As Per CBSE Syllabus 2022-23

Computer Science

Class XII

Chapter- 4

Computer Networks

Evolution of networking

A Computer Network is a group of computers and other devices, such as printers, scanners, and servers, that are connected together by a transmission media to share resources and communicate with each other.

The evolution of computer networks started with the development of the **ARPANET (Advanced Research Projects Agency Network)** in the 1960s. It was the first packet-switching network and was developed by the U.S. Department of Defence. ARPANET was initially used for military purposes, but later it was opened up for academic and research purposes.

In the 1980s, the **National Science Foundation Network (NSFNET)** was developed to provide high-speed connectivity to research institutions and universities. NSFNET played a crucial role in the development of the modern internet.

The internet, as we know it today, evolved from ARPANET and NSFNET. It is a global network of interconnected networks, and it enables users to communicate and share information over long distances.

Components of Data communication

Data communication is the exchange of information between two or more devices via some form of transmission medium. The following are the key terminologies related to data communication:
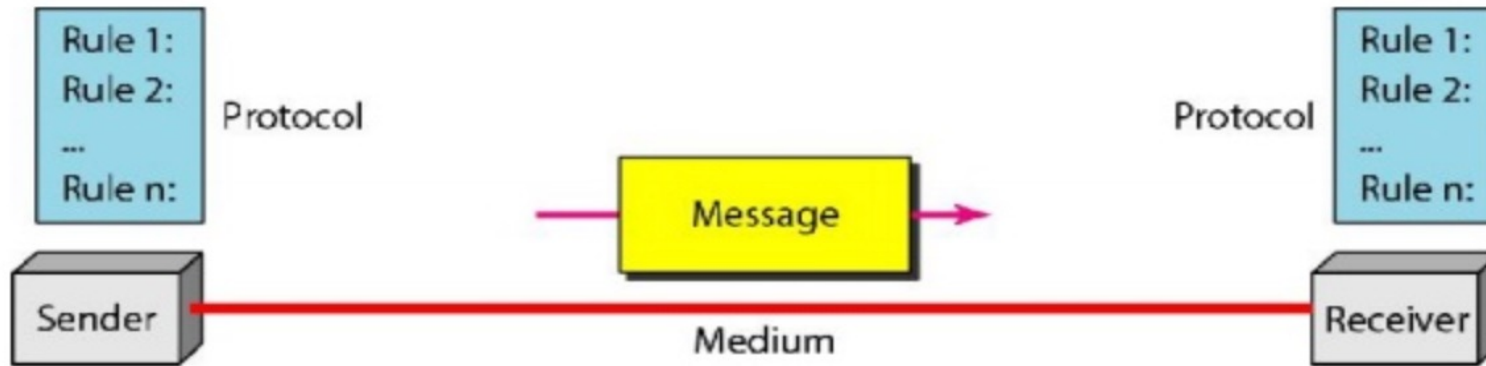
- Sender: The device that sends the information is called the sender.
- Receiver: The device that receives the information is called the receiver.
- Message: The information being exchanged is called the message.
- Communication media: The physical medium used to transmit the message is called the communication media
- Protocols: Protocols are rules that govern the communication between devices.

Measuring capacity of communication media

1.Bandwidth:

In computer networking, bandwidth refers to the maximum amount of data that can be transmitted over a network in a given period of time. It is usually measured in bits per second (bps), kilobits per second (Kbps), megabits per second (Mbps), or gigabits per second (Gbps).

2.Data transfer rate:

Data transfer rate, also known as data rate or bit rate, is the amount of data that can be transmitted over a network in a given period of time. It is usually measured in bits per second (bps), kilobits per second (Kbps), megabits per second (Mbps), or gigabits per second (Gbps).
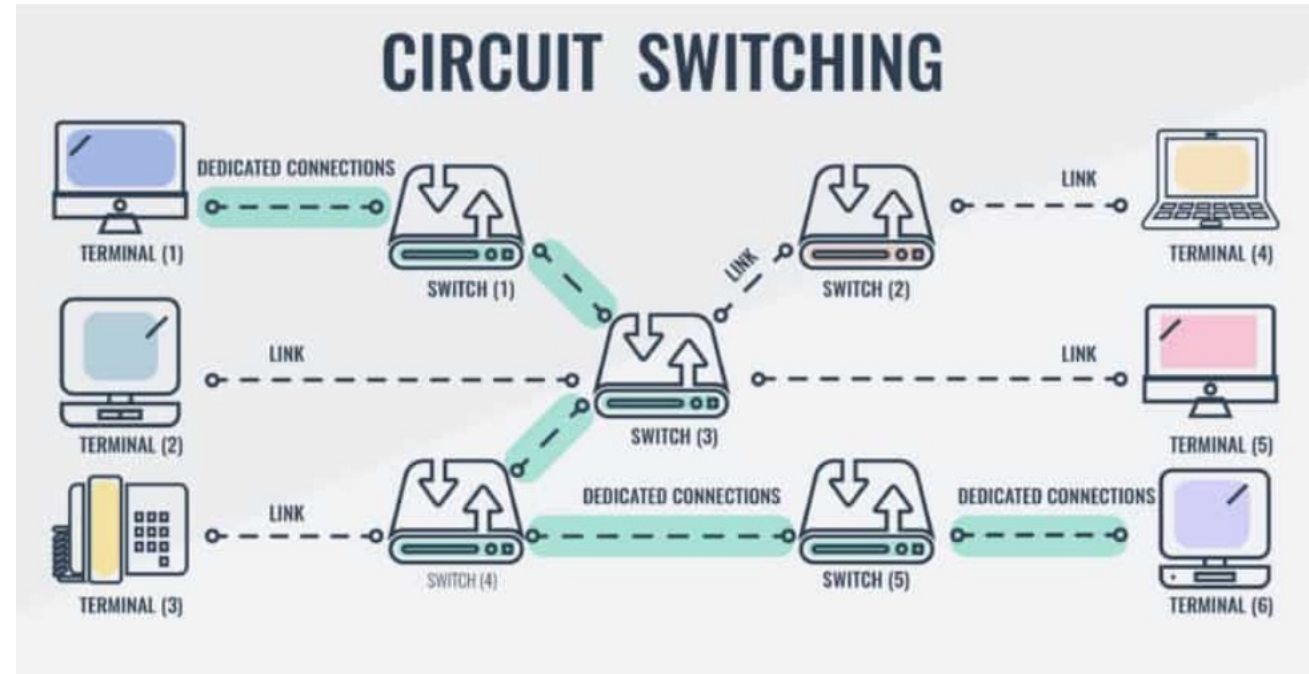
Switching Techniques

Circuit switching and packet switching are two different methods of transmitting data over a network.

1.Circuit switching:

In circuit switching, a dedicated communication path is established between two devices for the duration of a communication session. This path is reserved for the exclusive use of the devices, and no other devices can use it until the communication session ends.

In circuit switching, the entire capacity of the communication path is reserved for the duration of the session, even if no data is being transmitted.

Circuit switching is typically used in situations where a constant, high-quality connection is required, such as in voice communications over a telephone network.

Switching Techniques

2.Packet switching:

In packet switching, data is divided into small packets and transmitted over a network. Each packet contains information about its destination, source, and position in the sequence of packets.

Packet switching does not require the establishment of a dedicated communication path between two devices. Instead, each packet is independently routed through the network based on its destination address.
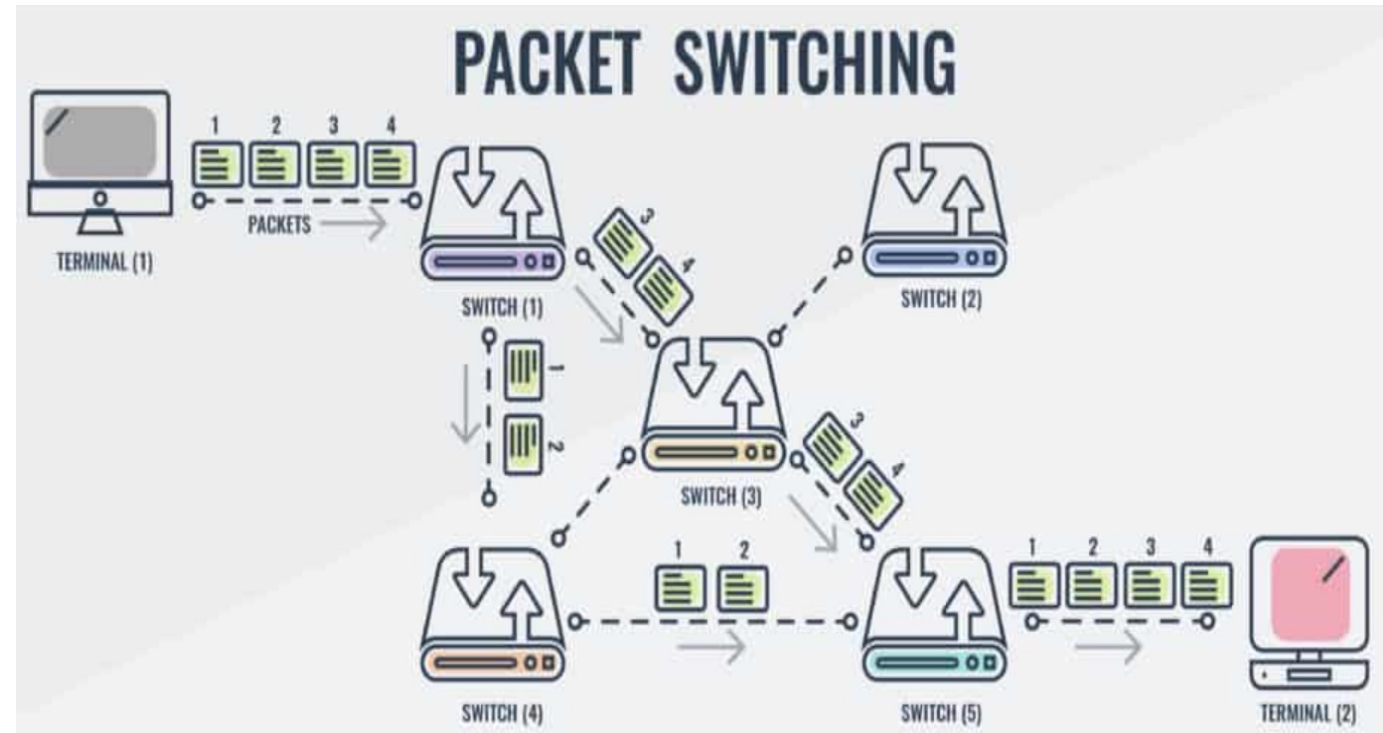
Transmission media:

In computer networks, Transmission media are used to transfer data between devices. There are two main types of transmission media: wired and wireless. In this explanation, we will discuss both wired and wireless transmission media.

Wired Transmission Media: Wired transmission media refers to the use of physical cables or wires to transmit data between devices.

Wireless Transmission Media: Wireless transmission media refers to the use of electromagnetic waves to transmit data between devices without physical cables.

Wired Transmission Media:

The most common types of wired transmission media are:

1.Coaxial Cable: Coaxial cable consists of a copper wire surrounded by an insulating material, which is then surrounded by a metal shield. It is commonly used in cable television and Ethernet networks.

2. Twisted Pair Cable: Twisted pair cable consists of two copper wires twisted together. It is commonly used in telephone systems and Ethernet networks.

3. Fiber Optic Cable: Fiber optic cable consists of thin glass fibers that transmit data using light signals. It is commonly used in high-speed internet connections and long-distance communications.

Coaxial Cable   Twisted Pair   Fiber Optic

Wireless Transmission Media:

Radio Waves: Radio waves are the longest wavelength and lowest frequency electromagnetic waves. They are used for communication in various devices such as radios, television, and cell phones. Radio waves can travel through various materials such as air, water, and solid objects

Microwaves: Microwaves are electromagnetic waves that have shorter wavelengths and higher frequencies than radio waves. They are commonly used for communication purposes, such as in satellite communication, cellular networks, and microwave ovens.

Infrared Waves: Infrared waves are electromagnetic waves that have shorter wavelengths and higher frequencies than microwaves. They are used for communication between devices in close proximity and are commonly used in remote controls, heat sensing cameras, and security systems. Infrared waves cannot pass through solid objects but can pass through certain materials such as glass.
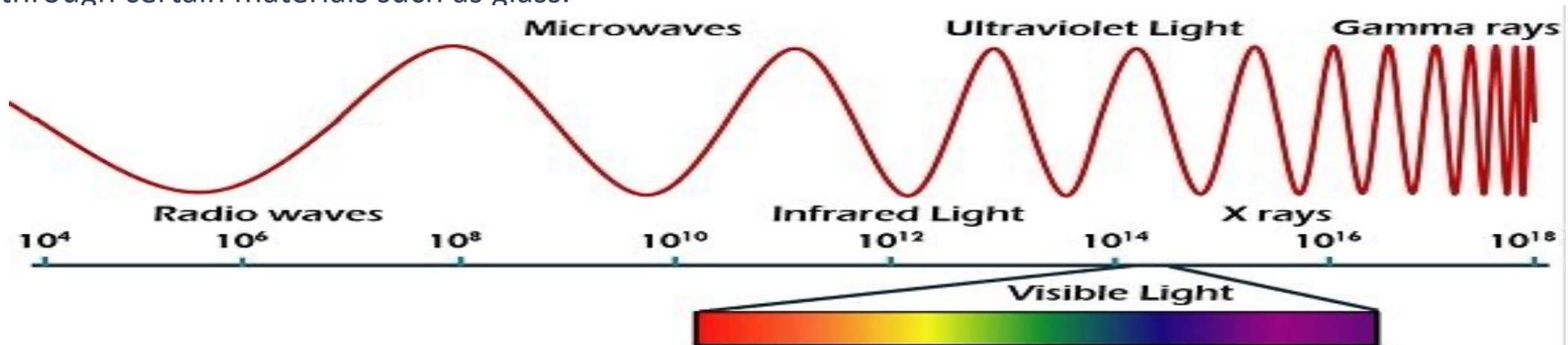
Network Devices

Modem: A modem is a device that converts digital signals from a computer into analog signals that can be transmitted over telephone lines. It is used to connect a computer to the internet or other remote networks. Modems can be either internal or external and come in various types, such as dial-up, cable, and DSL.

Computer   Modem   Telephone
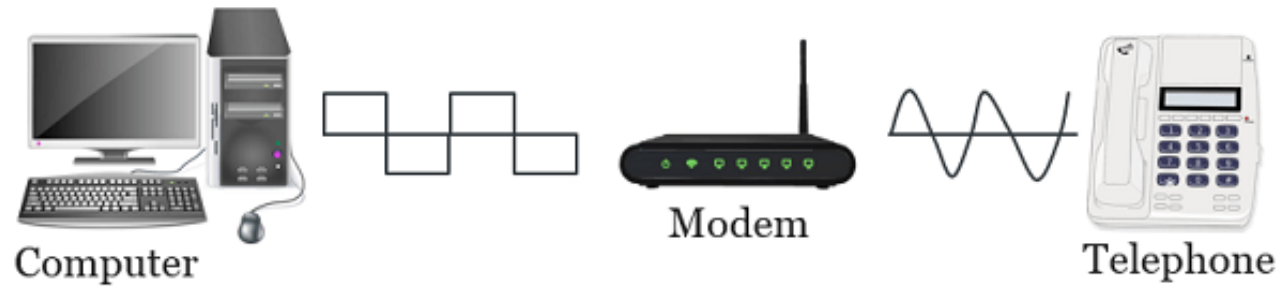
Ethernet Card: An Ethernet card, also known as a network interface card (NIC), is a hardware component that allows a computer to connect to a local area network (LAN) or wide area network (WAN). It is responsible for sending and receiving data packets over the network. Ethernet cards can be either integrated into a computer's motherboard or added as an expansion card.
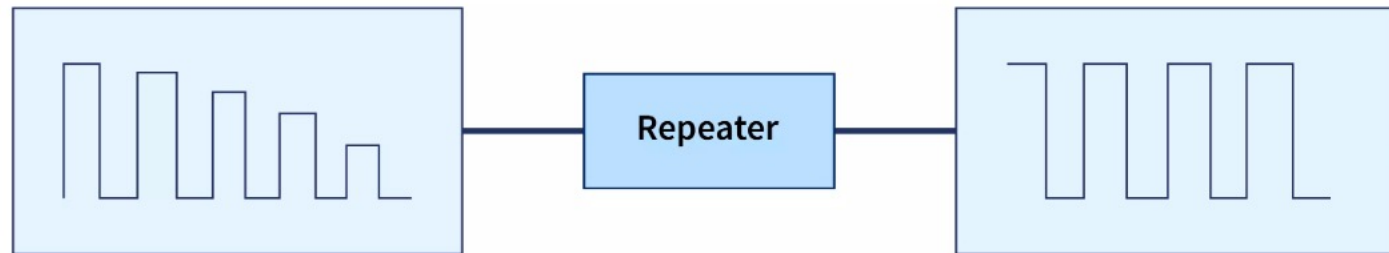
Network Devices

RJ45: RJ45 is a type of connector used to connect Ethernet cables to network devices. It is the most common type of connector used in Ethernet networks and can be found on Ethernet cards, switches, and routers.

Repeater: A repeater is a network device that regenerates and amplifies network signals to extend the distance that signals can travel without loss of data. It is used to extend the range of a network by amplifying signals and sending them to the next network device.

Repeater

Network Devices

Hub: A hub is a network device that connects multiple devices in a LAN. It operates by receiving data from one device and broadcasting it to all other devices connected to it.

Switch: A switch is a network device that connects multiple devices in a LAN. It operates by forwarding data packets only to the device it is intended for, reducing network congestion and improving performance. Switches are more efficient than hubs.
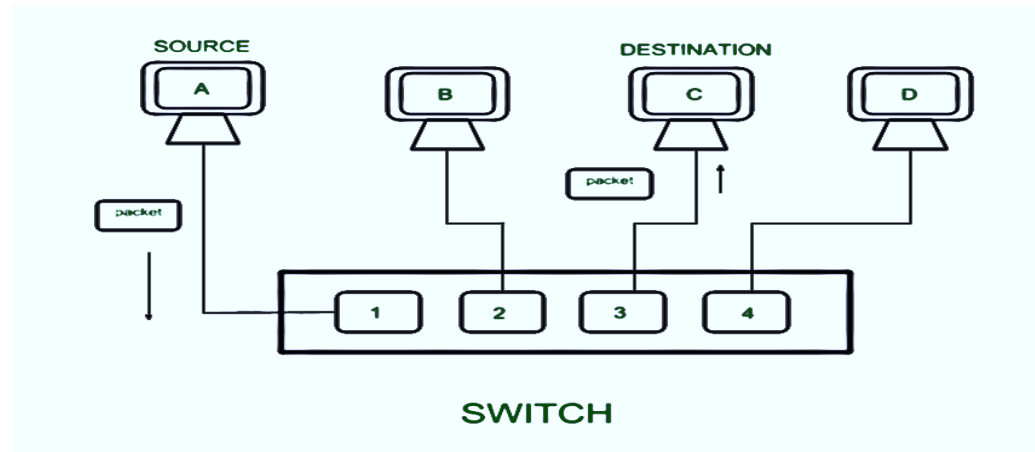
Network Devices

Router: A router is a network device that connects multiple networks together, such as LANs or WANs. It is responsible for forwarding data packets between networks based on their destination addresses

Gateway: A gateway is a network device that connects two or more different networks, such as a LAN and the internet. It acts as a bridge between networks and is responsible for translating data between different protocols and formats.
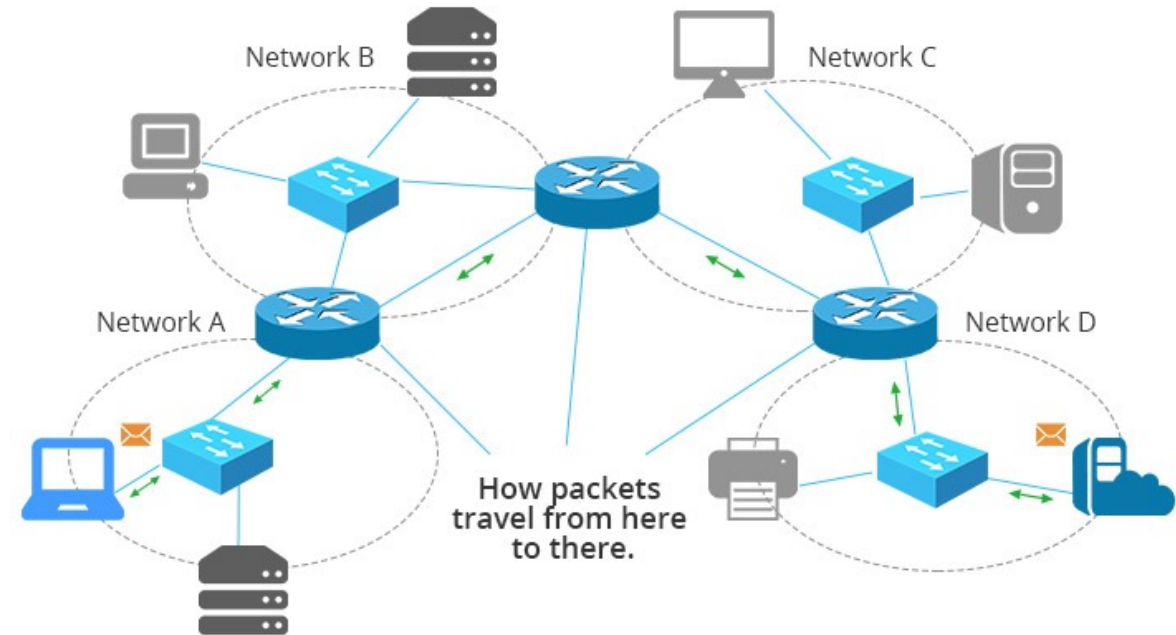

WiFi Card: A WiFi card, also known as a wireless network card or wireless adapter, is a hardware component that allows a computer to connect to a wireless network.
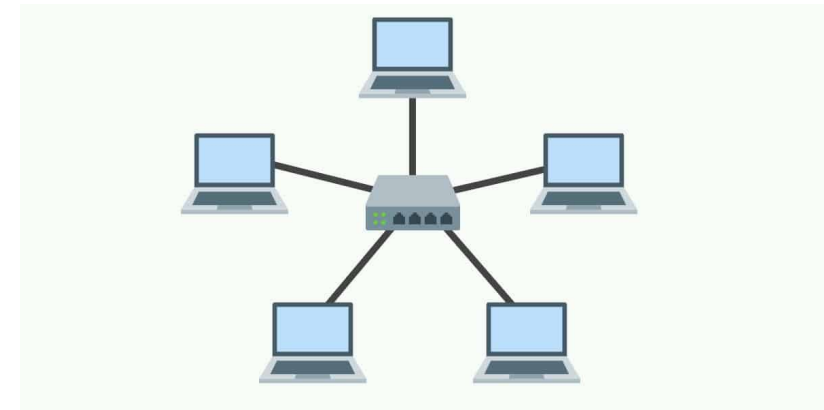
Network Topologies

A Topology refers to the arrangement of nodes (computers, servers, printers, etc.) and connections in a network. There are several types of network topologies, including bus, star, and tree topologies.

Bus Topology: In this type of topology, all devices are connected to a single backbone cable. The data is transmitted from one device to another in a linear fashion. The bus topology is simple to set up and cost-effective but it can be prone to signal reflection and collisions.
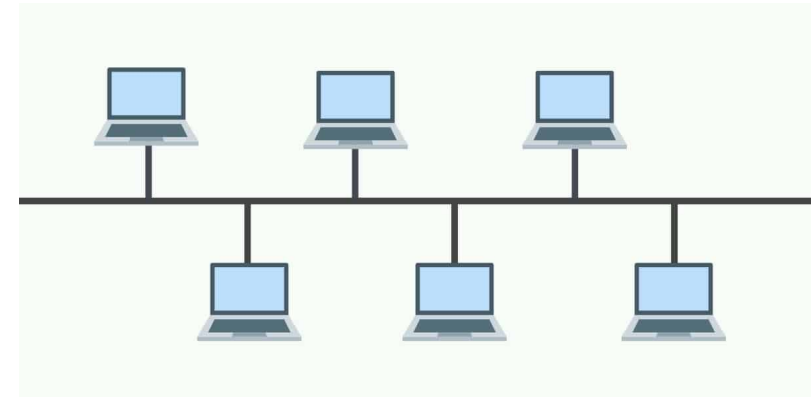
Star Topology: In a star topology, all devices are connected to a central hub or switch. The hub acts as a central point of communication, and all data transmitted between devices passes through the hub. This topology is easy to manage and troubleshoot because each device connects directly to the central hub. However, the failure of the hub can result in the failure of the entire network.

Network Topologies

Tree Topology: A tree topology is a combination of bus and star topologies. In this type of topology, groups of star topologies are connected together in a bus configuration. This allows for more devices to be connected to the network, and provides a greater level of redundancy in case of device failure. However, it can be complex to set up and manage.
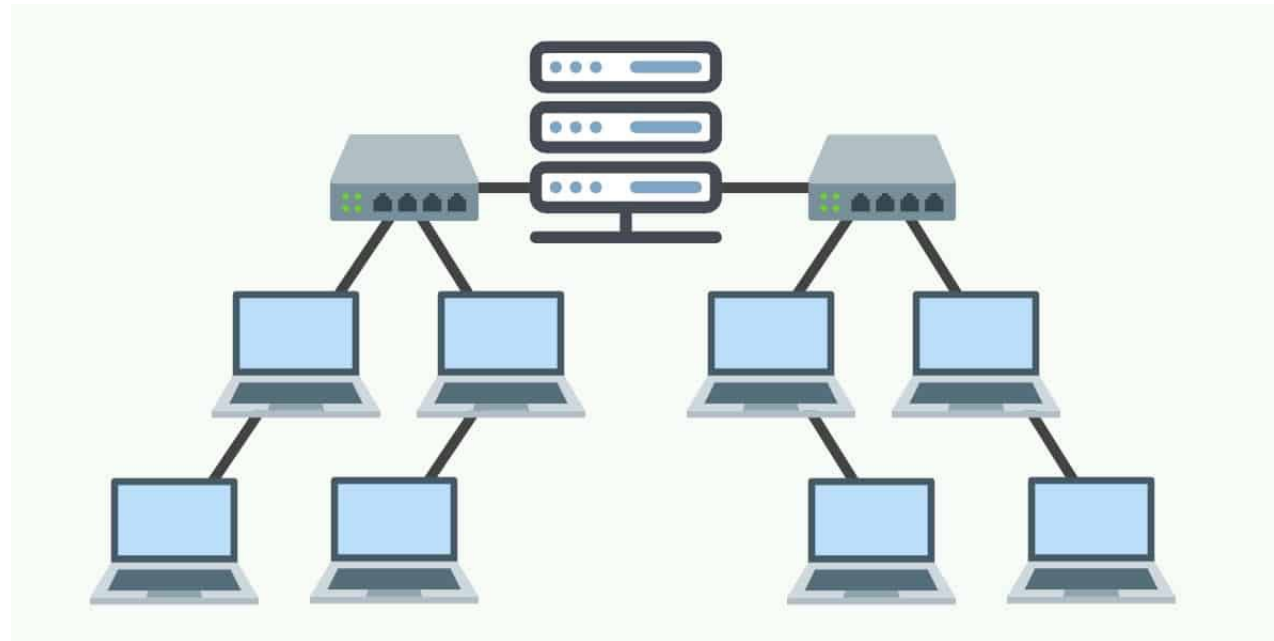
Network Types

Personal Area Network (PAN): A PAN is a network that connects devices within a short range, typically centered around an individual person. It is used for connecting personal devices like smartphones, tablets, laptops, and peripheral devices such as headphones, printers, and wearable gadgets.

Local Area Network (LAN): A LAN is a network that connects devices within a limited geographical area, such as a home, office, or school building. LANs typically use wired connections like Ethernet cables or wireless connections like Wi-Fi for data transmission

Metropolitan Area Network (MAN): A MAN is a network that covers a larger geographical area, such as a city or a town.

Wide Area Network (WAN): A WAN is a network that spans a vast geographical area, such as a country or even the entire world. It connects multiple LANs or MANs, typically using high-speed communication links like leased lines, satellite connections, or fiber-optic cables. The Internet is the most prominent example of a WAN.

Network protocol:

1. **HTTP (Hypertext Transfer Protocol):** It is an application-level protocol used for transmitting data over the internet. HTTP is the foundation of data communication for the World Wide Web (WWW). It is used by web browsers to communicate with web servers.

2. **FTP (File Transfer Protocol):** It is an application-level protocol used for transferring files between client and server computers over a network. FTP is used to upload and download files from a remote server.

3. **PPP (Point-to-Point Protocol):** It is a data link layer protocol used to establish a direct connection between two nodes in a network. PPP is commonly used in dial-up connections and VPNs.

4. **TCP/IP (Transmission Control Protocol/Internet Protocol):** It is a suite of protocols used for communication between devices over the internet. TCP is responsible for the reliable transmission of data, and IP is responsible for the routing of data packets.
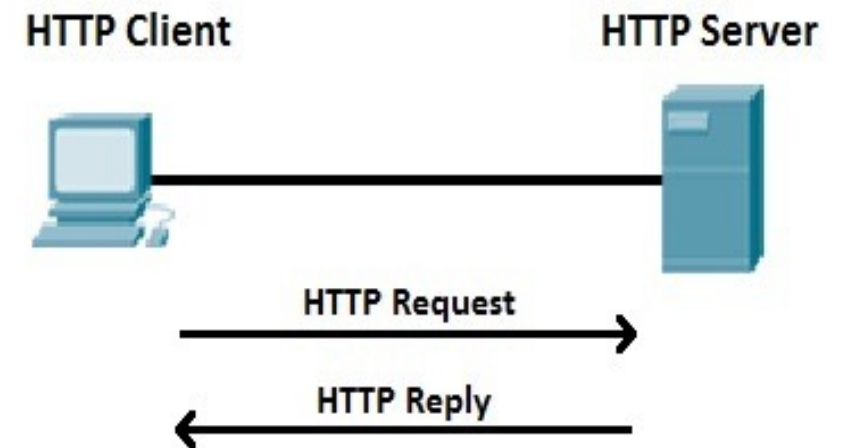
Network protocol:

5. **SMTP (Simple Mail Transfer Protocol):** It is an internet standard protocol used for email transmission. SMTP is responsible for sending emails from a mail client to a mail server.

6. **POP3 (Post Office Protocol version 3):** It is an application-level protocol used for retrieving emails from a remote mail server. POP3 is used by mail clients to download emails from a mail server.

7. **TELNET (Teletype Network):** It is a protocol used for remote login to a computer over a network. TELNET allows users to remotely access another computer's command-line interface.

8. **HTTPS (Hypertext Transfer Protocol Secure):** It is an extension of HTTP that adds security features, such as encryption and authentication, to ensure secure communication over the internet.

9. **VoIP (Voice over Internet Protocol):** It is a protocol used for transmitting voice and multimedia over the internet. VoIP allows users to make voice and video calls over the internet.