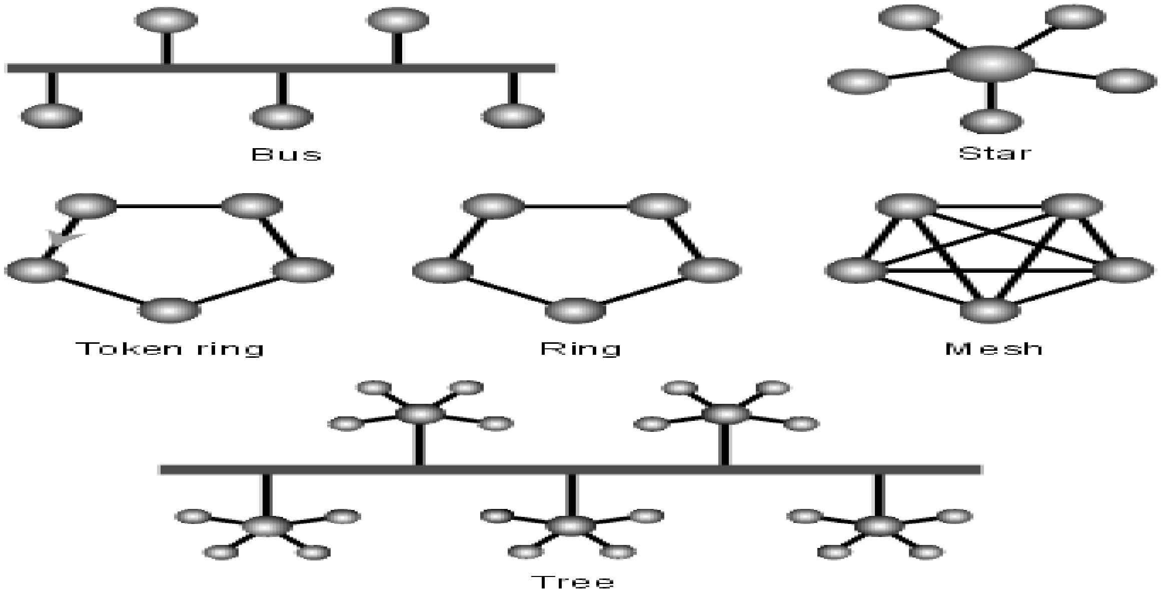
Network topology:

What is a network topology?

Network Topology refers to layout of a network and how different nodes in a network are connected to each other and how they communicate. In communication networks, a topology is a usually schematic description of the arrangement of a network, including its nodes and connecting lines.

There are two ways of defining network geometry: the physical topology and the logical (or signal) topology.

The physical topology of a network is the actual geometric layout of workstations. There are several common physical topologies, as described below and as shown in the illustration.



In the bus network topology, every workstation is connected to a main cable called the bus. Therefore, in effect, each workstation is directly connected to every other workstation in the network.

In the star network topology, there is a central computer or server to which all the workstations are directly connected. Every workstation is indirectly connected to every other through the central computer.

In the ring network topology, the workstations are connected in a closed loop configuration. Adjacent pairs of workstations are directly connected. Other pairs of workstations are indirectly connected, the data passing through one or more intermediate nodes.

If a Token Ring protocol is used in a star or ring topology, the signal travels in only one direction, carried by a so-called token from node to node.

The mesh network topology employs either of two schemes, called full mesh and partial mesh. In the full mesh topology, each workstation is connected directly to each of the others. In the partial mesh topology, some workstations are connected to all the others, and some are connected only to those other nodes with which they exchange the most data.

The tree network topology uses two or more star networks connected together. The central computers of the star networks are connected to a main bus. Thus, a tree network is a bus network of star networks.

Line topology: Nodes are arranged in a line, where most nodes are connected to two other nodes. However, the first and last node are not connected like they are in a ring.

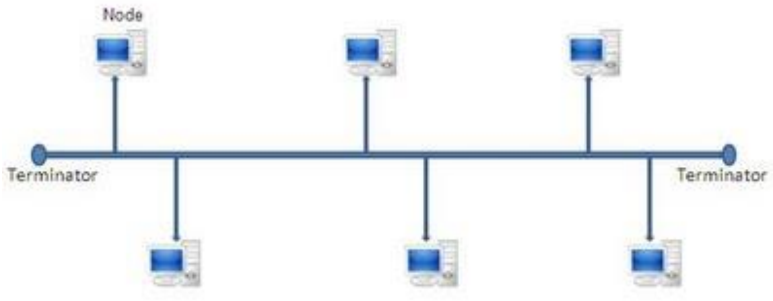
Logical (or signal) topology refers to the nature of the paths the signals follow from node to node. In many instances, the logical topology is the same as the physical topology. But this is not always the case. For example, some networks are physically laid out in a star configuration, but they operate logically as bus or ring networks.

What is Bus topology?

Bus Topology is the simplest of network topologies. In this type of topology, all the nodes (computers as well as servers) are connected to the single cable (called bus), by the help of interface connectors. This central cable is the backbone of the network and is known as Bus (thus the name). Every workstation 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 doesn’t 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. Below I have given a basic diagram of a bus topology and then have discussed advantages and disadvantages of Bus Network Topology.



Bus topology diagram

Advantages (benefits) of Linear Bus Topology

1) It is easy to set-up and extend bus network.
2) Cable length required for this topology is the least compared to other networks.
3) Bus topology costs very less.
4) Linear Bus network is mostly used in small networks. Good for LAN.

Disadvantages (Drawbacks) of Linear Bus Topology

1) There is a limit on central cable length and number of nodes that can be connected.

2) Dependency on central cable in this topology has its disadvantages. If the main cable (i.e. bus) encounters some problem, whole network breaks down.

3) Proper termination is required to dump signals. Use of terminators is must.

4) It is difficult to detect and troubleshoot fault at individual station.

5) Maintenance costs can get higher with time.

6) Efficiency of Bus network reduces, as the number of devices connected to it increases.

7) It is not suitable for networks with heavy traffic.

8) Security is very low because all the computers receive the sent signal from the source.

Bus Network

-Advantages

- Easy to implement and extend
- Well suited for temporary networks (quick setup)
- Initially less expensive than other topologies
- Cheap

-Disadvantages

- Difficult to administer/troubleshoot.
- Limited cable length and number of stations.
- If there is a problem with the cable, the entire network goes down.
- Maintenance costs may be higher in the long run.
- Performance degrades as additional computers are added or on heavy traffic.
- Low security (all computers on the bus can see all data transmissions).
- One virus in the network will affect all of them (but not as badly as a star or ring network).
- Proper termination is required.(loop must be in closed path).
- If one node fails, the whole network will shut down.
- If many computers are attached, the amount of data flowing causes the network to slow down.

Ring Network

-Advantages

- *Data is quickly transferred without a 'bottle neck'. (very fast, all data traffic is in the same direction)*
- The transmission of data is relatively simple as packets travel in one direction only.
- Adding additional nodes has very little impact on bandwidth
- It prevents network collisions because of the media access method or architecture required.

-Disadvantages

- Data packets must pass through every computer between the sender and recipient therefore this makes it slower.
- If any of the nodes fail then the ring is broken and data cannot be transmitted successfully.
- It is difficult to troubleshoot the ring.
- Because all stations are wired together, to add a station you must shut down the network temporarily.
- In order for all computers to communicate with each other, all computers must be turned on.
- Total dependence upon the one cable

Star Network

-Advantages

- Good performance
- Easy to set up and to expand. Any non-centralised failure will have very little effect on the network, whereas on a ring network it would all fail with one fault

-Disadvantages

- Expensive to install
- Extra hardware required

Computer Network:

A computer network is established when a series of computers is connected to each other for communication. The purpose of this connection or network is to share the resources within the connected units.

Computer networks are established using different software and hardware technologies. Computer networks can be established using different hardware structures such as Ethernet, optical fiber or using wireless connections. Ethernet network is the most common and widely used technology to establish any computer network. The network based on the use of Ethernet network is formed by physically connecting the individual computer units to each other through wiring. Various types of devices used for the Ethernet network are switches, bridges, routers and hubs mostly. Ethernet network can be started with the help of employing different types of cables such as twisted pair wire, coaxial cable and fiber optics mostly.

Wireless Networks

Wireless networks are established without physical welding or wiring techniques involved. Wireless technology is based on use of radio and infrared signals. Wireless communication can be established through communication satellites, terrestrial microwaves, cellular systems, wireless **LAN**s and Bluetooth.

Networks can be established using many types of physical interconnections usually referred to as the network topologies. Network topologies can be of many different types depending on the need of the network to be constituted.

Different network Devices:

- Gateway: this device is placed at a network node and interfaces with another network that uses different protocols. It works on OSI layers 4 to 7.
- Router: a specialized network device that determines the next network point to which it can forward a data packet towards the ultimate destination of the packet. Unlike a gateway, it cannot interface different protocols. It works on OSI layer 3.
- Switch: a device that allocates traffic from one network segment to certain lines (intended destination(s)) which connect the segment to another network segment. Unlike a hub, a switch splits the network traffic and sends it to different destinations rather than to all systems on the network. It works on OSI layer 2.
- Bridge: a device that connects multiple network segments along the data link layer. It works on OSI layer 2.
- Hub: a device that connects multiple Ethernet segments, making them acts as a single segment. When using a hub, every attached device shares the same broadcast domain. Therefore, only one computer connected to the hub is able to transmit at a time. Depending on the network topology, the hub provides a basic level 1 OSI model connection among the network objects

(workstations, servers, etc.). It provides bandwidth which is shared among all the objects, in contrast to switches, which provide a connection between individual nodes. It works on OSI layer 1.

- Repeater: a device which amplifies or regenerates digital signals received while sending them from one part of a network into another. It works on OSI layer 1.

Hardware or software components that typically sit on the connection point of different networks, e.g. between an internal network and an external network:

- Proxy server: computer network service which allows clients to make indirect network connections to other network services.
- Firewall: a piece of hardware or software put on the network to prevent some communications forbidden by the network policy.
- Network address translator (NAT): network service provided as hardware or software that converts internal to external network addresses and vice versa.