BASIC CONCEPT OF COMPUTER NETWORK AND CLOUD COMPUTING

Introduction of Computer Network and Its Type

A computer network comprises two or more computers that are connected—either by cables (wired) or WiFi (wireless)—with the purpose of transmitting, exchanging, or sharing data and resources. You build a computer network using hardware (e.g., routers, switches, access points, and cables) and software (e.g., operating systems or business applications).

Geographic location often defines a computer network. For example, a LAN (local area network) connects computers in a defined physical space, like an office building, whereas a WAN (wide area network) can connect computers across continents. The internet is the largest example of a WAN, connecting billions of computers worldwide.

You can further define a computer network by the protocols it uses to communicate, the physical arrangement of its components, how it controls traffic, and its purpose.

Computer networks enable communication for every business, entertainment, and research purpose. The internet, online search, email, audio and video sharing, online commerce, live-streaming, and social networks all exist because of computer networks.

Types of Computer network

As networking needs evolved, so did the computer network types that serve those need. Here are the most common and widely used computer network types:

LAN (Local Area Network): A LAN connects computers over a relatively short distance, allowing them to share data, files, and resources. For example, a LAN may connect all the computers in an office building, school, or hospital. Typically, LANs are privately owned and managed.

WLAN (wireless local area network): A WLAN is just like a LAN but connections between devices on the network are made wirelessly.

WAN (wide area network): As the name implies, a WAN connects computers over a wide area, such as from region to region or even continent to continent. The internet is the largest WAN, connecting billions of computers worldwide. You will typically see collective or distributed ownership models for WAN management.

MAN (Metropolitan Area Network): MANs are typically larger than LANs but smaller than WANs. Cities and government entities typically own and manage MANs.

PAN (Personal Area Network): A PAN serves one person. For example, if you have an iPhone and a Mac, it's very likely you've set up a PAN that shares and syncs content—text messages, emails, photos, and more—across both devices.

SAN (Storage Area Network): A SAN is a specialized network that provides access to block-level storage—shared network or cloud storage that, to the user, looks and works like a storage drive that's physically attached to a computer. (For more information on how a SAN works with block storage, see Block Storage: A Complete Guide.)

CAN (Campus Area Network): A CAN is also known as a corporate area network. A CAN is larger than a LAN but smaller than a WAN. CANs serve sites such as colleges, universities, and business campuses.

VPN (Virtual Private Network): A VPN is a secure, point-to-point connection between two network end points (see 'Nodes' below). A VPN establishes an encrypted channel that keeps a user's identity and access credentials, as well as any data transferred, inaccessible to hackers.
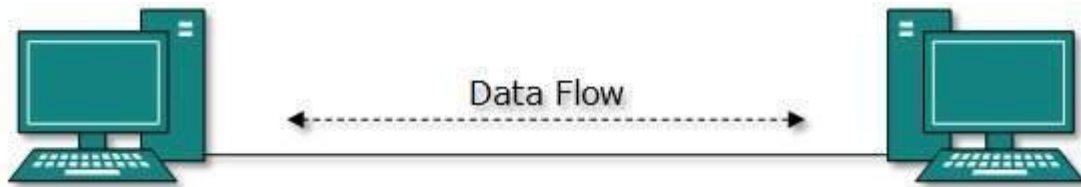
Topology

A Network Topology is the arrangement with which computer systems or network devices are connected to each other. Topologies may define both physical and

logical aspect of the network. Both logical and physical topologies could be same or different in a same network.

Point-to-Point

Point-to-point networks contain exactly two hosts such as computer, switches or routers, servers connected back to back using a single piece of cable. Often, the receiving end of one host is connected to sending end of the other and vice-versa.

If the hosts are connected point-to-point logically, then may have multiple intermediate devices. But the end hosts are unaware of underlying network and see each other as if they are connected directly.

1. Bus Topology

Bus topology is the kind of network topology where every node, i.e. every device on the network, is connected to a solo main cable line. Data is transmitted in a single route, from one point to the other. We cannot transmit data in both ways. When this topology has precisely two endpoints, it is known as Linear Bus Topology. It is mostly used for small networks.
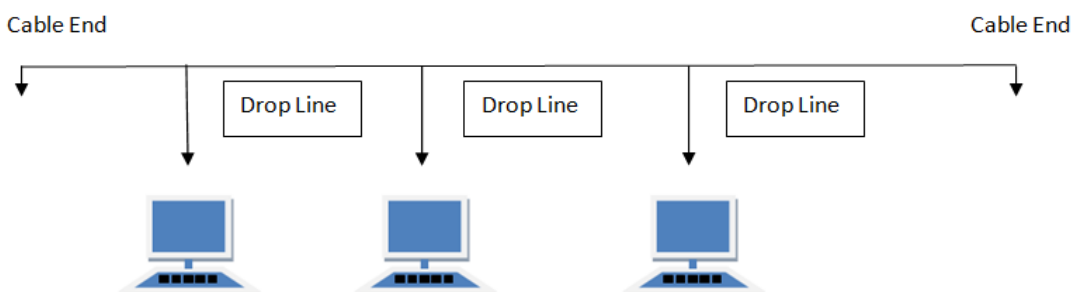
Benefits of Bus Topology

- It is cost-effective.

- The Cable length required is the least in comparison to other topologies.

- The working of this topology is easy to understand.

- Expansion can be done easily by linking the cables together.

Drawbacks of Bus Topology

- If the main cable collapses, the complete network collapses.

- The network performance is at stake and reduces if there are numerous nodes and heavy network traffic.

- The main cable can only be so long. The length of the cable is limited.

- Bus Topology is not as fast as Ring Topology.

2. Ring Topology

Ring Topology is a topology type in which every computer is connected to another computer on each side. The last computer is connected to the first, thus forming a ring shape. This topology allows for each computer to have exactly two neighbouring computers.

In this topology, the main computer is known as the monitor station, which is responsible for all the operations. Data transmission amongst devices is done with the help of tokens. For transmitting data, the computer station has to hold the token. The token is released only when the transmission is complete, following which other computer stations can use the token to transmit data.

Data transmission is done in a sequential method, i.e. bit by bit. Therefore, data has to route its way through each node in the network to reach the destination node. We use repeaters in a Ring topology to prevent loss of data during transmission. These repeaters are especially helpful when the topology has a vast number of nodes, and the data is to reach the very last node in the network.

The data transmission is unidirectional in a Ring topology, but it can be created to be bidirectional by connecting each node with another set of connecting lines. This is known as Dual Ring Topology. Here, two ring networks are created, with the data in each flowing in opposite directions.
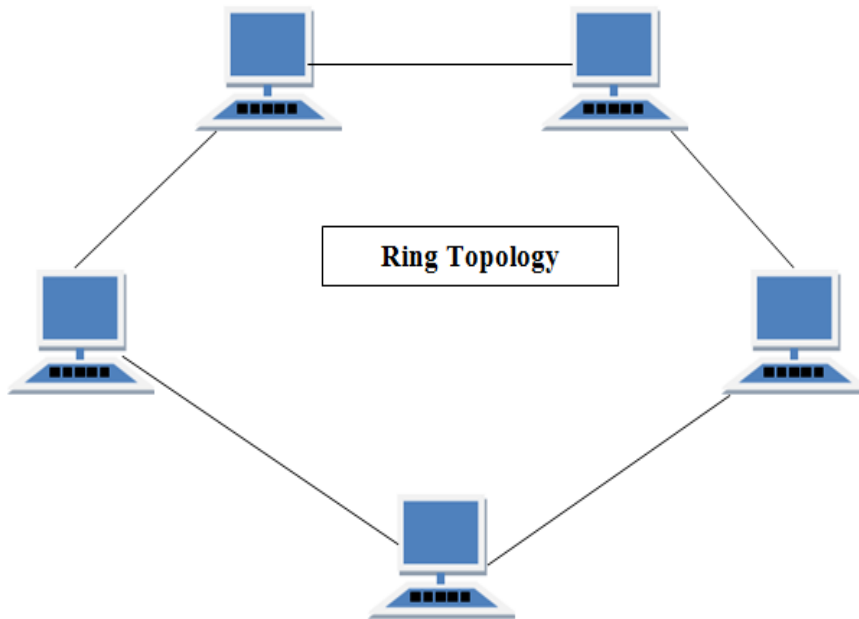

Ring Topology

Benefits of Ring Topology

- The network is not affected by numerous nodes or heavy traffic, as only the nodes possessing tokens can transfer data.

- Ring topology has cheap installation and expansion.

Drawbacks of Ring Topology

- It is a tedious task to troubleshoot in Ring topology.

- It is difficult to add or delete nodes, as it interrupts the network activity.

- If one computer crashes, the entire network activity is disrupted.

3. Star Topology

Star Topology is the kind of network topology in which all the nodes are connected via cables to a single node called a hub, which is the central node. The hub can be active or passive in nature. Active hubs contain repeaters, while passive hubs are considered non-intelligent nodes. Each node contains a reserved connection to the central node, which the central node acting as a repeater during data transmission.
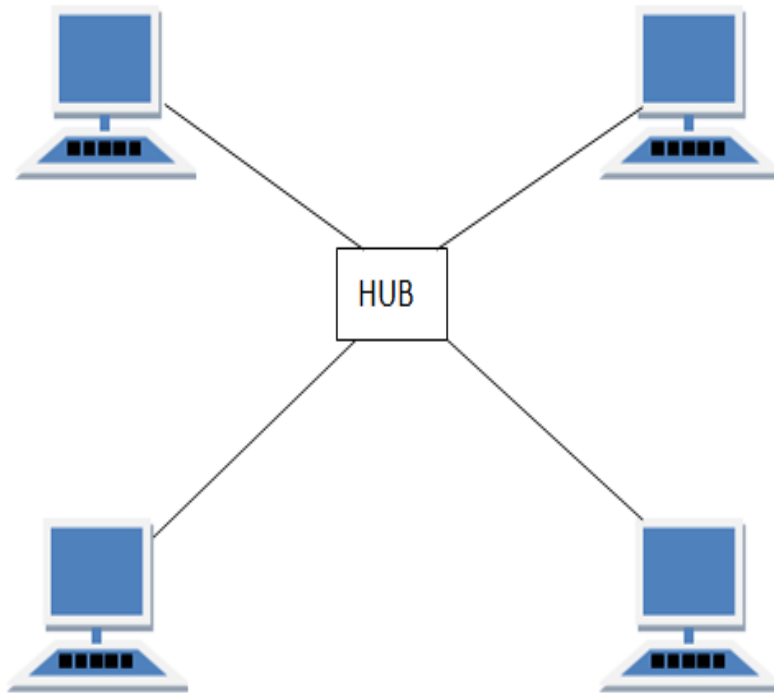
Benefits of Star Topology

- Star topology boasts fast performance due to low network traffic.

- It is easy to upgrade the Hub as and when required.

- Setup can be done easily and can be easily modified as well.

- Star Topology is easy to troubleshoot.

- In case a node has failed, it can easily be replaced without affecting the working of the rest of the network.
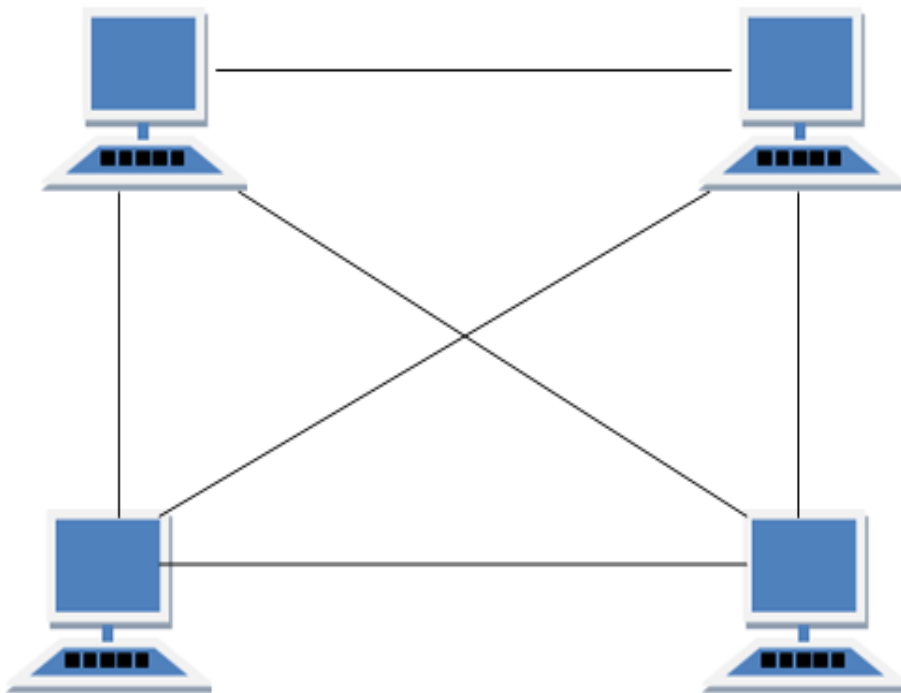
Drawbacks of Star Topology

- The installation cost is extreme, and it is costly to use.

- All the nodes are dependent on the hub.

4. Mesh Topology

Mesh topology is the kind of topology in which all the nodes are connected with all the other nodes via a network channel. Mesh topology is a point-to-point connection. It has n(n-1)/2 network channels to connect n nodes.

Mesh topology has two techniques for transmission of data, i.e. routing and flooding. In the routing technique, the nodes possess a routing logic, like the logic for the shortest distance to the destination node or the logic to avoid routes with broken connections. In the flooding technique, all the network nodes receive the same data. This leaves us no need for routing logic. This technique makes the network robust but results in unwanted load on the network.

Benefits of Mesh Topology

- Every connection has the ability to carry its particular data load.

- Mesh Topology is very robust.

- It is easy to diagnose faults.

- Mesh Topology provides privacy and security.

Drawbacks of Mesh Topology

- Mesh Topology is challenging to install and configure.

- As all the nodes are connected with each other, cabling is costly.

- Bulk wiring is essential.

5. Tree Topology

Tree topology is the topology in which the nodes are connected hierarchically, with all the nodes connected to the topmost node or root node. Hence, it is also known as hierarchical topology. Tree topology has at least three levels of hierarchy.

Tree topology is applied in Wide Area Network. It is an extension of Bus topology and Star topology. It is best if the workstations are situated in groups, for easy working and managing.
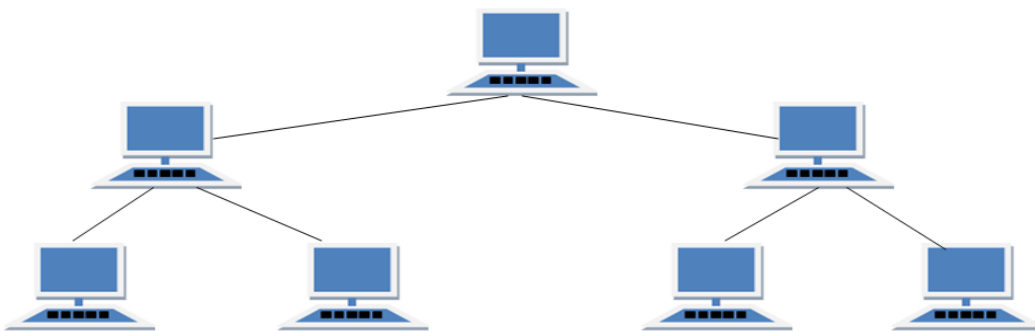
Benefits of Tree Topology

- It is easy to expand the network with more nodes.

- It is easy to maintain and manage.

- It is easy to detect an error in the network.

Drawbacks of Tree Topology

- It is profoundly cabled.

- It is expensive when compared to other topologies.

- If the root node collapses, the network will also collapse.

6. Hybrid Topology

Hybrid Topology is basically a network topology comprising of two or more different types of topologies. It is a reliable and scalable topology, but simultaneously, it is a costly one. It receives the merits and demerits of the topologies used to build it.
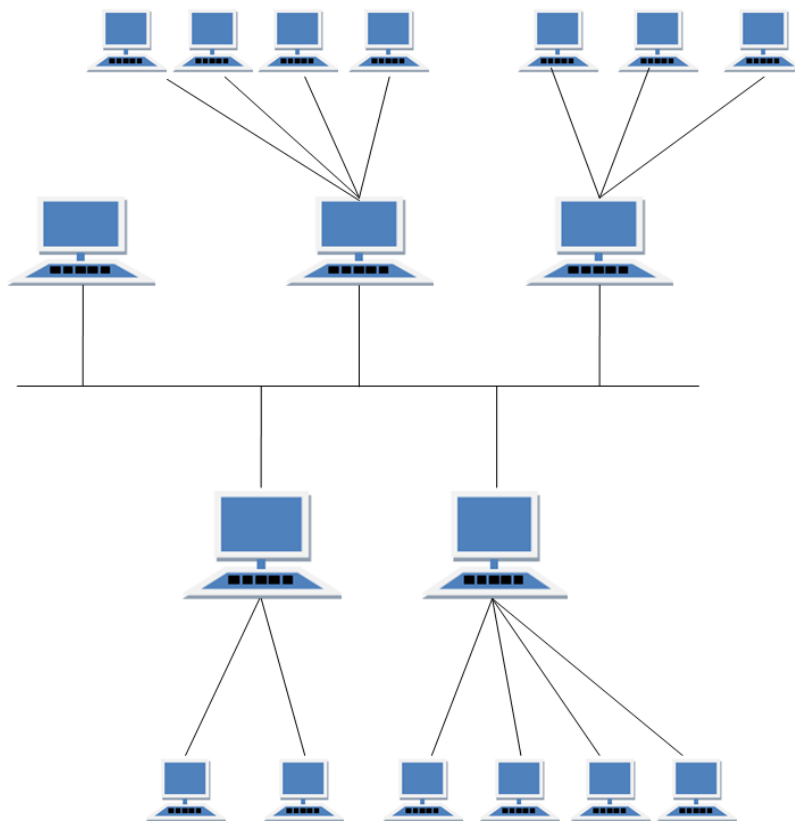
Benefits of Hybrid Topology

- It is easy to troubleshoot and provides simple error-detecting techniques.

- It is a flexible network topology, making it quite effective.

- It is scalable since the size can be made greater easily.

Drawbacks of Hybrid Topology

- It isn't very easy to design it.

- It is costly, as it involves more than one topology.

Connecting Devices

The devices which are used for communication between different hardware's used in the computer network are known as network devices. These devices are also known as physical devices, networking hardware, and network equipment otherwise computer networking devices. In a computer network, each network device plays a key role based on their functionality, and also works for different purposes at different segments.