

# An Overview on Network Topologies

Manisha<sup>1\*</sup>, Ramanpreet Kaur<sup>2</sup>, Daljit Kaur<sup>3</sup>, Ravneet Kaur<sup>4</sup>  
<sup>1,2,3,4</sup>Department of Computer Applications, Global Group of Institutes, Amritsar, India

**Abstract:** A network topologies is how computer, printers, and other devices are connected to a network in computer. In topologies networks is interconnection with two or more devices. The mapping or setup of a network’s elements is called networks topologies. The network topologies define the layout, virtual shape or structure of network, not only physically but also logically. They manage the distances between nodes, physical interconnections, transmission rates and signals.

**Keywords:** Bus topology, ring topology, star topology, tree topology, mesh topology, hybrid topology.

## 1. Introduction

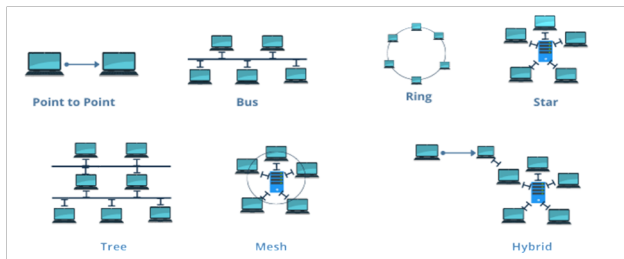


Fig. 1. Classifications of topologies

The network topologies communication network relates to how networks connection to computers or workstation together. The order to connection for share resources and communicate through a medium and data communication devices. The types of networks topologies are: Bus Topology, Ring Topology, Mesh Topology, Star Topology, Tree Topology and Hybrid Topology. The topologies can be used to define or describe the arrangement of various types of control radio networks, telecommunication networks, industrial field and computer networks. Topology is a term describing the “PHYSICAL and LOGICAL” arrangement of nodes, it has two dimensions.

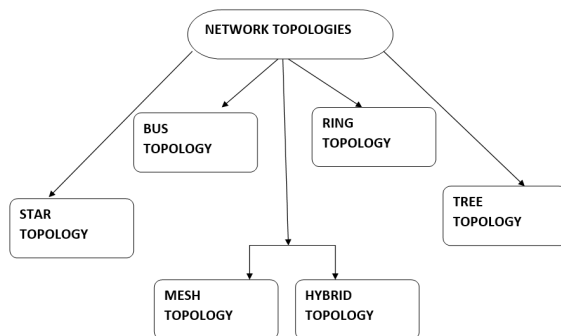


Fig. 1. Network topologies

1. *Physical Topology:* It tells the physical arraignment of devices within a network. In another words it defines the shape of the network.
2. *Logical Topology:* It tells how data is getting travel from one point to another within the network.

## 2. Explanations

### A. Bus Topology

The bus topology is a network to setup where each computer and network devices are connected with single nodes. A single cable is often backbone of network. It is commonly used for local area networks. Bus topology speed is low because one computer can send a message at a time. The destination of stripping mechanism is included and provision is made to transmit on the additional free slots is available through connected end.

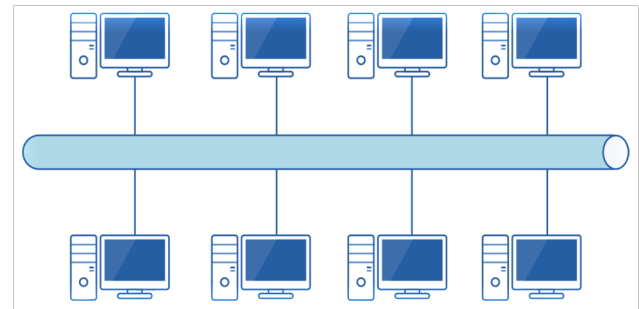


Fig. 2. Bus topology

*Physical View:* Nodes are connected to a single cable by a connector in a linear manner like bus.

*Logical View:* Data is always broadcasted within the network i.e., each and every node (including receiver) has access over the data packet send by a sender.

### Working Steps:

1. First of all, the node (especially node having data to send) will check the station of the cable if it is free then sender node will put its data packet on to the bus, otherwise it waits for the cable to be free.
2. Once data packet signal is released on to the bus, all the connected nodes will receive the signal.
3. All the nodes will make a match of their own address specified in the data packet. If match occurs then data packet will be received by intended devices and accordingly acknowledgement is sent else it will

\*Corresponding author: manisharajput01567@gmail.com

simply be ignored by node.

4. If in case two or more devices put their data packet on to the bus then collision will occur. This scenario can be resolve using guidelines of CSMA/CD (Carrier Sense Multiple Access / Collision Detection).

#### Advantages:

1. The bus topology is low down in cost.
2. Bus topology new devices are easy to expand.
3. It requires less cable than another topology.

#### Disadvantages:

1. The networks are shut down its difficult to identify the problem.
2. The cable's damage then network will be failed at that time in networking.
3. It requires less cable than another topology.

### B. Ring Topology

Each device is connected to two neighbours, producing a circular data route, in a ring architecture for computer networks. The tokens for transmitters in a ring topology receive data before passing it on to the next device. The data travels along a circular path. The workstations are connected using various loop configurations in the topology of ring networks. Each device on the network receives the data as it flows in a single direction. The ring topology is frequently used in "LANs" since it is straightforward and inexpensive.

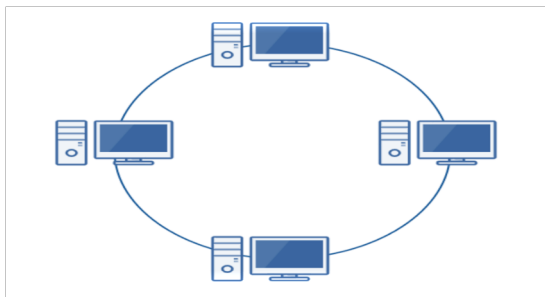


Fig. 3. Ring topology

*Physical View:* Nodes are connected in a circular fashion. So, this arrangement is just like a ring.

*Logical View:* Data flows from one direction to another connected node in a ring to reach its destination.

#### Working Steps:

1. A system always grabs the token before sending a data packet to another node in the network. To do this, the sender will examine the network's status of the token. If it is not free, it will continue to verify the token's status.
2. If the token is discovered to be free, the sender will attach a data packet to it before releasing it over the ring in the designated direction (clockwise or anticlockwise).
3. Each intermediary node examines the data packet and compares the receiver address to its own address. The packet is simply released to the next linked node if a match is not detected.
4. If match found, it means data packet is intended for this respected node only. It will accept the data packet

and attached acknowledgement and releases down the ring so that it reaches back to the sender.

#### Advantage:

1. It is easy to modify and install.
2. Easy to manage the network as it does not require a node.
3. In topology data flow only one direction and they transfer high rate of data.

#### Disadvantage:

1. Number of node's supports in ring topology and the result is find performance issues.
2. In ring topology the troubleshooting problem are difficult to manage.

### C. Star Topology

Star topology is connected with different – different types of switches or central hub with number of nodes. It is commonly used in "LAN" local area of networks. In the topology individually connection with hub, and they are failed to one node does not affect the functioning of the other nodes. Star topology is active central node that is usually means to put off echo related problems in networking.

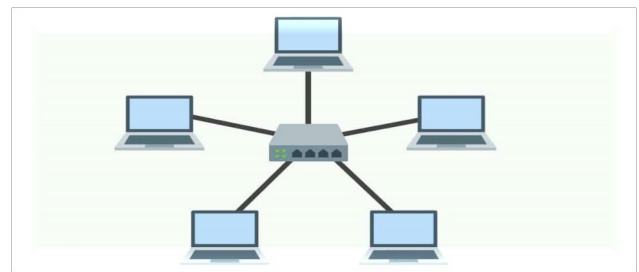


Fig. 4. Star topology

*Physical View:* Devices are linked to a central device (HUB) in shape of STAR.

*Logical View:* Via central component i.e., HUB data flows from one direction to another. There is no direct connection between devices.

#### Working Steps:

1. Firstly, sender node will check the availability of data packet and release it on to a respective cable segment via which it is connected to central device hub. Once data packet reached duty of sender is over.
2. Once data packet reaches to hub it is prime duty of it to read recipient address, residing in data packet.
3. Before matching recipient address with connected nodes address, it matches recipient address value with all the entire available in address table (address table is particularly maintain table by HUB which is used to store node address and its corresponding segment address).
4. Once a relevant entry is found or a match occurs hub will pass data packet over corresponding segment number so that it reaches to specified terminus.
- 5: In case no match is found in address table, then HUB didn't work at that time.

*Advantage:*

1. If troubleshoot easily in case one device fails it didn't affect the whole network.
2. Devices are added or removed from the network without any trouble.
3. Different devices are connected with a single hub in networks.

*Disadvantage:*

1. It depends on HUB or SWITCH. If the switch or hub fails, the entire network will be affected.
2. Star topology requires IT staff for its setup and maintenance.
3. Because of messy arrangements and involvement of individual cable this network is expensive.

*D. Tree Topology*

The computers are connected in a hierarchy pattern, with some computers acting as parent nodes and acting as child nodes. It is extent version of star topology. Star networks connected together in a logical arrangement. In other word it is combination of multiple star topologies with each other.

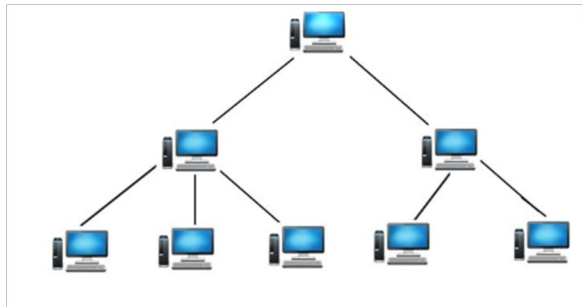


Fig. 5. Tree topology

*Advantage:*

1. Reliability: Unlike other topology such as a ring topology, troubles to the networks are localized and do not affect the entire network.
2. Scalability: Tree topology allows for easy scalability, as the network can be expanded by adding additional nodes to network.
3. Centralized control: The tree topology allows for centralized control, as one parent node can manage multiple child nodes.

*Disadvantage:*

1. Complexity: The complexity of the network increases as additional nodes added, making it difficult to manage and troubleshoot.
2. Single point of failure: If the root node fails, the entire network may become inaccessible.

*E. Mesh Topology*

Based on criteria like connectivity, speed, and unfinished node duties, source nodes in a mesh network topology choose the most efficient path from sender to destination. When there is a lot of traffic moving between nodes, this architecture is chosen. Usually, restrictions apply to a small number of nodes. Each node in the mesh network is primarily defined as being directly connected to another node. In the MESH topology,

network failure is considerably reduced. The data flows constantly throughout the network in a simpler mesh network that employs a flood strategy. A module will simply collect data containing its address if it is there. This works because of the time to live (TTL) parameter, which restricts the number of hops that messages can go through the mesh before being deleted.

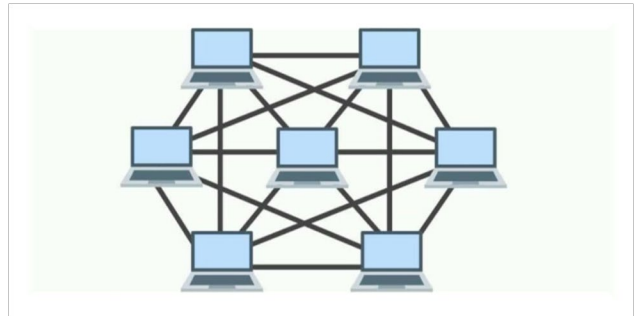


Fig. 6. Mesh topology

*Advantage:*

1. There is no traffic concern because each computer has a dedicated point-to-point link.
2. This architecture provides of redundancy and various paths to the target.
3. It provides high degrees of privacy and security.
4. Data transfer is more dependable because failure doesn't halt its activities.
5. This design contains powerful components that can manage any situation.

*Disadvantage:*

1. When compared to competing network topologies like the star, bus, and point-to-point topology, it is more expensive.
2. Mesh installation is really challenging.
3. Because each node must share the load and be active constantly, the power need is larger.
4. Additional utility costs for each node must be considered.

*F. Hybrid Topology*

Combinations of many topologies, such as mesh, bus, and ring topologies, are shown in one form. Its use and selection are influenced by its installations and requirements, which include the performance of the required network, the quantity of computers, and their location. Due to the low effective cost, hybrid topology is used in many applications. When compared to other fundamental mechanisms, the hybrid topology mechanism is efficient and useful in a range of contexts. As a result, it gives clients the benefit of building, running, and managing the business. Many various businesses, including the banking sector, automated industries, the financial sector, research organizations, and multinational enterprises, use the hybrid topology extensively. Any two topologies can be combined to create a new hybrid topology, such as full mesh topology, extended star, partial star, and point-to-point networks.

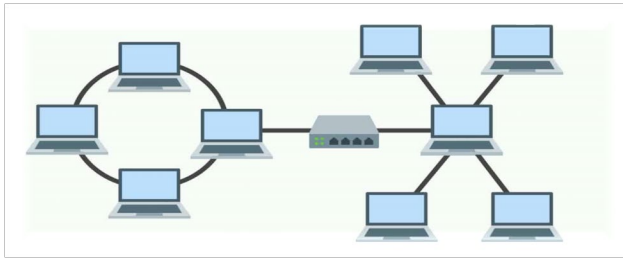


Fig. 7. Hybrid topology

*Advantages:*

1. You can modify this type of topology to meet your needs. It combines the benefits of several topologies into a single topology.
2. It is quite flexible.
3. Hybrid networks are easily expandable since they are made to make it simple to incorporate new hardware components.

*Disadvantage:*

1. A specific class of expensive network.
2. The architecture of a hybrid network is quite complex.
3. The hardware is updated and one topology is replaced with another.
4. Because hybrid constructions are often larger in size, installation calls for extra connections. Hubs are used to connect two distinct networks and are highly expensive. Additionally, hubs are different from standard hubs since they need to be able to work with a variety of designs.

### 3. Conclusion

The phrase "networking topology" refers to a number of topologies that describe various connections between different

devices with the intention of transferring data. Many topologies can be categorized based on a number of different criteria. These topologies have been covered in this study. Importance Each of these topologies has been explored in this study. It is explained how different device layouts are implemented in various topologies. In this paper, ring topology is discussed, along with its diagrammatic representation, advantages, and disadvantages. Similar to this, other different topologies have been covered in this work, including the mesh, star, bus, tree, and hybrid topologies. Several types of networks are present in all of them, from small enterprises to enormous corporations. These connections are made while considering the advantages of various topologies, and they are then made in accordance with those considerations. New business is designed to need the use of these topologies, hence extending the range of potential applications. They all have different kinds of networks, from tiny businesses to huge organizations.

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