Implementing DHCP for IPv6

First Published: June 26, 2006
Last Updated: June 26, 2006

The “Implementing DHCP for IPv6” module describes how to configure Dynamic Host Configuration Protocol (DHCP) for IPv6 prefix delegation on your networking devices. General prefixes can be defined in several ways: manually, based on a 6to4 interface, and dynamically, from a prefix received by a DHCP for IPv6 prefix delegation client.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the “Feature Information for Implementing DHCP for IPv6” section on page 43 or the “Start Here: Cisco IOS Software Release Specifics for IPv6 Features” document.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

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Prerequisites for Implementing DHCP for IPv6

This document assumes that you are familiar with IPv4. See the publications referenced in the "Additional References" section for IPv4 configuration and command reference information.

Restrictions for Implementing DHCP for IPv6

Cisco IOS Release 12.0S provides IPv6 support on Cisco 12000 series Internet routers and Cisco 10720 Internet routers only.

Information About Implementing DHCP for IPv6

To configure DHCP for IPv6 for Cisco IOS software, you must understand the following concept:

- DHCP for IPv6 Prefix Delegation, page 22

DHCP for IPv6 Prefix Delegation

The DHCP for IPv6 prefix delegation feature can be used to manage link, subnet, and site addressing changes. DHCP for IPv6 can be used in environments to deliver stateful and stateless information:

- Stateful—Address assignment is centrally managed and clients must obtain configuration information not available through protocols such as address autoconfiguration and neighbor discovery.
- Stateless—Stateless configuration parameters do not require a server to maintain any dynamic state for individual clients, such as Domain Name System (DNS) server addresses and domain search list options.

The DHCP for IPv6 implementation in Cisco IOS Release 12.3(4)T and Cisco IOS Release 12.0(32)S support only stateless address assignment.

Extensions to DHCP for IPv6 also enable prefix delegation, through which an Internet service provider (ISP) can automate the process of assigning prefixes to a customer for use within the customer's network. Prefix delegation occurs between a provider edge (PE) device and customer premises equipment (CPE), using the DHCP for IPv6 prefix delegation option. Once the ISP has delegated prefixes to a customer, the customer may further subnet and assign prefixes to the links in the customer's network.

Configuring Nodes Without Prefix Delegation

Stateless DHCP for IPv6 allows DHCP for IPv6 to be used for configuring a node with parameters that do not require a server to maintain any dynamic state for the node. The use of stateless DHCP is controlled by router advertisement (RA) messages multicated by routers. The Cisco IOS DHCP for IPv6 client will invoke stateless DHCP for IPv6 when it receives an appropriate RA. The Cisco IOS DHCP for IPv6 server will respond to a stateless DHCP for IPv6 request with the appropriate configuration parameters, such as the DNS servers and domain search list options.

Client and Server Identification

Each DHCP for IPv6 client and server is identified by a DHCP unique identifier (DUID). The DUID is carried in the client identifier and server identifier options. The DUID is unique across all DHCP clients and servers, and it is stable for any specific client or server. DHCP for IPv6 uses DUIDs based on link-layer addresses for both the client and server identifier. The device uses the MAC address from the lowest-numbered interface to form the DUID. The network interface is assumed to be permanently attached to the device.

Rapid Commit

The DHCP for IPv6 client can obtain configuration parameters from a server either through a rapid two-message exchange (solicit, reply) or through a normal four-message exchange (solicit, advertise, request, reply). By default, the four-message exchange is used. When the rapid-commit option is enabled by both client and server, the two-message exchange is used.

DHCP for IPv6 Client, Server, and Relay Functions

The DHCP for IPv6 client, server, and relay functions are mutually exclusive on an interface. When one of these functions is already enabled and a user tries to configure a different function on the same interface, one of the following messages is displayed: “Interface is in DHCP client mode,” “Interface is in DHCP server mode,” or “Interface is in DHCP relay mode.”

Client Function

The DHCP for IPv6 client function can be enabled on individual IPv6-enabled interfaces.

The DHCP for IPv6 client can request and accept those configuration parameters that do not require a server to maintain any dynamic state for individual clients, such as DNS server addresses and domain search list options. The DHCP for IPv6 client will configure the local Cisco IOS stack with the received information.

The DHCP for IPv6 client can also request the delegation of prefixes. The prefixes acquired from a delegating router will be stored in a local IPv6 general prefix pool. The prefixes in the general prefix pool can then be referred to from other applications; for example, the general prefix pools can be used to number router downstream interfaces.

Server Selection

A DHCP for IPv6 client builds a list of potential servers by sending a solicit message and collecting advertise message replies from servers. These messages are ranked based on preference value, and servers may add a preference option to their advertise messages explicitly stating their preference value. If the client needs to acquire prefixes from servers, only servers that have advertised prefixes are considered.

IAPD and IAID

An Identity Association for Prefix Delegation (IAPD) is a collection of prefixes assigned to a requesting router. A requesting router may have more than one IAPD; for example, one for each of its interfaces.

Each IAPD is identified by an identity association identification (IAID). The IAID is chosen by the requesting router and is unique among the IAPD IAIDs on the requesting router. IAIDs are made consistent across reboots by using information from the associated network interface, which is assumed to be permanently attached to the device.

Server Function

The DHCP for IPv6 server function can be enabled on individual IPv6-enabled interfaces.

The DHCP for IPv6 server can provide those configuration parameters that do not require the server to maintain any dynamic state for individual clients, such as DNS server addresses and domain search list options. The DHCP for IPv6 server may be configured to perform prefix delegation.

All the configuration parameters for clients are independently configured into DHCP for IPv6 configuration pools, which are stored in NVRAM. A configuration pool can be associated with a particular DHCP for IPv6 server on an interface when it is started. Prefixes to be delegated to clients may be specified either as a list of preassigned prefixes for a particular client or as IPv6 local prefix pools that are also stored in NVRAM. The list of manually configured prefixes or IPv6 local prefix pools can be referenced and used by DHCP for IPv6 configuration pools.

The DHCP for IPv6 server maintains an automatic binding table in memory to track the assignment of some configuration parameters, such as prefixes between the server and its clients. The automatic bindings can be stored permanently in the database agent, which can be, for example, a remote TFTP server or local NVRAM file system.

Configuration Information Pool

A DHCP for IPv6 configuration information pool is a named entity that includes information about available configuration parameters and policies that control assignment of the parameters to clients from the pool. A pool is configured independently of the DHCP for IPv6 service and is associated with the DHCP for IPv6 service through the command-line interface (CLI).

Each configuration pool can contain the following configuration parameters and operational information:

- Prefix delegation information, which could include:
  - A prefix pool name and associated preferred and valid lifetimes
  - A list of available prefixes for a particular client and associated preferred and valid lifetimes
- A list of IPv6 addresses of DNS servers
- A domain search list, which is a string containing domain names for DNS resolution

Prefix Assignment

A prefix-delegating router (DHCP for IPv6 server) selects prefixes to be assigned to a requesting router (DHCP for IPv6 client) upon receiving a request from the client. The server can select prefixes for a requesting client using static assignment and dynamic assignment mechanisms. Administrators can manually configure a list of prefixes and associated preferred and valid lifetimes for an IAPD of a specific client that is identified by its DUID.

When the delegating router receives a request from a client, it checks if there is a static binding configured for the IAPD in the client's message. If a static binding is present, the prefixes in the binding are returned to the client. If no such a binding is found, the server attempts to assign prefixes for the client from other sources.

The Cisco IOS DHCP for IPv6 server can assign prefixes dynamically from an IPv6 local prefix pool. When the server receives a prefix request from a client, it attempts to obtain unassigned prefixes from the pool. After the client releases the previously assigned prefixes, the server returns them to the pool for reassignment.

An IPv6 prefix delegating router can also select prefixes for a requesting router based on an external authority such as a RADIUS server using the Framed-IPv6-Prefix attribute. For more information on this feature, see the *Implementing ADSL and Deploying Dial Access for IPv6* module.

Automatic Binding

Each DHCP for IPv6 configuration pool has an associated binding table. The binding table contains the records about all the prefixes in the configuration pool that have been explicitly delegated to clients. Each entry in the binding table contains the following information:

- Client DUID
- Client IPv6 address
- A list of IAPDs associated with the client
- A list of prefixes delegated to each IAPD
- Preferred and valid lifetimes for each prefix
- The configuration pool to which this binding table belongs
- The network interface on which the server that is using the pool is running

A binding table entry is automatically created whenever a prefix is delegated to a client from the configuration pool, and it is updated when the client renews, rebinds, or confirms the prefix delegation. A binding table entry is deleted when the client releases all the prefixes in the binding voluntarily, all prefixes' valid lifetimes have expired, or administrators run the **clear ipv6 dhcp binding** command.

Binding Database

The automatic bindings are maintained in RAM and can be saved to some permanent storage so that the information about configuration such as prefixes assigned to clients is not lost after a system reload or power down. The bindings are stored as text records for easy maintenance. Each record contains the following information:

- DHCP for IPv6 pool name from which the configuration was assigned to the client
- Interface identifier from which the client requests were received
- The client IPv6 address
- The client DUID
- IAID of the IAPD
- Prefix delegated to the client
- The prefix length
- The prefix preferred lifetime in seconds
- The prefix valid lifetime in seconds
- The prefix expiration time stamp
- Optional local prefix pool name from which the prefix was assigned

At the beginning of the file, before the text records, a time stamp records the time when the database is written and a version number, which helps differentiate between newer and older databases. At the end of the file, after the text records, the text string "*end*" is stored to detect file truncation.

The permanent storage to which the binding database is saved is called the database agent. Database agents include FTP and TFTP servers, RCP, flash file system, and NVRAM.

DHCP Relay Agent

A DHCP relay agent, which may reside on the client's link, is used to relay messages between the client and server. DHCP relay agent operation is transparent to the client. A client locates a DHCP server using a reserved, link-scoped multicast address. Therefore, it is a requirement for direct communication between the client and the server that the client and the server be attached to the same link. However, in some situations in which ease of management, economy, or scalability is a concern, it is desirable to allow a DHCP client to send a message to a DHCP server that is not connected to the same link.

How to Implement DHCP for IPv6

The tasks in the following sections explain how to implement DHCP for IPv6:

- Configuring the DHCP for IPv6 Server Function, page 26
- Configuring the DHCP for IPv6 Client Function, page 28
- Configuring the DHCP for IPv6 Relay Agent, page 29
- Configuring a Database Agent for the Server Function, page 29
- Configuring the Stateless DHCP for IPv6 Function, page 30
- Defining a General Prefix with the DHCP for IPv6 Prefix Delegation Client Function, page 33
- Restarting the DHCP for IPv6 Client on an Interface, page 34
- Deleting Automatic Client Bindings from the DHCP for IPv6 Binding Table, page 34
- Troubleshooting DHCP for IPv6, page 35

Configuring the DHCP for IPv6 Server Function

This task explains how to create and configure the DHCP for IPv6 configuration pool and associate the pool with a server on an interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 dhcp pool** *poolname*
4. **domain-name** *domain*
5. **dns-server** *ipv6-address*
6. **prefix-delegation** *ipv6-prefix/prefix-length client-DUID* [**iaid** *iaid*] [*lifetime*]
7. **prefix-delegation pool** *poolname* [**lifetime** {*valid-lifetime* | *preferred-lifetime*}]
8. **exit**

9. **interface** *type number*
10. **ipv6 dhcp server** *poolname* [**rapid-commit**] [**preference** *value*] [**allow-hint**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ipv6 dhcp pool** *poolname* **Example:** `Router(config)# ipv6 dhcp pool pool1`	Configures a DHCP for IPv6 configuration information pool and enters DHCP for IPv6 pool configuration mode.
Step 4	**domain-name** *domain* **Example:** `Router(config-dhcp)# domain-name example.com`	Configures a domain name for a DHCP for IPv6 client.
Step 5	**dns-server** *ipv6-address* **Example:** `Router(config-dhcp)# dns-server 2001:0DB8:3000:3000::42`	Specifies the DNS IPv6 servers available to a DHCP for IPv6 client.
Step 6	**prefix-delegation** *ipv6-prefix/prefix-length client-DUID* [**iaid** *iaid*] [*lifetime*] **Example:** `Router(config-dhcp)# prefix-delegation 2001:0DB8:1263::/48 0005000400F1A4D070D03`	Specifies a manually configured numeric prefix to be delegated to a specified client's IAPD.
Step 7	**prefix-delegation pool** *poolname* [**lifetime** {*valid-lifetime* | *preferred-lifetime*}] **Example:** `Router(config-dhcp)# prefix-delegation pool prefix-pool 1800 60`	Specifies a named IPv6 local prefix pool from which prefixes are delegated to DHCP for IPv6 clients.
Step 8	**exit** **Example:** `Router(config-dhcp)# exit`	Exits DHCP for IPv6 pool configuration mode configuration mode, and returns the router to global configuration mode.

	Command or Action	Purpose
Step 9	**interface** *type number* **Example:** `Router(config)# interface serial 3`	Specifies an interface type and number, and places the router in interface configuration mode.
Step 10	**ipv6 dhcp server** *poolname* [**rapid-commit**] [**preference** *value*] [**allow-hint**] **Example:** `Router(config-if)# ipv6 dhcp server dhcp-pool`	Enables DHCP for IPv6 on an interface.

Configuring the DHCP for IPv6 Client Function

General prefixes can be defined dynamically from a prefix received by a DHCP for IPv6 prefix delegation client. This task shows how to configure the DHCP for IPv6 client function on an interface and enable prefix delegation on an interface. The delegated prefix is stored in a general prefix.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ipv6 dhcp client pd** {*prefix-name* | **hint** *ipv6-prefix*} [**rapid-commit**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 0/0`	Specifies an interface type and number, and places the router in interface configuration mode.
Step 4	**ipv6 dhcp client pd** {*prefix-name* | **hint** *ipv6-prefix*} [**rapid-commit**] **Example:** `Router(config-if)# ipv6 dhcp client pd dhcp-prefix`	Enables the DHCP for IPv6 client process and enables a request for prefix delegation through a specified interface.

Configuring the DHCP for IPv6 Relay Agent

This task describes how to enable the DHCP for IPv6 relay agent function and specify relay destination addresses on an interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ipv6 dhcp relay destination** *ipv6-address* [*interface-type interface-number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 4/2`	Specifies an interface type and number, and places the router in interface configuration mode.
Step 4	**ipv6 dhcp relay destination** *ipv6-address* [*interface-type interface-number*] **Example:** `Router(config-if) ipv6 dhcp relay destination FE80::250:A2FF:FEBF:A056 ethernet 4/3`	Specifies a destination address to which client messages are forwarded and enables DHCP for IPv6 relay service on the interface.

Configuring a Database Agent for the Server Function

This task shows how to configure a DHCP for IPv6 binding database agent for the server function.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 dhcp database** *agent-URL* [**write-delay** *seconds*] [**timeout** *seconds*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ipv6 dhcp database** *agent-URL* [**write-delay** *seconds*] [**timeout** *seconds*] **Example:** `Router(config)# ipv6 dhcp database tftp://10.0.0.1/dhcp-binding`	Specifies DHCP for IPv6 binding database agent parameters.

Configuring the Stateless DHCP for IPv6 Function

The following tasks describe how to use the DHCP for IPv6 function to configure clients with information about the name lookup system. The server maintains no state related to clients; for example, no prefix pools and records of allocation are maintained. Therefore, this function is "stateless" DHCP for IPv6.

- Configuring the Stateless DHCP for IPv6 Server, page 30
- Configuring the Stateless DHCP for IPv6 Client, page 32
- Enabling Processing of Packets with Source Routing Header Options, page 32

Configuring the Stateless DHCP for IPv6 Server

The following task describes how to configure the stateless DHCP for IPv6 server.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 dhcp pool** *poolname*
4. **dns-server** *ipv6-address*
5. **domain-name** *domain*
6. **exit**
7. **interface** *type number*
8. **ipv6 dhcp server** *poolname* [**rapid-commit**] [**preference** *value*] [**allow-hint**]
9. **ipv6 nd other-config-flag**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ipv6 dhcp pool** *poolname* **Example:** `Router(config)# ipv6 dhcp pool dhcp-pool`	Configures a DHCP for IPv6 configuration information pool and enters DHCP for IPv6 pool configuration mode.
Step 4	**dns-server** *ipv6-address* **Example:** `Router(config-dhcp) dns-server 2001:0DB8:3000:3000::42`	Specifies the DNS IPv6 servers available to a DHCP for IPv6 client.
Step 5	**domain-name** *domain* **Example:** `Router(config-dhcp)# domain-name domain1.com`	Configures a domain name for a DHCP for IPv6 client.
Step 6	**exit** **Example:** `Router(config-dhcp)# exit`	Exits DHCP for IPv6 pool configuration mode configuration mode, and returns the router to global configuration mode.
Step 7	**interface** *type number* **Example:** `Router(config)# interface serial 3`	Specifies an interface type and number, and places the router in interface configuration mode.
Step 8	**ipv6 dhcp server** *poolname* [**rapid-commit**] [**preference** *value*] [**allow-hint**] **Example:** `Router(config-if)# ipv6 dhcp server dhcp-pool`	Enables DHCP for IPv6 on an interface.
Step 9	**ipv6 nd other-config-flag** **Example:** `Router(config-if)# ipv6 nd other-config-flag`	Sets the “other stateful configuration” flag in IPv6 RAs.

Configuring the Stateless DHCP for IPv6 Client

The following task describes how to configure the stateless DHCP for IPv6 client.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ipv6 address autoconfig** [**default**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface serial 3`	Specifies an interface type and number, and places the router in interface configuration mode.
Step 4	**ipv6 address autoconfig** [**default**] **Example:** `Router(config-if)# ipv6 address autoconfig`	Enables automatic configuration of IPv6 addresses using stateless autoconfiguration on an interface and enables IPv6 processing on the interface.

Enabling Processing of Packets with Source Routing Header Options

The following task describes how to enable the processing of packets with source routing header options.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 source-route**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ipv6 source-route** **Example:** `Router(config)# ipv6 source-route`	Enables processing of the IPv6 type 0 routing header.

Defining a General Prefix with the DHCP for IPv6 Prefix Delegation Client Function

The following task describes how to configure the DHCP for IPv6 client function on an interface and enable prefix delegation on an interface. The delegated prefix is stored in a general prefix.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ipv6 dhcp client pd** {*prefix-name* | **hint** *ipv6-prefix*} [**rapid-commit**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 0/0`	Specifies an interface type and number, and places the router in interface configuration mode.
Step 4	**ipv6 dhcp client pd** {*prefix-name* | **hint** *ipv6-prefix*} [**rapid-commit**] **Example:** `Router(config-if)# ipv6 dhcp client pd dhcp-prefix`	Enables the DHCP for IPv6 client process and enables a request for prefix delegation through a specified interface. The delegated prefix is stored in the general prefix *prefix-name* argument.

Restarting the DHCP for IPv6 Client on an Interface

This task explains how to restart the DHCP for IPv6 client on a specified interface after first releasing and unconfiguring previously acquired prefixes and other configuration options.

SUMMARY STEPS

1. **enable**
2. **clear ipv6 dhcp client** *interface-type interface-number*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**clear ipv6 dhcp client** *interface-type interface-number* **Example:** `Router# clear ipv6 dhcp client Ethernet 1/0`	Restarts DHCP for IPv6 client on an interface.

Deleting Automatic Client Bindings from the DHCP for IPv6 Binding Table

This task explains how to delete automatic client bindings from the DHCP for IPv6 binding table.

SUMMARY STEPS

1. **enable**
2. **clear ipv6 dhcp binding** [*ipv6-address*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**clear ipv6 dhcp binding** [*ipv6-address*] **Example:** `Router# clear ipv6 dhcp binding`	Deletes automatic client bindings from the DHCP for IPv6 binding table.

Troubleshooting DHCP for IPv6

This task provides commands you can use as needed to troubleshoot your DHCP for IPv6 configuration.

SUMMARY STEPS

1. **enable**
2. **debug ipv6 dhcp** [**detail**]
3. **debug ipv6 dhcp database**
4. **debug ipv6 dhcp relay**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**debug ipv6 dhcp** [**detail**] **Example:** `Router# debug ipv6 dhcp`	Enables debugging for DHCP for IPv6.
Step 3	**debug ipv6 dhcp database** **Example:** `Router# debug ipv6 dhcp database`	Enables debugging for the DHCP for IPv6 binding database.
Step 4	**debug ipv6 dhcp relay** **Example:** `Router# debug ipv6 dhcp relay`	Enables DHCP for IPv6 relay agent debugging.

Verifying DHCP for IPv6 Configuration and Operation

This task explains how to display information to verify DHCP for IPv6 configuration and operation. These commands do not need to be entered in any specific order.

SUMMARY STEPS

1. **enable**
2. **show ipv6 dhcp**
3. **show ipv6 dhcp binding** [*ipv6-address*]
4. **show ipv6 dhcp database** [*agent-URL*]
5. **show ipv6 dhcp interface** [*interface-type interface-number*]
6. **show ipv6 dhcp pool** [*poolname*]
7. **show running-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router# enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ipv6 dhcp** **Example:** `Router# show ipv6 dhcp`	Displays the DUID on a specified device.
Step 3	**show ipv6 dhcp binding** [*ipv6-address*] **Example:** `Router# show ipv6 dhcp binding`	Displays automatic client bindings from the DHCP for IPv6 database.
Step 4	**show ipv6 dhcp database** [*agent-URL*] **Example:** `Router# show ipv6 dhcp database`	Displays the DHCP for IPv6 binding database agent information.
Step 5	**show ipv6 dhcp interface** [*interface-type interface-number*] **Example:** `Router# show ipv6 dhcp interface`	Displays DHCP for IPv6 interface information.

	Command or Action	Purpose
Step 6	**show ipv6 dhcp pool** [*poolname*] **Example:** `Router# show ipv6 dhcp pool`	Displays DHCP for IPv6 configuration pool information.
Step 7	**show running-config** **Example:** `Router# show running-config`	Displays the current configuration running on the router.

Examples

This section provides the following output examples:

- Sample Output for the show ipv6 dhcp Command, page 37
- Sample Output for the show ipv6 dhcp binding Command, page 37
- Sample Output for the show ipv6 dhcp database Command, page 37
- Sample Output for the show ipv6 dhcp interface Command, page 38
- Sample Output for the show ipv6 dhcp pool Command, page 39

Sample Output for the show ipv6 dhcp Command

The following example from the **show ipv6 dhcp** command shows the DUID of the device:

```
Router# show ipv6 dhcp

This device's DHCPv6 unique identifier(DUID): 000300010002FCA5DC1C
```

Sample Output for the show ipv6 dhcp binding Command

In the following example, the **show ipv6 dhcp binding** command shows information about two clients, including their DUIDs, IAPDs, prefixes, and preferred and valid lifetimes:

```
Router# show ipv6 dhcp binding

Client: FE80::202:FCFF:FEA5:DC39 (Ethernet2/1)
  DUID: 000300010002FCA5DC1C
  IA PD: IA ID 0x00040001, T1 0, T2 0
    Prefix: 3FFE:C00:C18:11::/68
            preferred lifetime 180, valid lifetime 12345
            expires at Nov 08 2002 02:24 PM (12320 seconds)
Client: FE80::202:FCFF:FEA5:C039 (Ethernet2/1)
  DUID: 000300010002FCA5C01C
  IA PD: IA ID 0x00040001, T1 0, T2 0
    Prefix: 3FFE:C00:C18:1::/72
            preferred lifetime 240, valid lifetime 54321
            expires at Nov 09 2002 02:02 AM (54246 seconds)
    Prefix: 3FFE:C00:C18:2::/72
            preferred lifetime 300, valid lifetime 54333
            expires at Nov 09 2002 02:03 AM (54258 seconds)
    Prefix: 3FFE:C00:C18:3::/72
            preferred lifetime 280, valid lifetime 51111
```

Sample Output for the show ipv6 dhcp database Command

In the following example, the **show ipv6 dhcp database** command provides information on the binding database agents TFTP, NVRAM, and flash:

```
Router# show ipv6 dhcp database

Database agent tftp://172.19.216.133/db.tftp:
  write delay: 69 seconds, transfer timeout: 300 seconds
  last written at Jan 09 2003 01:54 PM,
     write timer expires in 56 seconds
  last read at Jan 06 2003 05:41 PM
  successful read times 1
  failed read times 0
  successful write times 3172
  failed write times 2
Database agent nvram:/dhcpv6-binding:
  write delay: 60 seconds, transfer timeout: 300 seconds
  last written at Jan 09 2003 01:54 PM,
     write timer expires in 37 seconds
  last read at never
  successful read times 0
  failed read times 0
  successful write times 3325
  failed write times 0
Database agent flash:/dhcpv6-db:
  write delay: 82 seconds, transfer timeout: 3 seconds
  last written at Jan 09 2003 01:54 PM,
    write timer expires in 50 seconds
  last read at never
  successful read times 0
  failed read times 0
  successful write times 2220
  failed write times 614
```

Sample Output for the show ipv6 dhcp interface Command

The following is sample output from the **show ipv6 dhcp interface** command. In the first example, the command is used on a router that has an interface acting as a DHCP for IPv6 server. In the second example, the command is used on a router that has an interface acting as a DHCP for IPv6 client:

```
Router1# show ipv6 dhcp interface

Ethernet2/1 is in server mode
  Using pool: svr-p1
  Preference value: 20
  Rapid-Commit is disabled

Router2# show ipv6 dhcp interface

Ethernet2/1 is in client mode
  State is OPEN (1)
  List of known servers:
    Address: FE80::202:FCFF:FEA1:7439, DUID 000300010002FCA17400
    Preference: 20
      IA PD: IA ID 0x00040001, T1 120, T2 192
        Prefix: 3FFE:C00:C18:1::/72
                preferred lifetime 240, valid lifetime 54321
                expires at Nov 08 2002 09:10 AM (54319 seconds)
        Prefix: 3FFE:C00:C18:2::/72
                preferred lifetime 300, valid lifetime 54333
                expires at Nov 08 2002 09:11 AM (54331 seconds)
        Prefix: 3FFE:C00:C18:3::/72
                preferred lifetime 280, valid lifetime 51111
                expires at Nov 08 2002 08:17 AM (51109 seconds)
      DNS server: 2001:0DB8:1001::1
      DNS server: 2001:0DB8:1001::2
      Domain name: example1.net
      Domain name: example2.net
```

```
      Domain name: example3.net
    Prefix name is cli-p1
    Rapid-Commit is enabled
```

Sample Output for the show ipv6 dhcp pool Command

In the following example, the **show ipv6 dhcp pool** command provides information on the configuration pool named svr-p1, including the static bindings, prefix information, the DNS server, and the domain names found in the svr-p1 pool:

```
Router# show ipv6 dhcp pool

DHCPv6 pool: svr-p1
  Static bindings:
    Binding for client 000300010002FCA5C01C
      IA PD: IA ID 00040002,
        Prefix: 3FFE:C00:C18:3::/72
                preferred lifetime 604800, valid lifetime 2592000
      IA PD: IA ID not specified; being used by 00040001
        Prefix: 3FFE:C00:C18:1::/72
                preferred lifetime 240, valid lifetime 54321
        Prefix: 3FFE:C00:C18:2::/72
                preferred lifetime 300, valid lifetime 54333
        Prefix: 3FFE:C00:C18:3::/72
                preferred lifetime 280, valid lifetime 51111
  Prefix from pool: local-p1, Valid lifetime 12345, Preferred lifetime 180
  DNS server: 2001:0DB8:1001::1
  DNS server: 2001:0DB8:1001::2
  Domain name: example1.net
  Domain name: example2.net
  Domain name: example3.net
Active clients: 2
Current configuration : 22324 bytes
!
! Last configuration change at 14:59:38 PST Tue Jan 16 2001
! NVRAM config last updated at 04:25:39 PST Tue Jan 16 2001 by bird
!
hostname Router
!
ip cef
ipv6 unicast-routing
ipv6 cef
ipv6 cef accounting prefix-length
!
!
interface Ethernet0
 ip address 10.4.9.11 255.0.0.0
 media-type 10BaseT
 ipv6 address 2001:0DB8:C18:1::/64 eui-64
```

Configuration Examples for Implementing DHCP for IPv6

This section provides the following DHCP for IPv6 mapping configuration examples:

- Configuring the DHCP for IPv6 Server Function: Example, page 40
- Configuring the DHCP for IPv6 Client Function: Example, page 40
- Configuring a Database Agent for the Server Function: Example, page 40
- Configuring the Stateless DHCP for IPv6 Function: Example, page 41

Configuring the DHCP for IPv6 Server Function: Example

DHCP for IPv6 clients are connected to this server on Ethernet interface 0/0. The server is configured to use parameters from the DHCP pool called dhcp-pool. This pool provides clients with the IPv6 address of a DNS server and the domain name to be used. It also specifies that prefixes can be delegated from the prefix pool called client-prefix-pool1. The prefixes delegated will have valid and preferred lifetimes of 1800 and 600 seconds. The prefix pool named client-prefix-pool1 has a prefix of length /40 from which it will delegate (sub)prefixes of length /48.

```
ipv6 dhcp pool dhcp-pool
 prefix-delegation pool client-prefix-pool1 lifetime 1800 600
 dns-server 2001:0DB8:3000:3000::42
 domain-name examplecom
!
interface Ethernet0/0
 description downlink to clients
 ipv6 address FEC0:240:104:2001::139/64
 ipv6 dhcp server dhcp-pool
!
ipv6 local pool client-prefix-pool1 2001:0DB8:1200::/40 48
```

Configuring the DHCP for IPv6 Client Function: Example

This DHCP for IPv6 client has three interfaces: Ethernet interface 0/0 is the upstream link to a service provider, which has a DHCP for IPv6 server function enabled. The FastEthernet interfaces 0/0 and 0/1 are links to local networks.

The upstream interface, Ethernet interface 0/0, has the DHCP for IPv6 client function enabled. Prefixes delegated by the provider are stored in the general prefix called prefix-from-provider.

The local networks, FastEthernet interfaces 0/0 and 0/1, both assign interface addresses based on the general prefix called prefix-from-provider. The leftmost bits of the addresses come from the general prefix, and the rightmost bits are specified statically.

```
interface Ethernet 0/0
 description uplink to provider DHCP IPv6 server
 ipv6 dhcp client pd prefix-from-provider
!
interface FastEthernet 0/0
 description local network 0
 ipv6 address prefix-from-provider ::5:0:0:0:100/64
!
interface FastEthernet 0/1
 description local network 1
 ipv6 address prefix-from-provider ::6:0:0:0:100/64
```

Configuring a Database Agent for the Server Function: Example

The DHCP for IPv6 server is configured to store table bindings to the file named dhcp-binding on the server at address 10.0.0.1 using the TFTP protocol. The bindings are saved every 120 seconds.

```
ipv6 dhcp database tftp://10.0.0.1/dhcp-binding write-delay 120
```

Configuring the Stateless DHCP for IPv6 Function: Example

This example uses the DHCP for IPv6 function to configure clients with information about the name lookup system. The server is configured with a DHCP pool, which contains name lookup information to be passed to clients. It does not need to contain a prefix pool. This DHCP pool is attached to the access link to customers (Ethernet0/0) using the **ipv6 dhcp server** command. The access link also has the **ipv6 nd other-config-flag** command enabled. RA messages sent from this interface will inform clients that they should use DHCP for IPv6 for "other" (for example, nonaddress) configuration information.

```
ipv6 dhcp pool dhcp-pool
 dns-server 2001:0DB8:A:B::1
 dns-server 2001:0DB8:3000:3000::42
 domain-name example.com
!
interface Ethernet0/0
 description Access link down to customers
 ipv6 address 2001:0DB8:1234:42::1/64
 ipv6 nd other-config-flag
 ipv6 dhcp server dhcp-pool
```

The client has no obvious DHCP for IPv6 configuration. However, the **ipv6 address autoconfig** command on the uplink to the service provider (Ethernet 0/0) causes two things to happen:

- Addresses are autoconfigured on the interface, based on prefixes in RA messages received from the server.
- If received RA messages have the "other configuration" flag set, the interface will attempt to acquire other (for example, nonaddress) configuration from any DHCP for IPv6 servers.

```
interface Ethernet 0/0
 description Access link up to provider
 ipv6 address autoconfig
```

Additional References

The following sections provide references related to the Implementing DHCP for IPv6 feature:

Related Documents

Related Topic	Document Title
IPv6 supported feature list	*Start Here: Cisco IOS Software Release Specifics for IPv6 Features*
IPv6 basic connectivity	*Implementing IPv6 Addressing and Basic Connectivity*
IPv6 prefix delegation	• *Implementing IPv6 Addressing and Basic Connectivity* • *Implementing ADSL and Deploying Dial Access for IPv6*
IPv6 commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS IPv6 Command Reference*
IPv4 configuration and command reference information	Cisco IOS Configuration Guides and Command References, Release 12.4

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
RFC 3315	*Dynamic Host Configuration Protocol for IPv6*
RFC 3633	*IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6*
RFC 3646	*DNS Configuration Options for Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/techsupport

Feature Information for Implementing DHCP for IPv6

Table 1 lists the features in this module and provides links to specific configuration information. Only features that were introduced or modified in Cisco IOS Release 12.3(4)T or a later release appear in the table.

For information on a feature in this technology that is not documented here, see "Start Here: Cisco IOS Software Release Specifies for IPv6 Features."

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for Implementing DHCP for IPv6

Feature Name	Releases	Feature Information
IPv6 access services: DHCPv6 prefix delegation	12.0(32)S, 12.2(28)SB, 12.2(33)SRA, 12.2(18)SXE, 12.3(4)T, 12.4, 12.4(2)T	The DHCP for IPv6 prefix delegation feature can be used to manage link, subnet, and site addressing changes. DHCP for IPv6 can be used in environments to deliver stateful and stateless information. The following sections provide information about this feature: • DHCP for IPv6 Prefix Delegation, page 22 • Configuring the DHCP for IPv6 Server Function, page 26 • Configuring the DHCP for IPv6 Client Function, page 28 • Configuring the DHCP for IPv6 Server Function: Example, page 40 • Configuring the DHCP for IPv6 Client Function: Example, page 40
IPv6 access services: stateless DHCPv6	12.3(4)T, 12.4, 12.4(2)T	Stateless DHCP for IPv6 allows DHCP for IPv6 to be used for configuring a node with parameters that do not require a server to maintain any dynamic state for the node. The following sections provide information about this feature: • DHCP for IPv6 Prefix Delegation, page 22 • Configuring Nodes Without Prefix Delegation, page 22 • Configuring the Stateless DHCP for IPv6 Function, page 30 • Configuring the Stateless DHCP for IPv6 Function: Example, page 41
IPv6 access services: DHCP for IPv6 relay agent	12.2(28)SB, 12.3(11)T, 12.4, 12.4(2)T	A DHCP relay agent, which may reside on the client's link, is used to relay messages between the client and server. The following sections provide information about this feature: • DHCP Relay Agent, page 26 • Configuring the DHCP for IPv6 Relay Agent, page 29