

R&D Document on MAC Addressing, ARP, and RARP

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1. What is MAC Addressing?

MAC (Media Access Control) Address is a unique identifier assigned to a network interface card (NIC) for communication on the physical network segment. It operates at the Data Link Layer (Layer 2) of the OSI model and is used for local device identification.

2. Format and Structure of MAC Addresses

A MAC address is a 48-bit (6 bytes) address, usually represented in hexadecimal format and separated by colons or hyphens. Example: 00:1A:2B:3C:4D:5E.

The first 3 bytes represent the Organizationally Unique Identifier (OUI) assigned to the manufacturer, and the last 3 bytes are assigned by the manufacturer to uniquely identify the device.

3. Importance and Uses of MAC Addressing

- Ensures unique identification of devices on a LAN
- Used for frame forwarding in Ethernet
- Helps switches to learn MAC addresses and build MAC address tables
- Plays a vital role in ARP for resolving IP to MAC
- Used in MAC filtering and network security settings

4. ARP (Address Resolution Protocol)

ARP is a protocol used to map an IP address to its corresponding MAC address. It is essential for devices on a LAN to communicate using their IP addresses.

Working:

1. A device wants to send a packet to an IP address.
2. It checks its ARP table for the corresponding MAC address.
3. If not found, it broadcasts an ARP request.
4. The device with the matching IP replies with its MAC address.
5. The sender stores this MAC in its ARP table for future use.

5. RARP (Reverse Address Resolution Protocol)

RARP is used by a device to determine its IP address using its known MAC address. It is used primarily by diskless systems at boot time to obtain an IP address from a RARP server.

Working:

1. Device sends a RARP request with its MAC address.
2. RARP server looks up the IP for that MAC and replies.
3. The device uses the IP address received to configure its interface.

6. Differences between ARP and RARP

Aspect	ARP	RARP
Function	Resolves IP to MAC	Resolves MAC to IP
Usage	By devices to send data on LAN	By diskless devices to get IP
Direction	IP → MAC	MAC → IP
Support	Widely supported	Deprecated and replaced by DHCP

7. Conclusion

MAC addressing ensures reliable device-level identification on local networks. ARP is a fundamental protocol used to discover MAC addresses for IP communication, while RARP, though outdated, was used for reverse lookup in older network architectures. Together, they play a crucial role in the operation and management of IP-based networks.