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FiberstoreOS

IPv6 Routing Configuration Guide

Contents

Tables

Figures

1 Configuring IPv6 Unicast-Routing

1.1 Overview

Static routing is a concept describing one way of configuring path selection of routers in computer networks. It is the type of routing characterized by the absence of communication between routers regarding the current topology of the network.[1] This is achieved by manually adding routes to the routing table. The opposite of static routing is dynamic routing, sometimes also referred to as adaptive routing.

In these systems, routes through a data network are described by fixed paths (statically). These routes are usually entered into the router by the system administrator. An entire network can be configured using static routes, but this type of configuration is not fault tolerant. When there is a change in the network or a failure occurs between two statically defined nodes, traffic will not be rerouted. This means that anything that wishes to take an affected path will either have to wait for the failure to be repaired or the static route to be updated by the administrator before restarting its journey. Most requests will time out (ultimately failing) before these repairs can be made. There are, however, times when static routes can improve the performance of a network. Some of these include stub networks and default routes.

1.2 Topology

Figure 1-1 IPv6 Static Routing Topology Configuration

Configuring IPv6 Static Routing

Table 1-1 Switch1 configuration

Switch1# configure terminal	Enter the Configure mode
Switch1 (config)# ipv6 enable	Enable ipv6 globally
Switch1 (config)# interface eth-0-9	Enter the interface configuration mode

Switch1 (config-if)# no switchport	Change this port to Layer3 interface
Switch1 (config-if)# no shutdown	Turn up the interface
Switch1 (config-if)# ipv6 address auto link-local	Generate a link-local address
Switch1 (config-if)# ipv6 address 2001:1::1/64	Configure a global address
Switch1 (config-if)# exit	Exit the interface configuration mode
Switch1 (config)# ipv6 route 2001:2::/64 2001:1::2	Configure the static route
Switch1 (config)# end	Enter Privileged Exec mode

Table 1-2 Switch2 configuration

Switch2# configure terminal	Enter the Configure mode
Switch2 (config)# ipv6 enable	Enable ipv6 globally
Switch2 (config)# interface eth-0-9	Enter the interface configuration mode
Switch2 (config-if)# no switchport	Change this port to Layer3 interface
Switch2 (config-if)# no shutdown	Turn up the interface
Switch2 (config-if)# ipv6 address auto link-local	Generate a link-local address
Switch2 (config-if)# ipv6 address 2001:1::2/64	Configure a global address
Switch2 (config-if)# exit	Exit the interface configuration mode
Switch2 (config)# interface eth-0-17	Enter the interface configuration mode
Switch2 (config-if)# no switchport	Change this port to Layer3 interface
Switch2 (config-if)# no shutdown	Turn up the interface
Switch2 (config-if)# ipv6 address auto link-local	Generate a link-local address
Switch2 (config-if)# ipv6 address 2001:2::2/64	Configure a global address
Switch2 (config-if)# exit	Exit the interface configuration mode
Switch2 (config)# end	Enter Privileged Exec mode

Table 1-3 Switch3 configuration

Switch3# configure terminal	Enter the Configure mode
Switch3 (config)# ipv6 enable	Enable ipv6 globally
Switch3 (config)# interface eth-0-17	Enter the interface configuration mode
Switch3 (config-if)# no switchport	Change this port to Layer3 interface
Switch3 (config-if)# no shutdown	Turn up the interface

Switch3 (config-if)# ipv6 address auto link-local	Generate a link-local address
Switch3 (config-if)# ipv6 address 2001:2::3/64	Configure a global address
Switch3 (config-if)# exit	Exit the interface configuration mode
Switch3 (config)# ipv6 route 2001:1::/64 2001:2::2	Configure the static route
Switch3 (config)# end	Enter Privileged Exec mode

1.3 Validation Commands

Switch1# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime

C     2001:1::/64
      via ::, eth-0-9, 02:08:50
C     2001:1::1/128
      via ::1, eth-0-9, 02:08:50
S     2001:2::/64 [1/0]
      via 2001:1::2, eth-0-9, 02:05:36
C     fe80::/10
      via ::, Null0, 02:09:11
```

Switch2# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime

C     2001:1::/64
      via ::, eth-0-9, 00:03:37
C     2001:1::2/128
      via ::1, eth-0-9, 00:03:37
C     2001:2::/64
      via ::, eth-0-17, 00:03:21
C     2001:2::2/128
      via ::1, eth-0-17, 00:03:21
```

```
C      fe80::/10
       via ::, Null0, 00:03:44
```

Switch3# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime


S      2001:1::/64 [1/0]
       via 2001:2::2, eth-0-17, 00:02:14
C      2001:2::/64
       via ::, eth-0-17, 00:03:28
C      2001:2::3/128
       via ::1, eth-0-17, 00:03:28
C      fe80::/10
       via ::, Null0, 00:03:53
```

Ping Switch3 on Switch1:

DUT1# ping ipv6 2001:2::3

```
PING 2001:2::3(2001:2::3) 56 data bytes
64 bytes from 2001:2::3: icmp_seq=0 ttl=63 time=127 ms
64 bytes from 2001:2::3: icmp_seq=1 ttl=63 time=132 ms
64 bytes from 2001:2::3: icmp_seq=2 ttl=63 time=124 ms
64 bytes from 2001:2::3: icmp_seq=3 ttl=63 time=137 ms
64 bytes from 2001:2::3: icmp_seq=4 ttl=63 time=141 ms

--- 2001:2::3 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4010ms
rtt min/avg/max/mdev = 124.950/132.719/141.251/5.923 ms, pipe 2
```

2 Configuring OSPFv3

2.1 Overview

OSPF is an Interior Gateway Protocol (IGP) designed expressly for IP networks, supporting IP subnet ting and tagging of externally derived routing information.

The implementation conforms to the OSPF Version 3, which is described in RFC 5340, expands on OSPF version 2 to support IPv6 routing prefixes. Much of the OSPF for IPv6 feature is the same as in OSPF version 2. Changes between OSPF for IPv4, OSPF Version 2, and OSPF for IPv6 as described herein include the following:

➢ **Addressing semantics have been removed from OSPFv3 packets and the basic Link State Advertisements (LSAs).**

➢ **OSPFv3 now runs on a per-link basis rather than on a per-IP-subnet basis.**

➢ **Authentication has been removed from the OSPFv3 protocol.**

2.2 References

The OSPFv3 module is based on the following RFC:

RFC 5340 – OSPF for IPv6

2.3 Basic OSPFv3 Parameters Configuration

Enabling OSPFv3 requires that you create an OSPF routing process, specify Router ID and interfaces belongs to specified area and instance. Beginning in privileged EXEC mode, follow these steps to enable OSPFv3:

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 100	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 1.1.1.1	Specify Router-id
Switch(config-router)# end	Return to privileged EXEC mode
Switch# show ip protocols	Verify your entries.

To end an OSPFv3 routing process, use the "no router ipv6 ospf process-id" global configuration command.

2.4 Enabling OSPFv3 on an Interface

This example shows the minimum configuration required for enabling OSPFv3 on an interface Switch A and B are two routers in Area 0 connecting to prefix 2004:12:9::/96.

2.4.1 Topology

Figure 2-1 OSPF AS

2.4.2 Configuration

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 100	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 1.1.1.1	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::1/96	Specify IPv6 address

Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch B

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 200	Configure the Routing process and specify the Process ID (200). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 2.2.2.2	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

2.4.3 Validation

Use the commands as follows to validate the configuration:

Show ipv6 ospf database, show ipv6 ospf interface, show ipv6 ospf neighbor and show ipv6 ospf route

Switch A output

Switch# show ip ospf database

```
          OSPFv3 Router with ID (1.1.1.1) (Process 100)


            Link-LSA (Interface eth-0-9)

Link State ID   ADV Router      Age  Seq#       CkSum  Prefix
0.0.0.9         1.1.1.1         614 0x80000001 0x6a40     1
0.0.0.9         2.2.2.2          68 0x80000001 0x4316     1
```

```
                    Router-LSA (Area 0.0.0.0)


Link State ID   ADV Router      Age Seq#      CkSum   Link
0.0.0.0         1.1.1.1          54 0x80000003 0xb74b    1
0.0.0.0         2.2.2.2          55 0x80000003 0x9965    1


               Network-LSA (Area 0.0.0.0)


Link State ID   ADV Router      Age Seq#      CkSum
0.0.0.9         1.1.1.1          54 0x80000001 0x3ed1


              Intra-Area-Prefix-LSA (Area 0.0.0.0)


Link State ID   ADV Router      Age Seq#      CkSum Prefix Reference
0.0.0.2         1.1.1.1          53 0x80000001 0x450a     1 Network-LSA
```

Switch# show ipv6 ospf neighbor

```
OSPFv3 Process (100)

Neighbor ID    Pri  State          Dead Time   Interface  Instance ID

2.2.2.2          1  Full/Backup    00:00:33    eth-0-9     0
```

Switch# show ipv6 ospf route

```
OSPFv3 Process (100)
Codes: C - connected, D - Discard, O - OSPF, IA - OSPF inter area
       E1 - OSPF external type 1, E2 - OSPF external type 2


  Destination                          Metric
    Next-hop
C  2004:12:9::/96                          1
    directly connected, eth-0-9, Area 0.0.0.0
```

Switch B output

Switch# show ipv6 ospf database

```
          OSPFv3 Router with ID (2.2.2.2) (Process 200)



          Link-LSA (Interface eth-0-9)


Link State ID   ADV Router      Age Seq#      CkSum Prefix
0.0.0.9         1.1.1.1         774 0x80000001 0x6a40     1
0.0.0.9         2.2.2.2         228 0x80000001 0x4316     1


          Router-LSA (Area 0.0.0.0)


Link State ID   ADV Router      Age Seq#      CkSum   Link
0.0.0.0         1.1.1.1         217 0x80000003 0xb74b    1
0.0.0.0         2.2.2.2         214 0x80000003 0x9965    1
```

```
                  Network-LSA (Area 0.0.0.0)


Link State ID   ADV Router      Age  Seq#       CkSum
0.0.0.9         1.1.1.1        215 0x80000001 0x3ed1


              Intra-Area-Prefix-LSA (Area 0.0.0.0)


Link State ID   ADV Router      Age  Seq#       CkSum  Prefix  Reference
0.0.0.2         1.1.1.1        214 0x80000001 0x450a      1  Network-LSA
```

Switch# show ipv6 ospf neighbor

```
OSPFv3 Process (200)
Neighbor ID    Pri  State         Dead Time   Interface Instance ID
1.1.1.1          1  Full/DR       00:00:35    eth-0-9   0
```

Switch# show ipv6 ospf route

```
OSPFv3 Process (200)
Codes: C - connected, D - Discard, O - OSPF, IA - OSPF inter area
      E1 - OSPF external type 1, E2 - OSPF external type 2


   Destination                          Metric
     Next-hop
C  2004:12:9::/96                          1
     directly connected, eth-0-9, Area 0.0.0.0
```

2.5 Configuring Priority

This example shows the configuration for setting the priority for an interface. You can set a high priority for a router to make it the Designated Router (DR). Router Switch C is configured to have a priority of 10, which is higher than the default priority (default priority is 1) of Switch A and B; making it the DR.

2.5.1 Topology
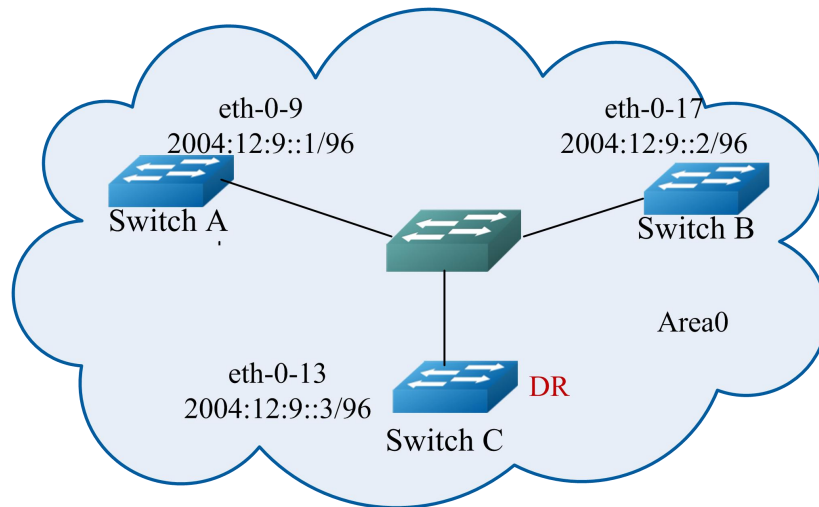
Figure 2-2 OSPFv3 Priority

2.5.2 Configuration

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 100	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process
Switch(config-router)# router-id 1.1.1.1	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch B

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 200	Configure the Routing process and specify the Process ID (200). The Process ID should be a unique positive integer identifying the routing process
Switch(config-router)# router-id 2.2.2.2	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-17	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 200 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch C

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 300	Configure the Routing process and specify the Process ID (300). The Process ID should be a unique positive integer identifying the routing process
Switch(config-router)# router-id 3.3.3.3	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-13	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::3/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 300, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

2.5.3 Validation

Use the commands as follows to validate the configuration:

Show ipv6 ospf neighbor and show ipv6 ospf interface

Switch C output

Switch# show ipv6 ospf interface

```
eth-0-13 is up, line protocol is up
  Interface ID 13
  IPv6 Prefixes
    fe80::ee66:91ff:fe45:db00/10 (Link-Local Address)
    2004:12:9::3/96
  OSPFv3 Process (300), Area 0.0.0.0, Instance ID 0
    Router ID 3.3.3.3, Network Type BROADCAST, Cost: 1
    Transmit Delay is 1 sec, State DR, Priority 10
    Designated Router (ID) 3.3.3.3
      Interface Address fe80::ee66:91ff:fe45:db00
    Backup Designated Router (ID) 2.2.2.2
      Interface Address fe80::c629:f2ff:fe02:3600
    Timer interval configured, Hello 10, Dead 40, Wait 40, Retransmit 5
      Hello due in 00:00:01
    Neighbor Count is 2, Adjacent neighbor count is 2
```

Switch# show ipv6 ospf neighbor

```
OSPFv3 Process (300)
Neighbor ID     Pri   State         Dead Time   Interface  Instance ID
1.1.1.1          1    Full/DROther   00:00:32    eth-0-13   0
2.2.2.2          1    Full/Backup    00:00:36    eth-0-13   0
```

2.6 Configuring OSPFv3 Area Parameters

You can optionally configure several OSPFv3 area parameters. These parameters include authentication for password-based protection against unauthorized access to an area and stub areas. Stub areas are areas into which information on external routes is not sent. Instead, the area border router (ABR) generates a default external route into the stub area for destinations outside the autonomous system (AS).

Route summarization is the consolidation of advertised addresses into a single summary route to be advertised by other areas. If network numbers are contiguous, you can use the area range router configuration command to configure the ABR to advertise a summary route that covers all networks in the range.

2.6.1 Topology
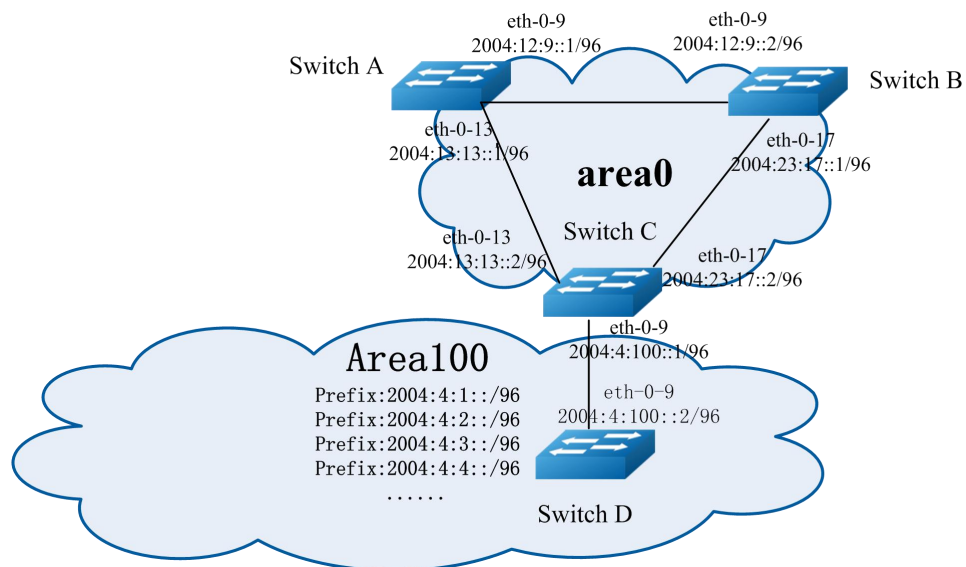
Figure 2-3 OSPFv3 Area

2.6.2 Configuration

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 100	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 1.1.1.1	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode

Switch(config)#interface eth-0-13	Enter Interface mode
Switch(config-if)#no switchport	Enable l3 interface
Switch(config-if)#no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:13:13::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch B

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 200	Configure the Routing process and specify the Process ID (200). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 2.2.2.2	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 200 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)#interface eth-0-17	Enter Interface mode
Switch(config-if)#no switchport	Enable l3 interface
Switch(config-if)#no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:23:17::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 200 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch C

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 300	Configure the Routing process and specify the Process ID (300). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 3.3.3.3	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-13	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:13:13::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 300, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)# interface eth-0-17	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:23:17::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:100::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 100 instance 0	Add this link to OSPFv3 process 200, area100 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode

Switch(config)# router ipv6 ospf 300	Configure the Routing process and specify the Process ID (300). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# area 100 range 2004:4::/32	(Optional) Specify an address range for which a single route is advertised. Use this command only with area border routers.
Switch(config-router)# area 100 stub no-summary	(Optional) Define an area as a stub area. The no-summary keyword prevents an ABR from sending summary link advertisements into the stub area.
Switch(config-if)# end	Exit to privileged EXEC mode

Switch D

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 400	Configure the Routing process and specify the Process ID (400). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 4.4.4.4	Specify Router ID
Switch(config-router)# area 100 stub no-summary	(Optional) Define an area as a stub area. The no-summary keyword prevents an ABR from sending summary link advertisements into the stub area.
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:100::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 400 area 100 instance 0	Add this link to OSPFv3 process 100, area100 and instance 0
Switch(config-if)# exit	Exit Interface mode
Switch(config)# interface eth-0-1	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:1::1/96	Specify IPv6 address

Switch(config-if)# ipv6 router ospf 400 area 100 instance 0	Add this link to OSPFv3 process 100, area100 and instance 0
Switch(config-if)# exit	Exit Interface mode
Switch(config)# interface eth-0-2	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:2::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 400 area 100 instance 0	Add this link to OSPFv3 process 100, area100 and instance 0
Switch(config-if)# exit	Exit Interface mode
Switch(config)# interface eth-0-3	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:3::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 400 area 100 instance 0	Add this link to OSPFv3 process 100, area100 and instance 0
Switch(config-if)# exit	Exit Interface mode
Switch(config)# interface eth-0-4	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:4::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 400 area 100 instance 0	Add this link to OSPFv3 process 100, area100 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

2.6.3 Validation

Use the command **show ipv6 route** to validate the configuration.

Switch A output

Switch# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
```

```
      Dr - DHCPV6 Relay
      [*] - [AD/Metric]
Timers: Uptime


O IA   2004:4::/32 [110/3]
      via fe80::c629:f2ff:fe02:3600, eth-0-13, 00:01:00
C      2004:12:9::/96
      via ::, eth-0-9, 00:15:56
C      2004:12:9::1/128
      via ::1, eth-0-9, 00:15:56
C      2004:13:13::/96
      via ::, eth-0-13, 00:15:55
C      2004:13:13::2/128
      via ::1, eth-0-13, 00:15:55
O      2004:23:17::/96 [110/2]
      via fe80::bc22:aeff:fe64:aa00, eth-0-9, 00:08:10
      via fe80::c629:f2ff:fe02:3600, eth-0-13, 00:08:10
C      fe80::/10
      via ::, Null0, 00:15:57
```

Switch B output

Switch# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
      Dr - DHCPV6 Relay
      [*] - [AD/Metric]
Timers: Uptime


O IA   2004:4::/32 [110/3]
      via fe80::c629:f2ff:fe02:3600, eth-0-17, 00:00:57
C      2004:12:9::/96
      via ::, eth-0-9, 00:12:24
C      2004:12:9::2/128
      via ::1, eth-0-9, 00:12:24
O      2004:13:13::/96 [110/2]
      via fe80::b242:55ff:fe05:ff00, eth-0-9, 00:07:52
      via fe80::c629:f2ff:fe02:3600, eth-0-17, 00:07:52
C      2004:23:17::/96
      via ::, eth-0-17, 00:12:24
C      2004:23:17::1/128
      via ::1, eth-0-17, 00:12:24
C      fe80::/10
      via ::, Null0, 00:12:26
```

Switch C output

Switch# show ipv6 route

```
IPv6 Routing Table
```

```
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime


O    2004:4::/32 [110/0]
     via ::, Null0, 00:08:31
O    2004:4:1::/96 [110/2]
     via fe80::ee66:91ff:fe45:db00, eth-0-9, 00:01:08
O    2004:4:2::/96 [110/2]
     via fe80::ee66:91ff:fe45:db00, eth-0-9, 00:01:08
O    2004:4:3::/96 [110/2]
     via fe80::ee66:91ff:fe45:db00, eth-0-9, 00:01:08
O    2004:4:4::/96 [110/2]
     via fe80::ee66:91ff:fe45:db00, eth-0-9, 00:01:08
C    2004:4:100::/96
     via ::, eth-0-9, 00:08:32
C    2004:4:100::1/128
     via ::1, eth-0-9, 00:08:32
O    2004:12:9::/96 [110/2]
     via fe80::b242:55ff:fe05:ff00, eth-0-13, 00:08:03
     via fe80::bc22:aeff:fe64:aa00, eth-0-17, 00:08:03
O    2004:13:13::/96 [110/1]
     via fe80::b242:55ff:fe05:ff00, eth-0-13, 00:08:18
C    2004:23:17::/96
     via ::, eth-0-17, 00:08:32
C    2004:23:17::2/128
     via ::1, eth-0-17, 00:08:32
C    fe80::/10
     via ::, Null0, 00:08:34
```

Switch D output

Switch# show ip route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime


O IA   ::/0 [110/2]
     via fe80::c629:f2ff:fe02:3600, eth-0-9, 00:00:53
C    2004:4:1::/96
     via ::, eth-0-1, 00:03:09
C    2004:4:1::1/128
     via ::1, eth-0-1, 00:03:09
C    2004:4:2::/96
     via ::, eth-0-2, 00:03:08
```

```
C      2004:4:2::1/128
       via ::1, eth-0-2, 00:03:08
C      2004:4:3::/96
       via ::, eth-0-3, 00:03:08
C      2004:4:3::1/128
       via ::1, eth-0-3, 00:03:08
C      2004:4:4::/96
       via ::, eth-0-4, 00:03:09
C      2004:4:4::1/128
       via ::1, eth-0-4, 00:03:09
C      2004:4:100::/96
       via ::, eth-0-9, 00:03:09
C      2004:4:100::2/128
       via ::1, eth-0-9, 00:03:09
C      fe80::/10
       via ::, Null0, 00:03:10
```

2.7 Redistributing Routes into OSPFv3

In this example the configuration causes RIPng routes to be imported into the OSPFv3 routing table and advertised as Type 5 External LSAs into Area 0.

2.7.1 Topology
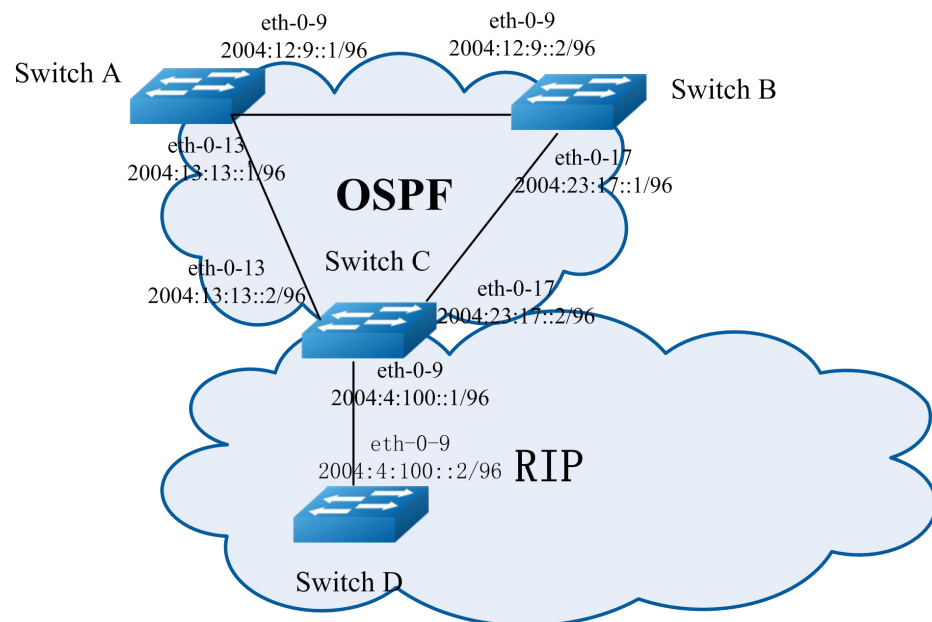
Figure 2-4 OSPFv3 Routes Redistributing

2.7.2 Configuration

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 100	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 1.1.1.1	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)#interface eth-0-13	Enter Interface mode
Switch(config-if)#no switchport	Enable l3 interface
Switch(config-if)#no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:13:13::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch B

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 200	Configure the Routing process and specify the Process ID (200). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 2.2.2.2	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode

Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 200 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)#interface eth-0-17	Enter Interface mode
Switch(config-if)#no switchport	Enable l3 interface
Switch(config-if)#no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:23:17::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 200 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch C

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 300	Configure the Routing process and specify the Process ID (300). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 3.3.3.3	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-13	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:13:13::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 300, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)# interface eth-0-17	Enter Interface mode

Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:23:17::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 rip	Enable IPv6 rip routing protocol
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:100::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router rip	Add this link to IPv6 rip routing domain
Switch(config-if)# end	Exit to privileged EXEC mode

Switch D

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 rip	Enable IPv6 rip routing protocol
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:100::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router rip	Add this link to OSPFv3 process 300, area0 and instance 0
Switch(config-if)# exit	Exit interface mode
Switch(config)# interface eth-0-1	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:4:1::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router rip	Add this link to IPv6 rip routing domain
Switch(config-if)# end	Exit to privileged EXEC mode

2.7.3 Validation

Use the command to validate the configuration:

Show ipv6 ospf database external and show ipv6 route

Switch A output

Switch# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime


O E2   2004:4:1::/96 [110/20]
       via fe80::c629:f2ff:fe02:3600, eth-0-13, 00:00:03
C      2004:12:9::/96
       via ::, eth-0-9, 00:34:20
C      2004:12:9::1/128
       via ::1, eth-0-9, 00:34:20
C      2004:13:13::/96
       via ::, eth-0-13, 00:34:19
C      2004:13:13::2/128
       via ::1, eth-0-13, 00:34:19
O      2004:23:17::/96 [110/2]
       via fe80::bc22:aeff:fe64:aa00, eth-0-9, 00:26:34
       via fe80::c629:f2ff:fe02:3600, eth-0-13, 00:26:34
C      fe80::/10
       via ::, Null0, 00:34:21
```

Switch# show ipv6 ospf database external

```
        OSPFv3 Router with ID (1.1.1.1) (Process 100)


              AS-external-LSA


  LS age: 140
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.1
  Advertising Router: 3.3.3.3
  LS Seq Number: 0x80000001
  Checksum: 0x66F7
  Length: 44
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2004:4:1::/96
    Prefix Options: 0 (-|-|-|-)
    External Route Tag: 0
```

Switch B output

Switch# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
     Dr - DHCPV6 Relay
     [*] - [AD/Metric]
Timers: Uptime

O E2   2004:4:1::/96 [110/20]
       via fe80::c629:f2ff:fe02:3600, eth-0-17, 00:02:43
C      2004:12:9::/96
       via ::, eth-0-9, 00:33:31
C      2004:12:9::2/128
       via ::1, eth-0-9, 00:33:31
O      2004:13:13::/96 [110/2]
       via fe80::b242:55ff:fe05:ff00, eth-0-9, 00:28:59
       via fe80::c629:f2ff:fe02:3600, eth-0-17, 00:28:59
C      2004:23:17::/96
       via ::, eth-0-17, 00:33:31
C      2004:23:17::1/128
       via ::1, eth-0-17, 00:33:31
C      fe80::/10
       via ::, Null0, 00:33:33
```

Switch# show ipv6 ospf database external

```
show ipv6 ospf database external

        OSPFv3 Router with ID (2.2.2.2) (Process 200)


            AS-external-LSA

  LS age: 195
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.1
  Advertising Router: 3.3.3.3
  LS Seq Number: 0x80000001
  Checksum: 0x66F7
  Length: 44
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2004:4:1::/96
    Prefix Options: 0 (-|-|-|-)
    External Route Tag: 0
```

Switch C output

Switch# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
      Dr - DHCPV6 Relay
      [*] - [AD/Metric]
Timers: Uptime


R     2004:4:1::/96 [120/2]
      via fe80::ee66:91ff:fe45:db00, eth-0-9, 00:03:43
C     2004:4:100::/96
      via ::, eth-0-9, 00:07:01
C     2004:4:100::1/128
      via ::1, eth-0-9, 00:07:01
O     2004:12:9::/96 [110/2]
      via fe80::b242:55ff:fe05:ff00, eth-0-13, 00:29:57
      via fe80::bc22:aeff:fe64:aa00, eth-0-17, 00:29:57
O     2004:13:13::/96 [110/1]
      via fe80::b242:55ff:fe05:ff00, eth-0-13, 00:30:12
C     2004:23:17::/96
      via ::, eth-0-17, 00:30:26
C     2004:23:17::2/128
      via ::1, eth-0-17, 00:30:26
C     fe80::/10
      via ::, Null0, 00:30:28
```

Switch# show ipv6 ospf database external

```
show ipv6 ospf database external

          OSPFv3 Router with ID (3.3.3.3) (Process 300)


              AS-external-LSA

  LS age: 250
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.1
  Advertising Router: 3.3.3.3
  LS Seq Number: 0x80000001
  Checksum: 0x66F7
  Length: 44
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2004:4:1::/96
    Prefix Options: 0 (-|-|-|-)
    External Route Tag: 0
```

Switch D output

Switch# show ipv6 route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
     Dr - DHCPV6 Relay
     [*] - [AD/Metric]
Timers: Uptime


C    2004:4:1::/96
     via ::, eth-0-1, 00:04:48
C    2004:4:1::1/128
     via ::1, eth-0-1, 00:04:48
C    2004:4:100::/96
     via ::, eth-0-9, 00:06:59
C    2004:4:100::2/128
     via ::1, eth-0-9, 00:06:59
C    fe80::/10
     via ::, Null0, 00:07:00
```

2.8 OSPFv3 Cost

You can make a route the preferred route by changing its cost. In this example, cost has been configured to make Switch B the next hop for Switch A.

The default cost on each interface is 1(1000M speed). Interface eth2 on Switch B has a cost of 100 and interface eth2 on Switch C has a cost of 150. The total cost to reach(Switch D network 10.10.14.0) through Switch B and Switch C:
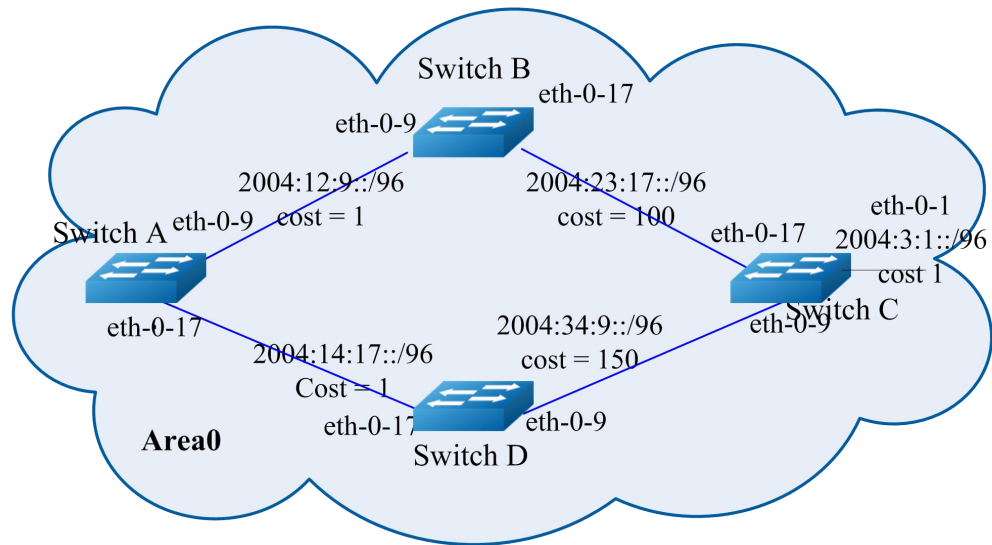
Switch B: 1+1+100 = 102

Switch C: 1+1+150 = 152

Therefore, Switch A chooses Switch B as its next hop for destination Switch D

2.8.1 Topology

Figure 2-5 OSPFv3 Cost

2.8.2 Configuration

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 100	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 1.1.1.1	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)#interface eth-0-17	Enter Interface mode

Switch(config-if)#no switchport	Enable l3 interface
Switch(config-if)#no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:14:17::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 100 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch B

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 200	Configure the Routing process and specify the Process ID (200). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 2.2.2.2	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:12:9::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 200 area 0 instance 0	Add this link to OSPFv3 process 200, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode
Switch# configure terminal	Enter the Configure mode
Switch(config)#interface eth-0-17	Enter Interface mode
Switch(config-if)#no switchport	Enable l3 interface
Switch(config-if)#no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:23:17::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 200 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# ipv6 ospf cost 100	Specify OSPFv3 interface cost
Switch(config-if)# end	Exit to privileged EXEC mode

Switch C

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 ospf 300	Configure the Routing process and specify the Process ID (300). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 3.3.3.3	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-17	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:23:17::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 300, area0 and instance 0
Switch(config-if)# exit	Exit Interface Mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:34:9::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 300, area0 and instance 0
Switch(config-if)# exit	Exit Interface Mode
Switch(config)# interface eth-0-1	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:3:1::1/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 300 area 0 instance 0	Add this link to OSPFv3 process 300, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

Switch D

Switch# configure terminal	Enter the Configure mode

Switch(config)# router ipv6 ospf 400	Configure the Routing process and specify the Process ID (400). The Process ID should be a unique positive integer identifying the routing process.
Switch(config-router)# router-id 4.4.4.4	Specify Router ID
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-9	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:34:9::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 400 area 0 instance 0	Add this link to OSPFv3 process 400, area0 and instance 0
Switch(config-if)# ipv6 ospf cost 150	Specify OSPFv3 interface cost
Switch(config-if)# exit	Exit Interface mode
Switch(config)# interface eth-0-17	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2004:14:17::2/96	Specify IPv6 address
Switch(config-if)# ipv6 router ospf 400 area 0 instance 0	Add this link to OSPFv3 process 100, area0 and instance 0
Switch(config-if)# end	Exit to privileged EXEC mode

2.8.3 Validation

Use the command **show ipv6 ospf route** to validate the configuration.

Switch A output

Switch# show ipv6 ospf route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime

O     2004:3:1::/96 [110/102]
```

```
        via fe80::bc22:aeff:fe64:aa00, eth-0-9, 00:08:06
C     2004:12:9::/96
        via ::, eth-0-9, 01:15:43
C     2004:12:9::1/128
        via ::1, eth-0-9, 01:15:43
C     2004:14:17::/96
        via ::, eth-0-17, 00:18:38
C     2004:14:17::1/128
        via ::1, eth-0-17, 00:18:38
O     2004:23:17::/96 [110/101]
        via fe80::bc22:aeff:fe64:aa00, eth-0-9, 00:08:06
O     2004:34:9::/96 [110/102]
        via fe80::bc22:aeff:fe64:aa00, eth-0-9, 00:03:56
C     fe80::/10
        via ::, Null0, 01:15:44
```

Switch B output

Switch# show ip ospf route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
      Dr - DHCPV6 Relay
      [*] - [AD/Metric]
Timers: Uptime

O     2004:3:1::/96 [110/101]
        via fe80::c629:f2ff:fe02:3600, eth-0-17, 00:08:33
C     2004:12:9::/96
        via ::, eth-0-9, 01:12:40
C     2004:12:9::2/128
        via ::1, eth-0-9, 01:12:40
O     2004:14:17::/96 [110/2]
        via fe80::b242:55ff:fe05:ff00, eth-0-9, 00:18:43
C     2004:23:17::/96
        via ::, eth-0-17, 01:12:40
C     2004:23:17::1/128
        via ::1, eth-0-17, 01:12:40
O     2004:34:9::/96 [110/101]
        via fe80::c629:f2ff:fe02:3600, eth-0-17, 00:04:23
C     fe80::/10
        via ::, Null0, 01:12:42
```

Switch C output

Switch# show ip ospf route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
      Dr - DHCPV6 Relay
      [*] - [AD/Metric]
Timers: Uptime


C      2004:3:1::/96
      via ::, eth-0-1, 00:13:54
C      2004:3:1::1/128
      via ::1, eth-0-1, 00:13:54
O      2004:12:9::/96 [110/2]
      via fe80::bc22:aeff:fe64:aa00, eth-0-17, 00:19:47
O      2004:14:17::/96 [110/2]
      via fe80::ee66:91ff:fe45:db00, eth-0-9, 00:02:27
C      2004:23:17::/96
      via ::, eth-0-17, 01:09:02
C      2004:23:17::2/128
      via ::1, eth-0-17, 01:09:02
C      2004:34:9::/96
      via ::, eth-0-9, 00:04:52
C      2004:34:9::1/128
      via ::1, eth-0-9, 00:04:52
C      fe80::/10
      via ::, Null0, 01:09:04
```

Switch D output

Switch# show ip route

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
      Dr - DHCPV6 Relay
      [*] - [AD/Metric]
Timers: Uptime


O      2004:3:1::/96 [110/103]
      via fe80::b242:55ff:fe05:ff00, eth-0-17, 00:02:35
O      2004:12:9::/96 [110/2]
      via fe80::b242:55ff:fe05:ff00, eth-0-17, 00:02:35
C      2004:14:17::/96
      via ::, eth-0-17, 00:04:09
C      2004:14:17::2/128
      via ::1, eth-0-17, 00:04:09
O      2004:23:17::/96 [110/102]
      via fe80::b242:55ff:fe05:ff00, eth-0-17, 00:02:35
C      2004:34:9::/96
      via ::, eth-0-9, 00:06:06
C      2004:34:9::2/128
      via ::1, eth-0-9, 00:06:06
C      fe80::/10
      via ::, Null0, 00:44:59
```

2.9 Monitoring OSPFv3

2.9.1 Configuration

You can display specific statistics such as the contents of IPv6 routing tables, caches, and databases.

Switch# show ipv6 ospf	Display general information about OSPFv3 routing processes
Switch # show ipv6 ospf database database-summary Switch # show ipv6 ospf database router Switch # show ipv6 ospf database network self-originate Switch # show ipv6 ospf database inter-router Switch # show ipv6 ospf database intra-prefix Switch # show ipv6 ospf database inter-prefix Switch # show ipv6 ospf database link Switch # show ipv6 ospf database external	Display lists of information related to the OSPFv3 database
Switch # show ipv6 ospf interface eth-0-1	Display OSPFv3-related interface information
Switch # show ipv6 ospf neighbor	Display OSPFv3 interface neighbor information

3 Configuring RIPng

3.1 Overview

Routing Information Protocol Next Generation (RIPng) is an IPv6 route exchange protocol that uses a distance vector (a number representing distance) to measure the cost of a given route. The cost is a distance vector because the cost is often equivalent to the number of router hops between the source and the destination networks. RIPng can receive multiple paths to a destination. The system evaluates the paths, selects the best path, and saves the path in the IPv6 route table as the route to the destination. Typically, the best path is the path with the fewest hops. A hop is another router through which packets must travel to reach the destination. If RIPng receives a RIPng update from another router that contains a path with fewer hops than the path stored in the route table, the system replaces the older route with the newer one. The system then includes the new path in the updates it sends to other RIPng routers. RIPng routers also can modify a route's cost, generally by adding to it, to bias the selection of a route for a given destination. In this case, the actual number of router hops may be the same, but the route has an administratively higher cost and is thus less likely to be used than other, lower-cost routes. A RIPng route can have a maximum cost of 15. Any destination with a higher cost is considered unreachable. Although limiting to larger networks, the low maximum hop count prevents endless loops in the network.

This chapter contains basic RIP ng configuration examples. To see details on the commands used in these examples, or to see the outputs of the Validation commands, refer to the RIPng Command Reference. To avoid repetition, some Common commands, like configure terminal, have not been listed under the Commands Used section.

There are some differences between RIPng and RIP:

➢ UDP port number: RIPng uses UDP port number 521 to send or receive package.

➢ Multicast address: RIPng uses FF02::9 to multicast package to other routers of link local.

➢ Nexthop address: RIPng uses 128 bit ipv6 address.

➢ Source address: RIPng uses IPv6 link-local address FE80::/10 to be the source address when updating package to neighbor.

3.2 References

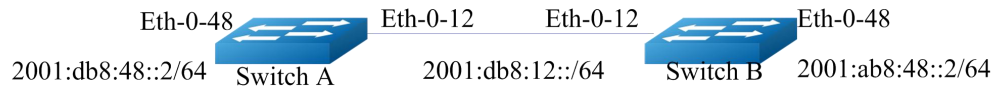The RIPng module is based on the following RFC:

RFC 2080 – RIPng for IPv6

3.3 Enabling RIPng

This example shows how to enable RIPng protocols on two switches:

3.3.1 Topology

Eth-0-48   Eth-0-12   Eth-0-12   Eth-0-48

2001:db8:48::2/64   Switch A   2001:db8:12::/64   Switch B   2001:ab8:48::2/64

3.3.2 Configuration

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 rip	Enable the RIPng on switch
Switch(config-router)# exit	Exit router configuration mode
Switch(config)# interface eth-0-12	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2001:db8:12::1/64	Specify IPv6 address
Switch(config-if)# ipv6 router rip	Enable RIPng on interface
Switch(config-if)# exit	Exit to configuration mode
Switch(config)# interface eth-0-48	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2001:db8:48::2/64	Specify IPv6 address
Switch(config-if)# ipv6 router rip	Enable RIPng on interface

Switch B

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 rip	Enable the RIPng on switch
Switch(config-router)# exit	Exit router configuration mode

Switch(config)# interface eth-0-12	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2001:db8:12::2/64	Specify IPv6 address
Switch(config-if)# ipv6 router rip	Enable RIPng on interface
Switch(config-if)# exit	Exit to configuration mode
Switch(config)# interface eth-0-48	Enter Interface mode
Switch(config-if)# no switchport	Enable l3 interface
Switch(config-if)# no shutdown	Bring up interface
Switch(config-if)# ipv6 address 2001:ab8:49::2/64	Specify IPv6 address
Switch(config-if)# ipv6 router rip	Enable RIPng on interface

3.3.3 Validation

Use the commands as follows to validate the configuration:

Show ipv6 rip database，show ipv6 rip interface，show ipv6 protocols rip 和 show ipv6 route rip

Switch A output

Switch# show ipv6 rip database

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static, Ra - RIP aggregated,
       Rcx - RIP connect suppressed, Rsx - RIP static suppressed,
       K - Kernel, C - Connected, S - Static, O - OSPF, I - IS-IS, B - BGP


   Network              Next Hop              If      Met Tag Time
R  2001:ab8:49::/64       fe80::1271:d1ff:fec8:3300 eth-0-12 5   0   00:02:34
Rc 2001:db8:12::/64       ::                    eth-0-12 1   0
Rc 2001:db8:48::/64       ::                    eth-0-48 1   0
```

Switch# show ipv6 rip interface

```
eth-0-12 is up, line protocol is up
 Routing Protocol: RIPng
   Passive interface: Disabled
   Split horizon: Enabled with Poisoned Reversed
   IPv6 interface address:
    2001:db8:12::1/64
    fe80::7e14:63ff:fe76:8900/10
eth-0-48 is up, line protocol is up
```

```
 Routing Protocol: RIPng
   Passive interface: Disabled
   Split horizon: Enabled with Poisoned Reversed
   IPv6 interface address:
     2001:db8:48::2/64
     fe80::7e14:63ff:fe76:8900/10
```

Switch# show ipv6 protocols rip

```
Routing Protocol is "ripng"
  Sending updates every 30 seconds with +/-5 seconds, next due in 7 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Default redistribute metric is 1
  Redistributing:
  Interface
    eth-0-12
    eth-0-48
  Routing for Networks:
  Number of routes (including connected): 3
  Distance: (default is 120)
```

Switch# show ipv6 route rip

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime


R     2001:ab8:49::/64 [120/5]
      via fe80::1271:d1ff:fec8:3300, eth-0-12, 00:26:05
```

Switch B output

Switch# show ipv6 rip database

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static, Ra - RIP aggregated,
       Rcx - RIP connect suppressed, Rsx - RIP static suppressed,
       K - Kernel, C - Connected, S - Static, O - OSPF, I - IS-IS, B - BGP
```

	Network	Next Hop	If	Met	Tag	Time
Rc	2001:ab8:49::/64	::	eth-0-48	1	0	
Rc	2001:db8:12::/64	::	eth-0-12	1	0	
R	2001:db8:48::/64	fe80::7e14:63ff:fe76:8900	eth-0-12	2	0	00:02:33

Switch# show ipv6 rip interface

```
eth-0-12 is up, line protocol is up
 Routing Protocol: RIPng
    Passive interface: Disabled
    Split horizon: Enabled with Poisoned Reversed
    IPv6 interface address:
      2001:db8:12::2/64
      fe80::1271:d1ff:fec8:3300/10
eth-0-48 is up, line protocol is up
 Routing Protocol: RIPng
    Passive interface: Disabled
    Split horizon: Enabled with Poisoned Reversed
    IPv6 interface address:
      2001:ab8:49::2/64
      fe80::1271:d1ff:fec8:3300/10
```

Switch# show ipv6 protocols rip

```
Routing Protocol is "ripng"
  Sending updates every 30 seconds with +/-5 seconds, next due in 13 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Outgoing routes will have 3 added to metric if on list ripng_acl
  Default redistribute metric is 1
  Redistributing:
  Interface
    eth-0-12
    eth-0-48
  Routing for Networks:
  Number of routes (including connected): 3
  Distance: (default is 120)
```

Switch# show ipv6 route rip

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, I - IS-IS, 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
       Dr - DHCPV6 Relay
       [*] - [AD/Metric]
Timers: Uptime

R     2001:db8:48::/64 [120/2]
      via fe80::7e14:63ff:fe76:8900, eth-0-12, 00:23:31
```

3.4 Configuring Metric Parameters

A RIPng offset list allows you to add to the metric of specific inbound or outbound routes learned or advertised by RIPng. RIPng offset lists provide a simple method for adding to the

cost of specific routes and therefore biasing the router's route selection away from those routes. An offset list consists of the following parameters:

➢ An ACL that specifies the routes to which to add the metric.

The direction:

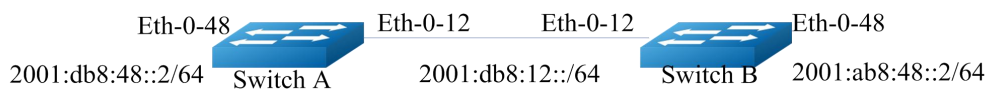In: applies to routes the router learns from RIPng neighbors.

Out: applies to routes the router is advertising to its RIPng neighbors.

➢ The offset value that will be added to the routing metric of the routes that match the ACL.

➢ The interface that the offset list applies (optional).

If a route matches both a global offset list (without specified interface) and an interface-based offset list, the interface-based offset list takes precedence. The interface-based offset list's metric is added to the route in this case.

This example Switch A will advertise route 2001:db8:48::2/64 out of interface eth-0-12 with metric 3.

3.4.1 Topology

Eth-0-48   Eth-0-12   Eth-0-12   Eth-0-48

2001:db8:48::2/64   Switch A   2001:db8:12::/64   Switch B   2001:ab8:48::2/64

3.4.2 Configuration

Switch A

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::1/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:db8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Switch B

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::2/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:ab8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Validation route table on Switch B

Switch# show ipv6 route rip

```
R     2001:db8:48::/64 [120/2]
      via fe80::7e14:63ff:fe76:8900, eth-0-12, 00:44:47
```

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)#ipv6 access-list ripoffset	Create new ACL.
Switch(config-ipv6-acl)# permit any 2001:db8:48::/64 any	Create ACL rule
Switch(config-ipv6-acl)# router ipv6 rip	Enable RIPng
Switch(config-router)# offset-list ripngoffset out 3 eth-0-13	Apply metric offset 3 when out from eth-0-13

3.4.3 Validation

Switch B output

Switch# show ipv6 route rip

```
R     2001:db8:48::/64 [120/5]
      via fe80::7e14:63ff:fe76:8900, eth-0-12, 00:00:07
```

3.5 Configuring the Administrative Distance

By default, RIPng assigns the default RIPng administrative distance (120) to RIPng routes. When comparing routes based on administrative distance, the router selects the route with the lower distance. You can change the administrative distance for RIPng routes.

This example shows how to change the RIPng administrative distance.

3.5.1 Topology
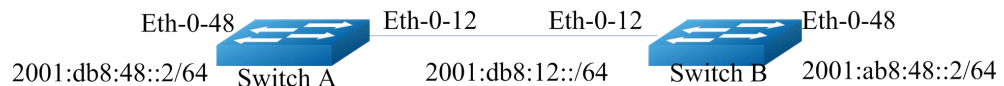
3.5.2 Configuration

Switch A configuration

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::1/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:db8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Switch B configuration

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::2/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
```

```
ipv6 address 2001:ab8:48::2/64
ipv6 router rip
!
router ipv6 rip
!
```

Validation route table on Switch B

Switch# show ipv6 route rip

```
R      2001:db8:48::/64 [120/2]
        via fe80::7e14:63ff:fe76:8900, eth-0-12, 00:44:47
```

Switch B

Switch# configure terminal	Enter the configure mode
Switch(config)# router ipv6 rip	Enable RIPng
Switch(config-router)# distance 100	Change the AD to 100

3.5.3 Validation

Switch B output

Switch# show ipv6 route rip

```
R      2001:db8:48::/64 [100/5]
        via fe80::7e14:63ff:fe76:8900, eth-0-12, 00:00:09
```

3.6 Configuring Redistribution

You can configure the router to redistribute static routes, direct connected routes or routes learned through Open Shortest Path First (OSPF) into RIPng. When you redistribute a route from one of these other protocols into RIPng, the router can use RIPng to advertise the route to its RIPng neighbors.

Change the default redistribution metric (optional). The router assigns a RIPng metric of 1 to each redistributed route by default. You can change the default metric to a value up to 16.
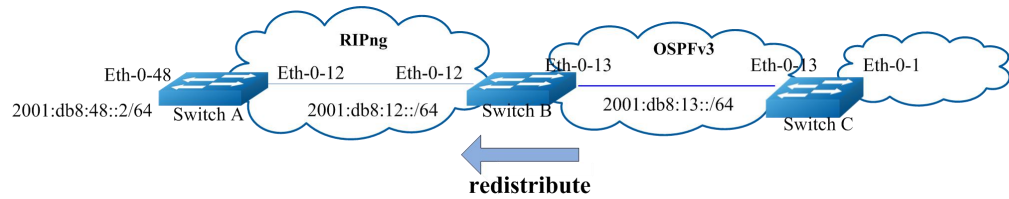
Enable specified routes to redistribute with default or specified metric.

This example shows how to redistribute other protocols into RIPng.

3.6.1 Topology

3.6.2 Configuration

Switch A

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::1/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:db8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Switch B

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::2/64
 ipv6 router rip
!
interface eth-0-13
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:13::1/64
 ipv6 router ospf area 0
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
```

```
ipv6 address auto link-local
ipv6 address 2001:ab8:48::2/64
ipv6 router rip
!
router ipv6 rip
!
router ipv6 ospf
router-id 1.1.1.1
```

Validation route table on Switch A

Switch# show ipv6 route rip

```
R     2001:ab8:49::/64 [120/5]
      via fe80::1271:d1ff:fec8:3300, eth-0-12, 01:43:37
```

Validation route table on Switch B

Switch# show ipv6 route

```
O     2001:db8:1::/64 [110/2]
      via fe80::5c37:1dff:febe:2d00, eth-0-13, 00:31:17
R     2001:db8:48::/64 [100/5]
      via fe80::7e14:63ff:fe76:8900, eth-0-12, 00:49:57
```

Switch B

Switch# configure terminal	Enter the configure mode
Switch(config)# router ipv6 rip	Enable RIPng
Switch(config-router)#default-metric 2	Change the default redistribute metric
Switch(config-router)#redistribute ospfv3 metric 5	Redistribute OSPFv3 into RIPng

3.6.3 Validation

Switch A output

Switch# show ipv6 route rip

```
R     2001:ab8:49::/64 [120/5]
      via fe80::1271:d1ff:fec8:3300, eth-0-12, 01:48:23
R     2001:db8:1::/64 [120/6]
      via fe80::1271:d1ff:fec8:3300, eth-0-12, 00:00:19
```
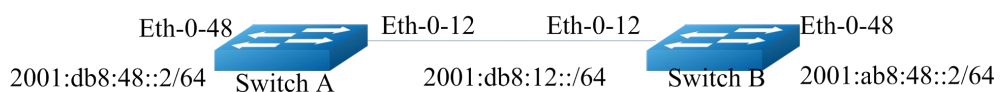
3.7 Configuring Split-horizon Parameters

Normally, routers that are connected to multicast-type IPv6 networks and that use distance-vector routing protocols employ the split horizon mechanism to reduce the

possibility of routing loops. Split horizon blocks information about routes from being advertised by a router out of any interface from which that information originated. This behavior usually optimizes communications among multiple routers, particularly when links are broken. However, with non-multicast networks (such as Frame Relay), situations can arise for which this behavior is less than ideal. For these situations, you might want to disable split horizon for RIPng.

You can avoid including routes in updates sent to the same gateway from which they were learned. Using the split horizon command omits routes learned from one neighbor, in updates sent to that neighbor. Using the poisoned parameter with this command includes such routes in updates, but sets their metrics to infinity. Thus, advertising these routes means that they are not reachable.

3.7.1 Topology

Eth-0-48   Eth-0-12   Eth-0-12   Eth-0-48

2001:db8:48::2/64   Switch A   2001:db8:12::/64   Switch B   2001:ab8:48::2/64

3.7.2 Configuration

Switch A

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::1/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:db8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Switch B

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::2/64
 ipv6 router rip
```

```
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:ab8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Switch B debug configuration

Switch# debug ipv6 rip packet send detail

Switch# terminal monitor

Disable Split-horizon on Switch B

Switch# configure terminal	Enter the configure mode
Switch(config)#interface eth-0-12	Enter the interface eth-0-12
Switch(config-if)# no ipv6 rip split-horizon	Forbid to use split-horizon

```
Oct 24 10:00:06 Switch RIPNG6-7: SEND[eth-0-12]: Send to [ff02::9]:521
Oct 24 10:00:06 Switch RIPNG6-7: SEND[eth-0-12]: RESPONSE version 1 packet size 64
Oct 24 10:00:06 Switch RIPNG6-7: 2001:ab8:49::/64 metric 4 tag 0
Oct 24 10:00:06 Switch RIPNG6-7: 2001:db8:12::/64 metric 1 tag 0
Oct 24 10:00:06 Switch RIPNG6-7: 2001:db8:48::/64 metric 5 tag 0
```

Enable Split-horizon on Switch B

Switch# configure terminal	Enter the configure mode
Switch(config)#interface eth-0-12	Enter the interface eth-0-12
Switch(config-if)# ipv6 rip split-horizon	Enable split-horizon

```
Oct 24 10:05:16 Switch RIPNG6-7: SEND[eth-0-12]: Send to [ff02::9]:521
Oct 24 10:05:16 Switch RIPNG6-7: SEND[eth-0-12]: RESPONSE version 1 packet size 44
Oct 24 10:05:16 Switch RIPNG6-7: 2001:ab8:49::/64 metric 4 tag 0
Oct 24 10:05:16 Switch RIPNG6-7: 2001:db8:12::/64 metric 1 tag 0
```

3.7.3 Validation

Use the commands as follows to validate the configuration:

show running-config 和 show ipv6 rip interface

```
00:02:33
```

3.8 Configuring Timers

RIPng use several timers that determine such variables as the frequency of routing updates, the length of time before a route becomes invalid, and other parameters. You can adjust these timers to tune RIPng performance to better suit your internet-work needs. You can make the following timer adjustments:

➢ The rate (time in seconds between updates) at which routing updates are sent.

➢ The interval of time (in seconds) after which a route is declared invalid.

➢ The amount of time (in seconds) that must pass before a route is removed from the routing table.

3.8.1 Configuration

To configure the timers, use the following command:

Switch# configure terminal	Enter the Configure mode
Switch(config)# router ipv6 rip	Enter the RIPng routing process
Switch(config-router)# timers basic 10 180 120	Specify the routing table update timer in 10 seconds. Specifies the routing information timeout timer in 180 seconds. Specifies the routing garbage collection timer in 120 seconds.

3.8.2 Validation

Use the commands as follows to validate the configuration:

show running-config and show ipv6 protocols rip

```
Switch# show ipv6 protocols rip
Routing Protocol is "ripng"
  Sending updates every 10 seconds with +/-5 seconds, next due in 5 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Outgoing routes will have 3 added to metric if on list ripng_acl
  Default redistribute metric is 2
  Redistributing:
  Interface
    eth-0-12
    eth-0-48
  Routing for Networks:
  Number of routes (including connected): 3
  Distance: (default is 100)
```

3.9 Configuring RIPng Route Distribute Filters

A RIP distribute list allows you to permit or deny learning or advertising of specific routes. A distribute list consists of the following parameters:
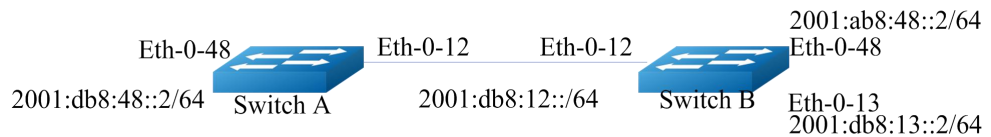
An ACL or a prefix list that filter the routes.

The direction:

- ➢ In: filter applies to learned routes.
- ➢ Out: filter applies to advertised routes

The interface that the filer applies (optional).

3.9.1 Topology

3.9.2 Configuration

Switch A

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::1/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:db8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Switch B

Switch# show run

```
interface eth-0-12
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:12::2/64
```

```
ipv6 router rip
!
interface eth-0-13
 no switchport
 ipv6 address auto link-local
 ipv6 address 2001:db8:13::1/64
 ipv6 router rip
!
interface eth-0-48
 no switchport
 ipv6 nd ra mtu suppress
 ipv6 address auto link-local
 ipv6 address 2001:ab8:48::2/64
 ipv6 router rip
!
router ipv6 rip
!
```

Switch A output

Switch# show ipv6 route rip

```
R      2001:ab8:49::/64 [120/5]
       via fe80::1271:d1ff:fec8:3300, eth-0-12, 00:18:29
R      2001:db8:13::/64 [120/2]
       via fe80::1271:d1ff:fec8:3300, eth-0-12, 00:03:37
```

To configure the distribute filter on Switch B, use the following command:

Switch# configure terminal	Enter the Configure mode
Switch(config)# ipv6 access-list ripngfilter Switch(config-ipv6-acl)# 10 deny any 2001:ab8:49::/64 any Switch(config-ipv6-acl)# 20 permit any any any Switch(config-ipv6-acl)# exit	Build a ACL list
Switch(config)# router ipv6 rip	Enter the RIPng routing process.
Switch(config-router)# distribute-list ripngfilter out eth-0-12	Apply the distribute filter

3.9.3 Validation

Switch A output

Switch# show ipv6 route rip

```
R      2001:db8:13::/64 [120/2]
       via fe80::1271:d1ff:fec8:3300, eth-0-12, 00:03:37
```