



Configuring OSPF

This chapter describes how to configure the ASA to route data, perform authentication, and redistribute routing information using the Open Shortest Path First (OSPF) routing protocol.

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Information About OSPF

OSPF is an interior gateway routing protocol that uses link states rather than distance vectors for path selection. OSPF propagates link-state advertisements rather than routing table updates. Because only LSAs are exchanged instead of the entire routing tables, OSPF networks converge more quickly than RIP networks.

OSPF uses a link-state algorithm to build and calculate the shortest path to all known destinations. Each router in an OSPF area contains an identical link-state database, which is a list of each of the router usable interfaces and reachable neighbors.

The advantages of OSPF over RIP include the following:

- OSPF link-state database updates are sent less frequently than RIP updates, and the link-state database is updated instantly, rather than gradually, as stale information is timed out.

- Routing decisions are based on cost, which is an indication of the overhead required to send packets across a certain interface. The ASA calculates the cost of an interface based on link bandwidth rather than the number of hops to the destination. The cost can be configured to specify preferred paths.

The disadvantage of shortest path first algorithms is that they require a lot of CPU cycles and memory.

The ASA can run two processes of OSPF protocol simultaneously on different sets of interfaces. You might want to run two processes if you have interfaces that use the same IP addresses (NAT allows these interfaces to coexist, but OSPF does not allow overlapping addresses). Or you might want to run one process on the inside and another on the outside, and redistribute a subset of routes between the two processes. Similarly, you might need to segregate private addresses from public addresses.

You can redistribute routes into an OSPF routing process from another OSPF routing process, a RIP routing process, or from static and connected routes configured on OSPF-enabled interfaces.

The ASA supports the following OSPF features:

- Intra-area, interarea, and external (Type I and Type II) routes.
- Virtual links.
- LSA flooding.
- Authentication to OSPF packets (both password and MD5 authentication).
- Configuring the ASA as a designated router or a designated backup router. The ASA also can be set up as an ABR.
- Stub areas and not-so-stubby areas.
- Area boundary router Type 3 LSA filtering.

OSPF supports MD5 and clear text neighbor authentication. Authentication should be used with all routing protocols when possible because route redistribution between OSPF and other protocols (such as RIP) can potentially be used by attackers to subvert routing information.

If NAT is used, if OSPF is operating on public and private areas, and if address filtering is required, then you need to run two OSPF processes—one process for the public areas and one for the private areas.

A router that has interfaces in multiple areas is called an Area Border Router (ABR). A router that acts as a gateway to redistribute traffic between routers using OSPF and routers using other routing protocols is called an Autonomous System Boundary Router (ASBR).

An ABR uses LSAs to send information about available routes to other OSPF routers. Using ABR Type 3 LSA filtering, you can have separate private and public areas with the ASA acting as an ABR. Type 3 LSAs (interarea routes) can be filtered from one area to other, which allows you to use NAT and OSPF together without advertising private networks.


Note

Only Type 3 LSAs can be filtered. If you configure the ASA as an ASBR in a private network, it will send Type 5 LSAs describing private networks, which will get flooded to the entire AS, including public areas.

If NAT is employed but OSPF is only running in public areas, then routes to public networks can be redistributed inside the private network, either as default or Type 5 AS external LSAs. However, you need to configure static routes for the private networks protected by the ASA. Also, you should not mix public and private networks on the same ASA interface.

You can have two OSPF routing processes, one RIP routing process, and one EIGRP routing process running on the ASA at the same time.

Implementation Differences Between OSPFv2 and OSPFv3

OSPFv3 is not backward compatible with OSPFv2. To use OSPF to route both IPv4 and IPv6 traffic, you must run both OSPFv2 and OSPFv3 at the same time. They coexist with each other, but do not interact with each other.

The additional features that OSPFv3 provides include the following:

- Protocol processing per link.
- Removal of addressing semantics.
- Addition of flooding scope.
- Support for multiple instances per link.
- Use of the IPv6 link-local address for neighbor discovery and other features.
- LSAs expressed as prefix and prefix length.
- Addition of two LSA types.
- Handling of unknown LSA types.
- Authentication support using the IPsec ESP standard for OSPFv3 routing protocol traffic, as specified by RFC-4552.

Using Clustering

For more information about dynamic routing and clustering, see the [“Dynamic Routing and Clustering” section on page 24-9](#).

For more information about using clustering, see [Chapter 8, “Configuring a Cluster of ASAs.”](#)

Licensing Requirements for OSPF

The following table shows the licensing requirements for this feature:

Model	License Requirement
All models	Base License.

Guidelines and Limitations

This section includes the guidelines and limitations for this feature.

Context Mode Guidelines

OSPFv2 supports single and multiple context mode.

OSPFv3 supports single mode only.

Firewall Mode Guidelines

OSPF supports routed firewall mode only. OSPF does not support transparent firewall mode.

Failover Guidelines

OSPFv2 and OSPFv3 support Stateful Failover.

IPv6 Guidelines

- OSPFv2 does not support IPv6.
- OSPFv3 supports IPv6.
- OSPFv3 uses IPv6 for authentication.
- The ASA installs OSPFv3 routes into the IPv6 RIB, provided it is the best route.
- OSPFv3 packets can be filtered out using IPv6 ACLs in the **capture** command.

Clustering Guidelines

- OSPFv2 and OSPFv3 support clustering.
- OSPFv3 encryption is not supported. An error message appears if you try to configure OSPFv3 encryption in a clustering environment.
- In the spanned interface mode, dynamic routing is not supported on management-only interfaces.
- In individual interface mode, make sure that you establish the master and slave units as either OSPFv2 or OSPFv3 neighbors.
- When you configure both OSPFv2 and EIGRP, you can use either spanned interface mode or individual interface mode; you cannot use the two modes at the same time.
- In individual interface mode, OSPFv2 adjacencies can only be established between two contexts on a shared interface on the master unit. Configuring static neighbors is supported only on point-to-point-links; therefore, only one neighbor statement is allowed on an interface.
- The router ID is optional in the OSPFv2, OSPFv3, and EIGRP router configuration mode. If you do not explicitly set a router ID, then a router ID is automatically generated and set to the highest IPv4 address on any data interface in each of the cluster units.
- If the cluster interface mode has not been configured, then only a single, dotted-decimal IPv4 address is allowed as the router ID, and the **cluster pool** option is disabled.
- If the cluster interface mode is set to a spanned configuration, then only a single, dotted-decimal IPv4 address is allowed as the router ID, and the **cluster pool** option is disabled.
- If the cluster interface mode is set to an individual configuration, then the **cluster pool** option is mandatory, and a single, dotted-decimal IPv4 address is not allowed as the router ID.
- When the cluster interface mode is changed from a spanned to an individual configuration and vice versa without specifying the **check-detail** or **nocheck** options, then the entire configuration including the router ID is removed.
- If any of the dynamic routing protocol router ID configurations are incompatible with the new interface mode, then an error message appears on the console and the interface mode CLI fails. The error message has one line per dynamic routing protocol (OSPFv2, OSPFv3, and EIGRP) and lists the names of each context in which the incompatible configuration occurs.
- If the **nocheck** option is specified for the **cluster interface mode** command, then the interface mode is allowed to change although all the router ID configurations may not be compatible with the new mode.
- When the cluster is enabled, the router ID compatibility checks are repeated. If any incompatibility is detected, then the **cluster enable** command fails. The administrator needs to correct the incompatible router ID configuration before the cluster can be enabled.

- When a unit enters a cluster as a slave, then we recommend that you specify the **nocheck** option for the **cluster interface mode** command to avoid any router ID compatibility check failures. The slave unit still inherits the router configuration from the master unit.
- When a mastership role change occurs in the cluster, the following behavior occurs:
 - In spanned interface mode, the router process is active only on the master unit and is in a suspended state on the slave units. Each cluster unit has the same router ID because the configuration has been synchronized from the master unit. As a result, a neighboring router does not notice any change in the router ID of the cluster during a role change.
 - In individual interface mode, the router process is active on all the individual cluster units. Each cluster unit chooses its own distinct router ID from the configured cluster pool. A mastership role change in the cluster does not change the routing topology in any way.

Additional Guidelines

- OSPFv2 and OSPFv3 support multiple instances on an interface.
- OSPFv3 supports encryption through ESP headers in a non-clustered environment.
- OSPFv3 supports Non-Payload Encryption.

Configuring OSPFv2

This section describes how to enable an OSPFv2 process on the ASA.

After you enable OSPFv2, you need to define a route map. For more information, see the [“Defining a Route Map” section on page 26-4](#). Then you generate a default route. For more information, see the [“Configuring Static and Default Routes” section on page 25-2](#).

After you have defined a route map for the OSPFv2 process, you can customize it for your particular needs. To learn how to customize the OSPFv2 process on the ASA, see the [“Customizing OSPFv2” section on page 27-7](#).

To enable OSPFv2, you need to create an OSPFv2 routing process, specify the range of IP addresses associated with the routing process, then assign area IDs associated with that range of IP addresses.

You can enable up to two OSPFv2 process instances. Each OSPFv2 process has its own associated areas and networks.

To enable OSPFv2, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<p>router <i>ospf process_id</i></p> <p>Example: ciscoasa(config)# router ospf 2</p>	<p>Creates an OSPF routing process and enters router configuration mode for this OSPF process.</p> <p>The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.</p> <p>If there is only one OSPF process enabled on the ASA, then that process is selected by default. You cannot change the OSPF process ID when editing an existing area.</p>
Step 2	<p>network <i>ip_address mask area area_id</i></p> <p>Example: ciscoasa(config)# router ospf 2 ciscoasa(config-rtr)# network 10.0.0.0 255.0.0.0 area 0</p>	<p>Defines the IP addresses on which OSPF runs and the area ID for that interface.</p> <p>When adding a new area, enter the area ID. You can specify the area ID as either a decimal number or an IP address. Valid decimal values range from 0 to 4294967295. You cannot change the area ID when editing an existing area.</p>

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.

In the OSPF Setup pane, you can enable OSPF processes, configure OSPF areas and networks, and define OSPF route summarization.

Step 2 The three tabs in ASDM used to enable OSPF are as follows:

- The Process Instances tab allows you to enable up to two OSPF process instances for each context. Single context mode and multiple context mode are both supported. After you check the **Enable Each OSPF Process** check box, you can enter a unique identifier numeric identifier for that OSPF process. This process ID is used internally and does not need to match the OSPF process ID on any other OSPF devices; valid values range from 1 to 65535. Each OSPF process has its own associated areas and networks.

If you click **Advanced**, the Edit OSPF Process Advanced Properties dialog box appears. From here, you can configure the Router ID, cluster IP address pools in Layer 2 or Layer 3 clustering, Adjacency Changes, Administrative Route Distances, Timers, and Default Information Originate settings for each OSPF process.

- The Area/Networks tab allows you to display the areas and the networks that they include for each OSPF process on the ASA. From this tab you can display the area ID, the area type, and the type of authentication set for the area. To add or edit the OSPF area or network, see the [“Configuring OSPFv2 Area Parameters”](#) section on page 27-19 for more information.
- The Route Summarization tab allows you to configure an ABR. In OSPF, an ABR will advertise networks in one area into another area. If the network numbers in an area are assigned in a way so that they are contiguous, you can configure the ABR to advertise a summary route that includes all the individual networks within the area that fall into the specified range. See the [“Configuring Route Summarization Between OSPFv2 Areas”](#) section on page 27-13 for more information.

Customizing OSPFv2

This section explains how to customize the OSPFv2 processes and includes the following topics:

- [Redistributing Routes Into OSPFv2, page 27-7](#)
- [Configuring Route Summarization When Redistributing Routes Into OSPFv2, page 27-11](#)
- [Configuring Route Summarization Between OSPFv2 Areas, page 27-13](#)
- [Configuring OSPFv2 Interface Parameters, page 27-14](#)
- [Configuring OSPFv2 Area Parameters, page 27-19](#)
- [Configuring an OSPFv2 NSSA, page 27-20](#)
- [Configuring an IP Address Pool for Clustering \(OSPFv2 and OSPFv3\), page 27-22](#)
- [Defining Static OSPFv2 Neighbors, page 27-24](#)
- [Configuring Route Calculation Timers, page 27-25](#)
- [Logging Neighbors Going Up or Down, page 27-26](#)
- [Configuring Filtering in OSPF, page 27-27](#)
- [Configuring a Virtual Link in OSPF, page 27-28](#)

Redistributing Routes Into OSPFv2

The ASA can control the redistribution of routes between OSPFv2 routing processes.



Note

If you want to redistribute a route by defining which of the routes from the specified routing protocol are allowed to be redistributed into the target routing process, you must first generate a default route. See the “[Configuring Static and Default Routes](#)” section on page 25-2, and then define a route map according to the “[Defining a Route Map](#)” section on page 26-4.

To redistribute static, connected, RIP, or OSPFv2 routes into an OSPFv2 process, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>router ospf process_id</pre> <p>Example: ciscoasa(config)# router ospf 2</p>	<p>Creates an OSPF routing process and enters router configuration mode for the OSPF process that you want to redistribute.</p> <p>The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.</p>
Step 2	Do one of the following to redistribute the selected route type into the OSPF routing process:	

Command	Purpose
<pre> redistribute connected [[metric <i>metric-value</i>] [metric-type {type-1 type-2}] [tag <i>tag_value</i>] [subnets] [route-map <i>map_name</i>] </pre> <p>Example:</p> <pre> ciscoasa(config)# redistribute connected 5 type-1 route-map-practice </pre>	<p>Redistributes connected routes into the OSPF routing process.</p>
<pre> redistribute static [metric <i>metric-value</i>] [metric-type {type-1 type-2}] [tag <i>tag_value</i>] [subnets] [route-map <i>map_name</i>] </pre> <p>Example:</p> <pre> ciscoasa(config)# redistribute static 5 type-1 route-map-practice </pre>	<p>Redistributes static routes into the OSPF routing process.</p>
<pre> redistribute ospf pid [match {internal external [1 2] nssa-external [1 2]}] [metric <i>metric-value</i>] [metric-type {type-1 type-2}] [tag <i>tag_value</i>] [subnets] [route-map <i>map_name</i>] </pre> <p>Example:</p> <pre> ciscoasa(config)# route-map 1-to-2 permit ciscoasa(config-route-map)# match metric 1 ciscoasa(config-route-map)# set metric 5 ciscoasa(config-route-map)# set metric-type type-1 ciscoasa(config-route-map)# router ospf 2 ciscoasa(config-rtr)# redistribute ospf 1 route-map 1-to-2 </pre>	<p>Allows you to redistribute routes from an OSPF routing process into another OSPF routing process.</p> <p>You can either use the match options in this command to match and set route properties, or you can use a route map. The subnets option does not have equivalents in the route-map command. If you use both a route map and match options in the redistribute command, then they must match.</p> <p>The example shows route redistribution from OSPF process 1 into OSPF process 2 by matching routes with a metric equal to 1. The ASA redistributes these routes as external LSAs with a metric of 5 and a metric type of Type 1.</p>

Command	Purpose
<pre>redistribute rip [metric metric-value] [metric-type {type-1 type-2}] [tag tag_value] [subnets] [route-map map_name]</pre> <p>Example:</p> <pre>ciscoasa(config)# redistribute rip 5 ciscoasa(config-route-map)# match metric 1 ciscoasa(config-route-map)# set metric 5 ciscoasa(config-route-map)# set metric-type type-1 ciscoasa(config-rtr)# redistribute ospf 1 route-map 1-to-2</pre>	Allows you to redistribute routes from a RIP routing process into the OSPF routing process.
<pre>redistribute eigrp as-num [metric metric-value] [metric-type {type-1 type-2}] [tag tag_value] [subnets] [route-map map_name]</pre> <p>Example:</p> <pre>ciscoasa(config)# redistribute eigrp 2 ciscoasa(config-route-map)# match metric 1 ciscoasa(config-route-map)# set metric 5 ciscoasa(config-route-map)# set metric-type type-1 ciscoasa(config-rtr)# redistribute ospf 1 route-map 1-to-2</pre>	Allows you to redistribute routes from an EIGRP routing process into the OSPF routing process.

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Redistribution**.

The Redistribution pane displays the rules for redistributing routes from one routing process into an OSPF routing process. You can redistribute routes discovered by RIP and OSPF into the EIGRP routing process. You can also redistribute static and connected routes into the EIGRP routing process. You do not need to redistribute static or connected routes if they fall within the range of a network that has been configured through the Setup > Networks tab.

Step 2 Click **Add** or **Edit**.

Alternatively, double-clicking a table entry in the Redistribution pane (if any) opens the Add/Edit OSPF Redistribution Entry dialog box for the selected entry.



Note All steps that follow are optional.

The Add/Edit OSPF Redistribution Entry dialog box lets you add a new redistribution rule or edit an existing redistribution rule in the Redistribution table. Some of the redistribution rule information cannot be changed when you are editing an existing redistribution rule.

Step 3 Choose the OSPF process associated with the route redistribution entry. If you are editing an existing redistribution rule, you cannot change this setting.

Step 4 Choose the source protocol from which the routes are being redistributed. You can choose one of the following options:

- **Static**—Redistributes static routes to the OSPF routing process.

- **Connected**—Redistributes connected routes (routes established automatically by virtue of having IP address enabled on the interface) to the OSPF routing process. Connected routes are redistributed as external to the AS.
- **OSPF**—Redistributes routes from another OSPF routing process. Choose the OSPF process ID from the list. If you choose this protocol, the Match options on this dialog box become visible. These options are not available when redistributing static, connected, RIP, or EIGRP routes. Skip to Step 5.
- **RIP**—Redistributes routes from the RIP routing process.
- **EIGRP**—Redistributes routes from the EIGRP routing process. Choose the autonomous system number of the EIGRP routing process from the list.

- Step 5** If you have chosen OSPF for the source protocol, choose the conditions used for redistributing routes from another OSPF routing process into the selected OSPF routing process. These options are not available when redistributing static, connected, RIP, or EIGRP routes. The routes must match the selected condition to be redistributed. You can choose one or more of the following match conditions:
- **Internal**—The route is internal to a specific AS.
 - **External 1**—Routes that are external to the autonomous system, but are imported into OSPF as Type 1 external routes.
 - **External 2**—Routes that are external to the autonomous system, but are imported into OSPF as Type 2 external routes.
 - **NSSA External 1**—Routes that are external to the autonomous system, but are imported into OSPF as Type 2 NSSA routes.
 - **NSSA External 2**—Routes that are external to the autonomous system, but are imported into OSPF as Type 2 NSSA routes.
- Step 6** In the Metric Value field, enter the metric value for the routes being redistributed. Valid values range from 1 to 16777214.
- When redistributing from one OSPF process to another OSPF process on the same device, the metric will be carried through from one process to the other if no metric value is specified. When redistributing other processes to an OSPF process, the default metric is 20 when no metric value is specified.
- Step 7** Choose one of the following options for the Metric Type.
- If the metric is a Type 1 external route, choose **1**.
 - If the metric is a Type 2 external route, choose **2**.
- Step 8** Enter the tag value in the Tag Value field.
- The tag value is a 32-bit decimal value attached to each external route that is not used by OSPF itself, but may be used to communicate information between ASBRs. Valid values range from 0 to 4294967295.
- Step 9** Check the **Use Subnets** check box to enable the redistribution of subnetted routes. Uncheck this check box to cause only routes that are not subnetted to be redistributed.
- Step 10** Choose the name of the route map to apply to the redistribution entry from the Route Map drop-down list.
- Step 11** If you need to add or configure a route map, click **Manage**.
- The Configure Route Map dialog box appears.
- Step 12** Click **Add** or **Edit** to define which of the routes from the specified routing protocol are allowed to be redistributed into the target routing process. For more information, see the [“Defining a Route Map” section on page 26-4](#).

Step 13 Click **OK**.

Configuring Route Summarization When Redistributing Routes Into OSPFv2

When routes from other protocols are redistributed into OSPF, each route is advertised individually in an external LSA. However, you can configure the ASA to advertise a single route for all the redistributed routes that are included for a specified network address and mask. This configuration decreases the size of the OSPF link-state database.

Routes that match the specified IP address mask pair can be suppressed. The tag value can be used as a match value for controlling redistribution through route maps.

There are two areas that you can configure for route summarization:

- [Adding a Route Summary Address, page 27-11](#)
- [Adding or Editing an OSPF Summary Address, page 27-12](#)

Adding a Route Summary Address

The Summary Address pane displays information about the summary addresses configured for each OSPF routing process.

Routes learned from other routing protocols can be summarized. The metric used to advertise the summary is the smallest metric of all the more specific routes. Summary routes help reduce the size of the routing table.

Using summary routes for OSPF causes an OSPF ASBR to advertise one external route as an aggregate for all redistributed routes that are covered by the address. Only routes from other routing protocols that are being redistributed into OSPF can be summarized.



Note OSPF does not support summary-address 0.0.0.0 0.0.0.0.

To configure the software advertisement on one summary route for all redistributed routes included for a network address and mask, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>router ospf process_id</code> Example: <code>ciscoasa(config)# router ospf 1</code>	Creates an OSPF routing process and enters router configuration mode for this OSPF process. The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.
Step 2	<code>summary-address ip_address mask</code> <code>[not-advertise] [tag tag]</code> Example: <code>ciscoasa(config)# router ospf 1</code> <code>ciscoasa(config-rtr)# summary-address</code> <code>10.1.0.0 255.255.0.0</code>	Sets the summary address. In this example, the summary address 10.1.0.0 includes addresses 10.1.1.0, 10.1.2.0, 10.1.3.0, and so on. Only the 10.1.0.0 address is advertised in an external link-state advertisement.

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- Step 1** In the main ASDM home page, choose **Configuration > Device Setup > Routing > OSPF > Summary Address**.
- Step 2** Click **Add**.
The Add OSPF Summary Address Entry dialog box appears. You can add new entries to existing entries in the Summary Address table. Some of the summary address information cannot be changed when editing an existing entry.
- Step 3** Choose the specified OSPF Process ID associated with the summary address from the OSPF Process drop-down list. You cannot change this information when editing an existing entry.
- Step 4** Enter the IP address of the summary address in the IP Address field. You cannot change this information when editing an existing entry.
- Step 5** Choose the network mask for the summary address from the Netmask drop-down list. You cannot change this information when editing an existing entry.
- Step 6** Check the **Advertise** check box to advertise the summary route. Uncheck this check box to suppress routes that fall under the summary address. By default, this check box is checked.
The Tag value displays a 32-bit decimal value that is attached to each external route. This value is not used by OSPF itself, but may be used to communicate information between ASBRs.
- Step 7** Click **OK**.
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Adding or Editing an OSPF Summary Address

To add or edit OSPF summary address setting, perform the following steps:

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- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.

- Step 2** Click the **Route Summarization** tab.
- The Add/Edit a Route Summarization Entry dialog box appears.
- The Add/Edit a Route Summarization Entry dialog box allows you to add new entries to or modify existing entries in the Summary Address table. Some of the summary address information cannot be changed when editing an existing entry.
- Step 3** Choose the specified OSPF Process ID associated with the summary address from the OSPF Process drop-down list. You cannot change this information when editing an existing entry.
- Step 4** Enter the IP address of the summary address in the IP Address field. You cannot change this information when editing an existing entry.
- Step 5** Enter the network mask for the summary address from the Netmask drop-down list. You cannot change this information when editing an existing entry.
- Step 6** Check the **Advertise** check box to advertise the summary route. Uncheck this check box to suppress routes that fall under the summary address. By default, this check box is checked.

Configuring Route Summarization Between OSPFv2 Areas

Route summarization is the consolidation of advertised addresses. This feature causes a single summary route to be advertised to other areas by an area boundary router. In OSPF, an area boundary router advertises networks in one area into another area. If the network numbers in an area are assigned in a way so that they are contiguous, you can configure the area boundary router to advertise a summary route that includes all the individual networks within the area that fall into the specified range.

To define an address range for route summarization, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>router ospf process_id</pre> <p>Example:</p> <pre>ciscoasa(config)# router ospf 1</pre>	<p>Creates an OSPF routing process and enters router configuration mode for this OSPF process.</p> <p>The <i>process_id</i> argument is an internally used identifier for this routing process. It can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.</p>
Step 2	<pre>area area-id range ip-address mask [advertise not-advertise]</pre> <p>Example:</p> <pre>ciscoasa(config)# router ospf 1 ciscoasa(config-rtr)# area 17 range 12.1.0.0 255.255.0.0</pre>	<p>Sets the address range.</p> <p>In this example, the address range is set between OSPF areas.</p>

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.

Step 2 Click the **Route Summarization** tab.

The Add/Edit a Route Summarization Entry dialog box appears.

The Add/Edit a Route Summarization Entry dialog box allows you to add new entries to or modify existing entries in the Summary Address table. Some of the summary address information cannot be changed when editing an existing entry.

- Step 3** Enter the OSPF Area ID in the Area ID field. You cannot change this information when editing an existing entry.
- Step 4** Enter the IP address of the summary address in the IP Address field. You cannot change this information when editing an existing entry.

Configuring OSPFv2 Interface Parameters

You can change some interface-specific OSPFv2 parameters, if necessary. You are not required to change any of these parameters, but the following interface parameters must be consistent across all routers in an attached network: **ospf hello-interval**, **ospf dead-interval**, and **ospf authentication-key** the Hello interval, the Dead interval, and the Authentication key. If you configure any of these parameters, be sure that the configurations for all routers on your network have compatible values.

To configure OSPFv2 interface parameters, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	router <i>ospf process_id</i> Example: ciscoasa(config)# router ospf 2	Creates an OSPF routing process and enters router configuration mode for the OSPF process that you want to redistribute. The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.
Step 2	network <i>ip_address mask area area_id</i> Example: ciscoasa(config)# router ospf 2 ciscoasa(config-rtr)# network 10.0.0.0 255.0.0.0 area 0	Defines the IP addresses on which OSPF runs and the area ID for that interface.
Step 3	interface <i>interface_name</i> Example: ciscoasa(config)# interface <i>my_interface</i>	Allows you to enter interface configuration mode.
Step 4	Do one of the following to configure optional OSPF interface parameters: ospf authentication [message-digest null] Example: ciscoasa(config-interface)# ospf authentication message-digest	Specifies the authentication type for an interface.

Command	Purpose
<p>ospf authentication-key <i>key</i></p> <p>Example: <pre>ciscoasa(config-interface)# ospf authentication-key cisco</pre></p>	<p>Allows you to assign a password to be used by neighboring OSPF routers on a network segment that is using the OSPF simple password authentication.</p> <p>The <i>key</i> argument can be any continuous string of characters up to 8 bytes in length.</p> <p>The password created by this command is used as a key that is inserted directly into the OSPF header when the ASA software originates routing protocol packets. A separate password can be assigned to each network on a per-interface basis. All neighboring routers on the same network must have the same password to be able to exchange OSPF information.</p>
<p>ospf cost <i>cost</i></p> <p>Example: <pre>ciscoasa(config-interface)# ospf cost 20</pre></p>	<p>Allows you to explicitly specify the cost of sending a packet on an OSPF interface. The <i>cost</i> is an integer from 1 to 65535.</p> <p>In this example, the cost is set to 20.</p>
<p>ospf dead-interval <i>seconds</i></p> <p>Example: <pre>ciscoasa(config-interface)# ospf dead-interval 40</pre></p>	<p>Allows you to set the number of seconds that a device must wait before it declares a neighbor OSPF router down because it has not received a hello packet. The value must be the same for all nodes on the network.</p> <p>In this example, the dead interval is set to 40.</p>
<p>ospf hello-interval <i>seconds</i></p> <p>Example: <pre>ciscoasa(config-interface)# ospf hello-interval 10</pre></p>	<p>Allows you to specify the length of time between the hello packets that the ASA sends on an OSPF interface. The value must be the same for all nodes on the network.</p> <p>In this example, the hello interval is set to 10.</p>
<p>ospf message-digest-key <i>key_id md5 key</i></p> <p>Example: <pre>ciscoasa(config-interface)# ospf message-digest-key 1 md5 cisco</pre></p>	<p>Enables OSPF MD5 authentication.</p> <p>The following argument values can be set:</p> <ul style="list-style-type: none"> <i>key_id</i>—An identifier in the range from 1 to 255. <i>key</i>—An alphanumeric password of up to 16 bytes. <p>Usually, one key per interface is used to generate authentication information when sending packets and to authenticate incoming packets. The same key identifier on the neighbor router must have the same key value.</p> <p>We recommend that you not keep more than one key per interface. Every time you add a new key, you should remove the old key to prevent the local system from continuing to communicate with a hostile system that knows the old key. Removing the old key also reduces overhead during rollover.</p>
<p>ospf priority <i>number_value</i></p> <p>Example: <pre>ciscoasa(config-interface)# ospf priority 20</pre></p>	<p>Allows you to set the priority to help determine the OSPF designated router for a network.</p> <p>The <i>number_value</i> argument ranges from 0 to 255.</p> <p>In this example, the priority number value is set to 20.</p>

Command	Purpose
ospf retransmit-interval <i>seconds</i> Example: <pre>ciscoasa(config-interface)# ospf retransmit-interval seconds</pre>	<p>Allows you to specify the number of seconds between LSA retransmissions for adjacencies belonging to an OSPF interface.</p> <p>The value for <i>seconds</i> must be greater than the expected round-trip delay between any two routers on the attached network. The range is from 1 to 65535 seconds. The default value is 5 seconds.</p> <p>In this example, the retransmit-interval value is set to 15.</p>
ospf transmit-delay <i>seconds</i> Example: <pre>ciscoasa(config-interface)# ospf transmit-delay 5</pre>	<p>Sets the estimated number of seconds required to send a link-state update packet on an OSPF interface. The <i>seconds</i> value ranges from 1 to 65535 seconds. The default value is 1 second.</p> <p>In this example, the transmit-delay is 5 seconds.</p>
ospf network point-to-point non-broadcast Example: <pre>ciscoasa(config-interface)# ospf network point-to-point non-broadcast</pre>	<p>Specifies the interface as a point-to-point, non-broadcast network.</p> <p>When you designate an interface as point-to-point and non-broadcast, you must manually define the OSPF neighbor; dynamic neighbor discovery is not possible. See the “Defining Static OSPFv2 Neighbors” section on page 27-24 for more information. Additionally, you can only define one OSPF neighbor on that interface.</p>

In ASDM, the Interface pane lets you configure interface-specific OSPF routing properties, such as OSPF message authentication and properties. There are two tabs that help you configure interfaces in OSPF:

- The Authentication tab displays the OSPF authentication information for the ASA interfaces.
- The Properties tab displays the OSPF properties defined for each interface in a table format.

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Interface**.
- Step 2** Click the **Authentication** tab to display the authentication information for the ASA interfaces. Double-clicking a row in the table opens the Edit OSPF Authentication Interface dialog box for the selected interface.
- Step 3** Click **Edit**.
- The Edit OSPF Authentication Interface dialog box appears. The Edit OSPF Interface Authentication dialog box lets you configure the OSPF authentication type and parameters for the selected interface.
- Step 4** Choose the Authentication type from the Authentication drop-down list according to the following options:
- **None** to disable OSPF authentication.
 - **Authentication Password** to use clear text password authentication (not recommended where security is a concern).
 - **MD5** to use MD5 authentication (recommended).

- **Area** (Default) to use the authentication type specified for the area. See the “[Configuring OSPFv2 Area Parameters](#)” section on page 27-19 for information about configuring area authentication. Area authentication is disabled by default. Therefore, unless you have previously specified an area authentication type, interfaces set to area authentication have authentication disabled until you configure this setting.
- Step 5** Click the radio button in the Authentication Password area, which includes the settings for entering the password when password authentication is enabled.
- a. In the Enter Password field, type a text string of up to eight characters.
 - b. In the Re-enter Password field, retype the password.
- Step 6** Choose the settings for MD5 IDs and keys in the ID area, which includes the settings for entering the MD5 keys and parameters when MD5 authentication is enabled. All devices on the interface using OSPF authentication must use the same MD5 key and ID.
- a. In the Key ID field, enter a numerical key identifier. Valid values range from 1 to 255. The Key ID displays for the selected interface.
 - b. In the Key field, enter an alphanumeric character string of up to 16 bytes. The key displays for the selected interface.
 - c. Click **Add** or **Delete** to add or delete the specified MD5 key to the MD5 ID and Key table.
- Step 7** Click **OK**.
- Step 8** Click the **Properties** tab.
- Step 9** Choose the interface that you want to edit. Double-clicking a row in the table opens the [Properties tab](#) dialog box for the selected interface.
- Step 10** Click **Edit**.
- The Edit OSPF Interface Properties dialog box appears. The Interface field displays the name of the interface for which you are configuring OSPF properties. You cannot edit this field.
- Step 11** Check or uncheck the **Broadcast** check box to specify that the interface is a broadcast interface.
- By default, this check box is checked for Ethernet interfaces. Uncheck this check box to designate the interface as a point-to-point, nonbroadcast interface. Specifying an interface as point-to-point, nonbroadcast lets you transmit OSPF routes over VPN tunnels.
- When an interface is configured as point-to-point, non-broadcast, the following restrictions apply:
- You can define only one neighbor for the interface.
 - You need to manually configure the neighbor. See the “[Defining Static OSPFv2 Neighbors](#)” section on page 27-24 for more information.
 - You need to define a static route pointing to the crypto endpoint. See the “[Configuring Static and Default Routes](#)” section on page 25-2 for more information.
 - If OSPF over a tunnel is running on the interface, regular OSPF with an upstream router cannot be run on the same interface.
 - You should bind the crypto map to the interface before specifying the OSPF neighbor to ensure that the OSPF updates are passed through the VPN tunnel. If you bind the crypto map to the interface after specifying the OSPF neighbor, use the **clear local-host all** command to clear OSPF connections so that the OSPF adjacencies can be established over the VPN tunnel.
- Step 12** Configure the following options:
- Enter a value in the Cost field, which determines the cost of sending a packet through the interface. The default value is 10.

- In the Priority field, enter the OSPF router priority value.

When two routers connect to a network, both attempt to become the designated router. The device with the higher router priority becomes the designated router. If there is a tie, the router with the higher router ID becomes the designated router.

Valid values for this setting range from 0 to 255. The default value is 1. Entering 0 for this setting makes the router ineligible to become the designated router or backup designated router. This setting does not apply to interfaces that are configured as point-to-point, nonbroadcast interfaces.

- Check or uncheck the **MTU Ignore** check box.

OSPF checks whether neighbors are using the same MTU on a common interface. This check is performed when neighbors exchange DBD packets. If the receiving MTU in the DBD packet is higher than the IP MTU configured on the incoming interface, OSPF adjacency will not be established.

- Check or uncheck the **Database filter** check box.

Use this setting to filter the outgoing LSA interface during synchronization and flooding. By default, OSPF floods new LSAs over all interfaces in the same area, except the interface on which the LSA arrives. In a fully meshed topology, this flooding can waste bandwidth and lead to excessive link and CPU usage. Checking this check box prevents OSPF flooding of the LSA on the selected interface.

Step 13 (Optional) Click **Advanced** to display the Edit OSPF Advanced Interface Properties dialog box, which lets you change the values for the OSPF hello interval, retransmit interval, transmit delay, and dead interval.

Typically, you only need to change these values from the defaults if you are experiencing OSPF problems on your network.

Step 14 Enter values for the following:

- The Hello Interval, which specifies the interval, in seconds, between hello packets sent on an interface. The smaller the hello interval, the faster topological changes are detected, but more traffic is sent on the interface. This value must be the same for all routers and access servers on a specific interface. Valid values range from 1 to 65535 seconds. The default value is 10 seconds.
- The Retransmit Interval, which specifies the time, in seconds, between LSA retransmissions for adjacencies belonging to the interface. When a router sends an LSA to its neighbor, it keeps the LSA until it receives the acknowledgement message. If the router receives no acknowledgement, it will resend the LSA. Be conservative when setting this value, or needless retransmission can result. The value should be larger for serial lines and virtual links. Valid values range from 1 to 65535 seconds. The default value is 5 seconds.
- The Transmit Delay, which specifies the estimated time, in seconds, required to send an LSA packet on the interface. LSAs in the update packet have their ages increased by the amount specified by this field before transmission. If the delay is not added before transmission over a link, the time in which the LSA propagates over the link is not considered. The value assigned should take into account the transmission and propagation delays for the interface. This setting has more significance on very low-speed links. Valid values range from 1 to 65535 seconds. The default value is 1 second.
- The Dead Interval, which specifies the interval, in seconds, in which no hello packets are received, causing neighbors to declare a router down. Valid values range from 1 to 65535. The default value of this setting is four times the interval that was set in the Hello Interval field.

Configuring OSPFv2 Area Parameters

You can configure several OSPF area parameters. These area parameters (shown in the following task list) include setting authentication, defining stub areas, and assigning specific costs to the default summary route. Authentication provides password-based protection against unauthorized access to an area.

Stub areas are areas into which information on external routes is not sent. Instead, there is a default external route generated by the ABR into the stub area for destinations outside the autonomous system. To take advantage of the OSPF stub area support, default routing must be used in the stub area. To further reduce the number of LSAs sent into a stub area, you can use the **no-summary** keyword of the **area stub** command on the ABR to prevent it from sending a summary link advertisement (LSA Type 3) into the stub area.

To specify OSPFv2 area parameters for your network, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	router ospf <i>process_id</i> Example: ciscoasa(config)# router ospf 2	Creates an OSPF routing process and enters router configuration mode for the OSPF process that you want to redistribute. The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.
Step 2	Do one of the following to configure optional OSPF area parameters:	
	area <i>area-id</i> authentication Example: ciscoasa(config-rtr)# area 0 authentication	Enables authentication for an OSPF area.
	area <i>area-id</i> authentication message-digest Example: ciscoasa(config-rtr)# area 0 authentication message-digest	Enables MD5 authentication for an OSPF area.

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.

Step 2 Click the **Area/Networks** tab.

The Add OSPF Area dialog box appears.

Step 3 Choose one of the following Area Type options:

- **Normal** to make the area a standard OSPF area. This option is selected by default when you first create an area.
- **Stub** to make the area a stub area. Stub areas do not have any routers or areas beyond it. Stub areas prevent AS External LSAs (Type 5 LSAs) from being flooded into the stub area. When you create a stub area, you have the option of preventing summary LSAs (Types 3 and 4) from being flooded into the area by unchecking the Summary check box.

- **Summary** to prevent LSAs from being sent into the stub area when the area being defined is a stub area, uncheck this check box. By default, this check box is checked for stub areas.
 - **NSSA** to make the area a not-so-stubby area. NSSAs accept Type 7 LSAs. When you create the NSSA, you have the option of preventing summary LSAs from being flooded into the area by unchecking the Summary check box. You can also disable route redistribution by unchecking the Redistribute check box and checking the Default Information Originate check box.
- Step 4** Enter the IP address in the IP Address field of the network or host to be added to the area. Use **0.0.0.0** with a netmask of **0.0.0.0** to create the default area. You can only enter **0.0.0.0** in one area.
- Step 5** Enter the network mask in the Network Mask field for the IP address or host to be added to the area. If adding a host, choose the **255.255.255.255** mask.
- Step 6** Choose the OSPF Authentication type from the following options:
- **None** to disable OSPF area authentication. This is the default setting.
 - **Password** to provide a clear text password for area authentication, which is not recommended where security is a concern.
 - **MD5** to allow MD5 authentication.
- Step 7** Enter a value in the Default Cost field to specify a default cost for the OSPF area.
Valid values range from 0 to 65535. The default value is 1.
- Step 8** Click **OK**.
-

Configuring an OSPFv2 NSSA

The OSPFv2 implementation of an NSSA is similar to an OSPFv2 stub area. NSSA does not flood Type 5 external LSAs from the core into the area, but it can import autonomous system external routes in a limited way within the area.

NSSA imports Type 7 autonomous system external routes within an NSSA area by redistribution. These Type 7 LSAs are translated into Type 5 LSAs by NSSA ABRs, which are flooded throughout the whole routing domain. Summarization and filtering are supported during the translation.

You can simplify administration if you are an ISP or a network administrator that must connect a central site using OSPFv2 to a remote site that is using a different routing protocol with NSSA.

Before the implementation of NSSA, the connection between the corporate site border router and the remote router could not be run as an OSPFv2 stub area because routes for the remote site could not be redistributed into the stub area, and two routing protocols needed to be maintained. A simple protocol such as RIP was usually run and handled the redistribution. With NSSA, you can extend OSPFv2 to cover the remote connection by defining the area between the corporate router and the remote router as an NSSA.

Before you use this feature, consider these guidelines:

- You can set a Type 7 default route that can be used to reach external destinations. When configured, the router generates a Type 7 default into the NSSA or the NSSA area boundary router.
- Every router within the same area must agree that the area is NSSA; otherwise, the routers cannot communicate with each other.

To specify area parameters for your network to configure an OSPFv2 NSSA, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>router ospf process_id</pre> <p>Example: ciscoasa(config)# router ospf 2</p>	<p>Creates an OSPF routing process and enters router configuration mode for the OSPF routing process that you want to redistribute.</p> <p>The <i>process_id</i> argument is an internally used identifier for this routing process. It can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.</p>
Step 2	<p>Do one of the following to configure optional OSPF NSSA parameters:</p> <pre>area area-id nssa [no-redistribution] [default-information-originate]</pre> <p>Example: ciscoasa(config-rtr)# area 0 nssa</p> <pre>summary-address ip_address mask [not-advertise] [tag tag]</pre> <p>Example: ciscoasa(config-rtr)# summary-address 10.1.0.0 255.255.0.0</p>	<p>Defines an NSSA area.</p> <p>Sets the summary address and helps reduce the size of the routing table. Using this command for OSPF causes an OSPF ASBR to advertise one external route as an aggregate for all redistributed routes that are covered by the address.</p> <p>In this example, the summary address 10.1.0.0 includes addresses 10.1.1.0, 10.1.2.0, 10.1.3.0, and so on. Only the 10.1.0.0 address is advertised in an external link-state advertisement.</p>



Note OSPF does not support summary-address 0.0.0.0 0.0.0.0.

- Step 1** From the main ASDM home page, choose **Configuration > Device Setup > Routing > OSPF > Setup**.
- Step 2** Click the **Area/Networks** tab.
- Step 3** Click **Add**.
The Add OSPF Area dialog box appears.
- Step 4** Click the **NSSA** radio button in the Area Type area.
Choose this option to make the area a not-so-stubby area. NSSAs accept Type 7 LSAs. When you create the NSSA, you have the option of preventing summary LSAs from being flooded into the area by unchecking the Summary check box. You can also disable route redistribution by unchecking the Redistribute check box and checking the Default Information Originate check box.
- Step 5** Enter the IP address in the IP Address field of the network or host to be added to the area. Use **0.0.0.0** with a netmask of **0.0.0.0** to create the default area. You can only enter **0.0.0.0** in one area.
- Step 6** Enter the network mask in the Network Mask field for the IP address or host to be added to the area. If adding a host, choose the **255.255.255.255** mask.
- Step 7** In the Authentication area, click the **None** radio button to disable OSPF area authentication.
- Step 8** Enter a value in the Default Cost field to specify a default cost for the OSPF area.

Valid values range from 0 to 65535. The default value is 1.

Step 9 Click **OK**.

Configuring an IP Address Pool for Clustering (OSPFv2 and OSPFv3)

You can assign a range of IPv4 addresses for the router ID cluster pool if you are using Layer 3 clustering.

To assign a range of IPv4 addresses for the router ID cluster pool in Layer 3 clustering for OSPFv2 and OSPFv3, enter the following command:

Command	Purpose
<pre>router-id cluster-pool hostname A.B.C.D ip_pool</pre> <p>Example:</p> <pre>hostname(config)# ip local pool rpool 1.1.1.1-1.1.1.4 hostname(config)# router ospf 1 hostname(config-rtr)# router-id cluster-pool rpool hostname(config-rtr)# network 17.5.0.0 255.255.0.0 area 1 hostname(config-rtr)# log-adj-changes</pre>	<p>Specifies the router ID cluster pool for Layer 3 clustering.</p> <p>The cluster-pool keyword enables configuration of an IP address pool when Layer 3 clustering is configured. The hostname A.B.C.D. keyword specifies the OSPF router ID for this OSPF process. The <i>ip_pool</i> argument specifies the name of the IP address pool.</p> <p>Note If you are using clustering, then you do not need to specify an IP address pool for the router ID. If you do not configure an IP address pool, then the ASA uses the automatically generated router ID.</p>

To assign a range of IPv4 addresses for the router ID cluster pool in Layer 3 clustering for OSPFv2, perform the following steps:

- Step 1** From the main ASDM home page, choose **Configuration > Device Setup > Routing > OSPF > Setup**.
- Step 2** Click the **Process Instances** tab.
- Step 3** Choose the OSPF process that you want to edit, then click **Advanced**.
The Edit OSPF Process Advanced Properties dialog box appears.
- Step 4** Click the **Cluster Pool** radio button. If you are using clustering, then you do not need to specify an IP address pool for the router ID (that is, leave the field blank). If you do not enter an IP address pool, then the ASA uses the automatically generated router ID.
- Step 5** Enter the name of the IP address pool, or click the ellipses to display the Select IP Address Pool dialog box.
- Step 6** Double-click an existing IP address pool name to add it to the Assign field. Alternatively, click **Add** to create a new IP address pool.
The Add IPv4 Pool dialog box appears.
- Step 7** Enter the new IP address pool name in the Name field.
- Step 8** Enter the starting IP address or click the ellipses to display the Browse Starting IP Address dialog box.
- Step 9** Double-click an entry to add it to the Starting IP Address field, then click **OK**.
- Step 10** Enter the ending IP address or click the ellipses to display the Browse Ending IP Address dialog box.
- Step 11** Double-click an entry to add it to the Ending IP Address field, then click **OK**.

- Step 12** Choose the subnet mask from the drop-down list, then click **OK**.
The new IP address pool appears in the Select IP Address Pool list.
- Step 13** Double-click the new IP address pool name to add it to the Assign field, then click **OK**.
The new IP address pool name appears in the Cluster Pool field of the Edit OSPF Process Advanced Properties dialog box.
- Step 14** Click **OK**.
- Step 15** If you want to change the newly added IP address pool settings, click **Edit**.
The Edit IPv4 Pool dialog box appears.
- Step 16** Repeat Steps 4 through 14.



Note You cannot edit or delete an existing IP address pool that has been assigned and is already being used by one or more connection profiles.

- Step 17** Click **OK**.

To assign a range of IPv4 addresses for the router ID cluster pool in Layer 3 clustering for OSPFv3, perform the following steps:

-
- Step 1** From the main ASDM home page, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
- Step 2** Click the **Process Instances** tab.
- Step 3** Choose the OSPF process that you want to edit, then click **Advanced**.
The Edit OSPFv3 Process Advanced Properties dialog box appears.
- Step 4** Choose the Cluster Pool option from the Router ID drop-down list. If you do not need to specify an IP address pool for the router ID, choose the Automatic option. If you do not configure an IP address pool, then the ASA uses the automatically generated router ID.
- Step 5** Enter the IP address pool name. Alternatively, click the ellipses to display the Select IP Address Pool dialog box.
- Step 6** Double-click an existing IP address pool name to add it to the Assign field. Alternatively, click **Add** to create a new IP address pool.
The Add IPv4 Pool dialog box appears.
- Step 7** Enter the new IP address pool name in the Name field.
- Step 8** Enter the starting IP address or click the ellipses to display the Browse Starting IP Address dialog box.
- Step 9** Double-click an entry to add it to the Starting IP Address field, then click **OK**.
- Step 10** Enter the ending IP address or click the ellipses to display the Browse Ending IP Address dialog box.
- Step 11** Double-click an entry to add it to the Ending IP Address field, then click **OK**.
- Step 12** Choose the subnet mask from the drop-down list, then click **OK**.
The new IP address pool appears in the Select IP Address Pool list.
- Step 13** Double-click the new IP address pool name to add it to the Assign field, then click **OK**.

The new IP address pool name appears in the Cluster Pool field of the Edit OSPF Process Advanced Properties dialog box.

Step 14 Click **OK**.

Step 15 If you want to change the newly added cluster pool settings, click **Edit**.

The Edit IPv4 Pool dialog box appears.

Step 16 Repeat Steps 4 through 14.



Note You cannot edit or delete an existing IP address pool that has been assigned and is already being used by another OSPFv3 process.

Step 17 Click **OK**.

Defining Static OSPFv2 Neighbors

You need to define static OSPFv2 neighbors to advertise OSPFv2 routes over a point-to-point, non-broadcast network. This feature lets you broadcast OSPFv2 advertisements across an existing VPN connection without having to encapsulate the advertisements in a GRE tunnel.

Before you begin, you must create a static route to the OSPFv2 neighbor. See [Chapter 25, “Configuring Static and Default Routes,”](#) for more information about creating static routes.

To define a static OSPFv2 neighbor, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>router ospf process_id</code> Example: ciscoasa(config)# router ospf 2	Creates an OSPFv2 routing process and enters router configuration mode for this OSPFv2 process. The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.
Step 2	<code>neighbor addr [interface if_name]</code> Example: ciscoasa(config-rtr)# neighbor 255.255.0.0 [interface my_interface]	Defines the OSPFv2 neighborhood. The <i>addr</i> argument is the IP address of the OSPFv2 neighbor. The <i>if_name</i> argument is the interface used to communicate with the neighbor. If the OSPF v2neighbor is not on the same network as any of the directly connected interfaces, you must specify the interface.

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Static Neighbor**.

Step 2 Click **Add** or **Edit**.

The Add/Edit OSPF Neighbor Entry dialog box appears. This dialog box lets you define a new static neighbor or change information for an existing static neighbor. You must define a static neighbor for each point-to-point, nonbroadcast interface. Note the following restrictions:

- You cannot define the same static neighbor for two different OSPF processes.
- You need to define a static route for each static neighbor.

- Step 3** From the OSPF Process drop-down list, choose the OSPF process associated with the static neighbor. If you are editing an existing static neighbor, you cannot change this value.
- Step 4** In the Neighbor field, enter the IP address of the static neighbor.
- Step 5** In the Interface field, choose the interface associated with the static neighbor. If you are editing an existing static neighbor, you cannot change this value.
- Step 6** Click **OK**.

Configuring Route Calculation Timers

You can configure the delay time between when OSPFv2 receives a topology change and when it starts an SPF calculation. You also can configure the hold time between two consecutive SPF calculations.

To configure route calculation timers, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>router ospf process_id</code> Example: <code>ciscoasa(config)# router ospf 2</code>	Creates an OSPFv2 routing process and enters router configuration mode for this OSPFv2 process. The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.
Step 2	<code>timers spf spf-delay spf-holdtime</code> Example: <code>ciscoasa(config-rtr)# timers spf 10 120</code>	Configures the route calculation times. The <i>spf-delay</i> argument is the delay time (in seconds) between when OSPF receives a topology change and when it starts an SPF calculation. It can be an integer from 0 to 65535. The default time is 5 seconds. The <i>spf-holdtime</i> argument is the minimum time (in seconds) between two consecutive SPF calculations. It can be an integer from 0 to 65535. The default time is 10 seconds.

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.
- Step 2** Click the **Process Instances** tab.
- Step 3** Choose the OSPF process that you want to edit, then click **Advanced**.
The Edit OSPF Process Advanced Properties dialog box appears.

- Step 4** The Timers area allows you to modify the settings that are used to configure LSA pacing and SPF calculation timers. In the Timers area, enter the following values:
- The SPF Delay Time, which specifies the time between when OSPF receives a topology change and when the SPF calculation starts. Valid values range from 0 to 65535. The default value is 5.
 - The SPF Hold Time, which specifies the hold time between consecutive SPF calculations. Valid values range from 1 to 65534. The default value is 10.
 - The LSA Group Pacing, which specifies the interval at which LSAs are collected into a group and refreshed, check summed, or aged. Valid values range from 10 to 1800. The default value is 240.
- Step 5** Click **OK**.

Logging Neighbors Going Up or Down

By default, a syslog message is generated when an OSPFv2 neighbor goes up or down.

Configure the **log-adj-changes** command if you want to know about OSPFv2 neighbors going up or down without turning on the **debug ospf adjacency** command. The **log-adj-changes** command provides a higher level view of the peer relationship with less output. Configure the **log-adj-changes detail** command if you want to see messages for each state change.

To log OSPFv2 neighbors going up or down, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>router ospf process_id</code> Example: <code>ciscoasa(config)# router ospf 2</code>	Creates an OSPFv2 routing process and enters router configuration mode for this OSPFv2 process. The <i>process_id</i> argument is an internally used identifier for this routing process and can be any positive integer. This ID does not have to match the ID on any other device; it is for internal use only. You can use a maximum of two processes.
Step 2	<code>log-adj-changes [detail]</code> Example: <code>ciscoasa(config-rtr)# log-adj-changes [detail]</code>	Configures logging for neighbors going up or down.

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.
- Step 2** Click the **Process Instances** tab.
- Step 3** Click **Advanced**.
The Edit OSPF Process Advanced Properties dialog box appears.
- Step 4** The Adjacency Changes area includes settings that define the adjacency changes that cause syslog messages to be sent. In the Adjacency Changes area, enter the following values:
- Check the **Log Adjacency Changes** check box to cause the ASA to send a syslog message whenever an OSPFv2 neighbor goes up or down. This setting is checked by default.

- Check the **Log Adjacency Changes Detail** check box to cause the ASA to send a syslog message whenever any state change occurs, not just when a neighbor goes up or down. This setting is unchecked by default.

Step 5 Click **OK**.



Note Logging must be enabled for the neighbor up or down messages to be sent.

Configuring Filtering in OSPF

The Filtering pane displays the ABR Type 3 LSA filters that have been configured for each OSPF process.

ABR Type 3 LSA filters allow only specified prefixes to be sent from one area to another area and restrict all other prefixes. This type of area filtering can be applied out of a specific OSPF area, into a specific OSPF area, or into and out of the same OSPF areas at the same time.

OSPF ABR Type 3 LSA filtering improves your control of route distribution between OSPF areas.



Note Only Type 3 LSAs that originate from an ABR are filtered.

To configure filtering in OSPF, perform the following steps:

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Filtering**.
- Step 2** Click **Add** or **Edit**.
- The Add or Edit OSPF Filtering Entry dialog box lets you add new filters to the Filter table or modify an existing filter. Some of the filtering information cannot be changed when you edit an existing filter.
- Step 3** Choose the OSPF process that is associated with the filter entry from the OSPF Process drop-down list.
- Step 4** Choose the Area ID that is associated with the filter entry from the Area ID drop-down list. If you are editing an existing filter entry, you cannot modify this setting.
- Step 5** Choose a prefix list from the Prefix List drop-down list.
- Step 6** Choose the traffic direction being filtered from the Traffic Direction drop-down list.
- Choose Inbound to filter LSAs coming into an OSPF area, or Outbound to filter LSAs coming out of an OSPF area. If you are editing an existing filter entry, you cannot modify this setting.
- Step 7** Click **Manage** to display the Configure Prefix Lists dialog box, from which you can add, edit, or delete prefix lists and prefix rules.
- Step 8** Click **OK**.
-

Configuring a Virtual Link in OSPF

If you add an area to an OSPF network, and it is not possible to connect the area directly to the backbone area, you need to create a virtual link. A virtual link connects two OSPF devices that have a common area, called the transit area. One of the OSPF devices must be connected to the backbone area.

To define new virtual links or change the properties of existing virtual links, perform the following steps:

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Virtual Link**.
- Step 2** Click **Add** or **Edit**.
- The Add or Edit OSPF Virtual Link dialog box appears, which allows you to define new virtual links or change the properties of existing virtual links.
- Step 3** Choose the OSPF process ID that is associated with the virtual link from the OSPF Process drop-down list. If you are editing an existing virtual link entry, you cannot modify this setting.
- Step 4** Choose the Area ID that is associated with the virtual link from the Area ID drop-down list.
- Choose the area shared by the neighbor OSPF devices. The selected area cannot be an NSSA or a Stub area. If you are editing an existing virtual link entry, you cannot modify this setting.
- Step 5** In the Peer Router ID field, enter the router ID of the virtual link neighbor.
- If you are editing an existing virtual link entry, you cannot modify this setting.
- Step 6** Click **Advanced** to edit advanced virtual link properties,
- The Advanced OSPF Virtual Link Properties dialog box appears. You can configure the OSPF properties for the virtual link in this area. These properties include authentication and packet interval settings.
- Step 7** In the Authentication area, choose the Authentication type by clicking the radio button next to one of the following options:
- **None** to disable OSPF authentication.
 - **Authentication Password** to use clear text password authentication. This is not recommended where security is a concern.
 - **MD5** to use MD5 authentication (recommended).
 - **Area** (Default) to use the authentication type specified for the area. See the “[Configuring OSPFv2 Area Parameters](#)” section on page 27-19 for information about configuring area authentication. Area authentication is disabled by default. Therefore, unless you have previously specified an area authentication type, interfaces set to area authentication have authentication disabled until you configure this setting.
- Step 8** In the Authentication Password area, enter and re-enter a password when password authentication is enabled. Passwords must be a text string of up to 8 characters.
- Step 9** In the MD5 IDs and Key area, enter the MD5 keys and parameters when MD5 authentication is enabled. All devices on the interface using OSPF authentication must use the same MD5 key and ID. Specify the following settings:
- a. In the Key ID field, enter a numerical key identifier. Valid values range from 1 to 255. The Key ID displays for the selected interface.
 - b. In the Key field, enter an alphanumeric character string of up to 16 bytes. The Key ID displays for the selected interface.
 - c. Click **Add** or **Delete** to add or delete the specified MD5 key to the MD5 ID and Key table.
- Step 10** In the Interval area, specify the interval timing for the packet by choosing from the following options:

- **Hello Interval** to specify the interval, in seconds, between hello packets sent on an interface. The smaller the hello interval, the faster topological changes are detected, but the more traffic is sent on the interface. This value must be the same for all routers and access servers on a specific interface. Valid values range from 1 to 65535 seconds. The default value is 10 seconds.
- **Retransmit Interval** to specify the time, in seconds, between LSA retransmissions for adjacencies belonging to the interface. When a router sends an LSA to its neighbor, it keeps the LSA until it receives the acknowledgement message. If the router receives no acknowledgement, it will resend the LSA. Be conservative when setting this value, or needless retransmission can result. The value should be larger for serial lines and virtual links. Valid values range from 1 to 65535 seconds. The default value is 5 seconds.
- **Transmit Delay** to specify the estimated time, in seconds, required to send an LSA packet on the interface. LSAs in the update packet have their ages increased by the amount specified by this field before transmission. If the delay is not added before transmission over a link, the time in which the LSA propagates over the link is not considered. The value assigned should take into account the transmission and propagation delays for the interface. This setting has more significance on very low-speed links. Valid values range from 1 to 65535 seconds. The default value is 1 second.
- **Dead Interval** to specify the interval, in seconds, in which no hello packets are received, causing neighbors to declare a router down. Valid values range from 1 to 65535. The default value of this field is four times the interval set by the Hello Interval field.

Step 11 Click **OK**.

Configuring OSPFv3

This section describes how to configure OSPFv3 routing processes and includes the following topics:

- [Enabling OSPFv3, page 27-30](#)
- [Configuring OSPFv3 Interface Parameters, page 27-31](#)
- [Configuring OSPFv3 Router Parameters, page 27-38](#)
- [Configuring OSPFv3 Area Parameters, page 27-40](#)
- [Configuring a Virtual Link Neighbor, page 27-42](#)
- [Configuring OSPFv3 Passive Interfaces, page 27-44](#)
- [Configuring OSPFv3 Administrative Distance, page 27-45](#)
- [Configuring OSPFv3 Timers, page 27-46](#)
- [Defining Static OSPFv3 Neighbors, page 27-50](#)
- [Resetting OSPFv3 Default Parameters, page 27-52](#)
- [Sending Syslog Messages, page 27-53](#)
- [Suppressing Syslog Messages, page 27-54](#)
- [Calculating Summary Route Costs, page 27-54](#)
- [Generating a Default External Route into an OSPFv3 Routing Domain, page 27-55](#)
- [Configuring an IPv6 Summary Prefix, page 27-56](#)
- [Redistributing IPv6 Routes, page 27-57](#)

Enabling OSPFv3

To enable OSPFv3, you need to create an OSPFv3 routing process, create an area for OSPFv3, enable an interface for OSPFv3, then redistribute the route into the targeted OSPFv3 routing processes.

To enable OSPFv3, enter the following command or perform the following stepsperform the following steps:

Command	Purpose
Command <code>ipv6 router ospf process-id</code> Example: <code>ciscoasa(config)# ipv6 router ospf 10</code>	Creates an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process-id</i> argument is an internally used tag for this routing process and can be any positive integer. This tag does not have to match the tag on any other device; it is for internal use only. You can use a maximum of two processes.

	Command	Purpose
Step 1	<code>interface interface_name</code> Example: <code>ciscoasa(config)# interface GigabitEthernet0/0</code>	Enables an interface.
Step 2	<code>ipv6 ospf process-id area area_id</code> Example: <code>ciscoasa(config)# ipv6 ospf 200 area 100</code>	Creates the OSPFv3 routing process with the specified process ID and an area for OSPFv3 with the specified area ID.

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
 - Step 2** On the Process Instances tab, check the **Enable OSPFv3 Process** check box. You can enable up to two OSPF process instances. Only single context mode is supported.
 - Step 3** Enter a process ID in the Process ID field. The ID can be any positive integer.
 - Step 4** Click **Apply** to save your changes.
 - Step 5** To continue, see the [“Configuring OSPFv3 Area Parameters”](#) section on page 27-40.
-

Configuring OSPFv3 Interface Parameters

You can change certain interface-specific OSPFv3 parameters, if necessary. You are not required to change any of these parameters, but the following interface parameters must be consistent across all routers in an attached network: **ipv6 ospf hello-interval** and **ipv6 ospf dead-interval** the hello interval and the dead interval. If you configure any of these parameters, be sure that the configurations for all routers on your network have compatible values.

To configure OSPFv3 interface parameters for IPv6, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf <i>process-id</i></pre> <p>Example: <pre>ciscoasa(config-if)# ipv6 router ospf 10</pre></p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process-id</i> argument is an internally used tag for this routing process and can be any positive integer. This tag does not have to match the tag on any other device; it is for internal use only. You can use a maximum of two processes.</p>
Step 2	<pre>ipv6 ospf area [<i>area-num</i>] [<i>instance</i>]</pre> <p>Example: <pre>ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200</pre></p>	<p>Creates an OSPFv3 area.</p> <p>The <i>area-num</i> argument is the area for which authentication is to be enabled and can be either a decimal value or an IP address. The instance keyword specifies the area instance ID that is to be assigned to an interface. An interface can have only one OSPFv3 area. You can use the same area on multiple interfaces, and each interface can use a different area instance ID.</p>
Step 3	<p>Do one of the following to configure OSPFv3 interface parameters:</p> <pre>ipv6 ospf cost <i>interface-cost</i></pre> <p>Example: <pre>ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200</pre></p>	<p>Explicitly specifies the cost of sending a packet on an interface. The <i>interface-cost</i> argument specifies an unsigned integer value expressed as the link-state metric, which can range in value from 1 to 65535. The default cost is based on the bandwidth.</p>

Command	Purpose
<p>ipv6 ospf database-filter all out</p> <p>Example:</p> <pre>ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf database-filter all out</pre>	<p>Filters outgoing LSAs to an OSPFv3 interface. All outgoing LSAs are flooded to the interface by default.</p>
<p>ipv6 ospf dead-interval seconds</p> <p>Example:</p> <pre>ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf dead-interval 60</pre>	<p>Sets the time period in seconds for which hello packets must not be seen before neighbors indicate that the router is down. The value must be the same for all nodes on the network and can range from 1 to 65535. The default is four times the interval set by the ipv6 ospf hello-interval command.</p>

Command	Purpose
<pre> ipv6 ospf encryption {ipsec spi spi esp encryption-algorithm [[key-encryption-type] key] authentication-algorithm [[key-encryption-type] key null} Example: ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf encryption ipsec spi 1001 esp null sha1 123456789A123456789B123456789C123456789D </pre>	<p>Specifies the encryption type for an interface. The ipsec keyword specifies the IP security protocol. The spi spi keyword-argument pair specifies the security policy index, which must be in the range of 256 to 42949667295 and entered as a decimal. The esp keyword specifies the encapsulating security payload. The <i>encryption-algorithm</i> argument specifies the encryption algorithm to be used with ESP. Valid values include the following:</p> <ul style="list-style-type: none"> • aes-cdc—Enables AES-CDC encryption. • 3des—Enables 3DES encryption. • des—Enables DES encryption. • null—Specifies ESP with no encryption. <p>The <i>key-encryption-type</i> argument can be one of the following two values:</p> <ul style="list-style-type: none"> • 0—The key is not encrypted. • 7—The key is encrypted. <p>The <i>key</i> argument specifies the number used in the calculation of the message digest. The number is 32 hexadecimal digits (16 bytes) long. The size of the key depends on the encryption algorithm used. Some algorithms, such as AES-CDC, allow you to choose the size of the key. The <i>authentication-algorithm</i> argument specifies the encryption authentication algorithm to be used, which can be one of the following:</p> <ul style="list-style-type: none"> • md5—Enables message digest 5 (MD5). • sha1—Enables SHA-1. <p>The null keyword overrides area encryption.</p> <p>Note If OSPFv3 encryption is enabled on an interface and a neighbor is on different area (for example, area 0), and you want the ASA to form adjacencies with that area, you must change the area on the ASA. After you have changed the area on the ASA to 0, there is a delay of two minutes before the OSPFv3 adjacency comes up.</p>
<pre> ipv6 ospf flood-reduction Example: ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf flood reduction </pre>	<p>Specifies the flood reduction of LSAs to the interface.</p>

Command	Purpose
<pre> ipv6 ospf hello-interval <i>seconds</i> Example: ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf hello-interval 15 </pre>	<p>Specifies the interval in seconds between hello packets sent on the interface. The value must be the same for all nodes on a specific network and can range from 1 to 65535. The default interval is 10 seconds for Ethernet interfaces and 30 seconds for non-broadcast interfaces.</p>
<pre> ipv6 ospf mtu-ignore Example: ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf mtu-ignore </pre>	<p>Disables the OSPF MTU mismatch detection when DBD packets are received. OSPF MTU mismatch detection is enabled by default.</p>
<pre> ipv6 ospf network {broadcast point-to-point non-broadcast} Example: ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf network point-to-point non-broadcast </pre>	<p>Sets the OSPF network type to a type other than the default, which depends on the network type. The point-to-point non-broadcast keyword sets the network type to point-to-point non-broadcast. The broadcast keyword sets the network type to broadcast.</p>

Command	Purpose
<pre> ipv6 ospf priority <i>number-value</i> Example: ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf priority 4 </pre>	<p>Sets the router priority, which helps determine the designated router for a network. Valid values range from 0 to 255.</p>
<pre> ipv6 ospf neighbor <i>ipv6-address</i> [priority <i>number</i>] [poll-interval <i>seconds</i>] [cost <i>number</i>] [database-filter all out] Example: ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf neighbor FE80::A8BB:CCFF:FE00:C01 </pre>	<p>Configures OSPFv3 router interconnections to non-broadcast networks.</p>

Command	Purpose
<p>Command</p> <pre>ipv6 ospf retransmit-interval seconds</pre> <p>Example:</p> <pre>ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf retransmit-interval 8</pre>	<p>Specifies the time in seconds between LSA retransmissions for adjacencies that belong to the interface. The time must be greater than the expected round-trip delay between any two routers on the attached network. Valid values range from 1 to 65535 seconds. The default is 5 seconds.</p>
<p>Command</p> <pre>ipv6 ospf transmit-delay seconds</pre> <p>Example:</p> <pre>ciscoasa(config-if)# interface GigabitEthernet3/2.200 vlan 200 nameif outside security-level 100 ip address 10.20.200.30 255.255.255.0 standby 10.20.200.31 ipv6 address 3001::1/64 standby 3001::8 ipv6 address 6001::1/64 standby 6001::8 ipv6 enable ospf priority 255 ipv6 ospf cost 100 ipv6 ospf 100 area 10 instance 200 ipv6 ospf retransmit-delay 3</pre>	<p>Sets the estimated time in seconds to send a link-state update packet on the interface. Valid values range from 1 to 65535 seconds. The default is 1 second.</p>

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Interfaces**.
- Step 2** Click the **Authentication** tab.
- Step 3** To specify the authentication parameters for an interface, select the interface and click **Edit**.
The Edit OSPFv3 Interface Authentication dialog box appears.
- Step 4** Choose the authentication type from the Authentication Type drop-down list. The available options are Area, Interface, and None. The None option indicates that no authentication is used.
- Step 5** Choose the authentication algorithm from the Authentication Algorithm drop-down list. Supported values are SHA-1 and MD5.
- Step 6** Enter the authentication key in the Authentication Key field. When MD5 authentication is used, the key must be 32 hexadecimal digits (16 bytes) long. When SHA-1 authentication is used, the key must be 40 hexadecimal digits (20 bytes) long.
- Step 7** Choose the encryption algorithm from the Encryption Algorithm drop-down list. Supported values are AES-CDC, 3DES, and DES. The NULL entry indicates no encryption.
- Step 8** Enter the encryption key in the Encryption Key field.
- Step 9** Click **OK**.

- Step 10** Click the **Properties** tab.
- Step 11** Select the interface whose properties you want to modify, and click **Edit**.
The Edit OSPFv3 Interface Properties dialog box appears.
- Step 12** Check the **Enable OSPFv3 on this interface** check box.
- Step 13** Choose the process ID from the drop-down list.
- Step 14** Choose the area ID from the drop-down list.
- Step 15** (Optional) Specify the area instance ID to be assigned to the interface. An interface can have only one OSPFv3 area. You can use the same area on multiple interfaces, and each interface can use a different area instance ID.
- Step 16** Choose the network type from the drop-down list. Supported options are Default, Broadcast, and Point-to-Point.
- Step 17** Enter the cost of sending a packet on an interface in the Cost field.
- Step 18** Enter the router priority, which helps determine the designated router for a network. in the Priority field. Valid values range from 0 to 255.
- Step 19** Check the **Disable MTU mismatch detection** check box to disable the OSPF MTU mismatch detection when DBD packets are received. OSPF MTU mismatch detection is enabled by default.
- Step 20** Check the **Filter outgoing link state advertisements** check box to filter outgoing LSAs to an OSPFv3 interface. All outgoing LSAs are flooded to the interface by default.
- Step 21** In the Timers area, in the Dead Interval field, enter the time period in seconds for which hello packets must not be seen before neighbors indicate that the router is down. The value must be the same for all nodes on the network and can range from 1 to 65535.
- Step 22** In the Hello Interval field, enter the interval in seconds between hello packets sent on the interface. The value must be the same for all nodes on a specific network and can range from 1 to 65535. The default interval is 10 seconds for Ethernet interfaces and 30 seconds for non-broadcast interfaces.
- Step 23** In the Retransmit Interval field, enter the time in seconds between LSA retransmissions for adjacencies that belong to the interface. The time must be greater than the expected round-trip delay between any two routers on the attached network. Valid values range from 1 to 65535 seconds. The default is 5 seconds.
- Step 24** In the Transmit Delay field, enter the estimated time in seconds to send a link-state update packet on the interface. Valid values range from 1 to 65535 seconds. The default is 1 second.
- Step 25** Click **OK**.
- Step 26** Click **Apply** to save your changes.
-

Configuring OSPFv3 Router Parameters

To configure OSPFv3 router parameters for IPv6, perform the following steps:

Command	Purpose
Step 1 <code>ipv6 router ospf process-id</code> Example: <code>ciscoasa(config)# ipv6 router ospf 10</code>	Enables an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.
Step 2 Do one of the following to configure optional OSPFv3 router parameters:	
<code>area</code> Example: <code>ciscoasa(config-rtr)# area 10</code>	Configures OSPFv3 area parameters. Supported parameters include the area ID as a decimal value from 0 to 4294967295 and the area ID in the IP address format of A.B.C.D.
default Example: <code>ciscoasa(config-rtr)# default originate</code>	Sets a command to its default value. The originate parameter distributes the default route.
default-information Example: <code>ciscoasa(config-rtr)# default-information</code>	Controls distribution of default information.
distance Example: <code>ciscoasa(config-rtr)# distance 200</code>	Defines the OSPFv3 route administrative distance based on the route type. Supported parameters include the administrative distance with values from 1 to 254 and ospf for the OSPFv3 distance.
<code>exit</code> Example: <code>ciscoasa(config-rtr)# exit</code>	Exits from IPv6 router configuration mode.
ignore Example: <code>ciscoasa(config-rtr)# ignore lsa</code>	Suppresses the sending of syslog messages with the lsa parameter when the router receives a link-state advertisement (LSA) for Type 6 Multicast OSPF (MOSPF) packets.
log-adjacency-changes Example: <code>ciscoasa(config-rtr)# log-adjacency-changes detail</code>	Configures the router to send a syslog message when an OSPFv3 neighbor goes up or down. With the detail parameter, all state changes are logged.

Command	Purpose
<p>passive-interface <i>[interface_name]</i></p> <p>Example: <pre>ciscoasa(config-rtr)# passive-interface inside</pre></p>	<p>Suppresses the sending and receiving of routing updates on an interface. The <i>interface_name</i> argument specifies the name of the interface on which the OSPFv3 process is running.</p>
<p>redistribute</p> <p>Example: <pre>ciscoasa(config-rtr)# redistribute ospf</pre></p>	<p>Configures the redistribution of routes from one routing domain into another according to the following parameters:</p> <ul style="list-style-type: none"> • connected—Specifies connected routes. • ospf—Specifies OSPFv3 routes. • static—Specifies static routes.
<p>router-id</p> <p>Example: <pre>ciscoasa(config-rtr)# router-id 10.1.1.1</pre></p>	<p>Creates a fixed router ID for a specified process with the following parameters:</p> <ul style="list-style-type: none"> • A.B.C.D—Specifies the OSPF router ID in IP address format. • cluster-pool—Configures an IP address pool when Layer 3 clustering is configured. For more information about IP address pools used in clustering, see the “Configuring an IP Address Pool for Clustering (OSPFv2 and OSPFv3)” section on page 27-22.
<p>summary-prefix</p> <p>Example: <pre>ciscoasa(config-if)# ipv6 router ospf 1 ciscoasa(config-router)# router-id 192.168.3.3 ciscoasa(config-router)# summary-prefix FECO::/24 ciscoasa(config-router)# redistribute static</pre></p>	<p>Configures IPv6 address summaries with valid values from 0 to 128. The X:X:X:X::X/ parameter specifies the IPv6 prefix.</p>
<p>timers</p> <p>Example: <pre>ciscoasa(config)# ipv6 router ospf 10 ciscoasa(config-rtr)# timers throttle spf 6000 12000 14000</pre></p>	<p>Adjusts routing timers. The routing timer parameters are the following:</p> <ul style="list-style-type: none"> • lsa—Specifies OSPFv3 LSA timers. • pacing—Specifies OSPFv3 pacing timers. • throttle—Specifies OSPFv3 throttle timers.

Configuring OSPFv3 Area Parameters

To configure OSPFv3 area parameters, perform the following steps:

	Command	Purpose
Step 1	<pre>ipv6 router ospf process-id</pre> <p>Example: ciscoasa(config)# ipv6 router ospf 1</p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	Do one of the following to configure optional OSPFv3 area parameters:	
	<pre>area area-id default-cost cost</pre> <p>Example: ciscoasa(config-rtr)# area 1 default-cost nssa</p>	<p>Sets the summary default cost of an NSSA area or a stub area.</p>
	<pre>area area-id range ipv6-prefix/ prefix-length [advertise not advertise] [cost cost]</pre> <p>Example: ciscoasa(config-rtr)# area 1 range FE01:1::1/64</p>	<p>Summarizes routes that match the address and mask for border routers only.</p> <p>The <i>area-id</i> argument identifies the area for which routes are to be summarized. The value can be specified as a decimal or an IPv6 prefix. The <i>ipv6-prefix</i> argument specifies the IPv6 prefix. The <i>prefix-length</i> argument specifies the prefix length. The advertise keyword sets the address range status to advertised and generates a Type 3 summary LSA. The not-advertise keyword sets the address range status to DoNotAdvertise. The Type 3 summary LSA is suppressed, and the component networks remain hidden from other networks. The cost cost keyword-argument pair specifies the metric or cost for the summary route, which is used during OSPF SPF calculations to determine the shortest paths to the destination. Valid values range from 0 to 16777215.</p>
	<pre>area area-id nssa</pre> <p>Example: ciscoasa(config-rtr)# area 1 nssa</p>	<p>Specifies an NSSA area.</p>

Command	Purpose
<p>area <i>area-id</i> stub</p> <p>Example: ciscoasa(config-rtr)# area 1 stub</p>	<p>Specifies a stub area.</p>
<p>area <i>area-id</i> virtual-link <i>router-id</i> [hello-interval <i>seconds</i>] [retransmit-interval <i>seconds</i>] [transmit-delay <i>seconds</i>] [dead-interval <i>seconds</i>] [ttl-security hops <i>hop-count</i>]</p> <p>Example: ciscoasa(config-rtr)# area 1 virtual-link 192.168.255.1 hello-interval 5</p>	<p>Defines a virtual link and its parameters.</p> <p>The <i>area-id</i> argument identifies the area for which routes are to be summarized. The virtual link keyword specifies the creation of a virtual link neighbor. The <i>router-id</i> argument specifies the router ID that is associated with the virtual link neighbor. Enter the show ospf or show ipv6 ospf command to display the router ID. There is no default value. The hello-interval keyword specifies the time in seconds between the hello packets that are sent on an interface. The hello interval is an unsigned integer that is to be advertised in the hello packets. The value must be the same for all routers and access servers that are attached to a common network. Valid values range from 1 to 8192. The default is 10. The retransmit-interval <i>seconds</i> keyword-argument pair specifies the time in seconds between LSA retransmissions for adjacencies that belong to the interface. The retransmit interval is the expected round-trip delay between any two routers on the attached network. The value must be greater than the expected round-trip delay, and can range from 1 to 8192. The default is 5. The transmit-delay <i>seconds</i> keyword-argument pair specifies the estimated time in seconds that is required to send a link-state update packet on the interface. The integer value must be greater than zero. LSAs in the update packet have their own ages incremented by this amount before transmission. The range of values can be from 1 to 8192. The default is 1. The dead-interval <i>seconds</i> keyword-argument pair specifies the time in seconds that hello packets are not seen before a neighbor indicates that the router is down. The dead interval is an unsigned integer. The default is four times the hello interval, or 40 seconds. The value must be the same for all routers and access servers that are attached to a common network. Valid values range from 1 to 8192. The ttl-security hops keyword configures the time-to-live (TTL) security on a virtual link. The <i>hop-count</i> argument value can range from 1 to 254.</p>

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
- Step 2** Click the **Areas** tab.
- Step 3** To add a new area, click **Add**. To modify an existing area, click **Edit**. To remove a selected area, click **Delete**.
The Add OSPFv3 Area dialog box or Edit OSPFv3 Area dialog box appears.
- Step 4** From the OSPFv3 Process ID drop-down list, choose the process ID.
- Step 5** Enter the area ID, which specifies the area for which routes are to be summarized, in the Area ID field.
- Step 6** Choose the area type from the Area Type drop-down list. Available options are Normal, NSSA, and Stub.

- Step 7** To allow the sending of summary LSAs into the area, check the **Allow sending of summary LSAs into the area** check box.
- Step 8** To allow redistribution to import routes to normal and not so stubby areas, check the **Redistribution imports routes to normal and NSSA areas** check box.
- Step 9** To generate a default external route into an OSPFv3 routing domain, check the **Default information originate** check box.
- Step 10** Enter the metric used for generating the default route in the Metric field. The default value is 10. Valid metric values range from 0 to 16777214.
- Step 11** Choose the metric type from the Metric Type drop-down list. The metric type is the external link type that is associated with the default route that is advertised into the OSPFv3 routing domain. The available options are 1 for a Type 1 external route or 2 for a Type 2 external route.
- Step 12** Enter the cost in the Default Cost field.
- Step 13** Click **OK**.
- Step 14** Click the **Route Summarization** tab.
- Step 15** To specify a new range for consolidating and summarizing routes, click **Add**. To modify an existing range for consolidating and summarizing routes, click **Edit**.
- The Add Route Summarization dialog box or Edit Route Summarization dialog box appears.
- Step 16** Choose the process ID from the Process ID drop-down list.
- Step 17** Choose the area ID from the Area ID drop-down list.
- Step 18** Enter the IPv6 prefix and prefix length in the IPv6 Prefix/Prefix Length field.
- Step 19** (Optional) Enter the metric or cost for the summary route, which is used during OSPF SPF calculations to determine the shortest paths to the destination. Valid values range from 0 to 16777215.
- Step 20** Check the **Advertised** check box to set the address range status to advertised and generate a Type 3 summary LSA.
- Step 21** Click **OK**.
- Step 22** To continue, see the [“Configuring a Virtual Link Neighbor”](#) section on page 27-42.

Configuring a Virtual Link Neighbor

To configure a virtual link neighbor, perform the following steps:

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Virtual Link**.
- Step 2** To add a new virtual link neighbor, click **Add**. To modify an existing virtual link neighbor, click **Edit**. To remove a selected virtual link neighbor, click **Delete**.
- The Add Virtual Link dialog box or Edit Virtual Link dialog box appears.
- Step 3** Choose the process ID from the Process ID drop-down list.
- Step 4** Choose the area ID from the Area ID drop-down list.
- Step 5** Enter the peer router ID (that is, the IP address) in the Peer Router ID field.

- Step 6** (Optional) Enter the time-to-live (TTL) security hop count on a virtual link in the TTL Security field. The hop count value can range from 1 to 254.
- Step 7** In the Timers area, enter the time in seconds that hello packets are not seen before a neighbor indicates that the router is down in the Dead Interval field. The dead interval is an unsigned integer. The default is four times the hello interval, or 40 seconds. The value must be the same for all routers and access servers that are attached to a common network. Valid values range from 1 to 8192.
- Step 8** Enter the time in seconds between the hello packets that are sent on an interface in the Hello Interval field. The hello interval is an unsigned integer that is to be advertised in the hello packets. The value must be the same for all routers and access servers that are attached to a common network. Valid values range from 1 to 8192. The default is 10.
- Step 9** Enter the time in seconds between LSA retransmissions for adjacencies that belong to the interface in the Retransmit Interval field. The retransmit interval is the expected round-trip delay between any two routers on the attached network. The value must be greater than the expected round-trip delay, and can range from 1 to 8192. The default is 5.
- Step 10** Enter the estimated time in seconds that is required to send a link-state update packet on the interface in the Transmit Delay field. The integer value must be greater than zero. LSAs in the update packet have their own ages incremented by this amount before transmission. The range of values can be from 1 to 8192. The default is 1.
- Step 11** In the Authentication area, check the **Enable Authentication** check box to enable authentication.
- Step 12** Enter the security policy index, which must be a number from 256 to 4294967295, in the Security Policy Index field.
- Step 13** Choose the authentication algorithm from the Authentication Algorithm drop-down list. Supported values are SHA-1 and MD5. When MD5 authentication is used, the key must be 32 hexadecimal digits (16 bytes) long. When SHA-1 authentication is used, the key must be 40 hexadecimal digits (20 bytes) long.
- Step 14** Enter the authentication key in the Authentication Key field. The key must include 32 hexadecimal characters.
- Step 15** Choose the encryption algorithm from the Encryption Algorithm drop-down list. Supported values are AES-CDC, 3DES, and DES. The NULL entry indicates no encryption.
- Step 16** Enter the encryption key in the Encryption Key field.
- Step 17** Click **OK**.
- Step 18** Click **Apply** to save your changes.
-

Configuring OSPFv3 Passive Interfaces

To configure OSPFv3 passive interfaces, perform the following steps:

	Command	Purpose
Step 1	<code>ipv6 router ospf <i>process_id</i></code> Example: <code>ciscoasa(config-if)# ipv6 router ospf 1</code>	Enables an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process_id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.
Step 2	<code>passive-interface [<i>interface_name</i>]</code> Example: <code>ciscoasa(config-rtr)# passive-interface inside</code>	Suppresses the sending and receiving of routing updates on an interface. The <i>interface_name</i> argument specifies the name of the interface on which the OSPFv3 process is running. If the <i>no interface_name</i> argument is specified, all of the interfaces in the OSPFv3 process <i>process_id</i> are made passive.

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
- Step 2** Click the **Process Instances** tab.
- Step 3** Choose the OSPFv3 process that you want to edit, then click **Advanced**.
The Edit OSPFv3 Process Advanced Properties dialog box appears.
- Step 4** The Passive Interfaces area allows you to enable passive OSPFv3 routing on an interface. Passive routing assists in controlling the advertisement of OSPFv3 routing information and disables the sending and receiving of OSPFv3 routing updates on an interface. In the Passive Interfaces area, choose the following settings:
- Check the **Global passive** check box to make all of the interfaces listed in the table passive. Uncheck individual interfaces to make them non-passive.
 - Uncheck the **Global passive** check box to make all of the interfaces non-passive. Check individual interfaces to make them passive.
- Step 5** Click **OK**.
- Step 6** Click **Apply** to save your changes.
-

Configuring OSPFv3 Administrative Distance

To configure OSPFv3 administrative distance for IPv6 routes, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf process_id</pre> <p>Example: ciscoasa(config-if)# ipv6 router ospf 1</p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process_id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	<pre>distance [ospf {external inter-area intra-area}] distance</pre> <p>Example: ciscoasa(config-rtr)# distance ospf external 200</p>	<p>Sets the administrative distance for OSPFv3 routes.</p> <p>The ospf keyword specifies OSPFv3 routes. The external keyword specifies the external Type 5 and Type 7 routes for OSPFv3. The inter-area keyword specifies the inter-area routes for OSPFv3. The intra-area keyword specifies the intra-area routes for OSPFv3. The <i>distance</i> argument specifies the administrative distance, which is an integer from 10 to 254.</p>

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.

Step 2 Click the **Process Instances** tab.

Step 3 Choose the OSPF process that you want to edit, then click **Advanced**.

The Edit OSPFv3 Process Advanced Properties dialog box appears.

The Administrative Route Distances area allows you to modify the settings that were used to configure administrative route distances. The administrative route distance is an integer from 10 to 254. In the Administrative Route Distances area, enter the following values:

- The Inter Area, which specifies the inter-area routes for OSPF for IPv6 routes.
- The Intra Area, which specifies the intra-area routes for OSPF for IPv6 routes.
- The External, which specifies the external type 5 and type 7 routes for OSPF for IPv6 routes.

Step 4 Click **OK**.

Step 5 Click **Apply** to save your changes.

Configuring OSPFv3 Timers

You can set LSA arrival, LSA pacing, and throttling timers for OSPFv3.

To set the minimum interval at which the ASA accepts the same LSA from OSPFv3 neighbors, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>ipv6 router ospf process-id</code> Example: <code>ciscoasa(config-if)# ipv6 router ospf 1</code>	Enables an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.
Step 2	<code>timers lsa arrival milliseconds</code> Example: <code>ciscoasa(config-rtr)# timers lsa arrival 2000</code>	Sets the minimum interval at which the ASA accepts the same LSA from OSPF neighbors. The <i>milliseconds</i> argument specifies the minimum delay in milliseconds that must pass between acceptance of the same LSA arriving from neighbors. The range is from 0 to 6,000,000 milliseconds. The default is 1000 milliseconds.

To configure LSA flood packet pacing, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>ipv6 router ospf process-id</code> Example: <code>ciscoasa(config-if)# ipv6 router ospf 1</code>	Enables an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.
Step 2	<code>timers pacing flood milliseconds</code> Example: <code>ciscoasa(config-rtr)# timers lsa flood 20</code>	Configures LSA flood packet pacing. The <i>milliseconds</i> argument specifies the time in milliseconds at which LSAs in the flooding queue are paced in between updates. The configurable range is from 5 to 100 milliseconds. The default value is 33 milliseconds.

To change the interval at which OSPFv3 LSAs are collected into a group and refreshed, check summed, or aged, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>ipv6 router ospf process-id</code> Example: <code>ciscoasa(config-if)# ipv6 router ospf 1</code>	Enables an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.
Step 2	<code>timers pacing lsa-group seconds</code> Example: <code>ciscoasa(config-rtr)# timers pacing lsa-group 300</code>	Changes the interval at which OSPFv3 LSAs are collected into a group and refreshed, checksummed, or aged. The <i>seconds</i> argument specifies the number of seconds in the interval at which LSAs are grouped, refreshed, check summed, or aged. The range is from 10 to 1800 seconds. The default value is 240 seconds.

To configure LSA retransmission packet pacing, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>ipv6 router ospf process-id</code> Example: <code>ciscoasa(config-if)# ipv6 router ospf 1</code>	Enables an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.
Step 2	<code>timers pacing retransmission milliseconds</code> Example: <code>ciscoasa(config-rtr)# timers pacing retransmission 100</code>	Configures LSA retransmission packet pacing. The <i>milliseconds</i> argument specifies the time in milliseconds at which LSAs in the retransmission queue are paced. The configurable range is from 5 to 200 milliseconds. The default value is 66 milliseconds.

LSA and SPF throttling provide a dynamic mechanism to slow down LSA updates in OSPFv3 during times of network instability and allow faster OSPFv3 convergence by providing LSA rate limiting in milliseconds.

To configure LSA and SPF throttling timers, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf <i>process-id</i></pre> <p>Example: <pre>ciscoasa(config-if)# ipv6 router ospf 1</pre></p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	Choose one of the following options:	

Command	Purpose
<pre>timers throttle lsa milliseconds1 milliseconds2 milliseconds3</pre> <p>Example:</p> <pre>ciscoasa(config-rtr)# timers throttle lsa 500 6000 8000</pre>	<p>Configures OSPFv3 LSA throttling.</p> <p>The <i>milliseconds1</i> argument specifies the delay in milliseconds to generate the first occurrence of the LSA. The <i>milliseconds2</i> argument specifies the maximum delay in milliseconds to originate the same LSA. The <i>milliseconds3</i> argument specifies the minimum delay in milliseconds to originate the same LSA.</p> <p>For LSA throttling, if the minimum or maximum time is less than the first occurrence value, then OSPFv3 automatically corrects to the first occurrence value. Similarly, if the maximum delay specified is less than the minimum delay, then OSPFv3 automatically corrects to the minimum delay value.</p> <p>The default values for LSA throttling are the following:</p> <ul style="list-style-type: none"> • For <i>milliseconds1</i>, the default value is 0 milliseconds. • For <i>milliseconds2</i> and <i>milliseconds3</i>, the default value is 5000 milliseconds.
<pre>timers throttle spf milliseconds1 milliseconds2 milliseconds3</pre> <p>Example:</p> <pre>ciscoasa(config-rtr)# timers throttle spf 5000 12000 16000</pre>	<p>Configures OSPFv3 SPF throttling.</p> <p>The <i>milliseconds1</i> argument specifies the delay in milliseconds to receive a change to the SPF calculation. The <i>milliseconds2</i> argument specifies the delay in milliseconds between the first and second SPF calculations. The <i>milliseconds3</i> argument specifies the maximum wait time in milliseconds for SPF calculations.</p> <p>For SPF throttling, if <i>milliseconds2</i> or <i>milliseconds3</i> is less than <i>milliseconds1</i>, then OSPFv3 automatically corrects to the <i>milliseconds1</i> value. Similarly, if <i>milliseconds3</i> is less than <i>milliseconds2</i>, then OSPFv3 automatically corrects to the <i>milliseconds2</i> value.</p> <p>The default values for SPF throttling are the following:</p> <ul style="list-style-type: none"> • For <i>milliseconds1</i>, the default value is 5000 milliseconds. • For <i>milliseconds2</i> and <i>milliseconds3</i>, the default value is 10000 milliseconds.

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
- Step 2** Click the **Process Instances** tab.
- Step 3** Choose the OSPFv3 process that you want to edit, then click **Advanced**.
The Edit OSPFv3 Process Advanced Properties dialog box appears.
- Step 4** The Timers area allows you to modify the settings that are used to configure LSA arrival, LSA pacing, LSA retransmission, LSA throttle, and SPF throttle times. In the Timers area, enter the following values:
 - The LSA Arrival, which specifies the minimum delay in milliseconds that must pass between acceptance of the same LSA arriving from neighbors. The range is from 0 to 6000,000 milliseconds. The default is 1000 milliseconds.
 - The LSA Flood Pacing, which specifies the time in milliseconds at which LSAs in the flooding queue are paced in between updates. The configurable range is from 5 to 100 milliseconds. The default value is 33 milliseconds.

- The LSA Group Pacing, which specifies the interval in seconds at which LSAs are collected into a group and refreshed, check summed, or aged. Valid values range from 10 to 1800. The default value is 240.
- The LSA Retransmission Pacing, which specifies the time in milliseconds at which LSAs in the retransmission queue are paced. The configurable range is from 5 to 200 milliseconds. The default value is 66 milliseconds.
- The LSA Throttle Initial, which specifies the delay in milliseconds to generate the first occurrence of the LSA. The default value is 0 milliseconds.
- The LSA Throttle Min Hold, which specifies the minimum delay in milliseconds to originate the same LSA. The default value is 5000 milliseconds.
- The LSA Throttle Max Wait, which specifies the maximum delay in milliseconds to originate the same LSA. The default value is 5000 milliseconds.



Note For LSA throttling, if the minimum or maximum time is less than the first occurrence value, then OSPFv3 automatically corrects to the first occurrence value. Similarly, if the maximum delay specified is less than the minimum delay, then OSPFv3 automatically corrects to the minimum delay value.

- The SPF Throttle Initial, specifies the delay in milliseconds to receive a change to the SPF calculation. The default value is 5000 milliseconds.
- The SPF Throttle Min Hold, which specifies the delay in milliseconds between the first and second SPF calculations. The default value is 10000 milliseconds.
- The SPF Throttle Max Wait, which specifies the maximum wait time in milliseconds for SPF calculations. The default value is 10000 milliseconds.



Note For SPF throttling, if the minimum or maximum time is less than the first occurrence value, then OSPFv3 automatically corrects to the first occurrence value. Similarly, if the maximum delay specified is less than the minimum delay, then OSPFv3 automatically corrects to the minimum delay value.

Step 5 Click **OK**.

Step 6 Click **Apply** to save your changes.

Defining Static OSPFv3 Neighbors

You need to define static OSPFv3 neighbors to advertise OSPF routes over a point-to-point, non-broadcast network. This feature lets you broadcast OSPFv3 advertisements across an existing VPN connection without having to encapsulate the advertisements in a GRE tunnel.

Before you begin, you must create a static route to the OSPFv3 neighbor. See [Chapter 25, “Configuring Static and Default Routes,”](#) for more information about creating static routes.

To define a static OSPFv3 neighbor, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf process-id</pre> <p>Example: ciscoasa(config)# ipv6 router ospf 1</p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	<pre>ipv6 ospf neighbor ipv6-address [priority number] [poll-interval seconds] [cost number] [database-filter all out]</pre> <p>Example: ciscoasa(config-if)# interface ethernet0/0 ipv6 ospf neighbor FE80::A8BB:CCFF:FE00:C01</p>	<p>Configures OSPFv3 router interconnections to non-broadcast networks.</p>

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Static Neighbor**.
- Step 2** Click **Add** or **Edit**.
- The Add or Edit Static Neighbor dialog box appears. This dialog box lets you define a new static neighbor or change information for an existing static neighbor. You must define a static neighbor for each point-to-point, nonbroadcast interface. Note the following restrictions:
- You cannot define the same static neighbor for two different OSPFv3 processes.
 - You need to define a static route for each static neighbor.
- Step 3** From the Interface drop-down list, choose the interface associated with the static neighbor. If you are editing an existing static neighbor, you cannot change this value.
- Step 4** In the Link-local Address field, enter the IPv6 address of the static neighbor.
- Step 5** (Optional) In the Priority field, enter the priority level.
- Step 6** (Optional) In the Poll Interval field, enter the poll interval in seconds.
- Step 7** Click **OK**.
-

Resetting OSPFv3 Default Parameters

To return an OSPFv3 parameter to its default value, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf process-id</pre> <p>Example: ciscoasa(config-if)# ipv6 router ospf 1</p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process_id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	<pre>default [area auto-cost default-information default-metric discard-route discard-route distance distribute-list ignore log-adjacency-changes maximum-paths passive-interface redistribute router-id summary-prefix timers]</pre> <p>Example: ciscoasa(config-rtr)# default metric 5</p>	<p>Returns an optional parameter to its default value.</p> <p>The area keyword specifies the OSPFv3 area parameters. The auto-cost keyword specifies the OSPFv3 interface cost according to bandwidth. The default-information keyword distributes default information. The default-metric keyword specifies the metric for a redistributed route. The discard-route keyword enables or disables the discard-route installation. The distance keyword specifies the administrative distance. The distribute-list keyword filters networks in routing updates. The ignore keyword ignores a specific event. The log-adjacency-changes keyword logs changes in the adjacency state. The maximum-paths keyword forwards packets over multiple paths. The passive-interface keyword suppresses routing updates on an interface. The redistribute keyword redistributes IPv6 prefixes from another routing protocol. The router-id keyword specifies the router ID for the specified routing process. The summary-prefix keyword specifies the IPv6 summary prefix. The timers keyword specifies the OSPFv3 timers.</p>

Sending Syslog Messages

To configure the router to send a syslog message when an OSPFv3 neighbor goes up or down, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf process-id</pre> <p>Example: ciscoasa(config-if)# ipv6 router ospf 1</p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	<pre>log-adjacency-changes [detail]</pre> <p>Example: ciscoasa(config-rtr)# log-adjacency-changes detail</p>	<p>Configures the router to send a syslog message when an OSPFv3 neighbor goes up or down.</p> <p>The detail keyword sends a syslog message for each state, not only when an OSPFv3 neighbor goes up or down.</p>

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.

Step 2 Click the **Process Instances** tab.

Step 3 Choose the OSPF process that you want to edit, then click **Advanced**.

The Edit OSPFv3 Process Advanced Properties dialog box appears.

The Adjacency Changes area allows you to modify the settings for sending syslog messages when an OSPFv3 neighbor goes up or down. In the Adjacency Changes area, do the following:

- To send a syslog message when an OSPFv3 neighbor goes up or down, check the **Log Adjacency Changes** check box.
- To send a syslog message for each state, not only when an OSPFv3 neighbor goes up or down, check the **Include Details** check box.

Step 4 Click **OK**.

Step 5 Click **Apply** to save your changes.

Suppressing Syslog Messages

To suppress the sending of syslog messages when the route receives unsupported LSA Type 6 multicast OSPF (MOSPF) packets, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>router ospf process_id</pre> <p>Example: ciscoasa(config-if)# router ospf 1 </p>	<p>Enables an OSPFv2 routing process and enters router configuration mode.</p> <p>The <i>process_id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	<pre>ignore lsa mospf</pre> <p>Example: ciscoasa(config-rtr)# ignore lsa mospf </p>	<p>Suppresses the sending of syslog messages when the router receives unsupported LSA Type 6 MOSPF packets.</p>

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
 - Step 2** Click the **Process Instances** tab.
 - Step 3** Choose the OSPFv3 process that you want to edit, then click **Advanced**.
The Edit OSPFv3 Process Advanced Properties dialog box appears.
 - Step 4** Check the **Ignore LSA MOSPF** check box, then click **OK**.
-

Calculating Summary Route Costs

To calculate summary route costs according to RFC 1583, enter the following commandperform the following steps:

Command	Purpose
<pre>compatible rfc1583</pre> <p>Example: ciscoasa (config-rtr)# compatible rfc1583 </p>	<p>Restores the methods that are used to calculate summary route costs according to RFC 1583.</p>

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
 - Step 2** Click the **Process Instances** tab.
 - Step 3** Choose the OSPF process that you want to edit, then click **Advanced**.

The Edit OSPFv3 Process Advanced Properties dialog box appears.

- Step 4** Check the **RFC1583 Compatible** check box, then click **OK**.

Generating a Default External Route into an OSPFv3 Routing Domain

To generate a default route into an OSPFv3 routing domain, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf process-id</pre> <p>Example: ciscoasa(config-if)# ipv6 router ospf 1</p>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	<pre>default-information originate [always] metric metric-value [metric-type type-value] [route-map map-name]</pre> <p>Example: ciscoasa(config-rtr)# default-information originate always metric 3 metric-type 2</p>	<p>Generates a default external route into an OSPFv3 routing domain.</p> <p>The always keyword advertises the default route whether or not the default route exists. The metric <i>metric-value</i> keyword-argument pair specifies the metric used for generating the default route. If you do not specify a value using the default-metric command, the default value is 10. Valid metric values range from 0 to 16777214. The metric-type <i>type-value</i> keyword-argument pair specifies the external link type that is associated with the default route that is advertised into the OSPFv3 routing domain. Valid values can be one of the following:</p> <ul style="list-style-type: none"> • 1—Type 1 external route • 2—Type 2 external route <p>The default is the type 2 external route. The route-map <i>map-name</i> keyword-argument pair specifies the routing process that generates the default route if the route map is satisfied.</p>

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
- Step 2** Click the **Process Instances** tab.
- Step 3** Choose the OSPFv3 process that you want to edit, then click **Advanced**.
The Edit OSPFv3 Process Advanced Properties dialog box appears.
- Step 4** In the Default Information Originate Area, do the following:
- Check the **Enable** check box to enable the OSPFv3 routing process.

- b. Check the **Always advertise** check box to always advertise the default route, whether or not one exists.
- c. Enter the metric used for generating the default route in the Metric field. Valid metric values range from 0 to 16777214. The default value is 10.
- d. From the Metric Type drop-down list, choose the external link type that is associated with the default route that is advertised into the OSPFv3 routing domain. Valid values are the following:
 - 1—Type 1 external route
 - 2—Type 2 external route
 The default is the Type 2 external route.
- e. From the Route Map drop-down list, choose the routing process that generates the default route if the route map is satisfied.

Step 5 Click **OK**.

Step 6 Click **Apply** to save your changes.

Configuring an IPv6 Summary Prefix

To configure an IPv6 summary prefix, perform the following steps:

Detailed Steps

	Command	Purpose
Step 1	<code>ipv6 router ospf process-id</code> Example: ciscoasa(config-if)# ipv6 router ospf 1	Enables an OSPFv3 routing process and enters IPv6 router configuration mode. The <i>process_id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.
Step 2	<code>summary-prefix prefix [not-advertise tag tag-value]</code> Example: ciscoasa(config-if)# ipv6 router ospf 1 ciscoasa(config-rtr)# router-id 192.168.3.3 ciscoasa(config-rtr)# summary-prefix FECO::/24 ciscoasa(config-rtr)# redistribute static	Configures an IPv6 summary prefix. The <i>prefix</i> argument is the IPv6 route prefix for the destination. The not-advertise keyword suppresses routes that match the specified prefix and mask pair. This keyword applies to OSPFv3 only. The tag tag-value keyword-argument pair specifies the tag value that can be used as a match value for controlling redistribution through route maps. This keyword applies to OSPFv3 only.

Step 1 In the ASDM main window, choose **Configuration > Device Setup > Routing > OSPFv3 > Summary Prefix**.

Step 2 To add a new summary prefix, click **Add**. To modify an existing summary prefix, click **Edit**. To remove a summary prefix, click **Delete**.

The Add Summary Prefix dialog box or Edit Summary Prefix dialog box appears.

- Step 3** Choose the process ID from the Process ID drop-down list.
 - Step 4** Enter the IPv6 prefix and prefix length in the IPv6 Prefix/Prefix Length field.
 - Step 5** Check the **Advertise** check box to advertise routes that match the specified prefix and mask pair. Uncheck this check box to suppress routes that match the specified prefix and mask pair.
 - Step 6** Enter the tag value that you can use as a match value for controlling redistribution through route maps in the Tag field.
 - Step 7** Click **OK**.
 - Step 8** Click **Apply** to save your changes.
-

Redistributing IPv6 Routes

To redistribute connected routes into an OSPFv3 process, perform the following steps:

- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Redistribution**.
- Step 2** To add new parameters for redistributing connected routes into an OSPFv3 process, click **Add**. To modify existing parameters for redistributing connected routes into an OSPFv3 process, click **Edit**. To remove a selected set of parameters, click **Delete**.
The Add Redistribution dialog box or Edit Redistribution dialog box appears.
- Step 3** Choose the process ID from the Process ID drop-down list.
- Step 4** Choose the source protocol from which routes are being redistributed from the Source Protocol drop-down list. The supported protocols are connected, static, and OSPF.
- Step 5** Enter the metric value in the Metric field. When redistributing routes from one OSPF process into another OSPF process on the same router, the metric is carried through from one process to the other if no metric value is specified. When redistributing other processes into an OSPF process, the default metric is 20 when no metric value is specified.
- Step 6** Choose the metric type from the Metric Type drop-down list. The available options are None, 1, and 2.
- Step 7** (Optional) Enter the tag value in the Tag field. This parameter specifies the 32-bit decimal value attached to each external route, which may be used to communicate information between ASBRs. If none is specified, then the remote autonomous system number is used for routes from BGP and EGP. For other protocols, zero is used. Valid values are from 0 to 4294967295.
- Step 8** Choose the route map from the Route Map drop-down list to check for filtering the importing of routes from the source routing protocol to the current routing protocol. If this parameter is not specified, all routes are redistributed. If this parameter is specified, but no route map tags are listed, no routes are imported.
- Step 9** To include connected routes in the redistribution, check the **Include connected** check box.
- Step 10** Check the **Match** check box to redistribute routes into other routing domains, then check one of the following check boxes:
 - **Internal** for routes that are internal to a specific autonomous system
 - **External 1** for routes that are external to the autonomous system, but are imported into OSPFv3 as Type 1 external routes

- **External 2** for routes that are external to the autonomous system, but are imported into OSPFv3 as Type 2 external routes
- **NSSA External 1** for routes that are external to the autonomous system, but are imported into OSPFv3 in an NSSA for IPv6 as Type 1 external routes
- **NSSA External 2** for routes that are external to the autonomous system, but are imported into OSPFv3 in an NSSA for IPv6 as Type 2 external routes

Step 11 Click **OK**.

Step 12 Click **Apply** to save your changes.

Detailed Steps

	Command	Purpose
Step 1	<pre>ipv6 router ospf process-id</pre> <p>Example:</p> <pre>ciscoasa(config-if)# ipv6 router ospf 1</pre>	<p>Enables an OSPFv3 routing process and enters IPv6 router configuration mode.</p> <p>The <i>process-id</i> argument is an internally used identifier for this routing process, is locally assigned, and can be any positive integer from 1 to 65535. This ID does not have to match the ID on any other device; it is for internal administrative use only. You can use a maximum of two processes.</p>
Step 2	<pre>redistribute source-protocol [process-id] [include-connected {[level-1 level-2]}] [as-number] [metric [metric-value transparent]] [metric-type type-value] [match {external [1 2] internal nssa-external [1 2]}] [tag tag-value] [route-map map-tag]</pre> <p>Example:</p> <pre>ciscoasa(config-rtr)# redistribute connected 5 type-1</pre>	<p>Redistributes IPv6 routes from one OSPFv3 process into another.</p> <p>The <i>source-protocol</i> argument specifies the source protocol from which routes are being redistributed, which can be static, connected, or OSPFv3. The <i>process-id</i> argument is the number that is assigned administratively when the OSPFv3 routing process is enabled. The include-connected keyword allows the target protocol to redistribute routes learned by the source protocol and connected prefixes on those interfaces over which the source protocol is running. The level-1 keyword specifies that for Intermediate System-to-Intermediate System (IS-IS), Level 1 routes are redistributed into other IP routing protocols independently. The level-1-2 keyword specifies that for IS-IS, both Level 1 and Level 2 routes are redistributed into other IP routing protocols. The level-2 keyword specifies that for IS-IS, Level 2 routes are redistributed into other IP routing protocols independently. For the metric <i>metric-value</i> keyword-argument pair, when redistributing routes from one OSPFv3 process into another OSPFv3 process on the same router, the metric is carried through from one process to the other if no metric value is specified. When redistributing other processes into an OSPFv3 process, the default metric is 20 when no metric value is specified. The metric transparent keyword causes RIP to use the routing table metric for redistributed routes as the RIP metric. The metric-type <i>type-value</i> keyword-argument pair specifies the external link type that is associated with the default route that is advertised into the OSPFv3 routing domain. Valid values can be one of the following: 1 for a Type 1 external route or 2 for a Type 2 external route. If no value is specified for the metric-type keyword, the ASA adopts a Type 2 external route. For IS-IS, the link type can be one of the following: internal for an IS-IS metric that is less than 63 or external for an IS-IS metric that is greater than 64 and less than 128. The default is internal. The match keyword redistributes routes into other routing domains and is used with one of the following options: external [1 2] for routes that are external to the autonomous system, but are imported into OSPFv3 as Type 1 or Type 2 external routes; internal for routes that are internal to a specific autonomous system; nssa-external [1 2] for routes that are external to the autonomous system, but are imported into OSPFv3 in an NSSA for IPv6 as Type 1 or Type 2 external routes. The tag tag-value keyword-argument pair specifies the 32-bit decimal value that is attached to each external route, which may be used to communicate information between ASBRs. If none is specified, then the remote autonomous system number is used for routes from BGP and EGP. For other protocols, zero is used. Valid values range from 0 to 4294967295. The route-map keyword specifies the route map to check for filtering the importing of routes from the source routing protocol to the current routing protocol. If this keyword is not specified, all routes are redistributed. If this keyword is specified, but no route map tags are listed, no routes are imported. The <i>map-tag</i> argument identifies a configured route map.</p>

Removing the OSPF Configuration

To remove the entire OSPFv2 configuration that you have already enabled, enter the following commandperform the following steps:

Command	Purpose
<pre>clear configure router ospf pid</pre> <p>Example: <pre>ciscoasa(config)# clear configure router ospf 1000</pre></p>	Removes the entire OSPFv2 configuration that you have enabled. After the configuration is cleared, you must reconfigure OSPF using the router ospf command.

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.
 - Step 2** Uncheck the **Enable this OSPF Process** check box.
 - Step 3** Click **Apply**.
-

To remove the entire OSPFv3 configuration that you have already enabled, enter the following commandperform the following steps:

Command	Purpose
<pre>clear configure ipv6 router ospf process-id</pre> <p>Example: <pre>ciscoasa(config)# clear configure ipv6 router ospf 1000</pre></p>	Removes the entire OSPFv3 configuration that you have enabled. After the configuration is cleared, you must reconfigure OSPFv3 using the ipv6 router ospf command.

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
 - Step 2** Uncheck the **Enable OSPFv3 Process** check box.
 - Step 3** Click **Apply**.
-

Configuration Example for OSPFv2

The following example shows how to enable and configure OSPFv2 with various optional processes:

-
- Step 1** To enable OSPFv2, enter the following commands:


```
ciscoasa(config)# router ospf 2
ciscoasa(config-rtr)# network 10.0.0.0 255.0.0.0 area 0
```
 - Step 2** (Optional) To redistribute routes from one OSPFv2 process to another OSPFv2 process, enter the following commands:

```

ciscoasa(config)# route-map 1-to-2 permit
ciscoasa(config-route-map)# match metric 1
ciscoasa(config-route-map)# set metric 5
ciscoasa(config-route-map)# set metric-type type-1
ciscoasa(config-route-map)# router ospf 2
ciscoasa(config-rtr)# redistribute ospf 1 route-map 1-to-2

```

Step 3 (Optional) To configure OSPFv2 interface parameters, enter the following commands:

```

ciscoasa(config)# router ospf 2
ciscoasa(config-rtr)# network 10.0.0.0 255.0.0.0 area 0
ciscoasa(config-rtr)# interface inside
ciscoasa(config-interface)# ospf cost 20
ciscoasa(config-interface)# ospf retransmit-interval 15
ciscoasa(config-interface)# ospf transmit-delay 10
ciscoasa(config-interface)# ospf priority 20
ciscoasa(config-interface)# ospf hello-interval 10
ciscoasa(config-interface)# ospf dead-interval 40
ciscoasa(config-interface)# ospf authentication-key cisco
ciscoasa(config-interface)# ospf message-digest-key 1 md5 cisco
ciscoasa(config-interface)# ospf authentication message-digest

```

Step 4 (Optional) To configure OSPFv2 area parameters, enter the following commands:

```

ciscoasa(config)# router ospf 2
ciscoasa(config-rtr)# area 0 authentication
ciscoasa(config-rtr)# area 0 authentication message-digest
ciscoasa(config-rtr)# area 17 stub
ciscoasa(config-rtr)# area 17 default-cost 20

```

Step 5 (Optional) To configure the route calculation timers and show the log neighbor up and down messages, enter the following commands:

```

ciscoasa(config-rtr)# timers spf 10 120
ciscoasa(config-rtr)# log-adj-changes [detail]

```

Step 6 (Optional) To show current OSPFv2 configuration settings, enter the **show ospf** command.

The following is sample output from the **show ospf** command:

```

ciscoasa(config)# show ospf

Routing Process "ospf 2" with ID 10.1.89.2 and Domain ID 0.0.0.2
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 5. Checksum Sum 0x 26da6
Number of opaque AS LSA 0. Checksum Sum 0x      0
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
  Area BACKBONE(0)
    Number of interfaces in this area is 1
    Area has no authentication
    SPF algorithm executed 2 times
    Area ranges are
    Number of LSA 5. Checksum Sum 0x 209a3
    Number of opaque link LSA 0. Checksum Sum 0x      0
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0

```

Step 7 To clear the OSPFv2 configuration, enter the following command:

```
ciscoasa(config)# clear configure router ospf pid
```

Step 1 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.

Step 2 Click the **Process Instances** tab and in the OSPF Process 1 field, type **2**.

Step 3 Click the **Area/Networks** tab, and click **Add**.

Step 4 Enter **0** in the Area ID field.

Step 5 In the Area Networks area, enter **10.0.0.0** in the IP Address field.

Step 6 Choose 255.0.0.0 from the Netmask drop-down list.

Step 7 Click **OK**.

Step 8 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Redistribution**.

Step 9 Click **Add**.

The Add/Edit OSPF Redistribution Entry dialog box appears.

Step 10 In the Protocol area, click the **OSPF** radio button to choose the source protocol from which the routes are being redistributed. Choosing OSPF redistributes routes from another OSPF routing process.

Step 11 Choose the OSPF process ID from the OSPF Process drop-down list.

Step 12 In the Match area, check the **Internal** check box.

Step 13 In the Metric Value field, enter **5** for the metric value for the routes being redistributed.

Step 14 From the Metric Type drop-down list, choose 1 for the Metric Type value.

Step 15 From the Route Map drop-down list, choose 1.

Step 16 Click **OK**.

Step 17 In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Interface**.

Step 18 From the Properties tab, choose the **inside** interface and click **Edit**.

The Edit OSPF Properties dialog box appears.

Step 19 In the Cost field, enter **20**.

Step 20 Click **Advanced**.

Step 21 In the Retransmit Interval field, enter **15**.

Step 22 In the Transmit Delay field, enter **20**.

Step 23 In the Hello Interval field, enter **10**.

Step 24 In the Dead Interval field, enter **40**.

Step 25 Click **OK**.

Step 26 In the Edit OSPF Properties dialog box, enter **20** in the Priorities field, and click **OK**.

Step 27 Click the **Authentication** tab.

The Edit OSPF Authentication dialog box appears.

Step 28 In the Authentication area, click the **MD5** radio button.

Step 29 In the MD5 and Key ID area, enter **cisco** in the MD5 Key field, and **1** in the MD5 Key ID field.

- Step 30** Click **OK**.
- Step 31** Choose **Configuration > Device Setup > Routing > OSPF > Setup**, and click the **Area/Networks** tab.
- Step 32** Choose the **OSPF 2** process and click **Edit**.
The Edit OSPF Area dialog box appears.
- Step 33** In the Area Type area, choose **Stub**.
- Step 34** In the Authentication area, choose **None**, and enter **20** in the Default Cost field.
- Step 35** Click **OK**.
- Step 36** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPF > Setup**.
- Step 37** Click the **Process Instances** tab and check the **OSPF process 2** check box.
- Step 38** Click **Advanced**.
The Edit OSPF Area dialog box appears.
- Step 39** In the Timers area, enter **10** in the SPF Delay Time field and **20** in the SPF Hold Time field.
- Step 40** In the Adjacency Changes area, check the **Log Adjacency Change Details** check box.
- Step 41** Click **OK**.
- Step 42** Click **Reset**.
-

Configuration Examples for OSPFv3

The following example shows how to configure OSPFv3 routing in ASDM:

-
- Step 1** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Setup**.
- Step 2** On the Process Instances tab, do the following:
- Check the **Enable OSPFv3 Process** check box.
 - Enter **1** in the Process ID field.
- Step 3** Click the **Areas** tab, then click **Add** to display the Add OSPFv3 Area dialog box.
- Step 4** From the OSPFv3 Process ID drop-down list, choose **1**.
- Step 5** Enter **22** in the Area ID field.
- Step 6** Choose **Normal** from the Area Type drop-down list.
- Step 7** Enter **10** in the Default Cost field.
- Step 8** Check the **Redistribution imports routes to normal and NSSA areas** check box.
- Step 9** Enter **20** in the Metric field.
- Step 10** Choose **1** from the Metric Type drop-down list.
- Step 11** Check the **inside** check box as the specified interface being used.
- Step 12** Check the **Enable Authentication** check box.
- Step 13** Enter **300** in the Security Policy Index field.
- Step 14** Choose **SHA-1** from the Authentication Algorithm drop-down list.
- Step 15** Enter **12345ABCDE** in the Authentication Key field.

- Step 16** Choose **DES** from the Encryption Algorithm drop-down list.
- Step 17** Enter **1122334455aabbccdde** in the Encryption Key field.
- Step 18** Click **OK**.
- Step 19** Click the **Route Summarization** tab, then click **Add** to display the Add Route Summarization dialog box.
- Step 20** Choose **1** from the Process ID drop-down list.
- Step 21** Choose **22** from the Area ID drop-down list.
- Step 22** Enter **2000:122::/64** in the IPv6 Prefix/Prefix Length field.
- Step 23** (Optional) Enter **100** in the Cost field.
- Step 24** Check the **Advertised** check box.
- Step 25** Click **OK**.
- Step 26** In the main ASDM window, choose **Configuration > Device Setup > Routing > OSPFv3 > Interface**.
- Step 27** Click the **Properties** tab.
- Step 28** Check the **inside** check box and click **Edit** to display the Edit OSPF Properties dialog box.
- Step 29** In the Cost field, enter **20**.
- Step 30** Enter **1** in the Priority field.
- Step 31** Check the **point-to-point** check box.
- Step 32** In the Dead Interval field, enter **40**.
- Step 33** In the Hello Interval field, enter **10**.
- Step 34** In the Retransmit Interval field, enter **15**.
- Step 35** In the Transmit Delay field, enter **20**.
- Step 36** Click **OK**.
- Step 37** In the main ASDM window, choose **Configuration > Device Setup > Routing > Redistribution**.
- Step 38** Choose **1** from the Process ID drop-down list.
- Step 39** Choose **OSPF** from the Source Protocol drop-down list.
- Step 40** Enter **50** in the Metric field.
- Step 41** Choose **1** from the Metric Type drop-down list.
- Step 42** Click **OK**.
- Step 43** Click **Apply** to save your changes.

The following example shows how to enable and configure OSPFv3 at the interface level:

```
ciscoasa (config)# interface GigabitEthernet3/1
ciscoasa (config-if)# ipv6 enable
ciscoasa (config-if)# ipv6 ospf 1 area 1
```

The following is sample output from the **show running-config ipv6** command:

```
ciscoasa (config)# show running-config ipv6
ipv6 router ospf 1
  log-adjacency-changes
```

The following is sample output from the **show running-config interface** command:


```
ciscoasa (config-if)# show running-config interface GigabitEthernet3/1
interface GigabitEthernet3/1
 nameif fda
 security-level 100
 ip address 1.1.11.1 255.255.255.0 standby 1.1.11.2
 ipv6 address 9098::10/64 standby 9098::11
 ipv6 enable
 ipv6 ospf 1 area 1
```

The following examples show how to configure OSPFv3-specific interfaces:

```
ciscoasa (config)# interface GigabitEthernet3/1
ciscoasa (config-if)# nameif fda
ciscoasa (config-if)# security-level 100
ciscoasa (config-if)# ip address 10.1.11.1 255.255.255.0 standby 10.1.11.2
ciscoasa (config-if)# ipv6 address 9098::10/64 standby 9098::11
ciscoasa (config-if)# ipv6 enable
ciscoasa (config-if)# ipv6 ospf cost 900
ciscoasa (config-if)# ipv6 ospf hello-interval 20
ciscoasa (config-if)# ipv6 ospf network broadcast
ciscoasa (config-if)# ipv6 ospf database-filter all out
ciscoasa (config-if)# ipv6 ospf flood-reduction
ciscoasa (config-if)# ipv6 ospf mtu-ignore
ciscoasa (config-if)# ipv6 ospf 1 area 1 instance 100
ciscoasa (config-if)# ipv6 ospf encryption ipsec spi 890 esp null md5
12345678901234567890123456789012

ciscoasa (config)# ipv6 router ospf 1
ciscoasa (config)# area 1 nssa
ciscoasa (config)# distance ospf intra-area 190 inter-area 100 external 100
ciscoasa (config)# timers lsa arrival 900
ciscoasa (config)# timers pacing flood 100
ciscoasa (config)# timers throttle lsa 900 900 900
ciscoasa (config)# passive-interface fda
ciscoasa (config)# log-adjacency-changes
ciscoasa (config)# redistribute connected metric 100 metric-type 1 tag 700
```

For an example of how to configure an OSPFv3 virtual link, see the following URL:

http://www.cisco.com/en/US/tech/tk365/technologies_configuration_example09186a0080b8fd06.shtml

Monitoring OSPF

You can display specific statistics such as the contents of IP routing tables, caches, and databases. You can also use the information provided to determine resource utilization and solve network problems. You can also display information about node reachability and discover the routing path that your device packets are taking through the network.

To monitor or display various OSPFv2 routing statistics, enter one of the following commands:

Command	Purpose
<code>show ospf [process-id [area-id]]</code>	Displays general information about OSPFv2 routing processes.
<code>show ospf border-routers</code>	Displays the internal OSPFv2 routing table entries to the ABR and ASBR.

Command	Purpose
<code>show ospf [process-id [area-id]] database</code>	Displays lists of information related to the OSPFv2 database for a specific router.
<code>show ospf flood-list if-name</code>	<p>Displays a list of LSAs waiting to be flooded over an interface (to observe OSPF v2packet pacing).</p> <p>OSPFv2 update packets are automatically paced so they are not sent less than 33 milliseconds apart. Without pacing, some update packets could get lost in situations where the link is slow, a neighbor could not receive the updates quickly enough, or the router could run out of buffer space. For example, without pacing, packets might be dropped if either of the following topologies exist:</p> <ul style="list-style-type: none"> • A fast router is connected to a slower router over a point-to-point link. • During flooding, several neighbors send updates to a single router at the same time. <p>Pacing is also used between resends to increase efficiency and minimize lost retransmissions. You also can display the LSAs waiting to be sent out of an interface. Pacing enables OSPFv2 update and retransmission packets to be sent more efficiently. There are no configuration tasks for this feature; it occurs automatically.</p>
<code>show ospf interface [if_name]</code>	Displays OSPFv2-related interface information.
<code>show ospf neighbor [interface-name] [neighbor-id] [detail]</code>	Displays OSPFv2 neighbor information on a per-interface basis.
<code>show ospf request-list neighbor if_name</code>	Displays a list of all LSAs requested by a router.
<code>show ospf retransmission-list neighbor if_name</code>	Displays a list of all LSAs waiting to be resent.
<code>show ospf [process-id] summary-address</code>	Displays a list of all summary address redistribution information configured under an OSPFv2 process.
<code>show ospf [process-id] traffic</code>	Displays a list of different types of packets being sent or received by a specific OSPFv2 instance.
<code>show ospf [process-id] virtual-links</code>	Displays OSPFv2-related virtual links information.
<code>show route cluster</code>	Displays additional OSPFv2 route synchronization information in clustering.

To monitor or display various OSPFv3 routing statistics, enter one of the following commands:

Command	Purpose
<code>show ipv6 ospf [process-id [area-id]]</code>	Displays general information about OSPFv3 routing processes.
<code>show ipv6 ospf [process-id] border-routers</code>	Displays the internal OSPFv3 routing table entries to the ABR and ASBR.
<code>show ipv6 ospf [process-id [area-id]] database [external inter-area prefix inter-area-router network nssa-external router area as ref-lsa [destination-router-id] [prefix ipv6-prefix] [link-state-id]] [link [interface interface-name] [adv-router router-id] self-originate] [internal] [database-summary]</code>	Displays lists of information related to the OSPFv3 database for a specific router.
<code>show ipv6 ospf [process-id [area-id]] events</code>	Displays OSPFv3 event information.
<code>show ipv6 ospf [process-id] [area-id] flood-list interface-type interface-number</code>	<p>Displays a list of LSAs waiting to be flooded over an interface (to observe OSPFv3 packet pacing). OSPFv3 update packets are automatically paced so they are not sent less than 33 milliseconds apart. Without pacing, some update packets could get lost in situations where the link is slow, a neighbor could not receive the updates quickly enough, or the router could run out of buffer space. For example, without pacing, packets might be dropped if either of the following topologies exist:</p> <ul style="list-style-type: none"> • A fast router is connected to a slower router over a point-to-point link. • During flooding, several neighbors send updates to a single router at the same time. <p>Pacing is also used between retransmissions to increase efficiency and minimize lost retransmissions. You also can display the LSAs waiting to be sent out of an interface. Pacing enables OSPFv3 update and retransmission packets to be sent more efficiently.</p> <p>There are no configuration tasks for this feature; it occurs automatically.</p>
<code>show ipv6 ospf [process-id] [area-id] interface [type number] [brief]</code>	Displays OSPFv3-related interface information.
<code>show ipv6 ospf neighbor [process-id] [area-id] [interface-type interface-number] [neighbor-id] [detail]</code>	Displays OSPFv3 neighbor information on a per-interface basis.
<code>show ipv6 ospf [process-id] [area-id] request-list [neighbor] [interface] [interface-neighbor]</code>	Displays a list of all LSAs requested by a router.

Command	Purpose
<code>show ipv6 ospf [process-id] [area-id] retransmission-list [neighbor] [interface] [interface-neighbor]</code>	Displays a list of all LSAs waiting to be resent.
<code>show ipv6 ospf statistic [process-id] [detail]</code>	Displays various OSPFv3 statistics.
<code>show ipv6 ospf [process-id] summary-prefix</code>	Displays a list of all summary address redistribution information configured under an OSPFv3 process.
<code>show ipv6 ospf [process-id] timers [lsa-group rate-limit]</code>	Displays OSPFv3 timers information.
<code>show ipv6 ospf [process-id] traffic [interface_name]</code>	Displays OSPFv3 traffic-related statistics.
<code>show ipv6 ospf virtual-links</code>	Displays OSPFv3-related virtual links information.
<code>show ipv6 route cluster [failover] [cluster] [interface] [ospf] [summary]</code>	Displays the IPv6 routing table sequence number, IPv6 reconvergence timer status, and IPv6 routing entries sequence number in a cluster.

To monitor or display various OSPFv2 routing statistics in ASDM, perform the following steps:

-
- Step 1** In the main ASDM window, choose **Monitoring > Routing > OSPF LSAs**.
- Step 2** You can select and monitor OSPF LSAs, Types 1 through 5 and 7. Each pane shows one LSA type, as follows:
- Type 1 LSAs represent the routes in an area under a process.
 - Type 2 LSAs show the IP address of the designated router that advertises the routers.
 - Type 3 LSAs show the IP address of the destination network.
 - Type 4 LSAs show the IP address of the AS boundary router.
 - Type 5 LSAs and Type 7 LSAs show the IP address of the AS external network.
- Step 3** Click **Refresh** to update each LSA type pane.
- Step 4** In the main ASDM window, choose **Monitoring > Routing > OSPF Neighbors**.
In the OSPF Neighbors pane, each row represents one OSPF neighbor. In addition, the OSPF Neighbors pane shows the network on which the neighbor is running, the priority, the state, the amount of dead time in seconds, the IP address of the neighbor, and the interface on which it is running. For a list of possible states for an OSPF neighbor, see RFC 2328.
- Step 5** Click **Refresh** to update the OSPF Neighbors pane.
-

To monitor or display various OSPFv3 routing statistics in ASDM, perform the following steps:

-
- Step 1** In the main ASDM window, choose **Monitoring > Routing > OSPFv3 LSAs**.
- Step 2** You can select and monitor OSPFv3 LSAs. Choose a link-state type to display its status according to specified parameters from the Link State type drop-down list. The supported link-state types are router, network, inter-area prefix, inter-area router, AS external, NSSA, link, and intra-area prefix.

Step 3 Click **Refresh** to update each link-state type.

Step 4 In the main ASDM window, choose **Monitoring > Routing > OSPFv3 Neighbors**.

In the OSPFv3 Neighbors pane, each row represents one OSPFv3 neighbor. In addition, the OSPFv3 Neighbors pane shows the IP address of the neighbor, the priority, the state, the amount of dead time in seconds, and the interface on which it is running. For a list of possible states for an OSPFv3 neighbor, see RFC 5340.

Step 5 Click **Refresh** to update the OSPFv3 Neighbors pane.

Additional References

For additional information related to implementing OSPF, see the following section:

- [RFCs](#)

RFCs

RFC	Title
2328	OSPFv2
4552	OSPFv3 Authentication
5340	OSPF for IPv6

Feature History for OSPF

[Table 27-1](#) lists each feature change and the platform release in which it was implemented. ASDM is backward-compatible with multiple platform releases, so the specific ASDM release in which support was added is not listed.

Table 27-1 Feature History for OSPF

Feature Name	Platform Releases	Feature Information
OSPF Support	7.0(1)	Support was added for route data, authentication, and redistribution and monitoring of routing information using the Open Shortest Path First (OSPF) routing protocol. We introduced the following command: route ospf We introduced the following screen: Configuration > Device Setup > Routing > OSPF.

Table 27-1 Feature History for OSPF (continued)

Feature Name	Platform Releases	Feature Information
Dynamic Routing in Multiple Context Mode	9.0(1)	OSPFv2 routing is supported in multiple context mode. We modified the following screen: Configuration > Device Setup > Routing > OSPF > Setup
Clustering		For OSPFv2 and OSPFv3, bulk synchronization, route synchronization, and Layer 2 load balancing are supported in the clustering environment. We introduced or modified the following commands: show route cluster , show ipv6 route cluster , debug route cluster , router-id cluster-pool .
OSPFv3 Support for IPv6		OSPFv3 routing is supported for IPv6. We introduced or modified the following commands: ipv6 ospf , ipv6 ospf area , ipv6 ospf cost , ipv6 ospf database-filter all out , ipv6 ospf dead-interval , ipv6 ospf encryption , ipv6 ospf hello-interval , ipv6 ospf mtu-ignore , ipv6 ospf neighbor , ipv6 ospf network , ipv6 ospf flood-reduction , ipv6 ospf priority , ipv6 ospf retransmit-interval , ipv6 ospf transmit-delay , ipv6 router ospf , ipv6 router ospf area , ipv6 router ospf default , ipv6 router ospf default-information , ipv6 router ospf distance , ipv6 router ospf exit , ipv6 router ospf ignore , ipv6 router ospf log-adjacency-changes , ipv6 router ospf no , ipv6 router ospf passive-interface , ipv6 router ospf redistribute , ipv6 router ospf router-id , ipv6 router ospf summary-prefix , ipv6 router ospf timers , area encryption , area range , area stub , area nssa , area virtual-link , default , default-information originate , distance , ignore lsa mospf , log-adjacency-changes , redistribute , router-id , summary-prefix , timers lsa arrival , timers pacing flood , timers pacing lsa-group , timers pacing retransmission , timers throttle , show ipv6 ospf , show ipv6 ospf border-routers , show ipv6 ospf database , show ipv6 ospf events , show ipv6 ospf flood-list , show ipv6 ospf graceful-restart , show ipv6 ospf interface , show ipv6 ospf neighbor , show ipv6 ospf request-list , show ipv6 ospf retransmission-list , show ipv6 ospf statistic , show ipv6 ospf summary-prefix , show ipv6 ospf timers , show ipv6 ospf traffic , show ipv6 ospf virtual-links , show ospf , show running-config ipv6 router , clear ipv6 ospf , clear configure ipv6 router , debug ospfv3 , ipv6 ospf neighbor . We introduced the following screens: Configuration > Device Setup > Routing > OSPFv3 > Setup, Configuration > Device Setup > Routing > OSPFv3 > Interface, Configuration > Device Setup > Routing > OSPFv3 > Redistribution, Configuration > Device Setup > Routing > OSPFv3 > Summary Prefix, Configuration > Device Setup > Routing > OSPFv3 > Virtual Link, Monitoring > Routing > OSPFv3 LSAs, Monitoring > Routing > OSPFv3 Neighbors.