Network Topologies: The art or arrangement of connecting different computers in a network is known as network topology. In other words we can say that the way in which the nodes (computer or other devices that needs to communicate) of a network are linked together is known as network topology.

There are some factors to be considered while choosing a topology. They are:-

1. The cost of establishing the network topology.
2. The length of the cable needed.
3. Type of cable to be used in the topology (Cable types: Co-axial, Twisted Pair or Optical Fiber Cable).

Types of Network Topologies: Network topologies can be classified into the following categories:

1. **Star topology:** In a star topology, all the nodes are connected to a central system called switch or a hub. This network device forwards the data from its source computer to its final destination. The switch or hub controls the communication on the network.

   Advantages of star topology: Some of its advantages are as follow:

   1) If any one of the local computers fails, the remaining portion of the network remains unaffected.
   2) Fault detection is easier.
   3) Access protocols used in the star topology are very simple.
   4) Devices can be added or removed without disturbing the network.
   5) They work well under heavy loading.

   Disadvantages of star topology: Some of its advantages are as follow:

   1) The system crucially depends on the central switch or hub. If it fails, the entire network goes down.
   2) The cost of installation is high as each node is connected to the central switch or hub.
   3) Performance is totally based on the central switch or hub.

2. **Ring Topology:** In ring topology, the nodes are connected to a close loop so that each device is connected to two other devices, one on either side. The computers in a ring topology are connected in the shape of a closed ring. Data travels in only one direction in a ring. Each computer passes the data o the next one on the line automatically.

   Advantages of ring topology: Some of its advantages are as follow:

   1) The ring topology works well where there is no central site computer system.
   2) It is more reliable than star topology.
   3) The possibility of collision is minimal in ring topology.
   4) The cost of installation and expansion is very less.

   Disadvantages of ring topology: Some of its advantages are as follow:

   1) The ring topology requires more complicated control software.
   2) Failure of one node result in the failure of the entire network.

3) Troubleshooting or fault detection is difficult in ring topology.
4) Addition of nodes in between or removal of nodes can disturb the whole network.
5) Communication delay is directly proportional to the number of nodes in the network.

3. **Bus Topology:** In a bus topology or linear topology, the nodes are connected to a central cable called bus. In bus topology, a bus is a single continuous cable. Transmission from any node travels the length of the bus in both directions and can be received by all the other nodes in the network. The bus has terminators at either ends which absorbs the signal, removing it from the bus.

   Advantages of bus topology: Some of its advantages are as follow:
   1) It is quite simple and reliable.
   2) It is quite easy to set up and expand up to a certain limit.
   3) Failure of one node does not affect the rest of the network.
   4) The cost of installation and expansion is very less.

   Disadvantages of bus topology: Some of its advantages are as follow:
   1) It offers limited flexibility for change.
   2) The signal on the bus must be strong enough to reach the receiver if not then repeaters might have to be used to amplify the signal.
   3) Fault detection is difficult as it is to be performed at many points on the network.
   4) As each node is directly connected to the central bus, there has to be some way of deciding which node can use the network at a given time.

4. **Mesh Topology:** In mesh topology, every device is connected to another device via dedicated channel, dynamically and non-hierarchically. Routers are used to provide the best and most efficient data path for effective communication. In the event of a hardware failure, many routes are available to continue the network communication process.

   Advantages of mesh topology: Some of its advantages are as follow:
   1) It is robust and secure.
   2) Fault detection is easier.
   3) It provides privacy due to dedicated channels connected dynamically.
   4) Data is reliable because data is transferred among the devices through dedicated channels or links.

   Disadvantages of mesh topology: Some of its advantages are as follow:
   1) Installation and configuration is difficult.
   2) Cost of cables is high as bulk wiring is required.
   3) Suitable of less number of devices.

   Note: For (N) number of devices number of ports required will be (N-1). Total number of dedicated links required to connect them is N (N-1)/2

5. **Tree Topology:** Tree Topology is a combination of bus and star topology in which many nodes are connected with each other like the branches of a tree. It is the

simplest form in which the hub or switch devices are directly connected to the tree bus. Data transmission takes place in the same way as in the bus topology that is when the signal reaches the end of the transmission medium, it is absorbed by the terminators. Tree topology is best suited for applications which have a hierarchical flow of data and control.

Advantages of tree topology: Some of its advantages are as follow:

1) It is highly flexible and its future expandability of the network is much better than bus topology.
2) Centralized monitoring makes users to control and manage a larger network easily.
3) It is easy to reconfigure the tree topology.
4) It reduces network traffic.
5) As tree topology is a large network all, computers have better access to the network.
6) In tree topology each computer is connected to the hub and also each part of a network is connected to the main cable providing point to point connection.
7) Tree topology is supported by many hardware and software venders.
8) The signals that are transmitted by the root nodes are received by all the computers at the same time

Disadvantages of tree topology: Some of its advantages are as follow:

1) In tree topology if the backbone of the entire network breaks both part of the network might not communicate to each other but a part of the network continues to communicate alone.
2) Tree topology is difficult to configure because of its size. Wiring big size network is difficult.
3) The cost of installation and expansion is high.

6. **Hybrid Topology:** A hybrid topology is a type of network topology that uses two or more other network topologies, including bus topology, mesh topology, ring topology, star topology, and tree topology. This is a scalable topology which can be expanded easily. It is reliable one but at the same it is a costly topology.

   Advantages of hybrid topology: Some of its advantages are as follow:

   1) It is effective and reliable.
   2) Fault detection is easy.
   3) Failure of one node does not affect the rest of the network.
   4) It is flexible and its future expandability of the network is possible.
   5) It is scalable as it offers integration of new hardware components.

   Disadvantages of hybrid topology: Some of its advantages are as follow:

   1) Network Processing on hybrid topology is quite complicated.
   2) Installation and configuration is difficult.
   3) The cost of installation and expansion is high.

7. **Point to Point Topology:** In a point to point topology there are only two nodes which are connected with each other via a dedicated link. It’s the simplest layout for any

network, and it is pretty easy to visualize. Data transfer can take place using half duplex (Transmission of signals in both directions but not simultaneously) and full duplex (Transmission of signals in both directions simultaneously).

Advantages of point to point topology: Some of its advantages are as follow:

1) Very easy to set up.
2) Best suitable for very small network.
3) Fault detection is easy.
4) Easy to maintain the layout with two nodes.

Disadvantages of point to point topology: Some of its advantages are as follow:

1) It offers no flexibility or expansion.
2) Not suitable for more than two nodes.
3) Failure of one node result in the failure of the entire network.