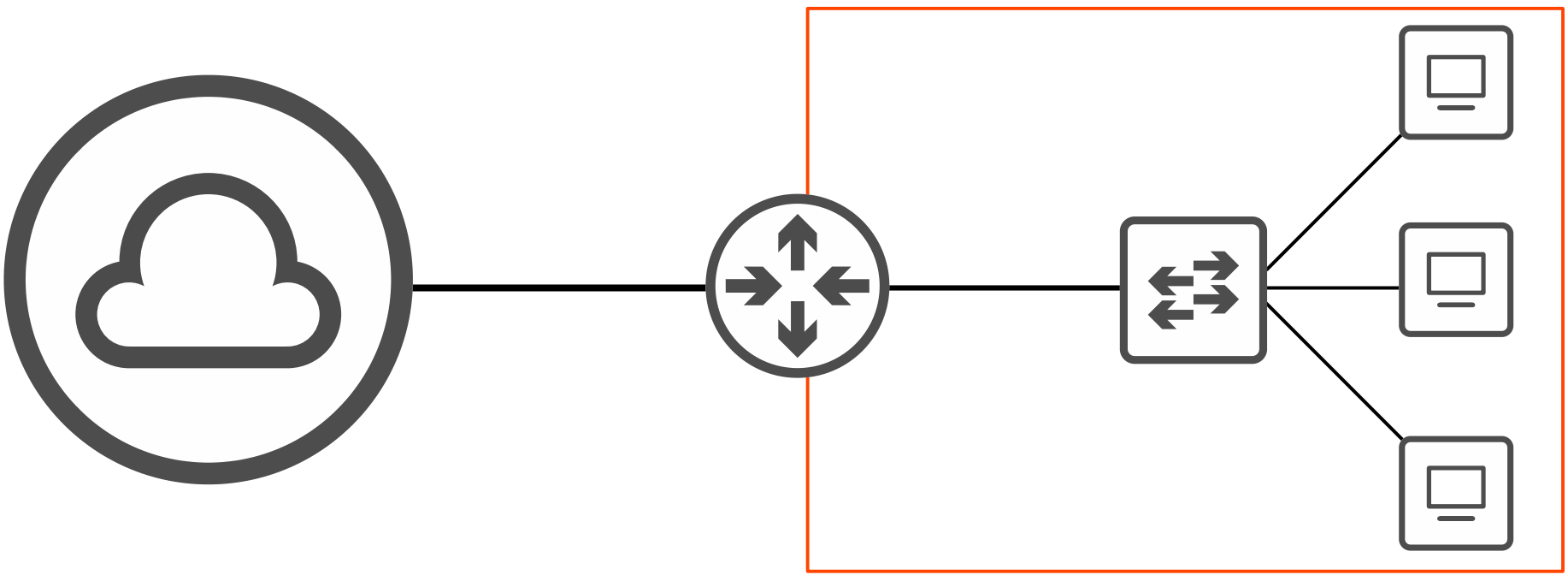
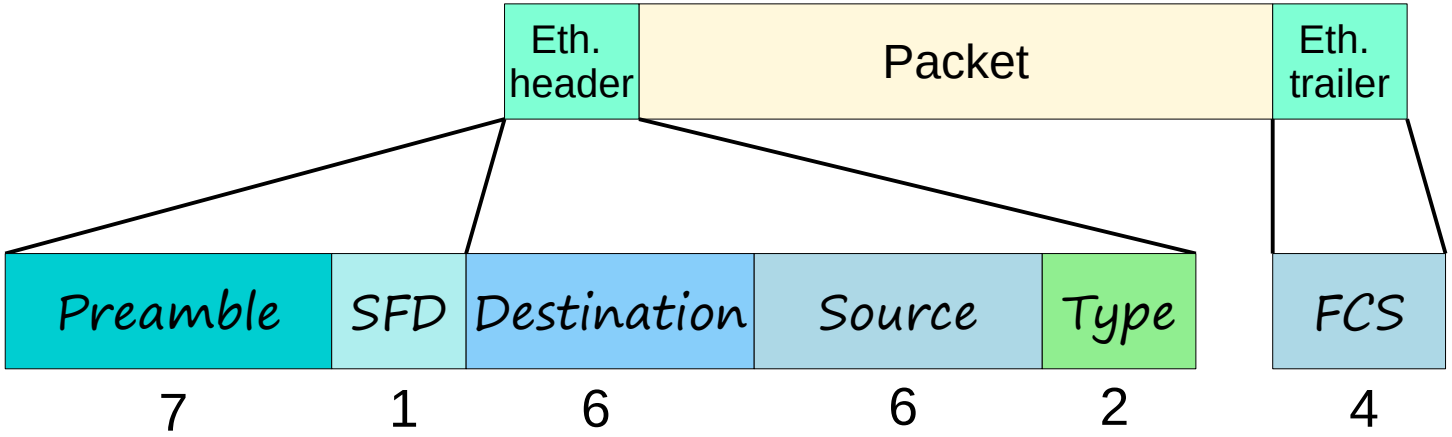
Jeremy's IT Lab

CCNA 200-301 Day 6

Ethernet LAN Switching (Part 2)

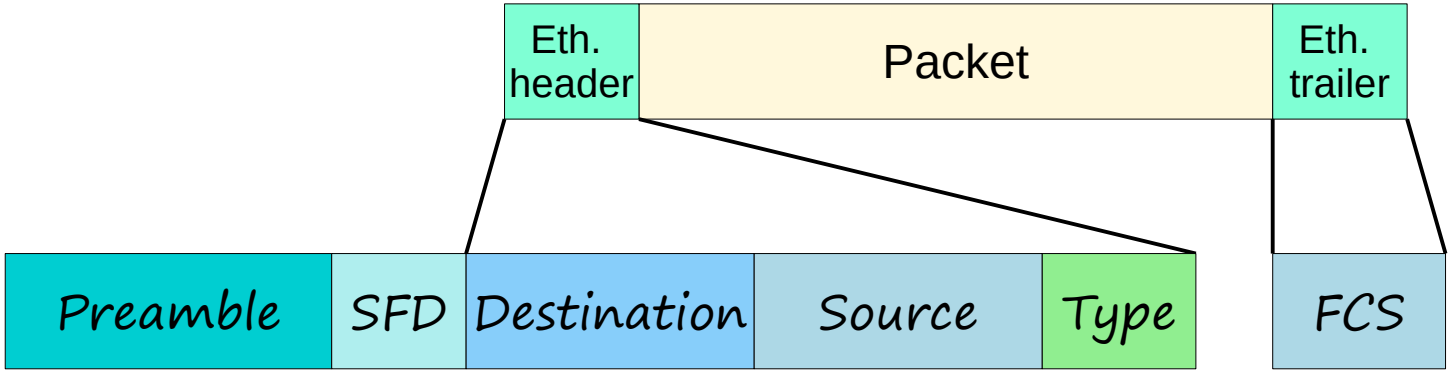


Ethernet Frame



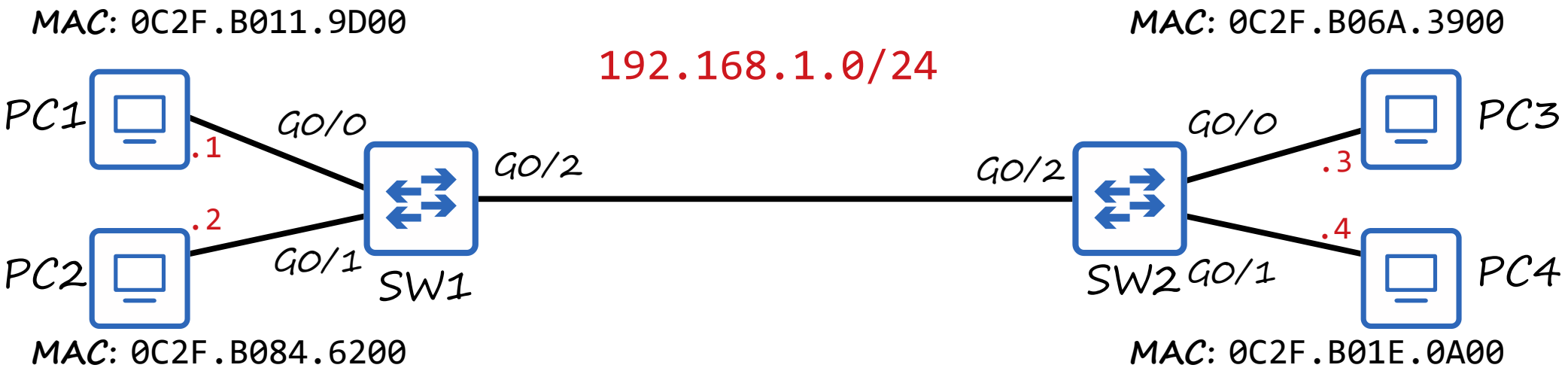
- The **Preamble + SFD** is usually not considered part of the Ethernet header
- Therefore the size of the Ethernet header + trailer is 18 bytes (6 + 6 + 2 + 4)

Ethernet Frame



- The minimum size for an Ethernet frame (Header + Payload [Packet] + Trailer) is **64 bytes**
- **64 bytes – 18 bytes** (header + trailer size) = 46 bytes
- Therefore the minimum payload (packet) size is 46 bytes
- If the payload is **less than 46 bytes**, padding bytes are added
- ie. 34-byte packet + 12-byte padding = 46 bytes

Ethernet LAN Switching



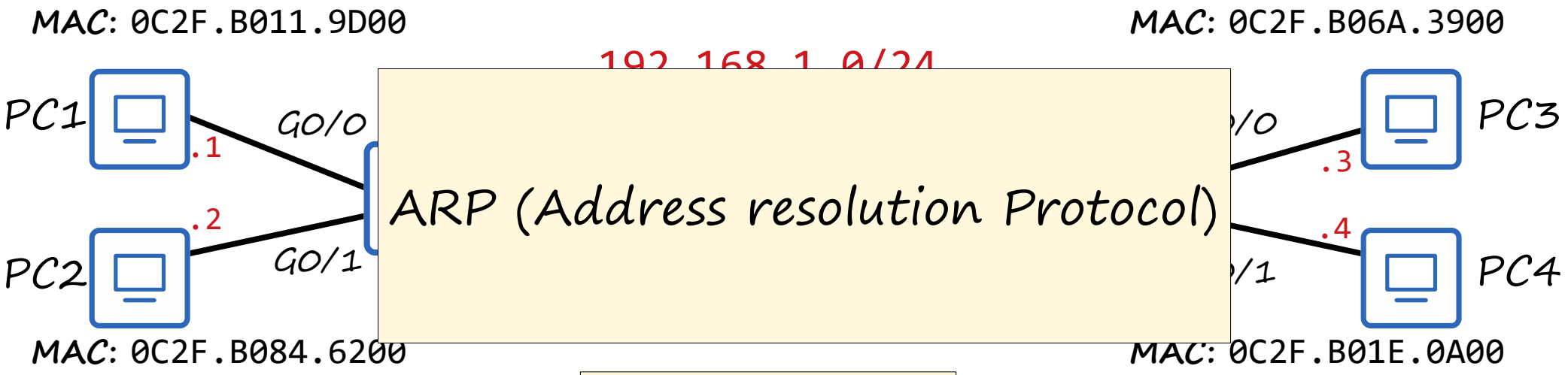
SW1 MAC Address Table

MAC	Interface

SW2 MAC Address Table

MAC	Interface

Ethernet LAN Switching



SW1 MAC Address Table

MAC	Interface

Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: .9D00
Dst MAC: ???

SW2 MAC Address Table

MAC	Interface

ARP

- ARP stands for 'Address Resolution Protocol'
- ARP is used to discover the Layer 2 address (MAC address) of a known Layer 3 address (IP address)
- Consists of two messages:

ARP Request

ARP Reply

- **ARP Request** is **broadcast** = sent to all hosts on the network
- **ARP Reply** is **unicast** = sent only to one host (the host that sent the request)

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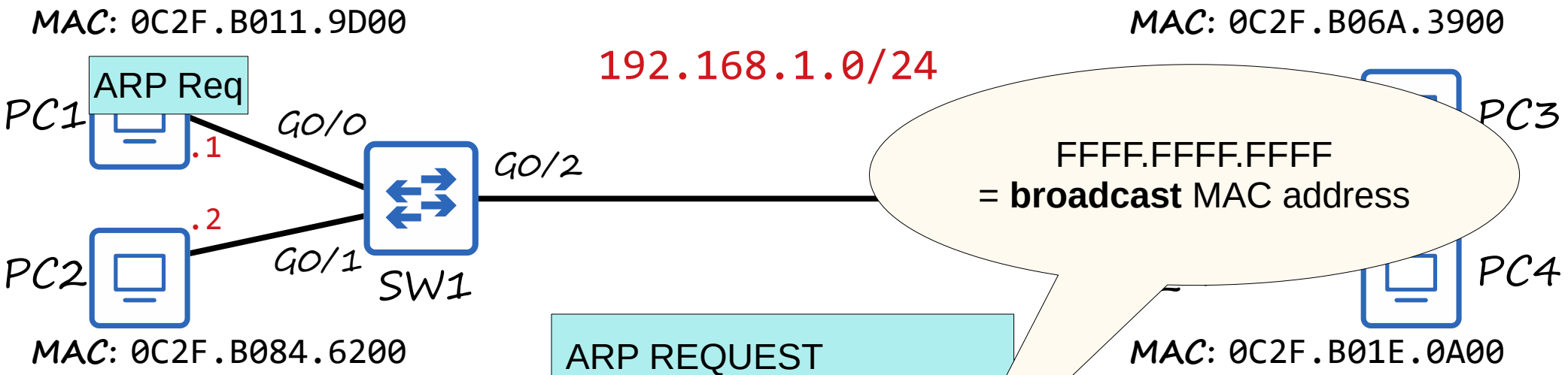
ARP Request



ARP REQUEST
Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: 0C2F.B011.9D00
Dst MAC: FFFF.FFFF.FFFF

Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: .9D00
Dst MAC: ???

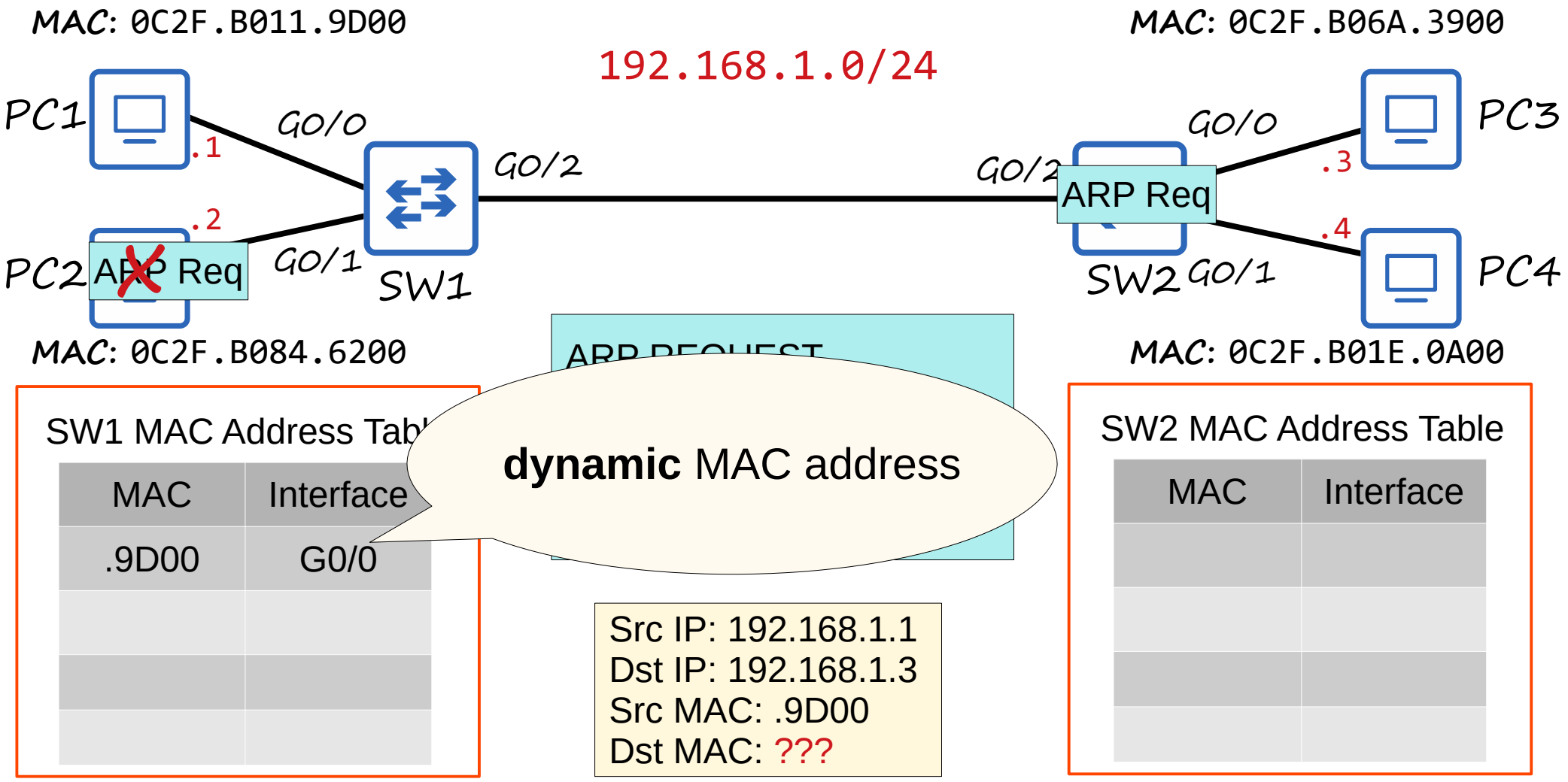
SW1 MAC Address Table

MAC	Interface

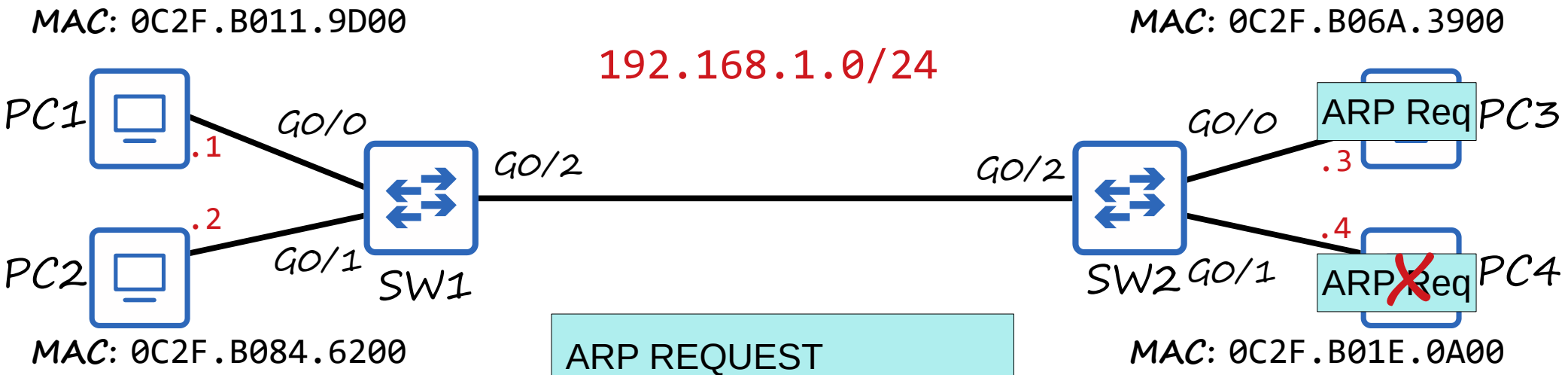
SW2 MAC Address Table

MAC	Interface

ARP Request


MAC: 0C2F.B011.9D00
MAC: 0C2F.B06A.3900
192.168.1.0/24
PC1
.1
G0/0
G0/2
G0/2
G0/0
PC3
.3
.2
ARP Req
PC2
ARP Req
G0/1
SW1
SW2
G0/1
.4
PC4
MAC: 0C2F.B084.6200
MAC: 0C2F.B01E.0A00
ARP REQUEST
dynamic MAC address
SW1 MAC Address Tabl
MAC
Interface
.9D00
G0/0
SW2 MAC Address Table
MAC
Interface
Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: .9D00
Dst MAC: ???

ARP Request



ARP REQUEST
Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: 0C2F.B011.9D00
Dst MAC: FFFF.FFFF.FFFF

Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: .9D00
Dst MAC: ???

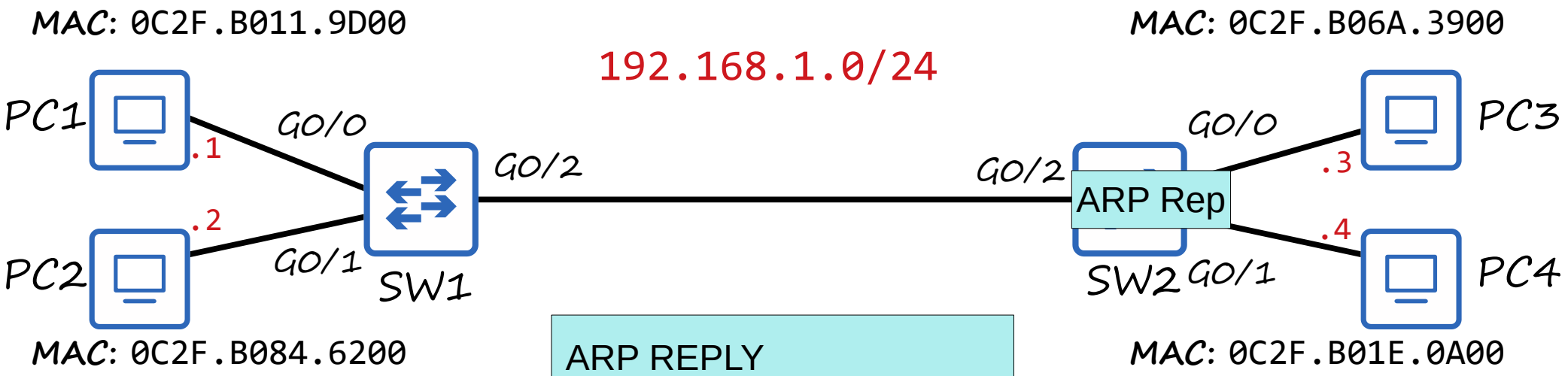
SW1 MAC Address Table

MAC	Interface
.9D00	G0/0

SW2 MAC Address Table

MAC	Interface
.9D00	G0/2

ARP Reply



ARP REPLY
Src IP: 192.168.1.3
Dst IP: 192.168.1.1
Src MAC: 0C2F.B06A.3900
Dst MAC: 0C2F.B011.9D00

Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: .9D00
Dst MAC: ???

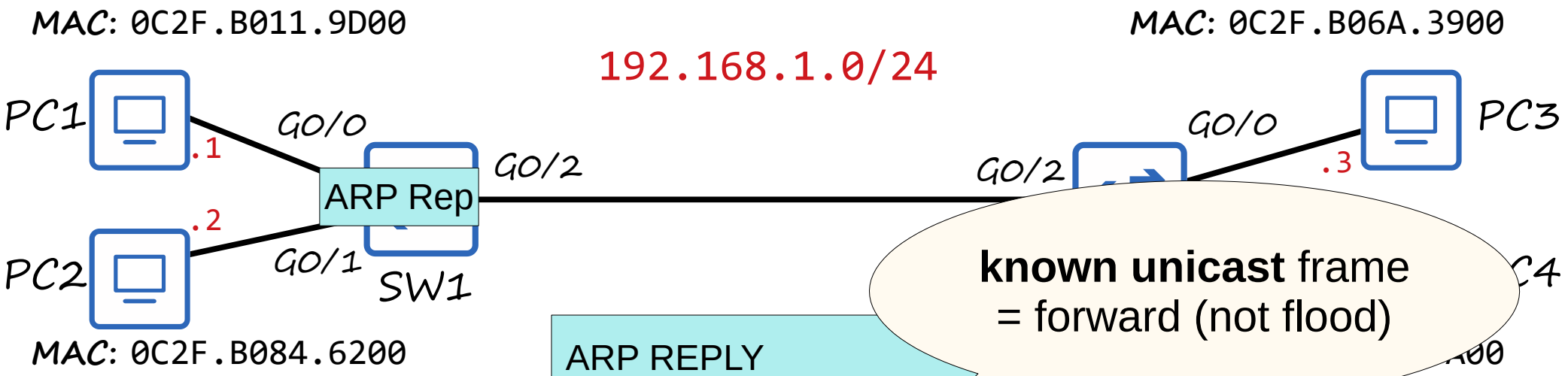
SW1 MAC Address Table

MAC	Interface
.9D00	G0/0

SW2 MAC Address Table

MAC	Interface
.9D00	G0/2

ARP Reply



ARP REPLY
Src IP: 192.168.1.3
Dst IP: 192.168.1.1
Src MAC: 0C2F.B06A.3900
Dst MAC: 0C2F.B011.9D00

Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: .9D00
Dst MAC: ???

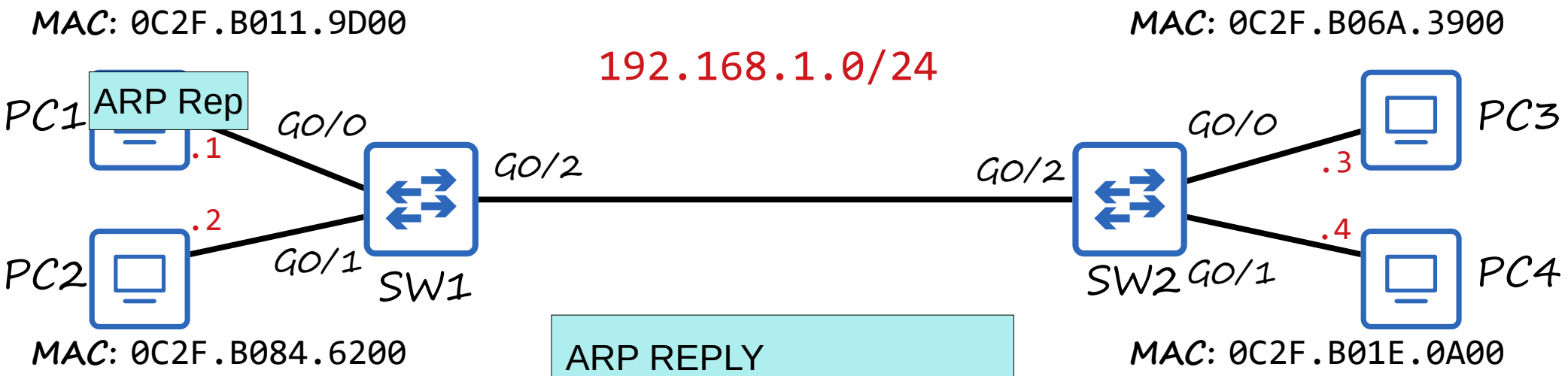
SW1 MAC Address Table

MAC	Interface
.9D00	G0/0

SW2 MAC Address Table

MAC	Interface
.9D00	G0/2
.3900	G0/0

ARP Reply



ARP REPLY
Src IP: 192.168.1.3
Dst IP: 192.168.1.1
Src MAC: 0C2F.B06A.3900
Dst MAC: 0C2F.B011.9D00

Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: .9D00
Dst MAC: ???

SW1 MAC Address Table

MAC	Interface
.9D00	G0/0
.3900	G0/2

SW2 MAC Address Table

MAC	Interface
.9D00	G0/2
.3900	G0/0

ARP Table

```
C:\Users\user>arp -a

Interface: 169.254.146.29 --- 0x9
  Internet Address      Physical Address      Type
  169.254.255.255       ff-ff-ff-ff-ff-ff     static
  224.0.0.2             01-00-5e-00-00-02     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.0.167 --- 0xd
  Internet Address      Physical Address      Type
  192.168.0.1           98-da-c4-dd-a8-e4     dynamic
  192.168.0.255         ff-ff-ff-ff-ff-ff     static
  224.0.0.2             01-00-5e-00-00-02     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

- Use `arp -a` to view the ARP table (Windows, macOS, Linux)
- `Internet Address` = IP address (Layer 3 address)
- `Physical Address` = MAC address (Layer 2 address)
- `Type static` = default entry
- `Type dynamic` = learned via ARP

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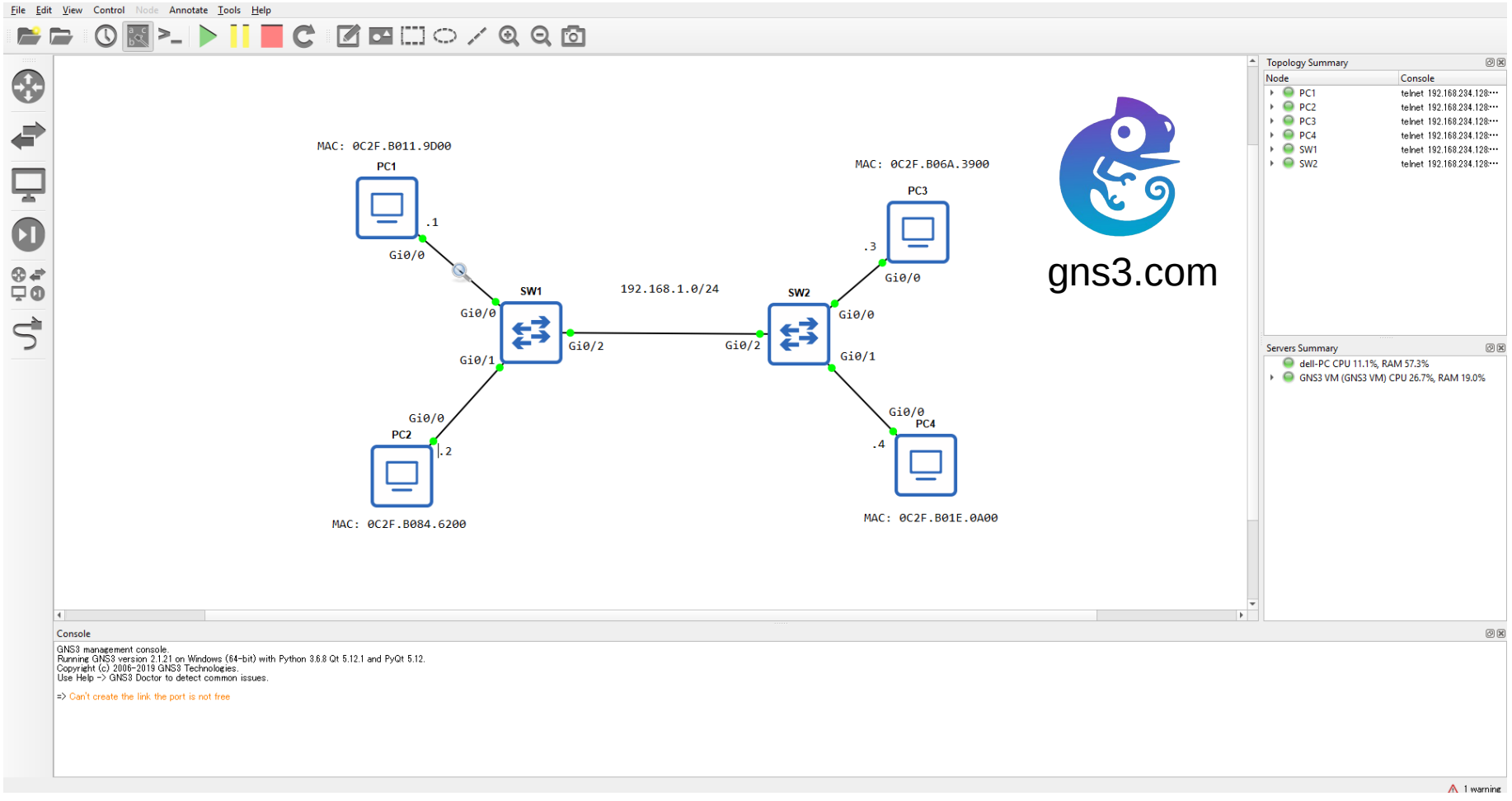
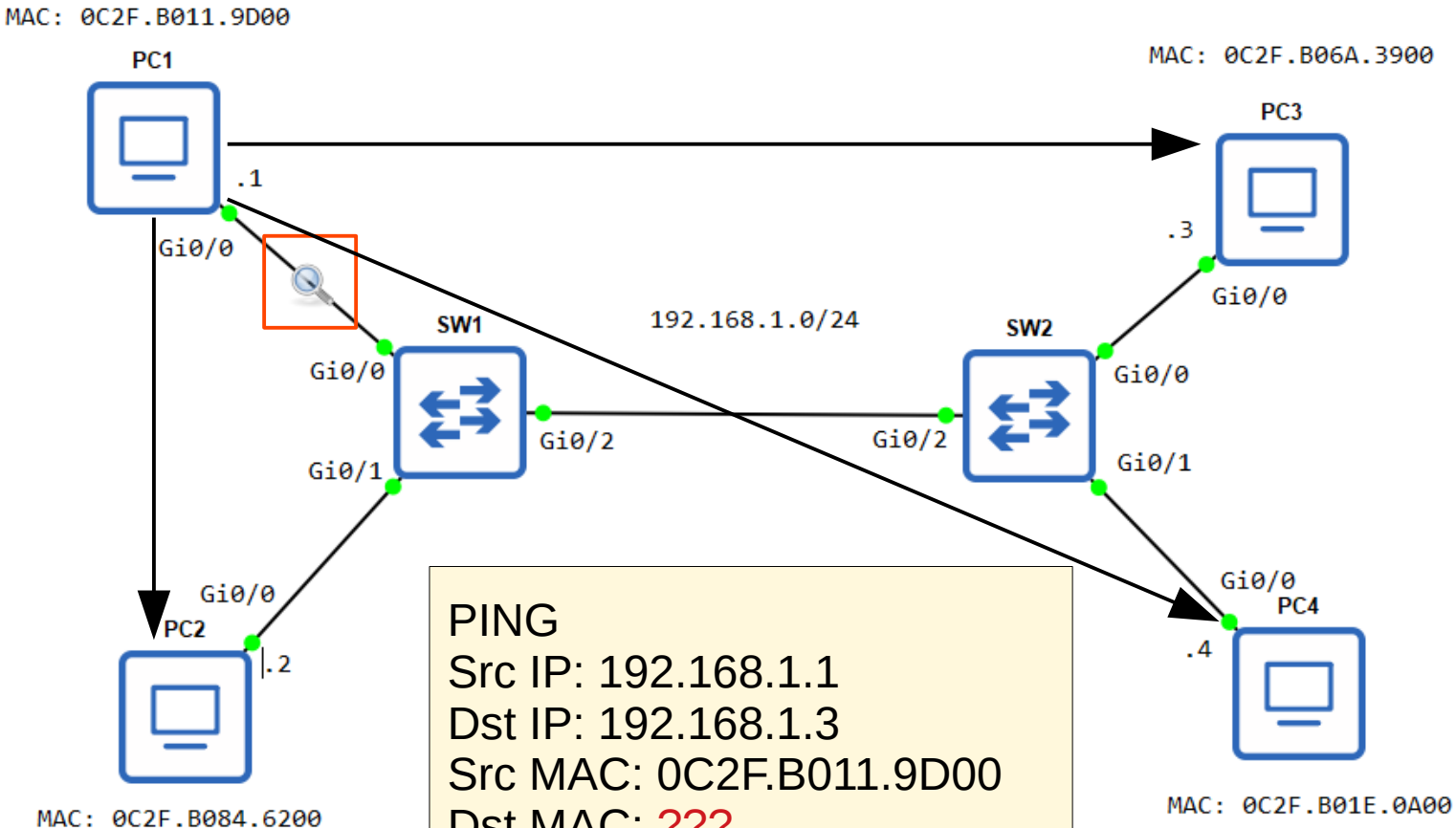
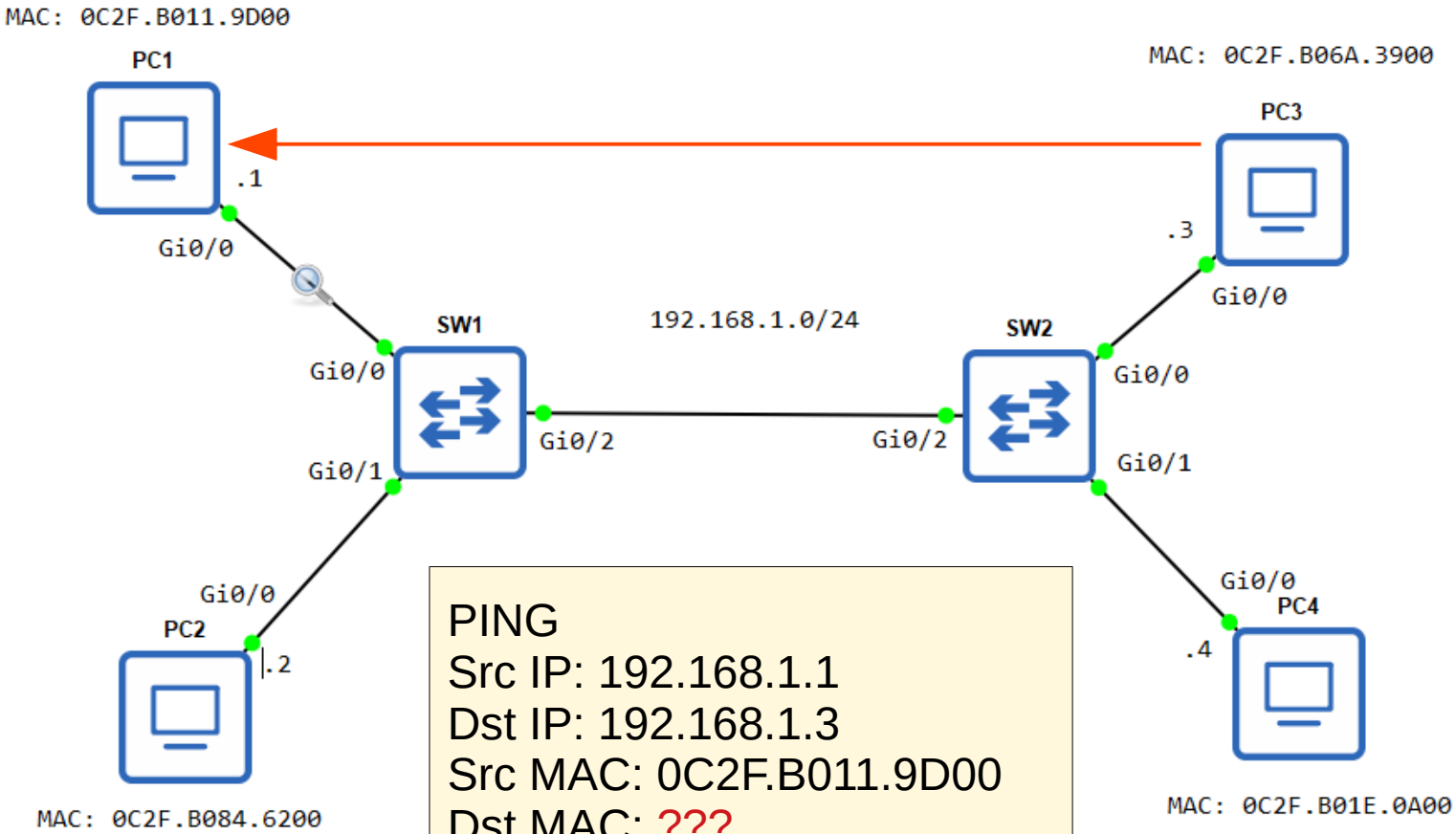
Ethernet LAN Switching



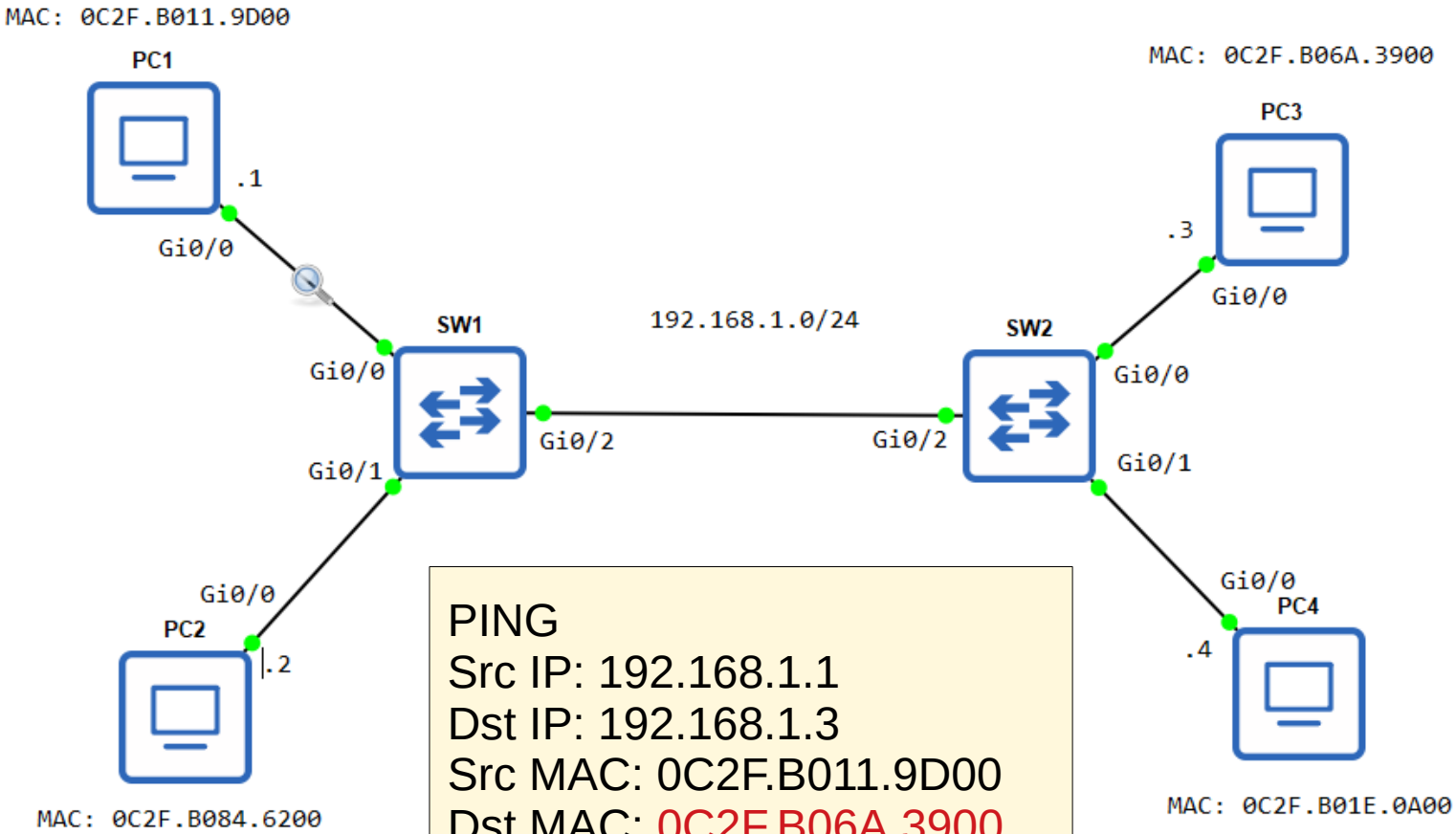
Ethernet LAN Switching



Ethernet LAN Switching



Ethernet LAN Switching



PING
Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: 0C2F.B011.9D00
Dst MAC: 0C2F.B06A.3900

Ping

- A network utility that is used to test reachability
- Measures round-trip time
- Uses two messages:

  ICMP Echo Request

  ICMP Echo Reply

- Command to use ping: **ping** (*ip-address*)

Ping

```
PC1#
PC1#ping 192.168.1.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 20/20/22 ms
PC1#
```

```
PC1#show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  192.168.1.1            -   0c2f.b011.9d00  ARPA   GigabitEthernet0/0
Internet  192.168.1.3           34   0c2f.b06a.3900  ARPA   GigabitEthernet0/0
PC1#
```

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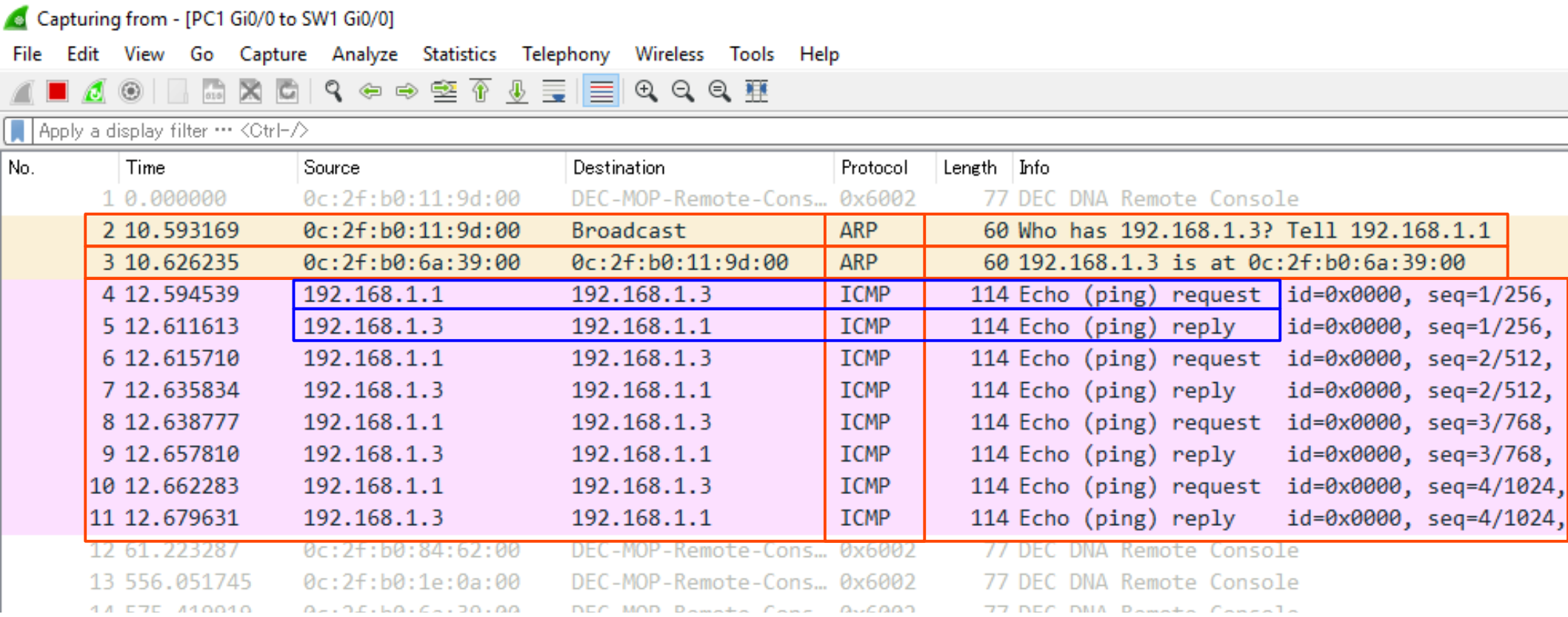
Ping

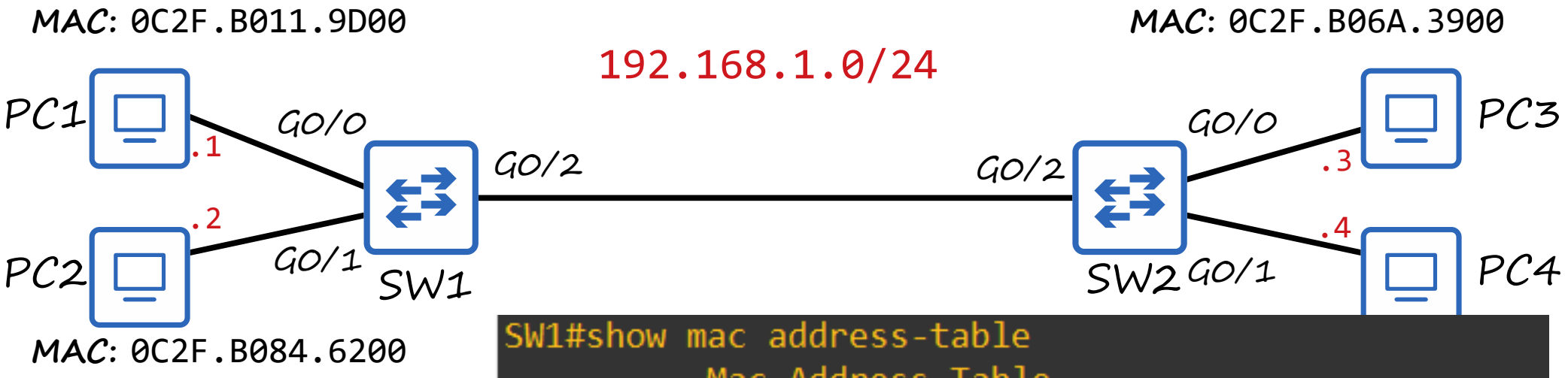


MAC Address Table

```
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
   1    0c2f.b011.9d00    DYNAMIC     Gi0/0
   1    0c2f.b06a.3900    DYNAMIC     Gi0/2
Total Mac Addresses for this criterion: 2
SW1#
```

MAC Address Table



SW1 MAC Address Table

MAC	Interface
.9D00	G0/0
.3900	G0/2

```
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
   1    0c2f.b011.9d00    DYNAMIC     Gi0/0
   1    0c2f.b06a.3900    DYNAMIC     Gi0/2
Total Mac Addresses for this criterion: 2
SW1#
```

Clearing the MAC Address Table

Aging

```
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
```

clear mac address-table dynamic

```
Total Mac Addresses for this criterion: 2
SW1#clear mac address-table dynamic
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
SW1#
```

Clearing the MAC Address Table

```
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
```

clear mac address-table dynamic address *mac-address*

```
SW1#clear mac address-table dynamic address 0c2f.b011.9d00
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
   1    0c2f.b06a.3900    DYNAMIC     Gi0/2
Total Mac Addresses for this criterion: 1
SW1#
```

Clearing the MAC Address Table

```
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
```

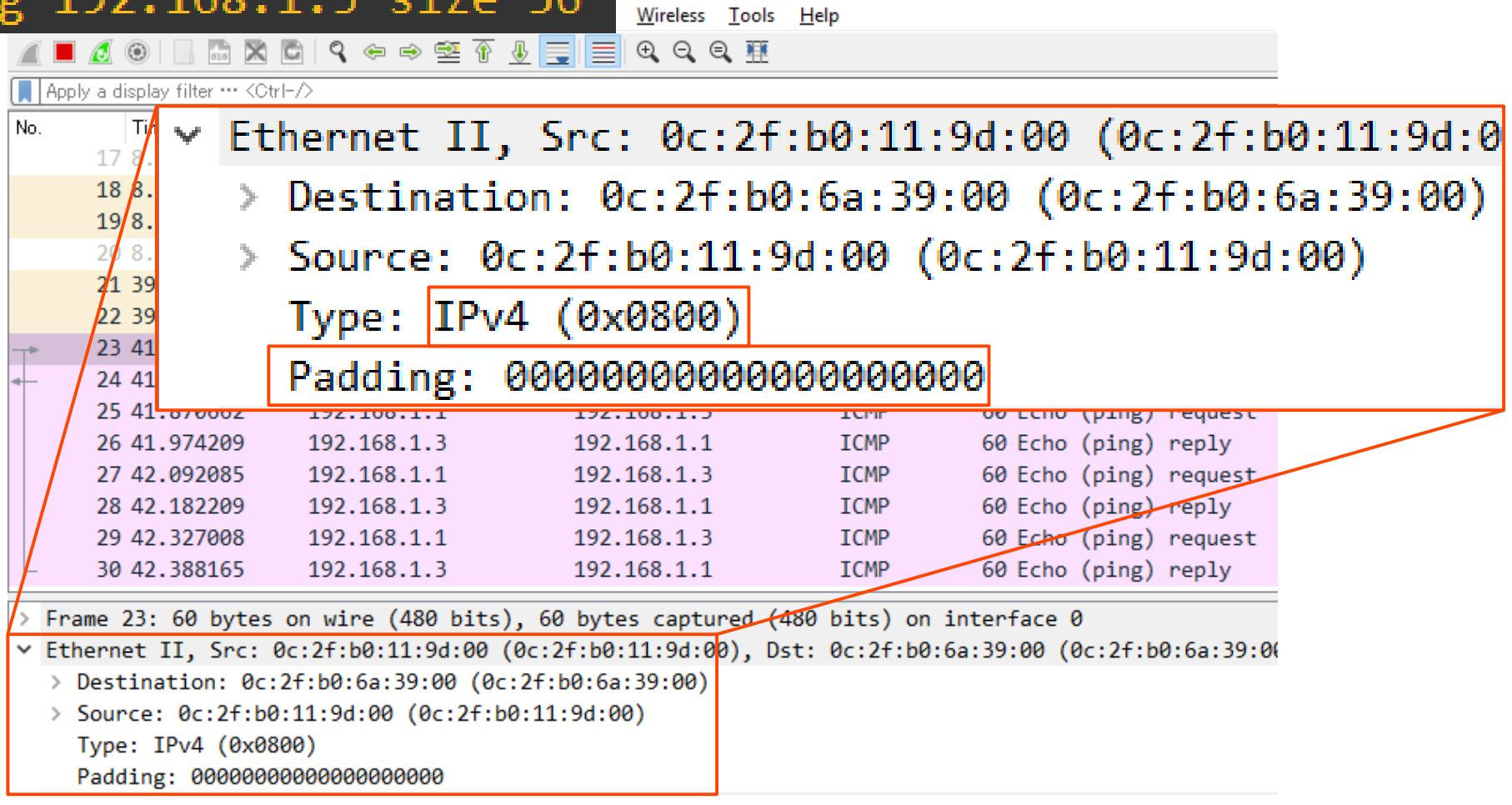
clear mac address-table dynamic interface *interface-id*

```
SW1#clear mac address-table dynamic interface Gi0/0
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
   1    0c2f.b06a.3900    DYNAMIC     Gi0/2
Total Mac Addresses for this criterion: 1
SW1#
```

Ethernet Frame

```
PC1#ping 192.168.1.3 size 36
```



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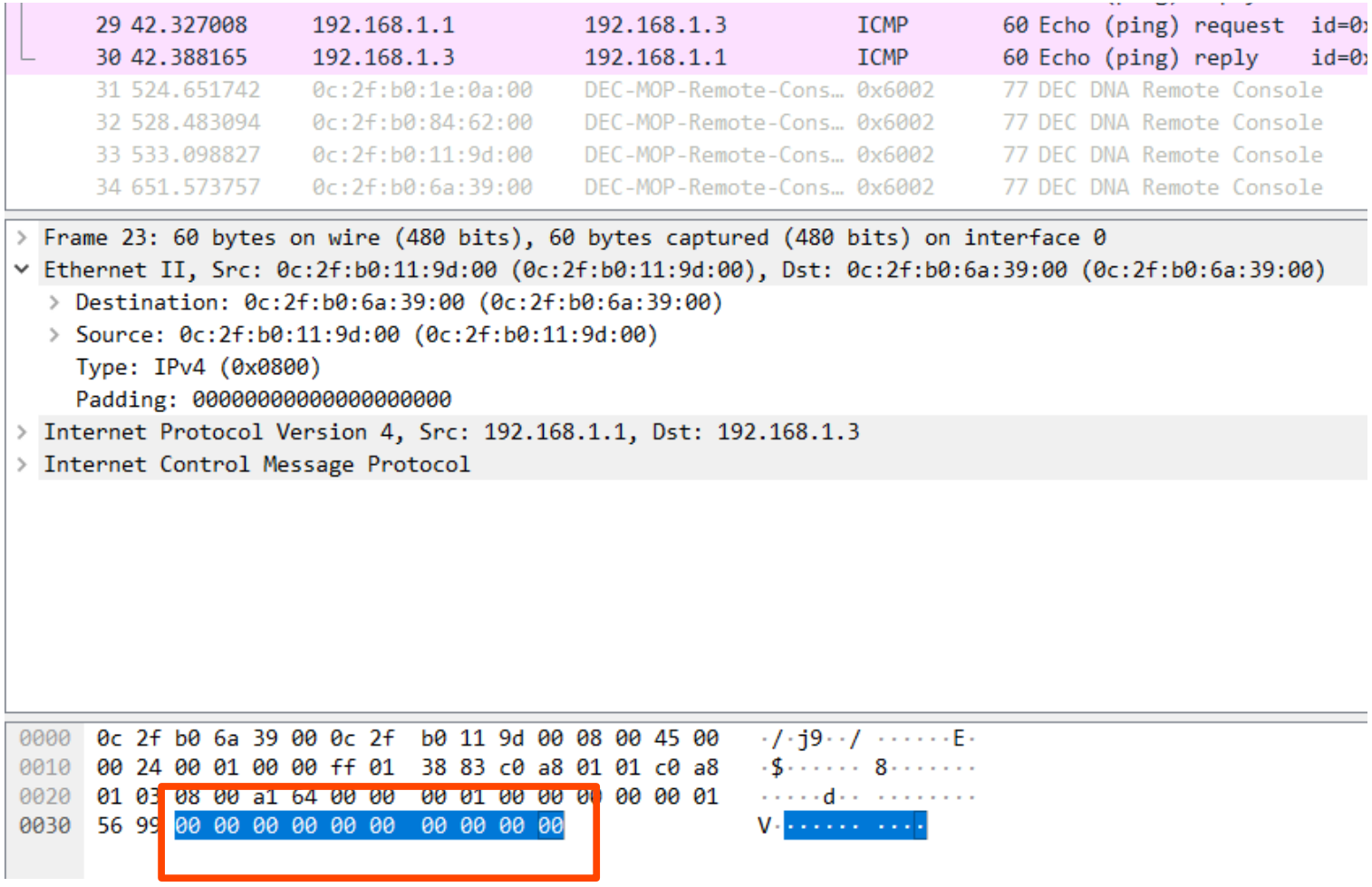
Ethernet Frame



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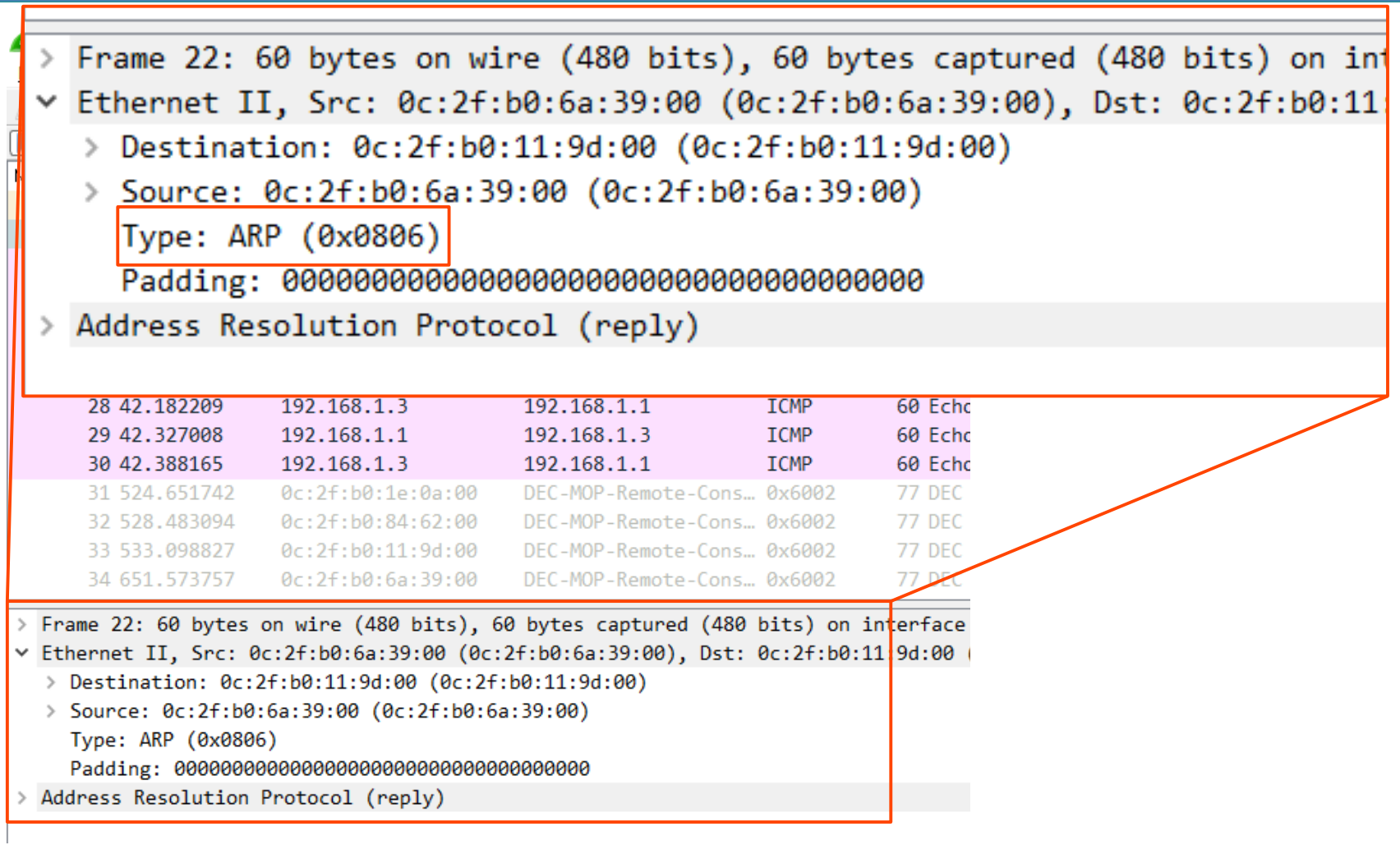
Ethernet Frame



Topics we covered

- Ethernet frame payload minimum size
- ARP (Address Resolution Protocol)

  ARP Request

  ARP Reply

- ARP table
- Ping

  ICMP Echo Request

  ICMP Echo Reply

- MAC Address Table

QUIZ

Quiz Question 1

You send a 36-byte ping to another computer and perform a packet capture to analyze the network traffic. You notice a long series of bytes of 00000000 at the end of the Ethernet payload. How can you explain these zeroes?

a) Pings are a series of zeroes.

b) They are padding bytes.

c) They are the Ethernet FCS.

The ping you sent was 36 bytes, but the minimum Ethernet payload size is 46 bytes, so a series of padding bytes must be added to meet the minimum payload size.

Quiz Question 2

Which of these messages is sent to all hosts on the local network?

a) ARP request

b) ARP reply

c) ICMP echo request

d) ICMP echo reply

Quiz Question 2

~~b~~) ARP Reply

The ARP reply message is a **unicast** message sent to the host that sent the ARP request.

Quiz Question 2

~~A~~) ICMP echo request, ~~D~~) ICMP echo reply

The ICMP echo request is a **unicast** message used to test the reachability of another specific host. The ICMP echo reply is a **unicast** reply to the request.

Quiz Question 2

★ a) ARP request

The ARP request message is used to learn the Layer 2 address of a host. Because the Layer 2 address is not yet known, the message has to be **broadcast** to all hosts on the local network.

Quiz Question 3

Which fields are present in the output of the `show mac address-table` command on a Cisco switch?

a) MAC Address, Ports

b) VLAN, MAC Address, Ports

c) VLAN, MAC Address, Type, Ports

d) Internet Address, Physical Address, Type

Quiz Question 3

★ c) VLAN, MAC address, Type, Ports

```
SW1#show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
   1    0c2f.b011.9d00    DYNAMIC     Gi0/0
   1    0c2f.b06a.3900    DYNAMIC     Gi0/2
Total Mac Addresses for this criterion: 2
SW1#
```

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Quiz Question 3

```
C:\Users\user>arp -a

Interface: 169.254.146.29 --- 0x9
  Internet Address      Physical Address      Type
  169.254.255.255       ff-ff-ff-ff-ff-ff     static
  224.0.0.2             01-00-5e-00-00-02     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.0.167 --- 0xd
  Internet Address      Physical Address      Type
  192.168.0.1           98-da-c4-dd-a8-e4     dynamic
  192.168.0.255         ff-ff-ff-ff-ff-ff     static
  224.0.0.2             01-00-5e-00-00-02     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

Quiz Question 4

Which types of frames does a switch send out of all interfaces, except the one the frame was received on?

a) Broadcast, unknown unicast

b) Broadcast, known unicast

c) Known unicast, unknown unicast

d) Broadcast, unknown unicast, known unicast

Quiz Question 4

A) Broadcast, known unicast

B) Known unicast, unknown unicast

C) Broadcast, unknown unicast, known unicast

Known unicast frames are sent to a single host. Because the switch already has an entry for the destination in its MAC address table, there is no need to flood the frame out all interfaces.

Quiz Question 4

★ a) Broadcast, unknown unicast

Broadcast frames have a destination address of FFFF.FFFF.FFFF and are sent to all hosts on the local network.

Unknown unicast frames are destined for a single host, however the switch doesn't have an entry for the destination in its MAC address table so it must flood the frame.

Quiz Question 5

Which command is used on a Cisco switch to clear all dynamic MAC addresses on a specific interface from the MAC address table?

a) **clear mac address-table interface** *interface-id*

b) **clear mac-address-table dynamic interface** *interface-id*

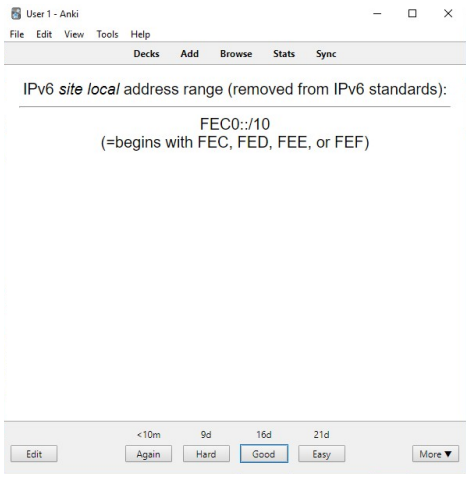
c) **clear mac-address table dynamic interface** *interface-id*

d) **clear mac address-table dynamic interface** *interface-id*

```
SW1#clear mac address-table dynamic interface Gi0/0
```

Supplementary Materials

- Review flash cards
  (link in the description)



- Packet Tracer lab