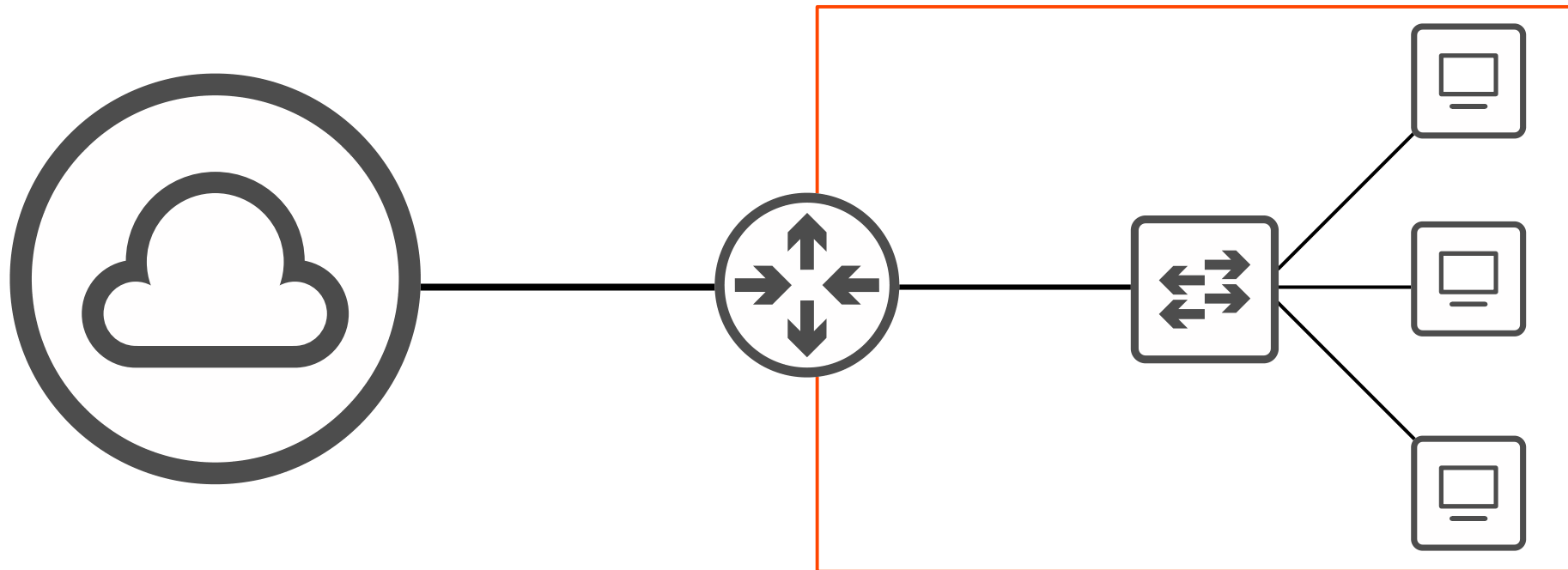




CCNA 200-301 Day 5

Ethernet LAN Switching



OSI Model – Physical Layer

7 Application

6 Presentation

5 Session

4 Transport

3 Network

2 Data Link

1 **Physical**

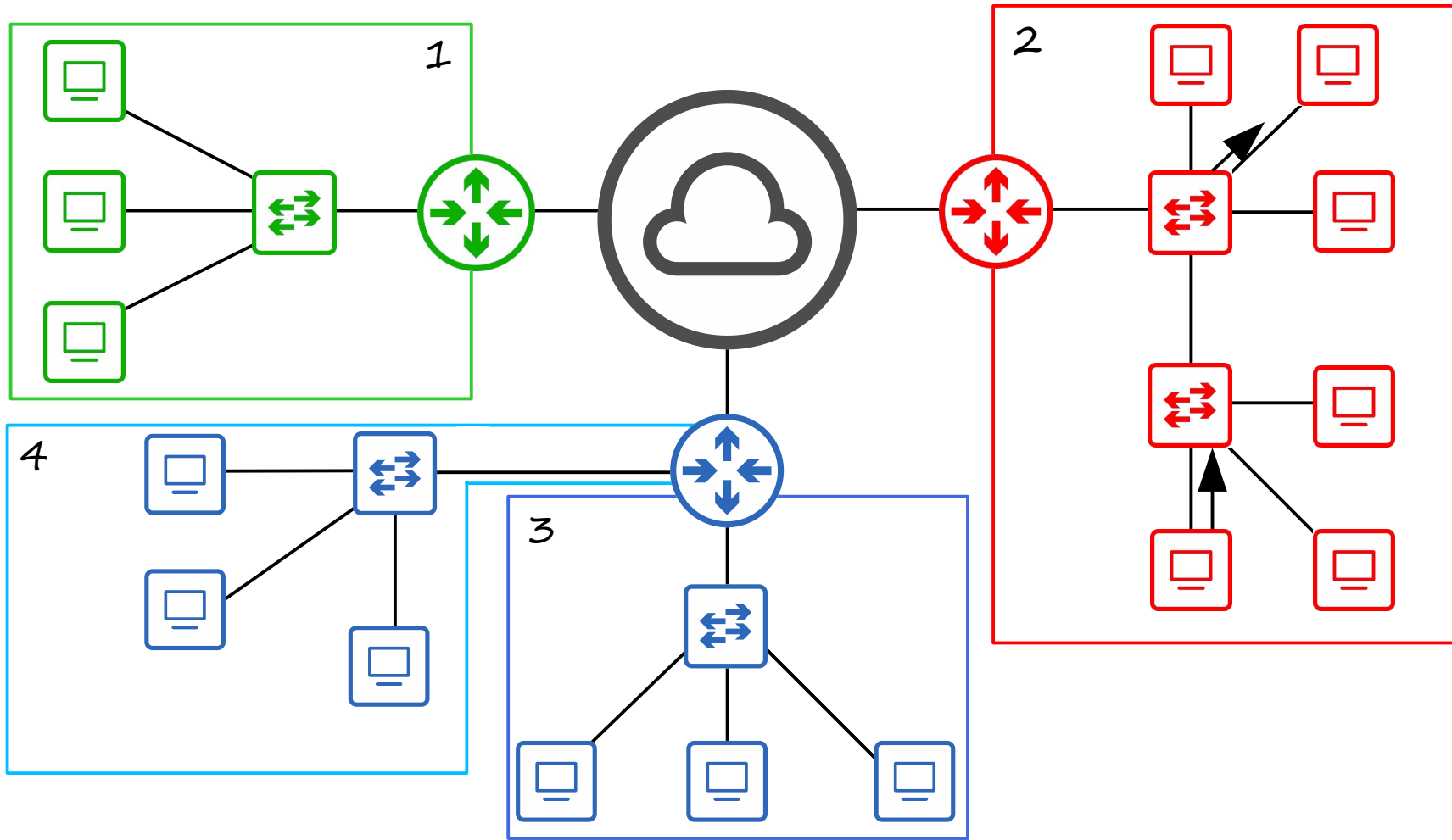
- Defines physical characteristics of the medium used to transfer data between devices.
- For example, voltage levels, maximum transmission distances, physical connectors, cable specifications, etc.
- Digital bits are converted into electrical (for wired connections) or radio (for wireless connections) 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

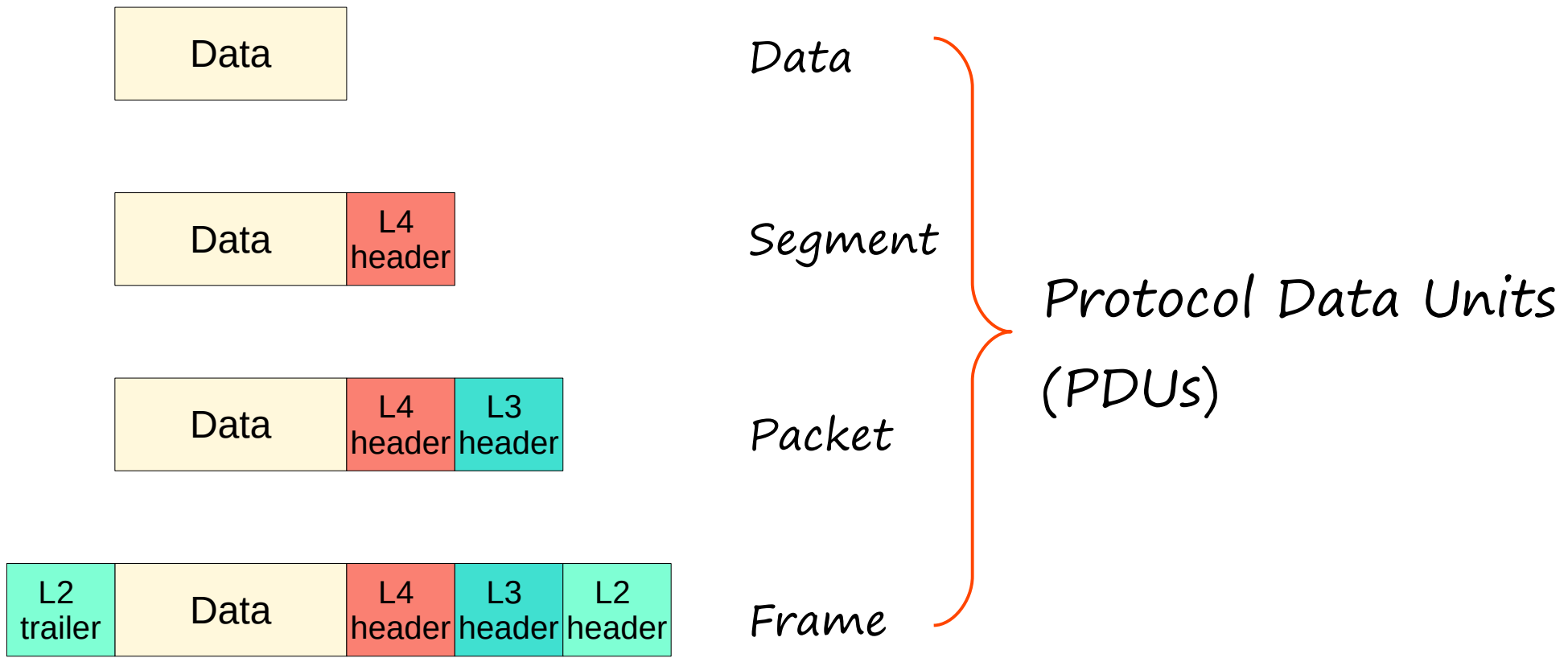
7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data Link
1	Physical

- 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.

Local Area Networks (LANs)

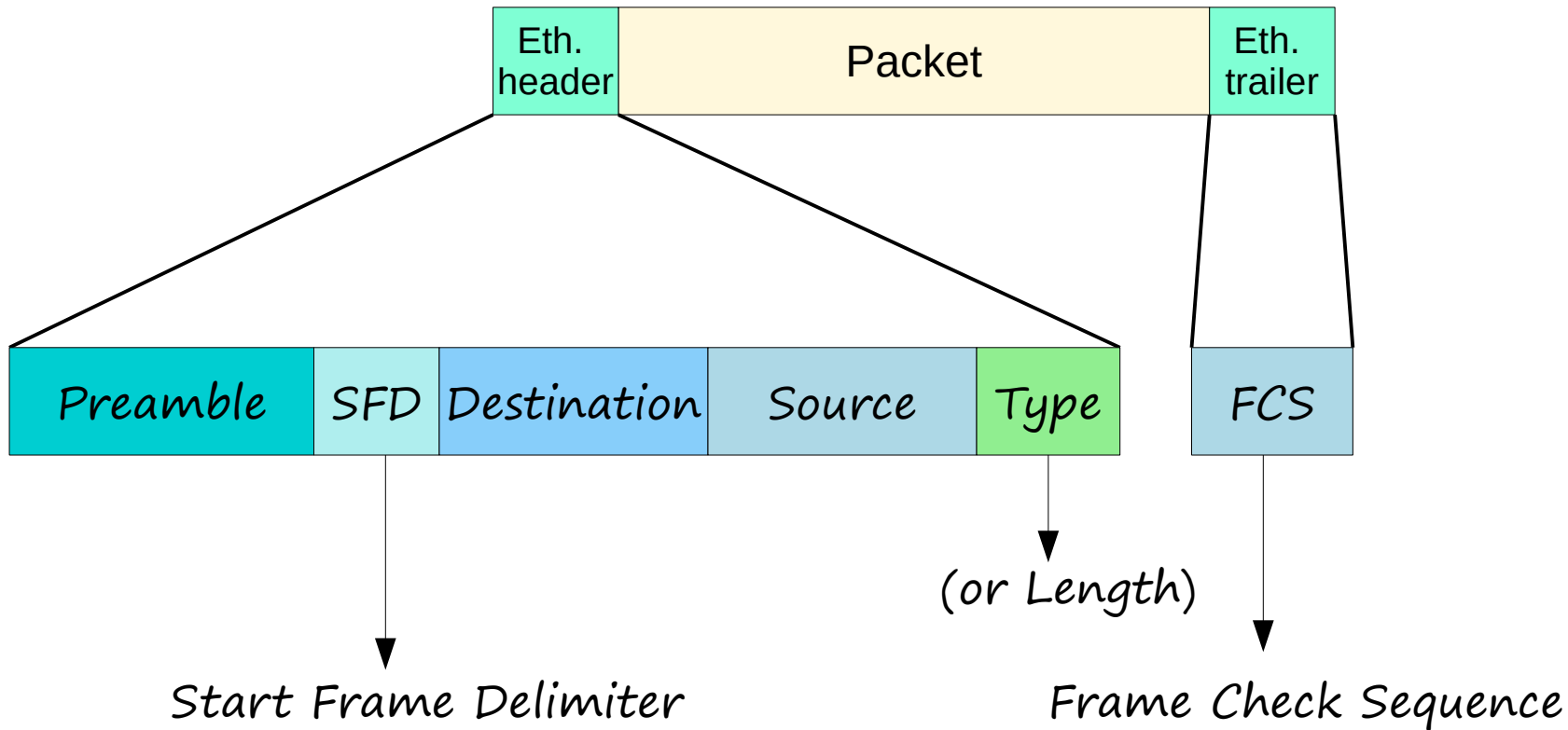


OSI Model – PDUs





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

- 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

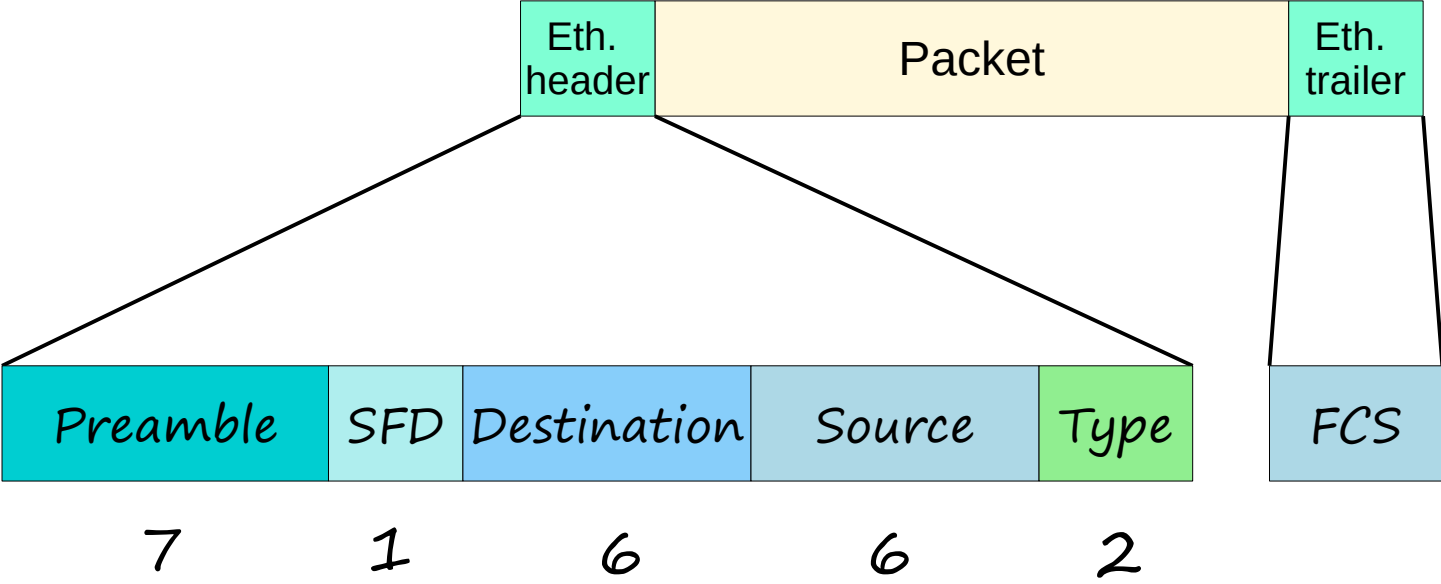
OR

Length

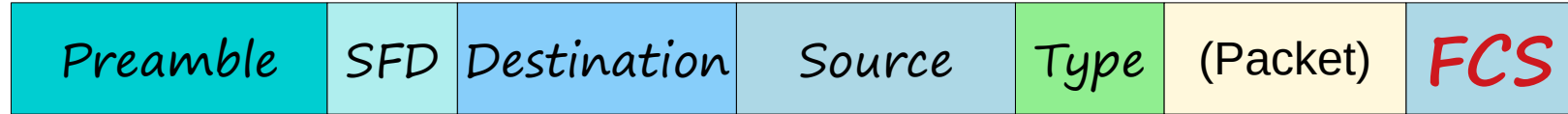
IPv4 = 0x0800 (hexadecimal) IPv6 = 0x86DD (hexadecimal)
(2048 in decimal) (34525 in decimal)



Ethernet Frame



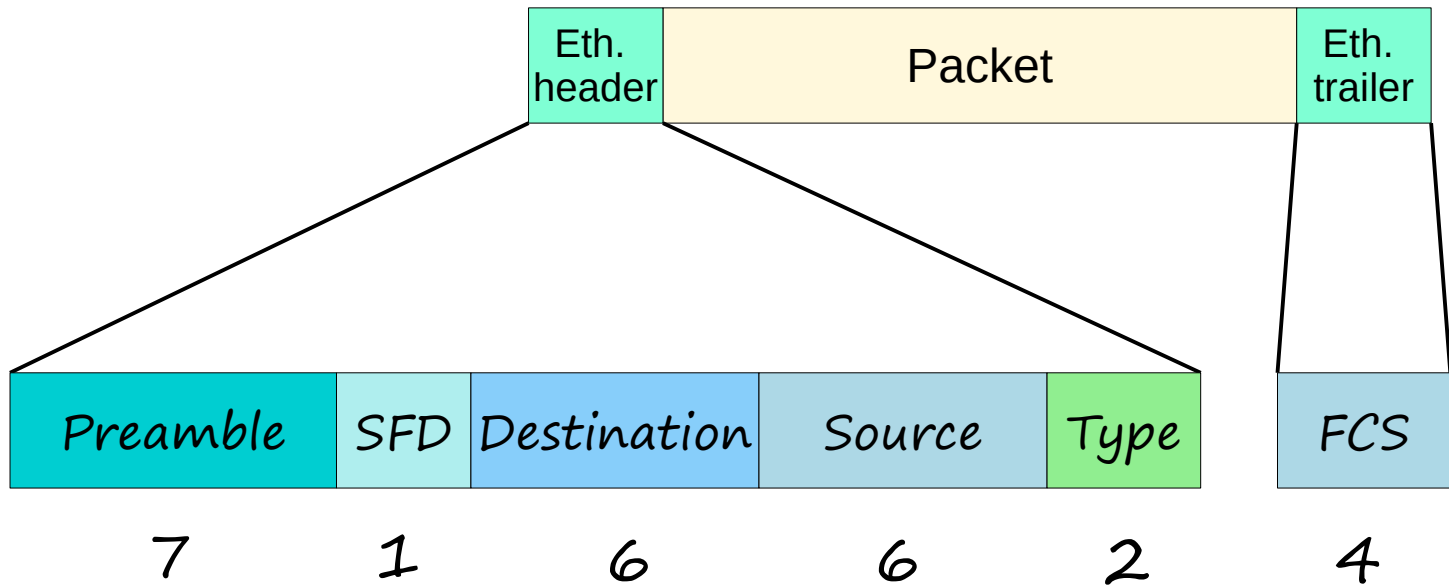
Frame Check Sequence (FCS)



- '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

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

0	10	20		100		1000
1	11	21		101		
2	12	22		102		
3	13		
4	14					
5	15					
6	16					
7	17					
8	18					
9	19					



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



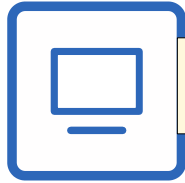
Hexadecimal

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

MAC:

AAAA.AA00.0001

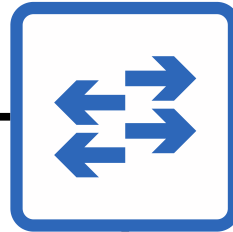


PC1

Dest: .0002
Src: .0001

FO/1

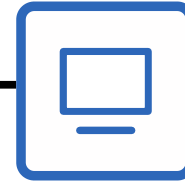
SW1



FO/3

MAC:

AAAA.AA00.0003



PC3

FO/2



PC2

MAC:

AAAA.AA00.0002

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

MAC Addresses

MAC:

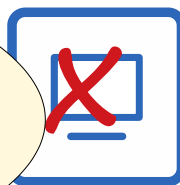
AAAA.AA00.0001



PC1

MAC:

AAAA.AA00.0003



PC3

Dynamically learned MAC address
/
Dynamic MAC address

SW1



PC2

MAC Address Table

MAC	Interface
.0001	F0/1

Unknown Unicast frame

= FLOOD

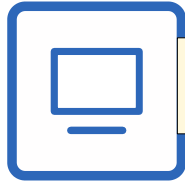
MAC:

AAAA.AA00.0002

MAC Addresses

MAC:

AAAA.AA00.0001

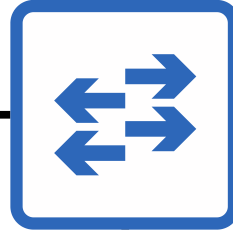


PC1

Dest: .0002
Src: .0001

F0/1

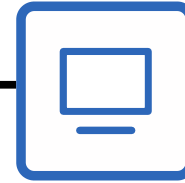
SW1



F0/3

MAC:

AAAA.AA00.0003



PC3

F0/2



PC2

MAC:

AAAA.AA00.0002

MAC Address Table

MAC	Interface
.0001	F0/1



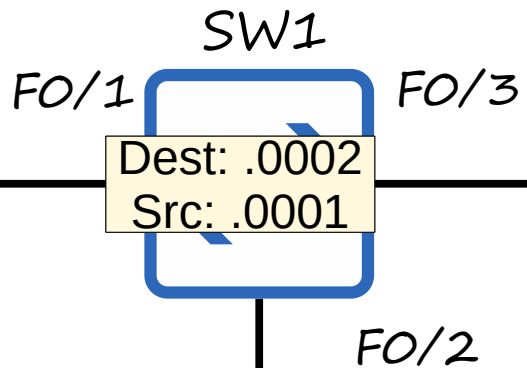
MAC Addresses

MAC:

AAAA.AA00.0001

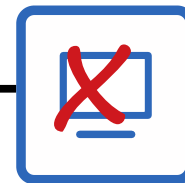


PC1



MAC:

AAAA.AA00.0003



PC3



PC2

MAC:

AAAA.AA00.0002

MAC Address Table

MAC	Interface
.0001	F0/1



MAC Addresses

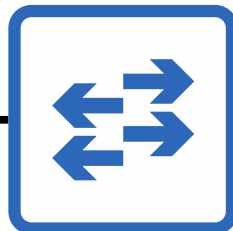
MAC:

AAAA.AA00.0001



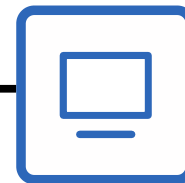
PC1

SW1
F0/1 F0/3



MAC:

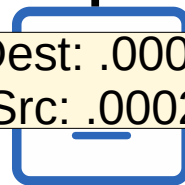
AAAA.AA00.0003



PC3

F0/2

Dest: .0001
Src: .0002



PC2

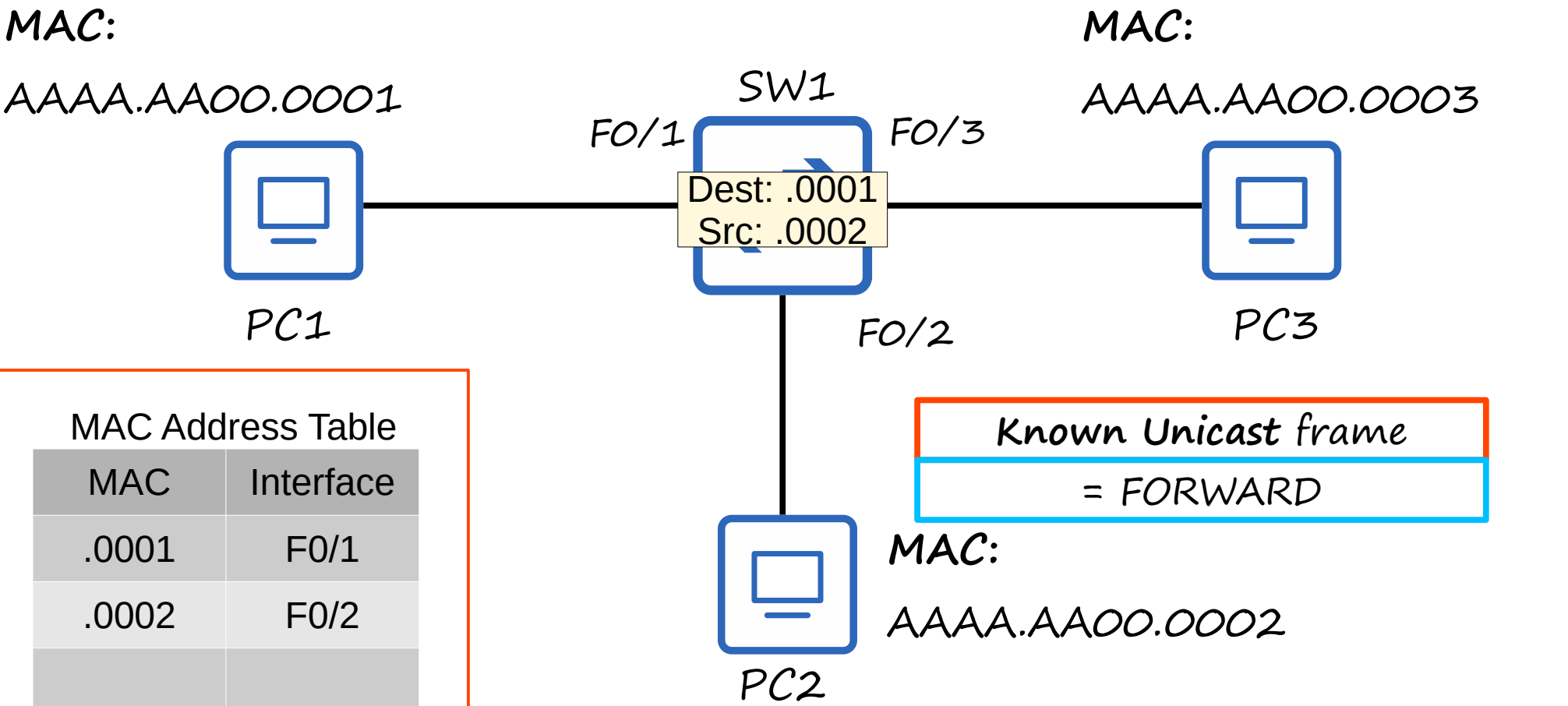
MAC:

AAAA.AA00.0002

MAC Address Table

MAC	Interface
.0001	F0/1

MAC Addresses



MAC Address Table

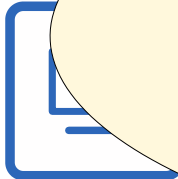
MAC	Interface
.0001	F0/1
.0002	F0/2

MAC Addresses

MAC:

AAAA.AA00.00003

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



PC1



PC3



PC2

MAC Address Table

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

Known Unicast frame

= FORWARD

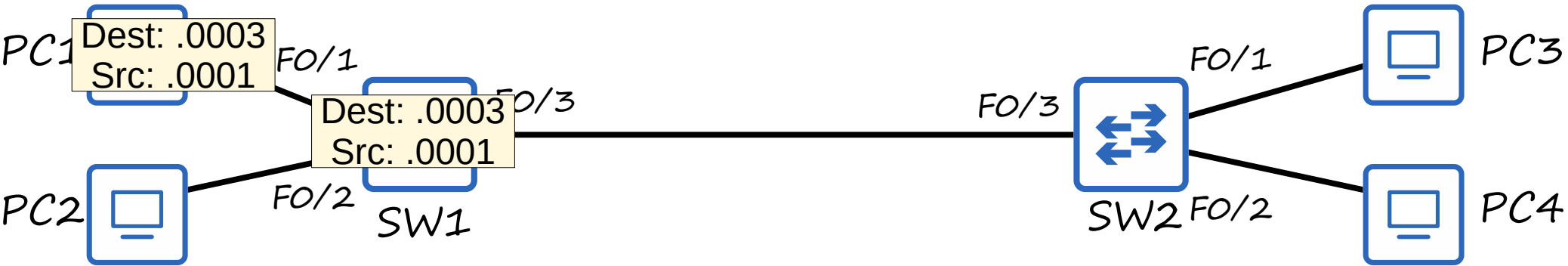
MAC:

AAAA.AA00.0002

MAC Addresses

MAC: AAAA.AA00.0001 SW1

MAC: AAAA.AA00.0003



MAC: AAAA.AA00.0002

MAC: AAAA.AA00.0004

SW1 MAC Address Table

MAC	Interface

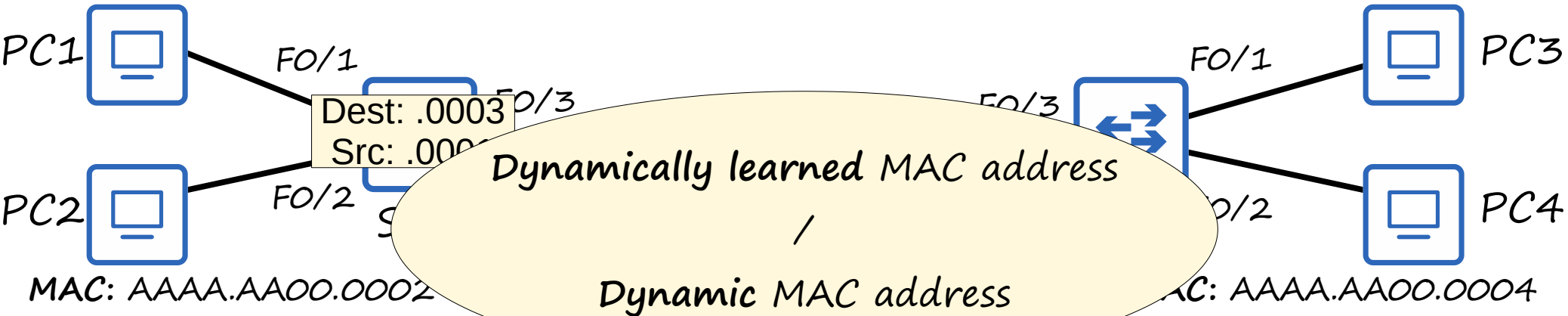
SW2 MAC Address Table

MAC	Interface

MAC Addresses

MAC: AAAA.AA00.0001 SW1

MAC: AAAA.AA00.0003



SW1 MAC Address Table

MAC	Interface
.0001	F0/1

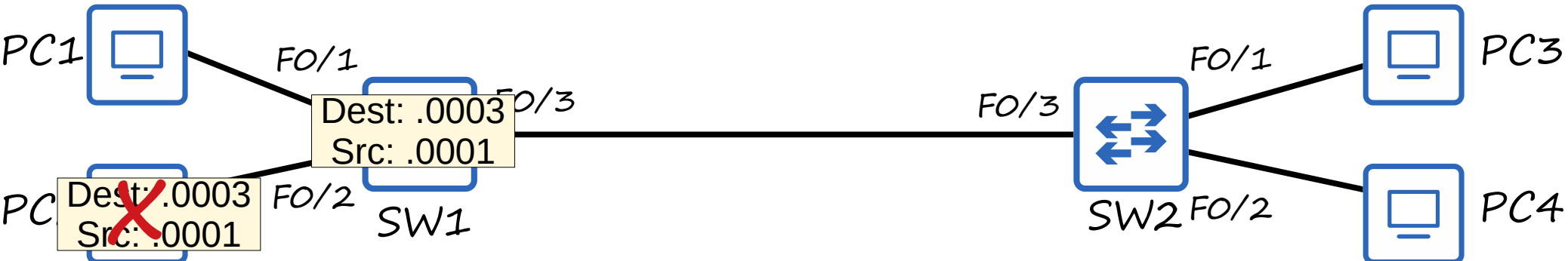
SW2 MAC Address Table

MAC	Interface

MAC Addresses

MAC: AAAA.AA00.0001

MAC: AAAA.AA00.0003



SW1 MAC Address Table

MAC	Interface
.0001	F0/1

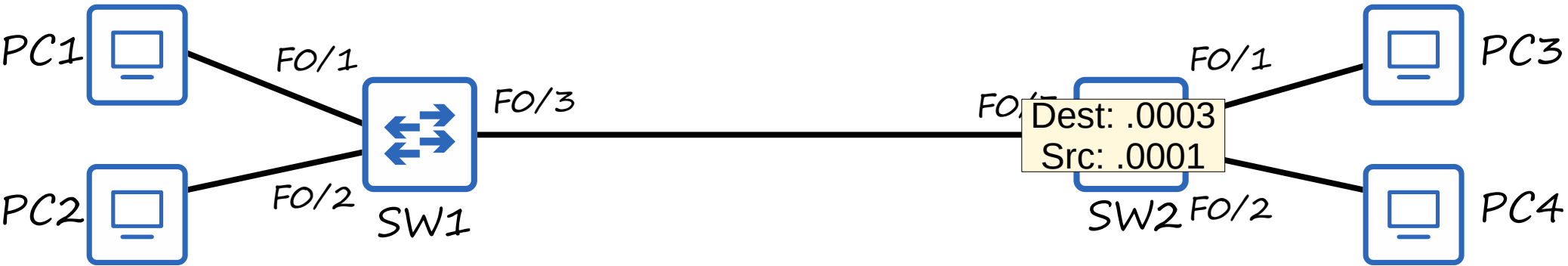
SW2 MAC Address Table

MAC	Interface

MAC Addresses

MAC: AAAA.AA00.0001

MAC: AAAA.AA00.0003



MAC: AAAA.AA00.0002

MAC: AAAA.AA00.0004

SW1 MAC Address Table

MAC	Interface
.0001	F0/1

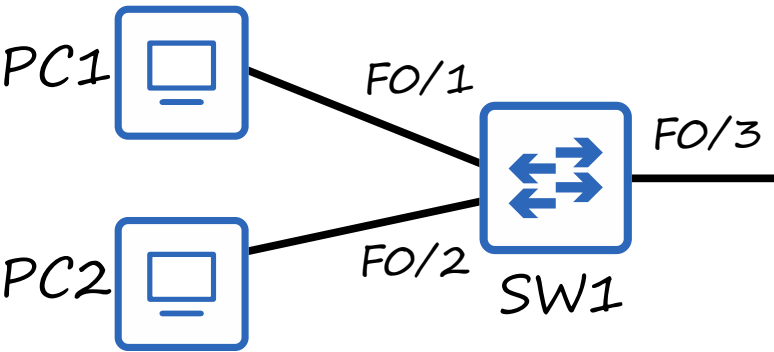
Unknown Unicast frame
= FLOOD

SW2 MAC Address Table

MAC	Interface
.0001	F0/3

MAC Addresses

MAC: AAAA.AA00.0001

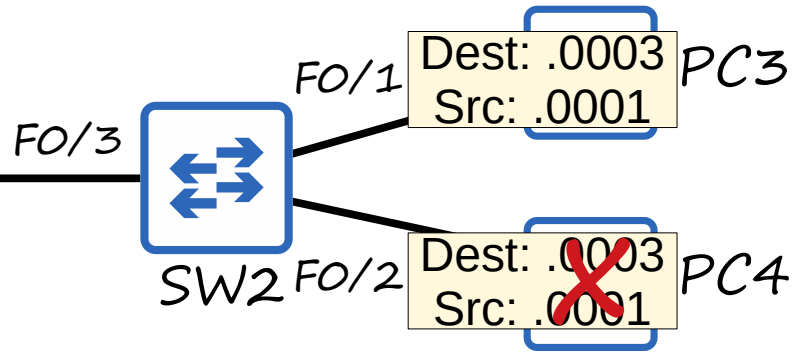


MAC: AAAA.AA00.0002

SW1 MAC Address Table

MAC	Interface
.0001	F0/1

MAC: AAAA.AA00.0003



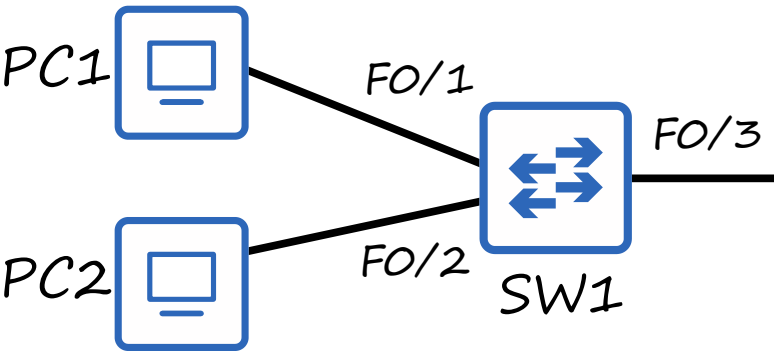
MAC: AAAA.AA00.0004

SW2 MAC Address Table

MAC	Interface
.0001	F0/3

MAC Addresses

MAC: AAAA.AA00.0001



MAC: AAAA.AA00.0003

MAC: AAAA.AA00.0002

MAC: AAAA.AA00.0004

SW1 MAC Address Table

MAC	Interface
.0001	F0/1

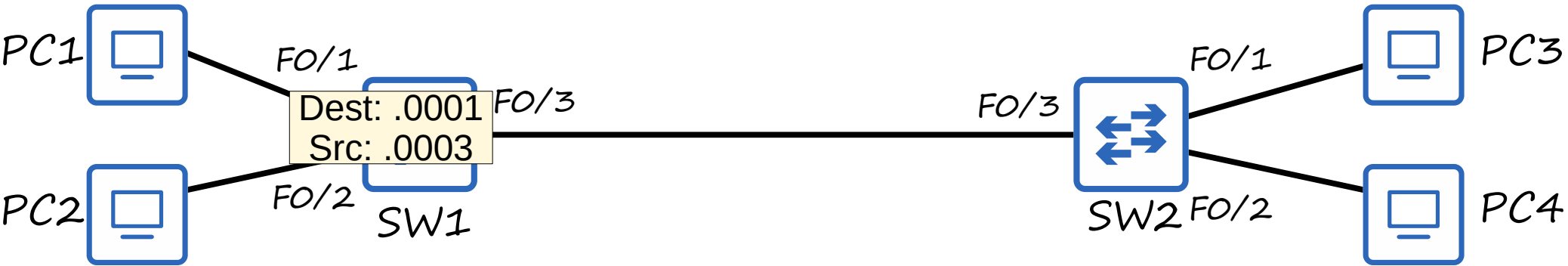
SW2 MAC Address Table

MAC	Interface
.0001	F0/3

MAC Addresses

MAC: AAAA.AA00.0001

MAC: AAAA.AA00.0003



SW1 MAC Address Table

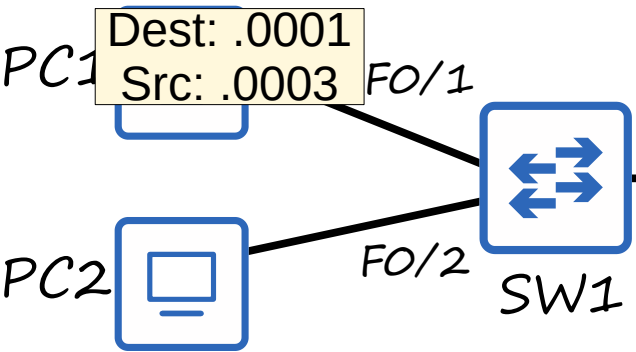
MAC	Interface
.0001	F0/1

SW2 MAC Address Table

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

MAC Addresses

MAC: AAAA.AA00.0001

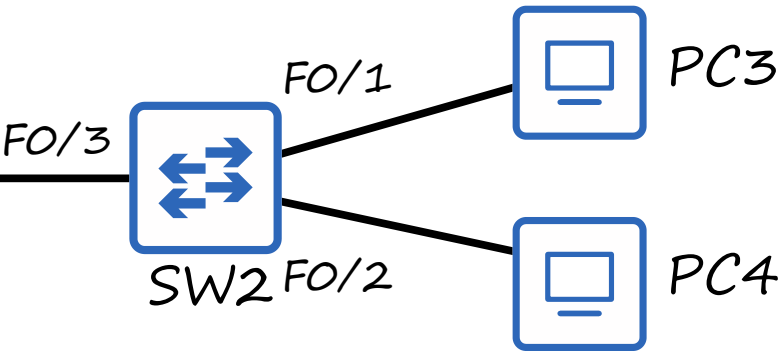


MAC: AAAA.AA00.0002

SW1 MAC Address Table

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

MAC: AAAA.AA00.0003



MAC: AAAA.AA00.0004

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

~~X~~) 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

~~X~~ 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

~~X~~) 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

~~X~~) 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

~~X~~) Length

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

Quiz Question 4

~~X~~) 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

~~X~~) 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

~~X~~) 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.