

Asymmetric Lease for DHCPv6 Relay Prefix Delegation

The Asymmetric Lease for DHCPv6 Relay Prefix Delegation feature is used to manage or change the lease renewal by the relay agent.

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Restrictions for Asymmetric Lease for DHCPv6 Prefix Delegation

- The Asymmetric Lease for DHCPv6 Prefix Delegation is enabled only when the relay destination is configured and IA-PD route option is enabled.
- The short lease value must be less than the allotted T1 value of the server.
- DHCPv6 relay agent must not remember the modified IA-PD option T1 and T2 values.
- Short Lease for Cisco IOS DHCPv6 PD client and IOS DHCPv6 server is not supported.
- Relay agent does not detect the live status of the prefix delegation clients. The Relay agent will not handle the prefix delegation client prefix when the client fails to renew.

Information about Asymmetric Lease for DHCPv6 Relay Prefix Delegation

Asymmetric lease is also referred as short lease which is shorter than the actual lease that is granted by the server. You can configure the short lease on a relay agent which overrides the actual lease. The short lease provides an option to force a lease renewal for clients before the original lease expires. It detects the lease expiry early and helps to keep the clients status live.

The Cisco DHCPv6 prefix delegation client receives the IPv6 prefix from the DHCPv6 server. The prefix delegation client uses the allotted prefix to assign IPv6 addresses to LAN side hosts. The prefix delegation client, relay agent, and server retain the allotted prefix even when the connnection is down in the following scenarios:

1. If the prefix delegation client is down, the relay or DHCPv6 server waits until the granted lease expires to release the allotted prefix.
2. If the relay or server is down, the prefix delegation client fails to renew the lease and retains the prefix until the valid lifetime timer expires.

In both scenarios, the prefix is retained until the valid lifetime timer is expired. The short lease enables the client to reclaim the unused address prefixes earlier. Also, it enables the client to detect the failure of the relay or server earlier and allows prefix delegation client to reinitiate the DHCP6 prefix delegation prefix assignment.

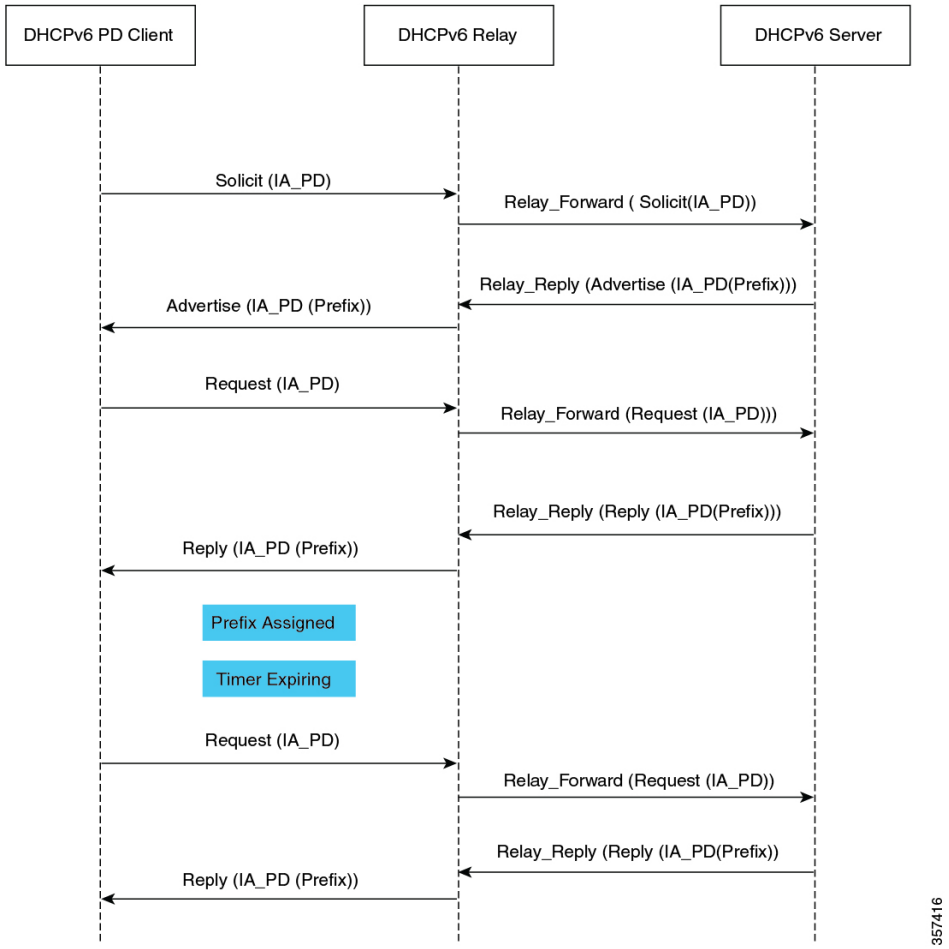
DHCPv6 Prefix Delegation with Asymmetric Lease

In DHCPv6 Prefix Delegation with Asymmetric Lease, the client initiates the prefix assignment by sending the multicast desired packet to the server. The Relay intercepts and encapsulates the desired request message in Relay-Forward and forwards it to the server. The server responds with the advertise or reply message encapsulated in relay-reply to a Relay agent. When the Relay agent receives the relay-reply message, it performs the following:

1. Extracts the encapsulated advertise or reply message destined to the prefix delegation client.
2. Stores the server assigned T1 and T2 values.
3. Validates the configured short lease value with the server that is assigned to T1 and T2 values.
4. Modifies the advertise or reply packet and replaces the T1 and T2 values with the new values defined as per the short lease configuration.

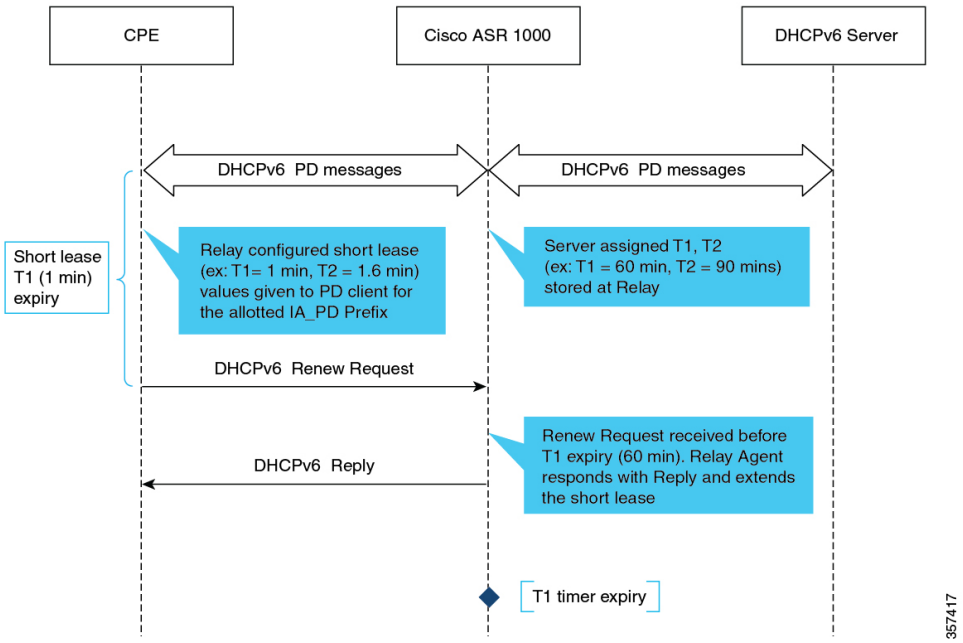
The following sequence diagram describes the prefix delegation flow with short lease.

Figure 1: DHCPv6 PD-Client, Relay and Server with Asymmetric Lease



The following sequence diagram depicts the message sequence between the DHCPv6 PD client, relay, and server.

Figure 2: Message Sequence between DHCPv6 PD Client, Relay, and Server



Deriving IA-PD Option T1 and T2 Values

The IA-PD option contatins the T1 and T2 values. The T1 represents the time at which prefix delegation client renews the IA_PD prefix and lifetime values. It sends the renewal message to the server which is provided with the client's addresses and configuration parameters to extend the lifetimes on the IA_PD prefix assigned to the client.

T2 represents the time at which the prefix delegation client tries to rebind. For example, contact any available DHCPv6 server to extend the lifetime of IA_PD prefix. The rebind message is sent after a client receives no response to a renewal message. Both T1 and T2 are time duration relative to the current time expressed in units of seconds.

```
  0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          OPTION_IA_PD         |         option-length         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         IAID (4 octets)                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                              T1                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                              T2                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                               .
.                         IA_PD-options                         .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

On the DHCPv6 relay agent, the minimum allowed short lease value is 60 seconds. The T1 can be assigned with the configured short lease value. T2 is derived from T1 as shown below.

T2 = minimum (2 * T1 * 0.8, DHCPv6 Server assigned T2 value)

If the DHCPv6 server sets T1 and T2 to the value 0, the T1 and T2 calculation is determined by the client. In this case, T1 can be assigned with the configured short lease.

T2 shall be calculated as shown below.

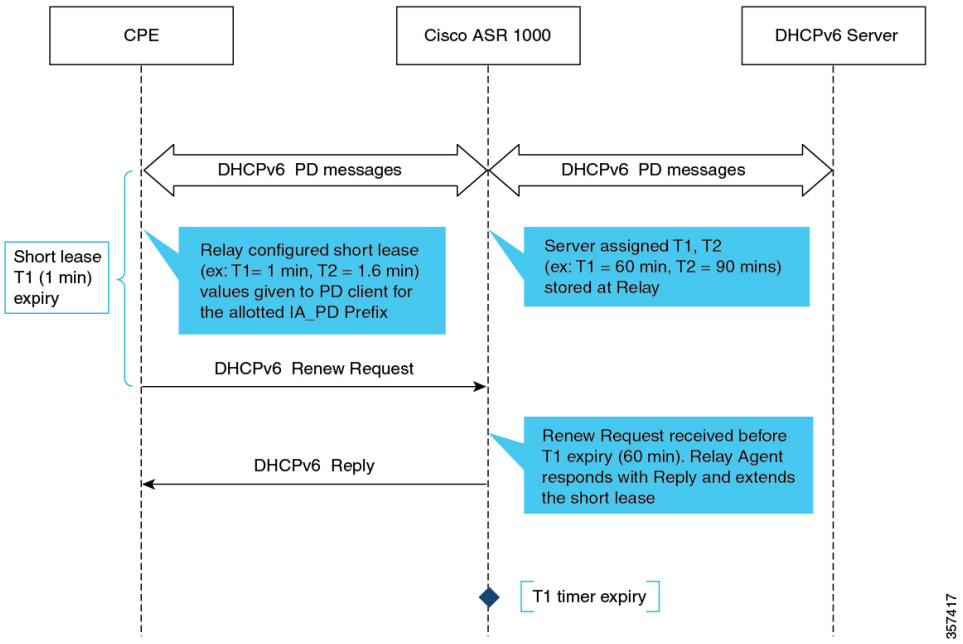
T2 = 2 * T1 * 0.8

Note If the configured short lease value is greater than the server assigned T1 value then this feature will not be applied.

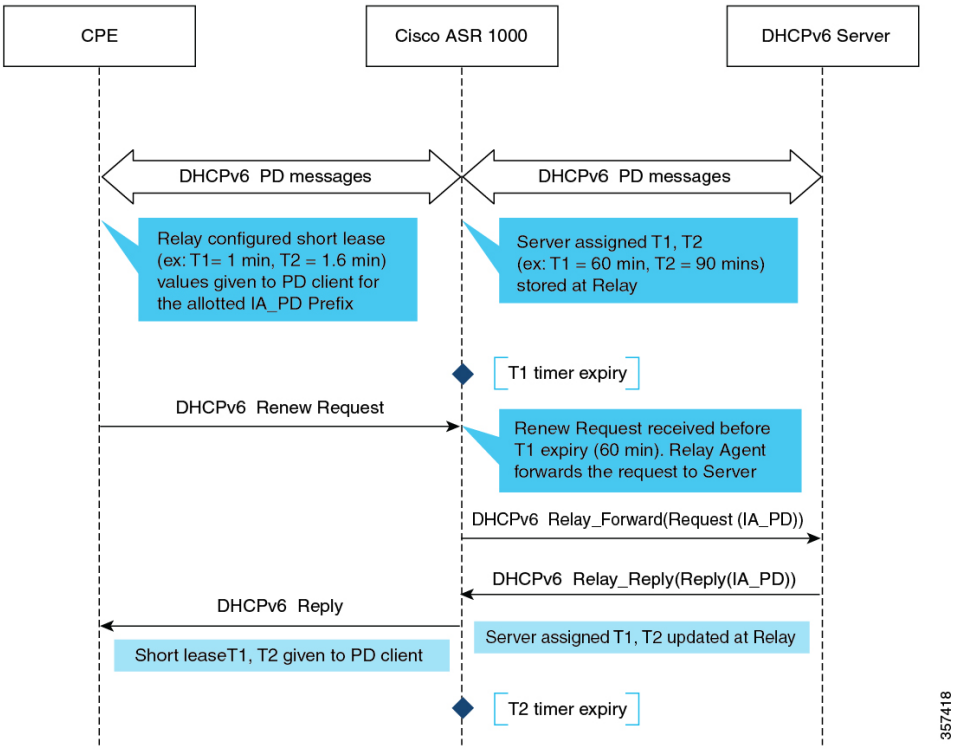
DHCPv6 relay agent uses timer wheel for handling the server assigned T1 and T2 values.

Renewing and Rebinding Scenarios

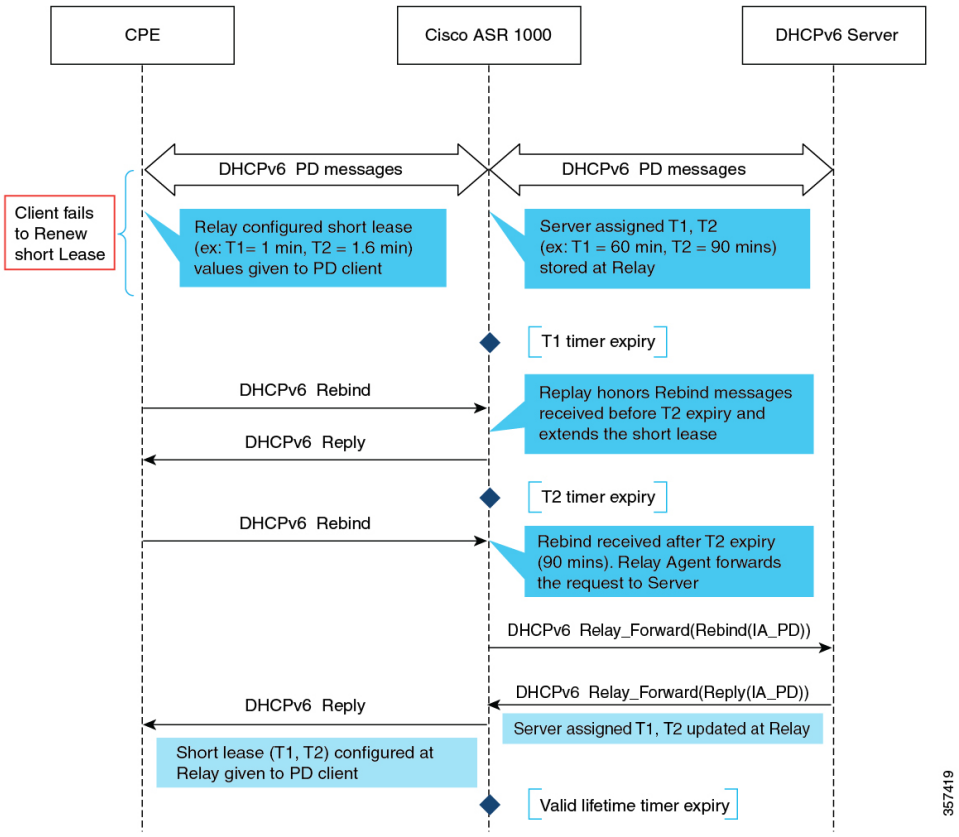
The relay agent stores the actual T1 and T2 values received from DHCPv6 Server. For every reply with IA options received from the server, relay will update the T1 and T2 values which will also take care of any changes in the server side configurations. In this sequence diagrams, CPE is the DHCPv6 Prefix Delegation client and Cisco ASR 1000 Series is the DHCPv6 relay agent.



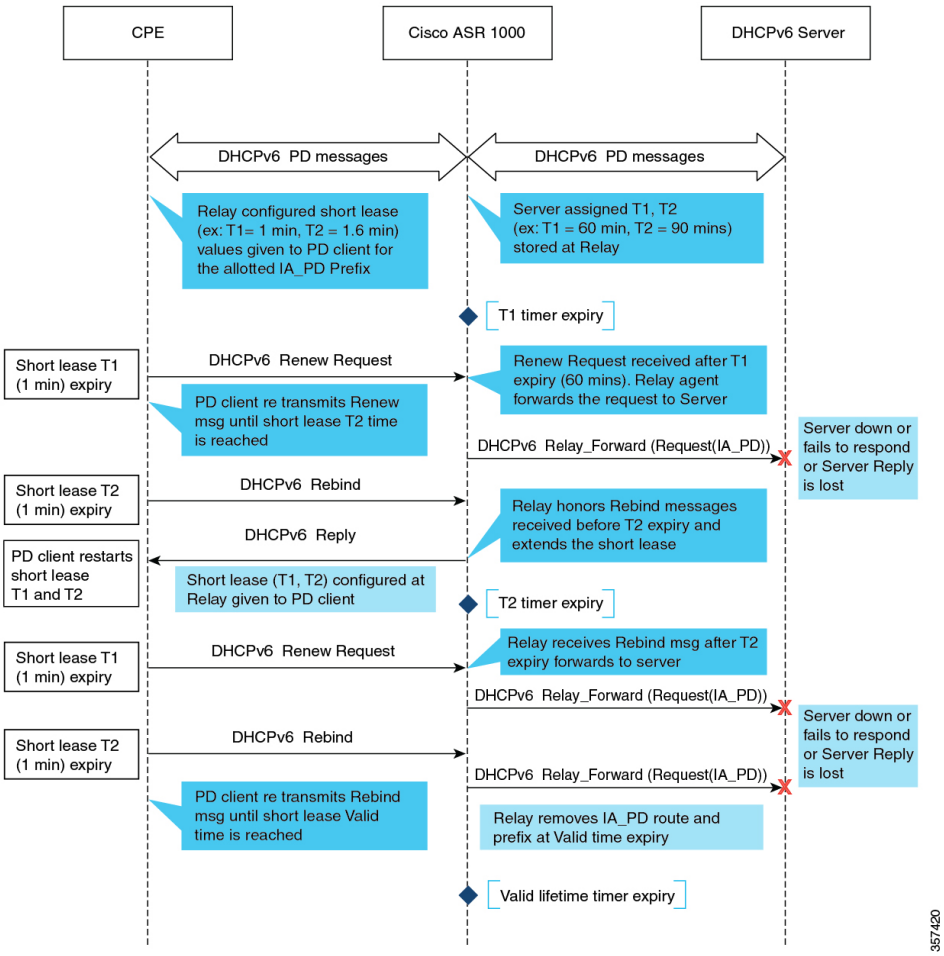
The following sequence diagram depicts the short lease renewal before the expiry of the server assigned T1 value.



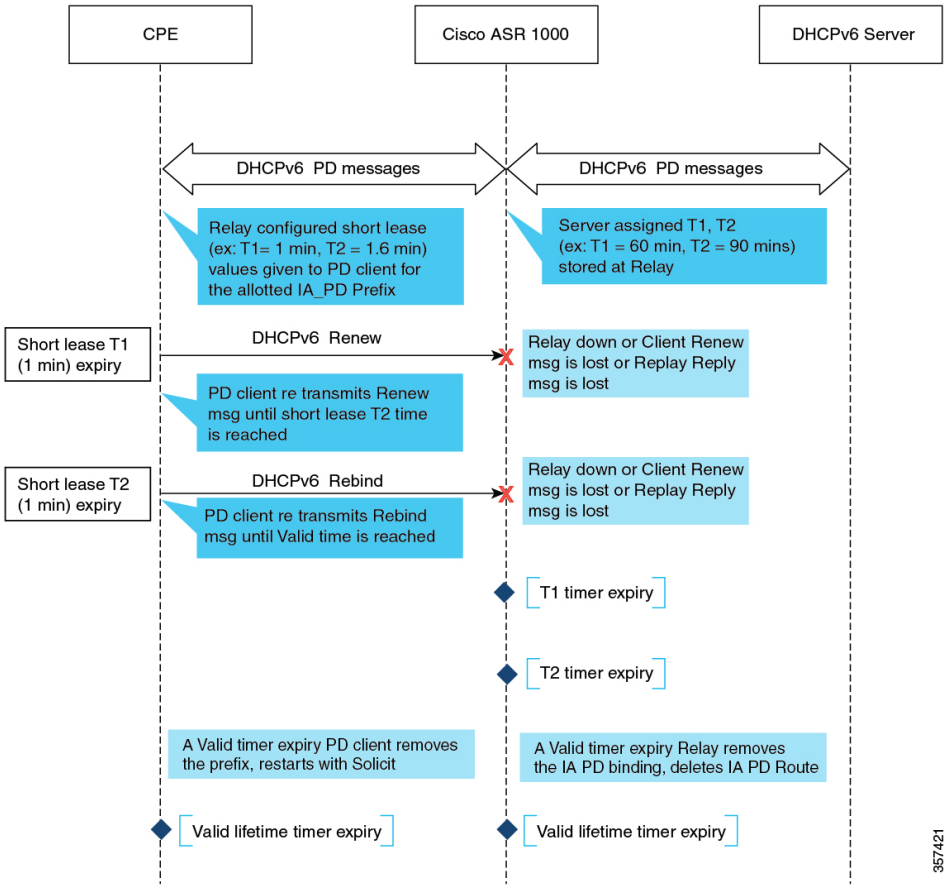
The following message sequence diagram depicts the short lease renewal after the expiry of the server assigned T1 value.



The following message sequence diagram depicts the short lease rebind scenario.



The following message sequence diagram depicts how to handle the short lease renewal and rebind when the server is down.



Reconfiguring Scenario

The DHCPv6 server sends a reconfigure message to the client to inform that the server has a new or updated configuration parameters. With this information, the client initiates a renewal or reply or information-request and reply transaction with the server to receive the updated information.

The server tries to send the reconfigure message to an IPv6 unicast address of the DHCP client. If the server does not have an address to which it can send the reconfigure message directly to the client, the server uses Relay-reply option to send the message to a relay agent that will relay the message to the client.

When responding to a reconfigure message, the client creates and sends the information-request message with the exception that the client includes a server identifier option with the identifier from the reconfigure message to which the client is responding.

Renewing Scenario

When responding to a reconfigure, the client creates and sends the renew message with the exception that the client copies the Option Request option and any IA options from the reconfigure message into the renew message.

Configuring Asymmetric Lease

You can apply the Asymmetric lease configuration on per interface or globally for all interfaces.

Configuring Asymmetric Lease on an Interface

Before you begin

To configure the asymmetric lease on an interface, perform these steps:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip dhcp relay destination optionshort-lease source-information** *time in seconds*
5. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface Ethernet 0/0`	Specifies an interface type and number, and enters interface configuration mode.
Step 4	**ip dhcp relay destination optionshort-lease source-information** *time in seconds* **Example:** `Router(config-if)# ip dhcp relay short-lease 500`	Sets and enables the short lease for the client on the interface. You can set the lease time in seconds. The range is from 60 to 3600 seconds.
Step 5	**end** **Example:**	Returns to privileged EXEC mode.

	Command or Action	Purpose
	`Device(config-if)# end`	

Configuring Asymmetric Lease in Global Configuration Mode

Before you begin

To configure the asymmetric lease globally:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp relay destination optionshort-lease source-information** *time in seconds*
4. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip dhcp relay destination optionshort-lease source-information** *time in seconds* **Example:** `Router(config)# ip dhcp relay short-lease 500`	Sets and enables the short lease for the client globally. You can set the lease time in seconds. The range is from 60 to 3600 seconds.
Step 4	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Configuration Examples for the Asymmetric Lease

Example: Configuring the Asymmetric Lease on an Interface

The **show running-config interface Ethernet** command displays the interface where short lease is configured:

```
Router# show running-config interface Ethernet0/0
Building configuration...

Current configuration : 215 bytes
!
interface Ethernet0/0
 no ip address
 ipv6 address 2001:DB8:10::1/64
 ipv6 enable
 ipv6 dhcp relay destination 2001:DB8:10::1
 ipv6 dhcp relay short-lease 500

end
```

Verifying the Configuration

To verify the configuration on the interface, use the **show ipv6 dhcp interface GigabitEthernet 2** and **show ipv6 dhcp relay binding** commands.

:

```
Router# show ipv6 dhcp interface GigabitEthernet 2
GigabitEthernet2 is in client mode
  Prefix State is OPEN
  Renew will be sent in 11:38:28
  Address State is IDLE
  List of known servers:
    Reachable via address: FE80::250:56FF:FEAE:17A8
    DUID: 00030001001EE6383500
    Preference: 0
    Configuration parameters:
      IA PD: IA ID 0x00080001, T1 120, T2 240
        Prefix: 8001:DB8::/48
                preferred lifetime 120, valid lifetime 240
                expires at Mar 31 2020 09:24 PM (51 seconds)
      DNS server: 2000:3000:4000::1
      Information refresh time: 0
  Prefix name: pd-client
  Prefix Rapid-Commit: disabled
  Address Rapid-Commit: disabled


end
```

```
Device# show ipv6 dhcp relay binding

Relay Bindings associated with default vrf:
Prefix: 8001:DB8::/48 (Ethernet0/0)
  DUID: 00030001AABBCC000A00
  IAID: 131073
  Short Lease T1: 60 (Expired)
  Short Lease T2: 96 (Active)
```

```
  T1: 3600
    expiration: 19:47:00 IST Jul 15 2020
  T2: 7200
    expiration: 20:47:00 IST Jul 15 2020
  lifetime: 150
  expiration: 21:17:00 IST Jul 15 2020
Summary:
  Total number of Relay bindings = 1
  Total number of IAPD bindings = 1
  Total number of IANA bindings = 0
  Total number of Relay bindings added by Bulk lease = 0
RELAY#
```

DHCPv6 Short Lease Performance Scaling

The following table provides the performance scaling information for the DHCPv6 short lease.

Table 1: DHCPv6 Short Lease Performance Scaling

Number of Sessions	Short Lease Value	Calls per Second	Performance with ISG	Performance without ISG
32000	60 sec	100	Yes	No
32000	60 sec	100	No	Yes

Feature Information for Asymmetric Lease for DHCPv6 Relay Prefix Delegation

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for Asymmetric Lease for DHCPv6 Relay Prefix Delegation

Feature Name	Releases	Feature Information
Asymmetric Lease for DHCPv6 Relay Prefix Delegation		This feature allows you to manage or change the lease renewal. It provides options to force renewal of lease and also detects when the lease is nearing the expiry date.