

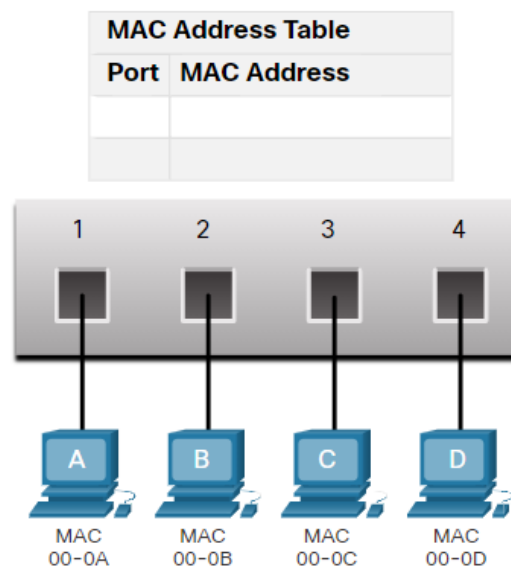
Switch Fundamentals

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.

Note: MAC addresses are shortened throughout this topic for demonstration purposes.



The switch MAC address table is empty.

The diagram shows four hosts, along with their associated MAC addresses, connected to ports 1 - 4 on a switch. The MAC address table which maps ports to MAC addresses is currently empty.

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.

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.

Click the Learn and Forward buttons for an illustration and explanation of this process.

Learn

Forward

Examine the Source MAC Address

Every frame that enters a switch is checked for new information to learn. It does this by examining the source MAC address of the frame and the port number where the frame entered the switch. If the source MAC address does not exist, it is added to the table along with the incoming port number. If the source MAC address does exist, the switch updates the refresh timer for that entry in the table. By default, most Ethernet switches keep an entry in the table for 5 minutes

In the figure for example, PC-A is sending an Ethernet frame to PC-D. The table shows the switch adds the MAC address for PC-A to the MAC Address Table.

Note: If the source MAC address does exist in the table but on a different port, the switch treats this as a new entry. The entry is replaced using the same MAC address but with the more current port number.

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.

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.

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.