

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.
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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).
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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)

	Running Configuration	Startup Configuration
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	<code>show running-config</code>	<code>show startup-config</code>
How to Save Changes	Changes are immediate but temporary	You must copy from running config using: <code>copy running-config startup-config</code> or <code>write memory</code>

Lab Work:

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