# IP Routing BFD Configuration Guide, Cisco IOS Release 15E

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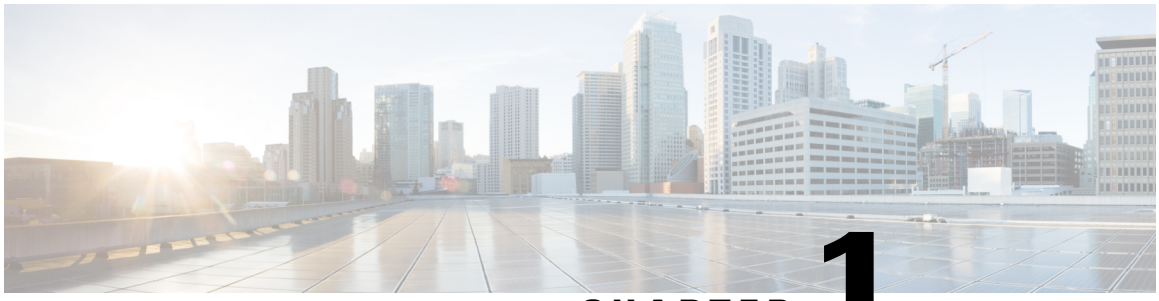


CHAPTER 1

# BFD - EIGRP Support

The BFD-EIGRP Support feature configures the Enhanced Interior Gateway Routing Protocol (EIGRP) with Bidirectional Forwarding Detection (BFD) so that EIGRP registers with BFD and receives all forwarding path detection failure messages from BFD.



## Finding Feature Information

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

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

## Prerequisites for BFD-EIGRP Support

- Enhanced Interior Gateway Routing Protocol (EIGRP) must be running on all participating routers.
- The baseline parameters for Bidirectional Forwarding Detection (BFD) sessions on the interfaces over which you want to run BFD sessions to BFD neighbors must be configured using the **bfd** command.

# Information About BFD-EIGRP Support

## Overview of BFD-EIGRP Support

The BFD-EIGRP Support feature configures Bidirectional Forwarding Detection (BFD) feature for Enhanced Interior Gateway Routing Protocol (EIGRP) so that EIGRP registers with the BFD sessions on the routing interfaces, and receives forwarding path detection failure messages from BFD.

Use **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier* command to enable BFD on any interface. Use the **bfd all-interfaces** command in router configuration mode to enable BFD for all of the interfaces where EIGRP routing is enabled. Use the **bfd interface** *type number* command in router configuration mode to enable BFD for a subset of the interfaces where EIGRP routing is enabled.

# How to Configure BFD-EIGRP Support

## Configuring BFD - EIGRP Support

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router eigrp** *as-number*
4. Do one of the following:
   - **bfd all-interfaces**
   - **bfd interface** *type number*
5. **end**
6. **show bfd neighbors** [**details**]
7. **show ip eigrp interfaces** [*type number*] [*as-number*] [**detail**]

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router eigrp** *as-number*<br><br>**Example:**<br>`Device(config)# router eigrp 123` | Configures the EIGRP routing process and enters router configuration mode. |
| **Step 4** | Do one of the following:<br>• **bfd all-interfaces**<br>• **bfd interface** *type number*<br><br>**Example:**<br>`Device(config-router)# bfd all-interfaces`<br><br>**Example:**<br>`Device(config-router)# bfd interface FastEthernet 6/0` | Enables BFD globally on all interfaces associated with the EIGRP routing process.<br>or<br>Enables BFD on a per-interface basis for one or more interfaces associated with the EIGRP routing process. |
| **Step 5** | **end**<br><br>**Example:**<br>`Device(config-router)# end` | Exits router configuration mode and returns the router to privileged EXEC mode. |
| **Step 6** | **show bfd neighbors** [**details**]<br><br>**Example:**<br>`Device# show bfd neighbors details` | (Optional) Verifies that the BFD neighbor is active and displays the routing protocols that BFD has registered. |
| **Step 7** | **show ip eigrp interfaces** [*type number*] [*as-number*] [**detail**]<br><br>**Example:**<br>`Device# show ip eigrp interfaces detail` | (Optional) Displays the interfaces for which BFD support for EIGRP has been enabled. |

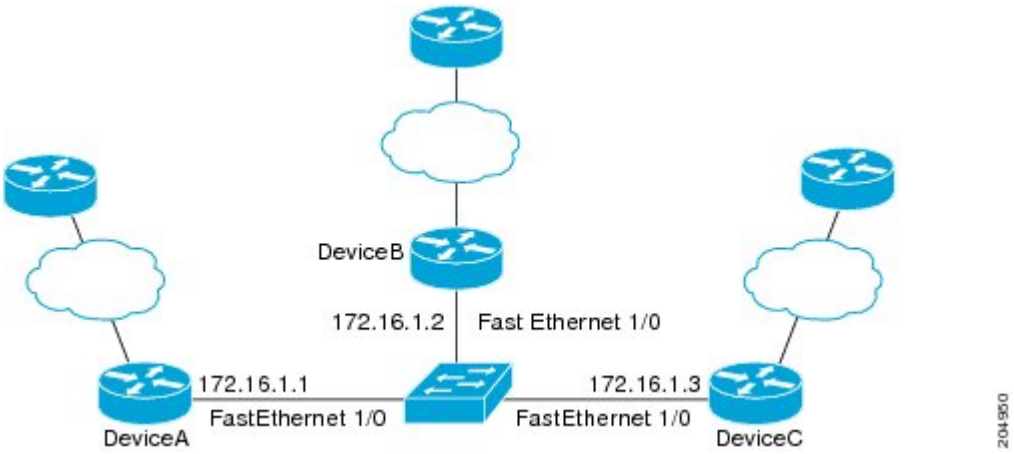
# Configuration Examples for BFD-EIGRP Support

## Example: Configuring BFD in an EIGRP Network with Echo Mode Enabled by Default

In the following example, the EIGRP network contains DeviceA, DeviceB, and DeviceC. Fast Ethernet interface 1/0 on DeviceA is connected to the same network as Fast Ethernet interface 1/0 on Device B. Fast Ethernet interface 1/0 on DeviceB is connected to the same network as Fast Ethernet interface 1/0 on DeviceC.

DeviceA and DeviceB are running BFD Version 1, which supports echo mode, and DeviceC is running BFD Version 0, which does not support echo mode. The BFD sessions between DeviceC and its BFD neighbors are said to be running echo mode with asymmetry because echo mode will run on the forwarding path for DeviceA and DeviceB, and their echo packets will return along the same path for BFD sessions and failure detections, while their BFD neighbor DeviceC runs BFD Version 0 and uses BFD controls packets for BFD sessions and failure detections.

The figure below shows a large EIGRP network with several devices, three of which are BFD neighbors that are running EIGRP as their routing protocol.




The example, starting in global configuration mode, shows the configuration of BFD.

### Configuration for DeviceA

```
interface Fast Ethernet0/0
no shutdown
ip address 10.4.9.14 255.255.255.0
duplex auto
speed auto
!
interface Fast Ethernet1/0
ip address 172.16.1.1 255.255.255.0
bfd interval 50 min_rx 50 multiplier 3
no shutdown
duplex auto
speed auto
!
router eigrp 11
```

```
network 172.16.0.0
bfd all-interfaces
auto-summary
!
ip default-gateway 10.4.9.1
ip default-network 0.0.0.0
ip route 0.0.0.0 0.0.0.0 10.4.9.1
ip route 172.16.1.129 255.255.255.255 10.4.9.1
!
no ip http server
!
logging alarm informational
!
control-plane
!
line con 0
exec-timeout 30 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
!
!
end
```

### Configuration for DeviceB

```
!
interface Fast Ethernet0/0
no shutdown
ip address 10.4.9.34 255.255.255.0
duplex auto
speed auto
!
interface Fast Ethernet1/0
ip address 172.16.1.2 255.255.255.0
bfd interval 50 min_rx 50 multiplier 3
no shtdown
duplex auto
speed auto
!
router eigrp 11
network 172.16.0.0
bfd all-interfaces
auto-summary
!
ip default-gateway 10.4.9.1
ip default-network 0.0.0.0
ip route 0.0.0.0 0.0.0.0 10.4.9.1
ip route 172.16.1.129 255.255.255.255 10.4.9.1
!
no ip http server
!
logging alarm informational
!
control-plane
!
line con 0
exec-timeout 30 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
!
!
end
```

### Configuration for DeviceC

```
!
!
interface Fast Ethernet0/0
no shutdown
ip address 10.4.9.34 255.255.255.0
duplex auto
speed auto
!
interface Fast Ethernet1/0
ip address 172.16.1.2 255.255.255.0
bfd interval 50 min_rx 50 multiplier 3
no shutdown
duplex auto
speed auto
!
router eigrp 11
network 172.16.0.0
bfd all-interfaces
auto-summary
!
ip default-gateway 10.4.9.1
ip default-network 0.0.0.0
ip route 0.0.0.0 0.0.0.0 10.4.9.1
ip route 172.16.1.129 255.255.255.255 10.4.9.1
!
no ip http server
!
logging alarm informational
!
control-plane
!
line con 0
exec-timeout 30 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
!
!
end
```

The output from the **show bfd neighbors details** command from DeviceA verifies that BFD sessions are created among all three devices and that EIGRP is registered for BFD support. The first group of output shows that DeviceC with the IP address 172.16.1.3 runs BFD Version 0 and therefore does not use the echo mode. The second group of output shows that DeviceB with the IP address 172.16.1.2 runs BFD Version 1, and the 50 millisecond BFD interval parameter had been adopted. The relevant command output is shown in bold in the output.

```
DeviceA# show bfd neighbors details

OurAddr
       NeighAddr
      LD/RD  RH/RS    Holdown(mult)  State     Int
172.16.1.1    172.16.1.3
     5/3    1(RH)    150 (3 )       Up   Fa1/0
Session state is UP and not using echo function.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3
Received MinRxInt: 50000, Received Multiplier: 3
Holdown (hits): 150(0), Hello (hits): 50(1364284)
Rx Count: 1351813, Rx Interval (ms) min/max/avg: 28/64/49 last: 4 ms ago
Tx Count: 1364289, Tx Interval (ms) min/max/avg: 40/68/49 last: 32 ms ago
Registered protocols: EIGRP
Uptime: 18:42:45
Last packet: Version: 0
            - Diagnostic: 0
```

```
            I Hear You bit: 1     - Demand bit: 0
            Poll bit: 0           - Final bit: 0
            Multiplier: 3         - Length: 24
            My Discr.: 3          - Your Discr.: 5
            Min tx interval: 50000    - Min rx interval: 50000
            Min Echo interval: 0
OurAddr       NeighAddr
     LD/RD  RH/RS   Holdown(mult)  State     Int
172.16.1.1    172.16.1.2

    6/1    Up        0    (3 )   Up        Fa1/0
Session state is UP and using echo function with 50 ms interval.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 3
Received MinRxInt: 1000000, Received Multiplier: 3
Holdown (hits): 3000(0), Hello (hits): 1000(317)
Rx Count: 305, Rx Interval (ms) min/max/avg: 1/1016/887 last: 448 ms ago
Tx Count: 319, Tx Interval (ms) min/max/avg: 1/1008/880 last: 532 ms ago
Registered protocols: EIGRP
Uptime: 00:04:30
Last packet: Version: 1

         - Diagnostic: 0
            State bit: Up         - Demand bit: 0
            Poll bit: 0           - Final bit: 0
            Multiplier: 3         - Length: 24
            My Discr.: 1          - Your Discr.: 6
            Min tx interval: 1000000    - Min rx interval: 1000000
            Min Echo interval: 50000
```

The output from the **show bfd neighbors details** command on Device B verifies that BFD sessions have been created and that EIGRP is registered for BFD support. As previously noted, DeviceA runs BFD Version 1, therefore echo mode is running, and DeviceC runs BFD Version 0, so echo mode does not run. The relevant command output is shown in bold in the output.

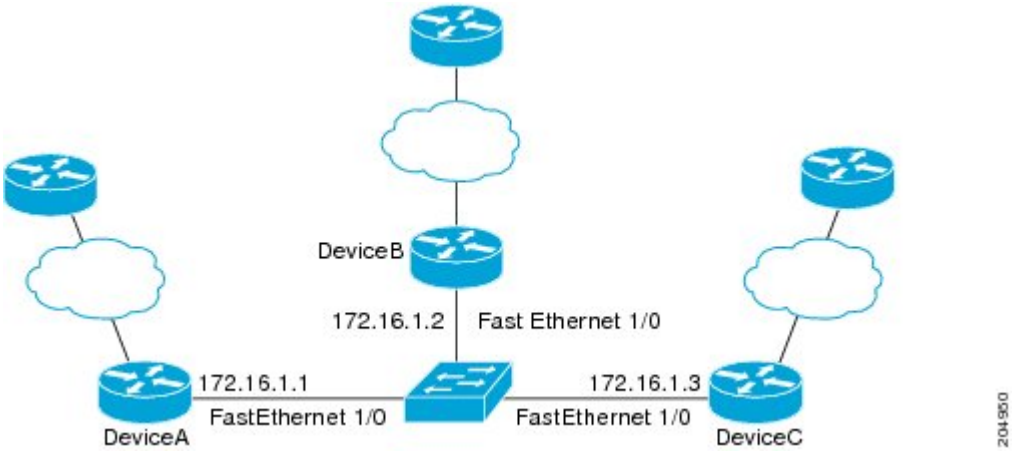
```
DeviceB# show bfd neighbors details

OurAddr       NeighAddr
     LD/RD  RH/RS   Holdown(mult)  State     Int
172.16.1.2    172.16.1.1
    1/6    Up        0    (3 )   Up        Fa1/0
Session state is UP and using echo function with 50 ms interval.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 3
Received MinRxInt: 1000000, Received Multiplier: 3
Holdown (hits): 3000(0), Hello (hits): 1000(337)
Rx Count: 341, Rx Interval (ms) min/max/avg: 1/1008/882 last: 364 ms ago
Tx Count: 339, Tx Interval (ms) min/max/avg: 1/1016/886 last: 632 ms ago
Registered protocols: EIGRP
Uptime: 00:05:00
Last packet: Version: 1
           - Diagnostic: 0
             State bit: Up         - Demand bit: 0
             Poll bit: 0           - Final bit: 0
             Multiplier: 3         - Length: 24
             My Discr.: 6          - Your Discr.: 1
             Min tx interval: 1000000    - Min rx interval: 1000000
             Min Echo interval: 50000
OurAddr       NeighAddr

 LD/RD  RH/RS   Holdown(mult)  State     Int
172.16.1.2    172.16.1.3
     3/6    1(RH)     118  (3 )   Up        Fa1/0
Session state is UP and not using echo function.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3
Received MinRxInt: 50000, Received Multiplier: 3
Holdown (hits): 150(0), Hello (hits): 50(5735)
Rx Count: 5731, Rx Interval (ms) min/max/avg: 32/72/49 last: 32 ms ago
Tx Count: 5740, Tx Interval (ms) min/max/avg: 40/64/50 last: 44 ms ago
```

```
Registered protocols: EIGRP
Uptime: 00:04:45
Last packet: Version: 0
            - Diagnostic: 0
             I Hear You bit: 1      - Demand bit: 0
             Poll bit: 0            - Final bit: 0
             Multiplier: 3          - Length: 24
             My Discr.: 6           - Your Discr.: 3
             Min tx interval: 50000    - Min rx interval: 50000
             Min Echo interval: 0
```

The figure below shows that Fast Ethernet interface 1/0 on DeviceB has failed. When Fast Ethernet interface 1/0 on DeviceB is shut down, the BFD statistics of the corresponding BFD sessions on DeviceA and DeviceB are reduced.




When Fast Ethernet interface 1/0 on DeviceB fails, BFD will no longer detect Device B as a BFD neighbor for DeviceA or for DeviceC. In this example, Fast Ethernet interface 1/0 has been administratively shut down on DeviceB.

The following output from the **show bfd neighbors** command on DeviceA now shows only one BFD neighbor for DeviceA in the EIGRP network. The relevant command output is shown in bold in the output.

```
DeviceA# show bfd neighbors
OurAddr       NeighAddr

    LD/RD  RH/RS   Holdown(mult)  State     Int
172.16.1.1    172.16.1.3

    5/3    1(RH)     134  (3 )   Up        Fa1/0
```

The following output from the **show bfd neighbors** command on DeviceC also now shows only one BFD neighbor for DeviceC in the EIGRP network. The relevant command output is shown in bold in the output.

```
DeviceC# show bfd neighbors

OurAddr       NeighAddr

   LD/RD RH  Holdown(mult)  State     Int
172.16.1.3    172.16.1.1

    3/5  1   114  (3 )      Up        Fa1/0
```

# Additional References for BFD-EIGRP Support

### Related Documents

| Related Topic | Document Title |
|---|---|
| BFD Commands | IP Routing Protocol-Independent Commands A through R<br>IP Routing Protocol-Independent Commands S through T |
| Cisco IOS Commands | Cisco IOS Master Command List, All Releases |

### 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/support |

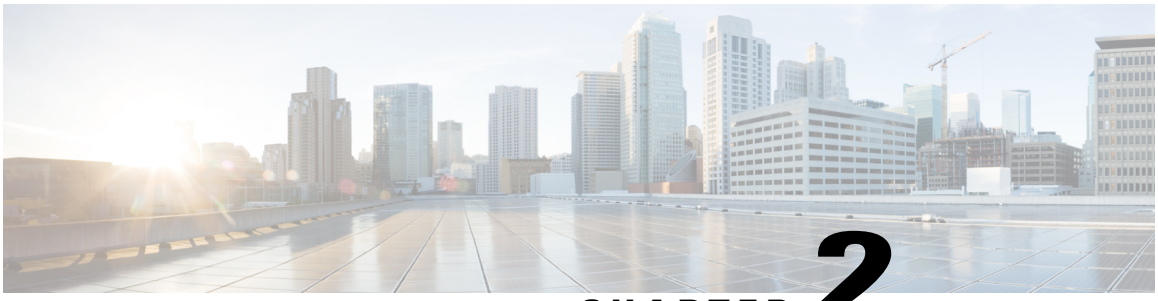
# Feature Information for BFD-EIGRP Support

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

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

*Table 1: Feature Information for BFD-EIGRP Support*

| Feature Name | Releases | Feature Information |
|---|---|---|
| BFD-EIGRP Support | 15.2(1)E | The BFD-EIGRP Support feature configures the Enhanced Interior Gateway Routing Protocol (EIGRP) with Bidirectional Forwarding Detection (BFD) so that EIGRP registers with BFD and receives all forwarding path detection failure messages from BFD. |



CHAPTER 2

# BFD Support for EIGRP IPv6

The BFD Support for EIGRP IPv6 feature provides Bidirectional Forwarding Detection (BFD) support for Enhanced Interior Gateway Routing Protocol (EIGRP) IPv6 sessions, thereby facilitating rapid fault detection and alternate-path selection in EIGRP IPv6 topologies. BFD is a detection protocol that provides a consistent failure-detection method for network administrators, and network administrators use BFD to detect forwarding path failures at a uniform rate and not at variable rates for different routing protocol 'Hello' mechanisms. This failure-detection methodology ensures easy network profiling and planning and consistent and predictable reconvergence time. This document provides information about BFD support for EIGRP IPv6 networks and explains how to configure BFD support in EIGRP IPv6 networks.



## Finding Feature Information

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# Prerequisites for BFD Support for EIGRP IPv6

EIGRP IPv6 sessions have a shutdown option in router, address family, and address-family interface configuration modes. To enable BFD support on EIGRP IPv6 sessions, the routing process should be in no shut mode in the abovementioned modes.

# Restrictions for BFD Support for EIGRP IPv6

- The BFD Support for EIGRP IPv6 feature is supported only in EIGRP named mode.
- EIGRP supports only single-hop Bidirectional Forwarding Detection (BFD).
- The BFD Support for EIGRP IPv6 feature is not supported on passive interfaces.

# Information About BFD Support for EIGRP IPv6

## BFD for EIGRP IPv6

Bidirectional Forwarding Detection (BFD) is a detection protocol that provides fast-forwarding, path-failure detection for all media types, encapsulations, topologies, and routing protocols. The BFD Support for EIGRP IPv6 feature enables BFD to interact with the Enhanced Interior Gateway Routing Protocol (EIGRP) to create BFDv6 sessions between EIGRP neighbors. In a BFD-enabled EIGRP IPv6 session, BFD constantly monitors the forwarding path (from a local device to a neighboring device) and provides consistent failure detection at a uniform rate. Because failure detection happens at a uniform rate and not at variable rates, network profiling and planning is easier, and the reconvergence time remains consistent and predictable.

BFD is implemented in EIGRP at multiple levels; it can be implemented per interface or on all interfaces. When BFD is enabled on a specific interface, all peer relationships formed through the EIGRP “Hello” mechanism on that interface are registered with the BFD process. Subsequently, BFD establishes a session with each of the peers in the EIGRP topology and notifies EIGRP through a callback mechanism of any change in the state of any peer. When a peer is lost, BFD sends a “peer down” notification to EIGRP, and EIGRP unregisters a peer from BFD. BFD does not send a “peer up” notification to EIGRP when the peer is up because BFD now has no knowledge of the state of the peer. This behavior prevents rapid neighbor bouncing and repetitive route computations. The EIGRP “Hello” mechanism will later allow peer rediscovery and reregistration with the BFD process.

# How to Configure BFD Support for EIGRP IPv6

## Configuring BFD Support on All Interfaces

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 unicast-routing**
4. **interface** *type number*
5. **ipv6 address** *ipv6-address/prefix-length*
6. **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*
7. **exit**
8. **router eigrp** *virtual-name*
9. **address-family ipv6 autonomous-system** *as-number*
10. **eigrp router-id** *ip-address*
11. **af-interface default**
12. **bfd**
13. **end**
14. **show eigrp address-family ipv6 neighbors**

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **ipv6 unicast-routing**<br><br>**Example:**<br>`Device(config)# ipv6 unicast-routing` | Enables the forwarding of IPv6 unicast datagrams. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 4** | **interface** *type number*<br><br>**Example:**<br>`Device(config)# interface gigabitethernet0/0/1` | Specifies the interface type and number, and enters the interface configuration mode. |
| **Step 5** | **ipv6 address** *ipv6-address/prefix-length*<br><br>**Example:**<br>`Device(config-if)# ipv6 address 2001:DB8:A:B::1/64` | Configures an IPv6 address. |
| **Step 6** | **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*<br><br>**Example:**<br>`Device(config-if)# bfd interval 50 min_rx 50 multiplier 3` | Sets the baseline BFD session parameters on an interface. |
| **Step 7** | **exit**<br><br>**Example:**<br>`Device(config-if)# exit` | Exits interface configuration mode and returns to global configuration mode. |
| **Step 8** | **router eigrp** *virtual-name*<br><br>**Example:**<br>`Device(config)# router eigrp name` | Specifies an EIGRP routing process and enters router configuration mode. |
| **Step 9** | **address-family ipv6 autonomous-system** *as-number*<br><br>**Example:**<br>`Device(config-router)# address-family ipv6 autonomous-system 3` | Enters address family configuration mode for IPv6 and configures an EIGRP routing instance. |
| **Step 10** | **eigrp router-id** *ip-address*<br><br>**Example:**<br>`Device(config-router-af)# eigrp router-id 172.16.1.3` | Sets the device ID used by EIGRP for this address family when EIGRP peers communicate with their neighbors. |
| **Step 11** | **af-interface default**<br><br>**Example:**<br>`Device(config-router-af)# af-interface default` | Configures interface-specific commands on all interfaces that belong to an address family in EIGRP named mode configurations, and enters address-family interface configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 12** | **bfd**<br><br>**Example:**<br>`Device(config-router-af-interface)# bfd` | Enables BFD on all interfaces. |
| **Step 13** | **end**<br><br>**Example:**<br>`Device(config-router-af-interface)# end` | Exits address-family interface configuration mode and returns to privileged EXEC mode. |
| **Step 14** | **show eigrp address-family ipv6 neighbors**<br><br>**Example:**<br>`Device# show eigrp address-family ipv6 neighbors` | (Optional) Displays neighbors for which BFD has been enabled. |

# Configuring BFD Support on an Interface

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 unicast-routing**
4. **interface** *type number*
5. **ipv6 address** *ipv6-address /prefix-length*
6. **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*
7. **exit**
8. **router eigrp** *virtual-name*
9. **address-family ipv6 autonomous-system** *as-number*
10. **eigrp router-id** *ip-address*
11. **af-interface** *interface-type interface-number*
12. **bfd**
13. **end**
14. **show eigrp address-family ipv6 neighbors**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable** | Enables privileged EXEC mode. |

| | Command or Action | Purpose |
|---|---|---|
| | **Example:**<br>`Device> enable` | • Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **ipv6 unicast-routing**<br>**Example:**<br>`Device(config)# ipv6 unicast-routing` | Enables the forwarding of IPv6 unicast datagrams. |
| **Step 4** | **interface** *type number*<br>**Example:**<br>`Device(config)# interface gigabitethernet0/0/1` | Specifies the interface type and number, and enters the interface configuration mode. |
| **Step 5** | **ipv6 address** *ipv6-address /prefix-length*<br>**Example:**<br>`Device(config-if)# ipv6 address 2001:DB8:A:B::1/64` | Configures an IPv6 address. |
| **Step 6** | **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*<br>**Example:**<br>`Device(config-if)# bfd interval 50 min_rx 50 multiplier 3` | Sets the baseline BFD session parameters on an interface. |
| **Step 7** | **exit**<br>**Example:**<br>`Device(config-if)# exit` | Exits interface configuration mode and returns to global configuration mode. |
| **Step 8** | **router eigrp** *virtual-name*<br>**Example:**<br>`Device(config)# router eigrp name` | Specifies an EIGRP routing process and enters router configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 9** | **address-family ipv6 autonomous-system** *as-number*<br>**Example:**<br>`Device(config-router)# address-family ipv6 autonomous-system 3` | Enters address family configuration mode for IPv6 and configures an EIGRP routing instance. |
| **Step 10** | **eigrp router-id** *ip-address*<br>**Example:**<br>`Device(config-router-af)# eigrp router-id 172.16.1.3` | Sets the device ID used by EIGRP for this address family when EIGRP peers communicate with their neighbors. |
| **Step 11** | **af-interface** *interface-type interface-number*<br>**Example:**<br>`Device(config-router-af)# af-interface gigabitethernet0/0/1` | Configures interface-specific commands on an interface that belongs to an address family in an EIGRP named mode configuration, and enters address-family interface configuration mode. |
| **Step 12** | **bfd**<br>**Example:**<br>`Device(config-router-af-interface)# bfd` | Enables BFD on the specified interface. |
| **Step 13** | **end**<br>**Example:**<br>`Device(config-router-af-interface)# end` | Exits address-family interface configuration mode and returns to privileged EXEC mode. |
| **Step 14** | **show eigrp address-family ipv6 neighbors**<br>**Example:**<br>`Device# show eigrp address-family ipv6 neighbors` | (Optional) Displays neighbors for which BFD has been enabled. |

# Configuration Examples for BFD Support for EIGRP IPv6

## Example: Configuring BFD Support on All Interfaces

```
Device(config)# ipv6 unicast-routing
Device(config)# interface GigabitEthernet0/0/1
Device(config-if)# ipv6 address 2001:0DB8:1::12/64
Device(config-if)# bfd interval 50 min_rx 50 multiplier 3
Device(config-if)# exit
Device(config)# router eigrp name
Device(config-router)# address-family ipv6 unicast autonomous-system 1
Device(config-router-af)# eigrp router-id 172.16.0.1
```

```
Device(config-router-af)# af-interface default
Device(config-router-af-interface)# bfd
Device(config-router-af-interface)# end
```

# Example: Configuring BFD Support on an Interface

```
Device(config)# ipv6 unicast-routing
Device(config)# GigabitEthernet0/0/1
Device(config-if)# ipv6 address 2001:DB8:A:B::1/64
Device(config-if)# bfd interval 50 min_rx 50 multiplier 3
Device(config-if)# exit
Device(config)# router eigrp name
Device(config-router)# address-family ipv6 autonomous-system 3
Device(config-router-af)# af-interface GigabitEthernet0/0/1
Device(config-router-af-interface)# bfd
Device(config-router-af-interface)# end
```

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | Master Commands List, All Releases |
| BFD commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples. | IP Routing: Protocol-Independent Command Reference |
| EIGRP commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples. | IP Routing: EIGRP Command Reference |
| Configuring EIGRP | "Configuring EIGRP" chapter in *IP Routing: EIGRP Configuration Guide* |

### Technical Assistance

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

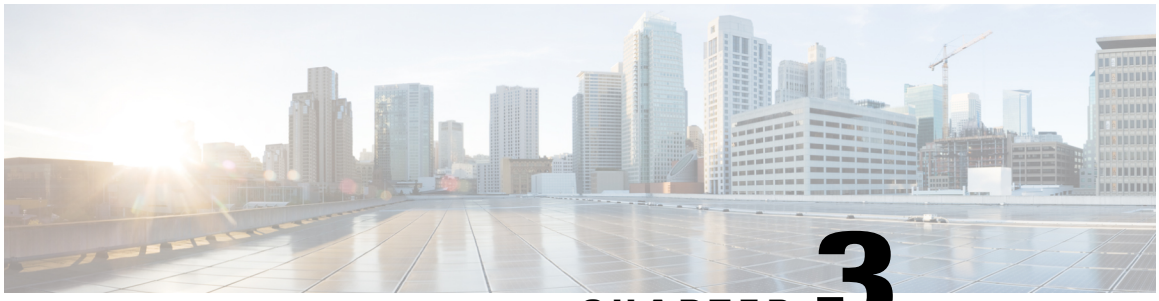
# Feature Information for BFD Support for EIGRP IPv6

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

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

***Table 2: Feature Information for BFD Support for EIGRP IPv6***

| Feature Name | Releases | Feature Information |
|---|---|---|
| BFD Support for EIGRP IPv6 | | Bidirectional Forwarding Detection (BFD) is a detection protocol that provides fast-forwarding, path-failure detection for all media types, encapsulations, topologies, and routing protocols. BFD helps network administrators to ensure easier network profiling and planning and consistent and predictable reconvergence time. BFD interacts with Enhanced Interior Gateway Routing Protocol (EIGRP) to create sessions (IPv4 type sessions) between EIGRP neighbors for fast-forwarding, path-failure detections. Each session tests the forwarding path for a single route from a local router to a neighboring router. For any change in state (forwarding path goes down or forwarding path comes up) for any of the sessions, BFD notifies EIGRP of the new state for that route. Support has been added for EIGRP IPv6 neighbors to use BFD as a fall-over mechanism.<br><br>The following commands were introduced or modified: **bfd**, **show eigrp address-family neighbors**, **show eigrp address-family interfaces**. |



CHAPTER 3

# BFD - Static Route Support

The BFD - Static Route Support feature enables association of static routes with a static Bidirectional Forwarding Detection (BFD) configuration in order to monitor static route reachability using the configured BFD session. Depending on status of the BFD session, static routes are added to or removed from the Routing Information Base (RIB).



## Finding Feature Information

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

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

## Prerequisites for BFD - Static Route Support

- Cisco Express Forwarding and IP routing must be enabled on all participating routers.
- The baseline parameters for Bidirectional Forwarding Detection (BFD) sessions on the interfaces over which you want to run BFD sessions to BFD neighbors must be configured.

# Restrictions for BFD - Static Route Support

- The Cisco IOS software incorrectly allows configuration of BFD on virtual-template and dialer interfaces; however, BFD functionality on virtual-template and dialer interfaces is not supported. Avoid configuring BFD on virtual-template and dialer interfaces.
- BFD works only for directly connected neighbors. BFD neighbors must be no more than one IP hop away. Multihop configurations are not supported.
- BFD support is not available for all platforms and interfaces. To confirm BFD support for a specific platform or interface and obtain the most accurate platform and hardware restrictions, see the Cisco IOS software release notes for your software version.

# Information About BFD - Static Route Support

## Overview of BFD - Static Route Support

The BFD - Static Route Support feature enables association of static routes with a static Bidirectional Forwarding Detection (BFD) configuration in order to monitor static route reachability using the configured BFD session. Depending on status of the BFD session, static routes are added to or removed from the Routing Information Base (RIB).

Unlike dynamic routing protocols, such as OSPF and BGP, static routing has no method of peer discovery. Therefore, when BFD is configured, the reachability of the gateway is completely dependent on the state of the BFD session to the specified neighbor. Unless the BFD session is up, the gateway for the static route is considered unreachable, and therefore the affected routes will not be installed in the appropriate RIB.

For a BFD session to be successfully established, BFD must be configured on the interface on the peer and there must be a BFD client registered on the peer for the address of the BFD neighbor. When an interface is used by dynamic routing protocols, the latter requirement is usually met by configuring the routing protocol instances on each neighbor for BFD. When an interface is used exclusively for static routing, this requirement must be met by configuring static routes on the peers.

If a BFD configuration is removed from the remote peer while the BFD session is in the up state, the updated state of the BFD session is not signaled to IPv4 static. This will cause the static route to remain in the RIB. The only workaround is to remove the IPv4 static BFD neighbor configuration so that the static route no longer tracks BFD session state. Also, if you change the encapsulation type on a serial interface to one that is unsupported by BFD, BFD will be in a down state on that interface. The workaround is to shut down the interface, change to a supported encapsulation type, and then reconfigure BFD.

A single BFD session can be used by an IPv4 static client to track the reachability of next hops through a specific interface. You can assign a BFD group for a set of BFD-tracked static routes. Each group must have one active static BFD configuration, one or more passive BFD configurations, and the corresponding static routes to be BFD-tracked. Nongroup entries are BFD-tracked static routes for which a BFD group is not assigned. A BFD group must accommodate static BFD configurations that can be part of different VRFs. Effectively, the passive static BFD configurations need not be in the same VRF as that of the active configuration.

For each BFD group, there can be only one active static BFD session. You can configure the active BFD session by adding a static BFD configuration and a corresponding static route that uses the BFD configuration.

The BFD session in a group is created only when there is an active static BFD configuration and the static route that uses the static BFD configuration. When the active static BFD configuration or the active static route is removed from a BFD group, all the passive static routes are withdrawn from the RIB. Effectively, all the passive static routes are inactive until an active static BFD configuration and a static route to be tracked by the active BFD session are configured in the group.

Similarly, for each BFD group, there can be one or more passive static BFD configurations and their corresponding static routes to be BFD-tracked. Passive static session routes take effect only when the active BFD session state is reachable. Though the active BFD session state of the group is reachable, the passive static route is added to the RIB only if the corresponding interface state is up. When a passive BFD session is removed from a group, it will not affect the active BFD session if one existed, or the BFD group reachability status.

# How to Configure BFD - Static Route Support

## Configuring BFD - Static Route Support

Perform this task to configure BFD support for static routing. Repeat the steps in this procedure on each BFD neighbor. For more information, see the "Example: Configuring BFD Support for Static Routing" section.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*
6. **exit**
7. **ip route static bfd** *interface-type interface-number ip-address* [**group** *group-name* [**passive**]]
8. **ip route** [**vrf** *vrf-name*] *prefix mask* {*ip-address* | *interface-type interface-number* [*ip-address*]} [**dhcp**] [*distance*] [**name** *next-hop-name*] [**permanent** | **track** *number*] [**tag** *tag*]
9. **exit**
10. **show ip static route**
11. **show ip static route bfd**

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>`Device> enable` | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** *type number*<br><br>**Example:**<br><br>`Device(config)# interface serial 2/0` | Configures an interface and enters interface configuration mode. |
| **Step 4** | **ip address** *ip-address mask*<br><br>**Example:**<br><br>`Device(config-if)# ip address 10.201.201.1 255.255.255.0` | Configures an IP address for the interface. |
| **Step 5** | **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*<br><br>**Example:**<br><br>`Device(config-if)# bfd interval 500 min_rx 500 multiplier 5` | Enables BFD on the interface. |
| **Step 6** | **exit**<br><br>**Example:**<br><br>`Device(config-if)# exit` | Exits interface configuration mode and returns to global configuration mode. |
| **Step 7** | **ip route static bfd** *interface-type interface-number ip-address* [**group** *group-name* [**passive**]]<br><br>**Example:**<br><br>`Device(config)# ip route static bfd serial 2/0 10.1.1.1 group group1 passive` | Specifies a static route BFD neighbor.<br><br>• The *interface-type*, *interface-number*, and *ip-address* arguments are required because BFD support exists only for directly connected neighbors. |
| **Step 8** | **ip route** [**vrf** *vrf-name*] *prefix mask* {*ip-address* \| *interface-type interface-number* [*ip-address*]} [**dhcp**] [*distance*] [**name** *next-hop-name*] [**permanent** \| **track** *number*] [**tag** *tag*]<br><br>**Example:**<br><br>`Device(config)# ip route 10.0.0.0 255.0.0.0` | Specifies a static route BFD neighbor. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 9** | **exit**<br><br>**Example:**<br><br>`Device(config)# exit` | Exits global configuration mode and returns to privileged EXEC mode. |
| **Step 10** | **show ip static route**<br><br>**Example:**<br><br>`Device# show ip static route` | (Optional) Displays static route database information. |
| **Step 11** | **show ip static route bfd**<br><br>**Example:**<br><br>`Device# show ip static route bfd` | (Optional) Displays information about the static BFD configuration from the configured BFD groups and nongroup entries. |

# Configuration Examples for BFD - Static Route Support

## Example: Configuring BFD - Static Route Support

In the following example, the network consists of Device A and Device B. Serial interface 2/0 on Device A is connected to the same network as serial interface 2/0 on Device B. In order for the BFD session to come up, Device B must be configured.

### Device A

```
configure terminal
interface Serial 2/0
ip address 10.201.201.1 255.255.255.0
bfd interval 500 min_rx 500 multiplier 5
ip route static bfd Serial 2/0 10.201.201.2
ip route 10.0.0.0 255.0.0.0 Serial 2/0 10.201.201.2
```

### Device B

```
configure terminal
interface Serial 2/0
ip address 10.201.201.2 255.255.255.0
bfd interval 500 min_rx 500 multiplier 5
ip route static bfd Serial 2/0 10.201.201.1
ip route 10.1.1.1 255.255.255.255 Serial 2/0 10.201.201.1
```

Note that the static route on Device B exists solely to enable the BFD session between 10.201.201.1 and 10.201.201.2. If there is no useful static route that needs to be configured, select a prefix that will not affect packet forwarding, for example, the address of a locally configured loopback interface.

In the following example, there is an active static BFD configuration to reach 209.165.200.225 through Ethernet interface 0/0 in the BFD group testgroup. As soon as the static route is configured that is tracked by the configured static BFD, a single hop BFD session is initiated to 209.165.200.225 through Ethernet interface 0/0. The prefix 10.0.0.0/8 is added to the RIB if a BFD session is successfully established.

```
configure terminal
ip route static bfd Ethernet 0/0 209.165.200.225 group testgroup
ip route 10.0.0.0 255.255.255.224 Ethernet 0/0 209.165.200.225
```

In the following example, a BFD session to 209.165.200.226 through Ethernet interface 0/0.1001 is marked to use the group testgroup. That is, this configuration is a passive static BFD. Though there are static routes to be tracked by the second static BFD configuration, a BFD session is not triggered for 209.165.200.226 through Ethernet interface 0/0.1001. The existence of the prefixes 10.1.1.1/8 and 10.2.2.2/8 is controlled by the active static BFD session (Ethernet interface 0/0 209.165.200.225).

```
configure terminal
ip route static bfd Ethernet 0/0 209.165.200.225 group testgroup
ip route 10.0.0.0 255.255.255.224 Ethernet 0/0 209.165.200.225
ip route static bfd Ethernet 0/0.1001 209.165.200.226 group testgroup passive
ip route 10.1.1.1 255.255.255.224 Ethernet 0/0.1001 209.165.200.226
ip route 10.2.2.2 255.255.255.224 Ethernet 0/0.1001 209.165.200.226
```

# Additional References for BFD - Static Route Support

### Related Documents

| Related Topic | Document Title |
|---|---|
| BFD Commands | IP Routing Protocol-Independent Commands A through R<br>IP Routing Protocol-Independent Commands S through T |
| Cisco IOS Commands | Cisco IOS Master Command List, All Releases |

### 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/support |

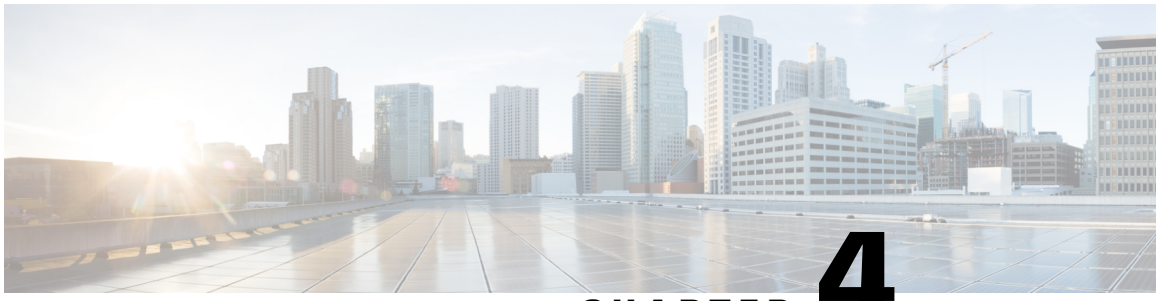
# Feature Information for BFD - Static Route Support

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

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

***Table 3: Feature Information for BFD - Static Route Support***

| Feature Name | Releases | Feature Information |
|---|---|---|
| BFD - Static Route Support | 15.2(1)E | The BFD - Static Route Support feature enables association of static routes with a static Bidirectional Forwarding Detection (BFD) configuration in order to monitor static route reachability using the configured BFD session. Depending on status of the BFD session, static routes are added to or removed from the Routing Information Base (RIB). |



CHAPTER 4

# Static Route Support for BFD over IPv6



## Finding Feature Information

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

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## Information About Static Route Support for BFD over IPv6

Using the BFDv6 protocol to reach the static route next hop ensures that an IPv6 static route is inserted only in the IPv6 Routing Information Base (RIB) when the next-hop neighbor is reachable. Using the BFDv6 protocol also can remove the IPv6 static route from the IPv6 RIB when the next hop becomes unreachable.

A user can configure IPv6 static BFDv6 neighbors. These neighbor can operate in one of two modes: associated (which is the default) and unassociated. A neighbor can be transitioned between the two modes without interrupting the BFDv6 session associated with the neighbor.

# BFDv6 Associated Mode

In Bidirectional Forwarding Detection for IPv6 (BFDv6) associated mode, an IPv6 static route is automatically associated with an IPv6 static BFDv6 neighbor if the static route next hop exactly matches the static BFDv6 neighbor.

An IPv6 static route requests a BFDv6 session for each static BFDv6 neighbor that has one or more associated IPv6 static routes and is configured over an interface on which BFD has been configured. The state of the BFDv6 session will be used to determine whether the associated IPv6 static routes are inserted in the IPv6 RIB. For example, static routes are inserted in the IPv6 RIB only if the BFDv6 neighbor is reachable, and the static route is removed from the IPv6 RIB if the BFDv6 neighbor subsequently becomes unreachable.

BFDv6 associated mode requires you to configure a BFD neighbor and static route on both the device on which the BFD-monitored static route is required and on the neighboring device.

# BFDv6 Unassociated Mode

An IPv6 static BFD neighbor may be configured as unassociated. In this mode, the neighbor is not associated with static routes, and the neighbor always requests a BFDv6 session if the interface has been configured for BFDv6.

Unassociated mode is useful in the following situations:

- Bringing up a BFDv6 session in the absence of an IPv6 static route—This case occurs when a static route is on router A, with router B as the next hop. Associated mode requires you to create both a static BFD neighbor and static route on both routers in order to bring up the BFDv6 session from B to A. Specifying the static BFD neighbor in unassociated mode on router B avoids the need to configure an unwanted static route.
- Transition to BFD monitoring of a static route—This case occurs when existing IPv6 static routes are inserted in the IPv6 RIB. Here, you want to enable BFD monitoring for these static routes without any interruption to traffic. If you configure an attached IPv6 static BFD neighbor, then the static routes will immediately be associated with the new static BFD neighbor. However, because a static BFD neighbor starts in a down state, the associated static routes are then removed from the IPv6 RIB and are reinserted when the BFDv6 session comes up. Therefore, you will see an interruption in traffic. This interruption can be avoided by configuring the static BFD neighbor as unassociated, waiting until the BFDv6 session has come up, and then reconfiguring the static BFD neighbor as associated.
- Transition from BFD monitoring of a static route—In this case, IPv6 static routes are monitored by BFD and inserted in the RIB. Here, you want to disable BFD monitoring of the static routes without interrupting traffic flow. This scenario can be achieved by first reconfiguring the static BFD neighbor as detached (thus disassociating the neighbor from the static routes) and then deconfiguring the static BFD neighbor.

# How to Configure Bidirectional Forwarding Detection for IPv6

## Specifying a Static BFDv6 Neighbor

An IPv6 static BFDv6 neighbor is specified separately from an IPv6 static route. An IPv6 static BFDv6 neighbor must be fully configured with the interface and neighbor address and must be directly attached to the local router.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 route static bfd** [**vrf** *vrf-name*] *interface-type interface-number ipv6-address* [**unassociated**]

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>`Device> enable` | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **ipv6 route static bfd** [**vrf** *vrf-name*] *interface-type interface-number ipv6-address* [**unassociated**]<br><br>**Example:**<br><br>`Device(config)# ipv6 route static bfd gigabitethernet 0/0/0 2001::1` | Specifies static route IPv6 BFDv6 neighbors. |

## Associating an IPv6 Static Route with a BFDv6 Neighbor

IPv6 static routes are automatically associated with a static BFDv6 neighbor. A static neighbor is associated with a BFDv6 neighbor if the static next-hop explicitly matches the BFDv6 neighbor.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 route static bfd** [**vrf** *vrf-name*] *interface-type interface-number ipv6-address* [**unassociated**]
4. **ipv6 route** [**vrf** *vrf-name*] *ipv6-prefix/prefix-length prefix-length* {*ipv6-address* | *interface-type* [*interface-number ipv6-address*]} [**nexthop-vrf** [*vrf-name1* | **default**]] [*administrative-distance*] [*administrative-multicast-distance* | **unicast** | **multicast**] [*next-hop-address*] [**tag** *tag*]

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **ipv6 route static bfd** [**vrf** *vrf-name*] *interface-type interface-number ipv6-address* [**unassociated**]<br><br>**Example:**<br>`Device(config)# ipv6 route static bfd ethernet 0/0 2001::1` | Specifies static route BFDv6 neighbors. |
| **Step 4** | **ipv6 route** [**vrf** *vrf-name*] *ipv6-prefix/prefix-length prefix-length* {*ipv6-address* \| *interface-type* [*interface-number ipv6-address*]} [**nexthop-vrf** [*vrf-name1* \| **default**]] [*administrative-distance*] [*administrative-multicast-distance* \| **unicast** \| **multicast**] [*next-hop-address*] [**tag** *tag*]<br><br>**Example:**<br>`Device(config)# ipv6 route 2001:DB8::/64 ethernet 0/0 2001::1` | Establishes static IPv6 routes. |

# Configuration Examples for Static Route Support for BFD over IPv6

## Example: Specifying an IPv6 Static BFDv6 Neighbor

The following example shows how to specify a fully configured IPv6 static BFDv6 neighbor. The interface is Ethernet 0/0 and the neighbor address is 2001::1.

```
Device(config)# ipv6 route static bfd ethernet 0/0 2001::1
```

## Example: Associating an IPv6 Static Route with a BFDv6 Neighbor

In this example, the IPv6 static route 2001:DB8::/32 is associated with the BFDv6 neighbor 2001::1 over the Ethernet 0/0 interface:

```
Device(config)# ipv6 route static bfd ethernet 0/0 2001::1
Device(config)# ipv6 route 2001:DB8::/32 ethernet 0/0 2001::1
```

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| IPv6 addressing and connectivity | *IPv6 Configuration Guide* |
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |
| IPv6 commands | Cisco IOS IPv6 Command Reference |
| Cisco IOS IPv6 features | Cisco IOS IPv6 Feature Mapping |
| Static Route Support for BFD over IPv6 | "*Bidirectional Forwarding Detection*" module |

### Standards and RFCs

| Standard/RFC | Title |
|---|---|
| RFCs for IPv6 | IPv6 RFCs |

### MIBs

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

### Technical Assistance

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

# Feature Information for Static Route Support for BFD over IPv6

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

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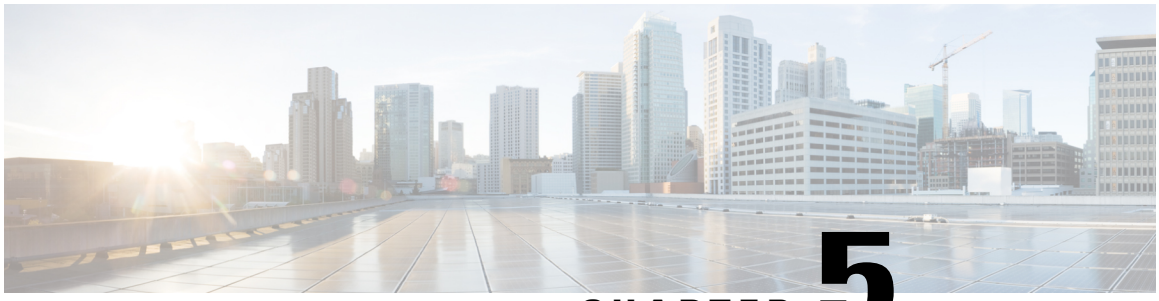
*Table 4: Feature Information for Static Route Support for BFD over IPv6*

| Feature Name | Releases | Feature Information |
|---|---|---|
| Static Route Support for BFD over IPv6 | 15.1(1)SG<br>15.1(1)SY<br>15.1(2)T<br>15.2(1)E<br>15.4(1)S | Using the BFDv6 protocol to reach the static route next hop ensures that an IPv6 static route is inserted only in the IPv6 Routing Information Base (RIB) when the next-hop neighbor is reachable. Using the BFDv6 protocol also can remove the IPv6 static route from the IPv6 RIB when the next hop becomes unreachable.<br>The following commands were introduced or modified: **debug bfd**, **debug ipv6 static**, **ipv6 route**, **ipv6 route static bfd**, **monitor event ipv6 static**, **show ipv6 static**.<br>In Cisco IOS 15.4(1)S Release, support was added for the Cisco ASR 901S router. |



CHAPTER 5

# OSPF Support for BFD over IPv4

The OSPF Support for BFD over IPv4 feature enables Open Shortest Path First (OSPF), which is a dynamic routing protocol, to regsiter with Bidirectional Forwarding Detection (BFD) to receive forwarding path detection failure messages from BFD.



## Finding Feature Information

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

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

## Prerequisites for OSPF Support for BFD over IPv4

- OSPF must be running on all participating routers.
- The baseline parameters for BFD sessions on the interfaces over which you want to run BFD sessions to BFD neighbors must be configured.

# Information About OSPF Support for BFD over IPv4

## Overview of OSPF Support for BFD over IPv4

The OSPF Support for BFD over IPv4 feature enables Open Shortest Path First (OSPF), which is a dynamic routing protocol, to register with Bidirectional Forwarding Detection (BFD) to receive forwarding path detection failure messages from BFD. Use the **bfd interface** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier* command to set the baseline BFD session parameters on an interface. You can either configure BFD Support for OSPF globally on all interfaces or configure it selectively on one or more interfaces.

There are two methods to enable OSPF Support for BFD:

- Enable BFD for all interfaces for which OSPF is routing by using the **bfd all-interfaces** command in router configuration mode.

  **Note** Disable BFD support on individual interfaces using the **ip ospf bfd** [**disable**] command in interface configuration mode.

- Enable BFD for a subset of interfaces for which OSPF is routing by using the **ip ospf bfd** command in interface configuration mode.

# How to Configure OSPF Support for BFD over IPv4

## Configuring OSPF Support for BFD over IPv4 for All Interfaces

To configure BFD for all OSPF interfaces, perform the steps in this section.

If you do not want to configure BFD on all OSPF interfaces and would rather configure BFD support specifically for one or more interfaces, see the Configuring OSPF Support for BFD over IPv4 for One or More Interfaces section.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospf** *process-id*
4. **bfd all-interfaces**
5. **exit**
6. **interface** *type number*
7. **ip ospf bfd** [**disable**]
8. **end**
9. **show bfd neighbors** [**details**]
10. **show ip ospf**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router ospf** *process-id*<br><br>**Example:**<br>`Device(config)# router ospf 4` | Specifies an OSPF process and enters router configuration mode. |
| **Step 4** | **bfd all-interfaces**<br><br>**Example:**<br>`Device(config-router)# bfd all-interfaces` | Enables BFD globally on all interfaces associated with the OSPF routing process. |
| **Step 5** | **exit**<br><br>**Example:**<br>`Device(config-router)# exit` | (Optional) Returns the router to global configuration mode. Enter this command only if you want to perform Step 7 to disable BFD for one or more interfaces. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 6** | **interface** *type number*<br>**Example:**<br>`Device(config)# interface fastethernet 6/0` | (Optional) Enters interface configuration mode. Enter this command only if you want to perform Step 7 to disable BFD for one or more interfaces. |
| **Step 7** | **ip ospf bfd** [**disable**]<br>**Example:**<br>`Device(config-if)# ip ospf bfd disable` | (Optional) Disables BFD on a per-interface basis for one or more interfaces associated with the OSPF routing process.<br>**Note** Use the **disable** keyword only if you enabled BFD on all of the interfaces that OSPF is associated with using the **bfd all-interfaces** command in router configuration mode. |
| **Step 8** | **end**<br>**Example:**<br>`Device(config-if)# end` | Exits interface configuration mode and returns the device to privileged EXEC mode. |
| **Step 9** | **show bfd neighbors** [**details**]<br>**Example:**<br>`Device# show bfd neighbors detail` | (Optional) Displays information that can help verify if the BFD neighbor is active and displays the routing protocols that BFD has registered. |
| **Step 10** | **show ip ospf**<br>**Example:**<br>`Device# show ip ospf` | (Optional) Displays information that can help verify if BFD for OSPF has been enabled. |

# Configuring OSPF Support for BFD over IPv4 for All Interfaces

To configure BFD for all OSPF interfaces, perform the steps in this section.

If you do not want to configure BFD on all OSPF interfaces and would rather configure BFD support specifically for one or more interfaces, see the Configuring OSPF Support for BFD over IPv4 for One or More Interfaces section.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospf** *process-id*
4. **bfd all-interfaces**
5. **exit**
6. **interface** *type number*
7. **ip ospf bfd** [**disable**]
8. **end**
9. **show bfd neighbors** [**details**]
10. **show ip ospf**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router ospf** *process-id*<br><br>**Example:**<br>`Device(config)# router ospf 4` | Specifies an OSPF process and enters router configuration mode. |
| **Step 4** | **bfd all-interfaces**<br><br>**Example:**<br>`Device(config-router)# bfd all-interfaces` | Enables BFD globally on all interfaces associated with the OSPF routing process. |
| **Step 5** | **exit**<br><br>**Example:**<br>`Device(config-router)# exit` | (Optional) Returns the router to global configuration mode. Enter this command only if you want to perform Step 7 to disable BFD for one or more interfaces. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 6** | **interface** *type number*<br>**Example:**<br>`Device(config)# interface fastethernet 6/0` | (Optional) Enters interface configuration mode. Enter this command only if you want to perform Step 7 to disable BFD for one or more interfaces. |
| **Step 7** | **ip ospf bfd** [**disable**]<br>**Example:**<br>`Device(config-if)# ip ospf bfd disable` | (Optional) Disables BFD on a per-interface basis for one or more interfaces associated with the OSPF routing process.<br>**Note** Use the **disable** keyword only if you enabled BFD on all of the interfaces that OSPF is associated with using the **bfd all-interfaces** command in router configuration mode. |
| **Step 8** | **end**<br>**Example:**<br>`Device(config-if)# end` | Exits interface configuration mode and returns the device to privileged EXEC mode. |
| **Step 9** | **show bfd neighbors** [**details**]<br>**Example:**<br>`Device# show bfd neighbors detail` | (Optional) Displays information that can help verify if the BFD neighbor is active and displays the routing protocols that BFD has registered. |
| **Step 10** | **show ip ospf**<br>**Example:**<br>`Device# show ip ospf` | (Optional) Displays information that can help verify if BFD for OSPF has been enabled. |

# Configuration Examples for OSPF Support for BFD over IPv4

## Example: Configuring OSPF Support for BFD over IPv4

The following example shows how to configure BFD in an OSPF network. In the following example, a simple OSPF network consists of Device A and Device B. Fast Ethernet interface 0/1 on Device A is connected to the same network as Fast Ethernet interface 6/0 in Device B. The example, starting in global configuration mode, shows the configuration of BFD. For both Devices A and B, BFD is configured globally for all interfaces associated with the OSPF process.

### Configuration for Device A

```
!
interface Fast Ethernet 0/1
ip address 172.16.10.1 255.255.255.0
```

```
bfd interval 50 min_rx 50 multiplier 3
!
interface Fast Ethernet 3/0.1
ip address 172.17.0.1 255.255.255.0
!
router ospf 123
log-adjacency-changes detail
network 172.16.0.0 0.0.0.255 area 0
network 172.17.0.0 0.0.0.255 area 0
bfd all-interfaces
```

### Configuration for Device B

```
!
interface Fast Ethernet 6/0
 ip address 172.16.10.2 255.255.255.0
 bfd interval 50 min_rx 50 multiplier 3
!
interface Fast Ethernet 6/1
 ip address 172.18.0.1 255.255.255.0
!
router ospf 123
 log-adjacency-changes detail
 network 172.16.0.0 0.0.255.255 area 0
 network 172.18.0.0 0.0.255.255 area 0
 bfd all-interfaces
```

The output from the **show bfd neighbors details** command verifies that a BFD session has been created and that OSPF is registered for BFD support.

### Device A

```
DeviceA# show bfd neighbors details

OurAddr       NeighAddr     LD/RD RH  Holdown(mult)  State     Int
172.16.10.1   172.16.10.2    1/2  1   532  (3 )      Up        Fa0/1
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 200000, MinRxInt: 200000, Multiplier: 5
Received MinRxInt: 1000, Received Multiplier: 3
Holdown (hits): 600(22), Hello (hits): 200(84453)
Rx Count: 49824, Rx Interval (ms) min/max/avg: 208/440/332 last: 68 ms ago
Tx Count: 84488, Tx Interval (ms) min/max/avg: 152/248/196 last: 192 ms ago
Registered protocols: OSPF

Uptime: 02:18:49
Last packet: Version: 0
            - Diagnostic: 0
             I Hear You bit: 1     - Demand bit: 0
             Poll bit: 0           - Final bit: 0
             Multiplier: 3         - Length: 24
             My Discr.: 2          - Your Discr.: 1
             Min tx interval: 50000    - Min rx interval: 1000
             Min Echo interval: 0
```

The output from the **show bfd neighbors details** command from Device B verifies that a BFD session has been created:

### Device B

```
DeviceB# attach 6
Entering Console for 8 Port Fast Ethernet in Slot: 6
Type "exit" to end this session
Press RETURN to get started!

Device> show bfd neighbors details
Cleanup timer hits: 0
OurAddr       NeighAddr     LD/RD RH  Holdown(mult)  State     Int
172.16.10.2   172.16.10.1    8/1  1   1000 (5 )      Up        Fa6/0
```

```
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 50000, MinRxInt: 1000, Multiplier: 3
Received MinRxInt: 200000, Received Multiplier: 5
Holdown (hits): 1000(0), Hello (hits): 200(5995)
Rx Count: 10126, Rx Interval (ms) min/max/avg: 152/248/196 last: 0 ms ago
Tx Count: 5998, Tx Interval (ms) min/max/avg: 204/440/332 last: 12 ms ago
Last packet: Version: 0            - Diagnostic: 0
I Hear You bit: 1     - Demand bit: 0
Poll bit: 0           - Final bit: 0
Multiplier: 5         - Length: 24
My Discr.: 1          - Your Discr.: 8
Min tx interval: 200000    - Min rx interval: 200000
Min Echo interval: 0
Uptime: 00:33:13
SSO Cleanup Timer called: 0
SSO Cleanup Action Taken: 0
Pseudo pre-emptive process count: 239103 min/max/avg: 8/16/8 last: 0 ms ago
IPC Tx Failure Count: 0
IPC Rx Failure Count: 0
Total Adjs Found: 1
```

The output from the **show ip ospf** command verifies that BFD has been enabled for OSPF.

### Device A

```
DeviceA# show ip ospf

 Routing Process "ospf 123" with ID 172.16.10.1
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 Supports Link-local Signaling (LLS)
 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 0x000000
 Number of opaque AS LSA 0. Checksum Sum 0x000000
 Number of DCbitless external and opaque AS LSA 0
 Number of DoNotAge external and opaque AS LSA 0
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 External flood list length 0
 BFD is enabled

    Area BACKBONE(0)
        Number of interfaces in this area is 2 (1 loopback)
        Area has no authentication
        SPF algorithm last executed 00:00:08.828 ago
        SPF algorithm executed 9 times
        Area ranges are
        Number of LSA 3. Checksum Sum 0x028417
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
```

### Device B

```
DeviceB# show ip ospf

 Routing Process "ospf 123" with ID 172.18.0.1
 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
BFD is enabled

   Area BACKBONE(0)
       Number of interfaces in this area is 2 (1 loopback)
       Area has no authentication
       SPF algorithm last executed 02:07:30.932 ago
       SPF algorithm executed 7 times
       Area ranges are
       Number of LSA 3. Checksum Sum 0x28417
       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
```

The output from the **show ip ospf interface** command verifies that BFD has been enabled for OSPF on the interfaces connecting Device A and Device B.

### Device A

```
DeviceA# show ip ospf interface Fast Ethernet 0/1

show ip ospf interface Fast Ethernet 0/1
Fast Ethernet0/1 is up, line protocol is up
Internet Address 172.16.10.1/24, Area 0
Process ID 123, Router ID 172.16.10.1, Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State BDR, Priority 1, BFD enabled
Designated Router (ID) 172.18.0.1, Interface address 172.16.10.2
Backup Designated router (ID) 172.16.10.1, Interface address 172.16.10.1
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
oob-resync timeout 40
Hello due in 00:00:03
Supports Link-local Signaling (LLS)
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with neighbor 172.18.0.1  (Designated Router)
Suppress hello for 0 neighbor(s)
```

### Device B

```
DeviceB# show ip ospf interface Fast Ethernet 6/1

Fast Ethernet6/1 is up, line protocol is up
Internet Address 172.18.0.1/24, Area 0
Process ID 123, Router ID 172.18.0.1, Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State DR, Priority 1, BFD enabled
Designated Router (ID) 172.18.0.1, Interface address 172.18.0.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
oob-resync timeout 40
```

```
Hello due in 00:00:01
Supports Link-local Signaling (LLS)
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 0, maximum is 0
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 0, Adjacent neighbor count is 0
Suppress hello for 0 neighbor(s)
```

# Additional References for OSPF Support for BFD over IPv4

### Related Documents

| Related Topic | Document Title |
|---|---|
| BFD Commands | IP Routing Protocol-Independent Commands A through R<br>IP Routing Protocol-Independent Commands S through T |
| Cisco IOS Commands | Cisco IOS Master Command List, All Releases |

### 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/support |

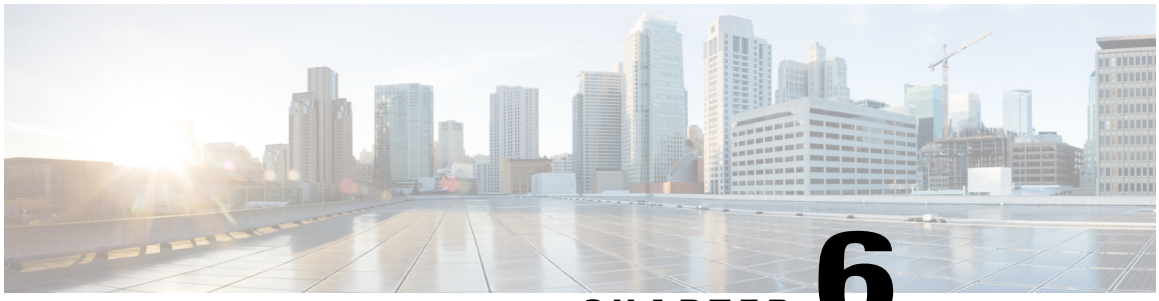
# Feature Information for OSPF Support for BFD over IPv4

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

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

*Table 5: Feature Information for OSPF Support for BFD over IPv4*

| Feature Name | Releases | Feature Information |
|---|---|---|
| OSPF Support for BFD over IPv4 | 15.2(1)E | The OSPF Support for BFD over IPv4 feature enables Open Shortest Path First (OSPF), which is a dynamic routing protocol, to regsiter with Bidirectional Forwarding Detection (BFD) to receive forwarding path detection failure messages from BFD. |



CHAPTER 6

# OSPFv3 for BFD

The Bidirectional Forwarding Detection protocol supports OSPFv3.



## Finding Feature Information

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

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

## Information About OSPFv3 for BFD

The Bidirectional Forwarding Detection (BFD) protocol supports Open Shortest Path First version 3 (OSPFv3).

# How to Configure OSPFv3 for BFD

## Configuring BFD Support for OSPFv3

This section describes the procedures for configuring BFD support for OSPFv3, so that OSPFv3 is a registered protocol with BFD and will receive forwarding path detection failure messages from BFD. You can either configure BFD support for OSPFv3 globally on all interfaces or configure it selectively on one or more interfaces.

There are two methods for enabling BFD support for OSPFv3:

- You can enable BFD for all of the interfaces for which OSPFv3 is routing by using the **bfd all-interfaces** command in router configuration mode. You can disable BFD support on individual interfaces using the **ipv6 ospf bfd disable** command in interface configuration mode.
- You can enable BFD for a subset of the interfaces for which OSPFv3 is routing by using the **ipv6 ospf bfd** command in interface configuration mode.

**Note** OSPF will only initiate BFD sessions for OSPF neighbors that are in the FULL state.

### Configuring Baseline BFD Session Parameters on the Interface

Repeat this task for each interface over which you want to run BFD sessions to BFD neighbors.

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*

#### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** *type number*<br><br>**Example:**<br><br>`Device(config)# interface GigabitEthernet 0/0/0` | Specifies an interface type and number, and places the device in interface configuration mode. |
| **Step 4** | **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*<br><br>**Example:**<br><br>`Device(config-if)# bfd interval 50 min_rx 50 multiplier 5` | Enables BFD on the interface. |

## Configuring BFD Support for OSPFv3 for All Interfaces

### Before You Begin

OSPFv3 must be running on all participating devices. The baseline parameters for BFD sessions on the interfaces over which you want to run BFD sessions to BFD neighbors must be configured.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 router ospf** *process-id* [**vrf** *vpn-name*]
4. **bfd all-interfaces**
5. **exit**
6. **show bfd neighbors** [**vrf** *vrf-name*] [**client** {**bgp** | **eigrp** | **isis** | **ospf** | **rsvp** | **te-frr**}] [*ip-address* | **ipv6** *ipv6-address*] [**details**]
7. **show ipv6 ospf** [*process-id*] [*area-id*] [**rate-limit**]

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable** | Enables privileged EXEC mode. |

| | Command or Action | Purpose |
|---|---|---|
| | **Example:**<br>`Device> enable` | • Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **ipv6 router ospf** *process-id* [**vrf** *vpn-name*]<br>**Example:**<br>`Device(config)# ipv6 router ospf 2` | Configures an OSPFv3 routing process. |
| **Step 4** | **bfd all-interfaces**<br>**Example:**<br>`Device(config-router)# bfd all-interfaces` | Enables BFD for all interfaces participating in the routing process. |
| **Step 5** | **exit**<br>**Example:**<br>`Device(config-router)# exit` | Enter this command twice to go to privileged EXEC mode. |
| **Step 6** | **show bfd neighbors** [**vrf** *vrf-name*] [**client** {**bgp** \| **eigrp** \| **isis** \| **ospf** \| **rsvp** \| **te-frr**}] [*ip-address* \| **ipv6** *ipv6-address*] [**details**]<br>**Example:**<br>`Device# show bfd neighbors detail` | (Optional) Displays a line-by-line listing of existing BFD adjacencies. |
| **Step 7** | **show ipv6 ospf** [*process-id*] [*area-id*] [**rate-limit**]<br>**Example:**<br>`Device# show ipv6 ospf` | (Optional) Displays general information about OSPFv3 routing processes. |

## Configuring OSPF Support for BFD over IPv4 for One or More Interfaces

To configure BFD on one or more OSPF interfaces, perform the steps in this section.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip ospf bfd** [**disable**]
5. **end**
6. **show bfd neighbors** [**details**]
7. **show ip ospf**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** *type number*<br><br>**Example:**<br>`Device(config)# interface fastethernet 6/0` | Enters interface configuration mode. |
| **Step 4** | **ip ospf bfd** [**disable**]<br><br>**Example:**<br>`Device(config-if)# ip ospf bfd` | Enables or disables BFD on a per-interface basis for one or more interfaces associated with the OSPF routing process.<br>**Note** Use the **disable** keyword only if you enable BFD on all of the interfaces that OSPF is associated with using the **bfd all-interfaces** command in router configuration mode. |
| **Step 5** | **end**<br><br>**Example:**<br>`Device(config-if)# end` | Exits interface configuration mode and returns the device to privileged EXEC mode. |
| **Step 6** | **show bfd neighbors** [**details**]<br><br>**Example:**<br>`Device# show bfd neighbors details` | (Optional) Displays information that can help verify if the BFD neighbor is active and displays the routing protocols that BFD has registered. |

| | Command or Action | Purpose |
|---|---|---|
| | | **Note** If hardware-offloaded BFD sessions are configured with Tx and Rx intervals that are not multiples of 50 ms, the hardware intervals are changed. However, output from the **show bfd neighbors details** command displays only the configured intervals, not the interval values that change. |
| **Step 7** | **show ip ospf**<br><br>**Example:**<br><br>`Device# show ip ospf` | (Optional) Displays information that can help verify if BFD support for OSPF has been enabled. |

# Retrieving BFDv6 Information for Monitoring and Troubleshooting

## SUMMARY STEPS

1. **enable**
2. **monitor event ipv6 static** [**enable** | **disable**]
3. **show ipv6 static** [*ipv6-address* | *ipv6-prefix/prefix-length*] [**interface** *type number* | **recursive**] [**vrf** *vrf-name*] [**bfd**] [**detail**
4. **show ipv6 static** [*ipv6-address* | *ipv6-prefix/prefix-length*] [**interface** *type number* | **recursive**] [**vrf** *vrf-name*] [**bfd**] [**detail**]
5. **debug ipv6 static**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>`Device> enable` | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| **Step 2** | **monitor event ipv6 static** [**enable** | **disable**]<br><br>**Example:**<br><br>`Device# monitor event ipv6 static enable` | Enables the use of event trace to monitor the operation of the IPv6 static and IPv6 static BFDv6 neighbors. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 3** | **show ipv6 static** [*ipv6-address* \| *ipv6-prefix/prefix-length*] [**interface** *type number* \| **recursive**] [**vrf** *vrf-name*] [**bfd**] [**detail**<br><br>**Example:**<br><br>`Device# show ipv6 static vrf vrf1 detail` | Displays the BFDv6 status for a static route associated with a static BFDv6 neighbor. |
| **Step 4** | **show ipv6 static** [*ipv6-address* \| *ipv6-prefix/prefix-length*] [**interface** *type number* \| **recursive**] [**vrf** *vrf-name*] [**bfd**] [**detail**]<br><br>**Example:**<br><br>`Device# show ipv6 static vrf vrf1 bfd` | Displays static BFDv6 neighbors and associated static routes. |
| **Step 5** | **debug ipv6 static**<br><br>**Example:**<br><br>`Device# debug ipv6 static` | Enables BFDv6 debugging. |

# Configuration Examples for OSPFv3 for BFD

## Example: Displaying OSPF Interface Information about BFD

The following display shows that the OSPF interface is enabled for BFD:

```
Device# show ipv6 ospf interface

Serial10/0 is up, line protocol is up
  Link Local Address FE80::A8BB:CCFF:FE00:6500, Interface ID 42
  Area 1, Process ID 1, Instance ID 0, Router ID 10.0.0.1
  Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT, BFD enabled
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:07
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 10.1.0.1
  Suppress hello for 0 neighbor(s)
```

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| IPv6 addressing and connectivity | *Cisco IOS IPv6 Configuration Guide* |
| Cisco IOS commands | *Cisco IOS Master Commands List, All Releases* |
| IPv6 commands | *Cisco IOS IPv6 Command Reference* |
| Cisco IOS IPv6 features | *Cisco IOS IPv6 Feature Mapping* |
| OSPFv3 for BFD | "*Bidirectional Forwarding Detection*" module |

### Standards and RFCs

| Standard/RFC | Title |
|---|---|
| RFCs for IPv6 | IPv6 RFCs |

MIBs

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

### Technical Assistance

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

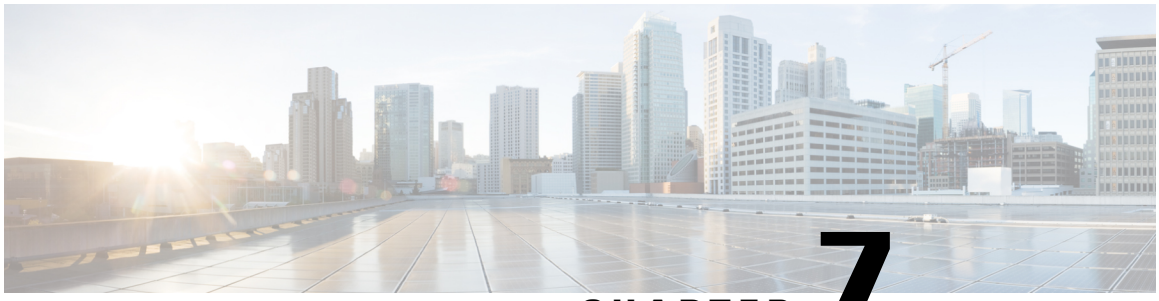
# Feature Information for OSPFv3 for BFD

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

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

***Table 6: Feature Information for OSPFv3 for BFD***

| Feature Name | Releases | Feature Information |
|---|---|---|
| OSPFv3 for BFD | 15.1(2)T<br>12.2(33)SRE<br>15.0(1)SY<br>15.2(1)E | BFD supports the dynamic routing protocol OSPFv3.<br>The following commands were introduced or modified: **bfd**, **bfd all-interfaces**, **debug bfd**, **ipv6 router ospf**, **show bfd neighbors**, **show ipv6 ospf**, **show ipv6 ospf interface**, **show ospfv3**, **show ospfv3 interface**. |



CHAPTER 7

# BGP Support for BFD

Bidirectional Forwarding Detection (BFD) is a detection protocol designed to provide fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. In addition to fast forwarding path failure detection, BFD provides a consistent failure detection method for network administrators. Because the network administrator can use BFD to detect forwarding path failures at a uniform rate, rather than the variable rates for different routing protocol hello mechanisms, network profiling and planning will be easier, and reconvergence time will be consistent and predictable. The main benefit of implementing BFD for BGP is a significantly faster reconvergence time.



# Finding Feature Information

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

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

# Information About BGP Support for BFD

## BFD for BGP

Bidirectional Forwarding Detection (BFD) is a detection protocol designed to provide fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. In addition to

fast forwarding path failure detection, BFD provides a consistent failure detection method for network administrators. Because the network administrator can use BFD to detect forwarding path failures at a uniform rate, rather than the variable rates for different routing protocol hello mechanisms, network profiling and planning will be easier, and reconvergence time will be consistent and predictable. The main benefit of implementing BFD for BGP is a marked decrease in reconvergence time.

**Caution** BFD and BGP Graceful Restart capability cannot both be configured on a router running BGP. If an interface goes down, BFD detects the failure and indicates that the interface cannot be used for traffic forwarding and the BGP session goes down, but graceful restart still allows traffic forwarding on platforms that support NSF even though the BGP session is down, allowing traffic forwarding using the interface that is down. Configuring both BFD and BGP graceful restart for NSF on a router running BGP may result in suboptimal routing.

See also the "Configuring BGP Neighbor Session Options" chapter, the section "Configuring BFD for BGP IPv6 Neighbors."

For more details about BFD, see the *Cisco IOS IP Routing: BFD Configuration Guide*.

# How to Decrease BGP Convergence Time Using BFD

## Prerequisites

- Cisco Express Forwarding (CEF) and IP routing must be enabled on all participating routers.
- BGP must be configured on the routers before BFD is deployed. You should implement fast convergence for the routing protocol that you are using. See the IP routing documentation for your version of Cisco IOS software for information on configuring fast convergence.

## Restrictions

- For the Cisco implementation of BFD Support for BGP in Cisco IOS Release15.1(1)SG, only asynchronous mode is supported. In asynchronous mode, either BFD peer can initiate a BFD session.
- IPv6 encapsulation is supported.
- BFD works only for directly-connected neighbors. BFD neighbors must be no more than one IP hop away. Multihop configurations are not supported.
- Configuring both BFD and BGP Graceful Restart for NSF on a router running BGP may result in suboptimal routing.

## Decreasing BGP Convergence Time Using BFD

You start a BFD process by configuring BFD on the interface. When the BFD process is started, no entries are created in the adjacency database, in other words, no BFD control packets are sent or received. The adjacency creation takes places once you have configured BFD support for the applicable routing protocols.

The first two tasks must be configured to implement BFD support for BGP to reduce the BGP convergence time. The third task is an optional task to help monitor or troubleshoot BFD.

See also the "Configuring BFD for BGP IPv6 Neighbors" section in the "Configuring BGP Neighbor Session Options" module.

# Configuring BFD Session Parameters on the Interface

The steps in this procedure show how to configure BFD on the interface by setting the baseline BFD session parameters on an interface. Repeat the steps in this procedure for each interface over which you want to run BFD sessions to BFD neighbors.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*
5. **end**

## 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** | **interface** *type number*<br><br>**Example:**<br>`Router(config)# interface FastEthernet 6/0` | Enters interface configuration mode. |
| **Step 4** | **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*<br><br>**Example:**<br>`Router(config-if)# bfd interval 50 min_rx 50 multiplier 5` | Enables BFD on the interface. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 5** | **end**<br><br>**Example:**<br>`Router(config-if)# end` | Exits interface configuration mode. |

# Configuring BFD Support for BGP

Perform this task to configure BFD support for BGP, so that BGP is a registered protocol with BFD and will receive forwarding path detection failure messages from BFD.

### Before You Begin

- BGP must be running on all participating routers.
- The baseline parameters for BFD sessions on the interfaces over which you want to run BFD sessions to BFD neighbors must be configured. See "Configuring BFD Session Parameters on the Interface" for more information.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *autonomous-system-number*
4. **neighbor** *ip-address* **fall-over bfd**
5. **end**
6. **show bfd neighbors** [**details**]
7. **show ip bgp neighbors** [*ip-address* [**received-routes** | **routes** | **advertised-routes** | **paths** [*regexp*] | **dampened-routes** | **flap-statistics** | **received prefix-filter** | **policy** [**detail**]]]

### 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. |

| | Command or Action | Purpose |
|---|---|---|
| **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 tag1` | Specifies a BGP process and enters router configuration mode. |
| **Step 4** | **neighbor** *ip-address* **fall-over bfd**<br><br>**Example:**<br>`Router(config-router)# neighbor 172.16.10.2 fall-over bfd` | Enables BFD support for fallover. |
| **Step 5** | **end**<br><br>**Example:**<br>`Router(config-router)# end` | Returns the router to privileged EXEC mode. |
| **Step 6** | **show bfd neighbors** [**details**]<br><br>**Example:**<br>`Router# show bfd neighbors detail` | Verifies that the BFD neighbor is active and displays the routing protocols that BFD has registered. |
| **Step 7** | **show ip bgp neighbors** [*ip-address* [**received-routes** \| **routes** \| **advertised-routes** \| **paths** [*regexp*] \| **dampened-routes** \| **flap-statistics** \| **received prefix-filter** \| **policy** [**detail**]]]<br><br>**Example:**<br>`Router# show ip bgp neighbors` | Displays information about BGP and TCP connections to neighbors. |

# Configuring BFD Support for BGP over IPv6

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *as-number*
4. **no bgp default ipv4-unicast**
5. **bgp router-id** *ip-address*
6. **address-family ipv6**
7. **neighbor** *ipv6-address* **remote-as** *as-number*
8. **exit**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router bgp** *as-number*<br><br>**Example:**<br>`Device(config)# router bgp 65000` | Configures a BGP routing process, and enters router configuration mode for the specified routing process. |
| **Step 4** | **no bgp default ipv4-unicast**<br><br>**Example:**<br>`Device(config-router)# no bgp default ipv4-unicast` | Disables the IPv4 unicast address family for the BGP routing process specified in the previous step.<br>**Note** Routing information for the IPv4 unicast address family is advertised by default for each BGP routing session configured with the **neighbor remote-as** command unless you configure the **no bgp default ipv4-unicast** command before configuring the neighbor remote-as command. |
| **Step 5** | **bgp router-id** *ip-address*<br><br>**Example:**<br>`Device(config-router)# bgp router-id 192.168.99.70` | Configures a BGP routing process, and enters router configuration mode for the specified routing process. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 6** | **address-family ipv6**<br><br>**Example:**<br>`Device(config-router)# address-family ipv6` | Specifies the IPv6 address family and enters address family configuration mode.<br>• The **unicast** keyword specifies the IPv6 unicast address family. By default, the device is placed in configuration mode for the IPv6 unicast address family if a keyword is not specified with the **address-family ipv6** command. |
| **Step 7** | **neighbor** *ipv6-address* **remote-as** *as-number*<br><br>**Example:**<br>`Device(config-router)# neighbor 2001:DB8:0:CC00::1 remote-as 64600` | Enables the neighbor to exchange prefixes for the IPv6 address family with the local device. |
| **Step 8** | **exit**<br><br>**Example:**<br>`Device(config-router)# exit` | Exits router configuration mode, and returns the device to global configuration mode. |

# Monitoring and Troubleshooting BFD

To monitor or troubleshoot BFD, perform one or more of the steps in this section.

## SUMMARY STEPS

1. **enable**
2. **show bfd neighbors** [**details**]
3. **debug bfd** [**event** | **packet** | **ipc-error** | **ipc-event** | **oir-error** | **oir-event**]

## 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** | **show bfd neighbors** [**details**]<br><br>**Example:**<br>`Router# show bfd neighbors details` | (Optional) Displays the BFD adjacency database.<br>• The **details** keyword shows all BFD protocol parameters and timers per neighbor. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 3** | **debug bfd** [**event** \| **packet** \| **ipc-error** \| **ipc-event** \| **oir-error** \| **oir-event**]<br><br>**Example:**<br><br>`Router# debug bfd packet` | (Optional) Displays debugging information about BFD packets. |

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | Cisco IOS Master Command List, All Releases |
| BGP commands | Cisco IOS IP Routing: BGP Command Reference |
| BFD commands | Cisco IOS IP Routing: Protocol Independent Command Reference |
| Configuring BFD support for another routing protocol | IP Routing: BFD Configuration Guide |

### Technical Assistance

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

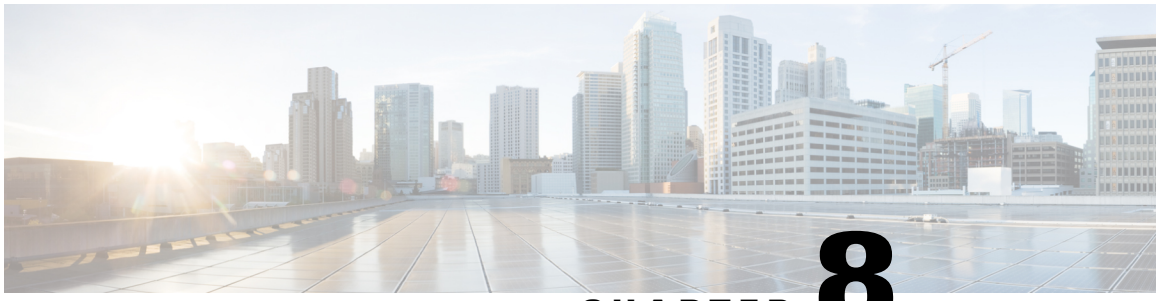
# Feature Information for BGP Support for BFD

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

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

***Table 7: Feature Information for BGP Support for BFD***

| Feature Name | Releases | Feature Information |
|---|---|---|
| BGP Support for BFD | | Bidirectional Forwarding Detection (BFD) is a detection protocol designed to provide fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. In addition to fast forwarding path failure detection, BFD provides a consistent failure detection method for network administrators. Because the network administrator can use BFD to detect forwarding path failures at a uniform rate, rather than the variable rates for different routing protocol hello mechanisms, network profiling and planning will be easier, and reconvergence time will be consistent and predictable. The main benefit of implementing BFD for BGP is a significantly faster reconvergence time.<br><br>The following commands were introduced or modified by this feature: **bfd**, **neighbor fall-over**, **show bfd neighbors**, and **show ip bgp neighbors**. |



CHAPTER 8

# BFD - VRF Support

The BFD - VRF Support feature enables Bidirectional Forwarding Detection (BFD) support for Virtual Routing and Forwarding (VRF) on Provider Edge (PE) and Customer Edge (CE) devices to provide fast detection of routing protocol failures between the devices.



## Finding Feature Information

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

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

## Prerequisites for BFD - VRF Support

All Bidirectional Forwarding Detection (BFD) clients must be Virtual Routing and Forwarding (VRF)-aware.

# Information About BFD - VRF Support

## Overview of BFD - VRF Support

The BFD - VRF Support feature enables Bidirectional Forwarding Detection (BFD) support for Virtual Routing and Forwarding (VRF) on Provider Edge (PE) and Customer Edge (CE) devices to provide fast detection of routing protocol failures between the devices.

A BFD client establishes a Virtual Private Networking (VPN) session with devices that have BFD configured on them before requesting for session monitoring. However, there are no route lookups to determine whether a BFD neighbor is connected to the same VPN session or a different one. BFD relies on its client to get information about the VPN session to monitor the associated neighbor device. All information about VPN sessions is used to forward BFD control packets to the appropriate VPN through Cisco Express Forwarding (CEF).

## Additional References for BFD - VRF Support

### Related Documents

| Related Topic | Document Title |
|---|---|
| BFD Commands | IP Routing Protocol-Independent Commands A through R<br>IP Routing Protocol-Independent Commands S through T |
| Cisco IOS Commands | Cisco IOS Master Command List, All Releases |

### 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/support |

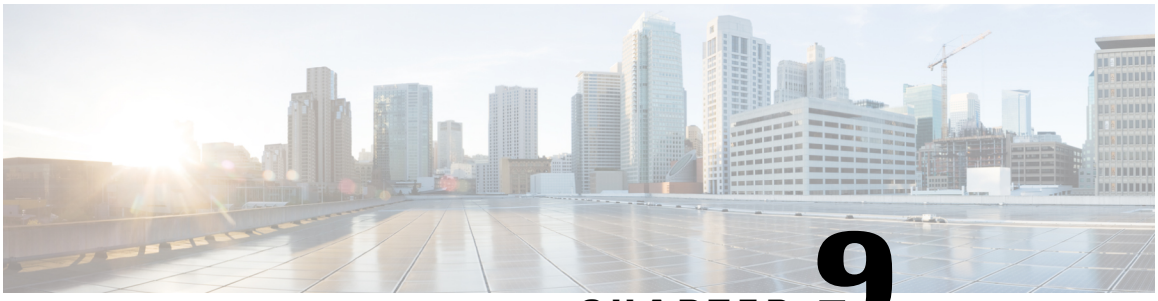
# Feature Information for BFD - VRF Support

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

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

***Table 8: Feature Information for BFD - VRF Support***

| Feature Name | Releases | Feature Information |
|---|---|---|
| BFD - VRF Support | 15.2(1)E | The BFD - VRF Support feature enables Bidirectional Forwarding Detection (BFD) support for Virtual Routing and Forwarding (VRF) on Provider Edge (PE) and Customer Edge (CE) devices to provide fast detection of routing protocol failures between the devices. |



CHAPTER 9

# IS-IS Client for BFD C-Bit Support

The Bidirectional Forwarding Detection (BFD) protocol provides short-duration detection of failures in the path between adjacent forwarding engines while maintaining low networking overheads. The BFD IS-IS Client Support feature enables Intermediate System-to-Intermediate System (IS-IS) to use Bidirectional Forwarding Detection (BFD) support, which improves IS-IS convergence as BFD detection and failure times are faster than IS-IS convergence times in most network topologies. The IS-IS Client for BFD C-Bit Support feature enables the network to identify whether a BFD session failure is genuine or is the result of a control plane failure due to a router restart. When planning a router restart, you should configure this feature on all neighboring routers.



## Finding Feature Information

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

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

## Prerequisites for IS-IS Client for BFD C-Bit Support

- IS-IS must be running on all participating devices.

- The baseline parameters for BFD sessions must be configured on the interfaces that run BFD sessions to BFD neighbors.

# Information About IS-IS Client for BFD C-Bit Support

## IS-IS Restarts and BFD Sessions

The IS-IS Client for BFD C-Bit Support feature provides BFD with a way to signal to its peers whether the BFD implementation shares the same status as the control plane. When a neighboring router's control plane restarts, a BFD session failure may occur, which does not actually represent a true forwarding failure. If this happens, you do not want the neighbors of the restarting router to react to the BFD session failure.

IS-IS does not have protocol extensions that allow it to signal in advance that it will be restarting. This means that the system cannot distinguish between a real forwarding failure and a restart. The IS-IS Client for BFD C-Bit Support feature allows you to configure the device to ignore control-plane related BFD session failures. We recommend that you configure this feature on the neighbors of a restarting device just prior to the planned restart of that device and that you remove the configuration after the restart has been completed.

The table below shows how the control plane independent failure status received from BFD on a session down event impacts IS-IS handling of that event.

***Table 9: Control Plane Failure and Session Down Events***

| IS-IS Check Control Plane Failure | BFD Control Plane Independent Failure Status | IS-IS Action on BFD session 'DOWN' Event |
|---|---|---|
| Enabled | True | Accept session DOWN |
| Enabled | False | Ignore session DOWN |
| Disabled | True | Accept session DOWN |
| Disabled | False | Accept session DOWN |

# How to Configure IS-IS Client for BFD C-Bit Support

## Configuring IS-IS Client for BFD C-Bit Support

Perfrom this task to enable control plane failure checking.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis**
4. **bfd check-control-plane-failure**
5. **end**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>`Device> enable` | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router isis**<br><br>**Example:**<br><br>`Device(config)# router isis` | Enables the IS-IS routing protocol and enters router configuration mode. |
| **Step 4** | **bfd check-control-plane-failure**<br><br>**Example:**<br><br>`Device(config-router)# bfd check-control-plane-failure` | Enables BFD control plane failure checking for the IS-IS routing protocol. |
| **Step 5** | **end**<br><br>**Example:**<br><br>`Device(config-router)# end` | Exits router configuration mode and returns to privileged EXEC mode. |

# Configuration Examples for IS-IS Client for BFD C-Bit Support

## Example: Configuring IS-IS Client for BFD C-Bit Support

The following example configures control plane failure detection on a router running the IS-IS protocol.

```
Device> enable
Device# configure terminal
Device(config)# router isis
Device(config-router)# bfd check-ctrl-plane-failure
Device(config-router)# end
```

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | *Cisco IOS Master Command List, All Releases* |
| BFD commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples | *Cisco IOS IP Routing: Protocol-Independent Command Reference* |
| Configuring and monitoring IS-IS | "Configuring Integrated IS-IS" module of the *Cisco IOS IP Routing Protocols Configuration Guide* |
| Cisco IOS IPv6 features | *Cisco IOS IPv6 Feature Mapping* |

### Standards and RFCs

| Standard/RFC | Title |
|---|---|
| RFC 5882 | *Generic Application of Bidirectional Forwarding Detection (BFD)* |

### Technical Assistance

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

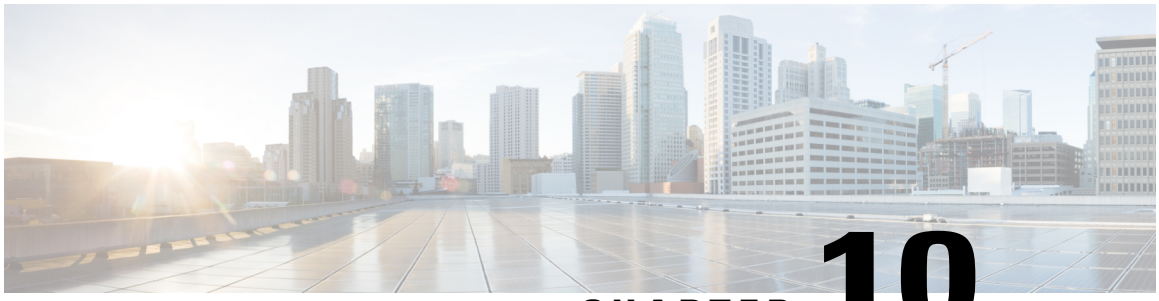
# Feature Information for IS-IS Client for BFD C-Bit Support

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

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

***Table 10: Feature Information for IS-IS Client for BFD C-Bit Support***

| Feature Name | Releases | Feature Information |
|---|---|---|
| IS-IS Client for BFD C-Bit Support | 15.1(1)SY<br>15.3(1)T | The IS-IS Client for BFD C-Bit Support feature enables the network to identify whether a BFD session failure is genuine or is the result of a control plane failure due to a router restart.<br>The following command was introduced: **bfd check-ctrl-plane-failure**. |



CHAPTER 10

# IS-IS IPv6 Client for BFD

When Bidirectional Forwarding Detection (BFD) support is configured with Intermediate System To Intermediate System (IS-IS) as a registered protocol with BFD, IS-IS receives forwarding path detection failure messages from BFD.



## Finding Feature Information

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

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

## Prerequisites for IS-IS IPv6 Client for BFD

- IS-IS must be running on all participating devices.
- The baseline parameters for BFD sessions must be configured on the interfaces that run BFD sessions to BFD neighbors.

# Information About IS-IS IPv6 Client for BFD

## IS-IS BFD Topology

When BFD support is configured with IS-IS as a registered protocol with BFD, IS-IS receives forwarding path detection failure messages from BFD. BFD support for IS-IS can be configured in either router address-family configuration mode or interface configuration mode. IS-IS IPv6 can run in single-topology or in Multi-Topology (MT) mode.

IS-IS BFD supports both IPv4 and IPv6 on the same adjacency for single-topology or multi-topology mode. If BFD is enabled for both IPv4 and IPv6, IS-IS sends two BFD session creation requests to BFD. For single-topology mode, the IS-IS adjacency state can only be UP if both BFD sessions are UP. If either of the BFD sessions is DOWN, the associated IS-IS adjacency state is also DOWN. For MT mode, the IS-IS adjacency state can be UP as long as one of topologies has a BFD session in an UP state.

## IS-IS BFD IPv6 Session Creation

IS-IS requests a BFD session for the interface and IPv6 address of the neighboring device when all of the following conditions are met:

- An IS-IS adjacency entry exists.
- The Address Family Identifier (AFI) specific peer interface address is known.
- IS-IS BFD is enabled for that AFI on an interface.
- IS-IS is enabled for that AFI on the local interface.
- If the neighboring device supports RFC 6213, BFD must be enabled for the specified Multi-Topology Identifier (MTID) or Network Layer Protocol Identifier (NLPID).

## IS-IS BFD IPv6 Session Deletion

When IS-IS BFD IPv6 is disabled on an interface, IS-IS removes related BFD sessions for IPv6 from the adjacent device. When the IS-IS adjacency entry is deleted, all BFD sessions are also deleted. IS-IS requests BFD to remove each BFD session that it has requested when any of the following events occur:

- The IS-IS instance is deleted or un-configured.
- The IS-IS adjacency entry is deleted.
- IS-IS BFD is disabled on the next hop interface for an address-family.
- The neighboring device supports RFC 6213 and indicates that it no longer supports BFD for the specified MTID or NLPID.

# How to Configure ISIS IPv6 Client for BFD

## Configuring IS-IS IPv6 Client Support for BFD on an Interface

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **isis ipv6 bfd**
5. **end**

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br><br>`Device> enable` | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br><br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** *type number*<br><br>**Example:**<br><br>`Device(config)# interface gigabitethernet 6/0/0` | Enters interface configuration mode. |
| **Step 4** | **isis ipv6 bfd**<br><br>**Example:**<br><br>`Device(config-if)# isis ipv6 bfd` | Enables IPv6 BFD on a specific interface that is configured for IS-IS. |
| **Step 5** | **end**<br><br>**Example:**<br><br>`Device(config-if)# end` | Exits interface configuration mode and returns to privileged EXEC mode. |

# Configuring IS-IS IPv6 Client Support for BFD on All Interfaces

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis**
4. **metric-style wide**
5. **address-family ipv6**
6. **multi-topology**
7. **bfd all-interfaces**
8. **end**

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **router isis**<br><br>**Example:**<br>`Device(config)# router isis` | Enables the IS-IS routing protocol and enters router configuration mode. |
| **Step 4** | **metric-style wide**<br><br>**Example:**<br>`Device(config-router)# metric-style wide` | (Optional) Configures a device that is running IS-IS so that it generates and accepts only new-style type, length, value objects (TLVs). |
| **Step 5** | **address-family ipv6**<br><br>**Example:**<br>`Device(config-router)# address-family ipv6` | Enters address family configuration mode for configuring IS-IS routing sessions that use standard IPv6 address prefixes. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 6** | **multi-topology**<br><br>**Example:**<br><br>`Device(config-router-af)# multi-topology` | (Optional) Enables multi-topology IS-IS for IPv6. |
| **Step 7** | **bfd all-interfaces**<br><br>**Example:**<br><br>`Device(config-router-af)# bfd all-interfaces` | Enables BFD for all interfaces participating in the routing process. |
| **Step 8** | **end**<br><br>**Example:**<br><br>`Device(config-router-af)# end` | Exits address family configuration mode and returns to privileged EXEC mode. |

# Configuration Examples for ISIS IPv6 Client for BFD

## Example: IS-IS IPv6 Client Support for BFD on a Single Interface

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 6/0/0
Device(config-if)# isis ipv6 bfd
Device(config-if)# end

Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 6/0
Device(config-if)# isis ipv6 bfd
Device(config-if)# end
```

## Example: IS-IS IPv6 Client Support for BFD on All Interfaces

```
Device> enable
Device# configure terminal
Device(config)# router isis
Device(config-router)# metric-style wide
Device(config-router)# address-family ipv6
Device(config-router-af)# multi-topology
Device(config-router-af)# bfd all-interfaces
Device(config-router-af)# end
```

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | *Cisco IOS Master Command List, All Releases* |
| BFD commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples. | *Cisco IOS IP Routing: Protocol-Independent Command Reference* |
| Configuring and monitoring IS-IS | "Configuring Integrated IS-IS" module of the *IP Routing Protocols Configuration Guide* |
| Cisco IOS IPv6 features | *Cisco IOS IPv6 Feature Mapping* |
| IPv6 commands | *Cisco IOS IPv6 Command Reference* |

### Technical Assistance

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

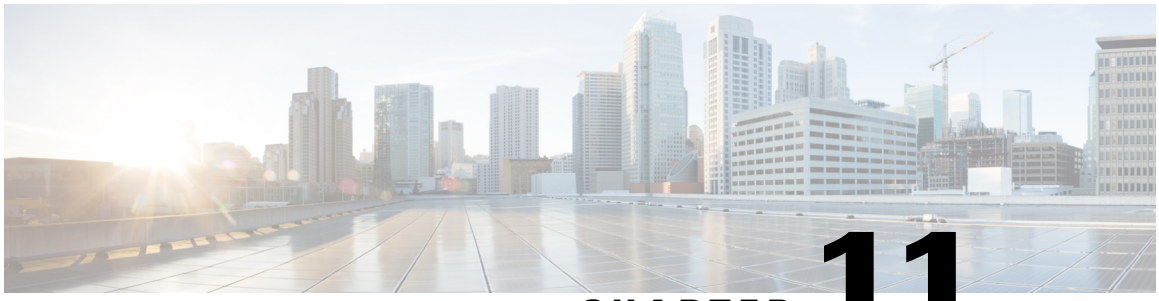
# Feature Information for IS-IS IPv6 Client for BFD

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

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

*Table 11: Feature Information for IS-IS IPv6 Client for BFD*

| Feature Name | Releases | Feature Information |
|---|---|---|
| IS-IS IPv6 Client for BFD | 15.1(1)SY<br>15.2(4)S<br>15.3(1)T | When BFD support is configured with IS-IS as a registered protocol with BFD, IS-IS receives forwarding path detection failure messages from BFD.<br>The following commands were introduced or modified: **bfd all-interfaces**, **isis ipv6 bfd**. |



CHAPTER 11

# Bidirectional Forwarding Detection MIB

The Bidirectional Forwarding Detection (BFD) MIB, Version 2 feature enables Simple Network Management Protocol (SNMP) agent support in Cisco IOS software for BFD management, as implemented in the Bidirectional Forwarding Detection Management Information Base (draft-ietf-bfd-mib-02.txt). The SNMP agent code operating with the BFD MIB enables a standardized, SNMP-based approach to be used in managing the BFD features in Cisco IOS software. The BFD MIB feature introduces the CISCO-IETF-BFD-MIB. The BFD MIB is also VPN-aware, which allows SNMP to differentiate incoming packets from different VPNs.



## Finding Feature Information

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

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

## Restrictions for the Bidirectional Forwarding Detection MIB

The following restrictions apply to the BFD MIB for Cisco IOS releases:

- This MIB supports read-only (RO) permission for MIB objects, except for ciscoBfdSessNotificationsEnable, which has read-write access to enable or disable BFD traps via SNMP set commands.
- The BFD Session Mapping Table (ciscoBfdSessMapTable) maps the complex indexing of the BFD sessions to the flat BFDIndex used in the ciscoBfdSessionTable.
- BFD does not support 64-bit counters. The session performance table (ciscoBfdSessionPerfTable) collects BFD performance counts on a per session basis. This table augments the ciscoBfdSessionTable.
- The VRF-Aware functionality of BFD MIB is not supported with IPv6 addresses.

# Information About the Bidirectional Forwarding Detection MIB

## BFD MIB Cisco Implementation

The BFD MIB is based on the Internet Engineering Task Force (IETF) draft MIB entitled draft-ietf-bfd-mib-02.txt which includes objects describing features that support BFD.

Slight differences between the IETF draft MIB and the implementation of the BFD capabilities within Cisco IOS software require some minor translations between the BFD MIB and the internal data structures of Cisco IOS software. These translations are made by the SNMP agent code that is installed and operating on various hosts within the network. This SNMP agent code, running in the background as a low priority process, provides a management interface to Cisco IOS software.

The SNMP objects defined in the BFD MIB can be displayed by any standard SNMP utility. All BFD MIB objects are based on the IETF draft MIB; thus, no specific Cisco SNMP application is required to support the functions and operations pertaining to the BFD MIB.

## Capabilities Supported by the BFD MIB

The following functionality is supported in the BFD MIB:

- The ability to generate and queue notification messages that signal changes in the operational status of BFD sessions.
- The ability to make the BFD MIB VPN aware.
- Extensions to existing SNMP commands that provide the ability to enable, disable, and configure notification messages for BFD sessions.
- The ability to specify the name or the IP address of a network management station (NMS) in the operating environment to which notification messages are to be sent.
- The ability to write notification configurations into nonvolatile memory.

# Notification Generation Events

When BFD notifications are enabled with the **snmp-serverenabletrapsbfd** command with the **session-up** and **session-down** keywords, notification messages relating to specific events within Cisco IOS software are generated and sent to a specified NMS in the network.

For example, a bfdSessUp notification is sent to an NMS when BFD is configured.

Conversely, a bfdSessDown notification is generated and sent to an NMS when BFD is disabled.

# Benefits of Bidirectional Forwarding Detection MIB

The BFD MIB provides the following benefits:

- Provides a standards-based SNMP interface for retrieving information about BFD.
- Forwards notification messages to a designated NMS for evaluation or action by network administrators.

# Features and Technologies Related to BFD MIB

The BFD MIB feature is used in conjunction with the following features and technologies:

- Standards-based SNMP network management application
- BFD

# Supported Objects in the BFD MIB

## BFD General Variables (scalars)

The following parameters apply globally to the router's BFD process:

- ciscoBfdAdminStatus is The global administrative status of BFD in this router. The value enabled denotes that the BFD Process is active on at least one interface; disabled means it is not enabled on any interface.
- ciscoBfdVersionNumber is the current default version number of the BFD protocol.
- ciscoBfdSessNotificationsEnable enables the emission of ciscoBfdSessUp and ciscoBfdSessDown notifications when set to true (1); otherwise these notifications are not emitted.

## BFD Session Table

The BFD Session Table specifies BFD session specific information and contains the following entries:

- ciscoBfdSessTable describes the BFD sessions.
- ciscoBfdSessEntry describes BFD session.

- ciscoBfdSessIndex contains an index used to represent a unique BFD session on this device. This is an Index and it does not show up in the MIB walk as an object.
- ciscoBfdSessApplicationId contains an index used to indicate a local application which owns or maintains this BFD session. This application ID provides a convenient way to segregate sessions by the applications that maintain them. The value corresponds to the ClientID in the output of the **showbfdclient** command.
- ciscoBfdSessDiscriminator specifies the local discriminator for this BFD session, used to uniquely identify it.
- ciscoBfdSessRemoteDiscr specifies the session discriminator chosen by the remote system for this BFD session.
- ciscoBfdSessUdpPort specifies the UDP Port for BFD. The default value is the well-known value for this port.
- ciscoBfdSessState specifies he perceived state of the BFD session. Valid values are adminDown (1), down (2), init (3), and up (4).
- ciscoBfdSessRemoteHeardFlag specifies status of BFD packet reception from the remote system. The flag is set to true (1) if the local system is actively receiving BFD packets from the remote system. The flag is set to false (0) if the local system has not received BFD packets recently (within the detection time) or if the local system is attempting to tear down the BFD session. This object is applicable only if the the session is runing at version 0. If the session is running version 1, that value will return false.
- ciscoBfdSessDiag displays a diagnostic code specifying the local system's reason for the last transition of the session from up (1) to some other state. This object is accessible only for notifications and will not display in the MIB walk for the ciscoBfdSessTable. The codes are:
    - BfdInterval—The delay in microseconds.
    - BfdDiag—A diagnostic code:
        - noDiagnostic(0)
        - controlDetectionTimeExpired(1)
        - echoFunctionFailed(2)
        - neighborSignaledSessionDown(3)
        - forwardingPlaneReset(4)
        - pathDown(5)
        - concatenatedPathDown(6)
        - administrativelyDown(7)
        - reverseConcatenatedPathDown (8)
- ciscoBfdSessOperMode specifies the current operating mode of the BFD session. The supported values are:
    - asyncModeWEchoFun (1),
    - asynchModeWOEchoFun (2),

- ciscoBfdSessDemandModeDesiredFlag indicates the local system's desire to use demand mode. It is set to true (1) if the local system wishes to use demand mode or false (0) if not. Demand Mode is not supported and therefore will always return a value of 0.
- ciscoBfdSessEchoFuncModeDesiredFlag indicates that the local system's desire to use echo mode. It is set to true (1) if the local system wishes to use Echo mode or false (0) if not.
- ciscoBfdSessControlPlanIndepFlag indicates if the local system's can function through a disruption of the control plane. It is set to true (1) if the local system BFD implementation is independent of the control plane. Otherwise, the value is set to false (0). This value will always return a value of 0.
- ciscoBfdSessAddrType specifies the IP address of the interface associated with this BFD session. Only values unknown (0), ipv4 (1) or ipv6 (2) are supported. A value of unknown (0) is allowed only when the outgoing interface is of type point-to-point, or when the BFD session is not associated with a specific interface.
- ciscoBfdSessAddr specifies the IP address of the interface associated with this BFD session. The value is set to zero when BFD session is not associated with a specific interface.
- ciscoBfdSessDesiredMinTxInterval specifies the minimum interval, in microseconds, that the local system would like to use when transmitting BFD control packets.
- ciscoBfdSessReqMinRxInterval specifies the minimum interval, in microseconds, between received BFD control packets the local system can support.
- ciscoBfdSessReqMinEchoRxInterval specifies the minimum interval, in microseconds, between received BFD Echo packets that this system can support. If echo mode is disabled for the configured interface for the session, this object will return value of 0.
- ciscoBfdSessDetectMult specifies the detect time multiplier.
- ciscoBfdSessStorType indicates the storage type for this object. The storage type for this entry is a read-only implementation that is always volatile.
- ciscoBfdSessRowStatus This object is a read-only implementation that is always active.
- ciscoBfdSessAuthPresFlag indicates the local system's desire to use Authentication. It is set to true (1) if the local system wishes the session to be authenticated or false (0) if not. Authentication is not supported and this object will always return a value of 0.
- ciscoBfdSessAuthenticationType specifies the authentication type used for this BFD session. This field is valid only when the authentication present bit is set. This object is not valid in BFD in Cisco IOS.

## BFD Session Performance Table

ciscoBfdSessPerfTable specifies BFD session performance counters and augments the ciscoBfdSessionTable. This table contains the following entries:

- ciscoBfdSessPerfEntry includes an entry created by a BFD-enabled node for every BFD session. ciscoBfdCounterDiscontinuityTime is used to indicate potential discontinuity for all counter objects in this table.
- ciscoBfdSessPerfPktIn specifies the total number of BFD messages received for this BFD session.
- ciscoBfdSessPerfPktOut specifies the total number of BFD messages sent for this BFD session.
- ciscoBfdSessUpTime specifies the value of sysUpTime on the most recent occasion at which the session came up. If no such up event exists, the value is zero.

- ciscoBfdSessPerfLastSessDownTime specifies the value of sysUpTime on the most recent occasion at which the last time communication was lost with the neighbor. If no such down event exists, the value is zero.
- ciscoBfdSessPerfLastCommLostDiag specifies the BFD diag code for the last time communication was lost with the neighbor. This object is not supported.
- ciscoBfdSessPerfSessUpCount specifies the number of times this session has gone into the up state since the router last rebooted.
- ciscoBfdSessPerfDiscTime indicates the value of sysUpTime on the most recent occasion at which any one or more of the session counters suffered a discontinuity. The relevant counters are the specific instances associated with this BFD session of any Counter32 object contained in the BfdSessPerfTable. If no such discontinuities have occurred since the last re-initialization of the local management subsystem, then the value is zero. This object is not supported.
- ciscoBfdSessPerfPktInHC represents the total number of BFD messages received for this BFD session. It must be equal to the least significant 32 bits of ciscoBfdSessPerfPktIn if ciscoBfdSessPerfPktInHC is supported according to the rules spelled out in RFC2863.
- ciscoBfdSessPerfPktOutHC represents the total number of BFD messages transmitted for this BFD session. It must be equal to the least significant 32 bits of ciscoBfdSessPerfPktIn if ciscoBfdSessPerfPktOutHC is supported according to the rules spelled out in RFC2863.

## BFD Session Mapping Table

The BFD Session Mapping Table maps the complex indexing of the BFD sessions to the flat BFDIndex used in the ciscoBfdSessionTable. If the value of the ciscoBfdSessAddr (an OID) has more that 111 sub-identifiers, then OIDs of column instances in this table have more than 128 sub-identifiers and cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3. The BFD Session Mapping table contains the following entries:

- ciscoBfdSessMapEntry describes BFD session that is mapped to this index. If the value of the mplsInSegmentMapLabelPtrIndex (an OID) has more that 111 sub-identifiers, then OIDs of column instances in this table have more than 128 sub-identifiers and cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3.
- ciscoBfdSessMapBfdIndex specifies the BfdIndex referred to by the indexes of this row. In essence, a mapping is provided between these indexes and the ciscoBfdSessTable. This is Index and does not show up in the MIB walk as an object.

See the MIB Walk for BFD MIB: Example in the configuration example section for an example of the mapping.

## BFD Notifications

Notification contains the following entries. The range mode for this notification is not supported. Therefore, only a single notification is sent for one of the ciscoBfdSessTable entries representing this session.

- ciscoBfdSessUp generates a notfication when the ciscoBfdSessState object for one or more entries in ciscoBfdSessTable is about to enter the up (4) state from some other state. The value of ciscoBfdSessDiag is set equal to noDiagnostic(0).
- ciscoBfdSessDown generates a notification when the ciscoBfdSessState object for one or more entries in ciscoBfdSessTable is about to enter the down (2) or adminDown (1) states from some other state.

The values of ciscoBfdSessDiag returns the Diag code providing the reason for this new state (that is, pathDown (5) or administrativelyDown (7)).

# How to Configure the Bidirectional Forwarding Detection MIB

## Enabling the SNMP Agent for BFD MIB Notifications

The SNMP agent for the BFD MIB is disabled by default. To enable the SNMP agent for BFD MIB notifications, perform the following steps.

### SUMMARY STEPS

1. **enable**
2. **show running-config** | **includesnmp**
3. **configure terminal**
4. **snmp-server community** *string* [**view***view-name*] [**ro** | **rw**] [**ipv6***nacl*] [*access-list-number*]
5. **snmp-server enable traps bfd** [**session-up**] [**session-down**]
6. **exit**
7. **write memory**

### 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** | **show running-config** | **includesnmp**<br><br>**Example:**<br>`Router# show running-config \| include snmp` | Displays the running configuration to determine if an SNMP agent is already running.<br>• If no SNMP information is displayed, go to Step 4 . If any SNMP information is displayed, you can modify the information or change it as needed. |
| **Step 3** | **configure terminal**<br><br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 4** | **snmp-server community** *string* [**view***view-name*] [**ro** | **rw**] [**ipv6***nacl*] [*access-list-number*] | Enables the community string.<br>• The example enables snmp with community string comaccess and read-only access. |

| | Command or Action | Purpose |
|---|---|---|
| | **Example:**<br>`Router(config)# snmp-server community comaccess ro 4` | |
| **Step 5** | **snmp-server enable traps bfd** [**session-up**] [**session-down**]<br>**Example:**<br>`Router(config)# snmp-server enable traps bfd` | Enables a router to send SNMP notifications or informs to an SNMP host.<br>**Note** This command is optional. After SNMP is enabled, all MIBs are available for the user to query. |
| **Step 6** | **exit**<br>**Example:**<br>`Router(config)# exit` | Exits global configuration mode and returns to privileged EXEC mode. |
| **Step 7** | **write memory**<br>**Example:**<br>`Router# write memory` | Writes the modified configuration to NVRAM, permanently saving the settings. |

# Verifying the Status of the SNMP Agent

To verify that the SNMP agent has been enabled on a host network device, perform the following steps.

## SUMMARY STEPS

1. **enable**
2. **show running-config** | **includesnmp**
3. show bfd neighbors detail

## DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router# enable` | Enables privileged EXEC mode<br>• Enter your password if prompted |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **show running-config \| includesnmp**<br><br>**Example:**<br>`Router# show running-config \| include snmp` | Displays the running configuration on the target device and is used to examine the output for displayed SNMP information. |
| **Step 3** | show bfd neighbors detail<br><br>**Example:**<br>`Router# show bfd neighbors detail` | Displays BFD protocol parameters and timers for each neighbor. |

#### Example

The follows example displays the running configuration on the target device and its SNMP information.

```
Router# show running-config | include snmp
.
.
.
snmp-server community public rw
snmp-server community private ro
```

Any **snmp-server** statement that appears in the output and takes the form shown here verifies that SNMP has been enabled on that device.

# Configuration Examples for the Bidirectional Forwarding Detection MIB

## Enabling the SNMP Agent to Enable BFD Notifications Example

The following example shows how to enable an SNMP agent on a host network device:

```
Router# configure terminal
Router(config)# snmp-server community
privatero
```

The following example shows how to allow read-only access to all BFD MIB objects relating to members of access list 4 that specify the comaccess community string. No other SNMP agents will have access to any BFD MIB objects.

```
Router(config)# snmp-server community comaccess ro 4
```

The following example shows how to enable a router to send BFD-related SNMP notifications or informs to an SNMP host.

```
Router(config)# snmp-server enable traps bfd
```

# Viewing BFD Sessions Example

The following example show the output of the **show bfd neighbors** command, which displays BFD sessions and timers for each neighbor.

```
Router# show bfd neighbors

NeighAddr                         LD/RD    RH/RS     State     Int
10.0.0.2                           7/7     Up        Up        Et1/2.2
10.1.0.2                           6/6     Up        Up        Et1/2.5
DDDD::1                            1/1     Up        Up        Et1/3

Router# show bfd neighbors detail

NeighAddr                         LD/RD    RH/RS     State     Int
10.0.0.2                           9/8     Up        Up        Gi3/8.1
Session state is UP and using echo function with 50 ms interval.
OurAddr: 10.0.0.1
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 5
Received MinRxInt: 1000000, Received Multiplier: 5
Holddown (hits): 0(0), Hello (hits): 1000(350)
Rx Count: 352, Rx Interval (ms) min/max/avg: 1/1000/874 last: 464 ms ago
Tx Count: 351, Tx Interval (ms) min/max/avg: 756/1000/876 last: 524 ms ago
Elapsed time watermarks: 0 0 (last: 0)
Registered protocols: CEF OSPF
Uptime: 00:05:07
Last packet: Version: 1                - Diagnostic: 0
State bit: Up              - Demand bit: 0
Poll bit: 0                - Final bit: 0
Multiplier: 5              - Length: 24
My Discr.: 8               - Your Discr.: 9
Min tx interval: 1000000   - Min rx interval: 1000000
Min Echo interval: 50000
NeighAddr                         LD/RD    RH/RS     State     Int
10.1.0.2                           6/6     Up        Up        Gi3/8.2
Session state is UP and using echo function with 50 ms interval.
OurAddr: 10.1.0.1
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 5
Received MinRxInt: 1000000, Received Multiplier: 5
Holddown (hits): 0(0), Hello (hits): 1000(352)
Rx Count: 352, Rx Interval (ms) min/max/avg: 1/1000/880 last: 248 ms ago
Tx Count: 354, Tx Interval (ms) min/max/avg: 1/1000/875 last: 244 ms ago
Elapsed time watermarks: 0 0 (last: 0)
Registered protocols: CEF OSPF
Uptime: 00:05:09
Last packet: Version: 1                - Diagnostic: 0
State bit: Up              - Demand bit: 0
Poll bit: 0                - Final bit: 0
Multiplier: 5              - Length: 24
My Discr.: 6               - Your Discr.: 6
Min tx interval: 1000000   - Min rx interval: 1000000
Min Echo interval: 50000
```

# MIB Walk for BFD MIB Example

This example shows sample output from a MIB walk of the BFD MIB:

### ciscoBfdSessMapTable

```
ciscoBfdSessMapBfdIndex.1.7.1.4.10.1.0.1 = 65543
ciscoBfdSessMapBfdIndex.3.1.2.16.221.221.0.0.0.0.0.0.0.0.0.0.0.2 = 196609
ciscoBfdSessMapBfdIndex.4.6.1.4.40.4.0.1 = 262150
```

```
The MapTable index includes the following information about BFD sessions and clients:
Index example: 1.7.1.4.10.1.0.1
1 – Client id
7 – Local discriminator
1 – IP address type (1 – IPv4, 2- IPv6)
4 – Length of next string (4 for IPv4 addresses or 16 for IPv6 addresses)
10.1.0.1 – IP address of the BFD session
```

### ciscoBfdSessTable

```
ciscoBfdSessApplicationId.65543 = 1
ciscoBfdSessApplicationId.196609 = 3
ciscoBfdSessApplicationId.262150 = 4
ciscoBfdSessDiscriminator.65543 = 7
ciscoBfdSessDiscriminator.196609 = 1
ciscoBfdSessDiscriminator.262150 = 6
ciscoBfdSessRemoteDiscr.65543 = 7
ciscoBfdSessRemoteDiscr.196609 = 1
ciscoBfdSessRemoteDiscr.262150 = 6
ciscoBfdSessUdpPort.65543 = 3785
ciscoBfdSessUdpPort.196609 = 3784
ciscoBfdSessUdpPort.262150 = 3785
ciscoBfdSessState.65543 = up
ciscoBfdSessState.196609 = up
ciscoBfdSessState.262150 = up
ciscoBfdSessRemoteHeardFlag.65543 = false
ciscoBfdSessRemoteHeardFlag.196609 = false
ciscoBfdSessRemoteHeardFlag.262150 = false
ciscoBfdSessOperMode.65543 = asyncModeWEchoFun
ciscoBfdSessOperMode.196609 = asynchModeWOEchoFun
ciscoBfdSessOperMode.262150 = asyncModeWEchoFun
ciscoBfdSessDemandModeDesiredFlag.65543 = false
ciscoBfdSessDemandModeDesiredFlag.196609 = false
ciscoBfdSessDemandModeDesiredFlag.262150 = false
ciscoBfdSessEchoFuncModeDesiredFlag.65543 = true
ciscoBfdSessEchoFuncModeDesiredFlag.196609 = false
ciscoBfdSessEchoFuncModeDesiredFlag.262150 = true
ciscoBfdSessControlPlanIndepFlag.65543 = false
ciscoBfdSessControlPlanIndepFlag.196609 = false
ciscoBfdSessControlPlanIndepFlag.262150 = false
ciscoBfdSessAddrType.65543 = ipv4
ciscoBfdSessAddrType.196609 = ipv6
ciscoBfdSessAddrType.262150 = ipv4
ciscoBfdSessAddr.65543 = 28:01:00:01
ciscoBfdSessAddr.196609 = DD:DD:00:00:00:00:00:00:00:00:00:00:00:00:00:02
ciscoBfdSessAddr.262150 = 10:04:00:01
ciscoBfdSessDesiredMinTxInterval.65543 = 1000000
ciscoBfdSessDesiredMinTxInterval.196609 = 50000
ciscoBfdSessDesiredMinTxInterval.262150 = 1000000
ciscoBfdSessReqMinRxInterval.65543 = 1000000
ciscoBfdSessReqMinRxInterval.196609 = 50000
ciscoBfdSessReqMinRxInterval.262150 = 1000000
ciscoBfdSessReqMinEchoRxInterval.65543 = 50000
ciscoBfdSessReqMinEchoRxInterval.196609 = 0
ciscoBfdSessReqMinEchoRxInterval.262150 = 50000
ciscoBfdSessDetectMult.65543 = 5
ciscoBfdSessDetectMult.196609 = 5
ciscoBfdSessDetectMult.262150 = 5
ciscoBfdSessStorType.65543 = volatile
ciscoBfdSessStorType.196609 = volatile
ciscoBfdSessStorType.262150 = volatile
ciscoBfdSessRowStatus.65543 = active
ciscoBfdSessRowStatus.196609 = active
ciscoBfdSessRowStatus.262150 = active
ciscoBfdSessAuthPresFlag.65543 = false
ciscoBfdSessAuthPresFlag.196609 = false
ciscoBfdSessAuthPresFlag.262150 = false
ciscoBfdSessAuthenticationType.65543 = 0
ciscoBfdSessAuthenticationType.196609 = 0
ciscoBfdSessAuthenticationType.262150 = 0
```

### ciscoBfdSessPerfTable

```
ciscoBfdSessPerfPktIn.65543 = 246
ciscoBfdSessPerfPktIn.196609 = 5159
ciscoBfdSessPerfPktIn.262150 = 290
ciscoBfdSessPerfPktOut.65543 = 247
ciscoBfdSessPerfPktOut.196609 = 5416
ciscoBfdSessPerfPktOut.262150 = 291
ciscoBfdSessUpTime.65543 = 43376
ciscoBfdSessUpTime.196609 = 39781
ciscoBfdSessUpTime.262150 = 39736
ciscoBfdSessPerfLastSessDownTime.65543 = 0
ciscoBfdSessPerfLastSessDownTime.196609 = 0
ciscoBfdSessPerfLastSessDownTime.262150 = 0
ciscoBfdSessPerfLastCommLostDiag.65543 = 0
ciscoBfdSessPerfLastCommLostDiag.196609 = 0
ciscoBfdSessPerfLastCommLostDiag.262150 = 0
ciscoBfdSessPerfSessUpCount.65543 = 1
ciscoBfdSessPerfSessUpCount.196609 = 1
ciscoBfdSessPerfSessUpCount.262150 = 1
ciscoBfdSessPerfDiscTime.65543 = 0
ciscoBfdSessPerfDiscTime.196609 = 0
ciscoBfdSessPerfDiscTime.262150 = 0
ciscoBfdSessPerfPktInHC.65543 = 247
ciscoBfdSessPerfPktInHC.196609 = 5179
ciscoBfdSessPerfPktInHC.262150 = 291
ciscoBfdSessPerfPktOutHC.65543 = 248
ciscoBfdSessPerfPktOutHC.196609 = 5440
ciscoBfdSessPerfPktOutHC.262150 = 292
```

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| BFD | *IP Routing Bidirectional Forwarding Detection Configuration Guide* |
| Configuring SNMP support for a VPN | *SNMP Support over VPNs—Context-Based Access* |

### Standards and RFCs

| Standard/RFC | Title |
|---|---|
| draft-ietf-bfd-mib-03 | Bidirectional Forwarding Detection MIB |
| RFC 2026 | The Internet Standards Process |

### MIBs

| MIB | MIBs Link |
|---|---|
| BFD MIB | 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 |

### Technical Assistance

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

# Feature Information for the Bidirectional Forwarding Detection MIB

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

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

*Table 12: Feature Information for the Bidirectional Forwarding Detection MIB*

| Feature Name | Releases | Feature Information |
|---|---|---|
| Bidirectional Forwarding Detection MIB, Version 2 | 12.2(33)SRE<br>15.1(1)SG<br>15.1(1)SY | The Bidirectional Forwarding Detection MIB feature enables the SNMP agent support in Cisco IOS software for BFD management, as implemented in the CISCO-IETF-BFD-MIB.<br>The following commands were introduced or modified:<br>• **snmp-server enable traps bfd**<br>• **snmp-server host** |