

NETWORK TOPOLOGY

A network topology is the arrangement of nodes — usually switches, routers, or software switch/router features — and connections in a network often represented as a graph. The topology of the network and the relative locations of the source and destination of traffic flows on the network, determine the optimum path for each flow and the extent to which redundant options for routing exist in the event of a failure. 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 layout of nodes and physical connections, including wires (Ethernet, DSL), fiber optics, and microwave. There are several common physical topologies, as described below, and as shown in the illustration.

Types of physical topologies

In the bus network topology, every node is connected in series along a linear path. This arrangement is found today primarily in cable broadband distribution networks.

In the **star network** topology, a central node has a direct connection to all other nodes. Switched local-area networks (LANs) based on Ethernet switches, including most wired home and office networks, have a physical star topology.

In the ring **network topology**, the nodes are connected in a closed-loop configuration. Some rings will pass data only in one direction, while others are capable of transmission in both directions. These bidirectional ring networks are more resilient than bus networks because traffic can reach a node by moving in either direction. Metro networks based on Synchronous Optical Network Technology (SONET) are the primary example of ring networks today.

The **mesh network** topology links nodes with connections so that multiple paths between at least some points of the network are available. A network is said to have fully meshed if all nodes are directly connected to all other nodes and partially meshed if only some nodes have multiple connections to others. Meshing to create multiple paths increases resiliency under failure, but increases cost. The Internet is a mesh network.

The **tree network** topology, also called a star of stars, is a network where star topologies are themselves connected in a star configuration. Many larger Ethernet switch networks including data center networks are configured as trees

Bus Topology

In the bus topology, the server is at one end, and the client PCs (devices) are connected at different points or positions along with the network. All signals pass through each of the devices. Each device has a unique identity and can recognize those signals intended for it. It is easy and simple to design and implement.

Advantages:

- Easy to implement and extend
- Well suited for temporary or small networks not requiring high speeds
- Cheaper than other topologies.
- Cost-effective as only a single cable is used.
- Cable faults are easily identified.

Disadvantages

- Limited cable length and the 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.
- It works best with a limited number of nodes.
- It is slower than the other topologies.

Star Topology

This is a form of LAN architecture in which nodes on a network are connected to a common central hub or switch, and this is done by the use of dedicated links.

- In this kind of topology all the cables run from the computers to the central location where they are all connected by a device called hub or switch (or host node).
- Each computer on a star network communicates with a central device that resends the message either to each computer or only to the destination computer, e.g. if it is a hub then it will send to all and if it is a switch then it will send to the only destination computer.
- When network expansion is expected and when the greater reliability is needed, star topology is the best.

Advantages:

- 1) It is easy to modify and add new computers without disturbing the rest of the network.
- 2) The center of the star network is a good place to diagnose the faults.

3) Single computer failure does not necessarily bring down the whole star network.

Disadvantages:

- 1) If the central device (or the host node) fails the whole network fails to operate.
- 2) Star networking is expensive because all network cables must be pulled to one central point, requires more cable than other network topologies.

Ring Topology

- This topology is a simple design and consists of a single cable that forms the main data path in the shape of a ring. Each device is connected to a closed-loop of cable. Signals travel in one direction from one node to all other nodes around the loop.
- In this type, each computer is connected to the next computer with the last one connected to the first.
- Each retransmits what it receives from the previous computer. The message flows around the ring in one direction.
- The ring network does not subject to signal loss problems as a bus network experience.
- There is no termination because there is no end to the ring.

Advantages:

- 1) Each node has equal access.
- 2) Capable of high-speed data transfer.

Disadvantages:

- 1) Failure of one computer on the ring can affect the whole network.
- 2) Difficult to troubleshoot the network.