



# Module 9: Address Resolution

Thomas Wyseur

Introduction to Networks v7.0  
(ITN)





# Module 9: Address Resolution

Introduction to Networks v7.0  
(ITN)



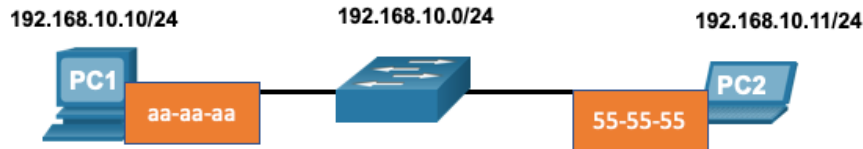
# 9.1 MAC and IP

# Destination on Same Network

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

- **Layer 2 physical address (the MAC address)** – Used for NIC to NIC communications on the same Ethernet network.
- **Layer 3 logical address (the IP address)** – Used to send the packet from the source device to the destination device.

Layer 2 addresses are used to deliver frames from one NIC to another NIC on the same network. If a destination IP address is on the same network, the destination MAC address will be that of the destination device.



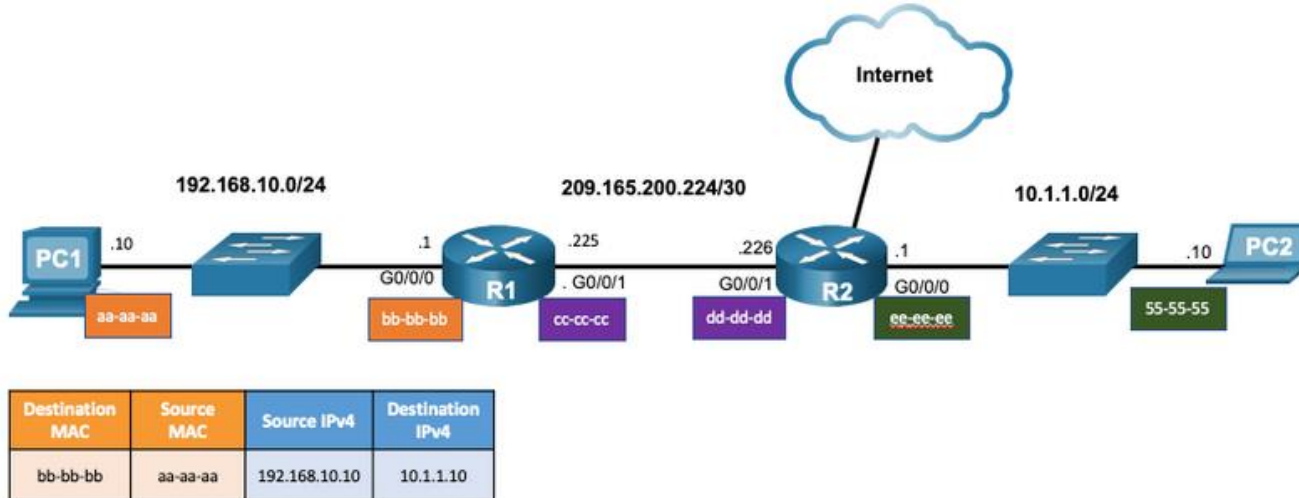
Destination MAC	Source MAC	Source IPv4	Destination IPv4
55-55-55	aa-aa-aa	192.168.10.10	192.168.10.11

# MAC and IP

## Destination on Remote Network

When the destination IP address is on a remote network, the destination MAC address is that of the default gateway.

- ARP is used by IPv4 to associate the IPv4 address of a device with the MAC address of the device NIC.
- ICMPv6 is used by IPv6 to associate the IPv6 address of a device with the MAC address of the device NIC.



# 9.2 ARP

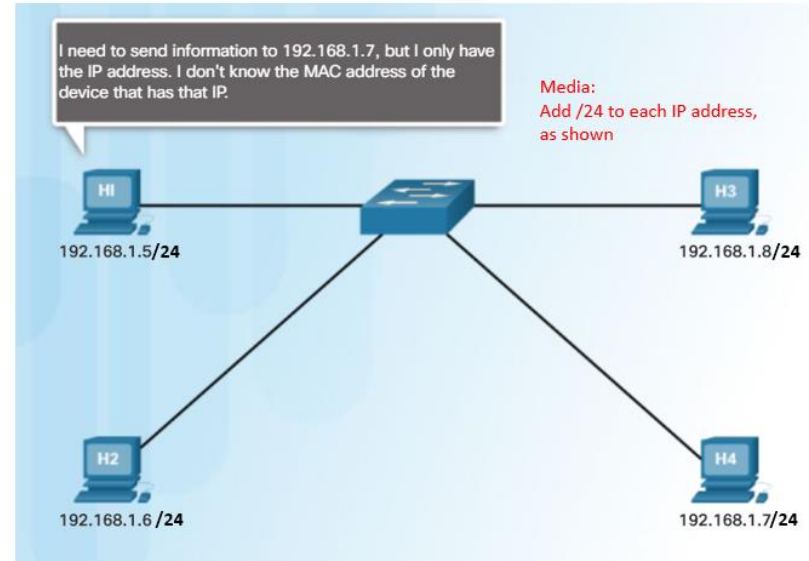
# ARP

## ARP Overview

A device uses ARP to determine the destination MAC address of a local device when it knows its IPv4 address.

ARP provides two basic functions:

- Resolving IPv4 addresses to MAC addresses
- Maintaining an ARP table of IPv4 to MAC address mappings



# ARP

## ARP Functions

To send a frame, a device will search its ARP table for a destination IPv4 address and a corresponding MAC address.

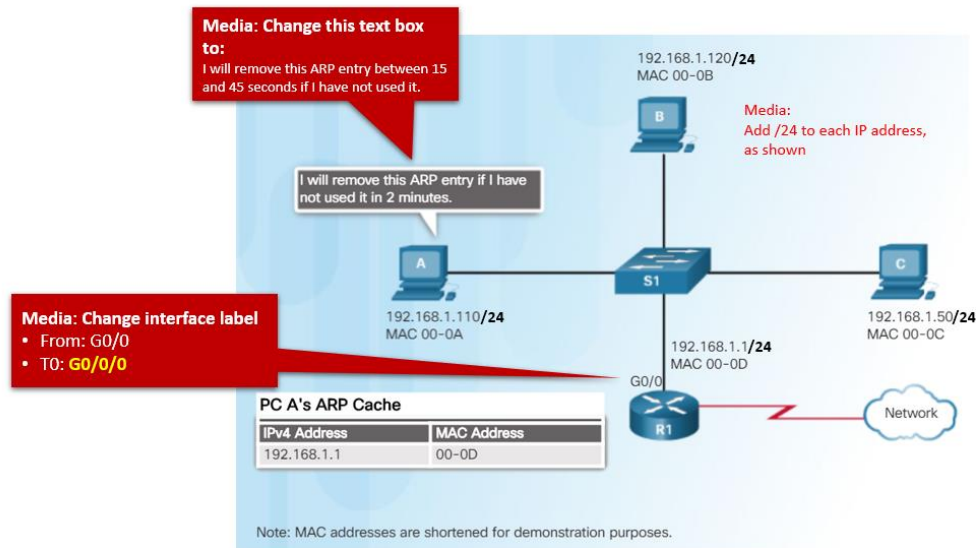
- If the packet's destination IPv4 address is on the same network, the device will search the ARP table for the destination IPv4 address.
- If the destination IPv4 address is on a different network, the device will search the ARP table for the IPv4 address of the default gateway.
- If the device locates the IPv4 address, its corresponding MAC address is used as the destination MAC address in the frame.
- If there is no ARP table entry is found, then the device sends an ARP request.



# ARP

## Removing Entries from an ARP Table

- Entries in the ARP table are not permanent and are removed when an ARP cache timer expires after a specified period of time.
- The duration of the ARP cache timer differs depending on the operating system.
- ARP table entries can also be removed manually by the administrator.



# ARP

## ARP Tables on Networking Devices

- The `show ip arp` command displays the ARP table on a Cisco router.
- The `arp -a` command displays the ARP table on a Windows 10 PC.

```
R1# show ip arp
```

Protocol	Address	Age (min)	Hardware Addr	Type	Interface
Internet	192.168.10.1	-	a0e0.af0d.e140	ARPA	GigabitEthernet0/0/0

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

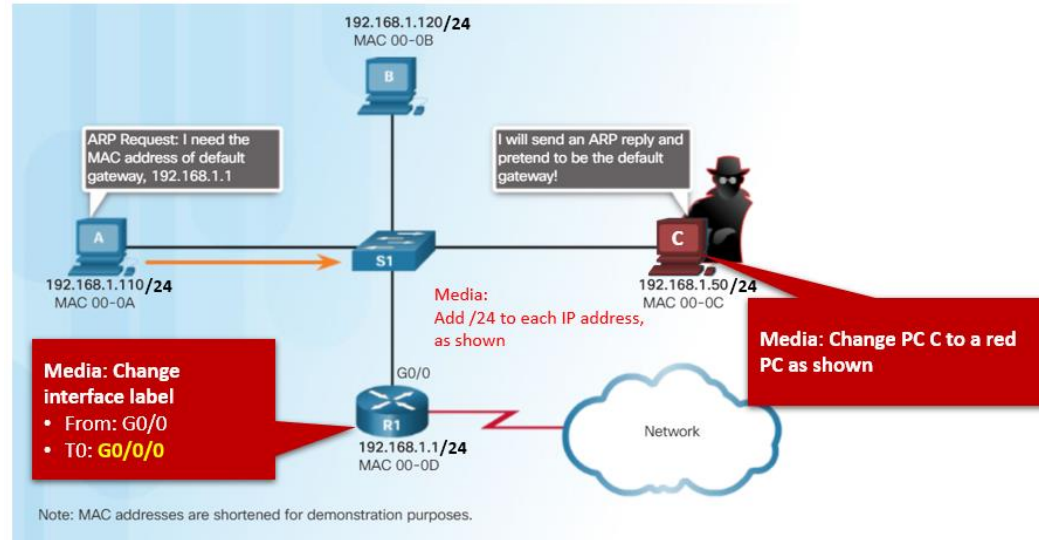
```
Interface: 192.168.1.124 --- 0x10
```

Internet Address	Physical Address	Type
192.168.1.1	c8-d7-19-cc-a0-86	dynamic
192.168.1.101	08-3e-0c-f5-f7-77	dynamic

# ARP

## ARP Issues – ARP Broadcasting and ARP Spoofing

- ARP requests are received and processed by every device on the local network.
- Excessive ARP broadcasts can cause some reduction in performance.
- ARP replies can be spoofed by a threat actor to perform an ARP poisoning attack.
- Enterprise level switches include mitigation techniques to protect against ARP attacks.



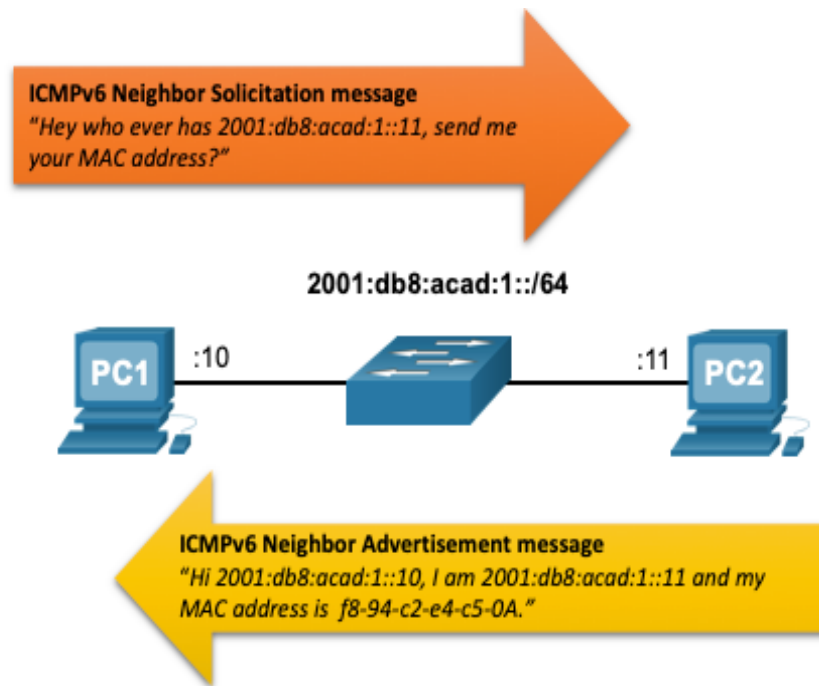
# 9.3 Neighbor Discovery

# IPv6 Neighbor Discovery Messages

IPv6 Neighbor Discovery (ND) protocol provides:

- Address resolution
- Router discovery
- Redirection services
- ICMPv6 Neighbor Solicitation (NS) and Neighbor Advertisement (NA) messages are used for device-to-device messaging such as address resolution.
- ICMPv6 Router Solicitation (RS) and Router Advertisement (RA) messages are used for messaging between devices and routers for router discovery.
- ICMPv6 redirect messages are used by routers for better next-hop selection.

# IPv6 Neighbor Discovery – Address Resolution



- IPv6 devices use ND to resolve the MAC address of a known IPv6 address.
- ICMPv6 Neighbor Solicitation messages are sent using special Ethernet and IPv6 multicast addresses.

