

DHCP

Dynamic Host Configuration Protocol

Overview

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- DHCP States & Procedures
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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

- **Client Software** :
 - installed in client machines
 - to handle broadcast requests
 - for automatic IP acquisition & acquiring other configuration
- **Sever Software** :
 - installed in server machines
 - designated to respond to client requests for IP address
 - manage pools of IP addresses & related configuration
- **Relay Agent Software** :
 - DHCP clients broadcasts requests onto local n/w

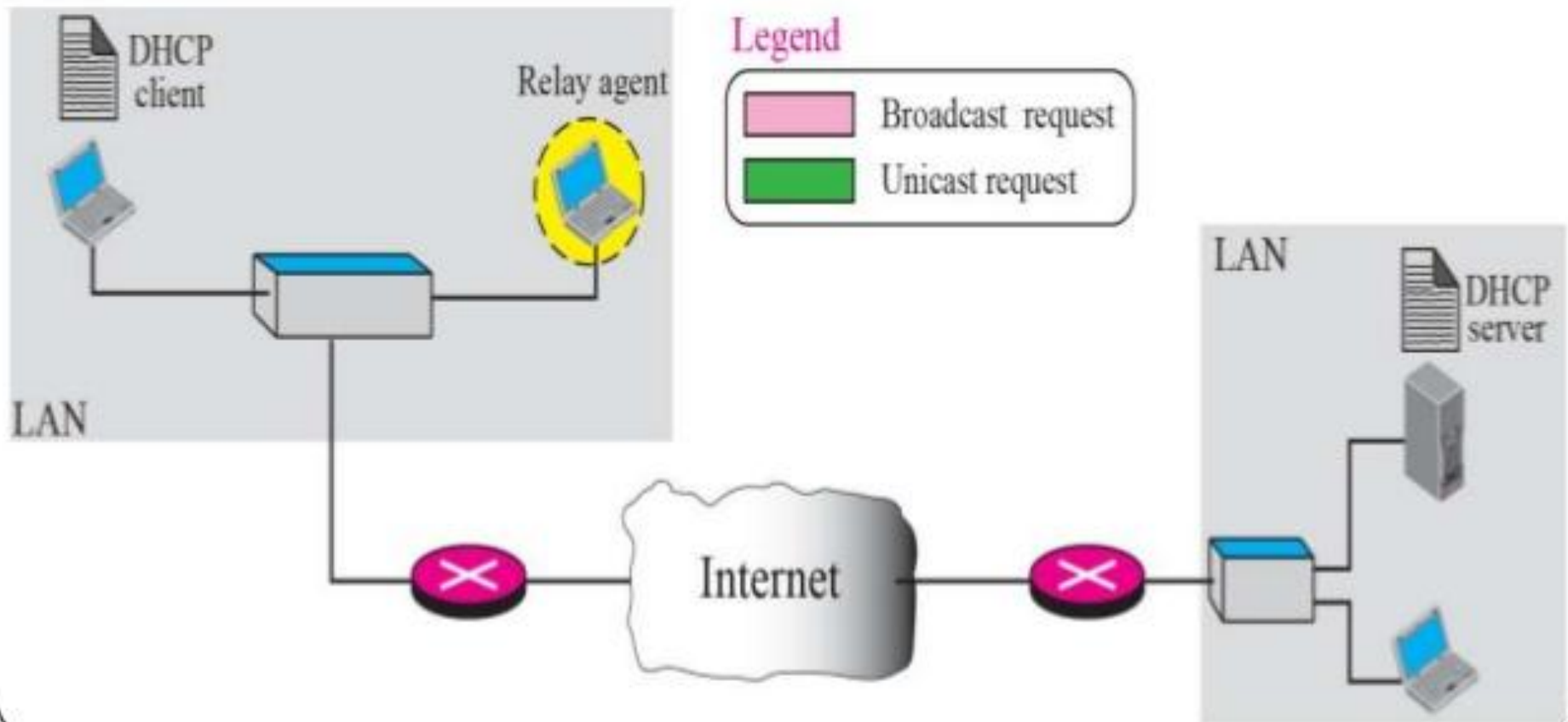
Software Elements

- **Relay Agent Software** :

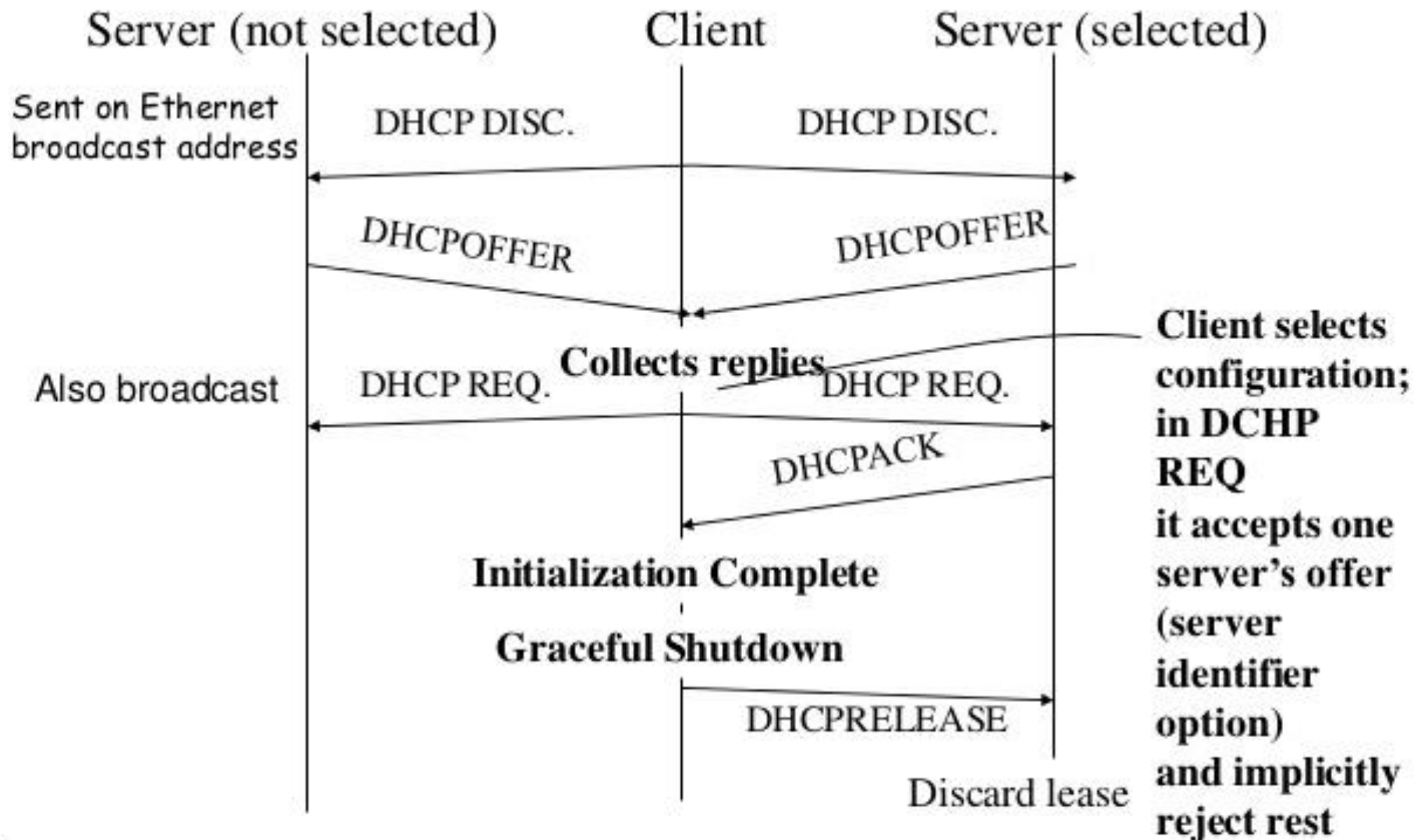
- Routers block broadcasts to outer network which means responses from the DHCP servers must come from same network
- DHCP relay agents intercepts IP address requests
- repackages the requests
- rebroadcasts them as unicast messages to DHCP servers with known addresses of other network
- DHCP servers sends its reply to relay agent which in turn forwards them to client requesting the IP address

Software Elements

- Relay Agent Software :



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**.

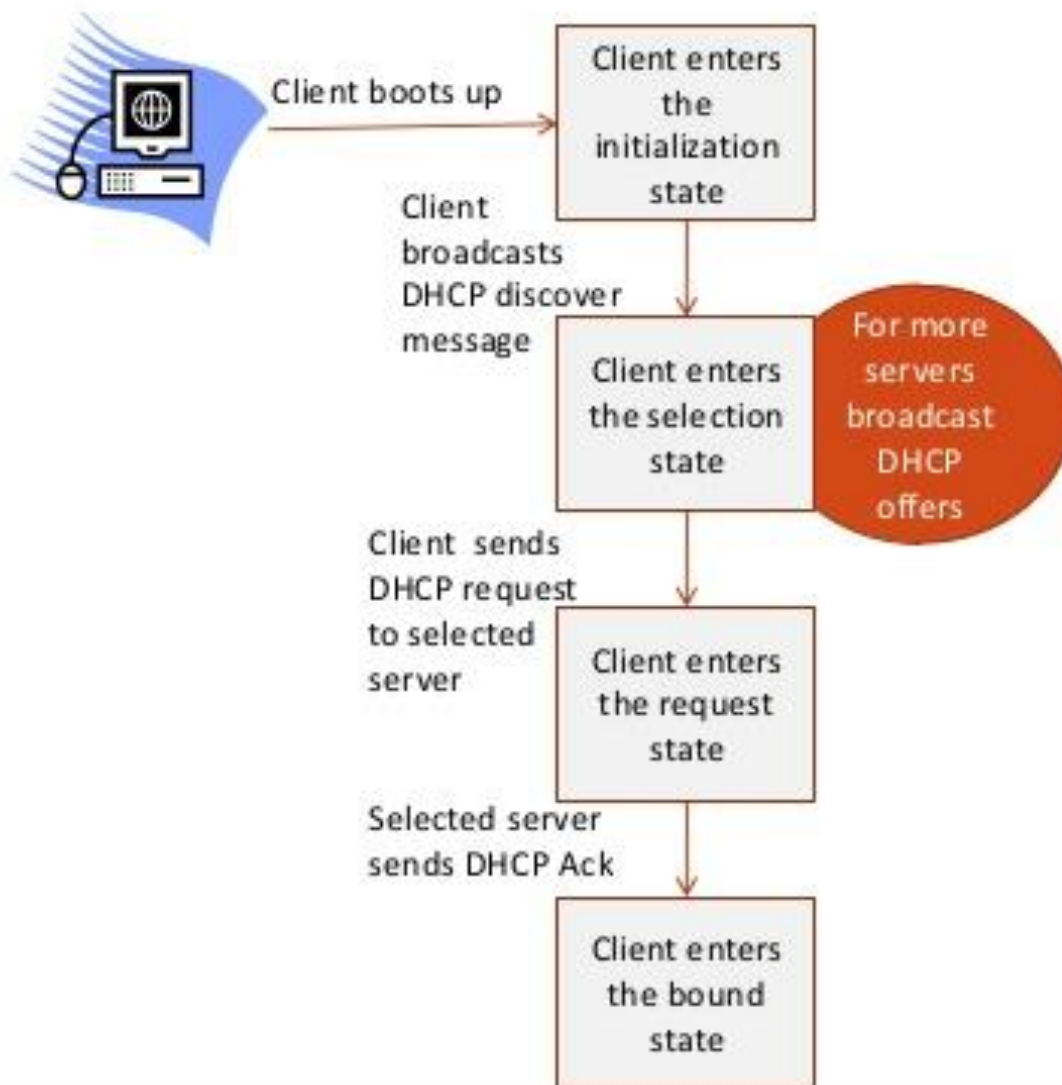
DHCP states & procedure

- 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..
- **DHCP Address Discovery Process :**
- 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

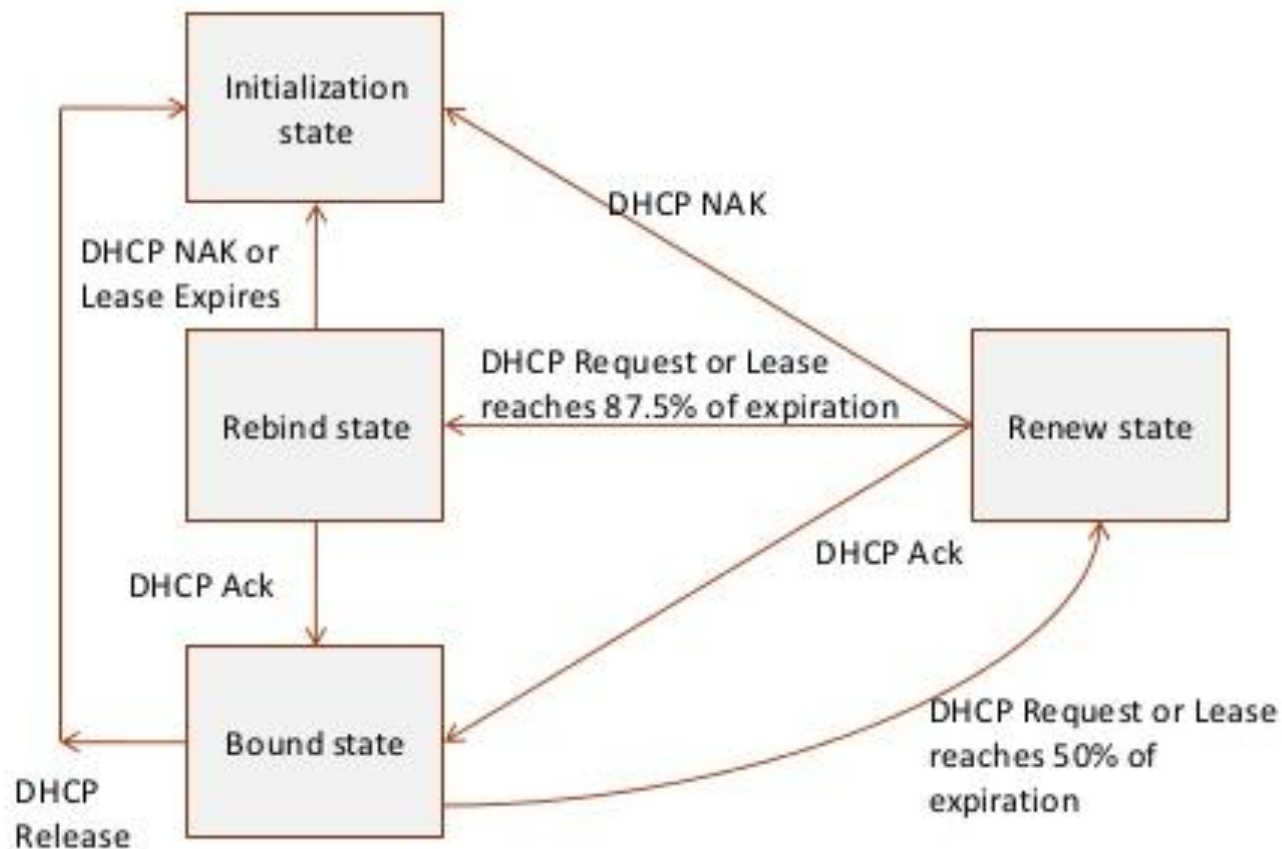
- **DHCP Address Discovery Process** : The state transitions that performs standard discovery procedure to acquire IP address is :
- i) Initialization State to Selection State : When the client is booting up, it is the first stage. Here it sends **DHCP Discover** message that places the client in Selection 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



DHCP states & procedure

- DHCP Address Renewal Process :



DHCP Security

- **DHCP is an unauthenticated protocol**
 - 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