DHCP

Dynamic Host Configuration Protocol

Overview

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- DHCP Client Initialization

- DHCP States & Procedures

- DHCP Security

What is DHCP?

▸ Clients should require no manual configuration by the user to connect to the network.
  ◦ Each client should be able to discover appropriate configuration information dynamically.
    • IP address, DNS servers, WINS servers, etc.

▸ This is normally accomplished through the use of a Dynamic Host Configuration Protocol
  ◦ Uses UDP
  ◦ Ports 67 and 68

DHCP - Introduction

- DHCP was created by the Dynamic Host Configuration Working Group of the **Internet Engineering Task Force(IETF)**
- Runs over **UDP**
- Utilizing ports:
  - **67 – connections to server**
  - **68 – connections to client**
- **Extension of BOOTP** (protocol used for simple interaction)- DHCP enhances the capabilities of BOOTP
- DHCP is basically used for **dynamic configuration**
- Uses **client–server model**

Objective of DHCP

- DHCP **temporarily binds IP address** & other configuration parameters to **DHCP client** & **provides framework for passing configuration** information **to hosts**

- DHCP was designed to **provide** computers with **temporary address**

- DHCP is well **adapted to** situation where **hosts move from one location to another** or are routinely connected and disconnected

- Thus DHCP is mainly used to simplify the installation & maintenance of networked computers.

Characteristics

- **Centralized IP address administration**

- **Backward compatible with BOOTP** – therefore a host running the BOOTP client software can request a static configuration from a DHCP server

- **Supports multiple servers**

- Provides **dynamic assignment**

- Allows **static assignment**

- **Doesn't interact with domain name service** (DNS)

Software Elements

- **<u>Client Software</u>** :
    - installed in client machines
    - to handle broadcast requests
    - for automatic IP acquisition & acquiring other configuration

- **<u>Sever Software</u>** :
    - installed in server machines
    - designated to respond to client requests for IP address
    - manage pools of IP addresses & related configuration

- **<u>Relay Agent Software</u>** :
   - DHCP clients broadcasts requests onto local n/w

Software Elements

- **<u>Relay Agent Software</u>** :

  - Routers block broadcasts to outer network which means responses from the DHCP servers must come from same network

  - DHCP relay agents intercepts IP address requests

  - repackages the requests

  - rebroadcasts them as unicast messages to DHCP servers with known addresses of other network

  - DHCP servers sends its reply to relay agent which in turn forwards them to client requesting the IP address

Software Elements

- **<u>Relay Agent Software</u>** :
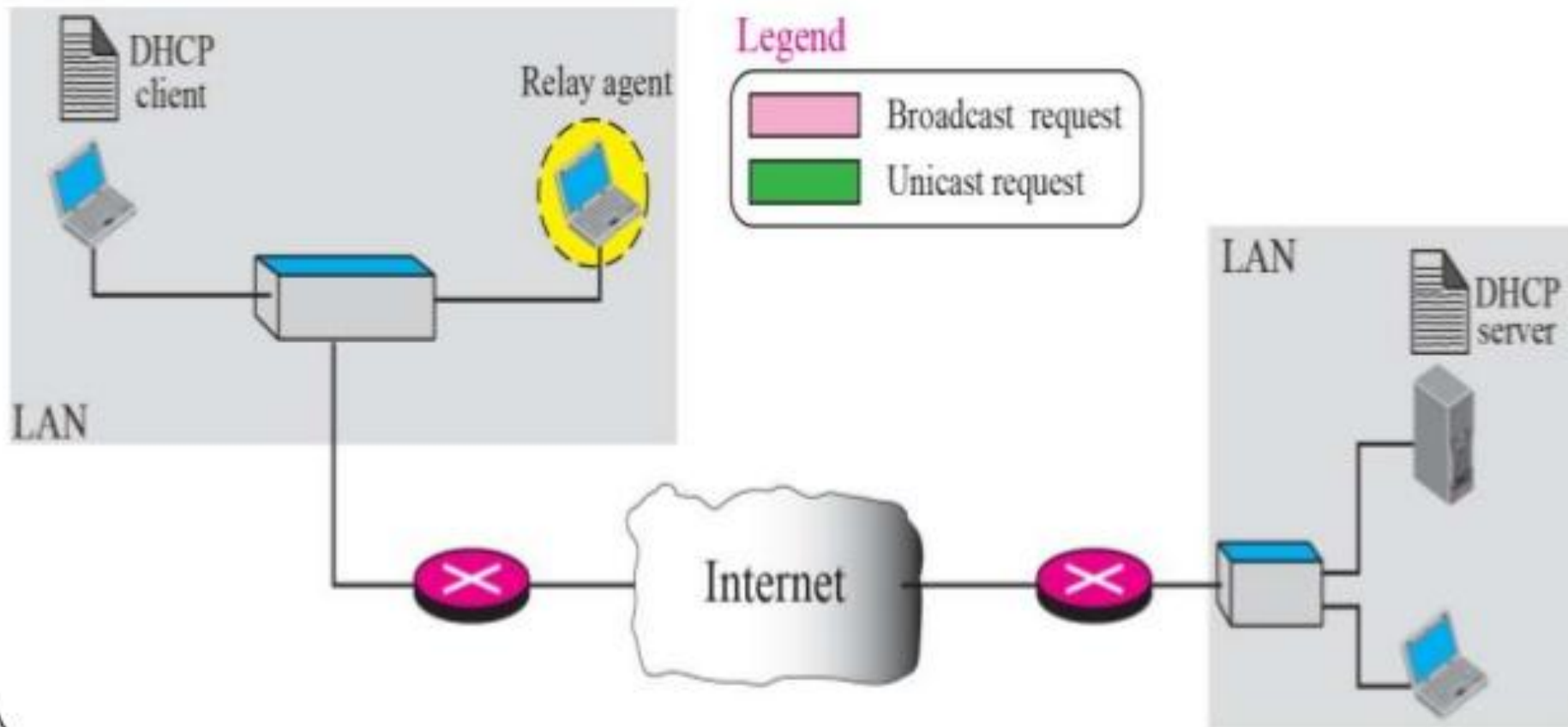
Client Initialization via DHCP
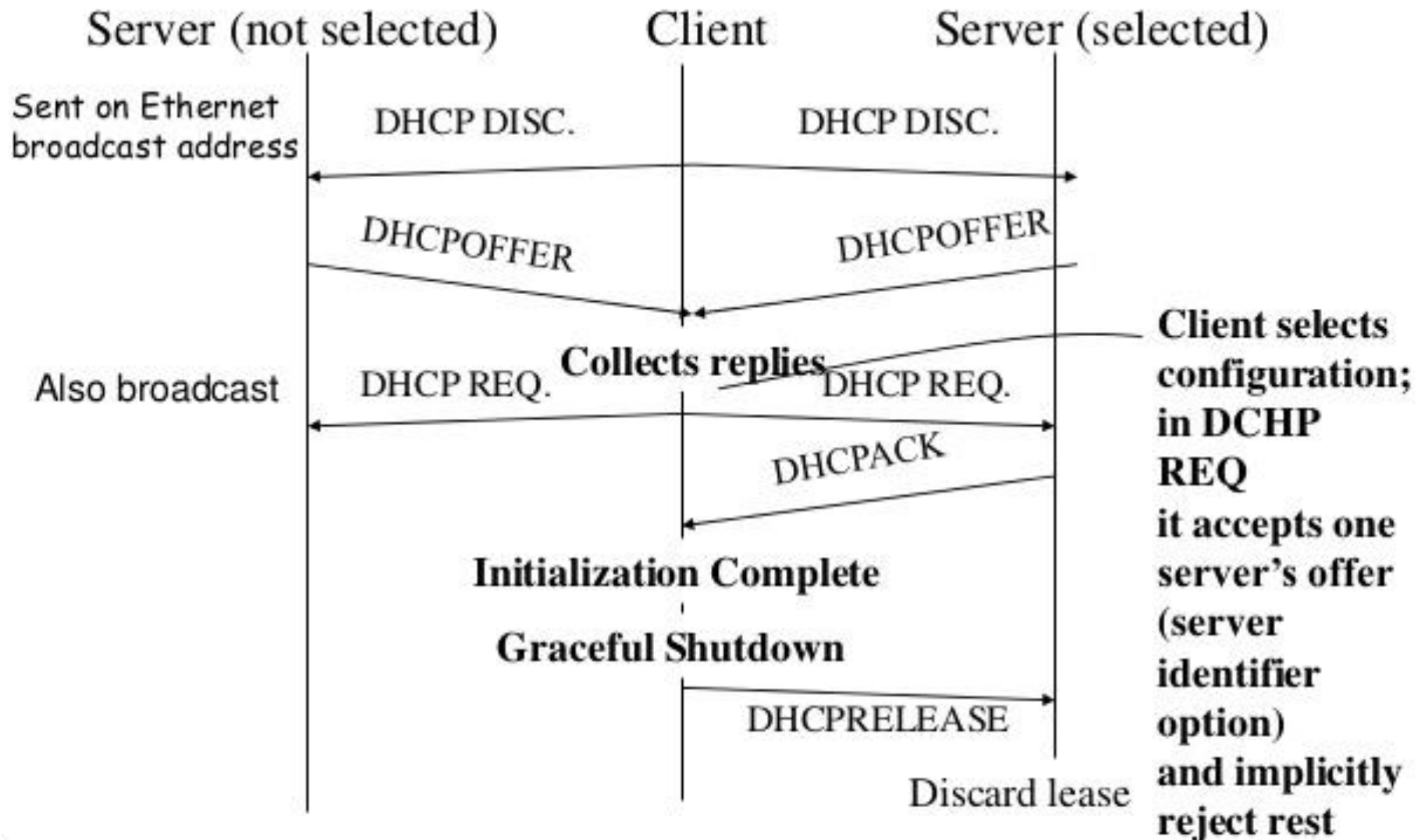
Client Initialization via DHCP

- Fig. shows one client and 2 servers

- **DHCPDISCOVER** is broadcast because client does not know IP address of DHCP server; BOOTP relay agents may relay it to other DHCP servers

- One or more DHCP servers respond with **DHCPOFFER**, which carry the IP address and other parameters.

- Client may wait for multiple replies and then choose one offer. It broadcasts **DHCPREQUEST** accepting one of the servers and rejecting the others

- The accepted server then confirms the configuration with **DHCPACK**

- If a client leaves a subnet it should release the server by **DHCPRELEASE**.
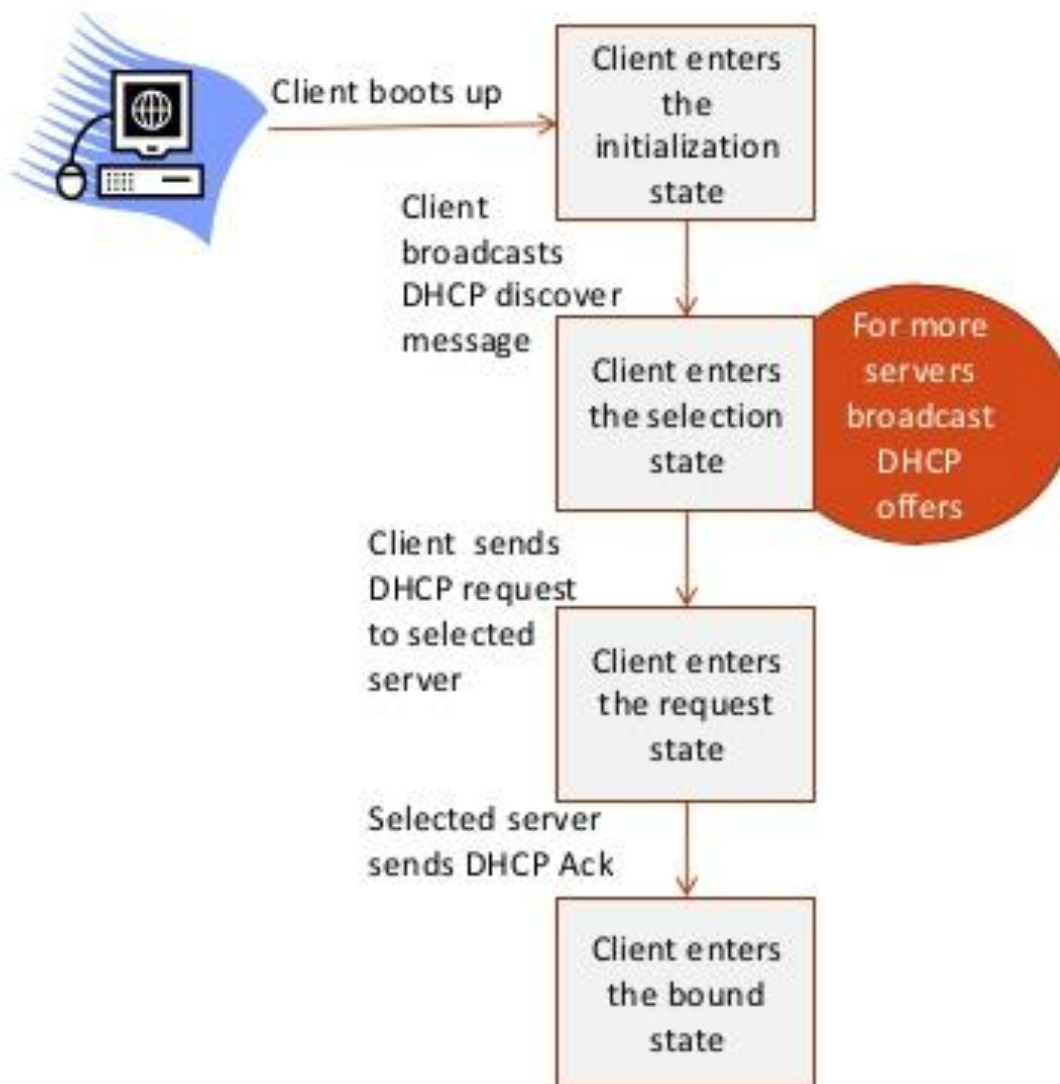
DHCP states & procedure

- With DHCP, transition of client occurs using 6 states : **initialization, selection, request, bound, renew and rebind**

- DHCP uses the first 4 states to initialize IP address

- And 4 states are used to rebind, renew or release an IP address.

- The six states are used to perform essentially 3 processes : **discovery, renewal, and release** which are described below..

- **<u>DHCP Address Discovery Process :</u>**

- When client boots ,it executes a standard address discovery process

- Once IP address acquired, it tests the address by sending ARP broadcast.

- DHCP uses 4-step processes to allocate IP addresses : Discovery, Offer, Request, Acknowledgment processes.
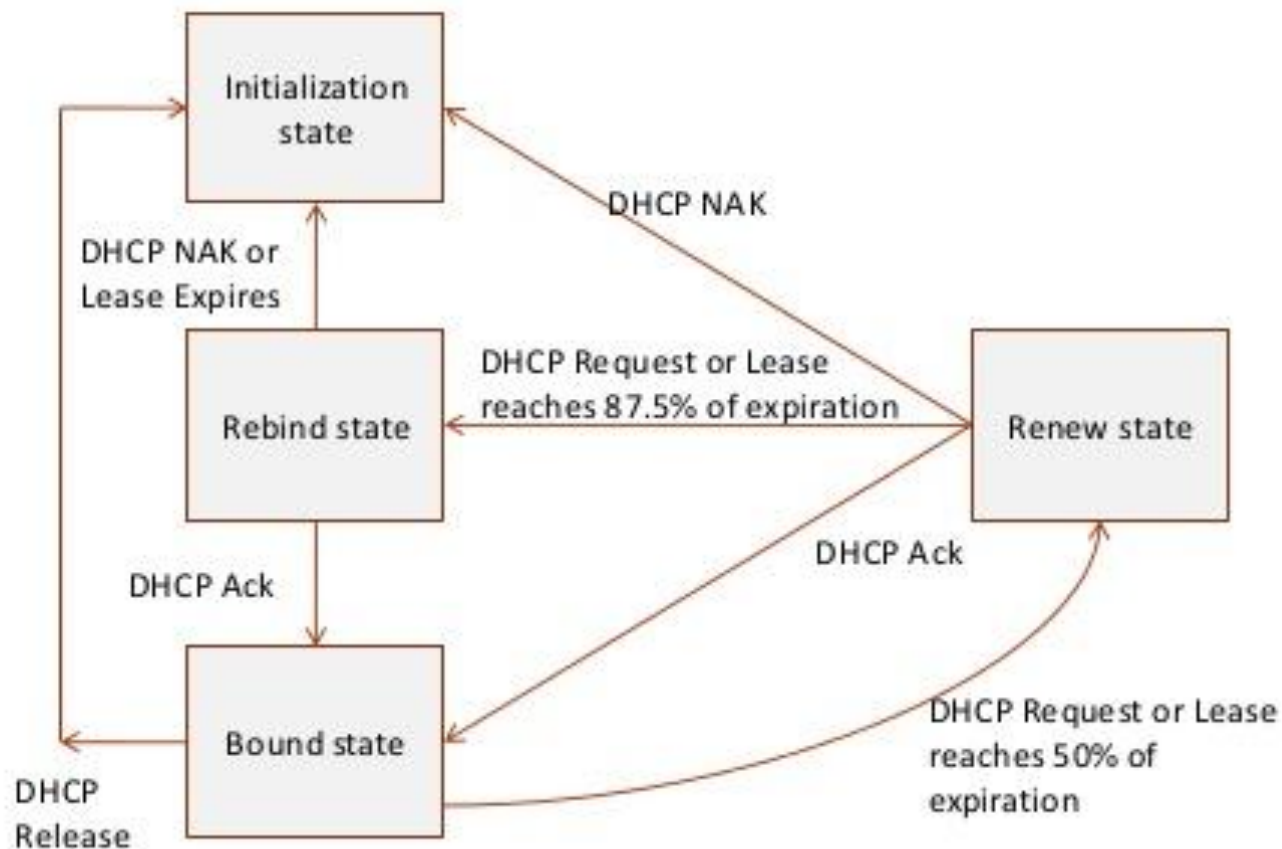
DHCP states & procedure

- **DHCP Address Discovery Process :** The state transitions that performs standard discovery procedure to acquire IP address is :

- i) Initialization State to Selection State : When the client is booting up, it is the first stage. Here it sends **DHCP Discover** message that places the client in Selection state.

- ii) Selection State to Request State : One or more servers respond to broadcast message with a **DHCP Offer** message. Client chooses the best offer and negotiate by sending DHCP REQUEST message

- iii) Request State to Bound State : The server responds to the request message with a positive acknowledgement (DHCP ACK) which begins the lease time and puts the client in the bound state

DHCP states & procedure

Client boots up

Client enters the initialization state

Client broadcasts DHCP discover message

Client enters the selection state

For more servers broadcast DHCP offers

Client sends DHCP request to selected server

Client enters the request state

Selected server sends DHCP Ack

Client enters the bound state

DHCP states & procedure

- **<u>DHCP Address Renewal Process</u>** :

DHCP Security

- **<u>DHCP is an unauthenticated protocol</u>**

  - When connecting to a network, the user is not required to provide credentials in order to obtain a lease

  - Also the server is also not the authenticated one

  - Malicious users with physical access to the DHCP-enabled network can start a denial-of-service attack on DHCP servers by requesting many leases from the server, thereby reducing the number of leases that are available to other DHCP clients