

UNIT 5: NETWORKING CONCEPT

What are the hardware components of a LAN?

The hardware components of a LAN consist of:

- PCs/workstations and servers
- Network Interface Card (NIC)
- Cabling and connectors, for example, coaxial cable and BNC connector, Unshielded Twisted Pair (UTP) and RJ-45 connector
- Hub, concentrator, and more complicated network devices such as Bridge, LAN Switch and Router

What are the software components of a LAN?

The software components of a LAN can be grouped into two categories:

1. Inside PCs/workstations and servers

- NIC Drivers
- Network Operating System for servers, for example, Novell® Netware 4.1 or Microsoft Windows® NT
- Network Operating System for clients (PCs/workstations), for example, Novell® Netware 4.1 client or Microsoft Windows® 95
- Networking protocol software, for example, TCP/IP, Novell® IPX
- Application software, for example, emails, Internet Web Browser

2. Inside network devices (Hub/Bridge/LAN Switch/Router)

- Network Management Software, for example, Simple Network Management Protocol (SNMP), Remote Network Monitoring (RMC)
- Forwarding/routing & control software, for examples, transparent bridging, spanning tree and IP routing software

Types of Network Topology

The arrangement of a network which comprises of nodes and connecting lines via sender and receiver is referred as network topology. The various network topologies are:

a) Mesh Topology:

In mesh topology, every device is connected to another device via particular channel.

UNIT 5: NETWORKING CONCEPT

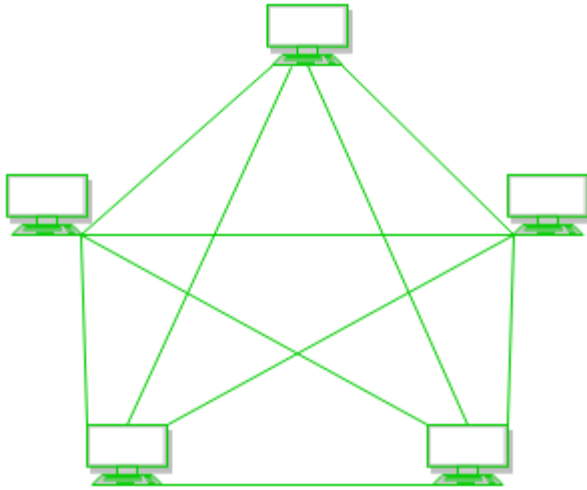


Figure 1: Every device is connected with another via dedicated channels. These channels are known as links.

- If suppose, N number of devices are connected with each other in mesh topology, then total number of ports that is required by each device is $N-1$. In the Figure 1, there are 5 devices connected to each other, hence total number of ports required is 4.
- If suppose, N number of devices are connected with each other in mesh topology, then total number of dedicated links required to connect them is NC_2 i.e. $N(N-1)/2$. In the Figure 1, there are 5 devices connected to each other, hence total number of links required is $5*4/2 = 10$.

Advantages of this topology:

- It is robust.
- Fault is diagnosed easily. Data is reliable because data is transferred among the devices through dedicated channels or links.
- Provides security and privacy.

Problems with this topology:

- Installation and configuration are difficult.
- Cost of cables are high as bulk wiring is required, hence suitable for a smaller number of devices.
- Cost of maintenance is high.

b) Star Topology:

In star topology, all the devices are connected to a single hub through a cable. This hub is the central node and all others nodes are connected to the central node. The hub can be passive in nature i.e. not intelligent hub such as broadcasting devices, at the same time the hub can be intelligent known as active hubs. Active hubs have repeaters in them.

UNIT 5: NETWORKING CONCEPT

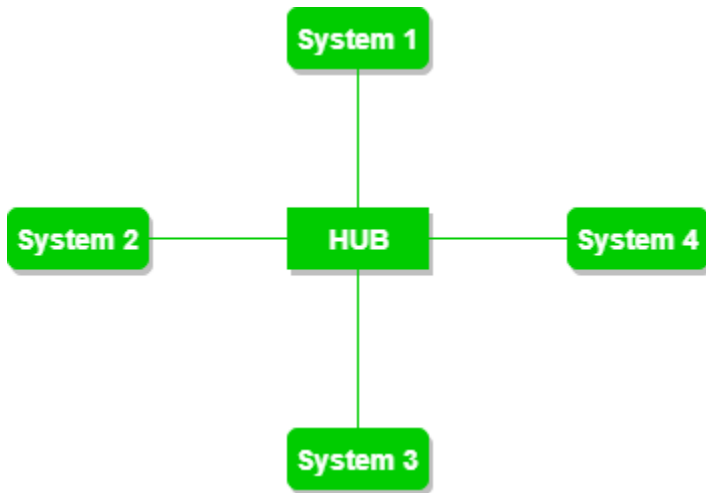


Figure 2: A star topology having four systems connected to single point of connection i.e. hub.

Advantages of this topology:

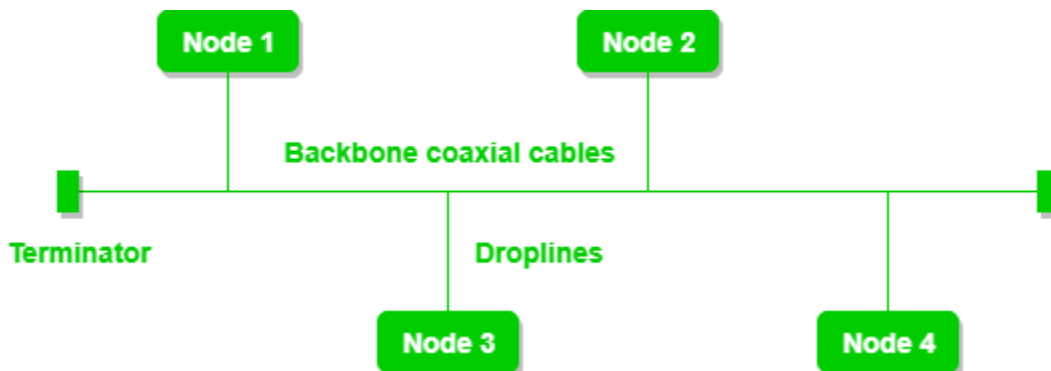
- If N devices are connected to each other in star topology, then the number of cables required to connect them is N. So, it is easy to set up.
- Each device requires only 1 port i.e. to connect to the hub.

Problems with this topology:

- If the concentrator (hub) on which the whole topology relies fails, the whole system will crash down.
- Cost of installation is high.
- Performance is based on the single concentrator i.e. hub.

c) Bus Topology:

Bus topology is a network type in which every computer and network device is connected to single cable. It transmits the data from one end to another in single direction. No bi-directional feature is in bus topology.



Figur 3 : A bus topology with shared backbone cable. The nodes are connected to the channel via drop lines.

Advantages of this topology:

UNIT 5: NETWORKING CONCEPT

- If N devices are connected to each other in bus topology, then the number of cables required to connect them is 1. which is known as backbone cable and N drop lines are required.
- Cost of the cable is less as compared to other topology, but it is used to build small networks.

Problems with this topology:

- If the common cable fails, then the whole system will crash down.
- If the network traffic is heavy, it increases collisions in the network. To avoid this, various protocols are used in MAC layer known as Pure Aloha, Slotted Aloha, CSMA/CD etc.

(d) Ring Topology:

In this topology, it forms a ring connecting a device with its exactly two neighbouring devices.

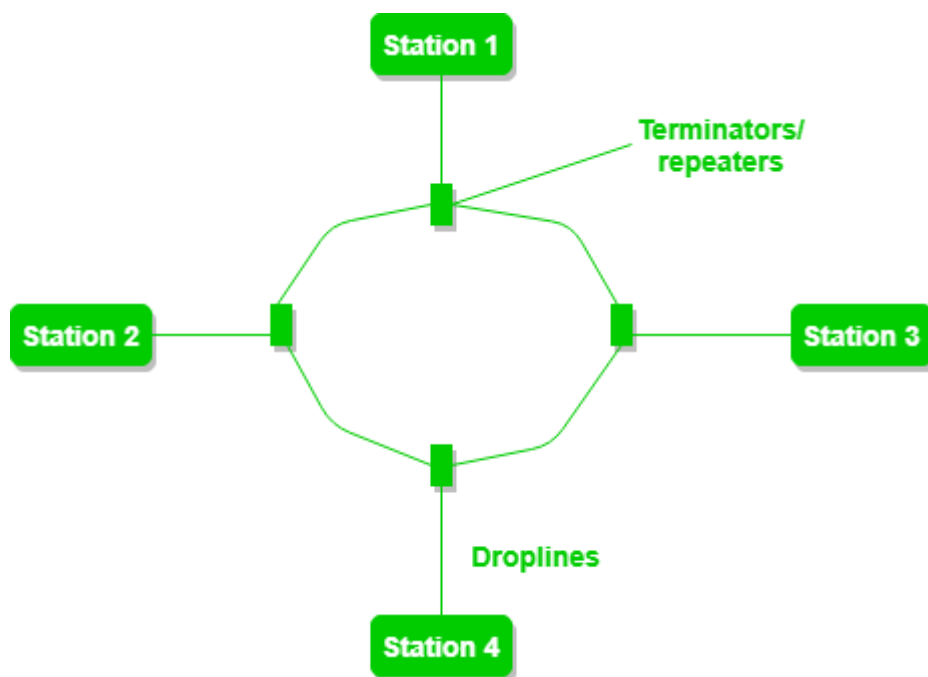


Figure 4: A ring topology comprises of 4 stations connected with each forming a ring..

The following operations takes place in ring topology are :

1. One station is known as **monitor** station which takes all the responsibility to perform the operations.
2. To transmit the data, station has to hold the token. After the transmission is done, the token is to be released for other stations to use.
3. When no station is transmitting the data, then the token will circulate in the ring.
4. There are two types of token release techniques: **Early token release** releases the token just after the transmitting the data and **Delay token release** releases the token after the acknowledgement is received from the receiver.

UNIT 5: NETWORKING CONCEPT

Advantages of this topology:

- The possibility of collision is minimum in this type of topology.
- Cheap to install and expand.

Problems with this topology:

- Troubleshooting is difficult in this topology.
- Addition of stations in between or removal of stations can disturb the whole topology.

e) Tree Topology :

? This topology is the variation of Star topology. This topology have hierarchical flow of data.

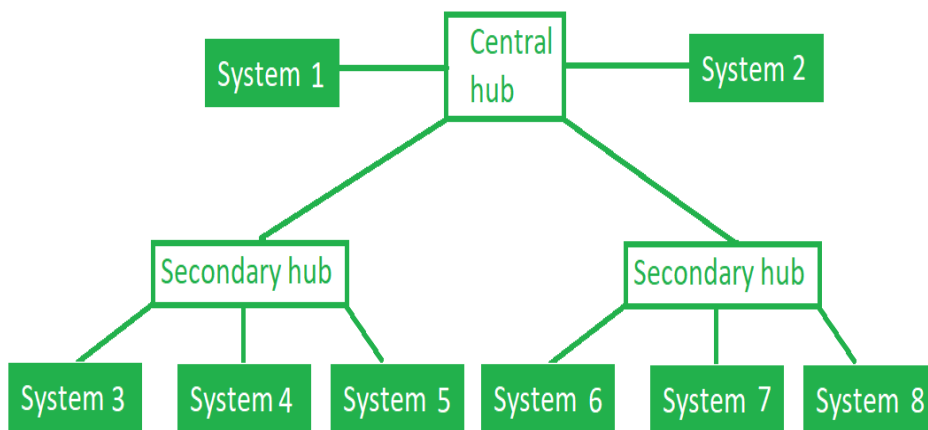


Figure 5: In this the various secondary hubs are connected to the central hub which contains the repeater. In this data flow from top to bottom i.e from the central hub to secondary and then to the devices or from bottom to top i.e. devices to secondary hub and then to the central hub.

Advantages of this topology:

- It allows more devices to be attached to a single central hub thus it increases the distance that is travel by the signal to come to the devices.
- It allows the network to get isolate and also prioritize from different computers.

Problems with this topology:

- If the central hub gets fails the entire system fails.
- The cost is high because of cabling.

f) Hybrid Topology:

This topology is a collection of two or more topologies which are described above. This is a scalable topology which can be expanded easily. It is reliable one but at the same it is a costly topology.

UNIT 5: NETWORKING CONCEPT

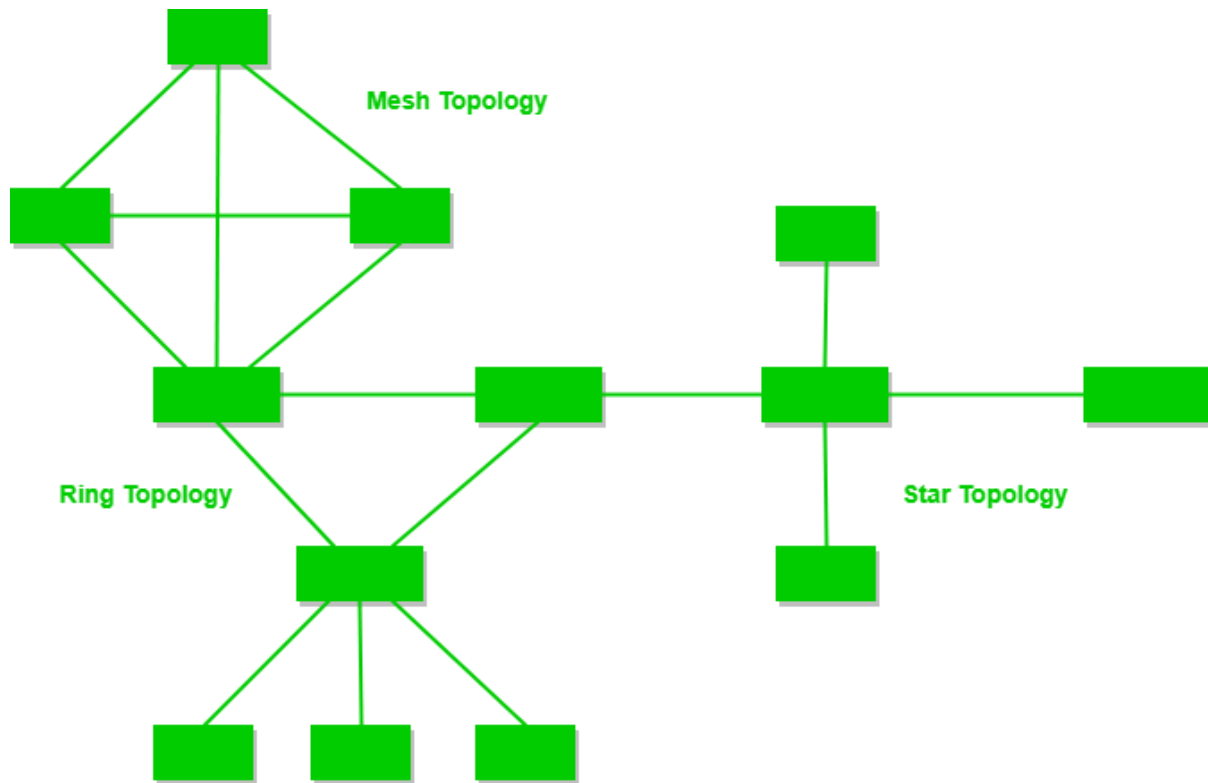


Figure - A Hybrid Topology