



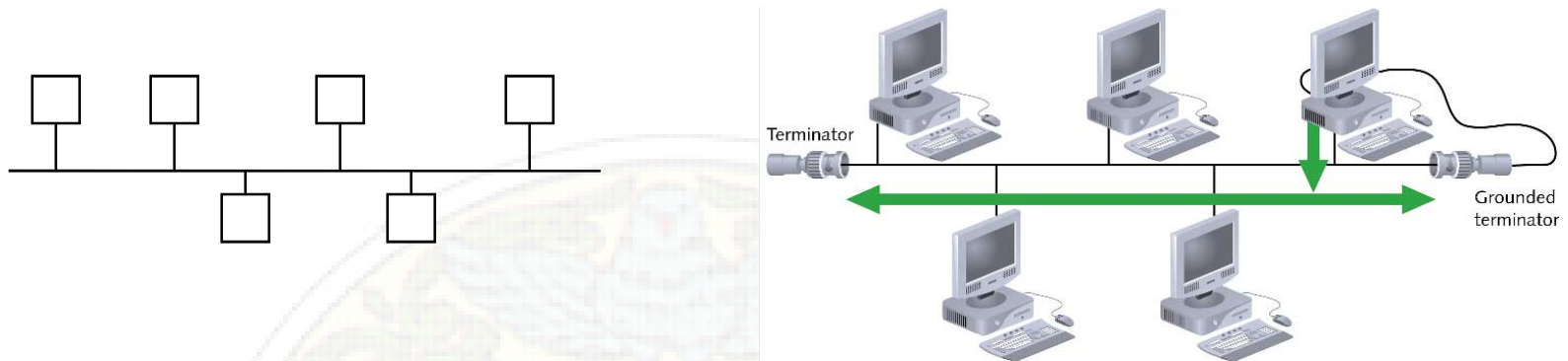
NETWORK TOPOLOGIES

Topology is basically the orientation of the nodes. It describes how nodes are connected with each other. There are six basic configurations used to connect computers they are the

- Bus
- Ring
- Star
- Tree
- Mesh (completely Connected)
- Hybrid



Bus topology



- This type of network was widely used in the 1980's
- In this configuration every computer (node) shares the networks total bus capacities.
- In this configuration adding more computers will reduce the access speed on the network.
- Each computer communicates to other computers on the network independently this is referred to as PEER-TO-PEER networking



Working of Bus Topology

- All computers on a network have a distinct address
- A message would be send from one computer with the address of another computer attached to the message
- The message is broadcasted to all the computers on the network until the addressed PC accepts the message
- At a time only one communication is possible between two nodes



Working of Bus Topology

- The type of wires used for Bus Networks in the 80's were called Thicknet and Thinnet
- A Thicknet cable (very large about 1 inch in diameter usually yellow was hung around a room)
- Thinnet cables were connected to the PC's NIC and a Transceiver. The Transceiver was tapped into the Thicknet cable
- To stop the message from bouncing back and forward down the wire (known as signal bounce) both ends of the network are terminated with 50Ω resistors



Advantages & Disadvantages

Advantages

- Works well for small networks
- Relatively inexpensive to implement
- Easy to add to it

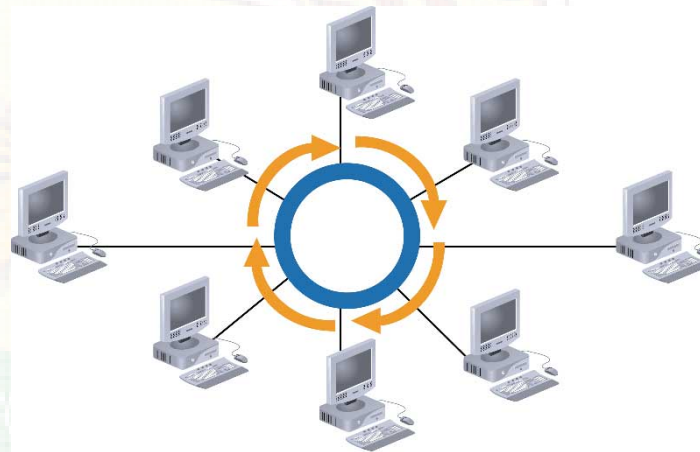
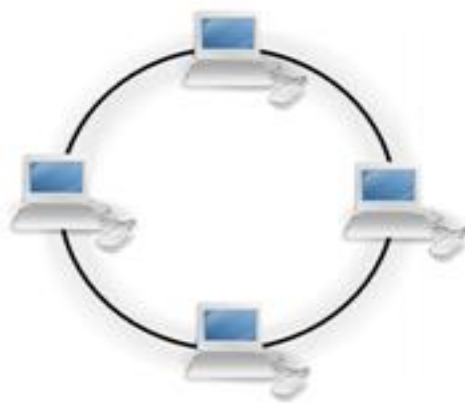
Disadvantages

- Management costs can be high
- Potential for congestion with network traffic
- Not Fault Tolerant
- A break in bus may affect whole network



Ring Topology

- In Ring topology each node is connected to the two nearest nodes so the entire network forms a circle
- Data only travels in one direction on a Ring network
- One method for passing data on ring networks is token passing





Working of Ring Topology

- A node has information to send to another computer on the network so it sends the information out on the network to the PC it is connected to, if the information is for this PC (the recipients NIC address is attached to the message, which is like putting an address on an envelope) then the PC accepts the data
- Otherwise it passes the information on to the next PC by repeating the data back out on the line
- This method of repeating the data helps keep the integrity of the data readable by other computers



Working of Ring Topology contd.

- As it is better to have computers take turns using the connecting Data cable, Ring topologies incorporated a system called Token passing
- In this topology, to transmit on the wire your computer must have control of the token or wait for the token to be free
- Larger Token Ring networks use multiple tokens



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
- Enables reliable communication
- Whole packet does not appear on ring at once so any no of bits can be sent using this topology

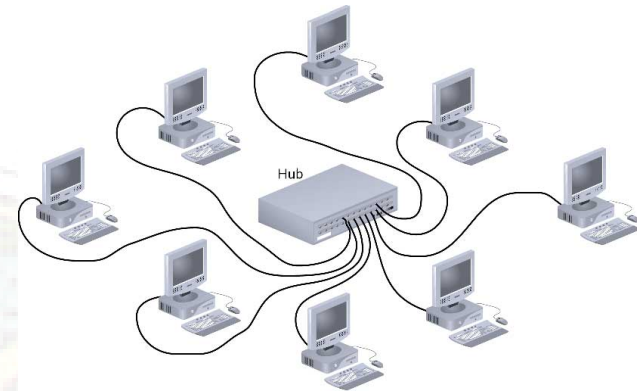
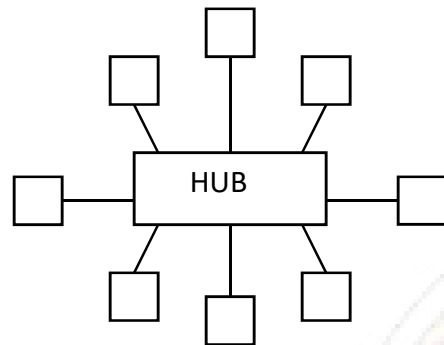


Disadvantages of Ring Topology

- The drawback to this type of topology is that a single malfunctioning workstation can disable the whole network
- To make sure all the information is sent the receiving PC sends the token back to the sending PC after it has received all the data
- If the sending PC is finished sending it passes the token to the next PC
- It is more Expensive than bus
- Requires more cable and network equipment at the start
- Not used as widely as bus topology because
 - Fewer equipment options
 - Fewer options for expansion to high-speed communication



Star Topology



- In a Star topology every node is connected through a central device such as a Hub, Switch or Router
- Compared to a Ring or Bus topology a Star topology requires that more thought be put into its setup



Star Topology

- Any single cable connects only two devices
 - Cabling problems affect two nodes at most
- Requires more cabling than ring or bus networks
 - More fault-tolerant
- Easily moved, isolated, or interconnected with other networks
 - Scalable
- Supports max of 1024 addressable nodes on logical network



Working of Star Topology

- All the data passed from the central hub or switch to the destination node
- Only hub is in direct connection to every node
- If any one cable fails then only the node connected on that cable would be affected
- It is very simple to join two star networks together by connecting their central devices to each other



Advantages and Disadvantages of Star Topology

Advantages

- 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

- Hub is a single point of failure if hub fail whole n/w down
- Requires more cable than the bus



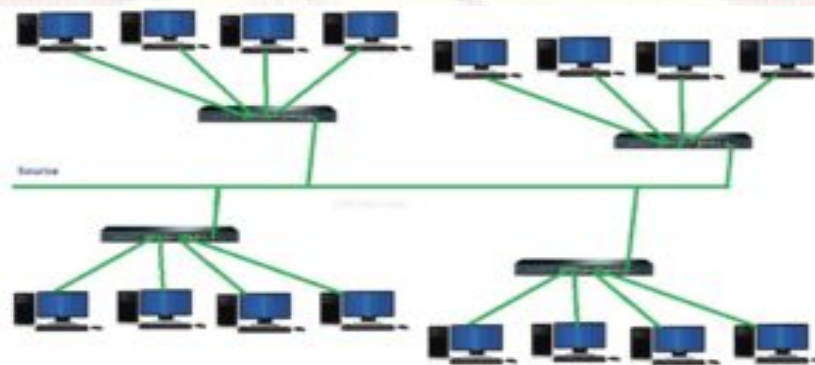
Pros and Cons of Star Network

- As each computer is connected to a central device (Hub) the location of the Hub must be made as central as possible, so as to reduce cable lengths
- The drawback to this type of topology is if a central device was to fail then all computers connected to that device would not be able to see the network



Tree Topology

A tree topology combination of linear bus and star topology. It is also called hierarchical topology. It consists of groups of star-configured nodes connected to a linear bus backbone cable. Tree topologies allow for the expansion of an existing network.





Working of Tree Topology

This Tree network is actually a hierarchical structure. Tree network is expendable network with bus and star network. In star network the centralized node connected to the main common bus line (Main cable).

In this network, signal from transmitting device first reaches the centralized device to which it is connected then directs this signal to tree bus which then travels along the entire network. Usually, tree network includes at least three specific levels. In this network, all connections can consist of wire cables, optical fiber cables, or wireless links.



Advantages of Tree Topology

1. It is an extension of Star and bus Topologies, so in networks where these topologies can't be implemented individually for reasons related to scalability, tree topology is the best alternative.
2. Expansion of Network is possible and easy.
3. Here, we divide the whole network into segments (star networks), which can be easily managed and maintained.
4. Error detection and correction is easy.
5. Each segment is provided with dedicated point-to-point wiring to the central hub.
6. If one segment is damaged, other segments are not affected.



Advantages of Tree Topology cotd

- Easy to expend and implementation the network
- Easy to identify the faulty device.
- Well suited for temporary networks.
- Point-to-point connection for each device.
- If one device is damaged then the other devices are not affected.



Disadvantages of Tree Topology

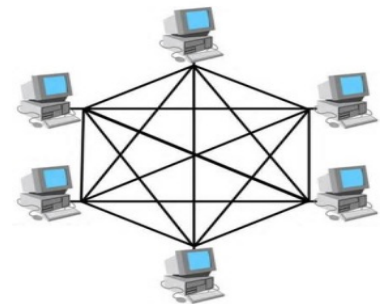
- Because of its basic structure, tree topology, relies heavily on the main bus cable, if it breaks whole network is crippled. 2. As more and more nodes and segments are added, the maintenance becomes difficult. 3. Scalability of the network depends on the type of cable used.
- Difficult to troubleshoot problem.
- If there is a problem with the main cable , the entire network goes down.
- This network is not secure, any one can see transmitted data
- As more and more nodes and segments are added, the maintenance becomes difficult.



Mesh Topology

In a mesh network topology, each of the network node, computer and other devices, are interconnected with one another. Every node not only sends its own signals but also relays data from other nodes.

In fact a true mesh topology is the one where every node is connected to every other node in the network. 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. Flooding or routing technique is used in mesh topology.





Types of Mesh Topology

Full Mesh Topology:

- Each component is connected to every other component. Even after considering the redundancy factor and cost of this network, its main advantage is that the network traffic can be redirected to other nodes if one of the nodes goes down. Full mesh topology is used only for backbone networks.

Partial Mesh Topology:-

- This is far more practical as compared to full mesh topology. Here, some of the systems are connected in similar fashion as in mesh topology while rests of the systems are only connected to 1 or 2 devices. It can be said that in partial mesh, the workstations are 'indirectly' connected to other devices. This one is less costly and also reduces redundancy.



Advantages of Mesh Topology

- 1) Data can be transmitted from different devices simultaneously. This topology can withstand high traffic.
- 2) Even if one of the components fails there is always an alternative present. So data transfer doesn't get affected.
- 3) Expansion and modification in topology can be done without disrupting other nodes.
- 4) A broken node won't distract the transmission of data in a mesh network. Each node is connected to several other nodes which make it easier to relay data. A broken device will be ignored by the signals and will then find a new one that is connected with the node.
- 5) Additional devices in a mesh topology will not affect its network connection.
- 6) A mesh topology can handle high amount of network traffic



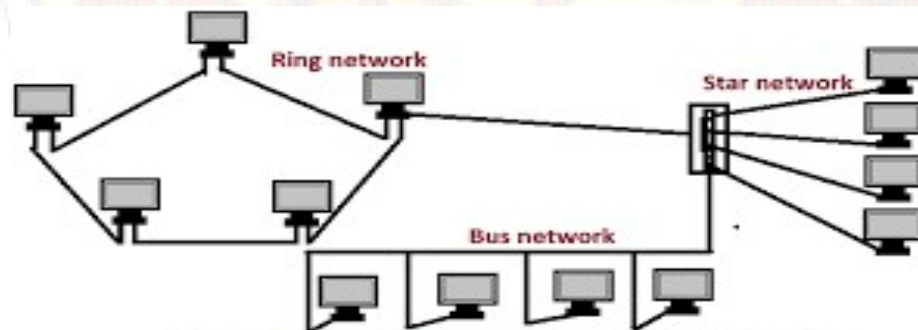
Disadvantages of Mesh Topology

- 1) There are high chances of redundancy in many of the network connections.
- 2) Overall cost of this network is way too high as compared to other network topologies.
- 3) Set-up and maintenance of this topology is very difficult. Even administration of the network is tough.
- 4) Maintaining mesh networks can be very hard to manage. It requires continuous supervision because of the redundancy present in the network.
- 5) Due to the fact that building this topology requires a lot of devices it will need a lot of capital to invest in



Hybrid Topology

in this type of topology we integrate two or more different topologies to form a resultant topology which has good points(as well as weaknesses) of all the constituent basic topologies rather than having characteristics of one specific topology. This combination of topologies is done according to the requirements of the organization.



HYBRID NETWORK



Advantages of Hybrid

- 1) **Reliable** : Unlike other networks, fault detection and troubleshooting is easy in this type of topology. The part in which fault is detected can be isolated from the rest of network and required corrective measures can be taken, without affecting the functioning of rest of the network.
- 2) **Scalable**: Its easy to increase the size of network by adding new components, without disturbing existing architecture.
- 3) **Flexible**: 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 as well as where chances of fault are high.
- 4) **Effective**: Hybrid topology is the combination of two or more topologies, so we can design it in such a way that strengths of constituent topologies are maximized while there weaknesses are neutralized. For example we saw Ring Topology has good data reliability (achieved by use of tokens) and Star topology has high tolerance capability (as each node is not directly connected to other but through central device), so these two can be used effectively in hybrid star-ring topology.



Disadvantages of Hybrid Topology

- 1) **Complexity of Design:** One of the biggest drawback of hybrid topology is its design. Its not easy to design this type of architecture and its a tough job for designers. Configuration and installation process needs to be very efficient.
- 2) **Costly Hub:** The hubs used to connect two distinct networks, are very expensive. These hubs are different from usual hubs as they need to be intelligent enough to work with different architectures and should be function even if a part of network is down.
- 3) **Costly Infrastructure:** As hybrid architectures are usually larger in scale, they require a lot of cables, cooling systems, sophisticate network devices, etc.