COMPUTER NETWORKS

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Uses of Computer Networks

1. **Resource Sharing:**

The goal is to make all programs, equipments(like printers etc), and especially data, available to anyone.

2. **Server-Client model:**

- a company's information system as consisting of one or more databases and some employees who need to access it remotely. In this model, the data is stored on powerful computers called **Servers**.
- Often these are centrally housed and maintained by a system administrator.
- In contrast, the employees have simple machines, called **Clients**, on their desks, using which they access remote data.

3. **Communication Medium:**

 provide a powerful communication medium among employees. Virtually every company that has two or more computers now has e-mail (electronic mail), use for a great deal of daily communication

4. ECommerce:

A goal that is starting to become more important in businesses is doing business with consumers over the Internet. Airlines, bookstores and music vendors have discovered that many customers like the convenience of shopping from home. This sector is expected to grow quickly in the future.

5. Cost Effective Systems

Computer networks have reduced the cost of establishment of computer systems in organizations. Previously, it was imperative for organizations to set up expensive mainframes for computation and storage. With the advent of networks, it is sufficient to set up interconnected personal computers (PCs) for the same purpose.

Network Hardware

1. Network Cables

Network cables are the transmission media to transfer data from one device to another. A commonly used network cable is category 5 cable with RJ – 45 connector, as shown in the image below:

Types of Cables

To connect two or more computers or networking devices in a network, network cables are used. There are three types of network cables; coaxial, twisted-pair, and fiber-optic.

a) Coaxial cable

This cable contains a conductor, insulator, braiding, and sheath. The sheath covers the braiding, braiding covers the insulation, and the insulation covers the conductor.

Sheath
This is the outer layer of the coaxial cable. It protects the cable from physical damage.

Braided shield
This shield protects signals from external interference and noise. This shield is built from the same metal that is used to build the core.

Insulation
Insulation protects the core. It also keeps the core separate from the braided-shield. Since both the core and the braided-shield use the same metal, without this layer, they will touch each other and create a short-circuit in the wire.

The following image shows these components.
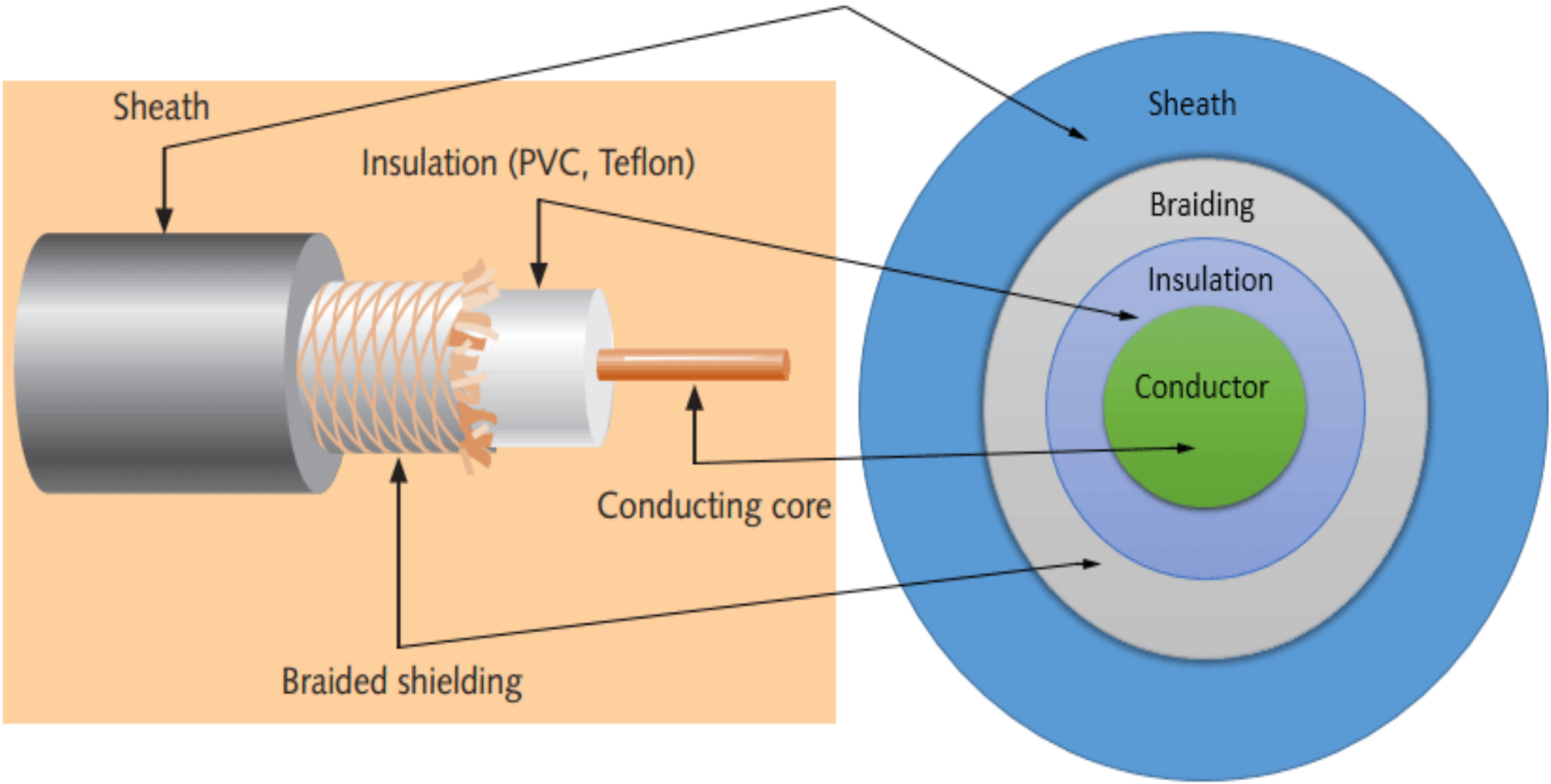
Conductor

The conductor carries electromagnetic signals. Based on conductor a coaxial cable can be categorized into two types; single-core coaxial cable and multi-core coaxial cable.

A **single-core** coaxial cable uses a single central metal (usually copper) conductor, while a **multi-core** coaxial cable uses multiple thin strands of metal wires. The following image shows both types of cable.
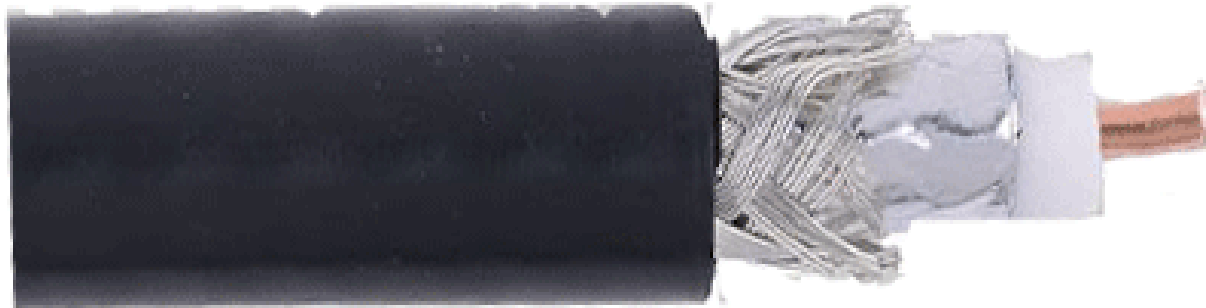

Single core coaxial cable

Multi-core coaxial cable

b.Twisted-pair cables

❑ The twisted-pair cable was primarily developed for computer networks. This cable is also known as **Ethernet cable**. Almost all modern LAN computer networks use this cable.

❑ This cable consists of color-coded pairs of insulated copper wires.

❑ Every two wires are twisted around each other to form pair. Usually, there are four pairs. Each pair has one solid color and one stripped color wire. Solid colors are blue, brown, green and orange. In stripped color, the solid color is mixed with the white color.

❑ Based on how pairs are stripped in the plastic sheath, there are two types of twisted-pair cable; UTP and STP.

❑ In the **UTP (*Unshielded twisted-pair*) cable**, all pairs are wrapped in a single plastic sheath.

❑ In the **STP (*Shielded twisted-pair*) cable**, each pair is wrapped with an additional metal shield, then all pairs are wrapped in a single outer plastic sheath.
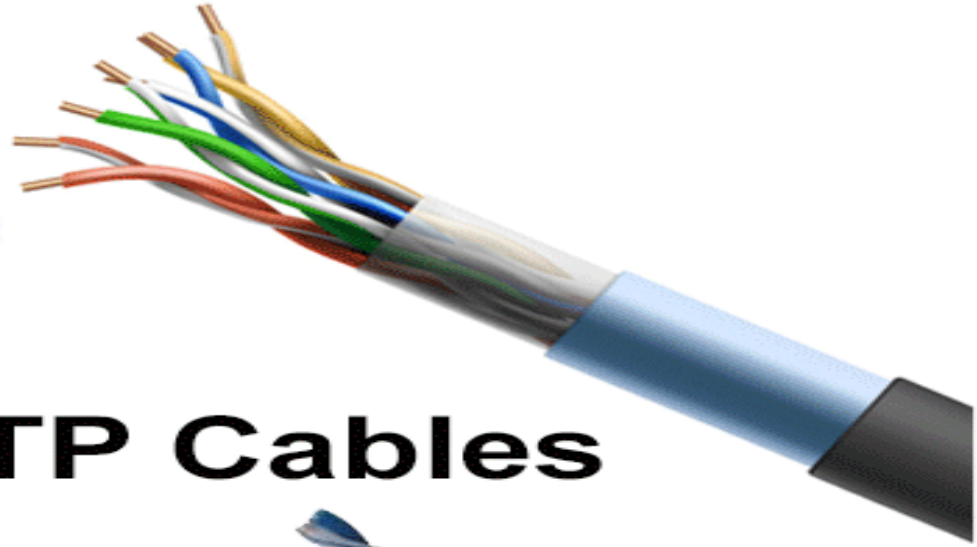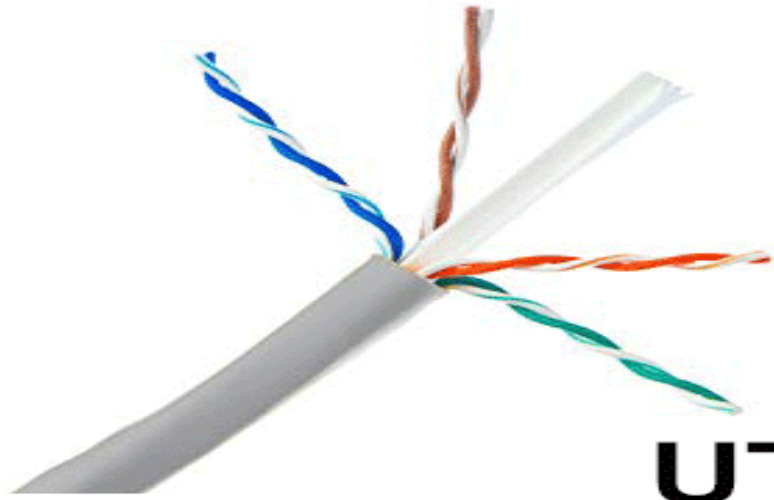
UTP Cables
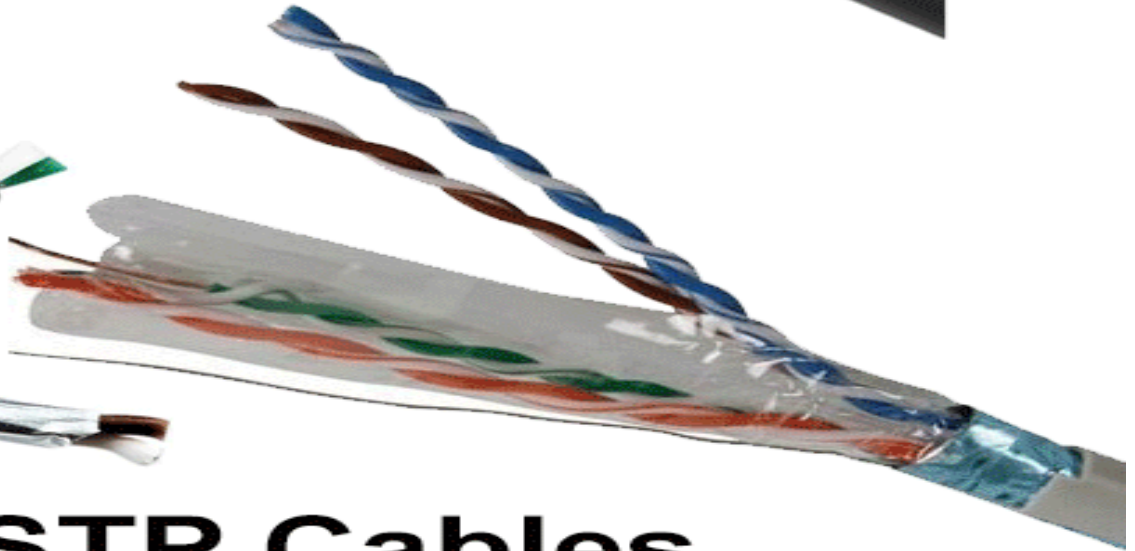
STP Cables

c. Fiber Optic Cable

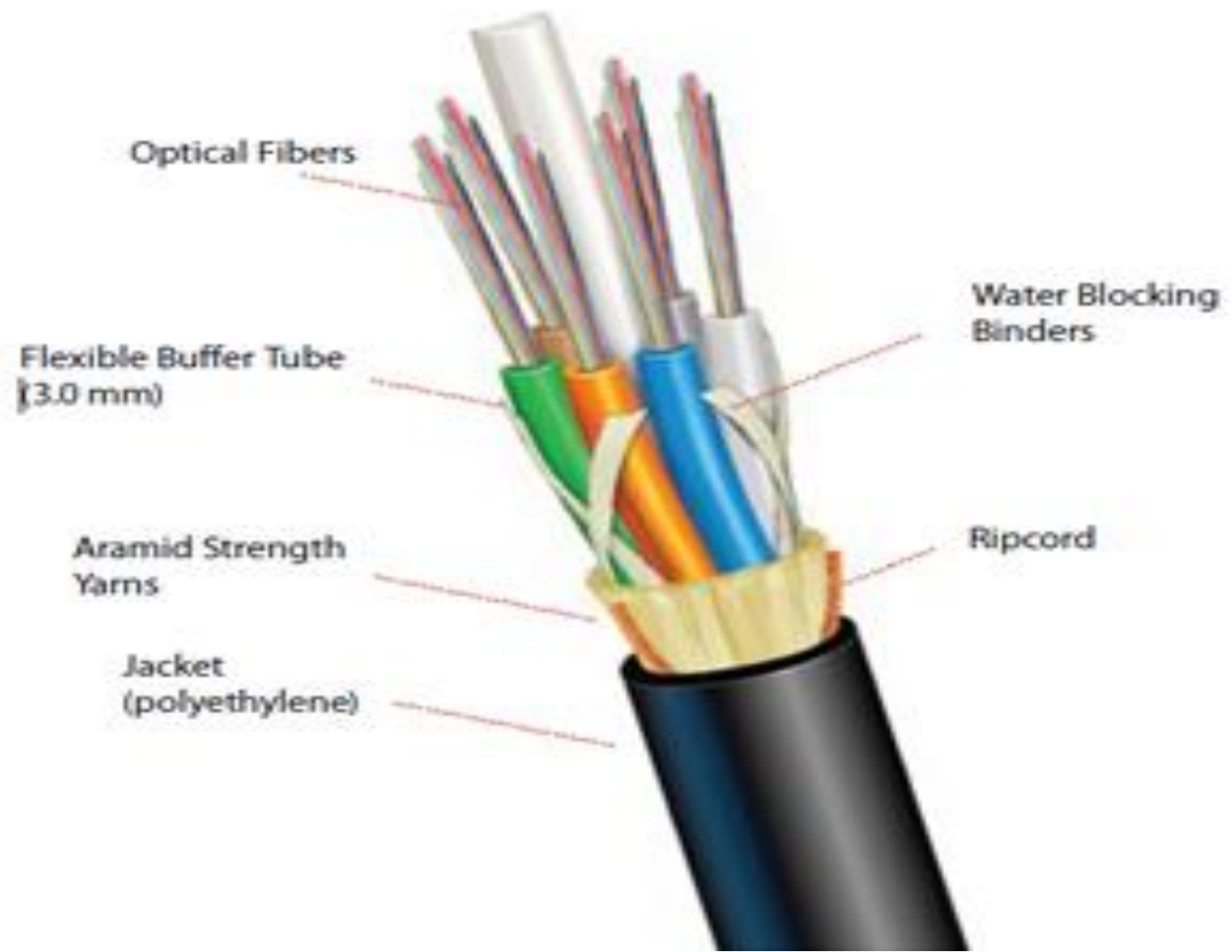This cable consists of core, cladding, buffer, and jacket.

The core is made from the thin strands of glass or plastic that can carry data over the long distance.
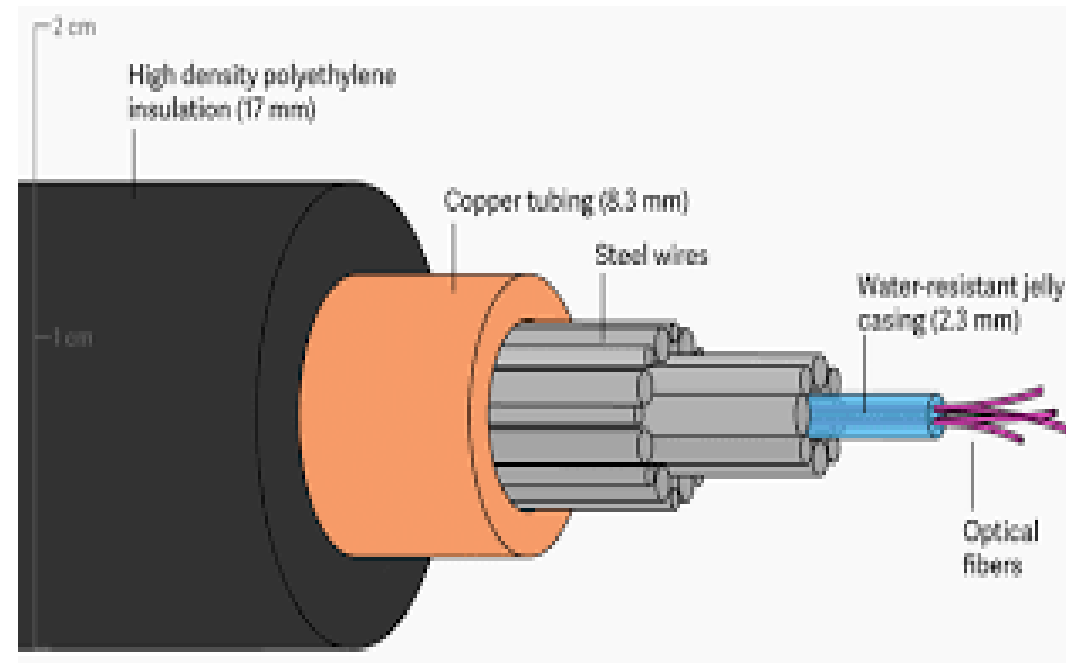
The core is wrapped in the cladding; the cladding is wrapped in the buffer, and the buffer is wrapped in the jacket.
- Core carries the data signals in the form of the light.
- Cladding reflects light back to the core.
- Buffer protects the light from leaking.
- The jacket protects the cable from physical damage.

This cable can transmit data over a long distance at the highest speed.

It can transmit data up to 40 kilometers at the speed of 100Gbps. Fiber optic uses light to send data.

Optical Fibers

Water Blocking Binders

Flexible Buffer Tube (3.0 mm)

Aramid Strength Yarns

Ripcord

Jacket (polyethylene)

2. N/W HARDWARE - HUB

- ✓ A hub is basically a multiport repeater.

- ✓ A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations.

- ✓ Hubs cannot filter data, so data packets are sent to all connected devices.

- ✓ In other words, collision domain of all hosts connected through Hub remains one.

- ✓ Also, they do not have intelligence to find out best path for data packets which leads to inefficiencies and wastage

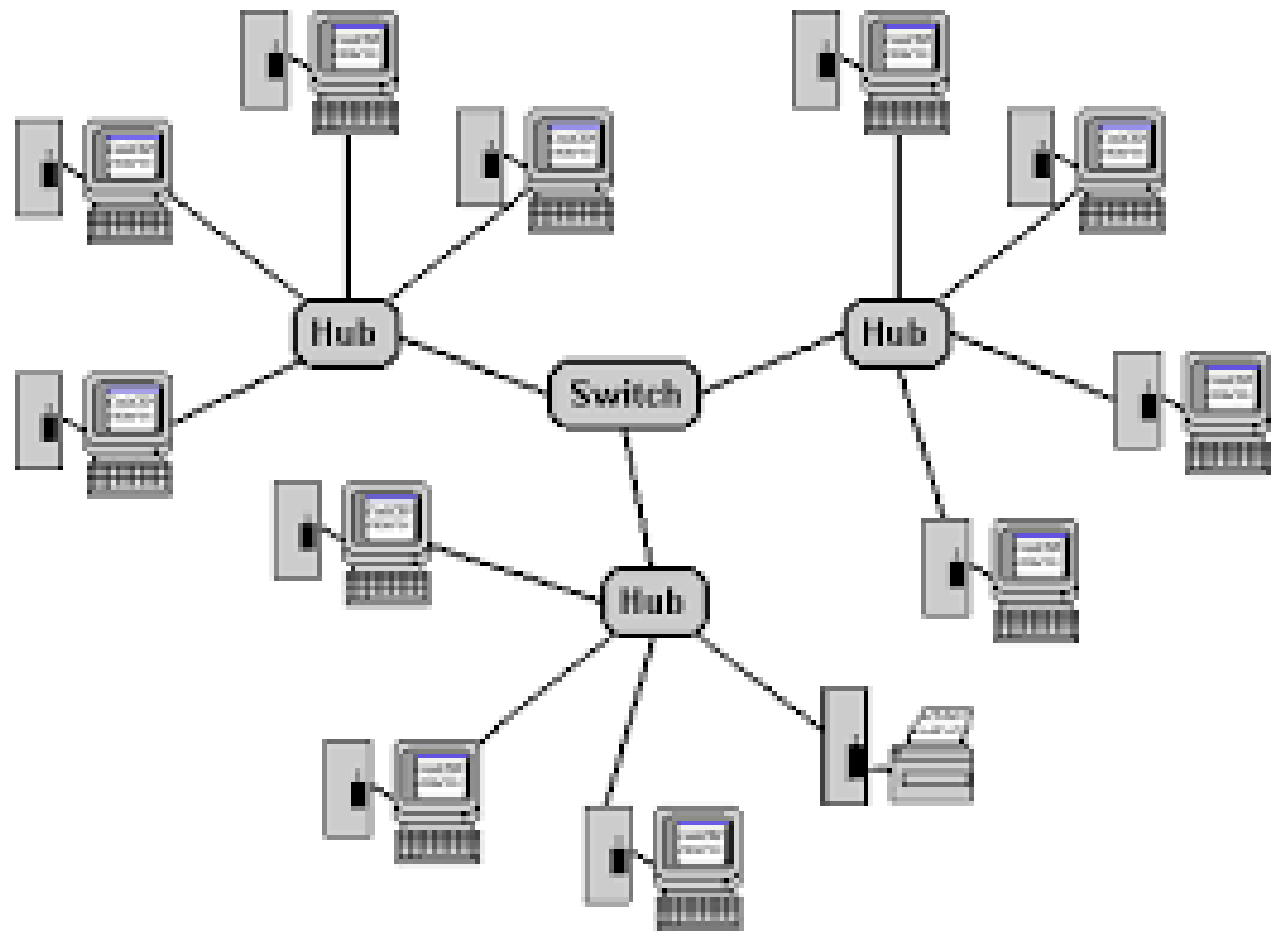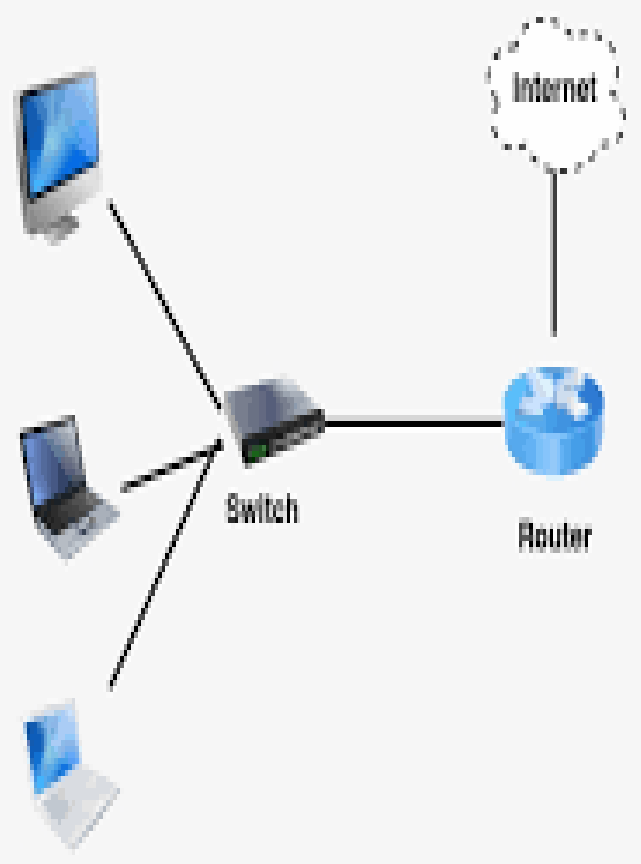REPEATER   HUB   SWITCH

TYPES OF HUB

Active Hub:-

- It has their own power supply and can clean, boost and relay the signal along with the network.

- It serves both as a repeater as well as wiring centre.

- These are used to extend the maximum distance between nodes.

Passive Hub :-

- It collect wiring from nodes and power supply from active hub.

- These hubs relay signals onto the network without cleaning and boosting them

- Can't be used to extend the distance between nodes.

3. SWITCH

❑ A switch is a multiport bridge with a buffer and a design that can boost its efficiency and performance.

❑ A switch is a data link layer device.

❑ The switch can perform error checking before forwarding data that makes it very efficient.

❑ it does not forward packets that have errors and forward good packets selectively to correct port only.

Hub/Switch

4. REPEATER

➤ A repeater operates at the physical layer.

➤ Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted.

➤ To extend the length to which the signal can be transmitted over the same network.

➤ repeaters do not amplify the signal.

➤ signal becomes weak- they copy the signal bit by bit and regenerate it at the original strength.

➤ It is a 2 port device.

Repeater

Weak Signal

Amplified Signal

OSI Model
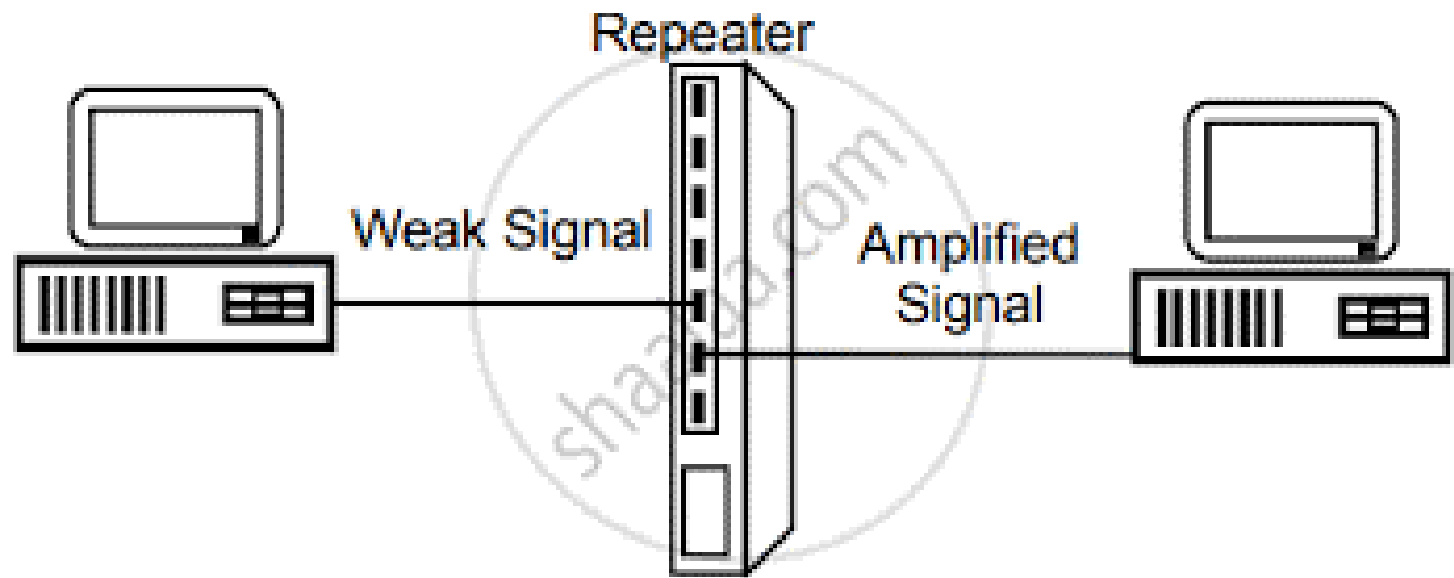
Layer	Description	Data Unit	Device
7. Application	User interface	Data	Gateways
6. Presentation	Data Presentation, encryption, compression, encoding.	Data	Gateways
5. Session	Maintaining sessions	Data	Gateways
4. Transport	Process to process communication, port nos.	Segments	Gateways
3. Network	Logical addressing, source to destination delivery.	Packets	Routers
2. Data-Link	Physical addressing, Node to Node delivery.	Frames	Switches, Bridges
1. Physical	Moves bits between devices	Bits	Hubs, Repeaters

Bridge

- A bridge operates at data link layer.

- A bridge is a repeater, with add on the functionality of filtering content by reading the MAC addresses of source and destination.

- It is also used for interconnecting two LANs working on the same protocol.

- It has a single input and single output port, thus making it a 2 port device.
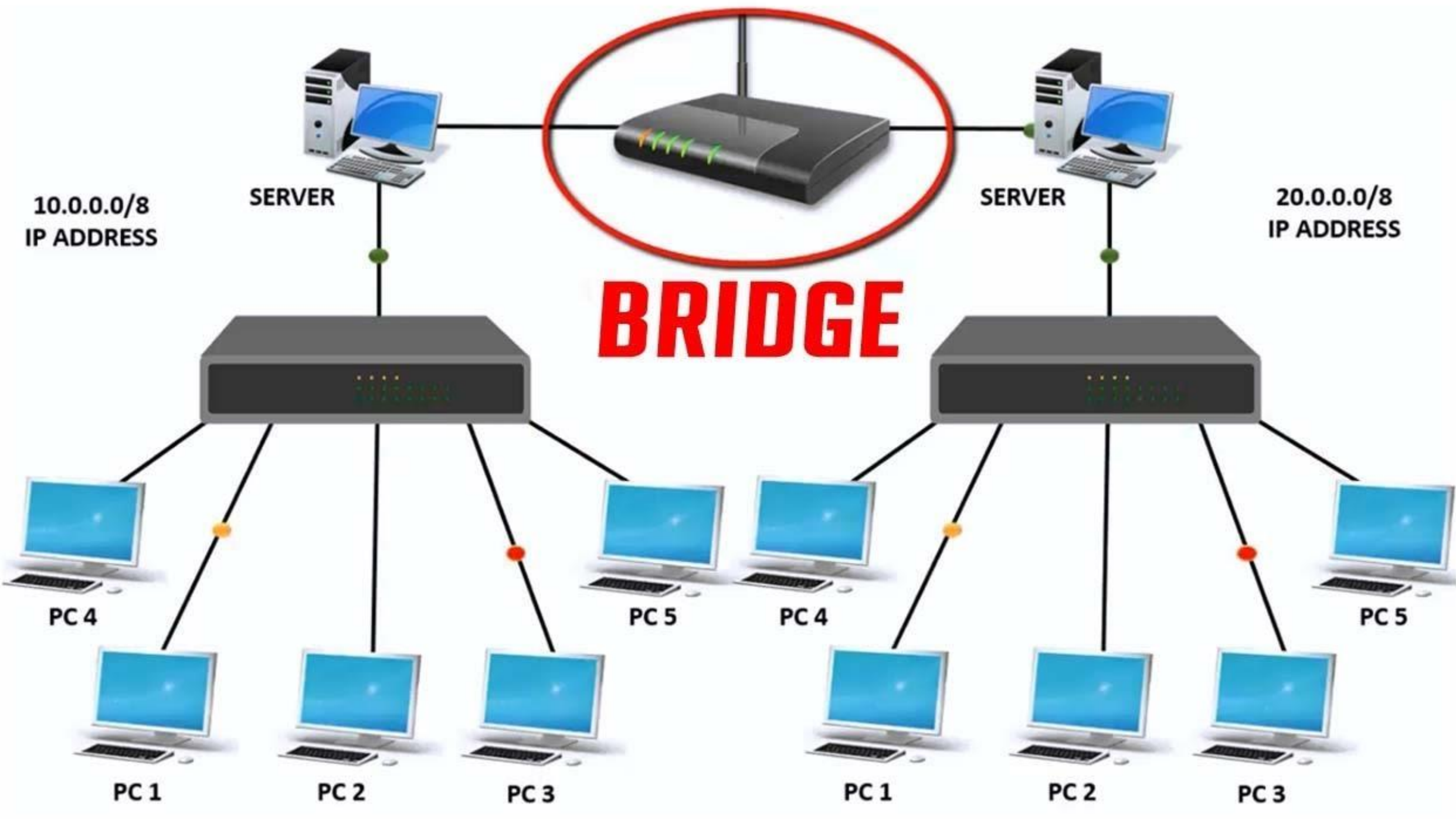
Bridge

Bridged LAN Network

❑ A **network bridge** is a computer networking device that creates a single aggregate network from multiple communication networks or network segments.

❑ If one or more segments of the bridged network are wireless, the device is known as a **wireless bridge**.

Network Hardware

there are two types of transmission technology that are in widespread use:

broadcast links and **point-to-point** links.

Point-to-point links connect individual pairs of machines. To go from the source to the destination on a network made up of point-to-point links, short messages, called **packets** in certain contexts, may have to first visit one or more intermediate machines. Often multiple routes, of different lengths, are possible, so finding good ones is important in point-to-point networks. Point-to-point transmission with exactly one sender and exactly one receiver is sometimes called **unicasting**.