

MAC and IP

9.1.1

Destination on Same Network

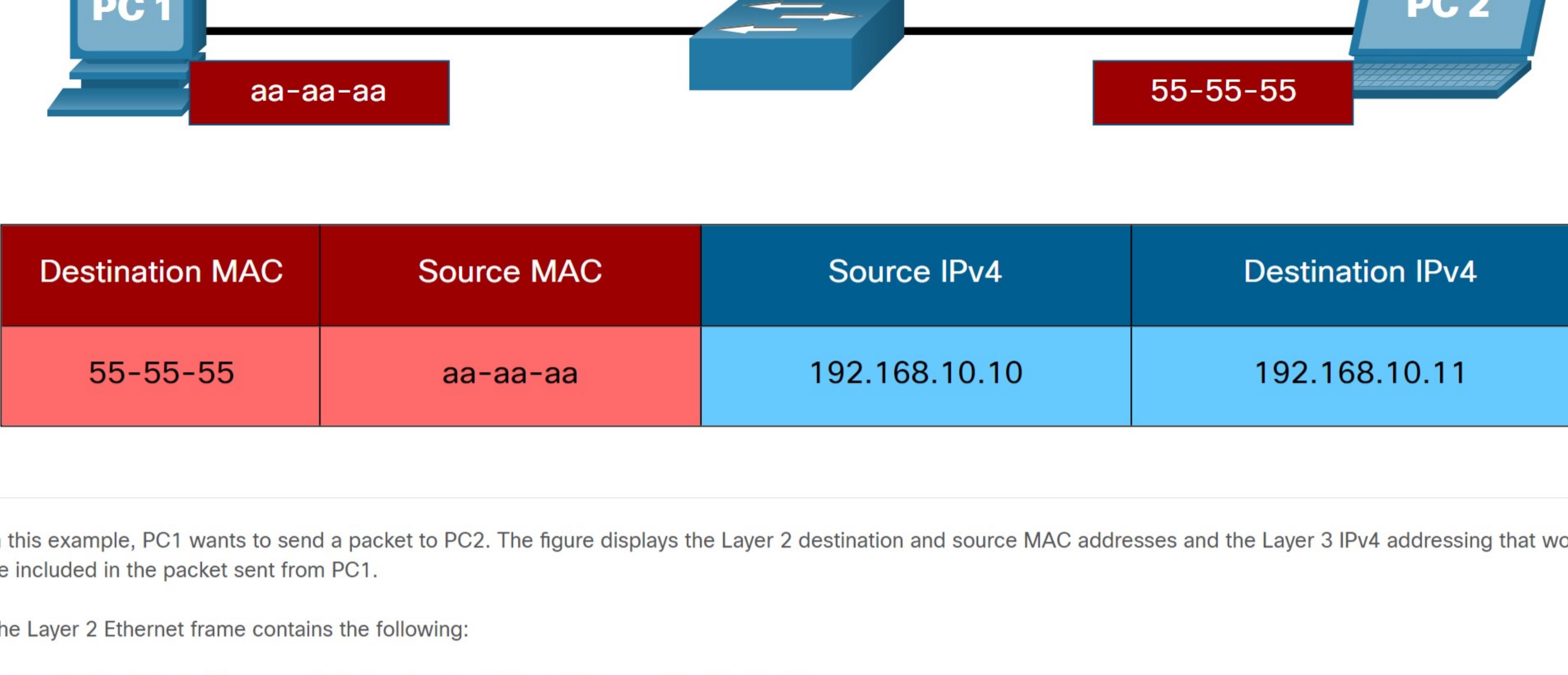
Sometimes a host must send a message, but it only knows the IP address of the destination device. The host needs to know the MAC address of that device, but how can it be discovered? That is where address resolution becomes critical.

There are two primary addresses assigned to a device on an Ethernet LAN:

- Physical address (the MAC address) – Used for NIC to NIC communications on the same Ethernet network.
- Logical address (the IP address) – Used to send the packet from the source device to the destination device. The destination IP address may be on the same IP network as the source or it may be on a remote network.

Layer 2 physical addresses (i.e., Ethernet MAC addresses) are used to deliver the data link frame with the encapsulated IP packet from one NIC to another NIC that is on the same network. If the destination IP address is on the same network, the destination MAC address will be that of the destination device.

Consider the following example using simplified MAC address representations.



In this example, PC1 wants to send a packet to PC2. The figure displays the Layer 2 destination and source MAC addresses and the Layer 3 IPv4 addressing that would be included in the packet sent from PC1.

The Layer 2 Ethernet frame contains the following:

- Destination MAC address – This is the simplified MAC address of PC2, 55-55-55.
- Source MAC address – This is the simplified MAC address of the Ethernet NIC on PC1, aa-aa-aa.

The Layer 3 IP packet contains the following:

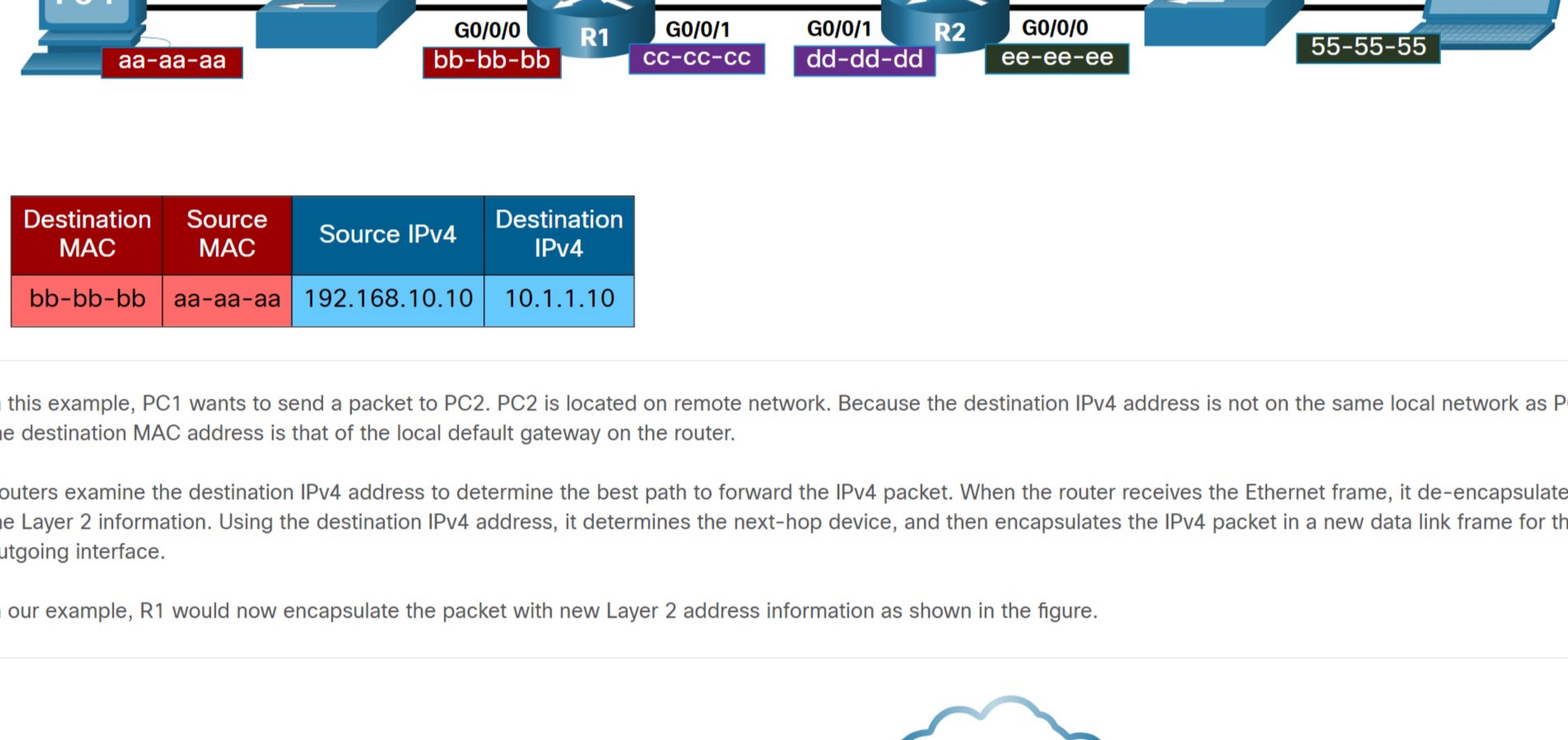
- Source IPv4 address – This is the IPv4 address of PC1, 192.168.10.10.
- Destination IPv4 address – This is the IPv4 address of PC2, 192.168.10.11.

9.1.2

Destination on Remote Network

When the destination IP address (IPv4 or IPv6) is on a remote network, the destination MAC address will be the address of the host default gateway (i.e., the router interface).

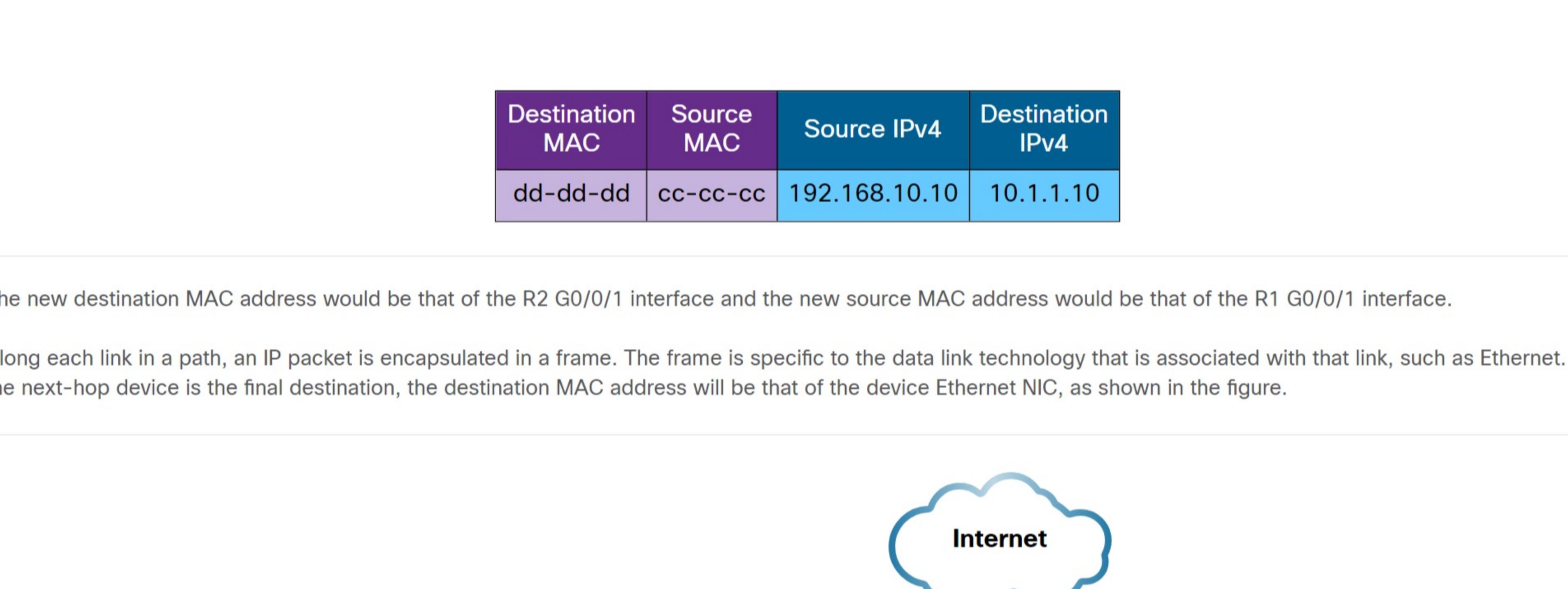
Consider the following example using a simplified MAC address representation.



In this example, PC1 wants to send a packet to PC2. PC2 is located on a remote network. Because the destination IPv4 address is not on the same local network as PC1, the destination MAC address is that of the local default gateway on the router.

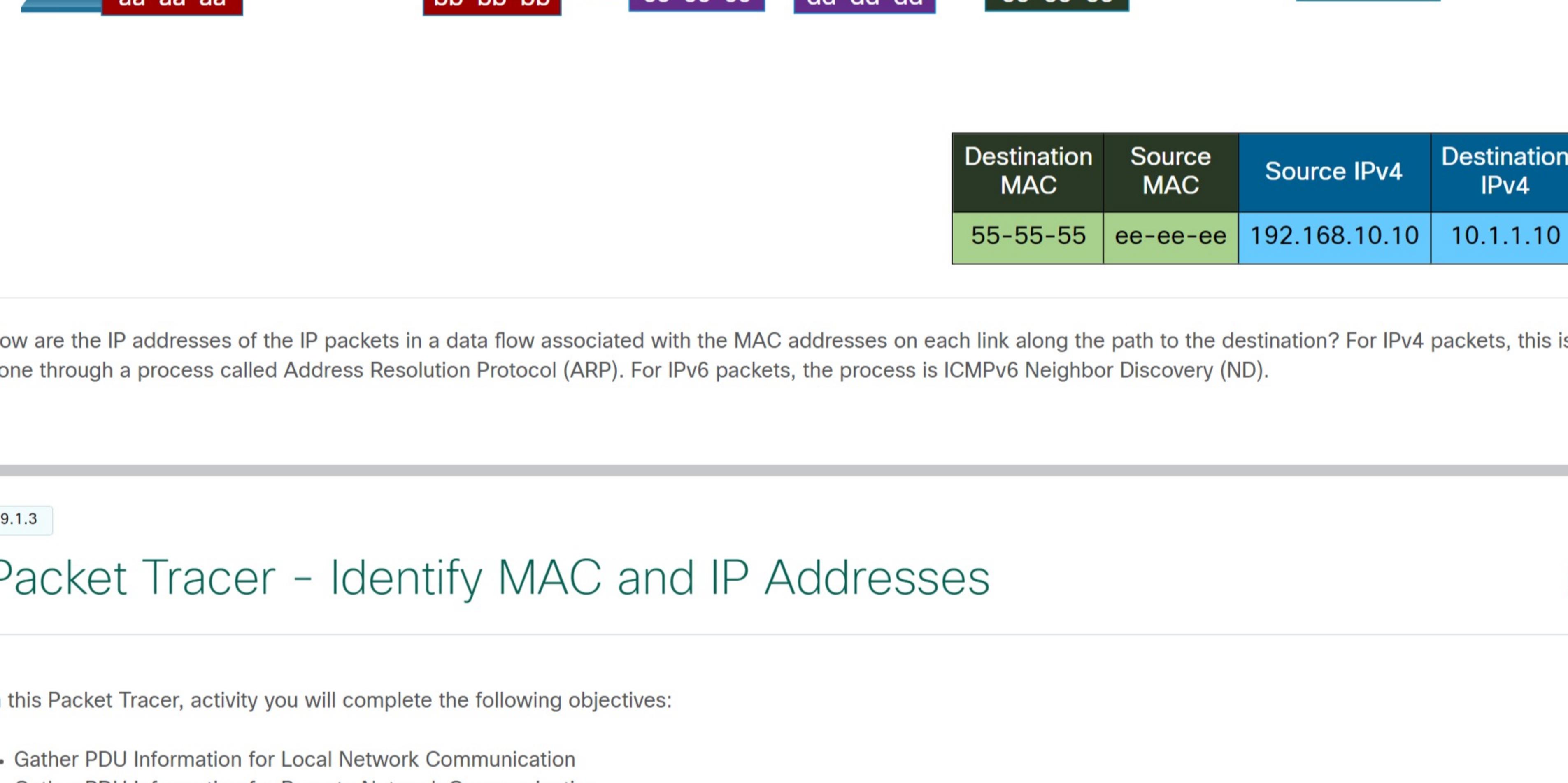
Routers examine the destination IPv4 address to determine the best path to forward the IPv4 packet. When the router receives the Ethernet frame, it de-encapsulates the Layer 2 information. Using the destination IPv4 address, it determines the next-hop device, and then encapsulates the IPv4 packet in a new data link frame for the outgoing interface.

In our example, R1 would now encapsulate the packet with new Layer 2 address information as shown in the figure.



The new destination MAC address would be that of the R2 G0/0/1 interface and the new source MAC address would be that of the R1 G0/0/1 interface.

Along each link in a path, an IP packet is encapsulated in a frame. The frame is specific to the data link technology that is associated with that link, such as Ethernet. If the next-hop device is the final destination, the destination MAC address will be that of the device Ethernet NIC, as shown in the figure.



How are the IP addresses of the IP packets in a data flow associated with the MAC addresses on each link along the path to the destination? For IPv4 packets, this is done through a process called Address Resolution Protocol (ARP). For IPv6 packets, the process is ICMPv6 Neighbor Discovery (ND).

9.1.3

Packet Tracer – Identify MAC and IP Addresses

In this Packet Tracer, activity you will complete the following objectives:

- Gather PDU Information for Local Network Communication
- Gather PDU Information for Remote Network Communication

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.

[Identify MAC and IP Addresses](#)

[Identify MAC and IP Addresses](#)

9.1.4

Check Your Understanding – MAC and IP

Check your understanding of MAC and IP addressing by choosing the BEST answer to the following questions.

1. What destination MAC address would be included in a frame sent from a source device to a destination device on the same local network?

- A broadcast MAC address of FF-FF-FF-FF-FF-FF.
- The MAC address of the destination device.
- The MAC address of the local router interface.

2. What destination MAC address would be included in a frame sent from a source device to a destination device on a remote local network?

- A broadcast MAC address of FF-FF-FF-FF-FF-FF.
- The MAC address of the destination device.
- The MAC address of the local router interface.

3. What two protocols are used to determine the MAC address of a known destination device IP address (IPv4 and IPv6)?

- DHCP

- ARP

- DNS

- ND

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