# BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)

**First Published: March 20, 2006**
**Last Updated: March 20, 2006**

The BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO) feature enables provider edge (PE) routers to maintain Border Gateway Protocol (BGP) state with customer edge (CE) routers and ensure continuous packet forwarding during a Route Processor (RP) switchover or during a planned In-Service Software Upgrade (ISSU) for a PE router. CE routers do not need to be Nonstop Forwarding (NSF)-capable or NSF-aware to benefit from BGP NSR capabilities on PE routers. Only PE routers need to be upgraded to support BGP NSR—no CE router upgrades are required. BGP NSR with SSO, thus, enables service providers to provide the benefits NSF with the additional benefits of NSR without requiring CE routers to be upgraded to support BGP graceful restart.

### Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. 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 BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)" section on page 16.

### 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.

## Contents



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

# Prerequisites for BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)

- This document assumes that your network is configured to run BGP.
- This document assumes that Multiprotocol Layer Switching (MPLS) Layer 3 Virtual Private Networks (VPNs) are configured.
- This document assumes that you are familiar NSF and SSO concepts and tasks.

# Restrictions for BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)

- This feature is supported on Cisco 10000 Series Performance Routing Engines 2 (PRE2s) and Cisco 10000 Series Performance Routing Engines 3 (PRE3s).

# Information About BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)

To configure BGP NSR with SS0, you should be familiar with the following concepts:



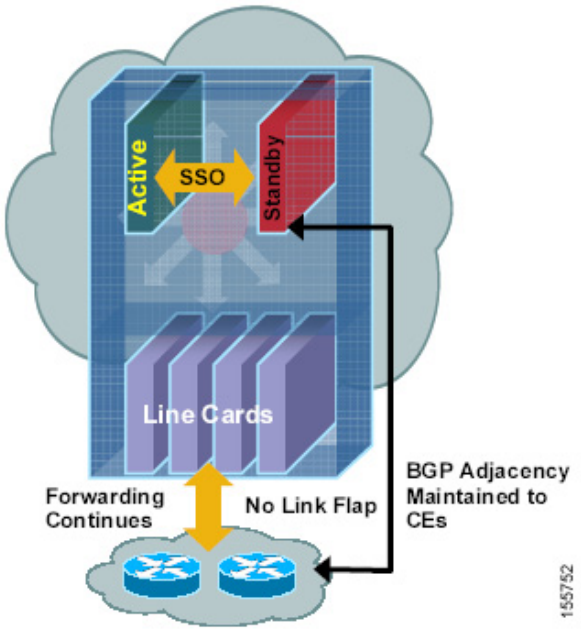
## Overview of BGP NSR with SSO

Prior to the introduction of BGP NSR with SS0 in Cisco IOS Release 12.2(28)SB, BGP required that all neighboring devices participating in BGP NSF be configured to be either NSF-capable or NSF-aware (by configuring the devices to support the BGP graceful restart mechanism). BGP NSF, thus, required that all neighboring devices be upgraded to a version of Cisco IOS software that supports BGP graceful restart. However, in many MPLS VPN deployments, there are situations where PE routers engage in exterior BGP (eBGP) peering sessions with CE routers that do not support BGP graceful restart and cannot be upgraded to a software version that supports BGP graceful restart in the same time frame as the provider (P) routers.

BGP NSR with SSO provides a high availability (HA) solution to service providers whose PE routers engage in eBGP peering relationships with CE routers that do not support BGP graceful restart. BGP NSR works with SSO to synchronize BGP state information between the active and standby RP. SSO minimizes the amount of time a network is unavailable to its users following a switchover. When the

BGP NSR with SSO feature is configured, in the event of an RP switchover, the PE router uses BGP NSR with SSO to maintain BGP state for eBGP peering sessions with CEs that are not NSF-aware (see Figure 1). Additionally, the BGP NSR with SSO feature dynamically detects NSF-aware peers and runs graceful restart with those CE routers. For eBGP peering sessions with NSF-aware peers and for internal BGP (iBGP) sessions with BGP Route Reflectors (RRs) in the service provider core, the PE uses NSF to maintain BGP state. BGP NSR with SSO, thus, enables service providers to provide the benefits of NSF with the additional benefits of NSR without requiring CE routers to be upgraded to support BGP graceful restart.

***Figure 1 BGP NSR with SSO Operations During an RP Switchover***




BGP NSR with SSO is supported in BGP peer, BGP peer group, and BGP session template configurations. To configure support for BGP NSR with SSO in BGP peer and BGP peer group configurations, use the **neighbor ha-mode sso** command in address family configuration mode for IPv4 VRF address family BGP peer sessions. To include support for Cisco BGP NSR with SSO in a peer session template, use the **ha-mode sso** command in session-template configuration mode.

# Benefits of BGP NSR with SSO

- Minimizes services disruptions—BGP NSR with SSO reduces impact on customer traffic during RP switchovers (scheduled or unscheduled events), extending HA deployments and benefits at the edge.
- Enhances high-availability NSF and SSO deployment at the edge—BGP NSR with SSO allows incremental deployment by upgrading the provider edge with the NSR capability so that customer-facing edge routers are synchronized automatically and no coordination or NSF awareness is needed with the customer side Cisco or third-party customer edge routers. The BGP NSR feature dynamically detects NSF-aware peers and runs graceful restart with those CE routers.
- Provides transparent route convergence—BGP NSR with SSO eliminates route flaps by keeping BGP state on both active and standby RPs and ensures continuous packet forwarding with minimal packet loss during RP failovers.

# How to Configure BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)

This section contains the following procedures:

- Configuring a PE Router to Support BGP NSR with SSO, page 4 (required)
- Verifying BGP Support for NSR with SSO, page 10 (optional)

## Configuring a PE Router to Support BGP NSR with SSO

Perform this task to enable a PE router to maintain BGP state with CE routers and ensure continuous packet forwarding during a RP switchover or during a planned ISSU. BGP NSR with SSO enables service providers to provide the benefits NSF with the additional benefits of NSR without requiring CE routers to be upgraded to support BGP graceful restart.

BGP NSR with SSO is supported in BGP peer, BGP peer group, and BGP session template configurations. Perform one of the following tasks in this section on a PE router, depending on whether you want to configure support for BGP NSR with SSO in a peer, a peer group, or a session template configuration:

- Configuring a Peer to Support BGP NSR with SSO, page 5
- Configuring a Peer Group to Support BGP NSR with SSO, page 6
- Configuring Support for BGP NSR with SSO in a Peer Session Template, page 8

### Prerequisites

- These tasks assume that you are familiar with BGP peer, BGP peer group, and BGP session template concepts. For more information, see the "Configuring a Basic BGP Network" module in the *Cisco IOS IP Routing Protocols Configuration Guide*.
- The active and standby RP must be in SSO mode. For information about configuring SSO mode, see the "Configuring SSO" task in the *Stateful Switchover* document.
- Graceful restart should be enabled on the PE router. For more information about configuring graceful restart, see the "Configuring Advanced BGP Features" module.

  **Note** We recommend that you enable graceful restart on all BGP peers in the provider core that participate in BGP NSF.

- CE routers must support the route refresh capability. For more information, refer to the "Configuring a Basic BGP Network" module in the *Cisco IOS IP Routing Protocols Configuration Guide*.

### Restrictions

- This feature is supported only on Cisco 10000 Series PRE2s and Cisco 10000 Series PRE3s.

## Configuring a Peer to Support BGP NSR with SSO

Perform this task on a PE router if you want to configure a BGP peer to support BGP NSR with SSO.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *autonomous-system-number*
4. **bgp graceful-restart [restart-time** *seconds*] [**stalepath-time** *seconds*]
5. **address-family ipv4 vrf** *vrf-name*
6. **neighbor** *ip-address* **remote-as** *autonomous-system-number*
7. **neighbor** *ip-address* **ha-mode sso**
8. **neighbor** *ip-address* **activate**
9. **end**
10. **show ip bgp vpnv4 all sso summary**

### 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 bgp** *autonomous-system-number*<br><br>**Example:**<br>`Router(config)# router bgp 40000` | Enters router configuration mode for the specified routing process. |
| **Step 4** | **bgp graceful-restart [restart-time** *seconds*] [**stalepath-time** *seconds*]<br><br>**Example:**<br>`Router(config-router)# bgp graceful-restart` | Enables the BGP graceful restart capability and BGP NSF awareness.<br>• If you enter this command after the BGP session has been established, you must restart the session for the capability to be exchanged with the BGP neighbor.<br>• Use this command on the restarting router and all of its peers (NSF-capable and NSF-aware). |

| | Command or Action | Purpose |
|---|---|---|
| **Step 5** | **address-family ipv4 vrf** *vrf-name*<br><br>**Example:**<br>`Router(config-router)# address-family ipv4 vrf test` | Enters address family configuration mode for IPv4 VRF address family sessions.<br>• The **vrf** keyword and *vrf-name* argument specify that IPv4 VRF instance information will be exchanged.<br>**Note** Only the syntax necessary for this task is displayed. For more details, see the *Cisco IOS IP Routing Protocols Command Reference*. |
| **Step 6** | **neighbor** *ip-address* **remote-as** *autonomous-system-number*<br><br>**Example:**<br>`Router(config-router-af)# neighbor 192.168.1.1 remote-as 45000` | Adds the IP address of the neighbor in the specified autonomous system to the IPv4 multiprotocol BGP neighbor table of the local router. |
| **Step 7** | **neighbor** *ip-address* **ha-mode sso**<br><br>**Example:**<br>`Router(config-router-af)# neighbor 192.168.1.1 ha-mode sso` | Configures the neighbor to support BGP NSR with SSO. |
| **Step 8** | **neighbor** *ip-address* **activate**<br><br>**Example:**<br>`Router(config-router-af)# neighbor testgroup activate` | Enables the neighbor to exchange prefixes for the IPv4 address family with the local router.<br>**Note** By default, neighbors that are defined using the **neighbor remote-as** command in router configuration mode exchange only unicast address prefixes. |
| **Step 9** | **end**<br><br>**Example:**<br>`Router(config-router-af)# end` | Exits address family configuration mode and enters privileged EXEC mode. |
| **Step 10** | **show ip bgp vpnv4 all sso summary**<br><br>**Example:**<br>`Router# show ip bgp vpnv4 all sso summary` | (Optional) Displays the number of BGP neighbors that are in SSO mode. |

## Configuring a Peer Group to Support BGP NSR with SSO

Perform this task on a PE router if you want to configure a BGP peer group to support BGP NSR with SSO.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *autonomous-system-number*
4. **bgp graceful-restart** [**restart-time** *seconds*] [**stalepath-time** *seconds*]
5. **address-family ipv4 vrf** *vrf-name*

6. **neighbor** *peer-group-name* **peer-group**
7. **neighbor** *ip-address* **remote-as** *autonomous-system-number*
8. **neighbor** *ip-address* **peer-group** *peer-group-name*
9. **neighbor** *peer-group-name* **ha-mode sso**
10. **neighbor** *peer-group-name* **activate**
11. **end**
12. **show ip bgp vpnv4 all sso summary**

## 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 bgp** *autonomous-system-number*<br><br>**Example:**<br>`Router(config)# router bgp 40000` | Enters router configuration mode for the specified routing process. |
| **Step 4** | **bgp graceful-restart [restart-time** *seconds*] [**stalepath-time** *seconds*]<br><br>**Example:**<br>`Router(config-router)# bgp graceful-restart` | Enables the BGP graceful restart capability and BGP NSF awareness.<br>• If you enter this command after the BGP session has been established, you must restart the session for the capability to be exchanged with the BGP neighbor.<br>• Use this command on the restarting router and all of its peers (NSF-capable and NSF-aware). |
| **Step 5** | **address-family ipv4 vrf** *vrf-name*<br><br>**Example:**<br>`Router(config-router)# address-family ipv4 vrf cisco` | Specifies the IPv4 address family and enters address family configuration mode.<br>• The **vrf** keyword and *vrf-name* argument specify that IPv4 VRF instance information will be exchanged.<br>**Note** Only the syntax necessary for this task is displayed. For more details, see the *Cisco IOS IP Routing Protocols Command Reference*. |
| **Step 6** | **neighbor** *peer-group-name* **peer-group**<br><br>**Example:**<br>`Router(config-router-af)# neighbor testgroup peer-group` | Creates a BGP peer group. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 7** | **neighbor** *ip-address* **remote-as** *autonomous-system-number*<br><br>**Example:**<br>`Router(config-router-af)# neighbor 192.168.1.1 remote-as 45000` | Adds the IP address of the neighbor in the specified autonomous system to the IPv4 multiprotocol BGP neighbor table of the local router. |
| **Step 8** | **neighbor** *ip-address* **peer-group** *peer-group-name*<br><br>**Example:**<br>`Router(config-router-af)# neighbor 192.168.1.1 peer-group testgroup` | Assigns the IP address of a BGP neighbor to a BGP peer group. |
| **Step 9** | **neighbor** *peer-group-name* **ha-mode sso**<br><br>**Example:**<br>`Router(config-router-af)# neighbor 192.168.1.1 ha-mode sso` | Configures the BGP peer group to support BGP NSR with SSO. |
| **Step 10** | **neighbor** *peer-group-name* **activate**<br><br>**Example:**<br>`Router(config-router-af)# neighbor testgroup activate` | Enables the neighbor to exchange prefixes for the IPv4 address family with the local router. |
| **Step 11** | **end**<br><br>**Example:**<br>`Router(config-router-af)# end` | Exits address family configuration mode and returns to global configuration mode. |
| **Step 12** | **show ip bgp vpnv4 all sso summary**<br><br>**Example:**<br>`Router# show ip bgp vpnv4 all sso summary` | (Optional) Displays the number of BGP neighbors that are in SSO mode. |

## Configuring Support for BGP NSR with SSO in a Peer Session Template

Perform this task on a PE router if you want to configure support for BGP NSR with SSO in a BGP peer session template.

### SUMMARY STEPS

1. **enable**
2. configure terminal
3. **router bgp** *autonomous-system-number*
4. **template peer-session** *session-template-name*
5. **ha-mode sso**
6. **exit-peer-session**
7. **end**
8. **show ip bgp template peer-session** [*session-template-name*]

### 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 bgp** *autonomous-system-number*<br><br>**Example:**<br>`Router(config)# router bgp 101` | Enters router configuration mode and creates a BGP routing process. |
| **Step 4** | **template peer-session** *session-template-name*<br><br>**Example:**<br>`Router(config-router)# template peer-session CORE1` | Enters session-template configuration mode and creates a peer session template. |
| **Step 5** | **ha-mode sso**<br><br>**Example:**<br>`Router(config-router-stmp)# ha-mode sso` | Configures the neighbor to support BGP NSR with SSO. |
| **Step 6** | **exit-peer-session**<br><br>**Example:**<br>`Router(config-router-stmp)# exit-peer-session` | Exits session-template configuration mode and returns to router configuration mode. |
| **Step 7** | **end**<br><br>**Example:**<br>`Router(config-router)# end` | Exits router configuration mode and returns to privileged EXEC mode. |
| **Step 8** | **show ip bgp template peer-session** [*session-template-name*]<br><br>**Example:**<br>`Router# show ip bgp template peer-session` | (Optional) Displays locally configured peer session templates.<br>• The output can be filtered to display a single peer policy template with the *session-template-name* argument. This command also supports all standard output modifiers. |

## What to Do Next

After the peer session template is created, the configuration of the peer session template can be inherited by or applied to another peer session template with the **inherit peer-session** or **neighbor inherit peer-session** command.

For more information about configuring peer session templates, see the "Configuring a Basic BGP Network" chapter in the *Cisco IOS IP Routing Protocols Configuration Guide*.

# Verifying BGP Support for NSR with SSO

Perform this optional task to verify BGP NSR with SSO support.

## SUMMARY STEPS

1. **enable**
2. **show ip bgp vpnv4 all sso summary**
3. **show ip bgp vpnv4 all neighbors**

## DETAILED STEPS

**Step 1** **enable**

Enables privileged EXEC mode. Enter your password if prompted.

```
Router> enable
```

**Step 2** **show ip bgp vpnv4 all sso summary**

This command is used to display the number of BGP neighbors that are in SSO mode.

The following is sample output from the **show ip bgp vpnv4 all sso summary** command:

```
Router# show ip bgp vpnv4 all sso summary

   Stateful switchover support enabled for 40 neighbors
```

**Step 3** **show ip bgp vpnv4 all neighbors**

This command displays VPN address information from the BGP table.

The following is sample output from the **show ip bgp vpnv4 all neighbors** command. The "Stateful switchover support" field indicates whether SSO is enabled or disabled. The "SSO Last Disable Reason" field displays information about the last BGP session that lost SSO capability.

```
Router# show ip bgp vpnv4 all neighbors 10.3.3.3

BGP neighbor is 10.3.3.3,  vrf vrf1,  remote AS 3, external link
  Inherits from template 10vrf-session for session parameters
   BGP version 4, remote router ID 10.1.105.12
   BGP state = Established, up for 04:21:39
   Last read 00:00:05, last write 00:00:09, hold time is 30, keepalive interval is 10
seconds
   Configured hold time is 30, keepalive interval is 10 seconds
   Minimum holdtime from neighbor is 0 seconds
   Neighbor capabilities:
     Route refresh: advertised and received(new)
     Address family IPv4 Unicast: advertised and received
     Stateful switchover support enabled
   Message statistics:
     InQ depth is 0
     OutQ depth is 0
                          Sent       Rcvd
     Opens:                  1          1
     Notifications:          0          0
     Updates:                1          4
     Keepalives:          1534       1532
     Route Refresh:          0          0
     Total:               1536       1537
   Default minimum time between advertisement runs is 30 seconds
```

```
  For address family: VPNv4 Unicast
   Translates address family IPv4 Unicast for VRF vrf1
   BGP table version 25161, neighbor version 25161/0
   Output queue size : 0
   Index 7, Offset 0, Mask 0x80
   7 update-group member
   Inherits from template 10vrf-policy
   Overrides the neighbor AS with my AS before sending updates
   Outbound path policy configured
   Route map for outgoing advertisements is Deny-CE-prefixes
                                Sent       Rcvd
   Prefix activity:             ----       ----
     Prefixes Current:            10         50 (Consumes 3400 bytes)
     Prefixes Total:              10         50
     Implicit Withdraw:            0          0
     Explicit Withdraw:            0          0
     Used as bestpath:           n/a          0
     Used as multipath:          n/a          0

                                  Outbound    Inbound
   Local Policy Denied Prefixes:  --------    -------
     route-map:                        150          0
     AS_PATH loop:                     n/a        760
     Total:                            150        760
   Number of NLRIs in the update sent: max 10, min 10

   Address tracking is enabled, the RIB does have a route to 10.3.3.3
   Address tracking requires at least a /24 route to the peer
   Connections established 1; dropped 0
   Last reset never
   Transport(tcp) path-mtu-discovery is enabled
   TCP session must be opened passively
Connection state is ESTAB, I/O status: 1, unread input bytes: 0 Connection is ECN Disabled
Local host: 10.0.21.1, Local port: 179 Foreign host: 10.0.21.3, Foreign port: 51205
Connection tableid (VRF): 1

Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x1625488):
Timer          Starts    Wakeups            Next
Retrans          1746        210             0x0
TimeWait            0          0             0x0
AckHold          1535       1525             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0
Linger              0          0             0x0

iss: 2241977291  snduna: 2242006573  sndnxt: 2242006573     sndwnd:  13097
irs:  821359845  rcvnxt:  821391670  rcvwnd:      14883  delrcvwnd:   1501

SRTT: 300 ms, RTTO: 303 ms, RTV: 3 ms, KRTT: 0 ms
minRTT: 0 ms, maxRTT: 300 ms, ACK hold: 200 ms Status Flags: passive open, retransmission
timeout, gen tcbs
   0x1000
Option Flags: VRF id set, always push, md5
```

```
Datagrams (max data segment is 4330 bytes):
Rcvd: 3165 (out of order: 0), with data: 1535, total data bytes: 31824
Sent: 3162 (retransmit: 210 fastretransmit: 0),with data: 1537, total data
bytes: 29300
SSO Last Disable Reason: Application Disable (Active)
```

### Troubleshooting Tips

To troubleshoot BGP NSR with SSO, use the following commands in privileged EXEC mode, as needed:

- **debug ip bgp sso**—Displays BGP-related SSO events or debugging information for BGP-related interactions between the active RP and the standby RP. This command is useful for monitoring or troubleshooting BGP sessions on a PE router during an RP switchover or during a planned ISSU.
- **debug ip tcp ha**—Displays TCP HA events or debugging information for TCP stack interactions between the active RP and the standby RP. This is command is useful for troubleshooting SSO-aware TCP connections.
- **show tcp**—Displays the status of TCP connections. The display output will display the SSO capability flag and will indicate the reason that the SSO property failed on a TCP connection.
- **show tcp ha connections**—Displays connection-ID-to-TCP mapping data.

# Configuration Examples for BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)

This section contains the following configuration example:

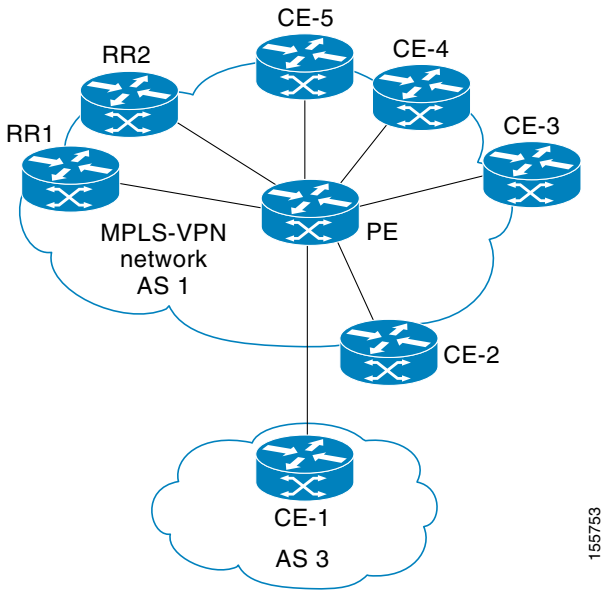
- Configuring BGP NSR with SSO: Example, page 12

## Configuring BGP NSR with SSO: Example

Figure 2 illustrates a sample BGP NSR with SSO network topology, and the configuration examples that follow show configurations from three routers in the topology: the RR1 router, the PE router, and the CE-1 router.

**Note** The configuration examples omit some of the configuration required for MPLS VPNs because the purpose of these examples is to illustrate the configuration of BGP NSR with SSO.

*Figure 2 BGP NSR with SSO Example Topology*




### RR1 Configuration

The following example shows the BGP configuration for RR1 in Figure 2. RR1 is configured as a NSF-aware route reflector. In the event of an RP switchover, the PE router uses NSF to maintain the BGP state of the internal peering session with RR1.

```
!
router bgp 1
 no synchronization
 bgp log-neighbor-changes
 bgp graceful-restart restart-time 120
 bgp graceful-restart stalepath-time 360
 bgp graceful-restart
 neighbor 10.2.2.2 remote-as 1
 neighbor 10.2.2.2 update-source Loopback0
 no auto-summary
 !
 address-family vpnv4
 neighbor 10.2.2.2 activate
 neighbor 10.2.2.2 send-community both
 neighbor 10.2.2.2 route-reflector-client
 exit-address-family
 !
```

### PE Configuration

The following example shows the BGP NSR with SSO configuration for the PE router in Figure 2. The PE router is configured to support both NSF-awareness and the BGP NSR with SSO capability. In the event of an RP switchover, the PE router uses BGP NSR with SSO to maintain BGP state for the eBGP peering session with the CE-1 router, a CE router in this topology that is not NSF-aware, and uses NSF to maintain BGP state for the iBGP session with RR1. The PE router also detects if any of the other CE routers in the MPLS VPN network are NSF-aware and runs graceful restart with those CE routers.

```
!
router bgp 2
 no synchronization
```

```
 bgp log-neighbor-changes
 bgp graceful-restart restart-time 120
 bgp graceful-restart stalepath-time 360
 bgp graceful-restart
 neighbor 10.1.1.1 remote-as 1
 neighbor 10.1.1.1 update-source Loopback0
 no auto-summary
 !
 address-family vpnv4
 neighbor 10.1.1.1 activate
 neighbor 10.1.1.1 send-community both
 exit-address-family
 !
 address-family ipv4 vrf ce-1
 neighbor 10.3.3.3 remote-as 3
 neighbor 10.3.3.3 ha-mode sso
 neighbor 10.3.3.3 activate
 neighbor 10.3.3.3 as-override
 no auto-summary
 no synchronization
 exit-address-family
!
```

### CE-1 Configuration

The following example shows the BGP configuration for CE-1 in Figure 2. The CE-1 router is configured as an external peer of the PE router. The CE-1 router is not configured to be NSF-capable or NSF-aware. The CE-1 router, however, does not need to be NSF-capable or NSF-aware to benefit from BGP NSR capabilities on the PE router nor does it need to be upgraded to support BGP NSR.

```
!
router bgp 3
 neighbor 10.2.2.2 remote-as 1
!
```

# Additional References

The following sections provide references related to configuring the BGP Support for NSR with SSO feature.

## Related Documents

| Related Topic | Document Title |
|---|---|
| BGP concepts and configuration tasks | "Cisco BGP Overview" module |
| BGP commands: complete command syntax, command mode, command history, command defaults, usage guidelines, and examples | *Cisco IOS IP Routing Protocols Command Reference* |
| BGP NSF awareness concepts, configuration tasks, and examples | "Configuring Advanced BGP Features" module |
| ISSU concepts, configuration tasks, and examples | "Cisco In Service Software Upgrade Process" module |
| MPLS Layer 3 VPN concepts and configuration tasks | "Configuring MPLS Layer 3 VPNs" module |

| Related Topic | Document Title |
|---|---|
| MPLS Layer 3 VPN commands: complete command syntax, command mode, command history, command defaults, usage guidelines, and examples | *Cisco IOS Multiprotocol Label Switching Command Reference* |
| SSO concepts, configuration tasks, and examples | *Stateful Switchover* |

## Standards

| Standard | Title |
|---|---|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | — |

## MIBs

| MIB | MIBs Link |
|---|---|
| No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature. | 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 |
|---|---|
| draft-ietf-idr-restart-06.txt | *Graceful Restart Mechanism for BGP* |

## 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.<br>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.<br>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. | http://www.cisco.com/techsupport |

# Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS IP Routing Protocols Command Reference* at http://www.cisco.com/en/US/docs/ios/iproute/command/reference/irp_book.html. For information about all Cisco IOS commands, go to the Command Lookup Tool at http://tools.cisco.com/Support/CLILookup or to the *Cisco IOS Master Commands List*.

- **debug ip bgp sso**
- **debug ip tcp ha**
- **neighbor ha-mode sso**
- **show ip bgp vpnv4**
- **show ip bgp vpnv4 all sso summary**
- **show tcp**
- **show tcp ha connections**

# Feature Information for BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)

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 BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO)*

| Feature Name | Releases | Feature Information |
|---|---|---|
| BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO) | 12.2(28)SB | The BGP Support for Nonstop Routing (NSR) with Stateful Switchover (SSO) feature enables provider edge (PE) routers to maintain Border Gateway Protocol (BGP) state with customer edge (CE) routers and ensure continuous packet forwarding during a Route Processor (RP) switchover or during a planned In-Service Software Upgrade (ISSU) for a PE router. CE routers do not need to be Nonstop Forwarding (NSF)-capable or NSF-aware to benefit from BGP NSR capabilities on PE routers. Only PE routers need to be upgraded to support BGP NSR—no CE router upgrades are required. BGP NSR with SSO, thus, enables service providers to provide the benefits NSF with the additional benefits of NSR without requiring CE routers to be upgraded to support BGP graceful restart.<br><br>The following commands were introduced or modified: **debug ip bgp sso**, **debug ip tcp ha**, **neighbor ha-mode sso**, **show ip bgp vpnv4**, **show ip bgp vpnv4 all sso summary**, **show tcp**, **show tcp ha connections**. |