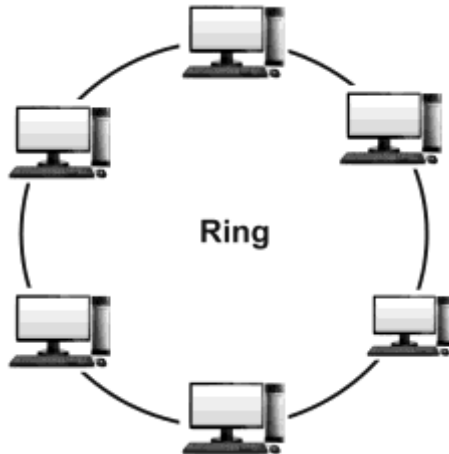
2.Central node dependency: If the central node in a star network fails, the entire network is rendered inoperable.

Ring Topology

In this case, each node is connected to two and only two neighbouring nodes.

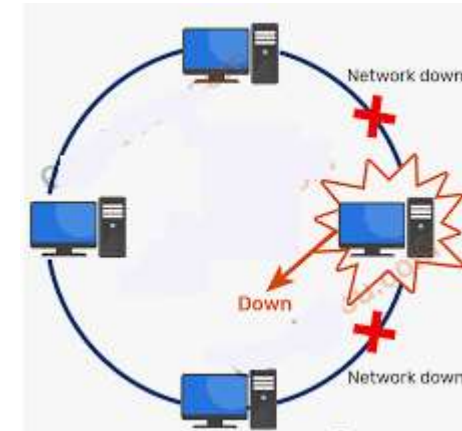
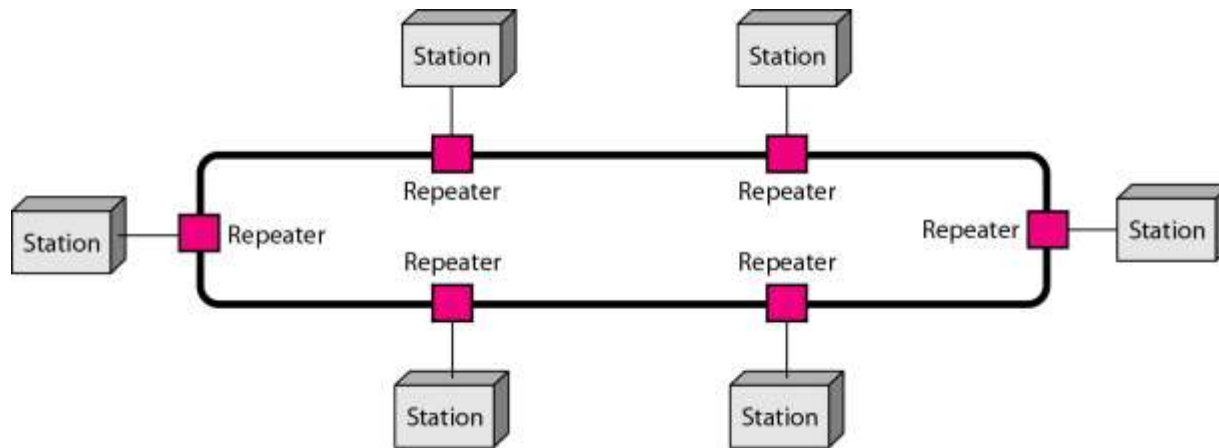
Data is accepted from one of the neighbouring nodes and is transmitted onwards to another.

Thus data travels in one direction only, from node to node around the ring. After passing through each node, it returns to the sending node, which removes it.



Ring Topology

- Dedicated point-to-point link only with the two nodes on each sides
- Advantages: Easy reconfiguration, fault isolation
- Disadvantage: Unidirectional traffic, a break in the ring can disable the entire network



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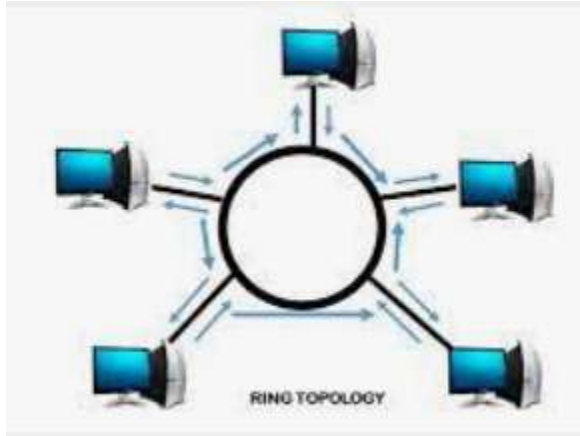
Advantages of Ring Topology

1. Short cable length. The amount of cabling involved in a ring topology is comparable to that of a bus and is small relative to that of a star.

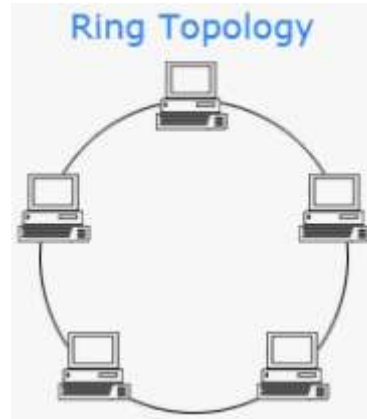
Drawbacks of Ring Topology

1. Each packet of data must pass through all the computers between source and destination, slower than star topology
2. If one workstation or port goes down, the entire network gets affected

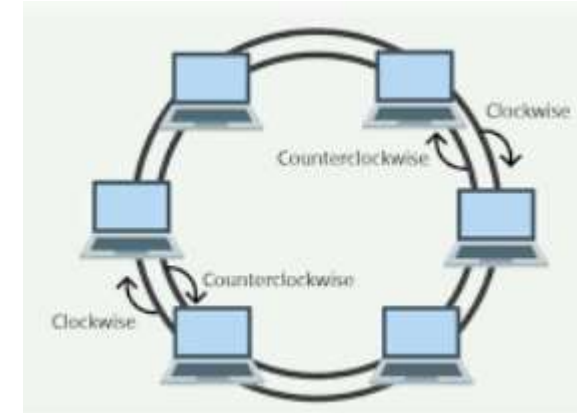
Types: Ring



Type1 Ring(like Bus topology)



Type 2 Ring point to point



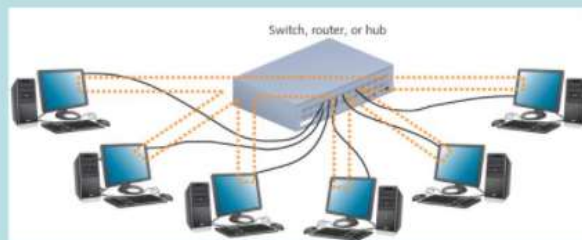
Dual counter rotating Ring

- Star-wired ring topology

- Star physical topology
- Ring logical topology

- Token passing data transmission method

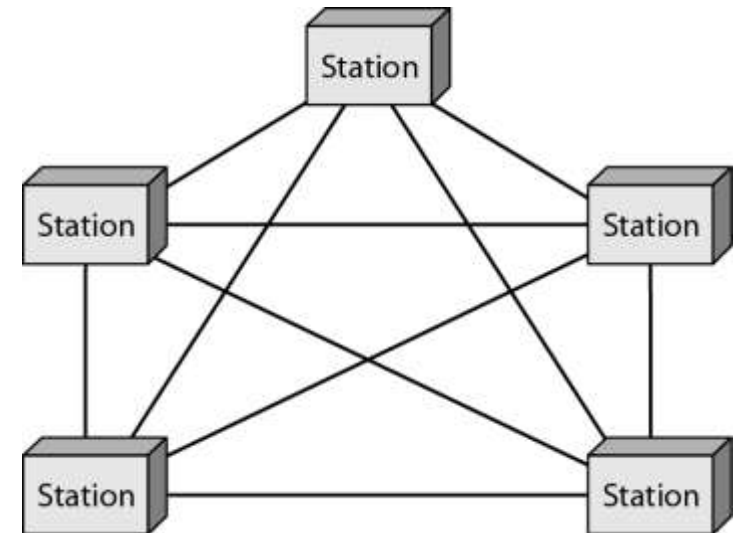
- Benefit
 - Star fault tolerance
 - Reliability of token passing
- Network use
 - Token Ring networks



←Star-wired Ring

Mesh Topology

- Dedicated point-to-point link to every other nodes
- A mesh network with n nodes has $n(n-1)/2$ links. A node has $n-1$ I/O ports (links)
- Advantages: No traffic problems, robust, security, easy fault identification & isolation
- Disadvantages: Difficult installation/reconfiguration, space, cost



Mesh topology

- Mesh technology is an arrangement of the network in which computers are interconnected with each other through various redundant connections.
- There are multiple paths from one computer to another computer. It does not contain the switch, hub or any central computer which acts as a central point of communication.

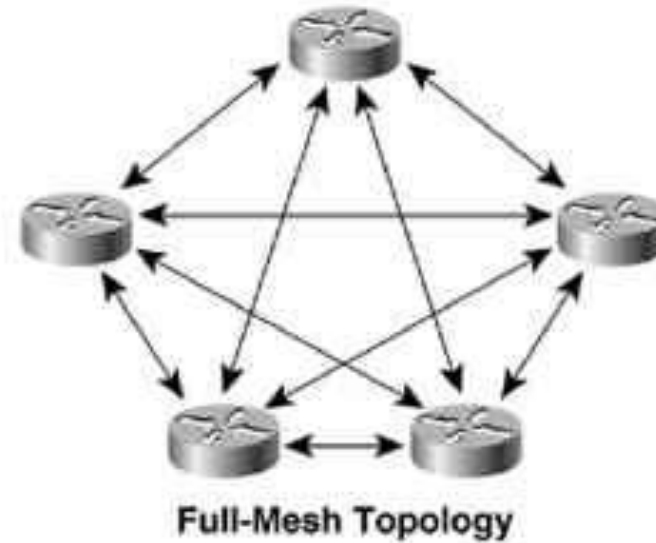
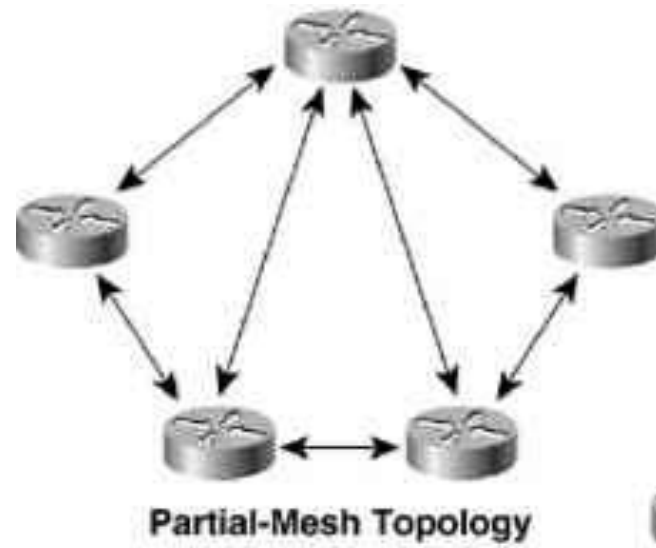
Full Mesh Topology: In a full mesh topology, each computer is connected to all the computers available in the network.

Mesh topology can be formed by using the formula:

Number of cables = $(n*(n-1))/2$; ($n \rightarrow$ no. of nodes)

Partial Mesh Topology: In a partial mesh topology, not all but certain computers are connected to those computers with which they communicate frequently.

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Advantages of Mesh Topology

- **Reliable:** The mesh topology networks are very reliable as if any link breakdown will not affect the communication between connected computers.
- **Fast Communication:** Communication is very fast between the nodes.
- **Adding devices:** Adding new devices would not disrupt the communication between other devices.

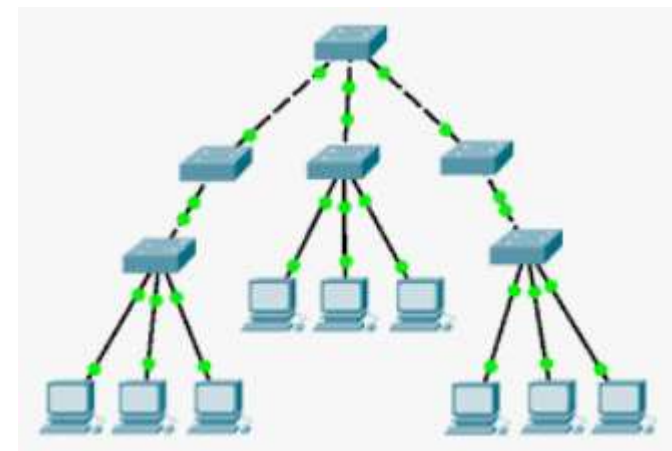
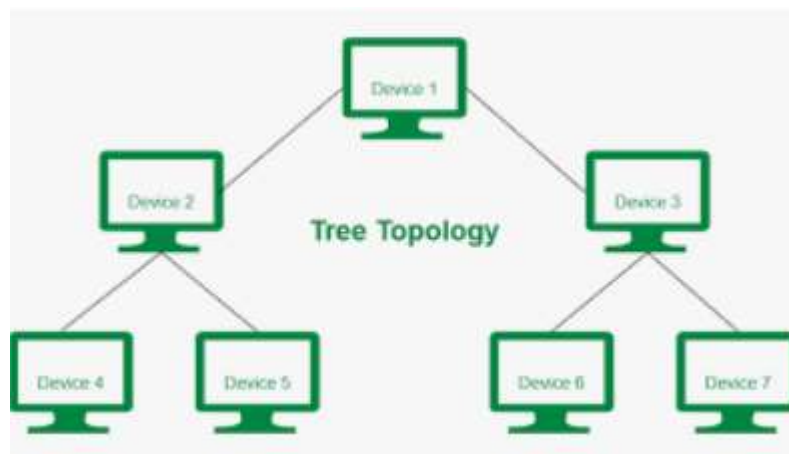
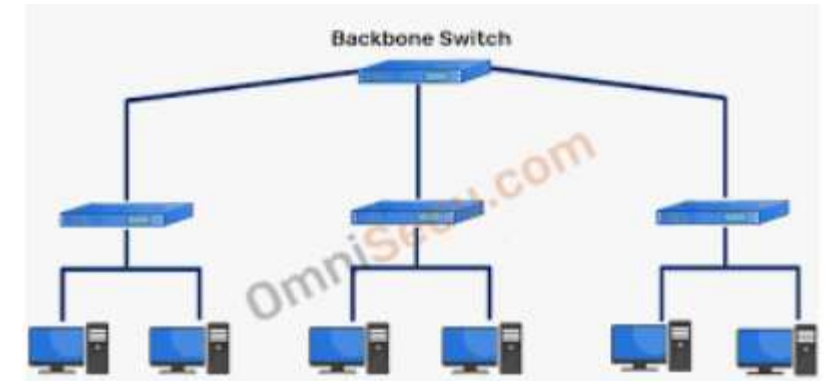
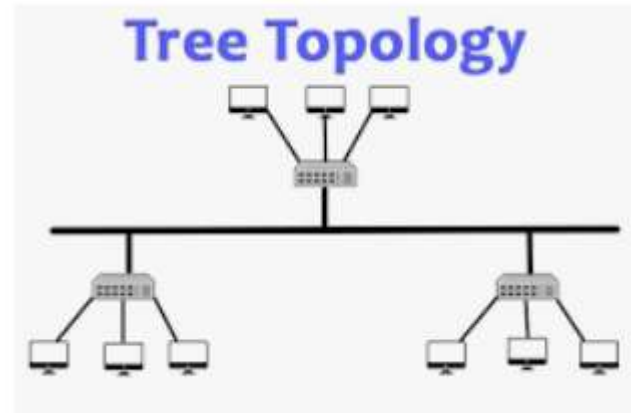
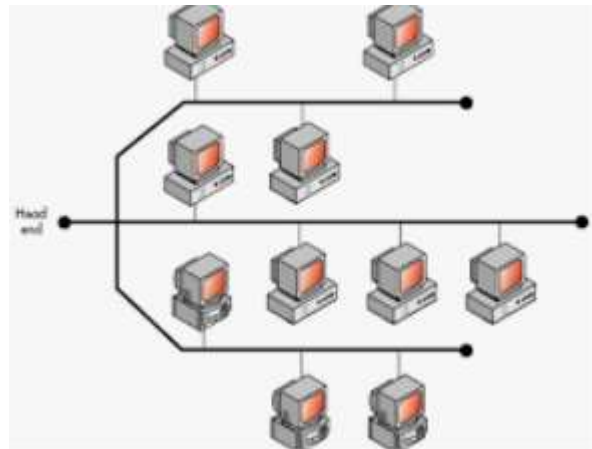
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Disadvantage of Mesh Topology

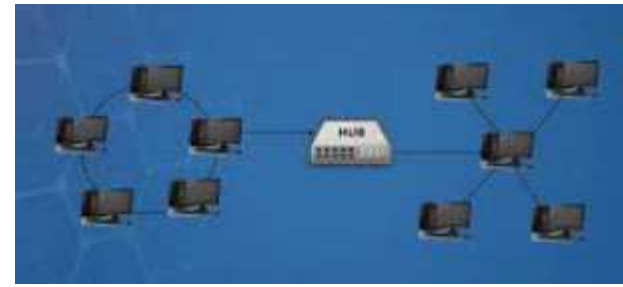
Cost: A mesh topology contains a large number of connected devices such as a router and more transmission media than other topologies.

Efficiency: In this topology, redundant connections are high that reduces the efficiency of the network.

Tree



Hybrid Topology



- Hybrid uses two or more topologies together
- Example: Main star topology with each branch connecting several stations in a bus topology
- To share the advantages from various topologies

