# NSF—OSPF (RFC 3623 OSPF Graceful Restart)

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This document focuses on nonstop forwarding (NSF) for OSPFv2 in Cisco IOS software, using the IETF standardized graceful restart functionality that is described in RFC 3623. Under very specific situations, a router may undergo certain well-known failure conditions that should not affect packet forwarding across the switching platform. NSF capability allows for the forwarding of data packets to continue along routes that are already known, while the routing protocol information is being restored. This capability is useful in cases in which there is a component failure (for example, a Route Processor [RP] crash with a backup RP taking over) or in which there is a scheduled hitless software upgrade.

Prior to RFC 3623, Cisco implemented Cisco-proprietary NSF, referred to as Cisco NSF. The OSPF RFC 3623 Graceful Restart feature allows you to configure IETF NSF in multivendor networks. Configuring IETF NSF increases the availability of your network by allowing OSPF routers to stay on the forwarding path even as their OSPF software is restarted. This document refers to the two forms of NSF as Cisco NSF and IETF NSF. The OSPF RFC 3623 Graceful Restart feature is the latest addition to the Cisco High Availability portfolio.

### Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for NSF—OSPF (RFC 3623 OSPF Graceful Restart)" section on page 24.

### Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

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Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

# Contents



# Prerequisites for Configuring IETF NSF or Cisco NSF

- OSPF must be configured on the router.
- The router undergoing OSPF graceful restart must be capable of performing a stateful switchover (SSO) operation.

# Restrictions for Configuring IETF NSF or Cisco NSF

- Only one of the possible methods for nonstop forwarding (Cisco NSF or IETF NSF) is supported at a time. For example, the restarting router uses either Cisco NSF or IETF NSF during switchover, depending on the configuration of the router. The helper mode for both methods is supported by default, based on the restarting method used by the restarting router. For example, if the restarting router is IETF NSF-capable, the helper router will use IETF NSF helper mode by default.
- Neither Cisco NSF nor IETF NSF is supported over sham-links.
- Cisco NSF is not support over virtual links.

# Information About IETF NSF and Cisco NSF

Before configuring the OSPF RFC 3623 Graceful Restart feature, you should understand the following concepts:

## Cisco NSF Routing and Forwarding Operation

Cisco NSF is supported by the BGP, EIGRP, OSPF, and IS-IS protocols for routing and by Cisco Express Forwarding (CEF) for forwarding. The BGP, EIGRP, OSPF, and IS-IS routing protocols have been enhanced with NSF capability and awareness, which means that routers that run these protocols can detect a switchover and take the necessary actions to continue forwarding network traffic and to recover route information from the neighbor routers.

In this document, a networking device is said to be NSF-aware if it is running NSF-compatible software. A device is said to be NSF-capable if it has been configured to support NSF; therefore, it would rebuild routing information from NSF-aware or NSF-capable neighbors. The NSF router modes of operation common to the Cisco and IETF NSF implementations are as follows:

- Restarting Mode—Also known as NSF-restarting mode or graceful-restarting mode. In this mode, the OSPF router process is performing nonstop forwarding recovery because of an RP switchover; this may result from an RP crash or a software upgrade on the active RP.
- Helper Mode—Also known as NSF-awareness. In this mode, a neighboring router is restarting, and this router is helping in the nonstop forwarding recovery.

## Cisco Express Forwarding for NSF

A key element of NSF is packet forwarding. The OSPF protocol depends on CEF to continue forwarding packets during switchover while the routing protocols rebuild the Routing Information Base (RIB) tables. Once OSPF has converged, CEF updates the Forwarding Information Base (FIB) table and removes stale route entries. CEF then updates the line cards with the new FIB information. CEF maintains the FIB and uses the FIB information that was current at the time of a switchover to continue forwarding packets during the switchover. This feature reduces traffic interruption during the switchover.

During normal NSF operation, CEF on the active RP synchronizes its current FIB and adjacency databases with the FIB and adjacency databases on the standby RP. Upon switchover of the active RP, the standby RP initially has FIB and adjacency databases that are mirror images of those that were current on the active RP. For platforms with intelligent line cards, the line cards maintain the current forwarding information over a switchover; for platforms with forwarding engines, CEF keeps the forwarding engine on the standby RP current with changes that are sent to it by CEF on the active RP. In this way, the line cards or forwarding engines can continue forwarding after a switchover as soon as the interfaces and a data path are available.

As the OSPF routing protocol starts to repopulate the RIB on a prefix-by-prefix basis, the updates in turn cause prefix-by-prefix updates that CEF uses to update the FIB and adjacency databases. Existing and new entries receive the new version number, indicating that they have been refreshed. The forwarding information is updated on the line cards or forwarding engines during convergence. The RP signals when the RIB has converged. The software removes all FIB and adjacency entries that have an epoch older than the current switchover epoch. The FIB now reflects the newest routing protocol forwarding information.

The OSPF routing protocol runs on only the active RP, and OSPF receives routing updates from OSPF neighbor routers. The OSPF routing protocol does not run on the standby RP. Following a switchover, OSPF requests that the NSF-aware neighbor devices send state information to help rebuild the routing tables.

**Note** For NSF operation, OSPF depends on CEF to continue forwarding packets while OSPF rebuilds the routing information.

# OSPF Graceful Restart Functionality per RFC 3623

This section describes the RFC 3623 graceful restart nonstop forwarding enhancement to the OSPF routing protocol. An OSPF NSF-capable router that is reloading and attempting a graceful restart originates grace-lsas to notify its neighbors that it will perform graceful restart within the specified amount of time or grace period. During this grace period, the neighboring OSPF routers, called helper routers, continue to announce the restarting router in their LSAs as if it were fully adjacent, as long as the network topology remains static.

The following sections contain more detailed information about the graceful restart process:

- Graceful Restart Router Operation, page 4
- Graceful Restart Helper Mode Operation, page 5

## Graceful Restart Router Operation

### Graceful Restart Initiation

The restarting router becomes aware that it should start the graceful restart process when the network administrator issues the appropriate command or when an RP reloads and forces and Redundancy Facility (RF) switchover. The length of the grace period can be set by the network administrator or calculated by the OSPF software of the restarting router. In order to prevent the LSAs from the restarting router from aging out, the grace period should not exceed an LSA refresh time of 1800 seconds.

In preparation for graceful restart, the restarting router must perform the following action before its software can be reloaded: The restarting router must ensure that its forwarding table is updated and will remain in place during the restart. No OSPF shutdown procedures are performed since neighbor routers must act as if the restarting router is still in service.

The OSPF software is reloaded on the router (it undergoes graceful restart).

### OSPF Processes During Graceful Restart

After the router has reloaded, it must modify its OSPF processes until it reestablishes full adjacencies with all former fully adjacent OSPF neighbors. During graceful restart, the restarting router modifies its OSPF processes in the following ways:

- The restarting router does not originate LSAs with LS types 1, 5, or 7 so that the other routers in the OSPF domain will use the LSAs that the restarting router had originated prior to reloading. The router does not modify or flush any self-originated LSAs.
- The restarting router runs its OSPF routing calculations in order to return any OSPF virtual links to operation. However, the restarting router does not install OSPF routes into the system's forwarding table, and the router relies on the forwarding entries that it had installed prior to undergoing the graceful restart process.
- If the restarting router determines that is was the Designated Router on a given segment prior to the graceful restart, it will reelect itself.

### Graceful Restart Process Exit

The restarting router exits the graceful restart process when one of the following events occur:

- The router has reestablished all adjacencies. The graceful restart was successful.
- The router receives an LSA that is inconsistent with an LSA from the same router prior to the graceful restart. The inconsistency can be mean either that the router does not support the graceful restart feature or that the router has terminated its helper mode for some reason. The graceful restart was unsuccessful.

- The grace period has expired. The graceful restart was not successful.
- Once the restarting router has completed the graceful restart process, it returns to normal OSPF operation, reoriginating LSAs based on the current state of the router and updating its forwarding tables based on current link-state database contents. At this time, it flushes the grace-lsas that it had originated during the initiation of the graceful restart process.

## Graceful Restart Helper Mode Operation

### Helper Mode Initiation

When a neighbor router that is on the same network segment as the restarting router receives a grace-lsa from the restarting router, the neighbor enters helper mode as long as the following criteria are met:

- The neighbor must have a full adjacency with the restarting router over the associated network segment.
- There have been no changes to the link-state database since the restarting router began restarting.
- The grace period has not yet expired.
- Local policy allows the neighbor router to act as a helper router.
- The neighbor router must not be in its own graceful restart process.
- Helper mode for this router has not been disabled by the network administrator.

### Helper Mode Exit

The helper router stops performing helper mode for its neighbor when one of the following events occur:

- The grace-lsa that was originated by the restarting router is flushed, to signify that the restarting router has exited the graceful restart process successfully.
- The grace period of the grace-lsa expires.
- A change in link-state database contents indicates a network topology change, forcing the termination of the graceful restart process when the strict-lsa-checking option is enabled on the helper.

For complete information regarding graceful restart functionality, see RFC 3623:

http://www.ietf.org/rfc/rfc3623.txt

# How to Configure IETF NSF or Cisco NSF

This section contains the following procedures:

- Enabling IETF NSF or Cisco NSF on the Router, page 5 (required)
- Disabling Helper Mode or Enabling Graceful Restart Strict LSA Checking on the Helper Router, page 7 (required)

# Enabling IETF NSF or Cisco NSF on the Router

Complete the steps in the following task to configure and verify configuration of Cisco NSF or IETF NSF on the router.

## Prerequisites

In order for the graceful restart process to work successfully, the OSPF neighbor (helper) routers need to run a version of Cisco IOS software that supports Cisco NSF or IETF NSF, or both.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospf** *process-id* [**vrf** *vpn-name*]
4. **nsf ietf** [**restart-interval** *seconds*]

   or

   **nsf cisco** [**enforce global**]
5. **end**
6. **show ip ospf** [*process-id*]

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router ospf** *process-id* [**vrf** *vpn-name*]<br><br>**Example:**<br>`Router(config)# router ospf 4` | Configures an Open Shortest Path First (OSPF) routing process and enters router configuration mode. |
| **Step 4** | **nsf ietf** [**restart-interval** *seconds*]<br><br>**Example:**<br>`Router(config-router)# nsf ietf restart-interval 600`<br><br>or<br><br>**nsf cisco** [**enforce global**]<br><br>**Example:**<br>`Router(config-router)# nsf cisco` | (Optional) Enables IETF NSF, or graceful restart, on the router.<br>• Optionally configures a maximum graceful restart interval, in seconds, after the graceful restart process.<br><br>(Optional) Enables Cisco NSF on a Cisco router. |

| | Command or Action | Purpose |
|---|---|---|
| Step 5 | **end**<br><br>**Example:**<br>`Router(config-router)# end` | Returns to privileged EXEC mode. |
| Step 6 | **show ip ospf** [*process-id*]<br><br>**Example:**<br>`Router# show ip ospf 4` | Displays general information about OSPF routing processes and whether OSPF graceful restart is configured. |

# Disabling Helper Mode or Enabling Graceful Restart Strict LSA Checking on the Helper Router

Graceful restart helper mode is enabled by default. It is not recommended to disable helper mode because the disabled neighbor will detect the lost adjacency and the graceful restart process will be terminated.

The strict LSA checking feature allows a helper router to terminate the graceful restart process if it detects a changed LSA that would cause flooding during the graceful restart process. Strict LSA checking is disabled by default. You can enable strict LSA checking on an OSPF helper to have the router terminate graceful restart when there is a change to an LSA that would be flooded to the restarting router. You can configure strict LSA checking on both NSF-aware and NSF-capable routers; however, this feature will become effective only when the router is in helper mode.

Complete the steps in the following task to disable helper mode or enable strict LSA checking on the NSF-aware (helper) router.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospf** *process-id* [**vrf** *vpn-name*]
4. **nsf cisco helper disable**

   or

   **nsf ietf helper disable**
5. **nsf ietf helper strict-lsa-checking**
6. **end**
7. **show ip ospf** [*process-id*]

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router ospf** *process-id* [**vrf** *vpn-name*]<br><br>**Example:**<br>`Router(config)# router ospf 454` | Configures an Open Shortest Path First (OSPF) routing process and enters router configuration mode. |
| **Step 4** | **nsf cisco helper disable**<br><br>**Example:**<br>`Router(config-router)# nsf cisco helper disable`<br><br>or<br><br>**nsf ietf helper disable**<br><br>**Example:**<br>`Router(config-router)# nsf ietf helper disable` | (Optional) Disables helper mode for Cisco NSF.<br><br>(Optional) Disables helper mode for IETF NSF. |
| **Step 5** | **nsf ietf helper strict-lsa-checking**<br><br>**Example:**<br>`Router(config-router)# nsf ietf helper strict-lsa-checking` | Enables strict LSA checking on an NSF-aware (helper) router. |
| **Step 6** | **end**<br><br>**Example:**<br>`Router(config-router)# end` | Returns to privileged EXEC mode. |
| **Step 7** | **show ip ospf** [*process-id*]<br><br>**Example:**<br>`Router# show ip ospf 454` | Displays general information about OSPF routing processes and whether helper mode or strict LSA checking is enabled for the NSF-aware (helper) router. |

# Configuration Examples for IETF NSF or Cisco NSF

This section provides the following configuration examples:



## Enabling and Verifying IETF NSF for OSPF: Example

The following example enables IETF NSF for OSPF process 10 on the router. The restart interval has been changed from the 120-second default value to 200 seconds.

```
Router(config)# router ospf 10
Router(config-router)# nsf ietf restart-interval 200
Router(config-router)# end
```

When the **show ip ospf** command is entered for OSPF process 10, the output verifies that IETF NSF was configured on the router, with a maximum route lifetime interval set for 200 seconds. The command output also confirms that NSF helper mode is enabled by default for IETF NSF, as well as for Cisco NSF.

```
Router# show ip ospf 10

 Routing Process "ospf 10" with ID 172.16.2.2
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 Supports Link-local Signaling (LLS)
 Supports area transit capability
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Incremental-SPF disabled
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 0. Checksum Sum 0x0
 Number of opaque AS LSA 0. Checksum Sum 0x0
 Number of DCbitless external and opaque AS LSA 0
 Number of DoNotAge external and opaque AS LSA 0
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Number of areas transit capable is 0
 External flood list length 0
 IETF Non-Stop Forwarding enabled
    restart-interval limit: 200 sec
 IETF NSF helper support enabled
 Cisco NSF helper support enabled
 Reference bandwidth unit is 100 mbps
    Area BACKBONE(0)
        Number of interfaces in this area is 4 (1 loopback)
        Area has no authentication
        SPF algorithm last executed 02:03:02.468 ago
        SPF algorithm executed 4 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x175DA
        Number of opaque link LSA 0. Checksum Sum 0x0
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
```

## Disabling Helper Mode for IETF NSF: Example

The following configuration disables helper support for IETF NSF on an OSPF router.

```
Router(config)# router ospf 200
Router(config-router)# nsf ietf helper disable
```

# Additional References

The following sections provide references related to the OSPF RFC 3623 Graceful Restart feature.

## Related Documents

| Related Topic | Document Title |
|---|---|
| OSPF commands | • *Cisco IOS IP Routing Protocols Command Reference*, Release 12.4T<br>• *Cisco IOS IP Routing Protocols Command Reference*, Release 12.2SB<br>• *Cisco IOS IP Routing Protocols Command Reference*, Release 12.2 SR |
| OSPF configuration | *Cisco IOS IP Routing Protocols Configuration Guide*, Release 12.4 |
| Cisco nonstop forwarding | *Cisco Nonstop Forwarding*, Cisco IOS Release 12.2S |

## Standards

| Standard | Title |
|---|---|
| None | — |

## MIBs

| MIB | MIBs Link |
|---|---|
| None | To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:<br>http://www.cisco.com/go/mibs |

## RFCs

| RFC | Title |
|---|---|
| RFC 2328 | *OSPF Version 2* |
| RFC 3623 | *Graceful OSPF Restart* |

## Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com. | http://www.cisco.com/techsupport |

# Command Reference

This section documents only commands that are new or modified.

- **nsf cisco**
- **nsf cisco helper disable**
- **nsf ietf**
- **nsf ietf helper disable**
- **nsf ietf helper strict-lsa-checking**
- **nsf (OSPF)**

# nsf cisco

To enable Cisco nonstop forwarding (NSF) operations on a router that is running Open Shortest Path First (OSPF), use the **nsf cisco** command in router configuration mode. To disable Cisco NSF, use the **no** form of this command.

**nsf cisco** [**enforce global**]

**no nsf cisco** [**enforce global**]

## Syntax Description

| | |
|---|---|
| **enforce global** | (Optional) Cancels NSF restart when non-NSF-aware neighboring networking devices are detected. |

## Command Default

This command is disabled by default; therefore, Cisco NSF operations are disabled on a router that is running OSPF.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(32)S | This command was introduced. This command replaces the **nsf** (OSPF) command. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(31)SB2 | This command was integrated into Cisco IOS Release 12.2(31)SB2. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

For Cisco IOS Release 12.0(32)S and later releases, the **nsf cisco** [**enforce global**] command replaces the **nsf** [**enforce global**] command for OSPF.

To enable Cisco NSF on an OSPF router, you need to enter the **nsf cisco** command. When a router has Cisco NSF enabled, the router is said to be NSF-capable and will operate in graceful restart mode—the OSPF router process performs non-stop forwarding recovery due to a Route Processor (RP) switchover. By default, the neighbor routers of the NSF-capable router will be NSF-aware and will operate in NSF helper mode. When the NSF-capable router is performing graceful restart, the neighbor router helps with the non-stop forwarding recovery.

During the NSF restart process, if neighbors that are not NSF-aware are detected on a network interface, NSF restart is aborted on the interface; however, NSF restart will continue on other interfaces. This functionality applies to the default NSF mode of operation when Cisco NSF is configured. If the user configures the **nsf cisco** command with the optional **enforce global** keywords, NSF restart will be canceled for the entire process when neighbors that are not NSF-aware are detected on any network interface during restart. The NSF restart will also be canceled for the entire process when a neighbor adjacency reset is detected on any interface or when an OSPF interface goes down. To revert to the default NSF behavior, enter the **no nsf cisco enforce global** command.

## Examples

The following example enables Cisco NSF on a router and causes the NSF restart to be canceled for the entire OSPF process if neighbors that are not NSF-aware are detected on any network interface during the restart.

```
router ospf 24
 nsf cisco enforce global
```

## Related Commands

| Command | Description |
|---|---|
| **nsf cisco helper disable** | Disables NSF helper mode on a router. |
| **nsf ietf** | Enables NSF (graceful restart) on a router. |
| **nsf ietf helper disable** | Disables NSF helper mode on a router. |
| **nsf ietf helper strict-lsa-checking** | Enables strict LSA checking on a router. |

# nsf cisco helper disable

To disable Cisco nonstop forwarding (NSF) helper mode on a Cisco router that is running Open Shortest Path First (OSPF), use the **nsf cisco helper disable** command in router configuration mode. To reenable Cisco NSF helper mode, use the **no** form of this command.

**nsf cisco helper disable**

**no nsf cisco helper disable**

## Syntax Description

This command has no arguments or keywords.

## Command Default

This command is enabled by default; therefore, NSF helper mode is disabled on a Cisco router that is running OSPF.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(32)S | This command was introduced. |
| 12.4(6)T | This command was integrated into Cisco IOS Release 12.4(6)T. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(31)SB2 | This command was integrated into Cisco IOS Release 12.2(31)SB2. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

When a router in an OSPF process has NSF enabled, the router is said to be NSF-capable and will operate in graceful restart mode—the OSPF router process performs nonstop forwarding recovery due to a Route Processor (RP) switchover. By default, the neighboring routers of the NSF-capable router will be NSF-aware and will operate in NSF helper mode. When the NSF-capable router is performing graceful restart, the helper routers assist in the nonstop forwarding recovery process. If you do not want the router to help the restarting neighbor with nonstop forwarding recovery, enter the **nsf cisco helper disable** command.

## Examples

The following example disables NSF helper mode for the Cisco router on OSPF process 3:

```
router ospf 3
 nsf cisco helper disable
```

## Related Commands

| Command | Description |
|---|---|
| **nsf cisco** | Enables Cisco NSF on a Cisco router. |
| **nsf ietf** | Enables IETF nonstop forwarding operations on a router that is running OSPF. |

| Command | Description |
|---|---|
| **nsf ietf helper disable** | Disables IETF NSF helper mode on a router. |
| **nsf ietf helper strict-lsa-checking** | Enables strict LSA checking on a router. |

# nsf ietf

To enable IETF nonstop forwarding (NSF) operations on a router that is running Open Shortest Path First (OSPF), use the **nsf ietf** command in router configuration mode. To disable IETF NSF, use the **no** form of this command.

**nsf ietf** [**restart-interval** *seconds*]

**no nsf ietf** [**restart-interval** *seconds*]

## Syntax Description

| | |
|---|---|
| **restart-interval** *seconds* | (Optional) Specifies length of the graceful restart interval, in seconds. The range is from 1 to 1800. The default is 120. |

## Command Default

This command is disabled by default; therefore, IETF NSF operations are disabled on a router that is running OSPF.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(32)S | This command was introduced. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(31)SB2 | This command was integrated into Cisco IOS Release 12.2(31)SB2. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

To enable IETF NSF on an OSPF router, enter the **nsf ietf** command. When a router has NSF enabled, the router is said to be NSF-capable and will operate in graceful restart mode—the OSPF router process performs nonstop forwarding recovery due to a Route Processor (RP) switchover. By default, the neighbor routers of the NSF-capable router will be NSF-aware and will operate in NSF helper mode. When the NSF-capable router is performing graceful restart, the neighbor router helps in the nonstop forwarding recovery.

## Examples

The following example enables IETF NSF (graceful restart) on a router, changing the graceful restart interval to 200 seconds:

```
router ospf 24
 nsf ietf restart-interval 200
```

## Related Commands

| Command | Description |
|---|---|
| **nsf cisco** | Enables Cisco NSF (graceful restart) on a router. |
| **nsf cisco helper disable** | Disables Cisco NSF helper mode on a router. |

| Command | Description |
|---|---|
| **nsf ietf helper disable** | Disables IETF NSF helper mode on a router. |
| **nsf ietf helper strict-lsa-checking** | Enables strict LSA checking on a router. |

# nsf ietf helper disable

To disable Internet Engineering Task Force (IETF) nonstop forwarding (NSF) helper mode on a router that is running Open Shortest Path First (OSPF), use the **nsf ietf helper disable** command in router configuration mode. To reenable IETF NSF helper mode, use the **no** form of this command.

**nsf ietf helper disable**

**no nsf ietf helper disable**

## Syntax Description

This command has no arguments or keywords.

## Command Default

This command is disabled by default; therefore, IETF NSF helper mode is enabled on a router that is running OSPF.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(32)S | This command was introduced. |
| 12.4(6)T | This command was integrated into Cisco IOS Release 12.4(6)T. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(31)SB2 | This command was integrated into Cisco IOS Release 12.2(31)SB2. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

When a router in an OSPF process has NSF enabled, the router is said to be NSF-capable and will operate in graceful restart mode—the OSPF router process performs nonstop forwarding recovery due to a Route Processor (RP) switchover. By default, the neighboring routers of the NSF-capable router will be NSF-aware and will operate in NSF helper mode. When the NSF-capable router is performing graceful restart, the helper routers assist in the nonstop forwarding recovery process. If you do not want the router to help the restarting neighbor with nonstop forwarding recovery, enter the **nsf ietf helper disable** command.

## Examples

The following example disables IETF NSF helper mode on a router on OSPF process 4:

```
router ospf 4
 nsf ietf helper disable
```

## Related Commands

| Command | Description |
|---|---|
| **nsf cisco** | Enables Cisco NSF on a router. |
| **nsf cisco helper disable** | Disables IETF NSF helper mode on a router. |

| Command | Description |
|---|---|
| **nsf ietf** | Enables IETF nonstop forwarding operations on a router that is running OSPF. |
| **nsf ietf helper strict-lsa-checking** | Enables strict LSA checking on a router. |

# nsf ietf helper strict-lsa-checking

To enable strict link-state advertisement (LSA) checking on routers in an Open Shortest Path First (OSPF) process, use the **nsf ietf helper strict-lsa-checking** command in router configuration mode. To disable strict LSA checking, use the **no** form of this command.

**nsf ietf helper strict-lsa-checking**

**no nsf ietf helper strict-lsa-checking**

## Syntax Description

This command has no arguments or keywords.

## Command Default

This command is disabled by default; therefore, strict LSA checking is not done on routers in an OSPF process.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(32)S | This command was introduced. |
| 12.4(6)T | This command was integrated into Cisco IOS Release 12.4(6)T. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(31)SB2 | This command was integrated into Cisco IOS Release 12.2(31)SB2. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

To enable strict LSA checking on both NSF-aware and NSF-capable routers, enter the **nsf ietf helper strict-lsa-checking** command. However, strict LSA checking will not become effective until the router becomes a helper router during an IETF graceful restart process. With strict LSA checking enabled, the helper router will terminate the helping process of the restarting router if it detects that there is a change to an LSA that would be flooded to the restarting router or if there is a changed LSA on the retransmission list of the restarting router when the graceful restart process is initiated.

## Examples

The following example enables strict LSA checking on a router on OSPF process 12:

```
router ospf 12
 nsf ietf helper strict-lsa-checking
```

## Related Commands

| Command | Description |
|---|---|
| **nsf cisco** | Enables Cisco NSF on a router. |
| **nsf cisco helper disable** | Disables Cisco NSF helper mode on a router. |

| Command | Description |
|---|---|
| **nsf ietf** | Enables IETF nonstop forwarding operations on a router that is running OSPF. |
| **nsf ietf helper disable** | Disables IETF NSF helper mode on a router. |

# nsf (OSPF)

**Note** Effective with Cisco IOS Release 12.0(32)S, the **nsf (OSPF)** command has been replaced by the **nsf cisco** [**enforce global**] command. See the **nsf cisco** [**enforce global**] command for more information.

To configure Cisco nonstop forwarding (NSF) operations for Open Shortest Path First (OSPF), use the **nsf** command in router configuration mode. To disable Cisco NSF for OSPF, use the **no** form of this command.

**nsf** [**enforce global**]

**no nsf** [**enforce global**]

## Syntax Description

| | |
|---|---|
| **enforce global** | (Optional) Cancels NSF restart when non-NSF-aware neighboring networking devices are detected. |

## Command Default

This command is disabled by default; therefore, NSF operations for OSPF is not configured.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(22)S | This command was introduced. |
| 12.2(18)S | This command was integrated into Cisco IOS Release 12.2(18)S. |
| 12.2(20)S | This command was implemented on the Cisco 7304 router. |
| 12.0(32)S | This command was replaced by the **nsf cisco** [**enforce global**] command. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(31)SB2 | This command was integrated into Cisco IOS Release 12.2(31)SB2. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

The user must configure NSF operation for OSPF only if a router is expected to perform NSF during restart. For users to have full NSF benefits, all OSPF neighbors of the specified router must be NSF-aware.

If neighbors that are not NSF-aware are detected on a network interface, NSF restart is aborted on the interface; however, NSF restart will continue on other interfaces. This functionality applies to the default NSF mode of operation when NSF is configured.

If the user configures the optional **enforce global** keywords, NSF restart will be canceled for the entire process when neighbors that are not NSF-aware are detected on any network interface during restart. NSF restart will also be canceled for the entire process if a neighbor adjacency reset is detected on any interface or if an OSPF interface goes down. To revert to the default NSF mode, enter the **no nsf enforce global** command.

## Examples

The following example enters router configuration mode and cancels the NSF restart for the entire OSPF process if neighbors that are not NSF-aware are detected on any network interface during restart:

```
Router(config)# router ospf 1
Router(config-router)# nsf enforce global
```

## Related Commands

| Command | Description |
|---|---|
| **debug ip ospf nsf** | Displays debugging messages related to OSPF NSF commands. |
| **router ospf** | Enables OSPF routing and places the router in router configuration mode. |

# Feature Information for NSF—OSPF (RFC 3623 OSPF Graceful Restart)

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

**Note** Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

***Table 1 Feature Information for NSF–OSPF RFC 3623 Graceful Restart***

| Feature Name | Releases | Feature Information |
|---|---|---|
| NSF—OSPF (RFC 3623 OSPF Graceful Restart) | 12.0(32)S<br>12.2(33)SRA<br>12.2(31)SB2<br>12.2(33)SXH | This document focuses on nonstop forwarding (NSF) for OSPFv2 in Cisco IOS software, using the IETF standardized graceful restart functionality as described in RFC 3623. |

# Glossary

**cutover**—An event in which system control and routing protocol execution are transferred from an active processor to a standby processor. This may include transfer of the packet forwarding function as well.

**NSF**—nonstop forwarding. The continuation of forwarding packets across line cards during RP cutover.

**OSPF**—Open Shortest Path First. An interior gateway routing protocol.

**RF**—Redundancy Facility. A state machine that controls the progression and state of the redundant processor cards.

**RP**—Route Processor. A processor module in the Cisco 7000 series routers that contains the CPU, system software, and most of the memory components that are used in the router. Sometimes called a *supervisory processor.*

**switchover**—*See* cutover.