

PART XXII

BOOTSTRAP AND AUTOCONFIGURATION (DHCP)

System Startup

- To keep protocol software general
 - IP stack designed with many parameters
 - Values filled in when system starts
- Two possible sources of information
 - Local storage device (e.g., disk)
 - Server on the network

Bootstrapping

- BOOTstrap Protocol (BOOTP)
 - Early alternative to RARP
 - Provided more than just an IP address
 - Obtained configuration parameters from a server
 - Used UDP
- Dynamic Host Configuration Protocol (DHCP)
 - Replaces and extends BOOTP
 - Provides dynamic address assignment

Apparent Contradiction

- DHCP used to obtain parameters for an IP stack
- DHCP uses IP and UDP to obtain the parameters
- Stack must be initialized before being initialized

Solving The Apparent Contradiction

- DHCP runs as application
- Only needs basic facilities
- In particular:

An application program can use the limited broadcast IP address to force IP to broadcast a datagram on the local network before IP has discovered the IP address of the local network or the machine's IP address.

- Note: server cannot use ARP when replying to client because client does not know its own IP address

DHCP Retransmission

- Client handles retransmission
- Initial timeout selected at random
- Timeout for successive retransmissions doubled

Two-Step Bootstrap

- DHCP provides information, not data
- Client receives
 - Name of file that contains boot image
 - Address of server
- Client must use another means to obtain the image to run (typically TFTP)

Dynamic Address Assignment

- Needed by ISPs
 - Client obtains an IP address and uses temporarily
 - When client finishes, address is available for another client
- Also used on many corporate networks

DHCP Address Assignment

- Backward compatible with BOOTP
- Can assign addresses in three ways
 - Manual (manager specifies binding as in BOOTP)
 - Automatic (address assigned by server, and machine retains same address)
 - Dynamic (address assigned by server, but machine may obtain new address for successive request)
- Manager chooses type of assignment for each address

DHCP Support For Autoconfiguration

Because it allows a host to obtain all the parameters needed for communication without manual intervention, DHCP permits autoconfiguration. Autoconfiguration is, of course, subject to administrative constraints.

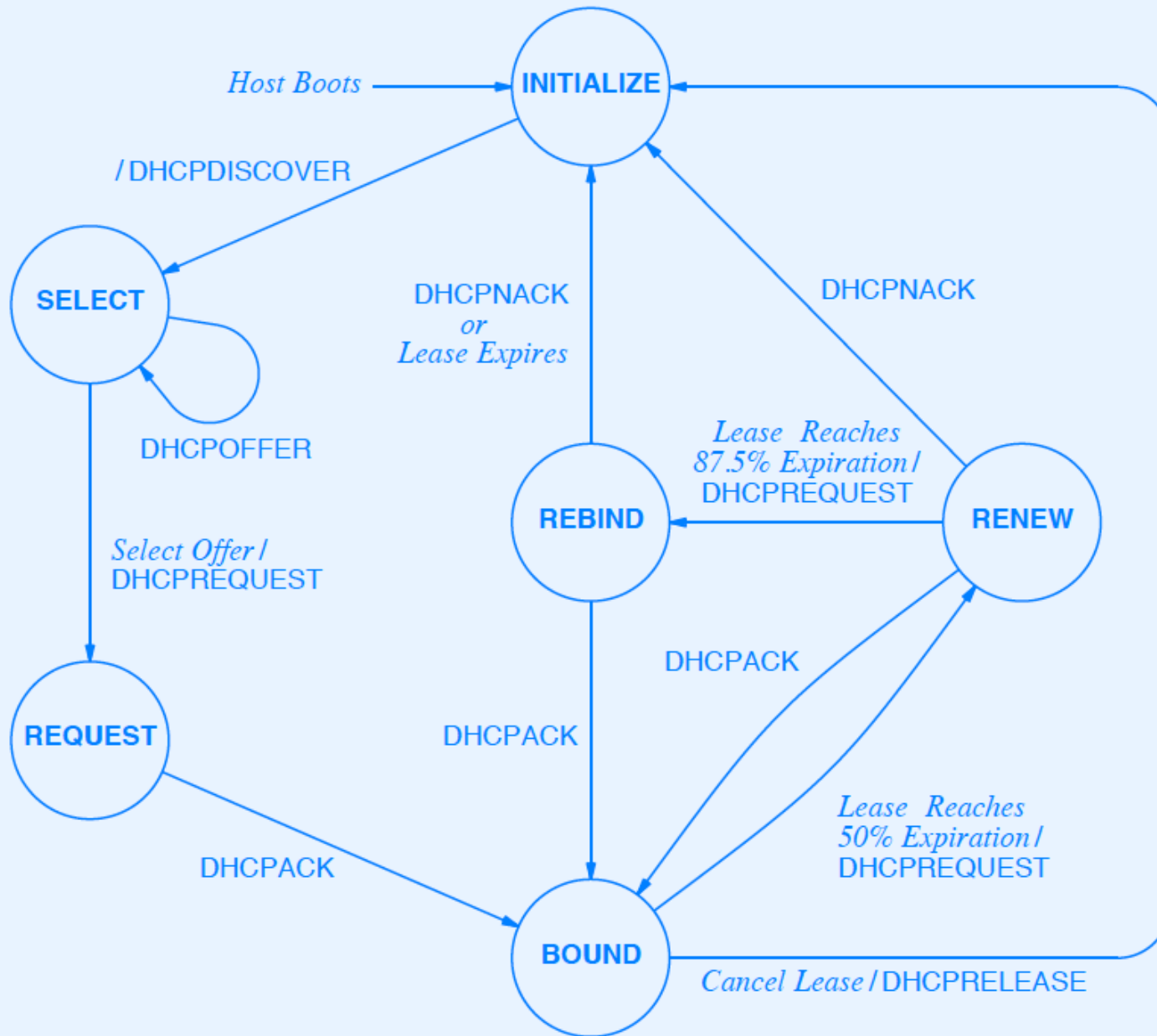
Dynamic Address Assignment

- Client is granted a *lease* on an address
- Server specifies length of lease
- At end of lease, client must renew lease or stop using address
- Actions controlled by finite state machine

Server Contact

To use DHCP, a host becomes a client by broadcasting a message to all servers on the local network. The host then collects offers from servers, selects one of the offers, and verifies acceptance with the server.

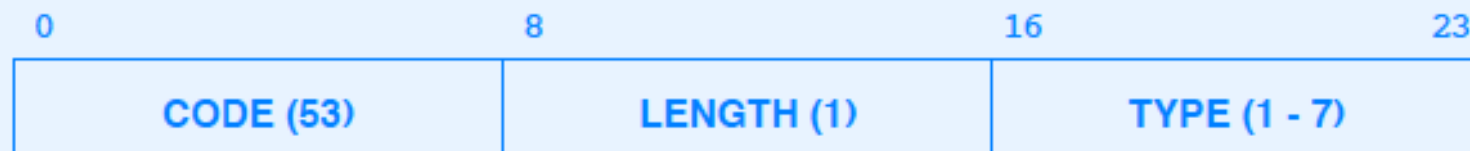
DHCP Finite State Machine



DHCP Message Format



Message Type Field



TYPE FIELD Corresponding DHCP Message Type

1	DHCPDISCOVER
2	DHCPOFFER
3	DHCPREQUEST
4	DHCPDECLINE
5	DHCPACK
6	DHCPNACK
7	DHCPRELEASE
8	DHCPINFORM

Summary

- Two protocols available for bootstrapping
 - BOOTP (static binding of IP address to computer)
 - DHCP (extension of BOOTP that adds dynamic binding of IP addresses)
- DHCP
 - Server grants lease for an address
 - Lease specifies length of time
 - Host must renew lease or stop using address when lease expires
 - Actions controlled by finite state machine