Contents

1 Configuring Static Route

1.1 Introduction

1.1.1 Overview

A static route is manually configured by a network administrator. A static route is easy to configure and less demanding on the system, and therefore applicable to a small-sized network that is stable and has a simple topology. Appropriate configuration and use of static routes improves the network performance and guarantees the bandwidth for important network applications. However, when the network topology changes, the static route must be manually reconfigured and cannot automatically adapt to the topological changes.

ⓘ   Note

In this chapter, the term "router" refers to any network device that supports the routing function. These network devices can be Layer-3 switches, routers, or firewalls.

1.1.2 Principles

1. **Static Route Basic**

   Whether a static route is active is computed based on the status of the local interface. When the exit interface of a static route is located at Layer-3 and is in Up status (the link status is Up and the IP address is configured), this route is active and can be used for packet forwarding.

   A static route can go across VPN routing & forwarding (VRF) instances. The next hop or exit interface of a static route of VRF 1 can be configured on VRF 2.

   A static route consists of two parts:

   ● Destination IP address and mask: The destination IP address of the packet is matched according to the destination address and mask, and the longest matching principle is adopted. The mask can be represented in dotted decimal form or using mask length.

   ● Outbound interface or next hop address: The next hop of a static route can be the IP address of the outbound interface or next hop router. On a point-to-point network, specifying the outbound interface indirectly determines the next hop router. However, on the Non Broadcast Multiple Access (NBMA) or broadcast network, using an outbound interface as the next hop will lead to multiple next hops. Therefore, you are advised to set the IP address for the next hop router on the NBMA and broadcast networks.

2. **Default Route**

   In a forwarding routing table, the route with the destination network segment 0.0.0.0 and the subnet mask 0.0.0.0 is the default route. Packets that cannot be forwarded by other routes will be forwarded by the default route. The default route can be statically configured or generated by a dynamic routing protocol.

   ● Default gateway

   After the IP routing function is disabled, run the **ip default gateway** command to generate a default route.

● Static default route

On a device, a static route with the network segment 0.0.0.0 and the subnet mask 0.0.0.0 is configured to generate a default route.

● Default network

The default network is configured to generate a default route. If the **ip default-network** command is configured to specify a network (a classful network, such as a Class A, B, or C network), and this network exists in the routing table, the router will use this network as the default network and the next hop of this network is the default gateway. As the network specified by the **ip default-network** command is a classful one, if this command is used to identify a subnet in a classful network, the router automatically generates a static route of the classful network instead of any default route.

3. **Static route reliability**

When a device on a network is faulty, some routes become unreachable, resulting in traffic interruption. If connectivity of the next hop can be detected in real time, the route can be re-computed when a fault occurs, or traffic can be switched over to the standby route.

● Correlation with track

A track object is an abstract concept. It can be used to trace whether an IP address is reachable or whether an interface is Up. If a dynamic routing protocol or a static route is correlated with the Track function, the dynamic routing protocol or the static route can quickly learn whether the next hop is reachable so as to respond quickly.

● Correlation with BFD

The bidirectional forwarding detection (BFD) protocol provides a light-load and fast method for detecting the connectivity of the forwarding path between two adjacent routers. If a dynamic routing protocol or a static route is correlated with the BFD function, the dynamic routing protocol or the static route can quickly learn whether the next hop is reachable so as to respond quickly.

> 🛈 **Note**
>
> The detection performance of BFD is better than that of Track.

● Correlation with ARP

If a static route is correlated with the ARP function, when the ARP does not exist, the static route can quickly learn that the next hop is unreachable so as to respond quickly.

● Fast reroute

Fast reroute provides a standby route. When a dynamic routing protocol or a static route detects that the next hop is unreachable, it immediately switches traffic over to the standby route to recover communication.

1.2 Configuration Task Summary

The configuration of static route includes the following tasks:

(1) Configuring Static Routes
    ○ Configuring an IPv4 Static Route

1.3 Configuring Static Routes

1.3.1 Overview

Generate a static route in the routing table. The static route can be used to forward packets to a remote network.

1.3.2 Restrictions and Guidelines

- If the **no ip routing** command is configured, you cannot configure IPv4 static routes on this switch, and existing IPv4 static routes will also be deleted. Before the device is restarted, reconfiguring the **ip routing** command can recover the deleted IPv4 static routes. After the device is restarted, deleted IPv4 static routes cannot be recovered.

- If the **no ipv6 unicast-routing** command is configured, you cannot configure IPv6 static routes on this switch, and existing IPv6 static routes will also be deleted. Before the device is restarted, reconfiguring the **ipv6 unicast-routing** command can recover the deleted IPv6 static routes. After the device is restarted, deleted IPv6 static routes cannot be recovered.

- To correlate a static route with the track function, you must run the **track** command to configure a track object.

1.3.3 Configuration Tasks

The configuration of static route includes the following tasks:

- Configuring an IPv4 Static Route

- Configuring an IPv6 Static Route

1.3.4 Configuring an IPv4 Static Route

1. Overview

In a simple network, you can configure IPv4 static routes to implement internetworking.

2. Restrictions and Guidelines

- If the static route is correlated with track and the Down status of the track object is detected, the static route is not active and does not participate in packet forwarding.

- If the static route is correlated with ARP, but no ARP information of the next hop and egress is detected, the static route is not active and does not participate in packet forwarding.

3. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure an IPv4 static route.

ip route [**vrf** *vrf-name*] *network mask* { *ipv4-address* [**global**] | *interface* [*ipv4-address* [**arp** | **global**] *
] } [*distance* | **description** *description-text* | [**disabled** | **enabled**] | [**track** *object-number*] [**permanent**]
| **tag** *tag* | **weight** *number*] *

No static route is configured by default.

1.3.5 Configuring an IPv6 Static Route

1. Overview

In a simple network, you can configure IPv6 static routes to implement internetworking.

2. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure an IPv6 static route.

ipv6 route [**vrf** *vrf-name*] *ipv6-prefix* / *prefix-length* { *ipv6-address* [**nexthop-vrf** { *vrf-name1* | **default** }]
| *interface* [*ipv6-address* [**nexthop-vrf** { *vrf-name1* | **default** }]] } [*distance*] [**tag** *tag*] [**weight** *number*]
[**description** *description-text*]

No IPv6 static route is configured by default.

1.4   Configuring Static Gateway

1.4.1 Overview

The router in an enterprise does not need to obtain all the routing information of the whole Internet. A default route is generated in the routing table and points to the operator gateway, and then the Internet can be accessed. The default route is used to forward packets that cannot be forwarded by other routes.

1.4.2 Configuration Tasks

The default static route configuration tasks are as follows and optional. Select tasks for configuration according to the actual condition.

- Configuring the IPv4 Gateway

- Configuring the IPv6 Gateway

- Configuring the IPv4 Default Gateway with Static Route

- Configuring the IPv6 Default Gateway with Static Route

- Configuring the IPv4 Default Network with Static Route

1.4.3 Configuring the IPv4 Gateway

1.   Overview

After running the **no ip routing** command to disable the IPv4 routing function, you can run the **ip default-gateway** command to specify the default IPv4 route. During data interaction, the packet with a destination address not in the local network segment is sent to the default gateway, and the gateway router completes the next-step routing, achieving internetworking between the device and other networks.

2.   Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the IPv4 gateway.

ip default-gateway *gateway*

No IPv4 default gateway is configured by default.

1.4.4 Configuring the IPv6 Gateway

1.   Overview

After running the **no ipv6 unicast-routing** command to disable the IPv6 routing function, you can run the **ipv6 default-gateway** command to specify the default IPv6 route. During data interaction, the packet with a destination address not in the local network segment is sent to the default gateway, and the gateway router completes the next-step routing, achieving internetworking between the device and other networks.

2.   Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the IPv6 gateway.

ipv6 default-gateway *gateway*

No IPv6 default gateway is configured by default.

1.4.5 Configuring the IPv4 Default Gateway with Static Route

1.   Overview

On a device, when the routing for packet sending cannot match an accurate route, the default gateway can be configured so that non-local packets are sent to the default gateway, and then the gateway router completes the next-step routing, achieving internetworking between the local device and other networks.

2.   Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the IPv4 default gateway with a static route.

ip route [**vrf** *vrf-name*] **0.0.0.0 0.0.0.0** { *ipv4-address* | *interface* [*ipv4-address*] } [*distance*] [**tag** *tag*] [**permanent** | { **track** *object-number* | **arp** }] [**weight** *number*] [**description** *description-text*] [**disabled** | **enabled**]

By default, no IPv4 default gateway is configured with the static route.

1.4.6 Configuring the IPv6 Default Gateway with Static Route

1.   Overview

On a device, when the routing for packet sending cannot match an accurate route, the default gateway can be configured so that non-local packets are sent to the default gateway, and then the gateway router completes the next-step routing, achieving internetworking between the local device and other networks.

2.   Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the IPv6 default gateway with a static route.

ipv6 route [**vrf** *vrf-name*] **::/0** { *ipv6-address* [**nexthop-vrf** { *vrf-name1* | **default** }] | *interface* [*ipv6-address* [**nexthop-vrf** { *vrf-name1* | **default** }]] } [*distance*] [**tag** *tag*] [**weight** *number*] [**description** *description-text*]

By default, no IPv6 default gateway is configured with the static route.

1.4.7 Configuring the IPv4 Default Network with Static Route

1.   Overview

On a device, when the routing for packet sending cannot match an accurate route, the default gateway can be configured so that non-local packets are sent to the default gateway, and then the gateway router completes the next-step routing, achieving internetworking between the local device and other networks.

2.   Restrictions and Guidelines

If the network specified by the **ip default-network** command exists in the routing table, a default route is generated and the next hop to this network is the default gateway. If the network specified by the **ip default-network** command does not exist, the default route is not generated.

3.   Procedure

(1) Enter the privileged EXEC mode.

   enable

(2) Enter the global configuration mode.

   configure terminal

(3) Configure the IPv4 default network with a static route.

   ip default-network *network*

   By default, no IPv4 default network is configured with the static route.

1.5   Configuring Route Limitations

1.5.1 Overview

This function limits the number of equal-cost routes and number of static routes, or disables routing.

1.5.2 Configuration Tasks

The route limitation configuration tasks are as follows and optional. Select tasks for configuration according to the actual condition.

- Configuring the Maximum Number of IPv4 Static Routes
- Configuring the Maximum Number of IPv6 Static Routes
- Prohibiting Static Routing Across VRFs
- Configuring the Maximum Number of VRF Routes

1.5.3 Configuring the Maximum Number of IPv4 Static Routes

1.   Overview

This command can be used to configure the maximum number of IPv4 static routes. When the maximum number of IPv4 static routes is reached, no more IPv4 static routes can be configured.

2.   Procedure

(1) Enter the privileged EXEC mode.

   enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the maximum number of IPv4 static routes.

ip static route-limit *number*

The configured maximum number of static routes is 1000 by default.

1.5.4 Configuring the Maximum Number of IPv6 Static Routes

1. Overview

This command can be used to configure the maximum number of IPv6 static routes. When the maximum number of IPv6 static routes is reached, no more IPv6 static routes can be configured.

2. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the maximum number of IPv6 static routes.

ipv6 static route-limit *number*

The configured maximum number of static routes is 1000 by default.

1.5.5 Prohibiting Static Routing Across VRFs

1. Overview

You can use this function to prohibit static IP routing across VRFs. After this command is configured, the static IP routing across VRFs is not active and cannot participate in packet forwarding.

2. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Prohibit static IP routing across VRFs.

no ip route static inter-vrf

Static routing across VRFs is allowed by default.

1.5.6 Configuring the Maximum Number of VRF Routes

1. Overview

This function is used to limit the number of routes running in the default VRF. You can receive warnings only through configuration.

2. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the maximum number of routes in the default VRF.

maximum routes *limit* { *warn-threshold* | **warning-only** }

The maximum number of routes in the default VRF is not limited by default.

1.6   Correlating a Static Route with BFD

1.6.1 Overview

A static route can quickly detect a route failure with the help of BFD.

1.6.2 Restrictions and Guidelines

- You must configure a static route.
- You must configure BFD session parameters using the **bfd interval min_rx multiplier** command.

1.6.3 Configuration Tasks

The configuration tasks for correlation of static routes with BFD are as follows and optional. Select tasks for configuration according to the actual condition.

- Configuring Correlation of IPv4 Static Routes with BFD
- Configuring Correlation of IPv6 Static Routes with BFD

1.6.4 Configuring Correlation of IPv4 Static Routes with BFD

1. Overview

You can use this function to configure correlation of IPv4 static routes with BFD, quickly sensing change to the destination address link. If the Down status of the BFD session is detected, the IPv4 static route is not active and does not participate in packet forwarding.

2. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure correlation of IPv4 static routes with BFD.

ip route static bfd [**vrf** *vrf-name*] *interface-type interface-number gateway* [**source** *ipv4-address*]

Correlation of static routes with BFD is disabled by default.

1.6.5   Configuring Correlation of IPv6 Static Routes with BFD

1.   Overview

You can use this function to configure correlation of IPv6 static routes with BFD, quickly sensing change to the destination address link. If the Down status of the BFD session is detected, the IPv6 static route is not active and does not participate in packet forwarding.

2.   Procedure

(1)   Enter the privileged EXEC mode.

enable

(2)   Enter the global configuration mode.

configure terminal

(3)   Configure correlation of IPv6 static routes with BFD.

ipv6 route static bfd [**vrf** *vrf-name*] *interface-type interface-number gateway* [**source** *ipv6-address*]

Correlation of static routes with BFD is disabled by default.

1.7   Configuring Static Fast Reroute

1.7.1 Overview

If a routing link fails on the network, the service will be interrupted and cause loss. To avoid the impact of a link failure, the static fast reroute function can be used to switch the link when a link fails.

1.7.2 Restrictions and Guidelines

- You must configure a static route.
- You must configure a route map.

1.7.3 Procedure

(1)   Enter the privileged EXEC mode.

enable

(2)   Enter the global configuration mode.

configure terminal

(3)   Create a routing policy.

route-map *route-map-name* [{ **permit** | **deny** } *sequence*]

(4)   Create a matching rule.

match interface *interface-type interface-number*

(5)   Configure to define a backup route in the route map.

set fast-reroute backup-interface *interface-type interface-number* **backup-nexthop** *ipv4-address*

By default, no backup egress or backup next hop is specified for the matched route.

(6)   Return to the global configuration mode.

exit

(7) Configure IPv4 static fast reroute.

ip fast-reroute [**vrf** *vrf-name*] **static route-map** *route-map-name*

The IPv4 static fast reroute function is disabled by default.

(8) Configure IPv6 static fast reroute.

ip fast-reroute [**vrf** *vrf-name*] **static route-map** *route-map-name*

The IPv6 static fast reroute function is disabled by default.

1.8 Configuring Correlation of Static Routes with ARP

1.8.1 Overview

This function is used to configure correlation of static routes with ARP so that ARP requests are actively sent when ARP fails.

1.8.2 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the interval for actively sending ARP requests.

ip route scan arp interval *request-interval*

The correlation of static routes with ARP is disabled by default, and the ARP request is sent every 5s.

(4) Configure the times of actively sending ARP requests.

ip route scan arp times *request-times*

By default, the correlation of static routes with ARP is disabled, and the ARP request is sent 65,535 times.

1.9 Monitoring

This section describes the **show** commands used for checking the running status of a configured function to verify the configuration effect.

Meanwhile, the **debug** command can be used to display the output debugging information.

⚠ **Caution**

The output debugging information occupies system resources. Therefore, disable the debugging function immediately after use.

The **clear** command can be used to clear the transmission count of ARP request.

Table 1-1   Monitoring

Command	Purpose
clear ip route arp scan times	Clears the ARP request transmission count and starts counting again.

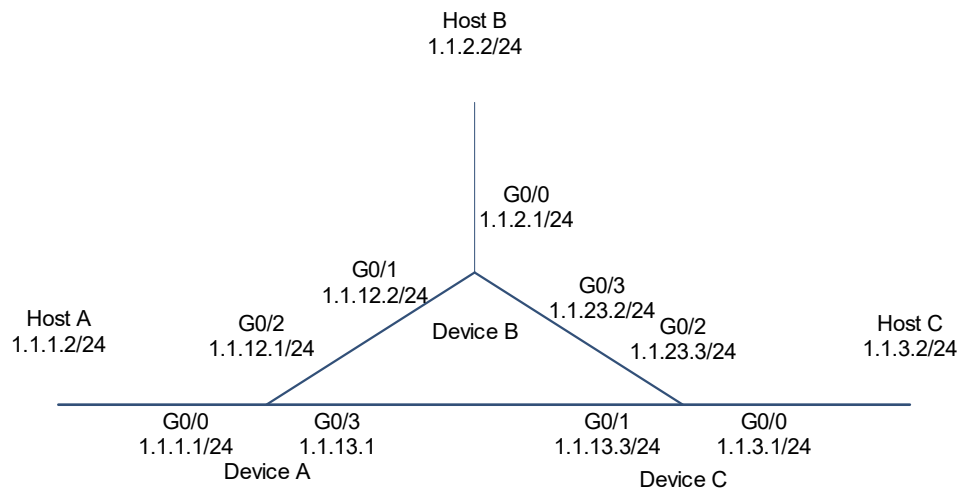| Command	Purpose
show ip redirects	Displays the default gateway.
show ipv6 redirects	Displays the IPv6 default gateway.

1.10 Configuration Examples

1.10.1 Configuring an IPv4 Static Route

1. Requirements

Configure static routes to make routes on the entire network reachable.

2. Topology

Figure 1-1   Topology for IPv4 Static Routes

3. Notes

- Configure an address on each interface of the device.
- Configure static routes on the device.

4. Procedure

(1) Configure an IP addresses for each interface.

Configure Device A.

```
Device A> enable
Device A# configure terminal
Device A(config)# interface gigabitEthernet 0/0
Device A(config-if-GigabitEthernet 0/0)# ip address 1.1.1.1 255.255.255.0
Device A(config-if-GigabitEthernet 0/0)# exit
Device A(config)# interface gigabitEthernet 0/2
Device A(config-if-GigabitEthernet 0/2)# ip address 1.1.12.1 255.255.255.0
```

```
Device A(config-if-GigabitEthernet 0/2)# exit
Device A(config)# interface gigabitEthernet 0/3
Device A(config-if-GigabitEthernet 0/3)# ip address 1.1.13.1 255.255.255.0
Device A(config-if-GigabitEthernet 0/3)# exit
```

Configure Device B.

```
Device B> enable
Device B# configure terminal
Device B(config)# interface gigabitEthernet 0/0
Device B(config-if-GigabitEthernet 0/0)# ip address 1.1.2.1 255.255.255.0
Device B(config-if-GigabitEthernet 0/0)# exit
Device B(config)# interface gigabitEthernet 0/1
Device B(config-if-GigabitEthernet 0/1)# ip address 1.1.12.2 255.255.255.0
Device B(config-if-GigabitEthernet 0/1)# exit
Device B(config)# interface gigabitEthernet 0/3
Device B(config-if-GigabitEthernet 0/3)# ip address 1.1.23.2 255.255.255.0
Device B(config-if-GigabitEthernet 0/3)# exit
```

Configure Device C.

```
Device C> enable
Device C# configure terminal
Device C(config)# interface gigabitEthernet 0/0
Device C(config-if-GigabitEthernet 0/0)# ip address 1.1.3.1 255.255.255.0
Device C(config-if-GigabitEthernet 0/0)# exit
Device C(config)# interface gigabitEthernet 0/1
Device C(config-if-GigabitEthernet 0/1)# ip address 1.1.13.3 255.255.255.0
Device C(config-if-GigabitEthernet 0/1)# exit
Device C(config)# interface gigabitEthernet 0/2
Device C(config-if-GigabitEthernet 0/2)# ip address 1.1.23.3 255.255.255.0
Device C(config-if-GigabitEthernet 0/2)# exit
```

(2) Enable the IPv4 static route function.

Configure Device A.

```
Device A(config)# ip route 1.1.2.0 255.255.255.0 GigabitEthernet 0/2 1.1.12.2
Device A(config)# ip route 1.1.3.0 255.255.255.0 GigabitEthernet 0/3 1.1.13.3
```

Configure Device B.

```
Device B(config)# ip route 1.1.1.0 255.255.255.0 GigabitEthernet 0/1 1.1.12.1
Device B(config)# ip route 1.1.3.0 255.255.255.0 GigabitEthernet 0/3 1.1.23.3
```

Configure Device C.

```
Device C(config)# ip route 1.1.2.0 255.255.255.0 GigabitEthernet 0/2 1.1.23.2
Device C(config)# ip route 1.1.1.0 255.255.255.0 GigabitEthernet 0/1 1.1.13.1
```

5. Verification

Check the routing table of the device and confirm that there are static route entries.

Check the routing table of Device A.

```
Device A# show ip route
```

```
Codes:  C - Connected, L - Local, S - Static
        R - RIP, O - OSPF, B - BGP, I - IS-IS
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        SU - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        IA - Inter area, * - candidate default


Gateway of last resort is no set
C     1.1.1.0/24 is directly connected, GigabitEthernet 0/0
C     1.1.1.1/32 is local host.
S     1.1.2.0/24 [1/0] via 1.1.12.2, GigabitEthernet 0/2
S     1.1.3.0/24 [1/0] via 1.1.13.3, GigabitEthernet 0/2
C     1.1.12.0/24 is directly connected, GigabitEthernet 0/2
C     1.1.12.1/32 is local host.
C     1.1.13.0/24 is directly connected, GigabitEthernet 0/3
C     1.1.13.1/32 is local host.
```

Check the routing table of Device B.

```
Device B# show ip route
Codes:  C - Connected, L - Local, S - Static
        R - RIP, O - OSPF, B - BGP, I - IS-IS
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        SU - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        IA - Inter area, * - candidate default


Gateway of last resort is no set
S     1.1.1.0/24 [1/0] via 1.1.12.1, GigabitEthernet 0/0
C     1.1.2.0/24 is directly connected, GigabitEthernet 0/0
C     1.1.2.1/32 is local host.
S     1.1.3.0/24 [1/0] via 1.1.23.3, GigabitEthernet 0/3
C     1.1.12.0/24 is directly connected, GigabitEthernet 0/1
C     1.1.12.2/32 is local host.
C     1.1.23.0/24 is directly connected, GigabitEthernet 0/3
C     1.1.23.2/32 is local host.
```

Check the routing table of Device C.

```
Device C# show ip route
Codes:  C - Connected, L - Local, S - Static
        R - RIP, O - OSPF, B - BGP, I - IS-IS
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        SU - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        IA - Inter area, * - candidate default


Gateway of last resort is no set
S     1.1.1.0/24 [1/0] via 1.1.13.1, GigabitEthernet 0/2
```

```
S    1.1.2.0/24 [1/0] via 1.1.23.2, GigabitEthernet 0/2
C    1.1.3.0/24 is directly connected, GigabitEthernet 0/0
C    1.1.3.1/32 is local host.
C    1.1.13.0/24 is directly connected, GigabitEthernet 0/1
C    1.1.13.3/32 is local host.
C    1.1.23.0/24 is directly connected, GigabitEthernet 0/2
C    1.1.23.3/32 is local host.
```

6.   Configuration Files

● Device A configuration file

```
!
interface gigabitEthernet 0/0
 ip address 1.1.1.1 255.255.255.0
!
interface gigabitEthernet 0/2
 ip address 1.1.12.1 255.255.255.0
!
interface gigabitEthernet 0/3
 ip address 1.1.13.1 255.255.255.0
!
ip route 1.1.2.0 255.255.255.0 GigabitEthernet 0/2 1.1.12.2
ip route 1.1.3.0 255.255.255.0 GigabitEthernet 0/3 1.1.13.3
!
```

● Device B configuration file

```
!
interface gigabitEthernet 0/0
 ip address 1.1.2.1 255.255.255.0
!
interface gigabitEthernet 0/1
 ip address 1.1.12.2 255.255.255.0
!
interface gigabitEthernet 0/3
 ip address 1.1.23.2 255.255.255.0
!
ip route 1.1.1.0 255.255.255.0 GigabitEthernet 0/1 1.1.12.1
ip route 1.1.3.0 255.255.255.0 GigabitEthernet 0/3 1.1.23.3
!
```

● Device C configuration file

```
!
interface gigabitEthernet 0/0
 ip address 1.1.3.1 255.255.255.0
!
interface gigabitEthernet 0/1
 ip address 1.1.13.3 255.255.255.0
!
```

```
interface gigabitEthernet 0/2
 ip address 1.1.23.3 255.255.255.0
!
ip route 1.1.2.0 255.255.255.0 GigabitEthernet 0/2 1.1.23.2
ip route 1.1.1.0 255.255.255.0 GigabitEthernet 0/1 1.1.13.1
!
```

7.   **Common Errors**

- The link on the interface is not Up.

- No IP address is configured for the interface.
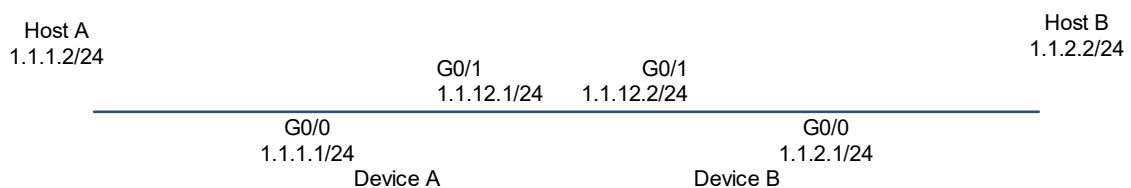
1.10.2 Configuring Correlation of IPv4 Static Routes with Track

1.   **Requirements**

Device A and Device B implement the interworking between Host A 1.1.1.2 and Host B 1.1.2.2 through a static
route. To know the link reachability in time, use correlation of IPv4 static routes with track.

2.   **Topology**

Figure 1-1   Topology for Correlating IPv4 Static Routes with Track

3.   **Notes**

- Configure an address on each interface of the device.

- Configure static routes on Device A and Device B, and specify the exit interface or next hop as the
  interworking interface.

- Correlate static routes with track on Device A and Device B, and check the connectivity of the next hops of
  static routes.

4.   **Procedure**

(1) Configure an IP address for each interface and start the unicast routing protocol.

Configure Device A.

```
Device A> enable
Device A# configure terminal
Device A(config)# interface gigabitEthernet 0/1
Device A(config-if-GigabitEthernet 0/1)# ip address 1.1.12.1 255.255.255.0
Device A(config-if-GigabitEthernet 0/1)# exit
```
Configure Device B.

```
Device B> enable
Device B# configure terminal
```

```
Device B(config)# interface gigabitEthernet 0/1
Device B(config-if-GigabitEthernet 0/1)# ip address 1.1.12.2 255.255.255.0
Device B(config-if-GigabitEthernet 0/1)# exit
```

(2) Configure the track function.

Configure Device A.

```
Device A(config)# track 2 interface gigabitEthernet 0/1 line-protocol
```
Configure Device B.

```
Device B(config)# track 2 interface gigabitEthernet 0/1 line-protocol
```

(3) Configure correlation of static routes with track.

Configure Device A.

```
Device A(config)# ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.2
track 2
```
Configure Device B.

```
Device B(config)# ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.1
track 2
```

5. **Verification**

Display the statistics of Track 2.

```
Device A# show track 2
Track 2
Interface gigabitEthernet 0/1
  The state is Up, delayed Down (5 secs remaining)
    1 change, current state last: 300 secs
  Delay up 0 secs, down 0 secs
```
Display the track correlation information and state of an IP route.

```
Device A# show ip route track-table
ip route 1.1.2.0 255.0.0.0 GigabitEthernet 0/1 1.1.12.2 track 2 up
```

6. **Configuration Files**

- Device A configuration file

```
!
interface gigabitEthernet 0/1
 ip address 1.1.12.1 255.255.255.0
!
track 2 interface gigabitEthernet 0/1 line-protocol
!
ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.2 track 2
!
```

- Device B configuration file

```
!
interface gigabitEthernet 0/1
 ip address 1.1.12.2 255.255.255.0
```

```
!
track 2 interface gigabitEthernet 0/1 line-protocol
!
ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.1 track 2
!
```

7.   Common Errors

● The static route is correlated with track, but no track object is configured.

1.10.3 Configuring Correlation of Static Routes with BFD

1.   Requirements

Configure static routes for Host A and Host B to realize interworking, where Device A-Device B is the primary link. After BFD is configured, if the primary link fails, packets can switch to Device C quickly to implement communication.

2.   Topology

Figure 1-1   Topology for Correlation of Static Routes with BFD
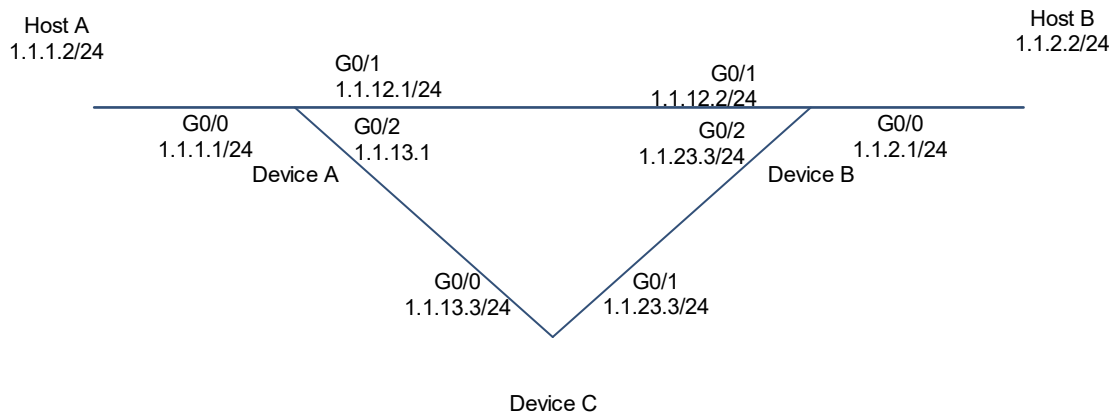
3.   Notes

● Configure static routes on Device A, Device B, and Device C, and specify the exit interface or next hop as the interworking interface.

● Configure a BFD session on the interconnect interface between Device A and Device B.

● Correlate static routes with BFD on Device A and Device B, and check the connectivity of the next hops of static routes.

4.   Procedure

(1) Configure IP addresses of interfaces (omitted).

(2) Configure static routes to implement internetworking.

Configure Device A.

```
Device A> enable
Device A# configure terminal
```

```
Device A(config)# ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.2
Device A(config)# ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/2 1.1.13.3 40
```

Configure Device B.

```
Device B> enable
Device B# configure terminal
Device B(config)# ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.1
Device B(config)# ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/2 1.1.23.3 40
```

Configure Device C.

```
Device C> enable
Device C# configure terminal
Device C(config)# ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/0 1.1.13.1
Device C(config)# ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/1 1.1.23.2
```

(3) Configure BFD for an interface.

Configure Device A.

```
Device A(config)# interface gigabitEthernet 0/1
Device A(config-if-GigabitEthernet 0/1)# bfd interval 50 min_rx 50 multiplier
3
Device A(config-if-GigabitEthernet 0/1)# exit
```

Configure Device B.

```
Device B(config)# interface gigabitEthernet 0/1
Device B(config-if-GigabitEthernet 0/1)# bfd interval 50 min_rx 50 multiplier
3
Device B(config-if-GigabitEthernet 0/1)# exit
```

(4) Configure correlation of static routes with BFD.

Configure Device A.

```
Device A(config)# ip route static bfd gigabitEthernet 0/1 1.1.12.2
```

Configure Device B.

```
Device B(config)# ip route static bfd gigabitEthernet 0/1 1.1.12.1
```

5. Verification

Display the states of BFD neighbors.

```
Device A# show bfd neighbors
OurAddr     NeighAddr    LD/RD    RH/RS   Holdown(mult)   State  Int
1.1.12.1    1.1.12.2     8192/0   Up       0(3   )           Up GigabitEthernet
0/1
```

Display the states of BFD neighbors.

```
Device A# show ip route static bfd
S     1.1.2.0/24 via 1.1.12.2, GigabitEthernet 0/1, BFD state is Up
```

6. Configuration Files

● Device A configuration file

```
!
```

```
interface gigabitEthernet 0/1
 bfd interval 50 min_rx 50 multiplier 3
!
ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.2
ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/2 1.1.13.3 40
!
ip route static bfd gigabitEthernet 0/1 1.1.12.2
!
```

● Device B configuration file

```
!
interface gigabitEthernet 0/1
 bfd interval 50 min_rx 50 multiplier 3
!
ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/1 1.1.12.1
ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/2 1.1.23.3 40
!
ip route static bfd gigabitEthernet 0/1 1.1.12.1
!
```

● Device C configuration file

```
!
ip route 1.1.1.0 255.0.0.0 gigabitEthernet 0/0 1.1.13.1
ip route 1.1.2.0 255.0.0.0 gigabitEthernet 0/1 1.1.23.2
!
```

7. Common Errors

- The link on the interface is not Up.
- No IP address is configured for the interface.
- No BFD session parameters are configured.
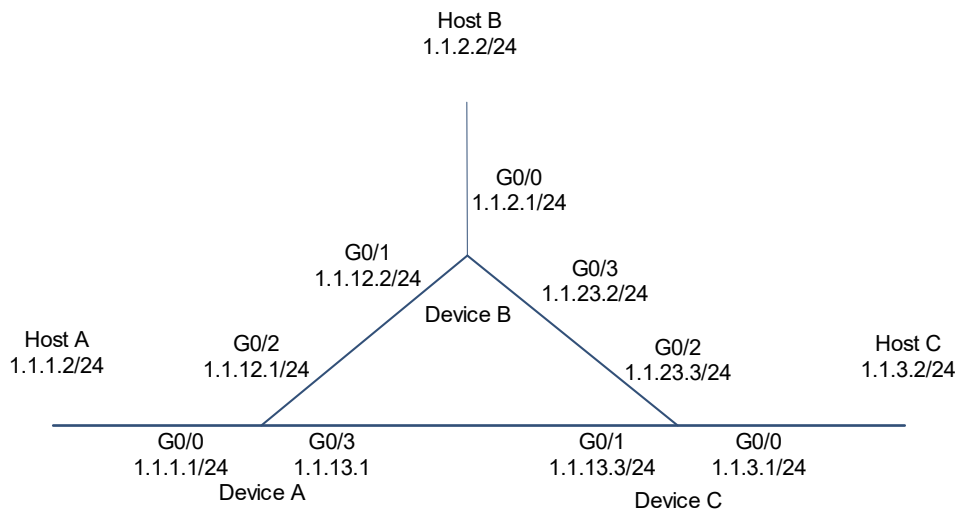- No static route is configured.

1.10.4 Configuring Fast Reroute

1. Requirements

Device A, Device B, and Device C are interconnected through static routes, and Device A accesses Host C through Device C by default. In consideration of the possible link failure of Device A and Device C, configure fast reroute to quickly switch to the backup link in case of a link failure.

2. Topology

Figure 1-1 Topology for Fast Reroute

3. Notes

- On Device A, configure a static route to the network segment of Host C, and the next hop of the exit interface is Device C.

- On Device A, configure static fast reroute. The next hop of the exit interface of the backup route is Device B.

4. Procedure

(1) Configure an IP address for the router (omitted).

(2) Configure static routes to implement internetworking between all the hosts (omitted).

(3) Configure a route map, and set the next hop of the exit interface of the backup route to Device B.

```
Device A> enable
Device A# configure terminal
Device A(config)# route-map fast-reroute
Device A(config-route-map)# set fast-reroute backup-interface GigabitEthernet
0/2 backup-nexthop 1.1.12.2
```

(4) Configure static fast reroute.

```
Device A(config-route-map)# exit
Device A(config)# ip fast-reroute static route-map fast-reroute
```

5. Verification

Display the primary and backup routes on Device A.

```
Device A# show ip route fast-reroute
Codes:  C - connected, S - static, R - RIP, B - BGP
        O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
```

```
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

        ia - IS-IS inter area, * - candidate default

        Status codes: m - main entry, b - backup entry, a - active entry


Gateway of last resort is no set
S    1.1.3.0 /24 [ma] via 1.1.13.3, GigabitEthernet 0/3
               [b]  via 1.1.12.2, GigabitEthernet 0/2
```

6.   Configuration Files

- Device A configuration file

```
!
route-map fast-reroute
set fast-reroute backup-interface GigabitEthernet 0/2 backup-nexthop 1.1.12.2
!
ip fast-reroute static route-map fast-reroute
!
```

7.   Common Errors

- The link on the interface is not Up.

- No static route is configured.

- The **match** matching conditions are not configured or are not correctly configured in the road map.