Switches: L2 and L3

Switches are crucial components in any network, acting as the central point where multiple devices connect to communicate. Switches come in various models and types, each serving a unique purpose in a network infrastructure.

* **Key Functions of Switches:**
  + Forward Frames: Switches direct data frames between devices based on MAC addresses.
  + Populate MAC Address Table: Switches maintain a table of MAC addresses to efficiently route frames.
* **Importance of Switches:**
  + Multiple Ports: Connect multiple devices such as computers, laptops, routers, servers, printers, and cameras.
  + Information Sharing: Facilitate the sharing of information by connecting devices within a network.
* Layer 2 (L2) Switches:
  + OSI Model Layer: Operate at the Data Link Layer (Layer 2).
  + MAC Address Table: Store physical addresses (MAC addresses) in a CAM (Content Addressable Memory) table.
  + ASIC Based: Use Application Specific Integrated Circuits (ASICs) for fast switching decisions, making them intelligent devices.
* Collision Domain Separation: Separate collision domains for connected devices (e.g., printer, camera, server).

**Types of Layer 2 Switches:**

* **Unmanaged Switches:**
  + - Features: Plug and play, no configuration needed, suitable for basic connectivity.
    - Example: Cisco 100 Series.
* **Managed Switches :**
  + - Features : Configurable, greater security, more features.
    - Example : Cisco Nexus Series.

**Layer 2 Switching :**

* + - Functionality : Works only with MAC addresses and performs switching.
    - No IP Handling : Does not handle IP addresses.

**Layer 3 (L3) Switches:**

* + - Layer 2 and More : Performs all functions of Layer 2 switches and operates at the Network Layer (Layer 3).
    - Routing Capabilities : Supports dynamic and static routing.
    - Tables : Utilizes both MAC address tables and routing tables.

**Frame Forwarding :**

* Learning MAC Addresses : Switches learn the MAC addresses of devices connected to the network.

**Example Scenario :**

* PC A MAC Address : 00:00:00:00:00:01.
* Laptop B MAC Address : 00:00:00:00:00:02.
* Initial Ping : When PC A pings Laptop B, the switch learns both MAC addresses.
* Address Resolution Protocol (ARP) : Used to discover the MAC address of devices.
* Frame Forwarding : Once the MAC addresses are learned, the switch forwards frames directly without broadcasting to all ports.

**Summary:**

Switches : Create networks by connecting multiple devices.

Routers : Connect different networks, providing path selection for data transfer.

Switches are fundamental in creating robust, efficient networks, facilitating seamless communication and resource sharing among connected devices. Layer 2 switches are ideal for basic data forwarding based on MAC addresses, while Layer 3 switches add advanced routing capabilities for more complex network environments.