Layer 2 Switch Modes & Related Concepts

The OSI Model (Open Systems Interconnection Model) is a conceptual framework used to describe how data moves through a network in seven layers, from physical transmission to user applications.

Here’s the breakdown from bottom (Layer 1) to top (Layer 7):

| Layer | Name | Main Function | Examples |
| --- | --- | --- | --- |
| 7 | Application | Interfaces directly with the user and provides network services. | HTTP, FTP, SMTP, DNS |
| 6 | Presentation | Formats, encrypts, and compresses data for the application layer. | SSL/TLS, JPEG, MP3 |
| 5 | Session | Manages sessions and connections between devices. | NetBIOS, RPC |
| 4 | Transport | Ensures reliable or unreliable delivery, error checking, and segmentation. | TCP, UDP |
| 3 | Network | Handles logical addressing and routing of data packets. | IP, ICMP, OSPF |
| 2 | Data Link | Provides error detection/correction and physical addressing (MAC). | Ethernet, PPP, Switches |
| 1 | Physical | Transmits raw bits over a physical medium. | Cables, hubs, Wi-Fi radio signals |

1. Introduction to Layer 2 Switches

A Layer 2 switch is a network device that operates at the Data Link Layer of the OSI model.  
It is primarily responsible for switching frames based on MAC addresses.  
Unlike routers (Layer 3), Layer 2 switches don’t look at IP addresses for forwarding decisions.

Key Roles of a Layer 2 Switch:

1. Learning – Records source MAC addresses into a MAC address table (CAM table).
2. Forwarding/Filtering – Sends frames only to the correct destination port.
3. Loop Prevention – Uses Spanning Tree Protocol (STP) to prevent broadcast storms.
4. Segmentation – Divides networks into separate collision domains.

2. Cisco Switch Operating Modes (CLI Levels)

Cisco switches have different modes, each allowing a specific set of commands.

2.1 Privileged EXEC Mode

* Prompt:

Switch#

* Purpose:  
  Access all monitoring commands and some configuration commands.
* Access: From User EXEC mode using:
* Example Commands:

bash

show running-config

show vlan brief

copy running-config startup-config

2.2 Global Configuration Mode

* Prompt:

Switch(config)#

* Purpose:  
  Make changes to the switch’s global settings.
* Access:

bash

Switch# configure terminal

* Example Commands:

bash

hostname Switch1

no ip domain-lookup

2.3 Interface Configuration Mode

* Prompt:

scss

Switch(config-if)#

* Purpose:  
  Configure a specific physical port or interface.
* Access:

bash

Switch(config)# interface FastEthernet0/1

* Example Commands:

bash

switchport mode access

switchport access vlan 10

description Connected\_to\_PC1

2.4 VLAN Configuration Mode

* Prompt:

scss

Switch(config-vlan)#

* Purpose:  
  Create and name VLANs.
* Access:

bash

Switch(config)# vlan 10

* Example Commands:

name STUDENT\_VLAN

3. Related Operational Concepts

3.1 MAC Address Table (CAM Table)

* Stores mapping between MAC addresses and switch ports.
* View using:

bash

show mac address-table

* Process:
  1. Switch learns source MAC from incoming frames.
  2. Stores it in the table with associated port.
  3. Forwards frame based on destination MAC.

3.2 Spanning Tree Protocol (STP)

* Prevents loops in a redundant Layer 2 network.
* STP States:
  + Blocking
  + Listening
  + Learning
  + Forwarding
* View STP status:

bash

show spanning-tree

3.3 Port Types

* Access Port – Belongs to a single VLAN; used for end devices.
* Trunk Port – Carries multiple VLANs between switches.
* Dynamic Port – Negotiates access/trunk via DTP (Dynamic Trunking Protocol).

3.4 Duplex & Speed

* Duplex:
  + Half-Duplex – One-way communication at a time.
  + Full-Duplex – Both ways simultaneously.
* Speed: 10 Mbps, 100 Mbps, 1 Gbps depending on port.
* Configure:

bash

speed 100

duplex full

|  | Running Configuration | Startup Configuration |
| --- | --- | --- |
| Purpose | Holds the active, currently used settings of the switch | Holds the saved settings that load at the next boot |
| Location | Stored in RAM (volatile memory) | Stored in NVRAM (non-volatile memory) |
| When loaded | Loaded immediately when changes are made via CLI | Loaded during switch boot-up |
| Persistence | Lost when the switch is powered off or restarted | Remains intact after reboot |
| How to View | show running-config | show startup-config |
| How to Save Changes | Changes are immediate but temporary | You must copy from running config using:  copy running-config startup-config or write memory |

Lab Work:

* Some basic switch commends (CLI)
* Change host name
* Create New User
* Show configuration
* Show vlan
* Switch between different modes