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

1. Working of below network devices:
   * Repeater
   * Modem((DSL and ADSL)
   * Hub
   * Bridge
   * Switch
   * Router
   * Gateway

# 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| 5 | Generally cheaper, but outdated | More expensive but efficient and widely used today |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 |

# 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.

## 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.

## 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.

## 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.

## 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.

## 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.