Configure and Verify BFD on Nexus 9000 Switches

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Introduction

This document describes how to configure and verify Bidirectional Forwarding Detection (BFD) sessions across Cisco Nexus NXOS® based switches.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Nexus NX-OS Software
- Bidirectional Forwarding Detection (BFD)
- Routing Protocols: Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), and Enhanced Interior Gateway Routing Protocol (EIGRP)

Components Used

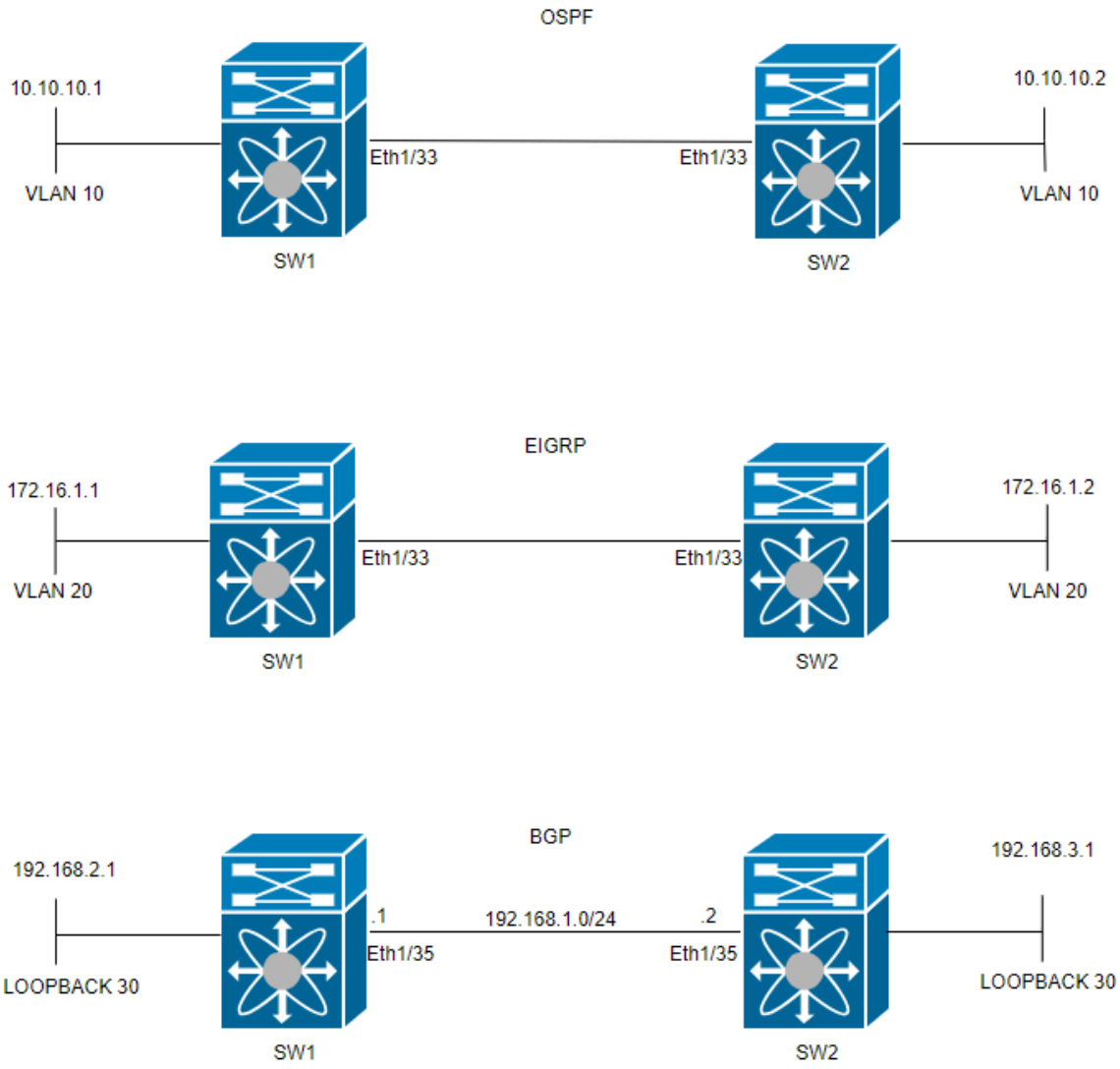
The information in this document is based on:

- Cisco Nexus 9000 with NXOS Version 10.3(4a).M

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Configure

Network Diagram



Configure

The purpose of configuring BFD is to detect and understand the differences among the configurations of various routing protocols.

Step 1. You must enable the BFD feature before you can configure BFD on an interface and protocol.

SWITCH 1	SWITCH 2
`SW1(config)# feature bfd`	`SW2(config)# feature bfd`

Step 2. Configuring Global BFD

SWITCH 1	SWITCH 2
SW1(config)# bfd interval 500 min_rx 500 multiplier 3	SW2(config)# bfd interval 500 min_rx 500 multiplie

Note: The min_tx and msec range is from 50 to 999 milliseconds and the default is 50. The multiplier range is from 1 to 50 and the multiplier default is 3.

Step 3. Configuring BFD on an interface.

Note: You can configure the BFD session parameters for all BFD sessions on an interface.

Note: Ensure the Internet Control Message Protocol (ICMP) redirect messages are disabled on BFD-enabled interfaces. Use the no IP redirects command or the no IPv6 redirects command on the interface.

SWITCH 1	SWITCH 2
SW1(config)# interface vlan 20 SW1(config-if)# bfd interval 500 min_rx 500 multiplier 3 SW1(config-if)# no ip redirects SW1(config-if)# no ipv6 redirects	SW2(config)# interface vlan 20 SW2(config-if)# bfd interval 500 min_rx 500 mul SW2(config-if)# no ip redirects SW2(config-if)# no ipv6 redirects

BFD asynchronous mode is like a handshake between two devices to keep their connection strong. You set it up on both devices, and once it is on, they start sending special messages to each other at a set time. These messages have some important settings, like how often they are sent and how fast one device can respond to the other. There is also a setting that decides how many missed messages it takes for one device to realize there can be a problem with the connection.

The BFD echo function sends test packets to a neighbor and sent back to check for issues without involving the neighbor in packet forwarding. It can use a slower timer to reduce control packet traffic and tests the forwarding path on the neighbors system without bothering the neighbor, making detection faster. If both neighbors use the echo function, there is no asymmetry.

Syslog BFD Down Reasons

- **Path Down**: This indicates the forwarding path between two BFD neighbors is no longer operational, possibly due to network congestion, hardware failure, or other issues.

```
2024 Apr 11 22:07:07 SW2 %BFD-5-SESSION_STATE_DOWN: BFD session 1090519062 to neighbor 172.16.1.1
```

- **Echo Function Failed**: Failure of the echo function, which is a feature of BFD where echo packets are sent and received to verify connectivity. If these packets fail to be transmitted or received successfully, it indicates a problem.

```
2024 Apr 11 22:17:45 SW2 %BFD-5-SESSION_STATE_DOWN: BFD session 1090519174 to neighbor 10.10.10.1
```

- **Neighbor Signaled Session Down**: The neighbor device signals the BFD session is down, typically due to detecting a problem on its end of the connection.

```
2024 Apr 11 22:03:48 SW2 %BFD-5-SESSION_STATE_DOWN: BFD session 1090519058 to neighbor 172.16.1.1
```

- **Control Detection Time Expired**: This occurs when the control detection timer runs out before receiving an expected response from the neighbor, indicating a potential issue with the connection.

```
2024 Apr 11 22:19:31 SW2 %BFD-5-SESSION_STATE_DOWN: BFD session 1090519061 to neighbor 192.168.2.1
```

- **Administratively Down**: The BFD session is intentionally brought down by an administrator, either for maintenance or for configuration changes.

```
2024 Apr 11 22:13:15 SW2 %BFD-5-SESSION_STATE_DOWN: BFD session 1090519064 to neighbor 10.10.10.1
```

Configuring BFD on Routing Protocols

Configuring BFD on OSPF

 **Tip**: When BFD is enabled under OSPF, it becomes active for all interfaces utilizing OSPF. The

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interfaces adopt the globally configured values if adjustments to these values are necessary. Refer to Step 3, 'BFD Configuration on an Interface'.

SWITCH 1	SWITCH 2
SW1(config)# router ospf 1 SW1(config-router)# bfd	SW2(config)# router ospf 1 SW2(config-router)# bfd

It also enables BFD under the OSPF interface when running the command`ip ospf bfd`

SWITCH 1	SWITCH 2
SW1(config)# interface vlan 10 SW1(config-if)# ip ospf bfd	SW2(config)# interface vlan 10 SW2(config-if)# ip ospf bfd

Example Configurations for BFD on OSPF

```
SW1# show running-config ospf

!Command: show running-config ospf
!Running configuration last done at: Wed Apr 10 21:06:31 2024
!Time: Wed Apr 10 21:09:45 2024

version 10.3(4a) Bios:version 01.07
feature ospf

router ospf 1
  bfd

interface Vlan10
  ip router ospf 1 area 0.0.0.0
  ip ospf bfd
```

Configuring BFD on EIGRP

```
SW1(config)# interface vlan 20
SW1(config-if)# ip eigrp 2 bfd
```

Tip: When BFD is enabled under EIGRP, it becomes active for all interfaces utilizing EIGRP (the interfaces adopt the globally configured values.) If adjustments to these values are necessary, refer to Step 3, 'BFD Configuration on an Interface'.

SWITCH 1	SWITCH 2
SW1(config)# router eigrp 2 SW1(config-router)# bfd	SW2(config)# router eigrp 2 SW2(config-router)# bfd

It also enables BFD under an EIGRP interface when running the command ip eigrp instance-tag bfd

SWITCH 1	SWITCH 2
SW1(config)# interface vlan 20 SW1(config-if)# ip eigrp 2 bfd	SW2(config)# interface vlan 20 SW2(config-if)# ip eigrp 2 bfd

Example Configurations for BFD on EIGRP

```
SW1# show running-config eigrp

!Command: show running-config eigrp
!Running configuration last done at: Wed Apr 10 21:24:29 2024
!Time: Wed Apr 10 21:53:08 2024

version 10.3(4a) Bios:version 01.07
feature eigrp

router eigrp 2
  address-family ipv4 unicast
    bfd

interface Vlan20
  ip router eigrp 2
  ip eigrp 2 bfd
```

Configuring BFD on BGP

Note: The update source feature facilitates BGP sessions to utilize the primary IP address of a designated interface as the local address during the establishment of a BGP session with a neighbor. Additionally, it enables BGP to register as a client with BFD.

Note: When configuring BFD sessions on the device, specifying either 'multihop' or 'singlehop' determines the session type. If no keyword is provided, the session type defaults to 'singlehop' when the peer is directly connected. If the peer is not connected, the session type defaults to 'multihop'.

SWITCH 1	SWITCH 2
SW1(config)# router bgp 65001 SW1(config-router)# address-family ipv4 unicast SW1(config-router)# neighbor 192.168.3.1 SW1(config-router-neighbor)# bfd multihop SW1(config-router-neighbor)# update-source loopback30	SW2(config)# router bgp 65002 SW2(config-router)# address-family ipv4 unicast SW2(config-router)# neighbor 192.168.2.1 SW2(config-router-neighbor)# bfd multihop SW2(config-router-neighbor)# update-source loopbac

Example Configurations for BFD on BGP

```
SW1# show running-config bgp

!Command: show running-config bgp
!Running configuration last done at: Thu Apr 11 04:47:53 2024
!Time: Thu Apr 11 06:48:43 2024

version 10.3(4a) Bios:version 01.07
feature bgp

router bgp 65001
  address-family ipv4 unicast
  neighbor 192.168.3.1
    bfd multihop
    remote-as 65002
    update-source loopback30
    ebgp-multihop 5
    address-family ipv4 unicast
```

Verify

After configuring BFD and associating it with a protocol such as OSPF, EIGRP, or BGP; the BFD neighbors must automatically be identified. To confirm this, run this command:

```
show bfd neighbors
```

On Switch 1:

```
SW1# show bfd neighbors

OurAddr         NeighAddr       LD/RD                   RH/RS           Holdown(mult)     State       Int
172.16.1.1      172.16.1.2      1090519059/1090519058 Up                5219(3)           Up          Vla
10.10.10.1      10.10.10.2      1090519060/1090519059 Up                5219(3)           Up          Vla
192.168.2.1     192.168.3.1     1090519062/1090519061 Up                728(3)            Up          Lo3
SW1#
```

On Switch 2:

```
SW2# show bfd neighbors

OurAddr         NeighAddr       LD/RD                   RH/RS           Holdown(mult)     State       Int
172.16.1.2      172.16.1.1      1090519058/1090519059 Up                5053(3)           Up          Vla
10.10.10.2      10.10.10.1      1090519059/1090519060 Up                5053(3)           Up          Vla
192.168.3.1     192.168.2.1     1090519061/1090519062 Up                745(3)            Up          Lo3
```

To confirm this and obtain detailed output, run this command:

```
SW1# show bfd neighbors interface lo30 details

OurAddr         NeighAddr       LD/RD                   RH/RS           Holdown(mult)     State       Int
192.168.2.1     192.168.3.1     1090519062/1090519061 Up                676(3)            Up          Lo3


Session state is Up and not using echo function

Session type: Multihop
Local Diag: 0, Demand mode: 0, Poll bit: 0, Authentication: None
MinTxInt: 250000 us, MinRxInt: 250000 us, Multiplier: 3
Received MinRxInt: 250000 us, Received Multiplier: 3
Holdown (hits): 750 ms (0), Hello (hits): 250 ms (82590)
Rx Count: 82588, Rx Interval (ms) min/max/avg: 207/1764/219 last: 73 ms ago
Tx Count: 82590, Tx Interval (ms) min/max/avg: 219/219/219 last: 67 ms ago
Registered protocols:  bgp
Uptime: 0 days 5 hrs 2 mins 2 secs, Upcount: 1
Last packet: Version: 1               - Diagnostic: 0
             State bit: Up            - Demand bit: 0
             Poll bit: 0              - Final bit: 0
             Multiplier: 3            - Length: 24
             My Discr.: 1090519061    - Your Discr.: 1090519062
             Min tx interval: 250000  - Min rx interval: 250000
             Min Echo interval: 0     - Authentication bit: 0
Hosting LC: 1, Down reason: None, Reason not-hosted: None



SW2# show bfd neighbors interface vlan 20  details
```

```
OurAddr         NeighAddr       LD/RD                  RH/RS           Holdown(mult)     State       Int
172.16.1.2      172.16.1.1      1090519058/1090519059 Up              4979(3)           Up          Vla


Session state is Up and using echo function with 500 ms interval

Session type: Singlehop
Local Diag: 0, Demand mode: 0, Poll bit: 0, Authentication: None
MinTxInt: 500000 us, MinRxInt: 2000000 us, Multiplier: 3
Received MinRxInt: 2000000 us, Received Multiplier: 3
Holdown (hits): 6000 ms (0), Hello (hits): 2000 ms (12454)
Rx Count: 12444, Rx Interval (ms) min/max/avg: 109/1919/1908 last: 1020 ms ago
Tx Count: 12454, Tx Interval (ms) min/max/avg: 1906/1906/1906 last: 856 ms ago
Registered protocols:  eigrp
Uptime: 0 days 6 hrs 35 mins 10 secs, Upcount: 2
Last packet: Version: 1               - Diagnostic: 0
             State bit: Up            - Demand bit: 0
             Poll bit: 0              - Final bit: 0
             Multiplier: 3            - Length: 24
             My Discr.: 1090519059    - Your Discr.: 1090519058
             Min tx interval: 500000  - Min rx interval: 2000000
             Min Echo interval: 500000 - Authentication bit: 0
Hosting LC: 1, Down reason: None, Reason not-hosted: None
```

Verify Using Session Details

```
SW1# sh bfd clients
              Client : Number of sessions
                 bgp : 1
                ospf : 1
               eigrp : 1

SW1# show system internal bfd sess-store interface vlan 10
No of sessions:  1  >>>>> Check Number of sessions
0x4100001b - 0x41000019 Hosting LC: 1 10.10.10.1 -> 10.10.10.2 bsid 0 >>>>> Check IP addresses
 BFD_SESS_ST_SESSION_UP for 0 days 0:6:22 594 >>>>> Check uptime
  Vlan10 [2 0x901000a:0x43 0:10 0x1000c 0x1000c]
  SMAC: 4464.3c81.ddd7 DMAC: 4464.3c81.cdb7
  Local  TX/RX/ST(ms): 500/500/2000000 Mult: 3   EchoRx: 50000 Ver:1 Flags(0x0):
 Echo  Auth Interop (Disabled) Auth(0 0 0) Group id 0x0
  Active TX/RX/ST(ms): 2000/2000/2000000 Mult: 3   State: 3 Diag: 0x0 Flags: 0xc
0000 Auth(0 0 0)
  Spray DIs: 0
 Port-Lcs:
  Module 1 has 2 links - ACL not programmed
 Applications:
   (1) ospf [0x1:0x41000119 flags 0x0]
     App Data   : [c0a80301000]
     Description:  10.10.10.2
     MTS Dest 0xfe000001:0x140
 No-Host reason: 0x0(SUCCESS)
 Counters:  >>>>>>>> Check the counters below
   Retries: LC remove(0), ACL Inst/Rem(0/0), Redisc(0)
   No. of ACLs Added(1)
```

```
 Flap counters:
   Ctrl Detect timer expired(0), Echo failed(0), Neigh Signaled down(0), Admin d
own(0),
   Forwarding plane reset(0), Path down(0), Concat path down(0), Rev Concat path
 down(0)
 Last ACL added time: 58781 usecs after Thu Apr 11 22:18:19 2024
 Last ACL response time: 81830 usecs after Thu Apr 11 22:18:19 2024
 Last session install time: 58285 usecs after Thu Apr 11 22:18:19 2024
 Last session install response time: 58717 usecs after Thu Apr 11 22:18:19 2024
```

Verify Using Access-List

```
SW2# show system internal access-list vlan 10 input statistics

slot  1
=======


INSTANCE 0x0
---------------

  Tcam 12 resource usage:
  ----------------------
  LBL M = 0x1
   Bank 0
   ------
     IPv4 Class
       Policies: BFD()  [Merged]
       Netflow profile: 0
       Netflow deny profile: 0
       Entries:
         [Index] Entry [Stats]
         ---------------------
  [0x0000:0x0003:0x0c0d] permit udp 0.0.0.0/0 0.0.0.0/0 range 3784 3785  encap 0x0  [205340] >>>>> This

SW2# show system internal access-list sup-redirect-stats | i i bfd
    3085                                              BFD    12217 >>>>> This counter need to increase
    3121                                 BFDC TCLASS PACKET    0
    3146                                     BFDC v4 PACKET    15
    3148                               BFDC TCLASS V6 PACKET    0
    3156                                     BFDC v6 PACKET    0
    3158                             BFDC v6 LL Ucast PACKET    0
    3209                             BFDC v4 multihop PACKET    383697 >>>>> This counter need to increas
    3121                                 BFDC TCLASS PACKET    0
    3146                                     BFDC v4 PACKET    0
    3148                               BFDC TCLASS V6 PACKET    0
    3156                                     BFDC v6 PACKET    0
    3158                             BFDC v6 LL Ucast PACKET    0
    3209                             BFDC v4 multihop PACKET    0
```

Verify Using Ethanalyzer

An alternative approach is to execute a packet capture, filtering specifically for UDP port 3785:

```
SW1# ethanalyzer local interface inband display-filter "udp.port==3785" limit-captured-frames 0
Capturing on 'ps-inb'
    5 2024-04-11 05:26:37.294596186   10.10.10.1 → 10.10.10.1   BFD Echo 70 Originator specific content
    6 2024-04-11 05:26:37.294623155   10.10.10.1 → 10.10.10.1   BFD Echo 70 Originator specific content
    7 2024-04-11 05:26:37.294635837   172.16.1.1 → 172.16.1.1   BFD Echo 70 Originator specific content
    8 2024-04-11 05:26:37.294653159   172.16.1.1 → 172.16.1.1   BFD Echo 70 Originator specific content
4    18 2024-04-11 05:26:37.780441619   10.10.10.1 → 10.10.10.1   BFD Echo 70 Originator specific content
   19 2024-04-11 05:26:37.780461351   172.16.1.1 → 172.16.1.1   BFD Echo 70 Originator specific content
   20 2024-04-11 05:26:37.780467533   10.10.10.1 → 10.10.10.1   BFD Echo 70 Originator specific content
   21 2024-04-11 05:26:37.780481315   172.16.1.1 → 172.16.1.1   BFD Echo 70 Originator specific content
   30 2024-04-11 05:26:38.266365493   10.10.10.1 → 10.10.10.1   BFD Echo 70 Originator specific content
   31 2024-04-11 05:26:38.266392766   10.10.10.1 → 10.10.10.1   BFD Echo 70 Originator specific content
```

The presence of identical source and destination IP addresses in the captured packets from the BFD Echo protocol is expected, as these Echo packets originate from the local switch itself.



Note: In the absence of the 'no bfd echo' statement under the interface, the capture reveals packets with both the locally sourced IP address and the neighboring destination IP address, along with the observation of BFD Control.

```
SW2# ethanalyzer local interface inband display-filter "ip.addr==192.168.2.1" limit-captured-frames 0
Capturing on 'ps-inb'
    1 2024-04-11 05:38:21.155483591  192.168.2.1 → 192.168.3.1  BFD Control 66 Diag: No Diagnostic, State: Up
    2 2024-04-11 05:38:21.182606602  192.168.3.1 → 192.168.2.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
   11 2024-04-11 05:38:21.375187034  192.168.2.1 → 192.168.3.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
   12 2024-04-11 05:38:21.402295701  192.168.3.1 → 192.168.2.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
4    14 2024-04-11 05:38:21.594612491  192.168.2.1 → 192.168.3.1  BFD Control 66 Diag: No Diagnostic, State: Up,
   15 2024-04-11 05:38:21.621742431  192.168.3.1 → 192.168.2.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
   20 2024-04-11 05:38:21.813971234  192.168.2.1 → 192.168.3.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
8    21 2024-04-11 05:38:21.841086554  192.168.3.1 → 192.168.2.1  BFD Control 66 Diag: No Diagnostic, State: Up,
   22 2024-04-11 05:38:22.033395440  192.168.2.1 → 192.168.3.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
   23 2024-04-11 05:38:22.060526055  192.168.3.1 → 192.168.2.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
   28 2024-04-11 05:38:22.252709432  192.168.2.1 → 192.168.3.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
   29 2024-04-11 05:38:22.279810427  192.168.3.1 → 192.168.2.1  BFD Control 66 Diag: No Diagnostic, State: Up, Fl
```