Configuring IPv6 Routing

- Finding Feature Information, on page 1
- Information About Configuring IPv6 Host Functions , on page 1
- Configuration Examples for IPv6 Unicast Routing, on page 32

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

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

Information About Configuring IPv6 Host Functions

This chapter describes how to configure IPv6 host functions on the Catalyst 2960, 2960-S, and 2960-C.

Note To use IPv6 Host Functions, the switch must be running the LAN Base image.

For information about configuring IPv6 Multicast Listener Discovery (MLD) snooping, see *Configuring MLD Snooping*.

To enable dual stack environments (supporting both IPv4 and IPv6) on a Catalyst 2960 switch, you must configure the switch to use the a dual IPv4 and IPv6 switch database management (SDM) template. See the "Dual IPv4 and IPv6 Protocol Stacks" section. This template is not required on Catalyst 2960-S switches.

Note For complete syntax and usage information for the commands used in this chapter, see the Cisco IOS documentation referenced in the procedures.

Understanding IPv6

IPv4 users can move to IPv6 and receive services such as end-to-end security, quality of service (QoS), and globally unique addresses. The IPv6 address space reduces the need for private addresses and Network Address Translation (NAT) processing by border routers at network edges.

For information about how Cisco Systems implements IPv6, go to:

http://www.cisco.com/en/US/products/ps6553/products_ios_technology_home.html

For information about IPv6 and other features in this chapter

- See the *Cisco IOS IPv6 Configuration Library*.
- Use the Search field on Cisco.com to locate the Cisco IOS software documentation. For example, if you want information about static routes, you can enter *Implementing Static Routes for IPv6* in the search field to learn about static routes.

IPv6 Addresses

The switch supports only IPv6 unicast addresses. It does not support site-local unicast addresses, or anycast addresses.

The IPv6 128-bit addresses are represented as a series of eight 16-bit hexadecimal fields separated by colons in the format: n:n:n:n:n:n:n:n. This is an example of an IPv6 address:

2031:0000:130F:0000:0000:09C0:080F:130B

For easier implementation, leading zeros in each field are optional. This is the same address without leading zeros:

2031:0:130F:0:0:9C0:80F:130B

You can also use two colons (::) to represent successive hexadecimal fields of zeros, but you can use this short version only once in each address:

2031:0:130F::09C0:080F:130B

For more information about IPv6 address formats, address types, and the IPv6 packet header, see the "Implementing IPv6 Addressing and Basic Connectivity" chapter of *Cisco IOS IPv6 Configuration Library* on Cisco.com.

- IPv6 Address Formats
- IPv6 Address Type: Multicast
- IPv6 Address Output Display
- Simplified IPv6 Packet Header

Supported IPv6 Unicast Routing Features

These sections describe the IPv6 protocol features supported by the switch:

Support on the switch includes expanded address capability, header format simplification, improved support of extensions and options, and hardware parsing of the extension header. The switch supports hop-by-hop extension header packets, which are routed or bridged in software.

128-Bit Wide Unicast Addresses

The switch supports aggregatable global unicast addresses and link-local unicast addresses. It does not support site-local unicast addresses.

- Aggregatable global unicast addresses are IPv6 addresses from the aggregatable global unicast prefix. The address structure enables strict aggregation of routing prefixes and limits the number of routing table entries in the global routing table. These addresses are used on links that are aggregated through organizations and eventually to the Internet service provider.

  These addresses are defined by a global routing prefix, a subnet ID, and an interface ID. Current global unicast address allocation uses the range of addresses that start with binary value 001 (2000::/3). Addresses with a prefix of 2000::/3(001) through E000::/3(111) must have 64-bit interface identifiers in the extended unique identifier (EUI)-64 format.

- Link local unicast addresses can be automatically configured on any interface by using the link-local prefix FE80::/10(1111 1110 10) and the interface identifier in the modified EUI format. Link-local addresses are used in the neighbor discovery protocol (NDP) and the stateless autoconfiguration process. Nodes on a local link use link-local addresses and do not require globally unique addresses to communicate. IPv6 routers do not forward packets with link-local source or destination addresses to other links.

For more information, see the section about IPv6 unicast addresses in the "Implementing IPv6 Addressing and Basic Connectivity" chapter in the *Cisco IOS IPv6 Configuration Library* on Cisco.com.

DNS for IPv6

IPv6 supports Domain Name System (DNS) record types in the DNS name-to-address and address-to-name lookup processes. The DNS AAAA resource record types support IPv6 addresses and are equivalent to an A address record in IPv4. The switch supports DNS resolution for IPv4 and IPv6.

ICMPv6

The Internet Control Message Protocol (ICMP) in IPv6 generates error messages, such as ICMP destination unreachable messages, to report errors during processing and other diagnostic functions. In IPv6, ICMP packets are also used in the neighbor discovery protocol and path MTU discovery.

Neighbor Discovery

The switch supports NDP for IPv6, a protocol running on top of ICMPv6, and static neighbor entries for IPv6 stations that do not support NDP. The IPv6 neighbor discovery process uses ICMP messages and solicited-node multicast addresses to determine the link-layer address of a neighbor on the same network (local link), to verify the reachability of the neighbor, and to keep track of neighboring routers.

The switch supports ICMPv6 redirect for routes with mask lengths less than 64 bits. ICMP redirect is not supported for host routes or for summarized routes with mask lengths greater than 64 bits.

Neighbor discovery throttling ensures that the switch CPU is not unnecessarily burdened while it is in the process of obtaining the next hop forwarding information to route an IPv6 packet. The switch drops any additional IPv6 packets whose next hop is the same neighbor that the switch is actively trying to resolve. This drop avoids further load on the CPU.

Note First Hop Security in IPv6 is not supported on EtherChannels.

IPv6 Stateless Autoconfiguration and Duplicate Address Detection

The switch uses stateless autoconfiguration to manage link, subnet, and site addressing changes, such as management of host and mobile IP addresses. A host autonomously configures its own link-local address, and booting nodes send router solicitations to request router advertisements for configuring interfaces.

For more information about autoconfiguration and duplicate address detection, see the "Implementing IPv6 Addressing and Basic Connectivity" chapter of *Cisco IOS IPv6 Configuration Library* on Cisco.com.

IPv6 Applications

The switch has IPv6 support for these applications:

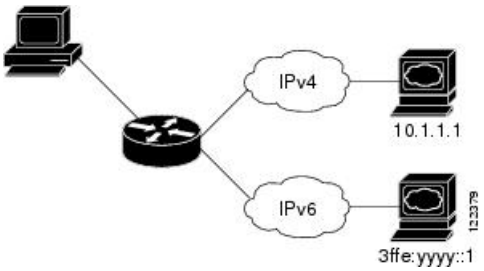
- Ping, traceroute, Telnet
- Secure Shell (SSH) over an IPv6 transport
- HTTP server access over IPv6 transport
- DNS resolver for AAAA over IPv4 transport
- Cisco Discovery Protocol (CDP) support for IPv6 addresses

For more information about managing these applications, see the *Cisco IOS IPv6 Configuration Library* on Cisco.com.

Dual IPv4 and IPv6 Protocol Stacks

This figure shows a router forwarding both IPv4 and IPv6 traffic through the same interface, based on the IP packet and destination addresses.

Figure 1: Dual IPv4 and IPv6 Support on an Interface



Use the dual IPv4 and IPv6 switch database management (SDM) template to enable IPv6 routing dual stack environments (supporting both IPv4 and IPv6). For more information about the dual IPv4 and IPv6 SDM template, see *Configuring SDM Templates*.

The dual IPv4 and IPv6 templates allow the switch to be used in dual stack environments.

- If you try to configure IPv6 without first selecting a dual IPv4 and IPv6 template, a warning message appears.
- In IPv4-only environments, the switch routes IPv4 packets and applies IPv4 QoS and ACLs in hardware. IPv6 packets are not supported.
- In dual IPv4 and IPv6 environments, the switch applies IPv4 QoS and ACLs in hardware .
- If you do not plan to use IPv6, do not use the dual stack template because this template results in less hardware memory capacity for each resource.

For more information about IPv4 and IPv6 protocol stacks, see the "Implementing IPv6 Addressing and Basic Connectivity" chapter of *Cisco IOS IPv6 Configuration Library* on Cisco.com.

SNMP and Syslog Over IPv6

To support both IPv4 and IPv6, IPv6 network management requires both IPv6 and IPv4 transports. Syslog over IPv6 supports address data types for these transports.

SNMP and syslog over IPv6 provide these features:

- Support for both IPv4 and IPv6
- IPv6 transport for SNMP and to modify the SNMP agent to support traps for an IPv6 host
- SNMP- and syslog-related MIBs to support IPv6 addressing
- Configuration of IPv6 hosts as trap receivers

For support over IPv6, SNMP modifies the existing IP transport mapping to simultaneously support IPv4 and IPv6. These SNMP actions support IPv6 transport management:

- Opens User Datagram Protocol (UDP) SNMP socket with default settings
- Provides a new transport mechanism called *SR_IPV6_TRANSPORT*
- Sends SNMP notifications over IPv6 transport
- Supports SNMP-named access lists for IPv6 transport
- Supports SNMP proxy forwarding using IPv6 transport
- Verifies SNMP Manager feature works with IPv6 transport

For information on SNMP over IPv6, including configuration procedures, see the "Managing Cisco IOS Applications over IPv6" chapter in the *Cisco IOS IPv6 Configuration Library* on Cisco.com.

For information about syslog over IPv6, including configuration procedures, see the "Implementing IPv6 Addressing and Basic Connectivity" chapter in the *Cisco IOS IPv6 Configuration Library* on Cisco.com.

HTTP(S) Over IPv6

The HTTP client sends requests to both IPv4 and IPv6 HTTP servers, which respond to requests from both IPv4 and IPv6 HTTP clients. URLs with literal IPv6 addresses must be specified in hexadecimal using 16-bit values between colons.

The accept socket call chooses an IPv4 or IPv6 address family. The accept socket is either an IPv4 or IPv6 socket. The listening socket continues to listen for both IPv4 and IPv6 signals that indicate a connection. The IPv6 listening socket is bound to an IPv6 wildcard address.

The underlying TCP/IP stack supports a dual-stack environment. HTTP relies on the TCP/IP stack and the sockets for processing network-layer interactions.

Basic network connectivity (**ping**) must exist between the client and the server hosts before HTTP connections can be made.

For more information, see the "Managing Cisco IOS Applications over IPv6" chapter in the *Cisco IOS IPv6 Configuration Library* on Cisco.com.

Configuring IPv6

Default IPv6 Configuration

Table 1: Default IPv6 Configuration

Feature	Default Setting
SDM template	Advance desktop. Default is advanced template
IPv6 addresses	None configured

Configuring IPv6 Addressing and Enabling IPv6 Routing

This section describes how to assign IPv6 addresses to individual Layer 3 interfaces and to globally forward IPv6 traffic on the switch.

Before configuring IPv6 on the switch, consider these guidelines:

- Be sure to select a dual IPv4 and IPv6 SDM template.
- In the **ipv6 address** interface configuration command, you must enter the *ipv6-address* and *ipv6-prefix* variables with the address specified in hexadecimal using 16-bit values between colons. The *prefix-length* variable (preceded by a slash [/]) is a decimal value that shows how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address).

To forward IPv6 traffic on an interface, you must configure a global IPv6 address on that interface. Configuring an IPv6 address on an interface automatically configures a link-local address and activates IPv6 for the interface. The configured interface automatically joins these required multicast groups for that link:

- solicited-node multicast group FF02:0:0:0:0:1:ff00::/104 for each unicast address assigned to the interface (this address is used in the neighbor discovery process.)
- all-nodes link-local multicast group FF02::1
- all-routers link-local multicast group FF02::2

For more information about configuring IPv6 routing, see the "Implementing Addressing and Basic Connectivity for IPv6" chapter in the *Cisco IOS IPv6 Configuration Library* on Cisco.com.

Beginning in privileged EXEC mode, follow these steps to assign an IPv6 address to a Layer 3 interface and enable IPv6 forwarding:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 2	**sdm prefer dual-ipv4-and-ipv6** {**default**} **Example:** `Switch(config)# sdm prefer dual-ipv4-and-ipv6 default`	Selects an SDM template that supports IPv4 and IPv6. • **default**—Sets the switch to the default template to balance system resources.
Step 3	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.
Step 4	**reload** **Example:** `Switch# reload`	Reloads the operating system.
Step 5	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode after the switch reloads.
Step 6	**interface** *interface-id* **Example:** `Switch(config)# interface gigabitethernet 1/0/1`	Enters interface configuration mode, and specifies the Layer 3 interface to configure.

Step 7	Use one of the following:
	• **ipv6 address** *ipv6-prefix/prefix length* **eui-64**
	• **ipv6 address** *ipv6-address/prefix length*
	• **ipv6 address** *ipv6-address* **link-local**
	• **ipv6 enable**
	Example:
	`Switch(config-if)# ipv6 address 2001:0DB8:c18:1::/64 eui 64`
	`Switch(config-if)# ipv6 address 2001:0DB8:c18:1::/64`
	`Switch(config-if)# ipv6 address 2001:0DB8:c18:1:: link-local`
	`Switch(config-if)# ipv6 enable`
		• Specifies a global IPv6 address with an extended unique identifier (EUI) in the low-order 64 bits of the IPv6 address. Specify only the network prefix; the last 64 bits are automatically computed from the switch MAC address. This enables IPv6 processing on the interface.
		• Manually configures an IPv6 address on the interface.
		• Specifies a link-local address on the interface to be used instead of the link-local address that is automatically configured when IPv6 is enabled on the interface. This command enables IPv6 processing on the interface.
		• Automatically configures an IPv6 link-local address on the interface, and enables the interface for IPv6 processing. The link-local address can only be used to communicate with nodes on the same link.

	Command or Action	Purpose
Step 8	**exit** **Example:** `Switch(config-if)# exit`	Returns to global configuration mode.
Step 9	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.
Step 10	**show ipv6 interface** *interface-id* **Example:** `Switch# show ipv6 interface gigabitethernet 1/0/1`	Verifies your entries.
Step 11	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

Configuring IPv6 Addressing and Enabling IPv6 Routing: Example, on page 32

Configuring IPv6 ICMP Rate Limiting (CLI)

ICMP rate limiting is enabled by default with a default interval between error messages of 100 milliseconds and a bucket size (maximum number of tokens to be stored in a bucket) of 10.

Beginning in privileged EXEC mode, follow these steps to change the ICMP rate-limiting parameters:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**ipv6 icmp error-interval** *interval* [*bucketsize*] **Example:** `Switch(config)# ipv6 icmp error-interval 50 20`	Configures the interval and bucket size for IPv6 ICMP error messages: • *interval*—The interval (in milliseconds) between tokens being added to the bucket. The range is from 0 to 2147483647 milliseconds.

	Command or Action	Purpose
		• *bucketsize*—(Optional) The maximum number of tokens stored in the bucket. The range is from 1 to 200.
Step 3	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.
Step 4	**show ipv6 interface** [*interface-id*] **Example:** `Switch# show ipv6 interface gigabitethernet 1/0/1`	Verifies your entries.
Step 5	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

Configuring IPv6 ICMP Rate Limiting: Example, on page 33

Configuring Static Routing for IPv6 (CLI)

Before configuring a static IPv6 route, you must enable routing by using the **ip routing** global configuration command, enable the forwarding of IPv6 packets by using the **ipv6 unicast-routing** global configuration command, and enable IPv6 on at least one Layer 3 interface by configuring an IPv6 address on the interface.

For more information about configuring static IPv6 routing, see the "Implementing Static Routes for IPv6" chapter in the *Cisco IOS IPv6 Configuration Library* on Cisco.com.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**ipv6 route** *ipv6-prefix/prefix length* {*ipv6-address* | *interface-id* [*ipv6-address*]} [*administrative distance*] **Example:** `Switch(config)# ipv6 route 2001:0DB8::/32`	Configures a static IPv6 route. • *ipv6-prefix*—The IPv6 network that is the destination of the static route. It can also be a hostname when static host routes are configured.

	Command or Action	Purpose
	`gigabitethernet2/0/1 130`	• */prefix length*—The length of the IPv6 prefix. A decimal value that shows how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value. • *ipv6-address*—The IPv6 address of the next hop that can be used to reach the specified network. The IPv6 address of the next hop need not be directly connected; recursion is done to find the IPv6 address of the directly connected next hop. The address must be in the form documented in RFC 2373, specified in hexadecimal using 16-bit values between colons. • *interface-id*—Specifies direct static routes from point-to-point and broadcast interfaces. With point-to-point interfaces, there is no need to specify the IPv6 address of the next hop. With broadcast interfaces, you should always specify the IPv6 address of the next hop, or ensure that the specified prefix is assigned to the link, specifying a link-local address as the next hop. You can optionally specify the IPv6 address of the next hop to which packets are sent. **Note** You must specify an *interface-id* when using a link-local address as the next hop (the link-local next hop must also be an adjacent router). • *administrative distance*—(Optional) An administrative distance. The range is 1 to 254; the default value is 1, which gives static routes precedence over any other type of route except connected routes. To configure a floating static route, use an administrative distance greater than that of the dynamic routing protocol.
Step 3	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.
Step 4	Use one of the following: • **show ipv6 static** [*ipv6-address* | *ipv6-prefix/prefix length*] [**interface** *interface-id*] [**detail**]][**recursive**] [**detail**] • **show ipv6 route static** [*updated*] **Example:**	Verifies your entries by displaying the contents of the IPv6 routing table. • **interface** *interface-id*—(Optional) Displays only those static routes with the specified interface as an egress interface. • **recursive**—(Optional) Displays only recursive static routes. The **recursive** keyword is mutually exclusive

	Command or Action	Purpose

	`Switch# show ipv6 static 2001:0DB8::/32 interface gigabitethernet2/0/1`
	
	or
	
	`Switch# show ipv6 route static`
		with the **interface** keyword, but it can be used with or without the IPv6 prefix included in the command syntax.
		• **detail**—(Optional) Displays this additional information:
		• For valid recursive routes, the output path set, and maximum resolution depth.
		• For invalid routes, the reason why the route is not valid.

Step 5	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

Configuring Static Routing for IPv6: Example, on page 33

Configuring IPv6 First Hop Security

Prerequisites for First Hop Security in IPv6

- You have configured the necessary IPv6 enabled SDM template.
- You should be familiar with the IPv6 neighbor discovery feature.

Restrictions for First Hop Security in IPv6

- The following restrictions apply when applying FHS policies to EtherChannel interfaces (Port Channels):
  - A physical port with an FHS policy attached cannot join an EtherChannel group.
  - An FHS policy cannot be attached to an physical port when it is a member of an EtherChannel group.
- By default, a snooping policy has a security-level of guard. When such a snooping policy is configured on an access switch, external IPv6 Router Advertisement (RA) or Dynamic Host Configuration Protocol for IPv6 (DHCPv6) server packets are blocked, even though the uplink port facing the router or DHCP server/relay is configured as a trusted port. To allow IPv6 RA or DHCPv6 server messages, do the following:
  - Apply an IPv6 RA-guard policy (for RA) or IPv6 DHCP-guard policy (for DHCP server messages) on the uplink port.

- Configure a snooping policy with a lower security-level, for example glean or inspect. However; configuring a lower security level is not recommended with such a snooping policy, because benefits of First Hop security features are not effective.

Information about First Hop Security in IPv6

First Hop Security in IPv6 (FHS IPv6) is a set of IPv6 security features, the policies of which can be attached to a physical interface, or a VLAN. An IPv6 software policy database service stores and accesses these policies. When a policy is configured or modified, the attributes of the policy are stored or updated in the software policy database, then applied as was specified. The following IPv6 policies are currently supported:

- IPv6 Snooping Policy—IPv6 Snooping Policy acts as a container policy that enables most of the features available with FHS in IPv6.
- IPv6 FHS Binding Table Content—A database table of IPv6 neighbors connected to the switch is created from information sources such as Neighbor Discovery (ND) protocol snooping. This database, or binding, table is used by various IPv6 guard features (such as IPv6 ND Inspection) to validate the link-layer address (LLA), the IPv4 or IPv6 address, and prefix binding of the neighbors to prevent spoofing and redirect attacks.
- IPv6 Neighbor Discovery Inspection—IPv6 ND inspection learns and secures bindings for stateless autoconfiguration addresses in Layer 2 neighbor tables. IPv6 ND inspection analyzes neighbor discovery messages in order to build a trusted binding table database and IPv6 neighbor discovery messages that do not conform are dropped. An ND message is considered trustworthy if its IPv6-to-Media Access Control (MAC) mapping is verifiable.

  This feature mitigates some of the inherent vulnerabilities of the ND mechanism, such as attacks on DAD, address resolution, router discovery, and the neighbor cache.

  For detailed information about IPv6 Neighbor Discovery Inspection, see the "IPv6 Neighbor Discovery Inspection" chapter of the Cisco IOS IPv6 Configuration Guide Library on Cisco.com.

- IPv6 Router Advertisement Guard—The IPv6 Router Advertisement (RA) guard feature enables the network administrator to block or reject unwanted or rogue RA guard messages that arrive at the network switch platform. RAs are used by routers to announce themselves on the link. The RA Guard feature analyzes the RAs and filters out bogus RAs sent by unauthorized routers. In host mode, all router advertisement and router redirect messages are disallowed on the port. The RA guard feature compares configuration information on the Layer 2 device with the information found in the received RA frame. Once the Layer 2 device has validated the content of the RA frame and router redirect frame against the configuration, it forwards the RA to its unicast or multicast destination. If the RA frame content is not validated, the RA is dropped.

  For detailed information about IPv6 Router Advertisement Guard, see the "IPv6 Router Advertisement Guard" chapter of the Cisco IOS IPv6 Configuration Guide Library on Cisco.com.

- IPv6 DHCP Guard—The IPv6 DHCP Guard feature blocks reply and advertisement messages that come from unauthorized DHCPv6 servers and relay agents. IPv6 DHCP guard can prevent forged messages from being entered in the binding table and block DHCPv6 server messages when they are received on ports that are not explicitly configured as facing a DHCPv6 server or DHCP relay. To use this feature, configure a policy and attach it to an interface or a VLAN. To debug DHCP guard packets, use the **debug ipv6 snooping dhcp-guard** privileged EXEC command.

Related Topics

How to Configure an IPv6 Snooping Policy, on page 13

How to Attach an IPv6 Snooping Policy to an Interface, on page 15
How to Attach an IPv6 Snooping Policy to a Layer 2 EtherChannel Interface, on page 16
How to Configure the IPv6 Binding Table Content , on page 17
How to Configure an IPv6 Neighbor Discovery Inspection Policy, on page 18
How to Attach an IPv6 Neighbor Discovery Inspection Policy to an Interface , on page 20
How to Attach an IPv6 Neighbor Discovery Inspection Policy to a Layer 2 EtherChannel Interface, on page 21
How to Configure an IPv6 Router Advertisement Guard Policy, on page 22
How to Attach an IPv6 Router Advertisement Guard Policy to an Interface, on page 25
How to Attach an IPv6 Router Advertisement Guard Policy to a Layer 2 EtherChannel Interface , on page 26
How to Configure an IPv6 DHCP Guard Policy , on page 27
How to Attach an IPv6 DHCP Guard Policy to an Interface or a VLAN on an Interface, on page 29
How to Attach an IPv6 DHCP Guard Policy to a Layer 2 EtherChannel Interface, on page 30

How to Configure an IPv6 Snooping Policy

Beginning in privileged EXEC mode, follow these steps to configure IPv6 Snooping Policy :

SUMMARY STEPS

1. **configure terminal**
2. **ipv6 snooping policy** *policy-name*
3. {[**default**] | [**device-role** {**node** | **switch**}] | [**limit address-count** *value*] | [**no**] | [**protocol** {**dhcp** | **ndp**}] | [**security-level** {**glean** | **guard** | **inspect**}] | [**tracking** {**disable** [**stale-lifetime** [*seconds* | **infinite**] | **enable** [**reachable-lifetime** [*seconds* | **infinite**] }] | [**trusted-port**] }
4. **end**
5. **show ipv6 snooping policy** *policy-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**ipv6 snooping policy** *policy-name* **Example:** `Switch(config)# ipv6 snooping policy example_policy`	Creates a snooping policy and enters IPv6 Snooping Policy Configuration mode.
Step 3	{[**default**]	[**device-role** {**node**	**switch**}]	[**limit address-count** *value*]	[**no**]	[**protocol** {**dhcp**	**ndp**}]	[**security-level** {**glean**	**guard**	**inspect**}]	[**tracking** {**disable** [**stale-lifetime** [*seconds*	**infinite**]	**enable** [**reachable-lifetime** [*seconds*	**infinite**] }]	[**trusted-port**] } **Example:**	Enables data address gleaning, validates messages against various criteria, specifies the security level for messages. • (Optional) **default**—Sets all to default options. • (Optional) **device-role**{**node**]	**switch**}—Specifies the role of the device attached to the port. Default is **node**.

	Command or Action	Purpose
	Switch **(config-ipv6-snooping)# security-level inspect** **Example:** Switch **(config-ipv6-snooping)# trusted-port**	• (Optional) **limit address-count** *value*—Limits the number of addresses allowed per target. • (Optional) **no**—Negates a command or sets it to defaults. • (Optional) **protocol**{**dhcp** | **ndp**}—Specifies which protocol should be redirected to the snooping feature for analysis. The default, is **dhcp** and **ndp**. To change the default, use the **no protocol** command. • (Optional) **security-level**{**glean**|**guard**|**inspect**}—Specifies the level of security enforced by the feature. Default is **guard.** **glean**—Gleans addresses from messages and populates the binding table without any verification. **guard**—Gleans addresses and inspects messages. In addition, it rejects RA and DHCP server messages. This is the default option. **inspect**—Gleans addresses, validates messages for consistency and conformance, and enforces address ownership. • (Optional) **tracking** {**disable** | **enable**}—Overrides the default tracking behavior and specifies a tracking option. • (Optional) **trusted-port**—Sets up a trusted port. It disables the guard on applicable targets. Bindings learned through a trusted port have preference over bindings learned through any other port. A trusted port is given preference in case of a collision while making an entry in the table.
Step 4	**end** **Example:** `Switch(config-ipv6-snooping)# exit`	Exits configuration modes to Privileged EXEC mode.
Step 5	**show ipv6 snooping policy** *policy-name* **Example:** `Switch#show ipv6 snooping policy example_policy`	Displays the snooping policy configuration.

What to do next

Attach an IPv6 Snooping policy to interfaces or VLANs.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 Snooping Policy to an Interface

Beginning in privileged EXEC mode, follow these steps to attach an IPv6 Snooping policy on an interface or VLAN:

SUMMARY STEPS

1. **configure terminal**
2. **interface** Interface_type *stack/module/port*
3. **switchport**
4. **ipv6 snooping** [**attach-policy** *policy_name* [**vlan** {*vlan_id* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids*}] | **vlan** {*vlan_id* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
5. **do show running-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**interface** Interface_type *stack/module/port* **Example:** `Switch(config)# interface gigabitethernet 1/1/4`	Specifies an interface type and identifier; enters the interface configuration mode.
Step 3	**switchport** **Example:** `Switch(config-if)# switchport`	Enters the Switchport mode. **Note** To configure Layer 2 parameters, if the interface is in Layer 3 mode, you must enter the switchport interface configuration command without any parameters to put the interface into Layer 2 mode. This shuts down the interface and then re-enables it, which might generate messages on the device to which the interface is connected. When you put an interface that is in Layer 3 mode into Layer 2 mode, the previous configuration information related to the affected interface might be lost, and the interface is returned to its default configuration. The command prompt displays as (config-if)# in Switchport configuration mode.
Step 4	**ipv6 snooping** [**attach-policy** *policy_name* [**vlan** {*vlan_id*	**add** *vlan_ids*	**except***vlan_ids*	**none**	**remove** *vlan_ids*}]	**vlan** {*vlan_id*	**add** *vlan_ids*	**except***vlan_ids*	**none**	**remove** *vlan_ids*	**all**}]	Attaches a custom ipv6 snooping policy to the interface or the specified VLANs on the interface. To attach the default policy to the interface, use the **ipv6 snooping** command without the **attach-policy** keyword. To attach the default

	Command or Action	Purpose

	Example:
	`Switch(config-if)# ipv6 snooping`
	
	or
	
	`Switch(config-if)# ipv6 snooping attach-policy example_policy`
	
	or
	`Switch(config-if)# ipv6 snooping vlan 111,112`
	
	or
	
	`Switch(config-if)# ipv6 snooping attach-policy example_policy vlan 111,112`
		policy to VLANs on the interface, use the **ipv6 snooping vlan** command. The default policy is, security-level **guard**, device-role **node**, protocol **ndp** and **dhcp.**

Step 5	**do show running-config** **Example:** `Switch#(config-if)# do show running-config`	Verifies that the policy is attached to the specified interface without exiting the interface configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 Snooping Policy to a Layer 2 EtherChannel Interface

Beginning in privileged EXEC mode, follow these steps to attach an IPv6 Snooping policy on an EtherChannel interface or VLAN:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**interface range** *Interface_name* **Example:** `Switch(config)# interface range Po11`	Specify the port-channel interface name assigned when the EtherChannel was created. Enters the interface range configuration mode. **Tip** Enter the **do show interfaces summary** command for quick reference to interface names and types.
Step 3	**ipv6 snooping** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] **Example:**	Attaches the IPv6 Snooping policy to the interface or the specified VLANs on that interface. The default policy is attached if the **attach-policy** option is not used.

	Command or Action	Purpose

	`Switch(config-if-range)# ipv6 snooping attach-policy example_policy`
	
	`or`
	
	`Switch(config-if-range)# ipv6 snooping attach-policy example_policy vlan 222,223,224`
	
	`or`
	
	`Switch(config-if-range)#ipv6 snooping vlan 222, 223,224`	

Step 4	**do show running-config interface***portchannel_interface_name* **Example:** `Switch#(config-if-range)# do show running-config int po11`	Confirms that the policy is attached to the specified interface without exiting the configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Configure the IPv6 Binding Table Content

Beginning in privileged EXEC mode, follow these steps to configure IPv6 Binding Table Content :

SUMMARY STEPS

1. **configure terminal**
2. [**no**] **ipv6 neighbor binding** [**vlan** *vlan-id* {*ipv6-address* **interface** interface_type *stack/module/port hw_address* [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] | [**tracking**{ [default | disable] [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] | [**enable** [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] | [**retry-interval** {*seconds*| **default** [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] }]
3. [**no**] **ipv6 neighbor binding max-entries** *number* [**mac-limit** *number* | **port-limit** *number* [**mac-limit** *number*] | **vlan-limit** *number* [[**mac-limit** *number*] | [**port-limit** *number* [**mac-limit***number*]]]]
4. **ipv6 neighbor binding logging**
5. **exit**
6. **show ipv6 neighbor binding**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.

	Command or Action	Purpose
Step 2	[**no**] **ipv6 neighbor binding** [**vlan** *vlan-id* {*ipv6-address* **interface** interface_type *stack/module/port hw_address* [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] | [**tracking**{ [default | disable] [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] | [**enable** [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] | [**retry-interval** {*seconds*| **default** [**reachable-lifetimevalue** [*seconds* | **default** | **infinite**] }] **Example:** `Switch(config)# ipv6 neighbor binding`	Adds a static entry to the binding table database.
Step 3	[**no**] **ipv6 neighbor binding max-entries** *number* [**mac-limit** *number* | **port-limit** *number* [**mac-limit** *number*] | **vlan-limit** *number* [[**mac-limit** *number*] | [**port-limit** *number* [**mac-limit***number*]]]] **Example:** `Switch(config)# ipv6 neighbor binding max-entries 30000`	Specifies the maximum number of entries that are allowed to be inserted in the binding table cache.
Step 4	**ipv6 neighbor binding logging** **Example:** `Switch(config)# ipv6 neighbor binding logging`	Enables the logging of binding table main events.
Step 5	**exit** **Example:** `Switch(config)# exit`	Exits global configuration mode, and places the router in privileged EXEC mode.
Step 6	**show ipv6 neighbor binding** **Example:** `Switch# show ipv6 neighbor binding`	Displays contents of a binding table.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Configure an IPv6 Neighbor Discovery Inspection Policy

Beginning in privileged EXEC mode, follow these steps to configure an IPv6 ND Inspection Policy:

SUMMARY STEPS

1. **configure terminal**
2. [**no**]**ipv6 nd inspection policy** *policy-name*
3. **device-role** {**host** | **monitor** | **router** | **switch**}
4. **drop-unsecure**
5. **limit address-count** *value*
6. **sec-level minimum** *value*

7. **tracking** {**enable** [**reachable-lifetime** {*value* | **infinite**}] | **disable** [**stale-lifetime** {*value* | **infinite**}]}
8. **trusted-port**
9. **validate source-mac**
10. **no** {**device-role** | **drop-unsecure** | **limit address-count** | **sec-level minimum** | **tracking** | **trusted-port** | **validate source-mac**}
11. **default** {**device-role** | **drop-unsecure** | **limit address-count** | **sec-level minimum** | **tracking** | **trusted-port** | **validate source-mac**}
12. **do show ipv6 nd inspection policy** *policy_name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	[**no**]**ipv6 nd inspection policy** *policy-name* **Example:** `Switch(config)# ipv6 nd inspection policy example_policy`	Specifies the ND inspection policy name and enters ND Inspection Policy configuration mode.
Step 3	**device-role** {**host**	**monitor**	**router**	**switch**} **Example:** `Switch(config-nd-inspection)# device-role switch`	Specifies the role of the device attached to the port. The default is **host**.
Step 4	**drop-unsecure** **Example:** `Switch(config-nd-inspection)# drop-unsecure`	Drops messages with no or invalid options or an invalid signature.
Step 5	**limit address-count** *value* **Example:** `Switch(config-nd-inspection)# limit address-count 1000`	Enter 1–10,000.
Step 6	**sec-level minimum** *value* **Example:** `Switch(config-nd-inspection)# limit address-count 1000`	Specifies the minimum security level parameter value when Cryptographically Generated Address (CGA) options are used.
Step 7	**tracking** {**enable** [**reachable-lifetime** {*value*	**infinite**}]	**disable** [**stale-lifetime** {*value*	**infinite**}]} **Example:** `Switch(config-nd-inspection)# tracking disable stale-lifetime infinite`	Overrides the default tracking policy on a port.
Step 8	**trusted-port** **Example:**	Configures a port to become a trusted port.

	Command or Action	Purpose
	`Switch(config-nd-inspection)# trusted-port`	
Step 9	**validate source-mac** **Example:** `Switch(config-nd-inspection)# validate source-mac`	Checks the source media access control (MAC) address against the link-layer address.
Step 10	**no** {**device-role** | **drop-unsecure** | **limit address-count** | **sec-level minimum** | **tracking** | **trusted-port** | **validate source-mac**} **Example:** `Switch(config-nd-inspection)# no validate source-mac`	Remove the current configuration of a parameter with the **no** form of the command.
Step 11	**default** {**device-role** | **drop-unsecure** | **limit address-count** | **sec-level minimum** | **tracking** | **trusted-port** | **validate source-mac**} **Example:** `Switch(config-nd-inspection)# default limit address-count`	Restores configuration to the default values.
Step 12	**do show ipv6 nd inspection policy** *policy_name* **Example:** `Switch(config-nd-inspection)# do show ipv6 nd inspection policy example_policy`	Verifies the ND Inspection Configuration without exiting ND inspection configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 Neighbor Discovery Inspection Policy to an Interface

Beginning in privileged EXEC mode, follow these steps to attach an IPv6 ND Inspection policy to an interface or VLANs on an interface :

SUMMARY STEPS

1. **configure terminal**
2. **interface** Interface_type *stack/module/port*
3. **ipv6 nd inspection** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
4. **do show running-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:**	Enters the global configuration mode.

	Command or Action	Purpose
	`Switch# configure terminal`	
Step 2	**interface** Interface_type *stack/module/port* **Example:** `Switch(config)# interface gigabitethernet 1/1/4`	Specifies an interface type and identifier; enters the interface configuration mode.

Step 3	**ipv6 nd inspection** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
	Example:
	`Switch(config-if)# ipv6 nd inspection attach-policy example_policy`
	or
	`Switch(config-if)# ipv6 nd inspection attach-policy example_policy vlan 222,223,224`
	or
	`Switch(config-if)# ipv6 nd inspection vlan 222, 223,224`
		Attaches the Neighbor Discovery Inspection policy to the interface or the specified VLANs on that interface. The default policy is attached if the **attach-policy** option is not used.

Step 4	**do show running-config** **Example:** `Switch#(config-if)# do show running-config`	Verifies that the policy is attached to the specified interface without exiting the interface configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 Neighbor Discovery Inspection Policy to a Layer 2 EtherChannel Interface

Beginning in privileged EXEC mode, follow these steps to attach an IPv6 Neighbor Discovery Inspection policy on an EtherChannel interface or VLAN:

SUMMARY STEPS

1. **configure terminal**
2. **interface range** *Interface_name*
3. **ipv6 nd inspection** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* \| **add** *vlan_ids* \| **except** *vlan_ids* \| **none** \| **remove** *vlan_ids* \| **all**}] \| **vlan** [{*vlan_ids* \| **add** *vlan_ids* \| **except***vlan_ids* \| **none** \| **remove** *vlan_ids* \| **all**}]
4. **do show running-config interface***portchannel_interface_name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**interface range** *Interface_name* **Example:** `Switch(config)# interface Po11`	Specify the port-channel interface name assigned when the EtherChannel was created. Enters the interface range configuration mode. **Tip** Enter the **do show interfaces summary** command for quick reference to interface names and types.

Step 3	**ipv6 nd inspection** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
	Example:
	`Switch(config-if-range)# ipv6 nd inspection attach-policy example_policy`
	`or`
	`Switch(config-if-range)# ipv6 nd inspection attach-policy example_policy vlan 222,223,224`
	`or`
	`Switch(config-if-range)#ipv6 nd inspection vlan 222, 223,224`
		Attaches the ND Inspection policy to the interface or the specified VLANs on that interface. The default policy is attached if the **attach-policy** option is not used.

Step 4	**do show running-config interface***portchannel_interface_name* **Example:** `Switch#(config-if-range)# do show running-config int po11`	Confirms that the policy is attached to the specified interface without exiting the configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Configure an IPv6 Router Advertisement Guard Policy

Beginning in privileged EXEC mode, follow these steps to configure an IPv6 Router Advertisement policy :

SUMMARY STEPS

1. **configure terminal**
2. [**no**]**ipv6 nd raguard policy** *policy-name*

3. [**no**]**device-role** {**host** | **monitor** | **router** | **switch**}
4. [**no**]**hop-limit** {**maximum** | **minimum**} *value*
5. [**no**]**managed-config-flag** {**off** | **on**}
6. [**no**]**match** {**ipv6 access-list** *list* | **ra prefix-list** *list*}
7. [**no**]**other-config-flag** {**on** | **off**}
8. [**no**]**router-preference maximum** {**high** | **medium** | **low**}
9. [**no**]**trusted-port**
10. **default** {**device-role** | **hop-limit** {**maximum** | **minimum**} | **managed-config-flag** | **match** {**ipv6 access-list** | **ra prefix-list** } | **other-config-flag** | **router-preference maximum**| **trusted-port**}
11. **do show ipv6 nd raguard policy** *policy_name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	[**no**]**ipv6 nd raguard policy** *policy-name* **Example:** `Switch(config)# ipv6 nd raguard policy example_policy`	Specifies the RA Guard policy name and enters RA Guard Policy configuration mode.
Step 3	[**no**]**device-role** {**host**	**monitor**	**router**	**switch**} **Example:** `Switch(config-nd-raguard)# device-role switch`	Specifies the role of the device attached to the port. The default is **host**.
Step 4	[**no**]**hop-limit** {**maximum**	**minimum**} *value* **Example:** `Switch(config-nd-raguard)# hop-limit maximum 33`	(1–255) Range for Maximum and Minimum Hop Limit values. Enables filtering of Router Advertisement messages by the Hop Limit value. A rogue RA message may have a low Hop Limit value (equivalent to the IPv4 Time to Live) that when accepted by the host, prevents the host from generating traffic to destinations beyond the rogue RA message generator. An RA message with an unspecified Hop Limit value is blocked. If not configured, this filter is disabled. Configure **minimum** to block RA messages with Hop Limit values lower than the value you specify. Configure **maximum**to block RA messages with Hop Limit values greater than the value you specify.
Step 5	[**no**]**managed-config-flag** {**off**	**on**} **Example:** `Switch(config-nd-raguard)# managed-config-flag on`	Enables filtering of Router Advertisement messages by the Managed Address Configuration, or "M" flag field. A rouge RA message with an M field of 1 can cause a host to use a rogue DHCPv6 server. If not configured, this filter is disabled.

	Command or Action	Purpose
		On—Accepts and forwards RA messages with an M value of 1, blocks those with 0. **Off**—Accepts and forwards RA messages with an M value of 0, blocks those with 1.
Step 6	[**no**]**match** {**ipv6 access-list** *list* | **ra prefix-list** *list*} **Example:** `Switch(config-nd-raguard)# match ipv6 access-list example_list`	Matches a specified prefix list or access list.
Step 7	[**no**]**other-config-flag** {**on** | **off**} **Example:** `Switch(config-nd-raguard)# other-config-flag on`	Enables filtering of Router Advertisement messages by the Other Configuration, or "O" flag field. A rouge RA message with an O field of 1 can cause a host to use a rogue DHCPv6 server. If not configured, this filter is disabled. **On**—Accepts and forwards RA messages with an O value of 1, blocks those with 0. **Off**—Accepts and forwards RA messages with an O value of 0, blocks those with 1.
Step 8	[**no**]**router-preference maximum** {**high** | **medium** | **low**} **Example:** `Switch(config-nd-raguard)# router-preference maximum high`	Enables filtering of Router Advertisement messages by the Router Preference flag. If not configured, this filter is disabled. • **high**—Accepts RA messages with the Router Preference set to high, medium, or low. • **medium**—Blocks RA messages with the Router Preference set to high. • **low**—Blocks RA messages with the Router Preference set to medium and high.
Step 9	[**no**]**trusted-port** **Example:** `Switch(config-nd-raguard)# trusted-port`	When configured as a trusted port, all attached devices are trusted, and no further message verification is performed.
Step 10	**default** {**device-role** | **hop-limit** {**maximum** | **minimum**} | **managed-config-flag** | **match** {**ipv6 access-list** | **ra prefix-list** } | **other-config-flag** | **router-preference maximum**| **trusted-port**} **Example:** `Switch(config-nd-raguard)# default hop-limit`	Restores a command to its default value.
Step 11	**do show ipv6 nd raguard policy** *policy_name* **Example:** `Switch(config-nd-raguard)# do show ipv6 nd raguard policy example_policy`	(Optional)—Displays the ND Guard Policy configuration without exiting the RA Guard policy configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 Router Advertisement Guard Policy to an Interface

Beginning in privileged EXEC mode, follow these steps to attach an IPv6 Router Advertisement policy to an interface or to VLANs on the interface :

SUMMARY STEPS

1. **configure terminal**
2. **interface** Interface_type *stack/module/port*
3. **ipv6 nd raguard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
4. **do show running-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**interface** Interface_type *stack/module/port* **Example:** `Switch(config)# interface gigabitethernet 1/1/4`	Specifies an interface type and identifier; enters the interface configuration mode.

Step 3	**ipv6 nd raguard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
	Example:
	`Switch(config-if)# ipv6 nd raguard attach-policy example_policy`
	`or`
	`Switch(config-if)# ipv6 nd raguard attach-policy example_policy vlan 222,223,224`
	`or`
	`Switch(config-if)# ipv6 nd raguard vlan 222, 223,224`
		Attaches the Neighbor Discovery Inspection policy to the interface or the specified VLANs on that interface. The default policy is attached if the **attach-policy** option is not used.

Step 4	**do show running-config** **Example:**	Confirms that the policy is attached to the specified interface without exiting the configuration mode.

	Command or Action	Purpose
	`Switch#(config-if)# do show running-config`	

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 Router Advertisement Guard Policy to a Layer 2 EtherChannel Interface

Beginning in privileged EXEC mode, follow these steps to attach an IPv6 Router Advertisement Guard Policy on an EtherChannel interface or VLAN:

SUMMARY STEPS

1. **configure terminal**
2. **interface range** *Interface_name*
3. **ipv6 nd raguard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
4. **do show running-config interface***portchannel_interface_name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**interface range** *Interface_name* **Example:** `Switch(config)# interface Po11`	Specify the port-channel interface name assigned when the EtherChannel was created. Enters the interface range configuration mode. **Tip** Enter the **do show interfaces summary** command for quick reference to interface names and types.

Step 3	**ipv6 nd raguard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
	Example:
	`Switch(config-if-range)# ipv6 nd raguard attach-policy example_policy`
	`or`
	`Switch(config-if-range)# ipv6 nd raguard attach-policy example_policy vlan 222,223,224`
	`or`
	`Switch(config-if-range)#ipv6 nd raguard vlan 222,`
		Attaches the RA Guard policy to the interface or the specified VLANs on that interface. The default policy is attached if the **attach-policy** option is not used.

	Command or Action	Purpose
	223,224	
Step 4	**do show running-config interface***portchannel_interface_name* **Example:** `Switch#(config-if-range)# do show running-config int po11`	Confirms that the policy is attached to the specified interface without exiting the configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Configure an IPv6 DHCP Guard Policy

Beginning in privileged EXEC mode, follow these steps to configure an IPv6 DHCP (DHCPv6) Guard policy:

SUMMARY STEPS

1. **configure terminal**
2. [**no**]**ipv6 dhcp guard policy** *policy-name*
3. [**no**]**device-role** {**client** | **server**}
4. [**no**] **match server access-list** *ipv6-access-list-name*
5. [**no**] **match reply prefix-list** *ipv6-prefix-list-name*
6. [**no**]**preference**{ **max** *limit* | **min** *limit* }
7. [**no**] **trusted-port**
8. **default** {**device-role** | **trusted-port**}
9. **do show ipv6 dhcp guard policy** *policy_name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	[**no**]**ipv6 dhcp guard policy** *policy-name* **Example:** `Switch(config)# ipv6 dhcp guard policy example_policy`	Specifies the DHCPv6 Guard policy name and enters DHCPv6 Guard Policy configuration mode.
Step 3	[**no**]**device-role** {**client**	**server**} **Example:** `Switch(config-dhcp-guard)# device-role server`	(Optional) Filters out DHCPv6 replies and DHCPv6 advertisements on the port that are not from a device of the specified role. Default is **client**. • **client**—Default value, specifies that the attached device is a client. Server messages are dropped on this port.

	Command or Action	Purpose
		• **server**—Specifies that the attached device is a DHCPv6 server. Server messages are allowed on this port.

Step 4	[**no**] **match server access-list** *ipv6-access-list-name*
	Example:
	`;;Assume a preconfigured IPv6 Access List as follows:`
	`Switch(config)# ipv6 access-list my_acls`
	`Switch(config-ipv6-acl)# permit host FE80::A8BB:CCFF:FE01:F700 any`
	`;;configure DCHPv6 Guard to match approved access list.`
	`Switch(config-dhcp-guard)# match server access-list my_acls`
		(Optional). Enables verification that the advertised DHCPv6 server or relay address is from an authorized server access list (The destination address in the access list is 'any'). If not configured, this check will be bypassed. An empty access list is treated as a permit all.

Step 5	[**no**] **match reply prefix-list** *ipv6-prefix-list-name*
	Example:
	`;;Assume a preconfigured IPv6 prefix list as follows:`
	`Switch(config)# ipv6 prefix-list my_prefix permit 2001:0DB8::/64 le 128`
	`;; Configure DCHPv6 Guard to match prefix`
	`Switch(config-dhcp-guard)# match reply prefix-list my_prefix`
		(Optional) Enables verification of the advertised prefixes in DHCPv6 reply messages from the configured authorized prefix list. If not configured, this check will be bypassed. An empty prefix list is treated as a permit.

Step 6	[**no**]**preference**{ **max** *limit* | **min** *limit* }
	Example:
	`Switch(config-dhcp-guard)# preference max 250`
	`Switch(config-dhcp-guard)#preference min 150`
		Configure **max** and **min** when **device-role** is **server**to filter DCHPv6 server advertisements by the server preference value. The defaults permit all advertisements.
		max *limit*—(0 to 255) (Optional) Enables verification that the advertised preference (in preference option) is less than the specified limit. Default is 255. If not specified, this check will be bypassed.
		min *limit*—(0 to 255) (Optional) Enables verification that the advertised preference (in preference option) is greater than the specified limit. Default is 0. If not specified, this check will be bypassed.

Step 7	[**no**] **trusted-port** **Example:** `Switch(config-dhcp-guard)# trusted-port`	(Optional) **trusted-port**—Sets the port to a trusted mode. No further policing takes place on the port. **Note** If you configure a trusted port then the device-role option is not available.
Step 8	**default** {**device-role** | **trusted-port**} **Example:** `Switch(config-dhcp-guard)# default device-role`	(Optional) **default**—Sets a command to its defaults.

	Command or Action	Purpose
Step 9	**do show ipv6 dhcp guard policy** *policy_name* **Example:** `Switch(config-dhcp-guard)# do show ipv6 dhcp guard policy example_policy`	(Optional) Displays the configuration of the IPv6 DHCP guard policy without leaving the configuration submode. Omitting the *policy_name* variable displays all DHCPv6 policies.

Example of DHCPv6 Guard Configuration

```
enable
configure terminal
ipv6 access-list acl1
 permit host FE80::A8BB:CCFF:FE01:F700 any
ipv6 prefix-list abc permit 2001:0DB8::/64 le 128
ipv6 dhcp guard policy pol1
 device-role server
 match server access-list acl1
 match reply prefix-list abc
 preference min 0
 preference max 255
 trusted-port
interface GigabitEthernet 0/2/0
 switchport
 ipv6 dhcp guard attach-policy pol1 vlan add 1
 vlan 1
  ipv6 dhcp guard attach-policy pol1
show ipv6 dhcp guard policy pol1
```

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 DHCP Guard Policy to an Interface or a VLAN on an Interface

Beginning in privileged EXEC mode, follow these steps to configure IPv6 Binding Table Content :

SUMMARY STEPS

1. **configure terminal**
2. **interface** Interface_type *stack/module/port*
3. **ipv6 dhcp guard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
4. **do show running-config interface** Interface_type *stack/module/port*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.

	Command or Action	Purpose
Step 2	**interface** Interface_type *stack/module/port* **Example:** `Switch(config)# interface gigabitethernet 1/1/4`	Specifies an interface type and identifier; enters the interface configuration mode.

Step 3	**ipv6 dhcp guard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
	Example:
	`Switch(config-if)# ipv6 dhcp guard attach-policy example_policy`
	or
	`Switch(config-if)# ipv6 dhcp guard attach-policy example_policy vlan 222,223,224`
	or
	`Switch(config-if)# ipv6 dhcp guard vlan 222, 223,224`
		Attaches the DHCP Guard policy to the interface or the specified VLANs on that interface. The default policy is attached if the **attach-policy** option is not used.

Step 4	**do show running-config interface** Interface_type *stack/module/port* **Example:** `Switch#(config-if)# do show running-config gig 1/1/4`	Confirms that the policy is attached to the specified interface without exiting the configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

How to Attach an IPv6 DHCP Guard Policy to a Layer 2 EtherChannel Interface

Beginning in privileged EXEC mode, follow these steps to attach an IPv6 DHCP Guard policy on an EtherChannel interface or VLAN:

SUMMARY STEPS

1. **configure terminal**
2. **interface range** *Interface_name*
3. **ipv6 dhcp guard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* \| **add** *vlan_ids* \| **except** *vlan_ids* \| **none** \| **remove** *vlan_ids* \| **all**}] \| **vlan** [{*vlan_ids* \| **add** *vlan_ids* \| **except***vlan_ids* \| **none** \| **remove** *vlan_ids* \| **all**}]
4. **do show running-config interface***portchannel_interface_name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**interface range** *Interface_name* **Example:** `Switch(config)# interface Po11`	Specify the port-channel interface name assigned when the EtherChannel was created. Enters the interface range configuration mode. **Tip** Enter the **do show interfaces summary** command for quick reference to interface names and types.

Step 3	**ipv6 dhcp guard** [**attach-policy** *policy_name* [**vlan** {*vlan_ids* | **add** *vlan_ids* | **except** *vlan_ids* | **none** | **remove** *vlan_ids* | **all**}] | **vlan** [{*vlan_ids* | **add** *vlan_ids* | **except***vlan_ids* | **none** | **remove** *vlan_ids* | **all**}]
	Example:
	`Switch(config-if-range)# ipv6 dhcp guard attach-policy example_policy`
	`or`
	`Switch(config-if-range)# ipv6 dhcp guard attach-policy example_policy vlan 222,223,224`
	`or`
	`Switch(config-if-range)#ipv6 dhcp guard vlan 222, 223,224`
		Attaches the DHCP Guard policy to the interface or the specified VLANs on that interface. The default policy is attached if the **attach-policy** option is not used.

Step 4	**do show running-config interface***portchannel_interface_name* **Example:** `Switch#(config-if-range)# do show running-config int po11`	Confirms that the policy is attached to the specified interface without exiting the configuration mode.

Related Topics

Information about First Hop Security in IPv6, on page 12

Displaying IPv6

For complete syntax and usage information on these commands, see the Cisco IOS command reference publications.

Table 2: Command for Monitoring IPv6

Command	Purpose
show ipv6 access-list	Displays a summary of access lists.
show ipv6 cef	Displays Cisco Express Forwarding for IPv6.
show ipv6 interface*interface-id*	Displays IPv6 interface status and configuration.
show ipv6 mtu	Displays IPv6 MTU per destination cache.
show ipv6 neighbors	Displays IPv6 neighbor cache entries.
show ipv6 prefix-list	Displays a list of IPv6 prefix lists.
show ipv6 protocols	Displays a list of IPv6 routing protocols on the switch.
show ipv6 rip	Displays IPv6 RIP routing protocol status.
show ipv6 route	Displays IPv6 route table entries.
show ipv6 static	Displays IPv6 static routes.
show ipv6 traffic	Displays IPv6 traffic statistics.

Related Topics

Displaying IPv6: Example, on page 33

Configuration Examples for IPv6 Unicast Routing

Configuring IPv6 Addressing and Enabling IPv6 Routing: Example

This example shows how to enable IPv6 with both a link-local address and a global address based on the IPv6 prefix 2001:0DB8:c18:1::/64. The EUI-64 interface ID is used in the low-order 64 bits of both addresses. Output from the **show ipv6 interface** EXEC command is included to show how the interface ID (20B:46FF:FE2F:D940) is appended to the link-local prefix FE80::/64 of the interface.

```
Switch(config)# ipv6 unicast-routing
Switch(config)# interface gigabitethernet1/0/11

Switch(config-if)# ipv6 address 2001:0DB8:c18:1::/64 eui 64
Switch(config-if)# end
Switch# show ipv6 interface gigabitethernet1/0/11
GigabitEthernet1/0/11 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::20B:46FF:FE2F:D940
  Global unicast address(es):
  2001:0DB8:c18:1:20B:46FF:FE2F:D940, subnet is 2001:0DB8:c18:1::/64 [EUI]
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF2F:D940
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
```

```
  ICMP redirects are enabled
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds
  ND advertised reachable time is 0 milliseconds
  ND advertised retransmit interval is 0 milliseconds
  ND router advertisements are sent every 200 seconds
  ND router advertisements live for 1800 seconds
  Hosts use stateless autoconfig for addresses.
```

Related Topics

Configuring IPv6 Addressing and Enabling IPv6 Routing, on page 6

Configuring IPv6 ICMP Rate Limiting: Example

This example shows how to configure an IPv6 ICMP error message interval of 50 milliseconds and a bucket size of 20 tokens.

```
Switch(config)#ipv6 icmp error-interval 50 20
```

Related Topics

Configuring IPv6 ICMP Rate Limiting (CLI), on page 8

Configuring Static Routing for IPv6: Example

This example shows how to configure a floating static route to an interface with an administrative distance of 130:

```
Switch(config)# ipv6 route 2001:0DB8::/32 gigabitethernet2/0/1 130
```

Related Topics

Configuring Static Routing for IPv6 (CLI), on page 9

Displaying IPv6: Example

This is an example of the output from the **show ipv6 interface** privileged EXEC command:

```
Switch# show ipv6 interface
Vlan1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::20B:46FF:FE2F:D940
  Global unicast address(es):
    3FFE:C000:0:1:20B:46FF:FE2F:D940, subnet is 3FFE:C000:0:1::/64 [EUI]
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF2F:D940
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds
  ND advertised reachable time is 0 milliseconds
  ND advertised retransmit interval is 0 milliseconds
```

```
  ND router advertisements are sent every 200 seconds
  ND router advertisements live for 1800 seconds
<output truncated>
```

Related Topics

Displaying IPv6, on page 31