

Applicable hardware and software versionsContents

Introduction	1
Prerequisites	1
Example: Configuring VRRP-BFD-Track collaboration	1
Network configuration	1
Analysis	2
Applicable hardware and software versions.....	2
Restrictions and guidelines	4
Procedures	5
Configuring interface IP addresses	5
Configuring the interfaces that connect the gateways	5
Disabling the spanning tree feature on uplink interfaces.....	5
Configuring static routes from Device E and Device F to the virtual IP addresses of the VRRP groups...	6
Configuring VRRP groups.....	6
Configuring BFD	7
Configuring Track	7
Configuring MSTP	7
Verifying the configuration	8
Configuration files	12
Example: Configuring BFD for static routing	16
Network configuration	16
Applicable hardware and software versions.....	17
Restrictions and guidelines	19
Procedures	19
Configuring interface IP addresses	19
Configuring static routes	19
Configuring BFD parameters on Device A	20
Verifying the configuration	20
Configuration files	21
Example: Configuring BFD for RIP	23
Network configuration	23
Applicable hardware and software versions.....	24
Restrictions and guidelines	26
Procedures	26
Configuring interface IP addresses	26
Configuring RIP	26
Configuring BFD parameters on Device A	27
Verifying the configuration	27
Configuration files	30
Example: Configuring BFD for OSPF	32
Network configuration	32
Applicable hardware and software versions.....	33
Restrictions and guidelines	35
Procedures	35
Configuring interface IP addresses	35
Configuring OSPF	36
Configuring BFD parameters	36
Verifying the configuration	37
Configuration files	41
Example: Configuring BFD for IS-IS	43
Network configuration	43
Applicable hardware and software versions.....	44

Restrictions and guidelines	46
Procedures	46
Configuring interface IP addresses	46
Configuring IS-IS	46
Configuring BFD parameters	47
Verifying the configuration	47
Configuration files	51
Example: Configuring BFD for BGP.....	53
Network configuration	53
Analysis	54
Applicable hardware and software versions.....	54
Restrictions and guidelines	56
Procedures	56
Configuring interface IP addresses	56
Configuring OSPF in AS 100	56
Configuring BGP	57
Configuring routing policies	58
Configuring BFD	59
Verifying the configuration	59
Configuration files	66
Example: Configuring BFD for PBR.....	70
Network configuration	70
Applicable hardware and software versions.....	70
Restrictions and guidelines	72
Procedures	72
Configuring interface IP addresses	72
Configuring static routes	73
Configuring routing policies on Device A	73
Configuring BFD parameters on Device A	73
Verifying the configuration	74
Configuration files	75

Introduction

This document provides BFD configuration examples.

Prerequisites

This document is not restricted to specific software or hardware versions.

The configuration examples in this document were created and verified in a lab environment, and all the devices were started with the factory default configuration. When you are working on a live network, make sure you understand the potential impact of every command on your network.

This document assumes that you have basic knowledge of BFD, VRRP, Track, OSPF, and IS-IS.

Example: Configuring VRRP-BFD-Track collaboration

Network configuration

As shown in [Figure 1](#):

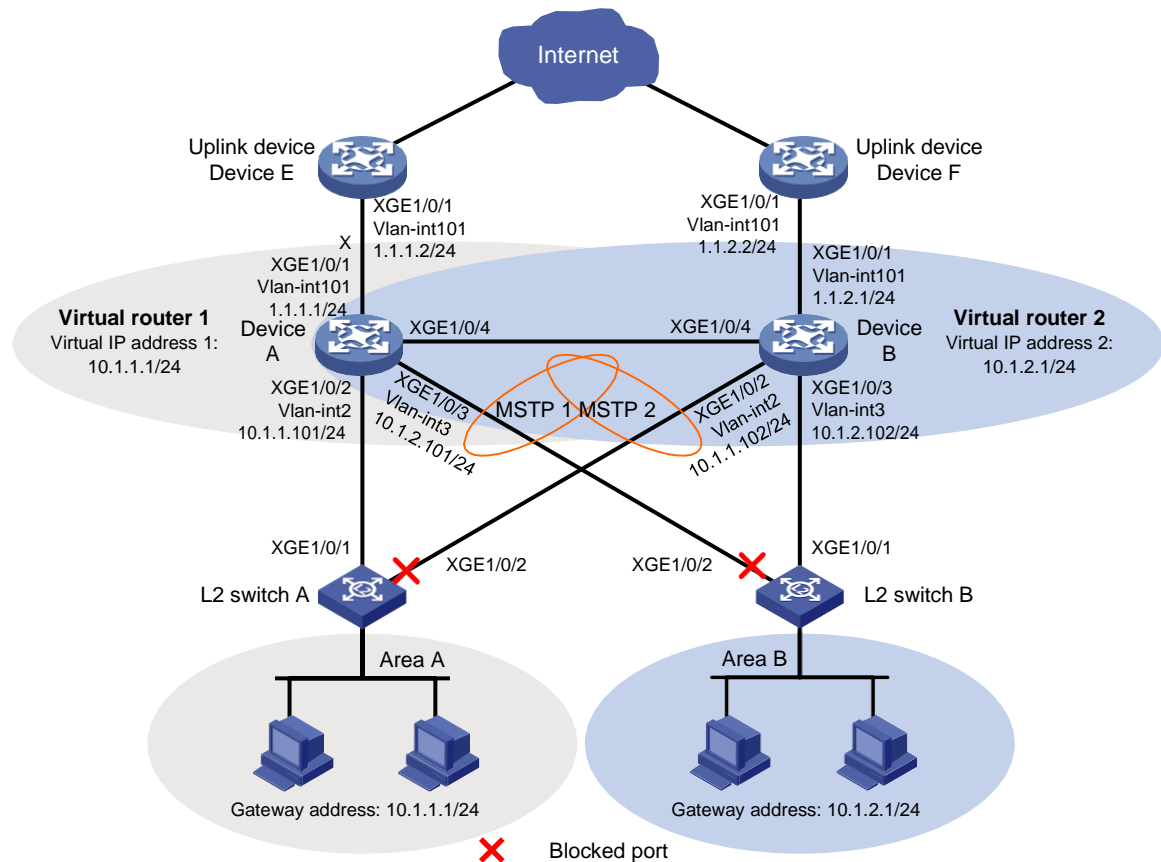
- Two distribution layer devices, Device A and Device B, are deployed at the egress of area A and area B.
- Device A and Device B belong to VRRP group 1 and VRRP group 2.
- Device A is the master in VRRP group 1. Device B is the master in VRRP group 2.
- The default gateway is VRRP group 1 for users in area A and VRRP group 2 for users in area B.

Configure VRRP-Track-BFD collaboration to meet the following requirements:

When Device A and Device B are operating correctly, they forward traffic for users in area A and area B, respectively.

- When one gateway device or the uplink of the device fails, BFD can detect the failure and the other device takes over to implement link switchover.
- When the downlink of a gateway device fails, L2 Switch A or L2 Switch B forwards user traffic to the gateway through interface GigabitEthernet 1/0/2. When the fault is cleared, L2 Switch A or L2 Switch B forwards user traffic to the gateway through interface GigabitEthernet 1/0/1.

Figure 1 Network diagram



Analysis

To meet the network requirements, you must perform the following tasks:

- For Device A to become the master in VRRP group 1, configure a higher priority (110) for Device A in VRRP group 1 (Device B uses the default priority 100). For Device B to become the master in VRRP group 2, configure a higher priority (110) for Device B in VRRP group 2 (Device A uses the default priority 100).
- To enable the failed master to forward traffic when it recovers, configure both VRRP groups to operate in preemptive mode.
- To enable Device A to communicate with Device B by using VRRP advertisement packets and BFD packets of different VLANs, configure the ports connecting Device A and Device B to allow packets from VLAN 2 and VLAN 3 to pass through.
- To eliminate Layer 2 loops, configure MSTP. Map VLAN 2 to MSTI 1 and map VLAN 3 to MSTI 2. The configuration traffic in MSTI 1 and MSTI 2 is forwarded through GigabitEthernet 1/0/1 of L2 Switch A and GigabitEthernet 1/0/1 of L2 Switch B, respectively.
- To prevent MSTP from blocking uplink interface GigabitEthernet 1/0/1 of Device A and Device B, disable the spanning tree feature on the interfaces.

Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Release 63xx

Restrictions and guidelines

When you configure VRRP-BFD-Track collaboration, follow these restrictions and guidelines:

- Make sure the VRRP versions on all devices of the VRRP group are the same.
- The source IP address for BFD echo packets cannot be on the same network segment as any local interface's IP address. Otherwise, a large number of ICMP redirect packets might be sent from the peer, resulting in link congestion.

- The virtual IP address of an IPv4 VRRP group and the downlink interface IP address of the VRRP group must be in the same subnet. Otherwise, the hosts in the subnet might fail to access external networks.

Procedures

Configuring interface IP addresses

1. Configure Device A:

```
<DeviceA> system-view
[DeviceA] vlan 101
[DeviceA-vlan101] port gigabitethernet 1/0/1
[DeviceA-vlan101] quit
[DeviceA] interface vlan-interface 101
[DeviceA-Vlan-interface101] ip address 1.1.1.1 24
[DeviceA-Vlan-interface101] quit
```
2. Configure other devices in the same way Device A is configured. (Details not shown.)

Configuring the interfaces that connect the gateways

1. Configure Device A:
Configure GigabitEthernet 1/0/4 as a trunk port, remove the interface from VLAN 1, and assign it to VLAN 2 and VLAN 3.

```
[DeviceA] interface gigabitethernet 1/0/4
[DeviceA-GigabitEthernet1/0/4] port link-type trunk
[DeviceA-GigabitEthernet1/0/4] undo port trunk permit vlan 1
[DeviceA-GigabitEthernet1/0/4] port trunk permit vlan 2 to 3
[DeviceA-GigabitEthernet1/0/4] port trunk pvid vlan 2
[DeviceA-GigabitEthernet1/0/4] quit
```
2. Configure Device B:
Configure GigabitEthernet 1/0/4 as a trunk port, remove the interface from VLAN 1, and assign it to VLAN 2 and VLAN 3.

```
[DeviceB] interface gigabitethernet 1/0/4
[DeviceB-GigabitEthernet1/0/4] port link-type trunk
[DeviceB-GigabitEthernet1/0/4] undo port trunk permit vlan 1
[DeviceB-GigabitEthernet1/0/4] port trunk permit vlan 2 to 3
[DeviceB-GigabitEthernet1/0/4] port trunk pvid vlan 2
[DeviceB-GigabitEthernet1/0/4] quit
```

Disabling the spanning tree feature on uplink interfaces

1. Disable the spanning tree feature on GigabitEthernet 1/0/1 of Device A:

```
[DeviceA] interface gigabitethernet 1/0/1
[DeviceA-GigabitEthernet1/0/1] undo stp enable
[DeviceA-GigabitEthernet1/0/1] quit
```
2. Disable the spanning tree feature on GigabitEthernet 1/0/1 of Device B:

```
[DeviceB] interface gigabitethernet 1/0/1
[DeviceB-GigabitEthernet1/0/1] undo stp enable
```

```
[DeviceB-GigabitEthernet1/0/1] quit
```

Configuring static routes from Device E and Device F to the virtual IP addresses of the VRRP groups

1. Configure Device E:

Configure static routes to the virtual IP addresses of VRRP group 1 and VRRP group 2.

```
<DeviceE> system-view
[DeviceE] ip route-static 10.1.1.0 255.255.255.0 1.1.1.1
[DeviceE] ip route-static 10.1.2.0 255.255.255.0 1.1.1.1
```

2. Configure Device F:

Configure static routes to the virtual IP addresses of VRRP group 1 and VRRP group 2.

```
<DeviceE> system-view
[DeviceF] ip route-static 10.1.1.0 255.255.255.0 1.1.2.1
[DeviceF] ip route-static 10.1.2.0 255.255.255.0 1.1.2.1
```

Configuring VRRP groups

1. Configure Device A:

Configure the virtual IP address for VRRP group 1, set the preemption delay, and configure the priority of Device A in VRRP group 1.

```
[DeviceA] interface vlan-interface 2
[DeviceA-Vlan-interface2] vrrp vrid 1 virtual-ip 10.1.1.1
[DeviceA-Vlan-interface2] vrrp vrid 1 priority 110
[DeviceA-Vlan-interface2] vrrp vrid 1 preempt-mode delay 500
[DeviceA-Vlan-interface2] quit
```

Configure the virtual IP address for VRRP group 2, and set the preemption delay.

```
[DeviceA] interface vlan-interface 3
[DeviceA-Vlan-interface3] vrrp vrid 2 virtual-ip 10.1.2.1
[DeviceA-Vlan-interface3] vrrp vrid 2 preempt-mode delay 500
[DeviceA-Vlan-interface3] quit
```

2. Configure Device B:

Configure the virtual IP address for VRRP group 1, and set the preemption delay.

```
[DeviceB] interface vlan-interface 2
[DeviceB-Vlan-interface2] vrrp vrid 1 virtual-ip 10.1.1.1
[DeviceB-Vlan-interface2] vrrp vrid 1 preempt-mode delay 500
[DeviceB-Vlan-interface2] quit
```

Configure the virtual IP address for VRRP group 2, set the preemption delay, and configure the priority of Device B in VRRP group 2.

```
[DeviceB] interface vlan-interface 3
[DeviceB-Vlan-interface3] vrrp vrid 2 virtual-ip 10.1.2.1
[DeviceB-Vlan-interface3] vrrp vrid 2 priority 110
[DeviceB-Vlan-interface3] vrrp vrid 2 preempt-mode delay 500
[DeviceB-Vlan-interface3] quit
```

Configuring BFD

1. **Configure Device A:**
Configure the source IP address for BFD echo packets.
`[DeviceA] bfd echo-source-ip 10.10.10.10`
2. **Configure Device B:**
Configure the source IP address for BFD echo packets.
`[DeviceB] bfd echo-source-ip 11.11.11.11`

Configuring Track

1. **Configure Device A:**
Create track entry 1, and associate it with the BFD session to verify the reachability of Device E.
`[DeviceA] track 1 bfd echo interface vlan-interface 101 remote ip 1.1.1.2 local ip 1.1.1.1`
`[DeviceA-track-1] quit`
Associate VRRP group 1 with track entry 1 and decrease the router priority by 20 when the state of track entry 1 changes to negative.
`[DeviceA] interface vlan-interface 2`
`[DeviceA-Vlan-interface2] vrrp vrid 1 track 1 priority reduced 20`
`[DeviceA-Vlan-interface2] quit`
2. **Configure Device B:**
Create track entry 1, and associate it with the BFD session to verify the reachability of Device F.
`[DeviceB] track 1 bfd echo interface vlan-interface 101 remote ip 1.1.2.2 local ip 1.1.2.1`
`[DeviceB-track-1] quit`
Associate VRRP group 2 with track entry 1 and decrease the router priority by 20 when the state of track entry 1 changes to negative.
`[DeviceB] interface vlan-interface 3`
`[DeviceB-Vlan-interface3] vrrp vrid 2 track 1 priority reduced 20`
`[DeviceB-Vlan-interface3] quit`

Configuring MSTP

1. **Configure Device A:**
`[DeviceA] stp region-configuration`
`[DeviceA-mst-region] region-name vrrp`
`[DeviceA-mst-region] instance 1 vlan 2`
`[DeviceA-mst-region] instance 2 vlan 3`
`[DeviceA-mst-region] active region-configuration`
`[DeviceA-mst-region] quit`
`[DeviceA] stp instance 1 root primary`
`[DeviceA] stp instance 2 root secondary`
`[DeviceA] stp global enable`
2. **Configure Device B:**
`[DeviceB] stp region-configuration`


```
[DeviceB-mst-region] region-name vrrp
[DeviceB-mst-region] instance 1 vlan 2
[DeviceB-mst-region] instance 2 vlan 3
[DeviceB-mst-region] active region-configuration
[DeviceB-mst-region] quit
[DeviceB] stp instance 2 root primary
[DeviceB] stp instance 1 root secondary
[DeviceB] stp global enable
```

3. Configure L2 Switch A:

```
<SwitchA> system-view
[SwitchA] stp region-configuration
[SwitchA-mst-region] region-name vrrp
[SwitchA-mst-region] instance 1 vlan 2
[SwitchA-mst-region] active region-configuration
[SwitchA-mst-region] quit
[SwitchA] stp global enable
```

4. Configure L2 Switch B:

```
<SwitchB> system-view
[SwitchB] stp region-configuration
[SwitchB-mst-region] region-name vrrp
[SwitchB-mst-region] instance 2 vlan 3
[SwitchB-mst-region] active region-configuration
[SwitchB-mst-region] quit
[SwitchB] stp global enable
```

Verifying the configuration

1. Verify that the hosts in the LAN can access the external network when Device A and Device B are operating correctly:

Ping 1.1.1.2 from host A in area A.

```
<host A> ping 1.1.1.2
PING 1.1.1.2 (1.1.1.2): 56 data bytes
56 bytes from 1.1.1.2: seq=0 ttl=128 time=22.43 ms
56 bytes from 1.1.1.2: seq=1 ttl=128 time=7.17 ms
56 bytes from 1.1.1.2: seq=2 ttl=128 time=8.91 ms
56 bytes from 1.1.1.2: seq=3 ttl=128 time=7.45 ms
56 bytes from 1.1.1.2: seq=4 ttl=128 time=9.11 ms

--- 1.1.1.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 7.17/11.01/22.43 ms
```

Ping 1.1.2.2 from host C in area B.

```
<host C> ping 1.1.2.2
PING 1.1.2.2 (1.1.2.2): 56 data bytes
56 bytes from 1.1.2.2: seq=0 ttl=128 time=22.43 ms
56 bytes from 1.1.2.2: seq=1 ttl=128 time=7.17 ms
56 bytes from 1.1.2.2: seq=2 ttl=128 time=8.91 ms
56 bytes from 1.1.2.2: seq=3 ttl=128 time=7.45 ms
```

56 bytes from 1.1.2.2: seq=4 ttl=128 time=9.11 ms

--- 1.1.2.2 ping statistics ---

5 packets transmitted, 5 packets received, 0% packet loss

round-trip min/avg/max = 7.17/11.01/22.43 ms

The output shows that the hosts in area A and area B can access the external network.

Display BFD session information on Device A.

[DeviceA] display bfd session

Total Session Num: 1 Up Session Num: 1 Init Mode: Active

IPv4 session working in echo mode:

LD	SourceAddr	DestAddr	State	Holdtime	Interface
129	1.1.1.1	1.1.1.2	Up	500ms	Vlan101

The output shows that a BFD session has been established.

Display detailed VRRP group information on Device A.

[DeviceA] display vrrp verbose

IPv4 Virtual Router Information:

Running mode : Standard

Total number of virtual routers : 2

Interface Vlan-interface2

VRID : 1

Adver Timer : 100

Admin Status : Up

State : Master

Config Pri : 110

Running Pri : 110

Preempt Mode : Yes

Delay Time : 500

Auth Type : None

Virtual IP : 10.1.1.1

Virtual MAC : 0000-5e00-0101

Master IP : 10.1.1.101

VRRP Track Information:

Track Object : 1

State : Positive Pri Reduced : 20

Interface Vlan-interface3

VRID : 2

Adver Timer : 100

Admin Status : Up

State : Backup

Config Pri : 100

Running Pri : 100

Preempt Mode : Yes

Delay Time : 500

Become Master : 3600ms left

Auth Type : None

Virtual IP : 10.1.2.1

Virtual MAC : 0000-5e00-0102

Master IP : 10.1.2.102

Display detailed VRRP group information on Device B.

[DeviceB] display vrrp verbose

IPv4 Virtual Router Information:

Running mode : Standard

Total number of virtual routers : 2

Interface Vlan-interface2

VRID	: 1	Adver Timer	: 100
Admin Status	: Up	State	: Backup
Config Pri	: 100	Running Pri	: 100
Preempt Mode	: Yes	Delay Time	: 500
Become Master	: 3100ms left		
Auth Type	: None		
Virtual IP	: 10.1.1.1		
Virtual MAC	: 0000-5e00-0101		
Master IP	: 10.1.1.101		

Interface Vlan-interface3

VRID	: 2	Adver Timer	: 100
Admin Status	: Up	State	: Master
Config Pri	: 110	Running Pri	: 110
Preempt Mode	: Yes	Delay Time	: 500
Auth Type	: None		
Virtual IP	: 10.1.2.1		
Virtual MAC	: 0000-5e00-0102		
Master IP	: 10.1.2.102		

VRRP Track Information:

Track Object	: 1	State	: Positive	Pri Reduced	: 20
--------------	-----	-------	------------	-------------	------

The output shows the following information:

- o In VRRP group 1, Device A is the master, and Device B is the backup. Hosts that use default gateway 10.1.1.1/24 access the Internet through Device A.
- o In VRRP group 2, Device B is the master, and Device A is the backup. Hosts that use default gateway 10.1.2.1/24 access the Internet through Device B.

2. Verify that the hosts in the LAN can access the external network when the uplink monitored by Device A fails:

Ping 1.1.1.2 from host A in area A.

```
<host A> ping 1.1.1.2
PING 1.1.1.2 (1.1.1.2): 56 data bytes
56 bytes from 1.1.1.2: seq=0 ttl=128 time=22.43 ms
56 bytes from 1.1.1.2: seq=1 ttl=128 time=7.17 ms
56 bytes from 1.1.1.2: seq=2 ttl=128 time=8.91 ms
56 bytes from 1.1.1.2: seq=3 ttl=128 time=7.45 ms
56 bytes from 1.1.1.2: seq=4 ttl=128 time=9.11 ms

--- 1.1.1.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 7.17/11.01/22.43 ms
```

Ping 1.1.2.2 from host C in area B.

```
<host C> ping 1.1.2.2
PING 1.1.2.2 (1.1.2.2): 56 data bytes
56 bytes from 1.1.2.2: seq=0 ttl=128 time=22.43 ms
56 bytes from 1.1.2.2: seq=1 ttl=128 time=7.17 ms
56 bytes from 1.1.2.2: seq=2 ttl=128 time=8.91 ms
56 bytes from 1.1.2.2: seq=3 ttl=128 time=7.45 ms
```

56 bytes from 1.1.2.2: seq=4 ttl=128 time=9.11 ms

--- 1.1.2.2 ping statistics ---

5 packets transmitted, 5 packets received, 0% packet loss

round-trip min/avg/max = 7.17/11.01/22.43 ms

The output shows that the hosts in area A and area B can access the external network.

Display BFD session information on Device A.

[DeviceA] display bfd session

Total Session Num: 1 Up Session Num: 0 Init Mode: Active

IPv4 session working in echo mode:

LD	SourceAddr	DestAddr	State	Holdtime	Interface
129	1.1.1.1	1.1.1.2	Down	/	Vlan101

The output shows that the BFD session has been terminated.

Display detailed VRRP group information on Device B.

[DeviceB] display vrrp verbose

IPv4 Virtual Router Information:

Running mode : Standard

Total number of virtual routers : 2

Interface Vlan-interface2

VRID	: 1	Adver Timer	: 100
Admin Status	: Up	State	: Master
Config Pri	: 100	Running Pri	: 100
Preempt Mode	: Yes	Delay Time	: 500
Auth Type	: None		
Virtual IP	: 10.1.1.1		
Virtual MAC	: 0000-5e00-0101		
Master IP	: 10.1.1.102		

Interface Vlan-interface3

VRID	: 2	Adver Timer	: 100
Admin Status	: Up	State	: Master
Config Pri	: 110	Running Pri	: 110
Preempt Mode	: Yes	Delay Time	: 500
Auth Type	: None		
Virtual IP	: 10.1.2.1		
Virtual MAC	: 0000-5e00-0102		
Master IP	: 10.1.2.102		

VRRP Track Information:

Track Object : 1 State : Positive Pri Reduced : 20

The output shows that Device B becomes the master in VRRP group 1. Hosts in area A access the external network through Device B.

When the fault is cleared, display BFD session information on Device A.

[DeviceA] display bfd session

Total Session Num: 1 Up Session Num: 1 Init Mode: Active

IPv4 session working in echo mode:

LD	SourceAddr	DestAddr	State	Holdtime	Interface
129	1.1.1.1	1.1.1.2	Up	1000ms	Vlan101

The output shows that the BFD session is resumed.

Display detailed VRRP group information on Device A.

```
[DeviceA] display vrrp verbose
```

IPv4 Virtual Router Information:

Running mode : Standard

Total number of virtual routers : 2

Interface Vlan-interface2

VRID : 1

Adver Timer : 100

Admin Status : Up

State : Master

Config Pri : 110

Running Pri : 110

Preempt Mode : Yes

Delay Time : 500

Auth Type : None

Virtual IP : 10.1.1.1

Virtual MAC : 0000-5e00-0101

Master IP : 10.1.1.101

VRRP Track Information:

Track Object : 1

State : Positive Pri Reduced : 20

Interface Vlan-interface3

VRID : 2

Adver Timer : 100

Admin Status : Up

State : Backup

Config Pri : 100

Running Pri : 100

Preempt Mode : Yes

Delay Time : 500

Become Master : 3550ms left

Auth Type : None

Virtual IP : 10.1.2.1

Virtual MAC : 0000-5e00-0102

Master IP : 10.1.2.102

The output shows that Device A resumes its priority and becomes the master in VRRP group 1 again. Hosts in area B access the external network through Device A.

Configuration files

NOTE:

Support for the **port link-mode bridge** command depends on the device model.

- Device A:

```
#
bfd echo-source-ip 10.10.10.10
#
vlan 2 to 3
#
vlan 101
```

```

#
stp region-configuration
  region-name vrrp
  instance 1 vlan 2
  instance 2 vlan 3
  active region-configuration
#
  stp instance 1 root primary
  stp instance 2 root secondary
  stp global enable
#
interface Vlan-interface2
  ip address 10.1.1.101 255.255.255.0
vrrp vrid 1 virtual-ip 10.1.1.1
  vrrp vrid 1 priority 110
  vrrp vrid 1 preempt-mode delay 500
  vrrp vrid 1 track 1 priority reduced 20
#
interface Vlan-interface3
  ip address 10.1.2.101 255.255.255.0
  vrrp vrid 2 virtual-ip 10.1.2.1
  vrrp vrid 2 preempt-mode delay 500
#
interface Vlan-interface101
  ip address 1.1.1.1 255.255.255.0
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  port access vlan 101
  undo stp enable
#
interface GigabitEthernet1/0/2
  port link-mode bridge
  port access vlan 2
#
interface GigabitEthernet1/0/3
  port link-mode bridge
  port access vlan 3
#
interface GigabitEthernet1/0/4
  port link-mode bridge
  port link-type trunk
  undo port trunk permit vlan 1
  port trunk permit vlan 2 to 3
  port trunk pvid vlan 2
#
  track 1 bfd echo interface Vlan-interface101 remote ip 1.1.1.2 local ip 1.1.1.1

```

- **Device B:**

```

#
bfd echo-source-ip 11.11.11.11
#
vlan 2 to 3
#
vlan 101
#
stp region-configuration
region-name vrrp
instance 1 vlan 2
instance 2 vlan 3
active region-configuration
#
stp instance 1 root secondary
stp instance 2 root primary
stp global enable
#
interface Vlan-interface2
ip address 10.1.1.102 255.255.255.0
vrrp vrid 1 virtual-ip 10.1.1.1
vrrp vrid 1 preempt-mode delay 500
#
interface Vlan-interface3
ip address 10.1.2.102 255.255.255.0
vrrp vrid 2 virtual-ip 10.1.2.1
vrrp vrid 2 priority 110
vrrp vrid 2 preempt-mode delay 500
vrrp vrid 2 track 1 priority reduced 20
#
interface Vlan-interface101
ip address 1.1.2.1 255.255.255.0
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 101
undo stp enable
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 2
#
interface GigabitEthernet1/0/3
port link-mode bridge
port access vlan 3
#
interface GigabitEthernet1/0/4
port link-mode bridge
port link-type trunk

```

```

undo port trunk permit vlan 1
port trunk permit vlan 2 to 3
port trunk pvid vlan 2
#
track 1 bfd echo interface Vlan-interface101 remote ip 1.1.2.2 local ip 1.1.2.1

```

- **L2 Switch A:**

```

#
vlan 2
#
stp region-configuration
region-name vrrp
instance 1 vlan 2
active region-configuration
#
stp global enable
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 2
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 2

```

- **L2 Switch B:**

```

#
vlan 3
#
stp region-configuration
region-name vrrp
instance 2 vlan 3
active region-configuration
#
stp global enable
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 3
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 3

```

- **Device E:**

```

#
vlan 101
#
interface Vlan-interface101
ip address 1.1.1.2 255.255.255.0
#

```



```

interface GigabitEthernet1/0/1
  port link-mode bridge
  port access vlan 101
#
  ip route-static 10.1.1.0 255.255.255.0 1.1.1.1
  ip route-static 10.1.2.0 255.255.255.0 1.1.1.1

```

- **Device F:**

```

#
vlan 101
#
interface Vlan-interface101
  ip address 1.1.2.2 255.255.255.0
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  port access vlan 101
#
  ip route-static 10.1.1.0 255.255.255.0 1.1.2.1
  ip route-static 10.1.2.0 255.255.255.0 1.1.2.1

```

Example: Configuring BFD for static routing

Network configuration

As shown in [Figure 2](#):

- Device A has two paths to reach Device B: one over a Layer 2 switch, and the other over Device C.
- A Layer 2 switch connects Device A and Device B.

Because Device B does not support BFD, enable BFD echo packet mode on Device A. When the link between Device B and the Layer 2 switch fails, Device A switches the path over Device C to reach Device B.

Figure 2 Network diagram

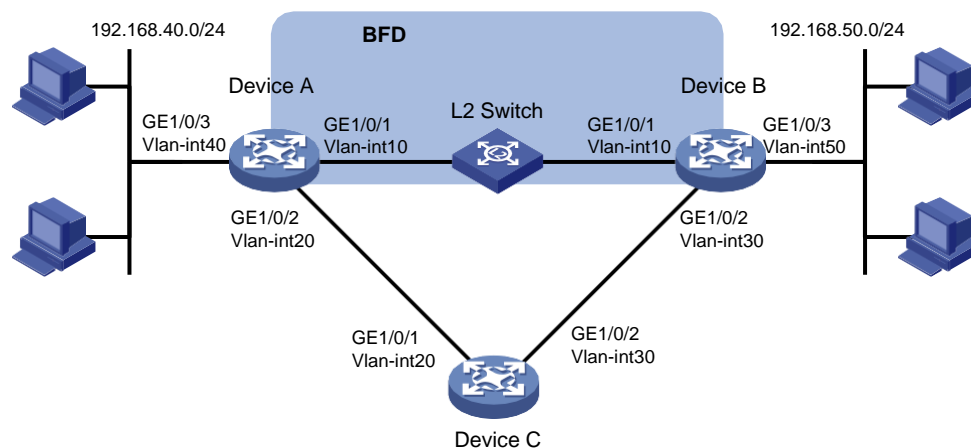


Table 1 Interface and IP address assignment

Device	Interface	IP address
Device A	Vlan-int10	192.168.10.101/24
Device A	Vlan-int20	192.168.20.101/24
Device A	Vlan-int40	192.168.40.101/24
Device B	Vlan-int10	192.168.10.102/24
Device B	Vlan-int30	192.168.30.101/24
Device B	Vlan-int50	192.168.50.101/24
Device C	Vlan-int20	192.168.20.102/24
Device C	Vlan-int30	192.168.30.102/24

Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Not supported

Restrictions and guidelines

The source IP address for BFD echo packets cannot be on the same network segment as any local interface's IP address. Otherwise, a large number of ICMP redirect packets might be sent from the peer, resulting in link congestion.

Procedures

Configuring interface IP addresses

1. Configure Device A:

```
<DeviceA> system-view
[DeviceA] vlan 10
[DeviceA-vlan10] port gigabitethernet 1/0/1
[DeviceA-vlan10] quit
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] ip address 192.168.10.101 24
[DeviceA-Vlan-interface10] quit
```

2. Configure other devices in the same way Device A is configured. (Details not shown.)

Configuring static routes

1. Configure Device A:

Configure two static routes with the same destination network 192.168.50.0/24 and different preferences. Configure the BFD echo packet mode for the preferred static route (Device A → L2 Switch → Device B).

```
[DeviceA] ip route-static 192.168.50.0 24 vlan-interface 10 192.168.10.102 bfd
echo-packet
[DeviceA] ip route-static 192.168.50.0 24 vlan-interface 20 192.168.20.102
preference 65
```

2. Configure Device B:

Configure two static routes with the same destination network 192.168.40.0/24 and different preferences. Configure the BFD echo packet mode for the preferred static route (Device B → L2 Switch → Device A).

```
[DeviceB] ip route-static 192.168.40.0 24 vlan-interface 10 192.168.10.101
[DeviceB] ip route-static 192.168.40.0 24 vlan-interface 30 192.168.30.102
preference 65
```

3. Configure Device C:

```
# Configure static routes with destination networks 192.168.40.0/24 and 192.168.50.0/24.
[DeviceC] ip route-static 192.168.40.0 24 vlan-interface 20 192.168.20.101
[DeviceC] ip route-static 192.168.50.0 24 vlan-interface 30 192.168.30.101
```

Configuring BFD parameters on Device A

```
# Configure the source IP address for BFD echo packets.
[DeviceA] bfd echo-source-ip 10.10.10.10

# Configure the minimum interval for receiving BFD echo packets and the single-hop detection
time multiplier.
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] bfd min-echo-receive-interval 100
[DeviceA-Vlan-interface10] bfd detect-multiplier 3
[DeviceA-Vlan-interface10] quit
```

Verifying the configuration

1. Verify the configuration when Device A and Device B and the link between them are operating correctly:

Display static route information on Device A.

```
[DeviceA] display ip routing-table protocol static
```

```
Summary Count : 1
```

```
Static Routing table Status : <Active>
```

```
Summary Count : 1
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
192.168.50.0/24	Static	60	0	192.168.10.102	Vlan10

```
Static Routing table Status : <Inactive>
```

```
Summary Count : 0
```

The output shows that Device A communicates with Device B through the Layer 2 switch.

Display BFD session information on Device A.

```
[DeviceA] display bfd session
```

```
Total Session Num: 1      Up Session Num: 1      Init Mode: Active
```

```
IPv4 session working in echo mode:
```

LD	SourceAddr	DestAddr	State	Holdtime	Interface
67	192.168.10.101	192.168.10.102	Up	300ms	Vlan10

The output shows that a BFD session has been established.

2. Verify the configuration when the link between Device B and the Layer 2 switch is faulty:

Display static route information on Device A.

```
[DeviceA] display ip routing-table protocol static
```

```
Summary Count : 1
```

Static Routing table Status : <Active>

Summary Count : 1

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
192.168.50.0/24	Static	65	0	192.168.20.102	Vlan20

Static Routing table Status : <Inactive>

Summary Count : 0

The output shows that Device A communicates with Device B through Device C.

Configuration files

NOTE:

Support for the **port link-mode bridge** command depends on the device model.

- Device A:

```
#
bfd echo-source-ip 10.10.10.10
#
vlan 10
#
vlan 20
#
vlan 40
#
interface Vlan-interface10
 ip address 192.168.10.101 255.255.255.0
 bfd min-echo-receive-interval 100
 bfd detect-multiplier 3
#
interface Vlan-interface20
 ip address 192.168.20.101 255.255.255.0
#
interface Vlan-interface40
 ip address 192.168.40.101 255.255.255.0
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 10
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 20
#
interface GigabitEthernet1/0/3
 port link-mode bridge
 port access vlan 40
#
```

```

ip route-static 192.168.50.0 24 Vlan-interface10 192.168.10.102 bfd echo-packet
ip route-static 192.168.50.0 24 Vlan-interface20 192.168.20.102 preference 65
#

```

- **Device B:**

```

#
vlan 10
#
vlan 30
#
vlan 50
#
interface Vlan-interface10
ip address 192.168.10.102 255.255.255.0
#
interface Vlan-interface30
ip address 192.168.30.101 255.255.255.0
#
interface Vlan-interface50
ip address 192.168.50.101 255.255.255.0
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 10
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 30
#
interface GigabitEthernet1/0/3
port link-mode bridge
port access vlan 50
#
ip route-static 192.168.40.0 24 Vlan-interface10 192.168.10.101
ip route-static 192.168.40.0 24 Vlan-interface30 192.168.30.102 preference 65
#

```

- **Device C:**

```

#
vlan 20
#
vlan 30
#
interface Vlan-interface20
ip address 192.168.20.102 255.255.255.0
#
interface Vlan-interface30
ip address 192.168.30.102 255.255.255.0
#
interface GigabitEthernet1/0/1

```

```

port link-mode bridge
port access vlan 20
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 30
#
ip route-static 192.168.40.0 24 Vlan-interface20 192.168.20.101
ip route-static 192.168.50.0 24 Vlan-interface30 192.168.30.101
#

```

Example: Configuring BFD for RIP

Network configuration

As shown in [Figure 3](#), Device A, Device B, and Device C run RIP. Device A and Device C are connected through a Layer 2 switch.

Enable BFD echo packet mode on Device A (Device C does not support BFD) to monitor the path over the Layer 2 switch. When BFD detects a link failure, it notifies RIP to switch to the path over Device B.

Figure 3 Network diagram

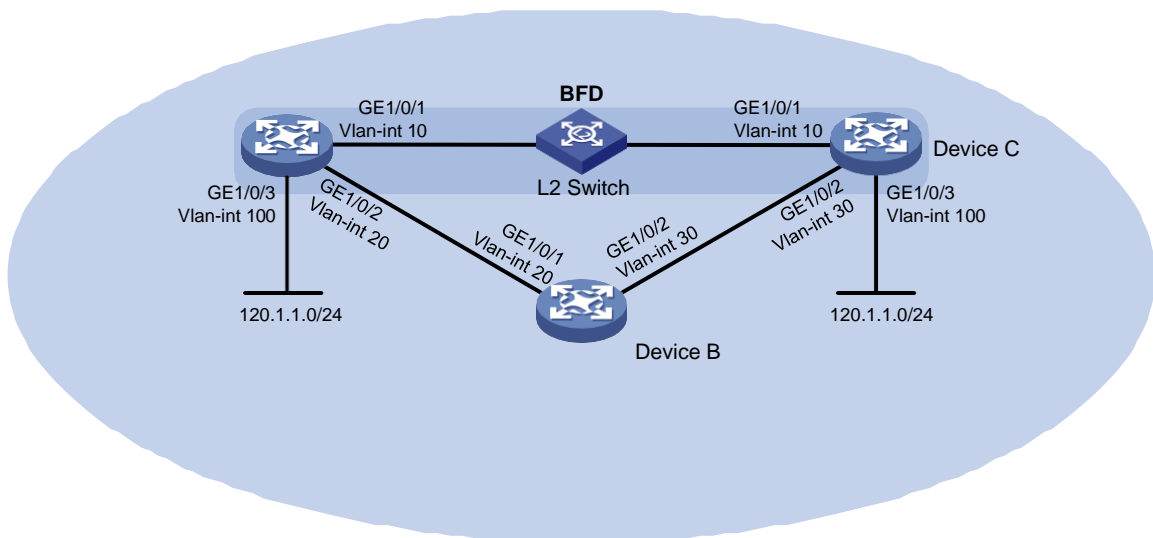


Table 2 Interface and IP address assignment

Device	Interface	IP address
Device A	Vlan-int10	10.1.0.101/24
Device A	Vlan-int20	192.168.0.101/24
Device A	Vlan-int100	120.1.1.1/24
Device B	Vlan-int20	192.168.0.102/24
Device B	Vlan-int30	13.1.1.101/24
Device C	Vlan-int10	10.1.0.102/24

Device	Interface	IP address
Device C	Vlan-int30	13.1.1.102/24
Device C	Vlan-int100	121.1.1.1/24

Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Not supported

Restrictions and guidelines

The source IP address for BFD echo packets cannot be on the same network segment as any local interface's IP address. Otherwise, a large number of ICMP redirect packets might be sent from the peer, resulting in link congestion.

Procedures

Configuring interface IP addresses

1. Configure Device A:

```
<DeviceA> system-view
[DeviceA] vlan 10
[DeviceA-vlan10] port gigabitethernet 1/0/1
[DeviceA-vlan10] quit
[DeviceA] interface vlan-interface10
[DeviceA-Vlan-interface10] ip address 10.1.0.101 24
[DeviceA-Vlan-interface10] quit
```
2. Configure other devices in the same way Device A is configured. (Details not shown.)

Configuring RIP

1. Configure Device A:

```
# Configure basic RIP functions, import direct routes, and enable BFD for RIP.
<DeviceA> system-view
[DeviceA] rip 1
[DeviceA-rip-1] version 2
[DeviceA-rip-1] undo summary
```



```
[DeviceA-rip-1] network 10.1.0.0
[DeviceA-rip-1] network 192.168.0.0
[DeviceA-rip-1] import-route direct
[DeviceA-rip-1] quit
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] rip bfd enable
[DeviceA-Vlan-interface10] quit
```

2. Configure Device B:

Configure basic RIP functions, and import direct routes.

```
<DeviceB> system-view
[DeviceB] rip 1
[DeviceB-rip-1] version 2
[DeviceB-rip-1] undo summary
[DeviceB-rip-1] network 192.168.0.0
[DeviceB-rip-1] network 13.1.1.0
[DeviceB-rip-1] import-route direct
[DeviceB-rip-1] quit
```

3. Configure Device C:

Configure basic RIP functions, and import direct routes.

```
<DeviceC> system-view
[DeviceC] rip 1
[DeviceC-rip-1] version 2
[DeviceC-rip-1] undo summary
[DeviceC-rip-1] network 10.1.0.0
[DeviceC-rip-1] network 13.1.1.0
[DeviceC-rip-1] import-route direct
[DeviceC-rip-1] quit
```

Configuring BFD parameters on Device A

Configure the source IP address for BFD echo packets.

```
[DeviceA] bfd echo-source-ip 11.11.11.11
```

Configure the minimum interval for receiving BFD echo packets and the single-hop detection time multiplier.

```
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] bfd min-echo-receive-interval 100
[DeviceA-Vlan-interface10] bfd detect-multiplier 3
[DeviceA-Vlan-interface10] quit
```

Verifying the configuration

Display BFD session information on Device A.

```
[DeviceA] display bfd session verbose
Total Session Num: 1      Up Session Num: 1      Init Mode: Active

IPv4 session working in echo mode:
    Local Discr: 2049
    Source IP: 10.1.0.101      Destination IP: 10.1.0.102
    Session State: Up          Interface: Vlan-interface10
    Hold Time: 300ms           Act Tx Inter: 100ms
    Min Rx Inter: 100ms        Detect Inter: 300ms
    Rx Count: 0                 Tx Count: 910
    Connect Type: Direct        Running Up for: 00:00:46
    Detect Mode: Async           Slot: 1
    Protocol: RIP
    Version: 1
    Diag Info: No Diagnostic
```

The output shows that a BFD session has been established and is up.

(Release 63xx) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 24 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```

Protocol: RIP
Process ID: 1
SubProtID: 0x1                      Age: 04h20m37s
Cost: 1                            Preference: 100
IpPre: N/A                          QosLocalID: N/A
Tag: 0                              State: Active Adv
OrigTblID: 0x0                      OrigVrf: default-vrf
TableID: 0x2                        OrigAs: 0
NibID: 0x26000002 LastAs: 0
AttrID: 0xffffffff Neighbor: 10.1.0.102
Flags: 0x1008c OrigNextHop: 10.1.0.102
Label: NULL RealNextHop: 10.1.0.102
BkLabel: NULL BkNextHop: N/A
SRLabel: NULL BkSRLabel: NULL
Tunnel ID: Invalid Interface: Vlan-interface10
BkTunnel ID: Invalid BkInterface: N/A
FtnIndex: 0x0 TrafficIndex: N/A
Connector: N/A PathID: 0x0

```

(Release 65xx, 6008 and later, and 8005 and later) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 24 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```

Protocol: RIP
Process ID: 1
SubProtID: 0x1                      Age: 04h20m37s
Cost: 1                            Preference: 100
IpPre: N/A                          QosLocalID: N/A
Tag: 0                              State: Active Adv
OrigTblID: 0x0                      OrigVrf: default-vrf
TableID: 0x2                        OrigAs: 0
NibID: 0x26000002 LastAs: 0
AttrID: 0xffffffff Neighbor: 10.1.0.102
Flags: 0x1008c OrigNextHop: 10.1.0.102
Label: NULL RealNextHop: 10.1.0.102
BkLabel: NULL BkNextHop: N/A
SRLabel: NULL BkSRLabel: NULL
SIDIndex: NULL InLabel: NULL
Tunnel ID: Invalid Interface: Vlan-interface10
BkTunnel ID: Invalid BkInterface: N/A
FtnIndex: 0x0 TrafficIndex: N/A
Connector: N/A PathID: 0x0
LinkCost: 0 MicroSegID: 0

```

The output shows that Device A communicates with Device C through the Layer 2 switch.

When the link between Device C and the Layer 2 switch fails, view BFD log information.

```
%Oct  9 18:42:17:650 2013 Device A BFD/5/BFD_CHANGE_FSM: Sess[10.1.0.101/10.1.0.102,
LD/RD:2049/2049, Interface:Vlan10, SessType:Echo, LinkType:INET], Ver:1, Sta: UP->
DOWN, Diag:1 (Control Detection Time Expired)
```

The output shows that BFD can quickly detect the failure and notify RIP.

(Release 63xx) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 24 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```
  Protocol: RIP
Process ID: 2
SubProtID: 0x1                      Age: 04h20m37s
  Cost: 2                          Preference: 100
  IpPre: N/A                       QosLocalID: N/A
  Tag: 0                          State: Active Adv
OrigTblID: 0x0                      OrigVrf: default-vrf
TableID: 0x2                       OrigAs: 0
  NibID: 0x26000002 LastAs: 0
AttrID:  0xffffffff Neighbor:  192.168.0.102
Flags:  0x1008c    OrigNextHop: 192.168.0.102
Label: NULL      RealNextHop: 192.168.0.102
BkLabel: NULL    BkNextHop: N/A
SRLabel: NULL    BkSRLabel: NULL
Tunnel ID: Invalid Interface: Vlan-interface20
BkTunnel ID: Invalid BkInterface: N/A
  FtnIndex: 0x0    TrafficIndex: N/A
Connector: N/A    PathID: 0x0
```

(Release 63xx, 6008 and later, and 8005 and later) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 24 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```
  Protocol: RIP
Process ID: 2
SubProtID: 0x1                      Age: 04h20m37s
  Cost: 2                          Preference: 100
  IpPre: N/A                       QosLocalID: N/A
  Tag: 0                          State: Active Adv
OrigTblID: 0x0                      OrigVrf: default-vrf
TableID: 0x2                       OrigAs: 0
  NibID: 0x26000002 LastAs: 0
AttrID:  0xffffffff Neighbor:  192.168.0.102
Flags:  0x1008c    OrigNextHop: 192.168.0.102
Label: NULL      RealNextHop: 192.168.0.102
BkLabel: NULL    BkNextHop: N/A
```

SRLabel: NULL	BkSRLabel: NULL
SIDIndex: NULL	InLabel: NULL
Tunnel ID: Invalid	Interface: Vlan-interface20
BkTunnel ID: Invalid	BkInterface: N/A
FtnIndex: 0x0	TrafficIndex: N/A
Connector: N/A	PathID: 0x0
LinkCost: 0	MicroSegID: 0

The output shows that Device A communicates with Device C through Device B.

Configuration files

NOTE:

Support for the **port link-mode bridge** command depends on the device model.

- Device A:

```
#
bfd echo-source-ip 11.11.11.11
#
rip 1
undo summary
version 2
network 10.0.0.0
network 192.168.0.0
import-route direct
#
vlan 10
#
vlan 20
#
vlan 100
#
interface Vlan-interface10
ip address 10.1.0.101 255.255.255.0
rip bfd enable
bfd min-transmit-interval 100
bfd min-receive-interval 100
bfd detect-multiplier 3
#
interface Vlan-interface20
ip address 192.168.0.101 255.255.255.0
#
interface Vlan-interface100
ip address 120.1.1.1 255.255.255.0
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 10
#
```

```

interface GigabitEthernet1/0/2
  port link-mode bridge
  port access vlan 20
#
interface GigabitEthernet1/0/3
  port link-mode bridge
  port access vlan 100
#

```

- **Device B:**

```

#
rip 1
  undo summary
  version 2
  network 192.168.0.0
  network 13.1.1.0
  import-route direct
#
vlan 20
#
vlan 30
#
interface Vlan-interface20
  ip address 192.168.0.102 255.255.255.0
#
interface Vlan-interface30
  ip address 13.1.1.101 255.255.255.0
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  port access vlan 20
#
interface GigabitEthernet1/0/2
  port link-mode bridge
  port access vlan 30
#

```

- **Device C:**

```

#
rip 1
  undo summary
  version 2
  network 10.1.0.0
  network 13.1.1.0
  import-route direct
#
vlan 10
#
vlan 30
#

```

```

vlan 100
#
interface Vlan-interface10
 ip address 10.1.0.102 255.255.255.0
#
interface Vlan-interface30
 ip address 13.1.1.102 255.255.255.0
#
interface Vlan-interface100
 ip address 121.1.1.1 255.255.255.0
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 10
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 30
#
interface GigabitEthernet1/0/3
 port link-mode bridge
 port access vlan 100
#

```

Example: Configuring BFD for OSPF

Network configuration

As shown in [Figure 4](#), Device A, Device B, and Device C run OSPF. Device A and Device C are connected through a Layer 2 switch.

Enable BFD control packet mode on Device A and Device C to monitor the path over the Layer 2 switch. When BFD detects a link failure, it notifies OSPF to switch to the path over Device B.

Figure 4 Network diagram

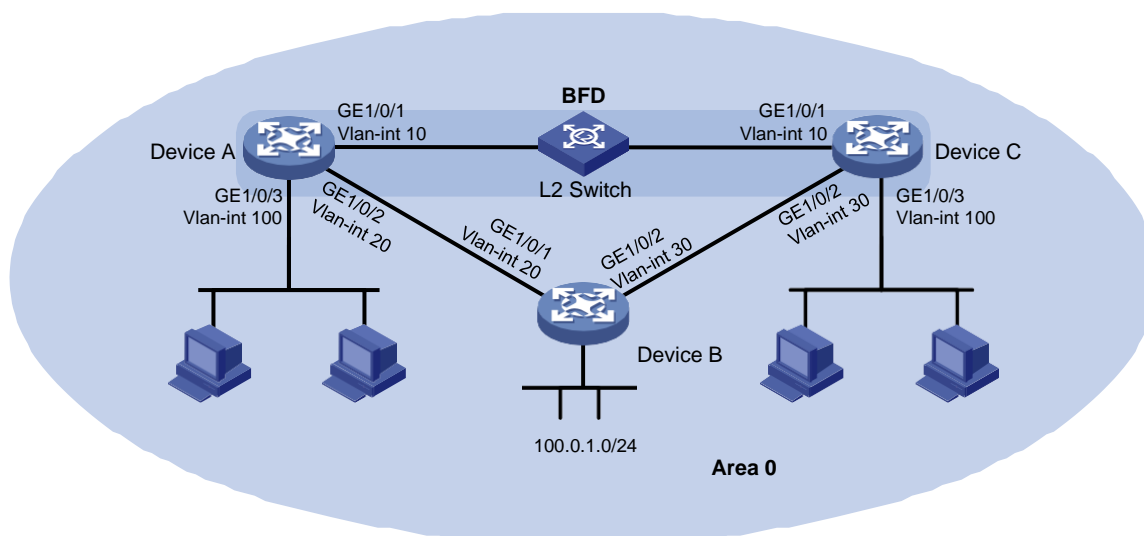


Table 3 Interface and IP address assignment

Device	Interface	IP address
Device A	Vlan-int10	10.1.0.101/24
Device A	Vlan-int20	192.168.0.101/24
Device A	Vlan-int100	120.1.1.1/24
Device B	Vlan-int20	192.168.0.102/24
Device B	Vlan-int30	13.1.1.101/24
Device C	Vlan-int10	10.1.0.102/24
Device C	Vlan-int30	13.1.1.102/24
Device C	Vlan-int100	121.1.1.1/24

Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Release 63xx

Restrictions and guidelines

In BFD control packet mode, a minimum of one end must operate in active mode for a BFD session to be established.

Procedures

Configuring interface IP addresses

1. Configure Device A:

```
<DeviceA> system-view
[DeviceA] vlan 10
[DeviceA-vlan10] port gigabitethernet 1/0/1
[DeviceA-vlan10] quit
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] ip address 10.1.0.101 24
[DeviceA-Vlan-interface10] quit
```

2. Configure other devices in the same way Device A is configured. (Details not shown.)

Configuring OSPF

1. Configure Device A:

Configure basic OSPF functions, and enable BFD for OSPF.

```
[DeviceA] ospf
[DeviceA-ospf-1] area 0
[DeviceA-ospf-1-area-0.0.0.0] network 10.1.0.0 0.0.0.255
[DeviceA-ospf-1-area-0.0.0.0] network 192.168.0.0 0.0.0.255
[DeviceA-ospf-1-area-0.0.0.0] network 120.1.1.0 0.0.0.255
[DeviceA-ospf-1-area-0.0.0.0] quit
[DeviceA-ospf-1] quit
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] ospf bfd enable
[DeviceA-Vlan-interface10] quit
```

2. Configure Device B:

Configure basic OSPF functions.

```
[DeviceB] ospf
[DeviceB-ospf-1] area 0
[DeviceB-ospf-1-area-0.0.0.0] network 192.168.0.0 0.0.0.255
[DeviceB-ospf-1-area-0.0.0.0] network 13.1.1.0 0.0.0.255
[DeviceB-ospf-1-area-0.0.0.0] quit
[DeviceB-ospf-1] quit
```

3. Configure Device C:

Configure basic OSPF functions, and enable BFD for OSPF.

```
[DeviceC] ospf
[DeviceC-ospf-1] area 0
[DeviceC-ospf-1-area-0.0.0.0] network 10.1.0.0 0.0.0.255
[DeviceC-ospf-1-area-0.0.0.0] network 13.1.1.0 0.0.0.255
[DeviceC-ospf-1-area-0.0.0.0] network 121.1.1.0 0.0.0.255
[DeviceC-ospf-1-area-0.0.0.0] quit
[DeviceC-ospf-1] quit
[DeviceC] interface vlan-interface 10
[DeviceC-Vlan-interface10] ospf bfd enable
[DeviceC-Vlan-interface10] quit
```

Configuring BFD parameters

1. Configure Device A:

Configure the session establishment mode as active (this is the default mode).

```
[DeviceA] bfd session init-mode active
```

Configure the minimum interval for sending and receiving single-hop BFD control packets and the single-hop detection time multiplier.

```
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] bfd min-transmit-interval 100
[DeviceA-Vlan-interface10] bfd min-receive-interval 100
[DeviceA-Vlan-interface10] bfd detect-multiplier 3
[DeviceA-Vlan-interface10] quit
```

2. Configure Device C:

Configure the session establishment mode as active (this is the default mode).

```
[DeviceC] bfd session init-mode active
```

Configure the minimum interval for sending and receiving single-hop BFD control packets and the single-hop detection time multiplier.

```
[DeviceC] interface vlan-interface 10
```

```
[DeviceC-Vlan-interface10] bfd min-transmit-interval 100
```

```
[DeviceC-Vlan-interface10] bfd min-receive-interval 100
```

```
[DeviceC-Vlan-interface10] bfd detect-multiplier 3
```

```
[DeviceC-Vlan-interface10] quit
```

Verifying the configuration

Ping host C (connected to Device C) from host A (connected to Device A) to verify the connectivity.

```
<host A> ping 121.1.1.2
```

```
PING 121.1.1.2 (121.1.1.2): 56 data bytes
```

```
56 bytes from 121.1.1.2: seq=0 ttl=128 time=22.43 ms
```

```
56 bytes from 121.1.1.2: seq=1 ttl=128 time=7.17 ms
```

```
56 bytes from 121.1.1.2: seq=2 ttl=128 time=8.91 ms
```

```
56 bytes from 121.1.1.2: seq=3 ttl=128 time=7.45 ms
```

```
56 bytes from 121.1.1.2: seq=4 ttl=128 time=9.11 ms
```

```
--- 121.1.1.2 ping statistics ---
```

```
5 packets transmitted, 5 packets received, 0% packet loss
```

```
round-trip min/avg/max/std-dev = 7.17/11.01/22.43 ms
```

The output shows that host C can be pinged successfully.

Display detailed OSPF neighbor information on Device A.

```
[DeviceA] display ospf peer verbose
```

```
OSPF Process 1 with Router ID 2.2.2.2
```

```
Neighbors
```

```
Area 0.0.0.0 interface 10.1.0.101(Vlan-interface10)'s neighbors
```

```
Router ID: 1.1.1.1          Address: 10.1.0.102          GR State: Normal
```

```
State: Full Mode: Nbr is Slave Priority: 1
```

```
DR: 10.1.0.101 BDR: 10.1.0.102 MTU: 0
```

```
Options is 0x42 (-|O|-|-|-|E|-)
```

```
Dead timer due in 39 sec
```

```
Neighbor is up for 00:09:01
```

```
Authentication Sequence: [ 0 ]
```

```
Neighbor state change count: 5
```

```
BFD status: Enabled(Control mode)
```

The output shows that Device A has established OSPF neighbor relationship with Device C.

Display BFD session information on Device A and Device C.

```
[DeviceA] display bfd session verbose
```

```
Total Session Num: 1      Up Session Num: 1      Init Mode: Active
```

```

IPv4 session working in control packet mode:
    Local Discr: 2049                Remote Discr: 2049
    Source IP: 10.1.0.101           Destination IP: 10.1.0.102
    Session State: Up                Interface: Vlan-interface10
    Min Tx Inter: 100ms             Act Tx Inter: 100ms
    Min Rx Inter: 100ms             Detect Inter: 300ms
    Rx Count: 536                   Tx Count: 536
    Connect Type: Direct             Running Up for: 00:04:48
    Hold Time: 300ms                 Auth mode: None
    Detect Mode: Async                Slot: 1
    Protocol: OSPF
    Version: 1
    Diag Info: No Diagnostic
[DeviceC] display bfd session verbose
Total Session Num: 1    Up Session Num: 1    Init Mode: Active

```

```

IPv4 session working in control packet mode:
    Local Discr: 2049                Remote Discr: 2049
    Source IP: 10.1.0.102           Destination IP: 10.1.0.101
    Session State: Up                Interface: Vlan-interface10
    Min Tx Inter: 100ms             Act Tx Inter: 100ms
    Min Rx Inter: 100ms             Detect Inter: 300ms
    Rx Count: 3971                  Tx Count: 3776
    Connect Type: Direct             Running Up for: 00:06:52
    Hold Time: 300ms                 Auth mode: None
    Detect Mode: Async                Slot: 1
    Protocol: OSPF
    Version: 1
    Diag Info: No Diagnostic

```

The output shows that BFD sessions have been established and are up.

(Release 63xx) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

```
Summary Count : 1
```

```

Destination: 121.1.1.0/24
    Protocol: OSPF
Process ID: 1
    SubProtID: 0x1                Age: 04h20m37s
    Cost: 1                        Preference: 10
    IpPre: N/A                     QosLocalID: N/A
    Tag: 0                          State: Active Adv
    OrigTblID: 0x0                 OrigVrf: default-vrf
    TableID: 0x2                   OrigAs: 0
    NibID: 0x26000002              LastAs: 0
    AttrID: 0xffffffff             Neighbor: 0.0.0.0
    Flags: 0x1008c                 OrigNextHop: 10.1.0.102

```

```

Label: NULL RealNextHop: 10.1.0.102
BkLabel: NULL BkNextHop: N/A
SRLabel: NULL BkSRLabel: NULL
Tunnel ID: Invalid Interface: Vlan-interface10
BkTunnel ID: Invalid BkInterface: N/A
FtnIndex: 0x0 TrafficIndex: N/A
Connector: N/A PathID: 0x0

```

(Release 65xx, 6008 and later, 8005 and later, 1106 and later, and 66xx) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```

Protocol: OSPF
Process ID: 1
SubProtID: 0x1 Age: 04h20m37s
Cost: 1 Preference: 10
IpPre: N/A QosLocalID: N/A
Tag: 0 State: Active Adv
OrigTblID: 0x0 OrigVrf: default-vrf
TableID: 0x2 OrigAs: 0
NibID: 0x26000002 LastAs: 0
AttrID: 0xffffffff Neighbor: 0.0.0.0
Flags: 0x1008c OrigNextHop: 10.1.0.102
Label: NULL RealNextHop: 10.1.0.102
BkLabel: NULL BkNextHop: N/A
SRLabel: NULL BkSRLabel: NULL
SIDIndex: NULL InLabel: NULL
Tunnel ID: Invalid Interface: Vlan-interface10
BkTunnel ID: Invalid BkInterface: N/A
FtnIndex: 0x0 TrafficIndex: N/A
Connector: N/A PathID: 0x0
LinkCost: 0 MicroSegID: 0

```

The output shows that Device A communicates with Device C through the Layer 2 switch.

When the link between Device C and the Layer 2 switch fails, view BFD log information.

```

%Oct 9 15:22:23:154 2013 DeviceC BFD/5/BFD_CHANGE_FSM: Sess[10.1.0.102/10.1.0.101,
LD/RD:2049/2049, Interface:Vlan10, SessType:Ctrl, LinkType:INET], Ver:1, Sta: UP->
DOWN, Diag: 1 (Control Detection Time Expired)
%Oct 9 15:22:23:155 2013 DeviceC OSPF/5/OSPF_NBR_CHG: OSPF 1 Neighbor
10.1.0.101(Vlan-interface10) from FULL to DOWN.

```

The output shows that BFD can quickly detect the failure and notify OSPF.

(Release 63xx) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```

Protocol: OSPF
Process ID: 1
SubProtID: 0x1                      Age: 04h20m37s
Cost: 2                            Preference: 10
IpPre: N/A                         QosLocalID: N/A
Tag: 0                             State: Active Adv
OrigTblID: 0x0                     OrigVrf: default-vrf
TableID: 0x2                       OrigAs: 0
NibID: 0x26000002                 LastAs: 0
AttrID: 0xffffffff                Neighbor: 0.0.0.0
Flags: 0x1008c                    OrigNextHop: 192.168.0.102
Label: NULL                        RealNextHop: 192.168.0.102
BkLabel: NULL                      BkNextHop: N/A
SRLabel: NULL                      BkSRLabel: NULL
Tunnel ID: Invalid                 Interface: Vlan-interface20
BkTunnel ID: Invalid              BkInterface: N/A
FtnIndex: 0x0                     TrafficIndex: N/A
Connector: N/A                     PathID: 0x0

```

(Release 65xx, 6008 and later, and 8005 and later) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```

Protocol: OSPF
Process ID: 1
SubProtID: 0x1                      Age: 04h20m37s
Cost: 2                            Preference: 10
IpPre: N/A                         QosLocalID: N/A
Tag: 0                             State: Active Adv
OrigTblID: 0x0                     OrigVrf: default-vrf
TableID: 0x2                       OrigAs: 0
NibID: 0x26000002                 LastAs: 0
AttrID: 0xffffffff                Neighbor: 0.0.0.0
Flags: 0x1008c                    OrigNextHop: 192.168.0.102
Label: NULL                        RealNextHop: 192.168.0.102
BkLabel: NULL                      BkNextHop: N/A
SRLabel: NULL                      BkSRLabel: NULL
SIDIndex: NULL                     InLabel: NULL
Tunnel ID: Invalid                 Interface: Vlan-interface20
BkTunnel ID: Invalid              BkInterface: N/A
FtnIndex: 0x0                     TrafficIndex: N/A
Connector: N/A                     PathID: 0x0
LinkCost: 0                        MicroSegID: 0

```

The output shows that Device A communicates with Device C through Device B.

Configuration files

NOTE:

Support for the **port link-mode bridge** command depends on the device model.

- **Device A:**

```
#
ospf 1
 area 0.0.0.0
   network 10.1.0.0 0.0.0.255
   network 120.1.1.0 0.0.0.255
   network 192.168.0.0 0.0.0.255
#
vlan 10
#
vlan 20
#
vlan 100
#
interface Vlan-interface10
 ip address 10.1.0.101 255.255.255.0
 ospf bfd enable
 bfd min-transmit-interval 100
 bfd min-receive-interval 100
 bfd detect-multiplier 3
#
interface Vlan-interface20
 ip address 192.168.0.101 255.255.255.0
#
interface Vlan-interface100
 ip address 120.1.1.1 255.255.255.0
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 10
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 20
#
interface GigabitEthernet1/0/3
 port link-mode bridge
 port access vlan 100
#
```

- **Device B:**

```
#
ospf 1
```

```

area 0.0.0.0
  network 13.1.1.0 0.0.0.255
  network 192.168.0.0 0.0.0.255
#
vlan 20
#
vlan 30
#
interface Vlan-interface20
  ip address 192.168.0.102 255.255.255.0
#
interface Vlan-interface30
  ip address 13.1.1.101 255.255.255.0
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  port access vlan 20
#
interface GigabitEthernet1/0/2
  port link-mode bridge
  port access vlan 30
#

```

- **Device C:**

```

#
ospf 1
  area 0.0.0.0
    network 10.1.0.0 0.0.0.255
    network 13.1.1.0 0.0.0.255
    network 121.1.1.0 0.0.0.255
#
vlan 10
#
vlan 30
#
vlan 100
#
interface Vlan-interface10
  ip address 10.1.0.102 255.255.255.0
  ospf bfd enable
  bfd min-transmit-interval 100
  bfd min-receive-interval 100
  bfd detect-multiplier 3
#
interface Vlan-interface30
  ip address 13.1.1.102 255.255.255.0
#
interface Vlan-interface100
  ip address 121.1.1.1 255.255.255.0

```



```
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 10
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 30
#
interface GigabitEthernet1/0/3
port link-mode bridge
port access vlan 100
#
```

Example: Configuring BFD for IS-IS

Network configuration

As shown in [Figure 5](#), Device A, Device B, and Device C run IS-IS. Device A and Device C are connected through a Layer 2 switch.

Enable BFD control packet mode on Device A and Device C to monitor the path over the Layer 2 switch. When BFD detects a link failure, it notifies IS-IS to switch to the path over Device B.

Figure 5 Network diagram

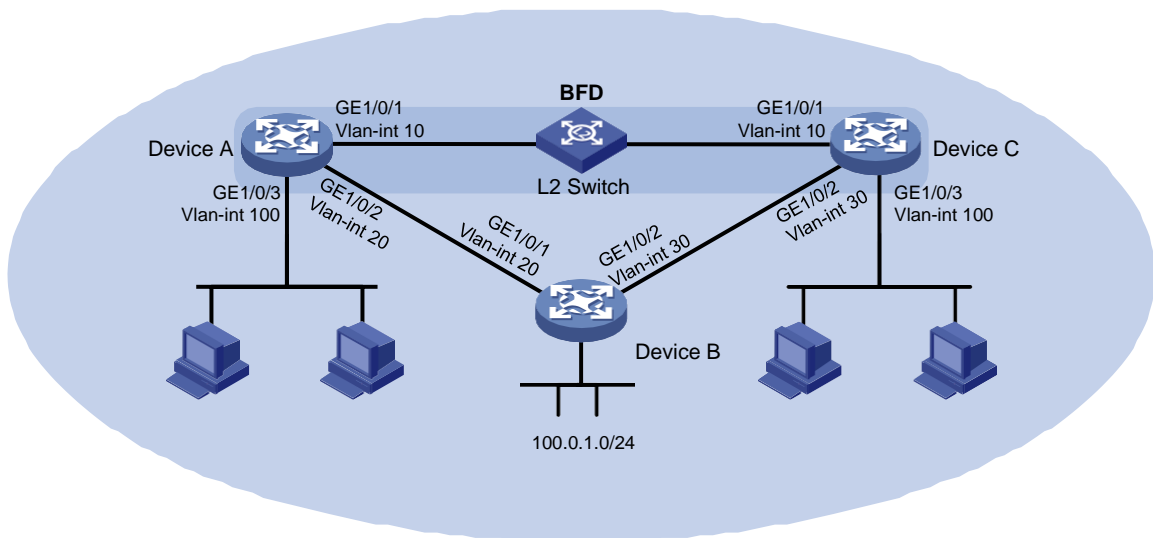


Table 4 Interface and IP address assignment

Device	Interface	IP address
Device A	Vlan-int10	10.1.0.101/24
Device A	Vlan-int20	192.168.0.101/24
Device A	Vlan-int100	120.1.1.1/24
Device B	Vlan-int20	192.168.0.102/24

Device	Interface	IP address
Device B	Vlan-int30	13.1.1.101/24
Device C	Vlan-int10	10.1.0.102/24
Device C	Vlan-int30	13.1.1.102/24
Device C	Vlan-int100	121.1.1.1/24

Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Not supported
SC 3130 switch series	Not supported

Restrictions and guidelines

In BFD control packet mode, a minimum of one end must operate in active mode for a BFD session to be established.

Procedures

Configuring interface IP addresses

1. Configure Device A:

```
<DeviceA> system-view
[DeviceA] vlan 10
[DeviceA-vlan10] port gigabitethernet 1/0/1
[DeviceA-vlan10] quit
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] ip address 10.1.0.101 24
[DeviceA-Vlan-interface10] quit
```
2. Configure other devices in the same way Device A is configured. (Details not shown.)

Configuring IS-IS

1. Configure Device A:

```
# Configure basic IS-IS functions, and enable BFD for IS-IS.
[DeviceA] isis
[DeviceA-isis-1] network-entity 10.0000.0000.0001.00
```

```
[DeviceA-isis-1] quit
[DeviceA] interface vlan-interface 20
[DeviceA-Vlan-interface20] isis enable
[DeviceA-Vlan-interface20] quit
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] isis enable
[DeviceA-Vlan-interface10] isis bfd enable
[DeviceA-Vlan-interface10] quit
[DeviceA] interface vlan-interface 100
[DeviceA-Vlan-interface100] isis enable
[DeviceA-Vlan-interface100] isis bfd enable
[DeviceA-Vlan-interface100] quit
```

2. Configure Device B:

Configure basic IS-IS functions.

```
[DeviceB] isis
[DeviceB-isis-1] network-entity 10.0000.0000.0003.00
[DeviceB-isis-1] quit
[DeviceB] interface vlan-interface 20
```

```
[DeviceB-Vlan-interface20] isis enable
[DeviceB-Vlan-interface20] quit
[DeviceB] interface vlan-interface 30
[DeviceB-Vlan-interface30] isis enable
[DeviceB-Vlan-interface30] quit
```

3. Configure Device C:

Configure basic IS-IS functions, and enable BFD for IS-IS.

```
[DeviceC] isis
[DeviceC-isis-1] network-entity 10.0000.0000.0002.00
[DeviceC-isis-1] quit
[DeviceC] interface vlan-interface 10
[DeviceC-Vlan-interface10] isis enable
[DeviceC-Vlan-interface10] isis bfd enable
[DeviceC-Vlan-interface10] quit
[DeviceC] interface vlan 30
[DeviceC-Vlan-interface30] isis enable
[DeviceC-Vlan-interface30] quit
[DeviceC] interface vlan-interface 100
[DeviceC-Vlan-interface100] isis enable
[DeviceC-Vlan-interface100] isis bfd enable
[DeviceC-Vlan-interface100] quit
```

Configuring BFD parameters

1. Configure Device A:

Configure the session establishment mode as active (this is the default mode).

```
[DeviceA] bfd session init-mode active
```

Configure the minimum interval for sending and receiving single-hop BFD control packets and the single-hop detection time multiplier.

```
[DeviceA] interface vlan-interface 10
[DeviceA-Vlan-interface10] bfd min-transmit-interval 100
[DeviceA-Vlan-interface10] bfd min-receive-interval 100
[DeviceA-Vlan-interface10] bfd detect-multiplier 3
[DeviceA-Vlan-interface10] quit
```

2. Configure Device C:

Configure the session establishment mode as active (this is the default mode).

```
[DeviceC] bfd session init-mode active
```

Configure the minimum interval for sending and receiving single-hop BFD control packets and the single-hop detection time multiplier.

```
[DeviceC] interface vlan 10
[DeviceC-Vlan-interface10] bfd min-transmit-interval 100
[DeviceC-Vlan-interface10] bfd min-receive-interval 100
[DeviceC-Vlan-interface10] bfd detect-multiplier 3
[DeviceC-Vlan-interface10] quit
```

Verifying the configuration

Display detailed IS-IS neighbor information on Device A.

[DeviceA] display isis peer verbose

```
Peer information for IS-IS(1)
-----

System ID: 0000.0000.0002
Interface: Vlan10          Circuit Id: 0000.0000.0002.01
State: Up      HoldTime: 6s      Type: L1(L1L2)      PRI: 64
Area address(es): 00
Peer IP address(es): 10.1.0.102
Peer local circuit ID: 1
Peer circuit SNPA address: ce9d-d91d-d100
Uptime: 00:01:19
Adj protocol: IPv4
Graceful Restart capable
  Restarting signal: No
  Suppress adjacency advertisement: No
Local topology:
  0
Remote topology:
  0
```

The output shows that Device A has established IS-IS neighbor relationship with Device C.

Display BFD session information on Device A and Device C.

[DeviceA] display bfd session verbose

```
Total Session Num: 1      Up Session Num: 1      Init Mode: Active
```

IPv4 session working in control packet mode:

```
Local Discr: 2049          Remote Discr: 2049
Source IP: 10.1.0.101      Destination IP: 10.1.0.102
Session State: Up          Interface: Vlan-interface10
Min Tx Inter: 100ms        Act Tx Inter: 100ms
Min Rx Inter: 100ms        Detect Inter: 300ms
Rx Count: 3                Tx Count: 3
Connect Type: Direct        Running Up for: 00:06:09
Hold Time: 300ms           Auth mode: None
Detect Mode: Async          Slot: 1
Protocol: ISIS_BR_L1/ISIS_BR_L2
Version: 1
Diag Info: No Diagnostic
```

[DeviceC] display bfd session verbose

```
Total Session Num: 1      Up Session Num: 1      Init Mode: Active
```

IPv4 session working in control packet mode:

```
Local Discr: 2049          Remote Discr: 2049
Source IP: 10.1.0.102      Destination IP: 10.1.0.101
Session State: Up          Interface: Vlan-interface10
Min Tx Inter: 100ms        Act Tx Inter: 100ms
Min Rx Inter: 100ms        Detect Inter: 300ms
```

```

Rx Count: 3                      Tx Count: 3
Connect Type: Direct              Running Up for: 00:07:10
Hold Time: 300ms                 Auth mode: None
Detect Mode: Async                Slot: 1
Protocol: ISIS_BR_L1/ISIS_BR_L2
Version: 1
Diag Info: No Diagnostic

```

The output shows that BFD sessions have been established and are up.

(Release 63xx) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```

Protocol: IS_L1
Process ID: 1
SubProtID: 0x1                      Age: 04h20m37s
Cost: 20                            Preference: 15
IpPre: N/A                          QosLocalID: N/A
Tag: 0                              State: Active Adv
OrigTblID: 0x2                      OrigVrf: default-vrf
TableID: 0x2                        OrigAs: 0
NibID: 0x26000002                  LastAs: 0
AttrID: 0xffffffff                 Neighbor: 0.0.0.0
Flags: 0x1008c                     OrigNextHop: 10.1.0.102
Label: NULL                         RealNextHop: 10.1.0.102
BkLabel: NULL                       BkNextHop: N/A
SRLabel: NULL                       BkSRLabel: NULL
Tunnel ID: Invalid                  Interface: Vlan-interface10
BkTunnel ID: Invalid                BkInterface: N/A
FtnIndex: 0x0                       TrafficIndex: N/A
Connector: N/A                      PathID: 0x0

```

(Release 65xx, 6008 and later, and 8005 and later) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

```
Summary Count : 1
```

```
Destination: 121.1.1.0/24
```

```

Protocol: IS_L1
Process ID: 1
SubProtID: 0x1                      Age: 04h20m37s
Cost: 20                            Preference: 15
IpPre: N/A                          QosLocalID: N/A
Tag: 0                              State: Active Adv
OrigTblID: 0x2                      OrigVrf: default-vrf
TableID: 0x2                        OrigAs: 0
NibID: 0x26000002                  LastAs: 0

```

```

AttrID: 0xffffffff      Neighbor: 0.0.0.0
Flags: 0x1008c          OrigNextHop: 10.1.0.102
Label: NULL             RealNextHop: 10.1.0.102
BkLabel: NULL           BkNextHop: N/A
SRLabel: NULL           BkSRLabel: NULL
SIDIndex: NULL          InLabel: NULL
Tunnel ID: Invalid      Interface: Vlan-interface10
BkTunnel ID: Invalid    BkInterface: N/A
FtnIndex: 0x0           TrafficIndex: N/A
Connector: N/A          PathID: 0x0
LinkCost: 0             MicroSegID: 0

```

The output shows that Device A communicates with Device C through the Layer 2 switch.

When the link between Device C and the Layer 2 switch fails, view BFD log information.

```

%Oct  9 16:11:24:163 2013 DeviceC BFD/5/BFD_CHANGE_FSM: Sess[10.1.0.102/10.1.0.101,
LD/RD:2049/2049, Interface:Vlan10, SessType:Ctrl, LinkType:INET], Ver:1, Sta: UP->
DOWN, Diag: 1 (Control Detection Time Expired)
%Oct  9 16:11:24:164 2013 DeviceC ISIS/5/ISIS_NBR_CHG: IS-IS 1, Level-1 adjacency
0000.0000.0001 (Vlan-interface10), state changed to DOWN, Reason: BFD session down.
%Oct  9 16:11:24:164 2013 DeviceC ISIS/5/ISIS_NBR_CHG: IS-IS 1, Level-2 adjacency
0000.0000.0001 (Vlan-interface10), state changed to DOWN, Reason: BFD session down.

```

The output shows that BFD can quickly detect the failure and notify IS-IS.

(Release 63xx) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

```
Summary Count : 1
```

```

Destination: 121.1.1.0/24
Protocol: IS_L1
Process ID: 1
SubProtID: 0x1          Age: 04h20m37s
Cost: 2                 Preference: 10
IpPre: N/A              QosLocalID: N/A
Tag: 0                  State: Active Adv
OrigTblID: 0x0          OrigVrf: default-vrf
TableID: 0x2            OrigAs: 0
NibID: 0x26000002       LastAs: 0
AttrID: 0xffffffff      Neighbor: 0.0.0.0
Flags: 0x1008c          OrigNextHop: 192.168.0.102
Label: NULL             RealNextHop: 192.168.0.102
BkLabel: NULL           BkNextHop: N/A
SRLabel: NULL           BkSRLabel: NULL
Tunnel ID: Invalid      Interface: Vlan-interface20
BkTunnel ID: Invalid    BkInterface: N/A
FtnIndex: 0x0           TrafficIndex: N/A
Connector: N/A          PathID: 0x0

```

(Release 65xx, 6008 and later, and 8005 and later) Display information about the routes to network 121.1.1.0/24 on Device A.

```
<DeviceA> display ip routing-table 121.1.1.0 verbose
```

Summary Count : 1

```
Destination: 121.1.1.0/24
  Protocol: IS_L1
Process ID: 1
  SubProtID: 0x1                      Age: 04h20m37s
    Cost: 2                          Preference: 10
    IpPre: N/A                       QosLocalID: N/A
    Tag: 0                           State: Active Adv
OrigTblID: 0x0                      OrigVrf: default-vrf
  TableID: 0x2                      OrigAs: 0
    NibID: 0x26000002              LastAs: 0
    AttrID: 0xffffffff             Neighbor: 0.0.0.0
    Flags: 0x1008c                OrigNextHop: 192.168.0.102
    Label: NULL                    RealNextHop: 192.168.0.102
  BkLabel: NULL                    BkNextHop: N/A
  SRLabel: NULL                    BkSRLabel: NULL
  SIDIndex: NULL                   InLabel: NULL
Tunnel ID: Invalid                  Interface: Vlan-interface20
BkTunnel ID: Invalid                BkInterface: N/A
  FtnIndex: 0x0                    TrafficIndex: N/A
Connector: N/A                      PathID: 0x0
LinkCost: 0                         MicroSegID: 0
```

The output shows that Device A communicates with Device C through Device B.

Configuration files

NOTE:

Support for the **port link-mode bridge** command depends on the device model.

- Device A:

```
#
isis 1
  network-entity 10.0000.0000.0001.00
#
vlan 10
#
vlan 20
#
vlan 100
#
interface Vlan-interface10
  ip address 10.1.0.101 255.255.255.0
isis enable 1
  isis bfd enable
  bfd min-transmit-interval 100
  bfd min-receive-interval 100
```



```

bfd detect-multiplier 3
#
interface Vlan-interface20
 ip address 192.168.0.101 255.255.255.0
 isis enable 1
#
interface Vlan-interface100
 ip address 120.1.1.1 255.255.255.0
 isis enable 1
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 10
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 20
#
interface GigabitEthernet1/0/3
 port link-mode bridge
 port access vlan 100
#

```

- **Device B:**

```

#
isis 1
 network-entity 10.0000.0000.0003.00
#
vlan 20
#
vlan 30
#
interface Vlan-interface20
 ip address 192.168.0.102 255.255.255.0
 isis enable 1
#
interface Vlan-interface30
 ip address 13.1.1.101 255.255.255.0
 isis enable 1
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 20
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 30
#

```

- **Device C:**

```

#
isis 1
 network-entity 10.0000.0000.0002.00
#
vlan 10
#
vlan 30
#
vlan 100
#
interface Vlan-interface10
 ip address 10.1.0.102 255.255.255.0
 isis enable 1
 isis bfd enable
 bfd min-transmit-interval 100
 bfd min-receive-interval 100
 bfd detect-multiplier 3
#
interface Vlan-interface30
 ip address 13.1.1.102 255.255.255.0
 isis enable 1
#
interface Vlan-interface100
 ip address 121.1.1.1 255.255.255.0
 isis enable 1
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 10
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 30
#
interface GigabitEthernet1/0/3
 port link-mode bridge
 port access vlan 100
#

```

Example: Configuring BFD for BGP

Network configuration

As shown in [Figure 6](#), the devices in AS 100 run OSPF to reach each other. There are two paths between Device B and Device D:

- **Path A**—Path over Device C.
- **Path B**—Path over Device E.

When both paths are available, BGP uses the path over Device C to forward traffic between Device A and Device F.

Enable BFD control packet mode on Device B and Device D to monitor the path over Device C. When BFD detects a link failure, it notifies BGP to switch to the path over Device E.

Figure 6 Network diagram

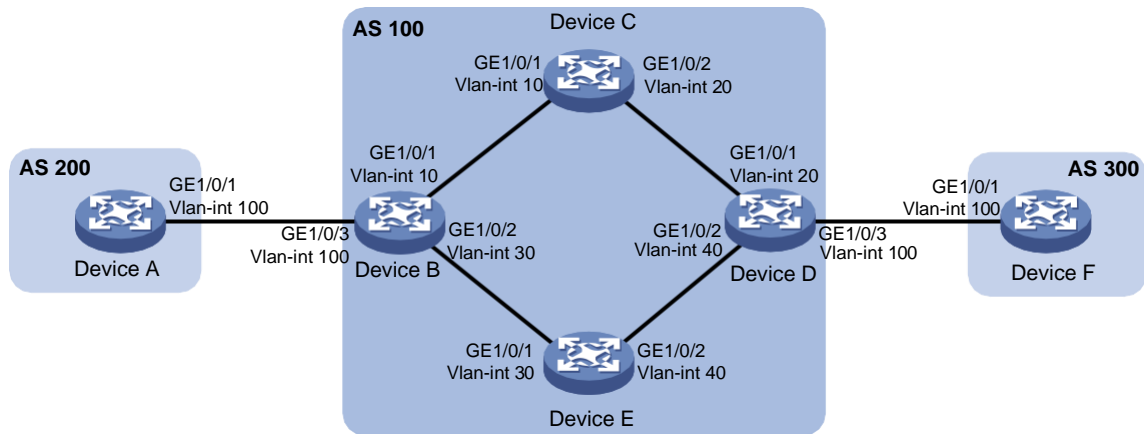


Table 5 Interface and IP address assignment

Device	Interface	IP address
Device A	Vlan-int100	120.1.0.1/24
Device B	Vlan-int10	10.1.0.101/24
Device B	Vlan-int30	192.168.0.101/24
Device B	Vlan-int100	120.1.0.2/24
Device C	Vlan-int10	10.1.0.102/24
Device C	Vlan-int20	10.2.0.102/24
Device D	Vlan-int20	10.2.0.101/24
Device D	Vlan-int40	13.1.1.101/24
Device D	Vlan-int100	120.2.0.2/24
Device E	Vlan-int30	192.168.0.102/24
Device E	Vlan-int40	13.1.1.102/24
Device F	Vlan-int100	120.2.0.1/24

Analysis

For Path A to become the primary path, use a routing policy to set a lower cost for Path A than Path B.

Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Not supported

Restrictions and guidelines

In BFD control packet mode, a minimum of one end must operate in active mode for a BFD session to be established.

Procedures

Configuring interface IP addresses

Configure IP addresses for the interfaces on the devices. (Details not shown.)

Configuring OSPF in AS 100

1. Configure Device B:

```
[DeviceB] ospf
[DeviceB-ospf-1] import-route direct
[DeviceB-ospf-1] area 0
[DeviceB-ospf-1-area-0.0.0.0] network 10.1.0.0 0.0.0.255
[DeviceB-ospf-1-area-0.0.0.0] network 192.168.0.0 0.0.0.255
[DeviceB-ospf-1-area-0.0.0.0] quit
[DeviceB-ospf-1] quit
```

2. Configure Device C:

```
[DeviceC] ospf
[DeviceC-ospf-1] area 0
[DeviceC-ospf-1-area-0.0.0.0] network 10.1.0.0 0.0.0.255
[DeviceC-ospf-1-area-0.0.0.0] network 10.2.0.0 0.0.0.255
[DeviceC-ospf-1-area-0.0.0.0] quit
[DeviceC-ospf-1] quit
```

3. Configure Device D:

```
[DeviceD] ospf
[DeviceD-ospf-1] import-route direct
[DeviceD-ospf-1] area 0
[DeviceD-ospf-1-area-0.0.0.0] network 10.2.0.0 0.0.0.255
[DeviceD-ospf-1-area-0.0.0.0] network 13.1.1.0 0.0.0.255
[DeviceD-ospf-1-area-0.0.0.0] quit
```

```
[DeviceD-ospf-1] quit
```

4. Configure Device E:

```
[DeviceE] ospf
[DeviceE-ospf-1] area 0
[DeviceE-ospf-1-area-0.0.0.0] network 13.1.1.0 0.0.0.255
[DeviceE-ospf-1-area-0.0.0.0] network 192.168.0.0 0.0.0.255
[DeviceE-ospf-1-area-0.0.0.0] quit
[DeviceE-ospf-1] quit
```

Configuring BGP

1. Configure Device A:

Enable BGP and set the local AS number to 200.

```
[DeviceA] bgp 200
[DeviceA-bgp-default] router-id 1.1.1.1
```

Establish an EBGP connection with Device B.

```
[DeviceA-bgp-default] peer 120.1.0.2 as-number 100
```

Create the BGP IPv4 unicast address family and enter its view.

```
[DeviceA-bgp-default] address-family ipv4 unicast
```

In BGP IPv4 unicast address family view, inject local network 120.1.0.0/24 to the BGP routing table.

```
[DeviceA-bgp-default-ipv4] network 120.1.0.0 255.255.255.0
```

Enable BGP to exchange IPv4 unicast routing information with peer 120.1.0.2.

```
[DeviceA-bgp-default-ipv4] peer 120.1.0.2 enable
[DeviceA-bgp-default-ipv4] quit
```

2. Configure Device B:

Enable BGP and set the local AS number to 100.

```
[DeviceB] bgp 100
[DeviceB-bgp-default] router-id 2.2.2.2
```

Establish an EBGP connection with Device A.

```
[DeviceB-bgp-default] peer 120.1.0.1 as-number 200
```

Establish IBGP connections with Device D.

```
[DeviceB-bgp-default] peer 10.2.0.101 as-number 100
[DeviceB-bgp-default] peer 13.1.1.101 as-number 100
```

Create the BGP IPv4 unicast address family and enter its view.

```
[DeviceB-bgp-default] address-family ipv4 unicast
```

Enable BGP to exchange IPv4 unicast routing information with peer 10.2.0.101.

```
[DeviceB-bgp-default-ipv4] peer 10.2.0.101 enable
```

In BGP IPv4 unicast address family view, specify the device as the next hop for routes sent to peer 10.2.0.101.

```
[DeviceB-bgp-default-ipv4] peer 10.2.0.101 next-hop-local
```

Enable BGP to exchange IPv4 unicast routing information with peer 13.1.1.101.

```
[DeviceB-bgp-default-ipv4] peer 13.1.1.101 enable
```

In BGP IPv4 unicast address family view, specify the device as the next hop for routes sent to peer 13.1.1.101.

```
[DeviceB-bgp-default-ipv4] peer 13.1.1.101 next-hop-local
```

Enable BGP to exchange IPv4 unicast routing information with peer 120.1.0.1.

```
[DeviceB-bgp-default-ipv4] peer 120.1.0.1 enable
[DeviceB-bgp-default-ipv4] quit
```

3. Configure Device D:

Enable BGP and set the local AS number to 100.

```
[DeviceD] bgp 100
[DeviceD-bgp-default] router-id 4.4.4.4
```

Establish IBGP connections with Device B.

```
[DeviceD-bgp-default] peer 10.1.0.101 as-number 100
[DeviceD-bgp-default] peer 192.168.0.101 as-number 100
```

Establish an EBGP connection with Device F.

```
[DeviceD-bgp-default] peer 120.2.0.1 as-number 300
```

Create the BGP IPv4 unicast address family and enter its view.

```
[DeviceD-bgp-default] address-family ipv4 unicast
```

Enable BGP to exchange IPv4 unicast routing information with peer 10.1.0.101.

```
[DeviceD-bgp-default-ipv4] peer 10.1.0.101 enable
```

In BGP IPv4 unicast address family view, specify the device as the next hop for routes sent to peer 10.1.0.101.

```
[DeviceD-bgp-default-ipv4] peer 10.1.0.101 next-hop-local
```

Enable BGP to exchange IPv4 unicast routing information with peer 192.168.0.101.

```
[DeviceD-bgp-default-ipv4] peer 192.168.0.101 enable
```

In BGP IPv4 unicast address family view, specify the device as the next hop for routes sent to peer 192.168.0.101.

```
[DeviceD-bgp-default-ipv4] peer 192.168.0.101 next-hop-local
```

Enable BGP to exchange IPv4 unicast routing information with peer 120.2.0.1.

```
[DeviceD-bgp-default-ipv4] peer 120.2.0.1 enable
[DeviceD-bgp-default-ipv4] quit
```

4. Configure Device F:

Enable BGP and set the local AS number to 300.

```
[DeviceF] bgp 300
[DeviceF-bgp-default] router-id 6.6.6.6
```

Establish an EBGP connection with Device D.

```
[DeviceF-bgp-default] peer 120.2.0.2 as-number 100
```

Create the BGP IPv4 unicast address family and enter its view.

```
[DeviceF-bgp-default] address-family ipv4 unicast
```

In BGP IPv4 unicast address family view, inject local network 120.2.0.0/24 to the BGP routing table.

```
[DeviceF-bgp-default-ipv4] network 120.2.0.0 255.255.255.0
```

Enable BGP to exchange IPv4 unicast routing information with peer 120.2.0.2.

```
[DeviceF-bgp-default-ipv4] peer 120.2.0.2 enable
[DeviceF-bgp-default-ipv4] quit
```

Configuring routing policies

1. Configure Device B:

Create ACL 2000 to permit packets sourced from 120.1.0.0/24.

```
[DeviceB] acl basic 2000
[DeviceB-acl-ipv4-basic-2000] rule permit source 120.1.0.0 0.0.0.255
```

```
[DeviceB-acl-ipv4-basic-2000] quit
# Set a local preference of 200 for routes advertised to peer 10.2.0.101, and set the
preference for IBGP routes to 100.
[DeviceB] route-policy local-pre permit node 10
[DeviceB-route-policy-local-pre] if-match ip address acl 2000
[DeviceB-route-policy-local-pre] apply local-preference 200
[DeviceB-route-policy-local-pre] quit
[DeviceB] bgp 100
[DeviceB-bgp-default] address-family ipv4 unicast
[DeviceB-bgp-default-ipv4] peer 10.2.0.101 route-policy local-pre export
[DeviceB-bgp-default-ipv4] preference 255 100 130
[DeviceB-bgp-default-ipv4] quit
```

2. Configure Device D:

Create ACL 2000 to permit packets sourced from 120.2.0.0/24.

```
[DeviceD] acl basic 2000
[DeviceD-acl-ipv4-basic-2000] rule permit source 120.2.0.0 0.0.0.255
[DeviceD-acl-ipv4-basic-2000] quit
```

Set a local preference of 200 for routes learned from peer 10.1.0.101, and configure the preference for IBGP routes as 100.

```
[DeviceD] route-policy local-pre permit node 10
[DeviceD-route-policy-local-pre] if-match ip address acl 2000
[DeviceD-route-policy-local-pre] apply local-preference 200
[DeviceD-route-policy-local-pre] quit
[DeviceD] bgp 100
[DeviceD-bgp-default] address-family ipv4 unicast
[DeviceD-bgp-default-ipv4] peer 10.1.0.101 route-policy local-pre export
[DeviceD-bgp-default-ipv4] preference 255 100 130
[DeviceD-bgp-default-ipv4] quit
```

Configuring BFD

1. Configure Device B:

Enable BFD for the link to BGP peer 10.2.0.101.

```
[DeviceB] bgp 100
[DeviceB-bgp-default] peer 10.2.0.101 bfd
[DeviceB-bgp-default] quit
```

2. Configure Device D:

Enable BFD for the link to BGP peer 10.1.0.101.

```
[DeviceD] bgp 100
[DeviceD-bgp-default] peer 10.1.0.101 bfd
[DeviceD-bgp-default] quit
```

Verifying the configuration

Ping Device F from Device A to verify the connectivity.

```
[DeviceA] ping 120.2.0.1
Ping 120.2.0.1 (120.2.0.1): 56 data bytes, press CTRL+C to break
56 bytes from 120.2.0.1: icmp_seq=0 ttl=252 time=1.189 ms
```



```
56 bytes from 120.2.0.1: icmp_seq=1 ttl=252 time=1.095 ms
56 bytes from 120.2.0.1: icmp_seq=2 ttl=252 time=1.086 ms
56 bytes from 120.2.0.1: icmp_seq=3 ttl=252 time=1.097 ms
56 bytes from 120.2.0.1: icmp_seq=4 ttl=252 time=1.089 ms
```

```
--- Ping statistics for 120.2.0.1 ---
```

```
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 1.086/1.111/1.189/0.039 ms
```

The output shows that Device F can be pinged successfully.

Display BGP peer information on Device B.

```
[DeviceB] display bgp peer ipv4
```

```
BGP local router ID: 2.2.2.2
```

```
Local AS number: 100
```

```
Total number of peers: 3
```

```
Peers in established state: 3
```

```
* - Dynamically created peer
```

```
^ - Peer created through link-local address
```

Peer	AS	MsgRcvd	MsgSent	OutQ	PrefRcv	Up/Down	State
10.2.0.101	100	6	4	0	1	00:00:56	Established
13.1.1.101	100	6	5	0	1	00:00:56	Established
120.1.0.1	200	6	5	0	1	00:00:56	Established

The output shows the following information:

- Two IBGP connections have been established between Device B and Device D.
- An EBGP connection has been established between Device B and Device A.

Display detailed BFD session information on Device B.

```
[DeviceB] display bfd session verbose
```

```
Total Session Num: 1      Up Session Num: 0      Init Mode: Active
```

```
IPv4 session working in control packet mode:
```

```
Local Discr: 2049
```

```
Remote Discr: 0
```

```
Source IP: 10.1.0.101
```

```
Destination IP: 10.2.0.101
```

```
Session State: UP
```

```
Interface: N/A
```

```
Hold Time: 0ms
```

```
Act Tx Inter: 400ms
```

```
Min Rx Inter: 400ms
```

```
Detect Inter: 2000ms
```

```
Rx Count: 0
```

```
Tx Count: 910
```

```
Connect Type: Indirect
```

```
Running Up for: 00:00:00
```

```
Detect Mode: Async
```

```
Slot: 1
```

```
Protocol: BGP
```

```
Version: 1
```

```
Diag Info: No Diagnostic
```

The output shows that a BFD session has been established and is up.

(Release 63xx) Display information about the routes to network 120.2.0.0/24 on Device B.

```
[DeviceB] display ip routing-table 120.2.0.0 24 verbose
```

```
Summary Count : 3
```

Destination: 120.2.0.0/24

Protocol: BGP instance default

Process ID: 0

SubProtID: 0x1 Age: 00h24m48s
Cost: 0 Preference: 100
IpPre: N/A QosLocalID: N/A
Tag: 0 State: Active Adv

OrigTblID: 0x0 OrigVrf: default-vrf
TableID: 0x2 OrigAs: 300

NibID: 0x15000001 LastAs: 300

AttrID: 0x1 Neighbor: 10.2.0.101

Flags: 0x10060 OrigNextHop: 10.2.0.101

Label: NULL RealNextHop: 10.1.0.102

BkLabel: NULL BkNextHop: N/A

SRLabel: NULL BkSRLabel: NULL

Tunnel ID: Invalid Interface: Vlan-interface10

BkTunnel ID: Invalid BkInterface: N/A

FtnIndex: 0x0 TrafficIndex: N/A

Connector: N/A PathID: 0x0

Destination: 120.2.0.0/24

Protocol: O_ASE2

Process ID: 1

SubProtID: 0x8 Age: 00h26m19s
Cost: 1 Preference: 150
IpPre: N/A QosLocalID: N/A
Tag: 1 State: Inactive Adv

OrigTblID: 0x0 OrigVrf: default-vrf

TableID: 0x2 OrigAs: 0

NibID: 0x13000005 LastAs: 0

AttrID: 0xffffffff Neighbor: 0.0.0.0

Flags: 0x41 OrigNextHop: 10.1.0.102

Label: NULL RealNextHop: 10.1.0.102

BkLabel: NULL BkNextHop: N/A

SRLabel: NULL BkSRLabel: NULL

Tunnel ID: Invalid Interface: Vlan-interface10

BkTunnel ID: Invalid BkInterface: N/A

FtnIndex: 0x0 TrafficIndex: N/A

Connector: N/A PathID: 0x0

Destination: 120.2.0.0/24

Protocol: O_ASE2

Process ID: 1

SubProtID: 0x8 Age: 00h26m19s
Cost: 1 Preference: 150
IpPre: N/A QosLocalID: N/A
Tag: 1 State: Inactive Adv

```

OrigTblID: 0x0                OrigVrf: default-vrf
TableID: 0x2                  OrigAs: 0
NibID: 0x13000003            LastAs: 0
AttrID: 0xffffffff            Neighbor: 0.0.0.0
Flags: 0x41                   OrigNextHop: 192.168.0.102
Label: NULL                   RealNextHop: 192.168.0.102
BkLabel: NULL                 BkNextHop: N/A
SRLabel: NULL                 BkSRLabel: NULL
Tunnel ID: Invalid            Interface: Vlan-interface30
BkTunnel ID: Invalid          BkInterface: N/A
FtnIndex: 0x0                 TrafficIndex: N/A
Connector: N/A                 PathID: 0x0

```

(Release 65xx, 6008 and later, and 8005 and later) Display information about the routes to network 120.2.0.0/24 on Device B.

```
[DeviceB] display ip routing-table 120.2.0.0 24 verbose
```

```
Summary Count : 3
```

```
Destination: 120.2.0.0/24
```

```

Protocol: BGP instance default
Process ID: 0
SubProtID: 0x1                Age: 00h24m48s
Cost: 0                        Preference: 100
IpPre: N/A                     QosLocalID: N/A
Tag: 0                         State: Active Adv
OrigTblID: 0x0                OrigVrf: default-vrf
TableID: 0x2                  OrigAs: 300
NibID: 0x15000001 LastAs: 300
AttrID: 0x1                   Neighbor: 10.2.0.101
Flags: 0x10060                OrigNextHop: 10.2.0.101
Label: NULL                    RealNextHop: 10.1.0.102
BkLabel: NULL                 BkNextHop: N/A
SRLabel: NULL                 BkSRLabel: NULL
SIDIndex: NULL                InLabel: NULL
Tunnel ID: Invalid            Interface: Vlan-interface10
BkTunnel ID: Invalid          BkInterface: N/A
FtnIndex: 0x0                 TrafficIndex: N/A
Connector: N/A                 PathID: 0x0
LinkCost: 0                    MicroSegID: 0

```

```
Destination: 120.2.0.0/24
```

```

Protocol: O_ASE2
Process ID: 1
SubProtID: 0x8                Age: 00h26m19s
Cost: 1                        Preference: 150
IpPre: N/A                     QosLocalID: N/A
Tag: 1                         State: Inactive Adv
OrigTblID: 0x0                OrigVrf: default-vrf

```

```

TableID: 0x2                OrigAs: 0
NibID: 0x13000005          LastAs: 0
AttrID: 0xffffffff         Neighbor: 0.0.0.0
Flags: 0x41                OrigNextHop: 10.1.0.102
Label: NULL                RealNextHop: 10.1.0.102
BkLabel: NULL              BkNextHop: N/A
SRLabel: NULL              BkSRLabel: NULL
SIDIndex: NULL             InLabel: NULL
Tunnel ID: Invalid         Interface: Vlan-interface10
BkTunnel ID: Invalid       BkInterface: N/A
FtnIndex: 0x0              TrafficIndex: N/A
Connector: N/A             PathID: 0x0
LinkCost: 0                MicroSegID: 0

```

Destination: 120.2.0.0/24

```

Protocol: O_ASE2
Process ID: 1
SubProtID: 0x8             Age: 00h26m19s
Cost: 1                    Preference: 150
IpPre: N/A                 QosLocalID: N/A
Tag: 1                     State: Inactive Adv
OrigTblID: 0x0             OrigVrf: default-vrf
TableID: 0x2               OrigAs: 0
NibID: 0x13000003          LastAs: 0
AttrID: 0xffffffff         Neighbor: 0.0.0.0
Flags: 0x41                OrigNextHop: 192.168.0.102
Label: NULL                RealNextHop: 192.168.0.102
BkLabel: NULL              BkNextHop: N/A
SRLabel: NULL              BkSRLabel: NULL
SIDIndex: NULL             InLabel: NULL
Tunnel ID: Invalid         Interface: Vlan-interface30
BkTunnel ID: Invalid       BkInterface: N/A
FtnIndex: 0x0              TrafficIndex: N/A
Connector: N/A             PathID: 0x0
LinkCost: 0                MicroSegID: 0

```

The output shows that Device B communicates with Device D through path over Device C.

When the path over Device C fails, ping Device F from Device A.

```

[DeviceA] ping 120.2.0.1
Ping 120.1.0.1 (120.2.0.1): 56 data bytes, press CTRL+C to break
56 bytes from 120.2.0.1: icmp_seq=0 ttl=252 time=0.680 ms
56 bytes from 120.2.0.1: icmp_seq=1 ttl=252 time=0.295 ms
56 bytes from 120.2.0.1: icmp_seq=2 ttl=252 time=0.423 ms
56 bytes from 120.2.0.1: icmp_seq=3 ttl=252 time=0.464 ms
56 bytes from 120.2.0.1: icmp_seq=4 ttl=252 time=0.445 ms

--- Ping statistics for 120.2.0.1 ---
5 packets transmitted, 5 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.295/0.461/0.680/0.124 ms

```

The output shows that Device F can be pinged successfully.

(Release 63xx) Display information about the routes to network 120.2.0.0/24 on Device B.

```
[DeviceB] display ip routing-table 120.2.0.0 24 verbose
```

Summary Count : 2

Destination: 120.2.0.0/24

```
Protocol: BGP instance default
Process ID: 0
SubProtID: 0x1                      Age: 00h00m18s
Cost: 0                             Preference: 100
IpPre: N/A                          QosLocalID: N/A
Tag: 0                              State: Active Adv
OrigTblID: 0x0                      OrigVrf: default-vrf
TableID: 0x2                        OrigAs: 300
NibID: 0x15000001                  LastAs: 300
AttrID: 0x1                        Neighbor: 13.1.1.101
Flags: 0x10060                     OrigNextHop: 13.1.1.101
Label: NULL                         RealNextHop: 192.168.0.102
BkLabel: NULL                       BkNextHop: N/A
SRLabel: NULL                       BkSRLabel: NULL
Tunnel ID: Invalid                  Interface: Vlan-interface30
BkTunnel ID: Invalid                BkInterface: N/A
FtnIndex: 0x0                       TrafficIndex: N/A
Connector: N/A                      PathID: 0x0
```

Destination: 120.2.0.0/24

```
Protocol: O_ASE2
Process ID: 1
SubProtID: 0x8                      Age: 00h00m18s
Cost: 1                             Preference: 150
IpPre: N/A                          QosLocalID: N/A
Tag: 1                              State: Inactive Adv
OrigTblID: 0x0                      OrigVrf: default-vrf
TableID: 0x2                        OrigAs: 0
NibID: 0x13000001                  LastAs: 0
AttrID: 0xffffffff                 Neighbor: 0.0.0.0
Flags: 0x41                         OrigNextHop: 192.168.0.102
Label: NULL                         RealNextHop: 192.168.0.102
BkLabel: NULL                       BkNextHop: N/A
SRLabel: NULL                       BkSRLabel: NULL
Tunnel ID: Invalid                  Interface: Vlan-interface30
BkTunnel ID: Invalid                BkInterface: N/A
FtnIndex: 0x0                       TrafficIndex: N/A
Connector: N/A                      PathID: 0x0
```

(Release 65xx, 6008 and later, and 8005 and later) Display information about the routes to network 120.2.0.0/24 on Device B.

```
[DeviceB] display ip routing-table 120.2.0.0 24 verbose
```

Summary Count : 2

Destination: 120.2.0.0/24

Protocol: BGP instance default

Process ID: 0

SubProtID: 0x1 Age: 00h00m18s

Cost: 0 Preference: 100

IpPre: N/A QosLocalID: N/A

Tag: 0 State: Active Adv

OrigTblID: 0x0 OrigVrf: default-vrf

TableID: 0x2 OrigAs: 300

NibID: 0x15000001 LastAs: 300

AttrID: 0x1 Neighbor: 13.1.1.101

Flags: 0x10060 OrigNextHop: 13.1.1.101

Label: NULL RealNextHop: 192.168.0.102

BkLabel: NULL BkNextHop: N/A

SRLabel: NULL BkSRLabel: NULL

SIDIndex: NULL InLabel: NULL

Tunnel ID: Invalid Interface: Vlan-interface30

BkTunnel ID: Invalid BkInterface: N/A

FtnIndex: 0x0 TrafficIndex: N/A

Connector: N/A PathID: 0x0

LinkCost: 0 MicroSegID: 0

Destination: 120.2.0.0/24

Protocol: O_ASE2

Process ID: 1

SubProtID: 0x8 Age: 00h00m18s

Cost: 1 Preference: 150

IpPre: N/A QosLocalID: N/A

Tag: 1 State: Inactive Adv

OrigTblID: 0x0 OrigVrf: default-vrf

TableID: 0x2 OrigAs: 0

NibID: 0x13000001 LastAs: 0

AttrID: 0xffffffff Neighbor: 0.0.0.0

Flags: 0x41 OrigNextHop: 192.168.0.102

Label: NULL RealNextHop: 192.168.0.102

BkLabel: NULL BkNextHop: N/A

SRLabel: NULL BkSRLabel: NULL

SIDIndex: NULL InLabel: NULL

Tunnel ID: Invalid Interface: Vlan-interface30

BkTunnel ID: Invalid BkInterface: N/A

FtnIndex: 0x0 TrafficIndex: N/A

Connector: N/A PathID: 0x0

LinkCost: 0 MicroSegID: 0

The output shows that Device B communicates with Device D through path over Device E.

Configuration files

NOTE:

Support for the **port link-mode bridge** command depends on the device model.

- **Device A:**

```
#
vlan 100
#
interface Vlan-interface100
 ip address 120.1.0.1 255.255.255.0
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 100
#
bgp 200
 router-id 1.1.1.1
 peer 120.1.0.2 as-number 100
#
 address-family ipv4 unicast
  network 120.1.0.0 255.255.255.0
  peer 120.1.0.2 enable
#
```

- **Device B:**

```
#
ospf 1
 import-route direct
 area 0.0.0.0
  network 10.1.0.0 0.0.0.255
  network 192.168.0.0 0.0.0.255
#
vlan 10
#
vlan 30
#
vlan 100
#
interface Vlan-interface10
 ip address 10.1.0.101 255.255.255.0
#
interface Vlan-interface30
 ip address 192.168.0.101 255.255.255.0
#
interface Vlan-interface100
 ip address 120.1.0.2 255.255.255.0
#
```

```

interface GigabitEthernet1/0/1
  port link-mode bridge
  port access vlan 10
#
interface GigabitEthernet1/0/2
  port link-mode bridge
  port access vlan 30
#
interface GigabitEthernet1/0/3
  port link-mode bridge
  port access vlan 100
#
bgp 100
  router-id 2.2.2.2
  peer 10.2.0.101 as-number 100
  peer 10.2.0.101 bfd
  peer 13.1.1.101 as-number 100
  peer 120.1.0.1 as-number 200
#
  address-family ipv4 unicast
    preference 255 100 130
    peer 10.2.0.101 enable
    peer 10.2.0.101 next-hop-local
    peer 10.2.0.101 route-policy local-pre export
    peer 13.1.1.101 enable
    peer 13.1.1.101 next-hop-local
    peer 120.1.0.1 enable
#
  route-policy local-pre permit node 10
    if-match ip address acl 2000
    apply local-preference 200
#
acl basic 2000
  rule 0 permit source 120.1.0.0 0.0.0.255
#

```

- **Device C:**

```

#
ospf 1
  area 0.0.0.0
    network 10.1.0.0 0.0.0.255
    network 10.2.0.0 0.0.0.255
#
vlan 10
#
vlan 20
#
interface Vlan-interface10
  ip address 10.1.0.102 255.255.255.0

```



```
#
interface Vlan-interface20
 ip address 10.2.0.102 255.255.255.0
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 10
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 20
#
```

- **Device D:**

```
#
ospf 1
 import-route direct
 area 0.0.0.0
  network 10.2.0.0 0.0.0.255
  network 13.1.1.0 0.0.0.255
#
vlan 20
#
vlan 40
#
vlan 100
#
interface Vlan-interface20
 ip address 10.2.0.101 255.255.255.0
#
interface Vlan-interface40
 ip address 13.1.1.101 255.255.255.0
#
interface Vlan-interface100
 ip address 120.1.0.1 255.255.255.0
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 20
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 40
#
interface GigabitEthernet1/0/3
 port link-mode bridge
 port access vlan 100
#
bgp 100
```

```

router-id 4.4.4.4
peer 10.1.0.101 as-number 100
peer 10.1.0.101 bfd
peer 120.2.0.1 as-number 300
peer 192.168.0.101 as-number 100
#
address-family ipv4 unicast
  preference 255 100 130
  peer 10.1.0.101 enable
  peer 10.1.0.101 next-hop-local
  peer 10.1.0.101 route-policy local-pre export
  peer 192.168.0.101 enable
  peer 192.168.0.101 next-hop-local
  peer 120.2.0.1 enable
#
acl basic 2000
  rule 0 permit source 120.2.0.0 0.0.0.255
#

```

- **Device E:**

```

#
ospf 1
  area 0.0.0.0
    network 13.1.1.0 0.0.0.255
    network 192.168.0.0 0.0.0.255
#
vlan 30
#
vlan 40
#
interface Vlan-interface30
  ip address 192.168.0.102 255.255.255.0
#
interface Vlan-interface40
  ip address 13.1.1.102 255.255.255.0
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  port access vlan 30
#
interface GigabitEthernet1/0/2
  port link-mode bridge
  port access vlan 40
#

```

- **Device F:**

```

#
vlan 100
#
interface Vlan-interface100

```

```

ip address 120.2.0.1 255.255.255.0
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 100
#
bgp 300
router-id 6.6.6.6
peer 120.2.0.2 as-number 100
#
address-family ipv4 unicast
network 120.2.0.0 255.255.255.0
peer 120.2.0.2 enable
#

```

Example: Configuring BFD for PBR

Network configuration

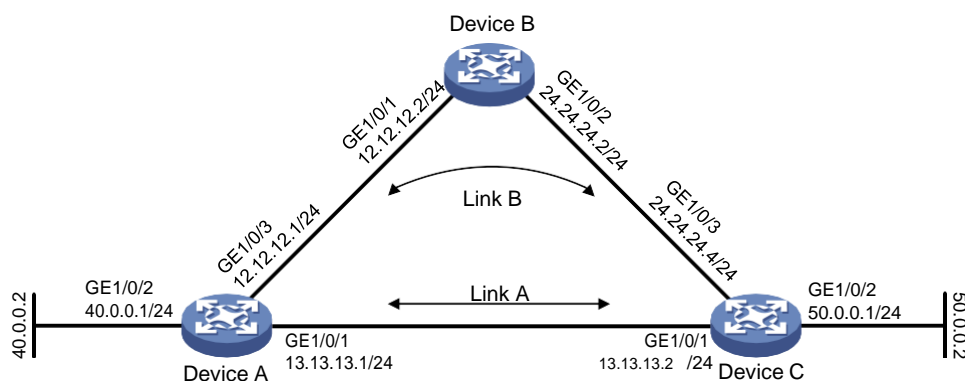
As shown in [Figure 7](#), Device A has two paths to reach Device C:

- Link A.
- Link B.

Configure PBR to enable Device A to forward traffic with source IP address 40.0.0.2 over Link B.

Enable BFD echo packet mode on Device A (Device C does not support BFD) to monitor Link B. When BFD detects a link failure, Device A switches the path to Link A.

Figure 7 Network diagram



Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx

SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Release 63xx

Restrictions and guidelines

The source IP address for BFD echo packets cannot be on the same network segment as any local interface's IP address. Otherwise, a large number of ICMP redirect packets might be sent from the peer, resulting in link congestion.

Procedures

Configuring interface IP addresses

1. Configure Device A:

```

<DeviceA> system-view
[DeviceA] vlan 40
[DeviceA-vlan40] port gigabitethernet 1/0/2
[DeviceA-vlan40] quit
[DeviceA] interface vlan-interface 40
[DeviceA-Vlan-interface40] ip address 40.0.0.1 24
[DeviceA-Vlan-interface40] quit

```

2. Configure other devices in the same way Device A is configured. (Details not shown.)

Configuring static routes

1. Configure Device A:

Configure a static route to reach network 50.0.0.0.

```
[DeviceA] ip route-static 50.0.0.0 24 vlan-interface 200 13.13.13.2
```

2. Configure Device B:

Configure a static route to reach network 50.0.0.0.

```
[DeviceB] ip route-static 50.0.0.0 24 vlan-interface 101 24.24.24.4
```

Configuring routing policies on Device A

Create ACL 3010 to permit packets sourced from 40.0.0.2.

```

[DeviceA] acl number 3010
[DeviceA-acl-adv-3010] rule 0 permit ip source 40.0.0.2 0
[DeviceA-acl-adv-3010] quit

```

Create routing policy **aaa** to set next hop 12.12.12.2 for packets matching ACL 3010, and associate the next hop with track entry 11.

```

[DeviceA] policy-based-route aaa permit node 5
[DeviceA-pbr-aaa-5] if-match acl 3010
[DeviceA-pbr-aaa-5] apply next-hop 12.12.12.2 track 11
[DeviceA-pbr-aaa-5] quit

```

Apply routing policy **aaa** to VLAN-interface 40.

```

[DeviceA] interface vlan-interface 40
[DeviceA-Vlan-interface40] ip policy-based-route aaa
[DeviceA-Vlan-interface40] quit

```

Configuring BFD parameters on Device A

Configure the source IP address for BFD echo packets.

```
[DeviceA] bfd echo-source-ip 3.3.3.3
```

Configure the minimum interval for receiving BFD echo packets and the single-hop detection time multiplier, and associate track entry 11 with BFD.

```

[DeviceA] interface vlan-interface 100
[DeviceA-Vlan-interface100] bfd min-echo-receive-interval 100
[DeviceA-Vlan-interface100] bfd detect-multiplier 3
[DeviceA-Vlan-interface100] quit
[DeviceA] track 11 bfd echo interface vlan-interface100 remote ip 12.12.12.2 local ip 12.12.12.1
[DeviceA-track-11] quit

```

Verifying the configuration

Display outbound traffic statistics for all interfaces on Device A.

```
<DeviceA> reset counters interface
```

```
<DeviceA> display counters outbound interface
```

Interface	Total (pkts)	Broadcast (pkts)	Multicast (pkts)	Err (pkts)
GE1/0/1	0	0	0	0
GE1/0/2	0	0	0	0
GE1/0/3	585414	0	0	0
GE1/0/4	0	0	0	0
GE1/0/5	0	0	0	0
GE1/0/6	0	0	0	0

The output shows that the traffic sourced from 40.0.0.0 is forwarded through VLAN-interface 100 (Link B).

Display BFD session information on Device A.

```
[DeviceA] display bfd session verbose
```

```
Total Session Num: 1      Up Session Num: 1      Init Mode: Active
```

```
IPv4 session working in echo mode:
```

```
Local Discr: 2049
```

```
Source IP: 12.12.12.1
```

```
Destination IP: 12.12.12.2
```

```
Session State: Up
```

```
Interface: Vlan-interface100
```

```
Hold Time: 0ms
```

```
Act Tx Inter: 100ms
```

```
Min Rx Inter: 100ms
```

```
Detect Inter: 300ms
```

```
Rx Count: 128234
```

```
Tx Count: 371950
```

```
Connect Type: Direct
```

```
Running Up for: 00:01:04
```

```
Detect Mode: Async
```

```
Slot: 1
```

```
Protocol: TRACK
```

```
Version: 1
```

```
Diag Info: No Diagnostic
```

The output shows that a BFD session has been established and is up.

When the link between Device A and Device B fails, view BFD log information.

```
%Dec 10 16:39:46:210 2013 DeviceA BFD/5/BFD_CHANGE_FSM: Sess[12.12.12.1/12.12.12.2, LD/RD:2049/2049, Interface:Vlan100, SessType:Echo, LinkType:INET], Ver: 1, Sta: UP-> DOWN, Diag: 1 (Control Detection Time Expired)
```

```
%Dec 10 16:39:47:343 2013 DeviceA IFNET/5/LINK_UPDOWN: Line protocol on the interface GigabitEthernet1/0/3 is down.
```

```
%Dec 10 16:39:47:343 2013 DeviceA IFNET/3/PHY_UPDOWN: Vlan-interface100 link status is down.
```

The output shows that the BFD session is down.

Clear the interface statistics, and display outbound traffic statistics for all interfaces on Device A again.

```
<DeviceA> reset counters interface
```

```
<DeviceA> display counters outbound interface
```

Interface	Total (pkts)	Broadcast (pkts)	Multicast (pkts)	Err (pkts)
GE1/0/1	863764	0	0	0
GE1/0/2	0	0	0	0

GE1/0/3	0	0	0	0
GE1/0/4	0	0	0	0
GE1/0/5	0	0	0	0
GE1/0/6	0	0	0	0

The output shows that the traffic sourced from 40.0.0.0 is forwarded through VLAN-interface 200 (Link A).

Configuration files

NOTE:

Support for the **port link-mode bridge** command depends on the device model.

- Device A:

```
#
bfd echo-source-ip 3.3.3.3
#
vlan 40
#
vlan 100
#
vlan 200
#
policy-based-route aaa permit node 5
if-match acl 3010
apply next-hop 12.12.12.2 track 11
#
interface Vlan-interface40
ip address 40.0.0.1 255.255.255.0
ip policy-based-route aaa
#
interface Vlan-interface100
ip address 12.12.12.1 255.255.255.0
bfd min-echo-receive-interval 100
bfd detect-multiplier 3
#
interface Vlan-interface200
ip address 13.13.13.1 255.255.255.0
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 200
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 40
#
interface GigabitEthernet1/0/3
port link-mode bridge
```

```

port access vlan 100
#
ip route-static 50.0.0.0 24 Vlan-interface200 13.13.13.2
#
ip local policy-based-route aaa
#
acl number 3010
rule 0 permit ip source 40.0.0.2 0
#
track 11 bfd echo interface Vlan-interface100 remote ip 12.12.12.2 local ip 12.
12.12.1
#

```

- **Device B:**

```

#
vlan 100 to 101
#
interface NULL0
#
interface Vlan-interface100
ip address 12.12.12.2 255.255.255.0
#
interface Vlan-interface101
ip address 24.24.24.2 255.255.255.0
#
interface GigabitEthernet1/0/1
port link-mode bridge
port access vlan 100
#
interface GigabitEthernet1/0/2
port link-mode bridge
port access vlan 101
#
ip route-static 50.0.0.0 24 Vlan-interface101 24.24.24.4

```

- **Device C:**

```

#
vlan 50
#
vlan 101
#
vlan 200
#
interface NULL0
#
interface Vlan-interface50
ip address 50.0.0.1 255.255.255.0
#
interface Vlan-interface101
ip address 24.24.24.4 255.255.255.0

```



```
#
interface Vlan-interface200
 ip address 13.13.13.2 255.255.255.0
#
interface GigabitEthernet1/0/1
 port link-mode bridge
 port access vlan 200
#
interface GigabitEthernet1/0/2
 port link-mode bridge
 port access vlan 50
#
interface GigabitEthernet1/0/3
 port link-mode bridge
 port access vlan 101
#
```