DHCP

Computer Networks
and
Communicaton Protocols

Overview

- What is DHCP?
- A Brief History & Motivation
- How It Works?
- DHCP Messages and Scenarios
- DHCP Message Format

Dynamic **H**ost **C**onfiguration **P**rotocol

The Dynamic Host Configuration Protocol (DHCP) provides a framework for passing configuration information to hosts on a TCP/IP network[1]

[1] RFC2131 - Dynamic Host Configuration Protocol

Dynamic Host Configuration Protocol

- Based on client/server model
- Uses UDP as transfer protocol
- Port number 67 for DHCP Server
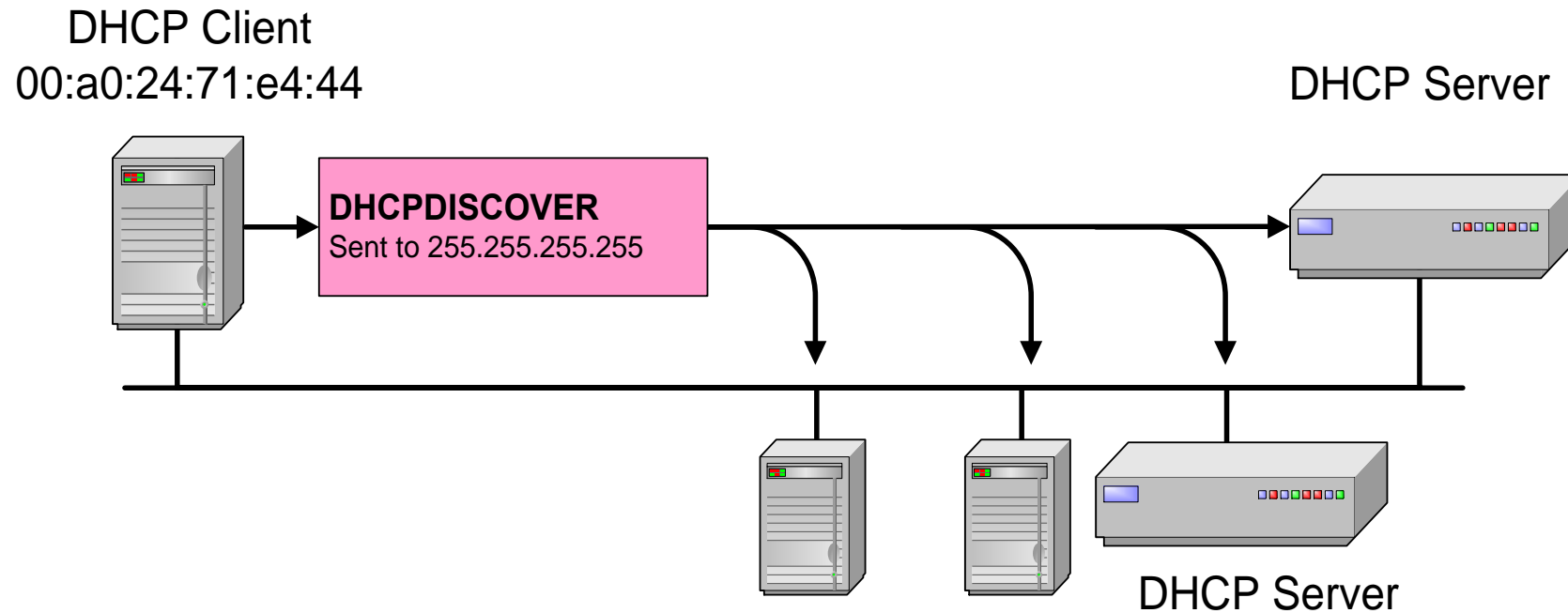- Port number 68 for DHCP Client
- Builds upon BOOTP

History

- Created by Dynamic Host Configuration Working Group, under IETF (1993)[2]

- Successor of BOOTP

- Initially defined in RFC1531 & RFC1541

- Updated by RFC2131 and remains standard for IPv4 networks

- RFC3315 and many subsequent RFCs for IPv6

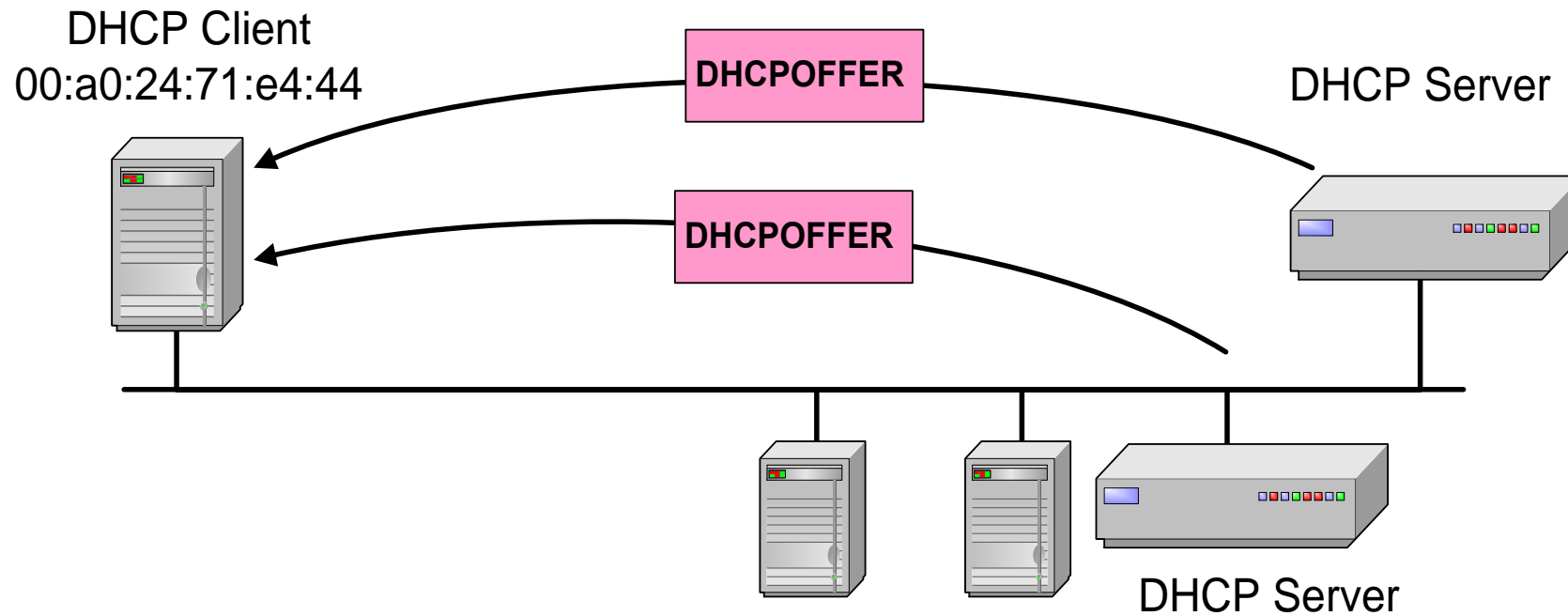[2] https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol

Why DHCP?

- Configuration is necessary to manage network
  - Manual configuration
    - Want to add/remove client
    - Get information about client
    - If network gets larger
  - Auto configuration
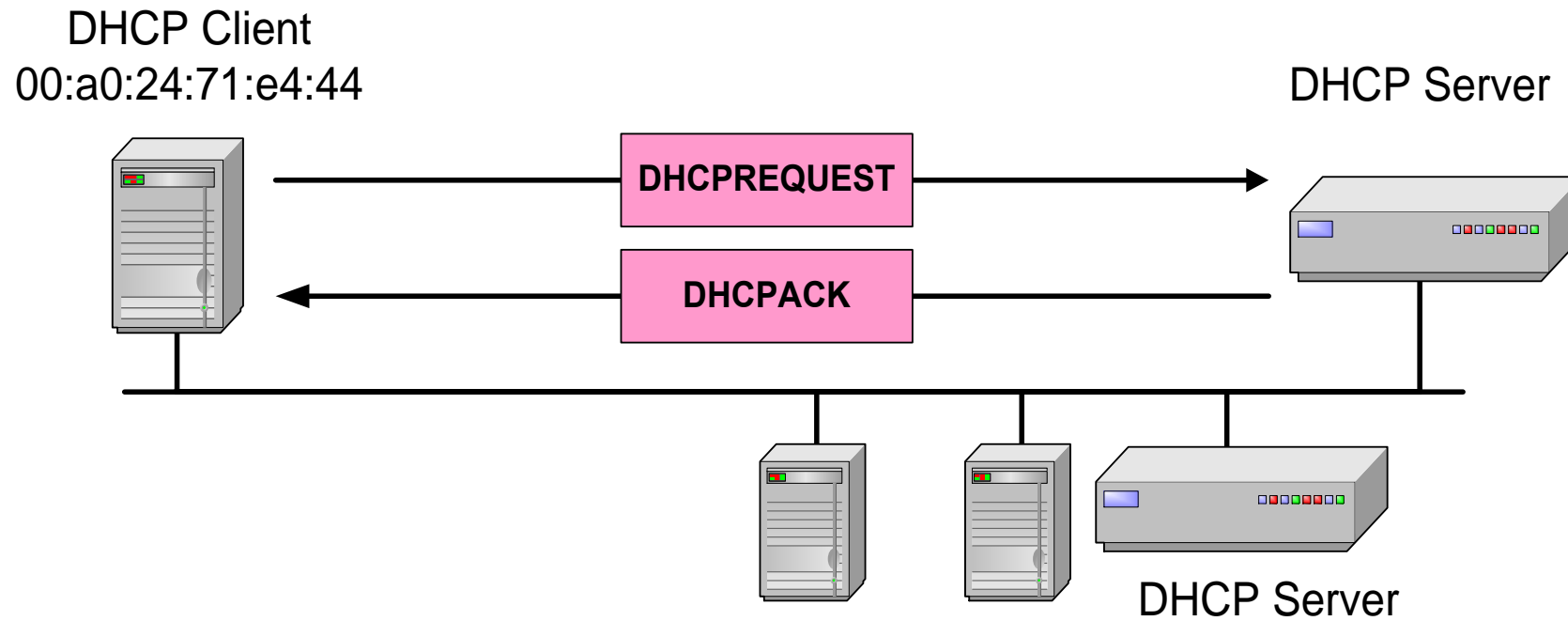   - Easy to manage from a center
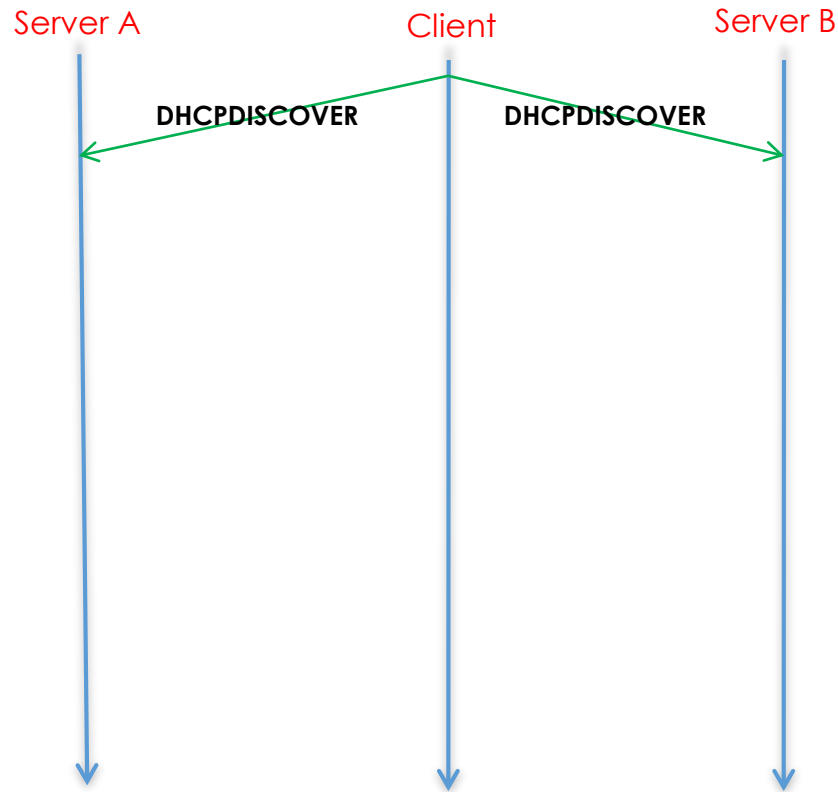   - Very fast changings

How it works?

How it works?

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

DHCP Server

DHCPREQUEST

DHCPACK

DHCP Server

DHCPDISCOVER

Server A   Client   Server B
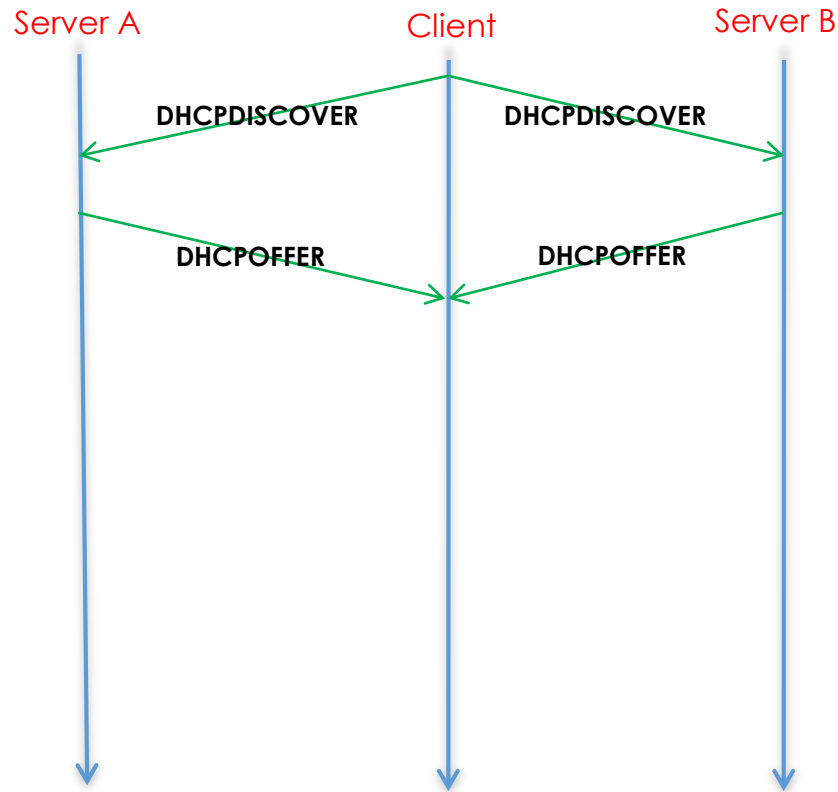
DHCPDISCOVER   DHCPDISCOVER

- To find an appropriate server, client sends a broadcast message
- It can give some advices inside the 'option' block (IP address, lease time)

DHCPOFFER

Server A   Client   Server B

DHCPDISCOVER   DHCPDISCOVER

DHCPOFFER   DHCPOFFER

- Server sends offered cofiguration parameters with this message
- Any server can send DHCPOFFER message
- If there is no DHCPOFFER message coming?
- Server does not have to reserve the offered IP address, but...

DHCPREQUEST
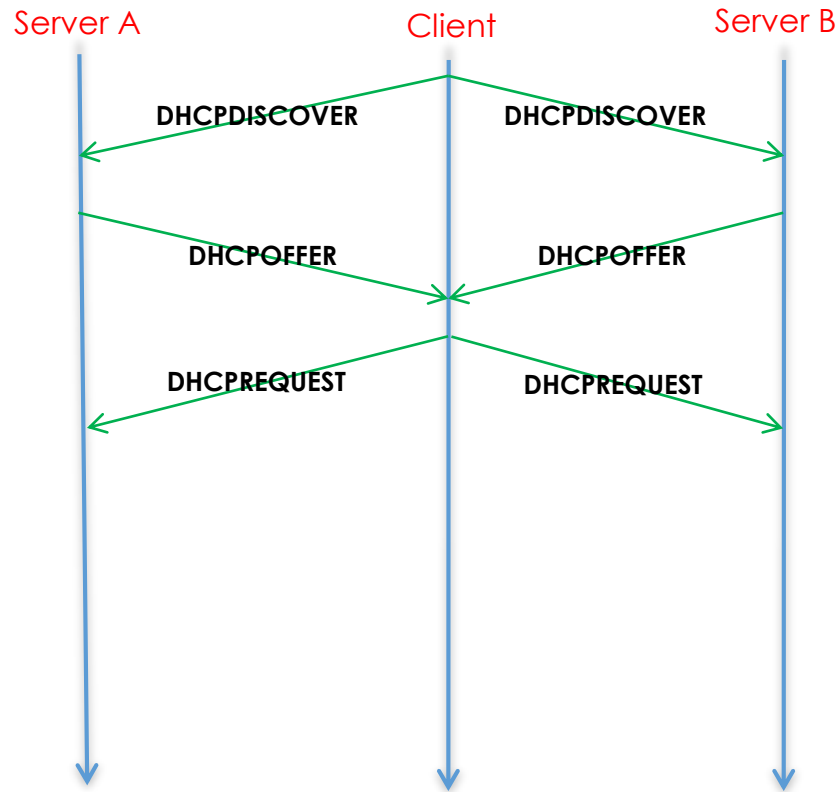
- Client chooses one of the offered addresses with this message
- This message contains the information of the selected servers to inform
- If client already has a valid address and want to extend its time, it also sends this message

DHCPACK

Server A   Client   Server B

DHCPDISCOVER   DHCPDISCOVER

DHCPOFFER   DHCPOFFER
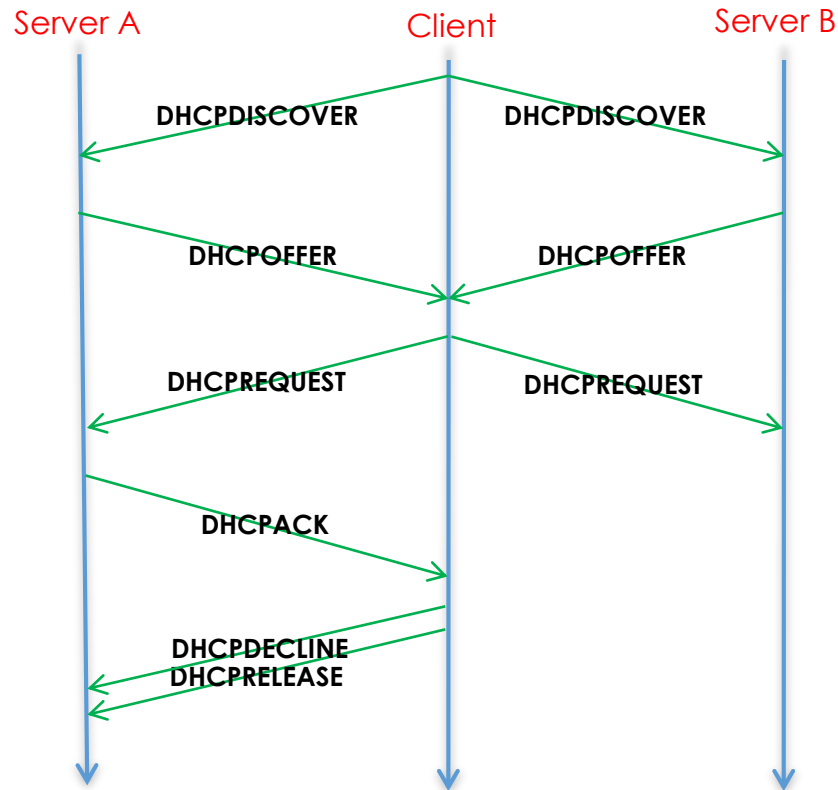
DHCPREQUEST   DHCPREQUEST
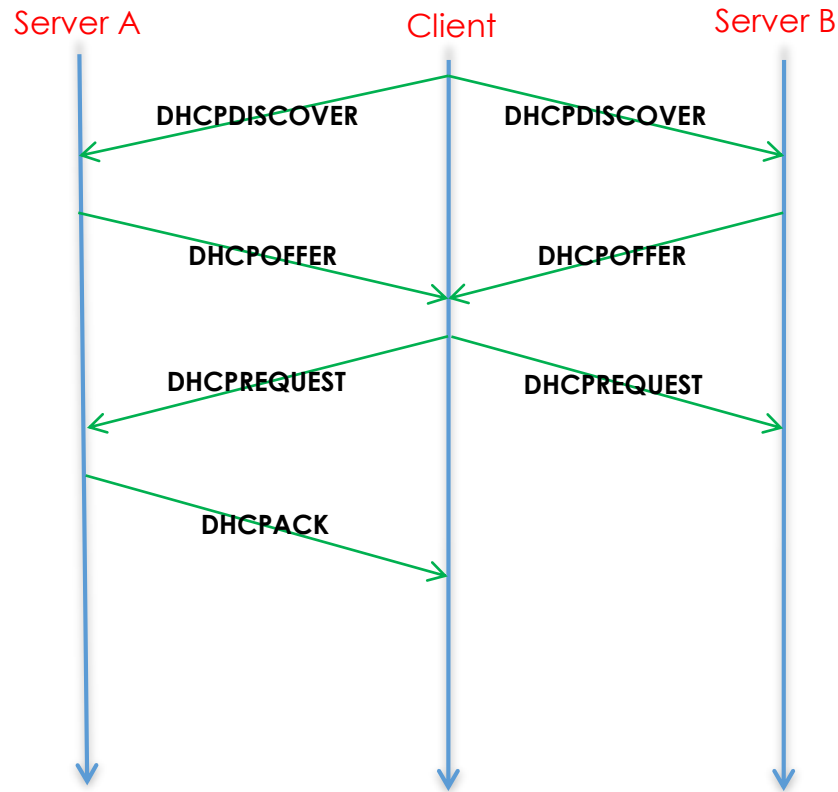
DHCPACK

- Selected server sends this message to confirm the use of IP address.
- If client doesn't get this DHCPACK message, it can't use the IP address.

DHCPNACK
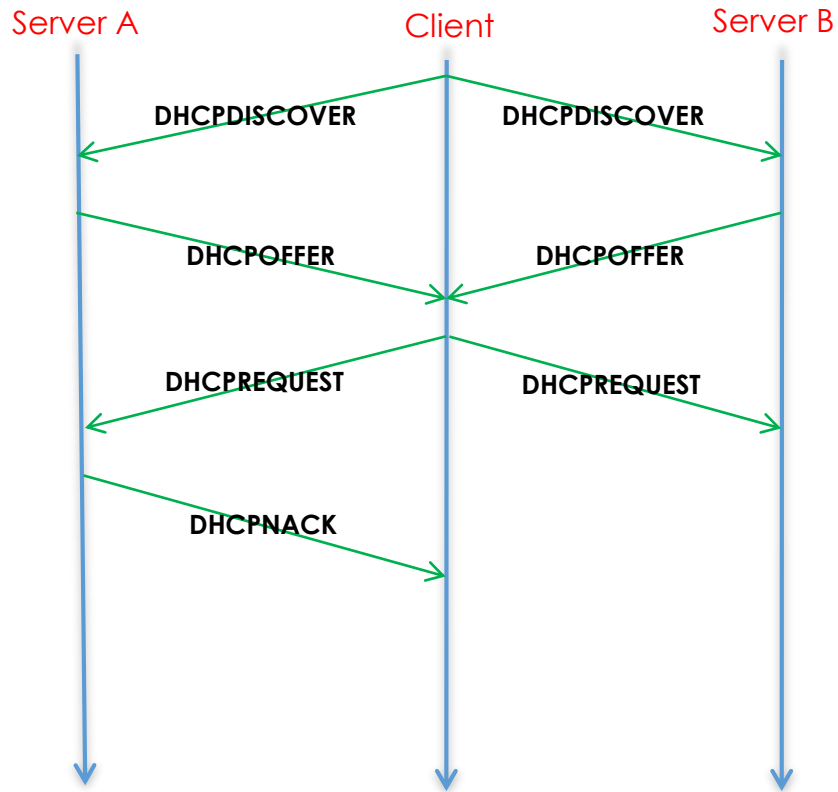
- If server doesn't want to confirm for some reasons, sends this message.
- Client, which gets a DCHPNACK message, restarts the process with DHCPDISCOVER message.

DHCPDECLINE - DHCPRELEASE

Server A   **Client**   **Server B**

DHCPDISCOVER   DHCPDISCOVER

DHCPOFFER   DHCPOFFER

DHCPREQUEST   DHCPREQUEST

DHCPACK

DHCPDECLINE
DHCPRELEASE

- After DHCPACK message, client can use the IP address for a predefined time
- If client detects an IP address conflict, it sends DHCPDECLINE message
- If not, client can use the IP address until it wants to send DHCPRELEASE to release it

State Diagram

T1 = 50% of LeaseTime
T2 = 87.5% of LeaseTime
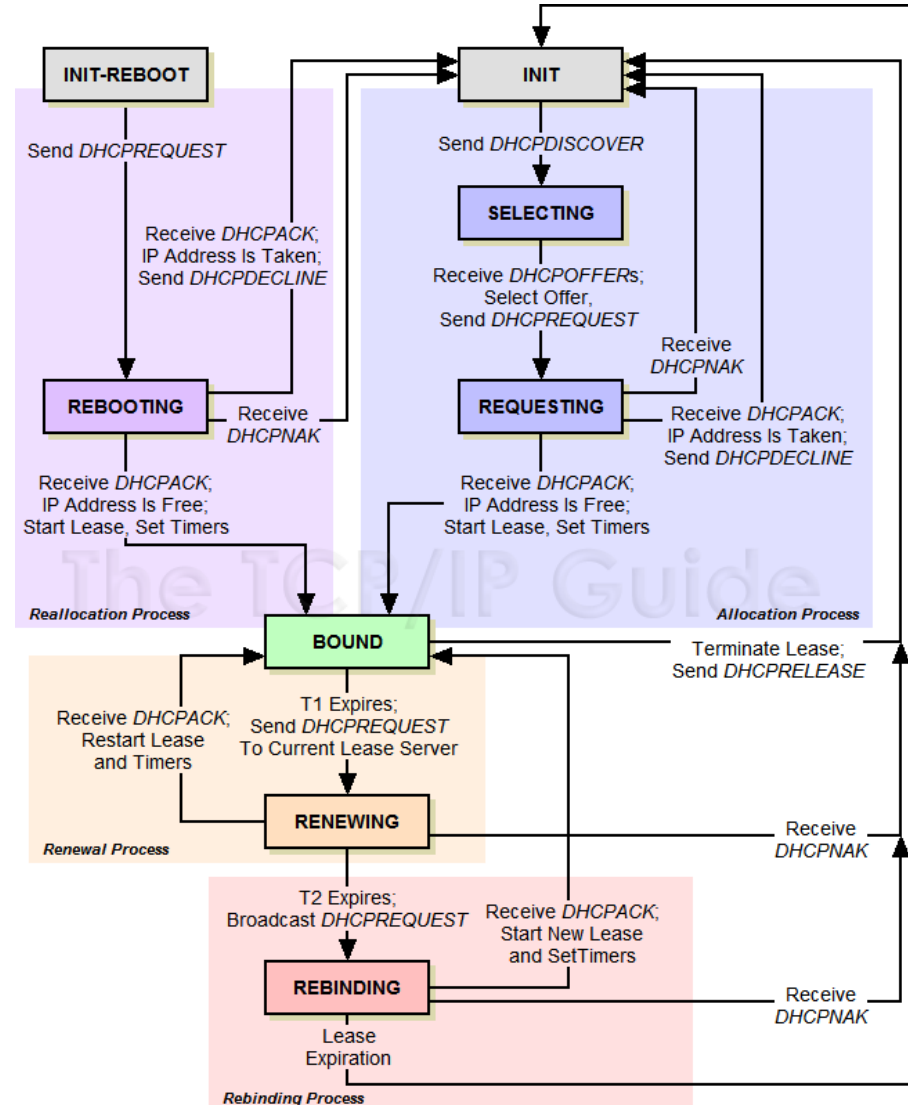
DHCPRELAY
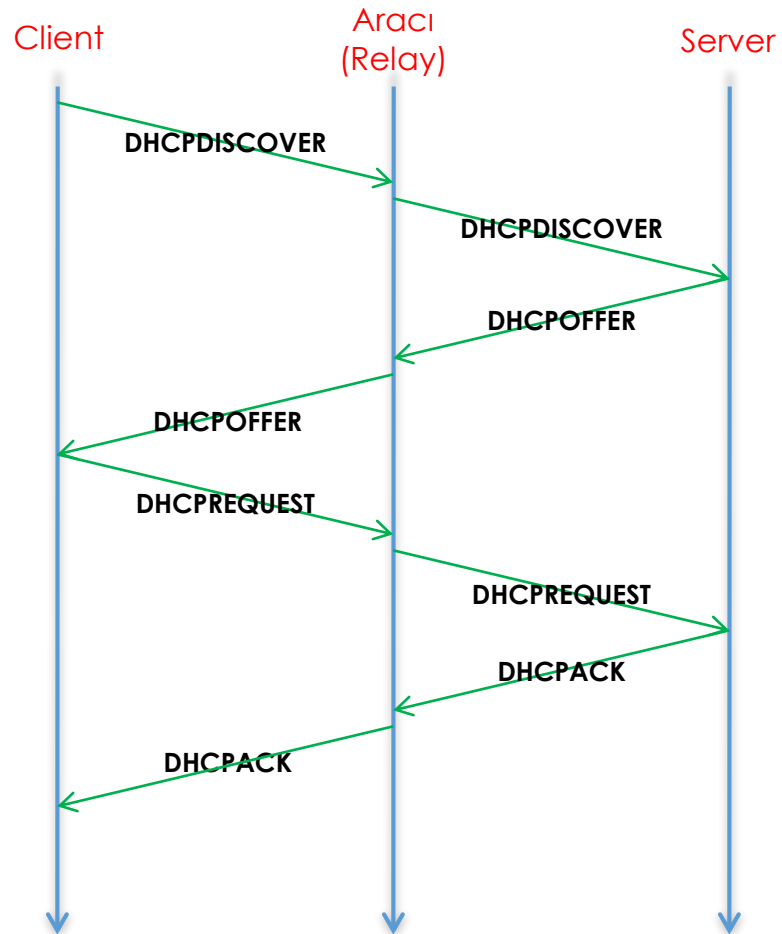
- If there is no server in local network
- Gets request from client
- Sends/receives Unicast message to/from DHCP Server
- Sends response to client

Message format

8	16	24	32
OP Code (1)	Hardware type (1)	Hardware address length (1)	Hops (1)
Transaction Identifier			
Seconds – 2 bytes		Flags – 2 bytes	
Client IP Address (CIADDR) – 4 bytes			
Your IP Address (YIADDR) – 4 bytes			
Server IP Address (SIADDR) – 4 bytes			
Gateway IP Address (GIADDR) – 4 bytes			
Client Hardware Address (CHADDR) – 16 bytes			
Server name (SNAME) – 64 bytes			
Filename – 128 bytes			
DHCP Options – variable			

Message format

- **Op (Operation Code)**
  - General type of message
  - Request=1 , Response=2
  - Detail information for the operation is inside the 'option' block

Message format

▪ Htype (Hardware Type)

  ▪ Specifies the type of the hardware used for the local network

  ▪ Some of them

HType Field Value	Hardware Type
1	Ethernet (10 Mb)
6	IEEE 802 Networks
7	ARCNET
11	LocalTalk
12	LocalNet (IBM PCNet or SYTEK LocalNET)
14	SMDS
15	Frame Relay
16	Asynchronous Transfer Mode (ATM)
17	HDLC
18	Fibre Channel
19	Asynchronous Transfer Mode (ATM)
20	Serial Line

http://www.tcpipguide.com/free/t_DHCPMessageFormat.htm

Message format

- **HLen (Hardware Address Length)**
  - Specifies how long hardware addresses are in this message.
  - For example, 6 octets for the MAC adress

Message format

- **Hops**
  - Set to 0 by a client before transmitting a request and used by relay agents to control the forwarding of BOOTP and/or DHCP messages.

Message format

- **XID (Transaction Identifier)**
  - Generated by the client to match up the request with replies from server

Message format

- **Secs (Seconds)**
  - Number of seconds elapsed since a client began an attempt to acquire or renew a lease
  - May be used by a busy server to prioritize replies

Message format

- **Flags**
  - Just first bit is used
  - Rest of the 16 bits reserved for future use and are set as 0
  - If first bit is set to 1, specifies that, this message is broadcast and reply it as a broadcast

Message format

- **CIAddr (Client IP Address)**
  - The client puts its own current IP address in this field if and only if it has a valid IP address.
  - Otherwise, it sets the field to 0

Message format

- **YIAddr (Your IP Address)**
  - The IP address that the server is assigning to the client.

Message format

- **SIAddr (Server IP Address)**
  - In BOOTP, it's the IP address of the server.
  - In DHCP it may not the IP Address of the server.
  - In DHCP, server includes its own IP address in the *Server Identifier* as a DHCP Option

Message format

- **GIAddr (Gateway IP Address)**
  - If there is a DHCPRelay agent in the process, it sets its own IP address to this field.
  - This field is not for the information of router. That's done using the *Router* as DHCP Option.

Message format

- **CHAddr (Client Hardware Address)**
  - The hardware address of the client, which is used for identification and communication.

Message format

- **Sname (Server Name)**
  - The server may optionally put its name in this field.
  - Can be a simple text 'nickname' or a DNS domain name.

Message format

- **File (Boot Filename)**
  - Optionally used by a client to request a particular type of boot file in a DHCPDISCOVER message.
  - Used by a server in a DHCPOFFER to fully specify a boot file directory path and filename.
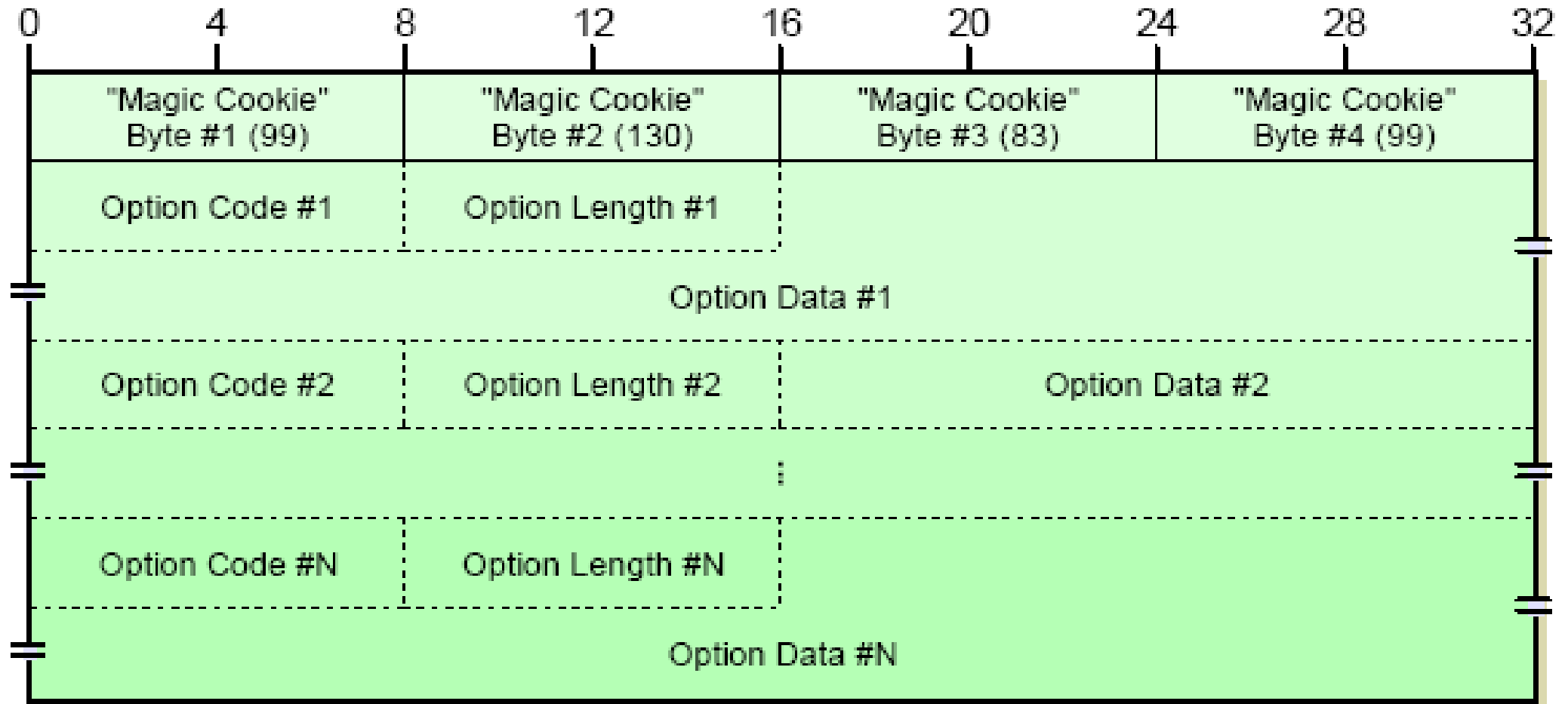
Message format

- **Option**
  - Holds DHCP options, including several parameters required for basic DHCP operation.
  - Extended version of the 'Vendor-Specific Area' of the BOOTP
  - The length is variable
  - At the same time, it's designed to support BOOTP messages
  - Data types for this field are defined in RFC2132

Message format

- **Option**
  - First 4 bytes, called 'magic number' and are set globally 99.130.83.99 to maintain compatibility between BOOTP
  - The information in this field is divided 3 parts
    - Code(1 byte): specifies the type of option
    - Len(1 byte): specifies the length of data (except Code and Len)
    - Data(variable): The data being send

DHCP 'Option' Format

'Option' Categories

Option Category	Description
RFC 1497 Vendor Extensions	The BOOTP vendor extensions defined in RFC 1497, the last RFC describing vendor extension fields that was BOOTP-specific (before DHCP was created). For easier reference, these were kept in a single group when DHCP options were created, even though some of the functions they represent might better belong in other categories.
IP Layer Parameters Per Host	Parameters that control the operation of the Internet Protocol on a host, which affect the host as a whole and are not interface-specific.
IP Layer Parameters Per Interface	Parameters that affect the operation of the Internet Protocol for a particular interface of a host. (Some devices have only one interface, of course, while others have more.)
Link Layer Parameters Per Interface	Parameters that affect the data link layer operation of a host, on a per-interface basis.
TCP Parameters	Parameters that impact the operation of the TCP layer; specified on a per-interface basis.
Application and Service Parameters	Parameters used to configure or control the operation of various miscellaneous applications or services.
DHCP Extensions	Parameters that are DHCP-specific, and used to control the operation of the DHCP protocol itself.

Thanks for your attention

...any questions?

ÖNEMLİ

Bu projeler lisansüstü öğrencilerinin hazırladığı çalışmalar olup tüm sorumluluk hazırlayan öğrencilere aittir. Öğrenciler hazırladığı projeye göre not almışlardır.