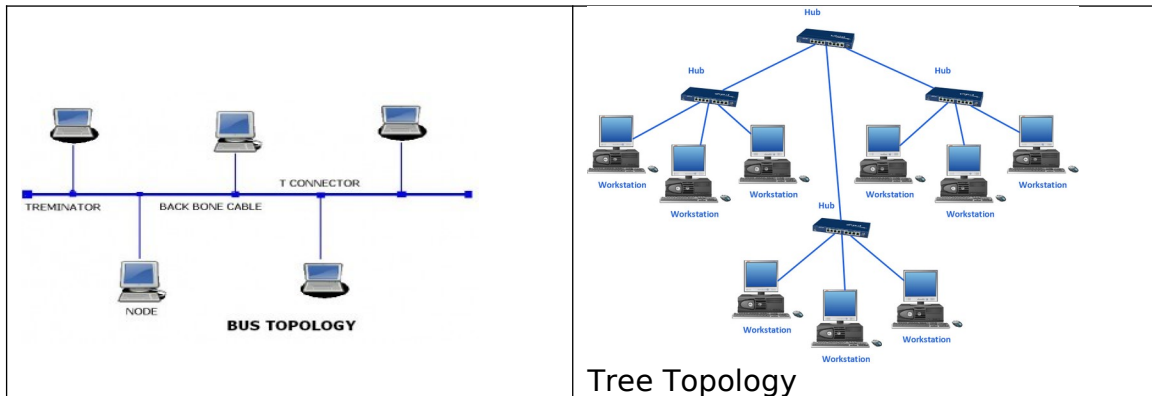- ***Network Topologies: Definition, Types of Topologies (Bus, Tree, Star, Ring).***

LAN topologies:

Physically, the term LAN topology describes the geometric arrangement of components that make up the LAN. Logically, it describes the possible connections between pairs of networked end-points that can communicate.

Tree Topology

Bus topology

All networked nodes are interconnected, peer to peer, using a single, open-ended cable.

Both ends of the bus must be terminated with a terminating resistor to prevent signal bounce.

In bus network, all stations are attached to a single cable. When a station sends a message, it is broadcast down on the cable in both directions. Terminators at the end of the cable prevent the signal from reflecting back to the sender. All stations on the cable constantly monitor for messages meant to them. When a station detects a message meant for it, it reads the message from the cable and the other stations will ignore it. Since all stations are sharing the same cable, some form of control is needed to make sure which station will transmit and when, otherwise there will be a collision.

Advantages of Bus topology
- Easy to implement and extend
- Well suited for temporary networks that must be set up in a hurry
- Typically the cheapest topology to implement
- Failure of one station does not affect others

Disadvantages of Bus topology
- Difficult to administer/troubleshoot
- Limited cable length and number of stations
- A backbone cable break can disable the entire network; there are no alternative links
- Maintenance costs may be higher in the long run

- Performance degrades as additional computers are added

In **hub or tree** network is a variation of the bus topology. The wires that are used to connect different nodes are connected into a central unit, called hub. Hub does not perform switching function. It consists of repeaters that retransmit all the signals from nodes to all other nodes in the network without any change.
The multipoint nature of tree topology gives rise to several problems. The access control to determine the time slot during which a node can transmit is fairly difficult. Another problem with multipoint is signal balancing. When two device exchange data over a link, the signal strength of the transmitter needs to be adjusted to ensure that the signal strength doesn't become too low or too high.
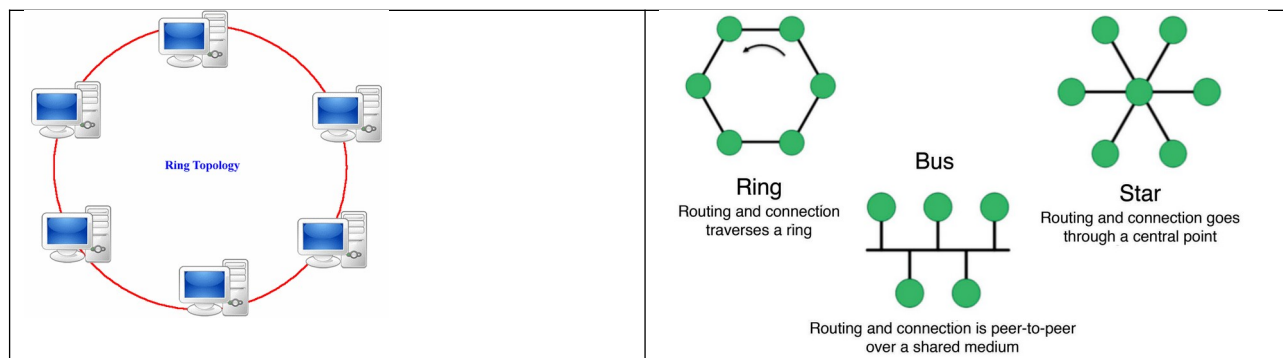
Ring network topology consists of nodes that are joined by point-to-point connection to form a closed loop or ring. The transmitted signal is regenerated at each node. Data is transmitted uni- directionally around the ring. Sending and receiving of data takes place by the help of TOKEN.

Token Passing
Token contains a piece of information which along with data is sent by the source computer. This token then passes to next node, which checks if the signal is intended to it. If yes, it receives the information and passes the empty token into the network Otherwise it passes token along with the data to next node.

Advantages
o This type of network topology is very organized
o Performance is better than that of Bus topology
o No need for network server to control the connectivity between workstations.
o Additional components do not affect the performance of network. Each computer has equal access to resources

o   The most important advantage of this network is its point-to-point connections. The electronics and maintenance of point-to-point links are much simpler than multi cast links.
o   The structure of this network is very simple and it is very easy to insert and delete any number of nodes. For this reason, ring network is easily scalable and highly modular. Fault isolation and recovery are much simpler than tree.

Disadvantages:
An important drawback of ring network is its large diameter. If diameter of a network is high, the number of edges involved in each communication will also be very high resulting in high signal attenuation and network blocking probability.
Each packet of data must pass through all the computers between source and destination, slower than star topology
If one workstation or port goes down, the entire network gets affected

Star Network
In star network, each station is connected via a point-to-point link to a central point. This central point is called hub, multi port repeater, or concentrator. The central point may be "passive", "active", or "intelligent". A passive hub simply connects the arms of a star, no signal regeneration is performed. An active hub is like a passive hub, except that it regenerates signals. Intelligent hubs not only regenerate signals but also perform activities such as intelligent path selection and network management.

Advantage:
Compared to Bus topology it gives far much better performance
Easy to connect new nodes or devices
Since all information in a star network goes through a central point, stars are easy to manage and troubleshoot.
Failure of one node or link doesn't affect the rest of network

Disadvantage:
Since all information in a star network goes through a central point, if the central device fails then the network goes down.
The use of hub, a router or a switch as central device increases the overall cost of the network
Performance and as well number of nodes which can be added in such topology is depended on capacity of central device

- ***Client Server Model: Concept of Client, Server, Client Server Model, and Backbone Network.***

The **client–server model** is a way of distributing applications to run on separate systems. A common way of organizing software to run on distributed systems is to separate tasks or workloads into two parts: clients and servers. A *client* is a program that uses services that other programs provide. The programs that provide the services are called *servers*. The client makes a request for a service, and a server performs that service. Often clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system.

Server functions often require some resource management, in which a server synchronizes and manages access to the resource, and responds to client requests with either data or status information. Client programs typically handle user interactions and often request data or initiate some data modification on behalf of a user.

For example, a client can provide a form onto which a user (a person working at a data entry terminal, for example) can enter orders for a product. The client sends this order information to the server, which checks the product database and performs tasks that are needed for billing and shipping. Typically, multiple clients use a single server. Examples of computer applications that use the client–server model are Email, network printing, and the World Wide Web.

Servers are classified by the services they provide. For example, a web server serves web pages and a file server serves computer files. A shared resource may be any of the server computer's software and electronic components, from programs and data to processors and storage devices. The sharing of resources of a server constitutes a *service*.

Client-Server Model	Backbone on a LAN	Backbone in a WAN
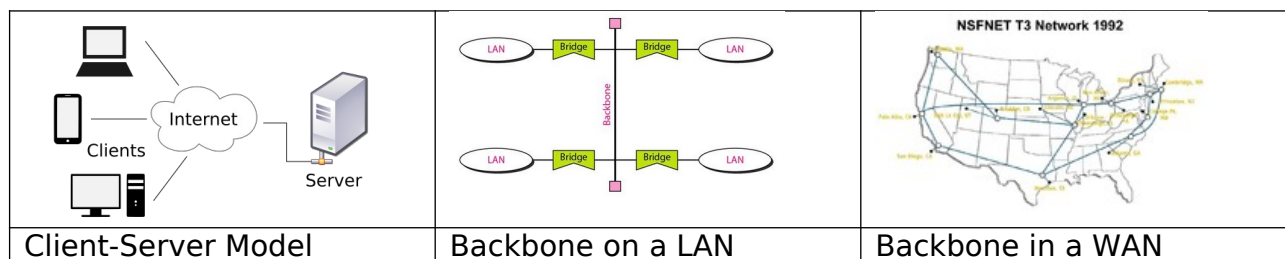
A **backbone** is a larger transmission line that carries data gathered from smaller lines that interconnect with it.

1) In a LAN, a backbone is a line or set of lines that local area networks connect to for a wide area network connection or within a local area network to span distances efficiently, for example, between buildings.

2) On the Internet or other wide area network, a backbone is a set of paths that local or regional networks connect to for long-distance interconnection. The connection points are known as network *nodes* or telecommunication data switching exchanges (DSEs)

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