**Network Infrastructure and Administration Lab Manual 2024-2025**

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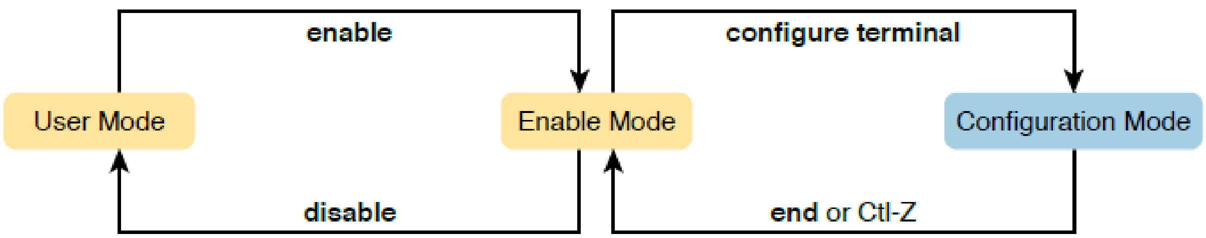
# Lab 4: MAC Address

## Configuring Cisco IOS Software

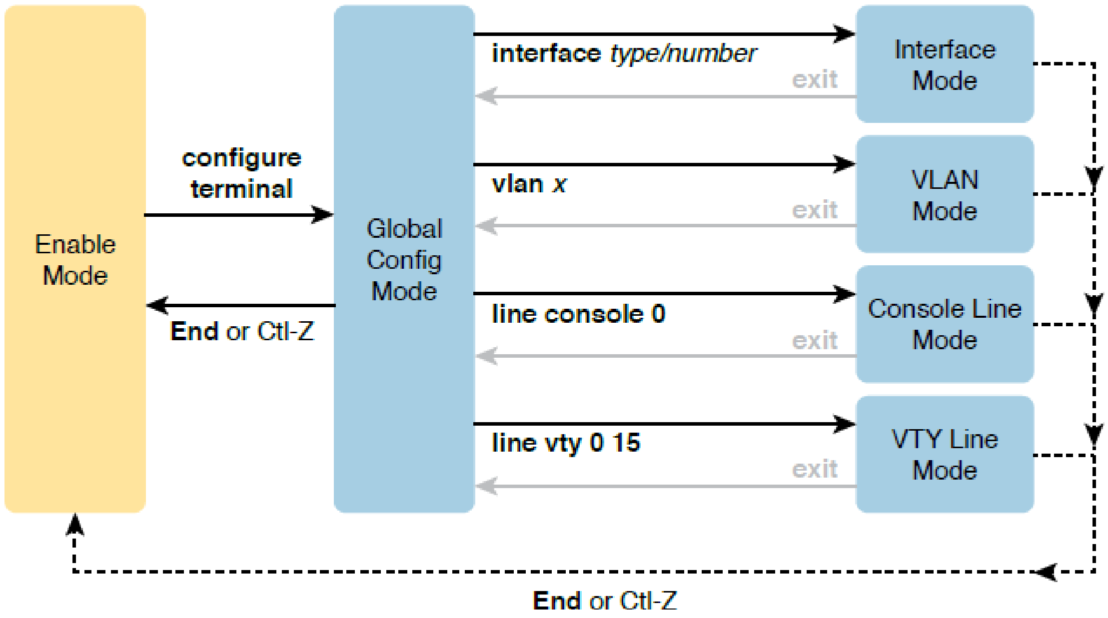
*Configuration mode* is another mode for the Cisco CLI, similar to user mode and privileged mode. Configuration mode accepts *configuration commands*—commands that tell the switch the details of what to do and how to do it. Figure below illustrates the relationships among configuration mode, user EXEC mode, and privileged EXEC mode.




### Configuration Submodes and Contexts

Configuration mode itself contains a multitude of commands. To help organize the configuration, IOS groups some kinds of configuration commands together. To do that, when using configuration mode, you move from the initial mode—global configuration mode—into subcommand modes. *Context-setting commands* move you from one configuration subcommand mode, or context, to another. These context-setting commands tell the switch the topic about which you will enter the next few configuration commands.

Figure below shows most of the navigation between global configuration mode and the four configuration submodes

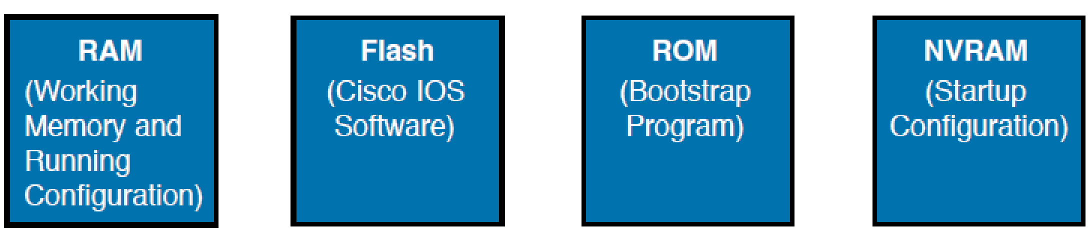



**Storing Switch Configuration Files**

When you configure a switch, it needs to use the configuration. It also needs to be able to retain the configuration in case the switch loses power. Cisco switches contain randomaccess memory (RAM) to store data while Cisco IOS is using it, but RAM loses its contents when the switch loses power or is reloaded. To store information that must be retained when the switch loses power or is reloaded, Cisco switches use several types of more permanent memory, none of which has any moving parts.

The following list details the four main types of memory found in Cisco switches, as well as the most common use of each type:

**RAM:** Sometimes called DRAM, for dynamic random-access memory, RAM is used by the switch just as it is used by any other computer: for working storage. The running (active) configuration file is stored here.
**Flash memory:** Either a chip inside the switch or a removable memory card, flash memory stores fully functional Cisco IOS images and is the default location where the switch gets its Cisco IOS at boot time. Flash memory also can be used to store any other files, including backup copies of configuration files.
**ROM:** Read-only memory (ROM) stores a bootstrap (or boothelper) program that is loaded when the switch first powers on. This bootstrap program then finds the full Cisco IOS image and manages the process of loading Cisco IOS into RAM, at which point Cisco IOS takes over operation of the switch.
**NVRAM:** Nonvolatile RAM (NVRAM) stores the initial or startup configuration file that is used when the switch is first powered on and when the switch is reloaded.



**Overview of Switching Logic:**

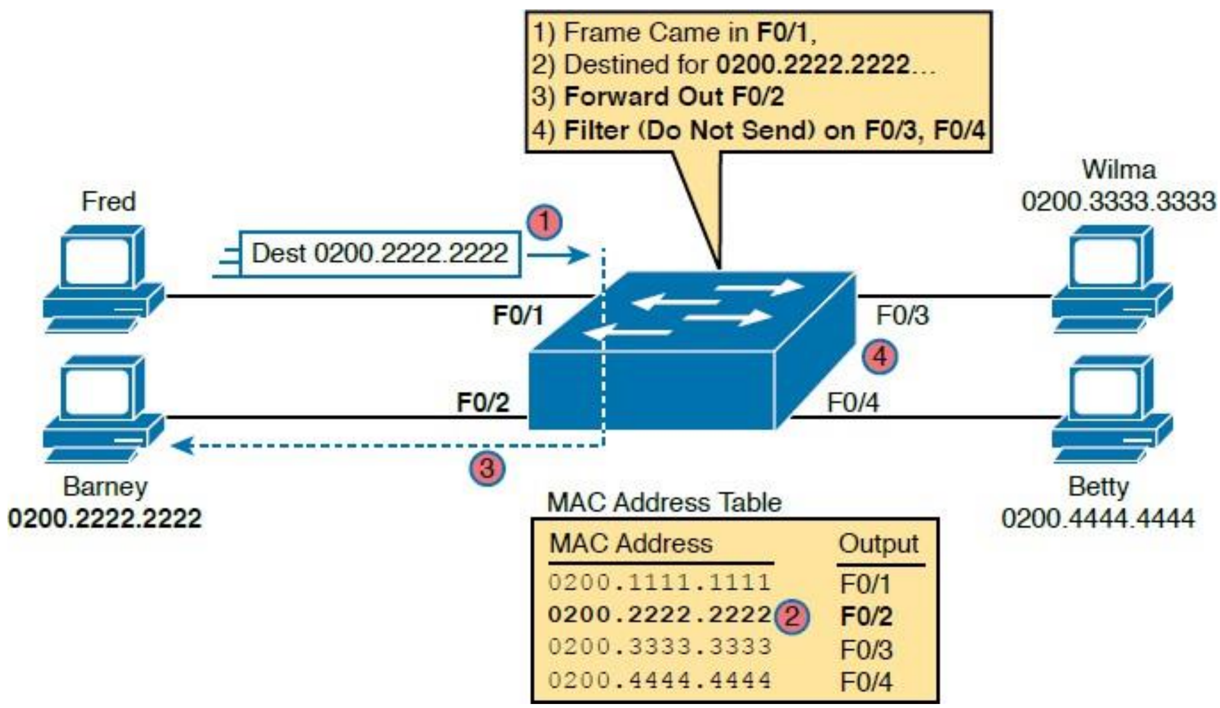
The LAN switch has one primary job: to forward frames to the correct destination (MAC) address. And to achieve that goal, switches use logic—logic based on the source and destination MAC address in each frame's Ethernet header

LAN switches receive Ethernet frames and then make a switching decision: either forward the frame out some other ports or ignore the frame. To accomplish this primary mission, switches perform three actions:

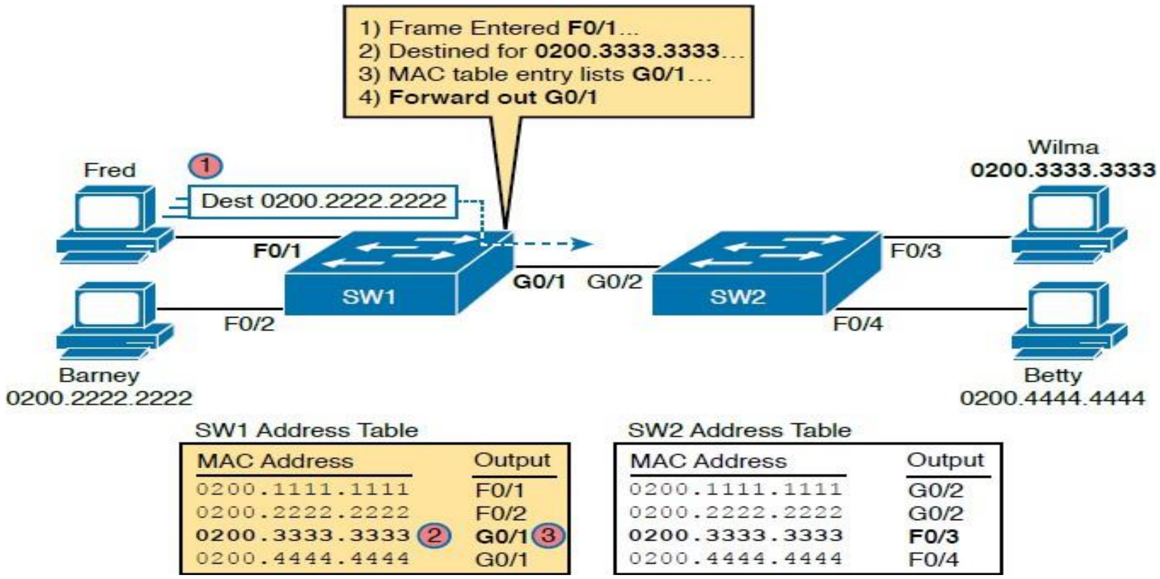
**1.** Deciding when to forward a frame or when to filter (not forward) a frame, based on the destination MAC address

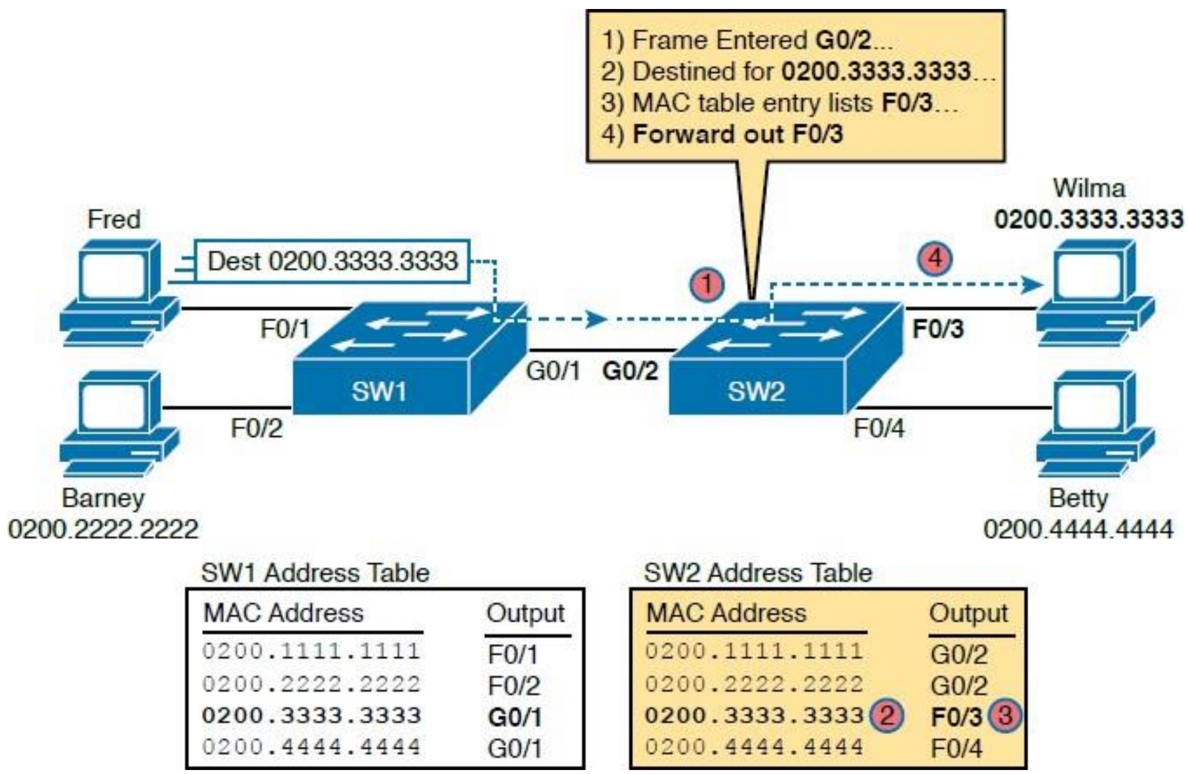
**2.** Preparing to forward frames by learning MAC addresses by examining the source MAC address of each frame received by the switch

**3.** Preparing to forward only one copy of the frame to the destination by creating a (Layer 2) loop-free environment with other switches by using Spanning Tree Protocol (STP)



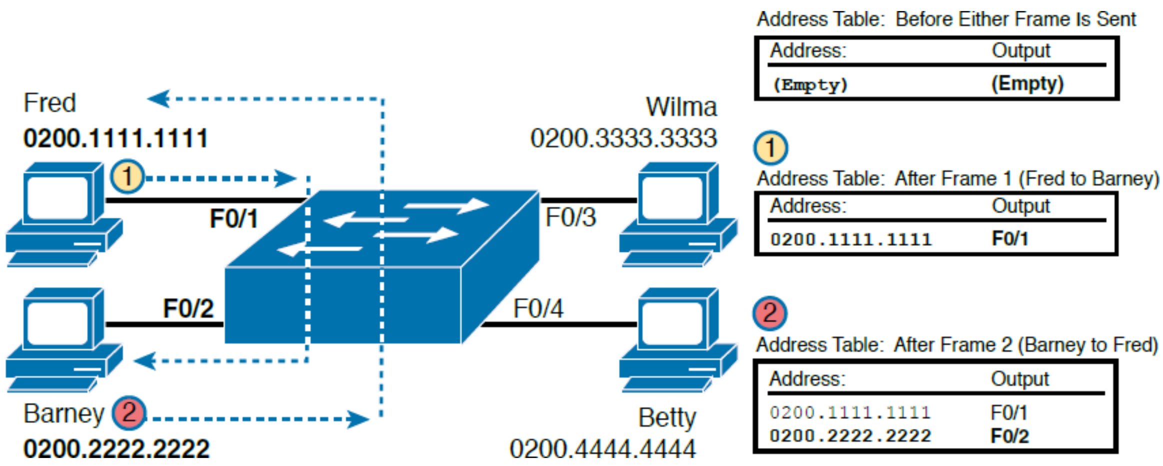

*Sample Switch Forwarding and Filtering Decision*




**Learning MAC Addresses**

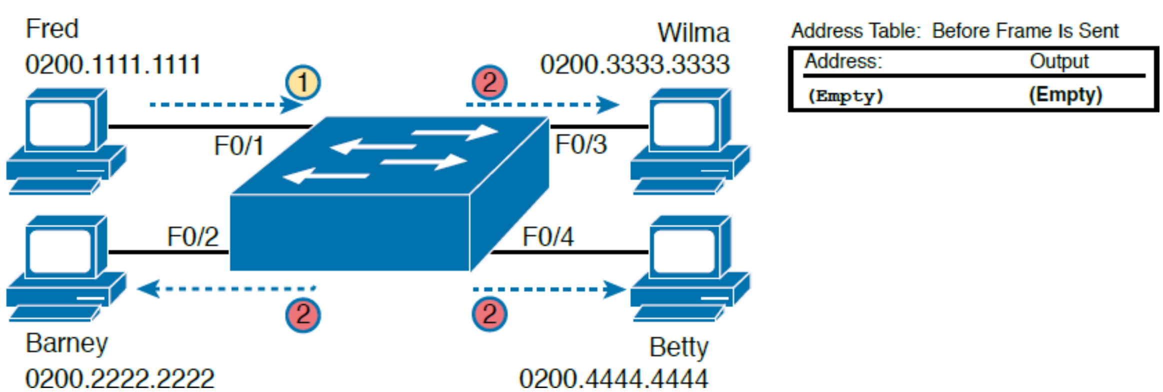
Switches build the address table by listening to incoming frames and examining the *source MAC address* in the frame. If a frame enters the switch and the source MAC address is not in the MAC address table, the switch creates an entry in the table. That table entry lists the interface from which the frame arrived. Switch learning logic is that simple.




**Flooding Unknown Unicast and Broadcast Frames**

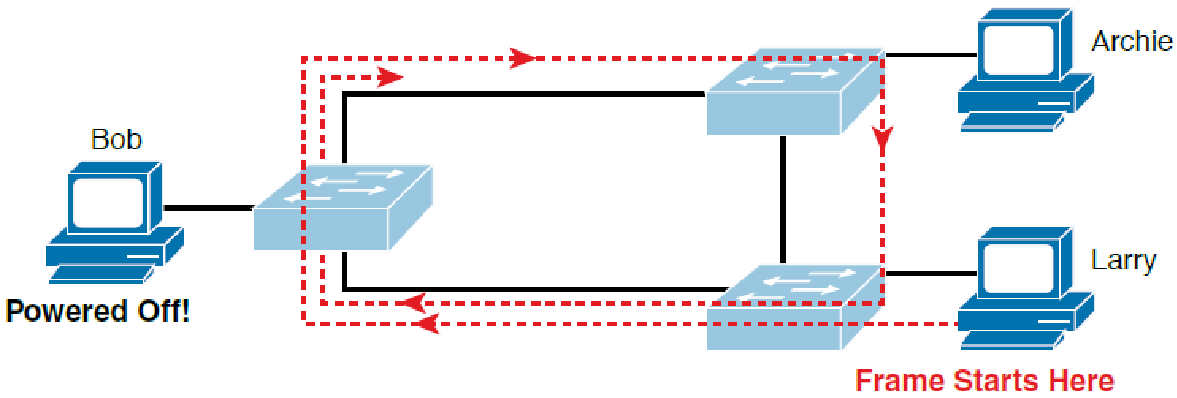
When there is no matching entry in the table, switches forward the frame out all interfaces (except the incoming interface) using a process called *flooding*

For example, Figure below shows the same first frame sent by Fred, when the switch's MAC table is empty. At step 1, Fred sends the frame. At step 2, the switch sends a copy of the frame out all three of the other interfaces.




**Avoiding Loops Using Spanning Tree Protocol**

The third primary feature of LAN switches is loop prevention, as implemented by Spanning Tree Protocol (STP). Without STP, any flooded frames would loop for an indefinite period of time in Ethernet networks with physically redundant links. To prevent looping frames, STP blocks some ports from forwarding frames so that only one active path exists between any pair of LAN segments.



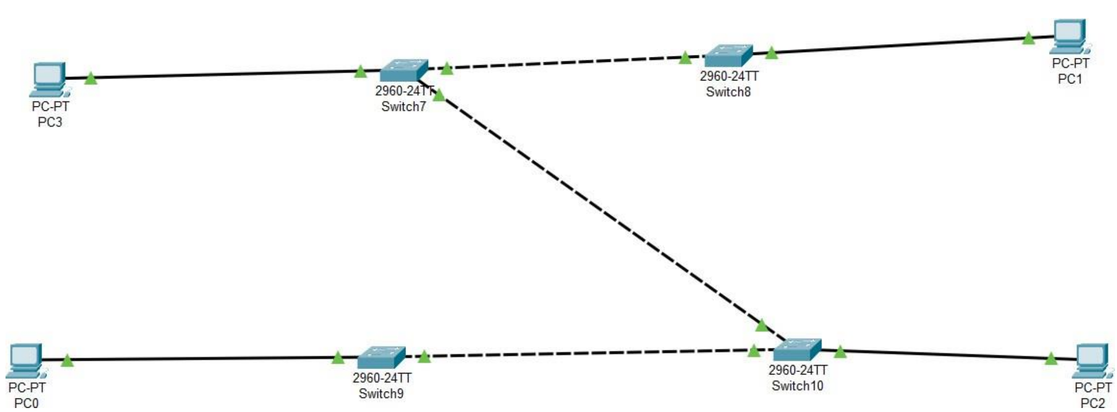

Cisco Catalyst switches come ready to get busy switching frames because of settings like these:

- The interfaces are enabled by default, ready to start working once a cable is connected.
- All interfaces are assigned to VLAN 1.
- 10/100 and 10/100/1000 interfaces use autonegotiation by default.
- The MAC learning, forwarding, flooding logic all works by default.
- STP is enabled by default.

To see a switch's MAC address table, use the **show mac address-table** command. With no additional parameters, this command lists all known MAC addresses in the MAC table, including some overhead static MAC addresses that you can ignore. To see all the dynamically learned MAC addresses only, instead use the **show mac address-table dynamic** command.

The aging time can be configured to a different time, globally and per-VLAN using the **mac address-table aging-time** *time-in-seconds* [**vlan** *vlan-number*] global configuration command.to clear mac address table **clear mac address-table dynamic**

**For the below Network:**



-Write the mac address for all interfaces by using **show interfaces[port]** and for PCs **ipconfig /all**
**-**Write the mac table of every switch by using **show mac address-table**
-Put the IPs address of every PCs
-Ping between all PCs
-Rewrite the mac-address types of all Switches