



CHAPTER 4

Configuring OSPFv2

This chapter describes how to configure Open Shortest Path First version 2 (OSPFv2) for IPv4 networks.

This chapter includes the following sections:

- [Information About OSPFv2, page 4-1](#)
- [Licensing Requirements for OSPFv2, page 4-13](#)
- [Prerequisites for OSPFv2, page 4-13](#)
- [Default Settings, page 4-14](#)
- [Guidelines and Limitations, page 4-13](#)
- [Configuring Basic OSPFv2, page 4-14](#)
- [Configuring Advanced OSPFv2, page 4-27](#)
- [Verifying the OSPFv2 Configuration, page 4-54](#)
- [Displaying OSPFv2 Statistics, page 4-55](#)
- [Configuration Examples for OSPFv2, page 4-56](#)
- [Additional References, page 4-56](#)
- [Feature History for OSPFv2, page 4-57](#)

Information About OSPFv2

OSPFv2 is an IETF link-state protocol (see the [“Link-State Protocols” section on page 1-9](#)) for IPv4 networks. An OSPFv2 router sends a special message, called a *hello packet*, out each OSPF-enabled interface to discover other OSPFv2 neighbor routers. Once a neighbor is discovered, the two routers compare information in the hello packet to determine if the routers have compatible configurations. The neighbor routers attempt to establish *adjacency*, which means that the routers synchronize their link-state databases to ensure that they have identical OSPFv2 routing information. Adjacent routers share *link-state advertisements* (LSAs) that include information about the operational state of each link, the cost of the link, and any other neighbor information. The routers then flood these received LSAs out every OSPF-enabled interface so that all OSPFv2 routers eventually have identical link-state databases. When all OSPFv2 routers have identical link-state databases, the network is *converged* (see the [“Convergence” section on page 1-6](#)). Each router then uses Dijkstra’s Shortest Path First (SPF) algorithm to build its route table.

You can divide OSPFv2 networks into areas. Routers send most LSAs only within one area, which reduces the CPU and memory requirements for an OSPF-enabled router.

OSPFv2 supports IPv4, while OSPFv3 supports IPv6. For more information, see [Chapter 7, “Configuring OSPFv3.”](#)

This section includes the following topics:

- [Hello Packet, page 4-2](#)
- [Neighbors, page 4-2](#)
- [Adjacency, page 4-3](#)
- [Designated Routers, page 4-3](#)
- [Areas, page 4-4](#)
- [Link-State Advertisements, page 4-5](#)
- [OSPFv2 and the Unicast RIB, page 4-7](#)
- [Authentication, page 4-7](#)
- [Advanced Features, page 4-8](#)

Hello Packet

OSPFv2 routers periodically send hello packets on every OSPF-enabled interface. The *hello interval* determines how frequently the router sends these hello packets and is configured per interface. OSPFv2 uses hello packets for the following tasks:

- Neighbor discovery
- Keepalives
- Bidirectional communications
- Designated router election (see the [“Designated Routers” section on page 4-3](#))

The hello packet contains information about the originating OSPFv2 interface and router, including the assigned OSPFv2 cost of the link, the hello interval, and optional capabilities of the originating router. An OSPFv2 interface that receives these hello packets determines if the settings are compatible with the receiving interface settings. Compatible interfaces are considered neighbors and are added to the neighbor table (see the [“Neighbors” section on page 4-2](#)).

Hello packets also include a list of router IDs for the routers that the originating interface has communicated with. If the receiving interface sees its own router ID in this list, then bidirectional communication has been established between the two interfaces.

OSPFv2 uses hello packets as a keepalive message to determine if a neighbor is still communicating. If a router does not receive a hello packet by the configured *dead interval* (usually a multiple of the hello interval), then the neighbor is removed from the local neighbor table.

Neighbors

An OSPFv2 interface must have a compatible configuration with a remote interface before the two can be considered neighbors. The two OSPFv2 interfaces must match the following criteria:

- Hello interval
- Dead interval
- Area ID (see the [“Areas” section on page 4-4](#))
- Authentication

- Optional capabilities

If there is a match, the following information is entered into the neighbor table:

- Neighbor ID—The router ID of the neighbor.
- Priority—Priority of the neighbor. The priority is used for designated router election (see the “[Designated Routers](#)” section on page 4-3).
- State—Indication of whether the neighbor has just been heard from, is in the process of setting up bidirectional communications, is sharing the link-state information, or has achieved full adjacency.
- Dead time—Indication of the time since the last Hello packet was received from this neighbor.
- IP Address—The IP address of the neighbor.
- Designated Router—Indication of whether the neighbor has been declared as the designated router or as the backup designated router (see the “[Designated Routers](#)” section on page 4-3).
- Local interface—The local interface that received the hello packet for this neighbor.

Adjacency

Not all neighbors establish adjacency. Depending on the network type and designated router establishment, some neighbors become fully adjacent and share LSAs with all their neighbors, while other neighbors do not. For more information, see the “[Designated Routers](#)” section on page 4-3.

Adjacency is established using Database Description packets, Link State Request packets, and Link State Update packets in OSPF. The Database Description packet includes only the LSA headers from the link-state database of the neighbor (see the “[Link-State Database](#)” section on page 4-7). The local router compares these headers with its own link-state database and determines which LSAs are new or updated. The local router sends a Link State Request packet for each LSA that it needs new or updated information on. The neighbor responds with a Link State Update packet. This exchange continues until both routers have the same link-state information.

Designated Routers

Networks with multiple routers present a unique situation for OSPF. If every router floods the network with LSAs, the same link-state information will be sent from multiple sources. Depending on the type of network, OSPFv2 might use a single router, the *designated router* (DR), to control the LSA floods and represent the network to the rest of the OSPFv2 area (see the “[Areas](#)” section on page 4-4). If the DR fails, OSPFv2 selects a *backup designated router* (BDR). If the DR fails, OSPFv2 uses the BDR.

Network types are as follows:

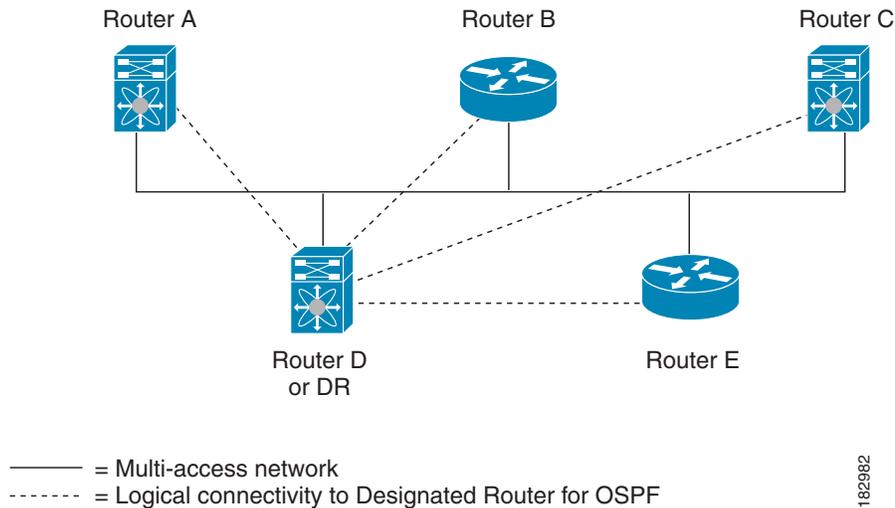
- Point-to-point—A network that exists only between two routers. All neighbors on a point-to-point network establish adjacency and there is no DR.
- Broadcast—A network with multiple routers that can communicate over a shared medium that allows broadcast traffic, such as Ethernet. OSPFv2 routers establish a DR and BDR that controls LSA flooding on the network. OSPFv2 uses the well-known IPv4 multicast addresses 224.0.0.5 and a MAC address of 0100.5300.0005 to communicate with neighbors.

The DR and BDR are selected based on the information in the Hello packet. When an interface sends a Hello packet, it sets the priority field and the DR and BDR field if it knows who the DR and BDR are. The routers follow an election procedure based on which routers declare themselves in the DR and BDR fields and the priority field in the Hello packet. As a final tie breaker, OSPFv2 chooses the highest router IDs as the DR and BDR.

All other routers establish adjacency with the DR and the BDR and use the IPv4 multicast address 224.0.0.6 to send LSA updates to the DR and BDR. Figure 4-1 shows this adjacency relationship between all routers and the DR.

DRs are based on a router interface. A router might be the DR for one network and not for another network on a different interface.

Figure 4-1 DR in Multi-Access Network



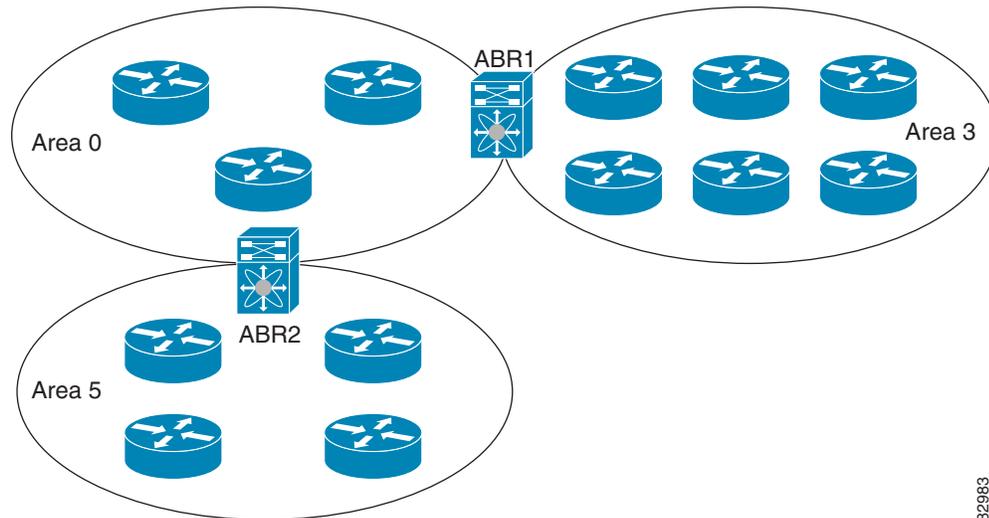
Areas

You can limit the CPU and memory requirements that OSPFv2 puts on the routers by dividing an OSPFv2 network into *areas*. An area is a logical division of routers and links within an OSPFv2 domain that creates separate subdomains. LSA flooding is contained within an area, and the link-state database is limited to links within the area. You can assign an area ID to the interfaces within the defined area. The Area ID is a 32-bit value that you can enter as a number or in dotted decimal notation, such as 10.2.3.1.

Cisco NX-OS always displays the area in dotted decimal notation.

If you define more than one area in an OSPFv2 network, you must also define the backbone area, which has the reserved area ID of 0. If you have more than one area, then one or more routers become *area border routers* (ABRs). An ABR connects to both the backbone area and at least one other defined area (see Figure 4-2).

Figure 4-2 OSPFv2 Areas



182983

The ABR has a separate link-state database for each area to which it connects. The ABR sends Network Summary (type 3) LSAs (see the “[Route Summarization](#)” section on page 4-10) from one connected area to the backbone area. The backbone area sends summarized information about one area to another area. In Figure 4-2, Area 0 sends summarized information about Area 5 to Area 3.

OSPFv2 defines one other router type: the autonomous system boundary router (ASBR). This router connects an OSPFv2 area to another autonomous system. An autonomous system is a network controlled by a single technical administration entity. OSPFv2 can redistribute its routing information into another autonomous system or receive redistributed routes from another autonomous system. For more information, see “[Advanced Features](#)” section on page 4-8.)

Link-State Advertisements

OSPFv2 uses link-state advertisements (LSAs) to build its routing table.

This section includes the following topics:

- [LSA Types](#), page 4-5
- [Link Cost](#), page 4-6
- [Flooding and LSA Group Pacing](#), page 4-6
- [Link-State Database](#), page 4-7
- [Opaque LSAs](#), page 4-7

LSA Types

Table 4-1 shows the LSA types supported by Cisco NX-OS.

Table 4-1 LSA Types

Type	Name	Description
1	Router LSA	LSA sent by every router. This LSA includes the state and the cost of all links and a list of all OSPFv2 neighbors on the link. Router LSAs trigger an SPF recalculation. Router LSAs are flooded to local OSPFv2 area.
2	Network LSA	LSA sent by the DR. This LSA lists all routers in the multi-access network. Network LSAs trigger an SPF recalculation. See the “Designated Routers” section on page 4-3 .
3	Network Summary LSA	LSA sent by the area border router to an external area for each destination in the local area. This LSA includes the link cost from the area border router to the local destination. See the “Areas” section on page 4-4 .
4	ASBR Summary LSA	LSA sent by the area border router to an external area. This LSA advertises the link cost to the ASBR only. See the “Areas” section on page 4-4 .
5	AS External LSA	LSA generated by the ASBR. This LSA includes the link cost to an external autonomous system destination. AS External LSAs are flooded throughout the autonomous system. See the “Areas” section on page 4-4 .
7	NSSA External LSA	LSA generated by the ASBR within a not-so-stubby area (NSSA). This LSA includes the link cost to an external autonomous system destination. NSSA External LSAs are flooded only within the local NSSA. See the “Areas” section on page 4-4 .
9–11	Opaque LSAs	LSA used to extend OSPF. See the “Opaque LSAs” section on page 4-7 .

Link Cost

Each OSPFv2 interface is assigned a *link cost*. The cost is an arbitrary number. By default, Cisco NX-OS assigns a cost that is the configured reference bandwidth divided by the interface bandwidth. By default, the reference bandwidth is 40 Gb/s. The link cost is carried in the LSA updates for each link.

Flooding and LSA Group Pacing

When an OSPFv2 router receives an LSA, it forwards that LSA out every OSPF-enabled interface, flooding the OSPFv2 area with this information. This LSA flooding guarantees that all routers in the network have identical routing information. LSA flooding depends on the OSPFv2 area configuration (see the [“Areas” section on page 4-4](#)). The LSAs are flooded based on the *link-state refresh* time (every 30 minutes by default). Each LSA has its own link-state refresh time.

You can control the flooding rate of LSA updates in your network by using the LSA group pacing feature. LSA group pacing can reduce high CPU or buffer utilization. This feature groups LSAs with similar link-state refresh times to allow OSPFv2 to pack multiple LSAs into an OSPFv2 Update message.

By default, LSAs with link-state refresh times within four minutes of each other are grouped together. You should lower this value for large link-state databases or raise it for smaller databases to optimize the OSPFv2 load on your network.

Link-State Database

Each router maintains a link-state database for the OSPFv2 network. This database contains all the collected LSAs, and includes information on all the routes through the network. OSPFv2 uses this information to calculate the best path to each destination and populates the routing table with these best paths.

LSAs are removed from the link-state database if no LSA update has been received within a set interval, called the MaxAge. Routers flood a repeat of the LSA every 30 minutes to prevent accurate link-state information from being aged out. Cisco NX-OS supports the LSA grouping feature to prevent all LSAs from refreshing at the same time. For more information, see the [“Flooding and LSA Group Pacing” section on page 4-6](#).

Opaque LSAs

Opaque LSAs allow you to extend OSPF functionality. Opaque LSAs consist of a standard LSA header followed by application-specific information. This information might be used by OSPFv2 or by other applications. OSPFv2 uses Opaque LSAs to support OSPFv2 Graceful Restart capability (see the [“Graceful Restart” section on page 3-11](#)). Three Opaque LSA types are defined as follows:

- LSA type 9—Flooded to the local network.
- LSA type 10—Flooded to the local area.
- LSA type 11—Flooded to the local autonomous system.

OSPFv2 and the Unicast RIB

OSPFv2 runs the Dijkstra shortest path first algorithm on the link-state database. This algorithm selects the best path to each destination based on the sum of all the link costs for each link in the path. The resultant shortest path for each destination is then put in the OSPFv2 route table. When the OSPFv2 network is converged, this route table feeds into the unicast RIB. OSPFv2 communicates with the unicast RIB to do the following:

- Add or remove routes
- Handle route redistribution from other protocols
- Provide convergence updates to remove stale OSPFv2 routes and for stub router advertisements (see the [“OSPFv2 Stub Router Advertisements” section on page 4-12](#))

OSPFv2 also runs a modified Dijkstra algorithm for fast recalculation for summary and external (type 3, 4, 5, and 7) LSA changes.

Authentication

You can configure authentication on OSPFv2 messages to prevent unauthorized or invalid routing updates in your network. Cisco NX-OS supports two authentication methods:

- Simple password authentication
- MD5 authentication digest

You can configure the OSPFv2 authentication for an OSPFv2 area or per interface.

Simple Password Authentication

Simple password authentication uses a simple clear-text password that is sent as part of the OSPFv2 message. The receiving OSPFv2 router must be configured with the same clear-text password to accept the OSPFv2 message as a valid route update. Because the password is in clear text, anyone who can watch traffic on the network can learn the password.

MD5 Authentication

You should use MD5 authentication to authenticate OSPFv2 messages. You configure a password that is shared at the local router and all remote OSPFv2 neighbors. For each OSPFv2 message, Cisco NX-OS creates an MD5 one-way message digest based on the message itself and the encrypted password. The interface sends this digest with the OSPFv2 message. The receiving OSPFv2 neighbor validates the digest using the same encrypted password. If the message has not changed, the digest calculation is identical and the OSPFv2 message is considered valid.

MD5 authentication includes a sequence number with each OSPFv2 message to ensure that no message is replayed in the network.

Advanced Features

Cisco NX-OS supports a number of advanced OSPFv2 features that enhance the usability and scalability of OSPFv2 in the network. This section includes the following topics:

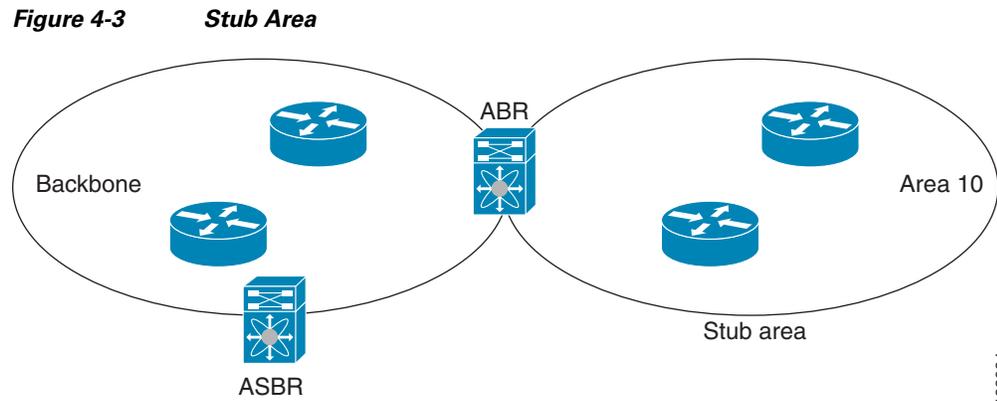
- [Stub Area, page 4-8](#)
- [Not-So-Stubby Area, page 4-9](#)
- [Virtual Links, page 4-9](#)
- [Route Redistribution, page 4-10](#)
- [Route Summarization, page 4-10](#)
- [Graceful Restart, page 3-11](#)
- [OSPFv2 Stub Router Advertisements, page 4-12](#)
- [Multiple OSPFv2 Instances, page 4-12](#)
- [SPF Optimization, page 4-12](#)
- [BFD, page 4-12](#)
- [BFD, page 4-12](#)
- [Virtualization Support, page 4-13](#)

Stub Area

You can limit the amount of external routing information that floods an area by making it a *stub area*. A stub area is an area that does not allow AS External (type 5) LSAs (see the [“Link-State Advertisements” section on page 4-5](#)). These LSAs are usually flooded throughout the local autonomous system to propagate external route information. Stub areas have the following requirements:

- All routers in the stub area are stub routers. See the [“Stub Routing” section on page 1-7](#).
- No ASBR routers exist in the stub area.
- You cannot configure virtual links in the stub area.

Figure 4-3 shows an example of an OSPFv2 autonomous system where all routers in area 0.0.0.10 have to go through the ABR to reach external autonomous systems. area 0.0.0.10 can be configured as a stub area.



Stub areas use a default route for all traffic that needs to go through the backbone area to the external autonomous system. The default route is 0.0.0.0 for IPv4.

Not-So-Stubby Area

A Not-so-Stubby Area (*NSSA*) is similar to a stub area, except that an NSSA allows you to import autonomous system external routes within an NSSA using redistribution. The NSSA ASBR redistributes these routes and generates NSSA External (type 7) LSAs that it floods throughout the NSSA. You can optionally configure the ABR that connects the NSSA to other areas to translate this NSSA External LSA to AS External (type 5) LSAs. The area border router (ABR) then floods these AS External LSAs throughout the OSPFv2 autonomous system. Summarization and filtering are supported during the translation. See the “[Link-State Advertisements](#)” section on page 4-5 for details on NSSA External LSAs.

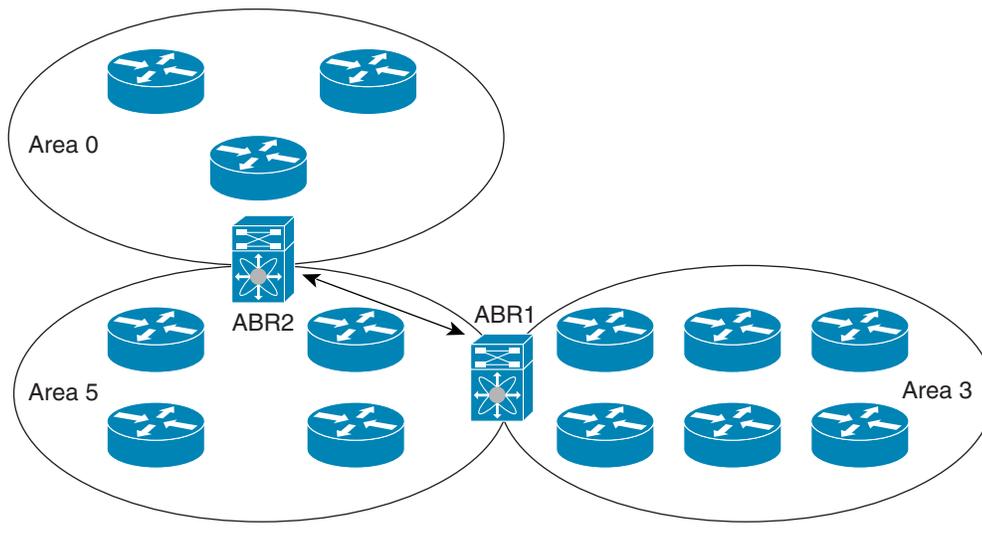
You can, for example, use NSSA to simplify administration if you are connecting a central site using OSPFv2 to a remote site that is using a different routing protocol. Before NSSA, the connection between the corporate site border router and a remote router could not be run as an OSPFv2 stub area because routes for the remote site could not be redistributed into a stub area. With NSSA, you can extend OSPFv2 to cover the remote connection by defining the area between the corporate router and remote router as an NSSA (see the “[Configuring NSSA](#)” section on page 4-32).

The backbone Area 0 cannot be an NSSA.

Virtual Links

Virtual links allow you to connect an OSPFv2 area ABR to a backbone area ABR when a direct physical connection is not available. Figure 4-4 shows a virtual link that connects Area 3 to the backbone area through Area 5.

Figure 4-4 Virtual Links



182985

You can also use virtual links to temporarily recover from a partitioned area, which occurs when a link within the area fails, isolating part of the area from reaching the designated ABR to the backbone area.

Route Redistribution

OSPFv2 can learn routes from other routing protocols by using route redistribution. See the [“Route Redistribution” section on page 1-6](#). You configure OSPFv2 to assign a link cost for these redistributed routes or a default link cost for all redistributed routes.

Route redistribution uses route maps to control which external routes are redistributed. See [Chapter 14, “Configuring Route Policy Manager,”](#) for details on configuring route maps. You can use route maps to modify parameters in the AS External (type 5) and NSSA External (type 7) LSAs before these external routes are advertised in the local OSPFv2 autonomous system.

Route Summarization

Because OSPFv2 shares all learned routes with every OSPF-enabled router, you might want to use route summarization to reduce the number of unique routes that are flooded to every OSPF-enabled router. Route summarization simplifies route tables by replacing more-specific addresses with an address that represents all the specific addresses. For example, you can replace 10.1.1.0/24, 10.1.2.0/24, and 10.1.3.0/24 with one summary address, 10.1.0.0/16.

Typically, you would summarize at the boundaries of area border routers (ABRs). Although you could configure summarization between any two areas, it is better to summarize in the direction of the backbone so that the backbone receives all the aggregate addresses and injects them, already summarized, into other areas. The two types of summarization are as follows:

- Inter-area route summarization
- External route summarization

You configure inter-area route summarization on ABRs, summarizing routes between areas in the autonomous system. To take advantage of summarization, you should assign network numbers in areas in a contiguous way to be able to lump these addresses into one range.

External route summarization is specific to external routes that are injected into OSPFv2 using route redistribution. You should make sure that external ranges that are being summarized are contiguous. Summarizing overlapping ranges from two different routers could cause packets to be sent to the wrong destination. Configure external route summarization on ASBRs that are redistributing routes into OSPF.

When you configure a summary address, Cisco NX-OS automatically configures a discard route for the summary address to prevent routing black holes and route loops.

High Availability and Graceful Restart

Cisco NX-OS supports high-availability. If a Cisco NX-OS system experiences a cold reboot, the network stops forwarding traffic to the system and removes the system from the network topology. In this scenario, OSPFv2 experiences a stateless restart, and removes all neighbor adjacencies on the local system. Cisco NX-OS applies the startup configuration and OSPFv2 rediscovers the neighbors and establishes the adjacencies again.

A platform with two supervisors that run Cisco NX-OS can experience a stateful supervisor switchover. Before the switchover happens, OSPFv2 initiates a graceful restart by announcing that OSPFv2 will be unavailable for some time. During a switchover, the network continues to forward traffic and keeps the system in the network topology.

After a switchover, Cisco NX-OS applies the running configuration, and OSPFv2 informs the neighbors that it is operational again. The neighbors help to reestablish adjacencies.

OSPFv2 automatically restarts if the process experiences problems. After the restart, OSPFv2 initiates a graceful restart so that the platform is not taken out of the network topology. If you manually restart OSPF, it performs a graceful restart, which is similar to a stateful switchover. The running configuration is applied in both cases.

A graceful restart, or nonstop forwarding (NSF), allows OSPFv2 to remain in the data forwarding path through a process restart. When OSPFv2 needs to restart, it first sends a link-local opaque (type 9) LSA, called a grace LSA (see the “Opaque LSAs” section on page 3-7). This restarting OSPFv2 platform is called NSF capable.

The grace LSA includes a grace period, which is a specified time that the neighbor OSPFv2 interfaces hold onto the LSAs from the restarting OSPFv2 interface. (Typically, OSPFv2 tears down the adjacency and discards all LSAs from a down or restarting OSPFv2 interface.) The participating neighbors, which are called NSF helpers, keep all LSAs that originate from the restarting OSPFv2 interface as if the interface were still adjacent.

When the restarting OSPFv2 interface is operational again, it rediscovers its neighbors, establishes adjacency, and starts sending its LSA updates again. At this point, the NSF helpers recognize that graceful restart has finished.

**Note**

If the restarting OSPFv2 interface does not come back up before the end of the grace period, or if the network experiences a topology change, the OSPFv2 neighbors tear down adjacency with the restarting OSPFv2 and treat it as a normal OSPFv2 restart.

**Note**

You must enable graceful restart to support in-service software upgrades (ISSU) for OSPFv2. If you disable graceful restart, Cisco NX-OS issues a warning that ISSU cannot be supported with this configuration.

OSPFv2 Stub Router Advertisements

You can configure an OSPFv2 interface to act as a stub router using the OSPFv2 stub router advertisements feature. Use this feature when you want to limit the OSPFv2 traffic through this router, such as when you want to introduce a new router to the network in a controlled manner or limit the load on a router that is already overloaded. You might also want to use this feature for various administrative or traffic engineering reasons.

OSPFv2 stub router advertisements do not remove the OSPFv2 router from the network topology, but they do prevent other OSPFv2 routers from using this router to route traffic to other parts of the network. Only the traffic that is destined for this router or directly connected to this router is sent.

OSPFv2 stub router advertisements mark all stub links (directly connected to the local router) to the cost of the local OSPFv2 interface. All remote links are marked with the maximum cost (0xFFFF).

Multiple OSPFv2 Instances

Cisco NX-OS supports multiple instances of the OSPFv2 protocol that run on the same node. You cannot configure multiple instances over the same interface. By default, every instance uses the same system router ID. You must manually configure the router ID for each instance if the instances are in the same OSPFv2 autonomous system.

SPF Optimization

Cisco NX-OS optimizes the SPF algorithm in the following ways:

- Partial SPF for Network (type 2) LSAs, Network Summary (type 3) LSAs, and AS External (type 5) LSAs—When there is a change on any of these LSAs, Cisco NX-OS performs a faster partial calculation rather than running the whole SPF calculation.
- SPF timers—You can configure different timers for controlling SPF calculations. These timers include exponential backoff for subsequent SPF calculations. The exponential backoff limits the CPU load of multiple SPF calculations.

BFD

This feature supports bidirectional forwarding detection (BFD). BFD is a detection protocol that provides fast forwarding-path failure detection times. BFD provides subsecond failure detection between two adjacent devices and can be less CPU-intensive than protocol hello messages because some of the BFD load can be distributed onto the data plane on supported modules.

BFD

This feature supports bidirectional forwarding detection (BFD). BFD is a detection protocol designed to provide fast forwarding-path failure detection times. BFD provides subsecond failure detection between two adjacent devices and can be less CPU-intensive than protocol hello messages because some of the BFD load can be distributed onto the data plane on supported modules. See the *Cisco Nexus 7000 Series NX-OS Interfaces Configuration Guide, Release 5.x* for more information.

Virtualization Support

OSPFv2 supports Virtual Routing and Forwarding (VRF) instances. VRFs exist within virtual device contexts (VDCs). By default, Cisco NX-OS places you in the default VDC and default VRF unless you specifically configure another VDC and VRF. You can have up to four instances of OSPFv2 in a VDC. Each OSPFv2 instance can support multiple VRFs, up to the system limit. For more information, see the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 5.x* and see Chapter 12, “Configuring Layer 3 Virtualization.”

Licensing Requirements for OSPFv2

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	OSPFv2 requires a LAN Base Services license. For over 256 routes, OSPFv2 requires an Enterprise services license. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the <i>Cisco NX-OS Licensing Guide</i> .

Prerequisites for OSPFv2

OSPFv2 has the following prerequisites:

- You must be familiar with routing fundamentals to configure OSPF.
- You are logged on to the switch.
- You have configured at least one interface for IPv4 that is capable of communicating with a remote OSPFv2 neighbor.
- You have installed the LAN Base Services license.

Reviewers: Is the Enterprise Services license required for 5.0(3)?

- You have completed the OSPFv2 network strategy and planning for your network. For example, you must decide whether multiple areas are required.
- You have enabled the OSPF feature (see the “[Enabling the OSPFv2 Feature](#)” section on page 4-15).
- You have installed the Advanced Services license and entered the desired VDC (see the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 5.x*) if you are configuring VDCs.

Guidelines and Limitations

OSPFv2 has the following configuration guidelines and limitations:

- You can have up to four instances of OSPFv2 in a VDC.
- Cisco NX-OS displays areas in dotted decimal notation regardless of whether you enter the area in decimal or dotted decimal notation.

**Note**

If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

Default Settings

Table 4-2 lists the default settings for OSPFv2 parameters.

Table 4-2 *Default OSPFv2 Parameters*

Parameters	Default
Hello interval	10 seconds
Dead interval	40 seconds
Graceful restart grace period	60 seconds
Graceful restart notify period	15 seconds
OSPFv2 feature	Disabled
Stub router advertisement announce time	600 seconds
Reference bandwidth for link cost calculation	40 Gb/s
LSA minimal arrival time	1000 milliseconds
LSA group pacing	240 seconds
SPF calculation initial delay time	0 milliseconds
SPF calculation hold time	5000 milliseconds
SPF calculation initial delay time	0 milliseconds

Configuring Basic OSPFv2

Configure OSPFv2 after you have designed your OSPFv2 network. Figure 4-5 shows the OSPFv2 feature selection.

Figure 4-5 **Configuring OSPFv2 for IPv4**

For more information about the Data Center Network Manager features, see the *Cisco Data Center Network Manager Getting Started Guide*

This section includes the following topics:

- [Enabling the OSPFv2 Feature, page 4-15](#)
- [Creating an OSPFv2 Instance, page 4-17](#)
- [Configuring Optional Parameters on an OSPFv2 Instance, page 4-19](#)
- [Configuring Optional Parameters on an OSPFv2 Instance, page 4-19](#)
- [Configuring Networks in OSPFv2, page 4-20](#)
- [Configuring Authentication for an Area, page 4-23](#)
- [Configuring Authentication for an Interface, page 4-25](#)

Enabling the OSPFv2 Feature

You must enable the OSPFv2 feature before you can configure OSPFv2.

BEFORE YOU BEGIN

Ensure that you are in the correct device (or choose **Virtual Devices** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **feature ospf**
3. (Optional) **show feature**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

To enable the OSPFv2 feature, follow these steps:

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device View tab and Network View tab (see [Figure 4-5](#)).
- Step 2** From the Contents pane, click the **Device View** tab.
A summary table of available Cisco NX-OS devices displays.
- Step 3** From the summary table, click the device to which you want to add an OSPF instance.
- Step 4** From the Top menu, choose **OSPFv2-IPv4 > xxx**.
Cisco NX-OS adds a new row to the summary table and displays the Global Tab in the Details pane.
- Step 5** From the summary table, in the Process ID field, enter an integer value.
This must be a unique value for this device.
- Step 6** From the Top menu, choose **File > Save** to implement your changes.
-

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	feature ospf Example: switch(config)# feature ospf	Enables the OSPFv2 feature.
Step 3	show feature Example: switch(config)# show feature	(Optional) Displays enabled and disabled features.
Step 4	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

Choose **OSPFv2-IPv4 > Delete Process** to remove the OSPFv2 instance and all associated configuration.

Use the **no feature ospf** command to disable the OSPFv2 feature and remove all associated configurations.

Command	Purpose
no feature ospf Example: switch(config)# no feature ospf	Disables the OSPFv2 feature and removes all associated configurations.

RELATED TOPICS

- [Configuring Optional Parameters on an OSPFv2 Instance, page 4-19](#)

Creating an OSPFv2 Instance

The first step in configuring OSPFv2 is to create an OSPFv2 instance. You assign a unique instance tag for this OSPFv2 instance. The instance tag can be any string.

For more information about OSPFv2 instance parameters, see the [“Configuring Advanced OSPFv2” section on page 4-27](#).

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature” section on page 4-15](#)).

Use the **show ip ospf instance-tag** command to verify that the instance tag is not in use.

OSPFv2 must be able to obtain a router identifier (for example, a configured loopback address) or you must configure the router ID option.

Ensure that you are in the correct device (or choose **Virtual Devices** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf instance-tag**
3. (Optional) **router-id ip-address**
4. (Optional) **show ip ospf instance-tag**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

To create an OSPFv2 instance, follow these steps:

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device View tab and Network View tab (see [Figure 4-5](#)).
- Step 2** From the Contents pane, click the **Device View** tab.
A summary table of available Cisco NX-OS devices displays.
- Step 3** From the summary table, click the device to which you want to add an OSPF instance.

- Step 4** From the Top menu, choose **OSPFv2-IPv4 > Add New Process**.
Cisco NX-OS adds a new row to the summary table and displays the Global Tab in the Details pane.
- Step 5** From the summary table, in the Process ID field, enter an integer value.
This must be a unique value for this device.
- Step 6** From the Top menu, choose **File > Save** to implement your changes.

	Command	Purpose
Step 1	<code>configure terminal</code> Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	<code>router ospf instance-tag</code> Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	<code>router-id ip-address</code> Example: switch(config-router)# router-id 192.0.2.1	(Optional) Configures the OSPFv2 router ID. This IP address identifies this OSPFv2 instance and must exist on a configured interface in the system.
Step 4	<code>show ip ospf instance-tag</code> Example: switch(config-router)# show ip ospf 201	(Optional) Displays OSPF information.
Step 5	<code>copy running-config startup-config</code> Example: switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

Choose **OSPFv2-IPv4 > Delete Process** to remove the OSPFv2 instance and all associated configuration.

Use the **no router ospf** command to remove the OSPFv2 instance and all associated configurations.

Command	Purpose
<code>no router ospf instance-tag</code> Example: switch(config)# no router ospf 201	Deletes the OSPF instance and the associated configurations.



Note This command does not remove OSPF configuration in interface mode. You must manually remove any OSPFv2 commands configured in interface mode.

RELATED TOPICS

- [Configuring Optional Parameters on an OSPFv2 Instance, page 4-19](#)

Configuring Optional Parameters on an OSPFv2 Instance

You can configure optional parameters for OSPF.

For more information about OSPFv2 instance parameters, see the [“Configuring Advanced OSPFv2” section on page 4-27](#).

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature” section on page 4-15](#)).

OSPFv2 must be able to obtain a router identifier (for example, a configured loopback address) or you must configure the router ID option.

Ensure that you are in the correct device (or choose **Virtual Devices** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the `switchto vdc` command).

DETAILED STEPS

Command	Purpose
distance <i>number</i> Example: switch(config-router)# distance 25	Configures the administrative distance for this OSPFv2 instance. The range is from 1 to 255. The default is 110.
log-adjacency-changes [<i>detail</i>] Example: switch(config-router)# log-adjacency-changes	Generates a system message whenever a neighbor changes state.
maximum-paths <i>path-number</i> Example: switch(config-router)# maximum-paths 4	Configures the maximum number of equal OSPFv2 paths to a destination in the route table. This command is used for load balancing. The range is from 1 to 16. The default is 8.

This example shows how to create an OSPFv2 instance:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# copy running-config startup-config
```

RELATED TOPICS

- [Enabling the OSPFv2 Feature, page 4-15](#)
- [Additional References](#)

Configuring Networks in OSPFv2

You can configure a network to OSPFv2 by associating it through the interface that the router uses to connect to that network (see the “Neighbors” section on page 4-2). You can add all networks to the default backbone area (Area 0), or you can create new areas using any decimal number or an IP address.



Note

All areas must connect to the backbone area either directly or through a virtual link.



Note

OSPF is not enabled on an interface until you configure a valid IP address for that interface.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the “Enabling the OSPFv2 Feature” section on page 4-15).

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface-type slot/port*
3. **no switchport**
4. **ip address** *ip-prefix/length*
5. **ip router ospf** *instance-tag area area-id* [**secondaries none**]
6. (Optional) **show ip ospf** *instance-tag interface interface-type slot/port*
7. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (see Figure 4-5).
- Step 2** From the summary table in the Device View tab, click the device to which you want to configure a network.
- Step 3** From the summary table, click the OSPF instance that you want to configure a network on.
- Step 4** From the Details pane, click the **Area** tab.
A summary of the existing areas displays.
- Step 5** (Optional) From the top menu, choose **OSPFv2-IPv4 > Add Area** to create a new area.
- a. In the Area ID field, enter a value as an integer or in IP address format.
 - b. From the Area Type drop-down list, select the area type.
- Step 6** Click the area that you want to configure an interface in and click the **Interfaces** tab.
The list of existing interfaces in this area displays.

- Step 7** From the top menu, choose **OSPFv2-IPv4 > Add Interface** to add an interface to this area and OSPF instance.
- A new row in the Interfaces tab appears.
- Step 8** From the Name drop-down list, select the new interface.
- Step 9** (Optional) To set the optional interface parameters, follow these steps:
- To suppress routing updates on the interface, check the **Passive** checkbox.
 - To assign a priority to determine the DR for an area, enter a value in the Priority field.
The range is from 0 to 255. The default is 1.
 - To assign the link cost metric, enter a value in the Link Cost field.
The default is to calculate the cost metric based on reference bandwidth and interface bandwidth.
 - To modify the default link delay, enter a value in the Link Delay field.
 - To set the hello interval, enter a value from 1 to 65535 in the Hello Timers field.
The default is 10 seconds.
 - To set the dead interval, enter a value from 1 to 65535 in the Dead Timers field.
The default is four times the hello interval in seconds.
 - To set the retransmission time, enter a value in the Retrans Timers field.
- Step 10** (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	interface <i>interface-type slot/port</i> Example: switch(config)# interface ethernet 1/2 switch(config-if)#	Enters interface configuration mode.
Step 3	no switchport Example: switch(config-if)# no switchport	Configures the interface as a Layer 3 routed interface.
Step 4	ip address <i>ip-prefix/length</i> Example: switch(config-if)# ip address 192.0.2.1/16	Assigns an IP address and subnet mask to this interface.
Step 5	ip router ospf <i>instance-tag area area-id</i> [secondaries none] Example: switch(config-if)# ip router ospf 201 area 0.0.0.15	Adds the interface to the OSPFv2 instance and area.

	Command	Purpose
Step 6	<pre>show ip ospf instance-tag interface interface-type slot/port</pre> <p>Example: switch(config-if)# show ip ospf 201 interface ethernet 1/2</p>	(Optional) Displays OSPF information.
Step 7	<pre>copy running-config startup-config</pre> <p>Example: switch(config)# copy running-config startup-config</p>	(Optional) Saves this configuration change.

You can configure the following optional parameters for OSPFv2 in interface configuration mode:

Command	Purpose
<pre>ip ospf cost number</pre> <p>Example: switch(config-if)# ip ospf cost 25</p>	Configures the OSPFv2 cost metric for this interface. The default is to calculate cost metric, based on reference bandwidth and interface bandwidth. The range is from 1 to 65535.
<pre>ip ospf dead-interval seconds</pre> <p>Example: switch(config-if)# ip ospf dead-interval 50</p>	Configures the OSPFv2 dead interval, in seconds. The range is from 1 to 65535. The default is four times the hello interval, in seconds.
<pre>ip ospf hello-interval seconds</pre> <p>Example: switch(config-if)# ip ospf hello-interval 25</p>	Configures the OSPFv2 hello interval, in seconds. The range is from 1 to 65535. The default is 10 seconds.
<pre>ip ospf mtu-ignore</pre> <p>Example: switch(config-if)# ip ospf mtu-ignore</p>	Configures OSPFv2 to ignore any IP MTU mismatch with a neighbor. The default is to not establish adjacency if the neighbor MTU does not match the local interface MTU.
<pre>ip ospf passive-interface</pre> <p>Example: switch(config-if)# ip ospf passive-interface</p>	Suppresses routing updates on the interface.
<pre>ip ospf priority number</pre> <p>Example: switch(config-if)# ip ospf priority 25</p>	Configures the OSPFv2 priority, used to determine the DR for an area. The range is from 0 to 255. The default is 1. See the “Designated Routers” section on page 4-3 .
<pre>ip ospf shutdown</pre> <p>Example: switch(config-if)# ip ospf shutdown</p>	Shuts down the OSPFv2 instance on this interface.

This example shows how to add a network area 0.0.0.10 in OSPFv2 instance 201:

```
switch# configure terminal
switch(config)# interface ethernet 1/2
switch(config-if)# no switchport
switch(config-if)# ip address 192.0.2.1/16
switch(config-if)# ip router ospf 201 area 0.0.0.10
switch(config-if)# copy running-config startup-config
```

Use the **show ip ospf interface** command to verify the interface configuration. Use the **show ip ospf neighbor** command to see the neighbors for this interface.

Configuring Authentication for an Area

You can configure authentication for all networks in an area or for individual interfaces in the area. Interface authentication configuration overrides area authentication.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature”](#) section on page 4-15).

Ensure that all neighbors on an interface share the same authentication configuration, including the shared authentication key.

Create the key-chain for this authentication configuration. See the *Cisco Nexus 7000 Series NX-OS Security Configuration Guide, Release 5.x*.

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf instance-tag**
3. **area area-id authentication [message-digest]**
4. **interface interface-type slot/port**
5. **no switchport**
6. (Optional) **ip ospf authentication-key [0 | 3] key**
or
(Optional) **ip ospf message-digest-key key-id md5 [0 | 3] key**
7. (Optional) **show ip ospf instance-tag interface interface-type slot/port**
8. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device that you want to configure authentication on.
- Step 3** Click the OSPF instance that you want to configure authentication on.

- Step 4** From the Details pane, click the **Area** tab.
A summary of the existing areas displays.
- Step 5** Click the area that you want to configure.
- Step 6** Double-click the **Authentication** field for this area.
- Step 7** From the Authentication Type drop-down list, choose the authentication type that you want to configure.
- Step 8** In the Key field, enter the authentication key.
- Step 9** Click **OK**.
- Step 10** (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	area area-id authentication [message-digest] Example: switch(config-router)# area 0.0.0.10 authentication	Configures the authentication mode for an area.
Step 4	interface interface-type slot/port Example: switch(config-router)# interface ethernet 1/2 switch(config-if)#	Enters interface configuration mode.
Step 5	no switchport Example: switch(config-if)# no switchport	Configures the interface as a Layer 3 routed interface.
Step 6	ip ospf authentication-key [0 3] key Example: switch(config-if)# ip ospf authentication-key 0 mypass	(Optional) Configures simple password authentication for this interface. Use this command if the authentication is not set to key-chain or message-digest. 0 configures the password in clear text. 3 configures the password as 3DES encrypted.
	ip ospf message-digest-key key-id md5 [0 3] key Example: switch(config-if)# ip ospf message-digest-key 21 md5 0 mypass	(Optional) Configures message digest authentication for this interface. Use this command if the authentication is set to message-digest. The key-id range is from 1 to 255. The MD5 option 0 configures the password in clear text and 3 configures the pass key as 3DES encrypted.

	Command	Purpose
Step 7	<pre>show ip ospf instance-tag interface interface-type slot/port</pre> <p>Example: switch(config-if)# show ip ospf 201 interface ethernet 1/2</p>	(Optional) Displays OSPF information.
Step 8	<pre>copy running-config startup-config</pre> <p>Example: switch(config)# copy running-config startup-config</p>	(Optional) Saves this configuration change.

Configuring Authentication for an Interface

You can configure authentication for individual interfaces in the area. Interface authentication configuration overrides area authentication.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the “[Enabling the OSPFv2 Feature](#)” section on page 4-15).

Ensure that all neighbors on an interface share the same authentication configuration, including the shared authentication key.

Create the key-chain for this authentication configuration. See the *Cisco Nexus 7000 Series NX-OS Security Configuration Guide, Release 5.x*.

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface-type slot/port*
3. **no switchport**
4. **ip ospf authentication** [**message-digest**]
5. (Optional) **ip ospf authentication key-chain** *key-name*
6. (Optional) **ip ospf authentication-key** [**0 | 3 | 7**] *key*
7. (Optional) **ip ospf message-digest-key** *key-id* **md5** [**0 | 3 | 7**] *key*
8. (Optional) **show ip ospf instance-tag interface** *interface-type slot/port*
9. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device that you want to configure authentication on.

- Step 3** Click the OSPF instance that you want to configure authentication on.
- Step 4** From the Details pane, click the **Area** tab.
A summary of the existing areas displays.
- Step 5** Click the area that you want to configure.
- Step 6** Click the **Interfaces** tab for this area.
The interfaces summary table displays.
- Step 7** Click the interface that you want to configure.
- Step 8** Double-click the **Authentication** field for this interface.
- Step 9** From the Authentication Type drop-down list, choose the authentication type that you want to configure.
- Step 10** In the Key field, enter the authentication key.
- Step 11** Click **OK**.
- Step 12** (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	<code>configure terminal</code> Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	<code>interface interface-type slot/port</code> Example: switch(config)# interface ethernet 1/2 switch(config-if)#	Enters interface configuration mode.
Step 3	<code>no switchport</code> Example: switch(config-if)# no switchport	Configures the interface as a Layer 3 routed interface.
Step 4	<code>ip ospf authentication [message-digest]</code> Example: switch(config-if)# ip ospf authentication	Enables interface authentication mode for OSPFv2 for either cleartext or message-digest type. Overrides area-based authentication for this interface. All neighbors must share this authentication type.
Step 5	<code>ip ospf authentication key-chain key-name</code> Example: switch(config-if)# ip ospf authentication key-chain Test1	(Optional) Configures interface authentication to use key chains for OSPFv2. See the <i>Cisco Nexus 7000 Series NX-OS Security Configuration Guide, Release 5.x</i> , for details on key chains.

	Command	Purpose
Step 6	<pre>ip ospf authentication-key [0 3 7] key</pre> <p>Example: switch(config-if)# ip ospf authentication-key 0 mypass</p>	<p>(Optional) Configures simple password authentication for this interface. Use this command if the authentication is not set to key-chain or message-digest.</p> <p>The options are as follows:</p> <ul style="list-style-type: none"> • 0—Configures the password in clear text. • 3—Configures the pass key as 3DES encrypted. • 7—Configures the key as Cisco type 7 encrypted.
Step 7	<pre>ip ospf message-digest-key key-id md5 [0 3 7] key</pre> <p>Example: switch(config-if)# ip ospf message-digest-key 21 md5 0 mypass</p>	<p>(Optional) Configures message digest authentication for this interface. Use this command if the authentication is set to message-digest. The key-id range is from 1 to 255. The MD5 options are as follows:</p> <ul style="list-style-type: none"> • 0—Configures the password in clear text. • 3—Configures the pass key as 3DES encrypted. • 7—Configures the key as Cisco type 7 encrypted.
Step 8	<pre>show ip ospf instance-tag interface interface-type slot/port</pre> <p>Example: switch(config-if)# show ip ospf 201 interface ethernet 1/2</p>	<p>(Optional) Displays OSPF information.</p>
Step 9	<pre>copy running-config startup-config</pre> <p>Example: switch(config)# copy running-config startup-config</p>	<p>(Optional) Saves this configuration change.</p>

This example shows how to set an interface for simple, unencrypted passwords and set the password for Ethernet interface 1/2:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# exit
switch(config)# interface ethernet 1/2
switch(config-if)# no switchport
switch(config-if)# ip router ospf 201 area 0.0.0.10
switch(config-if)# ip ospf authentication
switch(config-if)# ip ospf authentication-key 0 mypass
switch(config-if)# copy running-config startup-config
```

Configuring Advanced OSPFv2

Configure OSPFv2 after you have designed your OSPFv2 network.

This section includes the following topics:

- [Configuring Filter Lists for Border Routers, page 4-28](#)
- [Configuring Stub Areas, page 4-30](#)

- [Configuring a Totally Stubby Area, page 4-32](#)
- [Configuring NSSA, page 4-32](#)
- [Configuring Virtual Links, page 4-35](#)
- [Configuring Redistribution, page 4-38](#)
- [Limiting the Number of Redistributed Routes, page 4-40](#)
- [Configuring Route Summarization, page 4-42](#)
- [Configuring Stub Route Advertisements, page 4-44](#)
- [Modifying the Default Timers, page 4-46](#)
- [Configuring Graceful Restart, page 3-40](#)
- [Restarting an OSPFv2 Instance, page 4-52](#)
- [Configuring Graceful Restart, page 3-40](#)

Configuring Filter Lists for Border Routers

You can separate your OSPFv2 domain into a series of areas that contain related networks. All areas must connect to the backbone area through an area border router (ABR). OSPFv2 domains can connect to external domains through an *autonomous system border router* (ASBR). See the “[Areas](#)” section on [page 4-4](#).

ABRs have the following optional configuration parameters:

- **Area range**—Configures route summarization between areas. See the “[RELATED TOPICS](#)” section on [page 4-43](#).
- **Filter list**—Filters the Network Summary (type 3) LSAs on an ABR that are allowed in from an external area.

ASBRs also support filter lists.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the “[Enabling the OSPFv2 Feature](#)” section on [page 4-15](#)).

Create the route map that the filter list uses to filter IP prefixes in incoming or outgoing Network Summary (type 3) LSAs. See [Chapter 14, “Configuring Route Policy Manager.”](#)

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf** *instance-tag*
3. **area** *area-id* **filter-list route-map** *map-name* {in | out}
4. (Optional) **show ip ospf policy statistics area** *id* **filter-list** {in | out}
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device that you want to configure a filter list on.
- Step 3** Click the OSPF instance that you want to configure a filter list on.
- Step 4** From the Details pane, click the **Area/AS Border** tab.
- Step 5** Expand the Route Summarization and Filtering section.
A summary tree of inter-area filters displays.
- Step 6** To configure an inbound filter-list, follow these steps:
- Double-click the **Inbound Filter Policy** field for the area you are configuring.
A drop-down list of route policies displays.
 - From the policy drop-down list, choose the policy that you want to configure.
 - Click **OK**.
- Step 7** To configure an outbound filter-list, follow these steps:
- Double-click the **Outbound Filter Policy** field for the area you are configuring.
A drop-down list of route policies displays.
 - From the policy drop-down list, choose the policy that you want to configure.
 - Click **OK**.
- Step 8** (Optional) Choose **File > Save** from the top menu to save your changes.
-

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	area area-id filter-list route-map map-name {in out} Example: switch(config-router)# area 0.0.0.10 filter-list route-map FilterLSAs in	Filters incoming or outgoing Network Summary (type 3) LSAs on an ABR.

	Command	Purpose
Step 4	<pre>show ip ospf policy statistics area id filter-list {in out}</pre> <p>Example: switch(config-if)# show ip ospf policy statistics area 0.0.0.10 filter-list in</p>	(Optional) Displays OSPF policy information.
Step 5	<pre>copy running-config startup-config</pre> <p>Example: switch(config)# copy running-config startup-config</p>	(Optional) Saves this configuration change.

This example shows how to configure a filter list in area 0.0.0.10:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 filter-list route-map FilterLSAs in
switch(config-router)# copy running-config startup-config
```

Configuring Stub Areas

You can configure a stub area for part of an OSPFv2 domain where external traffic is not necessary. Stub areas block AS External (type 5) LSAs, limiting unnecessary routing to and from selected networks. See the “[Stub Area](#)” section on page 4-8. You can optionally block all summary routes from going into the stub area.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the “[Enabling the OSPFv2 Feature](#)” section on page 4-15).

Ensure that there are no virtual links or ASBRs in the proposed stub area.

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf instance-tag**
3. **area area-id stub**
4. (Optional) **area area-id default-cost cost**
5. (Optional) **show ip ospf instance-tag**
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab ([Figure 4-5](#)).

- Step 2** From the Device View tab, click the device that you want to configure a stub area on .
- Step 3** Click the OSPF instance that you want to configure a stub area on.
- Step 4** Click the **Area** tab in the Details pane.
A summary of the existing areas displays.
- Step 5** Choose **OSPFv2-IPv4 > Add Area** to create a new area.
- In the Area ID field, enter the area ID.
 - from the Area Type drop-down list, choose stub.
- Step 6** (Optional) Click the Stub/NSSA tab for the new area.
The stub and NSSA parameters display.
- Step 7** (Optional) In the Default Route Cost field, enter a default cost for this stub area.
- Step 8** (Optional) To allow summary routes into this stub area, check the **Allow Summary Routes** checkbox.
- Step 9** (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	area area-id stub Example: switch(config-router)# area 0.0.0.10 stub	Creates this area as a stub area.
Step 4	area area-id default-cost cost Example: switch(config-router)# area 0.0.0.10 default-cost 25	(Optional) Sets the cost metric for the default summary route sent into this stub area. The range is from 0 to 16777215. The default is 1.
Step 5	show ip ospf instance-tag Example: switch(config-if)# show ip ospf 201	(Optional) Displays OSPF information.
Step 6	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

This example shows how to create a stub area:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 stub
switch(config-router)# copy running-config startup-config
```

Configuring a Totally Stubby Area

You can create a totally stubby area and prevent all summary route updates from going into the stub area.

To create a totally stubby area, use the following command in router configuration mode:

Command	Purpose
<code>area area-id stub no-summary</code>	Creates this area as a totally stubby area.
Example: switch(config-router)# area 20 stub no-summary	

Configuring NSSA

You can configure an NSSA for part of an OSPFv2 domain where limited external traffic is required. See the [“Not-So-Stubby Area” section on page 4-9](#). You can optionally translate this external traffic to an AS External (type 5) LSA and flood the OSPFv2 domain with this routing information. An NSSA can be configured with the following optional parameters:

- No redistribution—Redistributed routes bypass the NSSA and are redistributed to other areas in the OSPFv2 autonomous system. Use this option when the NSSA ASBR is also an ABR.
- Default information originate—Generates an NSSA External (type 7) LSA for a default route to the external autonomous system. Use this option on an NSSA ASBR if the ASBR contains the default route in the routing table. This option can be used on an NSSA ABR whether or not the ABR contains the default route in the routing table.
- Route map—Filters the external routes so that only those routes that you want are flooded throughout the NSSA and other areas.
- Translate—Translates NSSA External LSAs to AS External LSAs for areas outside the NSSA. Use this command on an NSSA ABR to flood the redistributed routes throughout the OSPFv2 autonomous system. You can optionally suppress the forwarding address in these AS External LSAs. If you choose this option, the forwarding address is set to 0.0.0.0.
- No summary—Blocks all summary routes from flooding the NSSA. Use this option on the NSSA ABR.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature” section on page 4-15](#)).

Ensure that there are no virtual links in the proposed NSSA and that it is not the backbone area.

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the `switchto vdc` command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf** *instance-tag*
3. **area** *area-id* **nssa** [**no-redistribution**] [**default-information-originate** [**route-map** *map-name*]] [**no-summary**] [**translate type7** {**always** | **never**}] [**suppress-fa**]
4. (Optional) **area** *area-id* **default-cost** *cost*
5. (Optional) **show ip ospf** *instance-tag*
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device where you want to configure a NSSA area.
- Step 3** Click the OSPF instance where you want to configure an NSSA area.
- Step 4** From the Details pane, click the **Area** tab.
A summary of the existing areas displays.
- Step 5** Choose **OSPFv2-IPv4 > Add Area** to create a new area.
- a. In the Area ID field, enter the area ID.
 - b. from the Area Type drop-down list, choose NSSA.
- Step 6** (Optional) Click the Stub/NSSA tab for the new area.
The stub and NSSA parameters display.
- Step 7** (Optional) To allow route redistributin through this area, check the **Allow Redistribution** checkbox.
- Step 8** (Optional) To allow summary routes into this area, check the **Allow Summary Routes** checkbox.
- Step 9** (Optional) To translate Type-7 LSAs in this area, check the **Translate Type-7 LSA** checkbox.
- Step 10** (Optional) To suppress the forwarding address in this area, check the **Suppress Forwarding Address** checkbox.
- Step 11** (Optional) To advertise a default route into this area follow these steps:
- a. Check the **Advertise Default Route** checkbox.
 - b. From the Policy drop-down list, choose a route policy.
 - c. Click **OK**.
- Step 12** (Optional) Choose **File > Save** from the top menu to save your changes.
-

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	area area-id nssa [no-redistribution] [default-information-originate] [route-map map-name] [no-summary] [translate type7 {always never}] [suppress-fa] Example: switch(config-router)# area 0.0.0.10 nssa	Creates this area as an NSSA.
Step 4	area area-id default-cost cost Example: switch(config-router)# area 0.0.0.10 default-cost 25	(Optional) Sets the cost metric for the default summary route sent into this NSSA.
Step 5	show ip ospf instance-tag Example: switch(config-if)# show ip ospf 201	(Optional) Displays OSPF information.
Step 6	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

This example shows how to create an NSSA that blocks all summary route updates:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 nssa no-summary
switch(config-router)# copy running-config startup-config
```

This example shows how to create an NSSA that generates a default route:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 nssa default-info-originate
switch(config-router)# copy running-config startup-config
```

This example shows how to create an NSSA that filters external routes and blocks all summary route updates:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 nssa route-map ExternalFilter no-summary
switch(config-router)# copy running-config startup-config
```

This example shows how to create an NSSA that always translates NSSA External (type 5) LSAs to AS External (type 7) LSAs:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 nssa translate type 7 always
switch(config-router)# copy running-config startup-config
```

Configuring Virtual Links

A virtual link connects an isolated area to the backbone area through an intermediate area. See the “[Virtual Links](#)” section on page 4-9. You can configure the following optional parameters for a virtual link:

- Authentication—Sets a simple password or MD5 message digest authentication and associated keys.
- Dead interval—Sets the time that a neighbor waits for a Hello packet before declaring the local router as dead and tearing down adjacencies.
- Hello interval—Sets the time between successive Hello packets.
- Retransmit interval—Sets the estimated time between successive LSAs.
- Transmit delay—Sets the estimated time to transmit an LSA to a neighbor.



Note

You must configure the virtual link on both routers involved before the link becomes active.

You cannot add a virtual link to a stub area.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the “[Enabling the OSPFv2 Feature](#)” section on page 4-15).

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf** *instance-tag*
3. **area** *area-id* **virtual-link** *router-id*
4. (Optional) **show ip ospf virtual-link** [**brief**]
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device where you want to configure a virtual link.
- Step 3** Click the OSPF instance where you want to configure a virtual link.

- Step 4** From the Details pane, click the **Area/AS Border** tab.
- Step 5** Expand the Virtual Links section.
A list of virtual links displays.
- Step 6** Choose **OSPFv2-IPv4 > Add Virtual Link** to create a new virtual link.
- Step 7** In the ABR Router field, enter the router ID for the remote router at the other end of this virtual link.
You must configure a virtual link on that remote router to complete the configuration.
- Step 8** (Optional) To configure authentication on this virtual link, follow these steps:
- Double-click the **Authentication** field for this interface.
 - From the Authentication Type drop-down list, choose the authentication type that you want to configure.
 - In the Key field, enter the authentication key.
 - Click **OK**.
- Step 9** (Optional) To configure the link delay, enter a value in the Link Delay field.
- Step 10** (Optional) To set the hello interval, enter a value from 1 to 65535 in the Hello Timers field.
The default is 10 seconds.
- Step 11** (Optional) To set the dead interval, enter a value from 1 to 65535 in the Dead Timers field.
The default is four times the hello interval, in seconds.
- Step 12** (Optional) To set the retransmission time, enter a value in the Retrans Timers field.
- Step 13** (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	<code>configure terminal</code> Example: <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters configuration mode.
Step 2	<code>router ospf instance-tag</code> Example: <code>switch(config)# router ospf 201</code> <code>switch(config-router)#</code>	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	<code>area area-id virtual-link router-id</code> Example: <code>switch(config-router)# area 0.0.0.10</code> <code>virtual-link 10.1.2.3</code> <code>switch(config-router-vlink)#</code>	Creates one end of a virtual link to a remote router. You must create the virtual link on that remote router to complete the link.

	Command	Purpose
Step 4	show ip ospf virtual-link [brief] Example: switch(config-router-vlink)# show ip ospf virtual-link	(Optional) Displays OSPF virtual link information.
Step 5	copy running-config startup-config Example: switch(config-router-vlink)# copy running-config startup-config	(Optional) Saves this configuration change.

You can configure the following optional commands in virtual link configuration mode:

Commands	Purpose
authentication [key-chain <i>key-id</i> message-digest null] Example: switch(config-router-vlink)# authentication message-digest	(Optional) Overrides area-based authentication for this virtual link.
authentication-key [0 3] <i>key</i> Example: switch(config-router-vlink)# authentication-key 0 mypass	(Optional) Configures a simple password for this virtual link. Use this command if the authentication is not set to key-chain or message-digest. 0 configures the password in clear text. 3 configures the password as 3DES encrypted.
dead-interval <i>seconds</i> Example: switch(config-router-vlink)# dead-interval 50	(Optional) Configures the OSPFv2 dead interval, in seconds. The range is from 1 to 65535. The default is four times the hello interval, in seconds.
hello-interval <i>seconds</i> Example: switch(config-router-vlink)# hello-interval 25	(Optional) Configures the OSPFv2 hello interval, in seconds. The range is from 1 to 65535. The default is 10 seconds.
message-digest-key <i>key-id md5</i> [0 3] <i>key</i> Example: switch(config-router-vlink)# message-digest-key 21 md5 0 mypass	(Optional) Configures message digest authentication for this virtual link. Use this command if the authentication is set to message-digest. 0 configures the password in cleartext. 3 configures the pass key as 3DES encrypted.
retransmit-interval <i>seconds</i> Example: switch(config-router-vlink)# retransmit-interval 50	(Optional) Configures the OSPFv2 retransmit interval, in seconds. The range is from 1 to 65535. The default is 5.
transmit-delay <i>seconds</i> Example: switch(config-router-vlink)# transmit-delay 2	(Optional) Configures the OSPFv2 transmit-delay, in seconds. The range is from 1 to 450. The default is 1.

This example shows how to create a simple virtual link between two ABRs.

The configuration for ABR 1 (router ID 27.0.0.55) is as follows:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 virtual-link 10.1.2.3
switch(config-router-vlink)# copy running-config startup-config
```

The configuration for ABR 2 (Router ID 10.1.2.3) is as follows:

```
switch# configure terminal
switch(config)# router ospf 101
switch(config-router)# area 0.0.0.10 virtual-link 27.0.0.55
switch(config-router-vlink)# copy running-config startup-config
```

Configuring Redistribution

You can redistribute routes learned from other routing protocols into an OSPFv2 autonomous system through the ASBR.

You can configure the following optional parameters for route redistribution in OSPF:

- **Default information originate**—Generates an AS External (type 5) LSA for a default route to the external autonomous system.



Note Default information originate ignores **match** statements in the optional route map.

- **Default metric**—Sets all redistributed routes to the same cost metric.



Note

If you redistribute static routes, Cisco NX-OS also redistributes the default static route.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature”](#) section on page 4-15).

Create the necessary route maps used for redistribution.

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf** *instance-tag*
3. **redistribute** { **bgp** *id* | **direct** | **eigrp** *id* | **isis** *id* | **ospf** *id* | **rip** *id* | **static** } **route-map** *map-name*
4. **default-information originate** [**always**] [**route-map** *map-name*]
5. **default-metric** *cost*
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device where you want to configure redistribution.
- Step 3** Click the OSPF instance where you want to configure redistribution.
- Step 4** From the Details pane, click the **Area/AS Border** tab.
- Step 5** Expand the Redistribution area.
A list of redistributed protocols displays.
- Step 6** Choose **OSPFv2-IPv4 > Add External Route Source** to add a new distributed protocol.
- Step 7** Double-click the **External Route Source** field.
- Step 8** From the External Router Source drop-down list, choose the protocol that you want to redistribute into this OSPFv2 instance.
- Step 9** Double-click the **Redistribution Policy** field.
- Step 10** From the Redistribution Policy drop-down list, choose the protocol that you want to redistribute into this OSPFv2 instance.
- Step 11** (Optional) To set the default metric, enter a value in the Default Metric field.
- Step 12** (Optional) Choose **File > Save** from the top menu to save your changes.
-

	Command	Purpose
Step 1	<code>configure terminal</code> Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	<code>router ospf instance-tag</code> Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	<code>redistribute {bgp id direct eigrp id isis id ospf id rip id static}</code> <code>route-map map-name</code> Example: switch(config-router)# redistribute bgp 64496 route-map FilterExternalBGP	Redistributes the selected protocol into OSPF through the configured route map. Note If you redistribute static routes, Cisco NX-OS also redistributes the default static route.

	Command	Purpose
Step 4	<pre>default-information originate [always] [route-map map-name]</pre> <p>Example:</p> <pre>switch(config-router)# default-information-originate route-map DefaultRouteFilter</pre>	<p>Creates a default route into this OSPF domain if the default route exists in the RIB. Use the following optional keywords:</p> <ul style="list-style-type: none"> • always—Always generate the default route of 0.0.0. even if the route does not exist in the RIB. • route-map—Generate the default route if the route map returns true. <p>Note This command ignores match statements in the route map.</p>
Step 5	<pre>default-metric cost</pre> <p>Example:</p> <pre>switch(config-router)# default-metric 25</pre>	<p>Sets the cost metric for the redistributed routes. This does not apply to directly connected routes. Use a route map to set the default metric for directly connected routes.</p>
Step 6	<pre>copy running-config startup-config</pre> <p>Example:</p> <pre>switch(config-router)# copy running-config startup-config</pre>	<p>(Optional) Saves this configuration change.</p>

This example shows how to redistribute the Border Gateway Protocol (BGP) into OSPF:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# redistribute bgp route-map FilterExternalBGP
switch(config-router)# copy running-config startup-config
```

Limiting the Number of Redistributed Routes

Route redistribution can add many routes to the OSPFv2 route table. You can configure a maximum limit to the number of routes accepted from external protocols. OSPFv2 provides the following options to configure redistributed route limits:

- **Fixed limit**—Logs a message when OSPFv2 reaches the configured maximum. OSPFv2 does not accept any more redistributed routes. You can optionally configure a threshold percentage of the maximum where OSPFv2 will log a warning when that threshold is passed.
- **Warning only**—Logs a warning only when OSPFv2 reaches the maximum. OSPFv2 continues to accept redistributed routes.
- **Withdraw**—Starts the timeout period when OSPFv2 reaches the maximum. After the timeout period, OSPFv2 requests all redistributed routes if the current number of redistributed routes is less than the maximum limit. If the current number of redistributed routes is at the maximum limit, OSPFv2 withdraws all redistributed routes. You must clear this condition before OSPFv2 accepts more redistributed routes.
You can optionally configure the timeout period.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature”](#) section on page 4-15).

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf instance-tag**
3. **redistribute {bgp id | direct | eigrp id | isis id | ospf id | rip id | static} route-map map-name**
4. **redistribute maximum-prefix max [threshold] [warning-only | withdraw [num-retries timeout]]**
5. (Optional) **show running-config ospf**
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device where you want to configure redistribution.
- Step 3** Click the OSPF instance where you want to configure redistribution.
- Step 4** From the Details pane, click the **Area/AS Border** tab.
- Step 5** Expand the Redistribution area.
A list of redistributed protocols displays.
- Step 6** Choose **OSPFv2-IPv4 > Add External Route Source** to add a new distributed protocol.
- Step 7** Double-click the **External Route Source** field.
- Step 8** From the External Router Source drop-down list, choose the protocol that you want to redistribute into this OSPFv2 instance.
- Step 9** Double-click the **Redistribution Policy** field.
- Step 10** From the Redistribution Policy drop-down list, choose the protocol that you want to redistribute into this OSPFv2 instance.
- Step 11** (Optional) To set the default metric, enter a value in the Default Metric field.
- Step 12** (Optional) Choose **File > Save** from the top menu to save your changes.
-

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.

	Command	Purpose
Step 3	<pre>redistribute {bgp id direct eigrp id isis id ospf id rip id static} route-map map-name</pre> <p>Example: switch(config-router)# redistribute bgp route-map FilterExternalBGP</p>	Redistributes the selected protocol into OSPF through the configured route map.
Step 4	<pre>redistribute maximum-prefix max [threshold] [warning-only withdraw [num-retries timeout]]</pre> <p>Example: switch(config-router)# redistribute maximum-prefix 1000 75 warning-only</p>	<p>Specifies a maximum number of prefixes that OSPFv2 will distribute. The range is from 0 to 65536. Optionally specifies the following:</p> <ul style="list-style-type: none"> • threshold—Percent of maximum prefixes that will trigger a warning message. • warning-only—Logs an warning message when the maximum number of prefixes is exceeded. • withdraw—Withdraws all redistributed routes. Optionally tries to retrieve the redistributed routes. The <i>num-retries</i> range is from 1 to 12. The <i>timeout</i> is 60 to 600 seconds. The default is 300 seconds. Use clear ip ospf redistribution if all routes are withdrawn.
Step 5	<pre>show running-config ospf</pre> <p>Example: switch(config-router)# show running-config ospf</p>	(Optional) Displays the OSPFv2 configuration.
Step 6	<pre>copy running-config startup-config</pre> <p>Example: switch(config-router)# copy running-config startup-config</p>	(Optional) Saves this configuration change.

This example shows how to limit the number of redistributed routes into OSPF:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# redistribute bgp route-map FilterExternalBGP
switch(config-router)# redistribute maximum-prefix 1000 75
```

Configuring Route Summarization

You can configure route summarization for inter-area routes by configuring an address range that is summarized. You can also configure route summarization for external, redistributed routes by configuring a summary address for those routes on an ASBR. See the “[Route Summarization](#)” section on page 4-10.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the “[Enabling the OSPFv2 Feature](#)” section on page 4-15).

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf instance-tag**
3. **area area-id range ip-prefix/length [no-advertise] [cost cost]**
4. **summary-address ip-prefix/length [no-advertise | tag tag-id]**
5. (Optional) **show ip ospf summary-address**
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device where you want to configure a summary address.
- Step 3** Click the OSPF instance where you want to configure a summary address.
- Step 4** From the Details pane, click the **Area/AS Border** tab.
- Step 5** Expand the Redistribution area.
A list of summary addresses displays.
- Step 6** Choose **OSPFv2-IPv4 > Add External Route Summary** to add a new summary address.
- Step 7** Double-click the **External Route Summary** field and enter a summary address.
- Step 8** To advertise this summary address in a Network Summary (type 3) LSA, check the **Advertise** checkbox.
- Step 9** (Optional) To assign a tag for this summary address that can be used for redistribution with route maps, enter a value in the Route Tag field.
- Step 10** (Optional) Choose **File > Save** from the top menu to save your changes.
-

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	area area-id range ip-prefix/length [no-advertise] [cost cost] Example: switch(config-router)# area 0.0.0.10 range 10.3.0.0/16	Creates a summary address on an ABR for a range of addresses and optionally does not advertise this summary address in a Network Summary (type 3) LSA. The <i>cost</i> range is from 0 to 16777215.

	Command	Purpose
Step 4	summary-address <i>ip-prefix/length</i> [no-advertise tag <i>tag-id</i>] Example: switch(config-router)# summary-address 10.5.0.0/16 tag 2	Creates a summary address on an ASBR for a range of addresses and optionally assigns a tag for this summary address that can be used for redistribution with route maps.
Step 5	show ip ospf summary-address Example: switch(config-router)# show ip ospf summary-address	(Optional) Displays information about OSPF summary addresses.
Step 6	copy running-config startup-config Example: switch(config-router)# copy running-config startup-config	(Optional) Saves this configuration change.

This example shows how to create summary addresses between areas on an ABR:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# area 0.0.0.10 range 10.3.0.0/16
switch(config-router)# copy running-config startup-config
```

This example shows how to create summary addresses on an ASBR:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# summary-address 10.5.0.0/16
switch(config-router)# copy running-config startup-config
```

Configuring Stub Route Advertisements

Use stub route advertisements when you want to limit the OSPFv2 traffic through this router for a short time. See the [“OSPFv2 Stub Router Advertisements”](#) section on page 4-12.

Stub route advertisements can be configured with the following optional parameters:

- On startup—Sends stub route advertisements for the specified announce time.
- Wait for BGP—Sends stub router advertisements until BGP converges.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature”](#) section on page 4-15).

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf** *instance-tag*
3. **max-metric router-lsa** [**on-startup** [*announce-time*] [**wait-for bgp** *tag*]]

4. (Optional) **copy running-config startup-config****Note**

You should not save the running configuration of a router when it is configured for a graceful shutdown because the router will continue to advertise a maximum metric after it is reloaded.

DETAILED STEPS

- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the router where you want to configure stub route advertisements.
- Step 3** Click the OSPF instance where you want to configure stub route advertisements.
- Step 4** From the Details pane, click the **Global** tab.
- Step 5** Expand the Maximum Metric Advertisement section.
- Step 6** To configure stub route advertisements only on startup, follow these steps:
- Check the **Advertise Max Metric in Router LSA - On Startup** checkbox.
 - (Optional) To configure how long to advertise after startup, check the **Announcement Time** checkbox and enter a value in seconds.
 - (Optional) To send stub route advertisements until BGP converges, check the **Wait for BGP** checkbox and enter a value in the Tag field.
- Step 7** To always configure stub route advertisements, check the **Advertise Max Metric in Router LSA - Always** checkbox.
- Step 8** (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	max-metric router-lsa [on-startup [announce-time] [wait-for bgp tag]] Example: switch(config-router)# max-metric router-lsa	Configures OSPFv2 stub route advertisements. on-start-up - advertise when it first comes up or system start time. wait for that instance of bgp to come up. add to concepts
Step 4	copy running-config startup-config Example: switch(config-router)# copy running-config startup-config	(Optional) Saves this configuration change.

This example shows how to enable the stub router advertisements feature on startup for the default 600 seconds:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# max-metric router-lsa on-startup
switch(config-router)# copy running-config startup-config
```

Modifying the Default Timers

OSPFv2 includes a number of timers that control the behavior of protocol messages and shortest path first (SPF) calculations. OSPFv2 includes the following optional timer parameters:

- LSA arrival time—Sets the minimum interval allowed between LSAs arriving from a neighbor. LSAs that arrive faster than this time are dropped.
- Pacing LSAs—Set the interval at which LSAs are collected into a group and refreshed, checksummed, or aged. This timer controls how frequently LSA updates occur and optimizes how many are sent in an LSA update message (see the [“Flooding and LSA Group Pacing”](#) section on page 4-6).
- Throttle LSAs—Set rate limits for generating LSAs. This timer controls how frequently an LSA is generated if no topology change occurs.
- Throttle SPF calculation—Controls how frequently the SPF calculation is run.

At the interface level, you can also control the following timers:

- Retransmit interval—Sets the estimated time between successive LSAs.
- Transmit delay—Sets the estimated time to transmit an LSA to a neighbor.

See the [“Configuring Networks in OSPFv2”](#) section on page 4-20 for information about the hello interval and dead timer.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature”](#) section on page 4-15).

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf** *instance-tag*
3. **timers lsa-arrival** *msec*
4. **timers lsa-group-pacing** *seconds*
5. **timers throttle lsa** *start-time hold-interval max-time*
6. **timers throttle spf** *delay-time hold-time*
7. **interface** *type slot/port*
8. **no switchport**

9. **ip ospf hello-interval** *seconds*
10. **ip ospf dead-interval** *seconds*
11. **ip ospf retransmit-interval** *seconds*
12. **ip ospf transmit-delay** *seconds*
13. (Optional) **show ip ospf**
14. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device where you want to configure stub route advertisements.
- Step 3** Click the OSPF instance where you want to configure stub route advertisements.
- Step 4** To configure global OSPFv2 timers, follow these steps:
- a. From in the Details pane, click the **Global** tab.
 - b. Expand the Timers section.
 - c. (Optional) In the Min LSA Arrival Time field, enter a value from 1 to 600000.
The default is 1000 milliseconds.
 - d. (Optional) In the LSA Group Pacing Time field, enter a value from 1 to 1800.
The default is 240 seconds.
 - e. (Optional) In the Router LSA Hold Time field, enter a value from 1 to 600000.
The default is 5000 milliseconds.
 - f. (Optional) In the Network LSA Hold Time field, enter a value from 1 to 600000.
The default is 5000 milliseconds.
 - g. (Optional) In the Start Delay field, enter a value from 1 to 65535.
The default is 0 milliseconds.
 - h. (Optional) In the Min Hold Time field, enter a value from 1 to 65535.
The default is 1000 milliseconds.
 - i. (Optional) In the Max Wait Time field, enter a value from 1 to 65535.
The default is 5000 milliseconds.
- Step 5** To configure interface OSPFv2 timers, follow these steps:
- a. Click the **Area** tab in the Details pane.
A summary of the existing areas displays.
 - b. Click the area that you want to configure an interface in and click the **Interfaces** tab.
The list of existing interfaces in this area displays.
 - c. From the Hello Timers field, enter a value from 1 to 65535 to set the hello interval.
The default is 10 seconds.
 - d. From the Dead Timers field, enter a value from 1 to 65535 to set the dead interval.

The default is four times the hello interval, in seconds.

- e. the Retrans Timers field, enter a value from 1 to 65535 to set the retransmission time.

The default is five seconds.

Step 6 (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	<code>configure terminal</code> Example: <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters configuration mode.
Step 2	<code>router ospf instance-tag</code> Example: <code>switch(config)# router ospf 201</code> <code>switch(config-router)#</code>	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	<code>timers lsa-arrival msec</code> Example: <code>switch(config-router)# timers</code> <code>lsa-arrival 2000</code>	Sets the LSA arrival time in milliseconds. The range is from 10 to 600000. The default is 1000 milliseconds.
Step 4	<code>timers lsa-group-pacing seconds</code> Example: <code>switch(config-router)# timers</code> <code>lsa-group-pacing 1800</code>	Sets the interval in seconds for grouping LSAs. The range is from 1 to 1800. The default is 240 seconds.
Step 5	<code>timers throttle lsa start-time</code> <code>hold-interval max-time</code> Example: <code>switch(config-router)# timers throttle</code> <code>lsa 3000 6000 6000</code>	Sets the rate limit in milliseconds for generating LSAs with the following timers: <i>start-time</i> —The range is from 50 to 5000 milliseconds. The default value is 50 milliseconds. <i>hold-interval</i> —The range is from 50 to 30,000 milliseconds. The default value is 5000 milliseconds. <i>max-time</i> —The range is from 50 to 30,000 milliseconds. The default value is 5000 milliseconds.
Step 6	<code>timers throttle spf delay-time hold-time</code> <code>max-wait</code> Example: <code>switch(config-router)# timers throttle</code> <code>spf 3000 2000 4000</code>	Sets the SPF best path schedule initial delay time and the minimum hold time in seconds between SPF best path calculations. The range is from 1 to 600000. The default is no delay time and 5000 millisecond hold time.
Step 7	<code>interface type slot/port</code> Example: <code>switch(config)# interface ethernet 1/2</code> <code>switch(config-if)#</code>	Enters interface configuration mode.
Step 8	<code>no switchport</code> Example: <code>switch(config-if)# no switchport</code>	Configures the interface as a Layer 3 routed interface.

	Command	Purpose
Step 9	ip ospf hello-interval <i>seconds</i> Example: switch(config-if)# ip ospf retransmit-interval 30	Sets the hello interval this interface. The range is from 1 to 65535. The default is 10.
Step 10	ip ospf dead-interval <i>seconds</i> Example: switch(config-if)# ip ospf dead-interval 30	Sets the dead interval for this interface. The range is from 1 to 65535.
Step 11	ip ospf retransmit-interval <i>seconds</i> Example: switch(config-if)# ip ospf retransmit-interval 30	Sets the estimated time in seconds between LSAs transmitted from this interface. The range is from 1 to 65535. The default is 5.
Step 12	ip ospf transmit-delay <i>seconds</i> Example: switch(config-if)# ip ospf transmit-delay 450 switch(config-if)#	Sets the estimated time in seconds to transmit an LSA to a neighbor. The range is from 1 to 450. The default is 1.
Step 13	show ip ospf Example: switch(config-if)# show ip ospf	(Optional) Displays information about OSPF.
Step 14	copy running-config startup-config Example: switch(config-if)# copy running-config startup-config	(Optional) Saves this configuration change.

This example shows how to control LSA flooding with the lsa-group-pacing option:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# timers lsa-group-pacing 300
switch(config-router)# copy running-config startup-config
```

Configuring Graceful Restart

Graceful restart is enabled by default. You can configure the following optional parameters for graceful restart in an OSPFv2 instance:

- Grace period—Configures how long neighbors should wait after a graceful restart has started before tearing down adjacencies.
- Helper mode disabled—Disables helper mode on the local OSPFv2 instance. OSPFv2 will not participate in the graceful restart of a neighbor.
- Planned graceful restart only—Configures OSPFv2 to support graceful restart only in the event of a planned restart.

BEFORE YOU BEGIN

Ensure that you have enabled the OSPF feature (see the “[Enabling the OSPFv2 Feature](#)” section on page 4-15).

Ensure that all neighbors are configured for graceful restart with matching optional parameters set.

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **router ospf** *instance-tag*
3. **graceful-restart**
4. (Optional) **graceful-restart grace-period** *seconds*
5. (Optional) **graceful-restart helper-disable**
6. (Optional) **graceful-restart planned-only**
7. (Optional) **show ip ospf** *instance-tag*
8. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > Unicast > OSPFv2-IPv4**.
The Contents pane displays the OSPFv2 Device view tab and Network View tab (Figure 4-5).
- Step 2** From the Device View tab, click the device that you want to configure graceful restart on.
- Step 3** Click the OSPF instance that you want to configure graceful restart on.
- Step 4** From the Details pane, click the **Area** tab.
A summary of the existing areas displays.
- Step 5** Expand the **Graceful Restart** section.
The graceful restart parameters display.
- Step 6** (Optional) To enable graceful restart, click the **Enable Graceful Restart** radio button.
This option is enabled by default.
- Step 7** (Optional) To enable graceful restart only for planned restarts, click the **Enable Only Planned Graceful Restart** radio button.
- Step 8** (Optional) To disable graceful restart, click the **Disable Graceful Restart** radio button.
- Step 9** (Optional) In the **Grace Period** field, enter a value from 5 to 1800. The default is 60 seconds.
- Step 10** (Optional) In the **Notify Period** field, enter a value from 4 to 19 seconds. The default is 15 seconds.
- Step 11** (Optional) To enable the graceful restart helper function, check the **Enable Graceful Restart Helper** checkbox.
- Step 12** (Optional) To flush existing routes during a nongraceful restart, check the **Flush Routes on Non-graceful Restart** checkbox.

Step 13 (Optional) Choose **File > Save** from the top menu to save your changes.

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	router ospf instance-tag Example: switch(config)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 3	graceful-restart Example: switch(config-router)# graceful-restart	Enables a graceful restart. A graceful restart is enabled by default.
Step 4	graceful-restart grace-period seconds Example: switch(config-router)# graceful-restart grace-period 120	(Optional) Sets the grace period, in seconds. The range is from 5 to 1800. The default is 60 seconds.
Step 5	graceful-restart helper-disable Example: switch(config-router)# graceful-restart helper-disable	(Optional) Disables helper mode. Enabled by default.
Step 6	graceful-restart planned-only Example: switch(config-router)# graceful-restart planned-only	(Optional) Configures a graceful restart for planned restarts only.
Step 7	show ip ospf instance-tag Example: switch(config-if)# show ip ospf 201	(Optional) Displays OSPF information.
Step 8	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

This example shows how to enable a graceful restart if it has been disabled and set the grace period to 120 seconds:

```
switch# configure terminal
switch(config)# router ospf 201
switch(config-router)# graceful-restart
switch(config-router)# graceful-restart grace-period 120
switch(config-router)# copy running-config startup-config
```

Restarting an OSPFv2 Instance

You can restart an OSPFv2 instance. This clears all neighbors for the instance.

To restart an OSPFv2 instance and remove all associated neighbors, use the following command:

Command	Purpose
<pre>restart ospf instance-tag</pre> <p>Example: switch(config)# restart ospf 201</p>	Restarts the OSPFv2 instance and removes all neighbors.

Configuring OSPFv2 with Virtualization

You can configure multiple OSPFv2 instances in each VDC. You can also create multiple VRFs within each VDC and use the same or multiple OSPFv2 instances in each VRF. You assign an OSPFv2 interface to a VRF.



Note

Configure all other parameters for an interface after you configure the VRF for an interface. Configuring a VRF for an interface deletes all the configuration for that interface.

BEFORE YOU BEGIN

Create the VDCs.

Ensure that you have enabled the OSPF feature (see the [“Enabling the OSPFv2 Feature”](#) section on page 4-15).

Ensure that you are in the correct VDC (or choose **VDC** from the Feature Selector pane).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **vrf context** *vrf-name*
3. **router ospf** *instance-tag*
4. **vrf** *vrf-name*
5. **maximum-paths** *paths*
6. **interface** *interface-type slot/port*
7. **no switchport**
8. **vrf member** *vrf-name*
9. **ip-address** *ip-prefix/length*
10. **ip router ospf** *instance-tag area area-id*
11. (Optional) **copy running-config startup-config**

DETAILED STEPS

-
- Step 1** From the Feature Selector pane, choose **Routing > VRF**.
The Contents pane displays the summary table for VRFs.
- Step 2** From the VRF summary table, click the device that you want to configure a VRF on.
- Step 3** Choose **VRF > Add New Routing Instance** from the top menu.
Cisco NX-OS adds a new row to the VRF summary table .
- Step 4** From the VRF Name field, enter a value. This must be a unique value for this device.
- Step 5** (Optional) From the Routing fields, enter a static route for this VRF.
- Step 6** Choose **VRF > Add Interface** from the top menu.
Cisco NX-OS adds a new row to the VRF summary table.
- Step 7** From the Interface drop-down list, select the interface that you want to add to this VRF.
- Step 8** (Optional) Choose **File > Save** from the top menu to save your changes.
-

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters configuration mode.
Step 2	vrf context <i>vrf-name</i> Example: switch(config)# vrf context RemoteOfficeVRF switch(config-vrf)#	Creates a new VRF and enters VRF configuration mode.
Step 3	router ospf <i>instance-tag</i> Example: switch(config-vrf)# router ospf 201 switch(config-router)#	Creates a new OSPFv2 instance with the configured instance tag.
Step 4	vrf <i>vrf-name</i> Example: switch(config-router)# vrf RemoteOfficeVRF switch(config-router-vrf)#	Enters VRF configuration mode.
Step 5	maximum-paths <i>paths</i> Example: switch(config-router-vrf)# maximum-paths 4	(Optional) Configures the maximum number of equal OSPFv2 paths to a destination in the route table for this VRF. Used for load balancing.
Step 6	interface <i>interface-type slot/port</i> Example: switch(config-router-vrf)# interface ethernet 1/2 switch(config-if)#	Enters interface configuration mode.

	Command	Purpose
Step 7	no switchport Example: switch(config-if)# no switchport	Configures the interface as a Layer 3 routed interface.
Step 8	vrf member vrf-name Example: switch(config-if)# vrf member RemoteOfficeVRF	Adds this interface to a VRF.
Step 9	ip address ip-prefix/length Example: switch(config-if)# ip address 192.0.2.1/16	Configures an IP address for this interface. You must do this step after you assign this interface to a VRF.
Step 10	ip router ospf instance-tag area area-id Example: switch(config-if)# ip router ospf 201 area 0	Assigns this interface to the OSPFv2 instance and area configured.
Step 11	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

This example shows how to create a VRF and add an interface to the VRF:

```
switch# configure terminal
switch(config)# vrf context NewVRF
switch(config)# router ospf 201
switch(config)# interface ethernet 1/2
switch(config-if)# no switchport
switch(config-if)# vrf member NewVRF
switch(config-if)# ip address 192.0.2.1/16
switch(config-if)# ip router ospf 201 area 0
switch(config)# copy running-config startup-config
```

RELATED TOPICS

<xref to field descriptions from VRF chapter>

Verifying the OSPFv2 Configuration

To display the OSPFv2 configuration information, perform one of the following tasks:

Command	Purpose
show ip ospf	Displays the OSPFv2 configuration.
show ip ospf border-routers [vrf {vrf-name all default management}]	Displays the OSPFv2 border router configuration.
show ip ospf database [vrf {vrf-name all default management}]	Displays the OSPFv2 link-state database summary.

Command	Purpose
show ip ospf interface <i>number</i> [vrf { <i>vrf-name</i> all default management }]	Displays the OSPFv2 interface configuration.
show ip ospf lsa-content-changed-list <i>interface-type number</i> [vrf { <i>vrf-name</i> all default management }]	Displays the OSPFv2 LSAs that have changed.
show ip ospf neighbors [<i>neighbor-id</i>] [detail] [<i>interface-type number</i>] [vrf { <i>vrf-name</i> all default management }] [summary]	Displays the list of OSPFv2 neighbors.
show ip ospf request-list <i>neighbor-id</i> [<i>interface-type number</i>] [vrf { <i>vrf-name</i> all default management }]	Displays the list of OSPFv2 link-state requests.
show ip ospf retransmission-list <i>neighbor-id</i> [<i>interface-type number</i>] [vrf { <i>vrf-name</i> all default management }]	Displays the list of OSPFv2 link-state retransmissions.
show ip ospf route [<i>ospf-route</i>] [summary] [vrf { <i>vrf-name</i> all default management }]	Displays the internal OSPFv2 routes.
show ip ospf summary-address [vrf { <i>vrf-name</i> all default management }]	Displays information about the OSPFv2 summary addresses.
show ip ospf virtual-links [brief] [vrf { <i>vrf-name</i> all default management }]	Displays information about OSPFv2 virtual links.
show ip ospf vrf { <i>vrf-name</i> all default management }	Displays information about VRF-based OSPFv2 configuration.
show running-configuration ospf	Displays the current running OSPFv2 configuration.

Displaying OSPFv2 Statistics

To display OSPFv2 statistics, use the following commands:

Command	Purpose
show ip ospf policy statistics area <i>area-id</i> filter-list { in out } [vrf { <i>vrf-name</i> all default management }]	Displays the OSPFv2 route policy statistics for an area.
show ip ospf policy statistics redistribute { bgp <i>id</i> direct eigrp <i>id</i> isis <i>id</i> ospf <i>id</i> rip <i>id</i> static } <i>vrf</i> { <i>vrf-name</i> all default management }}	Displays the OSPFv2 route policy statistics.
show ip ospf statistics [vrf { <i>vrf-name</i> all default management }]	Displays the OSPFv2 event counters.
show ip ospf traffic [<i>interface-type number</i>] [vrf { <i>vrf-name</i> all default management }]	Displays the OSPFv2 packet counters.

Configuration Examples for OSPFv2

This example shows how to configure OSPFv2:

```
feature ospf
router ospf 201
  router-id 290.0.2.1

interface ethernet 1/2
  no switchport
  ip router ospf 201 area 0.0.0.10
  ip ospf authentication
  ip ospf authentication-key 0 mypass
```

Additional References

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

- [Related Documents, page 4-57](#)
- [MIBs, page 4-57](#)

Related Documents

Related Topic	Document Title
OSPFv2 CLI commands	<i>Cisco Nexus 3000 Series Command Reference</i> ,
VDCs	<i>Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 5.x</i>
OSPFv3 for IPv6 networks	Chapter 7, “Configuring OSPFv3”
Route maps	Chapter 14, “Configuring Route Policy Manager”

MIBs

MIBs	MIBs Link
<ul style="list-style-type: none"> • OSPF-MIB • OSPF-TRAP-MIB 	To locate and download MIBs, go to the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

Feature History for OSPFv2

Table 4-3 lists the release history for this feature.

Table 4-3 Feature History for IOSPFv2

Feature Name	Releases	Feature Information
BFD	5.0(2)N1(1)	This feature was introduced.
OSPFv2	5.0(3)U1(1)	This feature was introduced.

