

9.2.9 Packet Tracer - Examine the ARP Table

Addressing Table

Device	Interface	MAC Address	Switch Interface
Router0	Gg0/0	0001.6458.2501	G0/1
	S0/0/0	N/A	N/A
Router1	G0/0	00E0.F7B1.8901	G0/1
	S0/0/0	N/A	N/A
10.10.10.2	Wireless	0060.2F84.4AB6	F0/2
10.10.10.3	Wireless	0060.4706.572B	F0/2
172.16.31.2	F0	000C.85CC.1DA7	F0/1
172.16.31.3	F0	0060.7036.2849	F0/2
172.16.31.4	G0	0002.1640.8D75	F0/3

Objectives

Part 1: Examine an ARP Request

Part 2: Examine a Switch MAC Address Table

Part 3: Examine the ARP Process in Remote Communications

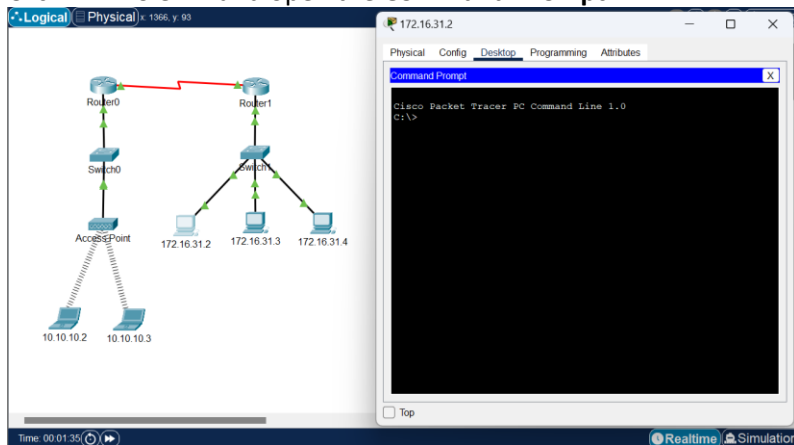
Background

This activity is optimized for viewing PDUs. The devices are already configured. You will gather PDU information in simulation mode and answer a series of questions about the data you collect.

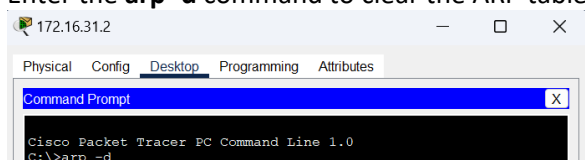
Part 1: Examine an ARP Request

Step 1: Generate ARP requests by pinging 172.16.31.3 from 172.16.31.2.

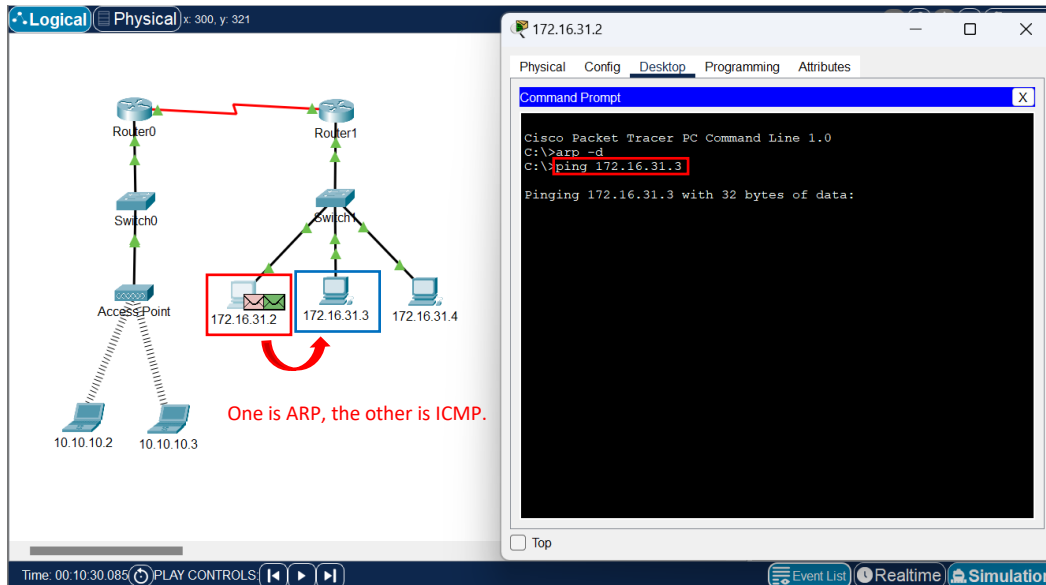
- a. Click **172.16.31.2** and open the **Command Prompt**.



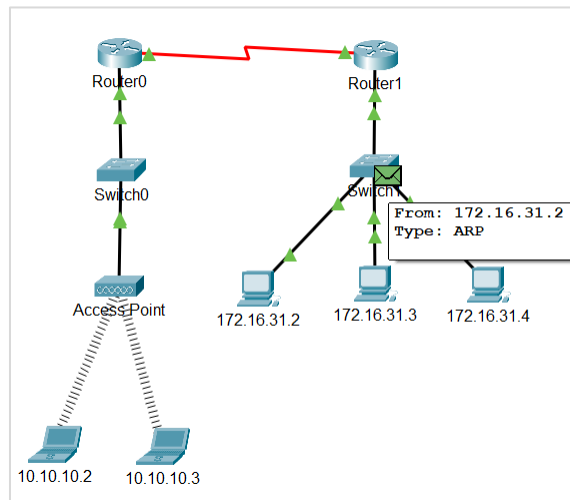
- b. Enter the **arp -d** command to clear the ARP table.



- c. Enter **Simulation** mode and enter the command **ping 172.16.31.3**. Two PDUs will be generated. The **ping** command cannot complete the ICMP packet without knowing the MAC address of the destination. So the computer sends an ARP broadcast frame to find the MAC address of the destination.



- d. Click **Capture/Forward** once. The ARP PDU moves **Switch1** while the ICMP PDU disappears, waiting for the ARP reply. Open the PDU and record the destination MAC address.



PDU Information at Device: Switch1

OSI Model Inbound PDU Details Outbound PDU Details

At Device: Switch1
Source: 172.16.31.2
Destination: Broadcast

In Layers

Layer7
Layer6
Layer5
Layer4
Layer3
Layer2: Ethernet II Header 000C.85CC.1DA7 >> FFFF.FFFF.FFFF ARP
Packet Src. IP: 172.16.31.2, Dest. IP: 172.16.31.3
Layer 1: Port FastEthernet0/1

Out Layers

Layer7
Layer6
Layer5
Layer4
Layer3
Layer2: Ethernet II Header 000C.85CC.1DA7 >> FFFF.FFFF.FFFF ARP
Packet Src. IP: 172.16.31.2, Dest. IP: 172.16.31.3
Layer 1: Port(s): FastEthernet0/2
FastEthernet0/3 GigabitEthernet0/1

PDU Information at Device: Switch1

OSI Model Inbound PDU Details Outbound PDU Details

PDU Formats

Ethernet II			
0	4	8	Bytes
PREAMBLE: 101010.10		SF	DESTADDR: FFFF.FFFF.FFFF
SRC ADDR: 000C.85CC.1DA7		TYPE: 0x0806	DATA (VARIABLE LENGTH)
		FCS: 0x00000000	

ARP			
0	8	16	Bits
HARDWARE TYPE: 0x0001		PROTOCOL TYPE: 0x0800	
HLN: 0x06	PLEN: 0x04	OPCODE: 0x0001	
SOURCE MAC: 000C.85CC.1DA7			
SOURCE IP: 172.16.31.2			
TARGET MAC: 0000.0000.0000			
TARGET IP: 172.16.31.3			

Is this address listed in the table above?

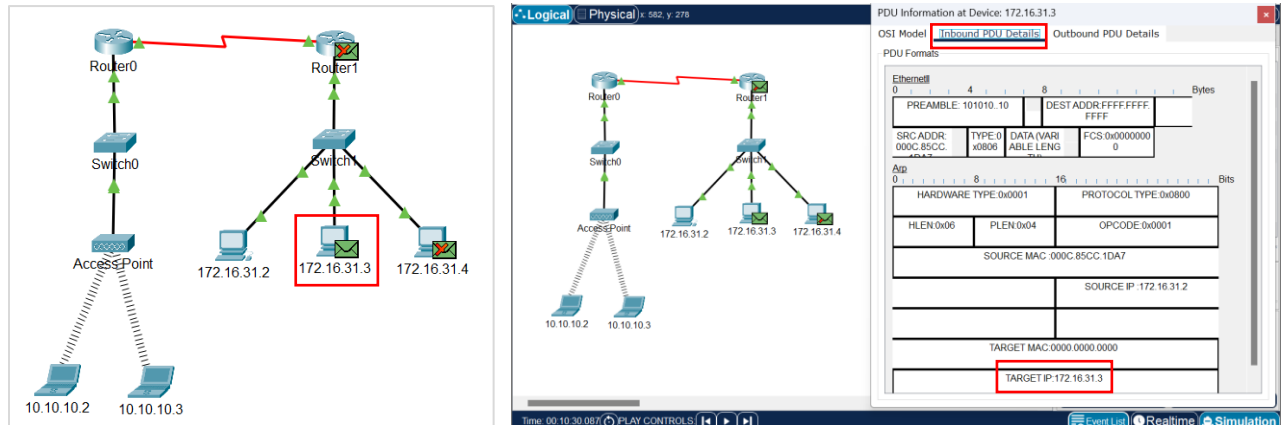
It's not because it's not a MAC address of any specific device. It's more of a broadcast address.

How many copies of the PDU did Switch1 make?

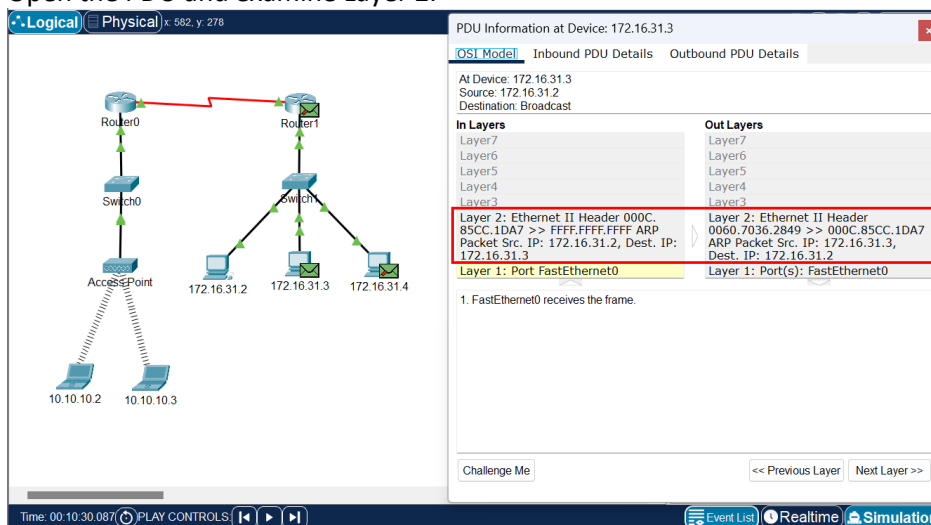
3 copies. One will go to Router1, one will go to the PC with the IP address of 172.16.31.3, and the remaining will go to the PC with the IP address of 172.16.31.4. (It will not go to the PC with the IP address of 172.16.31.2 because Switch1 received the frame from that device.)

What is the IP address of the device that accepted the PDU?

The device that accepted the frame is the PC with an IP address of 172.16.31.3. This PC accepted the PDU because the PDU is destined for this device.



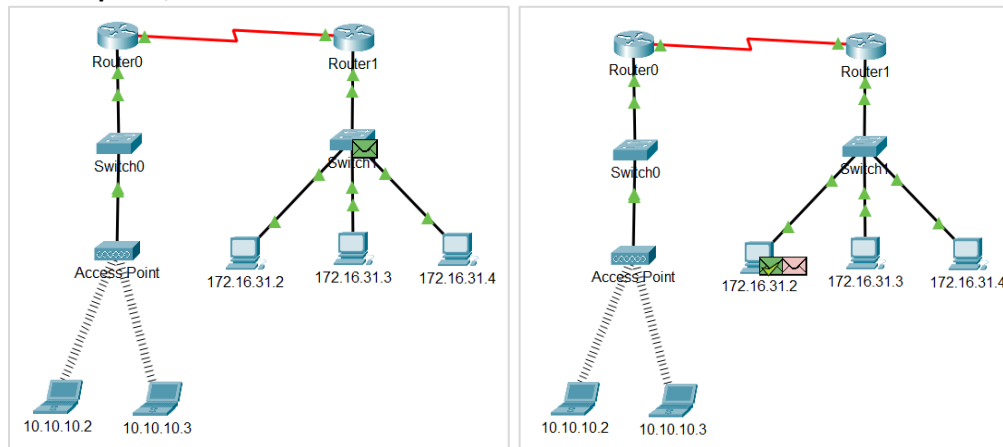
e. Open the PDU and examine Layer 2.



What happened to the source and destination MAC addresses?

The source MAC address is that of the 172.16.31.3 device (the original destination). The destination MAC address is that of the 172.16.31.2 device (the original source). This is because the 172.16.31.3 device will send back an ARP reply to the 172.16.31.2 device.

Click **Capture/Forward** until the PDU returns to **172.16.31.2**.



How many copies of the PDU did the switch make during the ARP reply?

Only one copy because this communication is a unicast communication.

Step 2: Examine the ARP table.

- a. Note that the ICMP packet reappears. Open the PDU and examine the MAC addresses.

PDU Information at Device: 172.16.31.2

OSI Model: Outbound PDU Details

At Device: 172.16.31.2
Source: 172.16.31.2
Destination: 172.16.31.3

In Layers: Layer 7, Layer 6, Layer 5, Layer 4, Layer 3, Layer 2, Layer 1

Out Layers: Layer 7, Layer 6, Layer 5, Layer 4, Layer 3, Layer 2: Ethernet II Header 000C.85CC.1DA7 >> 0060.7036.2849, Layer 1: Port(s): FastEthernet0

1. The ARP process takes out this packet from the buffer and resends it.
2. The device encapsulates the PDU into an Ethernet frame.

Challenge Me

<< Previous Layer Next Layer >>

Time: 00:10:30.089

PLAY CONTROLS: [Pause] [Play] [Stop]

Event List Realtime Simulation

Do the MAC addresses of the source and destination align with their IP addresses?

Yes.

Device	Interface	MAC Address	Switch Interface
172.16.31.2	F0	000C.85CC.1DA7	F0/1
172.16.31.3	F0	0060.7036.2849	F0/2

b. Switch back to **Realtime** and the ping completes.

The network diagram shows Router0 connected to Router1. Router0 is connected to Switch0, which is connected to an Access Point. The Access Point is connected to two laptops with IP addresses 10.10.10.2 and 10.10.10.3. Router1 is connected to Switch1, which is connected to three laptops with IP addresses 172.16.31.2, 172.16.31.3, and 172.16.31.4. The command prompt for 172.16.31.2 shows the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>arp -d
C:\>ping 172.16.31.3

Pinging 172.16.31.3 with 32 bytes of data:

Reply from 172.16.31.3: bytes=32 time=33ms TTL=128
Reply from 172.16.31.3: bytes=32 time<1ms TTL=128
Reply from 172.16.31.3: bytes=32 time<1ms TTL=128
Reply from 172.16.31.3: bytes=32 time<1ms TTL=128

Ping statistics for 172.16.31.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 33ms, Average = 8ms

C:\>
```

c. Click **172.16.31.2** and enter the **arp -a** command.

The network diagram is the same as in the previous screenshot. The command prompt for 172.16.31.2 shows the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>arp -d
C:\>ping 172.16.31.3

Pinging 172.16.31.3 with 32 bytes of data:

Reply from 172.16.31.3: bytes=32 time=33ms TTL=128
Reply from 172.16.31.3: bytes=32 time<1ms TTL=128
Reply from 172.16.31.3: bytes=32 time<1ms TTL=128
Reply from 172.16.31.3: bytes=32 time<1ms TTL=128

Ping statistics for 172.16.31.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 33ms, Average = 8ms

C:\>arp -a
```

Internet Address	Physical Address	Type
172.16.31.3	0060.7036.2849	dynamic

```
C:\>
```

To what IP address does the MAC address entry correspond?

172.16.31.3 (the destination IP address)

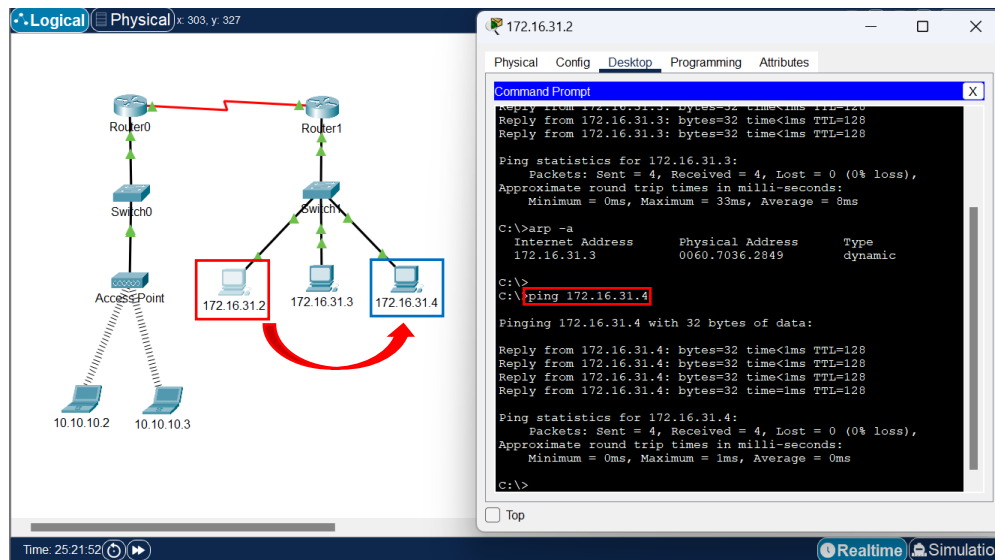
In general, when does an end device issue an ARP request?

Whenever a source device is unaware of its destination MAC address.

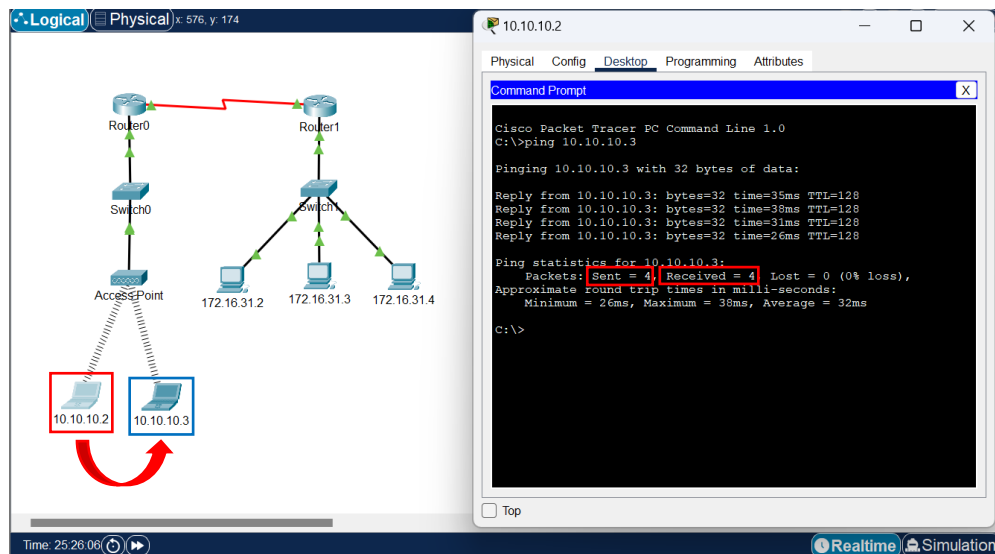
Part 2: Examine a Switch MAC Address Table

Step 1: Generate additional traffic to populate the switch MAC address table.

- a. From **172.16.31.2**, enter the ping **172.16.31.4** command.



- b. Click **10.10.10.2** and open the **Command Prompt**.
- c. Enter the **ping 10.10.10.3** command.

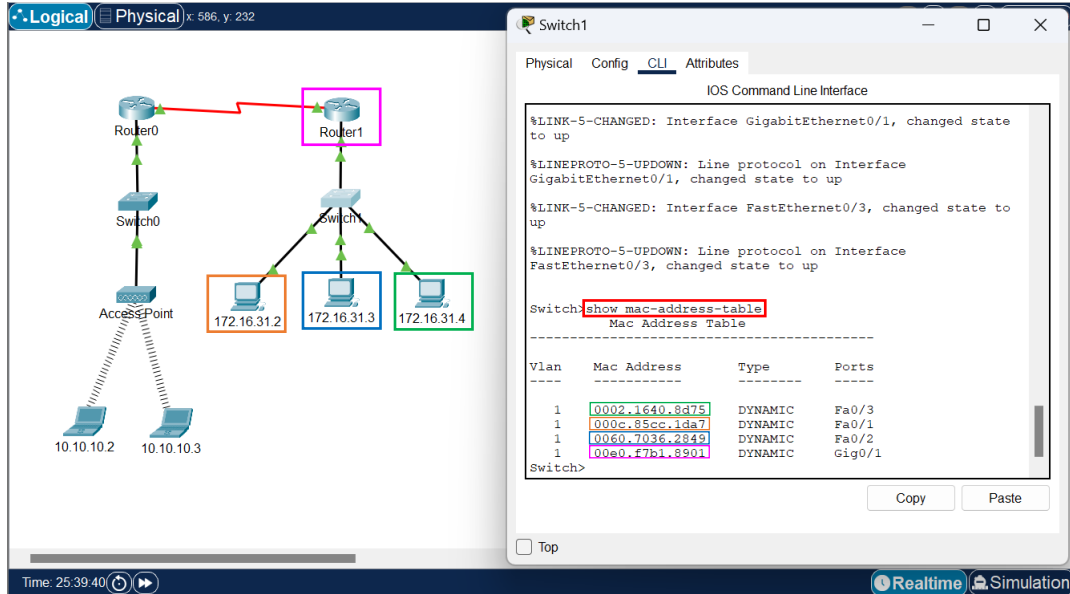


How many replies were sent and received?

Sent = 4, Received = 4.

Step 2: Examine the MAC address table on the switches.

- a. Click **Switch1** and then the **CLI** tab. Enter the **show mac-address-table** command.



```

Switch1
CLI
IOS Command Line Interface

%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

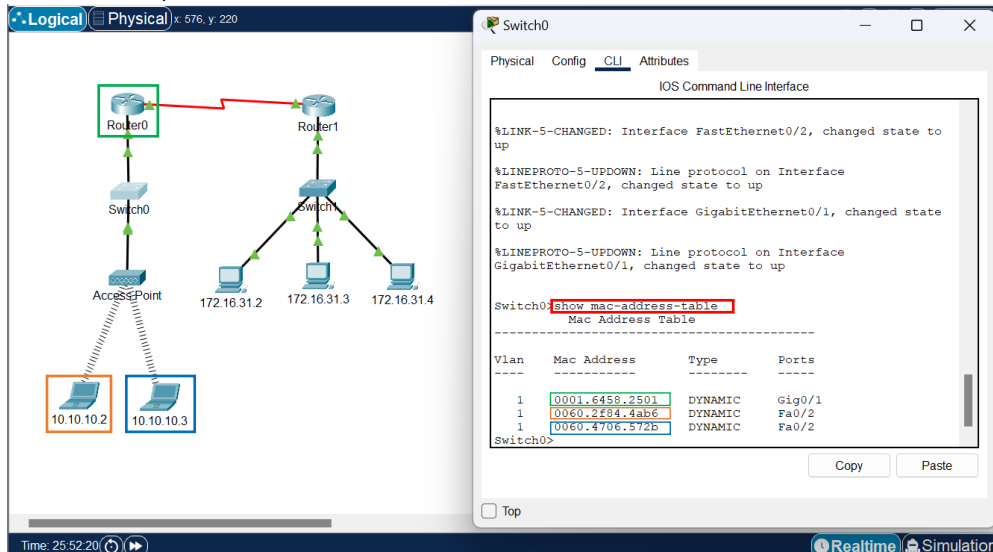
Switch1# show mac-address-table
Mac Address Table
-----
Vlan    Mac Address      Type      Ports
----    -
1       0002.1640.8d75   DYNAMIC   Fa0/3
1       000c.85cc.1da7   DYNAMIC   Fa0/1
1       0060.7036.2849   DYNAMIC   Fa0/2
1       00e0.f7b1.8901   DYNAMIC   Gig0/1
Switch1>
  
```

Do the entries correspond to those in the table above?

Yes.

Device	Interface	MAC Address	Switch Interface
Router0	Gg0/0	0001.6458.2501	G0/1
	S0/0/0	N/A	N/A
Router1	G0/0	00E0.F7B1.8901	G0/1
	S0/0/0	N/A	N/A
10.10.10.2	Wireless	0060.2F84.4AB6	F0/2
10.10.10.3	Wireless	0060.4706.572B	F0/2
172.16.31.2	F0	000C.85CC.1DA7	F0/1
172.16.31.3	F0	0060.7036.2849	F0/2
172.16.31.4	G0	0002.1640.8D75	F0/3

- b. Click Switch0, then the CLI tab. Enter the **show mac-address-table** command.



```

Switch0
CLI
IOS Command Line Interface

%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

Switch0# show mac-address-table
Mac Address Table
-----
Vlan    Mac Address      Type      Ports
----    -
1       0001.6458.2501   DYNAMIC   Gig0/1
1       0060.2f84.4ab6   DYNAMIC   Fa0/2
1       0060.4706.572b   DYNAMIC   Fa0/2
Switch0>
  
```

Do the entries correspond to those in the table above?

Yes.

Device	Interface	MAC Address	Switch Interface
Router0	Gg0/0	0001.6458.2501	G0/1
	S0/0/0	N/A	N/A
Router1	G0/0	00E0.F7B1.8901	G0/1
	S0/0/0	N/A	N/A
10.10.10.2	Wireless	0060.2F84.4AB6	F0/2
10.10.10.3	Wireless	0060.4706.572B	F0/2
172.16.31.2	F0	000C.85CC.1DA7	F0/1
172.16.31.3	F0	0060.7036.2849	F0/2
172.16.31.4	G0	0002.1640.8D75	F0/3

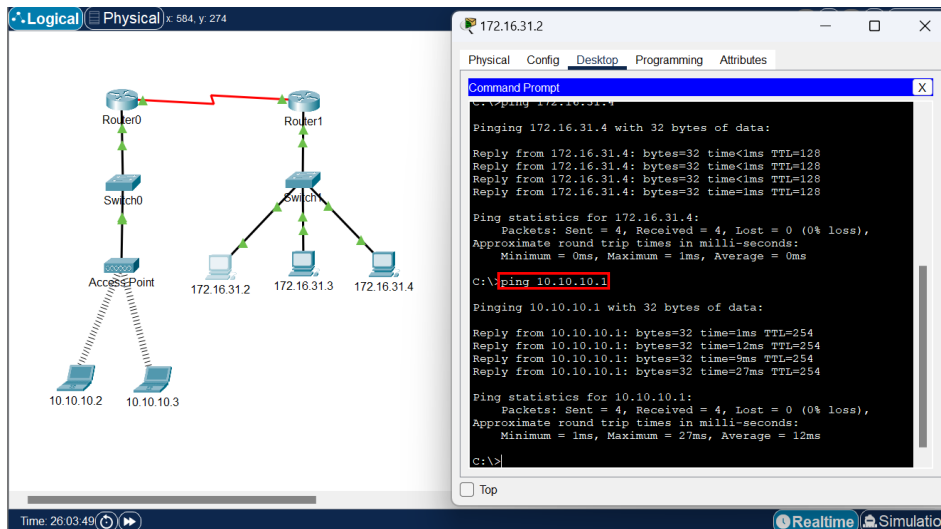
Why are two MAC addresses associated with one port?

We can see that port F0/2 is associated with two MAC addresses. The 10.10.10.2 and 10.10.10.23 end devices are connected to the access point through a single port.

Part 3: Examine the ARP Process in Remote Communications

Step 1: Generate traffic to produce ARP traffic.

- Click **172.16.31.2** and open the **Command Prompt**.
- Enter the **ping 10.10.10.1** command.



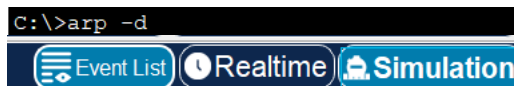
- Type **arp -a**.

```
C:\>arp -a
Internet Address      Physical Address      Type
172.16.31.1          00e0.f7b1.8901       dynamic
172.16.31.4          0002.1640.8d75       dynamic
```

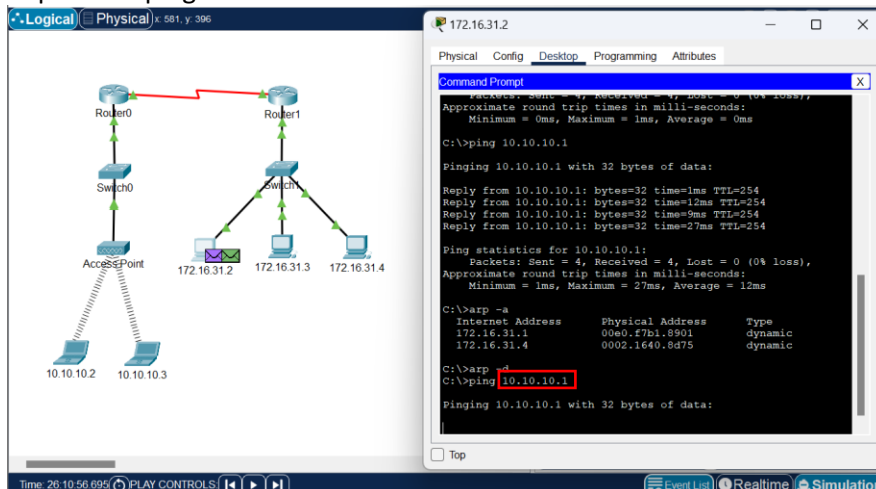
What is the IP address of the new ARP table entry?

172.16.31.1

- Enter **arp -d** to clear the ARP table and switch to **Simulation** mode.

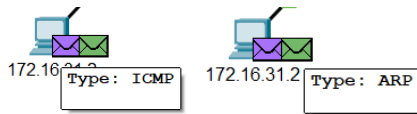


- Repeat the ping to 10.10.10.1.



How many PDUs appear?

2



f. Click **Capture/Forward**. Click the PDU that is now at **Switch1**.

The network topology shows Router0 connected to Router1. Router0 is connected to Switch0, which is connected to an AccessPoint. Router1 is connected to Switch1, which is connected to three PCs with IP addresses 172.16.31.2, 172.16.31.3, and 172.16.31.4. The AccessPoint is connected to two PCs with IP addresses 10.10.10.2 and 10.10.10.3.

PDU Information at Device: Switch1

OSI Model Inbound PDU Details Outbound PDU Details

At Device: Switch1
Source: 172.16.31.2
Destination: Broadcast

In Layers

Layer7
Layer6
Layer5
Layer4
Layer3
Layer2: Ethernet II Header 000C.85CC.1DA7 >> FFFF.FFFF.FFFF ARP
Packet Src. IP: 172.16.31.2, Dest. IP: 172.16.31.1
Layer 1: Port FastEthernet0/1

Out Layers

Layer7
Layer6
Layer5
Layer4
Layer3
Layer2: Ethernet II Header 000C.85CC.1DA7 >> FFFF.FFFF.FFFF ARP
Packet Src. IP: 172.16.31.2, Dest. IP: 172.16.31.1
Layer 1: Port(s): FastEthernet0/2
FastEthernet0/3 GigabitEthernet0/1

1. FastEthernet0/1 receives the frame.

PDU Information at Device: Switch1

OSI Model Inbound PDU Details Outbound PDU Details

PDU Formats

Ethernet II

0 4 8 Bytes

PREAMBLE: 101010.10 DEST ADDR: FFFF.FFFF.FFFF

SRC ADDR: 000C.85CC.1DA7 TYPE: 0x0806 DATA (VARIABLE LENGTH) FCS: 0x00000000

ARP

0 8 16 Bits

HARDWARE TYPE: 0x0001 PROTOCOL TYPE: 0x0800

HLEN: 0x06 PLEN: 0x04 OPCODE: 0x0001

SOURCE MAC: 000C.85CC.1DA7

SOURCE IP: 172.16.31.2

TARGET MAC: 0000.0000.0000

TARGET IP: 172.16.31.1

What is the target destination IP destination address of the ARP request?

172.16.31.1

g. The destination IP address is not 10.10.10.1.

Why?

The 172.16.31.1 IP address actually belongs to our router interface. It is the gateway address of our router.

NOTE: If the receiving host is not on the same network, the source uses ARP process to determine a MAC address for the router interface to serve as the gateway.

Step 2: Examine the ARP table on Router1.

a. Switch to **Realtime** mode. Click **Router1** and then the **CLI** tab.

The network topology is the same as in the previous screenshot.

Router1 CLI

Physical Config CLI Attributes

IOS Command Line Interface

```
%DUAL-5-NBRCHANGE: IPv6-EIGRP 1: Neighbor FE80::206:2AFF:FE3E:1E01 (Serial0/0/0) is down: holding time expired
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 192.168.0.1 (Serial0/0/0) is down: holding time expired
%DUAL-5-NBRCHANGE: IPv6-EIGRP 1: Neighbor FE80::206:2AFF:FE3E:1E01 (Serial0/0/0) is up: new adjacency
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 192.168.0.1 (Serial0/0/0) is up: new adjacency
%DUAL-5-NBRCHANGE: IPv6-EIGRP 1: Neighbor FE80::206:2AFF:FE3E:1E01 (Serial0/0/0) is down: Interface Goodbye received
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 192.168.0.1 (Serial0/0/0) is down: Interface Goodbye received
%DUAL-5-NBRCHANGE: IPv6-EIGRP 1: Neighbor FE80::206:2AFF:FE3E:1E01 (Serial0/0/0) is up: new adjacency
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 192.168.0.1 (Serial0/0/0) is up: new adjacency
```

- b. Enter privileged EXEC mode and then the **show mac-address-table** command.

```
Router>enable
Router#show mac-address-table
      Mac Address Table
-----
Vlan    Mac Address      Type    Ports
----    -

```

How many MAC addresses are in the table? Why?

None because the “show mac-address-table” command means something completely different for a router compared to a switch.

- c. Enter the **show arp** command.

```
Router#show arp
Protocol  Address          Age (min)  Hardware Addr  Type   Interface
Internet  172.16.31.1      -          00E0.F7B1.8901  ARPA   GigabitEthernet0/0
Internet  172.16.31.2      14         000C.85CC.1DA7  ARPA   GigabitEthernet0/0
```

Is there an entry for **172.16.31.2**?

Yes.

What happens to the first ping in a situation where the router responds to the ARP request?

It will timeout.