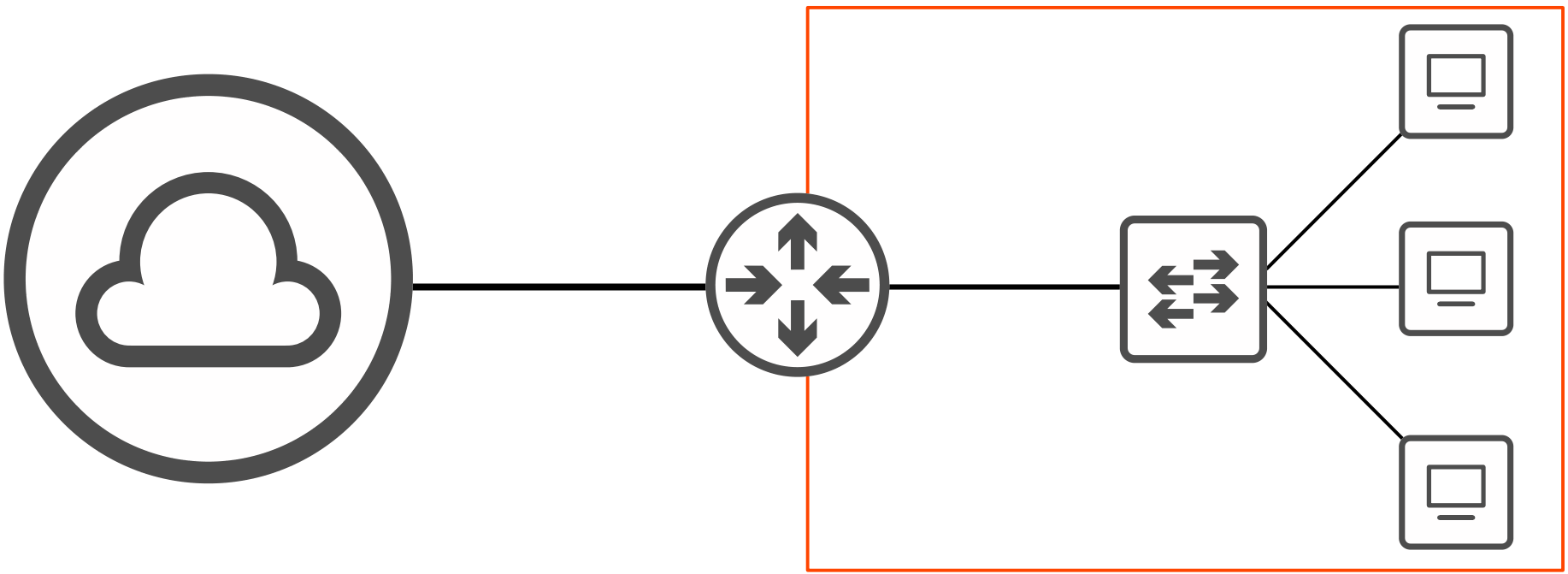
Jeremy's IT Lab

# CCNA 200-301 Day 5

## Ethernet LAN Switching



# OSI Model – Physical Layer

| | |
|---|---|
| 7 | Application |
| 6 | Presentation |
| 5 | Session |
| 4 | Transport |
| 3 | Network |
| 2 | Data Link |
| 1 | **Physical** |

- Defines physical characteristics of the medium used to transfer data between devices.
- For example, voltage levels, maximum transmission distances, physical connectors, cable specifications, etc.
- Digital bits are converted into electrical (for wired connections) or radio (for wireless connections) signals.
- All of the information in Day 2's video (cables, pin layouts, etc.) is related to the Physical Layer.

# OSI Model – Data Link Layer

| | |
|---|---|
| 7 | Application |
| 6 | Presentation |
| 5 | Session |
| 4 | Transport |
| 3 | Network |
| 2 | **Data Link** |
| 1 | Physical |

- Provides node-to-node connectivity and data transfer (for example, PC to switch, switch to router, router to router).
- Defines how data is formatted for transmission over a physical medium (for example, copper UTP cables)
- Detects and (possibly) corrects Physical Layer errors.
- Uses Layer 2 addressing, separate from Layer 3 addressing.
- Switches operate at Layer 2.

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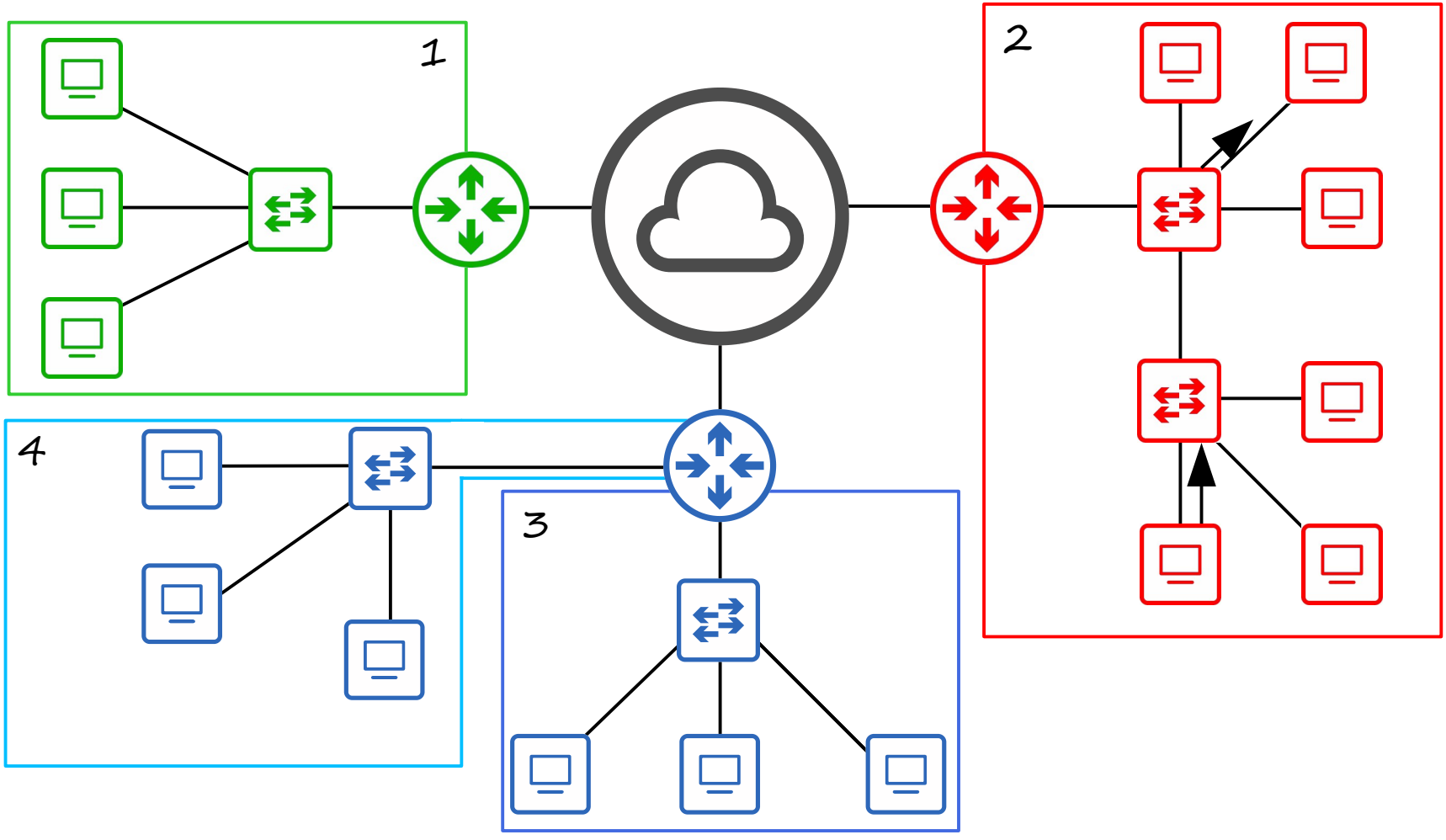
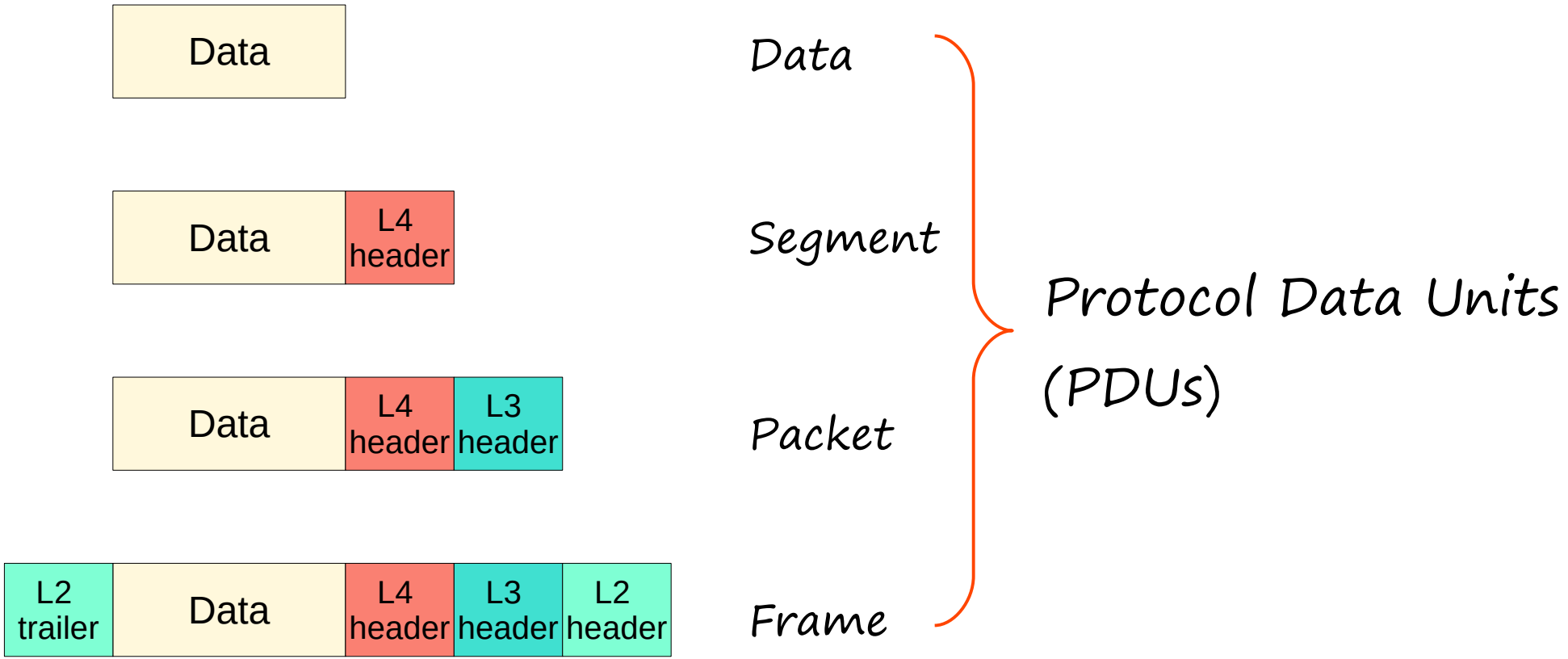
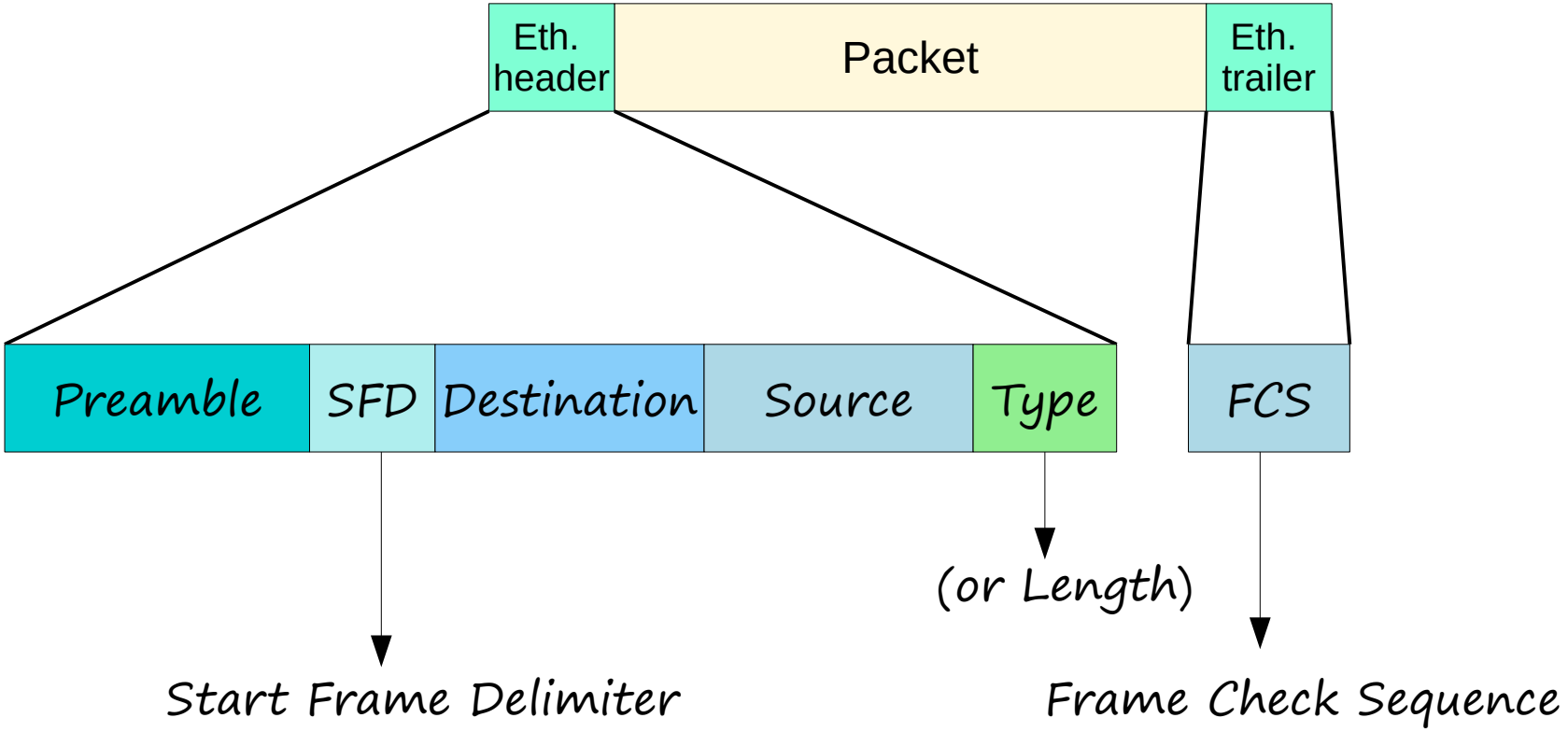
# Local Area Networks (LANs)



# OSI Model – PDUs



# Ethernet Frame



# Preamble & SFD

## Preamble

- Length: 7 bytes (56 bits)
- Alternating 1's and 0's
- 10101010 * 7
- Allows devices to synchronize their receiver clocks

## SFD

- 'Start Frame Delimiter'
- Length: 1 byte (8 bits)
- 10101011
- Marks the end of the preamble, and the beginning of the rest of the frame

# Destination & Source

Destination

Source

- Indicate the devices sending and receiving the frame
- Consist of the destination and source 'MAC address'
- MAC = Media Access Control
- = 6 byte (48-bit) address of the physical device

# Type / Length

Type

OR

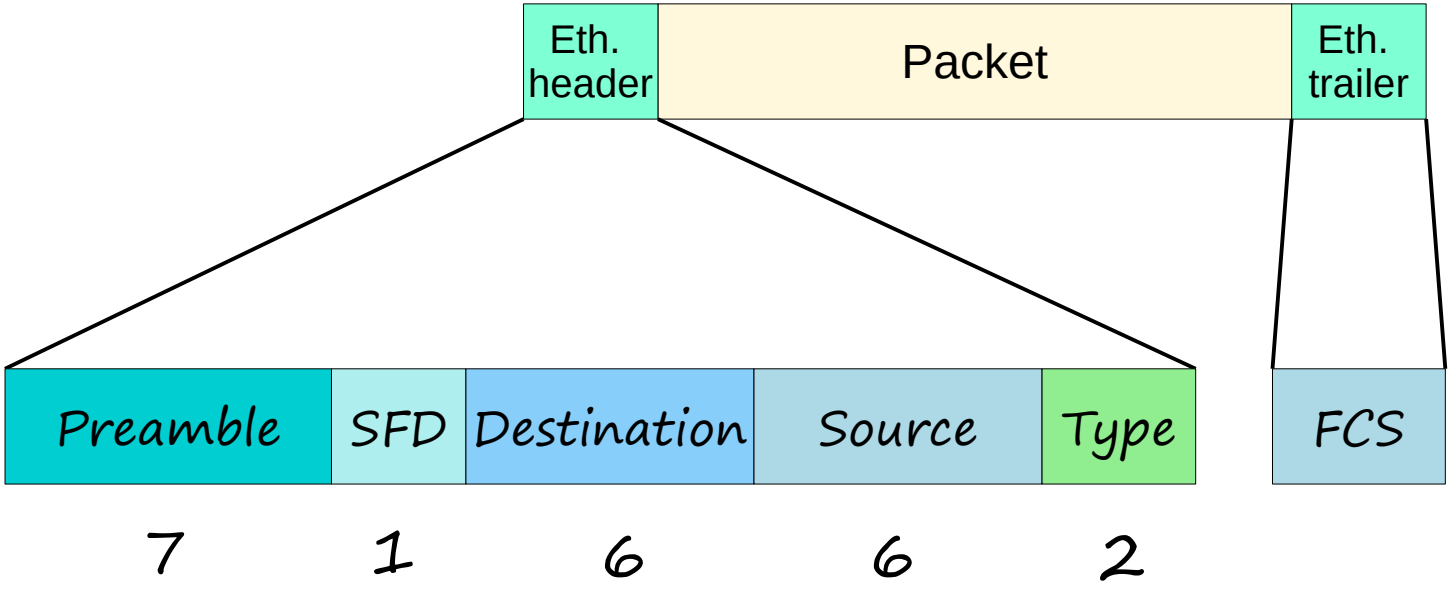
Length

- 2 byte (16-bit) field
- A value of **1500 or less** in this field indicates the LENGTH of the encapsulated packet (in bytes)
- A value of **1536 or greater** in this field indicates the TYPE of the encapsulated packet (usually IPv4 or IPv6), and the length is determined via other methods

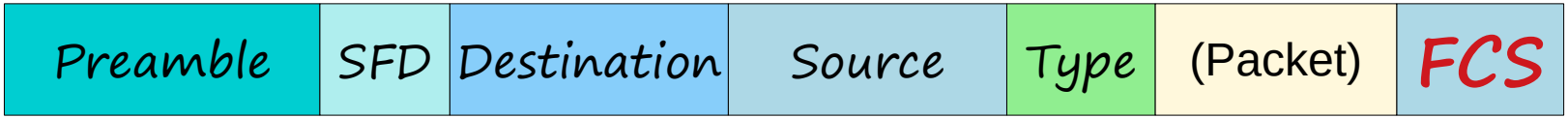
IPv4 = 0x0800 (hexadecimal)
(2048 in decimal)

IPv6 = 0x86DD (hexadecimal)
(34525 in decimal)

# Ethernet Frame

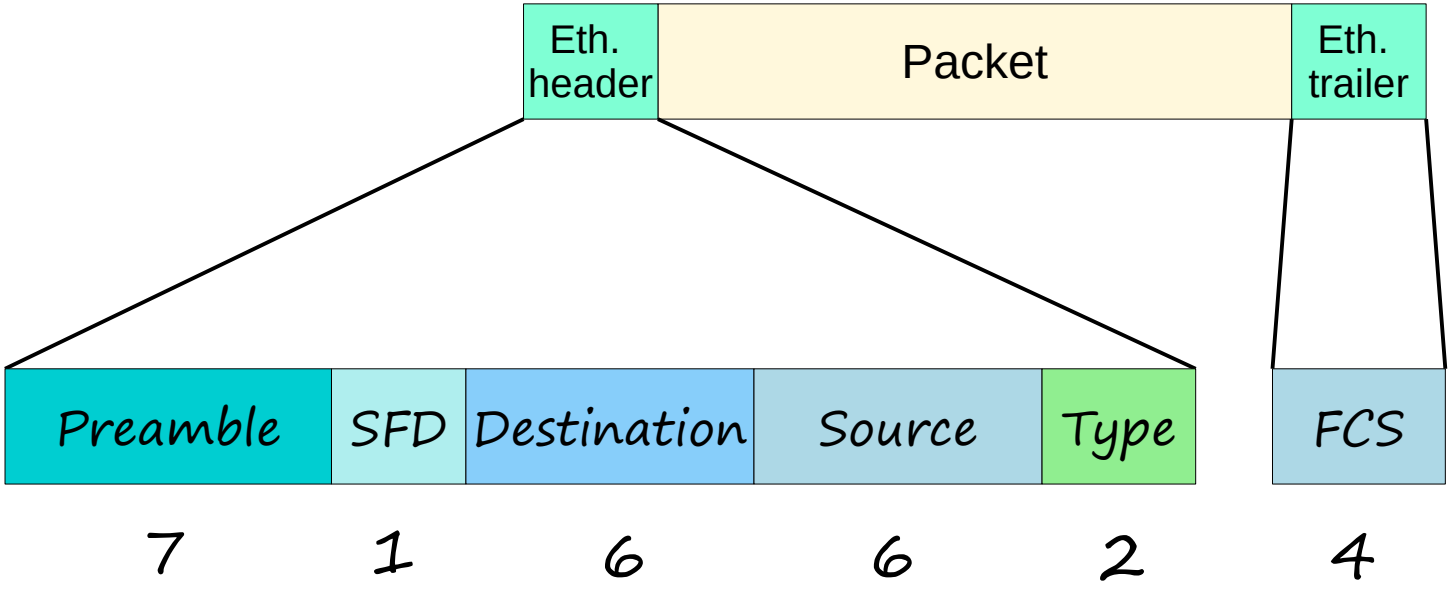


# Frame Check Sequence (FCS)




- 'Frame Check Sequence'
- 4 bytes (32 bits) in length
- Detects corrupted data by running a 'CRC' algorithm over the received data
- CRC = 'Cyclic Redundancy Check'

# Ethernet Frame



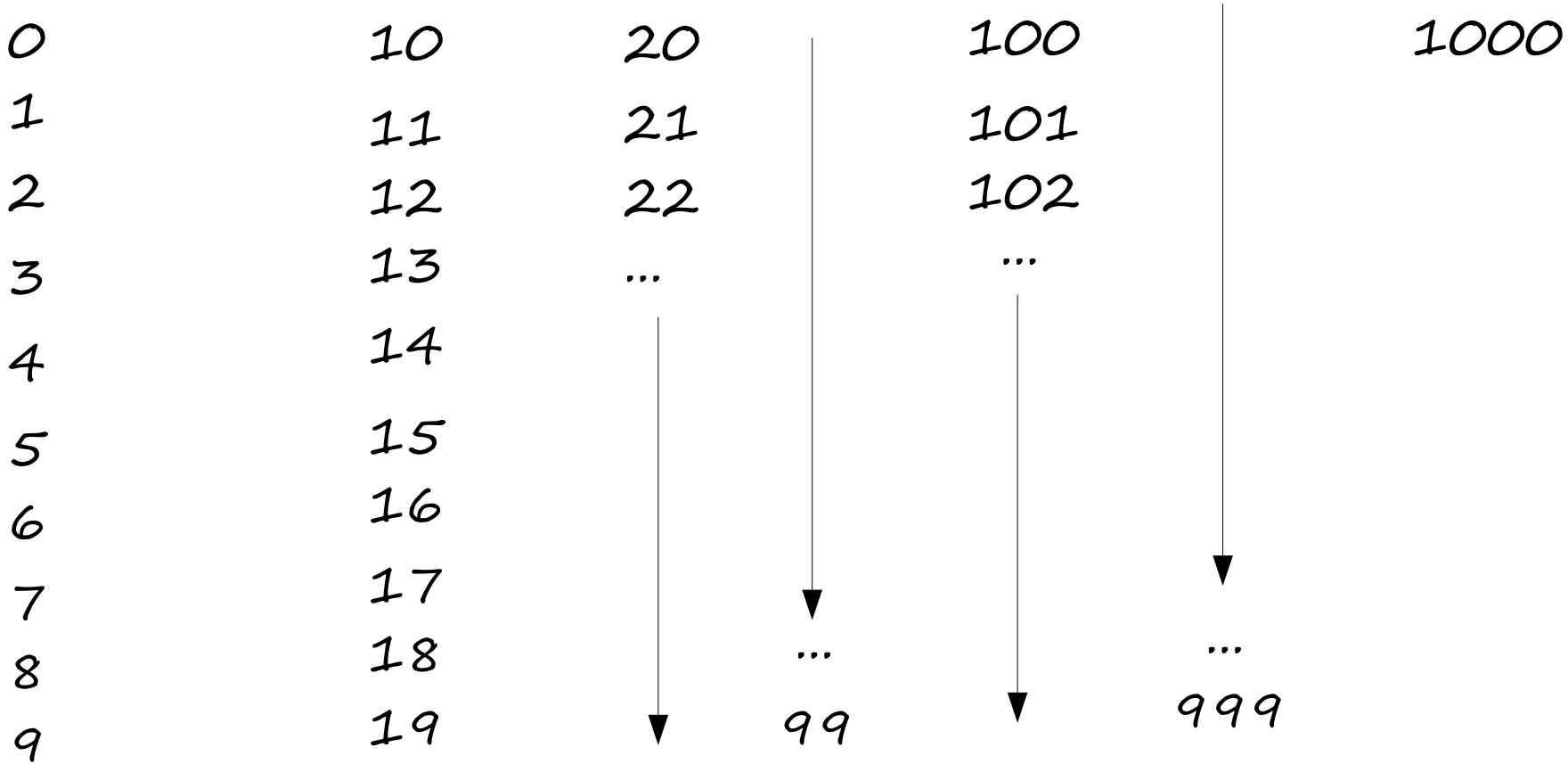

= 26 bytes (header + trailer)

# MAC Address

- 6-byte (48-bit) physical address assigned to the device when it is made
- A.K.A. 'Burned-In Address' (BIA)
- Is globally unique
- The first 3 bytes are the OUI (Organizationally Unique Identifier), which is assigned to the company making the device
- The last 3 bytes are unique to the device itself
- Written as 12 **hexadecimal** characters

# Decimal

Uses 10 possible digits: **0, 1, 2, 3, 4, 5, 6, 7, 8, 9**



# Hexadecimal

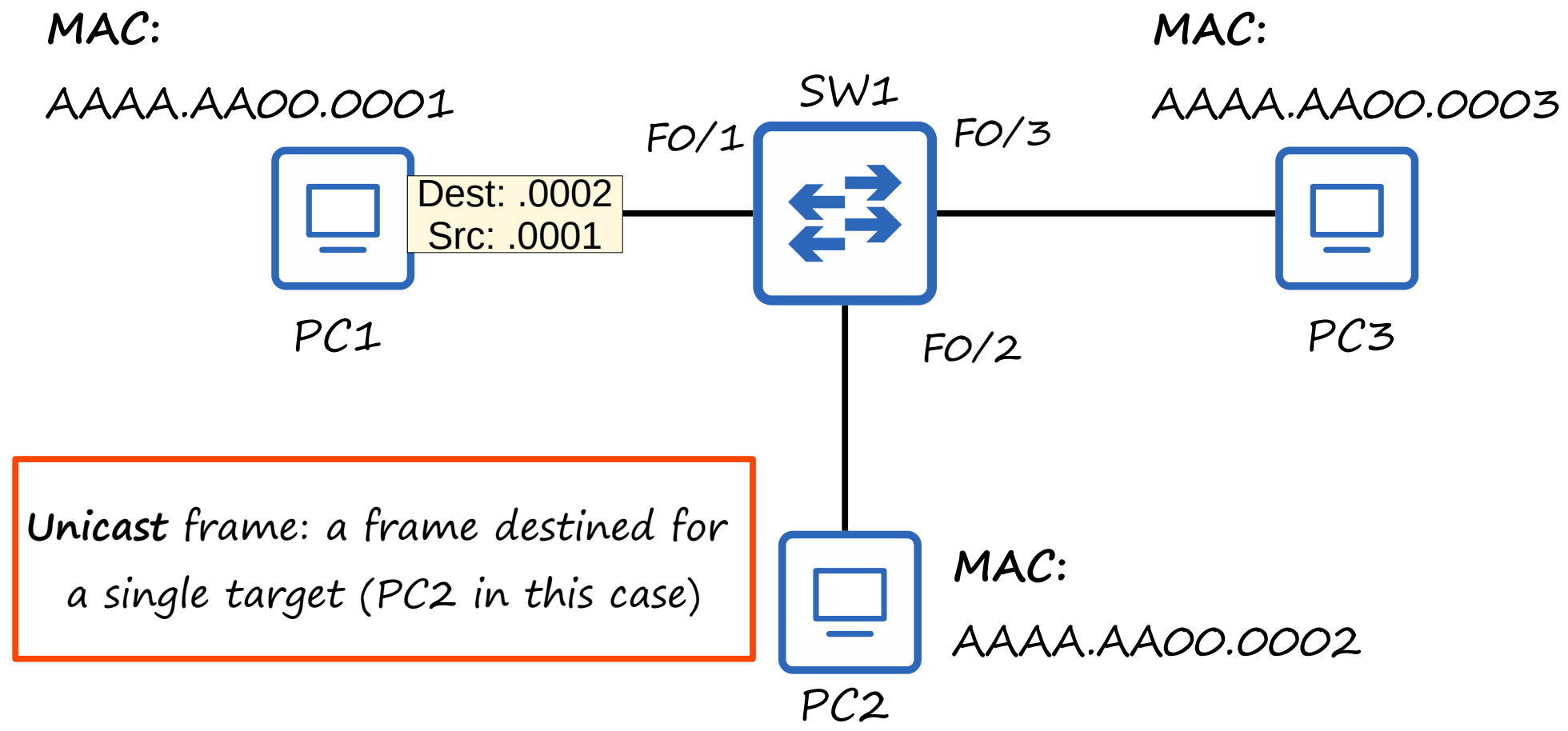
Uses 16 possible digits:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 10 | 11 | 12 | 13 | 14 | 15 |

# Hexadecimal

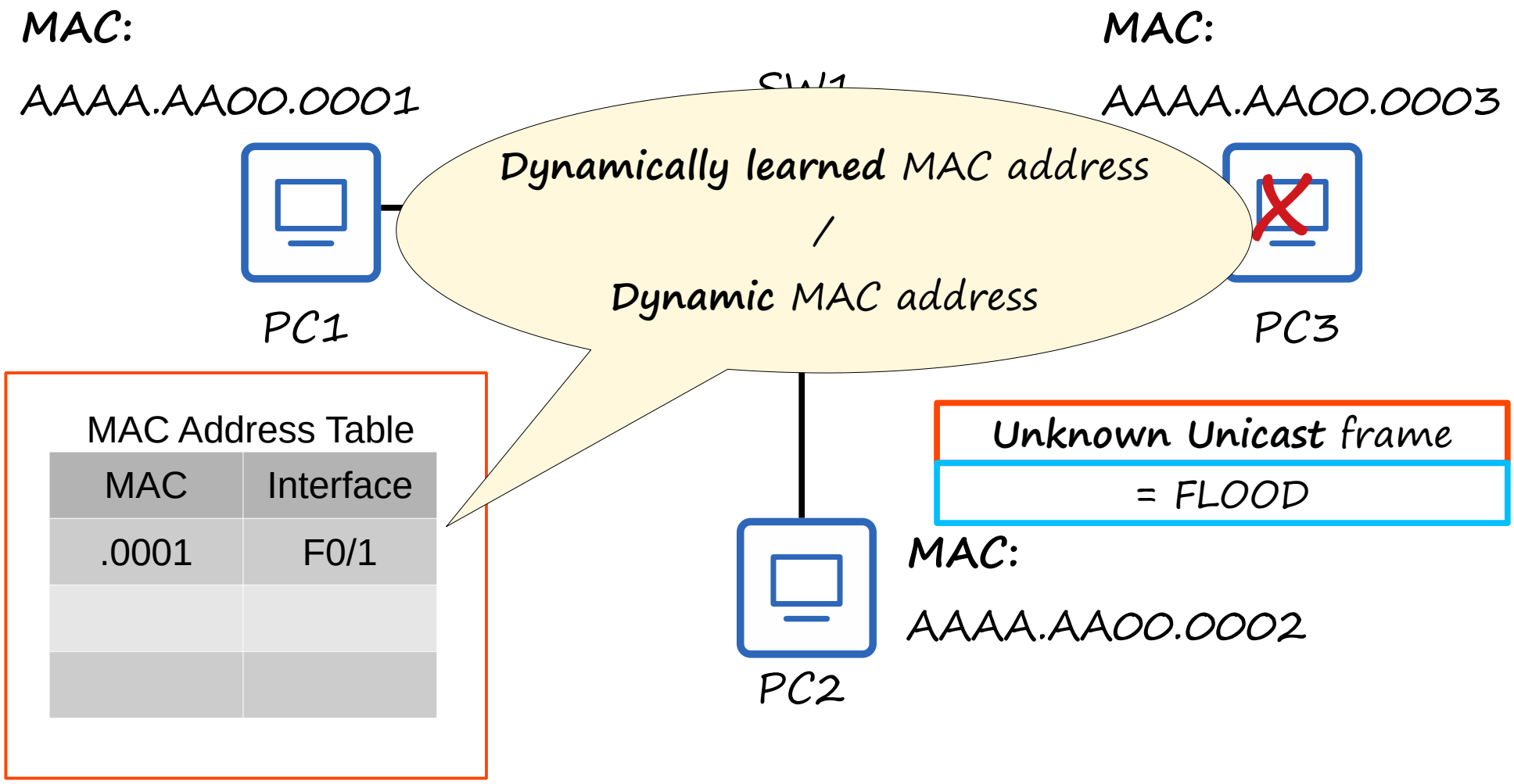
| DEC. | HEX. | DEC. | HEX. | DEC. | HEX. | DEC. | HEX. |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 8 | 8 | 16 | 10 | 24 | 18 |
| 1 | 1 | 9 | 9 | 17 | 11 | 25 | 19 |
| 2 | 2 | 10 | A | 18 | 12 | 26 | 1A |
| 3 | 3 | 11 | B | 19 | 13 | 27 | 1B |
| 4 | 4 | 12 | C | 20 | 14 | 28 | 1C |
| 5 | 5 | 13 | D | 21 | 15 | 29 | 1D |
| 6 | 6 | 14 | E | 22 | 16 | 30 | 1E |
| 7 | 7 | 15 | F | 23 | 17 | 31 | 1F |

# MAC Addresses

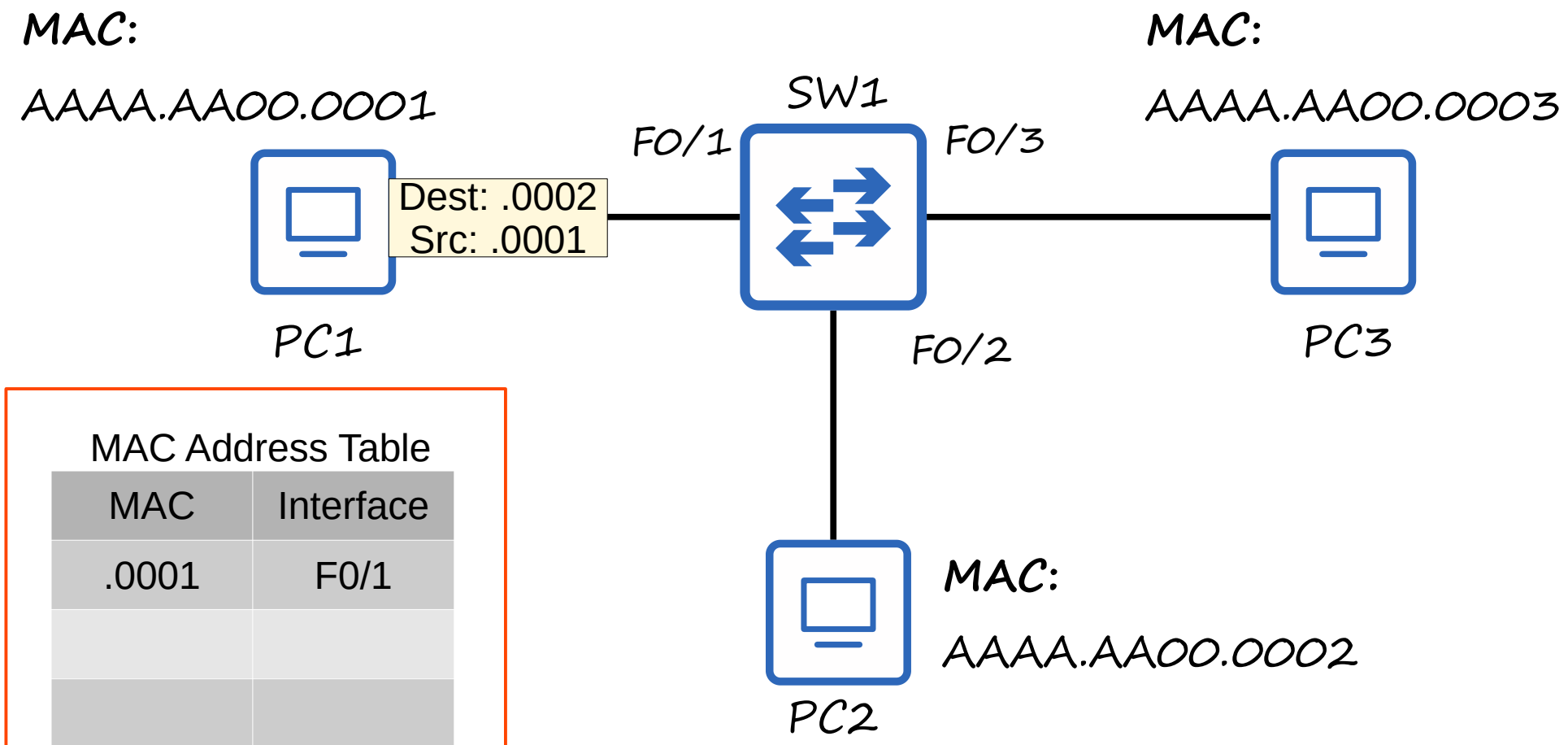



**Unicast** frame: a frame destined for a single target (PC2 in this case)

# MAC Addresses



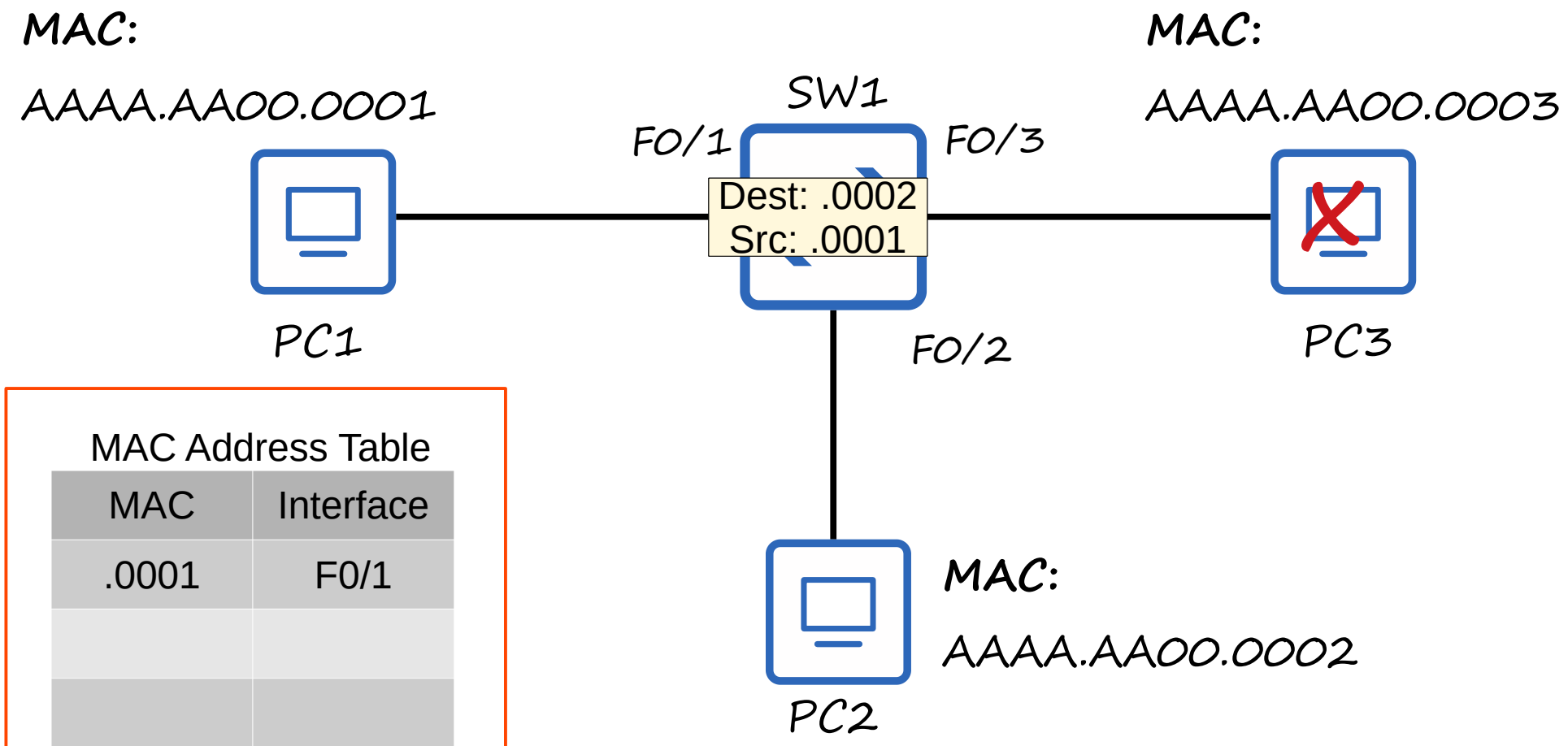
# MAC Addresses




MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |

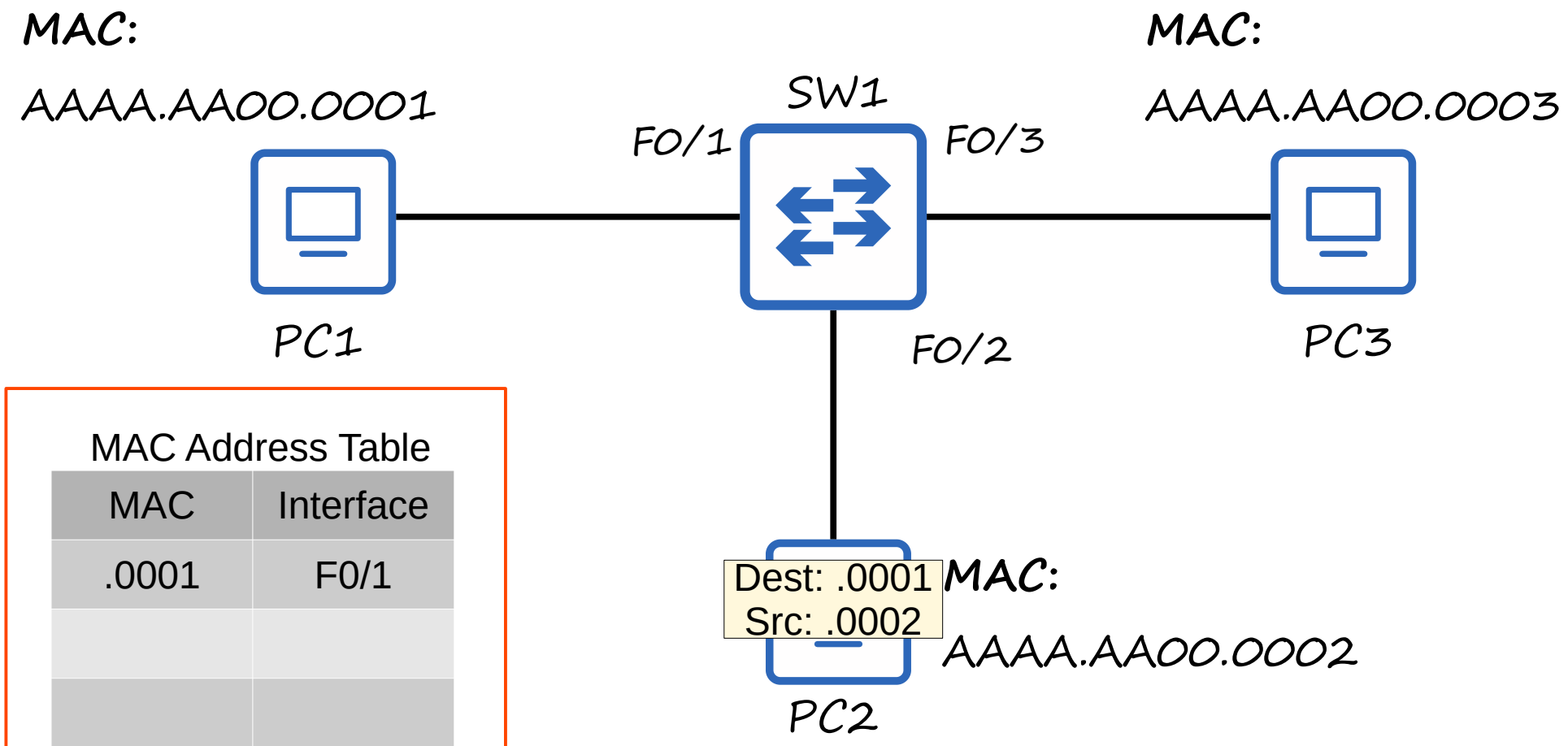
# MAC Addresses




MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |

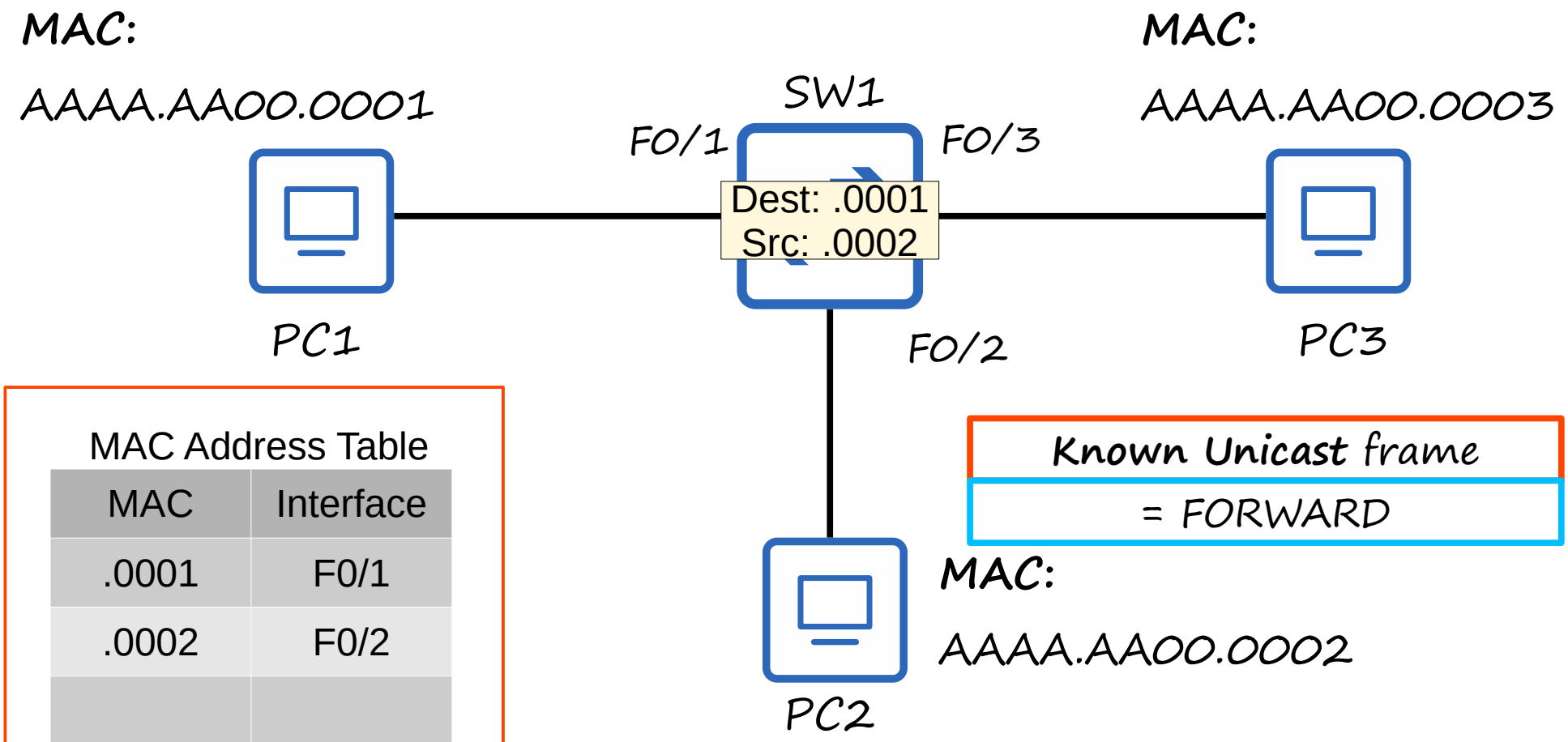
# MAC Addresses




MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |

# MAC Addresses




MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| .0002 | F0/2 |
| | |

**Known Unicast** frame

= FORWARD

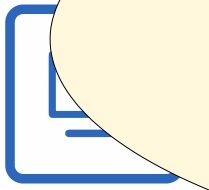
# MAC Addresses

MAC:

AAAA.AA00.C

.0003

Dynamic MAC addresses are removed from The MAC address table after **5 minutes** of inactivity.



PC1

PC3

MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| .0002 | F0/2 |
| | |

**Known Unicast** frame

= FORWARD

MAC:

AAAA.AA00.0002

PC2

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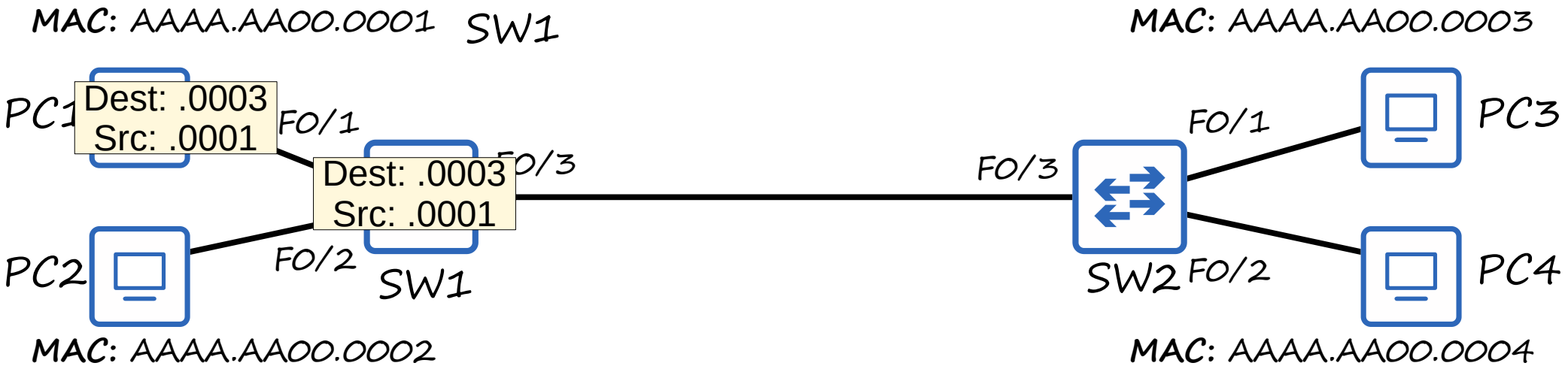
# MAC Addresses



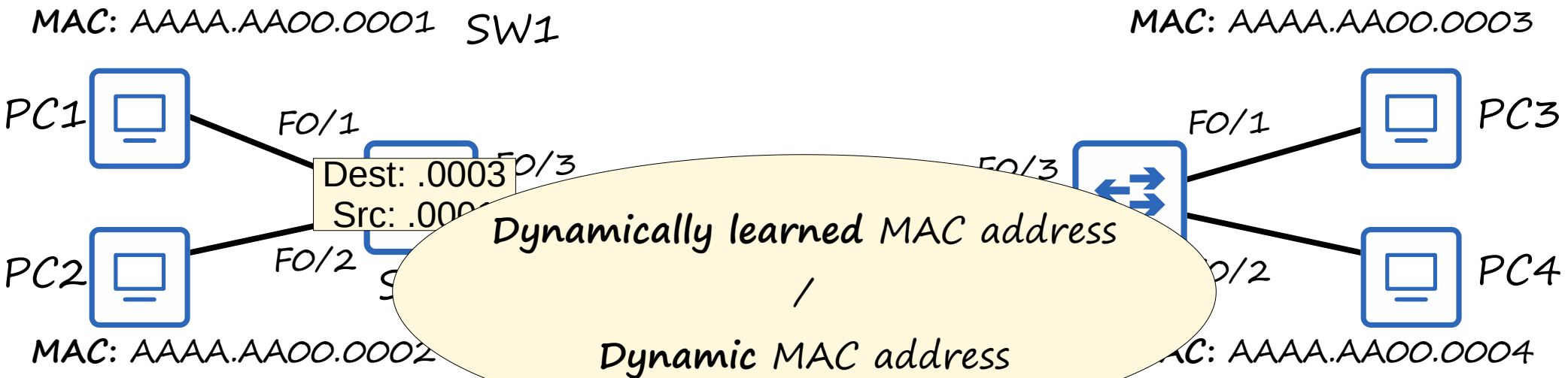

SW1 MAC Address Table

| MAC | Interface |
|---|---|
| | |
| | |
| | |
| | |

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| | |
| | |
| | |
| | |

# MAC Addresses




SW1 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |
| | |

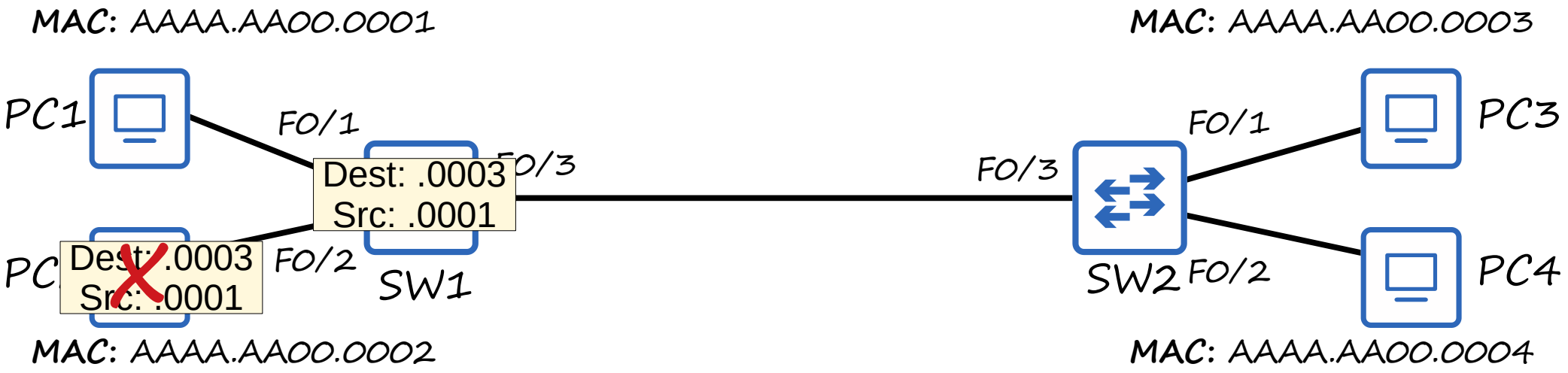
**Unknown Unicast** frame

= FLOOD

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| | |
| | |
| | |
| | |

# MAC Addresses



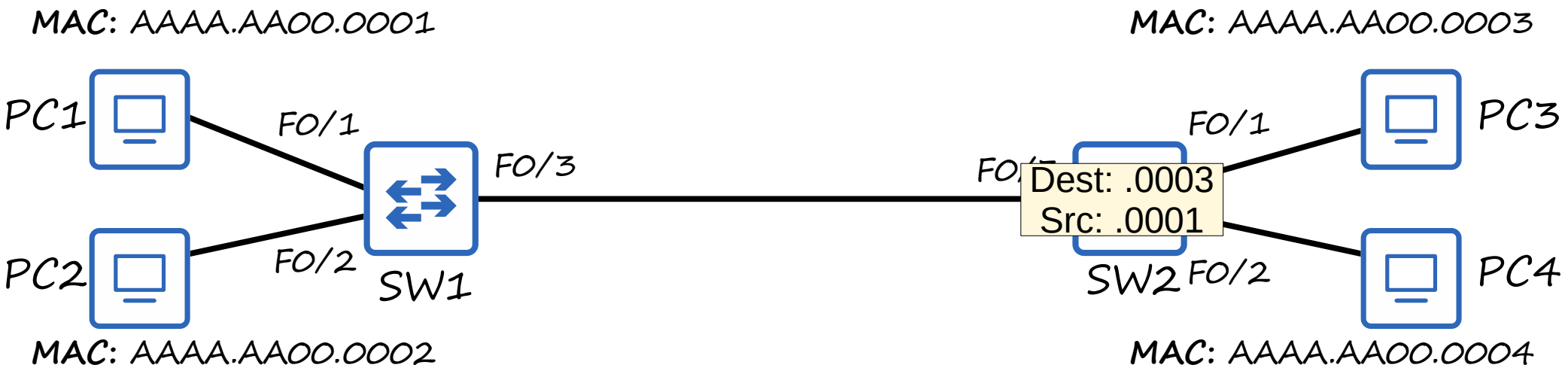

SW1 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |
| | |

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| | |
| | |
| | |
| | |

# MAC Addresses




SW1 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |
| | |

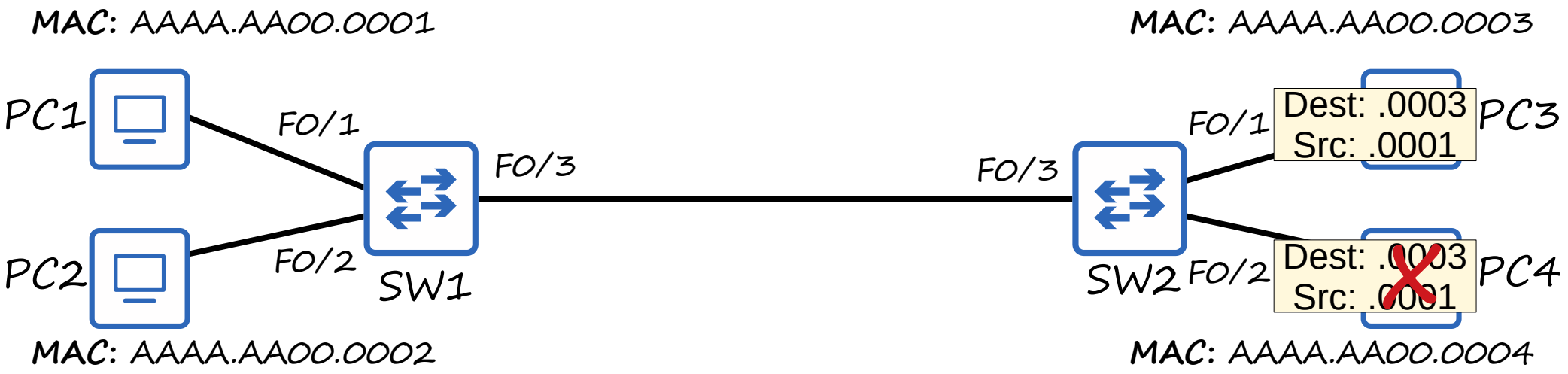
**Unknown Unicast** frame

= FLOOD

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/3 |
| | |
| | |
| | |

# MAC Addresses



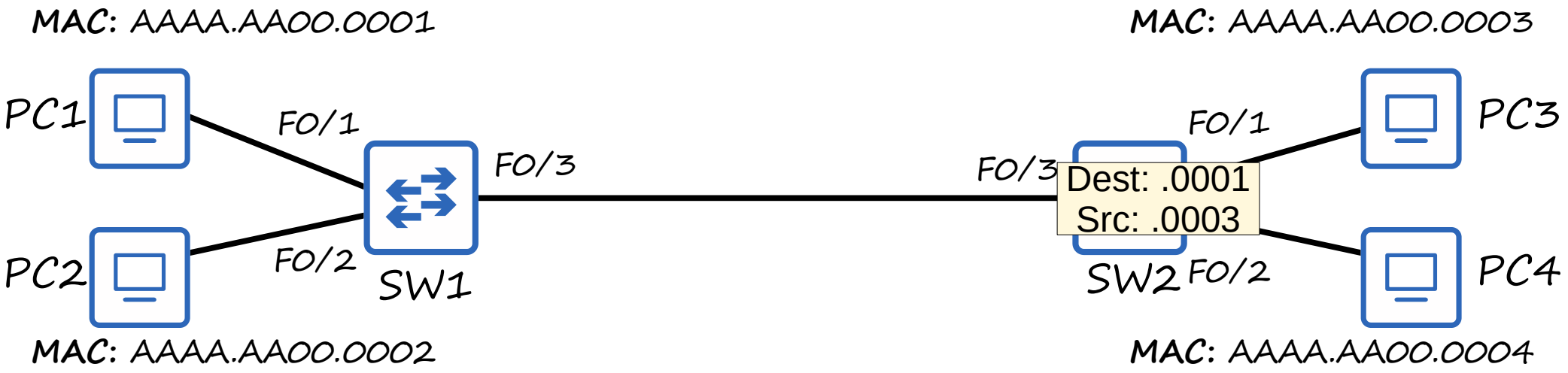

SW1 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |
| | |

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/3 |
| | |
| | |
| | |

# MAC Addresses



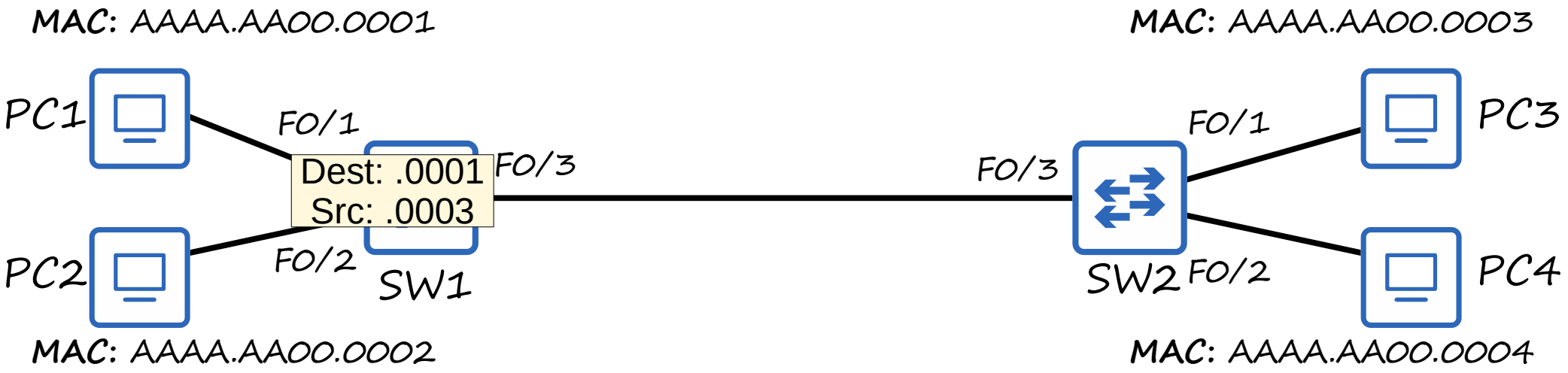

SW1 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |
| | |

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/3 |
| | |
| | |
| | |

# MAC Addresses



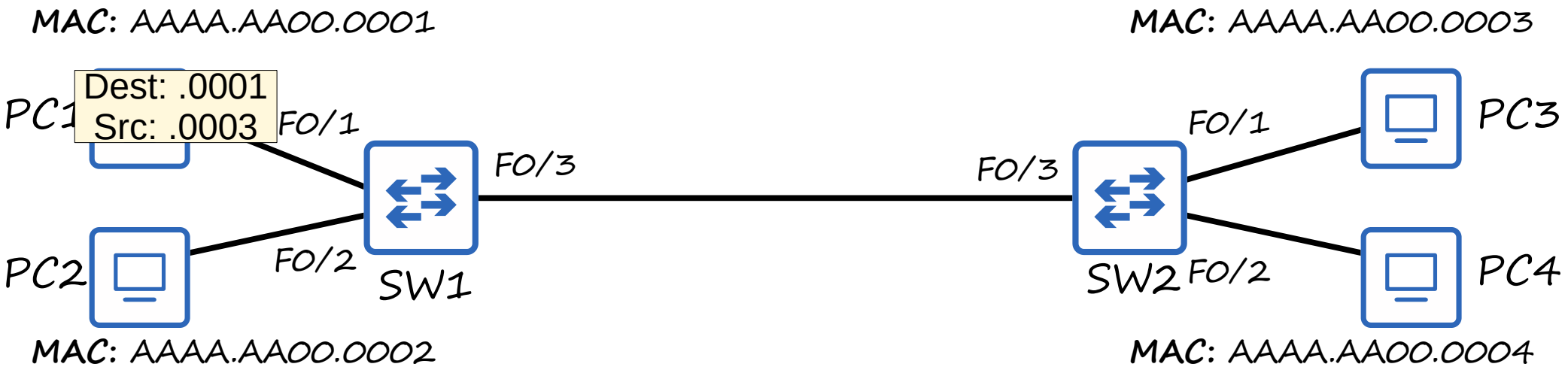

SW1 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| | |
| | |
| | |

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/3 |
| .0003 | F0/1 |
| | |
| | |

# MAC Addresses




SW1 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/1 |
| .0003 | F0/3 |
| | |
| | |

SW2 MAC Address Table

| MAC | Interface |
|---|---|
| .0001 | F0/3 |
| .0003 | F0/1 |
| | |
| | |

# QUIZ

# Quiz Question 1

Which field of an Ethernet frame provides receiver clock synchronization?

a) Preamble

b) SFD

c) Type

d) FCS

# Quiz Question 1

~~b~~) SFD

The SFD, or Start Frame Delimiter, signifies the end of the Preamble, it is not used to provide receiver clock synchronization.

# Quiz Question 1

~~A~~) Type

The Type field indicates the type of packet encapsulated within the frame.

# Quiz Question 1

★ a) Preamble

The preamble is a series of 1s and 0s (7 bytes of 10101010) which allows the receiving device to synchronize its receive clock.

# Quiz Question 1

~~d~~) FCS

The FCS, or Frame Check Sequence, is used to detect errors that occurred during transmission.

# Quiz Question 2

How long is the physical address of a network device?

a) 32 bytes

b) 32 bits

c) 48 bytes

d) 48 bits

# Quiz Question 3

What is the OUI of this MAC address? **E8BA.7011.2874**

a) E8BA

b) E8BA.70

c) 7011

d) E8BA.7011

The OUI (Organizationally Unique Identifier) is the **first half (24 bits)** of a MAC address. It is a unique value assigned to the maker of the device.

# Quiz Question 4

Which field of an Ethernet frame does a switch use to populate its MAC address table?

a) Preamble

b) Length

c) Source MAC Address

d) Destination MAC Address

# Quiz Question 4

a) Preamble

The preamble is a series of 1s and 0s (7 bytes of 10101010) which allows the receiving device to synchronize its receive clock. It is not used to populate the MAC address table.

# Quiz Question 4

~~A~~) Length

The Length field indicates the length of the encapsulated packet. It is not used to populate the MAC address table.

# Quiz Question 4

~~d~~) Destination MAC Address

Although this field does specify a MAC address, it does not help the switch populate the MAC address table.

# Quiz Question 1

★ c) Source MAC Address

A switch uses the Source MAC Address field to populate its MAC address table. It associates the source MAC address with the interface on which the frame was received. This allows the switch to learn how to reach other devices on the network.

# Quiz Question 5

What kind of frame does a switch flood out of all interfaces except the one it was received on?

a) Unknown unicast

b) Known unicast

c) Allcast

# Quiz Question 5

A) Known unicast

A known unicast frame is a frame for which the destination MAC address is already in the switch's MAC address table. Since it already knows how to reach the destination, there is no need to flood the frame.

# Quiz Question 5

~~a~~) Allcast

Allcast is not a type of Ethernet frame.

# Quiz Question 5

★ a) Unknown unicast

An unknown unicast frame is a frame destined for a single host, however the switch doesn't know how to reach the destination so it floods the frame out of all interfaces except the one it was received on.

# Supplementary Materials

- Review flash cards (link in the description)
- Packet Tracer lab (after PART 2's video)