Computer Network: A network consists of two or more nodes (e.g. computers) that are linked in order to share resources (such as printers and CDs), exchange files, or allow electronic communications. The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

Basic Hardware or Software Components of Computer Network:

Network is basically sharing of information via network components. So network component play a major role in designing and maintaining network.

- **Network interfaces Controller (NIC):** NIC is a hardware accessory that provides a computer with both a physical interface for accepting a network cable connector and the ability to process low-level network information.In Ethernet networks, each network interface controller has a unique Media Access Control address which is usually stored in the card's permanent memory. MAC address uniqueness is maintained and administered by the Institute of Electrical and Electronics Engineers (IEEE) in order to avoid address conflicts between devices on a network. The size of an Ethernet MAC address is six octets. The 3 most significant octets are reserved to identify card manufacturers. The card manufacturers, using only their assigned prefixes, uniquely assign the 3 least-significant octets of every Ethernet card they produce.

- **Repeaters :** A repeater is an electronic device that receives a network signal, cleans it of unnecessary noise, and regenerates it. The signal is re-transmitted at a higher power level, or to the other side of an obstruction, so that the signal can cover longer distances without degradation. In most twisted pair Ethernet configurations, repeaters are required for cable that runs longer than 100 meters. A repeater with multiple ports is known as a hub. Repeaters work on the physical layer of the OS I model. Repeaters require a small amount of time to regenerate the signal. This can cause a propagation delay which can affect network performance. As a result, many network architectures limit the number of repeaters that can be used in a row.

- **Bridges:** A network bridge connects multiple network segments at the data link layer of the OSI model to form a single network. Bridges broadcast to all ports except the port on which

the broadcast was received. However, bridges do not promiscuously copy traffic to all ports, as hubs do. Instead, bridges learn which MAC addresses are reachable through specific ports. Once the bridge associates a port with an address, it will send traffic for that address to that port only.Bridges learn the association of ports and addresses by examining the source address of frames that it sees on various ports. Once a frame arrives through a port, the bridge assumes that the MAC address is associated with that port and stores its source address. The first time a bridge sees a previously unknown destination address, the bridge will forward the frame to all ports other than the one on which the frame arrived.

- **Switches:** A network switch is a device that forwards and filters OSI layer 2 data-grams between ports based on the MAC addresses in the packets. A switch is distinct from a hub in that it only forwards the frames to the ports involved in the communication rather than all ports connected. A switch breaks the collision domain but represents itself as a broadcast domain. Switches make decisions about where to forward frames based on MAC addresses. A switch normally has numerous ports, facilitating a star topology for devices, and cascading additional switches. The term switch is often used loosely to include devices such as routers and bridges, as well as devices that may distribute traffic based on load or based on application content.

- **Router:** A router is an inter-networking device that forwards packets between networks by processing the routing information included in the packet or data-gram. The routing information is often processed in conjunction with the routing table . A router uses its routing table to determine where to forward packets.

- **Local Operating System:** A local operating system allows personal computers to access files, print to a local printer, and have and use one or more disk and CD drives that are located on the computer. Examples are MS-DOS, Unix, Linux, Windows 2000, Windows 98, Windows XP etc.

- **Network Operating System:** The network operating system is a program that runs on computers and servers, and allows the computers to communicate over the network.

- **Servers:** Servers are computers that hold shared files, programs, and the network operating system. Servers provide access to network resources to all the users of the network. There are many different kinds of servers, and one server can provide several functions. For example, there are file servers, print servers, mail servers, communication servers, database servers, fax servers and web servers, to name a few.

NETWORK GOALS:

- The main goal of networking is "Resource sharing", and it is to make all programs, data and equipment available to anyone on the network without the regard to the physical location of the resource and the user.

- A second goal is to provide high reliability by having alternative sources of supply. For example, all files could be replicated on two or three machines, so if one of them is unavailable, the other copies could be available.

- Another goal is saving money. Small computers have a much better price/performance ratio than larger ones. Mainframes are roughly a factor of ten times faster than the fastest single chip microprocessors, but they cost thousand times more. This imbalance has caused many system designers to build systems consisting of powerful personal computers, one per user, with data kept on one or more shared file server machines. This goal leads to networks with many computers located in the same building. Such a network is called a LAN (local area network).

- Another closely related goal is to increase the systems performance as the work load increases by just adding more processors. With central mainframes, when the system is full, it must be replaced by a larger one, usually at great expense and with even greater disruption to the users.

- Computer networks provide a powerful communication medium. A file that was updated or modified on a network can be seen by the other users on the network immediately.

Applications of Computer Networks

A network is a collection or set of computing devices connected to one another to establish communication and also share available resources. A network will comprise of software and hardware devices. You can have a network even if you are not connected to the internet. Computer networks make it possible for people to transfer files from one place to another and to communicate taking the shortest time possible.

Computer network applications are network software applications that utilize the Internet or other network hardware infrastructure to perform useful functions for example file transfers within a network. They help us to transfer data from one point to another within the network.

(A) Pure Network Applications

These are applications created to be used in networks using pure network applications on a single computer doesn't make sense. They help us to transfer data and communicate within a network. Such applications have a separate and distinct user interface that users must learn for instance:-

1. **Email programs**

   They allow users to type messages at their local nodes and then send to someone on the network. It is a fast and easy way of transferring mail from one computer to another.

2. File transfer protocol (FTP)

This application facilities transfer of files from one computer to another e.g. from a client to a server. There are 2 common processes involved in FTP

Downloading: - This is the process of obtaining files from a server to a workstation or a client (for example when you download programs and music from a server).

Uploading:- This is obtaining of files from a workstation to a server (for instance when you attach documents and upload them to a server, a good example being when you upload photos to Facebook).

3. Terminal Emulation (TELNET)

It allows a workstation to access the server for an application program. This enables you to control the server and communicate with other servers on the network. The workstation appears as a down terminal that is directly attached to the server. The user feels like he/she is using the server directly. **TELNET** enables PCs and workstations to function as dumb terminals in sessions with hosts on inter-networks.

4. Groupware

These applications are used to automate the administration functions of a modern office for instance **video conferencing** and **chatting**. They facilitate the work of groups and improve on their productivity; they can be used to communicate, co-operate, coordinate, solve problems, compete, negotiate among others.

(i) Video Conferencing

This is the process of conducting a *conference* between two or more participants at different sites by using computer networks to transmit audio and video data. For example, a *point-to-point* (two-person) video conferencing system works much like a video telephone.

Each participant has a video camera, microphone, and speakers mounted on his or her computer. As the two participants speak to one another, their voices are carried over the network and delivered to the others speakers, and whatever images appear in front of the video camera appear in a window on the other participant's monitor.

(ii) Chatting

It is a real-time communication between two users via computer. Once a chat has been initiated, either user can enter text by typing on the keyboard and the entered text will appear on the other user's monitor. The two must be online for a chat to be initiated. Most networks, cybers and online services offer a chat feature which enables computer users to chat as they go on with their work.