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The MAC Address Table

7.3.1

Switch Fundamentals   🔖

Now that you know all about Ethernet MAC addresses, it is time to talk about how a switch uses these addresses to forward (or discard) frames to other devices on a network. If a switch just forwarded every frame it received out all ports, your network would be so congested that it would probably come to a complete halt.

A Layer 2 Ethernet switch uses Layer 2 MAC addresses to make forwarding decisions. It is completely unaware of the data (protocol) being carried in the data portion of the frame, such as an IPv4 packet, an ARP message, or an IPv6 ND packet. The switch makes its forwarding decisions based solely on the Layer 2 Ethernet MAC addresses.

An Ethernet switch examines its MAC address table to make a forwarding decision for each frame, unlike legacy Ethernet hubs that repeat bits out all ports except the incoming port. In the figure, the four-port switch was just powered on. The table shows the MAC Address Table which has not yet learned the MAC addresses for the four attached PCs.

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MAC Addr...
Port	MAC

The switch MAC □□□□ ty.

Note: The MAC address table is sometimes referred to as a content addressable memory (CAM) table. While the term CAM table is fairly common, for the purposes of this course, we will refer to it as a MAC address table.

MAC   MAC
00-0A   00-0B

7.3.2

Switch Learning and Forwarding

The switch dynamically builds the MAC address table by examining the source MAC address of the frames received on a port. The switch forwards frames by searching for a match between the destination MAC address in the frame and an entry in the MAC address table.

> (i)   Click the Learn and Forward buttons for an illustration and explanation of this process.

Learn   **Forward**

Find the Destination MAC Address

If the destination MAC address is a unicast address, the switch will look for a match between the destination MAC address of the frame and an entry in its MAC address table. If the destination MAC address is in the table, it will forward the frame out the specified port. If the destination MAC address is not in the table, the switch will forward the frame out all ports except the incoming port. This is called an unknown
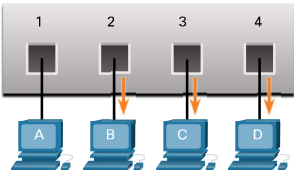
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unicast.

As shown in the figure, the switch does not have the destination MAC address in its table for PC-D, so it

sends the frame out all ports except port 1.

Note: If the destination MAC address is a broadcast or a multicast, the frame is also flooded out all ports except the incoming port.

1. The destination MAC address is not in the table.
2. The switch forwards the frame out all other ports.

⟨ ● ● ⟩

7.3.3

Filtering Frames

As a switch receives frames from different devices, it is able to populate its MAC address table by examining the source MAC address of every frame. When the MAC address table of the switch contains the destination MAC address, it is able to filter the frame and forward out a single port.

> ⓘ Click each button for an illustration and explanation of how a switch filters frames.

PC-D to Switch	Switch to PC-A	**PC-A to Switch to PC-D**

Next, PC-A sends another frame to PC-D, as shown in the figure. The MAC address table already contains the MAC address for PC-A; therefore, the five-minute refresh timer for that entry is reset. Next, because the switch table contains the destination MAC address for PC-D, it sends the frame only out port 4.

MAC Ad...	
Port	**M...**
1	00
4	00

1. The switch receives another frame from PC-A and refreshes the timer for the MAC address entry for port 1.
2. The switch has a recent entry for the destination MAC address and filters the frame, forwarding it only out port 4.

MAC   MA
00-0A   00-

⊙ ● ● ● ⊙

7.3.4

Video – MAC Address Tables on Connected Switches 🔖

A switch can have multiple MAC addresses associated with a single port. This is common when the switch is connected to another switch. The switch will have a separate MAC address table entry for each frame received with a different source MAC address.

Click Play in the figure to view a demonstration of how two connected switches build MAC address tables.

7.3.5

Video - Sending the Frame to the Default Gateway 🔖

When a device has an IP address that is on a remote network, the Ethernet frame cannot be sent directly to the destination device. Instead, the Ethernet frame is sent to the MAC address of the default gateway, the router.

Click Play in the figure to view a demonstration of how PC-A communicates with its default gateway.

Note: In the video, the IP packet that is sent from PC-A to a destination on a remote network has a source IP address of PC-A and a destination IP address of the remote host. The returning IP packet will have the source IP address of remote host and the destination IP address will be that of PC-A.

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7.3.6

Activity – Switch It! 🔖

Determine how the switch forwards a frame based on the source MAC address, the destination MAC address, and information in the switch MAC table. Answer the questions using the information provided.

Frame

Preamble	Destination MAC	Source MAC	Type / Length	Frame	End of Frame
	0B	0F			

MAC Table

Fa1	Fa2	Fa3	Fa4	Fa5	Fa6	Fa7	Fa8	Fa9	Fa10	Fa1
0A										

Question 1 – Where will the switch forward the frame?

☑ Fa1 ☐ Fa2 ☑ Fa3 ☐ Fa4 ☑ Fa5 ☐ Fa6 ☑ Fa7 ☐

Question 2 – When the switch forwards the frame, which statement(s) are true?

☑ Switch adds the source MAC address which is currently not in the MAC address table.

☐ Frame is a broadcast frame and will be forwarded to all ports.

☐ Frame is a unicast frame and will be sent to specific port only.

☑ Frame is a unicast frame and will be flooded to all ports.

☐ Frame is a unicast frame but it will be dropped at the switch.

(Check)   (New Problem)

(Show Me)   (Help)

7.3.7

Lab - View the Switch MAC Address Table

In this lab, you will complete the following objectives:

- Part 1: Build and Configure the Network
- Part 2: Examine the Switch MAC Address Table

(👤 View the Switch M...)