DHCP

DHCP — dynamic host configuration protocol
- Provides automatic configuration of remote hosts
- An extension to BOOTP
- Based on UDP, client-server paradigm
- Well-known port: server (67), client (68)

~~DHCP Features~~
- Simple administration
- Moving machines
- Eliminating erroneous IP information
- Eliminating additional configuration information
- Efficient use of IP addresses

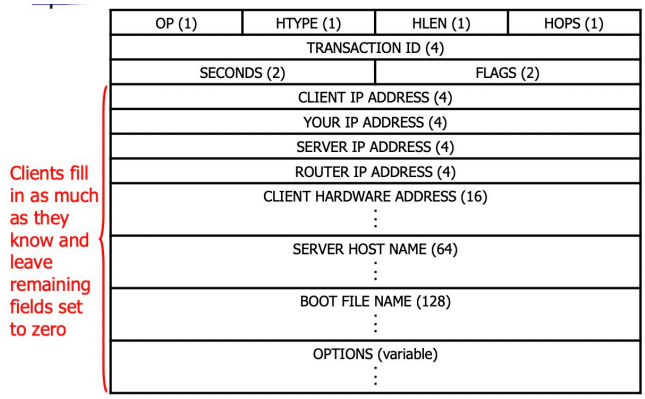
DHCP, BOOTP relationship
1. Similarities
- format structure to exchange messages
- well-known UDP ports for c/s communication
- IP address distribution as an integral part of configuration service
2. Differences

BOOTP	DHCP
Prior to DHCP	After BOOTP
Configure diskless workstations	Configure frequently relocated networked computers with local hard drives and full boot capabilities
Do not rebind or renew configuration	Clients automatically enter a rebinding state at set timed intervals to renew their leased address allocation

- DHCP client: an internet host using DHCP to obtain configuration parameters such as network address
- DHCP server: an internet host that returns configuration parameters to DHCP clients
- DHCP lease: the amount of time that the DHCP server grants to the DHCP client permission to use a particular IP address
- DHCP relay: used to interconnect hardware and software on different physical network segments called subnets and forward IP packets between each of the subnets

Phases of IP Assignment with DHCP
1. The client make a request for an IP address (broadcast)
2. The DHCP server(s) offer an IP address
3. The client selects an offer and requests an IP lease (broadcast)
4. The selected DHCP assigns an IP to the client

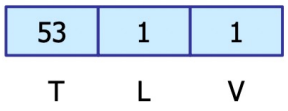
DHCP message of format



OP: 1—request, 2—reply
HOPS: client sets to 0, used by relay agents
Transaction ID: match response and requests
FLAGS: allow control of the request and response (unicast: 0, broadcast: 1 —> leftmost bit to control whether it is uni- or broad- cast)

Client IP address: only filled in if client is in BOUND, RENEW or REBIND state
Your IP address: Client IP address
Server IP address: Next Server to use in bootstrap — DHCP协议流程的下一个阶段要使用的服务器的IP地址
Router IP address: DHCP Relay Agent IP address

OPTIONS: TLV encoding style
e.g. Type = 53 (type of the DHCP message)



Length = 1, Value = 1 —> DHCP DISCOVER
(1, 2, 3, 5) —> discover, offer, request, ack

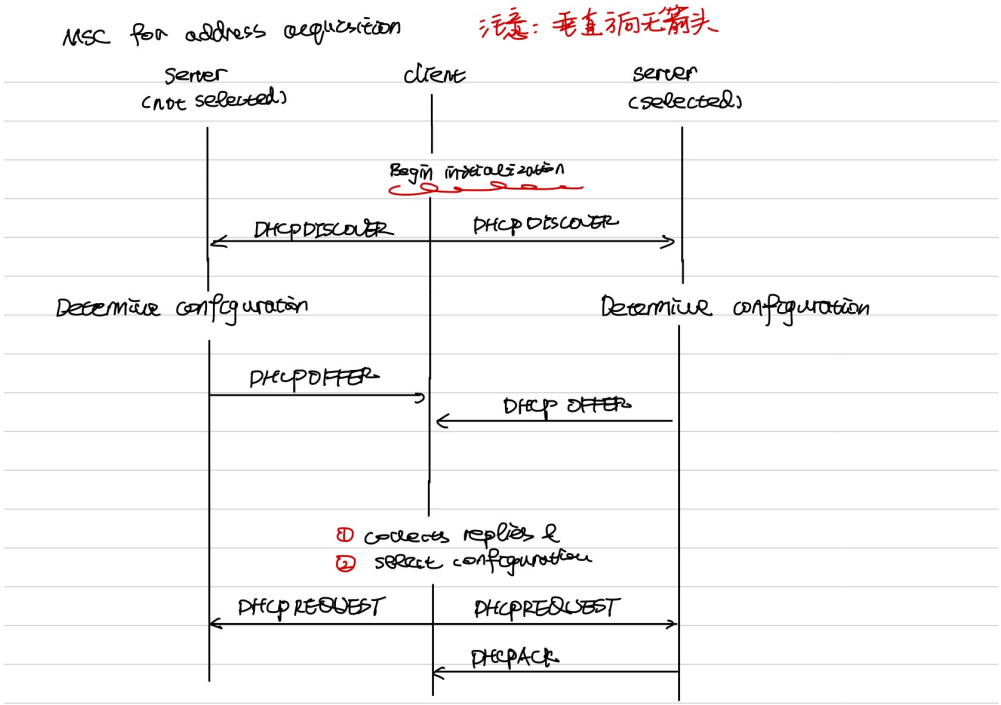
DHCP Messages

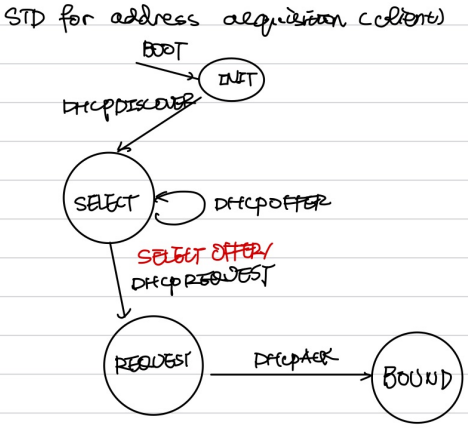
- DHCP DISCOVER
- DHCP OFFER
- DHCP REQUEST
- DHCP ACK
- DHCP NAK (client incorrect, client's lease expired)
- DHCP DECLINE (network address already in use)
- DHCP RELEASE (relinquish network address and cancelling remains lease)
- DHCP INFORM

Major Operations in DHCP (STD, MSC)

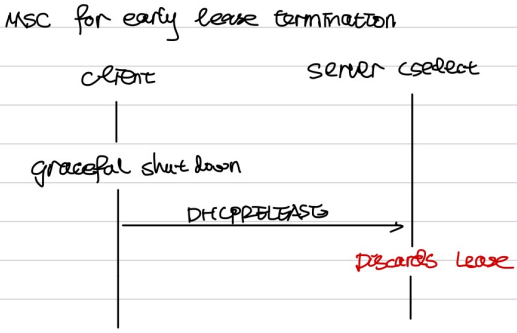
- Address acquisition
- Early lease termination
- Lease renewal

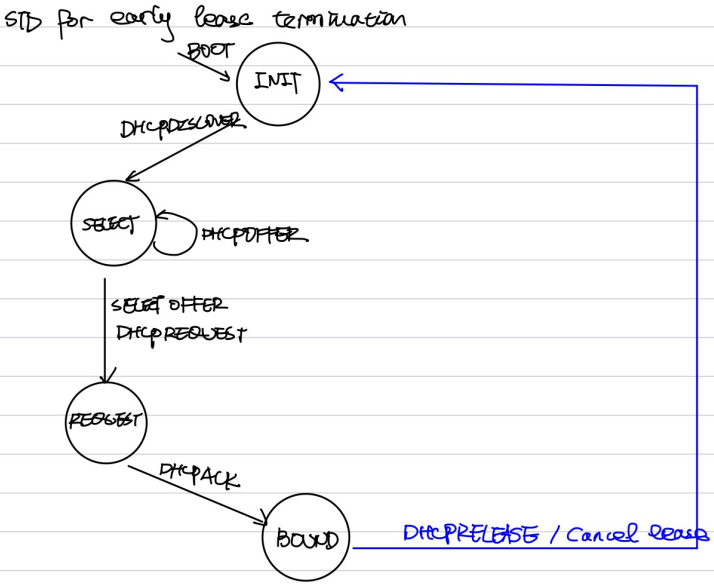
Address acquisition





Early Lease termination





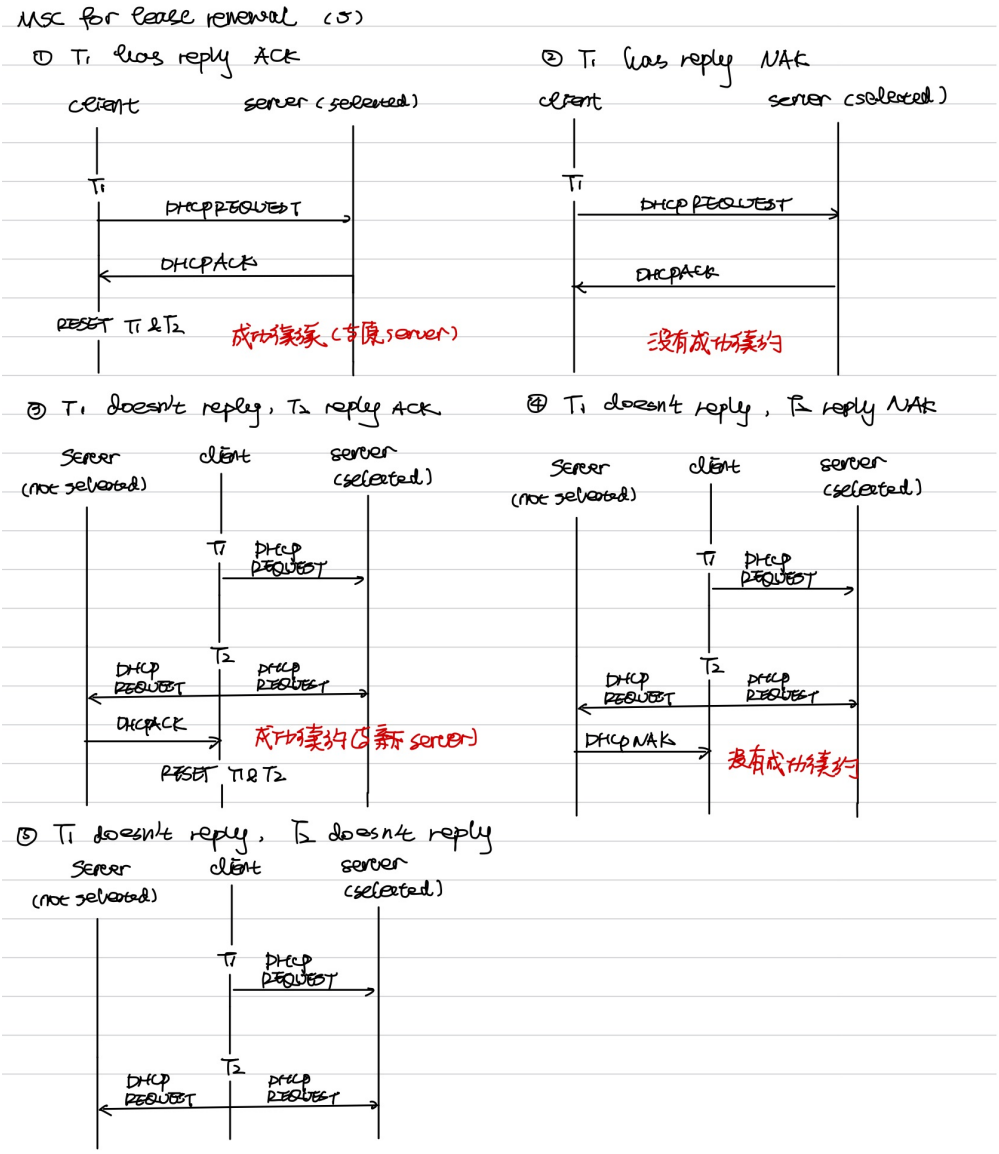
Lease renewal (5)

T1: the time at which the client enters the RENEW state and attempts to contact the server that originally issued the client's network address

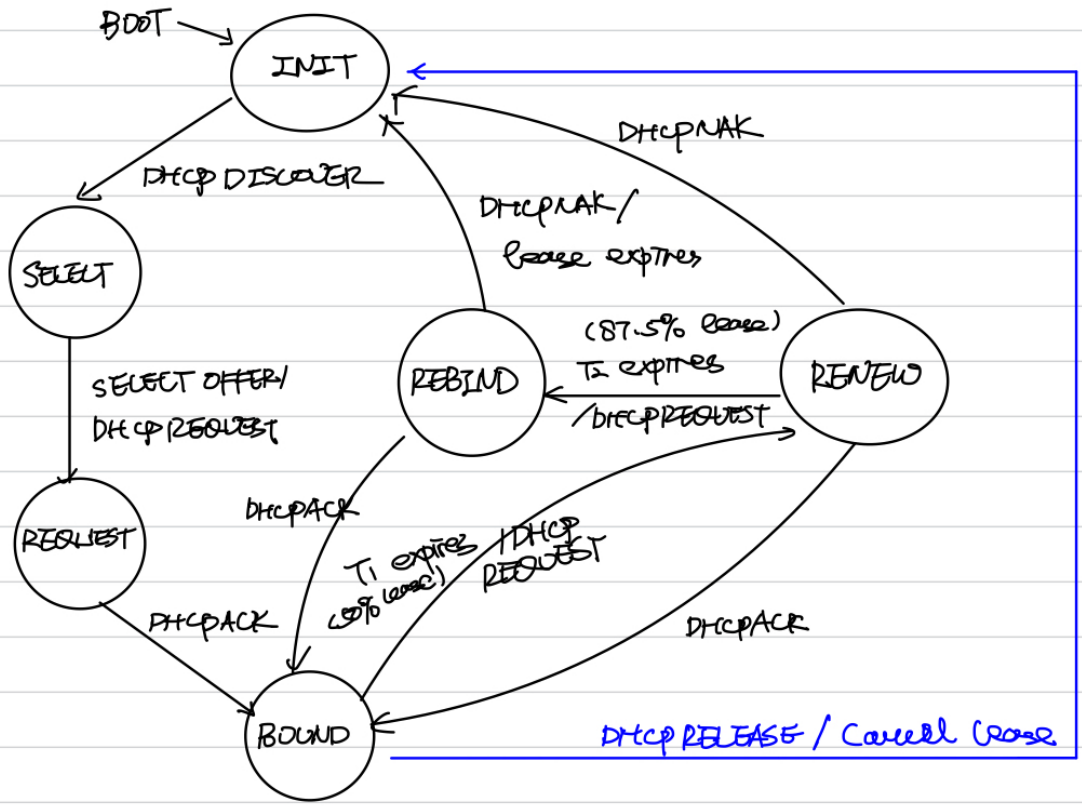
- 0.5 * duration_of_lease

T2: the time at which the client enters the REBIND state and attempts to contact any server

- 0.875 * duration_of_lease



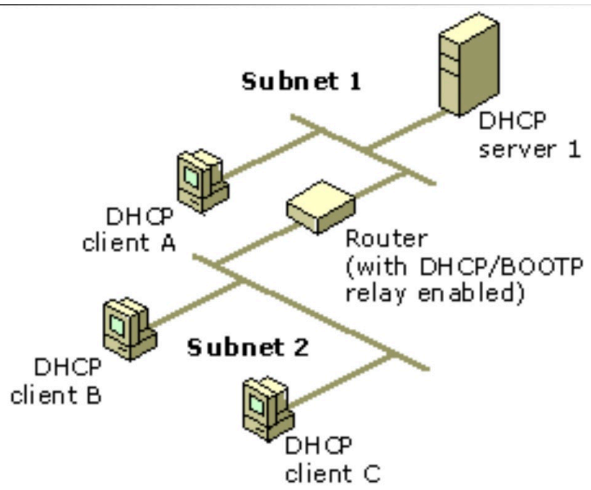
STD of client for lease renewal



DHCP relay
DHCP relay 作用: used to interconnect hardware and software on different physical network (subnets) and forward IP packets between each of the subnets

条件: Router must comply with DHCP/BOOTP relay agent

Basic address acquisition procedure through DHCP relay



Phase 1: client B broadcast a DHCPDISCOVER on subnet 2, using UDP (port 67), router will examine the gateway IP address field in DHCPDISCOVER, if this field is 0.0.0.0, fills with router's IP address, then forwards the message to the remote subnet 1

Phase 2: DHCP server processes and sends an DHCPOFFER directly to the relay agent identified in the GIADDR field, forward the message to the remote subnet 2

Phase 3: A DHCPREQUEST message is relayed from client to server

Phase 4: A DHCPACK message is relayed from server to client

补充:
DHCP 可以提供：IP address, subnet mask, default gateway