IPv6

Arista switches support Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6) for routing packets across network boundaries. This chapter describes Arista’s implementation of IPv6 and includes these sections:

- Section 28.1: Introduction
- Section 28.2: IPv6 Description
- Section 28.3: Configuring IPv6
- Section 28.4: IPv6 Commands

28.1 Introduction

Routing transmits network layer data packets over connected independent subnets. Each subnet is assigned an IP address range and each device on the subnet is assigned an IP address from that range.

Connected subnets have IP address ranges that do not overlap. A router is a network device connecting multiple subnets. Routers forward inbound packets to the subnet whose address range includes the packets’ destination address.

IPv4 and IPv6 are Internet layer protocols that define packet-switched inter-networking, including source-to-destination datagram transmission across multiple networks. The switch supports IP Version 4 (IPv4) and IP Version 6 (IPv6).

28.2 IPv6 Description

Internet Protocol Version 6 is a communications protocol used for relaying network packets across a set of connected networks using the Internet Protocol suite. Each network device is assigned a 128 bit IP address that identifies its network location.

IPv6 specifies a packet format that minimizes router processing of packet headers. Since the IPv4 and IPv6 packet headers differ significantly, the protocols are not interoperable. Many transport and application-layer protocols require little or no change to operate over IPv6.

28.2.1 IPv6 Address Format

IPv6 addresses have 128 bits, represented by eight 16-bit hexadecimal numbers separated by colons. IPv6 addresses are abbreviated as follows:

- Leading zeros in each 16-bit number may be omitted.
- One set of consecutive 16-bit numbers that equal zero may be replaced by a double colon.

Example

- The following three IPv6 hexadecimal number representations refer to the same address:
  
  \[ \text{d28e:0000:0000:0000:0234:812f:61ed:4419} \]
  
  \[ \text{d28e:0:0:0:234:812f:61ed:4419} \]
  
  \[ \text{d28e::234:812f:61ed:4419} \]

IPv6 addresses typically denote a 64-bit network prefix and a 64-bit host address.

Unicast and Anycast Addressing

Unicast addressing defines a one-to-one association between the destination address and a network endpoint. Each destination address uniquely identifies a single receiver endpoint. Anycast addressing defines a one-to-one-of-many association: packets to a single member of a group of potential receivers identified by the same destination address.

Unicast and anycast addresses are typically composed as follows:

- a 64-bit network prefix that identifies the network segment.
- a 64-bit interface identifier that is based on interface MAC address.

The format of a network address identifies the scope of the address

- Global address: valid in all networks and connect with other addresses with global scope anywhere or to addresses with link-local scope on the directly attached network.
- Link-local address: scope extends only to the link to which the interface is directly connected. Link-local addresses are not routable off the link.

Link-local addresses are created by the switch and are not configurable. Figure 28-1 depicts the switch’s link local address derivation method.

Multicast Addressing

Multicast addressing defines a one-to-many association: packets are simultaneously routed from a single sender to multiple endpoints in a single transmission. The network replicates packets as required by network links that contain a recipient endpoint. One multicast address is assigned to an interface for each multicast group to which the interface belongs.
A solicited-node multicast address is an IPv6 multicast address whose scope extends only to the link to which the interface is directly connected. All IPv6 hosts have at least one such address per interface. Solicited-node multicast addresses are used by the Neighbor Discovery Protocol to obtain layer 2 link-layer addresses of other nodes.

28.2.2 Neighbor Discovery Protocol

The Neighbor Discovery Protocol (RFC 4861) operates with IPv6 to facilitate the following tasks for nodes within a specified prefix space:

- autoconfiguring a node's IPv6 address
- sensing other nodes on the link
- discovering the link-local addresses of other nodes on the link
- detecting duplicate addresses
- discovering available routers
- discovering DNS servers
- discovering the link's address prefix
- maintaining path reachability data to other active neighbor nodes

The Neighbor Discovery Protocol protocol defines five different ICMPv6 packet types:

- Router Solicitation
- Router Advertisement
- Neighbor Solicitation
- Neighbor Advertisement
- Redirect
28.3 Configuring IPv6

These sections describe IPv6 configuration tasks:

- Section 28.3.1: Configuring IPv6 on the Switch
- Section 28.3.2: Configuring IPv6 on an Interface
- Section 28.3.3: Viewing IPv6 Network Components
- Section 28.3.4: DHCP Relay Agent for IPv6

28.3.1 Configuring IPv6 on the Switch

28.3.1.1 Enabling IPv6 Unicast Routing on the Switch

The `ipv6 unicast-routing` command enables the forwarding of IPv6 unicast packets. When routing is enabled, the switch attempts to deliver inbound packets to destination addresses by forwarding them to interfaces or next hop addresses specified by the IPv6 routing table.

Example

- This command enables IPv6 unicast-routing.

  ```
  switch(config)#ipv6 unicast-routing
  switch(config)#
  ```

28.3.1.2 Configuring Default and Static IPv6 Routes

The `ipv6 route` command creates an IPv6 static route. The destination is an IPv6 prefix; the source is an IPv6 address or a routable interface port. When multiple routes exist to a destination prefix, the route with the lowest administrative distance takes precedence.

By default, the administrative distance assigned to static routes is 1. Assigning a higher administrative distance to a static route configures it to be overridden by dynamic routing data. For example, a static route with a distance value of 200 is overridden by OSPF intra-area routes, which have a default distance of 110.

Example

- This command creates an IPv6 static route.

  ```
  switch(config)#ipv6 route 10:23:31:00:01:32:93/24 vlan 300
  switch(config)#
  ```

The default route denotes the packet forwarding rule that takes effect when no other route is configured for a specified IPv6 address. All packets with destinations that are not established in the routing table are sent to the destination specified by the default route.

The IPv6 default route source is ::/0. The default route destination is referred to as the default gateway.

Example

- This command creates a default route and establishes fd7a:629f:52a4:fe61::2 as the default gateway address.

  ```
  switch(config)#ipv6 route ::/0 fd7a:629f:52a4:fe61::2
  switch(config)#
  ```
28.3.1.3 IPv6 ECMP

Multiple routes that are configured to the same destination with the same administrative distance comprise an Equal Cost Multi-Path (ECMP) route. The switch attempts to spread outbound traffic across all ECMP route paths equally. All ECMP paths are assigned the same tag value; commands that change the tag value of any ECMP path change the tag value of all paths in the ECMP.

Resilient ECMP is available for IPv6 routes. Section 27.4.2 describes resilient ECMP. The ipv6 hardware fib ecmp resilience command implements IPv6 resilient ECMP.

Example
- This command implements IPv6 resilient ECMP by configuring a hardware ECMP table space of 15 entries for IPv6 address 2001:db8:0::/64. A maximum of five next-hop addresses can be specified for the address. When the table contains five addresses, each appears in the table three times. When the table contains fewer than five addresses, each is duplicated until the 15 table entries are filled.

```
switch(config)#ipv6 hardware fib ecmp resilience 2001:db8:0::/64 capacity 5 redundancy 3
```

28.3.2 Configuring IPv6 on an Interface

28.3.2.1 Enabling IPv6 on an Interface

The ipv6 enable command enables IPv6 on the configuration mode interface if it does not have a configured IPv6 address. It also configures the interface with an IPv6 address.

The no ipv6 enable command disables IPv6 on a configuration mode interface not configured with an IPv6 address. Interfaces configured with an IPv6 address are not disabled by this command.

Example
- This command enables IPv6 on VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-vl200)#ipv6 enable
```

28.3.2.2 Assigning an IPv6 Address to an Interface

The ipv6 address command enables IPv6 on the configuration mode interface, assigns a global IPv6 address to the interface, and defines the prefix length. This command is supported on routable interfaces. Multiple global IPv6 addresses can be assigned to an interface.

Example
- These commands configure an IPv6 address with subnet mask for VLAN 200:

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 address 10:23:31::1:32:93/64
```

28.3.2.3 IPv6 Neighbor Discovery

The IPv6 Neighbor Discovery protocol defines a method for nodes to perform the following network maintenance tasks:
- determine layer 2 addresses for neighbors known to reside on attached links
• detect changed layer 2 addresses
• purge invalid values from the neighbor cache table
• (hosts) find neighboring routers to forward packets
• track neighbor reachability status

IPv6 Neighbor Discovery is defined by RFC 2461. IPv6 Stateless Address Autoconfiguration is described by RFC 2462.

The following sections describe Neighbor Discovery configuration tasks.

Reachable Time

The `ipv6 nd reachable-time` command specifies the time period that the switch includes in the reachable time field of Router Advertisements (RAs) sent from the configuration mode interface. The reachable time defines the period that a remote IPv6 node is considered reachable after a reachability confirmation event.

Example

• These commands configure the entry of 25000 (25 seconds) in the reachable time field of RAs sent from VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd reachable-time 25000
switch(config-if-Vl200)#show active
interface Vlan200
  ipv6 address fd7a:4321::1/64
  ipv6 nd reachable-time 25000
switch(config-if-Vl200)#
```

Router Advertisement Interval

The `ipv6 nd ra interval` command configures the interval between IPv6 RA transmissions from the configuration mode interface.

Example

• These commands configure a RA transmission interval of 60 seconds on VLAN interface 200, then displays the interface status.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra interval 60
switch(config-if-Vl200)#show active
interface Vlan200
  ipv6 nd ra interval 60
switch(config-if-Vl200)#
```

Router Lifetime

The `ipv6 nd ra lifetime` command specifies the value that the switch places in the `router lifetime` field of IPv6 RAs sent from the configuration mode interface.

If the value is set to 0, IPv6 peers connected to the specified interface will remove the switch from their lists of default routers. Values greater than 0 indicate the time in seconds that peers should keep the router on their default router lists without receiving further RAs from the switch. Unless the value is 0, the router lifetime value should be equal to or greater than the interval between unsolicited RAs sent on the interface.
Example
- This command configures the switch to enter 2700 in the router lifetime field of RAs transmitted from VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra lifetime 2700
switch(config-if-Vl200)#show active
interface Vlan200
  ipv6 nd ra lifetime 2700
switch(config-if-Vl200)#
```

Router Advertisement Prefix

The `ipv6 nd prefix` command configures neighbor discovery router advertisement prefix inclusion for RAs sent from the configuration mode interface.

By default, all prefixes configured as IPv6 addresses are advertised in the interface’s RAs. The `ipv6 nd prefix` command with the `no-advertise` option prevents advertising of the specified prefix without affecting the advertising of other prefixes specified as IPv6 addresses. When an interface configuration includes at least one `ipv6 nd prefix` command that enables prefix advertising, RAs advertise only prefixes specified through `ipv6 nd prefix` commands.

Commands enabling prefix advertising also specify the advertised valid and preferred lifetime periods. Default periods are 2,592,000 (valid) and 604,800 (preferred) seconds.

Example
- These commands enable neighbor discovery advertising for IPv6 address 3012:D678::/64, specifying a valid lifetime of 1,296,000 seconds and the default preferred lifetime.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd prefix 3012:D678::/64 1296000
switch(config-if-Vl200)#
```

Router Advertisement Suppression

The `ipv6 nd ra disabled` command suppress IPv6 RA transmissions on the configuration mode interface. By default, only unsolicited RAs that are transmitted periodically are suppressed. The `all` option configures the switch to suppress all RAs, including those responding to a router solicitation.

Example
- This command suppresses all RAs on VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-vl200)#ipv6 nd ra disabled all
switch(config-vl200)#
```

Router Advertisement MTU Suppression

The `ipv6 nd ra mtu suppress` command suppresses the router advertisement MTU option on the configuration mode interface. The MTU option causes an identical MTU value to be advertised by all nodes on a link. By default, the router advertisement MTU option is not suppressed.

Example
- This command suppresses the MTU option on VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-vl200)#ipv6 nd ra mtu suppress
switch(config-vl200)#
```
Router Advertisement Flag Configuration

The following commands sets the specified configuration flag in IPv6 RAs transmitted from the configuration mode interface:

- The `ipv6 nd managed-config-flag` command sets the *managed address configuration* flag. This bit instructs hosts to use stateful address autoconfiguration.
- The `ipv6 nd other-config-flag` command sets the *other stateful configuration* flag. This bit indicates availability of autoconfiguration information, other than addresses. Hosts should use stateful autoconfiguration when available. The setting of this flag has no effect if the *managed address configuration* flag is set.
- These commands configure the switch to set the *managed address configuration* flag in advertisements sent from VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd managed-config-flag
switch(config-if-Vl200)#
```

- These commands configure the switch to set the *other stateful configuration* flag in advertisements sent from VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd other-config-flag
switch(config-if-Vl200)#
```

28.3.2.4 IPv6 Router Preference

The IPv6 Router Preference protocol supports an extension to RA messages for communicating default router preferences and more specific routes from routers to hosts. This provides assistance to hosts when selecting a router. RFC 4191 describes the IPv6 Router Preference Protocol.

The `ipv6 nd router-preference` command specifies the value that the switch enters in the Default Router Preference (DRP) field of RAs that it sends from the configuration mode interface. The default field entry value is *medium*.

**Example**

- This command configures the switch as a medium preference router on RAs sent from VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd router-preference medium
switch(config-if-Vl200)#
```

28.3.2.5 uRPF Configuration

Unicast Reverse Path Forwarding (uRPF) verifies the accessibility of source IP addresses in packets that the switch forwards. Section 27.4.3 describe uRPF. uRPF is enabled for IPv6 packets entering the configuration mode interface through the `ipv6 verify` command.

uRPF defines two operational modes: strict mode and loose mode.

- **Strict mode**: uRPF verifies that a packet is received on the interface that its routing table entry specifies for its return packet.
- **Loose mode**: uRPF validation does not consider the inbound packet’s ingress interface only that there is a valid return path.
28.3.3 Viewing IPv6 Network Components

Displaying the FIB and Routing Table

The `show ipv6 route` command displays routing table entries that are in the Forwarding Information Base (FIB), including static routes, routes to directly connected networks, and dynamically learned routes. Multiple equal cost paths to the same prefix are displayed contiguously as a block, with the destination prefix displayed only on the first line.

Example

- This command displays a route table entry for a specific IPv6 route.

  ```
  switch>show ipv6 route fd7a:3418:52a4:fe18::/64
  IPv6 Routing Table - 77 entries
  Codes: C - connected, S - static, K - kernel, O - OSPF, B - BGP, R - RIP, A - Aggregate
  O   fd7a:3418:52a4:fe18::/64 [10/20]
      via f180::21c:73ff:fe00:1319, Vlan3601
      via f180::21c:73ff:fe00:1319, Vlan3602
      via f180::21c:73ff:fe00:1319, Vlan3608
      via f180::21c:73ff:fe00:6a80, Vlan3610
      via f180::21c:73ff:fe00:1319, Vlan3611
  switch>
  ```

Displaying the Route Age

The `show ipv6 route age` command displays the IPv6 route age to the specified IPv6 address or prefix.

Example

- This command displays the route age for the specified prefix.

  ```
  switch>show ipv6 route 2001::3:0/11 age
  IPv6 Routing Table - 74 entries
  Codes: C - connected, S - static, K - kernel, O - OSPF, B - BGP, R - RIP, A - Aggregate
  C 2001::3:0/11 age 00:02:34
  switch>
  ```
Displaying Host Routes

The `show ipv6 route host` command displays all host routes in the IPv6 host forwarding table. Host routes are those whose destination prefix is the entire address (prefix = /128). Each displayed host route is labeled with its purpose:

- **F** static routes from the FIB.
- **R** routes defined because the IP address is an interface address.
- **A** routes to any neighboring host for which the switch has an ARP entry.

Example

- This command displays all IPv6 host routes in the host forwarding table.

```
switch# show ipv6 route host
R - receive  F - FIB,  A - attached

F  ::1 to cpu
A  fee7:48a2:0c11:1900:400::1 on Vlan102
R  fee7:48a2:0c11:1900:400::2 to cpu
F  fee7:48a2:0c11:1a00::b via fe80::21c:73ff:fe0b:a80e on Vlan3902
R  fee7:48a2:0c11:1a00::17 to cpu
F  fee7:48a2:0c11:1a00::20 via fe80::21c:73ff:fe0b:33e on Vlan3913
F  fee7:48a2:0c11:1a00::22 via fe80::21c:73ff:fe01:5fe1 on Vlan3908
                              via fe80::21c:73ff:fe01:5fe1 on Vlan3902

switch#
```

Displaying Route Summaries

The `show ipv6 route summary` command displays the current number of routes of the IPv6 routing table in summary format.

Example

- This command displays the route source and the corresponding number of routes in the IPv6 routing table.

```
switch> show ipv6 route summary

Route Source       Number Of Routes
------------------ ----------------
connected          2               
static             0               
ospf               5               
bgp                7               
isis               0               
internal           1               
attached           0               
aggregate          2               

Total Routes       17              
switch>
```
28.3.4 DHCP Relay Agent for IPv6

28.3.4.1 Configuring IPv6 DHCP Relay

**Configuring the IPv6 DHCP Relay Agent (Global)**

The `ipv6 dhcp relay always-on` command enables the switch DHCP relay agent globally regardless of the DHCP relay agent status on any interface. The DHCP relay agent is enabled by default if at least one routable interface is configured with an `ipv6 dhcp relay destination` statement.

**Example**

- This command enables the DHCP relay agent.
  
switch(config)#ipv6 dhcp relay always-on
  
**Configuring DHCP for IPv6 relay agent**

The `ipv6 dhcp relay destination` command enables the DHCPv6 relay agent function and specifies the client message destination address on an interface.

**Example**

- This command enables the DHCPv6 relay agent function and sets the client message destination address to `2001:0db8:0:1::1` on Ethernet interface 4.
  
switch(config)#interface ethernet 4
  
  switch(config-if-Et4)#ipv6 dhcp relay destination 2001:0db8:0:1::1

**Configuring the Client Link Layer Address for the IPv6 DHCP relay agent**

The `ipv6 dhcp relay option link-layer address` command enables the DHCPv6 relay agent to configure the client link layer address option to solicit and request messages. In other words, the command enables the link layer address option (79) in the global configuration mode. The `no ipv6 dhcp relay option link-layer address` command disables the link layer address option (79) in the global configuration mode.

**Example**

- This command enables the insertion of link layer address option (79) in the global configuration mode.
  
switch(config)#ipv6 dhcp relay option link-layer address

**Clearing IPv6 DHCP Relay Counters**

The `clear ipv6 dhcp relay counters` command resets the DHCP relay counters. The configuration mode determines which counters are reset:

- Global configuration: command clears the counters for the switch and for all interfaces.
- Interface configuration: command clears the counter for the configuration mode interface.

**Example**

- These commands clear all DHCP relay counters on the switch.
  
switch(config-if-Et4)#exit
  
  switch(config)#clear ipv6 dhcp relay counters
  
  switch(config)#
• These commands clear the DHCP relay counters for Ethernet interface 4.

  switch(config)#interface ethernet 4
  switch(config-if-Et4)#clear ipv6 dhcp relay counters
  switch(config)#

28.3.4.2 Viewing IPv6 DHCP Relay Information

IPv6 DHCP Status

The `show ipv6 helper-address` command displays the status of DHCP relay agent parameters on the switch and each interface where at least one feature parameter is listed. The command displays the status for both global and interface configurations.

Example

• This command displays the DHCP Agent Relay parameter status.

  switch>show ipv6 helper-address
  DHCP Relay Agent Information Option Enabled
  DHCP Relay Agent Always-On Mode Enabled
  Interface: Ethernet4
    Circuit ID: V-200
    DHCP servers: 2001:db8:0:1::1
  switch>

IPv6 DHCP Relay Counters

The `show ipv6 dhcp relay counters` command displays the number of DHCP packets received, forwarded, or dropped on the switch and on all interfaces enabled as DHCP relay agents.

Example

• This command displays the IP DHCP relay counter table.

  switch>show ipv6 dhcp relay counters

<table>
<thead>
<tr>
<th>Dhcp Packets</th>
<th>Rcvd Fwdd Drop</th>
<th>Last Cleared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>All Req</td>
<td>376</td>
<td>376  0</td>
</tr>
<tr>
<td>All Resp</td>
<td>277</td>
<td>277  0</td>
</tr>
<tr>
<td>Ethernet4</td>
<td>207</td>
<td>148  0</td>
</tr>
</tbody>
</table>

  switch>


28.4 IPv6 Commands

Global Configuration Commands
- ipv6 dhcp relay always-on
- ipv6 dhcp relay option link-layer address
- ipv6 hardware fib aggregate-address
- ipv6 hardware fib ecmp resilience
- ipv6 hardware fib nexthop-index
- ipv6 neighbor
- ipv6 neighbor cache persistent
- ipv6 route
- ipv6 unicast-routing

Interface Configuration Commands
- ipv6 address
- ipv6 dhcp relay destination
- ipv6 enable
- ipv6 helper-address
- ipv6 nd managed-config-flag
- ipv6 nd ns-interval
- ipv6 nd other-config-flag
- ipv6 nd prefix
- ipv6 nd ra dns-server
- ipv6 nd ra dns-servers lifetime
- ipv6 nd ra dns-suffix
- ipv6 nd ra dns-suffixes lifetime
- ipv6 nd ra hop-limit
- ipv6 nd ra interval
- ipv6 nd ra lifetime
- ipv6 nd ra mtu suppress
- ipv6 nd ra disabled
- ipv6 nd reachable-time
- ipv6 nd router-preference
- ipv6 verify

Privileged EXEC Commands
- clear ipv6 dhcp relay counters
- clear ipv6 neighbors

EXEC Commands
- show ipv6 dhcp relay counters
- show ipv6 hardware fib aggregate-address
- show ipv6 helper-address
- show ipv6 interface
- show ipv6 nd ra internal state
- show ipv6 neighbors
- show ipv6 route
- show ipv6 route age
- show ipv6 route host
- show ipv6 route interface
- show ipv6 route match tag
• `show ipv6 route summary`
clear ipv6 dhcp relay counters

The `clear ipv6 dhcp relay counters` command resets the DHCP relay counters. When no port is specified, the command clears the counters for the switch and for all interfaces. Otherwise, the command clears the counter for the specified interface.

**Command Mode**

Privileged EXEC

**Command Syntax**

```
clear ipv6 dhcp relay counters [PORT]
```

**Parameters**

- `PORT` Interface through which neighbor is accessed. Options include:
  - `<no parameter>` all dynamic entries are removed.
  - `interface ethernet e_num` Ethernet interface specified by `e_num`.
  - `interface loopback l_num` Loopback interface specified by `l_num`.
  - `interface port-channel p_num` Port-channel interface specified by `p_num`.
  - `interface vlan v_num` VLAN interface specified by `v_num`.
Examples

- These commands clear the DHCP relay counters for Ethernet interface 4 and shows the counters before and after the clear command.

```
switch(config)# show ipv6 dhcp relay counters

| Dhcp Packets |     |     |
|-------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
clear ipv6 neighbors

The **clear ipv6 neighbors** command removes the specified dynamic IPv6 neighbor discovery cache entries. Commands that do not specify an IPv6 address remove all dynamic entries for the listed interface. Commands that do not specify an interface remove all dynamic entries.

**Command Mode**
Privileged EXEC

**Command Syntax**
```
clear ipv6 neighbors [PORT] [DYNAMIC_IPV6]
```

**Parameters**
- **PORT** Interface through which neighbor is accessed. Options include:
  - `<no parameter>` all dynamic entries are removed.
  - *ethernet e_num* Ethernet interface specified by *e_num*.
  - *loopback l_num* Loopback interface specified by *l_num*.
  - *management m_num* Management interface specified by *m_num*.
  - *port-channel p_num* Port-channel interface specified by *p_num*.
  - *vlan v_num* VLAN interface specified by *v_num*.
  - *vxlan vx_num* VXLAN interface specified by *vx_num*.
- **DYNAMIC_IPV6** Address of entry removed by the command. Options include:
  - `<no parameter>` all dynamic entries for specified interface are removed.
  - *ipv6_addr* IPv6 address of entry.

**Example**
- This command removes all dynamic neighbor entries for VLAN interface 200.
  ```
  switch#clear ipv6 neighbors vlan 200
  switch#
  ```
ipv6 address

The `ipv6 address` command assigns a global IPv6 address to the IPv6 interface, and defines the prefix length. This command is supported on routable interfaces. Multiple global IPv6 addresses can be assigned to an interface.

The `no ipv6 address` and `default ipv6 address` commands remove the IPv6 address assignment from the configuration mode interface by deleting the corresponding `ipv6 address` command from `running-config`. If the command does not include an address, all address assignments are removed from the interface. IPv6 remains enabled on the interface after the removal of all IPv6 addresses only if an `ipv6 enable` command is configured on the interface.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 address ipv6_prefix
no ipv6 address [ipv6_prefix]
default ipv6 address [ipv6_prefix]
```

**Parameters**

- `ipv6_prefix` address assigned to the interface (CIDR notation).

**Guidelines**

This command is supported on routable interfaces.

**Example**

- These commands configure an IPv6 address and prefix length for VLAN 200:
  
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ipv6 address 10:23:31:00:01:32:93/64
  switch(config-if-Vl200)#
  ```
ipv6 dhcp relay always-on

The `ipv6 dhcp relay always-on` command enables the switch DHCP relay agent on the switch regardless of the DHCP relay agent status on any interface. By default, the DHCP relay agent is enabled only if at least one routable interface is configured with an `ipv6 dhcp relay destination` statement.

The `no ipv6 dhcp relay always-on` and `default ipv6 dhcp relay always-on` commands remove the `ipv6 dhcp relay always-on` command from `running-config`.

**Command Mode**
Global Configuration

**Command Syntax**
- `ipv6 dhcp relay always-on`
- `no ipv6 dhcp relay always-on`
- `default ipv6 dhcp relay always-on`

**Example**
- This command enables the DHCP relay agent.

  ```
  switch(config)#ipv6 dhcp relay always-on
  switch(config)#
  ```
ipv6 dhcp relay destination

The `ipv6 dhcp relay destination` command enables the DHCPv6 relay agent and sets the destination address on the configuration mode interface.

The `no ipv6 dhcp relay destination` and `default ipv6 dhcp relay destination` commands remove the corresponding `ipv6 dhcp relay destination` command from `running-config`. When the commands do not list an IPv6 address, all `ipv6 dhcp relay destination` commands are removed from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 dhcp relay destination ipv6_addr
no ipv6 dhcp relay destination [ipv6_addr]
default ipv6 dhcp relay destination [ipv6_addr]
```

**Parameters**
- `ipv6_addr` DCHP Server's IPv6 address.

**Example**
- This command enables the DHCPv6 relay agent and sets the destination address to 2001:0db8:0:1::1 on Ethernet interface 4.

```
switch(config)#interface ethernet 4
switch(config-if-Et4)#ipv6 dhcp relay destination 2001:0db8:0:1::1
switch(config-if-Et4)#show active
interface Ethernet4
  ipv6 dhcp relay destination 2001:db8:0:1::1
switch(config-if-Et4)#
```
ipv6 dhcp relay option link-layer address

The `ipv6 dhcp relay option link-layer address` command enables the DHCPv6 relay agent to configure the client link layer address option to solicit and request messages. In other words, the command enables the link layer address option (79) in the global configuration mode.

The `no ipv6 dhcp relay option link-layer address` command disables the link layer address option (79) in the global configuration mode.

**Command Mode**

Global Configuration

**Command Syntax**

```
ipv6 dhcp relay option link-layer address
no ipv6 dhcp relay option link-layer address
default ipv6 dhcp relay option link-layer address
```

**Example**

- This command enables the insertion of link layer address option (79) in the global configuration mode.

  ```
  switch(config)#ipv6 dhcp relay option link-layer address
  ```
**ipv6 enable**

The *ipv6 enable* command enables IPv6 on the configuration mode interface. Assigning an IPv6 address to an interface also enables IPv6 on the interface.

The *no ipv6 enable* and *default ipv6 enable* command remove the corresponding *ipv6 enable* command from *running-config*. This action disables IPv6 on interfaces that are not configured with an IPv6 address.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
- `ipv6 enable`
- `no ipv6 enable`
- `default ipv6 enable`

**Example**
- This command enables IPv6 on VLAN interface 200.
  
  ```
  switch(config)#interface vlan 200
  switch(config-vl200)#ipv6 enable
  switch(config-vl200)#
  ```
ipv6 hardware fib aggregate-address

The `ipv6 hardware fib aggregate-address` command specifies the routing table repository of specified IPv6 route.

By default, routes that are created statically through the CLI or dynamically through routing protocols are initially stored in software routing tables, then entered in the hardware routing table by the routing agent. This command prevents the entry of the specified route into the hardware routing table. Specified routes that are in the hardware routing table are removed by this command. Specific routes that are encompassed within the specified route prefix are affected by this command.

The `no ipv6 hardware fib aggregate-address` and `default ipv6 hardware fib aggregate-address` commands remove the restriction from the hardware routing table for the specified routes by removing the corresponding `ipv6 hardware fib aggregate-address` command from `running-config`.

**Command Mode**

Global Configuration

**Command Syntax**

```
ipv6 hardware fib aggregate-address ipv6_prefix summary-only software-forward
no ipv6 hardware fib aggregate-address ipv6_prefix
default ipv6 hardware fib aggregate-address ipv6_prefix
```

**Parameters**

- `ipv6_prefix` IPv6 prefix that is restricted from the hardware routing table (CIDR notation).

**Example**

- These commands configure a hardware routing restriction for an IPv6 prefix, then displays that restriction.

```
switch(config)#ipv6 hardware fib aggregate-address fd77:4890:5313:ffed::/64 summary-only software-forward
switch(config)#show ipv6 hardware fib aggregate-address
Codes: S - Software Forwarded
S  fd77:4890:5313:ffed::/64

switch(config)#
```
ipv6 hardware fib ecmp resilience

The `ipv6 hardware fib ecmp resilience` command configures a fixed number of next hop entries in the hardware ECMP table for the specified IPv6 address prefix. In addition to specifying the maximum number of next hop addresses that the table can contain for the prefix, the command introduces a redundancy factor that allows duplication of each next hop address. The fixed table space for the address is the maximum number of next hops multiplied by the redundancy factor.

The default method of adding or removing next hop entries when required by the active hashing algorithm leads to inefficient management of the ECMP table, which can result in the rerouting of packets to different next hops that breaks TCP packet flows. Implementing fixed table entries for a specified IP address allows data flows that are hashed to a valid next hop number to remain intact. Additionally, traffic is evenly distributed over a new set of next hops.

The `no ipv6 hardware fib ecmp resilience` and `default ipv6 hardware fib ecmp resilience` commands restore the default hardware ECMP table management by removing the `ipv6 hardware fib ecmp resilience` command from `running-config`.

**Command Mode**
Global Configuration

**Command Syntax**

```
ipv6 hardware fib ecmp resilience net_prfx capacity nhop_max redundancy duplicates
no ipv6 hardware fib ecmp resilience net_addr
default ipv6 hardware fib ecmp resilience net_addr
```

**Parameters**
- `net_prfx` IPv6 address prefix managed by command.
- `nhop_max` Specifies maximum number of nexthop entries for specified IP address prefix. Value range varies by platform:
  - Helix: `<2 to 64>`
  - Trident: `<2 to 32>`
  - Trident II: `<2 to 64>`
- `duplicates` Specifies the redundancy factor. Value ranges from 1 to 128.

**Example**
- This command configures a hardware ECMP table space of 15 entries for the IPv6 address 2001:db8:0::/64. A maximum of five nexthop addresses can be specified for the address. When the table contains five nexthop addresses, each appears in the table three times. When the table contains fewer than five nexthop addresses, each is duplicated until the 15 table entries are filled.

```
switch(config)#ipv6 hardware fib ecmp resilience 2001:db8:0::/64 capacity 5 redundancy 3
```
ipv6 hardware fib nexthop-index

The `ipv6 hardware fib nexthop-index` command deterministically selects the next hop used for ECMP routes. By default, routes that are created statically through the CLI or dynamically through routing protocols are initially stored in software routing tables, then entered in the hardware routing table by the routing agent. This command specifies the method of creating an index-offset number that points to the next hop from the list of the route’s ECMP next hops.

The index-offset is calculated by adding the next hop index to a prefix offset.

- **Next hop index**: specified in the command.
- **Prefix offset**: the least significant bits of the route’s prefix.

The command specifies the number of bits that comprise the prefix offset. The prefix offset is set to the prefix when the command specifies a prefix size larger than the prefix. If the command specifies an prefix size of zero, the prefix-offset is also zero and the index-offset is set to the next hop index.

When the index-offset is greater than the number of next hops in the table, the position of the next hop is the remainder of the division of the index-offset by the number of next hop entries.

The `no ipv6 hardware fib nexthop-index` and `default ipv6 hardware fib nexthop-index` commands remove the specified nexthop used for ECMP routes by removing the `ipv6 hardware fib nexthop-index` command from `running-config`.

**Command Mode**

Global Configuration

**Command Syntax**

```
ipv6 hardware fib nexthop nexthop_index [PREFIX]
no ipv6 hardware fib nexthop
default ipv6 hardware fib nexthop
```

**Parameters**

- **nexthop_index** specifies the next hop index. Value ranges from 0 to 32.
- **PREFIX** Number of bits of the route’s prefix to use as the prefix-offset. Value ranges from 0 to 64.
  - `<no parameter>` The prefix offset is set to zero.
  - `prefix-bits <0 to 64>` Specifies the number bits to use as the prefix-offset.

**Example**

- This command specifies the next hop from the list of ECMP next hops for the route.
```
switch(config)#ipv6 hardware fib nexthop-index 5 prefix-bits 10
switch>show ip
  IP Routing : Enabled
  IP Multicast Routing : Disabled
  VRRP: Configured on 0 interfaces

  IPv6 Unicast Routing : Enabled
  IPv6 ECMP Route support : False
  IPv6 ECMP Route nexthop index: 5
  IPv6 ECMP Route num prefix bits for nexthop index: 10
switch>
```
ipv6 helper-address

The `ipv6 helper-address` command enables the DHCP relay agent on the configuration mode interface and specifies a forwarding address for DHCP requests. An interface that is configured with multiple helper-addresses forwards DHCP requests to all specified addresses.

The `no ipv6 helper-address` and `default ipv6 helper-address` commands remove the corresponding `ipv6 helper-address` command from `running-config`. Commands that do not specify an IP helper-address removes all helper-addresses from the interface.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration

**Command Syntax**

- `ipv6 helper-address ipv6_addr`
- `no ipv6 helper-address [ipv6_addr]`
- `default ipv6 helper-address [ipv6_addr]`

**Parameters**

- `ipv6_addr` DHCP server address accessed by interface.

**Example**

- This command enables the DHCP relay agent on VLAN interface 200 and configures the switch to forward DHCP requests received on this interface to the server at 2001:0db8:0:1::1.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 helper-address 2001:0db8:0:1::1
switch(config-if-Vl200)#show active
interface Vlan200
  ipv6 helper-address 2001:0db8:0:1::1
switch(config-if-Vl200)#
```
ipv6 nd managed-config-flag

The `ipv6 nd managed-config-flag` command causes the `managed address configuration` flag to be set in IPv6 RA packets transmitted from the configuration mode interface.

The `no ipv6 nd managed-config-flag` and `default ipv6 nd managed-config-flag` commands restore the default setting where the `managed address configuration` flag is not set in IPv6 RA packets transmitted by the interface by removing the corresponding `ipv6 nd managed-config-flag` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
- `ipv6 nd managed-config-flag`
- `no ipv6 nd managed-config-flag`
- `default ipv6 nd managed-config-flag`

**Example**
- These commands cause the `managed address configuration` flag to be set in IPv6 RA packets sent from VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd managed-config-flag
switch(config-if-Vl200)#
```
ipv6 nd ns-interval

The `ipv6 nd ns-interval` command configures the interval between IPv6 neighbor solicitation (NS) transmissions from the configuration mode interface.

The `no ipv6 nd ns-interval` and `default ipv6 nd ns-interval` commands return the IPv6 NS transmission interval for the configuration mode interface to the default value of 1000 milliseconds by removing the corresponding `ipv6 nd ns-interval` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd ns-interval period
no ipv6 nd ns-interval
default ipv6 nd ns-interval
```

**Parameters**
- `period` interval in milliseconds between successive IPv6 neighbor solicitation transmissions. Values range from 1000 to 4294967295. The default period is 1000 milliseconds.

**Example**
- This command configures a neighbor solicitation transmission interval of 30 seconds on VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ns-interval 30000
switch(config-if-Vl200)#
```
ipv6 nd other-config-flag

The `ipv6 nd other-config-flag` command configures the configuration mode interface to send IPv6 RAs with the `other stateful configuration` flag set.

The `no ipv6 nd other-config-flag` and `default ipv6 nd other-config-flag` commands restore the default setting by removing the corresponding `ipv6 nd other-config-flag` command from `running-config`.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

- `ipv6 nd other-config-flag`
- `no ipv6 nd other-config-flag`
- `default ipv6 nd other-config-flag`

**Example**

- These commands configure the switch to set the other stateful configuration flag in advertisements sent from VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd other-config-flag
switch(config-if-Vl200)#
```

**ipv6 nd prefix**

The `ipv6 nd prefix` command configures neighbor discovery Router Advertisements (RAs) prefix inclusion for RAs sent from the configuration mode interface.

By default, all prefixes configured as IPv6 addresses (`ipv6 address`) are advertised in the interface’s RAs. The `ipv6 nd prefix` command with the `no-advertise` option prevents advertising of the specified prefix without affecting the advertising of other prefixes specified as IPv6 addresses. When an interface configuration includes at least one `ipv6 nd prefix` command that enables prefix advertising, RAs advertise only prefixes specified through `ipv6 nd prefix` commands.

Commands enabling prefix advertising also specify the advertised valid and preferred lifetime periods. Default periods are 2,592,000 (valid) and 604,800 (preferred) seconds.

The `no ipv6 nd prefix` and `default ipv6 nd prefix` commands remove the corresponding `ipv6 nd prefix` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd prefix ipv6_prefix LIFETIME [FLAGS]
ipv6 nd prefix ipv6_prefix no-advertise
no ipv6 nd prefix ipv6_prefix
default ipv6 nd prefix ipv6_prefix
```

**Parameters**
- `ipv6_prefix` IPv6 prefix (CIDR notation).
- `no-advertise` Prevents advertising of the specified prefix.
- `LIFETIME` Period that the specified IPv6 prefix is advertised (seconds). Options include
  - `valid preferred` Two values that set the `valid` and `preferred` lifetime periods.
  - `valid` One value that sets the `valid` lifetime. The `preferred` lifetime is set to the default value.
  - `<no parameter>` The `valid` and `preferred` lifetime periods are set to their default values.

  Options for `valid`: `<0` to `4294967295>` and `infinite`. Default value is 2592000
  Options for `preferred`: `<0` to `4294967295>` and `infinite`. Default value is 604800
  The maximum value (`4294967295`) and `infinite` are equivalent settings.

- `FLAGS` `on-link` and `autonomous address-configuration` flag values in RAs.
  - `<no parameter>` both flags are set.
  - `no-autoconfig` `autonomous address-configuration` flag is reset.
  - `no-onlink` `on-link` flag is reset.
  - `no-autoconfig no-onlink` both flags are reset.
  - `no-onlink no-autoconfig` both flags are reset.
Example

- These commands enable neighbor discovery advertising for IPv6 address 3012:D678::/64, on VLAN interface 200, specifying a valid lifetime of 1,296,000 seconds and the default preferred lifetime.

  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ipv6 nd prefix 3012:D678::/64 1296000
**ipv6 nd ra dns-server**

The `ipv6 nd ra dns-server` command configures the IPv6 address of a preferred Recursive DNS Server (RDNSS) for the command mode interface to include in its neighbor-discovery Router Advertisements (RAs). Including RDNSS information in RAs provides DNS server configuration for connected IPv6 hosts without requiring DHCPv6.

Multiple servers can be configured on the interface by using the command repeatedly. A lifetime value for the RDNSS can optionally be specified with this command, and overrides any default value configured for the interface using the `ipv6 nd ra dns-servers lifetime` command.

The `no ipv6 nd ra dns-server` and `default ipv6 nd ra dns-server` commands remove the corresponding `ipv6 nd ra dns-server` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
- `ipv6 nd ra dns-server ipv6_addr SERVER_LIFE`
- `no ipv6 nd ra dns-server ipv6_addr`
- `default ipv6 nd ra dns-server ipv6_addr`

**Parameters**
- `ipv6_addr` RDNSS address to be included in RAs from the command mode interface.
- `SERVER_LIFE` maximum lifetime value for the specified RDNSS entry. This value overrides any default lifetime value. Value should be between the RA interval configured on the interface and two times that interval. Options include:
  - `<no parameter>` lifetime period is the default lifetime period configured on the interface. If no lifetime period is configured on the interface, the default value is 1.5 times the maximum RA interval set by the `ipv6 nd ra interval` command.
  - `lifetime 0` the configured RDNSS is not to be used.
  - `lifetime <1 to 4294967295>` specifies the lifetime period for this RDNSS in seconds.

**Example**
- This command configures the RDNSS at 2001:0db8:0:1::1 as a preferred RDNSS for VLAN interface 200 to include in its neighbor-discovery route advertisements, and sets its lifetime value to 300 seconds.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra dns-server 2001:0db8:0:1::1 lifetime 300
switch(config-if-Vl200)#
```
**ipv6 nd ra dns-servers lifetime**

The `ipv6 nd ra dns-servers lifetime` command sets the default value that the configuration mode interface uses for the lifetime of any Recursive DNS Server (RDNSS) configured on the interface. A lifetime value set for an individual RDNSS overrides this value. The lifetime value is the maximum amount of time after a route advertisement packet is sent that the RDNSS referenced in the packet may be used for name resolution.

The `no ipv6 nd ra dns-servers lifetime` and `default ipv6 nd ra dns-servers lifetime` commands remove the default lifetime value from the interface by removing the corresponding `ipv6 nd ra dns-servers lifetime` command from `running-config`. When there is no default RDNSS lifetime value configured on the interface, an RDNSS without a custom lifetime value will default to 1.5 times the RA interval configured on the interface. A lifetime of zero seconds means that the RDNSS must not be used for name resolution.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
- `ipv6 nd ra dns-servers lifetime period`
- `no ipv6 nd ra dns-servers lifetime`
- `default ipv6 nd ra dns-servers lifetime`

**Parameters**
- `period` the RDNSS lifetime value for the configuration mode interface. Options include:
  - `<0>` any RDNSS configured on the command mode interface without a custom lifetime value must not be used.
  - `<1 to 4294967295>` maximum RDNSS lifetime value for the configuration mode interface. This value is overridden by any lifetime value set with the `ipv6 nd ra dns-server` command. Should be between the router advertisement interval configured on the interface and two times that interval.

**Example**
- This command sets the default RDNSS maximum lifetime value for VLAN 200 to 350 seconds.
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ipv6 nd ra dns-servers lifetime 350
  switch(config-if-Vl200)#
  ```
**ipv6 nd ra dns-suffix**

The `ipv6 nd ra dns-suffix` command creates a DNS Search List (DNSSL) for the command mode interface to include in its neighbor-discovery Router Advertisements as defined in RFC 6106. The DNSSL contains the domain names of DNS suffixes for IPv6 hosts to append to short, unqualified domain names for DNS queries.

Multiple DNS domain names can be added to the DNSSL by using the command repeatedly. A lifetime value for the DNSSL can optionally be specified with this command, and overrides any default value configured for the interface using the `ipv6 nd ra dns-suffixes lifetime` command.

The `no ipv6 nd ra dns-suffix` and `default ipv6 nd ra dns-suffix` commands remove the corresponding `ipv6 nd ra dns-suffix` command from running-config.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd ra dns-suffix domain SUFFIX_LIFE
no ipv6 nd ra dns-suffix ipv6_addr
default ipv6 nd ra dns-suffix ipv6_addr
```

**Parameters**

- `domain` domain suffix for IPv6 hosts to append to short, unqualified domain names for DNS queries. Suffix must contain only alphanumeric characters, "." and "-" and must begin and end with an alphanumeric character.
- `SUFFIX_LIFE` maximum lifetime value for the specified domain suffix. This value overrides any default lifetime value. Value should be between the RA interval configured on the interface and two times that interval. Options include:
  - `<no parameter>` lifetime period is the default lifetime period configured on the interface. If no lifetime period is configured on the interface, the default value is 1.5 times the maximum RA interval set by the `ipv6 nd ra interval` command.
  - `lifetime 0` the configured domain suffix is not to be used.
  - `lifetime <1 to 4294967295>` specifies the lifetime period for this domain suffix in seconds.

**Example**

```
These commands create a DNSSL for VLAN interface 200 to include in its neighbor-discovery route advertisements, and set its lifetime value to 300 seconds.

switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra dns-suffix test.com lifetime 300
switch(config-if-Vl200)#
```
**ipv6 nd ra dns-suffixes lifetime**

The **ipv6 nd ra dns-suffixes lifetime** command sets the default value that the configuration mode interface uses for the lifetime of any DNS Search List (DNSSL) configured on the interface. A lifetime value set for an individual DNSSL overrides this value. The lifetime value is the maximum amount of time after a route advertisement packet is sent that the DNSSL included in the packet may be used for name resolution.

The **no ipv6 nd ra dns-suffixes lifetime** and **default ipv6 nd ra dns-suffixes lifetime** commands remove the default lifetime value from the interface by removing the corresponding **ipv6 nd ra dns-suffixes lifetime** command from **running-config**. When there is no default DNSSL lifetime value configured on the interface, a DNSSL without a custom lifetime value will default to 1.5 times the RA interval configured on the interface. A lifetime of zero seconds means that the DNSSL must not be used for name resolution.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd ra dns-suffixes lifetime period
no ipv6 nd ra dns-suffixes lifetime
default ipv6 nd ra dns-suffixes lifetime
```

**Parameters**

- **period**  the DNSSL lifetime value for the configuration mode interface. Options include:
  - `<0>` any DNSSL configured on the command mode interface without a custom lifetime value must not be used.
  - `<1 to 4294967295>` maximum DNSSL lifetime value for the configuration mode interface. This value is overridden by any lifetime value set with the **ipv6 nd ra dns-suffix** command. Should be between the RA interval configured on the interface and two times that interval.

**Example**

- This command sets the default DNSSL maximum lifetime value for VLAN 200 to 350 seconds.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra dns-suffixes lifetime 350
switch(config-if-Vl200)#
```
**ipv6 nd ra hop-limit**

The `ipv6 nd ra hop-limit` command sets a suggested hop-limit value to be included in Router Advertisement (RA) packets. The hop-limit value is to be used by attached hosts in outgoing packets.

The `no ipv6 nd ra hop-limit` and `default ipv6 nd ra hop-limit` commands remove the corresponding `ipv6 nd ra hop-limit` command from **running-config**.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd ra hop-limit quantity
no ipv6 nd ra hop-limit lifetime
default ipv6 nd ra hop-limit lifetime
```

**Parameters**
- `quantity` the hop-limit value to be included in RA packets sent by the configuration mode interface. Options include:
  - `<0>` indicates that outgoing packets from attached hosts are to be immediately discarded.
  - `<1 to 255>` number of hops. The default value is 64.

**Example**
- These commands include a hop-limit value of 100 in RA packets sent by VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra hop-limit
switch(config-if-Vl200)#
```
**ipv6 nd ra interval**

The `ipv6 nd ra interval` command configures the interval between IPv6 Router Advertisement transmissions from the configuration mode interface.

The `no ipv6 nd ra interval` and `default ipv6 nd ra interval` commands return the IPv6 RA transmission interval for the configuration mode interface to the default value of 200 seconds by removing the corresponding `ipv6 nd ra interval` command from `running-config`.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd ra interval [SCALE] ra_period [minimum_period]
no ipv6 nd ra interval
default ipv6 nd ra interval
```

**Parameters**

- **SCALE** timescale in which command parameter values are expressed.
  - `<no parameter>` seconds
  - `msec` milliseconds
- **ra_period** maximum interval between successive IPv6 RA transmissions. The default period is 200 seconds.
  - `<4 - 1800>` valid range when `scale` is set to default value (seconds).
  - `<500 - 1800000>` valid range when `scale` is set to `msec`.
- **minimum_period** minimum interval between successive IPv6 RA transmissions. Must be smaller than `ra_period`. By default, a minimum period is not defined.
  - `<no parameter>` Command does not specify a minimum period.
  - `<3 - 1799>` valid range when `scale` is set to default value (seconds).
  - `<375 - 1799999>` valid range when `scale` is set to `msec`.

**Example**

- These commands configure a RA transmission interval of 60 seconds on VLAN interface 200, then displays the interface status.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra interval 60
switch(config-if-Vl200)#show active
interface Vlan200
  ipv6 nd ra interval 60
switch(config-if-Vl200)#
```
**ipv6 nd ra lifetime**

The **ipv6 nd ra lifetime** command specifies the value that the switch places in the **router lifetime** field of IPv6 Router Advertisements sent from the configuration mode interface.

If the value is set to 0, IPv6 peers connected to the specified interface will remove the switch from their lists of default routers. Values greater than 0 indicate the time in seconds that peers should keep the router on their default router lists without receiving further RAs from the switch. Unless the value is 0, the router lifetime value should be equal to or greater than the interval between unsolicited RAs sent on the interface.

The **no ipv6 nd ra lifetime** and **default ipv6 nd ra lifetime** commands return the IPv6 RA lifetime data entry filed for the configuration mode interface to the default value of 1800 seconds by removing the corresponding **ipv6 nd ra lifetime** command from **running-config**.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

- **ipv6 nd ra lifetime ra_lifetime**
- **no ipv6 nd ra lifetime**
- **default ipv6 nd ra lifetime**

**Parameters**

- **ra_lifetime**  router lifetime period (seconds). Default value is 1800. Options include
  - **<0>**  Router should not be considered as a default router
  - **<1 - 65535>**  Lifetime period advertised in RAs. Should be greater than or equal to the interval between IPv6 RA transmissions from the configuration mode interface as set by the **ipv6 nd ra interval** command.

**Example**

- This command configures the switch to enter 2700 in the router lifetime field of RAs transmitted from VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd ra lifetime 2700
switch(config-if-Vl200)#show active
interface Vlan20
  ipv6 nd ra lifetime 2700
switch(config-if-Vl200)#
```
**ipv6 nd ra mtu suppress**

The `ipv6 nd ra mtu suppress` command suppresses the Router Advertisement (RA) MTU option on the configuration mode interface. The MTU option causes an identical MTU value to be advertised by all nodes on a link. By default, the RA MTU option is not suppressed.

The `no ipv6 nd ra mtu suppress` and `default ipv6 nd ra mtu suppress` commands restores the MTU option setting to enabled by for the configuration mode interface by removing the corresponding `ipv6 nd ra mtu suppress` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
- `ipv6 nd ra mtu suppress`
- `no ipv6 nd ra mtu suppress`
- `default ipv6 nd ra mtu suppress`

**Example**
- This command suppresses the MTU option on VLAN interface 200.

```
switch(config)#interface vlan 200
switch(config-vl200)#ipv6 nd ra mtu suppress
switch(config-vl200)#
```
**ipv6 nd ra disabled**

The `ipv6 nd ra disabled` command suppresses IPv6 Router Advertisement (RA) transmissions on the configuration mode interface. By default, only unsolicited RAs that are transmitted periodically are suppressed. The `all` option configures the switch to suppress all RAs, including those responding to a router solicitation.

The `no ipv6 nd ra disabled` and `default ipv6 nd ra disabled` commands restore the transmission of RAs on the configuration mode interface by deleting the corresponding `ipv6 nd ra disabled` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd ra disabled [SCOPE]
no ipv6 nd ra disabled
default ipv6 nd ra disabled
```

**Parameters**

- **SCOPE** specifies the RAs that are suppressed.
  - `<no parameter>` Periodic unsolicited RAs are suppressed.
  - `all` All RAs are suppressed.

**Example**

- This command suppresses all RAs on VLAN interface 200.
  
  ```
  switch(config)#interface vlan 200
  switch(config-vl200)#ipv6 nd ra disabled all
  switch(config-vl200)#
  ```
The `ipv6 nd reachable-time` command specifies the time period that the switch includes in the reachable time field of RAs sent from the configuration mode interface. The reachable time defines the period that a remote IPv6 node is considered reachable after a reachability confirmation event.

RAs that advertise zero seconds indicate that the router does not specify a reachable time. The default advertisement value is 0 seconds. The switch reachability default period is 30 seconds.

The `no ipv6 nd reachable-time` and `default ipv6 nd reachable-time` commands restore the entry of the default value (0) in RAs sent from the configuration mode interface by deleting the corresponding `ipv6 nd reachable-time` command from `running-config`.

**Command Syntax**

```
ipv6 nd reachable-time period
no ipv6 nd reachable-time
default ipv6 nd reachable-time
```

**Parameters**

- `period`  Reachable time value (milliseconds). Value ranges from 0 to 4294967295. Default is 0.

**Example**

- These commands configure the entry of 25000 (25 seconds) in the reachable time field of RAs sent from VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd reachable-time 25000
interface Vlan200
  ipv6 address fd7a:4321::1/64
  ipv6 nd reachable-time 25000
switch(config-if-Vl200)#
```
**ipv6 nd router-preference**

The `ipv6 nd router-preference` command specifies the value that the switch enters in the Default Router Preference (DRP) field of Router Advertisements (RAs) that it sends from the configuration mode interface. The default field entry value is `medium`.

The `no ipv6 nd router-preference` and `default ipv6 nd router-preference` commands restore the switch to enter the default DRP field value of `medium` in RAs sent from the configuration mode interface by deleting the corresponding `ipv6 nd router-preference` command from *running-config*.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 nd router-preference RANK
no ipv6 nd router-preference
default ipv6 nd router-preference
```

**Parameters**

- **RANK**  
  Router preference value. Options include:
  - high
  - low
  - medium

**Example**

- This command configures the switch as a medium preference router on RAs sent from VLAN 200.

```bash
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 nd router-preference medium
switch(config-if-Vl200)#
```
ipv6 neighbor

The ipv6 neighbor command creates an IPv6 neighbor discovery cache static entry. The command converts pre-existing dynamic cache entries for the specified address to static entries.

The no ipv6 neighbor and default ipv6 neighbor commands remove the specified static entry from the IPv6 neighbor discovery cache and delete the corresponding ipv6 neighbor command from running-config. These commands do not affect any dynamic entries in the cache.

Command Mode
Global Configuration

Command Syntax
ipv6 neighbor ipv6_addr PORT mac_addr
no ipv6 neighbor ipv6_address PORT
default ipv6 neighbor ipv6_addr PORT

Parameters
- ipv6_addr Neighbor's IPv6 address.
- PORT Interface through which the neighbor is accessed. Options include:
  - ethernet e_num Ethernet interface specified by e_num.
  - loopback l_num Loopback interface specified by l_num.
  - management m_num Management interface specified by m_num.
  - port-channel p_num Port-channel interface specified by p_num.
  - vlan v_num VLAN interface specified by v_num.
  - vxlan vx_num VXLAN interface specified by vx_num.
- mac_addr Neighbor's data-link (hardware) address. (48-bit dotted hex notation – H.H.H).

Example
- This command will add a static entry to the neighbor discovery cache for the neighbor located at 3100:4219::3EF2 with hardware address 0100.4EA1.B100 and accessible through VLAN 200.
  switch(config)#ipv6 neighbor 3100:4219::3EF2 vlan 200 0100.4EA1.B100
  switch(config)#
**ipv6 neighbor cache persistent**

The **ipv6 neighbor cache persistent** command restores the IPv6 neighbor cache after reboot.

The **no ipv6 neighbor cache persistent** and **default ipv6 neighbor cache persistent** commands remove the ARP cache persistent configuration from the *running-config*.

**Command Mode**

  Global Configuration

**Command Syntax**

  - `ipv6 neighbor cache persistent`
  - `no ipv6 neighbor cache persistent`
  - `default ipv6 neighbor cache persistent`

**Example**

- This command restores the ipv6 neighbor cache after reboot.

  ```
  switch(config)# ipv6 neighbor cache persistent
  switch(config)#
  ```
**ipv6 route**

The `ipv6 route` command creates an IPv6 static route. The destination is a IPv6 prefix; the source is an IPv6 address or a routable interface port. When multiple routes exist to a destination prefix, the route with the lowest administrative distance takes precedence.

By default, the administrative distance assigned to static routes is 1. Assigning a higher administrative distance to a static route configures it to be overridden by dynamic routing data. For example, a static route with a distance value of 200 is overridden by OSPF intra-area routes, which have a default distance of 110.

The command provides these methods of designating the nexthop location:

- null0: Traffic to the specified destination is dropped.
- IPv6 gateway: Switch identifies egress interface by recursively resolving the next-hop.
- Egress interface: Switch assumes destination subnet is directly connected to interface; when routing to any subnet address, the switch sends an ARP request to find the MAC address for the first packet.
- Combination Egress interface and IPv6 gateway: Switch does not assume subnet is directly connected to interface; the only ARP traffic is for the nexthop address for the first packet on the subnet. Combination routes are not recursively resolved.

Multiple routes that are configured to the same destination with the same administrative distance comprise an Equal Cost Multi-Path (ECMP) route. The switch attempts to spread outbound traffic across all ECMP route paths equally. All ECMP paths are assigned the same tag value; commands that change the tag value of any ECMP path change the tag value of all paths in the ECMP.

The `no ipv6 route` and `default ipv6 route` commands delete static routes by removing the corresponding `ipv6 route` statements from `running-config`. Commands not including a source delete all statements to the destination. Only statements with parameters that match specified command arguments are deleted. Parameters that are not in the command line are not evaluated.

**Command Mode**

Global Configuration

**Command Syntax**

```plaintext
ipv6 route dest_prefix NEXTHOP [DISTANCE] [TAG_OPT] [RT_NAME]
no ipv6 route dest_prefix [nexthop_addr] [DISTANCE]
default ipv6 route dest_prefix [nexthop_addr] [DISTANCE]
```

**Parameters**

- `dest_prefix`  destination IPv6 prefix (CIDR notation).
- `NEXTHOP`  Access method of next hop device. Options include:
  - `null0`  Null0 interface – route is dropped.
  - `nexthop_addr`  IPv6 address of nexthop device.
  - `ethernet e_num`  Ethernet interface specified by `e_num`.
  - `loopback l_num`  Loopback interface specified by `l_num`.
  - `management m_num`  Management interface specified by `m_num`.
  - `port-channel p_num`  Port-channel interface specified by `p_num`.
  - `vlan v_num`  VLAN interface specified by `v_num`.
  - `vxlan vx_num`  VXLAN interface specified by `vx_num`.
  - `ethernet e_num nexthop_addr`  Combination route (Ethernet interface and gateway).```
- **loopback** `l_num nexthop_addr` Combination route (loopback interface and gateway).
- **management** `m_num nexthop_addr` Combination route (management interface and gateway).
- **port-channel** `p_num nexthop_addr` Combination route (port channel interface and gateway).
- **vlan** `v_num nexthop_addr` Combination route (VLAN interface and gateway).
- **vxlan** `vx_num nexthop_addr` Combination route (VXLAN interface and gateway).

**DISTANCE** administrative distance assigned to route. Options include:
- `<no parameter>` route assigned default administrative distance of one.
- `<1 to 255>` The administrative distance assigned to route.

**TAG_OPT** static route tag. Options include:
- `<no parameter>` assigns default static route tag of 0.
- `tag <0 to 4294967295>` Static route tag value.

**RT_NAME** Associates descriptive text to the route. Options include:
- `<no parameter>` No text is associated with the route.
- `name descriptive_text` The specified text is assigned to the route.

**Example**
- This command creates an IPv6 static route.

  ```
  switch(config)#ipv6 route 10:23:31:00:01:32:93/24 vlan 300
  ```
**ipv6 unicast-routing**

The `ipv6 unicast-routing` command enables the forwarding of IPv6 unicast packets. When routing is enabled, the switch attempts to deliver inbound packets to destination addresses by forwarding them to interfaces or next hop addresses specified by the IPv6 routing table.

The `no ipv6 unicast-routing` and default `ip ipv6 unicast-routing` commands disable IPv6 unicast routing by removing the `ipv6 unicast-routing` command from `running-config`. Dynamic routes added by routing protocols are removed from the routing table. Static routes are preserved by default; the `delete-static-routes` option removes static entries from the routing table.

IPv6 unicast routing is disabled by default.

**Command Mode**  
Global Configuration

**Command Syntax**

```
ipv6 unicast-routing  
no ipv6 unicast-routing [DELETE_ROUTES]  
default ipv6 unicast-routing [DELETE_ROUTES]
```

**Parameters**

- `DELETE_ROUTES`  
  Resolves routing table static entries when routing is disabled.
- `<no parameter>`  
  Routing table retains static entries.
- `delete-static-routes`  
  Static entries are removed from the routing table.

**Example**

- This command enables IPv6 unicast-routing.

  ```
  switch(config)#ipv6 unicast-routing  
  switch(config)#
  ```
**ipv6 verify**

The `ipv6 verify` command configures Unicast Reverse Path Forwarding (uRPF) for inbound IPv6 packets on the configuration mode interface. uRPF verifies the accessibility of source IP addresses in packets that the switch forwards.

uRPF defines two operational modes: strict mode and loose mode.

- **Strict mode**: uRPF also verifies that a packet is received on the interface that its routing table entry specifies for its return packet.
- **Loose mode**: uRPF validation does not consider the inbound packet’s ingress interface.

The `no ipv6 verify` and `default ipv6 verify` commands disable uRPF on the configuration mode interface by deleting the corresponding `ipv6 verify` command from `running-config`.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 verify unicast source reachable-via RPF_MODE
no ipv6 verify unicast
default ipv6 verify unicast
```

**Parameters**

- **RPF_MODE**  Specifies the uRPF mode. Options include:
  - **any**  Loose mode.
  - **rx**  Strict mode
  - **rx allow-default**  Strict mode. All inbound packets are forwarded if a default route is defined.

**Guidelines**

The first IPv6 uRPF implementation briefly disables IPv6 unicast routing. Subsequent `ip verify` commands on any interface do not disable IPv6 routing.

**Example**

- This command enables uRPF strict mode on VLAN interface 100. When a default route is configured on the interface, all inbound packets are checked as valid.

  ```
  switch(config)#interface vlan 100
  switch(config-if-Vl100)#ipv6 verify unicast source reachable-via rx allow-default
  switch(config-if-Vl100)#show active
  interface Vlan100
  ipv6 verify unicast source reachable-via rx allow-default
  switch(config-if-Vl100)#
  ```
show ipv6 dhcp relay counters

The **show ipv6 dhcp relay counters** command displays the number of DHCP packets received, forwarded, or dropped on the switch and on all interfaces enabled as DHCP relay agents.

**Command Mode**

EXEC

**Command Syntax**

`show ipv6 dhcp relay counters`

**Example**

- This command displays the IP DHCP relay counter table.

```
switch> show ipv6 dhcp relay counters

+-----------------+-----------------+-----------------+
| Interface       | Dhcp Packets    | Last Cleared    |
|-----------------+-----------------+-----------------|
| All Req         |  376  376  0    | 4 days, 19:55:12 ago |
| All Resp        |  277  277  0    |                 |
| Ethernet4       |  207  148  0    | 4 days, 19:54:24 ago |

switch>
```
show ipv6 hardware fib aggregate-address

The `show ipv6 hardware fib aggregate-address` command displays the IPv6 prefixes that are restricted from entry into the hardware routing table. The `ipv6 hardware fib aggregate-address` command configures IPv6 prefix restrictions.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 address fib aggregate-address [ADDRESS] [RESTRICTION]
```

**Parameters**

- `ROUTE_FILTER` filters by IPv6 address. Options include:
  - `<no parameter>` Displays all routes.
  - `ipv6_addr` Command displays only specified address.
  - `ipv6_prefix` Command displays addresses filtered by specified prefix (CIDR notation).
- `RESTRICTION` filters by route restriction.
  - `<no parameter>` displays routes restricted from the hardware routing table.
  - `software-forward` displays routes restricted from the hardware routing table.

**Example**

This command displays the routes that are restricted from the hardware routing table.

```
switch>show ipv6 hardware fib aggregate-address
Codes: S - Software Forwarded
S fd77:4890:5313:aaed::/64
S fd77:4890:5313:ffed::/64

switch>
```
show ipv6 helper-address

The `show ipv6 helper-address` command displays the status of DHCP relay agent parameters on the switch and each interface where at least one feature parameter is listed. The command provides status on the following parameters:

- Global: DHCP relay agent Always-on mode, DHCP relay agent Information option
- Interface: DHCP server (list of addresses), Circuit ID contents.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 helper-address
```

**Example**

- This command displays the DHCP Agent Relay parameter status.

```
switch>show ipv6 helper-address
DHCP Relay Agent Information Option Enabled
DHCP Relay Agent Always-On Mode Enabled
Interface: Ethernet4
    Circuit ID: V-200
    DHCP servers: 2001:db8:0:1::1
switch>
```

- This command indicates the status of the client link layer address that is enabled on the switch.

```
switch>show ipv6 helper-address
DHCP Relay is active
DHCP Relay Option 82 is disabled
DHCPv6 Relay Link-layer Address Option (79) is enabled
DHCP Smart Relay is disabled
switch>
```
**show ipv6 interface**

The `ipv6 interface` command displays the status of specified routed interfaces that are configured for IPv6.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 interface [INTERFACE_NAME] [INFO_LEVEL]
```

**Parameters**

- **INTERFACE_NAME**  interfaces for which command displays status.
  - <no parameter> all routed interfaces.
  - `ethernet e_num` Ethernet interface specified by `e_num`.
  - `loopback l_num` Loopback interface specified by `l_num`.
  - `management m_num` Management interface specified by `m_num`.
  - `port-channel p_num` Port-Channel Interface specified by `p_num`.
  - `vlan v_num` VLAN interface specified by `v_num`.
  - `vxlan vx_num` VXLAN interface specified by `vx_num`.
- **INFO_LEVEL** amount of information that is displayed. Options include:
  - <no parameter> command displays data block for each specified interface.
  - `brief` command displays table that summarizes IPv6 interface data.

**Example**

- This command displays the status of VLAN 903.
  ```
  switch>show ipv6 interface vlan 903
  Vlan903 is up, line protocol is up (connected)
  IPv6 is enabled, link-local is fe80::21c:73ff:fe01:21e/64
  Global unicast address(es):
    fd7a:629f:52a4:fe10::3, subnet is fd7a:629f:52a4:fe10::/64
  Joined group address(es):
    ff02::1
    ff02::1:ff00:3
    ff01::2
  switch>
  ```
show ipv6 nd ra internal state

The `ipv6 nd ra internal state` command displays the state of the IPv6 Router Advertisement (RA) daemon for the specified routable interface.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 nd ra internal state [INTERFACE_NAME]
```

**Parameters**

- `INTERFACE_NAME` interfaces for which command displays status.
- `<no parameter>` all routed interfaces.
- `ethernet e_num` Ethernet interface specified by `e_num`.
- `loopback l_num` Loopback interface specified by `l_num`.
- `management m_num` Management interface specified by `m_num`.
- `port-channel p_num` Port-Channel Interface specified by `p_num`.
- `vlan v_num` VLAN interface specified by `v_num`.
- `vxlan vx_num` VXLAN interface specified by `vx_num`.

**Example**

```
• This command displays the IPv6 RA daemon for VLAN interface 1243.

switch>show ipv6 nd ra internal state vlan 1243
INTERFACE: Vlan3908
    ifindex : 0x00000021
    mtu : 9212
    numIpv6Addr : 2
    numPrefixToAdvertise : 0
    numPrefixToSuppress : 0
    RaSuppress : 0
    RsRspSuppress : 0
    raIntervalMaxMsec : 200000
    raIntervalMinMsec : 0
    managedConfigFlag : 0
    otherConfigFlag : 0
    raMtuSuppress : 0
    raLifetime : 1800
    reachableTime : 0
    routerPreference : 0
    lastRaTime : 2012-05-01 09:22:57.020634
    lastRsRspSentTime : 1
    nextTimeout : 171.474535 (sec)
    raNotSentIntfNotReady : 0
    numRaSent : 219
    numRsRcvd : 0
    numRsSuppressed : 0
    numRsRspSent : 0
    numRsDroppedInvalidHopLimit : 0
    numPktDroppedUnexpectedType : 0
    initialized : 1

switch>
```
show ipv6 neighbors

The `show ipv6 neighbors` command displays the IPv6 neighbor discovery cache. The command provides filters to restrict the list to a specified IPv6 address or routable interface.

**Command Mode**

EXEC

**Command Syntax**

```bash
show ipv6 neighbors [PORT] [SOURCE] [INFO_LEVEL]
```

**Parameters**

- **PORT**  Filters by interface through which neighbor is accessed. Options include:
  - `<no parameter>`  all routed interfaces.
  - `ethernet e_num`  Ethernet interface specified by `e_num`.
  - `loopback l_num`  Loopback interface specified by `l_num`.
  - `management m_num`  Management interface specified by `m_num`.
  - `port-channel p_num`  Port-channel interface specified by `p_num`.
  - `vlan v_num`  VLAN interface specified by `v_num`.
  - `vxlan vx_num`  VXLAN interface specified by `vx_num`.
- **SOURCE**  Filters by neighbor IPv6 address. Options include:
  - `<no parameter>`  all IPv6 neighbors.
  - `ipv6_addr`  IPv6 address of individual neighbor.
- **INFO_LEVEL**  amount of information that is displayed. Options include:
  - `<no parameter>`  command displays the discovery cache for the specified interfaces.
  - `summary`  command displays summary information only.

**Example**

- This command displays the IPv6 neighbor discovery cache for IPv6 address `fe80::21c:73ff:fe01:5fe1`.

```bash
switch>show ipv6 neighbors fe80::21c:73ff:fe01:5fe1
IPv6 Address                        Age  Hardware Addr    State Interface
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Et12
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Po999
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl102
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl103
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl1205
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl1207
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl13901
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl13902
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl13903
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl13904
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl13905
fe80::21c:73ff:fe01:5fe1            0     001c.d147.8214   REACH Vl13996
```
show ipv6 route

The `show ipv6 route` command displays IPv6 routing table entries that are in the Forwarding Information Base (FIB), including static routes, routes to directly connected networks, and dynamically learned routes. Multiple equal cost paths to the same prefix are displayed contiguously as a block, with the destination prefix displayed only on the first line.

The `show running-config` command displays all configured routes.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 route [ADDRESS] [ROUTE_TYPE] [INFO_LEVEL]
```

**Parameters**

Address, when present, is always listed first. All other parameters can be placed in any order.

- **ADDRESS** filters routes by IPv6 address or prefix.
  - `<no parameter>` all routing table entries.
  - `ipv6_address` routing table entries matching specified IPv6 address.
  - `ipv6_prefix` routing table entries matching specified IPv6 prefix (CIDR notation).
- **ROUTE_TYPE** filters routes by specified protocol or origin.
  - `<no parameter>` all routing table entries.
  - `aggregate` entries for BGP aggregate routes.
  - `bgp` entries added through BGP protocol.
  - `connected` entries for routes to networks directly connected to the switch.
  - `kernel` entries appearing in Linux kernel but not added by EOS software.
  - `isis` entries added through IS-IS protocol.
  - `ospf` entries added through OSPF protocol.
  - `static` entries added through CLI commands.
- **INFO_LEVEL** Filters entries by next hop connection.
  - `<no parameter>` filters routes whose next hops are directly connected.
  - `detail` displays all routes.

**Example**

- This command displays a route table entry for a specific IPv6 route.
  ```
  switch>show ipv6 route fd7a:3418:52a4:fe18::/64
  IPv6 Routing Table - 77 entries
  Codes: C - connected, S - static, K - kernel, O - OSPF, B - BGP, R - RIP, A - Aggregate
  0 fd7a:3418:52a4:fe18::/64 [10/20]
    via fe80::21c:73ff:fe00:1319, Vlan3601
    via fe80::21c:73ff:fe00:1319, Vlan3602
    via fe80::21c:73ff:fe00:1319, Vlan3608
    via fe80::21c:73ff:fe0f:6a80, Vlan3610
    via fe80::21c:73ff:fe00:1319, Vlan3611
  
  switch>
  ```
**show ipv6 route age**

The `show ipv6 route age` command displays the IPv6 route age to the specified IPv6 address or prefix.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 route ADDRESS age
```

**Parameters**

- `ADDRESS` filters routes by IPv6 address or prefix.

**Example**

- This command displays the route age for the specified prefix.

  ```
  switch>show ipv6 route 2001::3:0/11 age
  IPv6 Routing Table - 74 entries
  Codes: C - connected, S - static, K - kernel, O - OSPF, B - BGP, R - RIP, A - Aggregate

  C 2001::3:0/11 age 00:02:34
  switch>
  ```
**show ipv6 route host**

The `show ipv6 route host` command displays all host routes in the IPv6 host forwarding table. Host routes are those whose destination prefix is the entire address (prefix = /128). Each displayed host route is labeled with its purpose:

- **F** static routes from the FIB.
- **R** routes defined because the IP address is an interface address.
- **A** routes to any neighboring host for which the switch has an ARP entry.

**Command Mode**

EXEC

**Command Syntax**

`show ipv6 route host`

**Example**

- This command displays all IPv6 host routes in the host forwarding table.

```plaintext
switch>show ipv6 route host
R - receive F - FIB, A - attached
F  ::1 to cpu
A  fee7:48a2:0c11:1900:400::1 on Vlan102
R  fee7:48a2:0c11:1900:400::2 to cpu
F  fee7:48a2:0c11:1a00::b via fe80::21c:73ff:fe0b:a80e on Vlan3902
R  fee7:48a2:0c11:1a00::17 to cpu
F  fee7:48a2:0c11:1a00::20 via fe80::21c:73ff:fe0b:33e on Vlan3913
F  fee7:48a2:0c11:1a00::22 via fe80::21c:73ff:fe01:5fe1 on Vlan3908
                     via fe80::21c:73ff:fe01:5fe1 on Vlan3902
switch>
```
show ipv6 route interface

The **show ipv6 route interface** command displays routing table entries on a specified routed port.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 route [ADDRESS] interface PORT_NAME [INFO_LEVEL]
```

**Parameters**

- **ADDRESS**, when present, is always listed first. All other parameters can be placed in any order.
  - **ADDRESS** filters routes by IPv6 address or prefix.
    - <no parameter> all routing table entries.
    - ipv6_address routing table entries matching specified IPv6 address.
    - ipv6_prefix routing table entries matching specified IPv6 prefix (CIDR notation).
  - **PORT_NAME** interfaces for which command displays status.
    - ethernet e_num Ethernet interface specified by e_num.
    - loopback l_num Loopback interface specified by l_num.
    - management m_num Management interface specified by m_num.
    - port-channel p_num Port-Channel Interface specified by p_num.
    - vlan v_num VLAN interface specified by v_num.
    - vxlan vx_num VXLAN interface specified by vx_num.
  - **INFO_LEVEL** filters entries by next hop connection.
    - <no parameter> filters routes whose next hops are directly connected.
    - detail displays all routes.

**Example**

- This command displays the IPv6 routes in VLAN interface 661.

```
switch>show ipv6 route interface ethernet 8
IPv6 Routing Table - 77 entries
Codes: C - connected, S - static, K - kernel, O - OSPF, B - BGP, R - RIP, A - Aggregate

O  fd7a:629f:63af:1232::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
O  fd7a:629f:63af:4119::/64 [150/11] via fe80::823c:73ff:fe00:3640, Ethernet8
C  fd7a:629f:63af:fe88::/64 [0/1] via ::, Ethernet12
C  fd7a:629f:63af:fe88::/64 [0/1] via ::, Ethernet12
O  fd7a:629f:63af:fe88::/64 [10/20] via fe80::21c:73ff:fe00:3640, Ethernet8
C  fe80::0:40::/64 [0/1] via ::, Ethernet8
```
show ipv6 route match tag

The `show ipv6 route match tag` command displays the route tag assigned to the specified IPv6 address or prefix. Route tags are added to static routes for use by route maps.

Command Mode

EXEC

Command Syntax

```
show ipv6 route ADDRESS match tag
```

Parameters

- **ADDRESS** filters routes by IPv6 address or prefix.
  - `ipv6_address` routing table entries matching specified address (A:B:C:D:E:F:G:H)

Example

- This command displays the route tag for the specified prefix.
  ```
  switch>show ipv6 route 2001:0DB8::/64 match tag
  IPv6 Routing Table - 74 entries
  Codes: C - connected, S - static, K - kernel, O3 - OSPFv3, B - BGP, R - RIP, A B - BGP Aggregate, I L1 - IS-IS level 1, I L2 - IS-IS level 2, DH - DHCP, NG - Nexthop Group Static Route, M - Martian, DP - Dynamic Policy Route, L - VRF Leaked
  C   2001:0DB8::/64 tag 0
  switch>
  ```
show ipv6 route summary

The show ipv6 route summary command displays the information about the IPv6 routing table.

Command Mode
EXEC

Command Syntax
show ipv6 route summary

Example
- This command displays the route source and the corresponding number of routes in the IPv6 routing table.

```
switch>show ipv6 route summary
Route Source       Number Of Routes
------------------ ----------------
connected          2
static             0
ospf               5
bgp                7
isis               0
internal           1
attached           0
aggregate          2

Total Routes       17
switch>
```