Module 9: Address Resolution

Return to overview

MAC and IP

Compare the roles of the MAC address and the IP address.

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 communication on the same network.
- **Layer 3 logical address (the IP address)** - Used to send the packet from the source device to the destination device.

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.

ARP

Describe the purpose of ARP.

The purpose of an ARP is to **couple the MAC Address to an IP address**. It does this with an ARP table. Which has to be updated with **request and replies**.

ARP Functions

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

- If destination on the same network: the device will search the ARP table for the destination IPv4 address.
- If destination 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, than the device **sends and ARP request**

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 -d`

Cisco IOS: `show ip arp` Desktop: `arp -a`

ARP Issues - ARP Broadcasting and ARP Spoofing

ARP Broadcasting: Excessive usage can cause some reduction in performance, but for gigabit this is not an issue only for fast ethernet.

ARP replies can be spoofed: A threat actor could perform an ARP poisoning attack and build its own ARP table. Recent switches have security software for this.

Neighbor Discovery

Describe the operation of IPv6 neighbor discovery.

Important:

- IPv6 uses Neighbor Discovery (ND) instead of ARP
- ND works with solicitations and is more efficient than ARP

Not important fun to know:

IPv6 Neighbor Discovery (ND) protocol provides:

- Address resolution
- Router discovery
- Redirection services
- ICMPv6 Neighbor Solicitation (NS) and Neighbor Advertisement (NA)
- 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.

ND looks a lot like ARP.