

NETWORK TECHNOLOGIES

Unit-2

Agenda

- Internet & its architecture
- Intranet & its architecture
- Network Devices
- Types of Cables

What is Internet?

- The concept of Internet was originated in **1969** and conceived by the **Advanced Research Projects Agency (ARPA)** of the **U.S. government** which was known as the **ARPANET**.
- Internet is a global network that connects billions of computers across the world with each other and to the World Wide Web.



- It **uses standard internet protocol suite (TCP/IP)** to connect billions of computer users worldwide.
- It is set up by using cables such as optical fibers and other wireless and networking technologies.
- At present, internet is the fastest way of sending or exchanging information and data between computers across the world.
- Internet is different from the World Wide Web as the World Wide Web is a network of computers and servers created by connecting them through the internet.
- So, the internet is the **backbone of the web** as it provides the technical infrastructure to establish the WWW and **acts as a medium** to transmit information from one computer to another computer.
- **It uses web browsers** to display the information on the client, which it fetches from web servers.

Advantages of the Internet:

- **Instant Messaging:** You can send messages or communicate to anyone using internet, such as email, voice chat, video conferencing, etc.
- **Get directions:** Using GPS technology, you can get directions to almost every place in a city, country, etc. You can find restaurants, malls, or any other service near your location.
- **Online Shopping:** It allows you to shop online such as you can be clothes, shoes, book movie tickets, railway tickets, flight tickets, and more.
- **Pay Bills:** You can pay your bills online, such as electricity bills, gas bills, college fees, etc.
- **Online Banking:** It allows you to use internet banking in which you can check your balance, receive or transfer money, get a statement, request cheque-book, etc.
- **Online Selling:** You can sell your products or services online. It helps you reach more customers and thus increases your sales and profit.
- **Work from Home:** In case you need to work from home, you can do it using a system with internet access. Today, many companies allow their employees to work from home.

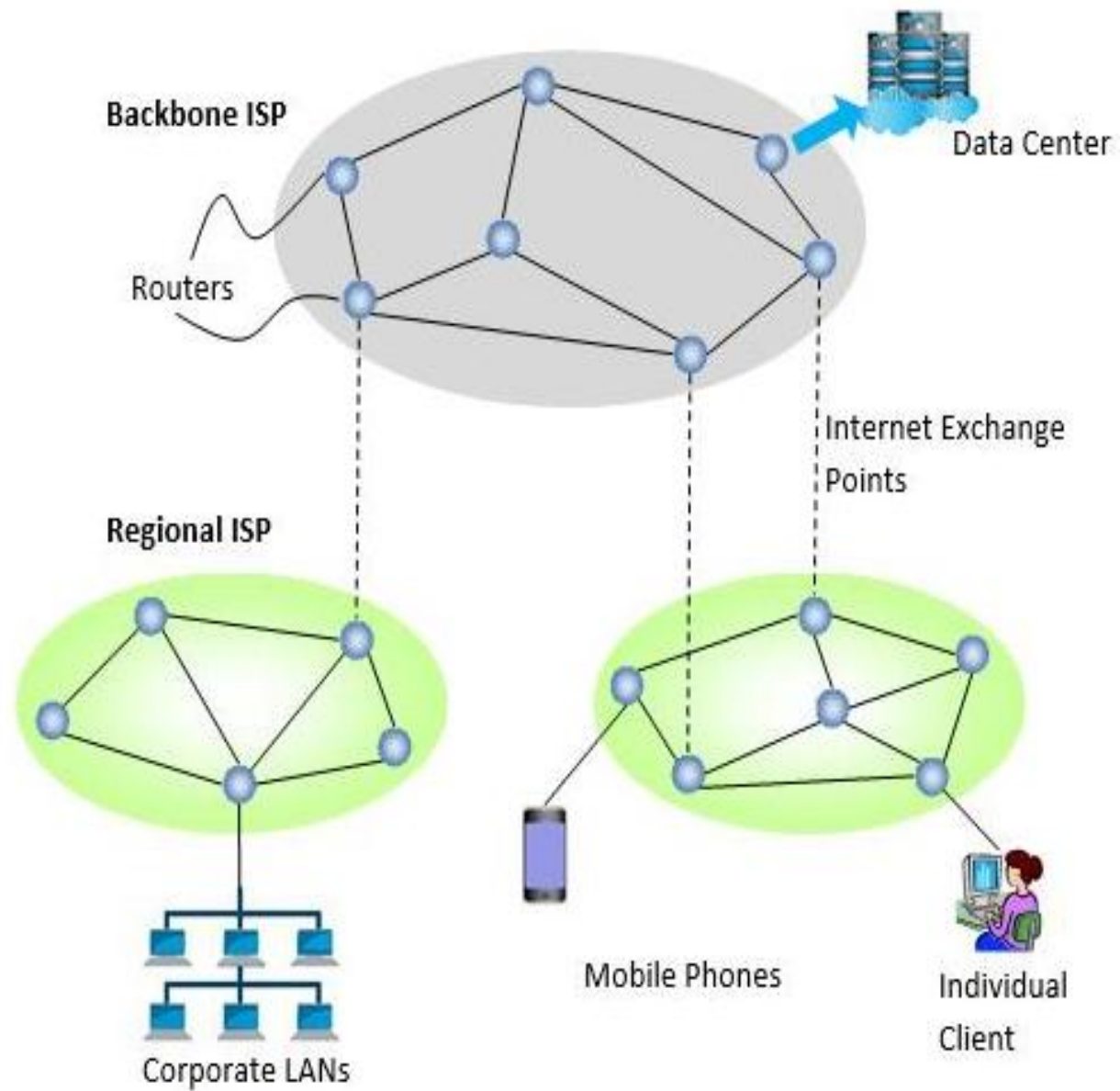
- **Entertainment:** You can listen to online music, watch videos or movies, play online games.
- **Cloud computing:** It enables you to connect your computers and internet-enabled devices to cloud services such as cloud storage, cloud computing, etc.
- **Career building:** You can search for jobs online on different job portals and send you CV through email if required.

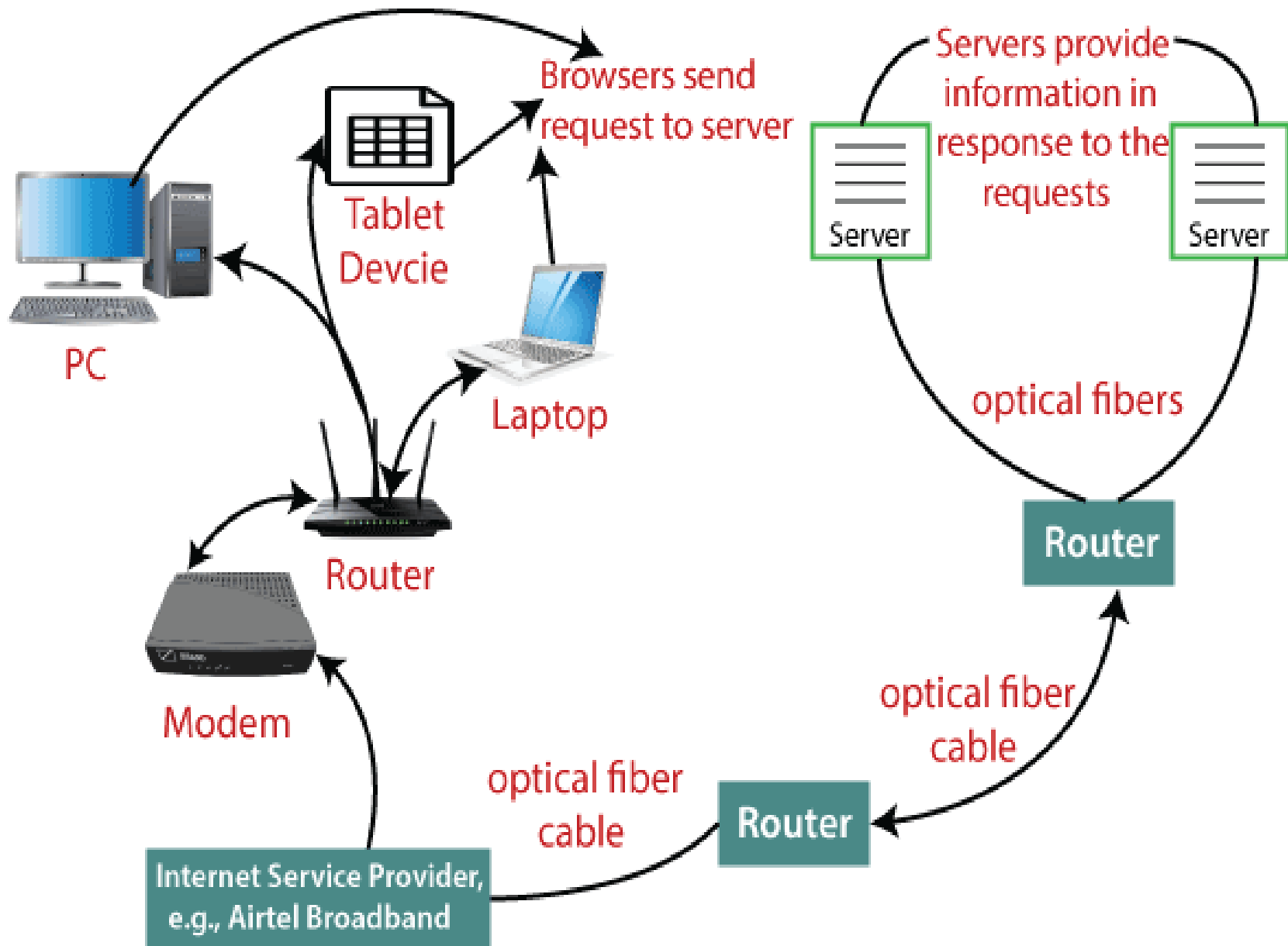
Disadvantages of the Internet:

- **Lose personal information:** There are always chances to lose personal information such as name, address, credit card number. Therefore, one should be very careful while sharing such information.
- **Spamming:** It corresponds to the unwanted e-mails in bulk. These e-mails serve no purpose and lead to obstruction of entire system.
- **Virus Attack:** Virus can easily be spread to the computers connected to internet. Such virus attacks may cause your system to crash or your important data may get deleted.
- **Misleading Information:** There are various websites that do not provide the authenticated information. This leads to misconception among many people.

Architecture of the Internet:

- The internet works with the help of clients and servers.
- A device such as a laptop, which is connected to the internet is called a client, as it is not directly connected to the internet.
- **It is indirectly connected to the internet through an Internet Service Provider (ISP) and is identified by an IP address, which is a string of numbers.**
- **An IP address acts as the shipping address of your device. The IP address is provided by your ISP.**
- A server is a large computer that stores websites. It also has an IP address.
- **A place where a large number of servers are stored is called a data center.**
- The server accepts requests send by the client through a browser over a network (internet) and responds accordingly.
- To access the internet we need a domain name, which represents an IP address number.
- For example, youtube.com, facebook.com, paypal.com are used to represent the IP addresses.
- Domain names are created as it is difficult for a person to remember a long string of numbers.





- However, internet does not understand the domain name, it understands the IP address, so when you enter the domain name in the browser address bar, the internet has to get the IP addresses of this domain name from DNS (Domain Name Server).
- DNS servers are managed by ISPs or similar organizations.
- After getting the IP address, the browser forwards the request to the respective server.
- As the servers are placed at distant, the data may have to travel thousands of miles through optical fiber cable to reach your computer.

Applications of Internet:

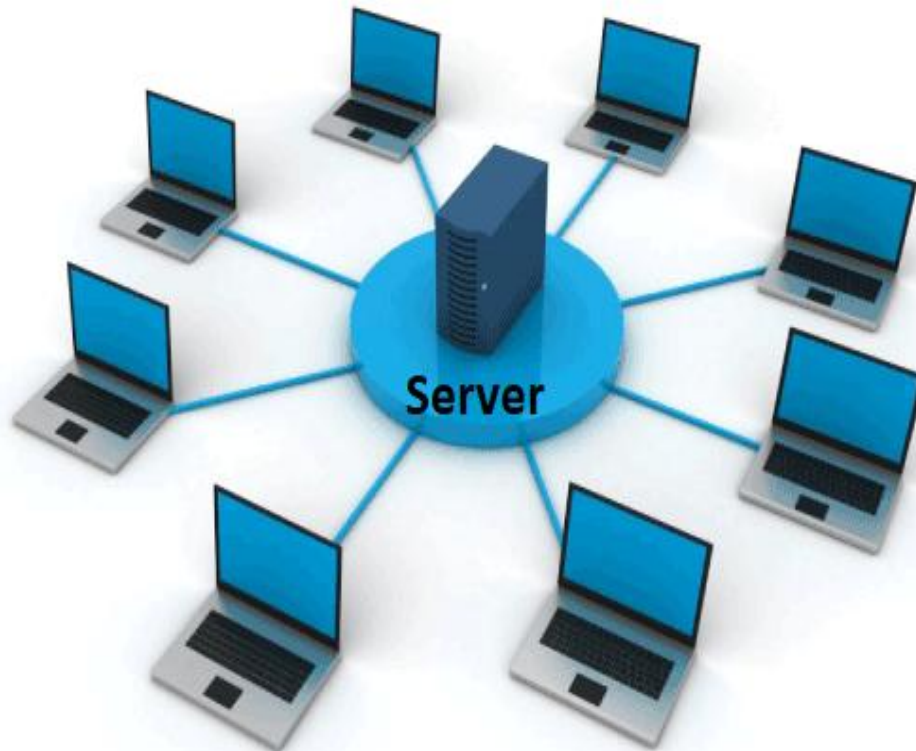
There are different kinds of internet application each have the different kind of use. They are as follows:

1. **Communication:** it is used for sending and receiving message from one and other through internet by using electronic mail. Some of the web sites providing this service are yahoo.com Hotmail.com rediffmail.com etc.
2. **Job searches:** getting information regarding availability of job in different sectors and areas. You can publish your resume in online for prospective job. Some of the web sites providing this service are naukri.com, monster.com, summerjob.com, recruitmentindia.com etc.
3. **Finding books and study material:** books and other study material stored around the world can be easily located through internet.
4. **Health and medicine:** internet provides information and knowledge about field of health medicine people can have information about various diseases and can receive help .patient can be taken to virtual check room where they can meet doctors.
5. **Travel:** one can use internet to gather information about various tourist place. it can be used for booking Holiday tours , hotels, train and flights. Some of the web sites providing this service are indiatravelog.com, rajtravel.com, makemytrip.com.

6. **Entertainment:** one can download jokes, songs movies, latest sports updates through internet Some of the web sites providing this service are cricinfo.com, movies.com espn.com.
7. **Shopping:** internet is also used for online shopping. By just giving accounts details you can perform the transaction. You can even pay your bills and perform bank related transaction.
8. **Stock market updates:** you can sell or buy shares while sitting on computer through internet. Several websites like ndtvprofit.com, moneypore.com, provide information regarding investment.
9. **Research:** a large number of people are using internet for research purposes you can download any kind information by using internet.
10. **Business use of internet:** different ways by which internet can be used for business are:
 - Information about the product can be provided can be provided online to the customer.
 - Provide market information to the business.
 - It helps business to recruit talented people.
 - Help in locating suppliers of the product.
 - Fast information regarding customers view about companies product.
 - Eliminate middle men and have a direct contact with contact with customer.
 - Providing information to the investor by providing companies back ground and financial information on web site

What is Intranet?

- The intranet is a **private network** that belongs to a particular organization.
- It is designed for the exclusive **use of an organization** and its associates, such as employees, customers, and other authorized people.
- It **offers a secure platform** to convey information and **share data with authorized users**.



- Confidential information, database, links, forms, and applications can be made available to the staff through the intranet.
- **It is like a private internet or an internal website that is operating within an organization to provide its employees access to its information and records.**
- Each computer in intranet is identified by a **unique IP Address**.
- It is based on **internet protocols (TCP/IP)** and is **protected from unauthorized access with firewalls** and other security systems.
- **The firewall monitors** the incoming and outgoing data packets to ensure they don't contain **unauthorized requests**.
- So, users on the intranet **can access the internet**, but the **internet users can't access the intranet** if they are not authorized for it.
- Furthermore, **to access the intranet, the authorized user is required to be connected to its LAN** (Local Area Network).

Advantages of the Internet:

- **Communication:** Intranet offers easy and cheap communication within an organization. Employees can communicate using chat, e-mail or blogs.
- **Time Saving:** Information on Intranet is shared in real time.
- **Collaboration:** Information is distributed among the employees as according to requirement and it can be accessed by the authorized users, resulting in enhanced teamwork.
- **Platform Independency:** Intranet can connect computers and other devices with different architecture.
- **Cost Effective:** Employees can see the data and other documents using browser rather than printing them and distributing duplicate copies among the employees, which certainly decreases the cost.
- **Workforce Productivity:** Data is available at every time and can be accessed using company workstation. This helps the employees work faster.
- **Business Management:** It is also possible to deploy applications that support business operations.
- **Security:** Since information shared on intranet can only be accessed within an organization, therefore there is almost no chance of being theft.

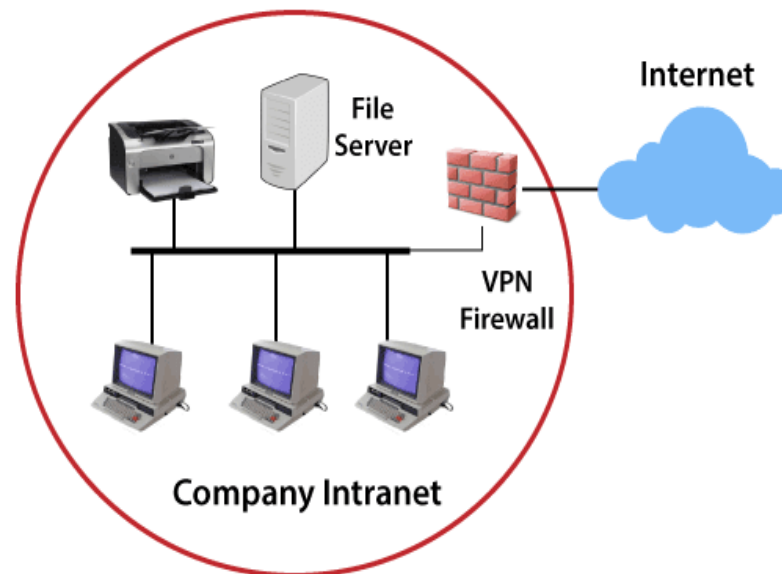
- **Specific Users:** Intranet targets only specific users within an organization therefore, once can exactly know whom he is interacting.
- **Immediate Updates:** Any changes made to information are reflected immediately to all the users.

Disadvantages of the Internet:

- It may be costly to set up an Intranet due to hidden costs and complexity.
- If the firewall does not work properly or not installed, it can be hacked by someone.
- High-security passwords are required, which cannot be guessed by outside users.
- There is always a fear of losing control over the intranet.
- Sometimes document duplication may happen which can cause confusion among employees.
- You have to give access to multiple users, so you may find it hard to control this network.

Architecture of the Intranet:

- Intranet basically comprises three components: **a web server, an intranet platform, and applications.**
- The web server is hardware that contains all the intranet software and data.
- It manages all requests for files hosted over the server and finds the requested files and then delivers it to the user's computer.
- The intranet platform, which is software, allows communication tools, collaboration apps, and databases to work seamlessly with each other.
- It is **tailored to the specific needs of a business.**



- The applications are required to enable users to work smoothly.
- They are the computing tools that allow users to do their work, communicate, and coordinate with each other and retrieve and store information.
- Furthermore, the user **who wants to access the intranet is required to have a special network password and should be connected to the LAN.**
- A user who is working remotely can gain access to the intranet through a virtual private network (VPN) that allows them to sign in to the intranet to access the information.

Applications of Internet:

There are different kinds of intranet application each have the different kind of use. They are as follows:

- **Educational:** It is generally found in a school, college, etc., For example, a school intranet is intended to allow teaching staff to communicate with each other and get information about upcoming updates such as exam dates, schools functions, holidays, etc.

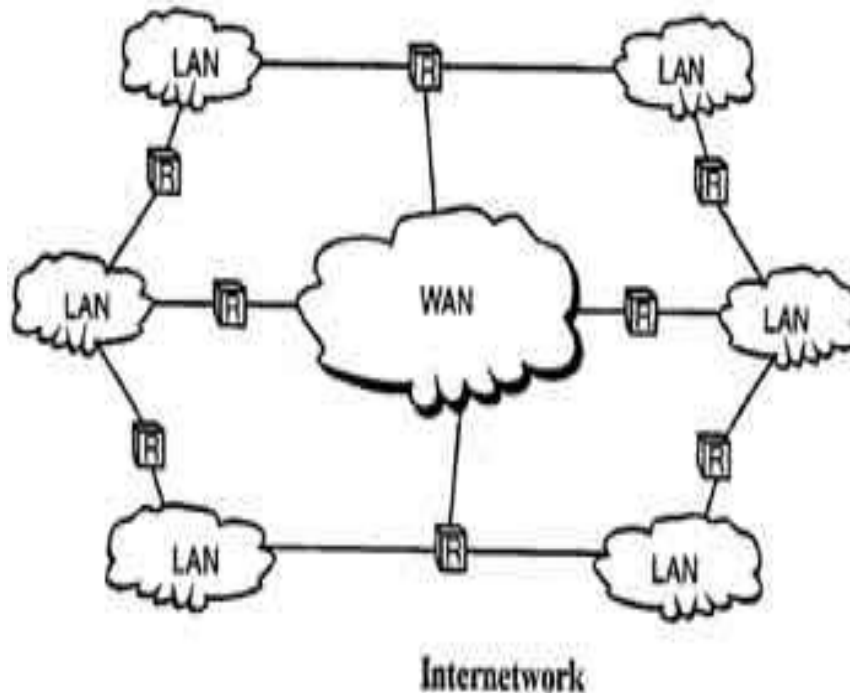
- **Real Estate:** The intranet of a real estate company allows its sales team to have access to all important brochures, templates, forms that they may need to close a sale. Employees also remain up to date with important events like meetings, training, sessions, etc. It can also be used to share motivational messages with the team.
- **Health Care:** In the healthcare sector, in big hospitals, the Intranet helps health care professionals to work as a team to provide proper care and treatment to their patients. Doctors can share reports, treatment procedures, bills and claims can be settled easily without moving from one department to another department.
- **IT Sector:** In the IT sector there is always a lot of information that needs to be shared with all the employees at one go. It may be related to a project that needs to be completed within the given time frame, such as guidelines, terms and conditions, and rules that are to be followed while working on a project.

Difference between Internet and Intranet :

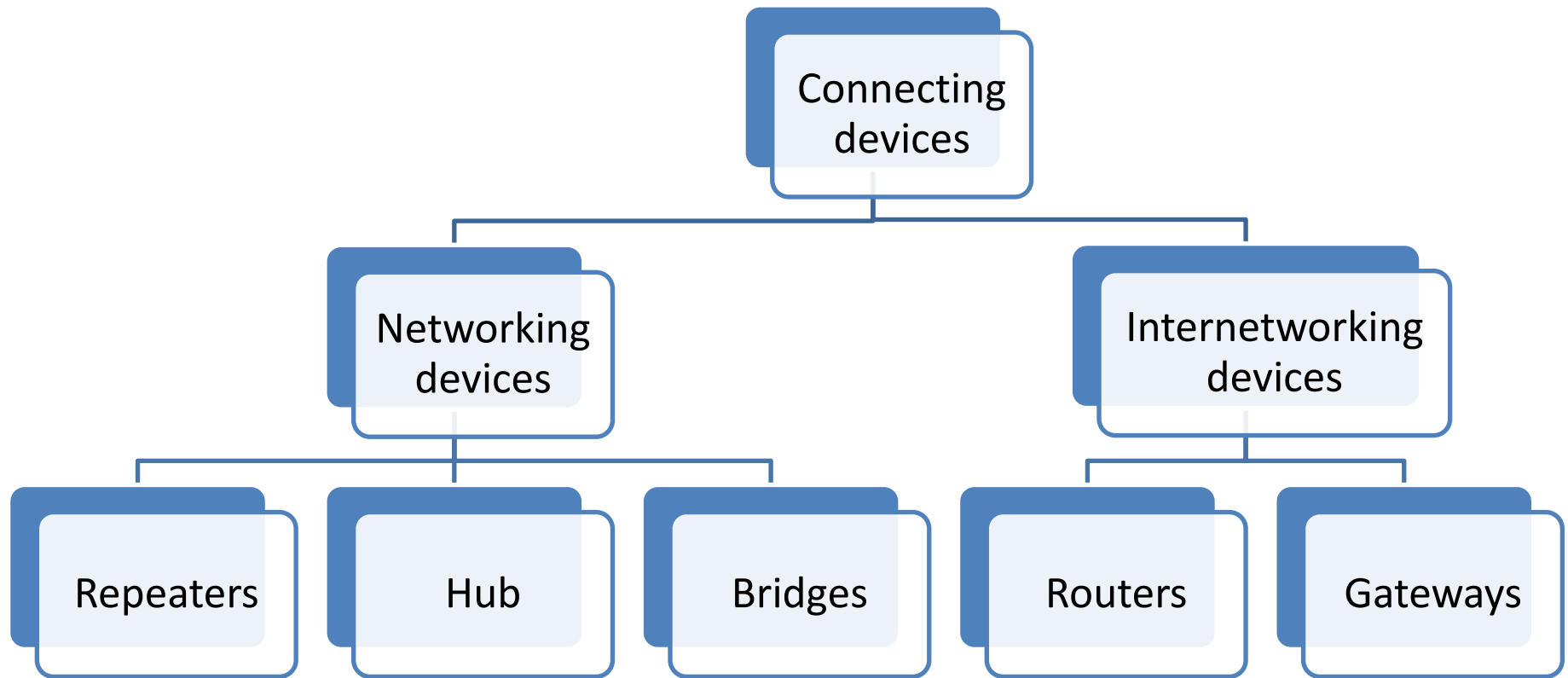
| Internet | Intranet |
|---|--|
| 1. It is a medium such as optical fiber cable that connects billions of computers with each other to establish a worldwide network. | 1. It is a small, private network as it belongs to a specific organization. |
| 2. It has billions of users as it is a public network with a worldwide presence. | 2. It has limited users. |
| 3. It is not as safe as an intranet. | 3. It is a safer network than the internet. |
| 4. It can be accessed or used by anyone using an internet-enabled devices, such as laptop, mobile phone, etc. | 4. Only authorized persons can use this network. |
| 5. It offers a wide range of information, such as news, blogs, websites, etc. | 5. It offers limited information related to its organization's work, policies, updates, etc. |
| 6. It is not owned by a single person or an organization. | 6. It can be owned by a person or an organization. |

Network / Connecting Devices

- When two or more networks or subnets connected to each other for communication between hosts on different types of network then it forms **internetwork**.
- That means, To separate / connect one corporate division with another, two LANs with different protocols, a LAN to the Internet, break a LAN into segments to relieve traffic congestion, provide a security wall between two different types of users, etc..

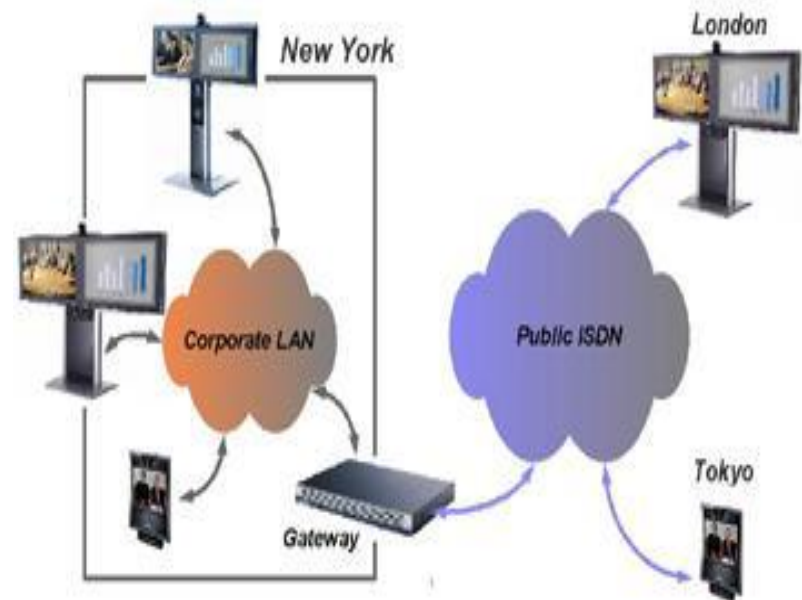
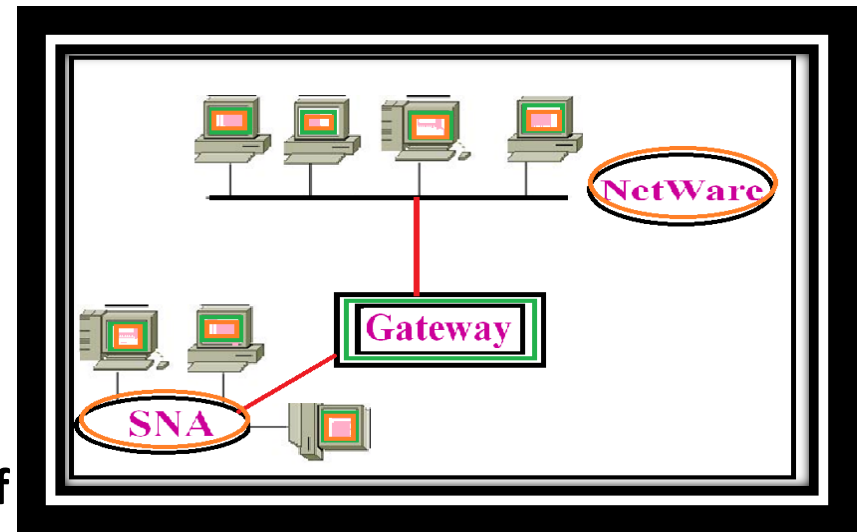


Connecting devices



1. Gateway

- It is **operate in all seven layers of OSI model** .
- A Gateway is also called as **protocol converter**.
- Gateway is **used to connect two different network systems**.
- The gateway is device **controls the flow of data between the two networks**.
- Gateway must **adjust data rate, size and format** .
- **Example**, Telephone & Internet networks, which works on different technologies. The telephone network follows the ISDN, and the Internet follows the IP. Here, 2 different technologies are being used. In this case, the router fails to work, since the router cannot understand the functionalities of both the networks. Hence, we require a Gateway, **which acts as a translator** in communicating between the 2 networks.



2. Router

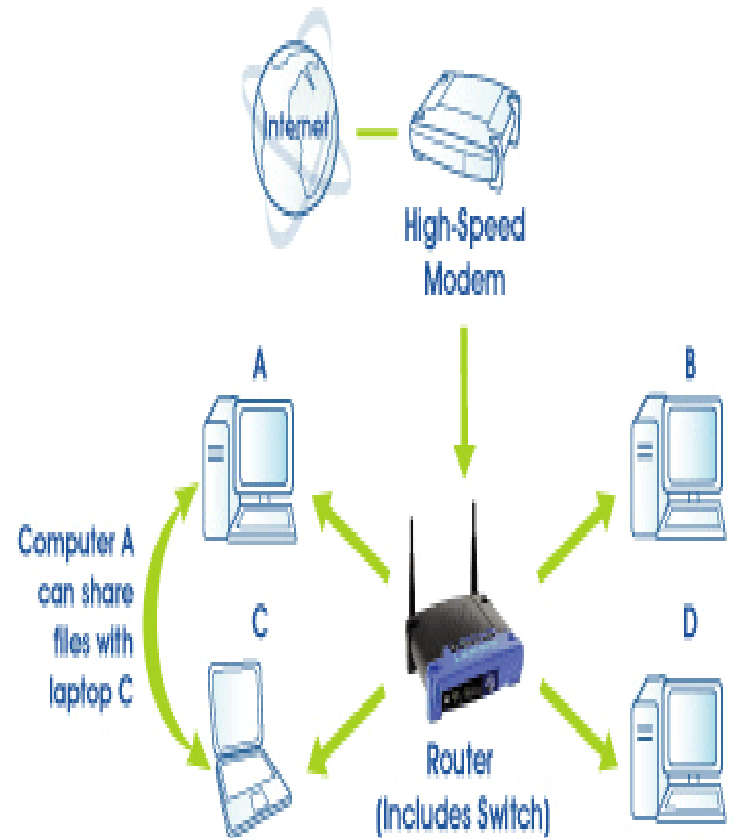
- Routers **operate** in the **physical, datalink and network layers**.
- It **chooses the best optimum path from available paths**.
- Can interconnect different networks.
- Simplest function of routers **is to receive packets from one connected network and pass them to second connected network**.
- Routers **consults with a routing table**.

Routing table

- Routers forward packets to other network by maintaining information about other networks in a **database called a routing table**.

Two primary functions:

1. To **determine the best path**
2. To **share details of routes with other router**.



A router determines how information is passed in the most efficient manner.

Types of routers

❖ Static router :

Routes are manually **configured by a network administrator**.

❖ Dynamic router :

Adjust automatically to changes in network topology and informations it receives from other routers.

Routing concepts

❖ *Least-cost routing* :

In this, decision is **based on efficiency of network, cheapest and shortest path**.

❖ Non-adaptive routing :

In non adaptive routing in which **once a path way to destination has been selected, the router sends all packets for that destination along that one route**.

❖ *Adaptive routing* :

In adaptive routing router **send the packets depending on which route is most efficient at the moment**.

Advantages

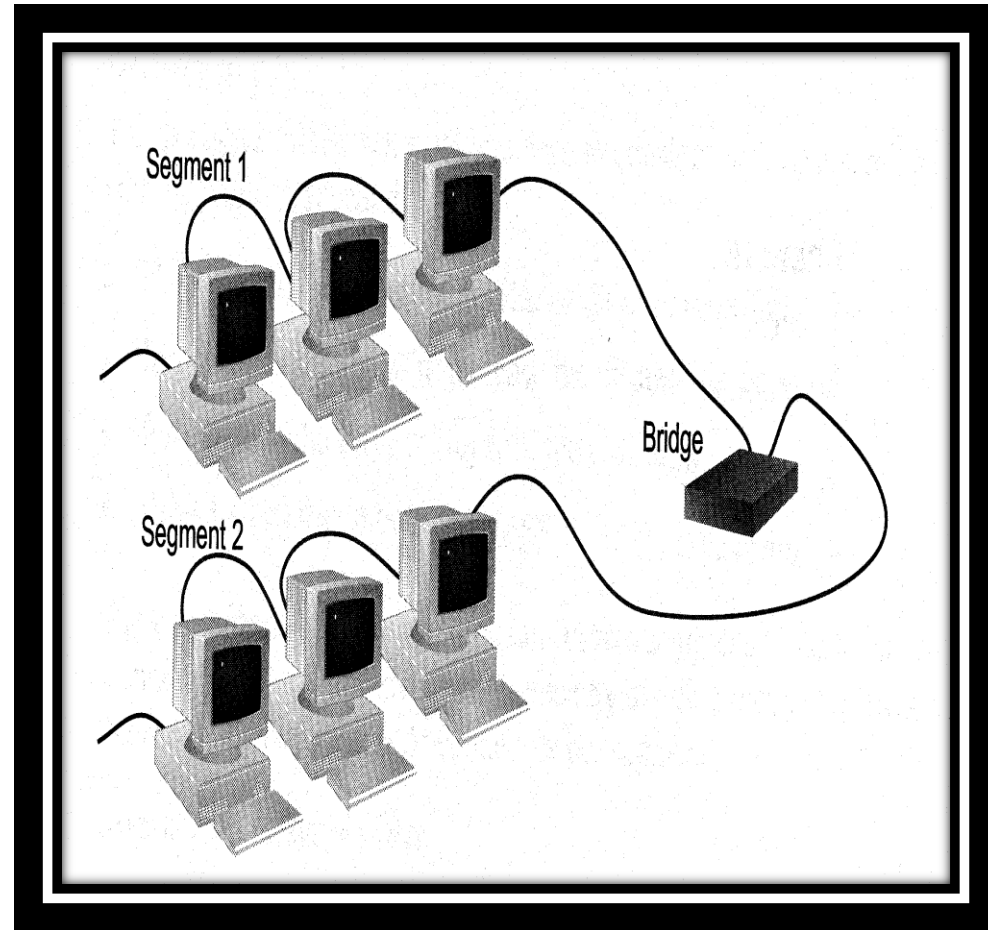
- Can **function in LAN or WAN**
- **Connects differing media**
- Can **determine best path or route**

Disadvantages

- **Expensive**
- **Must use routable protocols**
- **Slower than a bridge**

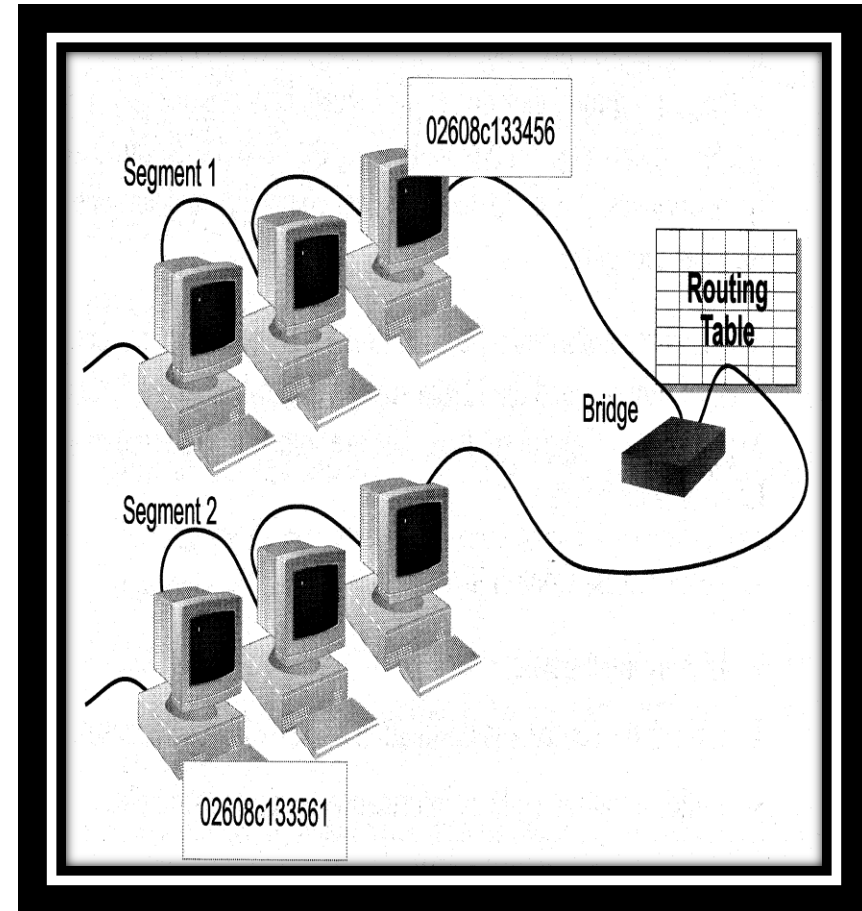
3. Bridge

- Bridges can operate : **data link layer** of OSI model.
- Bridge can **expand the distance of a segment**.
- Bridge **provides for an increased number of computers** on the network.
- Bridges can **divide large network into smaller segments**.
- Bridges **contain logic** that allows them **to keep the traffic** for each separate, in this way they filter the traffic.
- They **keep local traffic local** and send traffic only to other segments on which it belongs.
- Bridge can also **provide security through this partitioning of traffic**.



How bridge work

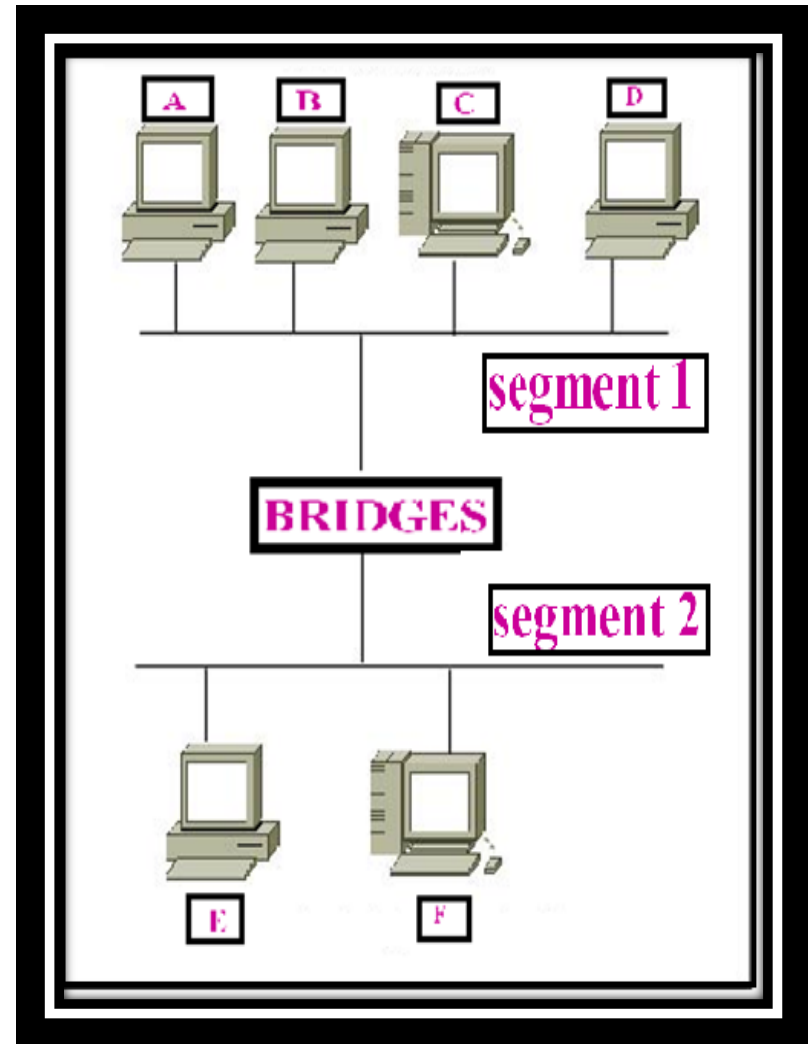
- Checks the source and destination addresses of each packet.
- creates routing table as information becomes available.
- Routing table is built to record the segment no. of address.
- It forwards packets:
 - If the destination is not listed in the routing table, the bridge forwards the packets to all segments.
 - If the destination is listed in the routing table, the bridge forwards the packets to that segment.



Types of bridges

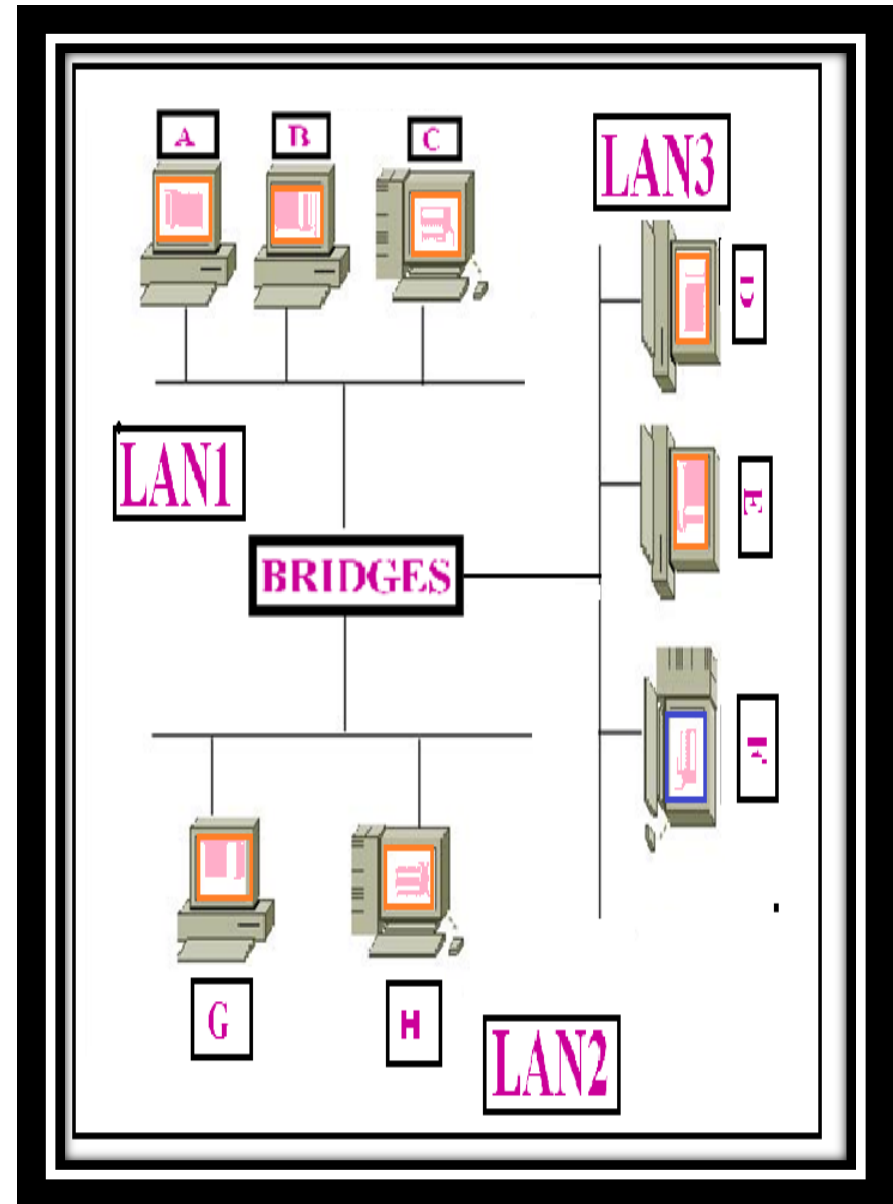
3.1.Simple bridge

- Simple bridge **links two segments** and contains a table that lists the addresses of all stations included in each of them.
- Time consuming.



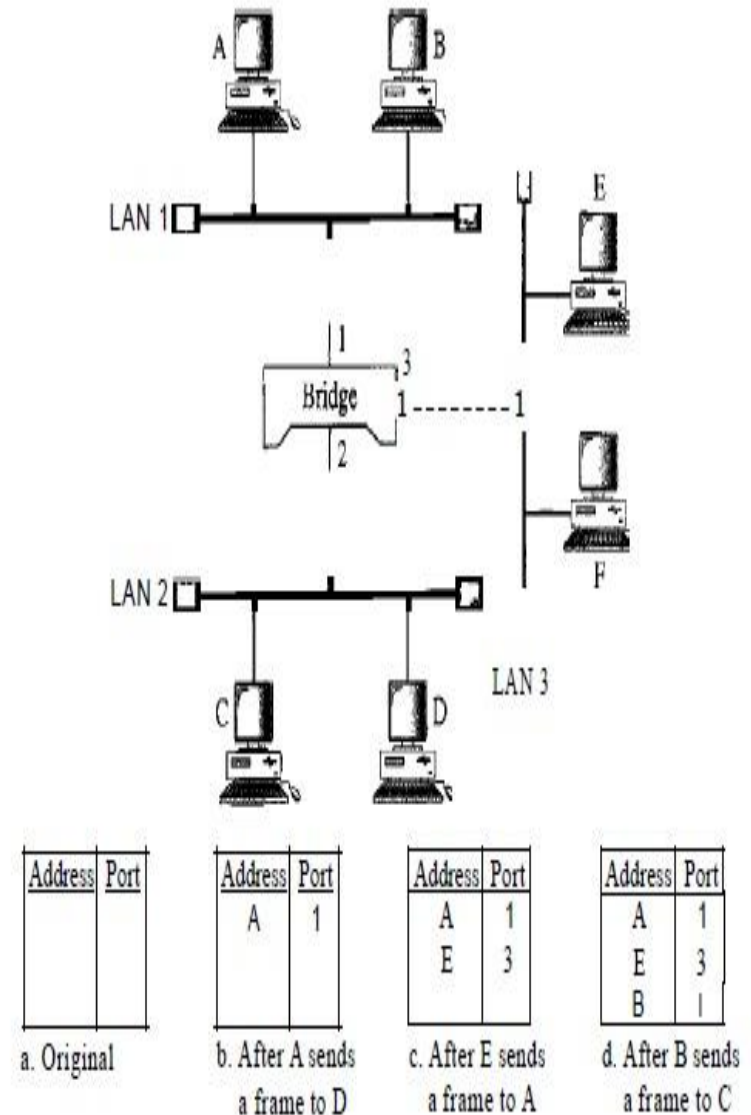
3.2. Multiport bridge

- Multiport bridge can be used to **connect more than two LANS.**
- In this bridge **three tables** are created, each one holding the physical address of station reachable through the corresponds port.



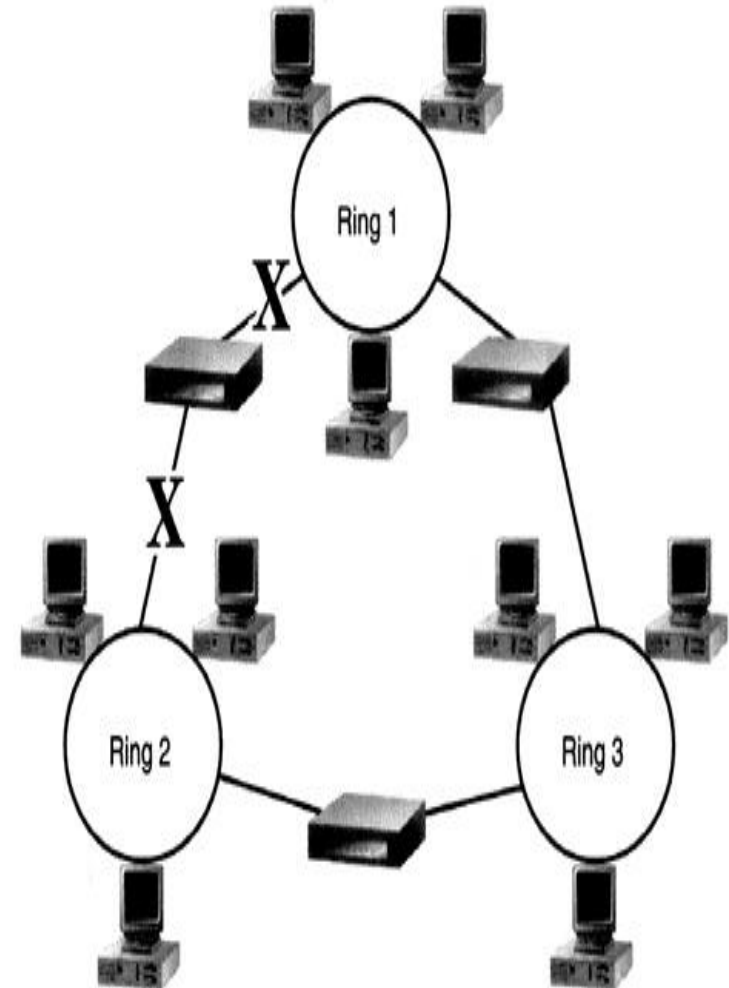
3.3.Transparent bridge

- Transparent Bridges is **invisible to the other devices** on the network.
- Transparent Bridge only **perform the function of blocking or forwarding data based on MAC address**.
- Also called **learning Bridge** as they build a table of MAC addresses as they receive frames.
- They learn which addresses are on which segment.
- The bridge uses the source MAC addresses to determine which addresses are on which segments – By determining a frame's origin, the bridge knows where to send frames in the future
- **Ethernet networks** mainly use transparent bridges.



3.4.Source-Routing bridge

- Source-Routing Bridge used in **Token ring networks**.
- Each station should determine the route to the destination when it wants to send a frame and therefore include the route information in the header of frame.
- Addresses of these bridges are included in the frame.
- Frame contains not only the source and destination address but also the bridge addresses



Advantages

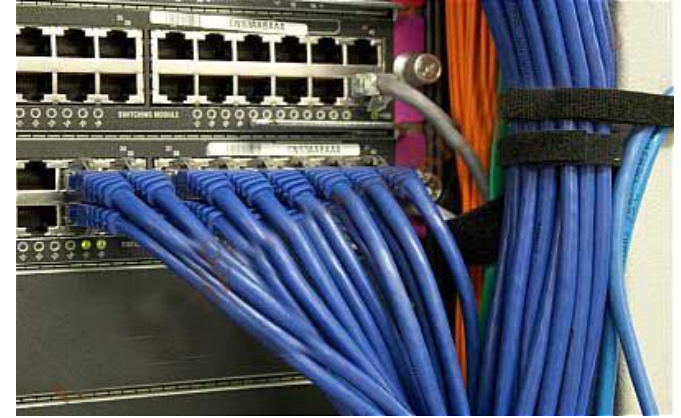
- Extend Physical Network.
- Reduce network traffic with different segment.
- Reduce Collisions.
- Connect different Architecture

Disadvantages

- More expensive than repeater.
- Slower than repeater due to filtering.

4. Switches

- Acts as **multiport bridge**.
- It operates at OSI's **data link layer**.
- Multiple inputs & output to specific device.
- It receives a frame & store it into buffer of receiving link & checks address to find outgoing link and then send it to particular link.



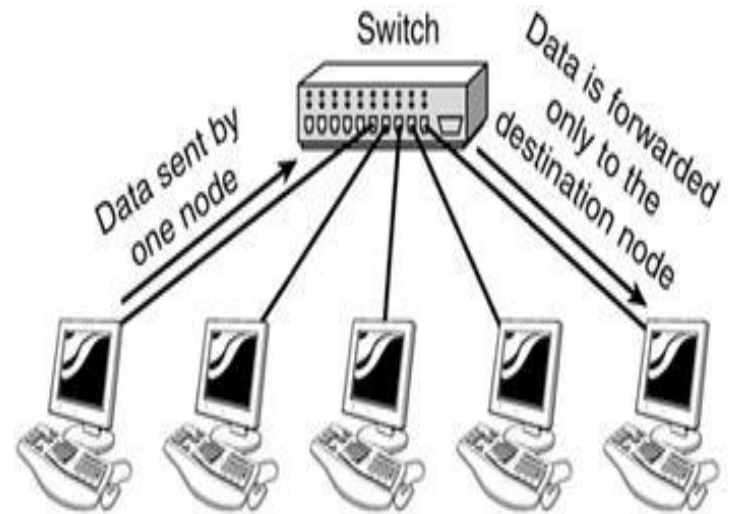
Types of switches

1. Store and forward switch

Stores frame in the input buffer.

2. Cut through switch

Forwards the frame to the output buffer.



Advantages

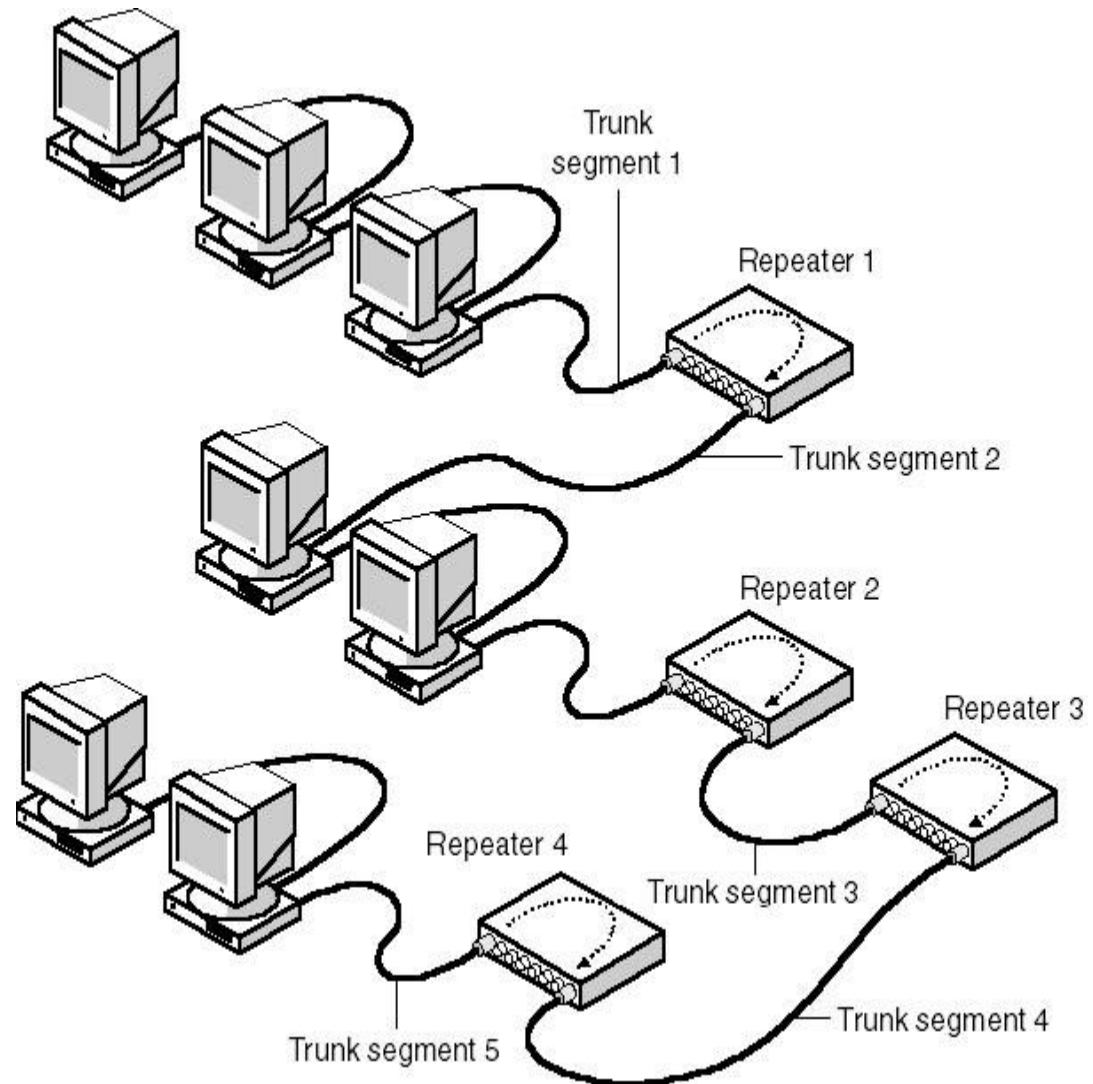
- Limits the collision domain.
- Can provide bridging.
- Can be configured to limit broadcast domain.

Disadvantages

- More expensive.
- Configuration of additional functions can be very complex.

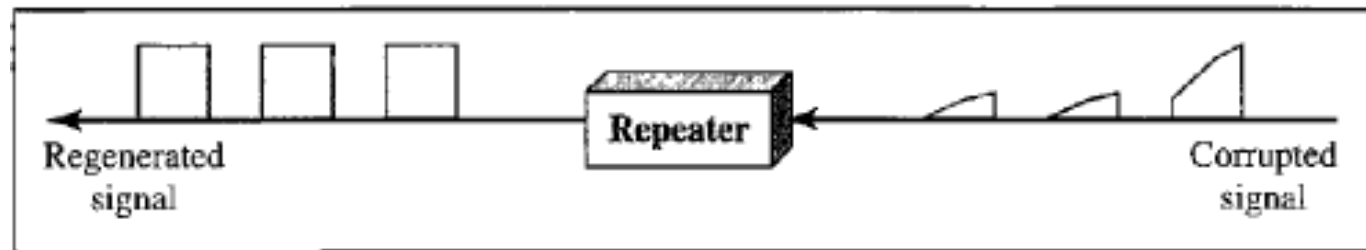
5. Repeater

- Repeater **operates on physical layer**.
- It receives the signal before it becomes corrupted and regenerates & amplifies the original bit pattern.
- It allows to extend the physical length of the network.
- It doesn't change the functionality of network.

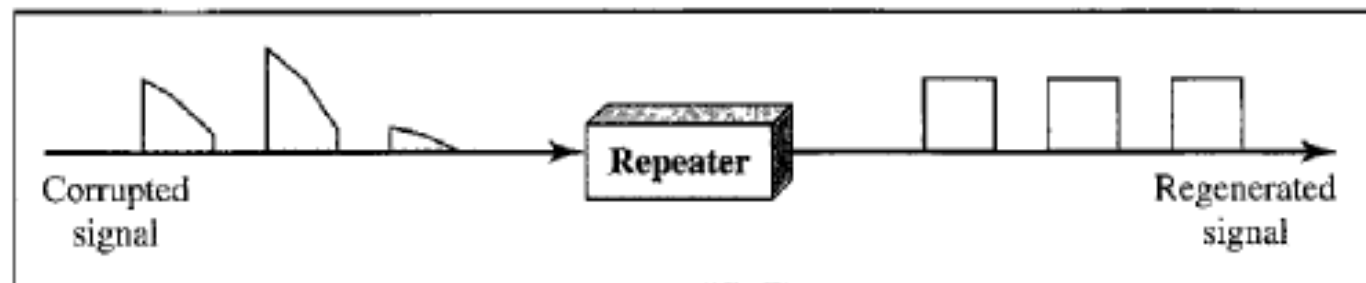


How it works:

- Forward bits from one network to another using **two networks logically like one network**.
- Don't alter the content of the packet moving across the wire. i.e. it simply copy bits without understanding what they are doing.
- An amplifier cant discriminate between the intended signal and noise; it amplifies equally everything fed in to it.
- **A repeater does not amplify the signal, it regenerates it.**



a. Right-to-left transmission.



b. Left-to-right transmission.

Advantages

- Can connect different types of media
- Can extend the network in terms of distance
- Cost effective

Disadvantages

- Can not filter the data
- Can not connect different network architectures

6. Hub

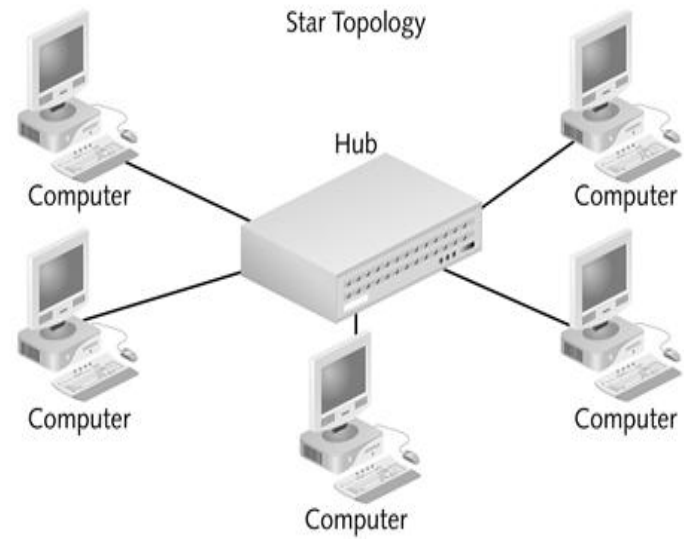
- A Hub interconnects two or more stations in a **star topology**.
- Used to collect signals from the input lines & **redistribute them to all stations**.
- Enables **high speed communication**.
- Hub is **operated in physical layer** of the OSI model.
- There are two types of Hub:

a. Active Hub:

- Also called **multiport repeater**.
- Need **electrical power supply** to run repeater .
- **performs amplification of signal** before broadcasting it.

b. Passive Hub:

- Act **as connection point** which means **without amplifying** the incoming signals it **simply broadcast them to all nodes**.
- **Do not require electricity** to run.
- **Inexpensive and easy to configure**



Note:

Difference between Active Hub & Passive Hub is that an **Active Hub regenerates the received bit patterns** before sending them out whereas a **Passive Hub provides a physical connection** between attached devices.

Advantages

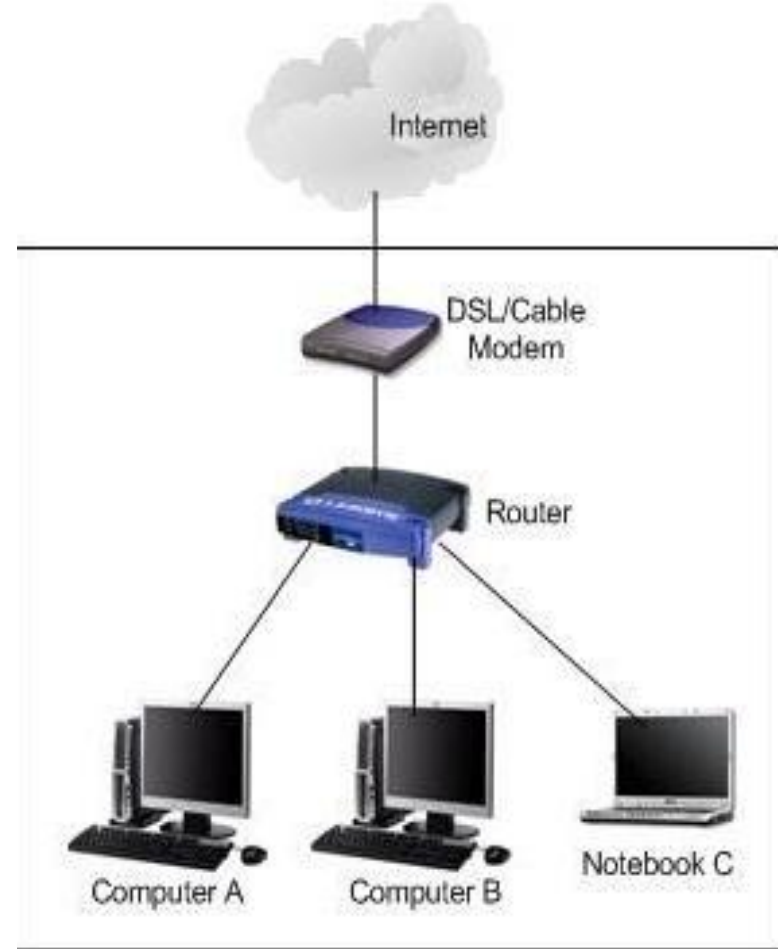
- Cheap
- Can connect different media types

Disadvantages

- Bandwidth is shared by all hosts.
- Time consuming.
- Don't reduce network traffic.
- Passes packets to all connected segments.

7. Modem

- The word Modem comes from '**Modulator**' & '**Demodulator**'.
- **Modulation:** Digital information to analog signals.
- **Demodulation:** Analog signals back into useful digital information.
- An ISP is required to complete a connection to the internet. i.e. **Modem is device that provides access to the internet.**
- The modem **connects to your ISP**, which typically provides either **cable or Digital Subscriber Line(DSL)** Internet service. **Cable modems have a coaxial (or "coax") connection**, which is the same type of connector found on a TV or cable box. This connects to a cable port on the wall. **DSL modems have a telephone connector, also called an RJ-11 jack**, which connects to a telephone socket on the wall.
- By connecting your modem to your router (instead of directly to a computer), all devices connected to the router are connected to the modem, and therefore, the Internet. The router provides a local IP address to each connected device, but they will all have the same external IP address, which is assigned by your ISP.



Types of Cables:

- Media/Cables means **physical path** between transmitter & receiver in data communication.
- what the messages is transmitted over like Television, Newspaper or Journal / Technical Report.
- In computer networking, media/Cable determines how quickly and to whom a computer can talk and how expansive process is.
- So, the **characteristics of the signal** and of the **medium** both determine the quality of the communication medium.

Characteristics:

- **Bandwidth:** Amount of data(Frequency) that a cable can carry.
- **Attenuation:** The loss of signal strength due to external interference.
- **Segment Length:** A **network segment** is a portion of a computer network wherein every device communicates using the same physical layer.
- **Cost:** Depends upon type of cable chosen.
- **Crosstalk:** is the effect of one wire on other.

Guided media includes everything that 'guides' the transmission. That usually takes the form of some sort of a wire. Usually copper, but can also be optical fibre.

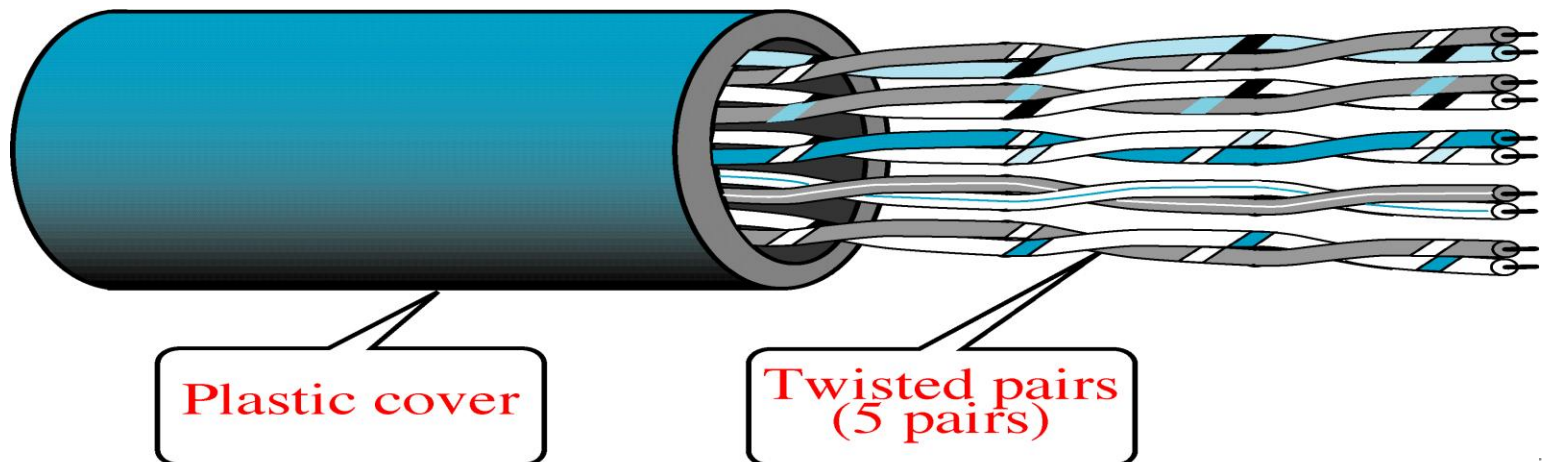
1. Twisted Pair Cable
2. Coaxial Cable
3. Fibber Optic Cable

1. Twisted Pair Cable

- It has **two conductors** wires scratch around each other & each are surrounded by an **insulating material**.
- Twisted Pair come in two forms.
 - a. Unshielded Twisted Pair cable
 - b. Shielded Twisted pair cable

Unshielded Twisted Pair Cable: (UTP)

- It is a most common type of **telecommunication medium**.
- It is used in the **telephone system**.
- Each pair is twisted with different number of **twist per inch** to help to **eliminate interference** from adjacent pair.
- Unshielded twisted pair is also **popular for token ring network**, which were traditionally wired with shielded twisted pair.



- The Electronic Industry Association(EIA)/ Telecommunication Industry Association (TIA) has establish standard of UTP and rated five category of wires:

| Type | Use |
|------------|---|
| Category 1 | Voice Only(Telephone Wire) |
| Category 2 | Data Transmission of up to 4 MBPS(Local talk) |
| Category 3 | Data Transmission of up to 10 MBPS(Ethernet) |
| Category 4 | Data transmission of up to 20mbps(16 mbps token) |
| Category 5 | Data transmission of up to 100mbps(Fast Ethernet) |

Advantages

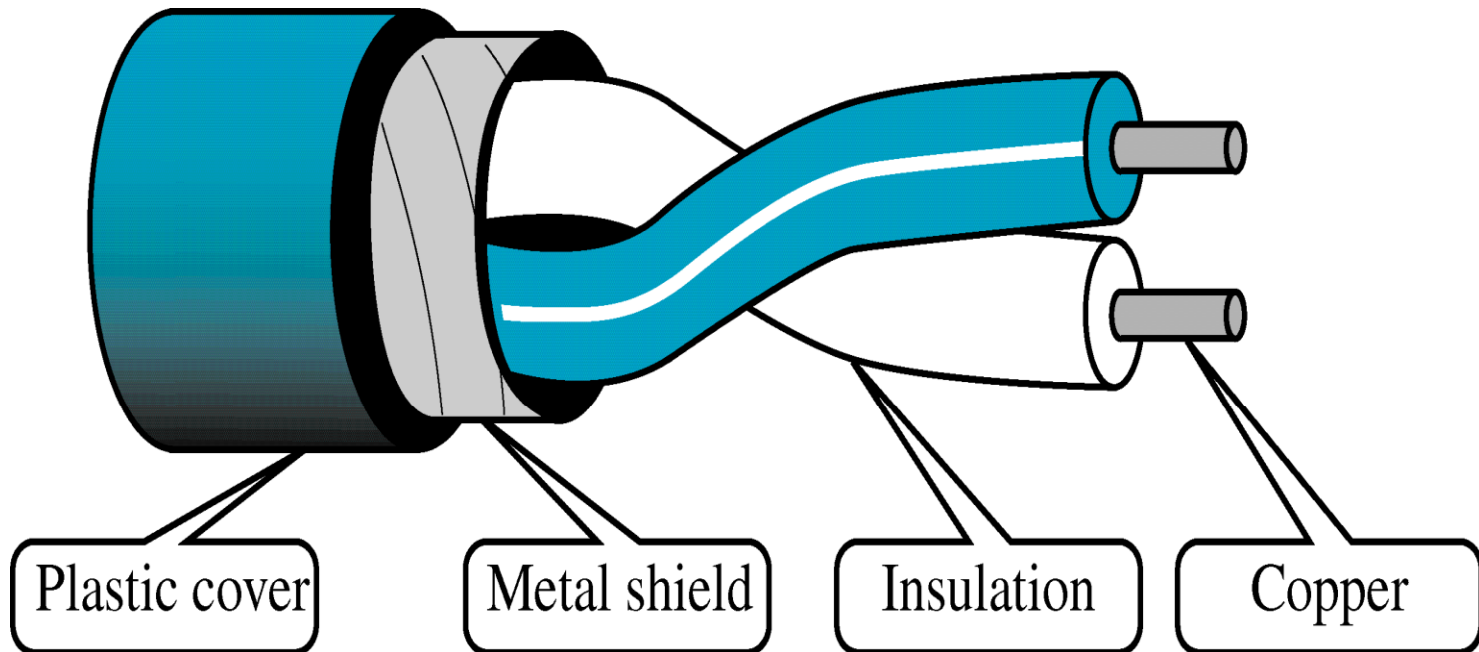
- UTP system is **colour coded cabling**.
- UTP is **less expensive** than co-axial and fiber.
- UTP is a very **easy media to install and reconfigure**.

Unshielded Twisted Pair connector:

- Each wire in a cable is attached to one pin in the connector.
- The most frequent use of this plug is **RJ45 connector with 8 pin**.
- One for each wire of **four twisted pair**.

Shielded Twisted Pair Cable: (STP)

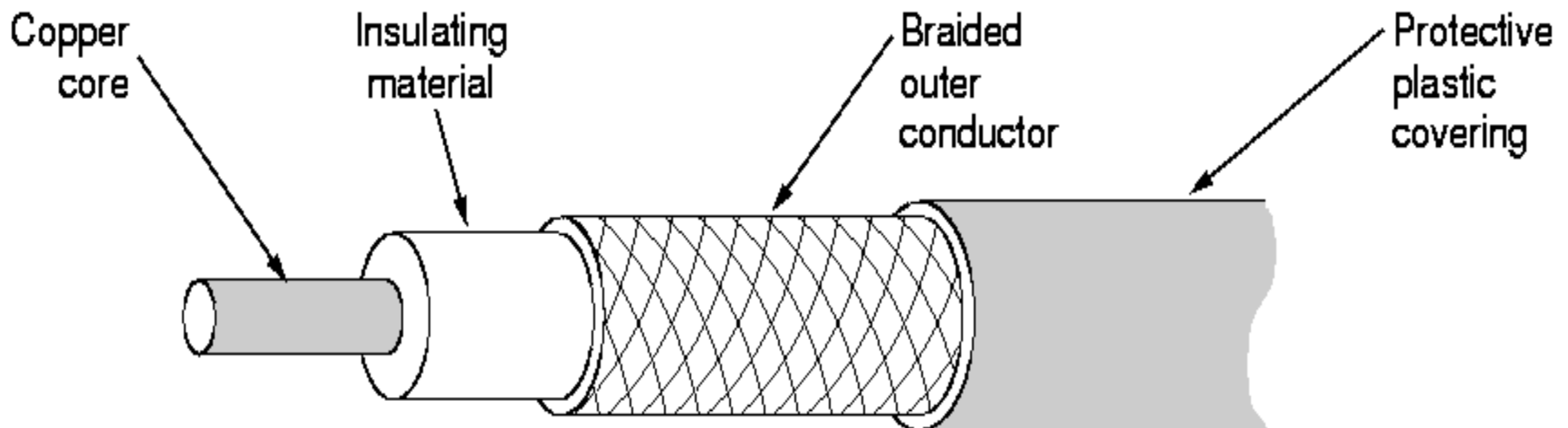
- STP cable has a **metal foil** covering each pair of conductor.
- It can **eliminate cross talk**, which is the undesired effect of one circuit on another line.
- It occurs when line pick up some of the signals travelling down another signal or another line.



- Shielded twisted pair's shielded **increase its immunity to electromagnetic interface which allows it to transmit data over longer distance then UTP.**
- Shielded twisted pair (STP) has the **same quality** consideration and uses the **same connector** as UTP.
- Materials and manufacturing requirement make STP more expensive then UTP.

2. Coaxial Cable

- In its simplest form, coaxial consists of a core made of solid copper surrounded by insulation, a braided metal shielding, and an outer cover.
- It is the oldest network cable which is easy to use.
- It has a larger bandwidth and can support transmission over long distance.
- The metal shield help to block any outside interface from florescent light, motors and other computers.
- Although Co-axial cable is difficult to install. It is highly resistance to signal interface.



- It can support greater cable length than twisted pair cable.
- There are two types of co-axial cable.
 - Thick co-axial cable
 - Thin co-axial cable

Thin co-axial cable

- Thin co-axial cable is also referred to as a thin net.
- 10base2 refers to the specification for thin co-axial cable carrying Ethernet signals. The 2 refers to approximate maximum segment length being 200 meters.
- Thin co-axial cable is popular in school network.

Thick Co-axial Cable

- 10base5 refers to the specification for thick co-axial cable carrying Ethernet signals. The 5 refers to the maximum segment length being 500 meters.
- Thick co-axial cable has an extruded protective plastic cover.
- One disadvantage of thick co-axial cable is that it does not bend easily and is difficult to install.
- The advantage of thick co-axial cable is that it is most robust, harder to change and transmit data over a longer distance.

Advantages :

- Co-axial has a sufficient frequency range to support multiple channels, which allows for much greater throughput.
- Because it has a greater bandwidth per channel, it supports a mix range of services. For ex, voice, data and video.
- Because the inner conductor is in a shield, it has lower error rate.
- It reduces the noise and cross talk.

Disadvantages:

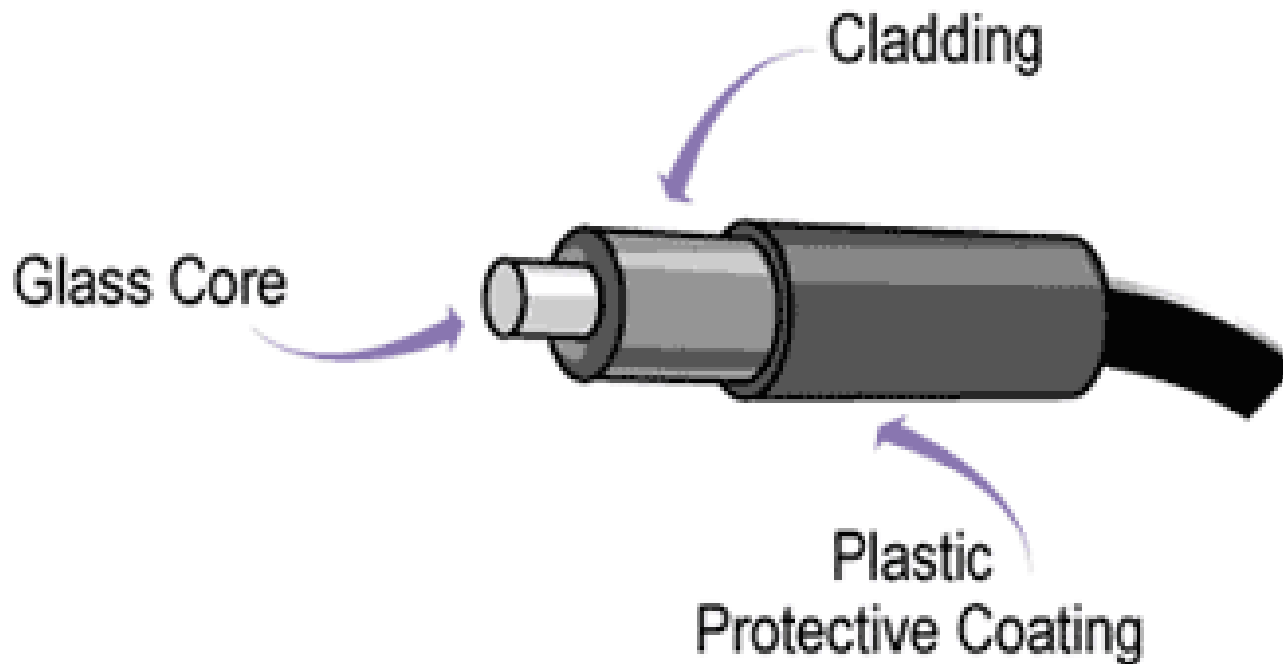
- Co-axial cable may be damage by lighting sock.
- Installation cost in the local environment is high.
- It is not supported for some network standard.

Co-axial cable connector:

- The most common type of connector used with co-axial cable is the BNC connector.

3. Optical Fiber/ Fiber Optic

- Optical fiber consists of a glass core, surrounded by a glass cladding with slightly lower refractive index.
- Fiber Optics is long, thin of very pure glass about the diameter of human hair.
- They are arranged in bundles called optical and used to transmit light signals over long distance.



- It has a following parts:
 - **Core:** Thin glass centre of the fiber where the light travels.
 - **Cladding:** Outer optical material surrounding the core that reflects light back into the core.
 - **Buffer coating:** Plastic coating that protect the fiber form damage.
- Hundreds or thousands of these optical fiber are arranged in bundles in optical cables. The bundles are protected by the cables outer covering called a jacket.
- In a fiber cable the electrical signals are converted into appropriate light signals and converted into appropriated light signals and transmitted through it.
- An emitter sends the signals from one end of the cable and a light sensor senses this signals and then convert into its digital equivalence.
- There are transited which located at both end of cable, where the signals are converted from electrical to light signal and vice-versa.
- Fiber optic cables are available in different size.

- There are two source of light:
 - Laser
 - LED [Light Emitting Diode]
- Fiber optic cables use the principle of total reflection to transmit light signals.
- Speed of a light defers depending on the medium.

Use and Need of the fiber optics:

- Fiber optic cables are mainly used in environment that is highly susceptible to noise other interface.
- These cables are highly secure as they do not emit any external signals.

- It is use due to the following characteristics:
 - **Bandwidth :**
Carries huge amount of data ranging from 100 mbps to 1 gbps.
 - **Segment length :**
Transmit readable data signals in a range of 2km to 100km. This allows the user to transmit data over a long distance.
 - **Interface :**
Secured data from being securely read as no electrical signal pass through this type of cable. It is used in TV towers, radio station and electric transformer.

How the Light propagate in FiberOptic?

- Fiber optic cables can support two modes for propagation light.

Single Mode & Multi Mode

- **Single Mode :**

- In this type cable the light travels straight down the fiber, which means data can travel greater distance.
- Single mode cable has a larger diameter then multi mode cable. it is header to manufacture.

Disadvantage of signal mode:

- only one signal can be transmitted through it.
- To transmit two signals you need two strands of fiber optic cables.

- **Multi Mode:**

- In multimode cable the light bounce off the cables as it travel down, which causes the signal to be slower and there for data can not travel great distance.
- Multi mode code is often used in LAN, seen Data is not required to travel across the country.
- Two or more signal can be transmitted though it.

Advantages of Fiber Optics:

- **Expansive:**
Several miles of optic cable can be made cheaper than equivalent length of copper wire.
- **Thinner :**
Optical fiber can be drawn to smaller diameter than copper wire.
- **Higher carrying capacity :**
Because optical fiber are thinner than copper wire, more fiber can be bundled in to a given diameter cable than copper wire.
- **Less Signal Degradation :**
The loss of signal in optic fiber is less than copper wire.
- **Light signal :**
Unlike electrical in copper wire, light signal from one fiber do not interfere with other fiber in the same cable.
- **Digital signal**
Optical fiber are ideally suited for carrying digital information which is useful in computer network.
- **Light weight**
This cable weight is less than as compare to copper wire.

Disadvantage Of optical fiber:

- Fiber optic cable is expensive.
- Glass fiber is more easily broken than wire. It is less useful for applications where hardware portability is required.

Fiber Optic Connector :

- The most common connector used with fiber optic cable is an **ST connector**. It is similar to BNC connector.

| Basis of Difference | UTP | STP | Co-axial | Fiber optic |
|----------------------------|------------------------------|-------------------------|---------------------------------|--------------------------------|
| Bandwidth | 10Mbps-100Mbps | 10Mbps-100mbps | 10Mbps | 100Mbps-1Gbps |
| Attenuation | Very high Attenuation | High Attenuation | Low Attenuation | Very Low Attenuation |
| Segment Length | 500metres | 100metres | 185m- 500m | 2km – above. |
| Installation | Least expensive | Costly than UTP | Costly than Twisted Pair | More costly to install. |
| Cost | Rs. 10 -20/m | Rs. 20- 40 /m | Rs. 250/m | Rs. 700/m |
| Crosstalk | More | Relatively less | Minimum | No affect |

Thank You