Computer Network

A computer network or data network is a telecommunications network which allows computers to exchange data using a data link. The connections between nodes (computers on networks called nodes) are established using either cable media or wireless media. Vint Cerf and Bob Kahn are known as fathers of the Internet.

The five components of a computer network are:

➢ Sender (Device)
➢ Sender Equipment (Encoder)
➢ Communication Channel (Cables, Wireless)
➢ Receiver Equipment (Decoder)
➢ Receiver (Device)

Sender - Sender is a device that sends a message which can consist of text, numbers, pictures etc. It is also called source or transmitter.

Sender Equipment - The encoder is a device that converts digital signals in a form that can pass through a transmission medium.

Communication Channel - It is the physical path that connects the sender and the receiver. It is used to transmit data. It is also called Medium. The channel can be a copper wire, a fiber optic cable, microwaves etc

Receiving Equipment - The decoder is a device that converts the encoded signals into digital form. The receiver can understand the digital form of message.

Receiver – Receiver is a device that receives the message. It is also called a sink. It must be capable of accepting the message.

Types of Computer Network

The Network allows computers to connect and share resources with other devices through a medium.

Based on the area coverage, there are three types of computer networks.

➢ LAN – Local Area Network
➢ MAN – Metropolitan Area Network
➢ WAN – Wide Area Network

Local Area Network

LAN is a computer network covering a small geographical area and is privately owned. The Communication medium used for LAN has twisted pair cables and coaxial cables. LAN offers high-speed communications data rates up to 1000 Mbps. The fault tolerance of a LAN is more, and congestion is less in this network. LAN can be used for an office building, home, hospital, schools, etc.

Metropolitan Area Network

MAN covers a large geographical area than LAN. It is designed for customers who need a high-speed connectivity and it is usually owned by large organizations to interconnect its various branches across a city. The fault tolerance of a MAN is less and congestion in the network is more. Modem and Wire/Cable are used as transmission devices. It may serve as an Internet Service Provider (ISP).

Wide Area Network

WAN covers the large geographical area and it might be restricted within the bounds of a state or country. It could be a connection of LAN connecting to other LAN through telephone lines and radio waves. The technology is high speed and relatively expensive.

The Speed of WAN ranges from few kilobits per second (Kbps) to megabits per second (Mbps). Public

packet networks, Large corporate networks, Military networks, Banking networks, Stock brokerage networks, and Airline reservation networks are constructed by WAN.

Other types

Wireless Local Area Network (WLAN) - WLAN is a wireless network communication over short distances. This distribution method uses high-frequency radio waves and often include an access point to the Internet. It is also called Local Area Wireless Network (LAWN).

Example - A mobile user can connect to LAN via wireless connection.

Storage Area Network (SAN) - SAN is a high-speed special-purpose network. It supports data storage, retrieval, and sharing of data, multiple disk arrays, data migration from one storage device to another and uses Fibre Channel interconnection technology.

Campus Area Network (CAN) - CAN is a computer network of interconnected local area networks. It is larger than a LAN but smaller than MAN or WAN. It can also stand for Corporate Area Network.

Example - Massachusetts Institute of Technology's (MIT) Project Athena has CAN network.

Personal Area Network (PAN) - PAN refers to the interconnection of telecommunications devices or gadgets such as a laptop, mobile phones, printers etc around an individual person. It can cover a network range of 30 feet (approximately 10 m). It can be constructed by using cables or it may be wireless.

Wireless Personal Network (WPAN) – WPAN is a type of personal area network. It uses wireless communication to transfer data between the connected devices of the user. It is also known as short wireless distance network.

Network Architecture

It is the physical and logical design which denotes to the software, hardware, protocols and the media of transmission of data. Peer-to-Peer (P2P) and Client/Server or tiered are the two types of widely used network architecture.

Peer-to-Peer Architecture - Tasks are allocated to all the devices of the network. There is no hierarchy among the computers and all of them are considered equal. All computer can able to use resources available on this network. This is also known as a distributed architecture. It doesn't use a server that controls network activity. Peer-to-peer is mostly used for file sharing.

Client/Server Architecture – The server acts as a hub in which other computers (clients) are connected. The server manages and provides resources to any client that requests them.

Other Terms used in networks

Protocol - Protocol is a set of guidelines for exchanging data over a computer network, such as local area network, Internet, Intranet, etc.

Ethernet - Ethernet is the most widely used LAN technology that defines wiring and signalling standards for the physical layer of TCP/IP. Ethernet was standardized as IEEE 802.3.

Token Ring - It is a local area network topology where nodes are arranged in a ring topology. The data passes between nodes on the network until it returns to the source station. A token ring topology uses a token to ensure that only one node on the line is used at a time to prevent congestion and collision. The token ring LAN system was standardized as IEEE 802.5.

Fiber distributed data interface (FDDI) - FDDI is an optical data communication standard used for long distance networks provides communication with fiber optic lines. This protocol is based on the token ring protocol.
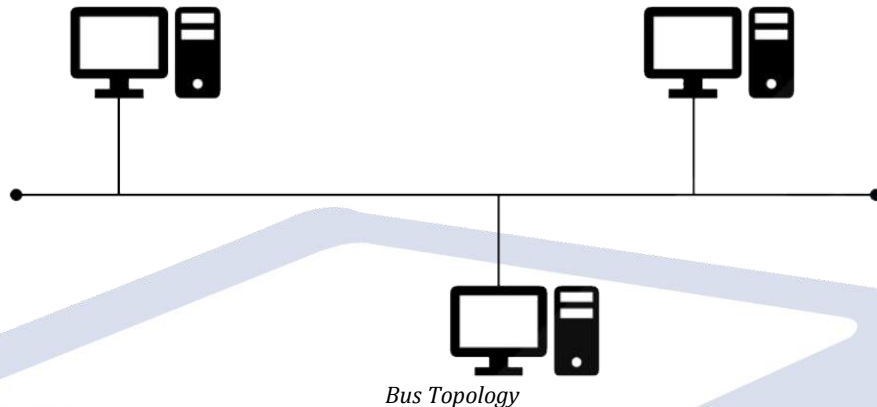
Network Topology

A network topology is the arrangement of a network, nodes and connecting lines. The physical topology and the logical (or signal) topology are the types of network topology.

Physical Topology

The physical topology refers to the geometric layout of the connected network. Bus Topology, Ring Topology, Tree Topology, Mesh Topology, Star Topology, and Hybrid Topology are several forms of Physical Topology.
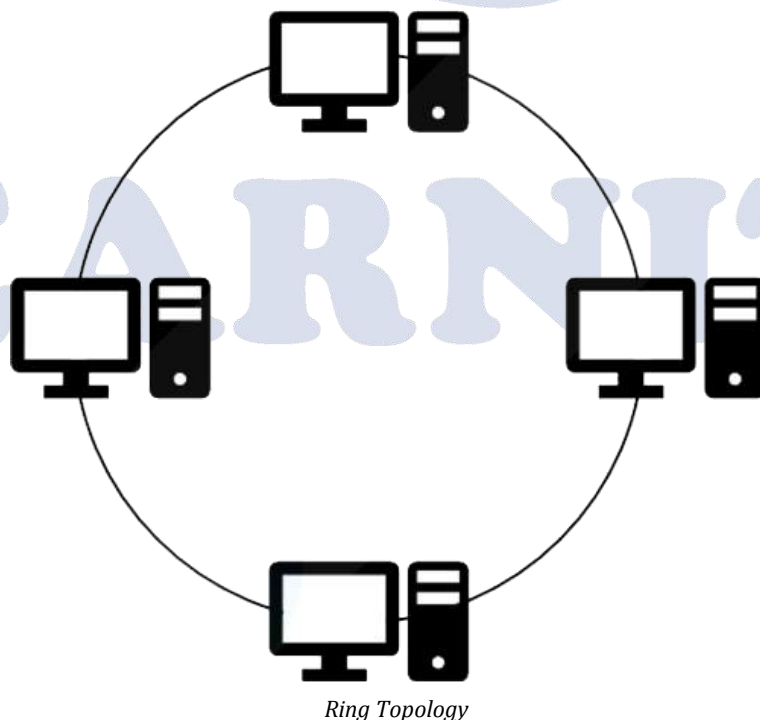
Bus Topology

In the Bus topology system, every computer and network are connected by using a single cable. The cable is known as Bus. It transmits the data from one end to another end only in a single direction. When it has exactly two endpoints, then it is called Linear Bus topology. A network that uses a bus topology is referred to as a bus network. Bus networks were the original form of an Ethernet network.
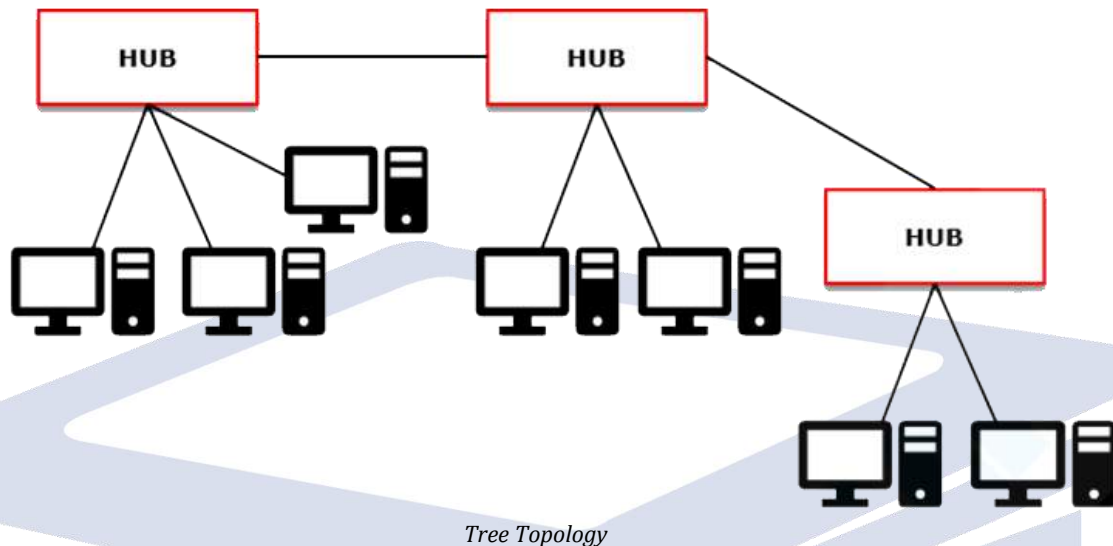
Bus Topology

Ring Topology

In ring Topology, network nodes are connected in a closed loop configuration. Each node has directly connected with its adjacent node on both sides. The Others are indirectly connected and the data passing through one or more intermediate nodes.

➢ **Dual Ring Topology** - When the transmission is bidirectional by having two connections between each network node, it is called Dual Ring Topology. It is a network redundant topology where nodes are connected using two concentric rings with four branches. If one ring fails, the second ring can act as a backup, to keep the network up.

Ring Topology

Tree Topology

In Tree Topology network, two or more-star networks connected with a root node and all other nodes are connected to it forming a hierarchy. It is also called hierarchical topology. It should at least have three levels to the hierarchy. This type of topology used in Wide Area Network. Tree topology is valued for its scalability and accessibility for troubleshooting.


Tree Topology

Star Topology

In a star topology, all the nodes are connected to a single hub through a cable. This hub is the central node. The data can send from one node to another through the hub. Hub acts as a repeater for data flow. It can be used with twisted pair, Optical Fibre or coaxial cable.

Star Topology
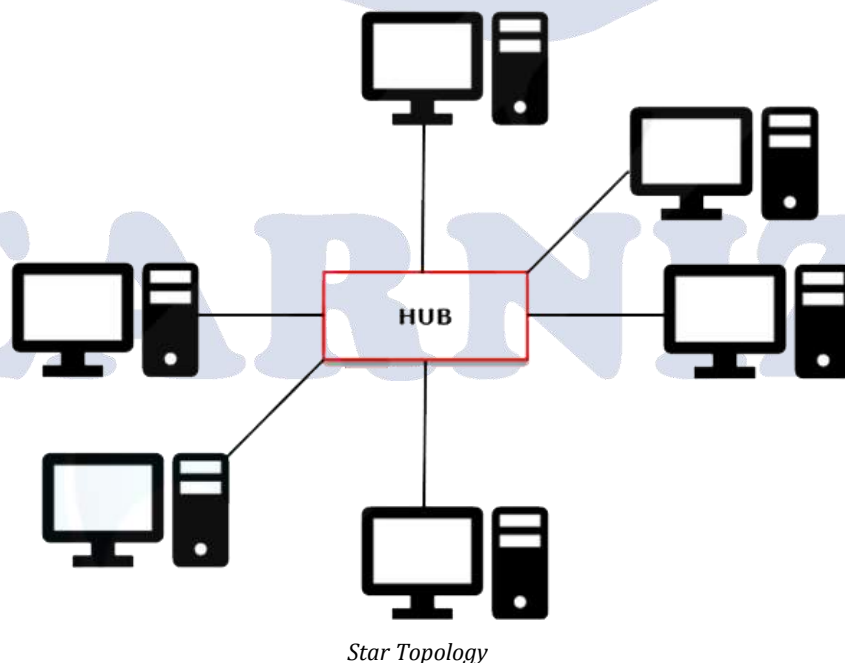
Mesh Topology

A mesh topology is a network setup where each computer and network device is interconnected with one another. This topology setup allows for most transmissions to be distributed even if one of the connections goes down. It is a topology commonly used for wireless networks.
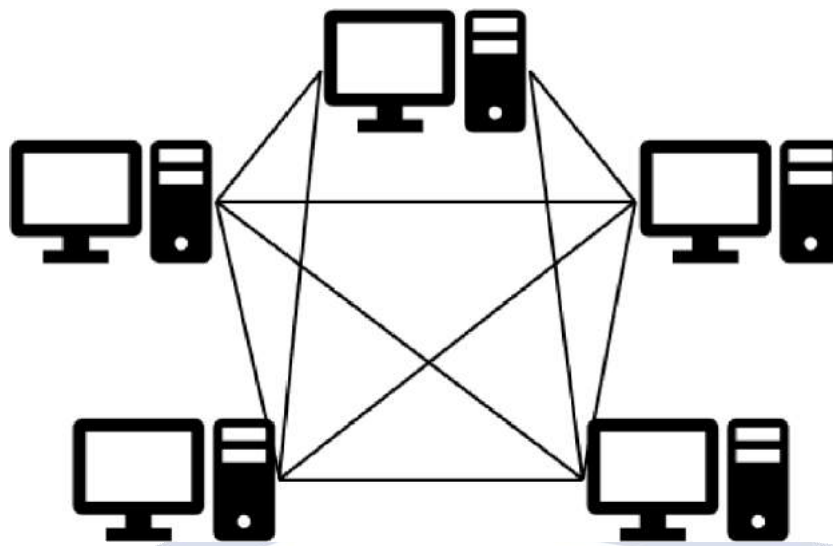
Mesh Topology

Logical/Signal Topology

Logical Topology denotes how the signals transmitted from node to node across the system. Broadcast and Token Passing are the two types of Logical topology.

  ➢ **In Broadcast**, there is no need for instructions. Ethernet is working in Broadcast transmission.
  ➢ **In Token Passing**, electronic token is passed to each node. When a token is received by the node, the node can send data on the network. Token Ring and Fibre Distributed Data Interface (FDDI) are using Token Passing. Arc net is token passing on a bus topology.