

DHCP - Dynamic Host Configuration Protocol

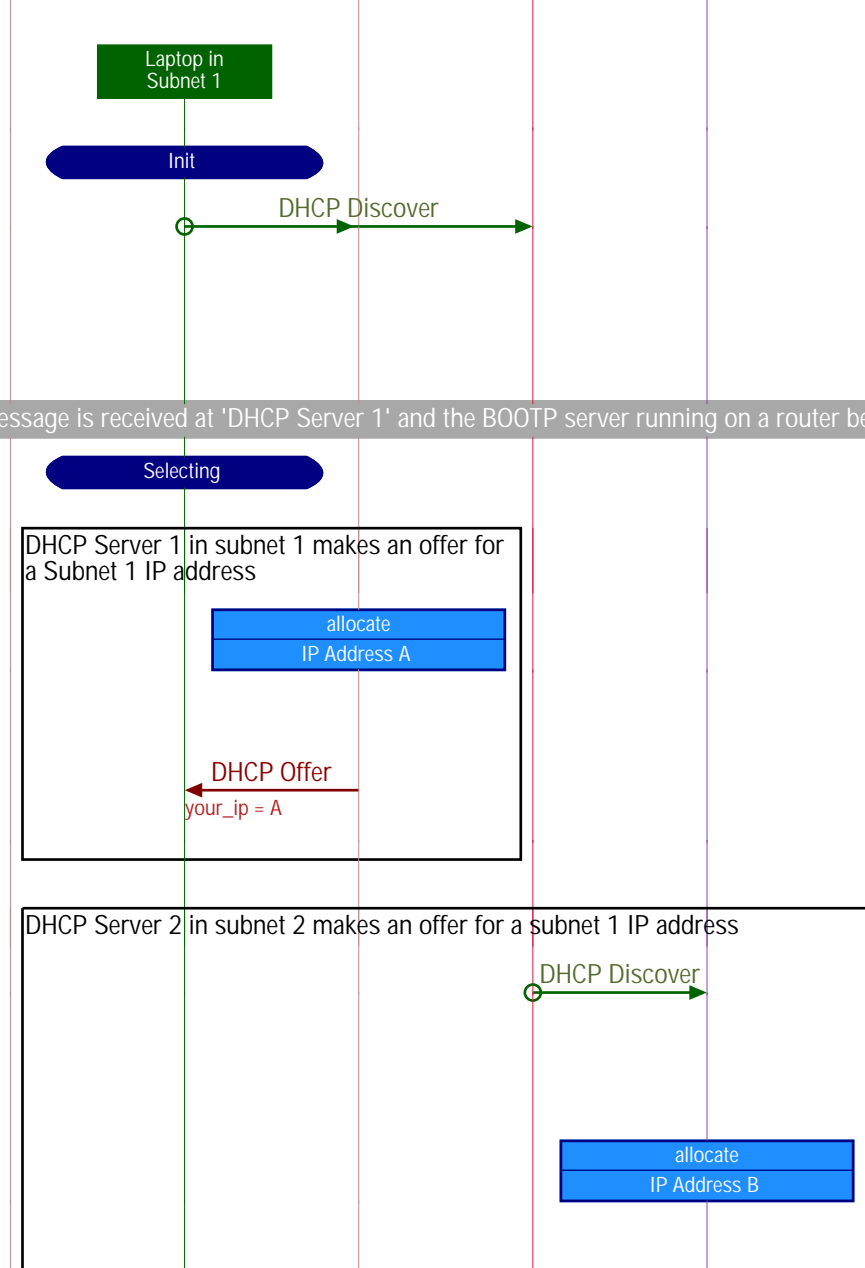
Dynamic Host Configuration Protocol (DHCP) is used to dynamically provide IP addresses and configuration information to client nodes. DHCP provides greater flexibility by leasing out IP addresses to host nodes. DHCP supports mechanisms that can be used by hosts to renew their lease.

This sequence diagram describes the DHCP interactions between a Laptop and the DHCP servers in the intranet. Four different cases are covered.

- (1.) Laptop boots up for the first time and requests an IP address.
- (2.) Laptop's IP address lease is renewed.
- (3.) Laptop reboots and confirms the IP address settings
- (4.) Laptop is disconnected from Subnet 1 and reconnected in Subnet 3.

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(1.) Laptop boots up for the first time and requests an IP address



Laptop is connected to Subnet 1.

DHCP Client starts in the Init state

Client machine comes up without an IP address. It sends out a DHCP Discover message on its subnet to identify the DHCP Servers on the subnet. The message is sent as an Ethernet broadcast, i.e. the message is sent to the Ethernet broadcast address (all Fs).

The message is received at 'DHCP Server 1' and the BOOTP server running on a router between Subnet 1 and Subnet2.

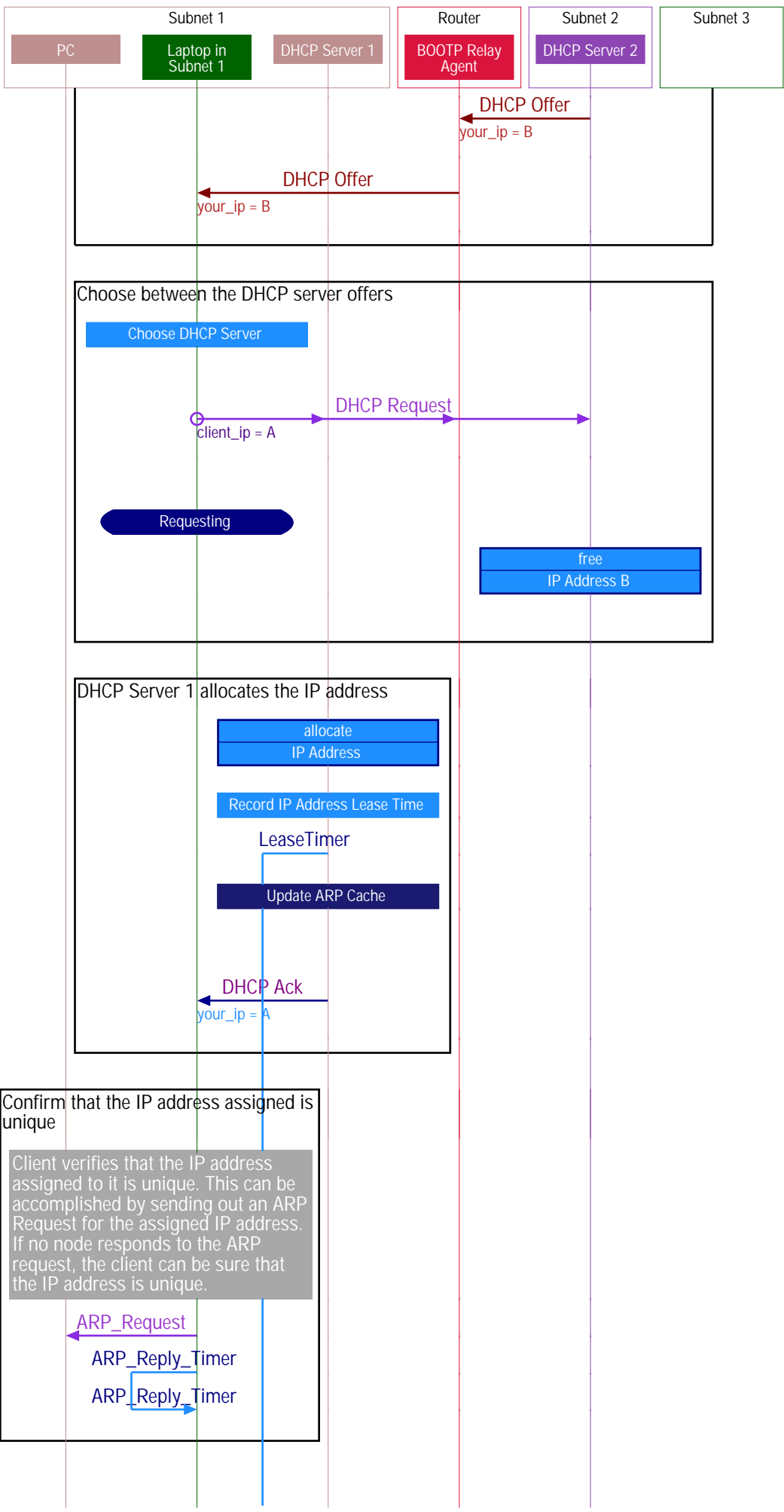
Now the DHCP Client is in the selecting state

DHCP Server 1 selects IP address A and marks it as offered. (This prevents the same IP address from being offered to another client, before DHCP Client 1 has a chance to respond.

DHCP Server on the same subnet responds with DHCP Offer and offers an IP address in the your IP address field

The message is picked up by the router and forwarded to a preconfigured DHCP Server on a different subnet. This functionality utilizes the BOOTP Relay Agent support in Routers. (See the BOOTP Sequence Diagram for details)

DHCP Server 2 selects IP address B and marks it as offered.



DHCP Client has received offers with IP address A and B. It selects one of the IP address

DHCP Client sends out a DHCP Request as a subnet broadcast. The selected IP address is stored in the client ip address field. In this case IP address A from DHCP Server 1 is selected

DHCP Server 2 sees that the client has sent a DHCP Request but it has not selected the IP address it had offered, so IP address B is returned to the free pool

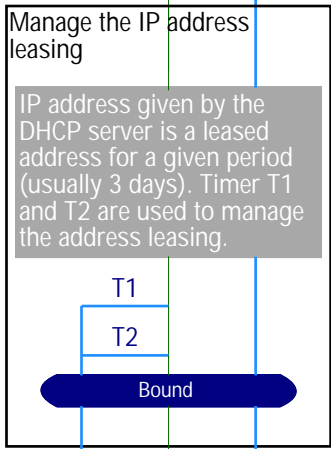
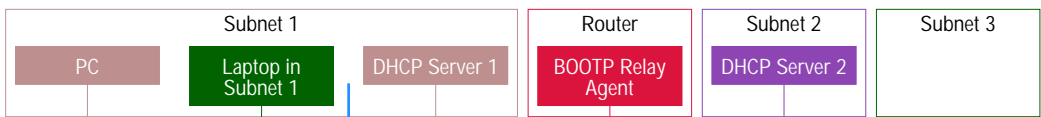
DHCP Server 1 allocates IP address A and stores this binding on the disk along with the lease time.

A timer is started for the duration of the lease for the IP address

DHCP Server 1 responds by a unicast. This requires that the ARP Cache is updated with the hardware address for the device. (This functionality is similar to BOOTP)

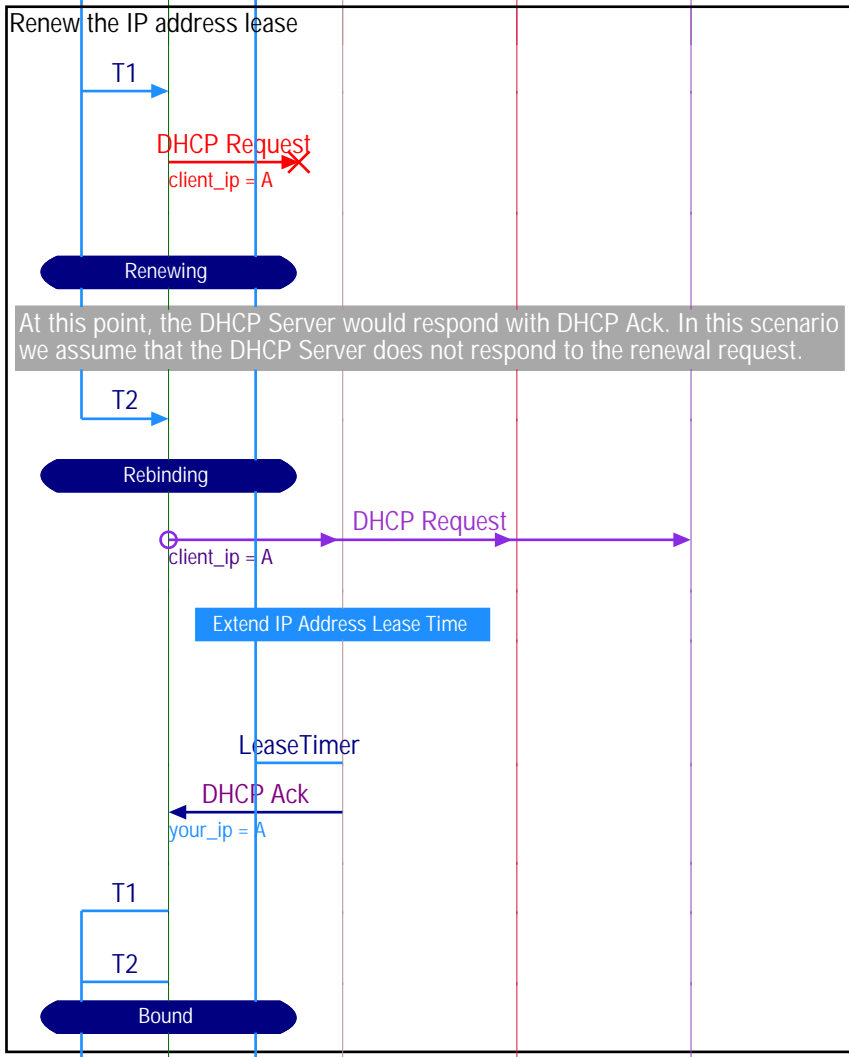
After DHCP Ack is received, the client validates the information provided by the DHCP server.

Timeout for a ARP Reply signals that the IP address is unique



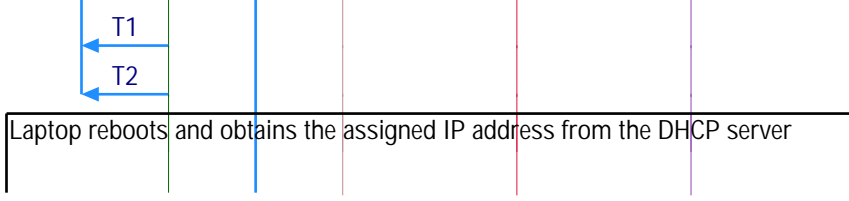
Client starts T1 (typically 0.5 Lease Time)
 Client starts T2 (typically 0.875 Lease Time)
 DHCP address is now in use on this machine. This state is referred to as Bound

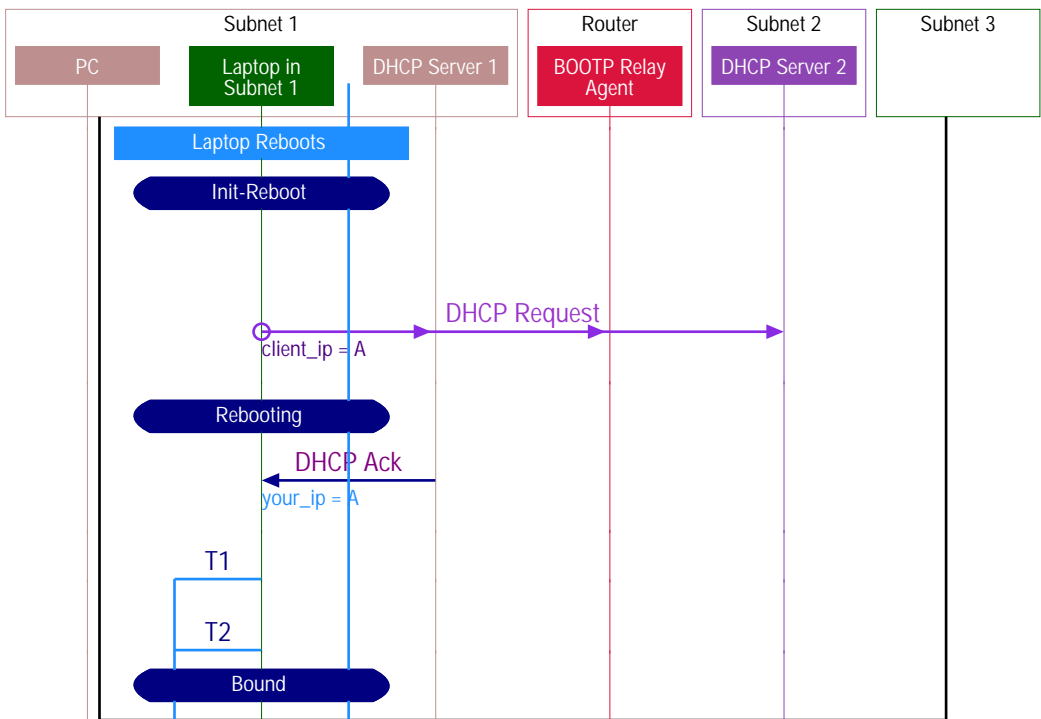
(2.) Laptop's IP address lease is renewed.



T1 has expired. Its time to renew the IP address lease
 A unicast DHCP Request is sent to the DHCP Server which had assigned the IP address. In this scenario, the renewal request is lost.
 DHCP client changes state to Renewing
 T2 times out but DHCP Ack has not been received from the DHCP Server
 The client now enters the Rebinding state
 DHCP Request is now broadcast on the subnet. Any DHCP server can respond to the request.
 This time DHCP Server 1 receives the request. It extends the lease timer and starts a new timer corresponding to the lease time.
 New lease timer is restarted.
 DHCP Server sends the ack back to the client
 Client starts T1 and T2 corresponding to the new lease time
 Now Client is bound

(3.) Laptop reboots and confirms IP address setting





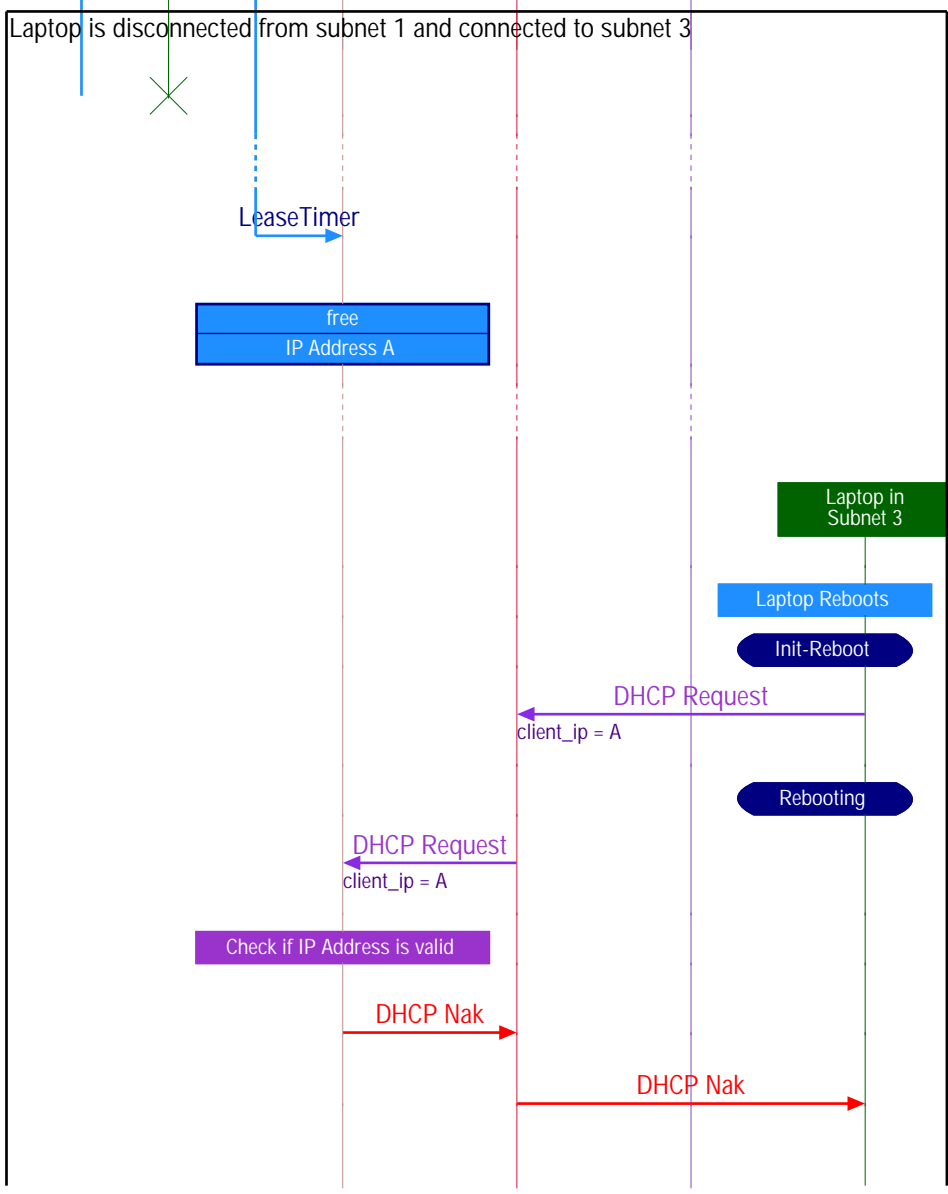
Client does not have a configured IP address, so it enters the Init-Reboot state to confirm the IP address and other configuration information

Client sends a DHCP Request to confirm its IP address and configuration. This message is sent as a subnet broadcast.

DHCP Server 1 has leased out an IP address to the client and the lease is still active so it responds back with a DHCP Ack.

The client proceeds to Bound state after starting T1 and T2

(4.) Laptop is disconnected from Subnet 1 and reconnected in Subnet 3



Disconnect laptop from subnet 1.

Laptop has been disconnected from subnet 1. The lease expires as no renewal is attempted.

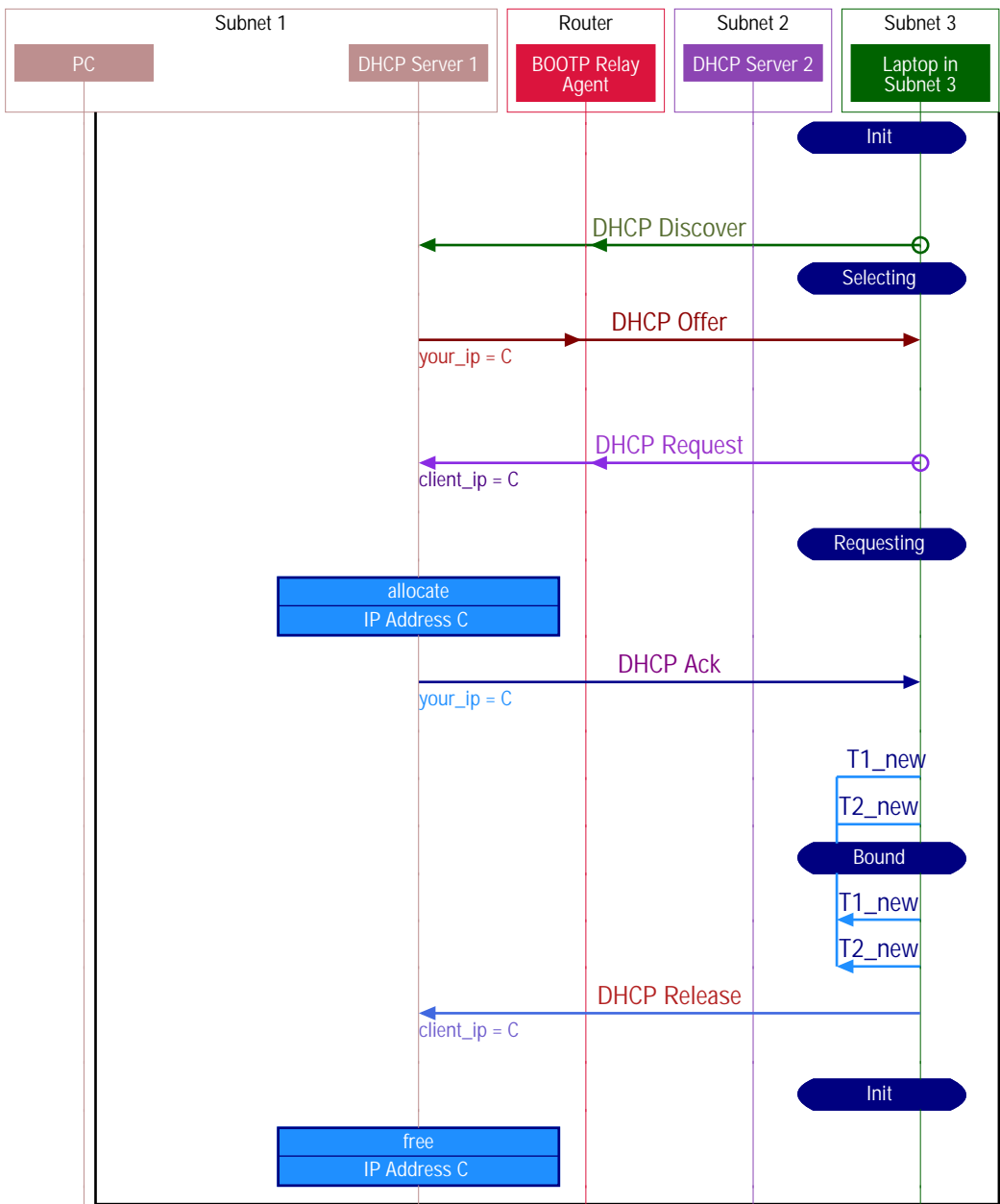
The IP address assigned to the laptop is freed.

Reattach the laptop to subnet 3.

DHCP Server 1 checks if the IP address is valid in the new setup.

IP Address A lease has expired. Send a negative acknowledgement to the client

Client receives the negative ack and restarts the DHCP address request procedure by going back to the DHCP Discovery phase



Move back to the initial state. The entire sequence of obtaining an IP address is repeated.

IP address C is allocated

IP address C is freed

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