MRA DAV PUBLIC SCHOOL, SOLAN

Class XII (Informatics Practices)
Topic: Network Topologies

- Learning about different physical or logical arrangement of a network

- Advantages of different topologies

- Disadvantages of topologies over one another

Network topology is the way a network is arranged, including the physical or logical description of how links and nodes are set up to relate to each other. There are numerous ways a network can be arranged, all with different pros and cons, and some are more useful in certain circumstances than others.
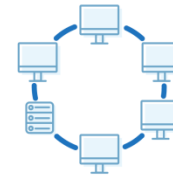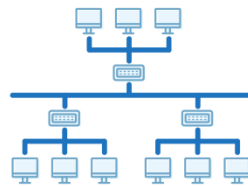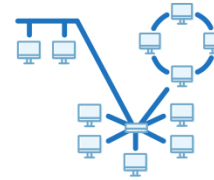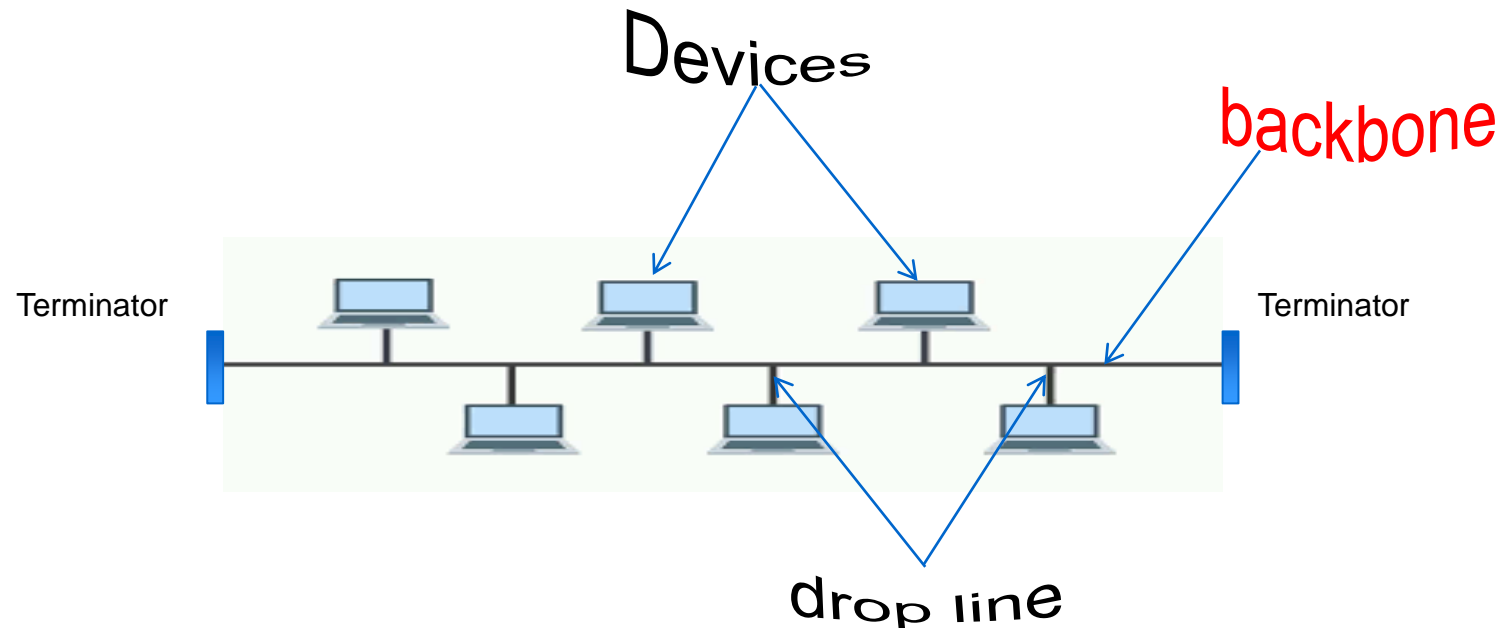

Network Topology Types
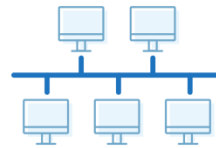
A bus topology is a network setup where each computer and network device is connected to a single cable or backbone.

There is a device called tap that connects the drop line to the main cable.

- It is best-suited for small networks.
- It is easy to set up, handle, and implement.
- It costs very less.

Disadvantages

- It is not easy to isolate faults in the network nodes.

- It is suitable for networks with low traffic. High traffic increases load on the bus, and the network efficiency drops.

- The cable length is limited. This limits the number of network nodes that can be connected.

- This network topology can perform well only for a limited number of nodes. When the number of devices connected to the bus increases, the efficiency decreases.

- It is heavily dependent on the central bus. A fault in the bus leads to network failure.

- Each device on the network "sees" all the data being transmitted, thus posing a security risk.

A star topology is a topology for a Local Area Network (LAN) in which all nodes are individually connected to a central connection point, like a hub or a switch.

A star takes more cable than e.g. a bus, but the benefit is
that if a cable fails, only one node will be brought down.

Hub/Switch
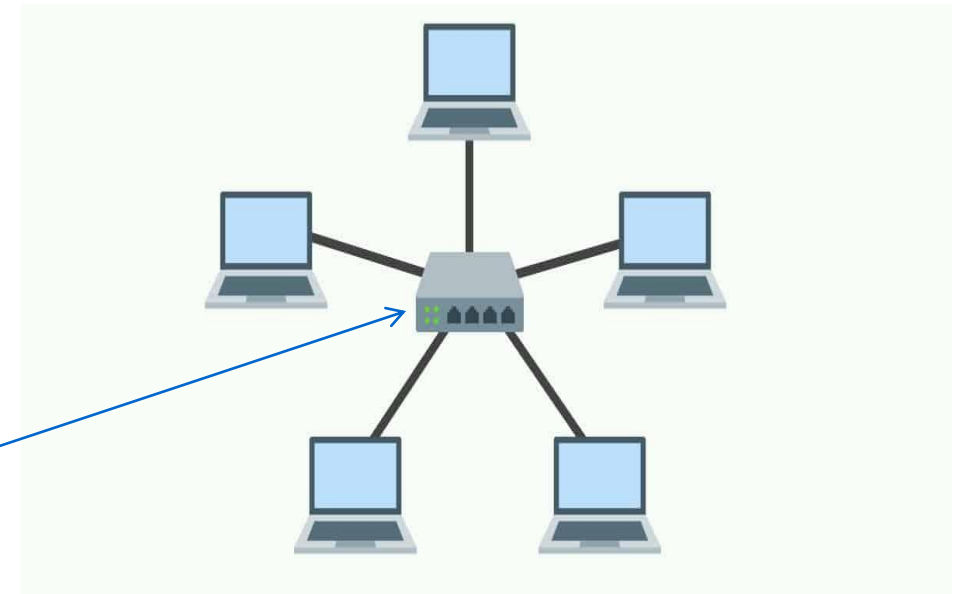
- As the analysis of traffic is easy, the topology poses lesser security risk.

- Adding or removing network nodes is easy, and can be done without affecting the entire network.

- Due to its centralized nature, the topology offers simplicity of operation.

- It also achieves isolation of each device in the network.

- Due to the centralized nature, it is easy to detect faults in the network devices.

- Data packets do not have to pass through many nodes, like in the case of a ring network. Thus, with the use of a high-capacity central hub, traffic load can be handled at fairly decent speeds.
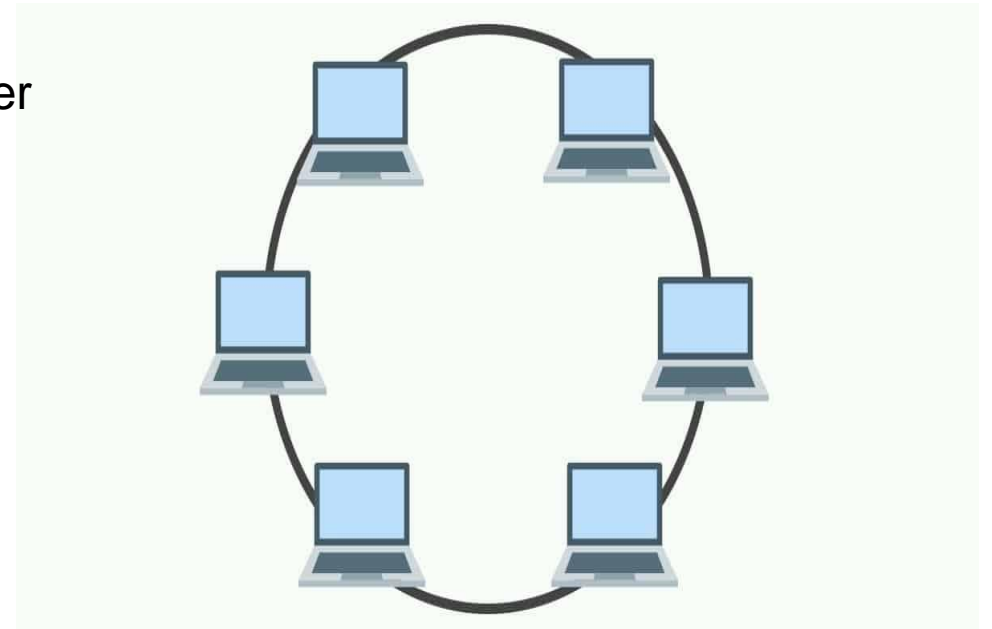
Disadvantages

- The number of nodes that can be added, depends on the capacity of the central device.

- Network operation depends on the functioning of the central device. Hence,the failure of central device leads to failure of the entire network.

- The setup cost is high.

Ring Topology

A ring topology is a network configuration in which device connections create a circular data path. Each networked device is connected to two others, like points on a circle. Together, devices in a ring topology are referred to as a ring network.

Unidirectional ring network:allow packets to travel only in one direction, called a unidirectional ring network.

Bidirectional ring network: permits data to move in either direction, called bidirectional ring network.

- In this topology, each node has the opportunity to transmit data. Thus, it is a very organized network topology.
- The adding or removing of network nodes is easy, as the process requires changing only two connections.
- The traffic is unidirectional and the data transmission is high-speed.
- The data being transmitted between two nodes passes through all the intermediate nodes. A central server is not required for the management of this topology.
- In comparison to a bus, a ring is better at handling load.
- The configuration makes it easy to identify faults in network nodes.
- It is less costly than a star topology.

- Data sent from one node to another has to pass through all the intermediate nodes. This makes the transmission slower in comparison to that in a star topology. The transmission speed drops with an increase in the number of nodes.

- The failure of a single node in the network can cause the entire network to fail.

- The movement or changes made to network nodes affect the entire network's performance.

- There is heavy dependency on the wire connecting the network nodes in the ring

In mesh topology each device is connected to every other device on the network through a dedicated point-to-point link.

Lets say we have n devices in the network then each device must be connected with (n-1) devices of the network. Number of links in a mesh topology of n devices would be n(n-1)/2.
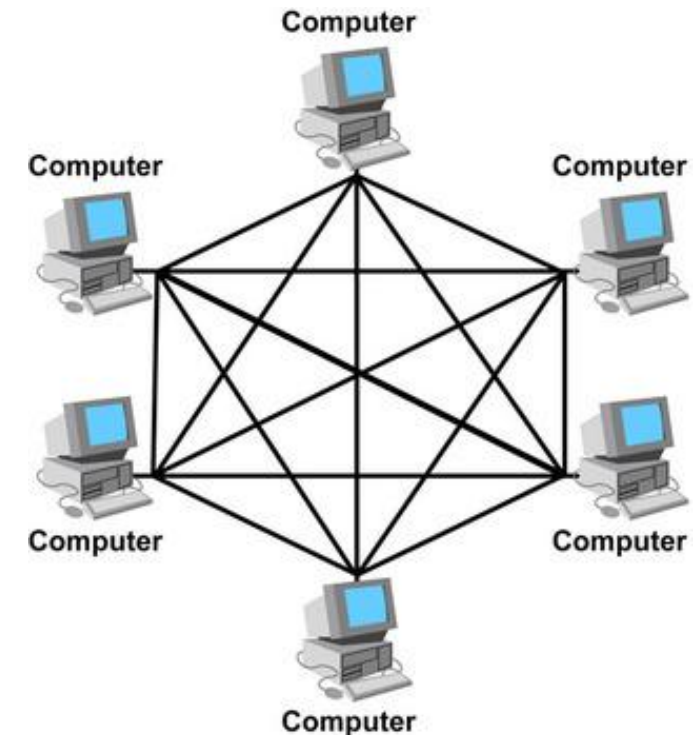
- It can handle heavy traffic, as there are dedicated paths between any two network nodes.

- The arrangement of the network nodes is such that it is possible to transmit data from one node to many other nodes at the same time.

- The failure of a single node does not cause the entire network to fail as there are alternate paths for data transmission.

- Point-to-point contact between every pair of nodes, makes it easy to identify faults.
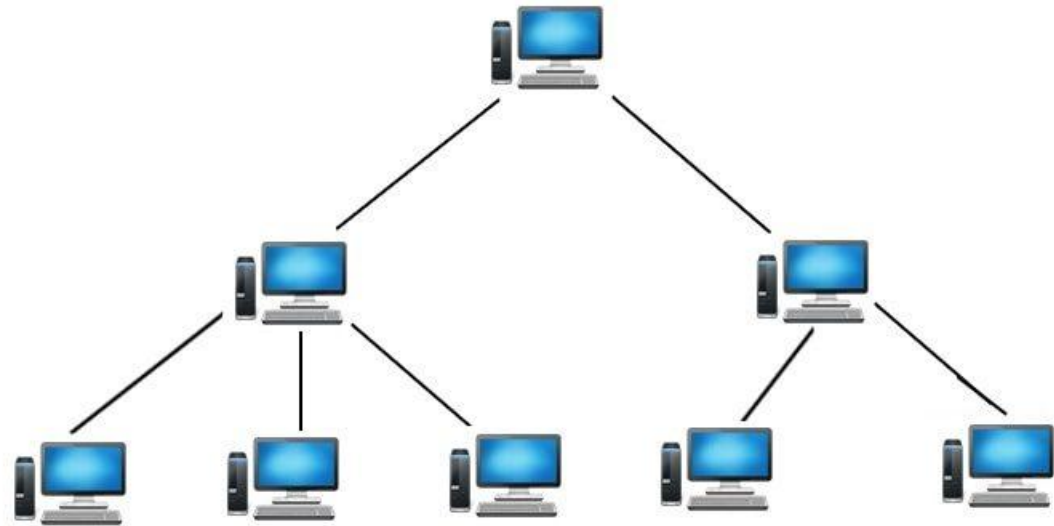
Disadvantages

- A lot of cabling is required. Thus, the costs incurred in setup and maintenance are high.

- The arrangement wherein every network node is connected to every other node of the network, many connections serve no major purpose. This leads to redundancy of many network connections.

- Owing to its complexity, the administration of a mesh network is difficult.

Tree topologies have a root node, and all other nodes are connected which form a hierarchy. So it is also known as hierarchical topology.

Tree topology based networks are not suitable for small networks because of the requirement for additional devices and cables.

- Fault identification is easy.

- The advantages of centralization that are achieved in a star topology are inherited by the individual star segments in a tree network.

- The tree topology is useful in cases where a star or bus cannot be implemented individually. It is most-suited in networking multiple departments of a university or corporation, where each unit (star segment) functions separately, and is also connected with the main node (root node).

- Each star segment gets a dedicated link from the central bus. Thus, failing of one segment does not affect the rest of the network.

- The network can be expanded by the addition of secondary nodes. Thus, scalability is achieved.

Disadvantages

- Owing to its size and complexity, maintenance is not easy and costs are high. Also, configuration is difficult in comparison to that in other topologies.

- As multiple segments are connected to a central bus, the network depends heavily on the bus. Its failure affects the entire network.

- Though it is scalable, the number of nodes that can be added depends on the capacity of the central bus and on the cable type.

- A hybrid topology is a kind of network topology that is a combination of two or more network topologies, such as **mesh topology, bus topology**, and **ring topology**. Its usage and choice are dependent on its deployments and requirements like the performance of the desired network, and the number of computers, their location. The below figure is describing the structure of hybrid topology that contains more than one topology.

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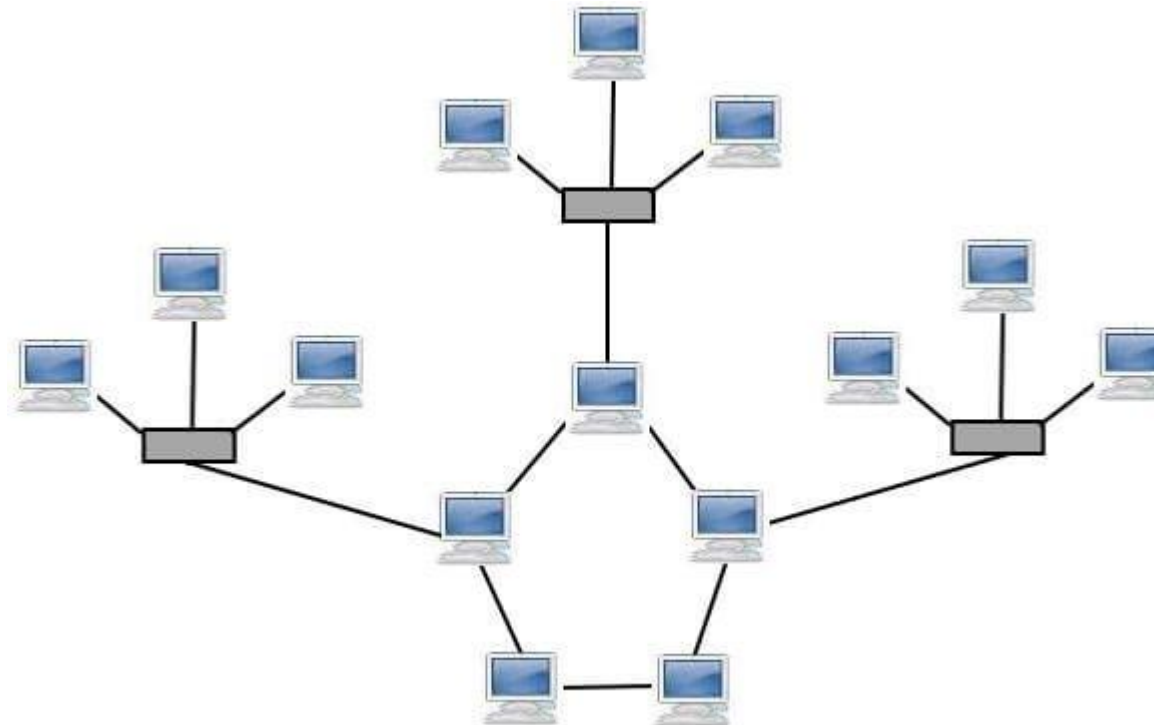
- **Reliable:** It is more reliable as it has better fault tolerance. If a node gets damaged between the network, it is possible in this network to singled out the damaged node from rest of the network. Also, in this case, without impacting the processing of the network, the needed steps can be taken.

- **Effective:** This is the biggest advantage of hybrid topology. The weakness of the several topologies connected in this topology is ignored. And, there is a consideration only about the strengths of these different topologies. For case, the high tolerance capability is offered by star topology, and good data reliability is provided by ring topology. Therefore, in hybrid star-ring topology, these two-function work quite well.

- **Scalable:** Hybrid networks are the kind of network that is designed in a way, which led to making capable them to easy integration of additional concentration points or other new hardware components. Without disturbing existing architecture, it is very easy to extend the network size with the latest addition of new elements.

- **Flexible:** One of the great benefits of hybrid topology is flexibility. This topology can be implemented for various different network environments as it is created. The hybrid network can be created by maximizing the available resources and in line with the demands of the corporation.

- A hybrid network is designed by combining various networks that employ many techniques of associating points for devices like personal computers and other hardware components, which are linked to servers. They also offer many benefits like data communication, signal strength, throughput, as well as high-end equipment.

- It has the ability to transfer data easily in between the different kinds of networks.

Disadvantage

- **Complexity:** To manage the topology become challenging, as the different topologies are linked in the hybrid topology. It is a difficult job for designers and not easy to create this type of architecture. There is a need to be very efficient for the installation and configuration process.

- **Expensive:** Purchasing and maintaining the hybrid topology is much expensive while comparing with other topologies. The hubs are also required in this network topology that are used to connect two different networks, and they are also expensive. Furthermore, the hybrid topology may need advanced network devices, a lot of cables, and more as its architectures are usually larger in scale.