Unit-1

Computer Networks--->

A computer network is a collection of interconnected computing devices that are capable of sharing data and resources.

The primary purpose of a computer network is to facilitate communication and resource sharing among connected devices.

KEY COMPONENTS OF COMPUTER NETWORKS--->

1. **Nodes:**
   - Nodes refer to the devices connected to the network. These can include computers, servers, routers, switches, printers, and other devices.
2. **Links:**
   - Links represent the communication pathways that connect nodes in a network. These links can be wired (e.g., Ethernet cables) or wireless (e.g., Wi-Fi).
3. **Topology:**
   - The network topology defines the physical or logical layout of the network. Common topologies include bus, ring, star, mesh, and hybrid configurations.
4. **Protocols:**
   - Protocols are rules and conventions that govern how data is transmitted and received in a network. Examples include TCP/IP (Transmission Control Protocol/Internet Protocol), HTTP (Hypertext Transfer Protocol), and others.
5. **Router:**
   - Routers are devices that connect different networks and facilitate the transfer of data between them. They operate at the network layer of the OSI model.
6. **Switch:**
   - Switches are devices that operate at the data link layer of the OSI model and are used to connect devices within the same network. They forward data based on MAC (Media Access Control) addresses.
7. **Gateway:**
   - A gateway is a device or software that connects different types of networks and facilitates communication between them. It can convert data between different protocols or formats.

GOALS OF COMPUTER NETWORK--->

1. **Resource Sharing:**
    - One of the primary goals of computer networks is to facilitate the sharing of resources such as files, printers, and internet connections among connected devices. This enables more efficient use of resources and reduces redundancy.
2. **Reliability:**
    - Networks aim to improve reliability by providing alternative paths for data transmission. If one path fails, data can be rerouted through other available paths, ensuring continuous communication.
3. **Communication:**
    - Networks enable communication between devices, allowing users to exchange information through various media, including text, voice, and video. Communication is a fundamental goal that underlies many network applications.
4. **Cost Efficiency:**
    - By sharing resources and facilitating efficient communication, networks contribute to cost savings. For example, multiple users in an office can share a single printer or internet connection instead of each having individual devices.
5. **Scalability:**
    - Networks should be designed to accommodate growth. Scalability ensures that as the number of users or devices increases, the network can expand without a significant loss of performance.
6. **Performance:**
    - Networks aim to provide satisfactory performance levels, including high data transfer rates, low latency, and reliable connectivity.

APPLICATION OF NETWORKS--->

1. **File Sharing:**
    - Networks enable the sharing of files and documents among connected devices. This is commonly used in both home and business environments.
2. **Email and Messaging:**
    - Communication applications, including email and instant messaging, rely on networks to facilitate the exchange of messages between users.
3. **Internet Access:**
    - Networks provide access to the internet, allowing users to browse websites, access online services, and communicate globally.

4. **Remote Access:**
    - Networks enable remote access to resources and systems. Users can connect to their work computers from home, access files stored on remote servers, and perform tasks remotely.
5. **Video Conferencing:**
    - With the help of networks, video conferencing applications allow users to conduct virtual meetings, presentations, and discussions.
6. **Online Gaming:**
    - Multiplayer online games rely on networks to connect players from different locations, allowing them to compete or collaborate in real-time.
7. **E-commerce:**
    - Networks are fundamental to the operation of e-commerce platforms, facilitating online shopping, payment processing, and order fulfillment.
8. SOCIAL MEDIA:

NETWORK ARCHITECTURE AND STRUCTURE--->

Computer network architecture--->

Computer Network Architecture is defined as the physical and logical design of the software, hardware, protocols, and media of the transmission of data. Simply we can say that how computers are organized and how tasks are allocated to the computer.

The two types of network architectures are used:

- Peer-To-Peer network
- Client/Server network

Peer-To-Peer network

- Peer-To-Peer network is a network in which all the computers are linked together with equal privilege and responsibilities for processing the data.
- Peer-To-Peer network is useful for small environments, usually up to 10 computers. Peer-To-Peer network has no dedicated server.

- In the P2P (Peer-to-Peer) network, “peers” generally represent computer system. These peers are connected to each other with help of Internet.

Advantages Of Peer-To-Peer Network:

- It is less costly as it does not contain any dedicated server.
- If one computer stops working but, other computers will not stop working.
- It is easy to set up and maintain as each computer manages itself.

Disadvantages Of Peer-To-Peer Network:

- In the case of Peer-To-Peer network, it does not contain the centralized system . Therefore, it cannot back up the data as the data is different in different locations.
- It has a security issue as the device is managed itself.

Client/Server Network

- Client/Server network is a network model designed for the end users called clients, to access the resources such as songs, video, etc. from a central computer known as Server.
- The central controller is known as a **server** while all other computers in the network are called **clients**.
- A server performs all the major operations such as security and network management.
- A server is responsible for managing all the resources such as files, directories, printer, etc.
- All the clients communicate with each other through a server. For example, if client1 wants to send some data to client 2, then it first sends the request to the server for the permission. The server sends the response to the client 1 to initiate its communication with the client 2.

CSN (Client/Server Network) is type of computer network in which one of centralized and powerful computers (commonly called as server) is hub to which many of personal computers that are less powerful or workstations (commonly known as clients) are connected.

Advantages Of Client/Server network:

- A Client/Server network contains the centralized system. Therefore we can back up the data easily.
- A Client/Server network has a dedicated server that improves the overall performance of the whole system.
- Security is better in Client/Server network as a single server administers the shared resources.
- It also increases the speed of the sharing resources.

Disadvantages Of Client/Server network:

- Client/Server network is expensive as it requires the server with large memory.
- A server has a Network Operating System(NOS) to provide the resources to the clients, but the cost of NOS is very high.
- It requires a dedicated network administrator to manage all the resources.

Computer Network Types

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

A computer network can be categorized by their size. A **computer network** is mainly of **four types**:

- LAN(Local Area Network)
- PAN(Personal Area Network)
- MAN(Metropolitan Area Network)
- WAN(Wide Area Network)

1. Personal Area Network (PAN)

PAN is the most basic type of computer network. This network is restrained to a single person, that is, communication between the computer devices is centered only on an individual's workspace. PAN offers a network range of 1 to 100 meters from person to device providing communication. Its transmission speed is very high with very easy maintenance and very low cost.

This use Bluetooth as a technology.

Examples of PAN are USB, computer, phone, tablet, printer, PDA, etc.

2. Local Area Network (LAN)

LAN is the most frequently used network. A LAN is a computer network that connects computers through a common communication path, contained within a limited area, that is, locally. A LAN encompasses two or more computers connected over a server. The two important technologies involved in this network are Ethernet and Wi-fi. It ranges up to 2km & transmission speed is very high with easy maintenance and low cost.

Examples of LAN are networking in a home, school, library, laboratory, college, office, etc.

3. Metropolitan Area Network (MAN)

A MAN is larger than a LAN but smaller than a WAN. This is the type of computer network that connects computers over a geographical distance through a shared communication path over a city, town, or metropolitan area. This network mainly uses a range from 5km to 50km. Its transmission speed is average. It is difficult to maintain and it comes with a high cost.

Examples of MAN are networking in towns, cities, a single large city, a large area within multiple buildings, etc.

4. Wide Area Network (WAN)

WAN is a type of computer network that connects computers over a large geographical distance through a shared communication path. It is not restrained to a single location but extends over many locations. WAN can also be defined as a group of local area networks that communicate with each other with a range above 50km.

Here we use Dial-up technology. Its transmission speed is very low and it comes with very high maintenance and very high cost.

The most common example of WAN is the Internet.

Internetwork

- An internetwork is defined as two or more computer network connected using devices, and they are configured by a local addressing scheme. This process is known as **internetworking**.
- An interconnection between public, private, commercial, industrial, or government computer networks can also be defined as **internetworking**.
- An internetworking uses the **internet protocol**.
- The reference model used for internetworking is **Open System Interconnection(OSI)**.

Types Of Internetwork:

1. **Extranet:** An extranet is a communication network based on the internet protocol such as **Transmission Control protocol** and **internet protocol**. It is used for information sharing. The access to the extranet is restricted to only those users who have login credentials. An extranet is the lowest level of internetworking. It can be categorized as **MAN**, **WAN** or other computer networks. An extranet cannot have a single **LAN**, atleast it must have one connection to the external network.

2. **Intranet:** An intranet is a private network based on the internet protocol such as **Transmission Control protocol** and **internet protocol**. An intranet belongs to an organization which is only accessible by the **organization's employee** or members. The main aim of the intranet is to share the information and resources among the organization employees. An intranet provides the facility to work in groups and for teleconferences.

TOPOLOGY--->