Bidirectional Forwarding Detection

This chapter describes Bidirectional Forwarding Detection (BFD) and how it is configured in relation to various protocols. Sections in this chapter include:

- Section 37.1: Introduction
- Section 37.2: BFD Configuration
- Section 37.3: BFD Commands

37.1 Introduction

In networks without data link signaling, connection failures are usually detected by the hello mechanisms of routing protocols. Detection can take over a second, and reducing detection time by increasing the rate at which hello packets are exchanged can create an excessive burden on the participating CPUs.

BFD is a low-overhead, protocol-independent mechanism which adjacent systems can use instead for faster detection of faults in the path between them. BFD is strictly a failure-detection mechanism, and does not discover neighbors or reroute traffic.

BFD is a simple mechanism which detects the liveness of a connection between adjacent systems, allowing it to quickly detect failure of any element in the connection. It does not operate independently, but only as an adjunct to routing protocols. The routing protocols are responsible for neighbor detection, and create BFD sessions with neighbors by requesting failure monitoring from BFD.

Once a BFD session is established with a neighbor, BFD exchanges control packets to verify connectivity and informs the requesting protocol of failure if a specified number of successive packets are not received. The requesting protocol is then responsible for responding to the loss of connectivity.

Routing protocols using BFD for failure detection continue to operate normally when BFD is enabled, including the exchange of hello packets.

The basic behavior of BFD is defined in RFC 5880.

37.1.1 BFD Modes

BFD functions in asynchronous or demand mode, and also offers an echo function. EOS supports asynchronous mode and the echo function.
37.1.1.1 Asynchronous Mode

In asynchronous mode, BFD control packets are exchanged by neighboring systems at regular intervals. If a specified number of sequential packets are not received, BFD declares the session to be down.

37.1.1.2 Demand Mode

In demand mode, once the BFD session is established, the participating systems can request that BFD packets not be sent, then request an exchange of packets only when needed to verify connectivity. EOS does not support demand mode.

37.1.2 Echo Function

When the echo function is in use, echo packets are looped back through the hardware forwarding path of the neighbor system without involving the CPU. Failure is detected by an interruption in the stream of echoed packets. The minimum reception rate for BFD control packets from the neighbor is also changed automatically when the echo function is operational, because liveness detection is supplied by the echo packets.

While BFD control messages are transmitted to port 3786, BFD echo messages use UDP port 3785 for both source and destination.
37.1.3 BFD on Port Channels

On port channels, the BFD per-link feature can be used to add resiliency to the port channel’s BFD sessions. When BFD per-link is enabled, BFD considers the port channel “up” as long as any link in the port channel is functioning properly.

BFD per-link can be configured in full compliance with RFC 7130, causing member ports to be removed from the port channel when their BFD micro sessions are down, or in legacy mode, which relies on the LAG itself to detect and remove unresponsive member ports. By default, BFD per-link operates in legacy mode, which allows the switch to inter-operate more effectively with older equipment, but which may drop traffic if downed links are not detected by other means. RFC7130 mode allows for faster detection and removal of downed links within the port channel and can be used in situations where LACP is not supported. For the BFD session to come up, both peers must be configured in the same way.
37.2 **BFD Configuration**

To use BFD as the failure detection mechanism for a routing protocol, it must be enabled for each participating protocol.

These sections describe BFD configuration tasks:

- Section 37.2.1: Configuring BFD on an Interface
- Section 37.2.2: Configuring BFD on a Port Channel
- Section 37.2.3: Configuring the Echo Function
- Section 37.2.4: Configuring BFD for PIM
- Section 37.2.5: Configuring BFD for BGP
- Section 37.2.6: Configuring BFD for VRRP
- Section 37.2.7: Configuring BFD for OSPF
- Section 37.2.8: Configure BFD for IS-IS
- Section 37.2.9: Displaying BFD Neighbor Information

### 37.2.1 Configuring BFD on an Interface

The transmission rate for BFD control packets, the minimum rate at which control packets are expected from the peer, and the multiplier (the number of packets that must be missed in succession before BFD declares the session to be down) can all be configured per interface. The values configured apply to all BFD sessions that pass through the interface.

The default values for these parameters are:

- **transmission rate** 300 milliseconds
- **minimum receive rate** 300 milliseconds
- **multiplier** 3

To configure different values for these parameters on an interface, use the `bfd interval` command.

For BFD to function as a failure detection mechanism, it must be enabled for each participating protocol.

**Example**

- These commands set the transmit and receive intervals to 200 milliseconds and the multiplier to 2 for all BFD sessions passing through Ethernet interface 3/20.

```bash
switch(config)#interface ethernet 3/20
switch(config-if-Et3/20)#bfd interval 200 min_rx 200 multiplier 2
switch(config-if-Et3/20)#
```
37.2.2 Configuring BFD on a Port Channel

Basic BFD parameters are configured on a port channel as described in Configuring BFD on an Interface above.

Additionally, BFD can be configured in per-link mode on a port channel so that the port channel will be considered up as long as any link in the channel is up. BFD per-link can be configured in compliance with RFC 7130 (causing member ports to be removed from the port channel when their BFD micro session is down), or in legacy mode for interoperability with older equipment. For the BFD session to come up, both peers must be configured in the same way (either RFC-7130 or legacy mode).

Note

In RFC 7130 mode, if multiple IP addresses are configured for a member of a port channel (e.g., one IPv4 address and one IPv6 address), the member will be removed from the port channel if the micro session associated with either IP address goes down.

37.2.2.1 Enabling BFD Per-link

To enable BFD per-link on a port channel, use the bfd per-link command.

Example

- These commands enabled BFD per-link on port channel 5.

  ```
  switch(config)#interface port-channel 5
  switch(config-if-Po5)#bfd per-link
  switch(config-if-Po5)#
  ```

37.2.2.2 Configuring BFD Per-link in RFC 7130 Mode

By default, BFD per-link operates in legacy mode. To enable RFC 7130 mode (in which a member port is removed from the port channel when its BFD micro session is down), configure the switch as follows.

Step 1 If you are configuring an L2 interface, specify a local L3 BFD address for the switch using the bfd local-address command. This is not necessary when configuring an L3 interface with an IP address configured on the port channel.

Step 2 Enable BFD per-link on the port channel using the bfd per-link command.

Step 3 Specify the L3 address of the port channel’s BFD neighbor using the bfd neighbor command. For an L2 port channel, the address is the globally configured BFD local address on the peer switch. For an L3 port channel, the address is the IP address configured on the peer port channel.

Examples

- These commands configure BFD per-link in RFC 7130 mode over an L2 port channel.

  Switch 1 configuration:

  ```
  switch1(config)#bfd local-address 10.0.0.5
  switch1(config)#interface port-channel 5
  switch1(config-if-Po5)#bfd per-link rfc-7130
  switch1(config-if-Po5)#bfd neighbor 10.0.0.4
  switch1(config-if-Po5)#
  ```
Switch 2 configuration:

```
switch2(config)#bfd local-address 10.0.0.4
switch2(config)#interface port-channel 5
switch2(config-if-Po5)#bfd per-link rfc-7130
switch2(config-if-Po5)#bfd neighbor 10.0.0.5
```

- These commands configure BFD per-link in RFC 7130 mode over an L3 port channel.

Switch 1 configuration:

```
switch1(config)#interface port-channel 5
switch1(config-if-Po5)#no switchport
switch1(config-if-Po5)#bfd per-link rfc-7130
switch1(config-if-Po5)#ip address 10.0.0.5/24
switch1(config-if-Po5)#bfd neighbor 10.0.0.4
```

Switch 2 configuration:

```
switch2(config)#interface port-channel 5
switch2(config-if-Po5)#no switchport
switch2(config-if-Po5)#bfd per-link rfc-7130
switch2(config-if-Po5)#ip address 10.0.0.4/24
switch2(config-if-Po5)#bfd neighbor 10.0.0.5
```
37.2.3 Configuring the Echo Function

The echo function is disabled by default, and is enabled on an interface using the `bfd echo` command. When the BFD echo function is enabled, a “slow-timer” value replaces the minimum receive interval value in BFD packets sent from the switch. The default value is 2000 milliseconds. To configure a different value for the slow-timer, use the `bfd slow-timer` command.

**Examples**

- These commands enable the BFD echo function on Ethernet interface 5. If a slow-timer value has been configured on the switch, the minimum receive rate expected from the BFD neighbor will be reset to that value; otherwise, the minimum receive rate will be set to 2000 milliseconds.
  
  ```
  switch(config)#interface ethernet 5
  switch(config-if-Et5)#bfd echo
  switch(config-if-Et5)#
  ```

- This command configures BFD to expect control packets from the peer every 10000 milliseconds when the BFD echo function is enabled.
  
  ```
  switch(config)#bfd slow-timer 10000
  switch(config)#
  ```

37.2.4 Configuring BFD for PIM

The `bfd (Router-PIM Sparse-mode)` command enables or disables Bidirectional Forwarding Detection (BFD) globally for all protocol-independent multicast (PIM) neighbors.

To enable or disable PIM BFD on a specific interface, use the `pim ipv4 bfd` command. The interface-level configuration supersedes the global setting.

**Example**

- These commands enable PIM BFD globally on the switch in the default VRF, enabling it on all PIM-SM interfaces where it is not explicitly disabled.
  
  ```
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#bfd
  switch(config-router-pim-sparse-ipv4)#
  ```

- These commands configure VLAN interface 200 to use BFD for PIM-SM connection failure detection regardless of the global PIM BFD configuration.
  
  ```
  switch(config)#interface vlan 200
  switch(config-if-VL200)#pim ipv4 bfd
  switch(config-if-VL200)#
  ```

37.2.5 Configuring BFD for BGP

To enable or disable Bidirectional Forwarding Detection (BFD) for border gateway protocol (BGP) connections with a BGP neighbor or peer group, use the `neighbor bfd` command.

**Example**

- These commands enable BFD failure detection for BGP connections with the neighbor at 10.13.64.1.
  
  ```
  switch(config)#router bgp 300
  switch(config-router-bgp)#neighbor 10.13.64.1 bfd
  switch(config-router-bgp)#
  ```
37.2.6 Configuring BFD for VRRP

To enable or disable Bidirectional Forwarding Detection (BFD) for virtual router redundancy protocol (VRRP), use the `vrrp bfd ip` command.

When enabled, BFD provides failure detection for a 2-router VRRP system. When the master is configured with the physical IP address of the backup router, and the backup is configured with the address of the master, a BFD session is established between them. If the BFD session goes down, the backup router immediately assumes the master role.

VRRP master advertisement packets are still sent even when the BFD session is established to accommodate VRRP systems involving more than two routers.

Example

- These commands enable BFD on Ethernet interface 3/20 for VRRP ID 15 with a connection to a router at IP address 192.168.2.1.

```
switch(config)#interface ethernet 3/20
switch(config-if-Et3/20)#vrrp 15 bfd ip 192.168.2.1
switch(config-if-Et3/20)#
```

37.2.7 Configuring BFD for OSPF

To enable or disable BFD globally for all OSPF neighbors, use the `bfd default (OSPF)` command in OSPF configuration mode.

To enable or disable BFD for OSPF on a specific interface, use the `ip ospf neighbor bfd` command. The interface-level configuration supersedes the global setting.

Example

- These commands enable BFD in OSPF instance 100 for all OSPF neighbors on BFD-enabled interfaces except those connected to interfaces on which OSPF BFD has been explicitly disabled.

```
switch(config)#router ospf 100
switch(config-router-ospf)#bfd default
switch(config-router-ospf)#
```

- This command enables OSPF BFD on Ethernet interface 3/21.

```
switch(config)#interface ethernet 3/21
switch(config-if-Et3/21)#ip ospf neighbor bfd
switch(config-if-Et3/21)#
```

37.2.8 Configure BFD for IS-IS

The `isis bfd` and `isis bfd` commands configure Bidirectional Forwarding Detection (BFD), a low overhead protocol designed to provide rapid detection of failures at any protocol layer in the path between adjacent forwarding engines over any media. BFD is supported for IS-IS IPv4 routes.

Examples

- These commands enable BFD for all the interfaces on which IS-IS is enabled. By default BFD is disabled on all the interfaces.

```
switch(config)#router isis 1
switch(config-router-isis)#address-family ipv4
switch(config-router-af)#bfd default
switch(config-router-af)#
```
• These commands enable BFD on IS-IS interfaces.

```
switch(config)#interface Ethernet 5/6
switch(config-if-Et5/6)#isis bfd
switch(config-if-Et5/6)#
```

### 37.2.9 Displaying BFD Neighbor Information

Use the `show bfd peers` command to display information about Bidirectional Forwarding Detection (BFD) neighbors.

**Example**

• This command displays general information about BFD neighbors.

```
switch>show bfd peers
DstAddr       MyDisc  YoDisc  If            LUp     LDown  Ldiag           Stat
------------  -----    -----    -------        -------  -------  -------         ------
10.168.1.56   16      13      et52_1(81)    17151450 0      No Diagnostic    Up
10.168.1.58   17      14      et52_2(65)    17151883 0      No Diagnostic    Up
10.168.1.24   18      15      et51_1(73)    17152175 0      No Diagnostic    Up
```

• This command displays detailed information about BFD neighbors.

```
switch>show bfd peers detail
Peer Addr 10.168.1.56, Intf Ethernet52/1, State Up
VRF default, LAddr 10.168.1.57, LD/RD 16/13
Last Up 17151450
Last Down 0
Last Diag: No Diagnostic
TxInt: 300, RxInt: 300, Multiplier: 3
Received RxInt: 300, Received Multiplier: 3
Rx Count: 433987, Tx Count: 433829
Detect Time: 900
Registered protocols: bgp

Peer Addr 10.168.1.58, Intf Ethernet52/2, State Up
VRF default, LAddr 10.168.1.59, LD/RD 17/14
Last Up 17151883
Last Down 0
Last Diag: No Diagnostic
TxInt: 300, RxInt: 300, Multiplier: 3
Received RxInt: 300, Received Multiplier: 3
Rx Count: 434235, Tx Count: 434050
Detect Time: 900
Registered protocols: bgp
<--------OUTPUT OMITTED FROM EXAMPLE--------->
37.3 BFD Commands

BFD Configuration Command
- bfd echo
- bfd interval
- bfd local-address
- bfd neighbor
- bfd per-link
- bfd slow-timer

BFD Display Commands
- show bfd peers

PIM-BFD Configuration Commands
- bfd (Router-PIM Sparse-mode)
- pim ipv4 bfd

BGP-BFD Configuration Commands
- neighbor bfd

VRRP-BFD Configuration Commands
- vrrp bfd ip

OSPF-BFD Configuration Commands
- bfd default (OSPF)
- ip ospf neighbor bfd

ISIS-BFD Configuration Commands
- isis bfd
- isis bfd
**bfd (Router-PIM Sparse-mode)**

The **bfd (Router-PIM Sparse-mode)** command enables Bidirectional Forwarding Detection (BFD) globally for use as a failure-detection mechanism for Protocol-Independent Multicast Sparse-Mode (PIM-SM) on the switch. To override the global configuration for a specific interface, use the `pim ipv4 bfd` command. All PIM-SM interfaces will use the global setting if they are not individually configured.

When PIM BFD is enabled, a BFD session is created for each PIM-SM neighbor and used to detect a loss of connectivity with the neighbor. PIM hello packets are still exchanged with PIM-SM neighbors when BFD is enabled.

The **no bfd** and **default bfd** commands disable PIM BFD globally by deleting the `bfd` statement from `running-config`. When this is done, only interfaces with PIM BFD explicitly enabled will use PIM BFD.

**Command Mode**
- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration

**Command Syntax**
- `bfd`
- `no bfd`
- `default bfd`

**Example**
- These commands enable PIM BFD globally on the switch in the default VRF, enabling it on all PIM-SM interfaces where it is not explicitly disabled.

```
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#bfd
switch(config-router-pim-sparse-ipv4)#
```
**bfd default (ISIS)**

The `bfd default` command places the switch in address-family configuration mode.

The `bfd default` and `isis bfd` commands configure Bidirectional Forwarding Detection (BFD), a low overhead protocol designed to provide rapid detection of failures at any protocol layer in the path between adjacent forwarding engines over any media. BFD is supported for IS-IS IPv4 routes.

**Command Mode**

Router-Address-Family Configuration

**Command Syntax**

`bfd default`

**Example**

- These commands enable BFD for all the interfaces on which IS-IS is enabled. By default BFD is disabled on all the interfaces.

  ```
  switch(config)#router isis 1
  switch(config-router-isis)#address-family ipv4
  switch(config-router-af)#bfd default
  switch(config-router-af)#
  ```
**bfd default (OSPF)**

The `bfd default` command globally configures OSPF to use Bidirectional Forwarding Detection (BFD). When this command is issued, BFD sessions will be established with all OSPF neighbors connected to BFD-enabled interfaces unless OSPF BFD has been disabled on a participating interface using the `ip ospf neighbor bfd` command. BFD is globally disabled in OSPF by default.

For OSPF BFD to function on an interface, BFD must also be enabled and configured on that interface using the `bfd interval` command.

The `no bfd default` and `default bfd default` commands disable OSPF BFD on all interfaces except those where it has been explicitly enabled using the `ip ospf neighbor bfd` command.

**Command Mode**

Router-OSPF Configuration

**Command Syntax**

```
bfd default
no bfd default
default bfd default
```

**Examples**

These commands enable BFD for OSPF instance 100 on all interfaces except those on which OSPF BFD has been explicitly disabled.

```
switch(config)#router ospf 100
switch(config-router-ospf)#bfd default
switch(config-router-ospf)#
```
**bfd echo**

The `bfd echo` command enables the BFD echo function on the configuration mode interface.

The `no bfd echo` and `default bfd echo` commands disable the BFD echo function by removing the corresponding `bfd echo` command from `running-config`.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
bfd echo
no bfd echo
default bfd echo
```

**Example**

- These commands enable the BFD echo function on Ethernet interface 5. If a slow-timer value has been configured on the switch, the minimum receive rate expected from the BFD neighbor will be reset to that value; otherwise, the minimum receive rate will be set to 2000 milliseconds.

  ```
  switch(config)#interface ethernet 5
  switch(config-if-Et5)#bfd echo
  switch(config-if-Et5)#
  ```
**bfd interval**

The `bfd interval` command configures the BFD control packet transmission rate, minimum control packet receive rate, and the number of missed packets that will signal that the session is down. These parameters can be configured globally for the switch or for the configuration mode interface. If a parameter is configured both globally and on the interface, the value configured on the interface takes precedence.

**Important!**

For a BFD session to be established, BFD must be enabled for any routing protocol using BFD for failure detection.

The `no bfd interval` and `default bfd interval` commands return the BFD parameters on the configuration mode interface to default values by removing the corresponding `bfd interval` command from `running-config`.

**Command Mode**

- Global Configuration
- Interface-Ethernet Configuration
- Interface-Loopback Configuration
- Interface-Management Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
    bfd interval transmit_rate min_rx receive_minimum multiplier factor
    no bfd interval
    default bfd interval
```

**Parameters**

- `transmit_rate` rate in milliseconds at which control packets will be sent. Values range from 50 to 60000; the default value is 300.
- `receive_minimum` rate in milliseconds at which control packets will be expected. Values range from 50 to 60000.
- `factor` number of consecutive missed BFD control packets after which BFD will declare the session as down. Values range from 3 to 50.

**Examples**

- These commands configure BFD on Ethernet interface 5 to expect packets from the peer every 200 milliseconds and declare the session down after failing to receive 5 consecutive packets. This configuration overrides any values configured globally.

  ```
  switch(config)#interface ethernet 5
  switch(config-if-Et5)#bfd interval 200 min_rx 200 multiplier 5
  switch(config-if-Et5)#
  ```
**bfd local-address**

The `bfd local-address` command specifies the local L3 address for use in Bidirectional Forwarding Detection (BFD). When configuring an L2 interface, specification of a local L3 address is required in order to run BFD per-link in RFC 7130 mode. (This is not necessary when configuring an L3 interface with an IP address configured on the port channel.)

The `no bfd local-address` and `default bfd local-address` commands remove the local L3 address by removing the corresponding `bfd local-address` command from `running-config`.

**Command Mode**

- Global Configuration

**Command Syntax**

```
  bfd local-address address
  no bfd local-address [address]
  default bfd local-address [address]
```

**Parameters**

- `address` local IPv4 or IPv6 address for BFD.

**Example**

- This command specifies the local L3 address for BFD.
  ```
  switch(config)#bfd local-address 10.0.0.4
  ```
  ```
  switch(config#)```
**bfd neighbor**

The `bfd neighbor` command specifies the L3 address of the BFD neighbor of the port channel being configured. This is required to run BFD per-link in RFC 7130 mode. For an L2 port channel, this address should be the BFD per-link “local address” globally configured on the peer switch. For an L3 port channel, this address should be the IP address configured on the peer port channel.

The `no bfd neighbor` and `default bfd neighbor` commands remove the BFD neighbor address by removing the corresponding `bfd neighbor` command from `running-config`.

**Command Mode**

  Interface-Port-channel Configuration

**Command Syntax**

```
  bfd neighbor address
  no bfd neighbor [address]
  default bfd neighbor [address]
```

**Parameters**

- `address` IPv4 or IPv6 address of the port channel’s BFD neighbor.

**Example**

- These commands specify the L3 address of the port channel’s BFD neighbor.

  ```
  switch(config)#interface port-channel 5
  switch(config-if-Po5)#bfd neighbor 10.0.0.5
  switch(config-if-Po5)#
  ```
**bfd per-link**

The `bfd per-link` command enables the BFD per-link function on the port channel being configured. When BFD per-link is enabled, BFD sub-sessions are run on each link of the port channel; BFD considers the port-channel to be “up” as long as any one of the links is live.

BFD per-link runs by default in legacy mode, which allows downed links to remain members of the port channel and relies on LACP or other means to prune the dead links. Legacy mode is provided for interoperability with older switches.

RFC 7130 mode runs BFD per-link in full compliance with RFC 7130, and automatically removes links in down state from the port-channel, then adds them back again when they come up. Use the `rfc-7130` keyword to enable per-link in RFC 7130 mode. You must also configure an L3 BFD neighbor address for each port-channel running RFC 7130 per-link using the `bfd neighbor` command. When configuring an L2 interface, you must also globally configure a local L3 BFD address on the switch using the `bfd local-address` command.

For the BFD session to come up, both peers must be configured in the same way (either RFC-7130 or legacy mode).

The `no bfd per-link` and `default bfd per-link` commands disable the BFD per-link function by removing the corresponding `bfd per-link` command from `running-config`.

**Command Mode**

Interface-Port-channel Configuration

**Command Syntax**

```
bfd per-link [rfc-7130]
no bfd per-link [rfc-7130]
default bfd per-link [rfc-7130]
```

**Example**

- These commands enable the BFD per-link function in legacy mode on port channel 5.

```
switch(config)#interface port-channel 5
switch(config-if-Po5)#bfd per-link
switch(config-if-Po5)#
```

- These commands globally specify a local L3 BFD address for the switch, enable the BFD per-link function in RFC 7130 mode on port channel 5, and specify the L3 address of the port channel’s BFD neighbor.

```
switch(config)#bfd local-address 10.0.0.5
switch(config)#interface port-channel 5
switch(config-if-Po5)#bfd per-link rfc-7130
switch(config-if-Po5)#bfd neighbor 10.0.0.4
switch(config-if-Po5)#
```
**bfd slow-timer**

The `bfd slow-timer` command configures the minimum reception rate for BFD control packets which will be used if the BFD echo function is enabled. The default value is 2000 milliseconds.

**Important!** For a BFD session to be established, BFD must be enabled for any routing protocol using BFD for failure detection.

The `no bfd slow-timer` and `default bfd slow-timer` commands return the BFD slow-timer to the default value of 2000 milliseconds by removing the corresponding `bfd interval` command from `running-config`.

**Command Mode**
Global Configuration

**Command Syntax**
```
  bfd slow-timer  receive_minimum
  no bfd slow-timer
  default bfd slow-timer
```

**Parameters**
- `receive_minimum` rate in milliseconds at which control packets will be expected when the BFD echo function is enabled. Values range from 2000 to 60000; default value is 2000.

**Examples**
- This command configures BFD to expect control packets from the peer every 10000 milliseconds when the BFD echo function is enabled.
  ```
  switch(config)#bfd slow-timer 10000
  switch(config)#
  ```
ip ospf neighbor bfd

The `ip ospf neighbor bfd` command enables Bidirectional Forwarding Detection (BFD) for the open shortest path first protocol (OSPF) on the configuration mode interface regardless of the global settings for the OSPF instance. All OSPF neighbors associated with the interface become BFD peers, and OSPF uses BFD for failure detection.

For OSPF BFD to function on an interface, BFD must also be enabled and configured on that interface using the `bfd interval` command.

The `no ip ospf neighbor bfd` command disables OSPF BFD on the interface and terminates all BFD sessions with the interface’s OSPF peers. The `default ip ospf neighbor bfd` command causes the interface to follow global OSPF BFD settings configured by the `bfd default (OSPF)` command.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

- `ip ospf neighbor bfd`
- `no ip ospf neighbor bfd`
- `default ip ospf neighbor bfd`

**Example**

- These commands enable BFD on Ethernet interface 3/20.

  ```
  switch(config)#interface ethernet 3/20
  switch(config-if-Et3/20)#ip ospf neighbor bfd
  switch(config-if-Et3/20)#
  ```

- These commands cause Ethernet interface 3/20 to follow the global OSPF BFD configuration.

  ```
  switch(config)#interface ethernet 3/20
  switch(config-if-Et3/20)#default ip ospf neighbor bfd
  switch(config-if-Et3/20)#
  ```
### isis bfd

The **isis bfd** command activates the corresponding IS-IS routing instance on the configuration mode interface. By default, the IS-IS routing instance is not enabled on an interface.

The **no isis enable** and **default isis enable** commands disable IS-IS on the configuration mode interface by removing the corresponding **isis enable** command from **running-config**.

#### Command Mode
- Interface-Ethernet Configuration

#### Command Syntax

- **isis bfd**
- **no isis bfd**
- **default isis bfd**

#### Examples

- These commands enable BFD on IS-IS interfaces.
  ```text
  switch(config)#interface Ethernet 5/6
  switch(config-if-Et5/6)#isis bfd
  switch(config-if-Et5/6)#
  ```
neighbor bfd

The `neighbor bfd` command enables Bidirectional Forwarding Detection (BFD) for use as a failure detection mechanism for border gateway protocol (BGP) connections to the specified BGP neighbor or peer group.

Once a BFD session is established with a BGP neighbor, if the BFD session goes down the status of the BGP session is changed to “down” as well.

The `no neighbor bfd` and `default neighbor bfd` commands disable BFD for BGP connections to the specified neighbor or peer group by removing the corresponding `neighbor bfd` command from `running-config`.

**Command Mode**
Router-BGP Configuration

**Command Syntax**

```
neighbor NEIGHBOR_ID bfd
no neighbor NEIGHBOR_ID bfd
default neighbor NEIGHBOR_ID bfd
```

**Parameters**

- `NEIGHBOR_ID` IP address or peer group name. Values include:
  - `ipv4_addr` neighbor’s IPv4 address.
  - `ipv6_addr` neighbor’s IPv6 address.
  - `group_name` peer group name.

**Example**

- These commands enable BFD failure detection for BGP connections with the neighbor at 10.13.64.1.

```
switch(config)#router bgp 300
switch(config-router-bgp)#neighbor 10.13.64.1 bfd
switch(config-router-bgp)#
```
**pim ipv4 bfd**

The `pim ipv4 bfd` command enables Bidirectional Forwarding Detection (BFD) on the configuration mode interface as a failure detection mechanism for Protocol-Independent Multicast Sparse-Mode (PIM-SM). To enable PIM BFD globally on the switch, use the `bfd` (Router-PIM Sparse-mode) command. Interface-level settings override the global setting.

When PIM BFD is enabled, a BFD session is created for each PIM-SM neighbor and used to detect a loss of connectivity with the neighbor. PIM-SM hello packets are still exchanged with PIM-SM neighbors when BFD is enabled.

The `no pim ipv4 bfd` disables PIM BFD on the configuration mode interface regardless of global settings. The `default pim ipv4 bfd` command causes the configuration mode interface to follow the global setting for PIM BFD by removing the corresponding `pim ipv4 bfd` statement from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
```
pim ipv4 bfd
no pim ipv4 bfd
default pim ipv4 bfd
```

**Example**
- These commands configure VLAN interface 200 to use BFD for PIM-SM connection failure detection regardless of the global PIM BFD configuration.
```
switch(config)#interface vlan 200
switch(config-if-VL200)#pim ipv4 bfd
switch(config-if-VL200)#
```
show bfd peers

The `show bfd peers` command displays information about the neighbors with which the switch currently has a Bidirectional Forwarding Detection (BFD) session.

**Command Mode**

EXEC

**Command Syntax**

```
show bfd peers [INFO_LEVEL]
```

**Parameters**

- `INFO_LEVEL` amount of information that is displayed. Options include:
  - `<no parameter>` command displays data block for each specified interface.
  - `detail` command displays table that summarizes interface data.

**Display Values**

- `DstAddr` IP address of the BFD neighbor.
- `MyDisc` Local discriminator value of the BFD session.
- `YoDisc` Neighbor’s discriminator value for the BFD session.
- `If` Interface to which the neighbor is connected.
- `LUp` Last up.
- `LDown` Last down.
- `Ldiag` Diagnostic for the last change in session state.
- `State` State of the BFD session.
- `TxInt` Transmit interval of the local interface.
- `RxInt` Minimum receive interval set on the local interface.
- `Multiplier` Local multiplier (number of packets that must be missed to declare session down).
- `Received RxInt` Minimum receive interval set on the neighbor interface.
- `Received Multiplier` Neighbor’s multiplier (number of packets that must be missed to declare session down).
- `Rx Count` BFD control packets transmitted.
- `Tx Count` BFD control packets received.
- `Detect Time` Total time in milliseconds it takes for BFD to detect connection failure.
- `Registered Protocols` Protocols using BFD with this neighbor.
Examples

- This command displays general information about BFD neighbors.

  switch>show bfd peers
  DstAddr MyDisc YoDisc If       LUp      LDown  Ldiag             S
  10.168.1.56  16      13      et52_1(81) 17151450 0       No
  Diagnostic  Up
  10.168.1.58  17      14      et52_2(65) 17151883 0       No
  Diagnostic  Up
  10.168.1.24  18      15      et51_1(73) 17152175 0       No
  Diagnostic  Up
  10.168.254.6 19      12      vlan4094(26) 17152336 0       No
  Diagnostic  Up
  10.168.1.26  20      16      et51_2(57) 17152523 0       No
  Diagnostic  Up
  10.168.1.40  21      12      et50_1(77) 17152966 0       No
  Diagnostic  Up
  10.168.1.42  22      13      et50_2(61) 17153488 0       No
  Diagnostic  Up
  10.168.1.8   27      55      et49_1(69) 26710447 0       No
  Diagnostic  Up
  10.168.1.10  28      56      et49_2(53) 26710847 0       No
  Diagnostic  Up

- This command displays detailed information about BFD neighbors.

  switch>show bfd peers detail
  Peer Addr 10.168.1.56, Intf Ethernet52/1, State Up
  VRF default, LAddr 10.168.1.57, LD/RD 16/13
  Last Up 17151450
  Last Down 0
  Last Diag: No Diagnostic
  TxInt: 300, RxInt: 300, Multiplier: 3
  Received RxInt: 300, Received Multiplier: 3
  Rx Count: 433987, Tx Count: 433829
  Detect Time: 900
  Registered protocols: bgp

  Peer Addr 10.168.1.58, Intf Ethernet52/2, State Up
  VRF default, LAddr 10.168.1.59, LD/RD 17/14
  Last Up 17151883
  Last Down 0
  Last Diag: No Diagnostic
  TxInt: 300, RxInt: 300, Multiplier: 3
  Received RxInt: 300, Received Multiplier: 3
  Rx Count: 434235, Tx Count: 434050
  Detect Time: 900
  Registered protocols: bgp

switch>
vrrp bfd ip

The `vrrp bfd ip` command enables and configures Bidirectional Forwarding Detection (BFD) for virtual router redundancy protocol (VRRP) on the configuration mode interface.

When enabled, BFD provides failure detection for a 2-router VRRP system. When the master is configured with the physical IP address of the backup router, and the backup is configured with the address of the master, a BFD session is established between them. If the BFD session goes down, the backup router immediately assumes the master role.

VRRP master advertisement packets are still sent even when the BFD session is established to accommodate VRRP systems involving more than two routers.

The `no vrrp bfd ip` and `default vrrp bfd ip` commands disable BFD for VRRP on the configuration mode interface by removing the corresponding `vrrp bfd ip` statement from `running-config`. The `no vrrp` command also removes the `vrrp bfd ip` command for the specified virtual router.

Command Mode
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

Command Syntax
```
vrrp group bfd ip ipv4_address
no vrrp group bfd ip
default vrrp group bfd ip
```

Parameters
- `group` virtual router identifier (VRID). Values range from 1 to 255.
- `ipv4_address` IPv4 address of the other VRRP router. On the master router, enter the physical IP address of the backup; on the backup, enter the physical IP address of the master.

Example
- These commands enable BFD on Ethernet interface 3/20 for VRRP ID 15 with a connection to a router at IP address 192.168.2.1.

```
switch(config)#interface ethernet 3/20
switch(config-if-Et3/20)#vrrp 15 bfd ip 192.168.2.1
switch(config-if-Et3/20)#
```