DHCP - Client

Introduction

Dynamic Host Configuration Protocol (DHCP) is a standardized client/server network protocol that dynamically assigns IP addresses and other related configuration information to network devices. Every device on a TCP/IP-based network must have a unique unicast IP address to access the network and its resources. Without DHCP, IP addresses for new computers or computers that are moved from one subnet to another must be configured manually.
DHCP is built on a client-server model, where designated DHCP server hosts allocate network addresses and deliver configuration parameters to dynamically configured hosts.
A DHCP client is any IP device connected on the network that has been configured to act as a host requesting configuration parameters such as an IP address from a DHCP server. Configuration parameters and other control information are carried in tagged data items that are stored in the Options field of the DHCP message. DHCP uses the Options to pass additional IP settings to DHCP clients such as the default gateway IP address, DNS server address, and the DNS domain name.

Client-Server Interaction

The communication between the client and the server is based on 8 DHCP main messages. The client uses UDP port 68 to communicate to the server's UDP port 67.

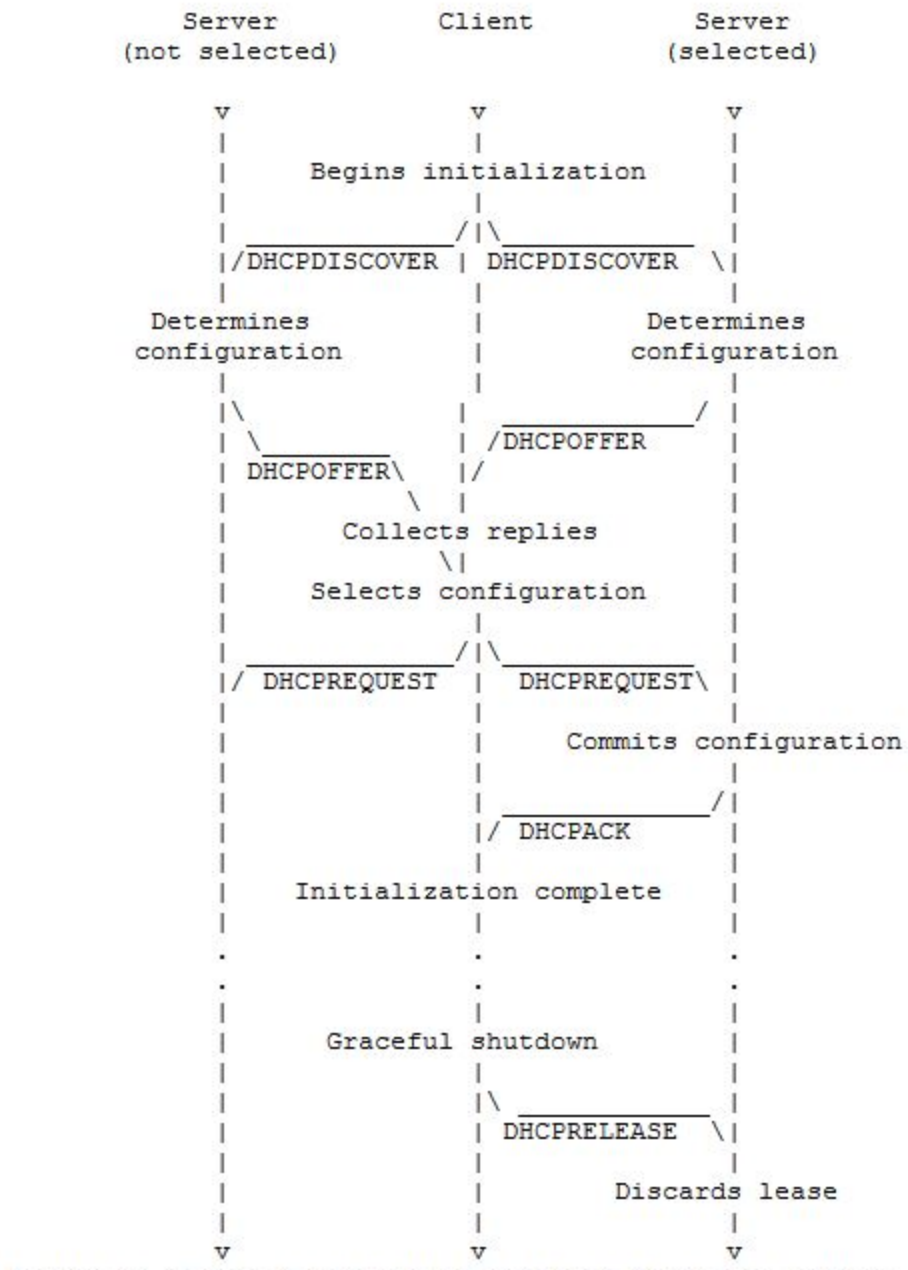

Figure 3: Timeline diagram of messages exchanged between DHCP client and servers when allocating a new network address

1. The exchange between a client and a server follows the next steps:
2. The client broadcasts a DHCPDISCOVER message in order to identify DHCP servers in the local network. The DHCPDISCOVER message may include a series of options such as a preferred IP address, lease time etc.

3. Each server that receives the discovery message may broadcast in response with a DHCPOFFER. This will include the ip address that the server can lease and a series of configuration parameters.

4. The client picks the first DHCP server based on the first offer received that meets the acceptable configuration and broadcasts a DHCPREQUEST message.This has the following meaning:

   a. Requesting the offered parameters and implicitly declining the other offers implicitly declining offers from all others.

   b. Confirming correctness of previously allocated address after, e.g. system reboot

   c. extending the lease on a particular network address.

5. At this point the dhcp server has two options: to unicast back to the client a DHCPACK message with all the configuration parameters included or to send a DHCPNAK message indicating client's notion of network address is incorrect (the client moved out to another network) or the lease has expired.

6. The client can choose to unicast a DHCPDECLINE message indicating the address is already in use (we are considering testing the network address using the ARP).

7. The client will unicast a DHCPRELEASE message when he decides to close the system connection.

8. If a client has obtained a network address through some other means (e.g., manual configuration), it may use a DHCPINFORM request message to obtain other local configuration parameters. Servers receiving a DHCPINFORM message construct a DHCPACK message with any local configuration parameters appropriate for the client without: allocating a new address, checking for an existing binding, filling in 'yiaddr' or including lease time parameters.

In case the client receives a DHCPNAK message it has to start the whole process all over again by broadcasting a DHCPDISCOVER message.
If the client doesn’t receive any message after the DHCPREQUEST message has been sent, the client times out. The client retransmits the DHCPREQUEST according to the retransmission algorithm.The client should choose to retransmit the DHCPREQUEST enough times to give adequate probability of contacting the server without causing the client (and the user of that client) to wait overly long before giving up; e.g., a client might retransmit the DHCPREQUEST message four times, for a total delay of 60 seconds, before restarting the initialization procedure.
If the client receives neither a DHCPACK or a DHCPNAK message after employing the retransmission algorithm, the client MAY choose to use the previously allocated network address and configuration parameters for the remainder of the unexpired lease.

DHCP options

Configuration parameters and other control information are carried in tagged data items that are stored in the options field of the DHCP message. The following options to be configured for a DHCP client:

- Option 12: This option specifies the name of the client. The name may or may not be qualified with the local domain.
- Option 50: Used in a client request (DHCPDISCOVER) to allow the client to request that a particular IP address be assigned.
- Option 51: This option is used in a client request (DHCPDISCOVER or DHCPREQUEST) to allow the client to request a lease time for the IP address.
- Option 53: Used to convey the type of DHCP message. The preset value is 1 . Values: 1=DHCPDISCOVER; 2=DHCPOFFER; 3=DHCPREQUEST; 4=DHCPDECLINE; 5=DHCPACK; 6=DHCPNAK; 7=DHCPRELEASE; 8=DHCPINFORM; 13=LEASEQUERY
- Option 54: Used in DHCPOFFER and DHCPREQUEST messages, and can optionally be included in the DHCPACK and DHCPNAK messages. DHCP servers include this option in the DHCPOFFER in order to allow the client to distinguish between lease offers. DHCP clients use the contents of the server identifier field as the destination address for any DHCP messages unicast to the DHCP server. DHCP clients also indicate which of several lease offers is being accepted by including this option in a DHCPREQUEST message. The identifier is the IP address of the selected server.
- Option 55: This option allows the DHCP client to request certain options from the DHCP server. The ip dhcp client request command allows the system administrator to turn off some of the requested options, thus removing them from the request list.
- Option 56: Used by a DHCP server to provide an error message to a DHCP client in a DHCPNAK message in the event of a failure. A client can use this option in a DHCPDECLINE message to indicate why the client declined the offered parameters. The message consists of *n* octets of NVT ASCII text, which the client can display on an available output device.
- Option 57: Maximum-length DHCP message that a server is willing to accept. The length is specified as an unsigned 16-bit integer. A client can use the

maximum DHCP message size option in DHCPDISCOVER or DHCPREQUEST messages, but should not use the option in DHCPDECLINE messages. Value: 576 minimum

- Option 58: Time interval from address assignment until the client transitions to RENEWING state. Value: seconds, as 32-bit unsigned integer
- Option 61: This option is used by DHCP clients to specify their unique identifier. DHCP servers use this value to index their database of address bindings. This value is expected to be unique for all clients in an administrative domain.
- Option 120: This option is used to specify a 32-bit (binary) IPv4 address to be used by the Session Initiation Protocol (SIP) client to locate a SIP server.
- Option 121: This option is used to configure classless static routes by specifying classless network destinations; that is, each routing table entry includes a subnet mask. Up to ten classless static routes are supported using option 121 on the DHCP client.

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