Chapter 3

Configuring Neighbor Discovery

This chapter describes how to configure Neighbor Discovery (ND) on your E-series router; it contains the following sections:

Overview

Though not a true protocol, routers and hosts (nodes) use Neighbor Discovery (ND) messages to determine the link-layer addresses of neighbors that reside on attached links and to overwrite invalid cache entries. Hosts also use ND to find neighboring routers that can forward packets on their behalf.

In addition, nodes use ND to actively track the ability to reach neighbors. When a router (or the path to a router) fails, nodes actively search for alternatives to reach the destination.

IPv6 Neighbor Discovery corresponds to a number of the IPv4 protocols — ARP, ICMP Router Discovery, and ICMP Redirect. However, Neighbor Discovery provides many improvements over the IPv4 set of protocols. These improvements address the following:

- Router discovery—How a host locates routers residing on an attached link.
- Prefix discovery—How a host discovers address prefixes for destinations residing on an attached link. Nodes use prefixes to distinguish between destinations that reside on an attached link and those destinations that it can reach only through a router.
- Parameter discovery—How a node learns various parameters (link parameters or Internet parameters) that it places in outgoing packets.
- Address resolution—How a node uses only a destination IPv6 address to determine a link-layer address for destinations on an attached link.
- Next-hop determination—The algorithm that a node uses for mapping an IPv6 destination address into a neighbor IPv6 address (either the next router hop or the destination itself) to which it plans to send traffic for the destination.
- Neighbor unreachability detection—How a node determines that it can no longer reach a neighbor.
- Duplicate address detection—How a node determines whether an address is already in use by another node.

Platform Considerations

For information about modules that support Neighbor Discovery on the ERX-7xx models, ERX-14xx models, and the ERX-310 router:

- See *ERX Module Guide, Table 1, Module Combinations* for detailed module specifications.
- See *ERX Module Guide, Appendix A, Module Protocol Support* for information about the modules that support Neighbor Discovery.

For information about modules that support Neighbor Discovery on the E120 router and the E320 router:

- See *E120 and E320 Module Guide, Table 1, Modules and IOAs* for detailed module specifications.
- See *E120 and E320 Module Guide, Appendix A, IOA Protocol Support* for information about the modules that support Neighbor Discovery.

References

For more information about Neighbor Discovery, consult the following resource:

- RFC 2461—Neighbor Discovery for IP Version 6 (IPv6) (December 1998)

You can access these and other Internet RFCs and drafts at the following URL:

http://www.ietf.org

Before You Configure Neighbor Discovery

Before you configure Neighbor Discovery, you must configure IPv6. For information about configuring IPv6, see *Chapter 2, Configuring IPv6*.

Configuring Ethernet interfaces to function with IPv6 requires Neighbor Discovery configuration for the interface.

NOTE: IPv6 Neighbor Discovery is fully supported when configured on broadcast interfaces. IPv6 neighbor discovery supports only router advertisement characteristics when configured on PPP interfaces.

Configuring Neighbor Discovery

To configure Neighbor Discovery:

1. Access an IPv6 interface.

   ```
   host1(config)#interface fastEthernet 3/0
   host1(config-if)#
   ```

2. Configure the current IPv6 interface to send neighbor solicitations and to respond with neighbor advertisements.

   ```
   host1(config)#ipv6 nd
   ```

NOTE: This command is redundant when configuring Neighbor Discovery over Ethernet, because router advertisements are automatically sent on Ethernet interfaces. However, unless explicitly enabled, IPv6 router advertisements are not sent on other types of interfaces.

3. (Optional) Configure the interface to retry sending neighbor solicitations using a specified interval.

   ```
   host1(config-if)#ipv6 nd ns-interval 500
   ```

4. (Optional) Configure the interface to assume that a neighbor is reachable for a specified time after a reachable confirmation event.

   ```
   host1(config-if)#ipv6 nd reachable-time 30000
   ```

5. (Optional) Configure the interface to suppress router advertisements, as well as replies to router solicitations.

   host1(config-if)#**ipv6 nd suppress-ra**

6. (Optional) Configure the interface to suppresses the source link-layer option in IPv6 router advertisement transmissions. This action forces neighbors to solicit the router link layer explicitly, and may prove necessary when enabling inbound load sharing across multiple link-layer addresses.

   host1(config-if)#**ipv6 nd suppress-ra-source-link-layer**

7. (Optional) Configure the interface to send router advertisements at a specified interval.

   host1(config-if)#**ipv6 nd ra-interval 500**

8. (Optional) Configure the router advertisement lifetime in seconds.

   host1(config-if)#**ipv6 nd ra-lifetime 900**

9. (Optional) Configure the router advertisement to list a specified prefix, for a valid lifetime and preferred lifetime. The following example also advertises the prefix as reachable on link and that the router can use it as part of the stateless address configuration.

   host1(config-if)#**ipv6 nd prefix-advertisement 2002:1::/64 60000 45000 onlink autoconfig**

10. (Optional) Configure the router advertisement to contain the “managed address configuration” flag.

    host1(config-if)#**ipv6 nd managed-config-flag**

11. (Optional) Configure the router advertisement to contain the “other stateful configuration” flag.

    host1(config-if)#**ipv6 nd other-config-flag**

12. (Optional) Enable active solicitations.

    host1(config-if)#**ipv6 nd active-solicitations**

Using IPv6 Profiles and RADIUS to Configure Neighbor Discovery Route Advertisements

In addition to the CLI-based configuration of Neighbor Discovery, you can also use IPv6 profiles to configure Neighbor Discovery route advertisements for dynamically configured interfaces. In addition, you can use RADIUS to configure the prefix in Neighbor Discovery route advertisements for dynamically configured interfaces.

When you configure either a profile-based or RADIUS-based Neighbor Discovery router advertisement, the following considerations apply:

- You can advertise one IPv6 prefix per interface.
- The router advertisement must have a prefix length of 64. For the Ipv6-NdRa-Prefix attribute, the prefix length is in the following format, in which 0040 indicates the prefix length of 64.

  0x 0040 xxxx xxxx xxxx xxxx

NOTE: If both an IPv6 profile and RADIUS are configured for Neighbor Discovery router advertisement, the prefix value returned in RADIUS VSA 26-129 takes precedence over the prefix specified in the IPv6 profile configuration.

IPv6 Profile-Based Configuration

The JUNOSe software enables you to use profiles to dynamically configure IPv6 interfaces. When you create an IPv6 profile, you can also include Neighbor Discovery route advertisement characteristics, which are then configured on the dynamically-created IPv6 interfaces.

You can include the following commands in IPv6 profiles to configure Neighbor Discovery route advertisement characteristics.

Command	Description
ipv6 nd	Enables Neighbor Discovery on an interface
ipv6 nd managed-config-flag	Sets the “managed address configuration” flag in IPv6 router advertisements
ipv6 nd other-config-flag	Sets the “other stateful configuration” flag in IPv6 router advertisements
ipv6 nd prefix-advertisement	Specifies which IPv6 prefixes are included in IPv6 router advertisements
ipv6 nd ra-interval	Configures the interval between IPv6 router advertisements
ipv6 nd ra-lifetime	Configures the router advertisement lifetime
ipv6 nd reachable-time	Configures the amount of time the router can reach an IPv6 node after a reachability confirmation event occurs
ipv6 nd suppress-ra	Disables router advertisement transmissions

For additional information about using IPv6 profiles to configure dynamic interfaces, see *Creating an IPv6 Profile* in *JUNOSe IP, IPv6, and IGP Configuration Guide, Chapter 2, Configuring IPv6* and *JUNOSe Link Layer Configuration Guide, Chapter 12, Configuring Dynamic Interfaces*.

RADIUS-Based Configuration

You can use RADIUS attribute Ipv6-NdRa-Prefix (VSA 26-129) to configure the prefix used in IPv6 Neighbor Discovery route advertisements. RADIUS then includes the VSA in Access-Accept messages. For information about the Ipv6-NdRa-Prefix RADIUS attribute, see *JUNOSe Broadband Access Configuration Guide, Chapter 3, Configuring RADIUS Attributes* and *JUNOSe Broadband Access Configuration Guide, Chapter 6, RADIUS Attribute Descriptions*.

ipv6 nd

- Use to enable the IPv6 Neighbor Discovery process on an interface.
- Example

  host1(config)#**interface fastEthernet 3/0**
  host1(config-if)#**ipv6 nd**

- Use the **no** version of this command to disable the Neighbor Discovery process.

ipv6 nd active-solicitations

- Use to specify that the router actively solicit neighbors that become stale (inactive). Normally, when a neighbor entry goes from a reachable state to a stale state, the router drops traffic until it resolves this neighbor entry. When enabled, the **ipv6 nd active-solicitations** command allows the router to use the stale neighbor entry while it solicits the neighbor. If the neighbor solicitation fails, the router removes the entry from the neighbor table and does not use the neighbor to forward any traffic.
- Example

  host1(config-if)#**ipv6 nd active-solicitations**

- Use the **no** version of this command to disable active solicitations.

ipv6 nd managed-config-flag

- Use to set the "managed address configuration" flag in IPv6 router advertisements.
- Example

  host1(config-if)#**ipv6 nd managed-config-flag**

- Use the **no** version of this command to clear the flag from IPv6 router advertisements.

ipv6 nd ns-interval

- Use to specify the interval, in milliseconds, between IPv6 neighbor solicitation retransmissions on an interface.
- Example

  host1(config-if)#**ipv6 nd ns-interval 500**

- Use the **no** version of this command to return the interval between neighbor solicitation retransmission to its default value (zero [0] milliseconds for router advertisements and 1000 milliseconds for Neighbor Discovery activity of the E-series router).

ipv6 nd other-config-flag

- Use to set the "other stateful configuration" flag in IPv6 router advertisements.
- Example

  host1(config-if)#**ipv6 nd other-config-flag**

- Use the **no** version of this command to clear the flag from IPv6 router advertisements.

ipv6 nd prefix-advertisement

- Use to specify which IPv6 prefixes the system includes in IPv6 router advertisements.
- Example

  host1(config-if)#**ipv6 nd prefix-advertisement 2002:1::/64 60000 45000 onlink autoconfig**

- Use the **no** version of this command to remove any prefixes from the IPv6 routing advertisements.

ipv6 nd ra-interval

- Use to specify the interval, in seconds, between IPv6 router advertisement retransmissions on an interface.
- Example

  host1(config-if)#**ipv6 nd ra-interval 500**

- Use the **no** version of this command to restore the default interval, 200 seconds.

ipv6 nd ra-lifetime

- Use to specify the router lifetime value, in seconds, in IPv6 router advertisements on an interface. The router lifetime value is the amount of time the router is considered the default router on this interface.
- Example

  host1(config-if)#**ipv6 nd ra-lifetime 900**

- Use the **no** version of this command to restore the default lifetime, 1800 seconds.

ipv6 nd reachable-time

- Use to specify the amount of time that the E-series router can reach a remote IPv6 node after some reachability confirmation event has occurred.
- Example 1—Sets the reachable-time to 30,000 milliseconds

  host1(config-if)#**ipv6 nd reachable-time 30000**

- Example 2—Sets the reachable-time to 1 hour, 10 minutes, and 45 seconds

  host1(config-if)#**ipv6 nd reachable-time 1 10 45**

- Use the **no** version of this command to restore the default value (zero [0] milliseconds for router advertisements and 3,600,000 milliseconds [1 hour] for Neighbor Discovery activity of the E-series router).

ipv6 nd suppress-ra

- Use to suppress IPv6 router advertisement transmissions on a local area network (Ethernet) interface.
- Example

  host1(config-if)#**ipv6 nd suppress-ra**

- Use the **no** version of this command to reenable the sending of IPv6 router advertisement transmissions on the LAN (Ethernet) interface

ipv6 nd suppress-ra-source-link-layer

- Use to suppress IPv6 router advertisement transmissions on a local area network (Ethernet) interface.
- Example

  host1(config-if)#**ipv6 nd suppress-ra-source-link-layer**

- Use the **no** version of this command to reenable the sending of IPv6 router advertisement transmissions on the LAN (Ethernet) interface.

Configuring Proxy Neighbor Advertisements

Much like proxy ARP, proxy Neighbor Discovery is a means by which one interface responds to a Neighbor Discovery query on behalf of another interface.

To configure proxy Neighbor Discovery:

1. Access an IPv6 interface.

   host1(config)#**interface fastEthernet 0/0**
   host1(config-if)#

2. Enable Neighbor Discovery on the current interface.

   host1(config)#**ipv6 nd**

NOTE: This command is redundant when configuring Neighbor Discovery over Ethernet, because neighbor solicitations and advertisements are automatically sent on Ethernet interfaces.

3. Enable IPv6 neighbor proxy.

   host1(config-if)#**ipv6 nd proxy**

ipv6 nd proxy

- Use to enable or disable Neighbor Discovery proxy.
- Example

  host1(config-if)#**ipv6 nd proxy**

- Use the **no** version of this command to disable Neighbor Discovery proxy.

Configuring Duplicate Address Detection Attempts

The duplicate address detection feature helps to verify that a new unicast IPv6 address is unique in the network. The router sends the IPv6 address in its neighbor solicitation messages. However, the router relies on the receiving device to understand the address duplication and does not prompt a conflict if the address already exists.

The CLI allows you to specify the number of consecutive neighbor solicitation messages that the router sends from the IPv6 interface.

ipv6 nd dad attempts

- Use to specify the number of consecutive neighbor solicitation messages that the router sends from the IPv6 interface.
- Use an attempt value of zero (0) to disable duplicate address detection on the current interface.
- The router suspends duplicate address detection on interfaces that are administratively down.
- Example

  host1(config-if)#**ipv6 nd dad attempts 10**

- Use the **no** version of this command to restore the default number of attempts to one (1).

Monitoring Neighbor Discovery

Neighbor Discovery-specific output appears in the output of various IPv6 **show** commands. For detailed information about IPv6 **show** commands and their output, see *Chapter 2, Configuring IPv6*.