Lecture 4c - ARP

Type	Lecture
Materials	Empty
Reviewed	☑

1. MAC and IP

- **MAC Address**
  - This address **does not change**
  - Similar to the **name** of a person
  - Known as **physical address** – physically assigned to the host **NIC**
  - Assigned by the vendor
- **IP Address**
  - Similar to the **address** of a person
  - Based on **where** the host is actually **located**
  - Known as a **logical address** because **assigned logically**
  - **Assigned** to each host by a **network administrator**
- Both the **physical MAC** and **logical IP** addresses are required for a computer to **communicate** just like both the **name and address** of a person are required to **send a letter.**

2. End-to-end connectivity, MAC, and IP

- *IP Packet* **Encapsulated in an Ethernet Frame**
  - **A switch examines MAC addresses**

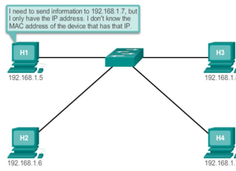
Destination MAC Address	Source MAC Address	Source IP Address	Destination IP Address	Data	Trailer
BB:BB:BB:BB:BB:BB	AA:AA:AA:AA:AA:AA	10.0.0.1	192.168.1.5		

  - **A router examines IP addresses**

Destination MAC Address	Source MAC Address	Source IP Address	Destination IP Address	Data	Trailer
BB:BB:BB:BB:BB:BB	AA:AA:AA:AA:AA:AA	10.0.0.1	192.168.1.5		

3. ARP

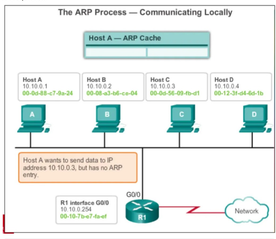
- **Introduction to ARP**
  - Once data is **encapsulated** in a **Layer 3 packet** containing **IP addressing** information, the **Layer 2 sub-system** will **encapsulate** the packet in a frame containing **source and destination MAC addresses.**
  - As **opposed to IP addresses**, there **isn't** a global system to match destination hostnames to MAC addresses. For this, the sender needs to **bind** the **destination IP address** to a **destination MAC** address using the `ARP (Address Resolution Protocol)`

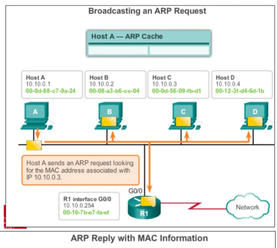


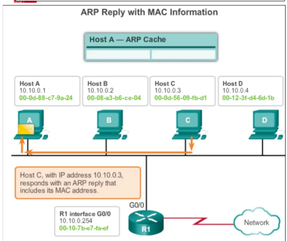
- When a host wants to send a packet to a known IP address:
  - First, it must **identify** if the **destination IP address** is **in the same network** or not by comparing the network portion
  - If there is a **match**, it must use the **destination MAC address** in the **layer 2 header** message.
  - If **not**, it must use the **MAC address** of the **default gateway**.

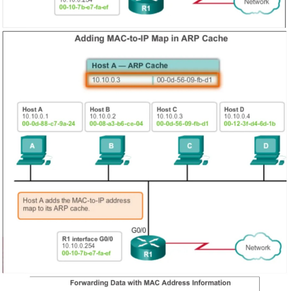
⇒ It need to send an **ARP request** only if the **binding information** of the next hop is **not** in the **ARP table.**

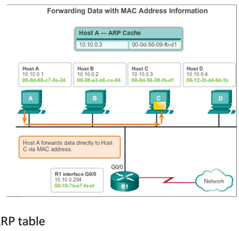
- **ARP Request**:
  - A **Layer 2** broadcast frame, with **no IP header**, containing **target IP information**.
- **ARP Operation**











4. ARP table

- All **IP-enabled devices** have a **local memory** space for the **ARP table**
- The **ARP table** can be **manually cleared** by the **administrator**
- **IP-to-MAC** bindings do **not stay** in the ARP cache **indefinitely**
  - **Bindings** will be **removed** after a pre-determined **timeout timer expired**
  - If the **ARP table** is running **out of space**, **older entries** are **removed** to make space for new ones

5. Quizzes