Section 5.2:
LAN Switches

Upon completion of this section, you should be able to:

- Explain how a switch operates.

- Explain how a switch builds its MAC address table and forwards frames.

- Describe switch forwarding methods.

- Describe the types of port settings available for Layer 2 switches.
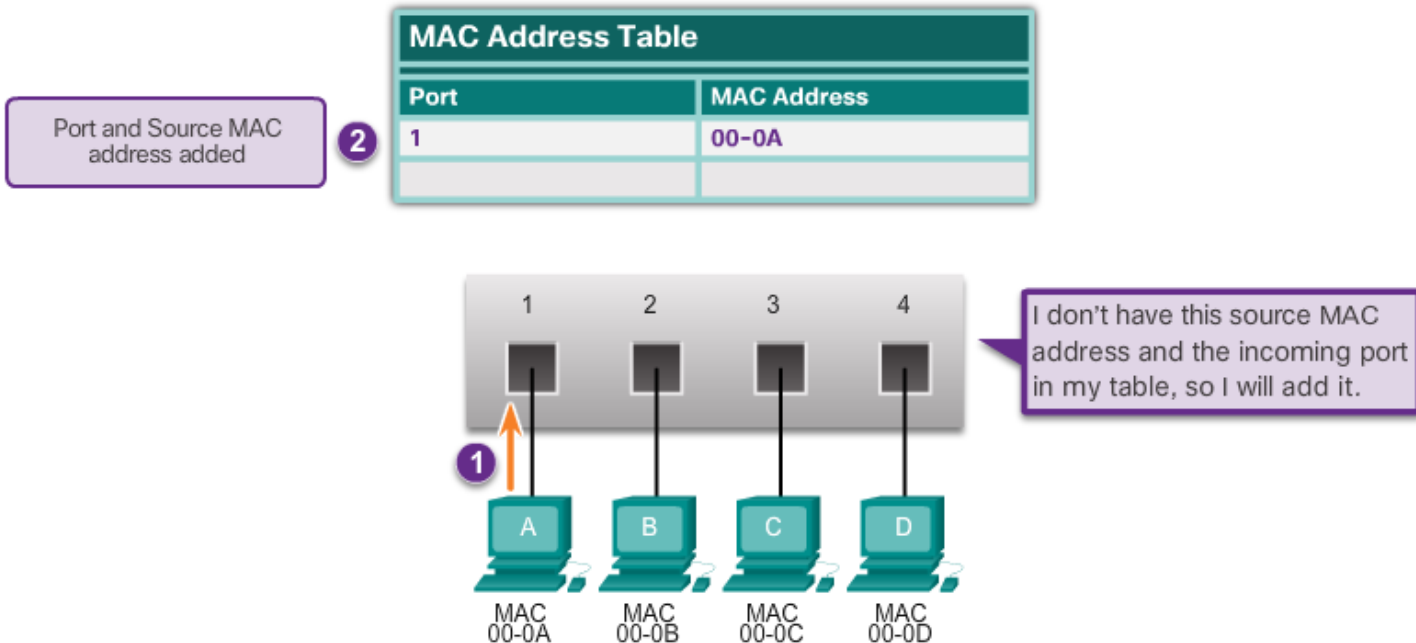
Topic 5.2.1:
MAC Address Table

Switch Fundamentals

- An Ethernet Switch is a Layer 2 device.

- It uses MAC addresses to make forwarding decisions.

- The MAC address table is sometimes referred to as a content addressable memory (CAM) table.

Learning MAC Addresses
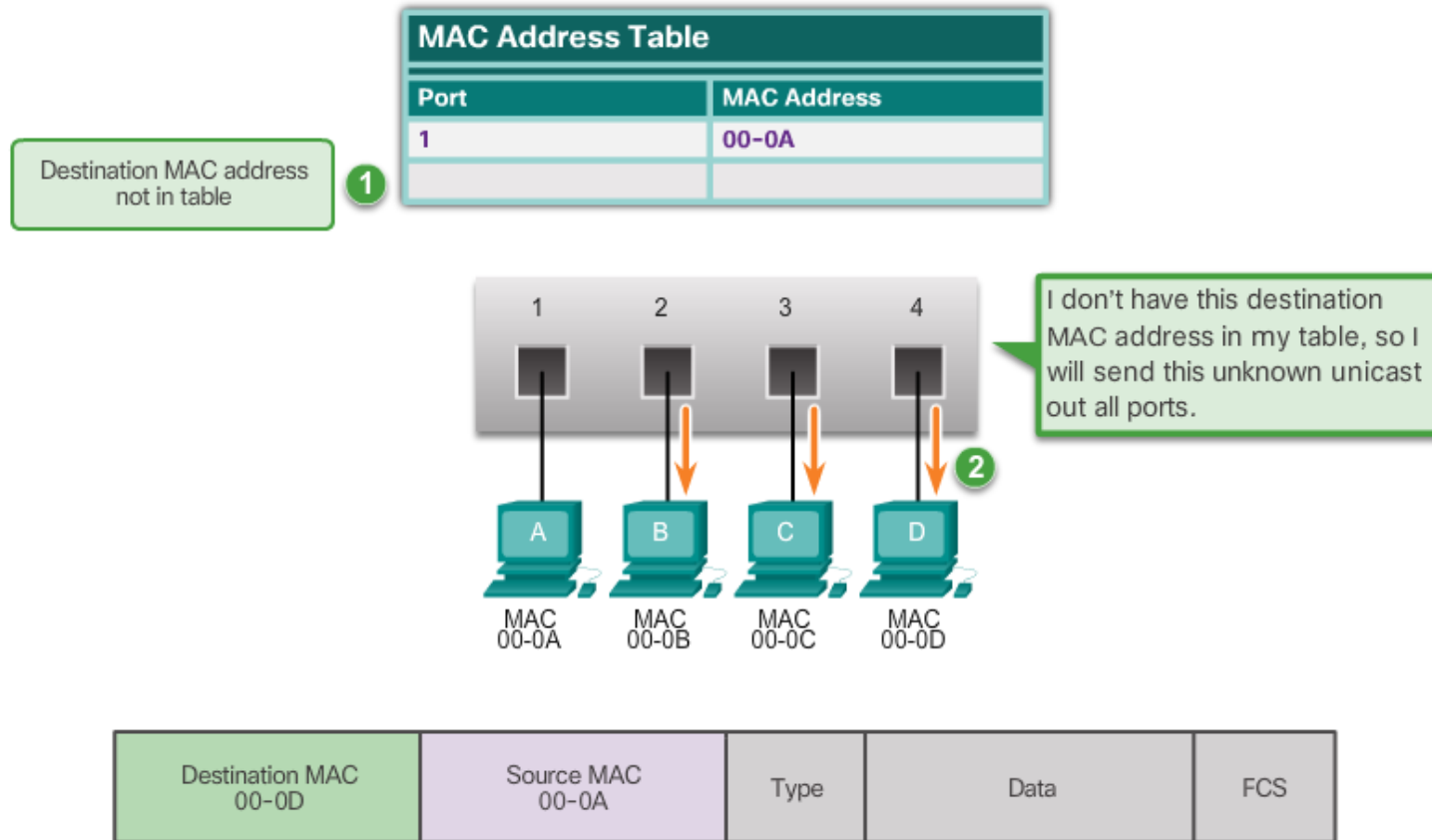

Learn: Examine Source MAC Address

MAC addresses are shortened for demonstration purposes.

Learning MAC Addresses (cont.)

Forward: Examine Destination MAC Address

MAC Address Table	
Port	**MAC Address**
1	00-0A

Destination MAC address not in table ❶

| 1 | 2 | 3 | 4 |

I don't have this destination MAC address in my table, so I will send this unknown unicast out all ports. ❷

| A | B | C | D |

MAC 00-0A | MAC 00-0B | MAC 00-0C | MAC 00-0D

Destination MAC 00-0D	Source MAC 00-0A	Type	Data	FCS

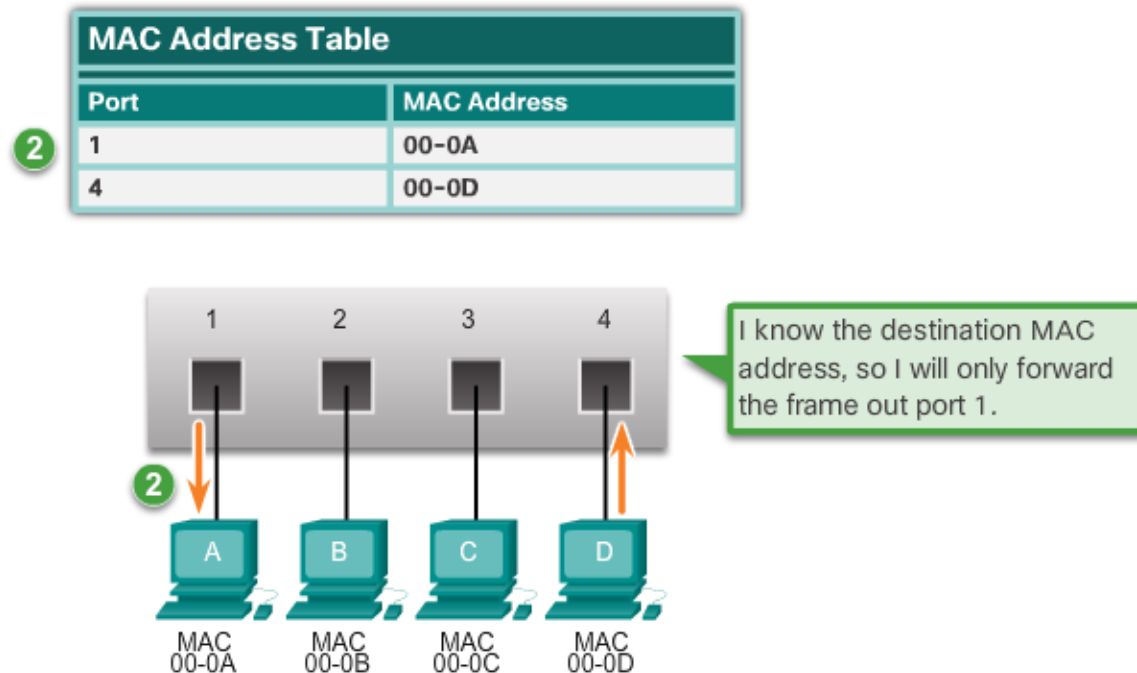MAC addresses are shortened for demonstration purposes.

Filtering Frames

PC-D sends a frame back to PC-A and the switch learns PC-D's MAC address.
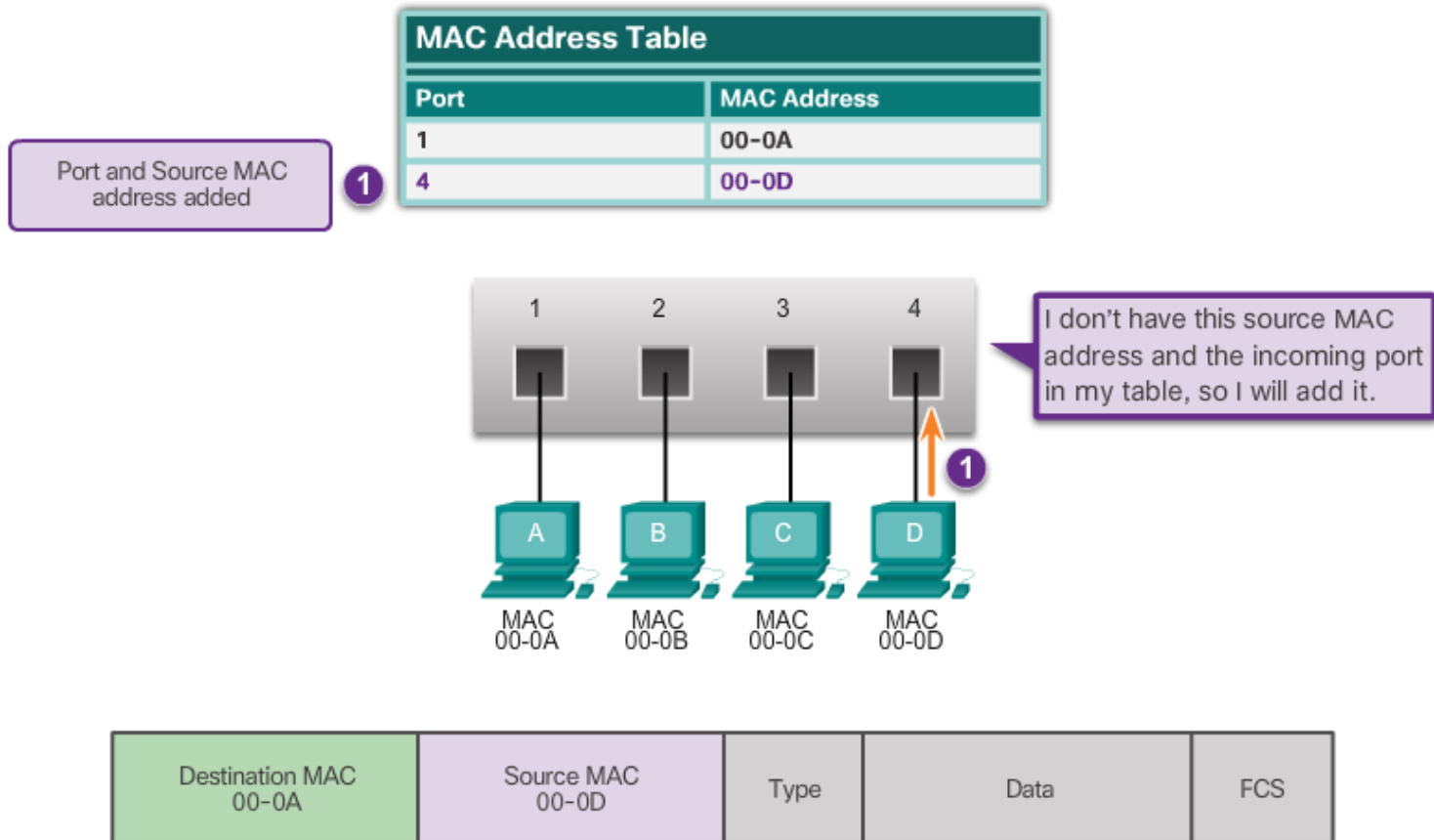
Filtering Frames (cont.)

Since the Switch MAC Address table contains PC-A's MAC Address, it sends the frame out only port 1.
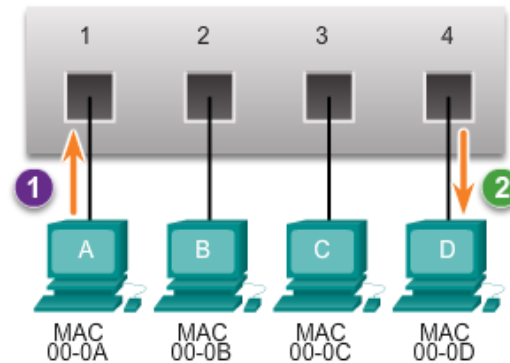
Filtering Frames (cont.)

PC-A sends another frame to PC-D. The switch's table now contains PC-D's MAC address, so it sends the frame out only port 4.

MAC Address Table	
Port	**MAC Address**
1	00-0A
4	00-0D

Destination MAC 00-0D	Source MAC 00-0A	Type	Data	FCS

Video Demonstration - MAC Address Tables on Connected Switches

- A switch can have multiple MAC addresses associated with a single port.

- This occurs when the switch is connected to another switch.

- See VIDEO DEMONSTRATION

Video Demonstration - Sending a 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.

- The Ethernet frame is sent to the MAC address of the default gateway, which is the router.

- See VIDEO DEMONSTRATION

Topic 5.2.2:
Switch Forwarding Methods

Frame Forwarding Methods on Cisco Switches

Store-and-forward

Cut-through

A store-and-forward switch receives the entire frame, and computes the CRC. If the CRC is valid, the switch looks up the destination address, which determines the outgoing interface. The frame is then forwarded out the correct port.

A cut-through switch forwards the frame before it is entirely received. At a minimum, the destination address of the frame must be read before the frame can be forwarded.
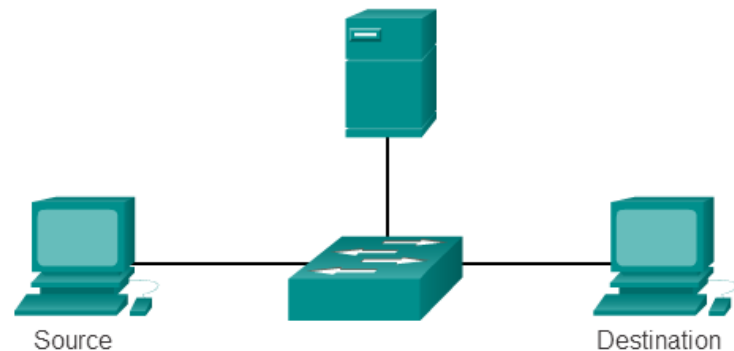
Cut-Through Switching

Fast-forward switching:

- Lowest level of latency immediately forwards a packet after reading the destination address.

- Typical cut-through method of switching.

Fragment-free switching:

- Switch stores the first 64 bytes of the frame before forwarding.

- Most network errors and collisions occur during the first 64 bytes.

Source

Destination

A cut-through switch forwards the frame before it is entirely received. At a minimum, the destination address of the frame must be read before the frame can be forwarded.

Memory Buffering on Switches

Port-based memory	In port-based memory buffering, frames are stored in queues that are linked to specific incoming and outgoing ports.
Shared memory	Shared memory buffering deposits all frames into a common memory buffer, which all the ports on the switch share.

Topic 5.2.3:
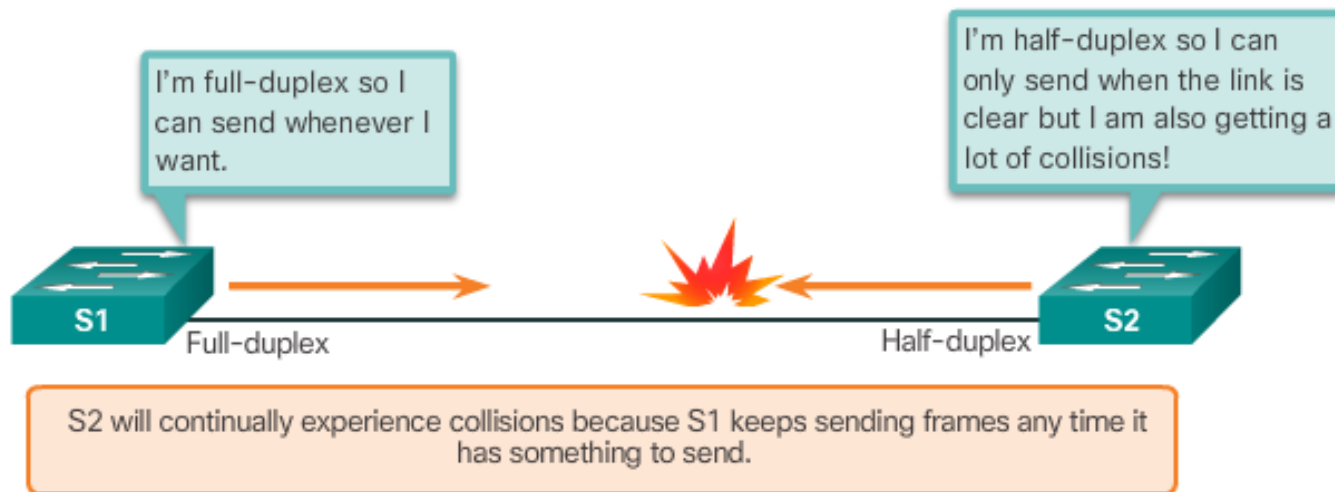# Switch Port Settings

Duplex and Speed Settings

- Full-duplex – Both ends of the connection can send and receive simultaneously.

- Half-duplex – Only one end of the connection can send at a time.
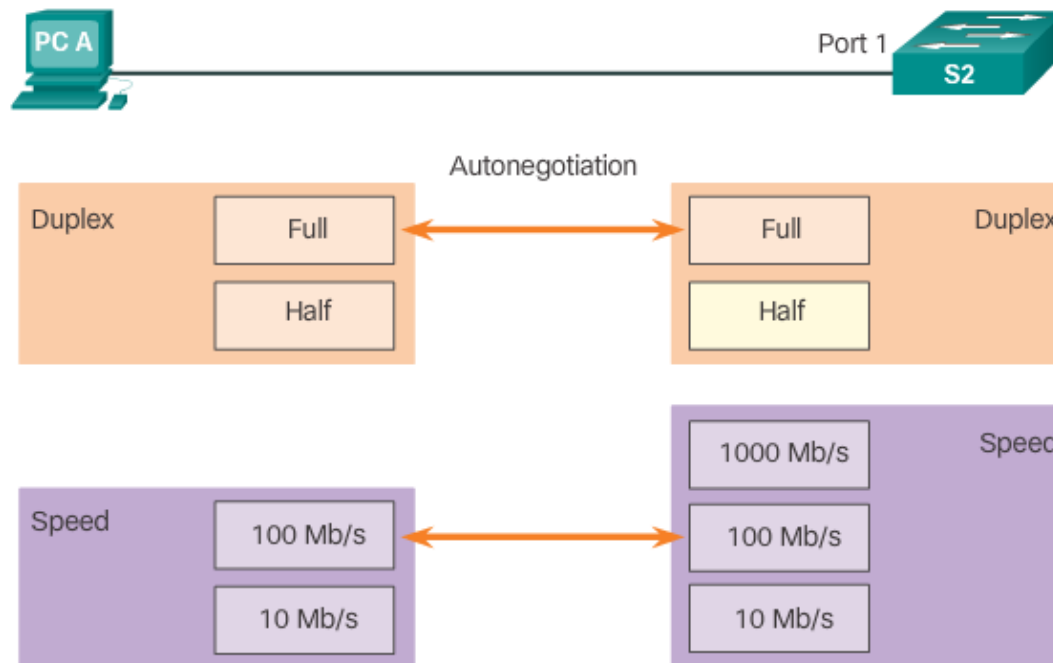
Duplex and Speed Settings (cont.)

A common cause of performance issues on 10/100 Mb/s Ethernet links is when one port on the link operates at half-duplex and the other on full-duplex.

Auto-MDIX

MDIX auto detects the type of connection required and configures the interface accordingly.