DHCPv4 (Dynamic Host Configuration Protocol)

**I. DHCP (Giao thức Cấu hình Máy chủ Động) Overall**

DHCP (Dynamic Host Configuration Protocol) is a network protocol that allows a server to automatically assign IP addresses and other network configuration information to devices on a network. This simplifies network management and avoids IP address conflicts.

**II. Purpose of DHCP**

- Automation: Instead of manually assigning IP addresses to each device, DHCP automates this process, saving time and effort.

- Efficient IP address management: DHCP helps centrally manage IP addresses, ensuring that each device has a unique IP address, preventing conflicts.

- Easy network configuration changes: When network configurations change (e.g., changing the DNS server IP address), you only need to change the configuration on the DHCP server, and devices will automatically receive the new configuration.

- Mobile device support: Mobile devices frequently connect and disconnect from networks; DHCP makes it easy for them to obtain new IP addresses each time they connect.

**III. How DHCP works?**

1. DHCP Discover: When a new device connects to the network, it sends a DHCP Discover packet to find a DHCP server.

2. DHCP Offer: The DHCP server receives the Discover packet and sends back a DHCP Offer packet, proposing an IP address and other configuration information.

3. DHCP Request: The device selects one of the offers and sends a DHCP Request packet to request that IP address.

4. DHCP Acknowledgement: The DHCP server confirms the IP address assignment and sends a DHCP Acknowledgement packet to the device.

5. IP address lease: The device receives the IP address and uses it for a specific period (lease time). When the lease time is about to expire, the device can request a lease renewal.

**IV. DHCP Packet Format**

A screen shot of a computer

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**- Operation Code**: specifies the type of message (e.g., request or reply).

- **Hardware Type**: indicates the hardware type

**- Hardware Length**: Specifies the length of the hardware address (e.g., 6 bytes for a MAC address).

**- Transition ID**: A transaction ID used to match requests and replies.

- **Client IP Address**: The client's current IP address

- **Your IP Address**: The IP address offered by the DHCP server to the client.

- **Server IP Address**: The IP address of the DHCP server.

**- Gateway IP Address**: The IP address of a relay agent (if used).

- **Chaddr (Client Hardware Address):** The client's MAC address.

**V. Steps to Obtain a Leese (When the client boots (or otherwise wants to join a network)**

1. DHCP Discover (DHCPDISCOVER)

* A client needing an IP address sends a broadcast "DHCPDISCOVER" message.
* This message uses broadcast addresses (Layer 2 and 3) because the client has no IP.
* A close-up of a message

  AI-generated content may be incorrect.The goal is to find available DHCP servers on the network.

2. DHCP Offer (DHCPOFFER)

* Reserves an available IP address for the client.
* Creates an ARP entry (MAC address to IP address mapping).
* A green line with black text

  AI-generated content may be incorrect.Sends a DHCPOFFER message to the client, offering the IP address.

3. DHCP Request (DHCPREQUEST)

* Client receives DHCPOFFER and responds with a broadcast DHCPREQUEST.
* This confirms the offered IP from the chosen server and rejects other offers.
* The broadcast informs all DHCP servers of the accepted lease.

A close-up of a message

AI-generated content may be incorrect.

4. DHCP Acknowledgment (DHCPACK)

* May verify the IP is unused (ICMP ping).
* Create an ARP entry.
* Send a DHCPACK message (similar to DHCPOFFER).

- The client:

* Logs the configuration.
* Performs an ARP lookup to confirm the IP is valid.
* A close-up of a green line

  AI-generated content may be incorrect.Starts using the assigned IP address.

=> The lease renewal process involves two messages. The client sends a DHCPREQUEST and the server responds with a DHCPAK.