



**Date: 13 / 7 /2024**

### **Lab Practical #03:**

Study of different network devices in detail.

### **Practical Assignment #03:**

1. Give difference between below network devices.
  - Hub and Switch
  - Switch and Router
  - Router and Gateway
2. Working of below network devices:
  - Switch
  - Router
  - Gateway

### **Hub and Switch**

No.	Hub	Switch
1	A basic network device that connects multiple devices in a network.	A network device that connects devices and manages data traffic intelligently.
2	Broadcasts data to all connected devices.	Uses MAC addresses to forward data only to the intended recipient.
3	Less efficient, as data is sent to all devices, causing potential network congestion.	More efficient, as data is sent only to the intended device.
4	Higher chance of collisions due to half-duplex communication.	Minimizes collisions using full-duplex communication.
5	Usually cheaper as it lacks advanced features.	Generally more expensive due to advanced features.

### **Switch and Router**

No.	Switch	Router
1	A network device that connects devices within a local area network (LAN) and manages data traffic.	A network device that connects multiple networks and directs data between them.
2	Forwards data within a single network based on MAC addresses.	Routes data between different networks based on IP addresses.
3	Operates at the Data Link layer (Layer 2) and sometimes at the Network layer (Layer 3).	Operates at the Network layer (Layer 3).
4	Uses MAC addresses to forward data to specific devices within the same network.	Uses IP addresses to forward data to different networks.
5	Typically does not include firewall capabilities.	Often includes firewall capabilities to protect the network from external threats.

## Router and Gateway

No.	Router	Gateway
1	A network device that connects multiple networks and directs data between them based on IP addresses.	A device that connects different types of networks and can translate different network protocols.
2	Routes data packets between different networks, typically using IP addresses.	Acts as an entry and exit point for data to and from different networks, often converting protocols.
3	Operates primarily at the Network layer (Layer 3) of the OSI model.	Can operate at any layer of the OSI model, depending on the specific implementation and purpose.
4	Does not perform protocol translation; works with IP-based networks.	Can perform protocol translation, enabling communication between networks using different protocols.
5	Typically supports VLANs to segment a network into smaller, isolated networks.	Support for VLANs varies depending on the specific type and implementation of the gateway.

## Working of below network devices:

### 1. Switch

#### • Initialization:

- When a switch is powered on, it initializes its hardware and software components.
- It clears its MAC address table, which will be populated as it learns about the devices on the network.

#### • Learning Phase:

- When a device sends a data packet, the switch receives the packet on one of its ports.
- The switch examines the source MAC address of the incoming packet and stores it in its MAC address table along with the port number where the packet was received. This process is known as "learning."

#### • Forwarding/Filtering:

- The switch then examines the destination MAC address of the incoming packet.
- If the destination MAC address is found in the MAC address table, the switch forwards the packet to the corresponding port.
- If the destination MAC address is not found in the MAC address table, the switch forwards the packet to all ports except the one it was received on. This process is called "flooding."



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- Switching Logic:

- **Unicast Traffic:** If the destination MAC address is known, the switch sends the packet only to the specific port that corresponds to the destination device. This reduces network congestion.
- **Broadcast Traffic:** If the packet is a broadcast packet (addressed to all devices in the network), the switch sends the packet to all ports.
- **Multicast Traffic:** If the packet is a multicast packet (addressed to a specific group of devices), the switch sends the packet to all relevant ports that belong to the multicast group.

- MAC Address Table Management:

- The switch continuously updates its MAC address table as it learns new MAC addresses and ports.
- Entries in the MAC address table are typically time-stamped and may be removed if they are not used for a certain period to ensure the table remains current.

- Handling Collisions:

- Switches operate in full-duplex mode, which means they can send and receive data simultaneously, significantly reducing the chances of collisions.
- In case of any collision, the switch manages the data flow to ensure efficient communication.

## 2. Router

- The router then examines the destination IP address of the packet to determine where it should be sent. If the destination IP address is on your network, the router sends the packet directly to the device with that IP address. If the destination IP address is not on your network, the router sends the packet to the modem, which then sends the packet to the internet.
- In addition to directing traffic between devices, a router also performs other important functions, such as providing security for your network. Routers often include features such as firewalls and network address translation (NAT), which help protect your network from unauthorized access.

## 3. Gateway

- A gateway acts like a translator and traffic controller at the same time, overseeing communication between different networks. Here's a breakdown of how it works:
- **Connection Point:** Imagine a gateway as an intersection between two different roads. Devices on one network can't directly communicate with devices on another network that uses a different language (protocol) - that's where the gateway comes in. It provides a connection point, allowing devices on separate networks to interact.
- **Traffic Control:** When a device on your home network (like your laptop) wants to access the internet, it sends a data packet to your router (which often acts as a gateway). The gateway intercepts this packet, analyzes it, and figures out where it needs to go. Think of the gateway reading the address on the packet to determine the destination.
- **Protocol Translation:** Networks sometimes use different languages, or protocols, to communicate. Just like you might need a translator to understand someone speaking a different language, a gateway can translate protocols if necessary. This ensures the data is understood by the receiving network.



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- **Security:** Gateways can also act as security guards. They can filter incoming and outgoing traffic based on pre-defined rules, like a firewall keeping out unwanted visitors. This helps protect your network from unauthorized access and malicious traffic.