**Date: 8/8/2025**

# Lab Practical #02:

Study of different network devices in detail.

## Practical Assignment #02:

1. Give difference between below network devices.
   - Hub and Switch
   - Switch and Router
   - Router and Gateway
2. Working of below network devices:
   - Repeater
   - Modem((DSL and ADSL)
   - Hub
   - Bridge
   - Switch
   - Router
   - Gateway

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# 1.Give difference between below network devices.

## Hub and Switch

| No. | Hub | Switch |
|---|---|---|
| 1 | Operates at OSI Layer 1 (Physical Layer) | Operates at OSI Layer 2 (Data Link Layer) |
| 2 | Broadcasts data to all connected devices | Sends data only to the intended recipient device |
| 3 | Less intelligent – no MAC address learning | More intelligent – uses MAC address table to forward data |
| 4 | More network collisions, less efficient | Fewer collisions due to full-duplex communication |
| 5 | Generally cheaper, but outdated | More expensive but efficient and widely used today |

## Switch and Router

| No. | Switch | Router |
|---|---|---|
| 1 | Operates at OSI Layer 2 (Data Link Layer) | Operates at OSI Layer 3 (Network Layer) |
| 2 | Connects devices within the same network (LAN) | Connects different networks (LAN to WAN or LAN to LAN) |
| 3 | Uses MAC addresses to forward data | Uses IP addresses to route data |
| 4 | No need for IP address configuration | Requires IP address configuration |
| 5 | Mainly used to expand network within a building | Mainly used to provide internet access or connect networks |

## Router and Gateway

| No. | Router | Gateway |
|---|---|---|
| 1 | Operates at OSI Layer 3 (Network Layer) | Can operate at any OSI layer (typically Layer 3 or above) |
| 2 | Connects two or more similar networks (e.g., LAN to LAN) | Connects two dissimilar networks (e.g., a private network to the internet) |
| 3 | Uses IP routing to forward packets | Performs protocol conversion as needed between networks |
| 4 | Commonly used in home and enterprise networks | Acts as an entry/exit point to external networks |
| 5 | Handles packet forwarding and routing | Translates data formats, addresses, or protocols |

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## 2. Working of below network devices:

### 1. Repeater

- A repeater is a network device used to regenerate and amplify signals.
- It operates at the **Physical Layer (Layer 1)** of the OSI model.
- When a signal travels over long distances, it weakens or degrades.
- The repeater receives this weak signal, strengthens it, and retransmits it.
- It helps extend the physical range of a network (e.g., Ethernet).
- Repeaters do **not** filter or route traffic, only regenerate it.
- Commonly used in both wired and wireless communication.
- It does not read the data; only deals with electrical signals.
- Ideal for LAN setups with distance limitations.

### 2. Modem (DSL and ADSL)

- A **Modem** (modulator-demodulator) converts digital data to analog and vice versa.
- **DSL** stands for Digital Subscriber Line, using phone lines for internet.
- **ADSL** is Asymmetric DSL: higher download speed than upload.
- It allows simultaneous voice and data communication.
- Modems are used to connect homes/offices to ISPs.
- Operates between digital networks (PCs) and analog systems (telephone lines).
- The modem modulates outgoing digital signals and demodulates incoming analog.
- Essential for internet access over copper telephone wires.
- Modern DSL modems often come integrated with routers.

### 3. Hub

- A **hub** is a basic networking device that connects multiple computers.
- Operates at the **Physical Layer (Layer 1)** of the OSI model.
- It simply repeats incoming data to all ports, regardless of the recipient.
- Causes unnecessary traffic and increases chances of data collisions.
- Hubs do not use MAC addresses or perform filtering.
- All connected devices share the same bandwidth.
- Performance degrades with network size and traffic.
- Useful in small, temporary, or legacy networks.
- Largely replaced by switches in modern networks.

### 4. Bridge

- A **bridge** connects two or more separate network segments.
- Operates at the **Data Link Layer (Layer 2)**.
- Uses MAC addresses to filter and forward data frames.
- Helps reduce network traffic by dividing a large network into segments.
- Prevents unnecessary traffic from crossing into other segments.
- Useful in managing congestion and improving performance.
- Can be hardware-based or software-based.

- Typically used in LAN environments.
- Unlike routers, bridges do not use IP addresses.

## 5. Switch

- A **switch** is a smart device that connects multiple devices within a LAN.
- Works at the **Data Link Layer (Layer 2)**, sometimes Layer 3 for advanced models.
- Uses MAC address tables to forward data to the intended device only.
- Reduces unnecessary traffic and collisions compared to hubs.
- Supports full-duplex communication, increasing efficiency.
- Improves bandwidth usage and network performance.
- Each port on a switch has its own collision domain.
- Widely used in modern Ethernet networks.
- Some switches support VLANs and Layer 3 routing.

## 6. Router

- A **router** connects multiple networks, such as LAN to WAN.
- Operates at the **Network Layer (Layer 3)** of the OSI model.
- Uses **IP addresses** to determine the best path for data packets.
- Performs network address translation (NAT) for internet sharing.
- Routes data between different subnets and networks.
- Can provide firewall and DHCP services.
- Essential for internet connectivity in homes and businesses.
- Maintains routing tables for efficient data forwarding.
- Can be wired, wireless, or combined with switches/modems.

## 7. Gateway

- A **gateway** connects two dissimilar networks using different protocols.
- Operates at **any OSI layer**, commonly Layer 3 and above.
- Translates data formats, addresses, or protocols as needed.
- Serves as an entry or exit point for a network.
- Often used when connecting enterprise networks to the internet.
- Converts protocols like TCP/IP to others (e.g., VoIP, email).
- Can be a standalone device or built into routers/firewalls.
- Handles data encapsulation and protocol conversion.
- Acts as a protocol interpreter between incompatible systems.