Open Shortest Path First (OSPF) is a link-state routing protocol that operates within a single autonomous system. OSPF version 3 is defined by RFC 5340.

This chapter contains the following sections.

- Section 32.1: OSPFv3 Introduction
- Section 32.2: OSPFv3 Conceptual Overview
- Section 32.3: Configuring OSPFv3
- Section 32.4: OSPFv3 Configuration Examples
- Section 32.5: OSPFv3 Commands

32.1 OSPFv3 Introduction

OSPFv3 is based on OSPF version 2 and includes enhancements that utilize IPv6 features. However, OSPFv3 is configured and operates independently of any implementation of OSPFv2 on the switch. OSPFv2 features that OSPFv3 implements include:

- Packet types
- Neighbor discovery and adjacency formation mechanisms
- LSA aging and flooding
- SPF calculations
- DR election procedure
- Multiple area support
- Router-ID (32 bits)
The following list describes the OSPFv3 differences and enhancements from OSPFv2:

- IPv6 128-bit addresses
- Use of link-local addresses
- OSPFv3 runs over links instead of subnets
- Support flood pacing

Arista switches support the following OSPFv3 functions:

- A single OSPFv3 instance for each VRF
- Intra- and inter-area routing
- Type 1 and 2 external routing
- Broadcast and P2P interfaces
- Stub areas
- Redistribution of static and connected routes into OSPFv3

32.2 OSPFv3 Conceptual Overview

32.2.1 Storing Link States

OSPFv3 is a dynamic, link-state routing protocol, where links represent routable paths. Dynamic routing protocols calculate the most efficient path between locations based on bandwidth and device status.

A link state advertisement (LSA) is an OSPFv3 packet that communicates a router’s topology to other routers. The link state database (LSDB) stores an area’s topology database and is composed of LSAs received from other routers. Routers update the LSDB by storing LSAs from other routers.

32.2.2 Topology

An autonomous system (AS) is the IP domain within which a dynamic protocol controls the routing of traffic. In OSPFv3, an AS is composed of areas, which define the LSDB computation boundaries. All routers in an area store identical LSDBs. Routers in different areas exchange updates without storing the entire database, reducing information maintenance on large, dynamic networks.

An AS shares internal routing information from its areas and external routing information from other processes to inform routers outside the AS about routes the network can access. Routers that advertise routes on other ASs commit to carry data to the IP space on the route.

OSPFv3 defines these routers:

- Internal router (IR) – a router whose interfaces are contained in a single area. All IRs in an area maintain identical LSDBs.
- Area border router (ABR) – a router that has interfaces in multiple areas. ABRs maintain one LSDB for each connected area.
- Autonomous system boundary router (ASBR) – a gateway router connecting the OSPFv3 domain to external routes, including static routes and routes from other autonomous systems.
**Figure 32-1** displays the OSPFv3 router types.

**Figure 32-1: OSPFv3 Router Types**

OSPFv3 areas are assigned a number between 0 and 4,294,967,295. Area numbers are often expressed in dotted decimal notation, similar to IP addresses.

Each AS has a backbone area, designated as area 0, that connects to all other areas. The backbone receives routing information from all areas, then distributes it to the other areas as required.

OSPFv3 area types include:

- Normal area – accepts intra-area, inter-area, and external routes. The backbone is a normal area.
- Stub area – does not receive router advertisements external to the AS. Stub area routing is based on a default route.

### 32.2.3 Link Updates

Routers periodically send hello packets to advertise status and establish neighbors. A router’s hello packet includes IP addresses of other routers from which it received a hello packet within the time specified by the router dead interval. Routers become neighbors when they detect each other in their hello packets if they:

- share a common network segment.
- are in the same area.
- have the same hello interval, dead interval, and authentication parameters.

Neighbors form adjacencies to exchange LSDB information. A neighbor group uses hello packets to elect a Designated Router (DR) and Backup Designated Router (BDR). The DR and BDR become adjacent to all other neighbors, including each other. Only adjacent neighbors share database information.
The DR is the central contact for database exchanges. Switches send database information to their DR, which relays the information to the other neighbors. All routers in an area maintain identical LSDBs. Switches also send database information to their BDR, which stores this data without distributing it. If the DR fails, the BDR distributes LSDB information to its neighbors.

OSPFv3 routers distribute LSAs by sending them on all of their active interfaces. The router does not send hello packets from passive interfaces preventing adjacencies. The router does not process any OSPFv2 packets received on a passive interface.

When a router’s LSDB is changed by an LSA, it sends the changes to the BDR and DR for distribution to the other neighbors. Routing information is updated only when the topology changes.

Routing devices use Dijkstra’s algorithm to calculate the shortest path to all known destinations, based on cumulative route cost. The cost of an interface indicates the transmission overhead and is usually inversely proportional to its bandwidth.

### 32.2.4 OSPFv3 Security

The OSPFv3 protocol relies on the IPsec Authentication Header (AH) and Encapsulating Security Payload (ESP) header to provide data integrity, authentication and confidentiality. Transport mode provides IPsec to OSPFv3 packets.

The IPsec SA has Security Policy Index (SPI), HMAC algorithm, and a secret key as parameters. These parameters are used to compute Integrity Check Value (ICV), that is used to authenticate peers. When authentication is enabled, all corresponding peers must use same SA parameters to clear OSPFv3 ICV verification. SA can be configured at both area and interface levels.

**Note**

On the same area or interface, EOS allows security configuration with either AH or ESP but not both. We can have one area or interface configured with AH and another with ESP.
32.2.4.1 OSPFv3 Authentication

While sending OSPFv3 packets, the HMAC-MD5 or SHA algorithm hash is inserted in the IPsec header and the packet is sent over the wire for peer authentication. While receiving OSPFv3 packets, the computed hash is verified with the one present in the IPsec header. If it fails, OSPFv3 packets are discarded.

32.2.4.2 OSPFv3 Encryption

ESP provides confidentiality to OSPFv3 packets. When confidentiality is enabled, ESP encrypts the sent data and decrypts the received data. OSPFv3 packets that are not encapsulated with security payload are discarded.

OSPFv3 encryption uses algorithms of Triple Data Encryption Standard (3DES) and Advanced Encryption Standard (AES). 3DES uses a 192 bit key, whereas the AES key length varies by 128, 192 and 256 bits.

32.2.5 Flood Pacing

OSPFv3 flood pacing allows configuring the minimum interval between the transmission of consecutive Link State (LS) update packets in a network. Flood pacing provides the following benefits:

- Prevents the rapid drain of flood queue by sending consecutive LSU packets with a delay
- Helps mitigate high CPU or socket buffer utilization issues that occur when a switch instantly floods a large number of LSAs
- When LSDB is updated frequently, an incremented flood pacing interval scales down LSA flooding

Note

A high flood pacing interval may lead to convergence delays in large OSPF LSDBs.
32.3 Configuring OSPFv3

These sections describe basic OSPFv3 configuration steps:

- Section 32.3.1: Configuring an OSPFv3 Instance
- Section 32.3.2: Configuring OSPFv3 Areas
- Section 32.3.3: Configuring Interfaces for OSPFv3
- Section 32.3.4: Enabling OSPFv3
- Section 32.3.5: Configuring OSPFv3 Security
- Section 32.3.6: Configuring OSPFv3 Flood Pacing
- Section 32.3.7: Displaying OSPFv3 Status

32.3.1 Configuring an OSPFv3 Instance

32.3.1.1 Entering OSPFv3 Configuration Mode

OSPFv3 configuration commands apply to the specified OSPFv3 instance. To perform OSPFv3 configuration commands, the switch must be in router-OSPFv3 configuration mode. The `ipv6 router ospf` command places the switch in router-OSPFv3 configuration mode, creating an OSPFv3 instance if OSPFv3 was not previously instantiated on the switch. If no VRF is specified, the OSPFv3 instance is in the default VRF. To instantiate or configure OSPFv3 on a non-default VRF, specify that VRF when using the `ipv6 router ospf` command.

The process ID identifies the OSPFv3 instance and is local to the router. Neighbor OSPFv3 routers can have different process IDs. OSPFv3 instances configured in different VRFs on the switch must have different process IDs.

The switch supports one OSPFv3 instance for each VRF. When an OSPFv3 instance already exists, the `ipv6 router ospf` command must specify its process ID (and VRF, if it is not configured in the default VRF). Attempts to define additional instances in the same VRF will generate errors. The `show ipv6 ospf` command displays information about OSPFv3 instances, including their process IDs.

Example

- This command places the switch in router-OSPFv3 configuration mode for the default VRF. If OSPFv3 was not previously instantiated in the default VRF, the command creates an OSPFv3 instance in the default VRF with a process ID of 9.

```plaintext
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#show active
ipv6 router ospf 9
switch(config-router-ospf3)#
```

32.3.1.2 Defining the Router ID

The router ID is a 32-bit number assigned to a router running OSPFv3. This number uniquely labels the router within an Autonomous System. Status commands identify the switch through the router ID. When configuring OSPFv3 instances in multiple VRFs, each should have a different router ID.

The switch sets the router ID to the first available alternative in the following list:

1. The `router-id` command.
2. The loopback IPv6 address, if a loopback interface is active on the switch.
3. The highest IPv6 address on the router.
When configuring VXLAN on an MLAG, always manually configure the OSPFv3 router ID to prevent the switch from using the common VTEP IP address as the router ID.

The `router-id (OSPFv3)` command configures the router ID for an OSPFv3 instance.

**Example**

- This command assigns 15.1.1.1 as the OSPFv3 router ID.

```plaintext
switch(config-router-ospf3)#router-id 15.21.4.9
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  router-id 15.21.4.9
switch(config-router-ospf3)#
```

### 32.3.1.3 Global OSPFv3 Parameters

These router-OSPFv3 configuration mode commands define OSPFv3 behavior for the OSPFv3 instance under which they are used.

#### Logging Adjacency Changes

The `log-adjacency-changes (OSPFv3)` command configures the switch to log OSPFv3 link-state changes and transitions of OSPFv3 neighbors into the up or down state.

**Examples**

- This command configures the switch to log transitions of OSPFv3 neighbors into the up or down state.

```plaintext
switch(config-router-ospf3)#log-adjacency-changes
switch(config-router-ospf3)#
```

- This command configures the switch to log all OSPFv3 link-state changes.

```plaintext
switch(config-router-ospf3)#log-adjacency-changes detail
switch(config-router-ospf3)#
```

#### Intra-Area Distance

The `distance ospf intra-area (OSPFv3)` command configures the administrative distance for routes contained in a single OSPFv3 area. Administrative distances compare dynamic routes configured by different protocols. The default administrative distance for intra-area routes is 10.

**Example**

- This command configures an administrative distance of 90 for OSPFv3 intra-area routes.

```plaintext
switch(config-router-ospf3)#distance ospf intra-area 90
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  distance ospf intra-area 90
switch(config-router-ospf3)#
```

#### Passive Interfaces

The `passive-interface (OSPFv3)` command prevents the transmission of hello packets on the specified interface. Passive interfaces drop all adjacencies and do not form new adjacencies. Although passive interfaces do not send or receive LSAs, other interfaces may generate LSAs for the network segment. The router does not send OSPFv3 packets from a passive interface or process OSPFv3 packets received on a passive interface. The router advertises the passive interface in the router LSA.
The `no passive-interface` command re-enables OSPFv3 processing on the specified interface.

**Examples**

- This command configures VLAN 200 as a passive interface.
  
  switch(config-router-ospf3)#passive-interface vlan 200  
  switch(config-router-ospf3)#show active  
  ipv6 router ospf 9  
  passive-interface Vlan200  
  switch(config-router-ospf3)#

- This command configures VLAN 200 as an active interface.
  
  switch(config-router-ospf3)#no passive-interface vlan 200  
  switch(config-router-ospf3)#show active  
  ipv6 router ospf 9  
  switch(config-router-ospf3)#

**Redistributing Connected Routes**

Redistributing connected routes causes the OSPFv3 instance to advertise all connected routes on the switch as external OSPFv3 routes. Connected routes are routes that are established when IPv6 is enabled on an interface.

**Example**

- The `redistribute (OSPFv3) connected` command converts connected routes to OSPFv3 external routes.
  
  switch(config-router-ospf3)#redistribute connected  
  switch(config-router-ospf3)#show active  
  ipv6 router ospf 9  
  redistribute connected  
  switch(config-router-ospf3)#

**Redistributing Static Routes**

Redistributing static routes causes the OSPFv3 instance to advertise all static routes on the switch as external OSPFv3 routes. The switch does not support redistributing individual static routes.

**Example**

- The `redistribute (OSPFv3) static` command converts static routes to OSPFv3 external routes.
  
  switch(config-router-ospf3)#redistribute static  
  switch(config-router-ospf3)#show active  
  ipv6 router ospf 9  
  redistribute static  
  switch(config-router-ospf3)#

**32.3.2 Configuring OSPFv3 Areas**

OSPFv3 areas are configured through area commands. The switch must be in router-OSPFv3 configuration mode, as described in Section 32.3.1.1: Entering OSPFv3 Configuration Mode, to run area commands.

Areas are assigned a 32-bit number that is expressed in decimal or dotted-decimal notation. When an OSPFv3 instance configuration contains multiple areas, the switch only configures areas associated with its interfaces.
32.3.2.1 Configuring the Area Type

The **no area (OSPFv3)** command specifies the area type. The switch supports three area types:

- Normal area: Area that accepts intra-area, inter-area, and external routes. The backbone area (area 0) is a normal area.
- Stub area: Area where external routes are not advertised. External routes are reached through a default summary route (0.0.0.0) inserted into stub areas. Networks with no external routes do not require stub areas.

The default area type is normal.

**Example**

- These commands configures area 200 as a NSSA area and 300 as a stub area.

```plaintext
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#area 200 nssa
switch(config-router-ospf3)#area 300 stub
switch(config-router-ospf3)#show active
ipv6 router ospf 9
    area 0.0.0.200
    area 0.0.1.44 stub
switch(config-router-ospf3)#
```

32.3.2.2 Configuring Area Parameters

These router-OSPFv3 configuration mode commands define OSPFv3 behavior in a specified area.

**Default Summary Route Cost**

The **area default-cost (OSPFv3)** command specifies the cost of the default summary route that ABRs send into a stub area or NSSA. Summary routes, also called inter-area routes, originate in areas different than their destination. When the **area default-cost** command is not configured for an area, the default-cost of that area is set to 10.

**Example**

- This command configures a cost of 25 for the default summary route in area 0.0.1.194 (450).

```plaintext
switch(config-router-ospf3)#area 450 default-cost 25
switch(config-router-ospf3)#show active
ipv6 router ospf 9
    area 0.0.0.200
    area 0.0.1.44 stub
switch(config-router-ospf3)#
```

**Area Stub**

The **area stub (OSPFv3)** command configures the area type of an OSPFv3 area. All routers in an AS must specify the same area type for identically numbered areas.

Stub areas are areas in which external routes are not advertised. To reach these external routes, the stub area uses a default summary route (0.0.0.0). Networks without external routes do not require stub areas.

Areas are **normal** by default; area type configuration is required only for stub NSSA areas. Area 0 is always a normal area and cannot be configured through this command.
Examples

- This command configures area 45 as a stub area.
  
  ```
  switch(config)#ipv6 router ospf 3
  switch(config-router-ospf3)#area 45 stub
  switch(config-router-ospf3)#
  ```

- This command configures area 10.92.148.17 as a stub area.
  
  ```
  switch(config-router-ospf3)#area 10.92.148.17 stub
  switch(config-router-ospf3)#
  ```

Area Range

The `area range (OSPFv3)` command is used by OSPFv3 area border routers (ABRs) to consolidate or summarize routes, to configure a cost setting for those routes, and to suppress summary route advertisements.

By default, an ABR creates a summary LSA for each route in an area and advertises that LSA to adjacent areas. The `area range (OSPFv3)` command aggregates routing information on area boundaries, allowing the ABR to use one summary LSA to advertise multiple routes.

Examples

- These commands consolidate and summarize routes at an area boundary 1.
  
  ```
  switch(config)#ipv6 router ospf 1
  switch(config-router-ospf3)#area 1 range 2001:0DB8:0:1::/64
  switch(config-router-ospf3)#
  ```

- These commands change the address range status to DoNotAdvertise. Neither one of the individual intra-area routes falling under range or the ranged prefix is advertised as summary LSA.
  
  ```
  switch(config)#ipv6 router ospf 1
  switch(config-router-ospf3)#area 1 range 2001:0DB8:0:1::/64 not-advertise
  switch(config-router-ospf3)#
  ```

32.3.3 Configuring Interfaces for OSPFv3

OSPFv3 interface configuration commands enable OSPFv3 on an interface, assign the interface to an area, and specify transmission parameters for routed ports and SVIs that handle OSPFv3 packets.

32.3.3.1 Assigning an Interface to an Area

The `ipv6 ospf area` command enables OSPFv3 on the configuration mode interface and associates the specified area to the interface. Each routed interface can be associated with one OSPFv3 area; subsequent `ipv6 ospf area` commands that designate a different area on an interface replace any existing command for the interface.

Example

- These commands enable OSPFv3 instance 9 on VLAN interface 200 and associate area 0 to the interface.
  
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ipv6 ospf 9 area 0
  switch(config-if-Vl200)#show active
  interface Vlan200
    ipv6 ospf 9 area 0.0.0.0
  switch(config-if-Vl200)#
  ```
32.3.3.2 Configuring Intervals

Interval configuration commands determine OSPFv3 packet transmission characteristics for a specified VLAN interface. Interval configuration commands are entered in vlan-interface configuration mode.

**Hello Interval**

The hello interval specifies the period between consecutive hello packet transmissions from an interface. Each OSPFv3 neighbor should specify the same hello interval, which should not be longer than any neighbor’s dead interval.

The `ospfv3 hello-interval` command configures the hello interval for the configuration mode interface. The default is 10 seconds.

**Example**

- These commands configure a hello interval of 45 seconds for VLAN 200.
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ospfv3 hello-interval 45
  switch(config-if-Vl200)#show active
  interface Vlan200
    ospfv3 hello-interval 45
  switch(config-if-Vl200)#
  ```

**Dead Interval**

The dead interval specifies the period that an interface waits for an OSPFv3 packet from a neighbor before it disables the adjacency under the assumption that the neighbor is down. The dead interval should be configured identically on all OSPFv3 neighbors and be longer than the hello interval of any neighbor.

The `ospfv3 dead-interval` command configures the dead interval for the configuration mode interface. The default is 40 seconds.

**Example**

- This command configures a dead interval of 75 seconds for VLAN 200.
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ospfv3 dead-interval 75
  switch(config-if-Vl200)#show active
  interface Vlan200
    ospfv3 dead-interval 75
  switch(config-if-Vl200)#
  ```

**Retransmission Interval**

Routers that send OSPFv3 advertisements to an adjacent router expect to receive an acknowledgment from that neighbor. Routers that do not receive an acknowledgment will retransmit the advertisement. The retransmission interval specifies the period between retransmissions.

The `ospfv3 ipv6 retransmit-interval` command configures the LSA retransmission interval for the configuration mode interface. The default retransmission interval is 5 seconds.
Example

- This command configures a retransmission interval of 25 seconds for VLAN 200.

```bash
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 ipv6 retransmit-interval 25
switch(config-if-Vl200)#show active
interface Vlan200
    ospfv3 ipv6 retransmit-interval 25
switch(config-if-Vl200)#
```

Transmission Delay

The transmission delay is an estimate of the time that an interface requires to transmit a link-state update packet. OSPFv3 adds this delay to the age of outbound packets to more accurately reflect the age of the LSA when received by a neighbor.

The `ospfv3 transmit-delay` command configures the transmission delay for the configuration mode interface. The default transmission delay is one second.

Example

- This command configures a transmission delay of 10 seconds for VLAN 200.

```bash
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 transmit-delay 10
switch(config-if-Vl200)#show active
interface Vlan200
    ospfv3 transmit-delay 10
switch(config-if-Vl200)#
```

32.3.3 Configuring Interface Parameters

Interface Cost

The OSPFv3 interface cost reflects the overhead of sending packets across the interface. The cost is typically assigned to be inversely proportional to the bandwidth of the interface. The `ospfv3 cost` command configures the OSPFv3 cost for the configuration mode interface. The default cost is 10.

Example

- This command configures a cost of 50 for VLAN 200.

```bash
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 cost 50
switch(config-if-Vl200)#show active
interface Vlan200
    ospfv3 cost 50
switch(config-if-Vl200)#
```

Router Priority

Router priority determines preference during designated router (DR) and backup designated router (BDR) elections. Routers with higher priority numbers have preference over other routers. Routers with a priority of zero cannot be elected as a DR or BDR.

The `ospfv3 priority` command configures router priority for the configuration mode interface. The default priority is 1.
Example

- This command configures a router priority of 128 for VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 priority 128
switch(config-if-Vl200)#show active
interface Vlan200
  ospfv3 priority 128
switch(config-if-Vl200)#
```

32.3.4 Enabling OSPFv3

32.3.4.1 IP Routing

OSPFv3 requires that IPv6 unicast routing is enabled on the switch. When IP routing is not enabled, entering OSPFv3 configuration mode generates a message.

Examples

- This message is displayed if, when entering router-OSPFv3 configuration mode, IPv6 unicast routing is not enabled.

```
switch(config)#ipv6 router ospf 9
! IPv6 routing not enabled
switch(config-router-ospf3)#
```

- This command enables IP routing on the switch.

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

32.3.4.2 Disabling OSPFv3

The `shutdown` (OSPFv3) disables OSPFv3 operations on the switch without disrupting the OSPFv3 configuration. To disable OSPFv3 on an interface, remove the `ipv6 ospf area` statement for the corresponding interface.

The `no shutdown` command resumes OSPFv3 activity.

Examples

- This command disables OSPFv3 activity on the switch.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#shutdown
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  shutdown
switch(config-router-ospf3)#
```

- This command resumes OSPFv3 activity on the switch.

```
switch(config-router-ospf3)#no shutdown
switch(config-router-ospf3)#show active
ipv6 router ospf 9
switch(config-router-ospf3)#
```
32.3.5 Configuring OSPFv3 Security

You can configure OSPFv3 security for either an area or an interface, or both, using either an Authentication Header (AH) or an Encapsulating Security Payload (ESP). When OSPFv3 security is configured on an area, the configured settings apply to all interfaces in that area. Interface-specific configuration overrides configuration on the area to which the interface belongs.

32.3.5.1 Configuring OSPFv3 Authentication

Configuring OSPFv3 Authentication for Areas

The `area authentication ipsec spi` command configures OSPFv3 authentication on an area.

Example

This command configures OSPFv3 authentication on an area with MD5 hash algorithm.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#area 0.0.0.0 authentication ipsec spi 34 md5 0 8FD6158BE81ADD961241D8E4169D411
switch(config-router-ospf3)#show active
ipv6 router ospf 9
    area 0.0.0.0 authentication ipsec spi 34 md5 7 $1$cNpcrQl1czqdvKAzKltVYv6i7+R3niuWouDkKYCPhi4/YOOG/Tap5Q==
switch(config-router-ospf3)#
```

Configuring OSPFv3 Authentication for Interfaces

The `ospfv3 authentication ipsec spi` command configures OSPFv3 authentication on an interface.

Example

This command configures OSPFv3 authentication on an interface with MD5 hash algorithm.

```
switch(config-if-Et9)#ospfv3 authentication ipsec spi 3456 md5 0 8FD6158BE81ADD961241D8E4169D411
switch(config-if-Et9)#show active
interface Ethernet9
    no switchport
    ospfv3 authentication ipsec spi 3456 md5 7 $1$xtmcMSPzEn+Njp8Lb4qryVVOjKcvjYuv6dx10+nSWQdaiRtZRPtQ==
switch(config-if-Et9)#
```

32.3.5.2 Configuring OSPFv3 Encryption

Configuring OSPFv3 Encryption for Areas

The `area encryption ipsec spi` command configures OSPFv3 security on an area.

Example

This command configures OSPFv3 security on an area with 3DES-CBC encryption and MD5 hash algorithm.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#area 0.0.0.0 encryption ipsec spi 5678 esp 3des-cbc md5 passphrase 0 8FD6158BE81ADD961241D8E4169D411
switch(config-router-ospf3)#show active
ipv6 router ospf 9
    area 0.0.0.0 encryption ipsec spi 5678 esp 3des-cbc md5 passphrase 7 $1sNpocrQl1czqdvKAzKltVYv6i7+R3niuWouDkKYCPhi4/YOOG/Tap5Q==
switch (config-router-ospf3)#
```

Configuring OSPFv3 Encryption for Interfaces

The `ospfv3 encryption ipsec spi` command configures OSPFv3 security on an interface.
### Example

This command configures OSPFv3 security on an interface with 3DES-CBC encryption and SHA1 algorithm.

```
switch(config)#interface ethernet 9
switch(config-if-Et9)#ospfv3 encryption ipsec spi 345 esp 3des-cbc sha1 passphrase 0
2fd4e1c67a2d28fced849ee1bb767391b93eb12
switch(config-if-Et9)#show active
interface Ethernet9
  no switchport
  ospfv3 encryption ipsec spi 345 esp 3des-cbc sha1 passphrase 7
$1$VmUkWk6IL2S343bR3BbH0RhgyvxHhwBpfvB4VXXN0OQF7HJ8p5VxfBaYYbgCKWU
switch(config-if-Et9)#
```

#### 32.3.6 Configuring OSPFv3 Flood Pacing

Flood pacing can be configured for global OSPFv3 instances and address families. The `timers pacing flood` command configures OSPFv3 flood pacing.

**Examples**

- This command configures OSPFv3 flood pacing timer to 50 ms in the global OSPFv3 instance.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#timers pacing flood 50
switch(config-router-ospf3)#show ipv6 ospf
Routing Process "ospfv3 9" with ID 13.13.13.13 and Instance 0 VRF default
  FIPS mode disabled
  It is not an autonomous system boundary router and is not an area border router
  Minimum LSA arrival interval 1000 msecs
  Initial LSA throttle delay 1000 msecs
  Minimum hold time for LSA throttle 5000 msecs
  Maximum wait time for LSA throttle 5000 msecs
  Interface flood pacing timer 50 msecs
  It has 0 fully adjacent neighbors
  Number of areas in this router is 0, 1 normal, 0 stub, 0 nssa
  Number of LSAs 1
  Initial SPF schedule delay 0 msecs
  Minimum hold time between two consecutive SPFIs 5000 msecs
  Current hold time between two consecutive SPFIs 5000 msecs
  Maximum wait time between two consecutive SPFIs 5000 msecs
  SPF algorithm last executed 21d19h ago
  No scheduled SPF
  Adjacency exchange-start threshold is 20
  Maximum number of next-hops supported in ECMP is 32
  Number of backbone neighbors is 0
  Graceful-restart is not configured
  Graceful-restart-helper mode is enabled
  Area 0.0.0.0
    Number of interface in this area is 0
    It is a normal area
    SPF algorithm executed 2 times
```
- This command configures OSPFv3 flood pacing timer to 50 ms for ipv4 address family.

```
switch(config)#router ospfv3
switch(config-router-ospfv3)#address-family ipv4
switch(config-router-ospfv3-af)#timers pacing flood 50
switch(config-router-ospfv3-af)#show ospfv3
OSPFV3 address-family ipv4
Routing Process "ospfv3" with ID 11.1.11.1 and Instance 64 VRF default
FIPS mode disabled
It is not an autonomous system boundary router and is not an area border router
Minimum LSA arrival interval 1000 msecs
Initial LSA throttle delay 1000 msecs
Minimum hold time for LSA throttle 5000 msecs
Maximum wait time for LSA throttle 5000 msecs
Interface flood pacing timer 50 msecs
It has 0 fully adjacent neighbors
Number of areas in this router is 1. 1 normal, 0 stub, 0 nssa
Number of LSAs 1
Initial SPF schedule delay 0 msecs
Minimum hold time between two consecutive SPF 5000 msecs
Current hold time between two consecutive SPF 5000 msecs
Maximum wait time between two consecutive SPF 5000 msecs
SPF algorithm last executed 00:01:05 ago
No scheduled SPF
Adjacency exchange-start threshold is 20
Maximum number of next-hops supported in ECMP is 32
Number of backbone neighbors is 0
Graceful-restart is not configured
Graceful-restart-helper mode is enabled
Area 0.0.0.0
  Number of interface in this area is 0
  It is a normal area
  SPF algorithm executed 2 times
  <-------OUTPUT OMITTED FROM EXAMPLE-------->
```

### 32.3.7 Displaying OSPFv3 Status

This section describes OSPFv3 `show` commands that display OSPFv3 status. General switch methods that provide OSPFv3 information include pinging routes, viewing route status (`show ip route` command), and viewing the configuration (`show running-config` command).

### 32.3.7.1 OSPFv3 Summary

The `show ipv6 ospf` command displays general OSPFv3 configuration information, operational statistics and status for the OSPFv3 instance, followed by a brief description of the areas configured on the switch.

**Example**

- This command displays OSPFv3 routing process information.
This command displays OSPFv3 routing process information.

```
switch(config-router-ospf3)#show ipv6 ospf
Routing Process "ospfv3 1" with ID 1.1.1.1 and Instance 0 VRF default
   It is not an autonomous system boundary router and is not an area border router
   Minimum LSA arrival interval 1000 msecs
   Initial LSA throttle delay 1000 msecs
   Minimum hold time for LSA throttle 5000 msecs
   Maximum wait time for LSA throttle 5000 msecs
   Interface flood pacing timer 50 msecs
   It has 0 fully adjacent neighbors
   ...
   Graceful-restart is not configured
   Graceful-restart-helper mode is enabled
```

### 32.3.7.2 Viewing OSPFv3 on the Interfaces

The `show ipv6 ospf interface` command displays OSPFv3 information for switch interfaces configured for OSPFv3. Different command options allow the display of either all interfaces or a specified interface. The command can also be configured to display complete information or a brief summary.

**Example**

This command displays OSPFv3 information for interfaces where OSPFv3 is enabled.

```
switch#show ipv6 ospf interface
Ethernet17 is up
   Interface Address fe80::48c:73ff:fe00:1319%Ethernet12, Area 0.0.0.0
   Network Type Broadcast, Cost 10
   Transmit Delay is 1 sec, State Backup DR, Priority 1
   Designated Router is 10.37.0.37
   Backup Designated Router is 10.37.0.23
   Timer intervals configured, Hello 10, Dead 40, Retransmit 5
   Neighbor Count is 1
Vlan31 is up
   Interface Address fe80::48c:73ff:fe00:1319%Vlan31, Area 0.0.0.0
   Network Type Broadcast, Cost 10
   Transmit Delay is 1 sec, State Backup DR, Priority 1
   Designated Router is 10.37.0.22
   Backup Designated Router is 10.37.0.23
   Timer intervals configured, Hello 10, Dead 40, Retransmit 5
   Neighbor Count is 1
Vlan32 is up
   Interface Address fe80::48c:73ff:fe00:1319%Vlan32, Area 0.0.0.0
   Network Type Broadcast, Cost 10
   Transmit Delay is 1 sec, State DR Other, Priority 1
   Designated Router is 10.37.0.11
   Backup Designated Router is 10.37.0.22
   Timer intervals configured, Hello 10, Dead 40, Retransmit 5
   Neighbor Count is 2
switch#
```

### 32.3.7.3 Viewing the OSPFv3 Database

The `show ipv6 ospf database <link state list>` command displays the LSAs in the LSDB for the specified area. If no area is listed, the command displays the contents of the database for each area on the switch. The database command provides options to display subsets of the LSDB database, a summary of database contents, and the link states that comprise the database.
Example

- This command displays the OSPFv3 database of link state advertisements (LSAs).

```bash
switch#show ipv6 ospf database
Routing Process "ospf 9":

   AS Scope LSDB
              Type       Link ID     ADV Router  Age       Seq#   Checksum
             AEX        0.0.0.5    10.37.0.37   15 0x80000005   0x00be82
             AEX        0.0.0.9    10.37.0.22 1747 0x8000002b   0x00df56
             AEX        0.0.0.3    10.37.0.46  599 0x8000002d   0x00651d

   Area 0.0.0.0 LSDB
              Type       Link ID     ADV Router  Age       Seq#   Checksum
             RTR        0.0.0.0    10.37.0.32  234 0x80000031   0x00585a
             NTW       0.0.0.26    10.37.0.32  271 0x80000005   0x005609
             NAP       0.0.0.26    10.37.0.32  274 0x80000005   0x00964c

   Interface vlan3911 LSDB
              Type       Link ID     ADV Router  Age       Seq#   Checksum
             LNK       0.0.0.38    10.37.0.22  267 0x80000005   0x00a45a
             LNK       0.0.0.23    10.37.0.23  270 0x8000002c   0x005b7e

   Interface vlan3902 LSDB
              Type       Link ID     ADV Router  Age       Seq#   Checksum
             LNK       0.0.0.17    10.37.0.11 1535 0x8000002b   0x007120
             LNK       0.0.0.37    10.37.0.22    7 0x8000002b   0x00ce23
             LNK       0.0.0.22    10.37.0.23  250 0x80000002d  0x00c350

<-------OUTPUT OMITTED FROM EXAMPLE-------->

switch#
```

32.3.7.4 Viewing OSPFv3 Neighbors

The `show ipv6 ospf neighbor` command displays information about the routers that are neighbors to the switch. Command options allow the display of summary or detailed information about the neighbors to all areas and interfaces on the switch. The command also allows for the display of neighbors to individual interfaces or areas. The `adjacency-changes` option displays the interface’s adjacency changes.
Example

- This command displays the switch’s neighbors.

```
switch#show ipv6 ospf neighbor
Routing Process "ospf 9":
Neighbor 10.37.0.37 priority is 1, state is Full
   In area 0.0.0.0 interface et12
   DR is 10.37.0.37 BDR is 10.37.0.23
   Options is 0
   Dead timer is due in 37 seconds
Neighbor 10.37.0.22 priority is 1, state is Full
   In area 0.0.0.0 interface vlan3911
   DR is 10.37.0.22 BDR is 10.37.0.23
   Options is 0
   Dead timer is due in 31 seconds
Neighbor 10.37.0.22 priority is 1, state is Full
   In area 0.0.0.0 interface vlan3902
   DR is 10.37.0.11 BDR is 10.37.0.22
   Options is 0
   Dead timer is due in 31 seconds
Neighbor 10.37.0.22 priority is 1, state is Full
   In area 0.0.0.0 interface vlan3908
   DR is 10.37.0.22 BDR is 10.37.0.21
   Options is 0
   Dead timer is due in 39 seconds
```

switch#

32.3.7.5 Viewing OSPFv3 Routes

The `show ipv6 routes` command provides an OSPFv3 option.

Example

- This command displays the switch’s OSPFv3 routes.

```
switch# show ipv6 route ospf
IPv6 Routing Table - 43 entries
Codes: C - connected, S - static, K - kernel, O - OSPF, B - BGP, R - RIP, A - Aggregate

O   fd7a:3279:81a4:1112::/64 [150/11]
    via fe80::21c:41ff:fe00:d120, Ethernet12
O   fd7a:3279:81a4:1114::/64 [150/11]
    via fe80::21c:41ff:fe00:d120, Ethernet12
O   fd7a:3279:81a4:1124::/64 [10/20]
    via fe80::21c:41ff:fe01:5fe1, Vlan3901
    via fe80::21c:41ff:fe01:5fe1, Vlan3902
    via fe80::21c:41ff:fe01:5fe1, Vlan3908
O   fd7a:3279:81a4:1a00::25/128 [150/11]
    via fe80::21c:41ff:fe00:d120, Ethernet12
O   fd7a:3279:81a4:1a00::28/128 [150/11]
    via fd7a:3279:81a4:fe40::5, Vlan3908
```
32.4 **OSPFv3 Configuration Examples**

This section describes the commands required to configure three OSPFv3 topologies.

### 32.4.1 OSPFv3 Configuration Example 1

The AS in Example 1 contains two areas that are connected through two routers. The backbone area also contains an internal router that connects two links.

#### 32.4.1.1 Example 1 Topology

*Figure 32-3* displays the Example 1 topology. Two ABRs connect area 0 and area 1 – Router A and Router B. Router C is an internal router that connects two links in area 0. Area 0 is normal; area 1 is stub.

*Figure 32-3: OSPFv3 Example 1*

Area 1 contains links to ABRs Router A and Router B.

- Router A is accessed through VLAN 301.
- Router B is accessed through VLAN 401.
- Designated Router (DR): Router A.
- Backup Designated Router (BDR): Router B.
- Each router defines an interface cost of 10.
- Router priority is not specified for either router on area 1.

**Area 1 Configuration**

**Area 0 ABR Configuration**

Area 0 contains links to ABRs Router A and Router B.

- Router A is accessed through VLAN 302.
- Router B is accessed through VLAN 402.
- Designated Router (DR): Router B.
- Backup Designated Router (BDR): Router A.
- Each router defines an interface cost of 20.
- Each router defines a retransmit-interval of 10.
- Each router defines a transmit-delay of 2.
• Router priority is specified such that Router B will be elected as the Designated Router.

**Area 0 IR Configuration**

Area 0 contains two links to an internal router.
• Router C is accessed through VLAN 501 and VLAN 502.
• VLAN 501 is configured as follows:
  • Interface cost of 20.
  • Retransmit-interval of 10.
  • Transmit-delay of 2.
• VLAN 502 is configured as follows:
  • Interface cost of 20.
  • Dead interval of 80 seconds.

32.4.1.2 Example 1 Code

This code configures the OSPFv3 instances on the three switches.

**Step 1** Configure the areas and router IDs.

a  Router A OSPFv3 instance configuration:

```
switch-A(config)#ipv6 router ospf 100
switch-A(config-router-ospfv3)#area 1 stub
switch-A(config-router-ospfv3)#router-id 10.17.0.1
```

b  Router B OSPFv3 instance configuration:

```
switch-B(config)#ipv6 router ospf 100
switch-B(config-router-ospfv3)#area 1 stub
switch-B(config-router-ospfv3)#router-id 10.17.0.2
```

c  Router C OSPFv3 instance configuration: interfaces:

```
switch-C(config)#ipv6 router ospf 100
switch-C(config-router-ospfv3)#router-id 10.17.0.3
```

**Step 2** Configure the interface OSPFv3 area and transmission parameters.

a  Router A interfaces:

```
switch-A(config)#interface vlan 301
switch-A(config-if-Vl301)#ipv6 ospf 100 area 1
switch-A(config-if-Vl301)#ospfv3 cost 10
switch-A(config-if-Vl301)#ospfv3 priority 6
switch-A(config-if-Vl301)#exit
switch-A(config)#interface vlan 302
switch-A(config-if-Vl302)#ipv6 ospf 100 area 0
switch-A(config-if-Vl302)#ospfv3 cost 20
switch-A(config-if-Vl302)#ospfv3 ipv6 retransmit-interval 10
switch-A(config-if-Vl302)#ospfv3 transmit-delay 2
switch-A(config-if-Vl302)#ospfv3 priority 4
```
b  Router B interfaces:
switch-B(config)#interface vlan 401
switch-B(config-if-Vl401)#ipv6 ospf 100 area 1
switch-B(config-if-Vl401)#ospfv3 cost 10
switch-B(config-if-Vl401)#ospfv3 priority 4
switch-B(config-if-Vl401)#exit
switch-B(config)#interface vlan 402
switch-B(config-if-Vl402)#ipv6 ospf 100 area 0
switch-B(config-if-Vl402)#ospfv3 cost 20
switch-B(config-if-Vl402)#ospfv3 ipv6 retransmit-interval 10
switch-B(config-if-Vl402)#ospfv3 transmit-delay 2
switch-B(config-if-Vl402)#ospfv3 priority 6
c  Router C interfaces:
switch-C(config)#interface vlan 501
switch-C(config-if-Vl501)#ipv6 ospf 100 area 0
switch-C(config-if-Vl501)#ospfv3 cost 20
switch-C(config-if-Vl501)#ospfv3 ipv6 retransmit-interval 10
switch-C(config-if-Vl501)#ospfv3 transmit-delay 2
switch-C(config-if-Vl501)#exit
switch-C(config)#interface vlan 502
switch-C(config-if-Vl502)#ipv6 ospf 100 area 0
switch-C(config-if-Vl502)#ospfv3 cost 20
switch-C(config-if-Vl502)#ospfv3 dead-interval 80

32.4.2 OSPFv3 Configuration Example 2
The AS in Example 2 contains three areas. Area 0 connects to the other areas through different routers and contains an internal router connecting two links. Area 0 is normal; the other areas are stub areas.
32.4.2.1 Example 2 Topology

Figure 32-4 displays the Example 2 topology. One ABR (Router B) connects area 0 and area 1; another ABR (router C) connects area 0 and area 2. Router A is an internal router that connects two links in area 0.

Figure 32-4: OSPFv3 Example 2

---

Area 1 Configuration

Area 1 contains one link that is accessed by Router B.
- Router B is accessed through VLAN 601.
- The router defines a interface cost of 10.

Area 2 Configuration

Area 2 contains one link that is accessed by Router C.
- Router C is accessed through VLAN 802.
- The router defines a interface cost of 20.

Area 0 ABR Configuration

One ABR Router B link connects area 1 to area 0. One ABR Router C link connects area 0 to area 2.
- Router B is accessed through VLAN 602.
• Router C is accessed through VLAN 801.
• Designated Router (DR): Router B.
• Backup Designated Router (BDR): Router C.
• Each router defines an interface cost of 20.
• Each router defines a retransmit-interval of 10.
• Each router defines a transmit-delay of 2.

**Area 0 IR Configuration**

Area 0 contains links connected by an internal router.

• Router A is accessed through VLAN 701 and 702.
• The VLAN 701 link is configured as follows:
  • Interface cost of 10.
• The VLAN 702 link is configured as follows:
  • Interface cost of 20.
  • Retransmit-interval of 10.
  • Transmit-delay of 2.

**32.4.2.2 Example 2 Code**

**Step 1** Configure the areas and router IDs.

a. Router A OSPFv3 instance configuration:

```plaintext
switch-A(config)#ipv6 router ospf 200
switch-A(config-router-ospfv3)#router-id 10.24.1.10
```

b. Router B OSPFv3 instance configuration:

```plaintext
switch-B(config)#ipv6 router ospf 200
switch-B(config-router-ospfv3)#area 1 stub
switch-B(config-router-ospfv3)#router-id 10.24.2.10
```

c. Router C OSPFv3 instance configuration:

```plaintext
switch-C(config)#ipv6 router ospf 200
switch-C(config-router-ospfv3)#area 1 stub
switch-C(config-router-ospfv3)#router-id 10.25.2.12
```

**Step 2** Configure the interface OSPFv3 area and transmission parameters.

a. Router A interfaces:

```plaintext
switch-A(config)#interface vlan 701
switch-A(config-if-Vl701)#ipv6 ospf 200 area 0
switch-A(config-if-Vl701)#ospfv3 cost 10
switch-A(config-if-Vl701)#exit
switch-A(config)#interface vlan 702
switch-A(config-if-Vl702)#ipv6 ospf 200 area 0
switch-A(config-if-Vl702)#ospfv3 cost 20
switch-A(config-if-Vl702)#ospfv3 ipv6 retransmit-interval 10
switch-A(config-if-Vl702)#ospfv3 transmit-delay 2
```
b Router B interfaces:

```
switch-B(config)#interface vlan 601
switch-B(config-if-Vl601)#ospfv3 200 area 1
switch-B(config-if-Vl601)#ospfv3 cost 10
switch-B(config-if-Vl601)#exit
switch-B(config)#interface vlan 602
switch-B(config-if-Vl602)#ospfv3 200 area 0
switch-B(config-if-Vl602)#ospfv3 cost 20
switch-B(config-if-Vl602)#ospfv3 ipv6 retransmit-interval 10
switch-B(config-if-Vl602)#ospfv3 transmit-delay 2
switch-B(config-if-Vl602)#ospfv3 priority 6
```

c Router C interfaces:

```
switch-C(config)#interface vlan 801
switch-C(config-if-Vl801)#ospfv3 200 area 0
switch-C(config-if-Vl801)#ospfv3 cost 20
switch-C(config-if-Vl801)#ospfv3 ipv6 retransmit-interval 10
switch-C(config-if-Vl801)#ospfv3 transmit-delay 2
switch-C(config-if-Vl801)#exit
switch-C(config)#interface vlan 802
switch-C(config-if-Vl802)#ospfv3 200 area 2
switch-C(config-if-Vl802)#ospfv3 cost 20
switch-C(config-if-Vl802)#ospfv3 dead-interval 80
```

32.4.3 OSPFv3 Configuration Example 3

The AS in Example 3 contains two areas that connect through one ABR. Each area also contains an ASBR that connects static routes to the AS.
32.4.3.1 Example 3 Topology

Figure 32-5 displays the Example 3 topology. One ABR connects area 0 and area 1. Router C is an ABR that connects the areas. Router A is an internal router that connects two links in area 1. Router D and Router E are internal routers that connect links in area 0. Router B and Router F are ASBRs that connect static routes outside the AS to area 1 and area 0, respectively.

Figure 32-5: OSPFv3 Example 3

---

**Area 0 ABR Configuration**

ABR Router C connects one area 0 link to an area 1 link.
- Router C is accessed through VLAN 1302.
- All interface OSPFv3 parameters are set to their default values.

**Area 0 IR Configuration**

Area 0 contains two internal routers, each of which connects two of the three links in the area.
- Router D is accessed through VLAN 1401 and VLAN 1402.
- Router E is accessed through VLAN 1501 and VLAN 1502.
- All interface OSPFv3 parameters are set to their default values.

**Area 0 ASBR Configuration**

ASBR Router F connects one area 0 link to an external link.
- Router F is accessed through VLAN 1601.
- Router F connects to the external AS through VLAN 1602.
- All interface OSPFv3 parameters are set to their default values.
Area 1 ABR Configuration
ABR Router C connects one area 0 link to an area 1 link.

- Router C is accessed by area 1 through VLAN 1301.
- Router C is accessed by area 0 through VLAN 1302.
- All interface OSPFv3 parameters are set to their default values.

Area 1 IR Configuration
Area 1 contains one internal router that connects two links in the area.

- Router A is accessed through VLAN 1101 and VLAN 1102.
- All interface OSPFv3 parameters are set to their default values.

Area 1 ASBR Configuration
ASBR Router B connects one area 1 link to an external link.

- Router B is access through VLAN 1201.
- Router B connects to the external AS through VLAN 1202.
- All interface OSPFv3 parameters are set to their default values.

32.4.3.2 Example 3 Code

Step 1 Configure the areas and router IDs.

a  Router A OSPFv3 instance configuration:
   switch-A(config)#ipv6 router ospf 300
   switch-A(config-router-ospfv3)#router-id 10.12.15.10
   switch-A(config-router-ospfv3)#area 1 stub

b  Router B OSPFv3 instance configuration:
   switch-B(config)#ipv6 router ospf 300
   switch-B(config-router-ospfv3)#router-id 10.12.15.12
   switch-B(config-router-ospfv3)#area 1 stub

c  Router OSPFv3 instance configuration:
   switch-C(config)#ipv6 router ospf 300
   switch-C(config-router-ospfv3)#router-id 10.12.15.13
   switch-C(config-router-ospfv3)#area 1 stub

d  Router D OSPFv3 instance configuration:
   switch-D(config)#ipv6 router ospf 300
   switch-D(config-router-ospfv3)#router-id 10.12.15.14

e  Router E OSPFv3 instance configuration:
   switch-E(config)#ipv6 router ospf 300
   switch-E(config-router-ospfv3)#router-id 10.12.15.15

f  Router F OSPFv3 instance configuration:
   switch-F(config)#ipv6 router ospf 300
   switch-F(config-router-ospfv3)#router-id 10.12.15.31
Step 2  Configure the interfaces.

a  Router A interfaces:
   switch-A(config)#interface vlan 1101
   switch-A(config-if-Vl1101)#ospfv3 300 area 1
   switch-A(config-if-Vl1101)#exit
   switch-A(config)#interface vlan 1102
   switch-A(config-if-Vl1102)#ospfv3 300 area 1

b  Router B interfaces:
   switch-B(config)#interface vlan 1201
   switch-B(config-if-Vl1201)#ospfv3 300 area 1
   switch-B(config-if-Vl1201)#exit

c  Router C interfaces:
   switch-C(config)#interface vlan 1301
   switch-C(config-if-Vl1301)#ospfv3 300 area 1
   switch-C(config-if-Vl1301)#exit
   switch-C(config)#interface vlan 1302
   switch-C(config-if-Vl1302)#ospfv3 300 area 0

d  Router D interfaces:
   switch-D(config)#interface vlan 1401
   switch-D(config-if-Vl1401)#ospfv3 300 area 0
   switch-D(config-if-Vl1401)#exit
   switch-D(config)#interface vlan 1402
   switch-D(config-if-Vl1402)#ospfv3 300 area 0

e  Router E interfaces:
   switch-E(config)#interface vlan 1501
   switch-E(config-if-Vl1501)#ospfv3 300 area 0
   switch-E(config-if-Vl1501)#exit
   switch-E(config)#interface vlan 1502
   switch-E(config-if-Vl1502)#ospfv3 300 area 0

f  Router F interfaces:
   switch-F(config)#interface vlan 1601
   switch-F(config-if-Vl1601)#ospfv3 300 area 0
   switch-F(config-if-Vl1601)#exit
32.5 **OSPFv3 Commands**

**Global Configuration Mode**
- clear ospfv3 ipv6 force-spf
- ipv6 router ospf

**Interface Configuration Mode**
- ipv6 ospf area
- ospfv3 authentication ipsec spi
- ospfv3 cost
- ospfv3 dead-interval
- ospfv3 encryption ipsec spi
- ospfv3 hello-interval
- ospfv3 ipv6 retransmit-interval
- ospfv3 network
- ospfv3 priority
- ospfv3 transmit-delay

**Router-OSPFv3 Configuration Mode**
- adjacency exchange-start threshold (OSPFv3)
- area authentication ipsec spi
- area default-cost (OSPFv3)
- area encryption ipsec spi
- area nssa (OSPFv3)
- area nssa default-information-originate (OSPFv3)
- area not-so-stubby lsa type-7 convert type-5 (OSPFv3)
- area range (OSPFv3)
- area stub (OSPFv3)
- default-information originate (OSPFv3)
- default-metric (OSPFv3)
- distance ospf intra-area (OSPFv3)
- log-adjacency-changes (OSPFv3)
- max-metric router-lsa (OSPFv3)
- maximum-paths (OSPFv3)
- no area (OSPFv3)
- passive-interface (OSPFv3)
- redistribute (OSPFv3)
- router-id (OSPFv3)
- shutdown (OSPFv3)
- timers
- timers lsa rx min interval (OSPFv3)
- timers lsa tx delay initial (OSPFv3)
- timers spf delay initial (OSPFv3)

**Display Commands**
- show ipv6 ospf
- show ipv6 ospf border-routers
- show ipv6 ospf database
- show ipv6 ospf database<link-state details>
- show ipv6 ospf database <link state list>
- show ipv6 ospf database link
- show ipv6 ospf database link if-name
- show ipv6 ospf database link if-type
- show ipv6 ospf interface
- show ipv6 ospf lsa-log
- show ipv6 ospf neighbor
- show ipv6 ospf neighbor state
- show ipv6 ospf neighbor summary
- show ipv6 ospf spf-log
- show ospfv3
adjacency exchange-start threshold (OSPFv3)

The **adjacency exchange-start threshold** command sets the exchange-start options for an OSPF instance.

The **no adjacency exchange-start threshold** and **default adjacency exchange-start threshold** command resets the default by removing the corresponding **adjacency exchange-start threshold** command from **running-config**.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
adjacency exchange-start threshold peers
no adjacency exchange-start threshold
default adjacency exchange-start threshold
```

**Parameters**

- **peers**  Value ranges from 1 4294967295. Default value is 10.

**Example**

- This command sets the adjacency exchange start threshold to 156923.
  
  ```
  switch(config)#ipv6 router ospf 3
  switch(config-router-ospf3)#adjacency exchange-start threshold 156923
  switch(config-router-ospf3)#
  ```
area authentication ipsec spi

The `area authentication ipsec spi` command configures OSPFv3 authentication on an area.

The `default area authentication` and `no area authentication` commands delete the OSPFv3 authentication on an area.

**Command Mode**
Router-OSPFv3 Configuration

**Command Syntax**

- `area area_id authentication ipsec spi` `spi_value` `{md5 | sha1} {0 unencrypted_key | 7 hidden_key | KEY}

- `area area_id authentication ipsec spi` `spi_value` `{md5 | sha1} passphrase {0 unencrypted_key | 7 hidden_key | LINE}

- `default area area_id authentication`

- `no area area_id authentication`

**Parameters**

- `area area_id` configures OSPF area ID in either IP address or decimal formats. The value for decimal format ranges from 0 to 4294967295.
- `spi spi_value` configures the IPsec Security Parameter Index. The value ranges from 0 to 4294967295.
- `md5` configures HMAC-MD5 hash algorithm.
- `sha1` configures HMAC-SHA1 algorithm.
- `0 unencrypted_key` configures either a 192 bit 3DES key or 128/192/256 bit AES key in an unencrypted format.
- `7 encrypted_key` configures either a 192 bit 3DES key or 128/192/256 bit AES key in an encrypted format.
- `KEY` configures either a 128 bit MD5 key or a 140 bit SHA1 key.
- `passphrase` configures passphrase for authentication and encryption. Options include:
  - `0 unencrypted_passphrase` configures an unencrypted key.
  - `7 encrypted_passphrase` configures an encrypted key.
  - `LINE` uses passphrase string to derive keys for authentication and encryption.

**Related Commands**

- `ospfv3 authentication ipsec spi`
- `area encryption ipsec spi`

**Guidelines**

Passphrase and key value are exclusive. MD5 and SHA1 keys are derived from the configured passphrase.

**Restriction**

On the same area, EOS allows security configuration with either AH or ESP but not both. We can have one area configured with AH and another with ESP.
Examples

- This command configures OSPFv3 authentication on an area with MD5 hash algorithm.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#area 0.0.0.0 authentication ipsec spi 34 md5 0 8FD6158BFEB81ADD61241D8E4169D411
```

- This command configures OSPFv3 authentication on an area with SHA1 algorithm.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#area 0.0.0.0 authentication ipsec spi 5789 sha1 passphrase 7 $1$Ab754G0OHbGllIKqlCl7lyUKscUl1pPTpcvQ6hjJmlOUzGJDbh4bLWxSDKhVWMo6
```

- This command deletes the OSPFv3 authentication on an area.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  area 1.1.1.1 authentication ipsec spi 2437 md5 7 cNpcrQ11czqdvKAzKLT6Vr6l7+R3niuWouDKKYCFNs4/XOWG/Iap5Q==
  area 0.0.0.0 authentication ipsec spi 5789 sha1 passphrase 7 Ab754G0OHbGllIKqlCl7lyUKscUl1pPTpcvQ6hjJmlOUzGJDbh4bLWxSDKhVWMo6
switch(config-router-ospf3)#no area 0.0.0.0 authentication
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  area 1.1.1.1 authentication ipsec spi 2437 md5 7 cNpcrQ11czqdvKAzKLT6Vr6l7+R3niuWouDKKYCFNs4/XOWG/Iap5Q==
switch(config-router-ospf3)#
```
area default-cost (OSPFv3)

The `area default-cost` command sets the cost for the default summary routes sent into an area. When the `area default-cost` command is not configured for an area, the default-cost of that area is set to 10.

The `no area default-cost` and `default area default-cost` command resets the default-cost value of the specified area to 10 by removing the corresponding `area default-cost` command from `running-config`. The `no area (OSPFv3)` command removes all area commands for the specified area from `running-config`, including the `area default-cost` command.

Command Mode
- Router-OSPFv3 Configuration

Command Syntax
```
area area_id default-cost def_cost
no area area_id default-cost
default area area_id default-cost
```

Parameters
- `area_id` area number. `<0 to 4294967295>` or `<0.0.0.0 to 255.255.255.255>`
  - `Running-config` stores value in dotted decimal notation.
- `def_cost` Values range from 1 to 65535.

Example
- These commands configure a cost of 15 for default summary routes that an ABR sends into area 100.
  ```
  switch(config)#ipv6 router ospf 9
  switch(config-router-ospf3)#area 100 default 15
  switch(config-router-ospf3)#show active
  ipv6 router ospf 9
    area 0.0.0.100 default-cost 15
  switch(config-router-ospf3)#
  ```
area encryption ipsec spi

The `area encryption ipsec spi` command configures OSPFv3 security on an area. The `default area area_id encryption` and `no area area_id encryption` commands delete the OSPFv3 security on an area.

Command Mode

Router-OSPFv3 Configuration

Command Syntax

```
area area_id encryption ipsec spi spi_value esp {3des-cbc | aes-128-cbc |
aes-192-cbc | aes-256-cbc} {0 unencrypted_key | 7 encrypted_key} {md5 | sha1} {0
unencrypted_key | 7 encrypted_key | KEY}
```

```
area area_id encryption ipsec spi spi_value esp null {md5 | sha1} {0
unencrypted_key | 7 encrypted_key | KEY}
```

```
area area_id encryption ipsec spi spi_value esp {3des-cbc | aes-128-cbc |
aes-192-cbc | aes-256-cbc | null} {md5 | sha1} passphrase {0
unencrypted_passphrase | 7 encrypted_passphrase | LINE}
```

```
default area area_id encryption
```

```
no area area_id encryption
```

Parameters

- **area area_id**  configures OSPF area ID in either IP address or decimal formats. The value for decimal format ranges from 0 to 4294967295.
- **spi spi_value**  configures the value for IPsec Security Parameter Index. The value ranges from 0 to 4294967295.
- **3des-cbc**  configures ESP with 3DES-CBC encryption.
- **aes-128-cbc**  configures ESP with AES-128-CBC encryption.
- **aes-192-cbc**  configures ESP with AES-192-CBC encryption.
- **aes-256-cbc**  configures ESP with AES-256-CBC encryption.
- **null**  configures ESP with null encryption.
- **0 unencrypted_key**  configures either a 192 bit 3DES key or 128/192/256 bit AES key in an unencrypted format.
- **7 encrypted_key**  configures either a 192 bit 3DES key or 128/192/256 bit AES key in an encrypted format.
- **KEY**  configures either a 128 bit MD5 key or a 140 bit SHA1 key.
- **md5**  configures HMAC-MD5 hash algorithm.
- **sha1**  configures HMAC-SHA1 algorithm.
- **passphrase**  configures passphrase for authentication and encryption. Options include:
  - **0 unencrypted_passphrase**  configures an unencrypted key.
  - **7 encrypted_passphrase**  configures an encrypted key.
  - **LINE**  uses passphrase string to derive keys for authentication and encryption.

Related Commands

- **area authentication ipsec spi**
Guidelines
Passphrase and key value are exclusive. MD5 and SHA1 keys are derived from the configured passphrase.

Restriction
On the same area, EOS allows security configuration with either AH or ESP but not both. We can have one area configured with AH and another with ESP.

Examples
- This command configures OSPFv3 security on an area with 3DES-CBC encryption and MD5 hash algorithm.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#area 0.0.0.0 encryption ipsec spi 5678 esp 3des-cbc md5 passphrase 0 8FD6158BFE81ADD961241D8E4169D411
switch(config-router-ospf3)#show active
ipv6 router ospf 9
area 0.0.0.0 encryption ipsec spi 5678 esp 3des-cbc md5 passphrase 7 $1$cNpcrQl1czqdvKAlvKtYVr6l7+R3niuWouDBKX6CFN7s4/XOGW/1ap5q==
switch (config-router-ospf3)#
```

- This command deletes the OSPFv3 security on an area.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#show active
ipv6 router ospf 9
area 0.0.0.0 encryption ipsec spi 5678 esp 3des-cbc md5 passphrase 7 $1$cNpcrQl1czqdvKAlvKtYVr6l7+R3niuWouDBKX6CFN7s4/XOGW/1ap5q==
switch(config-router-ospf3)#no area 0.0.0.0 encryption
switch(config-router-ospf3)#show active
ipv6 router ospf 9
switch(config-router-ospf3)#
```
area nssa (OSPFv3)

The area nssa command configures an OSPFv3 area as a not-so-stubby area (NSSA). All routers in an AS must specify the same area type for identically numbered areas.

NSSA ASBRs advertise external LSAs that are part of the area, but do not advertise external LSAs from other areas.

Areas are normal by default; area type configuration is required only for stub NSSA areas. Area 0 is always a normal area and cannot be configured through this command.

The no area nssa command configures the specified area as a normal area by removing the specified area nssa command from running-config.

Command Mode
Router-OSPFv3 Configuration

Command Syntax

```
area area_id nssa [TYPE]
no area area_id nssa [TYPE]
default area area_id nssa [TYPE]
```

Parameters
- **area_id**
  - Valid formats: integer <1 to 4294967295> or dotted decimal <0.0.0.1 to 255.255.255.255>
  - Area 0 (or 0.0.0.0) is not configurable; it is always normal.
  - Running-config stores value in dotted decimal notation.
- **TYPE**
  - Values include:
    - <no parameter>
    - nssa-only

Example
- This command configures area 3 as a NSSA area.
  ```
  switch(config)#ipv6 router ospf 1
  switch(config-router-ospf3)#area 3 nssa nssa-only
  switch(config-router-ospf3)#
  ```
area nssa default-information-originate (OSPFv3)

The `area nssa default-information-originate` command sets an area as an NSSA and the generation of a type 7 default LSAs is created if a default route exists in the routing table.

The switch supports three area types:

Areas are `normal` by default; area type configuration is required only for stub NSSA areas. Area 0 is always a normal area and cannot be configured through this command.

The `no area` and `default area` commands remove the specified area from the OSPFv3 instance by deleting all `area` commands from `running-config` for the specified area, including the `area default-cost (OSPFv3)` command.

The `no area stub` and `default area stub` commands configure the specified area as a normal area.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
area area_id nssa default-information-originate [VALUE] [TYPE] [EXCL]
no area area_id nssa default-information-originate [VALUE] [TYPE] [EXCL]
default area area_id nssa default-information-originate [VALUE] [TYPE] [EXCL]
```

All parameters except `area_id` can be placed in any order.

**Parameters**

- **area_id**
  - Valid formats: integer <1 to 4294967295> or dotted decimal <0.0.0.1 to 255.255.255.255>
  - Area 0 (or 0.0.0.0) is not configurable; it is always `normal`.
  - `Running-config` stores value in dotted decimal notation.
- **VALUE**  Values include:
  - <no parameter>
  - `metric` <1-65535>
- **TYPE**  Values include:
  - <no parameter>
  - `metric-type` <1-2>
- **EXCL**  Values include:
  - <no parameter>
  - `nssa-only`

**Example**

- These commands sets area 1 as NSSA only and generates a type 7 default LSA if a default route exists in the routing table.
  ```
  switch(config-router-ospf3)#area 3 nssa default-information-originate nssa-only
  switch(config-router-ospf3)#
  ```
- These commands generates a type 7 default route.
  ```
  switch(config-router-ospf3)#area 3 nssa default-information-originate
  switch(config-router-ospf3)#
  ```
area not-so-stubby lsa type-7 convert type-5 (OSPFv3)

The `area not-so-stubby lsa type-7 convert type-5` command configures the switch to always translate Type-7 link-state advertisement (LSAs) to Type-5 LSAs.

The `no area not-so-stubby lsa type-7 convert type-5` and `no area not-so-stubby lsa type-7 convert type-5` commands allow LSAs to be translated dynamically by removing the `no area not-so-stubby lsa type-7 convert type-5` command from `running-config`.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
area area_id not-so-stubby lsa type-7 convert type-5
no area_id not-so-stubby lsa type-7 convert type-5
default area_id not-so-stubby lsa type-7 convert type-5
```

**Parameters**

- `area_id`
  - Valid formats: integer `<1` to `4294967295>` or dotted decimal `<0.0.0.1` to `255.255.255.255>`
  - Area 0 (or `0.0.0.0`) is not configurable; it is always `normal`.
  - `Running-config` stores value in dotted decimal notation.

**Example**

- These commands configure the switch to always translate Type-7 link-state advertisement (LSAs) to Type-5 LSAs.

```
switch(config)#ipv6 router ospf 3
switch(config-router-ospf3)#area 3 not-so-stubby lsa type-7 convert type-5
switch(config-router-ospf)#
```
area range (OSPFv3)

The area range command is used by OSPFv3 area border routers to summarize routes. The no area range and default area range commands remove the area-range by deleting the corresponding area range command from running-config.

Command Mode
Router-OSPFv3 Configuration

Command Syntax

area area_id range net_addr [ADVERTISE_SETTING] [COST_SETTING]
no area area_id range net_addr [ADVERTISE_SETTING] [COST_SETTING]
default area area_id range net_addr [ADVERTISE_SETTING] [COST_SETTING]

Parameters

- area_id <0 to 4294967295> or <0.0.0.0 to 255.255.255.255>
- net_addr
- ADVERTISE_SETTING specifies the LSA advertising activity. Values include
  - <no parameter>
  - advertise
  - not-advertise
- COST_SETTING Values include
  - <no parameter>
  - cost range_cost Value ranges from 1 to 65535.

Examples

- These commands summarize routes at an area boundary 1.
  switch(config)#ipv6 router ospf 1
  switch(config-router-ospf3)#area 1 range 2001:0DB8:0:1::/64
  switch(config-router-ospf3)#

- These commands modify the address range status to DoNotAdvertise.
  switch(config)#ipv6 router ospf 1
  switch(config-ospf6-router)#area 1 range 2001:0DB8:0:1::/64 not-advertise
  switch(config-ospf6-router)#
area stub (OSPFv3)

The **area stub** command configures the area type of an OSPFv3 area.
Areas are **normal** by default.

The **no area stub** command configures the specified area as a normal area.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
area area_id stub
no area area_id stub
default area area_id stub
```

**Parameters**

- **area_id**
  - Valid formats: integer <1 to 4294967295> or dotted decimal <0.0.0.1 to 255.255.255.255>
  - Area 0 (or 0.0.0.0) is not configurable; it is always **normal**.
  - *Running-config* stores value in dotted decimal notation.

**Examples**

- This command configures area 45 as a stub area.
  
  ```
  switch(config)#ipv6 router ospf 3
  switch(config-router-ospf3)#area 45 stub
  switch(config-router-ospf3)#
  ```

- This command configures area 10.92.148.17 as a stub area.
  
  ```
  switch(config-router-ospf3)#area 10.92.148.17 stub
  switch(config-router-ospf3)#
  ```
clear ospfv3 ipv6 force-spf

The `clear ospfv3 ipv6 force-spf` command starts the SPF algorithm without clearing the OSPF database.

**Command Mode**

Privileged EXEC

**Command Syntax**

    clear ospfv3 ipv6 force-spf [VRF_INSTANCE]

**Parameters**

- **VRF_INSTANCE** Values include:
  - `<no parameter>` Action is performed in the default VRF.
  - `vrf vrf_name` Action is performed in the specified VRF.

**Example**

- This command restarts the SPF algorithm in the default VRF without first clearing the OSPFv3 database.

  switch(config)#clear ospfv3 ipv6 force-spf
  switch(config)#
**default-information originate (OSPFv3)**

The **default-information originate** command generates a default external route into an OSPF domain.

The **no default-information originate** and **default default-information originate** command removes the configuration from the **running-config**.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```plaintext
default-information originate [DURATION] [VALUE] [TYPE] [MAP]
no default-information originate
default default-information originate
```

All parameters can be placed in any order.

**Parameters**

- **DURATION** Values include:
  - `<no parameter>`
  - `always`
- **VALUE** Values include:
  - `<no parameter>`
  - `metric <1-65535>`
- **TYPE** Values include:
  - `<no parameter>`
  - `metric-type <1-2>`
- **MAP** Values include:
  - `<no parameter>`
  - `route-map map_name`

**Examples**

- These commands will advertise the OSPFv3 default route regardless of whether the switch has a default route configured.
  ```plaintext
  switch(config)#ipv6 router ospf 1
  switch(config-router-ospf3)#default-information originate always
  switch(config-router-ospf3)#show active
  ipv6 router ospf 1
  default-information originate always
  ```
- These commands configures OSPF area 1 as metric of 100 for the default route with an external metric type of Type 1.
  ```plaintext
  switch(config)#ipv6 router ospf 1
  switch(config-router-ospf3)#default-information originate metric 100 metric-type 1
  switch(config-router-ospf3)#show active
  ipv6 router ospf 1
  default-information originate metric 100 metric-type 1
  ```
default-metric (OSPFv3)

The `default-metric` command sets default metric value for routes redistributed into the OSPFv3 domain.

The `no default-metric` and `default default-metric` commands restores the default metric to its default value of 10 by removing the `default-metric` command from `running-config`.

Command Mode

Router-OSPFv3 Configuration

Command Syntax

```
default-metric def_metric
no default-metric
default default-metric
```

Parameters

- `def_metric` Values range from 1 to 65535. Default value is 10.

Example

- These commands configure a default metric of 30 for routes redistributed into OSPFv3.
  ```
  switch(config)#ipv6 router ospf 9
  switch(config-router-ospf3)#default-metric 30
  switch(config-router-ospf3)#show active
  ipv6 router ospf 9
    default-metric 30
  switch(config-router-ospf3)#
  ```
distance ospf intra-area (OSPFv3)

The `distance ospf intra-area` command sets the administrative distance for routes in a single OSPFv3 area. The default is 110.

The `no distance ospf intra-area` and `default distance ospf intra-area` commands remove the `distance ospf intra-area` command from `running-config`, returning the OSPFv3 intra-area distance setting to the default value of 110.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
distance ospf intra-area distance
no distance ospf intra-area
default distance ospf intra-area
```

**Parameters**

- `distance`  Values range from 1 to 255. Default is 110.

**Example**

- This command configures a distance of 90 for all OSPFv3 intra-area routes on the switch.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#distance ospf intra-area 90
switch(config-router-ospf3)#show active
ipv6 router ospf 9
         distance ospf intra-area 90
switch(config-router-ospf3)#
```
ipv6 ospf area

The **ipv6 ospf area** command enables OSPFv3 on the interface and associates the area to the interface.

OSPFv3 areas are configured in by **no area (OSPFv3)** commands in router-OSPFv3 configuration mode.

The **no ipv6 ospf area** and **default ipv6 ospf area** commands disable OSPFv3 on the configuration mode interface by removing the corresponding **ipv6 ospf area** command from **running-config**.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ipv6 ospf process_id area area_id
no ipv6 ospf process_id [area area_id]
default ipv6 ospf process_id [area area_id]
```

**Parameters**

- **process_id** Values range from 1 to 65535.
- **area_id**
  - Valid formats: integer <0 to 4294967295> or dotted decimal <0.0.0.0 to 255.255.255.255>
  - **Running-config** stores value in dotted decimal notation.

**Example**

- These commands enable OSPFv3 on VLAN interface 200 and associates area 0 to the interface.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ipv6 ospf 9 area 0
switch(config-if-Vl200)#show active
interface Vlan200
  ipv6 ospf 9 area 0.0.0.0
switch(config-if-Vl200)#
```
ospfv3 authentication ipsec spi

The `ospfv3 authentication ipsec spi` command configures OSPFv3 authentication on an interface. The `default ospfv3 authentication` and `no ospfv3 authentication` commands delete the OSPFv3 authentication on an interface.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

ospfv3 authentication ipsec spi `spi_value` `{md5 | sha1}` `{0 unencrypted_key | 7 hidden_key | KEY}

ospfv3 authentication ipsec spi `spi_value` `{md5 | sha1}` passphrase `{0 unencrypted_passphrase | 7 encrypted_passphrase | LINE}

default ospfv3 authentication

no ospfv3 authentication

**Parameters**

- `spi spi_value` configures IPsec Security Parameter Index. The value ranges from 0 to 4294967295.
- `md5` configures HMAC-MD5 hash algorithm.
- `sha1` configures HMAC-SHA1 algorithm.
- `0 unencrypted_key` configures either a 192 bit 3DES key or 128/192/256 bit AES key in an unencrypted format.
- `7 encrypted_key` configures either a 192 bit 3DES key or 128/192/256 bit AES key in an encrypted format.
- `KEY` configures either a 128 bit MD5 key or a 140 bit SHA1 key.
- `passphrase` configures passphrase for authentication and encryption. Options include:
  - `0 unencrypted_passphrase` configures an unencrypted passphrase.
  - `7 encrypted_passphrase` configures an encrypted passphrase.
  - `LINE` uses passphrase string to derive keys for authentication and encryption.

**Related Commands**

- `area authentication ipsec spi`
- `ospfv3 encryption ipsec spi`

**Guidelines**

Passphrase and key value are exclusive. MD5 and SHA1 keys are derived from the configured passphrase.

Arista devices also support the legacy `ipv6 ospf authentication ipsec spi` command in certain software releases of the EOS.

**Restriction**

On the same interface, EOS allows security configuration with either AH or ESP but not both. We can have one interface configured with AH and another with ESP.
Examples

- This command configures OSPFv3 authentication on an interface with MD5 hash algorithm.

```
switch(config)#interface ethernet 9
switch(config-if-Et9)#ospfv3 authentication ipsec spi 3456 md5 0 8FD6158BFE81ADD961241D8E4169D411
switch(config-if-Et9)#show active
    interface Ethernet9
    no switchport
    ospfv3 authentication ipsec spi 3456 md5 7 $1$xtmcMSFzEn+Njp81b4qryVVOjKcjsrYuv6dx10+nSwKQdsiRt2RPTQ==
```

- This command configures OSPFv3 authentication on an interface with SHA1 algorithm.

```
switch(config)#interface ethernet 9
switch(config-if-Et9)#ospfv3 authentication ipsec spi 987 sha1 7 $1$VmUkWk6IL2S343bR3BbH0RhgvxHhwBpfvB4VXKN0QOF7HJBp5VvXTfBaVYbgCkWU
```

- This command deletes the OSPFv3 authentication on an interface.

```
switch(config)#interface ethernet 9
switch(config-if-Et9)#show active
    interface Ethernet9
    no switchport
    ospfv3 authentication ipsec spi 3456 md5 7 $1$xtmcMSFzEn+Njp81b4qryVVOjKcjsrYuv6dx10+nSwKQdsiRt2RPTQ==
switch(config-if-Et9)#no ospfv3 authentication
switch(config-if-Et9)#show active
    interface Ethernet9
    no switchport
```
ospfv3 cost

The ospfv3 cost command sets the OSPFv3 cost for the interface. The default OSPFv3 cost is 10.

The no ospfv3 cost and default ospfv3 cost commands restore the default cost of 10 for the configuration mode interface by removing the corresponding ospfv3 cost command from running-config.

Command Mode
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

Command Syntax
- ospfv3 cost interface_cost
- no ospfv3 cost
- default ospfv3 cost

Parameters
- interface_cost Value ranges from 1 to 65535; default is 10.

Guideline
Arista devices also support the legacy ipv6 ospf cost command in certain software releases of the EOS.

Example
- This command configures a cost of 50 for VLAN 200.

```bash
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 cost 50
switch(config-if-Vl200)#show active
interface Vlan200
  ospfv3 cost 50
switch(config-if-Vl200)#
```
ospfv3 dead-interval

The `ospfv3 dead-interval` command sets the OSPFv3 dead interval.

The `no ospfv3 dead-interval` and `default ospfv3 dead-interval` commands restore the default dead interval of 40 seconds on the configuration mode interface by removing the corresponding `ospfv3 dead-interval` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
```
ospfv3 dead-interval time
no ospfv3 dead-interval
default ospfv3 dead-interval
```

**Parameters**
- `time` Value ranges from 1 to 65535; default is 40.

**Guideline**
Arista devices also support the legacy `ipv6 ospf dead-interval` command in certain software releases of the EOS.

**Example**
- This command configures a dead interval of 75 seconds for VLAN 200.
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ospfv3 dead-interval 75
  switch(config-if-Vl200)#show active
  interface Vlan200
    ospfv3 dead-interval 75
  switch(config-if-Vl200)#
  ```
ospfv3 encryption ipsec spi

The ospfv3 encryption ipsec spi command configures OSPFv3 security on an interface.

The default ospf3 encryption and no ospf3 encryption commands delete the OSPFv3 security on an interface.

Command Mode
   Interface-Ethernet Configuration

Command Syntax

ospfv3 encryption ipsec spi spi_value esp {3des-cbc | aes-128-cbc | aes-128-cbc | aes-192-cbc} {0 unencrypted_key | 7 encrypted_key} {md5 | sha1} {0 unencrypted_key | 7 encrypted_key | KEY}

ospfv3 encryption ipsec spi spi_value esp {3des-cbc | aes-128-cbc | aes-128-cbc | aes-192-cbc} [md5 | sha1] passphrase {0 unencrypted_passphrase | 7 encrypted_passphrase | LINE}

ospfv3 encryption ipsec spi spi_value esp null {md5 | sha1} {0 unencrypted_key | 7 encrypted_key | KEY}

ospfv3 encryption ipsec spi spi_value esp null {md5 | sha1} passphrase {0 unencrypted_passphrase | 7 encrypted_passphrase | LINE}

default ospfv3 encryption

no ospf3 encryption

Parameters

- spi spi_value configures the value for IPsec Security Parameter Index. The value ranges from 0 to 4294967295.
- 3des-cbc configures ESP with 3DES-CBC encryption.
- aes-128-cbc configures ESP with AES-128-CBC encryption.
- aes-192-cbc configures ESP with AES-192-CBC encryption.
- aes-256-cbc configures ESP with AES-256-CBC encryption.
- null configures ESP with null encryption.
- 0 unencrypted_key configures either a 192 bit 3DES key or 128/192/256 bit AES key in an unencrypted format.
- 7 encrypted_key configures either a 192 bit 3DES key or 128/192/256 bit AES key in an encrypted format.
- md5 configures HMAC-MD5 hash algorithm.
- sha1 configures HMAC-SHA1 algorithm.
- KEY configures either a 128 bit MD5 key or a 140 bit SHA1 key.
- passphrase configures passphrase for authentication and encryption. Options include:
  - 0 unencrypted_passphrase configures an unencrypted passphrase.
  - 7 encrypted_passphrase configures an encrypted passphrase.
  - LINE uses passphrase string to derive keys for authentication and encryption.

Related Commands

- area encryption ipsec spi
OSPFv3 Commands

Chapter 32: Open Shortest Path First – Version 3

- `ospfv3 authentication ipsec spi`

Guidelines

Passphrase and key value are exclusive. MD5 and SHA1 keys are derived from the configured passphrase.

Arista devices also support the legacy `ipv6 ospf encryption ipsec spi` command in certain software releases of the EOS.

Restrictions

On the same interface, EOS allows security configuration with either AH or ESP but not both. We can have one interface configured with AH and another with ESP.

Examples

- This command configures OSPFv3 security on an interface with 3DES-CBC encryption and SHA1 algorithm.

```plaintext
switch(config)#interface ethernet 9
switch(config-if-Et9)#ospfv3 encryption ipsec spi 345 esp 3des-cbc sha1 passphrase 0 2fd0ec7a2e2ad89ed46a54be4443e39b393eb12
switch(config-if-Et9)#show active
  interface Ethernet9
    no switchport
  ospfv3 encryption ipsec spi 345 esp 3des-cbc sha1 passphrase 7 $1$VmUkWk6IL2S343bR3BbH0RhgvxHbwBpfv8VXs0GpQF7HgBpStVxXfBdyYbgCkWU
switch(config-if-Et9)#
```

- This command configures OSPFv3 security on an interface with 3DES-CBC encryption and MD5 hash algorithm.

```plaintext
switch(config)#interface ethernet 9
switch(config-if-Et9)#ospfv3 encryption ipsec spi 345 esp 3des-cbc md5 passphrase 7 $1$VmUkWk6IL2S343bR3BbH0RhgvxHbwBpfv8VXs0GpQF7HgBpStVxXfBdyYbgCkWU
switch(config-if-Et9)#show active
  interface Ethernet9
    no switchport
  ospfv3 encryption ipsec spi 345 esp 3des-cbc md5 passphrase 7 $1$VmUkWk6IL2S343bR3BbH0RhgvxHbwBpfv8VXs0GpQF7HgBpStVxXfBdyYbgCkWU
switch(config-if-Et9)#
```

- This command deletes the OSPFv3 security on an interface.

```plaintext
switch(config)#interface ethernet 9
switch(config-if-Et9)#show active
  interface Ethernet9
    no switchport
  ospfv3 encryption ipsec spi 3456 md5 $1$xtmcMSPzEn+Njp8Lb4qrYVVoKcjysrYuv6dx10+n9WQda1Rt2RPTQ==
switch(config-if-Et9)#no ospfv3 encryption
switch(config-if-Et9)#show active
  interface Ethernet9
    no switchport
switch(config-if-Et9)#
```
**ospfv3 hello-interval**

The `ospfv3 hello-interval` command sets the OSPFv3 hello interval. The hello interval is the period between the transmission of consecutive hello packets.

Each OSPFv3 neighbor should be the same hello interval and should not be longer than any neighbor’s dead interval.

The `no ospfv3 hello-interval` and `default ospfv3 hello-interval` commands restore the default hello interval of 10 seconds on the configuration mode interface by removing the `ospfv3 hello-interval` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
```
ospfv3 hello-interval time
no ospfv3 hello-interval
default ospfv3 hello-interval
```

**Parameters**
- `time` Values range from 1 to 65535; default is 10.

**Guideline**
Arista devices also support the legacy `ipv6 ospf hello-interval` command in certain software releases of the EOS.

**Example**
- This command configures a hello interval of 45 seconds for VLAN 200.
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ospfv3 hello-interval 45
  switch(config-if-Vl200)#show active
  interface Vlan200
    ospfv3 hello-interval 45
  switch(config-if-Vl200)#
  ```
**ospfv3 ipv6 retransmit-interval**

The `ospfv3 ipv6 retransmit-interval` command configures the link state advertisement retransmission interval.

The `no ospfv3 ipv6 retransmit-interval` and `default ospfv3 ipv6 retransmit-interval` commands restore the default retransmission interval of 5 seconds on the configuration mode interface by removing the corresponding `ospfv3 ipv6 retransmit-interval` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ospfv3 ipv6 retransmit-interval period
no ospfv3 ipv6 retransmit-interval
default ospfv3 ipv6 retransmit-interval
```

**Parameters**
- `period` Value ranges from 1 to 65535; default is 5.

**Example**
- This command configures a retransmission interval of 25 seconds for VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 ipv6 retransmit-interval 25
switch(config-if-Vl200)#show active
interface Vlan200
    ospfv3 ipv6 retransmit-interval 25
switch(config-if-Vl200)#
```
ospfv3 network

The **ospfv3 network** command sets the configuration mode interface as a point-to-point link. By default, interfaces are set as broadcast links.

The **no ospfv3 network** and **default ospfv3 network** commands set the configuration mode interface as a broadcast link by removing the corresponding **ospfv3 network** command from **running-config**.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

- `ospfv3 network point-to-point`
- `no ospfv3 network`
- `default ospfv3 network`

**Guideline**
Arista devices also support the legacy **ipv6 ospf network** command in certain software releases of the EOS.

**Examples**

- This command configures VLAN interface 200 as a point-to-point link.
  
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#ospfv3 network point-to-point
  switch(config-if-Vl200)#show active
  interface Vlan200
   ospfv3 network point-to-point
  switch(config-if-Vl200)#
  ```

- This command restores Ethernet interface 10 as a broadcast link.
  
  ```
  switch(config)#interface vlan 200
  switch(config-if-Vl200)#no ospfv3 network
  switch(config-if-Vl200)#show active
  interface Vlan200
  switch(config-if-Vl200)#
  ```
**ospfv3 priority**

The `ospfv3 priority` command configures the OSPFv3 router priority.

The `no ospfv3 priority` and `default ospfv3 priority` commands restore the default priority (1) on the interface by removing the corresponding `ospfv3 priority` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
ospfv3 priority priority_level
no ospfv3 priority
default ospfv3 priority
```

**Parameters**

- `priority_level`  Settings range from 0 to 255.

**Guideline**

Arista devices also support the legacy `ipv6 ospf priority` command in certain software releases of the EOS.

**Example**

- This command configures a router priority of 128 for VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 priority 128
switch(config-if-Vl200)#show active
interface Vlan200
  ospfv3 priority 128
switch(config-if-Vl200)#
```
ospfv3 transmit-delay

The `ospfv3 transmit-delay` command configures the transmission delay for OSPFv3 packets.

The `no ospfv3 transmit-delay` and `default ospfv3 transmit-delay` commands restore the default transmission delay of one second on the configuration mode interface by removing the corresponding `ospfv3 transmit-delay` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
```
ospfv3 transmit-delay trans
no ospfv3 transmit-delay
default ospfv3 transmit-delay
```

**Parameters**
- `trans` Value ranges from 1 to 65535; default is 1.

**Guideline**
Arista devices also support the legacy `ipv6 ospf transmit-delay` command in certain software releases of the EOS.

**Example**
- This command configures a transmission delay of 10 seconds for VLAN 200.

```
switch(config)#interface vlan 200
switch(config-if-Vl200)#ospfv3 transmit-delay 10
switch(config-if-Vl200)#show active
interface Vlan200
    ospfv3 transmit-delay 10
switch(config-if-Vl200)#
```
ipv6 router ospf

The `ipv6 router ospf` command places the switch in router-OSPFv3 configuration mode and creates
and OSPFv3 instance if one does not already exist. Note that each OSPFv3 instance on the switch
must have a unique process ID. A router ID for the new instance will be created if one does not already
exist.

The `show ipv6 ospf` command displays the router ID of each OSPFv3 instance configured on the
switch.

The `no ipv6 router ospf` and `default ipv6 router ospf` command deletes the OSPFv3 instance.

Refer to the `Router-OSPFv3 Configuration Mode` command for a list of commands available in
router-OSPFv3 configuration mode.

Command Mode
Global Configuration

Command Syntax
```
ipv6 router ospf  process_id  [VRF_INSTANCE]
no ipv6 router ospf  process_id  [VRF_INSTANCE]
default ipv6 router ospf  process_id  [VRF_INSTANCE]
```

Parameters
- `process_id`  Values range from 1 to 65535.
- `VRF_INSTANCE`  Values include:
  - `<no parameter>`  OSPF instance is in the default VRF.
  - `vrf vrf_name`  OSPF instance is the specified VRF.

Examples
- This command creates an OSPFv3 instance in the default VRF with process ID 9.
```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#show active
ipv6 router ospf 9
switch(config-router-ospf3)#
```
- This command deletes the OSPFv3 instance.
```
switch(config)#no ipv6 router ospf 9
switch(config)#
```
log-adjacency-changes (OSPFv3)

The **log-adjacency-changes** command enables syslog messages to be sent when it detects OSPFv3 link state changes or when it detects that a neighbor has gone up or down. Log message sending is enabled by default.

The **default log-adjacency-changes** command restores the default state by removing the **log-adjacency-changes** statement from *running-config*.

The default option (sending a message only when a neighbor goes up or down) is active when running-config does not contain any form of the command. Entering the command in any form replaces the previous command state in *running-config*.

The **no log-adjacency-changes** disables link state change syslog reporting.

The **default log-adjacency-changes** command restores the default state by removing the **log-adjacency-changes detail** or **no log-adjacency-changes** statement from *running-config*.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
log-adjacency-changes [INFO_LEVEL]
no log-adjacency-changes
default log-adjacency-changes
```

**Parameters**

- **INFO_LEVEL** Options include
  - <no parameter> Sends messages when a neighbor goes up or down.
  - **detail** Sends messages for all neighbor state changes.

**Example**

- This command configures the switch to send a syslog message when a neighbor state changes.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#log-adjacency-changes
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  log-adjacency-changes
switch(config-router-ospf3)#
```
max-metric router-lsa (OSPFv3)

The max-metric router-lsa command configures OSPF to include the maximum value in LSA metric fields to keep other network devices from using the switch as a preferred intermediate SPF hop.

The no max-metric router-lsa and default max-metric router-lsa commands disable the advertisement of a maximum metric.

Command Mode
Router-OSPFv3 Configuration

Command Syntax
max-metric router-lsa [EXTERNAL] [STUB] [STARTUP] [SUMMARY]
no max-metric router-lsa [EXTERNAL] [STUB] [STARTUP] [SUMMARY]
default max-metric router-lsa [EXTERNAL] [STUB] [STARTUP] [SUMMARY]

All parameters can be placed in any order.

Parameters
- **EXTERNAL** Values include:
  - <no parameter>  Default value of 1.
  - external-lsa
  - external-lsa <1 to 16777215>  The default value is 0xFF0000.
- **STUB** Values include:
  - <no parameter>  Default value of 2.
  - include-stub
- **STARTUP** Values include:
  - <no parameter>
  - on-startup
  - on-startup wait-for-bgp
  - on-startup <5 to 86400>
    wait-for-bgp or an on-start time value is not included in no and default commands.
- **SUMMARY** Values include:
  - <no parameter>  Metric is set to the default value of 1.
  - summary-lsa
  - summary-lsa <1 to 16777215>

Example
- This command configures OSPFv3 to include the maximum value in LSA metric fields until BGP has converged:
  switch(config-router-ospf3)#max-metric router-lsa on-startup wait-for-bgp
  switch(config-router-ospf3)#
maximum-paths (OSPFv3)

The maximum-paths command sets the maximum number of parallel routes that OSPFv3 supports on the switch.

The no maximum-paths command restores the maximum number of parallel routes that OSPFv3 supports on the switch to the default value of 16 by removing the maximum-paths command from running-config.

Command Mode
Router-OSPFv3 Configuration

Command Syntax

maximum-paths paths
no maximum-paths
default maximum-paths

Parameters

- **paths** Value range is platform dependent:
  - Arad: Value ranges from 1 to 128. Default value is 128.
  - FM6000: Value ranges from 1 to 32. Default value is 32.
  - PetraA: Value ranges from 1 to 16. Default value is 16.
  - Trident: Value ranges from 1 to 32. Default value is 32.
  - Trident II: Value ranges from 1 to 128. Default value is 128.

Example

- This command configures the maximum number of OSPFv3 parallel paths to 12.

  switch(config)#ipv6 router ospf 9
  switch(config-router-ospf3)#maximum-paths 12
  switch(config-router-ospf3)#
no area (OSPFv3)

The no area command removes all area configuration commands for the specified OSPFv3 area. Commands removed by the no area command include:

- area
- nssa
- range
- stub

Area settings can be removed individually; refer to the command description page of the desired command for details.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
no area area_id [TYPE]
default area area_id [TYPE]
```

**Parameters**

- **area_id** area number.
  - Valid formats: integer `<1 to 4294967295>` or dotted decimal `<0.0.0.1 to 255.255.255.255>`
  - Area 0 (or 0.0.0.0) is not configurable; it is always normal.
  - Running-config stores value in dotted decimal notation.
- **TYPE** area type. Values include:
  - nssa
  - nssa translate type7 always
  - stub
  - stub no-summary

**Example**

- This command remove the area 1 stub configuration.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)# no area 1 stub
switch(config-router-ospf3)#
```
passive-interface (OSPFv3)

The **passive-interface** command disables OSPF on an interface range. All interfaces are active by default.

The **no passive-interface** and **default passive-interface** commands enable OSPFv3 on the specified interface range by removing the corresponding **passive-interface** statements from **running-config**.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
passive-interface INTERFACE_NAME
no passive-interface INTERFACE_NAME
default passive-interface INTERFACE_NAME
```

**Parameters**

- **INTERFACE_NAME** Options include:
  - ethernet *e_range*
  - loopback *l_range*
  - management *m_range*
  - port-channel *p_range*
  - vlan *v_range*
  - vxlan *vx_range*
  - default

Valid *e_range*, *l_range*, *m_range*, *p_range* *v_range*, and *vx_range* formats include number, range, or comma-delimited list of numbers and ranges.

**Example**

- This command configures VLAN interfaces 101 through 103 as passive interfaces.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#passive-interface vlan 101-103
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  passive-interface Vlan101
  passive-interface Vlan102
  passive-interface Vlan103
switch(config-router-ospf3)#
```
redistribute (OSPFv3)

The **redistribute** command enables the advertising of all specified routes into the OSPFv3 domain as external routes.

The **no redistribute** and **default redistribute** commands remove the corresponding **redistribute** command from **running-config**, disabling route redistribution for the specified route type.

**Command Mode**
Router-OSPFv3 Configuration

**Command Syntax**

```
redistribute ROUTE_TYPE [ROUTE_MAP]
no redistribute ROUTE_TYPE
default redistribute ROUTE_TYPE
```

**Parameters**

- **ROUTE_TYPE** Options include:
  - BGP
  - connected
  - static
- **ROUTE_MAP** Options include:
  - route-map map_name

**Example**

- The **redistribute static** command starts the advertising of static routes as OSPFv3 external routes.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#redistribute static
switch(config-router-ospf3)#show active
ipv6 router ospf 9
  redistribute connected
  redistribute static
switch(config-router-ospf3)#
```
router-id (OSPFv3)

The router-id command assigns the router ID for an OSPFv3 instance. The switch sets the router ID to the first available alternative in the following list:

1. The router-id command
2. The loopback IP address
3. The highest IP address present on the device

Important! When configuring VXLAN on an MLAG, always manually configure the OSPFv3 router ID to prevent the switch from using the common VTEP IP address as the router ID.

The no router-id and default router-id commands remove the router ID command from running-config.

Command Mode

Router-OSPFv3 Configuration

Command Syntax

```
router-id identifier
no router-id
default router-id
```

Parameters

- **identifier**  Value ranges from 0.0.0.0 to 255.255.255.255 (dotted decimal notation).

Example

- This command assigns 10.10.1.4 as the router ID for the OSPFv3 instance.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#router-id 10.10.1.4
switch(config-router-ospf3)#show active
ipv6 router ospf 9
    router-id 15.10.1.4
switch(config-router-ospf3)#
```
show ipv6 ospf

The `show ipv6 ospf` command displays information about OSPFv3 routing.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 ospf [access-list | border-routers | database | interface | lsa-log | neighbor | request-list | retransmission-list | spf-log | vrf | Process ID]
```

**Parameters**

- `<no parameters>` displays the complete configuration of OSPFv3 address family and routing process.
- `access-list` displays the information of configured OSPFv3 access-list. Options include:
  - `<no parameters>` displays the information of all configured OSPFv3 access lists.
  - `WORD` displays the information of the specified access list.
  - `summary` displays the summary of all configured access lists.
- `border-routers` displays the information of configured OSPFv3 border and boundary routers. Options include:
  - `<no parameters>` displays the information of all configured OSPFv3 borders and boundary routers.
  - `vrf` displays the OSPFv3 borders and boundary routers information of the specified Virtual Routing and Forwarding (VRF).
- `database` displays the summary of database. Options include:
  - `<no parameters>` displays the complete summary of database.
  - `ipv4` displays the database information of link state ID.
  - `adv-router` displays the database information of advertising router link states.
  - `area` displays the database information filtered by area scope LSAs.
  - `as` displays the database information filtered by AS scope LSAs.
  - `database-summary` displays the count of LSAs in OSPFv3 database.
  - `detail` displays the detailed information of LSA.
  - `link` displays the database information filtered by link scoped LSAs.
  - `self originate` displays the database information of self-originated link states.
  - `vrf` displays the VRF information in OSPFV3 database.
- `interface` displays the information of OSPFv3 interfaces. Options include:
  - `<no parameters>` displays the information of all OSPFv3 interfaces.
  - `Ethernet eth_num` displays the information of the specified Ethernet interface. The value ranges from 1 to 24.
  - `Loopback lb_num` displays the information of the specified loop back interface. The value ranges from 0 to 1000.
  - `Port-Channel pc_num` displays the interface or sub-interface information of the specified port channel. The interface and sub-interface values of port channel ranges from <1-1000> and <1-2000>,<1-4094> respectively.
  - `Tunnel t_num` displays the information of the specified tunnel. The value ranges from 0 to 255.
- **Vlan vlan_num** displays the information of the specified VLAN interface. The value ranges from 1 to 4094.
- **vrf vrf_name** displays the information of the specified VRF.
- **lsa-log** displays the log entries of OSPFv3 LSA updates.
- **neighbor** displays the list of OSPFv3 neighbors.
- **request-list** displays the list of all OSPFv3 LSAs requested by a router.
- **retransmission-list** displays the list of all OSPFv3 LSAs waiting to be re-sent.
- **spf-log** displays the start-time, duration of completion, and reason of delay to calculate the OSPFv3 Sender Policy Framework (SPF).
- **vrf vrf_name** displays the information of specified VRF.
- **Process ID** displays the OSPFv3 configuration of the specified process ID. The value ranges from 1 to 65535.

**Example**
- This command displays OSPFv3 routing information for all VRFs.

```plaintext
switch>show ipv6 ospf
Routing Process "ospfv3 0" with ID 11.1.11.1 and Instance 0 VRF default
  FIPS mode disabled
  It is not an autonomous system boundary router and is not an area border router
  Minimum LSA arrival interval 1000 msecs
  Initial LSA throttle delay 1000 msecs
  Minimum hold time for LSA throttle 5000 msecs
  Maximum wait time for LSA throttle 5000 msecs
  It has 0 fully adjacent neighbors
  Number of areas in this router is 0. 0 normal, 0 stub, 0 nssa
  Number of LSAs 0
  Initial SPF schedule delay 0 msecs
  Minimum hold time between two consecutive SPF's 5000 msecs
  Current hold time between two consecutive SPF's 5000 msecs
  Maximum wait time between two consecutive SPF's 5000 msecs
  SPF algorithm last executed 00:07:13 ago
  No scheduled SPF
  Adjacency exchange-start threshold is 20
  Maximum number of next-hops supported in ECMP is 32
  Number of backbone neighbors is 0
  Graceful-restart is not configured
  Graceful-restart-helper mode is enabled
```
This command displays the log entries of OSPFv3 LSA updates.

switch>show ipv6 ospf lsa-log
[22:11:02] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[21:31:02] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[20:56:22] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[20:18:12] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[19:47:22] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[19:13:22] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[18:39:32] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[18:06:32] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[17:26:42] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[16:48:42] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[16:13:12] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[15:36:52] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[15:03:32] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[14:27:02] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[13:52:02] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[13:15:02] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[12:39:42] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[12:00:02] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[11:27:22] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[10:53:22] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[10:17:12] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs
[09:42:42] type RTR: 0.0.0.0 [13.13.13.13], event 2, backoff restarted, new hold value 1000 msecs

<---------OUTPUT OMITTED FROM EXAMPLE--------->
show ipv6 ospf border-routers

The `show ipv6 ospf border-routers` command displays the OSPF routing table entries.

**Command Mode**
EXEC

**Command Syntax**
```
show ipv6 ospf border-routers [VRF_INSTANCE]
```

**Parameters**
- VRF_INSTANCE Values include:
  - <no parameter> Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

**Example**
- This command displays the ABRs and ASBRs configured in the switch in all VRFs.

```
switch>show ipv6 ospf border-routers
Routing Process "ospf 9", VRF default
 Router 10.37.0.32 area 0.0.0.0 ASBR
 Router 10.37.0.18 area 0.0.0.0 ASBR
 Router 10.37.0.22 area 0.0.0.0 ASBR ABR
 Router 10.37.0.31 area 0.0.0.0 ASBR ABR
 Router 10.37.0.58 area 0.0.0.0 ASBR
 Router 10.37.0.37 area 0.0.0.0 ASBR
 Router 10.37.0.22 area 0.0.0.2 ASBR ABR
 Router 10.37.0.31 area 0.0.0.2 ASBR ABR
switch>
```
show ipv6 ospf database

The `show ipv6 ospf database` command displays data from the OSPF database. The switch can return link state data for a single VRF or for all VRFs on the switch.

**Command Mode**

EXEC

**Command Syntax**

`show ipv6 ospf database [VRF_INSTANCE]`

**Parameters**

- **VRF_INSTANCE** Values include:
  - `<no parameter>` Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

**Example**

- This command displays OSPF database information for VRF blue.

```
switch>show ipv6 ospf database vrf blue
Codes:  AEX - AS External,  GRC - Grace,
       IAP - Inter Area Prefix,  IAR - Inter Area Router,
       LNK - Link,  NAP - Intra Area Prefix,
       NSA - Not So Stubby Area,  NTW - Network,
       RTR - Router
Routing Process "ospf 9",  VRF blue
AS Scope LSDB
switch>
```
show ipv6 ospf database<link-state details>

The `show ipv6 ospf database <link-state details>` command displays detailed information about the specified link state advertisements. The switch can return link state data about a single area or for all areas on the switch.

**Command Mode**
EXEC

**Command Syntax**
```
show ipv6 ospf database [FILTER] LINK_TYPE [LINKSTATE_ID] [ROUTER] [DATA_LEVEL]
```

**Parameters**
- **FILTER** filters the output of the command by specifying areas. Options include:
  - area <A.B.C.D>
  - area backbone
- **LINK_TYPE** Parameter options include:
  - router
  - network
  - inter-area-prefix
  - inter-area-router
  - intra-area-prefix
  - nssa
- **LINKSTATE_ID** Options include:
  - <no parameter>
  - <A.B.C.D>
- **ROUTER** Options include:
  - <no parameter>
  - adv-router [a.b.c.d]
  - self-originate
- **DATA_LEVEL** Options include:
  - <no parameter>
  - detail
Example

- This command displays the OSPF database summary.

```bash
switch>show ipv6 ospf database detail
Codes: AEX - AS External, GRC - Grace,
      IAP - Inter Area Prefix, IAR - Inter Area Router,
      LNK - Link, NAP - Intra Area Prefix,
      NSA - Not So Stubby Area, NTW - Network,
      RTR - Router

Routing Process "ospf 9":

AS Scope LSDB

LSA Type: AEX
  Link State ID: 0.0.0.1
  Advertising Router: 10.21.4.9
  Age: 1123
  Sequence Number: 0x80000001
  Checksum: 0x009c89
  Length: 40
  Metric Type: 2
  Metric: 1
  External Route Tag: 0
  Prefix
    Prefix: fd7a:629f:52a4:1::
    Length: 64
    Options: (null)
    Metric: 0

Area 0.0.1.44 LSDB

LSA Type: LNK
  Link State ID: 0.0.0.1
  Advertising Router: 10.26.0.11
  Age: 1285
  Sequence Number: 0x800000c1
  Checksum: 0x00629b
  Length: 56
  Option Priority: 16777235
  Link Local Addr: fe80::21c:73ff:fe0b:a80e
  Number of Prefixes: 1
  Prefix
    Prefix: fd7a:629f:52a4:fe08::
    Length: 64
    Options: (null)
    Metric: 0

LSA Type: LNK
  Link State ID: 0.0.0.34
  Advertising Router: 10.26.0.11
  Age: 1042
  Sequence Number: 0x800000c2
  Checksum: 0x00bd9f
  Length: 56
  Option Priority: 16777235
  Link Local Addr: fe80::21c:73ff:fe01:5fe1
  Number of Prefixes: 1
```
Prefix
  Prefix: fd7a:629f:52a4:fe08::
  Length: 64
  Options: (null)
  Metric: 0

LSA Type: LNK
  Link State ID: 0.0.0.15
  Advertising Router: 10.26.0.23
  Age: 1128
  Sequence Number: 0x800000c7
  Checksum: 0x00d4ab
  Length: 56
  Option Priority: 16777235
  Link Local Addr: fe80::21c:73ff:fe00:1319
  Number of Prefixes: 1

Prefix
  Prefix: fd7a:629f:52a4:fe08::
  Length: 64
  Options: (null)
  Metric: 0

Interface vlan3925 LSDB

LSA Type: LNK
  Link State ID: 0.0.0.153
  Advertising Router: 10.27.0.52
  Age: 1186
  Sequence Number: 0x800009b6
  Checksum: 0x002f27
  Length: 56
  Option Priority: 16777235
  Link Local Addr: fe80::21c:73ff:fe17:3906
  Number of Prefixes: 1

Prefix
  Prefix: fd7a:629f:52a4:fe67::
  Length: 64
  Options: (null)
  Metric: 0

Interface lo0 LSDB

switch>
**show ipv6 ospf database <link state list>**

The `show ipv6 ospf database <link state list>` command displays the OSPF link state advertisements that originate on a switch.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 ospf database [FILTER] [LINKSTATE_ID] [ROUTER] [DATA_LEVEL]
```

**Parameters**

- **FILTER** filters the output of the command by specifying areas. Options include:
  - <no parameter>
  - area `<A.B.C.D>`
  - area backbone
  - as
  - as external

- **LINKSTATE_ID** Options include:
  - <no parameter>
  - `<A.B.C.D>`

- **ROUTER** Options include:
  - <no parameter>
  - adv-router `[a.b.c.d]`
  - self-originate

- **DATA_LEVEL** Options include:
  - <no parameter>
  - detail
Example

- This command displays the OSPFv3 database of link state advertisements.

```bash
switch>show ipv6 ospf database 10.26.0.23

Codes:  AEX - AS External,  GRC - Grace,
        IAP - Inter Area Prefix,  IAR - Inter Area Router,
        LNK - Link,  NAP - Intra Area Prefix,
        NSA - Not So Stubby Area,  NTW - Network,
        RTR - Router

Routing Process "ospf 9":

AS Scope LSDB

<table>
<thead>
<tr>
<th>Type</th>
<th>Link ID</th>
<th>ADV Router</th>
<th>Age</th>
<th>Seq#</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEX</td>
<td>0.0.0.5</td>
<td>10.37.0.37</td>
<td>15</td>
<td>0x80000005</td>
<td>0x00be82</td>
</tr>
<tr>
<td>AEX</td>
<td>0.0.0.9</td>
<td>10.37.0.22</td>
<td>1747</td>
<td>0x8000002b</td>
<td>0x00df56</td>
</tr>
<tr>
<td>AEX</td>
<td>0.0.0.3</td>
<td>10.37.0.46</td>
<td>599</td>
<td>0x8000002d</td>
<td>0x00651d</td>
</tr>
</tbody>
</table>

Area 0.0.0.0 LSDB

<table>
<thead>
<tr>
<th>Type</th>
<th>Link ID</th>
<th>ADV Router</th>
<th>Age</th>
<th>Seq#</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTR</td>
<td>0.0.0.0</td>
<td>10.37.0.32</td>
<td>234</td>
<td>0x80000031</td>
<td>0x00585a</td>
</tr>
<tr>
<td>NTW</td>
<td>0.0.0.26</td>
<td>10.37.0.32</td>
<td>271</td>
<td>0x80000005</td>
<td>0x005609</td>
</tr>
<tr>
<td>NAP</td>
<td>0.0.0.26</td>
<td>10.37.0.32</td>
<td>274</td>
<td>0x80000005</td>
<td>0x00964c</td>
</tr>
</tbody>
</table>

Interface vlan3911 LSDB

<table>
<thead>
<tr>
<th>Type</th>
<th>Link ID</th>
<th>ADV Router</th>
<th>Age</th>
<th>Seq#</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNK</td>
<td>0.0.0.38</td>
<td>10.37.0.22</td>
<td>267</td>
<td>0x80000005</td>
<td>0x00a45a</td>
</tr>
<tr>
<td>LNK</td>
<td>0.0.0.23</td>
<td>10.37.0.23</td>
<td>270</td>
<td>0x80000002c</td>
<td>0x005b7e</td>
</tr>
</tbody>
</table>

Interface vlan3902 LSDB

<table>
<thead>
<tr>
<th>Type</th>
<th>Link ID</th>
<th>ADV Router</th>
<th>Age</th>
<th>Seq#</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNK</td>
<td>0.0.0.17</td>
<td>10.37.0.11</td>
<td>1535</td>
<td>0x8000002b</td>
<td>0x007120</td>
</tr>
<tr>
<td>LNK</td>
<td>0.0.0.37</td>
<td>10.37.0.22</td>
<td>7</td>
<td>0x8000002b</td>
<td>0x00ce23</td>
</tr>
<tr>
<td>LNK</td>
<td>0.0.0.22</td>
<td>10.37.0.23</td>
<td>250</td>
<td>0x8000002d</td>
<td>0x00c350</td>
</tr>
</tbody>
</table>

switch>
```
**show ipv6 ospf database link**

The `show ipv6 ospf database link` command displays details of the specified link state advertisements. The switch can return link state data about a single area or for all areas on the switch.

**Command Mode**

EXEC

**Command Syntax**

```plaintext
show ipv6 ospf database link [LINKSTATE_ID] [ROUTER] [DATA_LEVEL]
```

**Parameters**

- **LINKSTATE_ID** Options include:
  - <no parameter>
  - <A.B.C.D>
- **ROUTER** Options include:
  - <no parameter>
  - adv-router [a.b.c.d]
  - self-originate
- **DATA_LEVEL** Options include:
  - <no parameter>
  - detail

**Example**

- This command displays information about the Open Shortest Path First (OSPF).

  ```plaintext
  switch> show ipv6 ospf database link
  Codes: AEX - AS External, GRC - Grace,
  IAP - Inter Area Prefix, IAR - Inter Area Router,
  LNK - Link, NAP - Intra Area Prefix,
  NSA - Not So Stubby Area, NTW - Network,
  RTR - Router
  
  Routing Process "ospf 9":
  
  switch>
  ```
show ipv6 ospf database link if-name

The `show ipv6 ospf database link` command displays link state advertisement details. The switch can return link state data about a single area or for all areas on the switch.

**Command Mode**
EXEC

**Command Syntax**
```
show ipv6 ospf database link if-name [INTF_ID] [LS_ID] [ROUTER] [DATA_LEVEL]
```

**Parameters**
- **INTF_ID** Options include:
  - `ethernet e_range` Ethernet interface list.
  - `loopback l_range` Loopback interface list.
  - `management m_range` Management interface list.
  - `port-channel p_range` Channel group interface list.
  - `vlan v_range` VLAN interface list.
  - `vxlan vx_range` VXLAN interface list.
Valid `range` formats include number, range, or comma-delimited list of numbers and ranges.
- **LS_ID** Options include:
  - `<no parameter>`
  - `<A.B.C.D>`
- **ROUTER** Options include:
  - `<no parameter>`
  - `adv-router [a.b.c.d]`
  - `self-originate`
- **DATA_LEVEL** Options include:
  - `<no parameter>`
  - `detail`

**Example**
- This command displays information for Ethernet 4/1 link state advertisements.
```
switch>show ipv6 ospf database link if-name ethernet 4/1
Codes: AEX - AS External, GRC - Grace,
IAP - Inter Area Prefix, IAR - Inter Area Router,
LNK - Link, NAP - Intra Area Prefix,
NSA - Not So Stubby Area, NTW - Network,
RTR - Router

Routing Process "ospf 1":
```
switch>
```
show ipv6 ospf database link if-type

The `show ipv6 ospf database link` command displays information of the link state advertisements. The switch can return link state data about a single area or for all areas on the switch.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 ospf database link if-type [INTF_TYPE] [LS_ID] [ROUTER] [DATA_LEVEL]
```

**Parameters**

- **INTF_TYPE**
  - broadcast
  - nbma
  - p2mp
  - p2p

- **LS_ID** Options include:
  - <no parameter>
  - <A.B.C.D>

- **ROUTER** Options include:
  - <no parameter>
  - adv-router [a.b.c.d]
  - self-originate

- **DATA_LEVEL** Options include:
  - <no parameter>
  - detail
Example

- This command displays LSA information for the interfaces configured for broadcast transmissions.

```
switch>show ipv6 ospf database link if-type broadcast
Codes:  AEX - AS External, GRC - Grace,
        IAP - Inter Area Prefix, IAR - Inter Area Router,
        LNK - Link, NAP - Intra Area Prefix,
        NSA - Not So Stubby Area, NTW - Network,
        RTR - Router

Routing Process "ospf 1":

    Interface et4 LSDB
    Type   Link ID     ADV Router  Age       Seq#   Checksum
    LNK    0.0.0.61    10.26.0.49  1378 0x80000027   0x00f8b0
    LNK    0.0.0.20    10.26.0.23  1371 0x80000027   0x005423

    Interface et7 LSDB
    Type   Link ID     ADV Router  Age       Seq#   Checksum
    LNK    0.0.0.61    10.26.0.50  1298 0x80000028   0x005e0d
    LNK    0.0.0.38    10.26.0.23  1291 0x80000028   0x00ce8d

    Interface vlan3901 LSDB
    Type   Link ID     ADV Router  Age       Seq#   Checksum
    LNK    0.0.0.36    10.26.0.22  216  0x800000b0   0x00c2b1
    LNK    0.0.0.19    10.26.0.23  231  0x800000b0   0x00cfca

switch>
```
The `show ipv6 ospf interface` command displays OSPFv3 information on interfaces where OSPFv3 is enabled.

**Command Mode**

EXEC

**Command Syntax**

```bash
show ipv6 ospf interface [VRF_INSTANCE]
```

**Parameters**

- **VRF_INSTANCE** Values include:
  - `<no parameter>` Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

**Example**

This command displays OSPFv3 information for interfaces where OSPFv3 is enabled.

```
switch>show ipv6 ospf interface
Ethernet17 is up
  Interface Address fe80::48c:73ff:fe00:1319, VRF default, Area 0.0.0.0
  Network Type Broadcast, Cost 10
  Transmit Delay is 1 sec, State Backup DR, Priority 1
  Designated Router is 10.37.0.37
  Backup Designated Router is 10.37.0.23
  Timer intervals configured, Hello 10, Dead 40, Retransmit 5
  Neighbor Count is 1
  Options are R E V6

Vlan31 is up
  Interface Address fe80::48c:73ff:fe00:1319, VRF default, Area 0.0.0.0
  Network Type Broadcast, Cost 10
  Transmit Delay is 1 sec, State Backup DR, Priority 1
  Designated Router is 10.37.0.22
  Backup Designated Router is 10.37.0.23
  Timer intervals configured, Hello 10, Dead 40, Retransmit 5
  Neighbor Count is 1
  Options are R E V6

Vlan32 is up
  Interface Address fe80::48c:73ff:fe00:1319, VRF default, Area 0.0.0.0
  Network Type Broadcast, Cost 10
  Transmit Delay is 1 sec, State DR Other, Priority 1
  Designated Router is 10.37.0.11
  Backup Designated Router is 10.37.0.22
  Timer intervals configured, Hello 10, Dead 40, Retransmit 5
  Neighbor Count is 2
  Options are R E V6
```

switch>
show ipv6 ospf lsa-log

The `show ipv6 ospf lsa-log` command displays log entries when LSA update messages are sent or received for OSPFv3.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 ospf [PROCESS_ID] lsa-log [VRF_INSTANCE]
```

**Parameters**

- **PROCESS_ID**  OSPFv3 process ID. Values include:
  - `<no parameter>` Displays information for all process IDs.
  - `<1 to 65535>` Displays information for the specified process ID.
- **VRF_INSTANCE** Values include:
  - `<no parameter>` Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

**Examples**

- This command displays log entries when LSA update messages are sent or received for OSPFv3.

```
switch> show ipv6 ospf lsa-log
OSPF3 Process 3.3.3.3, VRF default, LSA Throttling Log:
[04:21:09] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 2000 msecs
[04:21:08] type 1: 3.3.3.3/32 [3.3.3.3], event 2, backoff restarted, new hold value 900 msecs
[04:21:00] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 3000 msecs
[04:21:00] type 1: 3.3.3.3/32 [3.3.3.3], event 4, maxwait value changed, new hold value 3000 msecs
/* Here the maxwait value was changed to 3000 from earlier 32000, this is not part of the log */
[04:20:42] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 32000 msecs
[04:20:10] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 32000 msecs
[04:19:54] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 16000 msecs
[04:19:46] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 8000 msecs
[04:19:42] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 4000 msecs
[04:19:40] type 1: 3.3.3.3/32 [3.3.3.3], event 1, backed off, new hold value 2000 msecs
[04:19:39] type 1: 3.3.3.3/32 [3.3.3.3], event 2, backoff restarted, new hold value 900 msecs
[04:19:22] type 1: 4.4.4.4/32 [4.4.4.4], event 3, discarded, was early by 995 msecs
[04:19:22] type 1: 3.3.3.3/32 [3.3.3.3], event 0, backoff started, new hold value 1000 msecs
switch>
```
show ipv6 ospf neighbor

The `show ipv6 ospf neighbor` command displays OSPFv3 neighbor information.

**Command Mode**

**EXEC**

**Command Syntax**

```
show ipv6 ospf neighbor [VRF_INSTANCE]
```

**Parameters**

- **VRF_INSTANCE** Values include:
  - `<no parameter>` Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

**Example**

- This command displays the switch’s neighbors.

```
switch> show ipv6 ospf neighbor
Routing Process "ospf 9":
Neighbor 10.37.0.37 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface et12
  DR is 10.37.0.37 BDR is 10.37.0.23
  Options is 0
  Dead timer is due in 37 seconds
Neighbor 10.37.0.22 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface vlan3911
  DR is 10.37.0.22 BDR is 10.37.0.23
  Options is 0
  Dead timer is due in 31 seconds
Neighbor 10.37.0.11 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface vlan3923
  DR is 10.37.0.22 BDR is 10.37.0.46
  Options is 0
  Dead timer is due in 31 seconds
Neighbor 10.37.0.22 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface vlan3902
  DR is 10.37.0.22 BDR is 10.37.0.22
  Options is 0
  Dead timer is due in 31 seconds
Neighbor 10.37.0.11 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface vlan3902
  DR is 10.37.0.11 BDR is 10.37.0.22
  Options is 0
  Dead timer is due in 33 seconds
Neighbor 10.37.0.22 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface vlan3902
  DR is 10.37.0.22 BDR is 10.37.0.22
  Options is 0
  Dead timer is due in 33 seconds
Neighbor 10.37.0.22 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface vlan3908
  DR is 10.37.0.22 BDR is 10.37.0.21
  Options is 0
  Dead timer is due in 39 seconds
Neighbor 10.37.0.22 VRF default priority is 1, state is Full
  In area 0.0.0.0 interface vlan3992
  DR is 10.37.0.22 BDR is 10.37.0.23
  Options is 0
  Dead timer is due in 39 seconds
switch>
```
**show ipv6 ospf neighbor state**

The `show ipv6 ospf neighbor state` command displays the state information on OSPF neighbors on a per-interface basis.

**Command Mode**

`EXEC`

**Command Syntax**

```
show ipv6 ospf neighbor state [STATE_NAME] [VRF_INSTANCE]
```

**Parameters**

- **STATE_NAME** Values include:
  - 2-ways
  - attempt
  - down
  - exch-start
  - exchange
  - full
  - restart
  - init
  - loading

- **VRF_INSTANCE** Values include:
  - `<no parameter>` Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

**Examples**

- This command displays OSPF information for neighboring devices that are adjacent.

  ```
  switch>show ipv6 ospf neighbor state full
  Routing Process "ospf 3":
  switch>
  ```
show ipv6 ospf neighbor summary

The `show ipv6 ospf neighbor summary` command displays a single line of state information for each OSPFv3 neighbor.

**Command Mode**

EXEC

**Command Syntax**

```
show ipv6 ospf neighbor summary [VRF_INSTANCE]
```

**Parameters**

- **VRF_INSTANCE** Values include:
  - `<no parameter>` Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

**Examples**

- This command shows the summary information for the OSPFv3 neighbors.

```
switch>show ipv6 ospf neighbor summary
Routing Process "ospf 1":
  3 neighbors are in state Down
  3 neighbors are in state Full
  5 neighbors are in state Init
  0 neighbors are in state Loading
  0 neighbors are in state Attempt
  3 neighbors are in state Restarting
  0 neighbors are in state Exchange
  3 neighbors are in state 2 Ways
  0 neighbors are in state Exch Start
switch>
```
show ipv6 ospf spf-log

The `show ipv6 ospf spf-log` command displays when and how long the switch took to run a full SPF calculation for OSPFv3.

Command Mode
EXEC

Command Syntax
```
show ipv6 ospf [PROCESS_ID] spf-log [VRF_INSTANCE]
```

Parameters
- **PROCESS_ID** OSPFv3 process ID. Values include:
  - `<no parameter>` Displays information for all process IDs.
  - `<1 to 65535>` Displays information for the specified process ID.
- **VRF_INSTANCE** Values include:
  - `<no parameter>` Displays information for all VRFs.
  - `vrf vrf_name` Displays information for the specified VRF.

Examples
- This command displays the SPF information for OSPFv3 in all VRFs.

```
switch>show ipv6 ospf spf-log
OSPF3 Process 172.26.0.22, VRF default
TIME EVENT REASON
04:54:52.070 SPF ran for 0.70 ms
04:54:52.070 Scheduled after 0 ms Router LSA generation
04:54:39.151 SPF ran for 0.71 ms
04:54:39.151 Scheduled after 0 ms Router LSA generation
04:54:12.071 SPF ran for 0.56 ms
04:54:12.070 Scheduled after 0 ms Router LSA generation
04:54:04.153 SPF ran for 0.29 ms
04:53:59.153 Scheduled after 4999 ms Router LSA generation
04:53:59.153 SPF ran for 0.25 ms
04:53:59.151 Scheduled after 0 ms Router LSA generation
04:53:33.081 SPF ran for 0.3 ms
04:53:33.081 Scheduled after 0 ms ECMP max nexthop cfg change
switch>
```
show ospfv3

The `show ospfv3` command displays the OSPFv3 configuration of OSPFv3 address family and routing process.

**Command Mode**

EXEC

**Command Syntax**

```
show ospfv3 [access-list | border-routers | database | interface | ipv4 | ipv6 | lsa-log | neighbor | request-list | retransmission-list | spf-log | vrf]
```

**Parameters**

- `<no parameters>` displays the complete configuration of OSPFv3 address family and routing process.
- `access-list` displays the information of configured OSPFv3 access-list. Options include:
  - `<no parameters>` displays the information of all configured OSPFv3 access lists.
  - `WORD` displays the information of the specified access list.
  - `summary` displays the summary of all configured access lists.
- `border-routers` displays the information of configured OSPFv3 border and boundary routers. Options include:
  - `<no parameters>` displays the information of all configured OSPFv3 borders and boundary routers.
  - `vrf` displays the OSPFv3 borders and boundary routers information of the specified Virtual Routing and Forwarding (VRF).
- `database` displays the summary of database. Options include:
  - `<no parameters>` displays the complete summary of database.
  - `ipv4` displays the database information of link state ID.
  - `adv-router` displays the database information of advertising router link states.
  - `area` displays the database information filtered by area scope LSAs.
  - `as` displays the database information filtered by AS scope LSAs.
  - `database-summary` displays the count of LSAs in OSPFv3 database.
  - `detail` displays the detailed information of LSA.
  - `link` displays the database information filtered by link scoped LSAs.
  - `self-originate` displays the database information of self-originated link states.
  - `vrf` displays the VRF information in OSPFv3 database.
- `interface` displays the information of OSPFv3 interfaces. Options include:
  - `<no parameters>` displays the information of all OSPFv3 interfaces.
  - `Ethernet eth_num` displays the information of the specified Ethernet interface. The value ranges from 1 to 24.
  - `Loopback lb_num` displays the information of the specified loop back interface. The value ranges from 0 to 1000.
  - `Port-Channel pc_num` displays the interface or sub-interface information of the specified port channel. The interface and sub-interface values of port channel ranges from `<1-1000>` and `<1-2000>-<1-4094>` respectively.
- **Tunnel** `t_num` displays the information of the specified tunnel. The value ranges from 0 to 255.
- **Vlan** `vlan_num` displays the information of the specified VLAN interface. The value ranges from 1 to 4094.
- **vrf** `vrf_name` displays the information of the specified VRF.
- **ipv4** displays the IPv4 address family information.
- **ipv6** displays the IPv6 address family information.
- **lsa-log** displays the log entries of OSPFv3 LSA updates.
- **neighbor** displays the list of OSPFv3 neighbors.
- **request-list** displays the list of all OSPFv3 LSAs requested by a router.
- **retransmission-list** displays the list of all OSPFv3 LSAs waiting to be re-sent.
- **spf-log** displays the start-time, duration of completion, and reason of delay to calculate the OSPFv3 Sender Policy Framework (SPF).
- **vrf** `vrf_name` displays the information of specified VRF.

**Examples**

This command displays the complete configuration of OSPFv3 address family and routing process.

```
switch#show ospfv3
OSPFV3 address-family ipv6
Routing Process "ospfv3" with ID 13.13.13.13 and Instance 0 VRF default
  FIPS mode disabled
  It is not an autonomous system boundary router and is not an area border router
  Minimum LSA arrival interval 1000 msecs
  Initial LSA throttle delay 1000 msecs
  Minimum hold time for LSA throttle 5000 msecs
  Maximum wait time for LSA throttle 5000 msecs
  Interface flood pacing timer 50 msecs
  It has 0 fully adjacent neighbors
  Number of areas in this router is 1. 1 normal, 0 stub, 0 nssa
  Number of LSAs 1
  Initial SPF schedule delay 0 msecs
  Minimum hold time between two consecutive SPFs 5000 msecs
  Current hold time between two consecutive SPFs 5000 msecs
  Maximum wait time between two consecutive SPFs 5000 msecs
  SPF algorithm last executed 3d23h ago
  No scheduled SPF
  Adjacency exchange-start threshold is 20
  Maximum number of next-hops supported in ECMP is 32
  Number of backbone neighbors is 0
  Graceful-restart is not configured
  Graceful-restart-helper mode is enabled
  Area 0.0.0.0
    Number of interface in this area is 0
    It is a normal area
    SPF algorithm executed 2 times
```
• This command displays the count of LSAs in OSPFv3 database.

```
switch#show ospfv3 database database-summary
OSPFv3 address-family ipv4
Routing Process "ospfv3" Instance 64 VRF default

<table>
<thead>
<tr>
<th>LSA Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router</td>
<td>1</td>
</tr>
<tr>
<td>Network</td>
<td>0</td>
</tr>
<tr>
<td>Inter Area Prefix</td>
<td>0</td>
</tr>
<tr>
<td>Inter Area Router</td>
<td>0</td>
</tr>
<tr>
<td>Summary Asex</td>
<td>0</td>
</tr>
<tr>
<td>Nssa</td>
<td>0</td>
</tr>
<tr>
<td>Link</td>
<td>0</td>
</tr>
<tr>
<td>Intra Area Prefix</td>
<td>0</td>
</tr>
<tr>
<td>Grace</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
</tr>
</tbody>
</table>

OSPFv3 address-family ipv6
Routing Process "ospfv3" Instance 0 VRF default

<table>
<thead>
<tr>
<th>LSA Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router</td>
<td>0</td>
</tr>
<tr>
<td>Network</td>
<td>0</td>
</tr>
<tr>
<td>Inter Area Prefix</td>
<td>0</td>
</tr>
<tr>
<td>Inter Area Router</td>
<td>0</td>
</tr>
<tr>
<td>Summary Asex</td>
<td>0</td>
</tr>
<tr>
<td>Nssa</td>
<td>0</td>
</tr>
<tr>
<td>Link</td>
<td>0</td>
</tr>
<tr>
<td>Intra Area Prefix</td>
<td>0</td>
</tr>
<tr>
<td>Grace</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
</tr>
</tbody>
</table>
```

ro301.02:05:02(config-router-ospfv3-af)#

• This command displays the start-time, duration of completion, and reason of delay to calculate the OSPFv3 SPF.

```
switch#show ospfv3 spf-log
OSPFv3 address-family ipv4
Routing Process "ospfv3" with ID 11.1.11.1 and Instance 64, VRF default

<table>
<thead>
<tr>
<th>TIME</th>
<th>EVENT</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>02:00:13.495</td>
<td>SPF ran for 0.064 ms</td>
<td></td>
</tr>
<tr>
<td>02:00:13.335</td>
<td>Scheduled after 0.000 ms Router LSA generation</td>
<td></td>
</tr>
<tr>
<td>01:59:55.499</td>
<td>SPF ran for 0.061 ms</td>
<td></td>
</tr>
<tr>
<td>01:59:54.604</td>
<td>Scheduled after 0.000 ms ECMP max nexthop cfg change</td>
<td></td>
</tr>
</tbody>
</table>

OSPFv3 address-family ipv6
Routing Process "ospfv3" with ID 11.1.11.1 and Instance 0, VRF default

<table>
<thead>
<tr>
<th>TIME</th>
<th>EVENT</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>02:00:13.495</td>
<td>SPF ran for 0.064 ms</td>
<td></td>
</tr>
<tr>
<td>02:00:13.335</td>
<td>Scheduled after 0.000 ms OSPF3 re-initialisation</td>
<td></td>
</tr>
<tr>
<td>01:59:55.499</td>
<td>SPF ran for 0.089 ms</td>
<td></td>
</tr>
<tr>
<td>01:59:54.603</td>
<td>Scheduled after 0.000 ms ECMP max nexthop cfg change</td>
<td></td>
</tr>
</tbody>
</table>

ro301.02:04:06(config-router-ospfv3-af)#
```
shutdown (OSPFv3)

The `shutdown` command disables OSPFv3 on the switch. OSPFv3 is disabled by default on individual interfaces and enabled through `ipv6 ospf area` commands. The `no shutdown` and `default shutdown` commands enable the OSPFv3 instance by removing the `shutdown` statement from the OSPFv3 block in `running-config`.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
shutdown
no shutdown
default shutdown
```

**Example**

- This command disables OSPFv3 activity on the switch.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#shutdown
switch(config-router-ospf3)#show active
ipv6 router ospf 9
    shutdown
switch(config-router-ospf3)#
```
timers

The **timers** command configures the minimum interval between the transmission of consecutive LS update packets in a network.

The **no timers** and **default timers** commands set the configured timer value to its default.

**Command Mode**

Router-OSPFv3 Configuration

**Command Syntax**

```
timers {lsa | out-delay | pacing | throttle}
default timers {lsa | out-delay | pacing | throttle}
no timers {lsa | out-delay | pacing | throttle}
```

**Parameters**

- **lsa** configures threshold for the retransmission of LSA. Option includes:
  - **arrival** configures the OSPF LSA arrival timer.
- **out-delay** configures the delay to flood router LSA in milliseconds. Option includes:
  - **out-delay_time** minimum interval in milliseconds between accepting the same LSAs. The value ranges from 0 to 65000 milliseconds. The default value is zero.
- **pacing** configures the OSPF packet pacing. Option includes:
  - **flood** configures the OSPF flood pacing.
- **throttle** configures ospf throttle timers. Options include:
  - **lsa** configures threshold for the retransmission of LSA.
  - **spf** configures the time between SPF calculations.
Examples

- This command configures OSPFv3 flood pacing timer to 50 ms in the global OSPFv3 instance.

```
switch(config)#ipv6 router ospf 9
switch(config-router-ospf3)#timers pacing flood 50
switch(config-router-ospf3)#show ospfv3
Routing Process "ospfv3 9" with ID 13.13.13.13 and Instance 0 VRF default
  FIPS mode disabled
  It is not an autonomous system boundary router and is not an area border router
  Minimum LSA arrival interval 1000 msecs
  Initial LSA throttle delay 1000 msecs
  Minimum hold time for LSA throttle 5000 msecs
  Maximum wait time for LSA throttle 5000 msecs
  Interface flood pacing timer 50 msecs
  It has 0 fully adjacent neighbors
  Number of areas in this router is 1. 1 normal, 0 stub, 0 nssa
  Number of LSAs 1
  Initial SPF schedule delay 0 msecs
  Minimum hold time between two consecutive SPF s 5000 msecs
  Current hold time between two consecutive SPF s 5000 msecs
  Maximum wait time between two consecutive SPF s 5000 msecs
  SPF algorithm last executed 21d19h ago
  No scheduled SPF
  Adjacency exchange-start threshold is 20
  Maximum number of next-hops supported in ECMP is 32
  Number of backbone neighbors is 0
  Graceful-restart is not configured
  Graceful-restart-helper mode is enabled
  Area 0.0.0.0
    Number of interface in this area is 0
    It is a normal area
    SPF algorithm executed 2 times
  <--------OUTPUT OMITTED FROM EXAMPLE-------->
```
• This command configures the OSPFv3 flood pacing timer to 50 ms in IPv4 address family.

```bash
switch(config)#router ospfv3
switch(config-router-ospfv3)#address-family ipv4
switch(config-router-ospfv3-af)#timers pacing flood 50
switch(config-router-ospfv3-af)#show ospfv3
OSPFv3 address-family ipv4
Routing Process "ospfv3" with ID 11.1.11.1 and Instance 64 VRF default
FIPS mode disabled
It is not an autonomous system boundary router and is not an area border router
Minimum LSA arrival interval 1000 msecs
Initial LSA throttle delay 1000 msecs
Minimum hold time for LSA throttle 5000 msecs
Maximum wait time for LSA throttle 5000 msecs
Interface flood pacing timer 50 msecs
It has 0 fully adjacent neighbors
Number of areas in this router is 1. 1 normal, 0 stub, 0 nssa
Number of LSAs 1
Initial SPF schedule delay 0 msecs
Minimum hold time between two consecutive SPFs 5000 msecs
Current hold time between two consecutive SPFs 5000 msecs
Maximum wait time between two consecutive SPFs 5000 msecs
SPF algorithm last executed 00:10:38 ago
No scheduled SPF
Adjacency exchange-start threshold is 20
Maximum number of next-hops supported in ECMP is 32
Number of backbone neighbors is 0
Graceful-restart is not configured
Graceful-restart-helper mode is enabled
Area 0.0.0.0
  Number of interface in this area is 0
  It is a normal area
  SPF algorithm executed 2 times
<--------OUTPUT OMITTED FROM EXAMPLE-------->
```
**timers lsa rx min interval (OSPFv3)**

The *timers lsa rx min interval* command sets the minimum interval for accepting identical link-state advertisements (LSAs) from OSPFv3 neighbors.

The *no timers lsa rx min interval* and *default timers lsa rx min interval* commands restore the minimum interval to the default value of one second by removing the *timers lsa rx min interval* command from *running-config*.

**Command Mode**
- Router-OSPFv3 Configuration
- Router-OSPFv3 Address-Family IPv4/IPv6 Configuration

**Command Syntax**

```
timers lsa rx min interval lsa_time
no timers lsa rx min interval
default timers lsa rx min interval
```

**Parameters**
- *lsa_time*  minimum time (in milliseconds) after which the switch accepts an identical LSA from OSPFv3 neighbors. Value ranges from 0 to 600000 (ms). Default value is 1000 milliseconds (1 second).

**Example**

This command sets the minimum LSA arrival interval to ten milliseconds.

```
switch(config)#router ospfv3
switch(config-router-ospfv3)#timers lsa rx min interval 10
switch(config-router-ospfv3)#
```
timers lsa tx delay initial (OSPFv3)

The `timers lsa tx delay initial` command sets the rate-limiting values for OSPFv3 Link-State Advertisement (LSA) generation.

The `no timers lsa tx delay initial` and `default timers lsa tx delay initial` commands restore the default LSA rate-limiting values by removing the `timers lsa tx delay initial` command from `running-config`.

**Command Mode**
- Router-OSPFv3 Configuration
- Router-OSPFv3 Address-Family IPv4/IPv6 Configuration

**Command Syntax**
```
timers lsa tx delay initial initial_delay min_hold max_wait
no timers lsa tx delay initial
default timers lsa tx delay initial
```

**Parameters**
- `initial_delay`  Initial delay in milliseconds to generate the first instance of LSAs. Value ranges from 0 to 600000 (ms). The default value is 1000 ms.
- `min_hold`  Minimum hold interval availed in milliseconds between the generation of same LSA. Value ranges from 1 to 600000 (ms). The default interval is 5000 ms.
- `max_wait`  Maximum hold interval availed in milliseconds between the generation of same LSA. Value ranges from 1 to 600000 (ms). The default interval is 5000 ms.

**Example**
These commands set the LSA transmission timers on the switch.
```
switch(config)#router ospfv3
switch(config-router-ospfv3)#
switch(config-router-ospfv3)#timers lsa tx delay initial 5 100 20000
switch(config-router-ospfv3)#
```
timers spf delay initial (OSPFv3)

The purpose of SPF throttling is to delay Shortest Path First (SPF) calculations when network topology is changing rapidly. The `timers spf delay initial` command controls the intervals of SPF calculations in a switch. The command sets three values:

- **Initial delay**: Initial wait by a switch to calculate SPF after a topology change in a network that has been stable throughout the hold interval. Because a topology change often requires several link state updates to be sent, the initial delay is configured to allow the network to settle before the switch calculates SPF. If an additional topology change occurs during the initial interval, the SPF calculation still takes place after the initial delay period has expired and no other change is made to the throttle timers.

- **Hold interval**: This is an additional wait timer that reduces the frequency of SPF calculations during periods of network instability. If a network change occurs during the hold period, an SPF calculation is scheduled to occur when the hold interval expires. Subsequent hold intervals are doubled if further topology changes occur during a hold interval until either the hold interval reaches its configured maximum or no topology change occurs during the interval. If the next topology change occurs after the hold interval expires, the hold interval is reset to its configured value and the SPF calculation is scheduled to take place after the initial delay.

- **Maximum interval**: The maximum wait time of a switch after a topology change before performing an SPF calculation.

The `no timers spf delay initial` and `default timers spf delay initial` commands restore the default OSPFv3 SPF calculation intervals by removing the `timers spf delay initial` command from `running-config`.

**Command Mode**

- Router-OSPFv3 Configuration
- Router-OSPFv3 Address-Family IPv4/IPv6 Configuration

**Command Syntax**

```
timers spf delay initial initial_delay hold_interval max_interval
no timers spf
default timers spf
```

**Parameters**

- **initial_delay**: Initial delay between a topology change and SPF calculation. Value ranges from 0 to 65535000 (ms). The default value is 0 ms.
- **hold_interval**: Additional wait time after SPF calculation to allow the network to settle. If a topology change occurs during the hold interval, another SPF calculation is scheduled to occur after the hold interval expires. The next hold interval is doubled if topology changes occur during the hold interval. If doubling exceeds the maximum value, the maximum value is used instead. Value ranges from 0 to 65535000 (ms). The default value is 5000 ms.
- **max_interval**: The maximum hold interval before a switch calculates SPF. Value ranges from 0 to 65535000 (ms). The default value is 5000 ms.

**Example**

These commands set the SPF timers on the switch.

```
switch(config)#router ospfv3
switch(config-router-ospfv3)#
switch(config-router-ospfv3)#timers spf delay initial 5 100 20000
switch(config-router-ospfv3)#
```