

Networking Concept

Network

Network is a connection between two or more element or object. There are different types of Network.

Ex:

1. Human network
2. Telephone network
3. Radio network
4. T.V network
5. Computer network.

Computer Network:

Computer Network is the inter connection of two or more autonomous computers with the help transmission media and set of common rules. The transmission media helps to link the network equipment and it is divided into two types Guided (wire) and Unguided (wireless). The set of common rules help the computers to communicate with each other.

Network Architecture:

Basically there are two types of computer network in use i.e. peer- to peer Network and Server/Client network.

Peer to Peer Network:

Peer-to-peer (abbreviated to **P2P**) refers to a computer network in which each computer in the network can act as a client or server for the other computers in the network, allowing shared access to files and peripherals without the need for a central server. P2P networks can be set up in the home, a business or over the Internet. Each network type requires all computers in the network to use the same or a compatible program to connect to each other and access files and other resources found on the other computer. P2P networks can be used for sharing content such as audio, video, data or anything in digital format. In a typical peer to peer network each node has access to all peripherals.



Advantages (Why)

- *Peer to Peer Networks are easy and simple to set up and only require a Hub or a Switch to connect all the computers together*
- *You can access any file on the computer as long as it is set to shared folder.*
- *The requirements for a Peer to Peer Network are that you have a 10 Base T Ethernet cable and an Ethernet hub/ switch. This is rather cheap than having a server.*
- *The architecture of the lay out (How It Connects) is simple.*
- *If one computer fails to work all the other computers connected to it continue to work.*

Disadvantages (Why)

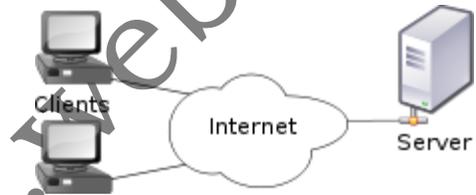
- *If you have not connected the computers together properly then there can be problems accessing certain files.*
- *It doesn't always work if you have many computers and works better with 2 – 8 computers.*

- *Security is not good and you can set passwords for files that you don't want people to access but apart from that the security is pretty poor.*

Client and server Network:

One popular type of server based network is client/ server network, where individual computer share the processing and storage workload with a central server. This arrangement requires specific special software for the nodes and the server. It does not, however requires any specific type of network. Client /server software can be used on LANs or WANs, and a single client/server program can be used on a LAN where all the other software is based on a simple file sharing system.

The most common example of client/server computing involves a database that can be accessed by many different computers on the network. The database is stored on the network server, along with a portion of the database management system (DBMS) the program that allows users to work with the database. The user's computer stores and runs the client portion of the DBMS. When a user needs to find information in the database, he or she uses client software to send a query to the server , which searches the database and returns the information to the user's PC.



Advantages (Why)

- *A Client Sever Can Be scaled up to many services that can also be used by multiple users.*
- *A client server enables the roles and responsibilities of a computing system. This means that it can update all the computers connected to it. An example of this would be software updates or hardware updates.*
- *All the data is stored on the servers, which generally have far greater security controls than most clients. Servers can better control access and resources, to guarantee that only those clients with the appropriate permissions may access and change data.*
- *The security is a lot more advanced than a peer to peer network. You can have passwords to your won profile so that no one can access everything when they want. And the level off access range in different organizations*
- *Many mature client-server technologies are already available which were designed to ensure security, 'friendliness' of the user interface, and ease of use.*
- *It functions with multiple different clients of different capabilities.*

Disadvantages (Why)

- *When the server goes down or crashes. All the computers connected to it become unavailable to use.*

- *When everyone tries to do the same thing it takes a little while for the server to do certain tasks. An example of this would be everyone logging into their profile in an organization or a college at the same time.*
- *More expensive than a peer to peer network. You have to pay for startup cost.*
- *When you expand the server it starts to slow down due to the Bit rate per second.*

Types of Network:

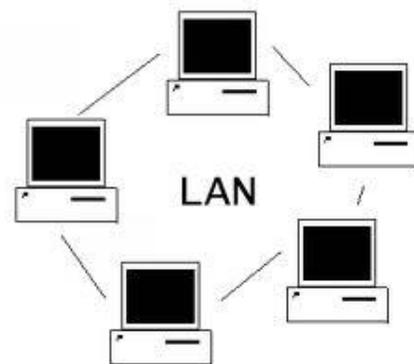
Local Area Network (LAN)

A **local area network (LAN)** supplies networking capability to a group of computers in close proximity to each other such as in an office building, a school, or a home. A LAN is useful for sharing resources like files, printers, games or other applications. A LAN in turn often connects to other LANs, and to the Internet or other WAN.

Most local area networks are built with relatively inexpensive hardware such as Ethernet cables, network adapters, and hubs. Wireless LAN and other more advanced LAN hardware options also exist.

Specialized operating system software may be used to configure a local area network. For example, most flavors of Microsoft Windows provide a software package called Internet Connection Sharing (ICS) that supports controlled access to LAN resources

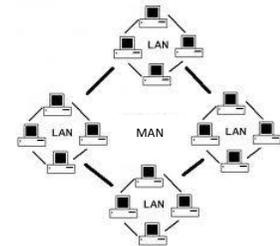
The most common type of local area network is an Ethernet LAN. The smallest home LAN can have exactly two computers; a large LAN can accommodate many thousands of computers. Many LANs are divided into logical groups called subnets. An Internet Protocol (IP) "Class A" LAN can in theory accommodate more than 16 million devices organized into subnets.



Metropolitan Area Network (MAN)

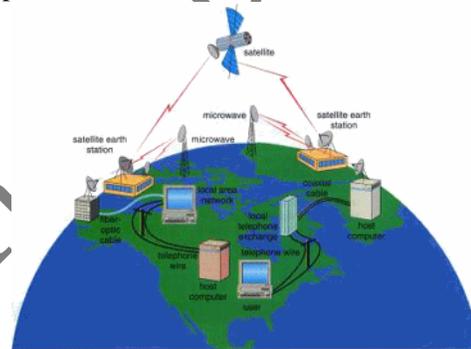
A metropolitan area network (MAN) is a network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN). The term is applied to the interconnection of networks in a city into a single larger network (which may then also offer efficient connection to a wide area network). It is also used to mean the interconnection of several local area networks by bridging them with backbone lines. The latter usage is also sometimes referred to as a campus network.

Examples of metropolitan area networks of various sizes can be found in the metropolitan areas of London, England; Lodz, Poland; and Geneva, Switzerland. Large universities also sometimes use the term to describe their networks. A recent trend is the installation of wireless MANs.



Wide Area Network (WAN)

A wide area network (WAN) is a geographically dispersed telecommunications network. The term distinguishes a broader telecommunication structure from a local area network (LAN). A wide area network may be privately owned or rented, but the term usually connotes the inclusion of public (shared user) networks. An intermediate form of network in terms of geography is a metropolitan area network (MAN).



Network Transmission and Communication devices:

- **Hub:** A network hub is a central point that receives the information from NIC and rebroadcasts it to the workstations connected to it.
- **NIC:** A Network Interface Card (NIC) is an interface that connects the workstations and the file server and enables them to communicate with each other. The most commonly used NIC is Ethernet.
- **Repeaters:** Repeaters accept signals, regenerate them and send them back on their way.
- **Routers:** A device that forwards data packets along networks. A router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP network. Routers are located at gateways, the places where two or more networks connect.
Routers use headers and forwarding tables to determine the best path for forwarding the packets, and they use protocols such as ICMP to communicate with each other and configure the best route between any two hosts.

Very little filtering of data is done through routers.

- **Bridge :** A **bridge** device filters data traffic at a network boundary. Bridges reduce the amount of traffic on a LAN by dividing it into two segments. Bridges operate at the data link layer (Layer 2) of the OSI model. Bridges inspect incoming traffic and decide whether to forward or discard

it. An Ethernet bridge, for example, inspects each incoming Ethernet frame - including the source and destination MAC addresses, and sometimes the frame size - in making individual forwarding decisions. Bridges serve a similar function as switches, that also operate at Layer 2. Traditional bridges, though, support one network boundary, whereas switches usually offer four or more hardware ports. Switches are sometimes called "multi-port bridges" for this reason.

- **Network Gateway:** A **network gateway** is an *internetworking* system capable of joining together two networks that use different base protocols. A network gateway can be implemented completely in software, completely in hardware, or as a combination of both. Depending on the types of protocols they support, network gateways can operate at any level of the OSI model.
- **Modem:** A **modem (modulator-demodulator)** is a device that modulates an analog carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information. The goal is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data. Modems can be used over any means of transmitting analog signals, from light emitting diodes to radio. The most familiar example is a voice band modem that turns the digital data of a personal computer into modulated electrical signals in the voice frequency range of a telephone channel. These signals can be transmitted over telephone lines and demodulated by another modem at the receiver side to recover the digital data.

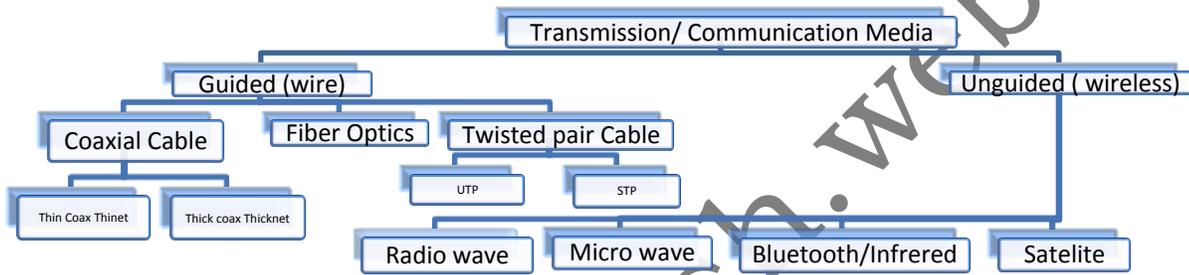
Modems are generally classified by the amount of data they can send in a given unit of time, usually expressed in bits per second (bit/s, or bps). Modems can alternatively be classified by their symbol rate, measured in baud. The *baud* unit denotes symbols per second, or the number of times per second the modem sends a new signal. For example, the ITU V.21 standard used audio frequency-shift keying, that is to say, tones of different frequencies, with two possible frequencies corresponding to two distinct symbols (or one bit per symbol), to carry 300 bits per second using 300 baud. By contrast, the original ITU V.22 standard, which was able to transmit and receive four distinct symbols (two bits per symbol), handled 1,200 bit/s by sending 600 symbols per second (600 baud) using phase shift keying.

- Multiplexers
- CSU/DSU

Things to know

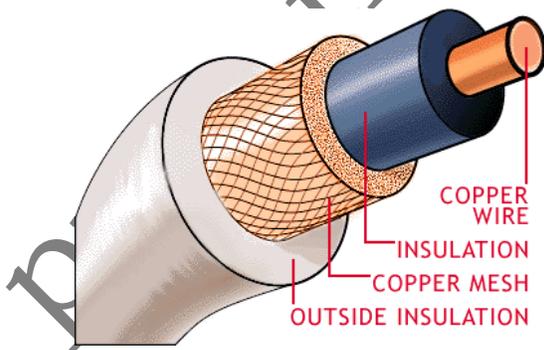
- Node : Point of the cable or part of network where computer is connected.
- www : World Wide Web
- OSI : Open Systems Interconnection
- FTP : File Transfer Protocol
- ADSL : Asynchronous Digital Subscriber Line.
- VOIP : Voice Over Internet Protocol

Notes:

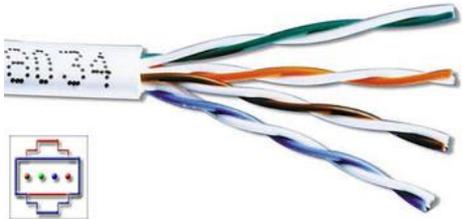


Transmission media is path for data transmission between two or more computers. It takes data from one location and submits to the destination computer. It transmits data in the form of voltage, intensity of light and wave. It is classified into two type guided and unguided. Guided transmission media means cable or wire media and unguided means wireless system.

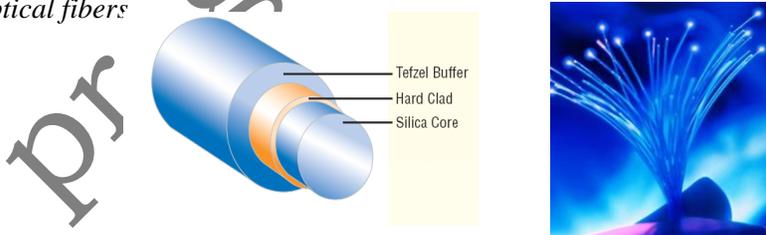
Coaxial cable:



Twisted pair Cable:

<u>Unshielded twisted pair (UTP)</u>	<u>Shielded twisted pair (STP)</u>
	
Bandwidth: Slow Error/Noise :- High Cost:- less expansive Use: Telephone wire	Bandwidth: Cat3- 16mbps, Cat4- 20 mbps Cat5- 100 mbps Cost:- more expansive Use: Ethernet

Optical fibers



An optical fiber (or optical fiber) is a flexible, transparent fiber made of a pure glass (silica) not much thicker than a human hair. It functions as a waveguide, or “light pipe”, to transmit light between the two ends of the fiber.^[2] The field of applied science and engineering concerned with the design and application of optical fibers is known as fiber optics. Optical fibers are widely used in fiber-optic communications, which permits transmission over longer distances and at higher bandwidths (data rates) than other forms of communication.

Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference. Fibers are also used for illumination, and are wrapped in bundles so that they may be used to carry images, thus allowing viewing in confined spaces. Specially-designed fibers are used for a variety of other applications, including sensors and fiber lasers.

An optical fiber junction box. The yellow cables are single mode fibers; the orange and blue cables are multi-mode fibers: 50/125 μm OM2 and 50/125 μm OM3 fibers respectively.

Optical fibers typically include a transparent core surrounded by a transparent cladding material with a lower index of refraction. Light is kept in the core by total internal reflection. This causes the fiber to act as a waveguide. Fibers that support many propagation paths or transverse modes are called multi-mode fibers (MMF), while those that only support a single mode are called single-mode fibers (SMF). Multi-mode fibers generally have a wider core diameter, and are used for short-distance communication links and for applications where high power must be transmitted. Single-mode fibers are used for most communication links longer than 1,050 meters (3,440 ft). Joining lengths of optical fiber is more complex than joining electrical wire or cable. The ends of the fibers must be carefully cleaved, and then spliced together, either mechanically or by fusing them with heat. Special optical fiber connectors for removable connections are also available.

Unguided Media

Radio Wave (kHz to MHz):

Radio waves are the signal of data transferring in Unguided media. The data are transferred by radio wave. They are transferred on different frequency like F.M radio signal are in range of 88 to 108 MHz and A.M frequency range is in KHz. The signal does not break due to any blockage in the path of the signal.

Microwave (1 GHz \uparrow) (50 Kms. Or 30 miles) :

Microwave radio signal transmission involves sending signals from one microwave station to another. Microwave are limited to line of sight transmission, which means that microwave must be transmitted in a straight line without obstruction between microwave antennas i.e avoiding possible obstructions such as building or mountains.

Infrared / Bluetooth:

Infrared or Bluetooth both are unseen light rays frequency which can transfer data. Now a days we can find Bluetooth in every mobile and electronic device to connect with other device for data transfer.

Satellite:

In bus topology computer are connected from the main cable also known as bus with the help of connecting cable, T-connector and BNC connector it is based on broadcasting. The main bus is terminated on both side to minimize noise or error on the bus.

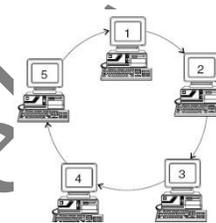
Advantage

1. *It is simple and flexible topology.*
2. *It is less expensive because it does not require more cable and other network equipment.*

Disadvantage

1. *Data traffic is maximum at bus so there is data collision.*
2. *If there is a problem on main bus the entire network gets down.*
3. *T-connector and BNC connector also make disturbance on data transmission.*

Ring topology:



A **ring network** is a network topology in which each node connects to exactly two other nodes, forming a single continuous pathway for signals through each node - a ring. Data travels from node to node, with each node along the way handling every packet.

Because a ring topology provides only one pathway between any two nodes, ring networks may be disrupted by the failure of a single link. A node failure or cable break might isolate every node attached to the ring.

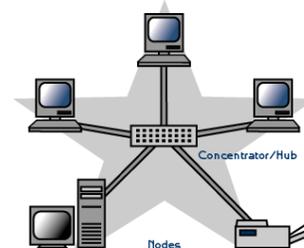
Advantages

1. *Very orderly network where every device has access to the token and the opportunity to transmit*
2. *Performs better than a bus topology under heavy network load*
3. *Does not require a central node to manage the connectivity between the computers*

Disadvantages

1. *One malfunctioning workstation can create problems for the entire network*
2. *Moves, adds and changes of devices can affect the network*
3. *Communication delay is directly proportional to number of nodes in the network*
4. *Bandwidth is shared on all links between devices*
5. *More difficult to configure than a Star: node adjunction \Rightarrow Ring shutdown and reconfiguration*

Star Topology:



Star networks are one of the most common computer network topologies. In its simplest form, a star network consists of one central switch, hub or computer, which acts as a conduit to transmit messages. This

consists of a central node, to which all other nodes are connected; this central node provides a common connection point for all nodes through a hub. Thus, the hub and leaf nodes, and the transmission lines between them, form a graph with the topology of a star. If the central node is passive, the originating node must be able to tolerate the reception of an echo of its own transmission, delayed by the two-way transmission time (i.e. to and from the central node) plus any delay generated in the central node. An active star network has an active central node that usually has the means to prevent echo-related problems.

The star topology reduces the chance of network failure by connecting all of the systems to a central node. When applied to a bus-based network, this central hub rebroadcasts all transmissions received from any peripheral node to all peripheral nodes on the network, sometimes including the originating node. All peripheral nodes may thus communicate with all others by transmitting to, and receiving from, the central node only. The failure of a transmission line linking any peripheral node to the central node will result in the isolation of that peripheral node from all others, but the rest of the systems will be unaffected.

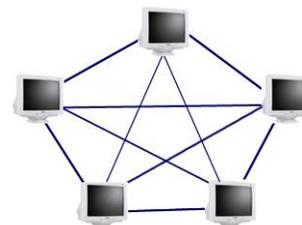
Advantages

- **Better performance:** star topology prevents the passing of data packets through an excessive number of nodes. At most, 3 devices and 2 links are involved in any communication between any two devices. Although this topology places a huge overhead on the central hub, with adequate capacity, the hub can handle very high utilization by one device without affecting others.
- **Isolation of devices:** Each device is inherently isolated by the link that connects it to the hub. This makes the isolation of individual devices straightforward and amounts to disconnecting each device from the others. This isolation also prevents any non-centralized failure from affecting the network.
- **Benefits from centralization:** As the central hub is the bottleneck, increasing its capacity, or connecting additional devices to it, increases the size of the network very easily. Centralization also allows the inspection of traffic through the network. This facilitates analysis of the traffic and detection of suspicious behavior.
- Easy to detect faults and to remove parts.
- No disruptions to the network when connecting or removing devices.

Disadvantages

- High dependence of the system on the functioning of the central hub
- Failure of the central hub renders the network inoperable

Mesh topology



A network setup where each of the computers and network devices are interconnected with one another, allowing for most transmissions to be distributed, even if one of the connections go down. This topology is not commonly used for most computer networks as it is difficult and expensive to have redundant connection to every computer. However, this topology is commonly used for wireless networks. Below is a visual example of a simple computer setup on a network using a mesh topology.

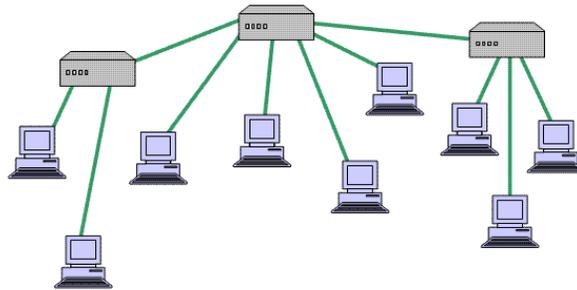
Advantages

1. It has fewer amounts of data traffic and alternative paths. Therefore communication channel capacity is more.
2. It is easy to find out error on network.

Disadvantages

1. It is difficult to install because of complex architecture.
2. It needs very large amount of transmission media and expensive multiport connector.
3. It is expensive.

Tree Topology:



Tree topology is farther expansion of star topology. It is also known as star of star. Computers are connected with the help of hubs or switches by making tree structure. As shown in the figure. It is also based on broadcasting architecture. It helps to maintain hierarchical architecture in an organization also suitable for providing different privilege to the different level of employs in an organization .

Notes:
