**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

# Hub and Switch

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| No. | Hub | Switch |
| 1 | Hub is operated on Physical layer of OSI model. | While Switch is operated on Data link layer of  OSI model. |
| 2 | Hub is a broad cast type transmission. | While Switch is a Unicast, multicast and  Broadcast type transmission. |
| 3 | In Hub, there is only one collision domain. | While in switch**,** different ports have own Collision domain |
| 4 | Hub sends data in the form of binary bits | Switch sends data in the form of frames |
| 5 | Cheaper as compare to switch | Expensive as compare to Hub |

# Switch and Router

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| No. | Switch | Router |
| 1 | While the main objective of switch is to connect various devices simultaneously. | The main objective of router is to connect various networks simultaneously. |
| 2 | While it works in data link layer. | It works in network layer. |
| 3 | While switch is used by only LAN. | Router is used by LAN as well as MAN. |
| 4 | While through switch data is sent in the form of frame. | Through the router, data is sent in the form  of packets. |
| 5 | Maximum speed is 10Mbps to 100Mbps. | maximum speed for wireless is 1-10 Mbps and maximum speed for wired connections is 100Mbps. |

# Router and Gateway

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| No. | Router | Gateway |
| 1 | A device that forwards data between networks based on IP addresses. | A device or software that connects two different networks using different protocols. |
| 2 | Routes packets between similar networks (e.g., LAN to WAN). | Acts as a protocol converter between dissimilar networks. |
| 3 | The main function of a router is routing the  Traffic from one network to the other. | The main function of agate way is to  Translate one protocol to the other. |
| 4 | It is hosted on only the dedicated applications | It is hosted on dedicated applications,  Physical servers or virtual applications. |
| 5 | The additional features provided by a router are Wireless networking, Static routing, NAT, DHCP server. | The additional features provided by a gateway are network access control, protocol, conversion. |

# Working of below network devices:

1. Switch
   * **Layer2Device**: Operates at the Data Link Layer (Layer 2) of the OSI model.
   * **MAC Addresses**: Uses MAC (Media Access Control) addresses to identify and forward data to the correct destination.
   * **Packet Switching**: When a device sends data, the switch receives it and looks at the MAC address to determine the appropriate port to forward the data to.
   * **Learning**: Switches maintain a MAC address table (or CAM table) where they learn and store the MAC addresses of devices connected to each port.
2. Router
   * **Layer3Device**: Operates at the Network Layer (Layer 3) of the OSI model.
   * **IP Addresses**: Uses IP addresses to determine the best path to forward packets to their destination.
   * **Routing Tables**: Maintains a routing table with information about different networks and the best routes to reach them.
   * **Routing Protocols**: Uses routing protocols (like OSPF, BGP, and EIGRP) to dynamically learn about network topology changes and update the routing table.
   * **NAT**: Often performs Network Address Translation (NAT), allowing multiple devices on a LAN to share a single public IP address for Internet access.
3. Gateway
   * **Protocol Translation**: Performs protocol conversion to ensure communication between different network architectures or systems (e.g., from TCP/IP to another protocol).
   * **Application Layer**: Can operate at various layers of the OSI model, often at the Application Layer (Layer 7), but also at lower layers depending on the function.
   * **Security and Filtering:** Often in corporate security functions like firewall, capabilities, filtering, and traffic management.
   * **Connectivity**: Provides connectivity between different networks, such as connecting a local network to the Internet or bridging different network environments.
4. Repeater
   * **Layer1Device**: Operates at the Physical Layer (Layer 1) of the OSI model.
   * **Signal Booster**: Amplifies and regenerates weak signals to extend the transmission range.
   * **No Addressing**: Doesn’t use IP or MAC addresses.
   * **Extends Network Distance**: Used to extend the physical reach of wired or wireless networks.
   * **No Protocols**: Does not use routing or data protocols.
   * **Simple Device**: Acts as a basic signal repeater, with no data filtering or intelligence.
5. Modem (DSL and ADSL)
   * **Layer 1 & 2 Device**: Operates mainly at the Physical Layer (Layer 1) and sometimes at Data Link Layer (Layer 2).
   * **Modulation/Demodulation**: Converts digital signals to analog (for transmission over telephone lines) and vice versa.
   * **DSL/ADSL Support**: Used for Digital Subscriber Line (DSL) and Asymmetric DSL (ADSL) internet connections over telephone lines.
   * **Internet Access**: Connects the home/office network to the ISP (Internet Service Provider).
   * **Bridge Mode**: Can work in bridge mode (passing traffic to a router) or have built-in router functionality in some models.
   * **One Device Connection**: A standalone modem usually connects one device at a time, unless paired with a router.
6. Hub
   * **Layer 1 Device:** Operates at the Physical Layer (Layer 1) of the OSI model.
   * **Broadcasts Data**: Forwards incoming data to all ports, regardless of the destination.
   * **No Addressing**: Does not use MAC or IP addresses.
   * **One Collision Domain**: All connected devices share the same collision domain.
   * **Simple Device**: Basically a multi-port repeater — no intelligence involved
   * **Use Case**: Mostly obsolete — replaced by switches in modern networks.
7. Bridge
   * **Layer 2 Device:** Operates at the Data Link Layer (Layer 2) of the OSI model.
   * **MAC Address Filtering**: Uses MAC addresses to forward or block traffic.
   * **Network Segmentation**: Divides a large network into smaller collision domains, reducing traffic.
   * **Forwarding Decisions**: Learns MAC addresses and forwards frames only to the correct segment.
   * **Two or More Ports**: Typically connects two LAN segments.