Analyze and Verify Ouput of "debug dhcp ipv6 packets" in ASR9k

Contents

Introduction

This document describes troubleshooting ASR9k acting as Dynamic Host Configuration Protocol (DHCP) Relay by reviewing output of the **debug dhcp ipv6 packets** command. This is quite common when setting up the ASR9k as a DHCPv6 Relay Agent and using external DHCPv6 Server. It is useful to run debug to troubleshoot why customer is not getting IPv6 address.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Basic knowledge of the DHCPv6 Server and Client communication.
- Basic IPv6 knowledge

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Summary of DHCPv6 Relay-Agent , Server and Client communication

Here is the summary of the DHCPv6 Server and Client communication:

- When an IPv6 Client boots for the first time, it'll assign itself a Link-local address, which is automatically generated from this range: FE80::/10.

- Client sends a Solicit message to all DHCPv6 Relay Agents and Servers to locate the Server. Client uses a link-scoped multicast address FF02::1:2 to communicate with neighbor Relay Agents and Servers.

- Relay Agent uses a site-scoped multicast address FF05::1:3 to communicate with Servers, either because the Relay Agent wants to send messages to all Servers or because it does not know the unicast addresses of the Servers.

- DHCPv6 Servers respond with Advertise messages to indicate that it is available for DHCP service, in response to a Solicit message received from a Client.Client chooses a Server and sends a Request message to request configuration parameters, including IP addresses, from a specific Server.

- DHCPv6 Server responds with a Reply message containing assigned addresses and configuration parameters in response to a Solicit, Request message received from a Client.

Note: Clients listen for DHCP messages on UDP port 546. Servers and Relay Agents listen for DHCP messages on UDP port 547.

Troubleshooting Methodology

There are many reasons why a Client can't get IPv6 address from DHCPv6 Server. It can be Client configuration, DHCPv6 Relay or DHCPv6 Server. The following discussion describes a scenario which includes ASR9k acting as a DHCPv6 Relay Agent.

In such a network, when Client is not receiving IP address, one of the troubleshooting steps is to analyze the communicated message, which is handled by DHCPv6 Relay Agent.
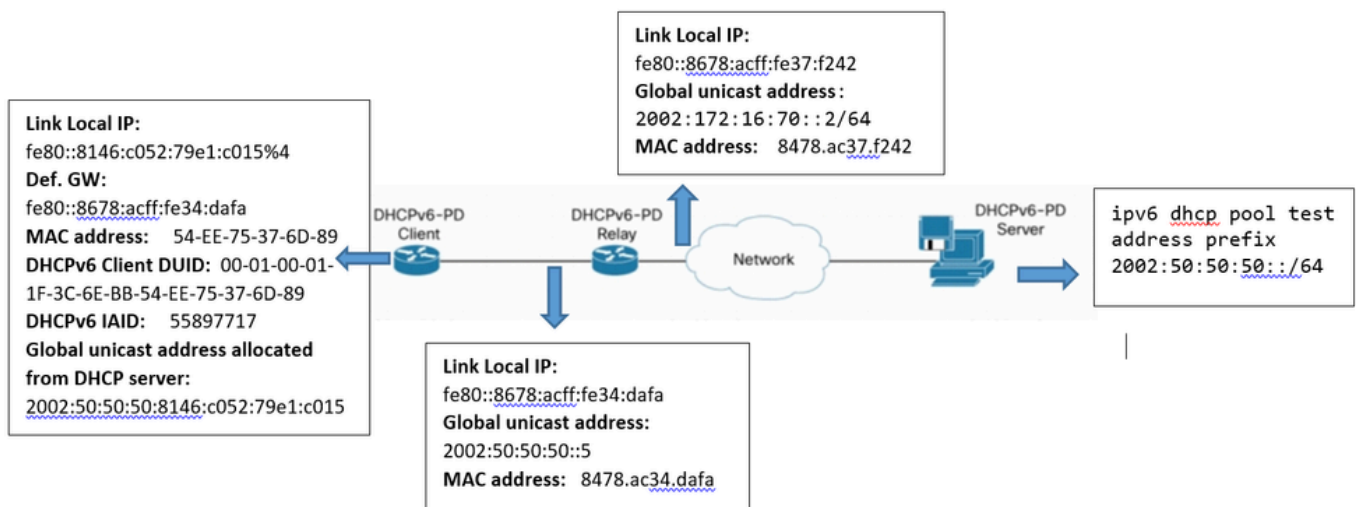
You can run "debug dhcp IPv6 packet" on DHCPv6 Relay Agent which shows you the content and sequence of the communicated messages in normal situation. It can assist you to find where the issue occurs by comparing a successful vs. unsuccessful transaction between Client/Server and find out the root cause and

the next step for troubleshooting.

This is image shows the topology of the case study including Client, DHCPv6 Relay Agent (ASR9k) and DHCPv6 Server.

DHCP Relay configuration:
dhcp ipv6
  profile dhcpv6-test relay
  helper-address vrf default 2002:172:16:151::2 ----> Reachable Global IP address at DHCP server
interface GigabitEthernet0/0/0/4 relay profile dhcpv6-test -- > Activate profile toward the client interface

Link Local IP:
fe80::8678:acff:fe37:f242
Global unicast address :
2002:172:16:70::2/64
MAC address: 8478.ac37.f242

Link Local IP:
fe80::8146:c052:79e1:c015%4
Def. GW:
fe80::8678:acff:fe34:dafa
MAC address: 54-EE-75-37-6D-89
DHCPv6 Client DUID: 00-01-00-01-
1F-3C-6E-BB-54-EE-75-37-6D-89
DHCPv6 IAID: 55897717
Global unicast address allocated
from DHCP server:
2002:50:50:50:8146:c052:79e1:c015

DHCPv6-PD
Client

DHCPv6-PD
Relay

Network

DHCPv6-PD
Server

ipv6 dhcp pool test
address prefix
2002:50:50:50::/64

Link Local IP:
fe80::8678:acff:fe34:dafa
Global unicast address:
2002:50:50:50::5
MAC address: 8478.ac34.dafa

DHCPv6 Terminology

This is the basic terminology:

DHCPv6

The Dynamic Host Configuration Protocol version 6 (DHCPv6) is a network protocol for configuring Internet Protocol version 6 (IPv6) hosts with IP addresses, IP prefixes and other configuration data required to operate in an IPv6 network. It is the IPv6 equivalent of the Dynamic Host Configuration Protocol for IPv4.

IPv6 hosts can automatically generate IP addresses internally using stateless address auto configuration, or they can be assigned configuration data with DHCPv6.

DHCPv6 Server

DHCPv6 Server (or Server) is a node that responds to requests from Clients, and may or may not be on the same link as the Client(s).

DHCPv6 Client

DHCPv6 Client (or Client) is a node that initiates requests on a link to obtain configuration parameters from one or more DHCPv6 servers.

DHCP Relay Agent

DHCP Relay Agent (or Relay Agent) is a node that acts as an intermediary to deliver DHCP messages between Clients and Servers, and is on the same link as the Client.

Users configure DHCPv6 Relay Agents [RFC3315] to forward DHCPv6 messages between Clients and Servers when they are not on the same IPv6 link. They implement DHCPv6 alongside a routing function in a common node.

Message

Message is a unit of data carried as the payload of a UDP datagram, exchanged among DHCPv6 Servers, Relay Agents and Clients.

DUID

DUID is a DHCP Unique Identifier for a DHCPv6 participant; each DHCPv6 Client and Server has exactly one DUID.

IAID

Identity association (IA) is a collection of addresses assigned to a Client. Each IA has an associated IAID.

A Client can have more than one IA assigned to it; for example, one for each of its interfaces.

Each IA holds one type of address; for example, an identity association for temporary addresses (IA_TA) holds temporary addresses.

Identity association identifier (IAID) is an identifier for an IA, chosen by the Client. Each IA has an IAID, which is unique among all IAIDs for IAs belonging to that Client.

IA_NA

Identity association for non-temporary addresses (IA_NA) is an IA that carries assigned addresses that are not temporary addresses (see "identity association for temporary addresses")

Status Codes

DHCPv6 uses status codes to communicate the success or failure of operations requested in messages from Clients and Servers, and to provide additional information about the specific cause of the failure of a message.

Verifying "debug dhcp IPv6 packet" output

Considering the DHCPv6 Relay-Agent/Server and Client communication, you can analyze each type of message, shown in the debug output separately:

Client sends Solicit message to multicast All_DHCP_Relay_Agents_and_Servers

Client sends the "Solicit" message from link local to multicast address FF02::1:2 in order to find DHCP Server.

It includes:

- Source address: Link local IP address of the Client

- Destination address: Multicast address to All_DHCP_Relay_Agents_and_Servers

- Message Type: Solicit

- Client ID:
    - DUID : DHCP Unique Identifier around all DHCPv6 servers and clients; carries as DHCPv6 option; cannot be longer than 128 octets (Can be verified with running **ipconfig/all** command at Client)

        You can find DUID of the Client by running **ipconfig/all** command, then look for DUID information in the debug to see if the Client is sending message or not.

    - IAID **:** Identity association for binding. It is a 32-bit value assigned by the Client. (Can be verified with running **ipconfig/all** command at Client)

This is an example of the captured information:

```
LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP763: PKT IPv6 DHCP: Detailed packet co
LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP762: PKT: src:fe80::8146:c052:79e1:c01

LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP758: PKT: type: SOLICIT dhcp->type:1 d
LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ELAPSED-TIME(8) optle
LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP738: PKT: elaspsed_time:0
LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optlen:14
LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6ebb54e

LC/0/0/CPU0:Sep  5  15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:12
LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (55897717)

LC/0/0/CPU0:Sep  5 15:26:18.336 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENT-FQDN(39) optle
LC/0/0/CPU0:Sep  5 15:26:18.337 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:VENDOR-CLASS(16) optl
LC/0/0/CPU0:Sep  5 15:26:18.337 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ORO(6) optlen:8
LC/0/0/CPU0:Sep  5 15:26:18.337 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: VENDOR-OPTS
LC/0/0/CPU0:Sep  5 15:26:18.337 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DNS-SERVERS
LC/0/0/CPU0:Sep  5 15:26:18.337 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DOMAIN-LIST
LC/0/0/CPU0:Sep  5  15:26:18.337 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: CLIENT-FQDN
```

DHCP Relay Agent forwards the Relay-Forward message to the Server

DHCP Relay send the "Solicit" message to the DHCP Server which includes:

- Source address: Global unicast address of the Relay interface toward DHCP Server.

- Destination address: Global address of DHCP specified at Relay as a helper address.

- Message type: RELAY-Forward.

- Link and Peer includes information of how to get to the Client as follow:

  ◦ Link: Global IP of Relay Interface toward Client

  ◦ Peer: Link local IP of the Client
- Forward the message received from Client to the Server which includes:

  ◦ Type of message: Solicit

  ◦ DUID of the Client

  ◦ IAID of the Client

This is an example of the captured information:

```
LC/0/0/CPU0:Sep  5 15:26:18.339 : dhcpv6d[159]: DHCPV6 PACKET: TP764: PKT IPv6 DHCP: Det pkt cntents
LC/0/0/CPU0:Sep  5  15:26:18.339 : dhcpv6d[159]: DHCPV6 PACKET: TP762: PKT: src:2002:172:16:70::2 dest:

LC/0/0/CPU0:Sep  5 15:26:18.339 : dhcpv6d[159]: DHCPV6 PACKET: TP760: PKT: type:RELAY-FORWARD relay->msg

LC/0/0/CPU0:Sep  5  15:26:18.339 : dhcpv6d[159]: DHCPV6 PACKET: TP761: PKT: link:2002:50:50:50::5 peer:f

LC/0/0/CPU0:Sep  5 15:26:18.339 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:INTERFACE-ID(18) optl
LC/0/0/CPU0:Sep  5 15:26:18.340 : dhcpv6d[159]: DHCPV6 PACKET: TP774: PKT: 0x
LC/0/0/CPU0:Sep  5 15:26:18.340 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5 15:26:18.340 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
LC/0/0/CPU0:Sep  5 15:26:18.340 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5 15:26:18.340 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5 15:26:18.341 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5  15:26:18.341 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
LC/0/0/CPU0:Sep  5 15:26:18.341 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:REMOTEID(37) optlen:1
LC/0/0/CPU0:Sep  5 15:26:18.341 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 0000000900068478ac3
LC/0/0/CPU0:Sep  5 15:26:18.341 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:RELAY-MSG(9) optlen:1
LC/0/0/CPU0:Sep  5 15:26:18.341 : dhcpv6d[159]: DHCPV6 PACKET: TP758: PKT: type: SOLICIT dhcp->type:1 d
LC/0/0/CPU0:Sep  5 15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ELAPSED-TIME(8) optle
LC/0/0/CPU0:Sep  5 15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP738: PKT: elaspsed_time:0
LC/0/0/CPU0:Sep  5 15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optlen:14
LC/0/0/CPU0:Sep  5 15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6ebb54e

LC/0/0/CPU0:Sep  5  15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:12
LC/0/0/CPU0:Sep  5  15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (55897717)

LC/0/0/CPU0:Sep  5 15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENT-FQDN(39) optle
LC/0/0/CPU0:Sep  5 15:26:18.342 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:VENDOR-CLASS(16) optl
LC/0R0/0/CPU0:Sep  5 15:26:18.343 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ORO(6) optlen:8
LC/0/0/CPU0:Sep  5 15:26:18.343 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: VENDOR-OPTS
LC/0/0/CPU0:Sep  5 15:26:18.343 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DNS-SERVERS
LC/0/0/CPU0:Sep  5 15:26:18.343 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DOMAIN-LIST
```

```
LC/0/0/CPU0:Sep  5 15:26:18.343 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: CLIENT-FQDN
```

DHCP Server reply to DHCP Relay

DHCP Server respond with "Advertise" message and it receives as a "Relay Reply" packet by DHCP Relay Agent which includes:

- Source Address: Global address of DHCP Server (configured as helper-address in DHCP Relay)

- Destination Address: Global unicast address of the DHCP Relay interface toward DHCP Server

- Message Type**:** RELAY-REPLY

- Link and Peer includes information of how to get to the Client as follow:

    - Link: Global IP of Relay Interface toward Client

    - Peer: Link local IP of the Client
- Server ID:
    - DUID of the Server: in case of Cisco Router, it can be verified by using "show ipv6 dhcp" command
- Client ID:

    - DUID of the Client

    - IAID of the Client

This is an example of the captured information:

```
RP/0/RSP0/CPU0:Sep  5 15:26:18.346 : dhcpv6d[1087]: DHCPV6 PACKET: TP763: PKT IPv6 DHCP: Detailed packet
RP/0/RSP0/CPU0:Sep  5 15:26:18.346 : dhcpv6d[1087]: DHCPV6 PACKET: TP762: PKT: src:2002:172:16:151::2 d
RP/0/RSP0/CPU0:Sep  5 15:26:18.346 : dhcpv6d[1087]: DHCPV6 PACKET: TP760: PKT: type:RELAY-REPLY relay->
RP/0/RSP0/CPU0:Sep  5 15:26:18.346 : dhcpv6d[1087]: DHCPV6 PACKET: TP761: PKT: link:2002:50:50:50::5 pe
RP/0/RSP0/CPU0:Sep  5 15:26:18.346 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:INTERFACE-ID(18)
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP774: PKT: 0x
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:RELAY-MSG(9) optl
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP758: PKT: type: ADVERTISE dhcp->ty
RP/0/RSP0/CPU0:Sep  5 15:26:18.347 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:SERVERID(2) optle
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP725: PKT: duidbuf: 00030001c8f9f98
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optle
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6eb
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:4
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (558977
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:IAADDR(5) optlen:
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP729: PKT: IPV6 addr:2002:50:50:50:
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP730: PKT: preferred
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP769: PKT: 86400
```

```
RP/0/RSP0/CPU0:Sep  5 15:26:18.348 : dhcpv6d[1087]: DHCPV6 PACKET: TP731: PKT: valid
RP/0/RSP0/CPU0:Sep  5 15:26:18.349 : dhcpv6d[1087]: DHCPV6 PACKET: TP733: PKT: len:172800
RP/0/RSP0/CPU0:Sep  5 15:26:18.349 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:DNS-SERVERS(23) o
RP/0/RSP0/CPU0:Sep  5 15:26:18.349 : dhcpv6d[1087]: DHCPV6 PACKET: TP744: PKT: ipv6_addr:2001:4860:4860
RP/0/RSP0/CPU0:Sep  5 15:26:18.349 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:DOMAIN-LIST(24) op
RP/0/RSP0/CPU0:Sep  5 15:26:18.349 : dhcpv6d[1087]: DHCPV6 PACKET: TP746: PKT: Domain_name: cisco.com
```

DHCP Relay Agent send message to the Client

DHCP Relay Agent send "Advertise" message to the Client which includes:

- Source Address: Link Local IP address of the Relay Agent interface toward the Client

- Destination Address: Link Local IP address of Client

- Message Type**:** ADVERTISE

- Server ID:
  ◦ DUID of the Server: in case of Cisco Router, it can be verified by using "show ipv6 dhcp" command
- Client ID:

  ◦ DUID of the Client

  ◦ IAID of the Client

This is an example of the captured information:

```
LC/0/0/CPU0:Sep  5 15:26:18.351 : dhcpv6d[159]: DHCPV6 PACKET: TP765: PKT IPv6 DHCP: Det pkt cntents
LC/0/0/CPU0:Sep  5  15:26:18.351 : dhcpv6d[159]: DHCPV6 PACKET: TP762: PKT: src:fe80::8678:acff:fe34:da
LC/0/0/CPU0:Sep  5 15:26:18.351 : dhcpv6d[159]: DHCPV6 PACKET: TP758: PKT: type: ADVERTISE dhcp->type:2

LC/0/0/CPU0:Sep  5 15:26:18.351 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:SERVERID(2) optlen:10
LC/0/0/CPU0:Sep  5 15:26:18.351 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 00030001c8f9f98c3e8
LC/0/0/CPU0:Sep  5 15:26:18.351 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optlen:14
LC/0/0/CPU0:Sep  5  15:26:18.351 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6ebb54
LC/0/0/CPU0:Sep  5 15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:40
LC/0/0/CPU0:Sep  5 15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (55897717)
LC/0/0/CPU0:Sep  5  15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IAADDR(5) optlen:24
LC/0/0/CPU0:Sep  5 15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP729: PKT: IPV6 addr:2002:50:50:50:2cdd
LC/0/0/CPU0:Sep  5  15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP730: PKT: preferred
LC/0/0/CPU0:Sep  5 15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP769: PKT: 86400
LC/0/0/CPU0:Sep  5 15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP731: PKT: valid
LC/0/0/CPU0:Sep  5 15:26:18.352 : dhcpv6d[159]: DHCPV6 PACKET: TP733: PKT: len:172800
LC/0/0/CPU0:Sep  5 15:26:18.353 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:DNS-SERVERS(23) optle
LC/0/0/CPU0:Sep  5 15:26:18.353 : dhcpv6d[159]: DHCPV6 PACKET: TP744: PKT: ipv6_addr:2001:4860:4860::88
LC/0/0/CPU0:Sep  5 15:26:18.353 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:DOMAIN-LIST(24) optle
LC/0/0/CPU0:Sep  5  15:26:18.353 : dhcpv6d[159]: DHCPV6 PACKET: TP746: PKT: Domain_name: cisco.com
```

Client sends "Request" message to DHCP Server

DHCP Relay Agent send "Request" message to the Server which includes:

- Source Address: Link Local IP address of Client

- Destination Address: Multicast address to All_DHCP_Relay_Agents_and_Servers

- Message Type: REQUEST

- Client ID:

  ◦ DUID of the Client

  ◦ IAID of the Client
- Server ID:
  ◦ DUID of the Server: in case of Cisco Router, it can be verified by using "show ipv6 dhcp" command

This is an example of the captured information:

```
LC/0/0/CPU0:Sep  5 15:26:19.338 : dhcpv6d[159]: DHCPV6 PACKET: TP763: PKT IPv6 DHCP: Detailed packet co
LC/0/0/CPU0:Sep  5 15:26:19.338 : dhcpv6d[159]: DHCPV6 PACKET: TP762: PKT: src:fe80::8146:c052:79e1:c01
LC/0/0/CPU0:Sep  5 15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP758: PKT: type: REQUEST dhcp->type:3 d
LC/0/0/CPU0:Sep  5  15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ELAPSED-TIME(8) optl
LC/0/0/CPU0:Sep  5 15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP738: PKT: elaspsed_time:0
LC/0/0/CPU0:Sep  5 15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optlen:14
LC/0/0/CPU0:Sep  5 15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6ebb54e
LC/0/0/CPU0:Sep  5 15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:SERVERID(2) optlen:10
LC/0/0/CPU0:Sep  5  15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 00030001c8f9f98c3e
LC/0/0/CPU0:Sep  5 15:26:19.339 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:40
LC/0/0/CPU0:Sep  5 15:26:19.340 : dhcpv6d[159]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (55897717)
LC/0/0/CPU0:Sep  5  15:26:19.340 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IAADDR(5) optlen:24
LC/0/0/CPU0:Sep  5 15:26:19.340 : dhcpv6d[159]: DHCPV6 PACKET: TP729: PKT: IPV6 addr:2002:50:50:50:2cdd
LC/0/0/CPU0:Sep  5 15:26:19.340 : dhcpv6d[159]: DHCPV6 PACKET: TP730: PKT: preferred
LC/0/0/CPU0:Sep  5 15:26:19.340 : dhcpv6d[159]: DHCPV6 PACKET: TP769: PKT: 86400
LC/0/0/CPU0:Sep  5 15:26:19.340 : dhcpv6d[159]: DHCPV6 PACKET: TP731: PKT: valid
LC/0/0/CPU0:Sep  5  15:26:19.340 : dhcpv6d[159]: DHCPV6 PACKET: TP733: PKT: len:172800
LC/0/0/CPU0:Sep  5   15:26:19.341 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENT-FQDN(39) opt
LC/0/0/CPU0:Sep  5 15:26:19.341 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:VENDOR-CLASS(16) optl
LC/0/0/CPU0:Sep  5 15:26:19.341 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ORO(6) optlen:8
LC/0/0/CPU0:Sep  5 15:26:19.341 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: VENDOR-OPTS
LC/0/0/CPU0:Sep  5 15:26:19.341 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DNS-SERVERS
LC/0/0/CPU0:Sep  5 15:26:19.341 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DOMAIN-LIST
LC/0/0/CPU0:Sep  5 15:26:19.341 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: CLIENT-FQDN
```

DHCP Relay Agent forward "Request" message to DHCP Server

DHCP Relay Agent forward "Request" message as " RELAY-Forward" type to the Server which includes:

- Source Address: Global unicast address of the Relay interface toward DHCP Server

- Destination Address: Global address of DHCP specified at Relay as a helper address

- Message Type: RELAY-FORWARD

- Link and Peer includes information of how to get to the Client as follow:

  ◦ Link: Global IP of Relay Interface toward Client

  ◦ Peer: Link local IP of the clientForward the message received from Client to the Server which includes:
- Type of message: Request

- DUID of the Client

- IAID of the Client

This is an example of the captured information:

```
LC/0/0/CPU0:Sep  5 15:26:19.343 : dhcpv6d[159]: DHCPV6 PACKET: TP764: PKT IPv6 DHCP: Det pkt cntents
LC/0/0/CPU0:Sep  5  15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP762: PKT: src:2002:172:16:70::2 dest:
LC/0/0/CPU0:Sep  5  15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP760: PKT: type:RELAY-FORWARD relay->m
LC/0/0/CPU0:Sep  5 15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP761: PKT: link:2002:50:50:50::5 peer:f
LC/0/0/CPU0:Sep  5 15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:INTERFACE-ID(18) optl
LC/0/0/CPU0:Sep  5 15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP774: PKT: 0x
LC/0/0/CPU0:Sep  5 15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5 15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
LC/0/0/CPU0:Sep  5 15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5 15:26:19.344 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5  15:26:19.345 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
LC/0/0/CPU0:Sep  5 15:26:19.345 : dhcpv6d[159]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
LC/0/0/CPU0:Sep  5 15:26:19.345 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:REMOTEID(37) optlen:1
LC/0/0/CPU0:Sep  5 15:26:19.345 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 0000000900068478ac3
LC/0/0/CPU0:Sep  5 15:26:19.345 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:RELAY-MSG(9) optlen:1
LC/0/0/CPU0:Sep  5 15:26:19.345 : dhcpv6d[159]: DHCPV6 PACKET: TP758: PKT: type: REQUEST dhcp->type:3 d
LC/0/0/CPU0:Sep  5  15:26:19.345 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ELAPSED-TIME(8) optl
LC/0/0/CPU0:Sep  5 15:26:19.346 : dhcpv6d[159]: DHCPV6 PACKET: TP738: PKT: elaspsed_time:0
LC/0/0/CPU0:Sep  5 15:26:19.346 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optlen:14
LC/0/0/CPU0:Sep  5 15:26:19.346 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6ebb54e
LC/0/0/CPU0:Sep  5 15:26:19.346 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:SERVERID(2) optlen:10
LC/0/0/CPU0:Sep  5 15:26:19.346 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 00030001c8f9f98c3e8
LC/0/0/CPU0:Sep  5  15:26:19.346 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:40
LC/0/0/CPU0:Sep  5 15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (55897717)
LC/0/0/CPU0:Sep  5 15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IAADDR(5) optlen:24
LC/0/0/CPU0:Sep  5 15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP729: PKT: IPV6 addr:2002:50:50:50:2cdd
LC/0/0/CPU0:Sep  5 15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP730: PKT: preferred
LC/0/0/CPU0:Sep  5  15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP769: PKT: 86400
LC/0/0/CPU0:Sep  5 15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP731: PKT: valid
LC/0/0/CPU0:Sep  5 15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP733: PKT: len:172800
LC/0/0/CPU0:Sep  5 15:26:19.347 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENT-FQDN(39) optle
LC/0/0/CPU0:Sep  5 15:26:19.348 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:VENDOR-CLASS(16) optl
LC/0/0/CPU0:Sep  5 15:26:19.348 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:ORO(6) optlen:8
LC/0/0/CPU0:Sep  5 15:26:19.348 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: VENDOR-OPTS
LC/0/0/CPU0:Sep  5 15:26:19.348 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DNS-SERVERS
LC/0/0/CPU0:Sep  5  15:26:19.348 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: DOMAIN-LIST
LC/0/0/CPU0:Sep  5  15:26:19.348 : dhcpv6d[159]: DHCPV6 PACKET: TP734: PKT: option: CLIENT-FQDN
```

DHCP Server reply Client via DHCP Relay Agent

DHCP Server respond with "Reply" message and DHCP Relay Agent receives it as a "Relay Reply" packet which includes:

- Source Address: Global address of DHCP Server (configured as helper-address in DHCP Relay)

- Destination Address: Global unicast address of the DHCP Relay interface toward DHCP Server

- Message Type**:** RELAY-REPLY

- Link and Peer includes information of how to get to the Client as follow:

    - Link: Global IP of Relay Interface toward Client

    - Peer: Link local IP of the Client
- Server ID:
    - DUID of the Server: in case of Cisco Router, it can be verified by using "show ipv6 dhcp" command
- Client ID:

    - DUID of the Client

    - IAID of the Client
- Status Message: success

This is the example of the captured information:

```
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP763: PKT IPv6 DHCP: Detailed packet
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP762: PKT: src:2002:172:16:151::2 d
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP760: PKT: type:RELAY-REPLY relay->
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP761: PKT: link:2002:50:50:50::5 pe

RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:INTERFACE-ID(18)
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP774: PKT: 0x
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
RP/0/RSP0/CPU0:Sep  5 15:39:21.225 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x0 (0)
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP743: PKT: 0x4 (4)
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:RELAY-MSG(9) optl
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP758: PKT: type: REPLY dhcp->type:7
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:SERVERID(2) optle
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP725: PKT: duidbuf: 00030001c8f9f98
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optle
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6eb
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:STATUS-CODE(13) o
RP/0/RSP0/CPU0:Sep  5 15:39:21.226 : dhcpv6d[1087]: DHCPV6 PACKET: TP740: PKT: status message:
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP739: PKT: Status_code:SUCCESS   << 
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:5
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (558977
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:STATUS-CODE(13) o
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP740: PKT: status message:
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP739: PKT: Status_code:SUCCESS
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP723: PKT: optype:IAADDR(5) optlen:
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP729: PKT: IPV6 addr:2002:50:50:50:
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP730: PKT: preferred
```

```
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP769: PKT: 0
RP/0/RSP0/CPU0:Sep  5 15:39:21.227 : dhcpv6d[1087]: DHCPV6 PACKET: TP731: PKT: valid
RP/0/RSP0/CPU0:Sep  5 15:39:21.228 : dhcpv6d[1087]: DHCPV6 PACKET: TP733: PKT: len:0
```

DHCP Relay Agent send message to the Client

DHCP Relay Agent send "Reply" message to the Client which includes:

- Source Address: Link Local IP address of the Relay Agent interface toward the Client
- Destination Address: Link Local IP address of Client
- Message type: REPLY

- Server ID:
  ◦ DUID of the Server: in case of Cisco Router, it can be verified by using "show ipv6 dhcp" command
- Client ID:

  ◦ DUID of the Client

  ◦ IAID of the Client
- Status Message: success

This is an example of the captured information:

```
LC/0/0/CPU0:Sep 5 15:39:21.229 : dhcpv6d[159]: DHCPV6 PACKET: TP765: PKT IPv6 DHCP: Det pkt cntents
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP762: PKT: src:fe80::8678:acff:fe34:dafa
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP758: PKT: type: REPLY dhcp->type:7 dhcp
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:SERVERID(2) optlen:10
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 00030001c8f9f98c3e80
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:CLIENTID(1) optlen:14
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP725: PKT: duidbuf: 000100011f3c6ebb54ee
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:STATUS-CODE(13) optlen
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP740: PKT: status message:Status_code:SU
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP739: PKT:
LC/0/0/CPU0:Sep 5 15:39:21.230 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IA-NA(3) optlen:53
LC/0/0/CPU0:Sep 5 15:39:21.231 : dhcpv6d[159]: DHCPV6 PACKET: TP748: PKT: IAID 0x0x354ee75 (55897717) T
LC/0/0/CPU0:Sep 5 15:39:21.231 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:STATUS-CODE(13) optlen
LC/0/0/CPU0:Sep 5 15:39:21.231 : dhcpv6d[159]: DHCPV6 PACKET: TP740: PKT: status message:
LC/0/0/CPU0:Sep 5 15:39:21.231 : dhcpv6d[159]: DHCPV6 PACKET: TP739: PKT: Status_code:SUCCESS << DHCP S
LC/0/0/CPU0:Sep 5 15:39:21.231 : dhcpv6d[159]: DHCPV6 PACKET: TP723: PKT: optype:IAADDR(5) optlen:24
LC/0/0/CPU0:Sep 5 15:39:21.232 : dhcpv6d[159]: DHCPV6 PACKET: TP729: PKT: IPV6 addr:2002:50:50:50:2cdd:
LC/0/0/CPU0:Sep 5 15:39:21.232 : dhcpv6d[159]: DHCPV6 PACKET: TP730: PKT: preferred
LC/0/0/CPU0:Sep 5 15:39:21.232 : dhcpv6d[159]: DHCPV6 PACKET: TP769: PKT: 0
LC/0/0/CPU0:Sep 5 15:39:21.232 : dhcpv6d[159]: DHCPV6 PACKET: TP731: PKT: valid
LC/0/0/CPU0:Sep 5 15:39:21.232 : dhcpv6d[159]: DHCPV6 PACKET: TP733: PKT: len:0
```