Date: 13/06/2025

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

Hub and Switch

No.	Hub	Switch
1	OSI Layer: Works at the Physical Level (Layer 1).	OSI Layer: Works at the Data Link Layer (Layer 2) (Layer 3 for advanced switches).
2	Data Forwarding: Broadcasts data to all connected devices, regardless of destination.	Data Forwarding: Forwards data to the specific port based on MAC address.
3	Collision Domain: One shared collision domain; more data collisions.	Collision Domain: Each port has its own collision domain, reducing collisions.
4	Intelligence: No filtering or decision-making; cannot identify the destination device.	Intelligence: Learns MAC addresses and makes intelligent forwarding decisions.
5	Efficiency: Low; causes unnecessary traffic and slower network performance.	Efficiency: High; minimizes network traffic and improves performance.

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Switch and Router

No.	Switch	Router
1	OSI Layer: Operates mainly at the Data Link Layer (Layer 2) (Layer 3 for advanced switches).	OSI Layer: Operates at the Network Layer (Layer 3).
2	Function: Connects devices within the same network (LAN) and forwards data based on MAC addresses.	Function: Connects different networks (e.g., LAN to WAN) and routes data based on IP addresses.
3	Collision Domain: Each port has a separate collision domain, improving performance.	Collision Domain: Each port has its own collision domain.
4	Broadcast Domain: Same broadcast domain unless VLANs are used.	Broadcast Domain: Divides broadcast domains, enhancing network isolation.
5	Routing: Cannot route data between different networks (unless it's a Layer 3 switch).	Routing Table: Uses a routing table to determine the best path for data packets.

Router and Gateway

No.	Router	Gateway
1	OSI Layer: Works at the Network Layer (Layer 3).	OSI Layer: Can work at any OSI layer (Layer 3 and above).
2	Function: Routes data between different networks using IP addresses.	Function: Connects and translates data between different protocols/networks.
3	Protocol Handling: Works within similar network protocols (like TCP/IP).	Protocol Handling: Acts as a protocol converter (e.g., TCP/IP to AppleTalk).
4	Routing Table: Uses a routing table to choose the best path for data.	Routing: Does not just route; it also converts and reformats data.
5	Common Use: Connects a local network (LAN) to the internet (WAN).	Common Use: Used when two different systems or architectures need to communicate.

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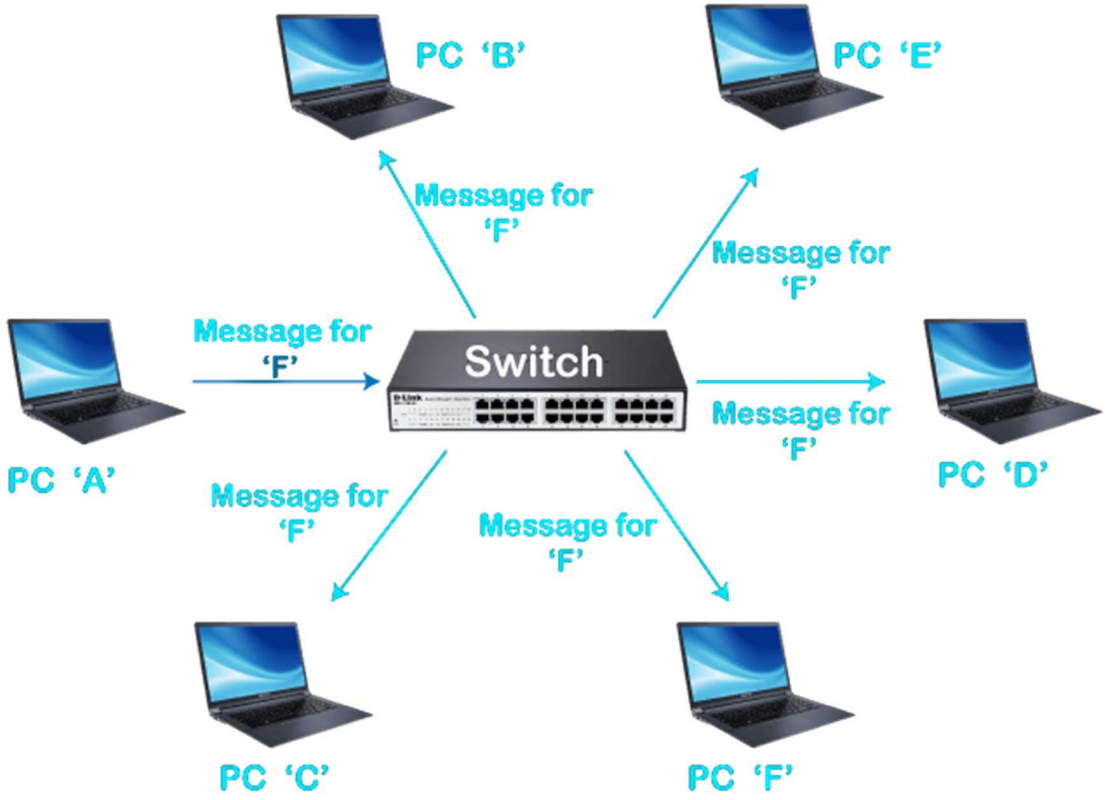
Working of below network devices:

1. Switch

   A switch is a multiport bridge that works at the data link layer (Layer 2) of the OSI model.
   It uses MAC addresses to forward data only to the correct port, improving network efficiency.
   Switches can check for errors before forwarding packets and help reduce collisions by dividing the collision domain for each connected device.
   However, the broadcast domain remains the same.

   Types of Switches
   1. Unmanaged Switch: Plug-and-play; no setup needed. Good for small networks.
   2. Managed Switch: Offers full control (e.g., VLANs, QoS). Used in large networks.
   3. Smart Switch: Limited management features; simpler than managed switches.
   4. Layer 2 Switch: Works at Data Link Layer; forwards within same network.
   5. Layer 3 Switch: Works at Network Layer; can route between networks.
   6. PoE Switch: Sends power and data through one Ethernet cable.
   7. Gigabit Switch: Supports high-speed (1 Gbps+) Ethernet connections.
   8. Rack-Mounted Switch: Fits in server racks; ideal for data centers.
   9. Desktop Switch: Small, compact; for home/small office use.
   10. Modular Switch: Customizable with additional modules; for large networks.



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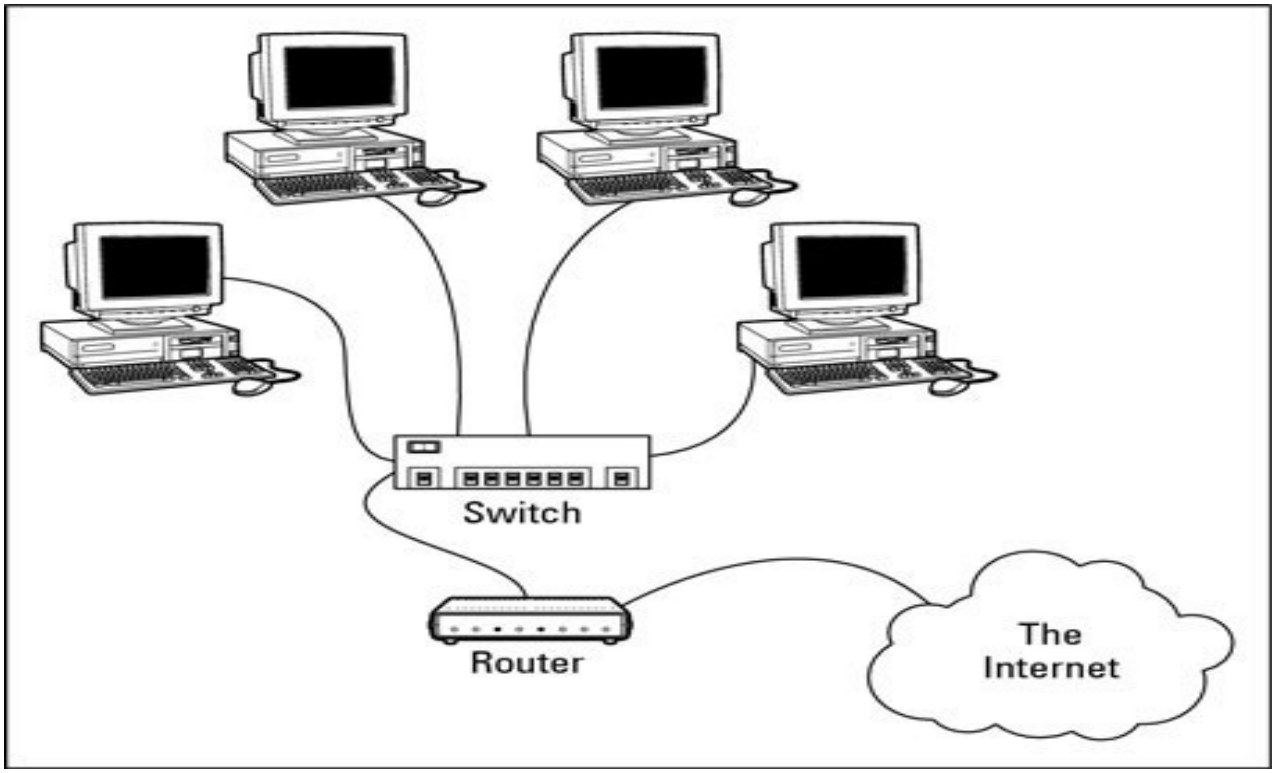
2. Router

   A router is a network device that works at the network layer (Layer 3) of the OSI model.
   It routes data packets based on IP addresses and connects different networks like LANs and WANs.
   Routers use a routing table, which is updated dynamically, to decide the best path for data.
   Unlike switches, routers divide broadcast domains, improving network efficiency.



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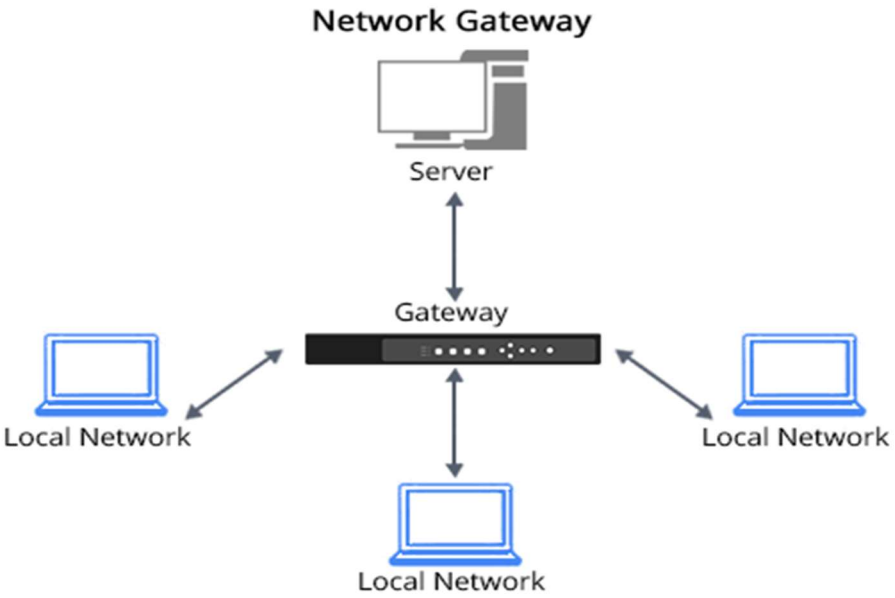
3. Gateway

   A gateway is a network device that connects two different networks using different protocols.

   It acts as a translator, converting data formats so that communication can happen between incompatible systems.

   Gateways are also known as protocol converters and can operate at any layer of the OSI model, depending on their function.

   They are more complex than switches or routers.



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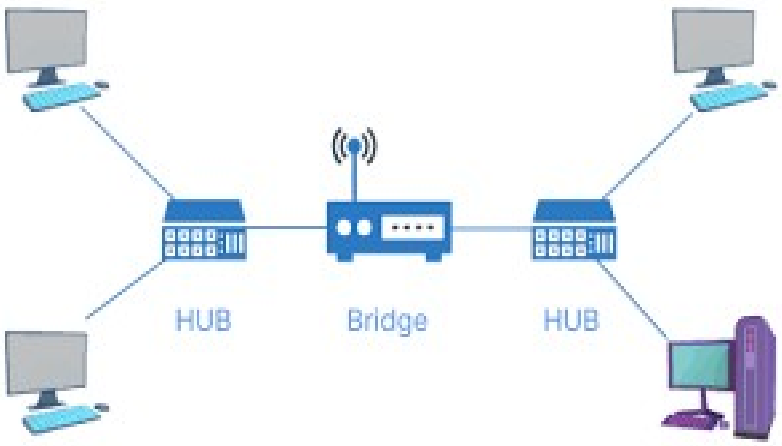
4. Bridge

A bridge is a network device that operates at the data link layer (Layer 2) of the OSI model.
It functions like a repeater, but with the added ability to filter traffic by reading MAC addresses.
Bridges are used to connect two or more LAN segments working on the same protocol.
Each port is connected to a different segment, and modern multi-port bridges work like Layer 2 switches.

Types of Bridges

1. Transparent Bridge: Devices don't know the bridge exists. It uses bridge forwarding and bridge learning to manage traffic.
2. Source Routing Bridge: The source device chooses the route. It uses a special discovery frame to find all possible paths to the destination.



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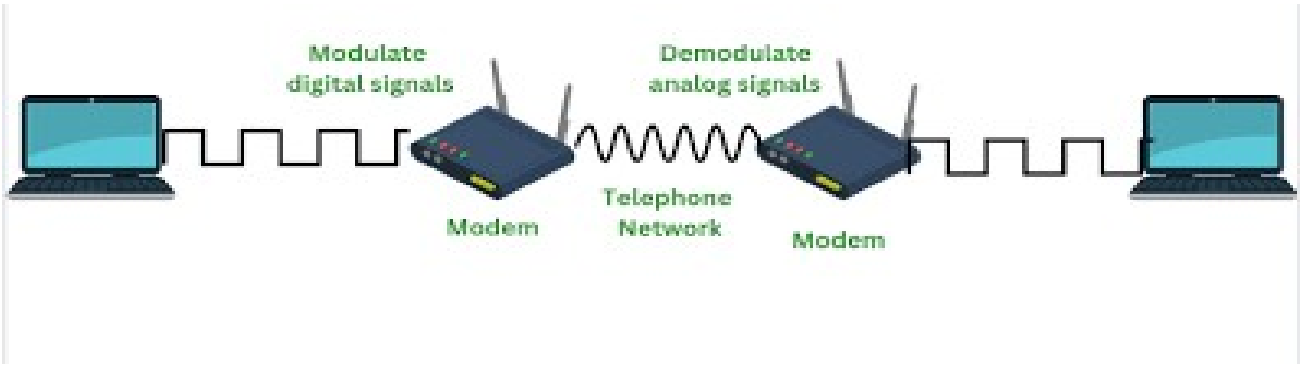
5. Modem

A modem is a network device that operates at the physical layer (Layer 1).
It converts digital signals into analog signals for transmission over phone lines or cables, and then converts them back to digital signals at the receiving end. This process is called modulation and demodulation.
Modems are commonly used to connect to the internet through an Internet Service Provider (ISP).

Types of Modems

1. DSL Modem: Uses telephone lines; slower than cable.
2. Cable Modem: Uses TV cables; faster than DSL.
3. Wireless Modem: Connects via Wi-Fi; no physical cables.
4. Cellular Modem: Uses mobile data (3G/4G/5G); works without Wi-Fi or wires.



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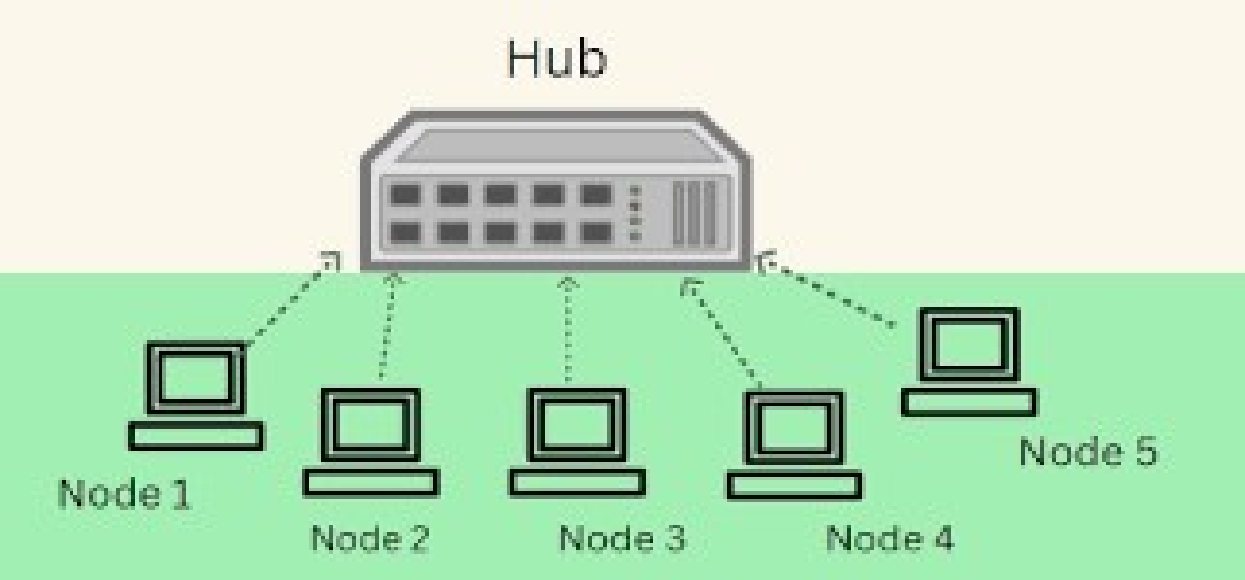
6. Hub

A hub is a multiport repeater that works at the physical layer (Layer 1) of the OSI model.
It connects multiple devices (like in a star topology) and broadcasts incoming data to all connected devices, regardless of the destination.
It cannot filter data or choose the best path, so all devices share the same collision domain, leading to more data collisions and inefficiency.

Types of Hubs

1. Active Hub: Has power supply; amplifies and forwards signals. Extends network range.
2. Passive Hub: No amplification; just passes signals. Does not extend range.
3. Intelligent Hub: Like active hub but with management features, monitoring, and flexible data rates.



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7. Repeater

A repeater is a network device that operates at the physical layer (Layer 1) of the OSI model.
Its main function is to regenerate and amplify weak or corrupted signals to extend the distance a signal can travel over a network without degradation.
Repeaters take the incoming signal, copy it bit by bit, clean it up (remove noise), and retransmit it at its original strength.
This helps maintain the quality of the signal over long distances.
A repeater typically has two ports—one for receiving the signal and one for forwarding it.
Repeaters are commonly used in star topology networks to connect different segments and ensure smooth communication.