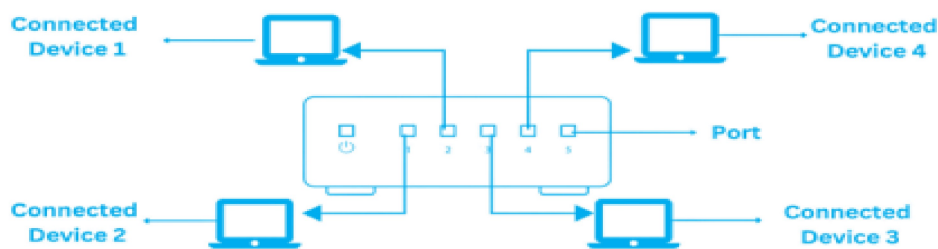


EXPERIMENT NO.1

1. Hub

A hub is a simple connectivity device that connects cables, forming a network segment. It serves as a repeater for long-distance data and retransmits without filtering. It handles both digital and analog data when configured appropriately.



Types of Hub :-

- **Active Hub**
- **Passive Hub**
- **Intelligent Hub**

Advantages of Network Hubs

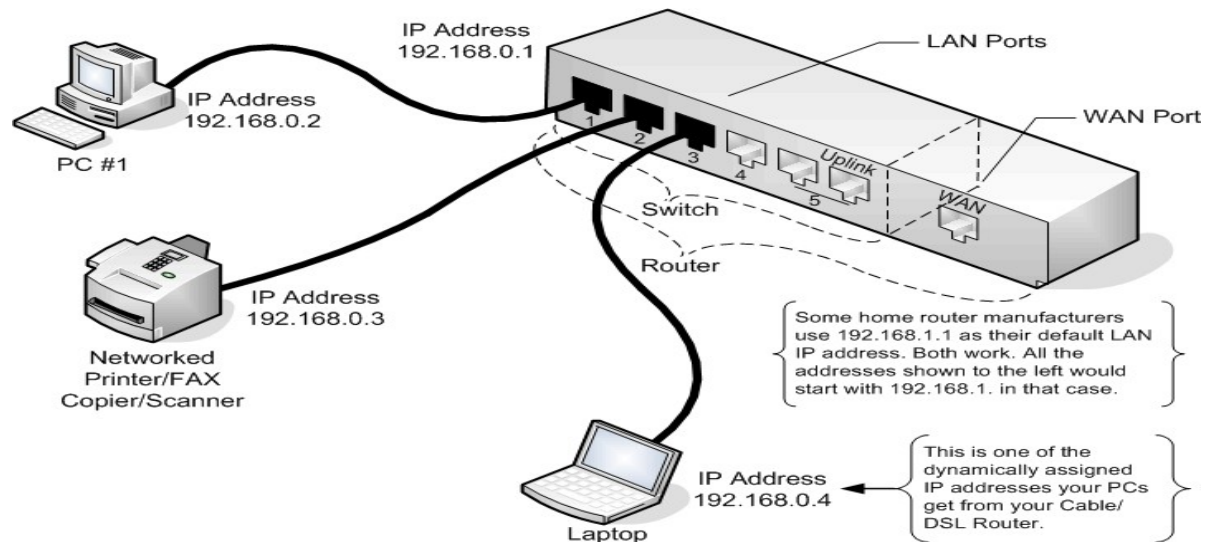
- It is less expensive.
- It does not impact network performance.
- Hub support different network media.

Disadvantages of Network Hubs

- It cannot find the best/ shortest path of the network.
- No mechanism for traffic detection.
- No mechanism for data filtration.

2. Switch

A switch is more advanced than a hub. It intelligently forwards data based on hardware addresses. Switches enhance network efficiency and security by making forwarding decisions using TCP/IP protocol headers. Additionally, multilayer switches can function as both a switch and a router.



Types of Switches :-

- Unmanaged Switches:
- Managed Switches
- Smart Switches
- Layer 2 Switches
- Layer 3 switches
- PoE Switches
- Gigabit switches
- Rack-Mounted Switches
- Desktop Switches
- Modular Switches

Advantages of Switches

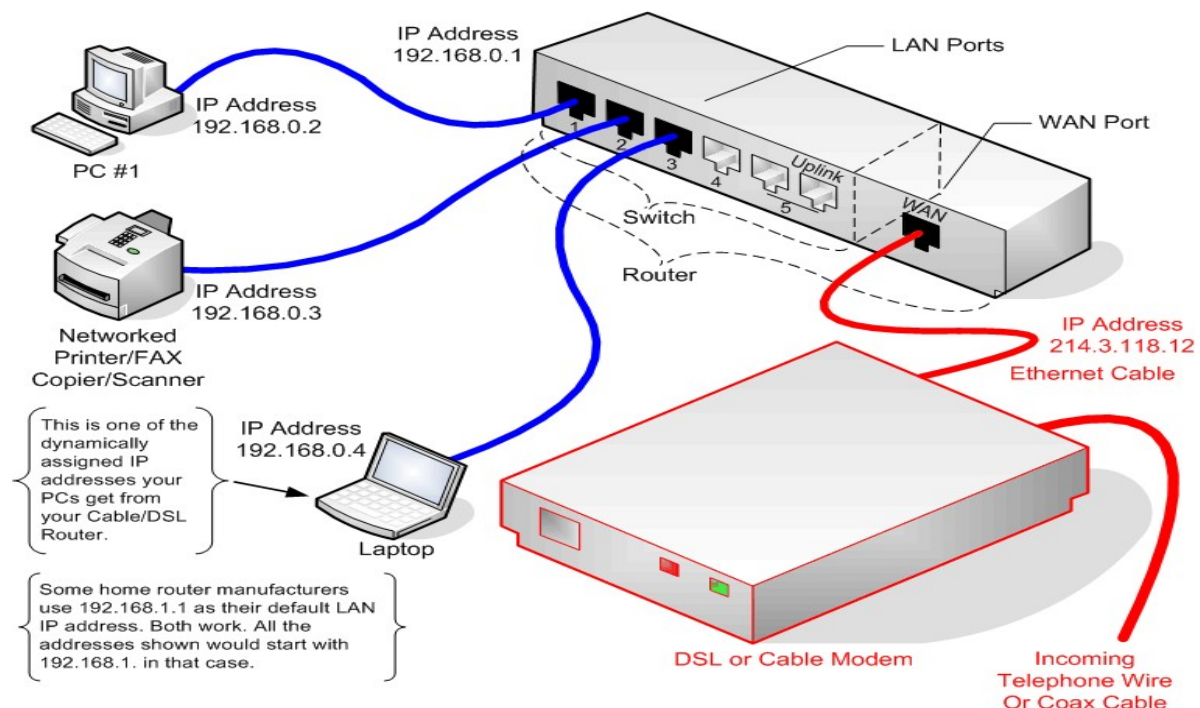
- Prevents traffic overloading in a network by segmenting the network into smaller subnets.
- Increases the bandwidth of the network.
- Less frame collision as the switch creates the collision domain for each connection.

Disadvantages of Switches

- It can not stop traffic destined for a different LAN segment from traveling to all other LAN segments.
- Switches are more expensive.

3. Router

Routers can filter and forward data using logical addresses like IP addresses. They store network information, act as packet-filtering firewalls, and play a vital role in controlling and optimizing network traffic.



Types of Routers :-

- **Broadband Routers**
- **Wireless routers**
- **Wired Routers**
- **Edge Routers**
- **Core Routers**
- **Virtual Router**
- **Portable Routers**

Advantages of a Router:

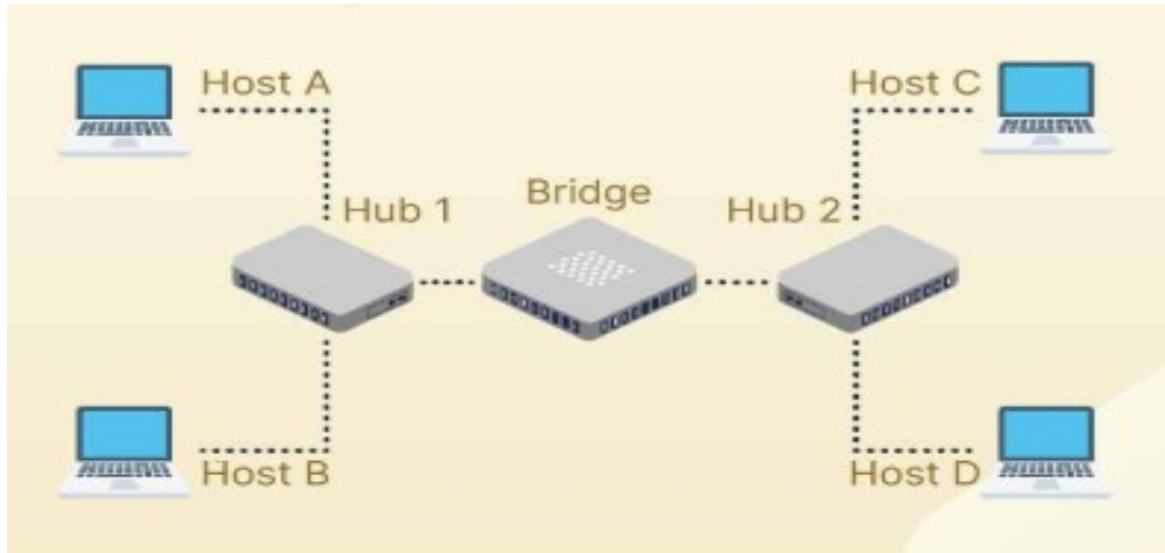
- **Easier Connection:** Allows multiple devices to share a single internet connection, increasing productivity.
- **Security:** Acts as an intermediary between networks, offering a layer of security.
- **NAT Usage:** Maps private IPs to a single public IP, improving internet flow.
- **Supports Dynamic Routing:** Optimizes network communication and reduces traffic.
- **Packet Filtering:** Filters packets based on rules for better network management.

Disadvantages of a Router:

- **Slower Speeds:** Analyzing multiple layers can slow down connections, especially with many devices.
- **High Cost:** Routers are more expensive compared to other networking tools.
- **Need for Configuration:** Requires professional setup, adding to the cost.
- **Quality Issues:** Signal interference may occur, particularly in crowded environments.

4. Bridge

A bridge is a networking device that filters and forwards packets based on physical addresses, connecting different network segments. It manages data flow between segments and is beneficial for dividing extensive networks into smaller sections.



Types of Bridges

There are three types of bridges in computer networks, which are as follows:

- **Transparent Bridge**
- **Source Routing Bridge**
- **Translational Bridge**

Advantages of a Router:

- **Easier Connection:** Allows multiple devices to share a single internet connection, increasing productivity.
- **Security:** Acts as an intermediary between networks, offering a layer of security.
- **NAT Usage:** Maps private IPs to a single public IP, improving internet flow.
- **Supports Dynamic Routing:** Optimizes network communication and reduces traffic.

- **Packet Filtering:** Filters packets based on rules for better network management.

Disadvantages of a Router:

- **Slower Speeds:** Analyzing multiple layers can slow down connections, especially with many devices.
- **High Cost:** Routers are more expensive compared to other networking tools.
- **Need for Configuration:** Requires professional setup, adding to the cost.
- **Quality Issues:** Signal interference may occur, particularly in crowded environments.
- **Bandwidth Shortages:** Dynamic routing can cause network overhead, reducing bandwidth.

5. Firewall

A firewall (hardware or software) operates at various OSI Model layers, protecting networks from unauthorized access or malicious attacks. It enforces rules to control packet flow, ensuring network security through encryption, authentication, logging, and auditing.



Types of Network Firewalls :-

- **Stateful Inspection Firewalls**
- **Software Firewall**
- **Hardware Firewall**
- **Cloud Firewall**

Advantages of Using a Firewall:

- **Protection from Unauthorized Access:** Blocks malicious traffic and unauthorized access from specific IPs.
- **Prevention of Malware:** Can block traffic linked to malware, enhancing security.
- **Control of Network Access:** Restricts access to certain resources or services for specific users.
- **Monitoring Network Activity:** Tracks and records all network activity for security purposes.
- **Regulation Compliance:** Helps meet industry-specific security regulations.
- **Network Segmentation:** Divides large networks into smaller subnets, improving security.

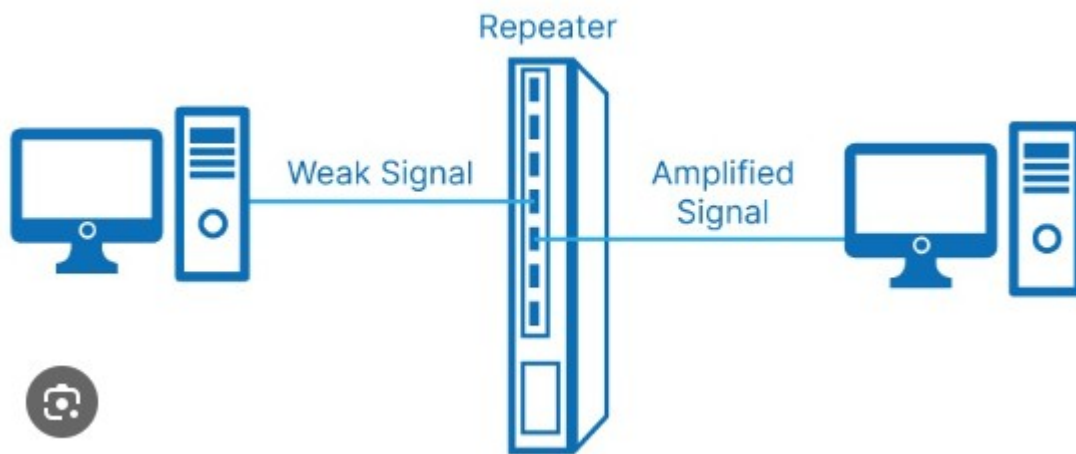
Disadvantages of Using a Firewall:

- **Complexity:** Setting up and maintaining firewalls can be time-consuming and difficult.
- **Limited Visibility:** May miss security threats at the application or endpoint level.
- **False Sense of Security:** Over-reliance on firewalls can neglect other security measures.
- **Limited Adaptability:** Rule-based firewalls may struggle with new, unknown threats.
- **Performance Impact:** Can slow down network performance if handling high traffic.
- **Limited Scalability:** Multiple firewalls may be needed for larger networks, adding cost.

- **Limited VPN Support:** Some firewalls may not support advanced VPN features.
- **Cost:** Purchasing additional features or devices can be expensive for businesses.

6. Repeater

A repeater is an electronic device that amplifies received signals and extends signal transmission over longer distances. It is specifically beneficial for standard LAN cables.



Types of Repeaters :-

- Analog Repeater
- Digital Repeater
- Wired Repeaters
- Wireless Repeaters
- Local Repeaters
- Remote Repeaters
- Microwave Repeater
- Optical Repeater
- Radio Repeater
- Telephone Repeater

Advantages of a Repeater:

- **Better Network Performance:** Enhances network performance by reducing processing overhead.
- **Cost-Effective:** Repeaters are more affordable compared to other network devices.
- **Extends Network Range:** Extends the reach of a network for data transmission.
- **No Physical Barriers:** Wireless repeaters overcome physical barriers to signal transmission.
- **Enhanced Signals:** Improves signal strength over long distances, especially between devices like computers and routers.

Disadvantages of a Repeater:

- **Network Traffic:** Cannot segment network traffic, leading to potential congestion.
- **No Network Segmentation:** Cannot separate traffic between different network segments.
- **Limited Number of Repeaters:** Too many repeaters can cause packet collisions and increased noise.
- **Collision Domain:** Cannot isolate devices, leading to potential collisions in the network.

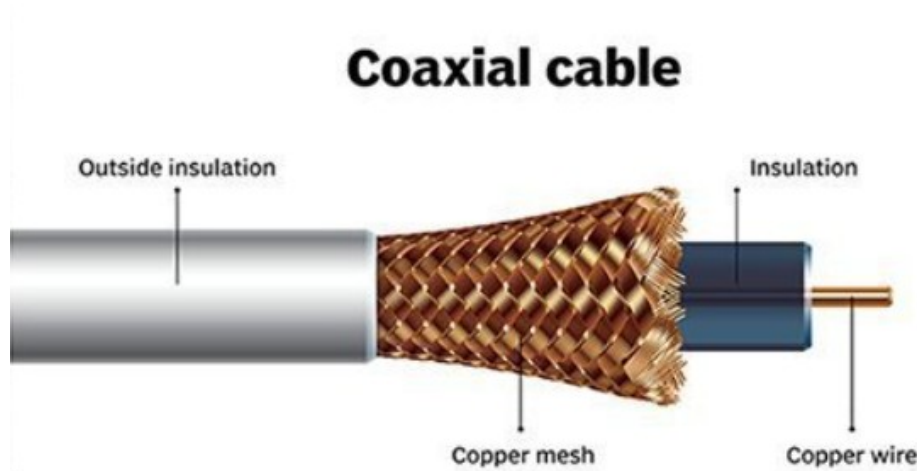
Types of Ethernet Cables :-

Mainly there are three types of ethernet cables used in LANs

- Coaxial Cables
- Twisted Pair Cables
- Fiber optic Cables

1. Coaxial Cables

- **Coaxial cables** contain a centre conductor and a metal shield insulated by a plastic layer placed in between. The metal shield in coaxial cables blocks any elements or interferences from the outside.
- In a coaxial cable, the outer layer, known as sheath, protects the cable from physical damage. Meanwhile, the metal shield protects the cable from any external interference, and the insulation between the metal shield and the conductor protects the conductor – the core of the coaxial cable.



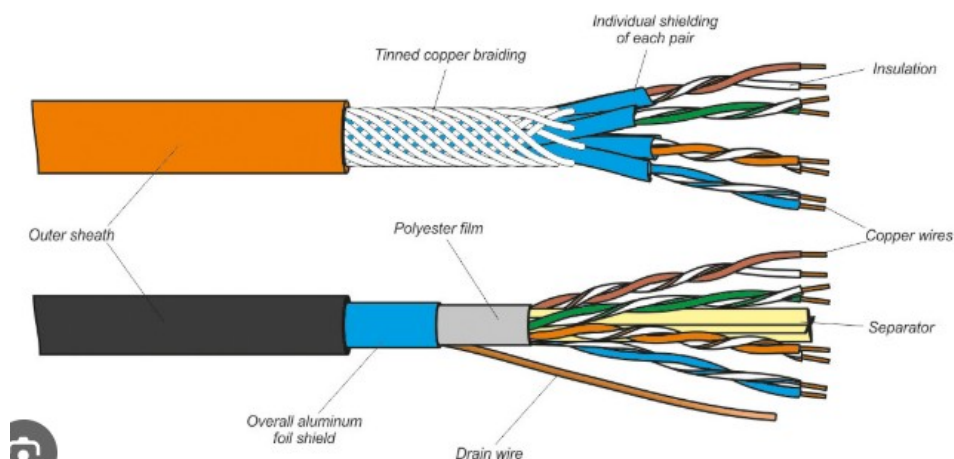
Types of Coaxial Cables :-

- **Hardline Coaxial Cable:** It is used in applications where high signal strength is required, this type is most commonly used. They are used in internet lines and telephone lines.

- **RG-6 Coaxial Cable:** It is used where better signal quality is required; it has a thicker dielectric insulator, they are used in broadband internet, cable TV, etc.
- **Tri-Axial Cable:** They offer more bandwidth and interference rejection; they use an additional copper braid shield. Commonly used in connecting cameras and cable TVs. Etc.

2. Twisted Pair Cables :-

- A twisted pair is a copper wire cable in which two insulated copper wires are twisted around each other to reduce interference or crosstalk. It uses 10BASE-T, 100BASE-T, and some other newer ethernet variants. It uses RJ-45 connectors.



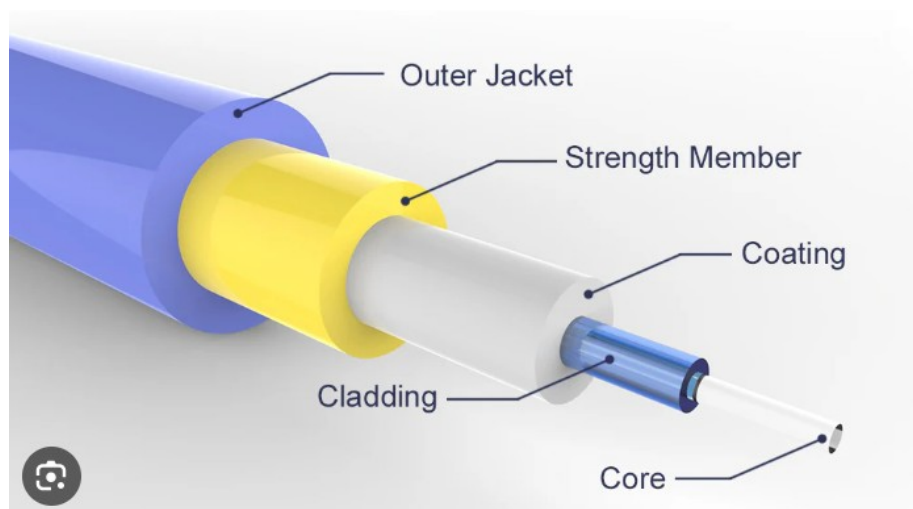
Types of Twisted Pair Cable

- **Shielded Twisted Pair (STP) Cable:** In STP the wires are covered by a copper braid covering or a foil shield, this foil shield adds a layer that protects it against interference leaking into and out of the cable. Hence, they are used for longer distances and higher transmission rates.

- **Unshielded Twisted Pair (UTP) Cable:** Unshielded twisted pair cable is one of the most commonly used cables in computer networks at present time. UTP consists of two insulated copper wires twisted around one another, the twisting of wires helps in controlling interference.

3. Fiber Optic Cable :-

- Fiber optic cables use optical fibers which are made of glass cores surrounded by several layers of covering material generally made of PVC or Teflon.
- It transmits data in the form of light signals due to which there are no interference issues in fiber optics.
- Fiber optics can transmit signals over a very long distance as compared to twisted pairs or coaxial cables. It uses 10BaseF, 100BaseFX, 100BaseBX, 100BaseSX, 1000BaseFx, 1000BaseSX, and 1000BaseBx ethernet variants. Hence, it is capable of carrying information at a great speed.



Types of Fiber Optics Cable

- **Single-Mode Fiber:** It uses one single ray of light to transmit data. It is used for long-distance transmission.

Multi-Mode Fiber: It uses multiple light rays to transmit data. It is comparatively less expensive.