DYNAMIC HOST CONFIGURATION PROTOCOL

DHCP

Purpose of DHCP

- DHCP automates the assignment of
  - Unique IP addresses
  - Subnet masks
  - Default gateways
  - Other IP parameters to individual computers and devices on the network.
- DHCP lets a network administrator supervise and distribute IP addresses from a central point and automatically sends a new IP address when a computer is plugged into a different place in the network.

Without DHCP Servers

- Network Administrators would be over-worked, and underpaid.
- The desktop client would be responsible for assigning a proper IP address within the appropriate range.
- Two different clients may end up claiming the same IP address.
- Desktop clients will need too much knowledge about IP address ranges, etc. This for example could lead to problems when the network ranges change.
- Will make it difficult to move a computer from one subnet to another.

Preliminary

- (DHCP) Message → DHCP-PDU (A-PDU)
- Client → DHCP Client
- Server → DHCP Server
- Well-known port numbers
  - DHCP Server → UDP port 67
  - DHCP Client → UDP port 68
- Broadcast and Unicast used for PDU's in both directions

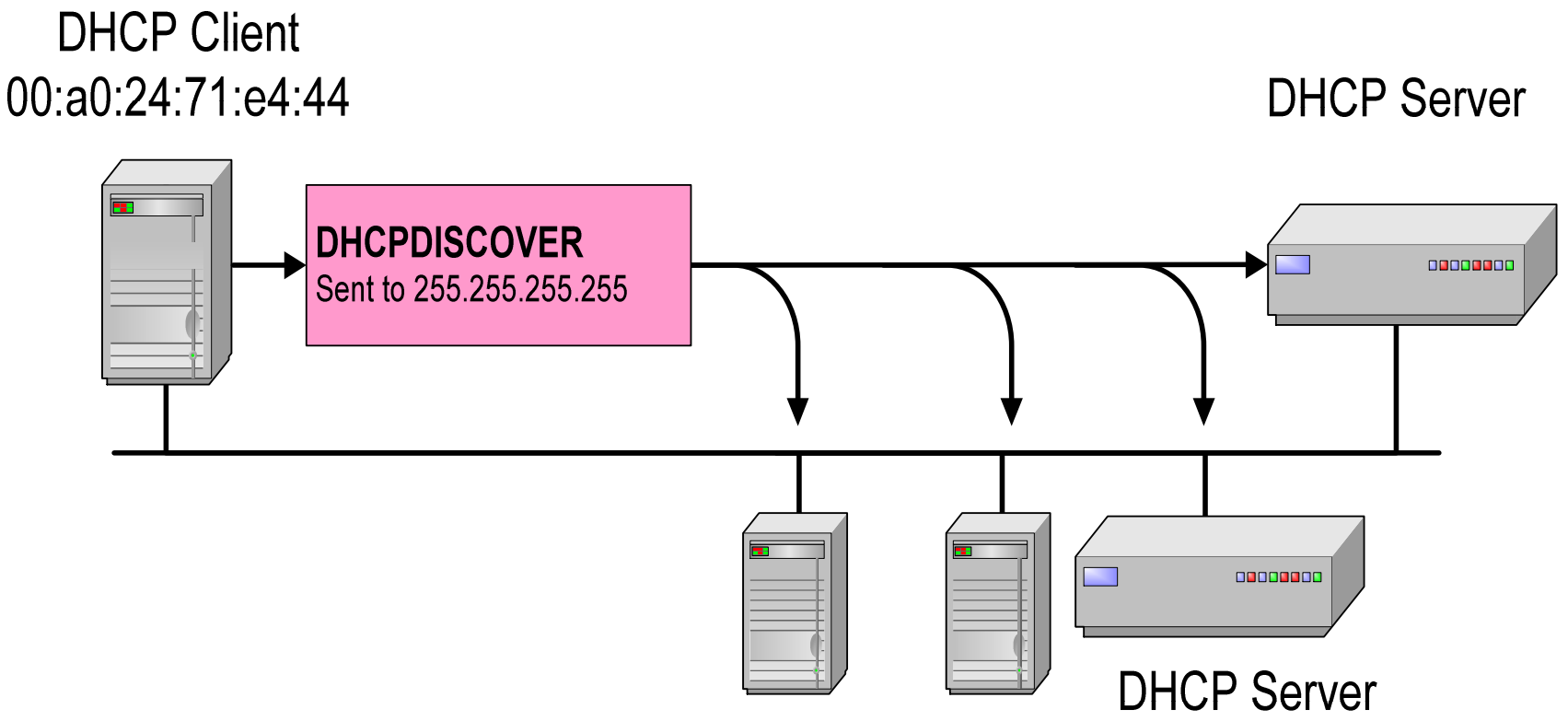
Phases of DHCP

- Discover Phase
- Offer Phase
- Request Phase
- Acknowledgement Phase
- Release Phase

Discover Phase

- When a DHCP configured devices connect to the network, the client sends a broadcast request (called a DISCOVER or DHCPDISCOVER) looking for a DHCP server to answer.
- The router directs the DHCPDISCOVER packet to the correct DHCP server.
- The DHCP server receives the DHCPDISCOVER packet.
- Based up on availability the server determines an appropriate IP address to give to the client.

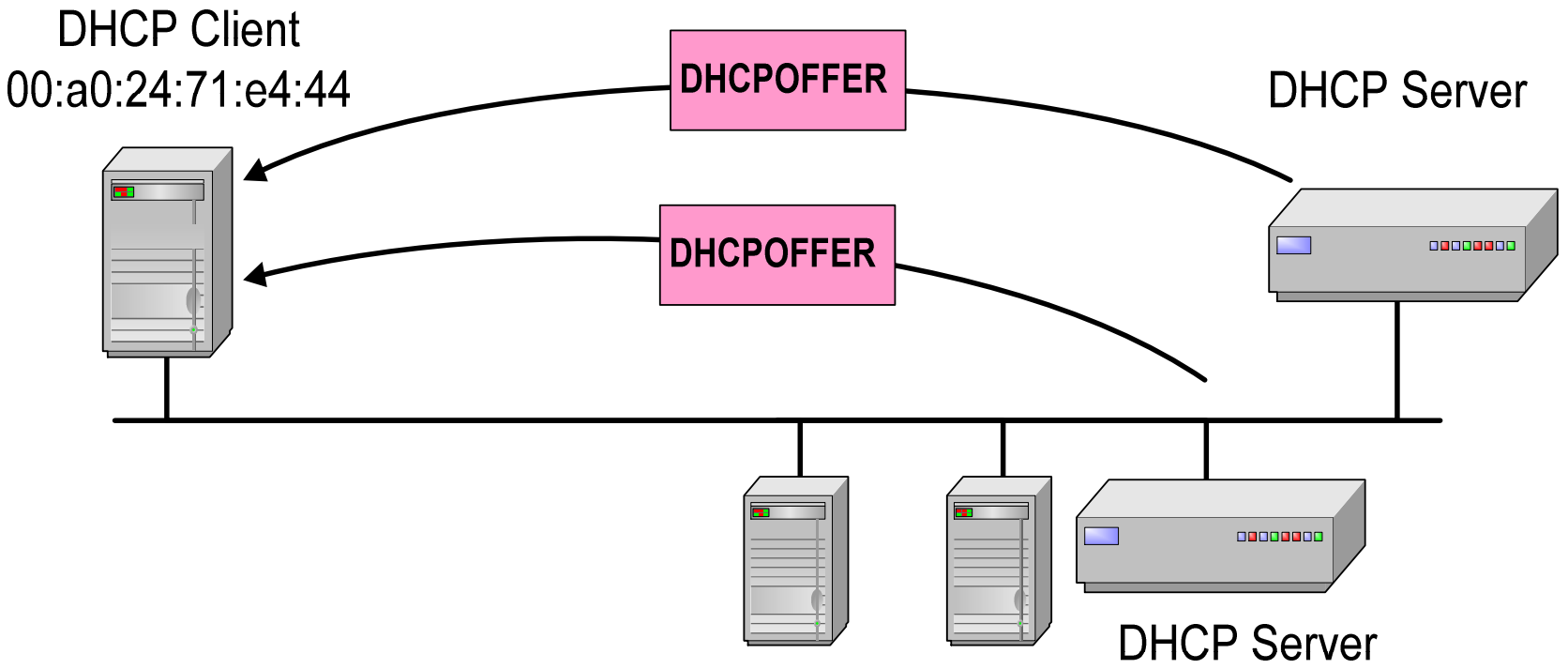
Discover Phase



Offer Phase

- The server temporarily reserves the IP address and response the client an Offer (DHCPOFFER) packet with the address information
- The server also configures the clients DNS servers, WINS servers, NTP servers, etc.

Offer Phase


DHCP Client
00:a0:24:71:e4:44
DHCPOFFER
DHCP Server
DHCPOFFER
DHCP Server

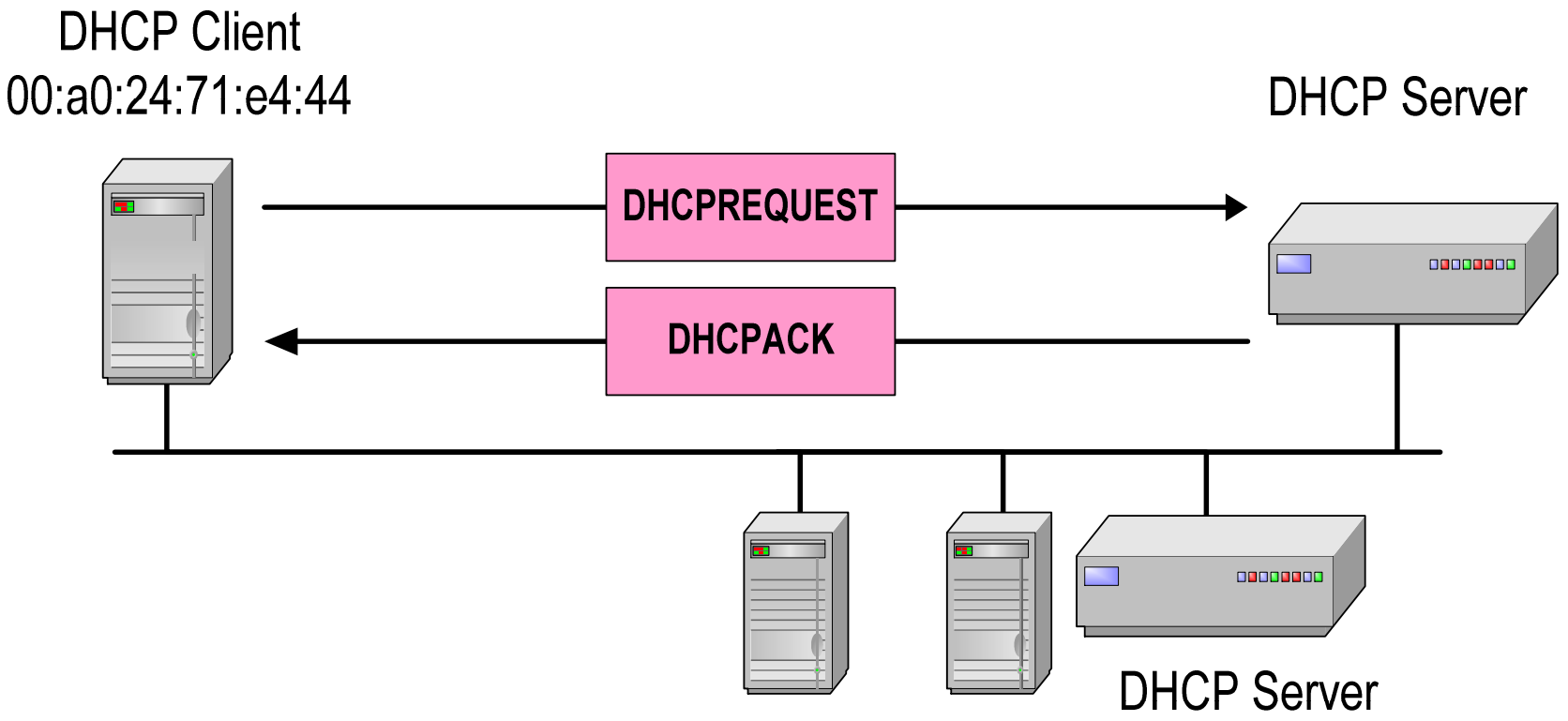
Request Phase

- The client sends a Request (DHCP REQUEST) packet, letting the DHCP server know that it intends to use that address.

Acknowledgement Phase

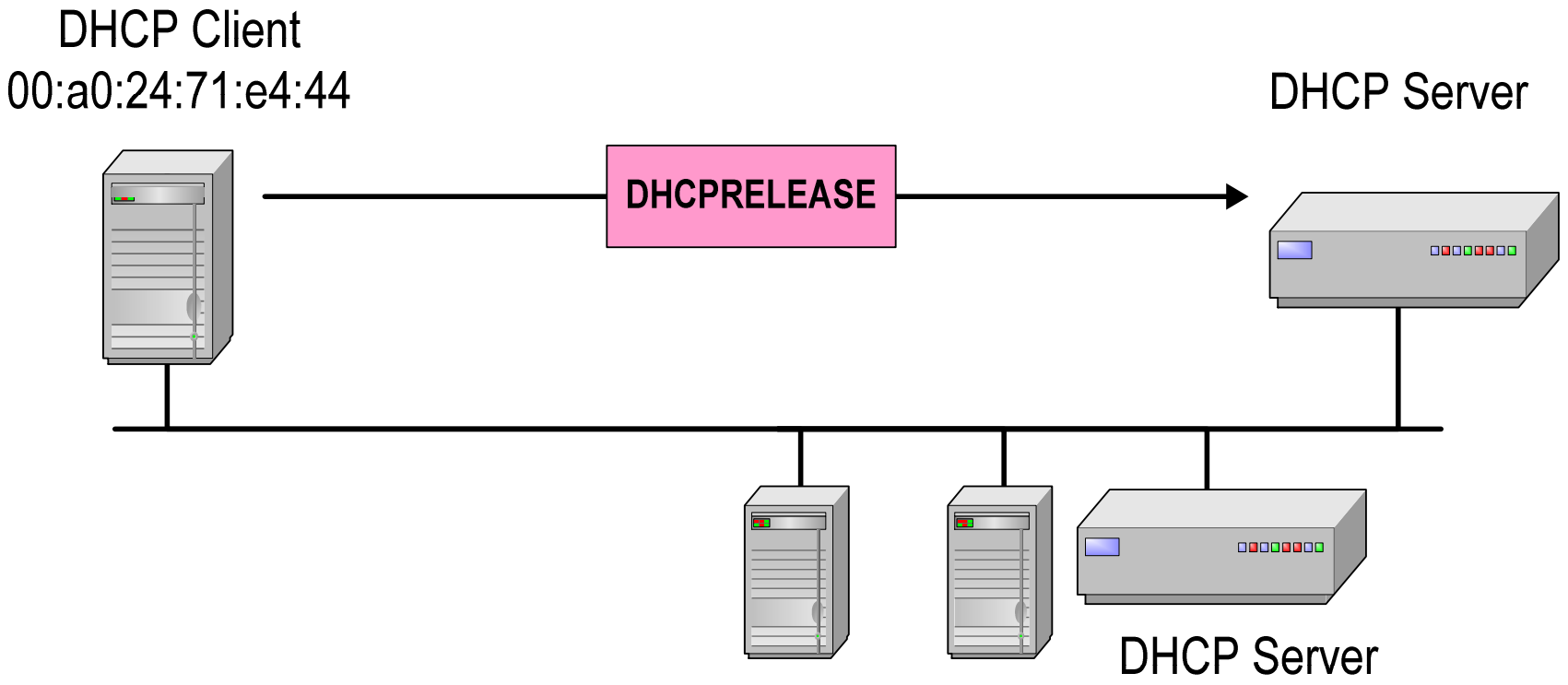
- The Server sends an Acknowledgement (DHCPACK) packet confirming client has been given a lease on the address
- A DHCP Lease is the amount of time a DHCP server grants the client permission to use a particular IP address.
- The Administrator of the DHCP server can set this.

Request and Acknowledgement Phase

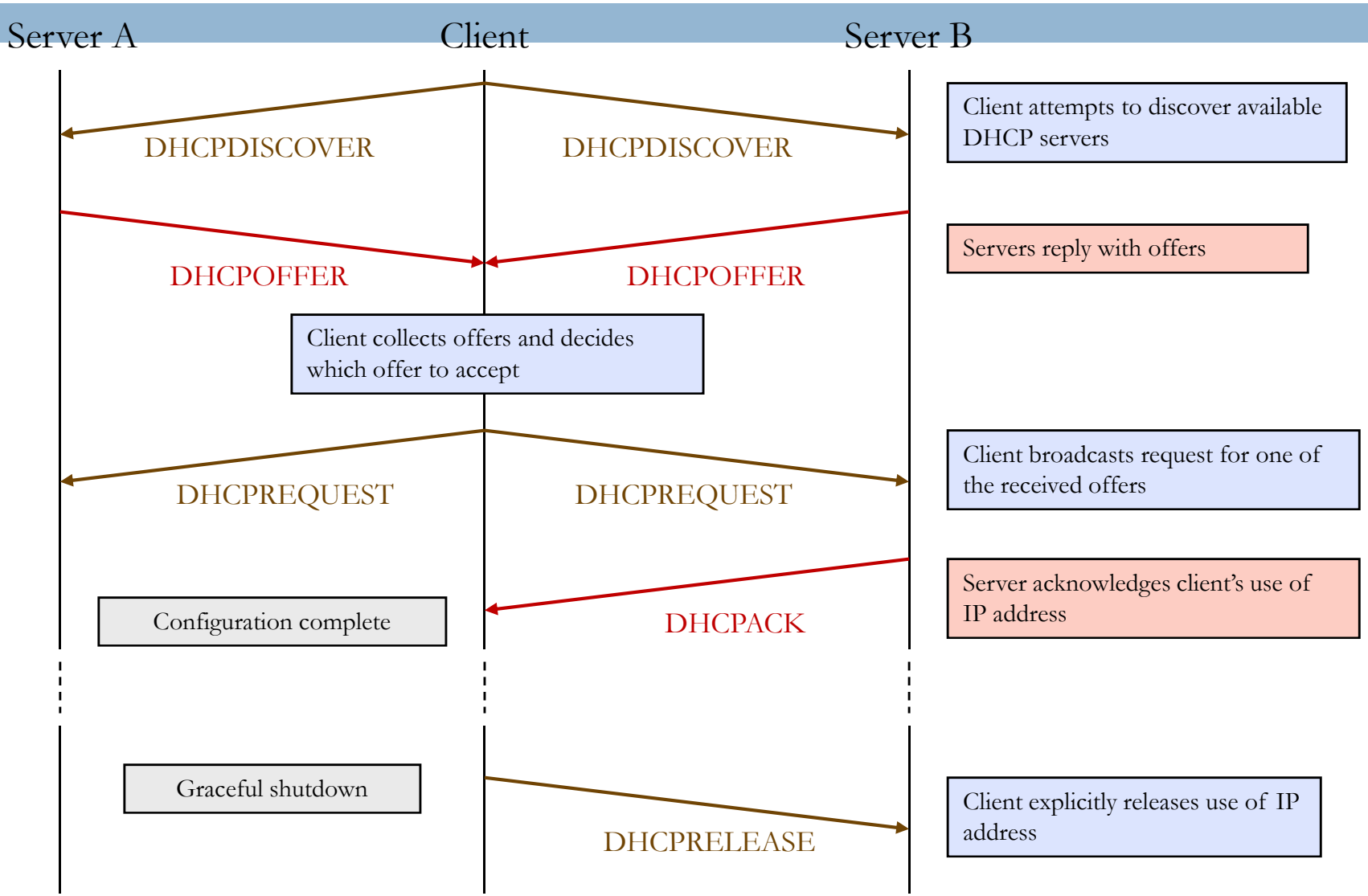


Release Phase

- The DHCP client releases the IP address



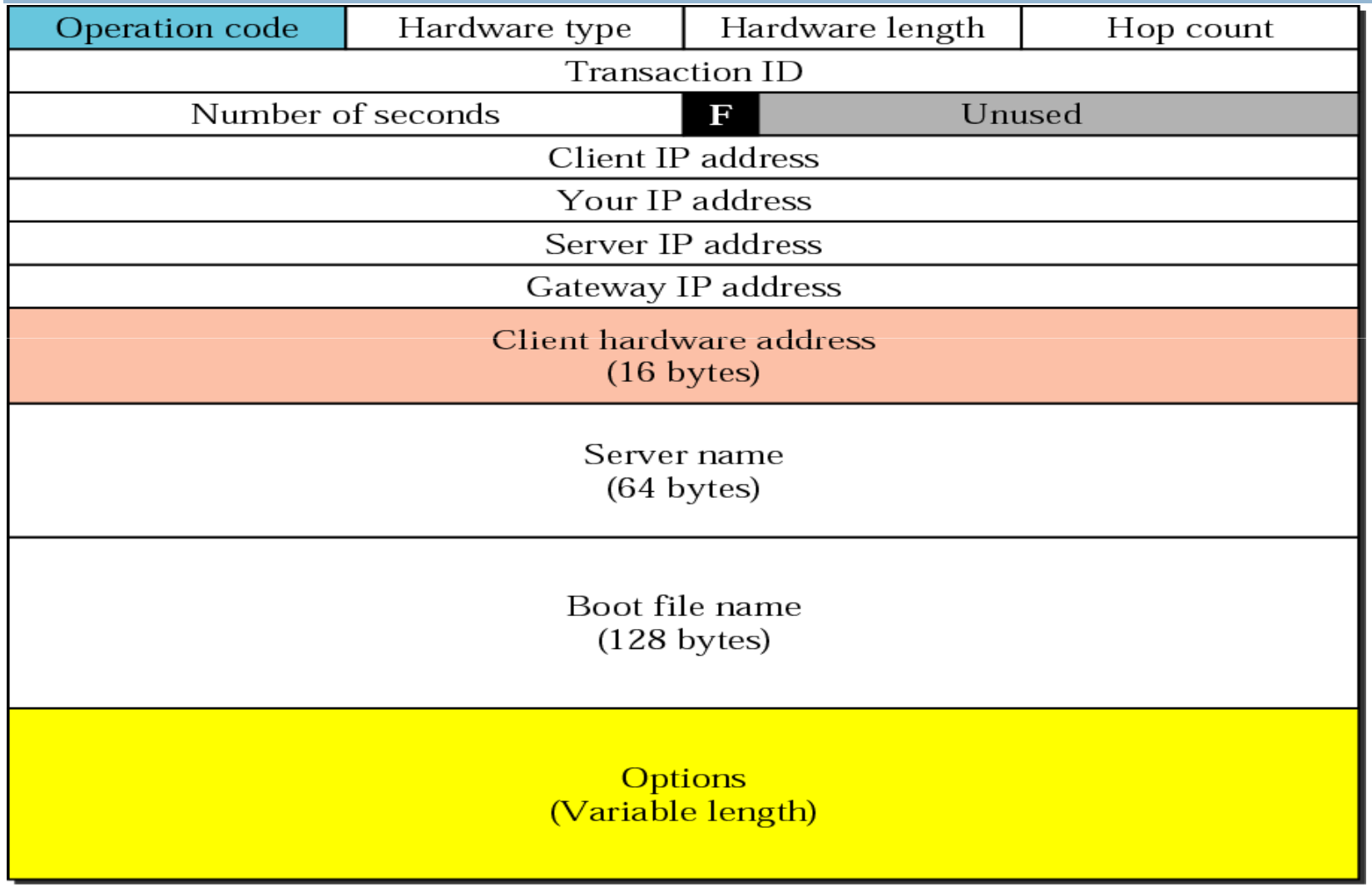
DHCP - Protocol Mechanisms



DHCP Message Types

DHCP Message	Use
DHCPDISCOVER	Client broadcast to locate available servers
DHCPOFFER	Server to client response offering configuration parameters
DHCPREQUEST	Client broadcast requesting offered parameters
DHCPDECLINE	Client to server notification that IP address is in use
DHCPACK	Server to client response confirming a request
DHCPNAK	Server to client response denying a request
DHCPRELEASE	Client to server request to relinquish IP address
DHCPINFORM	Client to server request for configuration parameters

Frame Format



Frame Format

- **OpCode**: 1 → Request 2 → Reply
  DHCP message type is sent in an option
- **Hardware Type**: 1 (for Ethernet)
- **Hardware address length**: 6 (for Ethernet)
- **Hop count**: set to 0 by client before transmitting the request
- **Transaction ID**: A 32-bit identification field generated by the client, to allow it to match up the request with replies received from DHCP servers.
- **Number of Seconds:** elapsed since a client began an attempt to acquire or renew a lease.
- **Flag:** Broadcast → 1

Frame Format

- **Client IP address, Your IP address, server IP address, Gateway IP address, client hardware address, server host name, boot file name:**
  client fills in the information that it has, leaves rest blank

Ways of allocating IP Addresses

- **Manual allocation:** (static IP addresses): The server's administrator creates a configuration for the server that includes the MAC address and IP address of each DHCP client that will be able to get an address.
- **Automatic allocation:** The server's administrator creates a configuration for the server that includes only IP addresses, which it gives out to clients. An IP address, once associated with a MAC address, is permanently associated with it until the server's administrator intervenes.
- **Dynamic allocation**: Like automatic allocation except that the server will track leases and give IP addresses whose lease has expired to other DHCP clients.

DHCP Settings