IPv6 Routing: OSPFv3

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Open Shortest Path First version 3 (OSPFv3) is an IPv4 and IPv6 link-state routing protocol that supports IPv6 and IPv4 unicast address families (AFs).

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Finding Feature Information

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

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

Prerequisites for IPv6 Routing: OSPFv3

- Complete the OSPFv3 network strategy and planning for your IPv6 network. For example, you must decide whether multiple areas are required.
- Enable IPv6 unicast routing.
- Enable IPv6 on the interface.

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Restrictions for IPv6 Routing: OSPFv3

When running a dual-stack IP network with OSPF version 2 for IPv4 and OSPFv3, be careful when changing the defaults for commands used to enable OSPFv3. Changing these defaults may affect your OSPFv3 network, possibly adversely.

Information About IPv6 Routing: OSPFv3

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How OSPFv3 Works

OSPFv3 is a routing protocol for IPv4 and IPv6. It is a link-state protocol, as opposed to a distance-vector protocol. Think of a link as being an interface on a networking device. A link-state protocol makes its routing decisions based on the states of the links that connect source and destination machines. The state of a link is a description of that interface and its relationship to its neighboring networking devices. The interface information includes the IPv6 prefix of the interface, the network mask, the type of network it is connected to, the devices connected to that network, and so on. This information is propagated in various type of link-state advertisements (LSAs).

A device's collection of LSA data is stored in a link-state database. The contents of the database, when subjected to the Dijkstra algorithm, result in the creation of the OSPF routing table. The difference between the database and the routing table is that the database contains a complete collection of raw data; the routing table contains a list of shortest paths to known destinations via specific device interface ports.

OSPFv3, which is described in RFC 5340, supports IPv6 and IPv4 unicast AFs.

Comparison of OSPFv3 and OSPF Version 2

Much of OSPF version 3 is the same as in OSPF version 2. OSPFv3, which is described in RFC 5340, expands on OSPF version 2 to provide support for IPv6 routing prefixes and the larger size of IPv6 addresses.

In OSPFv3, a routing process does not need to be explicitly created. Enabling OSPFv3 on an interface will cause a routing process, and its associated configuration, to be created.

In OSPFv3, each interface must be enabled using commands in interface configuration mode. This feature is different from OSPF version 2, in which interfaces are indirectly enabled using the device configuration mode.

When using a nonbroadcast multiaccess (NBMA) interface in OSPFv3, you must manually configure the device with the list of neighbors. Neighboring devices are identified by their device ID.

In IPv6, you can configure many address prefixes on an interface. In OSPFv3, all address prefixes on an interface are included by default. You cannot select some address prefixes to be imported into OSPFv3; either all address prefixes on an interface are imported, or no address prefixes on an interface are imported.

Unlike OSPF version 2, multiple instances of OSPFv3 can be run on a link.

OSPF automatically prefers a loopback interface over any other kind, and it chooses the highest IP address among all loopback interfaces. If no loopback interfaces are present, the highest IP address in the device is chosen. You cannot tell OSPF to use any particular interface.

LSA Types for OSPFv3

The following list describes LSA types, each of which has a different purpose:

- Router LSAs (Type 1)—Describes the link state and costs of a router's links to the area. These LSAs are flooded within an area only. The LSA indicates if the router is an Area Border Router (ABR) or Autonomous System Boundary Router (ASBR), and if it is one end of a virtual link. Type 1 LSAs are also used to advertise stub networks. In OSPFv3, these LSAs have no address information and are network-protocol-independent. In OSPFv3, router interface information may be spread across multiple router LSAs. Receivers must concatenate all router LSAs originated by a given router when running the SPF calculation.
- Network LSAs (Type 2)—Describes the link-state and cost information for all routers attached to the network. This LSA is an aggregation of all the link-state and cost information in the network. Only a designated router tracks this information and can generate a network LSA. In OSPFv3, network LSAs have no address information and are network-protocol-independent.
- Interarea-prefix LSAs for ABRs (Type 3)—Advertises internal networks to routers in other areas (interarea routes). Type 3 LSAs may represent a single network or a set of networks summarized into one advertisement. Only ABRs generate summary LSAs. In OSPFv3, addresses for these LSAs are expressed as *prefix, prefix length* instead of *address, mask*. The default route is expressed as a prefix with length 0.
- Interarea-router LSAs for ASBRs (Type 4)—Advertises the location of an ASBR. Routers that are trying to reach an external network use these advertisements to determine the best path to the next hop. Type 4 LSAs are generated by ABRs on behalf of ASBRs.
- Autonomous system external LSAs (Type 5)—Redistributes routes from another autonomous system, usually from a different routing protocol into OSPFv3. In OSPFv3, addresses for these LSAs are expressed as *prefix, prefix length* instead of *address, mask*. The default route is expressed as a prefix with length 0.
- Link LSAs (Type 8)—Have local-link flooding scope and are never flooded beyond the link with which they are associated. Link LSAs provide the link-local address of the router to all other routers attached to the link, inform other routers attached to the link of a list of prefixes to associate with the link, and allow the router to assert a collection of Options bits to associate with the network LSA that will be originated for the link.
- Intra-Area-Prefix LSAs (Type 9)—A router can originate multiple intra-area-prefix LSAs for each router or transit network, each with a unique link-state ID. The link-state ID for each intra-area-prefix LSA describes its association to either the router LSA or the network LSA and contains prefixes for stub and transit networks.

An address prefix occurs in almost all newly defined LSAs. The prefix is represented by three fields: PrefixLength, PrefixOptions, and Address Prefix. In OSPFv3, addresses for these LSAs are expressed as *prefix, prefix length* instead of *address, mask*. The default route is expressed as a prefix with length 0. Type 3 and Type 9 LSAs carry all prefix (subnet) information that, in OSPFv2, is included in router LSAs and network LSAs. The Options field in certain LSAs (router LSAs, network LSAs, interarea-router LSAs, and link LSAs) has been expanded to 24 bits to provide support for OSPFv3.

In OSPFv3, the sole function of the link-state ID in interarea-prefix LSAs, interarea-router LSAs, and autonomous-system external LSAs is to identify individual pieces of the link-state database. All addresses or router IDs that are expressed by the link-state ID in OSPF version 2 are carried in the body of the LSA in OSPFv3.

The link-state ID in network LSAs and link LSAs is always the interface ID of the originating router on the link being described. For this reason, network LSAs and link LSAs are now the only LSAs whose size cannot be limited. A network LSA must list all routers connected to the link, and a link LSA must list all of the address prefixes of a router on the link.

NBMA in OSPFv3

On NBMA networks, the designated router (DR) or backup DR (BDR) performs the LSA flooding. On point-to-point networks, flooding simply goes out an interface directly to a neighbor.

Devices that share a common segment (Layer 2 link between two interfaces) become neighbors on that segment. OSPFv3 uses the Hello protocol, periodically sending hello packets out each interface. Devices become neighbors when they see themselves listed in the neighbor's hello packet. After two devices become neighbors, they may proceed to exchange and synchronize their databases, which creates an adjacency. Not all neighboring devices have an adjacency.

On point-to-point and point-to-multipoint networks, the software floods routing updates to immediate neighbors. There is no DR or BDR; all routing information is flooded to each networking device.

On broadcast or NBMA segments only, OSPFv3 minimizes the amount of information being exchanged on a segment by choosing one router to be a DR and one router to be a BDR. Thus, the devices on the segment have a central point of contact for information exchange. Instead of each device exchanging routing updates with every other device on the segment, each device exchanges information with the DR and BDR. The DR and BDR relay the information to the other devices.

The software looks at the priority of the devices on the segment to determine which devices will be the DR and BDR. The router with the highest priority is elected the DR. If there is a tie, then the router with the higher router ID takes precedence. After the DR is elected, the BDR is elected the same way. A device with a router priority set to zero is ineligible to become the DR or BDR.

When using NBMA in OSPFv3, you cannot automatically detect neighbors. On an NBMA interface, you must configure your neighbors manually using interface configuration mode.

Load Balancing in OSPFv3

When a device learns multiple routes to a specific network via multiple routing processes (or routing protocols), it installs the route with the lowest administrative distance in the routing table. Sometimes the device must select a route from among many learned via the same routing process with the same administrative distance. In this case, the device chooses the path with the lowest cost (or metric) to the destination. Each routing process calculates its cost differently and the costs may need to be manipulated in order to achieve load balancing.

OSPFv3 performs load balancing automatically in the following way. If OSPFv3 finds that it can reach a destination through more than one interface and each path has the same cost, it installs each path in the routing table. The only restriction on the number of paths to the same destination is controlled by the **maximum-paths** command. The default maximum paths is 16, and the range is from 1 to 64.

Addresses Imported into OSPFv3

When importing the set of addresses specified on an interface on which OSPFv3 is running into OSPFv3, you cannot select specific addresses to be imported. Either all addresses are imported, or no addresses are imported.

OSPFv3 Customization

You can customize OSPFv3 for your network, but you likely will not need to do so. The defaults for OSPFv3 are set to meet the requirements of most customers and features. If you must change the defaults, refer to the IPv6 command reference to find the appropriate syntax.

Caution Be careful when changing the defaults. Changing defaults will affect your OSPFv3 network, possibly adversely.

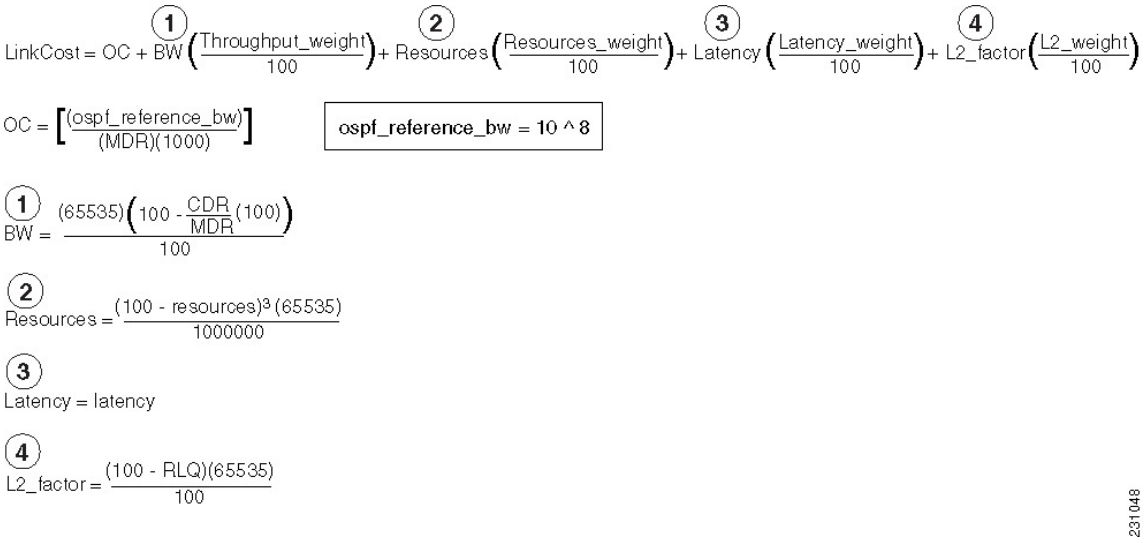
- OSPFv3 Cost Calculation, page 5

OSPFv3 Cost Calculation

Because cost components can change rapidly, it might be necessary to reduce the volume of changes to reduce network-wide churn. The recommended values for S2, S3, and S4 in the second table below are based on network simulations that may reduce the rate of network changes. The recommended value for S1 is 0 to eliminate this variable from the route cost calculation.

The overall link cost is computed using the formula shown in the figure below.

Figure 1 Overall Link Cost Formula



The table below defines the symbols used in the OSPFv3 cost calculation.

Table 1 OSPFv3 Cost Calculation Definitions

Cost Component	Component Definition
OC	The default OSPFv3 cost. Calculated from reference bandwidth using reference_bw / (MDR*1000), where reference_bw=10^8.
A through D	Various radio-specific data-based formulas that produce results in the 0 through 64,000 range.
A	CDR- and MDR-related formula: (2^16 * (100 – (CDR * 100 / MDR)))/100
B	Resources related formula: ((100 – RESOURCES)^3 * 2^16 / 10^6)
C	Latency as reported by the radio, already in the 0 through 64,000 range when reported (LATENCY).
D	RLF-related formula: ((100 – RLF) * 2^16)/100
S1 through S4	Scalar weighting factors input from the CLI. These scalars scale down the values as computed by A through D. The value of 0 disables and the value of 100 enables full 0 through 64,000 range for one component.

Because each network might have unique characteristics that require different settings to optimize actual network performance, these are recommended values intended as a starting point for optimizing an OSPFv3 network. The table below lists the recommended value settings for OSPFv3 cost metrics.

Table 2 Recommended Value Settings for OSPFv3 Cost Metrics

Setting	Metric Description	Default Value	Recommended Value
S1	ipv6 ospf dynamic weight throughout	100	0
S2	ipv6 ospf dynamic weight resources	100	29
S3	ipv6 ospf dynamic weight latency	100	29
S4	ipv6 ospf dynamic weight L2 factor	100	29

The default path costs were calculated using this formula, as noted in the following list. If these values do not suit your network, you can use your own method of calculating path costs.

- 56-kbps serial link—Default cost is 1785.
- 64-kbps serial link—Default cost is 1562.
- T1 (1.544-Mbps serial link)—Default cost is 64.
- E1 (2.048-Mbps serial link)—Default cost is 48.
- 4-Mbps Token Ring—Default cost is 25.
- Ethernet—Default cost is 10.
- 16-Mbps Token Ring—Default cost is 6.
- FDDI—Default cost is 1.
- X25—Default cost is 5208.
- Asynchronous—Default cost is 10,000.
- ATM—Default cost is 1.

To illustrate these settings, the following example shows how OSPFv3 cost metrics might be defined for a Virtual Multipoint Interface (VMI) interface:

```
interface vmi1
 ipv6 ospf cost dynamic weight throughput 0
 ipv6 ospf cost dynamic weight resources 29
 ipv6 ospf cost dynamic weight latency 29
 ipv6 ospf cost dynamic weight L2-factor 29
```

Force SPF in OSPFv3

When the **process** keyword is used with the **clear ipv6 ospf** command, the OSPFv3 database is cleared and repopulated, and then the SPF algorithm is performed. When the **force-spf** keyword is used with the **clear ipv6 ospf** command, the OSPFv3 database is not cleared before the SPF algorithm is performed.

How to Configure IPv6 Routing: OSPFv3

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Configuring the OSPFv3 Router Process

Once you have completed step 3 and entered OSPFv3 router configuration mode, you can perform any of the subsequent steps in this task as needed to configure OSPFv3 router configuration.

This task can be performed in Cisco IOS Release 15.1(3)S and 15.2(1)T and later releases.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospfv3** [*process-id*]
4. **area** *area-ID* [**default-cost** | **nssa** | **stub**]
5. **auto-cost reference-bandwidth** *Mbps*
6. **bfd all-interfaces**
7. **default** {**area** *area-ID* [**range** *ipv6-prefix* | **virtual-link** *router-id*]} [**default-information originate** [**always** | **metric** | **metric-type** | **route-map**] | **distance** | **distribute-list** *prefix-list prefix-list-name* {**in** | **out**} [*interface*] | **maximum-paths** *paths* | **redistribute** *protocol* | **summary-prefix** *ipv6-prefix*]
8. **ignore lsa mospf**
9. **interface-id snmp-if-index**
10. **log-adjacency-changes** [**detail**]
11. **passive-interface** [**default** | *interface-type interface-number*]
12. **queue-depth** {**hello** | **update**} {*queue-size* | **unlimited**}
13. **router-id** *router-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router ospfv3** [*process-id*] **Example:** `Device(config)# router ospfv3 1`	Enters router configuration mode for the IPv4 or IPv6 address family.
Step 4	**area** *area-ID* [**default-cost**	**nssa**	**stub**] **Example:** `Device(config-router)# area 1`	Configures the OSPFv3 area.

	Command or Action	Purpose
Step 5	**auto-cost reference-bandwidth** *Mbps* **Example:** `Device(config-router)# auto-cost reference-bandwidth 1000`	Controls the reference value OSPFv3 uses when calculating metrics for interfaces in an IPv4 OSPFv3 process.
Step 6	**bfd all-interfaces** **Example:** `Device(config-router)# bfd all-interfaces`	Enables BFD for an OSPFv3 routing process
Step 7	**default** {**area** *area-ID* [**range** *ipv6-prefix* | **virtual-link** *router-id*]} [**default-information originate** [**always** | **metric** | **metric-type** | **route-map**] | **distance** | **distribute-list** *prefix-list prefix-list-name* {**in** | **out**} [*interface*] | **maximum-paths** *paths* | **redistribute** *protocol* | **summary-prefix** *ipv6-prefix*] **Example:** `Device(config-router)# default area 1`	Returns an OSPFv3 parameter to its default value.
Step 8	**ignore lsa mospf** **Example:** `Device(config-router)# ignore lsa mospf`	Suppresses the sending of syslog messages when the device receives LSA Type 6 multicast OSPFv3 packets, which are unsupported.
Step 9	**interface-id snmp-if-index** **Example:** `Device(config-router)# interface-id snmp-if-index`	Configures OSPFv3 interfaces with Simple Network Management Protocol (SNMP) MIB-II interface Index (ifIndex) identification numbers in IPv4 and IPv6.
Step 10	**log-adjacency-changes** [**detail**] **Example:** `Device(config-router)# log-adjacency-changes`	Configures the device to send a syslog message when an OSPFv3 neighbor goes up or down.
Step 11	**passive-interface** [**default** | *interface-type interface-number*] **Example:** `Device(config-router)# passive-interface default`	Suppresses sending routing updates on an interface when an IPv4 OSPFv3 process is used.

	Command or Action	Purpose
Step 12	**queue-depth** {**hello** | **update**} {*queue-size* | **unlimited**} **Example:** `Device(config-router)# queue-depth update 1500`	Configures the number of incoming packets that the IPv4 OSPFv3 process can keep in its queue.
Step 13	**router-id** *router-id* **Example:** `Device(config-router)# router-id 10.1.1.1`	Enter this command to use a fixed router ID.

Configuring NBMA Interfaces in OSPFv3

You can customize OSPFv3 in your network to use NBMA interfaces. OSPFv3 cannot automatically detect neighbors over NBMA interfaces. On an NBMA interface, you must configure your neighbors manually using interface configuration mode.

Before you configure NBMA interfaces, you must perform the following tasks:

- Configure your network to be an NBMA network
- Identify each neighbor

Note

- You cannot automatically detect neighbors when using NBMA interfaces. You must manually configure your router to detect neighbors when using an NBMA interface.
- When the **ipv6 ospf neighbor** command is configured, the IPv6 address used must be the link-local address of the neighbor.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **frame-relay map ipv6** *ipv6-address dlci* [**broadcast**] [**cisco**] [**ietf**] [**payload-compression** {**packet-by-packet** | **frf9 stac** [*hardware-options*] | **data-stream stac** [*hardware-options*]}]
5. **ipv6 ospf neighbor** *ipv6-address* [**priority** *number*] [**poll-interval** *seconds*] [**cost** *number*] [**database-filter all out**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface serial 0`	Specifies an interface type and number, and places the device in interface configuration mode.
Step 4	**frame-relay map ipv6** *ipv6-address dlci* [**broadcast**] [**cisco**] [**ietf**] [**payload-compression** {**packet-by-packet** | **frf9 stac** [*hardware-options*] | **data-stream stac** [*hardware-options*]}] **Example:** `Device(config-if)#  frame-relay map ipv6 FE80::A8BB:CCFF:FE00:C01 120`	Defines the mapping between a destination IPv6 address and the data-link connection identifier (DLCI) used to connect to the destination address. • In this example, the NBMA link is Frame Relay. For other kinds of NBMA links, different mapping commands are used.
Step 5	**ipv6 ospf neighbor** *ipv6-address* [**priority** *number*] [**poll-interval** *seconds*] [**cost** *number*] [**database-filter all out**] **Example:** `Device(config-if) ipv6 ospf neighbor FE80::A8BB:CCFF:FE00:C01`	Configures an OSPFv3 neighboring device.

Forcing an SPF Calculation

SUMMARY STEPS

1. **enable**
2. **clear ospfv3** [*process-id*] **force-spf**
3. **clear ospfv3** [*process-id*] **process**
4. **clear ospfv3** [*process-id*] **redistribution**
5. **clear ipv6 ospf** [*process-id*] {**process** | **force-spf** | **redistribution**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**clear ospfv3** [*process-id*] **force-spf** **Example:** `Device# clear ospfv3 1 force-spf`	Runs SPF calculations for an OSPFv3 process. • If the **clear ospfv3 force-spf** command is configured, it overwrites the **clear ipv6 ospf** configuration. • Once the **clear ospfv3 force-spf** command has been used, the **clear ipv6 ospf** command cannot be used.
Step 3	**clear ospfv3** [*process-id*] **process** **Example:** `Device# clear ospfv3 2 process`	Resets an OSPFv3 process. • If the **clear ospfv3 force-spf** command is configured, it overwrites the **clear ipv6 ospf** configuration. • Once the **clear ospfv3 force-spf** command has been used, the **clear ipv6 ospf** command cannot be used.
Step 4	**clear ospfv3** [*process-id*] **redistribution** **Example:** `Device# clear ospfv3 redistribution`	Clears OSPFv3 route redistribution. • If the **clear ospfv3 force-spf** command is configured, it overwrites the **clear ipv6 ospf** configuration. • Once the **clear ospfv3 force-spf** command has been used, the **clear ipv6 ospf** command cannot be used.
Step 5	**clear ipv6 ospf** [*process-id*] {**process** | **force-spf** | **redistribution**} **Example:** `Device# clear ipv6 ospf force-spf`	Clears the OSPFv3 state based on the OSPFv3 routing process ID, and forces the start of the SPF algorithm. • If the **clear ospfv3 force-spf** command is configured, it overwrites the **clear ipv6 ospf** configuration. • Once the **clear ospfv3 force-spf** command has been used, the **clear ipv6 ospf** command cannot be used.

Verifying OSPFv3 Configuration and Operation

This task is optional. The commands in this task are available in Cisco IOS Release 15.1(3)S and 15.2(1)T and later releases.

SUMMARY STEPS

1. **enable**
2. **show ospfv3** [*process-id*] [*address-family*] **border-routers**
3. **show ospfv3** [*process-id* [*area-id*]] [*address-family*] **database** [**database-summary** | **internal** | **external** [*ipv6-prefix*] [*link-state-id*] | **grace** | **inter-area prefix** [*ipv6-prefix* | *link-state-id*] | **inter-area router** [*destination-router-id* | *link-state-id*] | **link** [**interface** *interface-name* | *link-state-id*] | **network** [*link-state-id*] | **nssa-external** [*ipv6-prefix*] [*link-state-id*] | **prefix** [**ref-lsa** {**router** | **network**} | *link-state-id*] | **promiscuous** | **router** [*link-state-id*] | **unknown** [{**area** | **as** | **link**} [*link-state-id*]] [**adv-router** *router-id*] [**self-originate**]
4. **show ospfv3** [*process-id*] [*address-family*] **events** [**generic** | **interface** | **lsa** | **neighbor** | **reverse** | **rib** | **spf**]
5. **show ospfv3** [*process-id*] [*area-id*] [*address-family*] **flood-list** *interface-type interface-number*
6. **show ospfv3** [*process-id*] [*address-family*] **graceful-restart**
7. **show ospfv3** [*process-id*] [*area-id*] [*address-family*] **interface** [*type number*] [**brief**]
8. **show ospfv3** [*process-id*] [*area-id*] [*address-family*] **neighbor** [*interface-type interface-number*] [*neighbor-id*] [**detail**]
9. **show ospfv3** [*process-id*] [*area-id*] [*address-family*] **request-list**[*neighbor*] [*interface*] [*interface-neighbor*]
10. **show ospfv3** [*process-id*] [*area-id*] [*address-family*] **retransmission-list** [*neighbor*] [*interface*] [*interface-neighbor*]
11. **show ospfv3** [*process-id*] [*address-family*] **statistic** [**detail**]
12. **show ospfv3** [*process-id*] [*address-family*] **summary-prefix**
13. **show ospfv3** [*process-id*] [*address-family*] **timers rate-limit**
14. **show ospfv3** [*process-id*] [*address-family*] **traffic**[*interface-type interface-number*]
15. **show ospfv3** [*process-id*] [*address-family*] **virtual-links**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ospfv3** [*process-id*] [*address-family*] **border-routers** **Example:** `Device# show ospfv3 border-routers`	Displays the internal OSPFv3 routing table entries to an ABR and ASBR.

	Command or Action	Purpose
Step 3	**show ospfv3** [*process-id* [*area-id*]] [*address-family*] **database** [**database-summary** | **internal** | **external** [*ipv6-prefix*] [*link-state-id*] | **grace** | **inter-area prefix** [*ipv6-prefix* | *link-state-id*] | **inter-area router** [*destination-router-id* | *link-state-id*] | **link** [**interface** *interface-name* | *link-state-id*] | **network** [*link-state-id*] | **nssa-external** [*ipv6-prefix*] [*link-state-id*] | **prefix** [**ref-lsa** {**router** | **network**} | *link-state-id*] | **promiscuous** | **router** [*link-state-id*] | **unknown** [{**area** | **as** | **link**} [*link-state-id*]] [**adv-router** *router-id*] [**self-originate**] **Example:** `Device# show ospfv3 database`	Displays lists of information related to the OSPFv3 database for a specific device.
Step 4	**show ospfv3** [*process-id*] [*address-family*] **events** [**generic** | **interface** | **lsa** | **neighbor** | **reverse** | **rib** | **spf**] **Example:** `Device# show ospfv3 events`	Displays detailed information about OSPFv3 events.
Step 5	**show ospfv3** [*process-id*] [*area-id*] [*address-family*] **flood-list** *interface-type interface-number* **Example:** `Device# show ospfv3 flood-list`	Displays a list of OSPFv3 LSAs waiting to be flooded over an interface.
Step 6	**show ospfv3** [*process-id*] [*address-family*] **graceful-restart** **Example:** `Device# show ospfv3 graceful-restart`	Displays OSPFv3 graceful restart information.
Step 7	**show ospfv3** [*process-id*] [*area-id*] [*address-family*] **interface** [*type number*] [**brief**] **Example:** `Device# show ospfv3 interface`	Displays OSPFv3-related interface information.
Step 8	**show ospfv3** [*process-id*] [*area-id*] [*address-family*] **neighbor** [*interface-type interface-number*] [*neighbor-id*] [**detail**] **Example:** `Device# show ospfv3 neighbor`	Displays OSPFv3 neighbor information on a per-interface basis.

	Command or Action	Purpose
Step 9	**show ospfv3** [*process-id*] [*area-id*] [*address-family*] **request-list**[*neighbor*] [*interface*] [*interface-neighbor*] **Example:** `Device# show ospfv3 request-list`	Displays a list of all LSAs requested by a device.
Step 10	**show ospfv3** [*process-id*] [*area-id*] [*address-family*] **retransmission-list** [*neighbor*] [*interface*] [*interface-neighbor*] **Example:** `Device# show ospfv3 retransmission-list`	Displays a list of all LSAs waiting to be re-sent.
Step 11	**show ospfv3** [*process-id*] [*address-family*] **statistic** [**detail**] **Example:** `Device# show ospfv3 statistics`	Displays OSPFv3 SPF calculation statistics.
Step 12	**show ospfv3** [*process-id*] [*address-family*] **summary-prefix** **Example:** `Device# show ospfv3 summary-prefix`	Displays a list of all summary address redistribution information configured under an OSPFv3 process.
Step 13	**show ospfv3** [*process-id*] [*address-family*] **timers rate-limit** **Example:** `Device# show ospfv3 timers rate-limit`	Displays all of the LSAs in the rate limit queue.
Step 14	**show ospfv3** [*process-id*] [*address-family*] **traffic**[*interface-type interface-number*] **Example:** `Device# show ospfv3 traffic`	Displays OSPFv3 traffic statistics.
Step 15	**show ospfv3** [*process-id*] [*address-family*] **virtual-links** **Example:** `Device# show ospfv3 virtual-links`	Displays parameters and the current state of OSPFv3 virtual links.

Configuration Examples for IPv6 Routing: OSPFv3

- Example: Configuring the OSPFv3 Router Process, page 16
- Example: Configuring NBMA Interfaces, page 16
- Example: Forcing SPF Configuration, page 17

Example: Configuring the OSPFv3 Router Process

```
Router# show ospfv3 database
            OSPFv3 Router with ID (172.16.4.4) (Process ID 1)
                Router Link States (Area 0)
ADV Router         Age         Seq#        Fragment ID   Link count  Bits
172.16.4.4         239         0x80000003  0             1           B
172.16.6.6         239         0x80000003  0             1           B
            Inter Area Prefix Link States (Area 0)
ADV Router         Age         Seq#        Prefix
172.16.4.4         249         0x80000001  FEC0:3344::/32
172.16.4.4         219         0x80000001  FEC0:3366::/32
172.16.6.6         247         0x80000001  FEC0:3366::/32
172.16.6.6         193         0x80000001  FEC0:3344::/32
172.16.6.6         82          0x80000001  FEC0::/32
            Inter Area Router Link States (Area 0)
ADV Router         Age         Seq#        Link ID    Dest RtrID
172.16.4.4         219         0x80000001  50529027   172.16.3.3
172.16.6.6         193         0x80000001  50529027   172.16.3.3

            Link (Type-8) Link States (Area 0)
ADV Router         Age         Seq#        Link ID    Interface
172.16.4.4         242         0x80000002  14         PO4/0
172.16.6.6         252         0x80000002  14         PO4/0
            Intra Area Prefix Link States (Area 0)
ADV Router         Age         Seq#        Link ID    Ref-lstype  Ref-LSID
172.16.4.4         242         0x80000002  0          0x2001      0
172.16.6.6         252         0x80000002  0          0x2001      0



Router# show ospfv3 neighbor

OSPFv3 Router with ID (42.1.1.1) (Process ID 42)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
44.4.4.4        1    FULL/  -        00:00:39    12              vm1
OSPFv3 Router with ID (1.1.1.1) (Process ID 100)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
4.4.4.4          1    FULL/  -        00:00:35    12              vm1
```

Example: Configuring NBMA Interfaces

The following example shows how to configure an OSPFv3 neighboring router with the IPv6 address of FE80::A8BB:CCFF:FE00:C01.

```
interface serial 0
 ipv6 enable
 ipv6 ospf 1 area 0
 encapsulation frame-relay
 frame-relay map ipv6 FE80::A8BB:CCFF:FE00:C01 120
 ipv6 ospf neighbor FE80::A8BB:CCFF:FE00:C0
```

Example: Forcing SPF Configuration

The following example shows how to trigger SPF to redo the SPF and repopulate the routing tables:

```
clear ipv6 ospf force-spf
```

Additional References

Related Documents

Related Topic	Document Title
IPv6 addressing and connectivity	*IPv6 Configuration Guide*
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
IPv6 commands	Cisco IOS IPv6 Command Reference
Cisco IOS IPv6 features	Cisco IOS IPv6 Feature Mapping
IPv6 Routing: OSPFv3	"*Configuring OSPF*" module

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	IPv6 RFCs

MIBs

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

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for IPv6 Routing: OSPFv3

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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

Table 3 Feature Information for IPv6 Routing: OSPFv3

Feature Name	Releases	Feature Information
IPv6 Routing: OSPFv3	12.2(15)T 12.3 12.2(25)SEA 12.2(25)SG 3.2.0SG 15.0(2)SG 12.2(33)SRA 12.2(17a)SX1	OSPF version 3 for IPv6 expands on OSPF version 2 to provide support for IPv6 routing prefixes and the larger size of IPv6 addresses.
OSPFv3 Dynamic Interface Cost Support	12.4(15)T	OSPFv3 dynamic interface cost support provides enhancements to the OSPFv3 cost metric for supporting mobile ad hoc networking.

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