Implementing DHCPv6 Relay Agent

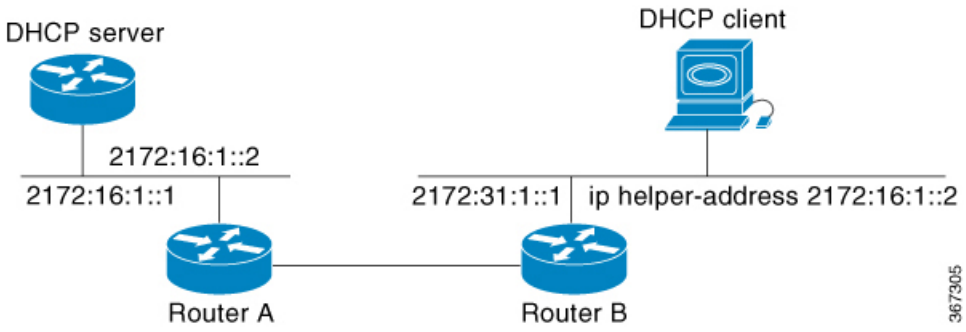
A DHCPv6 relay agent is a host that forwards DHCPv6 packets between clients and servers that do not reside on a shared physical subnet. Relay agent forwarding is distinct from the normal forwarding of an IP router where IP packets are switched between networks transparently.

DHCPv6 clients use User Datagram Protocol (UDP) broadcasts to send DHCP DISCOVER messages when they lack information about the network to which they belong.

If a client is on a network segment that does not include a server, a relay agent is needed on that network segment to ensure that DHCPv6 packets reach the servers on another network segment. UDP broadcast packets are not forwarded, because most routers are not configured to forward broadcast traffic. You can configure a DHCPv6 relay agent to forward DHCPv6 packets to a remote server by configuring a DHCPv6 relay profile and configure one or more helper addresses in it. You can assign the profile to an interface or a VRF.

The figure below demonstrates the process. The DHCPv6 client broadcasts a request for an IPv6 address and additional configuration parameters on its local LAN. Acting as a DHCPv6 relay agent, Router B picks up the broadcast, changes the destination address to the DHCPv6 server's address and sends the message out on another interface. The relay agent inserts the IPv6 address of the interface, on which the DHCPv6 client's packets are received into the gateway address (giaddr) field of the DHCPv6 packet, which enables the DHCPv6 server to determine which subnet should receive the offer and identify the appropriate IPv6 address range. The relay agent unicasts the messages to the server address, in this case 2172:16:1::2 (which is specified by the helper address in the relay profile).

Figure 1: Forwarding UDP Broadcasts to a DHCPv6 Server Using a Helper Address



Prerequisites for Configuring DHCP Relay Agent

The following are the prerequisites to configure a DHCP relay agent:

- You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.
- A configured and running DHCP client and DHCP server.
- Connectivity between the relay agent and DHCP server

Limitations for DHCP Relay Feature

These are the limitations for implementing DHCP relay feature:

- The multicast addresses are not supported. The **helper-address** command in DHCP relay profile submode will only support global unicast IP address as the helper address.
- Only interface-id and remote-id DHCP option code are added by a relay agent while forwarding the packet to a DHCP server.

Note Configuring DHCP option code is not supported in DHCP relay profile submode.

How to Configure and Enable DHCP Relay Agent

This section contains the following tasks:

Configuring and Enabling the DHCPv6 Relay Agent

This task describes how to configure and enable a DHCPv6 relay agent.

```
RP/0/RSP0/CPU0:router# configure terminal
RP/0/RSP0/CPU0:router(config)# dhcp ipv6
RP/0/RSP0/CPU0:router(config-dhcpv6)# commit
```

Enabling DHCPv6 Relay Agent on an Interface

This task describes how to enable the Cisco IOS XR DHCPv6 relay agent on an interface.

Note On Cisco IOS XR software, the DHCPv6 relay agent is disabled by default.

```
RP/0/RSP0/CPU0:router# configure terminal
RP/0/RSP0/CPU0:router(config)# dhcp ipv6
RP/0/RSP0/CPU0:router(config-dhcpv6)# interface type interface-instance relay profile
profile-name
RP/0/RSP0/CPU0:router(config-dhcpv6-if)# commit
```

Disabling DHCP Relay on an Interface

This task describes how to disable the DHCP relay on an interface by using the **no** keyword on the interface.

```
Router# configure terminal
Router(config)# dhcp ipv6
Router(config-dhcpv6)# no interface type name relay profile profile-name
Router(config-dhcpv6-if)# commit
```

Enabling DHCP Relay on a VRF

This task describes how to enable DHCP relay on a VRF.

```
/CPU0:router# configure terminal
Router(config)# dhcp ipv6
Router(config-dhcpv6)# vrf vrf-name relay profile profile-name
Router(config-dhcpv6-if)# commit
```

Configure a DHCP Relay Profile with Multiple Helper Addresses

You can configure up to 16 helper IPv4 and IPv6 addresses for a DHCPv4 or DHCpv6 relay profile.

1. Enter the DHCPv4 or DHCPv6 configuration mode.

   ```
   Router(config)# dhcp ipv6
   ```

2. Configure the DHCPv4 or DHCPv6 relay profile.

   ```
   Router(config-dhcpv6)# profile helper relay
   ```

3. Configure helper addresses.

Note You can configure up to 16 IPv4 and IPv6 addresses.

```
Router(config-dhcpv6-relay-profile)# helper-address vrf default 2001:1:1::2
```

4. Confirm your configuration.

```
Router(config-dhcpv6-relay-profile)# show configuration

!! IOS XR Configuration 0.0.0
dhcp ipv6
 profile helper relay
  helper-address vrf default 2001:1:1::2
 !
!
end
```

5. Commit your configuration.

```
Router(config-dhcpv6-relay-profile)# commit
```

6. Exit the configuration mode and verify the configured helper addresses.

```
Router# show dhcp ipv6 relay profile name helper
...
!
Profile: helper
Helper Addresses:
        2001:1:1::2, vrf default
Information Option: Disabled
Information Option Allow Untrusted: Disabled
Information Option VPN: Disabled
Information Option VPN Mode: RFC
Information Option Policy: Replace
Information Option Check: Disabled
GIADDR Policy: Keep
Broadcast-flag Policy: Ignore
VRF References:
Interface References:
```

You have successfully configured the DHCPv6 relay helper address.

Configuring DHCP Relay Binding Database Write to System Persistent Memory

Perform this task to configure the DHCP relay binding database write to the system persistent memory. This helps to recover the DHCP relay binding table after a system reload. The file names used for a full persistent file write are dhcpv4_srpb_{nodeid}_odd or dhcpv6_srpb_{nodeid}_odd and dhcpv4_srpb_{nodeid}_even or dhcpv6_srpb_{nodeid}_even. The nodeid is the actual node ID of the node where the file is written. The incremental file is named the same way as the full file, with a _inc appended to it.

```
Router# configure
Router(config)# dhcp ipv6
Router(config-dhcpv6)# database [relay] [full-write-interval full-write-interval]
[incremental-write-interval incremental-write-interval]
Router(config-dhcpv6)# commit
```

DHCP Server

A DHCP server accepts address assignment requests and renewals, and assigns the IP addresses from predefined groups of addresses contained within Distributed Address Pools (DAPS). DHCP servers can also be configured to supply additional information to the requesting client such as subnet mask, domain-name, the IP address of the DNS server, the default router, and other configuration parameters. DHCP servers can accept broadcasts

from locally attached LAN segments or from DHCP requests that have been forwarded by other DHCP relay agents within the network.

The DHCP proxy performs all the functions of a relay and also provides some additional functions. The DHCP proxy conceals DHCP server details from DHCP clients. The DHCP proxy modifies the DHCP replies such that the client considers the proxy to be the server. In this state, the client interacts with the proxy as if it is the DHCP server.

DHCP Service-based Mode Selection

As part of DHCP service-based mode selection feature, a new mode called DHCP base is introduced. If an interface is configured in the DHCP base mode, then the DHCP selects either the DHCP proxy or the DHCP server mode to process the client request by matching option 60 (class-identifier) value of the client request with the configured value under the DHCP base profile.

The pool is configured under server-profile mode and server-profile-class submode. The class-based pool selection is always given priority over profile pool selection.

The DHCPv6 server-profile-class submode supports configuring DHCP options except few (0, 12, 50, 52, 53, 54, 58, 59, 61, 82, and 255).

```
dhcp ipv6
profile DHCP_BASE base
  match option 60 41424344 profile DHCPv6_PROXY proxy
  match option 60 41424355 profile DHCPv6_SERVER server
  default profile DEFAULT_PROFILE server
  relay information authenticate inserted
   !
profile DHCPv6_PROXY proxy
  helper-address vrf default 10.10.10.1 giaddr 0.0.0.0
!
profile DHCPv6_SERVER server
  lease 1 0 0
  pool IP_POOL
!
profile DEFAULT_PROFILE server
  lease 1 0 0
  pool IP_POOL
!
!
interface gigabitEthernet 0/0/0/0 base profile DHCP_BASE
```

Configuring DHCP Server Profile

You can configure routers with DHCPv4 or DHCPv6 server profile.

Perform this task to configure the DHCPv6 server profile.

```
Router# configure
Router(config)# dhcp ipv6
Router(config-dhcpv6)# profile profile-name server
Router(config-dhcpv6-server-profile)# bootfile boot-file-name
Router(config-dhcpv6-server-profile)# broadcast-flag policy unicast-always
Router(config-dhcpv6-server-profile)# class class-name
Router(config-dhcpv6-server-profile-class)# exit
Router(config-dhcpv6-server-profile)# default-router address1 address2 ... address8
Router(config-dhcpv6-server-profile)# lease {infinite | days minutes seconds }
Router(config-dhcpv6-server-profile)# limit lease {per-circuit-id | per-interface|
per-remote-id} value
```

```
Router(config-dhcpv6-server-profile)# netbios-name server address1 address2 ... address8
Router(config-dhcpv6-server-profile)# netbios-node-type {number |b-node|h-node |m-node
|p-node}
Router(config-dhcpv6-server-profile)# option option-code {ascii string | hex string |ip
address}
Router(config-dhcpv6-server-profile)# pool pool-name
Router(config-dhcpv6-server-profile)# requested-ip-address-check disable
Router(config-dhcpv6-server-profile)# commit
```

Configuring Multiple Classes with a Pool

Perform this task to configure multiple classes with a pool.

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# dhcp ipv6
RP/0/RSP0/CPU0:router(config-dhcpv6)# profile profile-name server
RP/0/RSP0/CPU0:router(config-dhcpv6-server-profile)# pool pool-name
RP/0/RSP0/CPU0:router(config-dhcpv6-server-profile)# class class-name
RP/0/RSP0/CPU0:router(config-dhcpv6-server-class)# pool pool-name
RP/0/RSP0/CPU0:router(config-dhcpv6-server-class)# match option option [ sub-option
sub-option] [ ascii asciiString | hex hexString ]
RP/0/RSP0/CPU0:router(config-dhcpv6-server-class)# exit
RP/0/RSP0/CPU0:router(config-dhcpv6-server-profile)# class class-name
RP/0/RSP0/CPU0:router(config-dhcpv6-server-class)# pool pool-name
RP/0/RSP0/CPU0:router(config-dhcpv6-server-class)# match vrf vrf-name
RP/0/RSP0/CPU0:router(config-dhcpv6-server-class)# commit
```

DHCP Client

The Dynamic Host Configuration Protocol (DHCP) client functionality enables the router interfaces to dynamically acquire the IPv4 or DHCPv4 or DHCPv6 server, and forwards the responses back to the correct Layer 2 address so that the correct device gets the correct configuration information.

DHCP has the ability to allocate IP addresses only for a configurable period of time, called the lease period. If the client is required to retain this IP address for a longer period beyond the lease period, the lease period must be renewed before the IP address expires. The client renews the lease based on configuration that was sent from the server. The client unicasts a REQUEST message using the IP address of the server. When a server receives the REQUEST message and responds with an ACK message. The lease period of the client is extended by the lease time configured in the ACK message.

Restrictions and Limitations

- DHCPv4 or DHCPv6 client can be enabled only on management interfaces.
- Either DHCPv4, DHCPv6, static IPv4, or static IPv6 can be configured on an interface.

Enabling DHCP Client on an Interface

The DHCPv4 or DHCPv6 client can be enabled at an interface level. The DHCP component receives a notification when DHCPv4 or DHCPv6 is enabled or disabled on an interface.

```
Router# configure
Router(config)# interface MgmtEth rack/slot/CPU0/port
Router(config)# interface interface_name ipv6 address dhcp
```