INTERNETWORK
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IEWB-RS Technology Labs

RIP

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RIPv1 Contiguous Networks

Objective: Configure RIPv1 between R1 and R2 to obtain connectivity between VLAN A and VLAN B

Directions

- Configure R1's interface Ethernet0/0 with the IP address 1.0.0.1/16
- Configure R2's interface Ethernet0/0 with the IP address 2.0.0.2/16
- Configure R1's interface Serial0/0 with the IP address 12.0.0.1/16
- Configure R2's interface Serial0/0 with the IP address 12.0.0.2/16
- Configure the Frame Relay circuit between R1 and R2 using static layer 3 to layer 2 resolution
- Configure RIP version 1 on R1 and R2
- All active interfaces on R1 and R2 should participate in RIPv1 routing

Ask Yourself

- What is the difference between RIPv1 and RIPv2?
- How does RIPv1 transmit updates?
- How does RIPv1 deal with fixed-length subnetted networks?
- How does RIPv1 deal with variable-length subnetted networks?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 1.0.0.1 255.255.0.0
!
interface Serial0/0
 ip address 12.0.0.1 255.255.0.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.2 102 broadcast
!
router rip
 network 1.0.0.0
 network 12.0.0.0

R2:
interface Ethernet0/0
 ip address 2.0.0.2 255.255.0.0
!
interface Serial0/0
 ip address 12.0.0.2 255.255.0.0
 encapsulation frame-relay
```

```
 frame-relay map ip 12.0.0.1 201 broadcast
!
router rip
 network 2.0.0.0
 network 12.0.0.0
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     1.0.0.0/16 is subnetted, 1 subnets
C       1.0.0.0 is directly connected, Ethernet0/0
R    2.0.0.0/8 [120/1] via 12.0.0.2, 00:00:25, Serial0/0
     12.0.0.0/16 is subnetted, 1 subnets
C       12.0.0.0 is directly connected, Serial0/0


R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 12.0.0.1, 00:00:28, Serial0/0
     2.0.0.0/16 is subnetted, 1 subnets
C       2.0.0.0 is directly connected, Ethernet0/0
     12.0.0.0/16 is subnetted, 1 subnets
C       12.0.0.0 is directly connected, Serial0/0


R1#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 28 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface            Send  Recv  Triggered RIP  Key-chain
    Ethernet0/0            1     1 2
    Serial0/0             1     1 2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
    1.0.0.0
    12.0.0.0
  Routing Information Sources:
    Gateway          Distance      Last Update
```

```
    12.0.0.2              120        00:00:15
  Distance: (default is 120)

R1#debug ip rip
RIP protocol debugging is on
R1#
05:11:30: RIP: received v1 update from 12.0.0.2 on Serial0/0
05:11:30:        1.0.0.0 in 2 hops
05:11:30:        2.0.0.0 in 1 hops
05:11:30:        12.0.0.0 in 1 hops
05:11:38: RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (1.0.0.1)
05:11:39: RIP: build update entries
05:11:39:         network 2.0.0.0 metric 2
05:11:39:         network 12.0.0.0 metric 1
05:11:39: RIP: sending v1 update to 255.255.255.255 via Serial0/0 (12.0.0.1)
05:11:39: RIP: build update entries
05:11:39:         network 1.0.0.0 metric 1
05:11:39:         network 2.0.0.0 metric 2
05:11:39:         subnet 12.0.0.0 metric 1
```

📖   **Recommended Reading**

Configuring Routing Information Protocol

RIPv1 Discontiguous Networks

Objective: Configure RIPv1 between R1 and R2 to obtain connectivity between VLAN A and VLAN B

Directions

- Configure R1's interface Ethernet0/0 with the IP address 10.1.0.1/16
- Configure R2's interface Ethernet0/0 with the IP address 10.2.0.2/16
- Configure R1's interface Serial0/0 with the IP address 12.0.0.1/8
- Configure R2's interface Serial0/0 with the IP address 12.0.0.2/8
- Configure the Frame Relay circuit between R1 and R2 using static layer 3 to layer 2 resolution
- Configure RIP version 1 on R1 and R2
- All active interfaces on R1 and R2 should participate in RIP routing

Ask Yourself

- What is the difference between RIPv1 and RIPv2?
- How does RIPv1 transmit updates?
- How does RIPv1 deal with fixed-length subnetted networks?
- How does RIPv1 deal with variable-length subnetted networks?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 10.1.0.1 255.255.0.0
!
interface Serial0/0
 ip address 12.0.0.1 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.2 102 broadcast
!
router rip
 network 10.0.0.0
 network 12.0.0.0

R2:
interface Ethernet0/0
 ip address 10.2.0.2 255.255.0.0
!
 interface Serial0/0
```

```
 ip address 12.0.0.2 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.1 201 broadcast
!
router rip
 network 10.0.0.0
 network 12.0.0.0
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 1 subnets
C       10.1.0.0 is directly connected, Ethernet0/0
C    12.0.0.0/8 is directly connected, Serial0/0

R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 1 subnets
C       10.2.0.0 is directly connected, Ethernet0/0
C    12.0.0.0/8 is directly connected, Serial0/0

R1#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 5 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface             Send  Recv  Triggered RIP  Key-chain
    Ethernet0/0             1     1 2
    Serial0/0               1     1 2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
    10.0.0.0
    12.0.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    12.0.0.2            120        00:00:23
  Distance: (default is 120)
```

```
R1#debug ip rip
RIP protocol debugging is on
RIP: received v1 update from 12.0.0.2 on Serial0/0
     10.0.0.0 in 1 hops
     12.0.0.0 in 1 hops
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.1.0.1)
RIP: build update entries
       network 12.0.0.0 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/0 (12.0.0.1)
RIP: build update entries
       network 10.0.0.0 metric 1
       subnet 12.0.0.0 metric 1
```

📖 Recommended Reading

Configuring Routing Information Protocol

RIPv1 FLSM

Objective: Configure RIPv1 between R1 and R2 to obtain connectivity between VLAN A and VLAN B
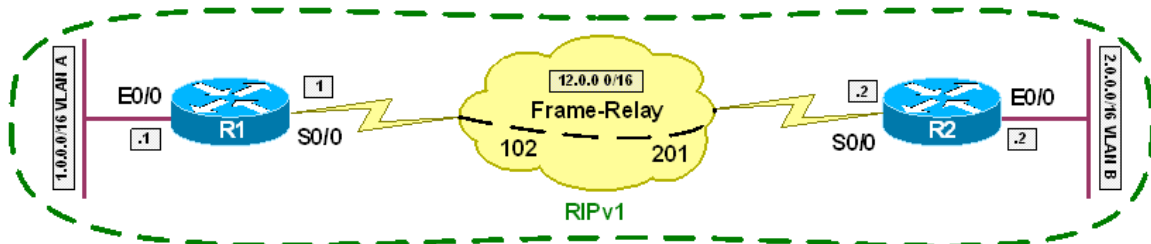
Directions

- Configure R1's interface Ethernet0/0 with the IP address 10.1.0.1/16
- Configure R2's interface Ethernet0/0 with the IP address 10.2.0.2/16
- Configure R1's interface Serial0/0 with the IP address 10.12.0.1/16
- Configure R2's interface Serial0/0 with the IP address 10.12.0.2/16
- Configure the Frame Relay circuit between R1 and R2 using static layer 3 to layer 2 resolution
- Configure RIP version 1 on R1 and R2
- All active interfaces on R1 and R2 should participate in RIP routing

Ask Yourself

- What is the difference between RIPv1 and RIPv2?
- How does RIPv1 transmit updates?
- How does RIPv1 deal with fixed-length subnetted networks?
- How does RIPv1 deal with variable-length subnetted networks?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 10.1.0.1 255.255.0.0
!
interface Serial0/0
 ip address 10.12.0.1 255.255.0.0
 encapsulation frame-relay
 frame-relay map ip 10.12.0.2 102 broadcast
!
router rip
 network 10.0.0.0

R2:
interface Ethernet0/0
 ip address 10.2.0.2 255.255.0.0
```

```
!
 interface Serial0/0
 ip address 10.12.0.2 255.255.0.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.1 201 broadcast
!
router rip
 network 10.0.0.0
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 3 subnets
C       10.12.0.0 is directly connected, Serial0/0
R       10.2.0.0 [120/1] via 10.12.0.2, 00:00:26, Serial0/0
C       10.1.0.0 is directly connected, Ethernet0/0

R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 3 subnets
C       10.12.0.0 is directly connected, Serial0/0
C       10.2.0.0 is directly connected, Ethernet0/0
R       10.1.0.0 [120/1] via 10.12.0.1, 00:00:22, Serial0/0

R1#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.1.0.1)
RIP: build update entries
       subnet 10.2.0.0 metric 2
       subnet 10.12.0.0 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/0 (10.12.0.1)
RIP: build update entries
       subnet 10.1.0.0 metric 1
       subnet 10.2.0.0 metric 2
       subnet 10.12.0.0 metric 1
RIP: received v1 update from 10.12.0.2 on Serial0/0
     10.1.0.0 in 2 hops
     10.2.0.0 in 1 hops
     10.12.0.0 in 1 hops
```

📖 **Recommended Reading**

[Configuring Routing Information Protocol](#)

RIPv1 VLSM

Objective: Configure RIPv1 between R1 and R2 to obtain connectivity between VLAN A and VLAN B
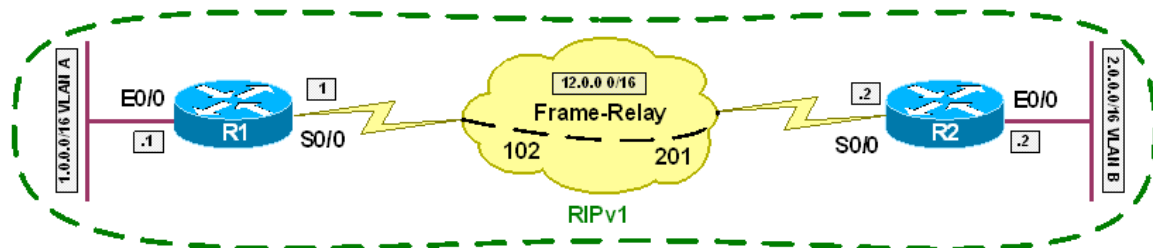
Directions

- Configure R1's interface Ethernet0/0 with the IP address 10.1.0.1/16
- Configure R2's interface Ethernet0/0 with the IP address 10.2.0.2/24
- Configure R1's interface Serial0/0 with the IP address 10.12.0.1/16
- Configure R2's interface Serial0/0 with the IP address 10.12.0.2/24
- Configure the Frame Relay circuit between R1 and R2 using static layer 3 to layer 2 resolution
- Configure RIP version 1 on R1 and R2
- All active interfaces on R1 and R2 should participate in RIP routing

Ask Yourself

- What is the difference between RIPv1 and RIPv2?
- How does RIPv1 transmit updates?
- How does RIPv1 deal with fixed-length subnetted networks?
- How does RIPv1 deal with variable-length subnetted networks?
- How will the difference in subnet mask of R1 and R2 affect the behavior of RIP?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 10.1.0.1 255.255.0.0
!
interface Serial0/0
 ip address 10.12.0.1 255.255.0.0
 encapsulation frame-relay
 frame-relay map ip 10.12.0.2 102 broadcast
!
router rip
 network 10.0.0.0

R2:
interface Ethernet0/0
 ip address 10.2.0.2 255.255.255.0
```

```
!
 interface Serial0/0
 ip address 10.12.0.2 255.255.255.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.1 201 broadcast
!
router rip
 network 10.0.0.0
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 3 subnets
C       10.12.0.0 is directly connected, Serial0/0
R       10.2.0.0 [120/1] via 10.12.0.2, 00:00:24, Serial0/0
C       10.1.0.0 is directly connected, Ethernet0/0

R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
C       10.12.0.0 is directly connected, Serial0/0
C       10.2.0.0 is directly connected, Ethernet0/0
R       10.1.0.0 [120/1] via 10.12.0.1, 00:00:09, Serial0/0

R1#debug ip rip
RIP protocol debugging is on
RIP: received v1 update from 10.12.0.2 on Serial0/0
      10.1.0.0 in 2 hops
      10.2.0.0 in 1 hops
      10.12.0.0 in 1 hops
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.1.0.1)
RIP: build update entries
       subnet 10.2.0.0 metric 2
       subnet 10.12.0.0 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/0 (10.12.0.1)
RIP: build update entries
      subnet 10.1.0.0 metric 1
      subnet 10.2.0.0 metric 2
      subnet 10.12.0.0 metric 1
```

📖 Recommended Reading

Configuring Routing Information Protocol

RIPv2

Objective: Configure RIPv2 between R1 and R2 to obtain connectivity between VLAN A and VLAN B.
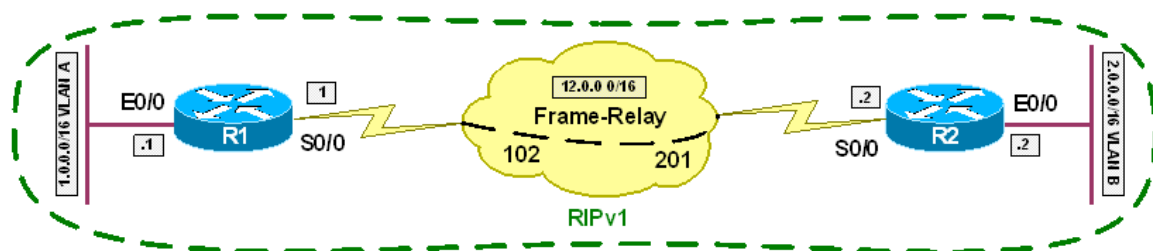
Directions

- Configure R1's interface Ethernet0/0 with the IP address 10.1.0.1/16
- Configure R2's interface Ethernet0/0 with the IP address 10.2.0.2/16
- Configure R1's interface Serial0/0 with the IP address 12.0.0.1/8
- Configure R2's interface Serial0/0 with the IP address 12.0.0.2/8
- Configure the Frame Relay circuit between R1 and R2 using static layer 3 to layer 2 resolution
- Configure RIP version 2 on R1 and R2
- Disable auto-summarization for RIPv2
- All active interfaces on R1 and R2 should participate in RIP routing

Ask Yourself

- What is the difference between RIPv1 and RIPv2?
- How does RIPv2 transmit updates?
- How does RIPv2 deal with fixed-length subnetted networks?
- How does RIPv2 deal with variable-length subnetted networks?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 10.1.0.1 255.255.0.0
!
interface Serial0/0
 ip address 12.0.0.1 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.2 102 broadcast
!
router rip
version 2
network 10.0.0.0
```

```
network 12.0.0.0
no auto-summary

R2:
interface Ethernet0/0
 ip address 10.2.0.2 255.255.0.0
!
 interface Serial0/0
 ip address 12.0.0.2 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.1 201 broadcast
!
router rip
version 2
network 10.0.0.0
network 12.0.0.0
no auto-summary
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 2 subnets
R       10.2.0.0 [120/1] via 12.0.0.2, 00:00:03, Serial0/0
C       10.1.0.0 is directly connected, Ethernet0/0
C    12.0.0.0/8 is directly connected, Serial0/0


R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 2 subnets
C       10.2.0.0 is directly connected, Ethernet0/0
R       10.1.0.0 [120/1] via 12.0.0.1, 00:00:12, Serial0/0
C    12.0.0.0/8 is directly connected, Serial0/0


R1#debug ip rip
RIP protocol debugging is on
RIP: sending v2 update to 224.0.0.9 via Serial0/0 (12.0.0.1)
RIP: build update entries
      10.1.0.0/16 via 0.0.0.0, metric 1, tag 0
      10.2.0.0/16 via 12.0.0.2, metric 2, tag 0
      12.0.0.0/8 via 0.0.0.0, metric 1, tag 0
RIP: received v2 update from 12.0.0.2 on Serial0/0
```

```
    10.2.0.0/16 via 0.0.0.0 in 1 hops
    12.0.0.0/8 via 0.0.0.0 in 1 hops

R1#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 0 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface           Send  Recv  Triggered RIP  Key-chain
    Ethernet0/0           2     2
    Serial0/0             2     2
  Automatic network summarization is not in effect
  Maximum path: 4
  Routing for Networks:
    10.0.0.0
    12.0.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    12.0.0.2             120      00:00:21
  Distance: (default is 120)
```

📖   **Recommended Reading**

Configuring Routing Information Protocol

RIP Send-Receive Version

Objective: Configure RIPv1 between R1 and R3 and RIPv2 between R2 and R3 to obtain connectivity between VLAN A, VLAN B, and VLAN C
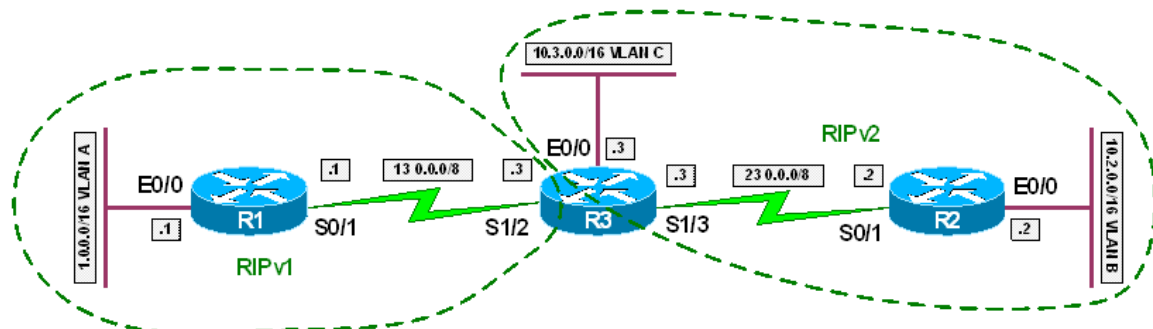
Directions

- Configure R1's interface Ethernet0/0 with the IP address 1.0.0.1/16
- Configure R2's interface Ethernet0/0 with the IP address 10.2.0.2/16
- Configure R3's interface Ethernet0/0 with the IP address 10.3.0.3/16
- Configure R1's interface Serial0/1 with the IP address 13.0.0.1/8
- Configure R3's interface Serial1/2 with the IP address 13.0.0.3/8
- Configure R2's interface Serial0/1 with the IP address 23.0.0.2/8
- Configure R3's interface Serial1/3 with the IP address 23.0.0.3/8
- Configure RIPv1 on all interfaces of R1
- Configure RIPv2 on all interfaces of R2
- Configure R3 to run RIPv1 with R1 and RIPv2 with R2
- Configure RIP on R3's interface Ethernet0/0

Ask Yourself

- What is the difference between RIPv1 and RIPv2?
- What is the default version when RIP is enabled?
- How can you verify what RIP version is running?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 1.0.0.1 255.255.0.0
!
interface Serial0/1
 ip address 13.0.0.1 255.0.0.0
!
router rip
 version 1
 network 1.0.0.0
 network 13.0.0.0
```

```
R2:
interface Ethernet0/0
 ip address 10.2.0.2 255.255.0.0
!
interface Serial0/1
 ip address 23.0.0.2 255.0.0.0
!
router rip
 version 2
 no auto-summary
 network 10.0.0.0
 network 23.0.0.0

R3:
interface Ethernet0/0
 ip address 10.3.0.3 255.255.0.0
!
interface Serial1/2
 ip address 13.0.0.3 255.0.0.0
 clock rate 64000
 ip rip send version 1
 ip rip receive version 1
!
interface Serial1/3
 ip address 23.0.0.3 255.0.0.0
 clock rate 64000
 ip rip send version 2
 ip rip receive version 2
!
router rip
 no auto-summary
 network 10.0.0.0
 network 13.0.0.0
 network 23.0.0.0
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     1.0.0.0/16 is subnetted, 1 subnets
C       1.0.0.0 is directly connected, Ethernet0/0
R    23.0.0.0/8 [120/1] via 13.0.0.3, 00:00:06, Serial0/1
R    10.0.0.0/8 [120/1] via 13.0.0.3, 00:00:06, Serial0/1
C    13.0.0.0/8 is directly connected, Serial0/1

R2#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
```

```
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/2] via 23.0.0.3, 00:00:17, Serial0/1
C    23.0.0.0/8 is directly connected, Serial0/1
     10.0.0.0/16 is subnetted, 2 subnets
C       10.2.0.0 is directly connected, Ethernet0/0
R       10.3.0.0 [120/1] via 23.0.0.3, 00:00:17, Serial0/1
R    13.0.0.0/8 [120/1] via 23.0.0.3, 00:00:17, Serial0/1

R3#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 13.0.0.1, 00:00:22, Serial1/2
C    23.0.0.0/8 is directly connected, Serial1/3
     10.0.0.0/16 is subnetted, 2 subnets
R       10.2.0.0 [120/1] via 23.0.0.2, 00:00:15, Serial1/3
C       10.3.0.0 is directly connected, Ethernet0/0
C    13.0.0.0/8 is directly connected, Serial1/2

R3#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 9 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface              Send  Recv  Triggered RIP  Key-chain
    Ethernet0/0            1     1 2
    Serial1/2             1     1
    Serial1/3             2     2
  Automatic network summarization is not in effect
  Maximum path: 4
  Routing for Networks:
    10.0.0.0
    13.0.0.0
    23.0.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    13.0.0.1            120       00:00:47
    23.0.0.2            120       00:00:12
  Distance: (default is 120)

R3#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.3.0.3)
RIP: build update entries
        network 1.0.0.0 metric 2
        subnet 10.2.0.0 metric 2
        network 13.0.0.0 metric 1
        network 23.0.0.0 metric 1
```

```
RIP: sending v1 update to 255.255.255.255 via Serial1/2 (13.0.0.3)
RIP: build update entries
        network 10.0.0.0 metric 1
        network 23.0.0.0 metric 1
RIP: sending v2 update to 224.0.0.9 via Serial1/3 (23.0.0.3)
RIP: build update entries
        1.0.0.0/8 via 0.0.0.0, metric 2, tag 0
        10.3.0.0/16 via 0.0.0.0, metric 1, tag 0
        13.0.0.0/8 via 0.0.0.0, metric 1, tag 0
RIP: received v2 update from 23.0.0.2 on Serial1/3
     10.2.0.0/16 via 0.0.0.0 in 1 hops
RIP: received v1 update from 13.0.0.1 on Serial1/2
     1.0.0.0 in 1 hops
```
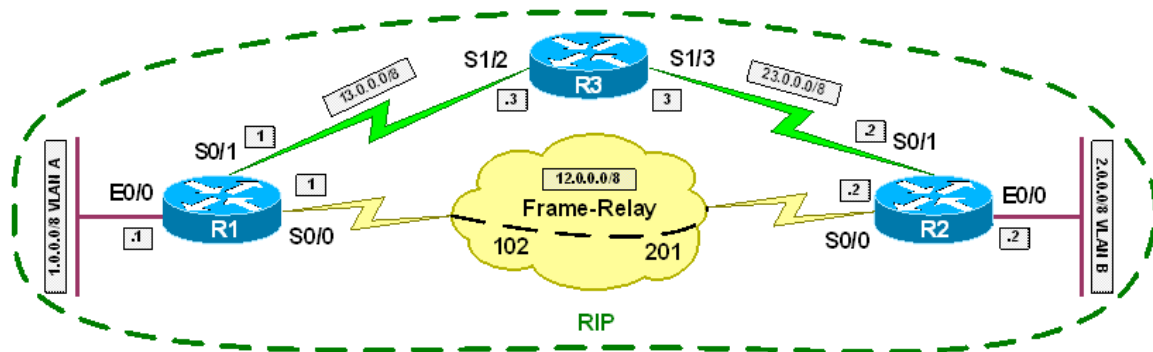
📖 **Recommended Reading**

Configuring Routing Information Protocol

Tuning RIP Convergence Timers

Objective: Configure the network so that VLAN A regains connectivity to VLAN B within 5 seconds in the case that the Frame Relay circuit between R1 and R2 is down

Directions

- Configure IP addressing on R1, R2, and R3 per the diagram
- Configure the Frame Relay circuit between R1 and R2 using static layer 3 to layer 2 resolution
- Configure RIP on all active interfaces of R1, R2, and R3
- Configure R1, R2, and R3 so that VLAN A regains connectivity to VLAN B within 5 seconds in the case that the Frame Relay circuit between R1 and R2 is down

Ask Yourself

- What factors determines the convergence time of RIP?
- Can these factors be manipulated? If so, how?
- How can you verify that the manipulation was successful?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 1.0.0.1 255.0.0.0
!
interface Serial0/0
 ip address 12.0.0.1 255.255.255.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.2 102 broadcast
!
interface Serial0/1
 ip address 13.0.0.1 255.0.0.0
!
router rip
 timers basic 1 3 0 3
 network 1.0.0.0
```

```
 network 12.0.0.0
 network 13.0.0.0

R2:
interface Ethernet0/0
 ip address 2.0.0.2 255.0.0.0
!
interface Serial0/0
 ip address 12.0.0.2 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 12.0.0.1 201 broadcast
!
interface Serial0/1
 ip address 23.0.0.2 255.0.0.0
!
router rip
 timers basic 1 3 0 3
 network 2.0.0.0
 network 12.0.0.0
 network 23.0.0.0

R3:
interface Serial1/2
 ip address 13.0.0.3 255.0.0.0
 clock rate 64000
!
interface Serial1/3
 ip address 23.0.0.3 255.0.0.0
 clock rate 64000
!
router rip
 timers basic 1 3 0 3
 network 13.0.0.0
 network 23.0.0.0
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, Ethernet0/0
R    2.0.0.0/8 [120/1] via 12.0.0.2, 00:00:00, Serial0/0
R    23.0.0.0/8 [120/1] via 13.0.0.3, 00:00:00, Serial1
                [120/1] via 12.0.0.2, 00:00:00, Serial0/0
     12.0.0.0/24 is subnetted, 1 subnets
C       12.0.0.0 is directly connected, Serial0/0
C    13.0.0.0/8 is directly connected, Serial1

R1#ping 2.0.0.2 repeat 10000 timeout 1 source e0/0

Type escape sequence to abort.
Sending 10000, 100-byte ICMP Echos to 2.0.0.2, timeout is 1 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
AccessServer>2
```

```
[Resuming connection 2 to r2 ... ]

R2#config t
R2(config)#interface serial0/0
R2(config-if)#shut
R2(config-if)#
AccessServer>1
[Resuming connection 1 to r1 ... ]
!!..
*Mar  2 08:18:55.235: RT: delete route to 2.0.0.0 via 12.0.0.2, rip metric [120/1]
*Mar  2 08:18:55.239: RT: no routes to 2.0.0.0, entering holddown
*Mar  2 08:18:55.243: RT: del 23.0.0.0 via 12.0.0.2, rip metric [120/1]
*Mar  2 08:18:55.927: RT: 2.0.0.0 came out of holddown
*Mar  2 08:18:55.931: RT: add 2.0.0.0/8 via 13.0.0.3, rip metric [120/2]
.!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!.
Success rate is 98 percent (249/254), round-trip min/avg/max = 56/61/120 ms

R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, Ethernet0/0
R    2.0.0.0/8 [120/2] via 13.0.0.3, 00:00:00, Serial1
R    23.0.0.0/8 [120/1] via 13.0.0.3, 00:00:00, Serial1
     12.0.0.0/24 is subnetted, 1 subnets
C       12.0.0.0 is directly connected, Serial0/0
C    13.0.0.0/8 is directly connected, Serial1
```

📖 Recommended Reading

Cisco IOS Command Reference: timers basic

RIP and IP Split Horizon

Objective: Configure RIP over the Frame Relay network between R1, R4, and R5 to obtain connectivity between VLAN A, VLAN B, and VLAN C
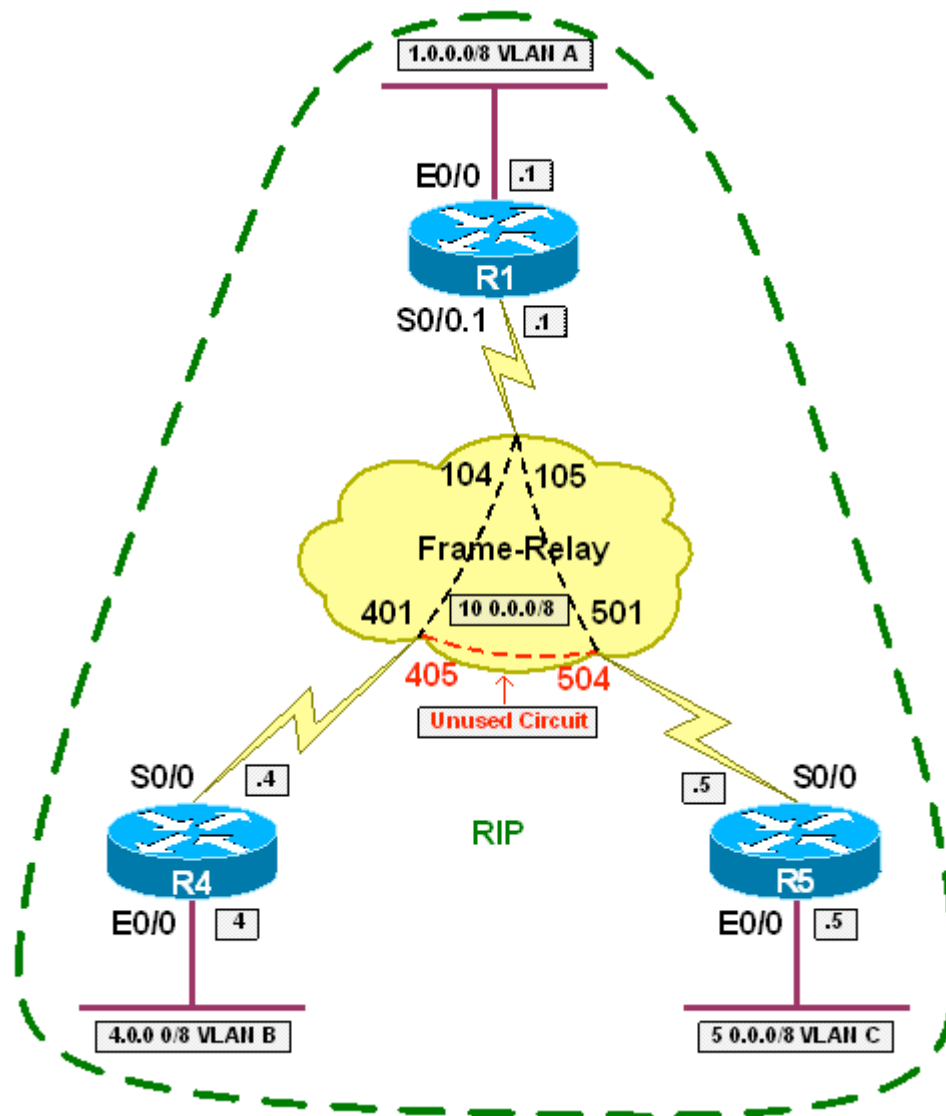
Directions

- Configure R1's interface Ethernet0/0 with the IP address 1.0.0.1/8
- Configure R4's interface Ethernet0/0 with the IP address 4.0.0.4/8
- Configure R5's interface Ethernet0/0 with the IP address 5.0.0.5/8
- Configure R1's interface Serial0/0.1 as a Frame Relay multipoint subinterface with the IP address 10.0.0.1/8
- Configure R4's interface Serial0/0 with the IP address 10.0.0.4/8
- Configure R5's interface Serial0/0 with the IP address 10.0.0.5/8

- Configure a Frame Relay hub-and-spoke network between R1, R4, and R5 with R1 as the hub
- All traffic from R4 to R5 should transit R1
- Enable RIP for all active interfaces on R1, R4, and R5
- Disable split-horizon on R1's Serial interface attached to the Frame Relay cloud

Ask Yourself

- What is IP Split Horizon used to accomplish?
- In what circumstances does IP Split Horizon introduce problems into the network?
- In what cases is IP Split Horizon disabled by default? Enabled by default?
- How can you verify whether IP Split Horizon is enabled or not?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 1.0.0.1 255.0.0.0
!
interface Serial0/0
 encapsulation frame-relay
!
interface Serial0/0.1 multipoint
 ip address 10.0.0.1 255.0.0.0
 no ip split-horizon
 frame-relay map ip 10.0.0.4 104 broadcast
 frame-relay map ip 10.0.0.5 105 broadcast
!
router rip
 network 1.0.0.0
 network 10.0.0.0

R4:
interface Ethernet0/0
 ip address 4.0.0.4 255.0.0.0
!
interface Serial0/0
 ip address 10.0.0.4 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 10.0.0.1 401 broadcast
 frame-relay map ip 10.0.0.5 401
 no frame-relay inverse-arp
!
router rip
 network 4.0.0.0
 network 10.0.0.0

R5:
interface Ethernet0/0
 ip address 5.0.0.5 255.0.0.0
!
interface Serial0/0
 ip address 10.0.0.5 255.0.0.0
 encapsulation frame-relay
```

```
 frame-relay map ip 10.0.0.1 501 broadcast
 frame-relay map ip 10.0.0.4 501
 no frame-relay inverse-arp
!
router rip
 network 5.0.0.0
 network 10.0.0.0
```

Verification

Before Disabling IP Split-Horizon

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, Ethernet0/0
R    4.0.0.0/8 [120/1] via 10.0.0.4, 00:00:00, Serial0/0.1
R    5.0.0.0/8 [120/1] via 10.0.0.5, 00:00:10, Serial0/0.1
C    10.0.0.0/8 is directly connected, Serial0/0.1

R4#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.0.0.1, 00:00:05, Serial0/0
C    4.0.0.0/8 is directly connected, Ethernet0/0
C    10.0.0.0/8 is directly connected, Serial0/0

R5#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.0.0.1, 00:00:15, Serial0/0
C    5.0.0.0/8 is directly connected, Ethernet0/0
C    10.0.0.0/8 is directly connected, Serial0/0

R1#show ip interface Serial0/0.1
Serial0/0.1 is up, line protocol is up
```

```
   Internet address is 10.0.0.1/8
   Broadcast address is 255.255.255.255
   Address determined by setup command
   MTU is 1500 bytes
   Helper address is not set
   Directed broadcast forwarding is disabled
   Multicast reserved groups joined: 224.0.0.9
   Outgoing access list is not set
   Inbound  access list is not set
   Proxy ARP is enabled
   Security level is default
   Split horizon is enabled
   [output omitted]
```

After disabling IP Split Horizon:

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, Ethernet0/0
R    4.0.0.0/8 [120/1] via 10.0.0.4, 00:00:01, Serial0/0.1
R    5.0.0.0/8 [120/1] via 10.0.0.5, 00:00:08, Serial0/0.1
C    10.0.0.0/8 is directly connected, Serial0/0.1


R4#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.0.0.1, 00:00:04, Serial0/0
C    4.0.0.0/8 is directly connected, Ethernet0/0
R    5.0.0.0/8 [120/2] via 10.0.0.1, 00:00:04, Serial0/0
C    10.0.0.0/8 is directly connected, Serial0/0


R5#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.0.0.1, 00:00:10, Serial0/0
R    4.0.0.0/8 [120/2] via 10.0.0.1, 00:00:10, Serial0/0
C    5.0.0.0/8 is directly connected, Ethernet0/0
```

```
C    10.0.0.0/8 is directly connected, Serial0/0

R1#show ip interface Serial0/0.1
Serial0/0.1 is up, line protocol is up
  Internet address is 10.0.0.1/8
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.9
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is enabled
  Security level is default
  Split horizon is disabled
  [output omitted]
```
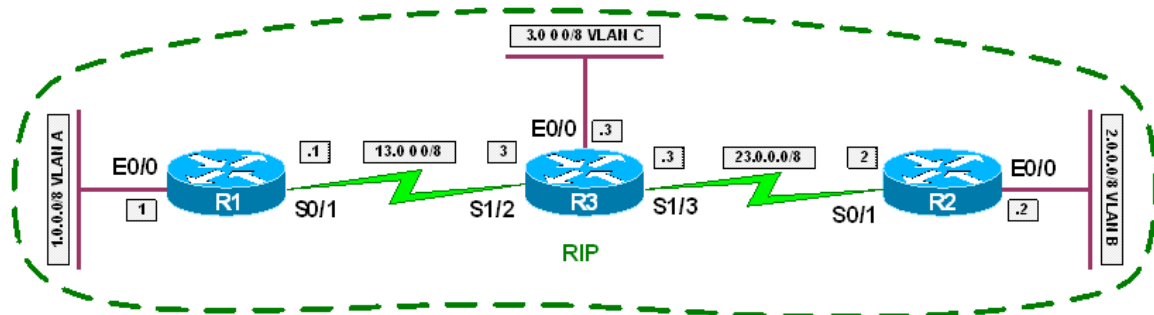
🕮 **Recommended Reading**

[Cisco IOS Command Reference: ip split-horizon](#)

Controlling RIP Updates

Objective: Configure RIP between R1, R2, and R3 to obtain connectivity
between VLAN A and VLAN C & VLAN B and VLAN C. R3 should
not advertise the route for VLAN B to R1 nor should it advertise the
route for VLAN A to R2

Directions

- Configure R1's interface Ethernet0/0 with the IP address 1.0.0.1/8
- Configure R2's interface Ethernet0/0 with the IP address 2.0.0.2/8
- Configure R3's interface Ethernet0/0 with the IP address 3.0.0.3/8
- Configure R1's interface Serial0/1 with the IP address 13.0.0.1/8
- Configure R2's interface Serial0/1 with the IP address 23.0.0.2/8
- Configure R3's interface Serial0/1/2 with the IP address 13.0.0.3/8
- Configure R3's interface Serial0/1/3 with the IP address 23.0.0.3/8
- Enable RIP routing on R1, R2, and R3 for all active interfaces
- Configure R3 so that the only network advertised to R1 and R2 via RIP is
3.0.0.0/8

Ask Yourself

- How is route filtering implemented in RIP?
- Can it be applied on the process basis? On an interface basis?
- What is the difference between using an access-list vs. a prefix-list for
route-filtering?
- Which is appropriate in this case?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 1.0.0.1 255.0.0.0
!
interface Serial0/1
 ip address 13.0.0.1 255.0.0.0
!
router rip
 network 1.0.0.0
 network 13.0.0.0

R2:
interface Ethernet0/0
 ip address 2.0.0.2 255.0.0.0
!
interface Serial0/1
 ip address 23.0.0.2 255.0.0.0
!
router rip
 network 2.0.0.0
 network 23.0.0.0

R3:
interface Ethernet0/0
 ip address 3.0.0.3 255.0.0.0
!
interface Serial0/0
 ip address 13.0.0.3 255.0.0.0
 clock rate 64000
!
interface Serial0/1
 ip address 23.0.0.3 255.0.0.0
 clock rate 64000
!
router rip
 network 3.0.0.0
 network 13.0.0.0
 network 23.0.0.0
 distribute-list prefix ONLY_VLAN_C out
!
ip prefix-list ONLY_VLAN_C seq 5 permit 3.0.0.0/8
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set
```

```
C    1.0.0.0/8 is directly connected, Ethernet0/0
R    3.0.0.0/8 [120/1] via 13.0.0.3, 00:00:22, Serial0/1
C    13.0.0.0/8 is directly connected, Serial0/1


R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    2.0.0.0/8 is directly connected, Ethernet0/0
R    3.0.0.0/8 [120/1] via 23.0.0.3, 00:00:06, Serial0/1
C    23.0.0.0/8 is directly connected, Serial0/1


R3#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 13.0.0.1, 00:00:18, Serial0/0
R    2.0.0.0/8 [120/1] via 23.0.0.2, 00:00:21, Serial0/1
C    3.0.0.0/8 is directly connected, Ethernet0/0
C    23.0.0.0/8 is directly connected, Serial0/1
C    13.0.0.0/8 is directly connected, Serial0/0


R3#debug ip rip
RIP protocol debugging is on
RIP: received v1 update from 23.0.0.2 on Serial0/1
     2.0.0.0 in 1 hops
RIP: received v1 update from 13.0.0.1 on Serial0/0
     1.0.0.0 in 1 hops
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (3.0.0.3)
RIP: build update entries - suppressing null update
RIP: sending v1 update to 255.255.255.255 via Serial0/0 (13.0.0.3)
RIP: build update entries
     network 3.0.0.0 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/1 (23.0.0.3)
RIP: build update entries
     network 3.0.0.0 metric 1
```
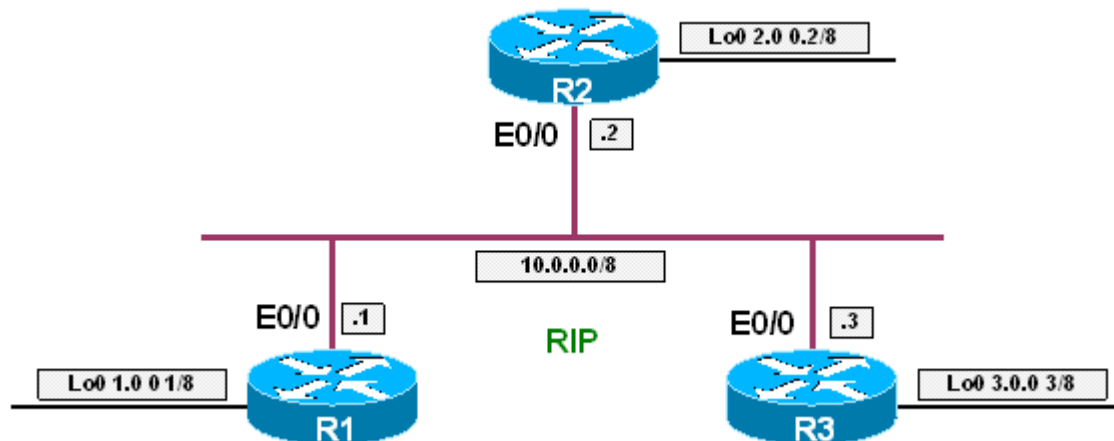
<table>
<tr><td>📖 Recommended Reading</td></tr>
<tr><td>Cisco IOS Command Reference: distribute-list
Cisco IOS Command Reference: ip prefix-list</td></tr>
</table>

Unicast RIP Updates

Objective: Configure RIP on the Ethernet segment between R1, R2, and R3. R3 should not be able to receive RIP updates passed between R1 and R2

Directions

- Configure R1's interface Ethernet0/0 with the IP address 10.0.0.1/8
- Configure R2's interface Ethernet0/0 with the IP address 10.0.0.2/8
- Configure R3's interface Ethernet0/0 with the IP address 10.0.0.3/8
- Configure R1's interface Loopback0 with the IP address 1.0.0.1/8
- Configure R2's interface Loopback0 with the IP address 2.0.0.2/8
- Configure R3's interface Loopback0 with the IP address 3.0.0.3/8
- Enable RIP routing on R1, R2, and R3's active interfaces
- Configure the neighbor statement under the RIP routing process of R1 and R2 to unicast RIP updates to each other
- Configure the passive-interface statement under the RIP routing process of R1 and R2 to stop the transmission of broadcast packets out interface Ethernet0/0

Ask Yourself

- How are RIPv1 packets transmitted by default?
- How are RIPv2 packets transmitted by default?
- How can unicasting routing protocol information be a form of network security?
- How can you verify that devices in the transit path are no longer receiving the updates?

Final Configuration

```
R1:
interface Loopback0
 ip address 1.0.0.1 255.0.0.0
!
interface Ethernet0/0
 ip address 10.0.0.1 255.0.0.0
!
router rip
 passive-interface Ethernet0/0
 network 1.0.0.0
 network 10.0.0.0
 neighbor 10.0.0.2

R2:
interface Loopback0
 ip address 2.0.0.2 255.0.0.0
!
interface Ethernet0/0
 ip address 10.0.0.2 255.0.0.0
!
router rip
 passive-interface Ethernet0/0
 network 2.0.0.0
 network 10.0.0.0
 neighbor 10.0.0.1

R3:
interface Loopback0
 ip address 3.0.0.3 255.0.0.0
!
interface Ethernet0/0
 ip address 10.0.0.3 255.0.0.0
!
router rip
 network 3.0.0.0
 network 10.0.0.0
```

Verification

```
Before neighbor and passive interface

R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, Loopback0
R    2.0.0.0/8 [120/1] via 10.0.0.2, 00:00:05, Ethernet0/0
R    3.0.0.0/8 [120/1] via 10.0.0.3, 00:00:05, Ethernet0/0
C    10.0.0.0/8 is directly connected, Ethernet0/0
```

```
R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.0.0.1, 00:00:23, Ethernet0/0
C    2.0.0.0/8 is directly connected, Loopback0
R    3.0.0.0/8 [120/1] via 10.0.0.3, 00:00:09, Ethernet0/0
C    10.0.0.0/8 is directly connected, Ethernet0/0

R3#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.0.0.1, 00:00:03, Ethernet0/0
R    2.0.0.0/8 [120/1] via 10.0.0.2, 00:00:03, Ethernet0/0
C    3.0.0.0/8 is directly connected, Loopback0
C    10.0.0.0/8 is directly connected, Ethernet0/0

R1#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.0.0.1)
RIP: build update entries
  network 1.0.0.0 metric 1
RIP: received v1 update from 10.0.0.3 on Ethernet0/0
     3.0.0.0 in 1 hops
RIP: received v1 update from 10.0.0.2 on Ethernet0/0
     2.0.0.0 in 1 hops

R2#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.0.0.2)
RIP: build update entries
     network 2.0.0.0 metric 1
RIP: received v1 update from 10.0.0.3 on Ethernet0/0
     3.0.0.0 in 1 hops
RIP: received v1 update from 10.0.0.1 on Ethernet0/0
     1.0.0.0 in 1 hops

R3#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.0.0.3)
RIP: build update entries
     network 3.0.0.0 metric 1
RIP: received v1 update from 10.0.0.2 on Ethernet0/0
     2.0.0.0 in 1 hops
RIP: received v1 update from 10.0.0.1 on Ethernet0/0
     1.0.0.0 in 1 hops
```

```
After neighbor and passive-interface

R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, Loopback0
R    2.0.0.0/8 [120/1] via 10.0.0.2, 00:00:06, Ethernet0/0
R    3.0.0.0/8 [120/1] via 10.0.0.3, 00:00:10, Ethernet0/0
C    10.0.0.0/8 is directly connected, Ethernet0/0

R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.0.0.1, 00:00:18, Ethernet0/0
C    2.0.0.0/8 is directly connected, Loopback0
R    3.0.0.0/8 [120/1] via 10.0.0.3, 00:00:00, Ethernet0/0
C    10.0.0.0/8 is directly connected, Ethernet0/0

R3#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    3.0.0.0/8 is directly connected, Loopback0
C    10.0.0.0/8 is directly connected, Ethernet0/0

R1#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 10.0.0.2 via Ethernet0/0 (10.0.0.1)
RIP: build update entries
  network 1.0.0.0 metric 1
RIP: received v1 update from 10.0.0.2 on Ethernet0/0
     2.0.0.0 in 1 hops
RIP: received v1 update from 10.0.0.3 on Ethernet0/0
     3.0.0.0 in 1 hopsõ

R2#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 10.0.0.1 via Ethernet0/0 (10.0.0.2)
```

```
RIP: build update entries
      network 2.0.0.0 metric 1
RIP: received v1 update from 10.0.0.1 on Ethernet0/0
      1.0.0.0 in 1 hops
RIP: received v1 update from 10.0.0.3 on Ethernet0/0
      3.0.0.0 in 1 hops

R3#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via Ethernet0/0 (10.0.0.3)
RIP: build update entries
      network 3.0.0.0 metric 1
```
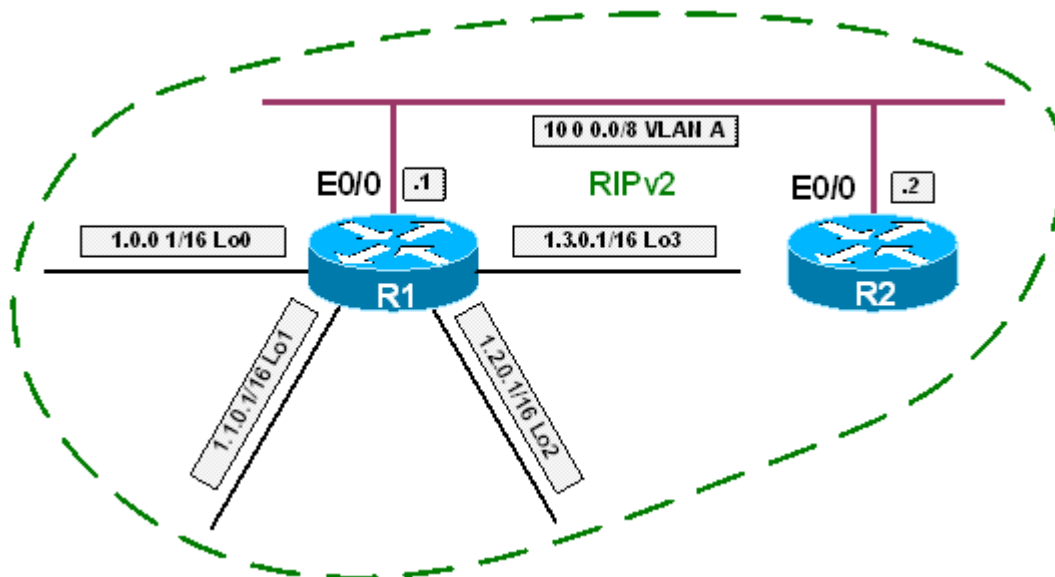
📖 **Recommended Reading**

Cisco IOS Command Reference: neighbor (RIP)

RIP Summarization

Objective: Configure RIP between R1 and R2. R2 should have a single route for the loopback networks originated by R1 that does not overlap any address space

Directions

- Configure R1's interface Ethernet0/0 with the IP address 10.0.0.1/8
- Configure R2's interface Ethernet0/0 with the IP address 10.0.0.2/8
- Configure R1's interface Loopback0 with the IP address 1.0.0.1/16
- Configure R1's interface Loopback1 with the IP address 1.1.0.1/16
- Configure R1's interface Loopback2 with the IP address 1.2.0.1/16
- Configure R1's interface Loopback3 with the IP address 1.3.0.1/16
- Configure RIP version 2 on all active interfaces of R1 and R2
- Disable auto-summarization for RIP on R1 and R2
- Configure RIP summarization on R1's interface Ethernet0/0 for the network 1.0.0.0/14

Ask Yourself

- Which version or versions of RIP support manual summarization? Why?
- How is summarization configured in RIP?
- What are the restrictions of summarization in RIP?

Final Configuration

```
R1:
interface Loopback0
 ip address 1.0.0.1 255.255.0.0
!
interface Loopback1
 ip address 1.1.0.1 255.255.0.0
!
interface Loopback2
 ip address 1.2.0.1 255.255.0.0
!
interface Loopback3
 ip address 1.3.0.1 255.255.0.0
!
interface Ethernet0/0
 ip address 10.0.0.1 255.0.0.0
 ip summary-address rip 1.0.0.0 255.252.0.0
!
router rip
 version 2
 network 1.0.0.0
 network 10.0.0.0
 no auto-summary

R2:
interface Ethernet0/0
 ip address 10.0.0.2 255.0.0.0
!
router rip
 version 2
 network 10.0.0.0
 no auto-summary
```

Verification

```
R2#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     1.0.0.0/14 is subnetted, 1 subnets
R       1.0.0.0 [120/1] via 10.0.0.1, 00:00:19, Ethernet0/0
C    10.0.0.0/8 is directly connected, Ethernet0/0

R2#show ip route 1.0.0.0
Routing entry for 1.0.0.0/14
  Known via "rip", distance 120, metric 1
  Redistributing via rip
  Last update from 10.0.0.1 on Ethernet0/0, 00:00:04 ago
  Routing Descriptor Blocks:
  * 10.0.0.1, from 10.0.0.1, 00:00:04 ago, via Ethernet0/0
```

```
        Route metric is 1, traffic share count is 1

R2#show ip route 1.1.0.0
Routing entry for 1.0.0.0/14
  Known via "rip", distance 120, metric 1
  Redistributing via rip
  Last update from 10.0.0.1 on Ethernet0/0, 00:00:04 ago
  Routing Descriptor Blocks:
  * 10.0.0.1, from 10.0.0.1, 00:00:04 ago, via Ethernet0/0
      Route metric is 1, traffic share count is 1

R2#show ip route 1.2.0.0
Routing entry for 1.0.0.0/14
  Known via "rip", distance 120, metric 1
  Redistributing via rip
  Last update from 10.0.0.1 on Ethernet0/0, 00:00:15 ago
  Routing Descriptor Blocks:
  * 10.0.0.1, from 10.0.0.1, 00:00:15 ago, via Ethernet0/0
      Route metric is 1, traffic share count is 1

R2#show ip route 1.3.0.0
Routing entry for 1.0.0.0/14
  Known via "rip", distance 120, metric 1
  Redistributing via rip
  Last update from 10.0.0.1 on Ethernet0/0, 00:00:13 ago
  Routing Descriptor Blocks:
  * 10.0.0.1, from 10.0.0.1, 00:00:13 ago, via Ethernet0/0
      Route metric is 1, traffic share count is 1

R2#show ip route 1.4.0.0
% Subnet not in table
```
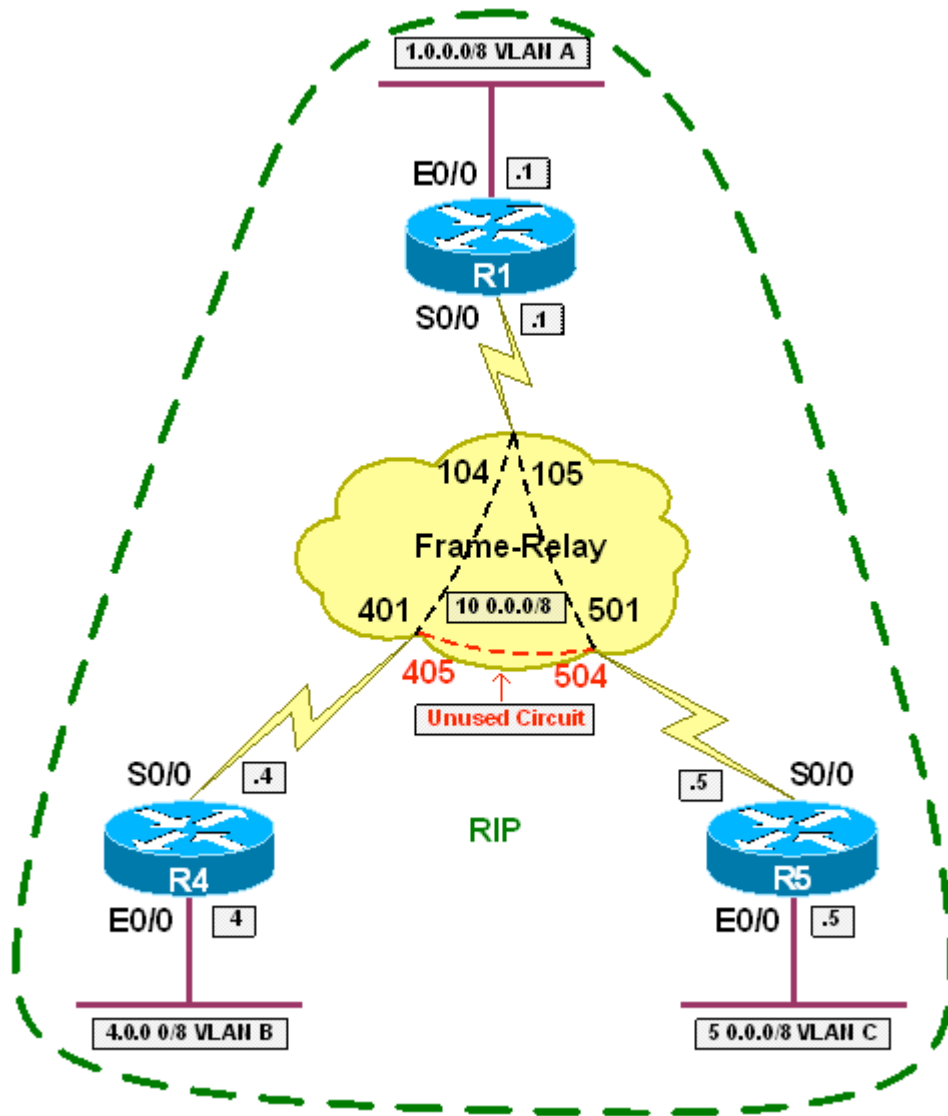
📖 Recommended Reading

Cisco IOS Command Reference: ip summary-address rip

RIP Default Origination

Objective: Configure RIP on the Frame Relay segment between R1, R4, and R5 to obtain connectivity between VLAN A, VLAN B, and VLAN C. R1 should advertise only a default route to R4 and R5 via RIP

Directions

- Configure IP addressing on R1, R4, and R5 per the above diagram
- Configure a Frame Relay hub-and-spoke network between R1, R4, and R5 with R1 as the hub using
- All traffic between R4 and R5 should transit R1
- Configure RIP for all active interfaces on R1, R4, and R5
- Configure R1 to originate a default route to R4 and R5 via RIP
- Configure R1 so that only this default route is advertised to R4 and R5 via RIP

Ask Yourself

- How does default routing work in RIP?
- How can a default route be matched for filtering with a prefix-list? With an access-list?

Final Configuration

```
R1:
interface Ethernet0/0
 ip address 1.0.0.1 255.0.0.0
!
interface Serial0/0
 ip address 10.0.0.1 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 10.0.0.4 104 broadcast
 frame-relay map ip 10.0.0.5 105 broadcast
 no frame-relay inverse-arp
!
router rip
 network 1.0.0.0
 network 10.0.0.0
 default-information originate
 distribute-list prefix DEFAULT_ONLY out
!
ip prefix-list DEFAULT_ONLY seq 5 permit 0.0.0.0/0

R4:
interface Ethernet0/0
 ip address 4.0.0.4 255.0.0.0
!
interface Serial0/0
 ip address 10.0.0.4 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 10.0.0.1 401 broadcast
 frame-relay map ip 10.0.0.5 401
 no frame-relay inverse-arp
!
router rip
 network 4.0.0.0
 network 10.0.0.0

R5:
interface Ethernet0/0
 ip address 5.0.0.5 255.0.0.0
!
interface Serial0/0
 ip address 10.0.0.5 255.0.0.0
 encapsulation frame-relay
 frame-relay map ip 10.0.0.1 501 broadcast
 frame-relay map ip 10.0.0.4 501
 no frame-relay inverse-arp
!
router rip
 network 5.0.0.0
 network 10.0.0.0
```

Verification

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, Ethernet0/0
R    4.0.0.0/8 [120/1] via 10.0.0.4, 00:00:26, Serial0/0
R    5.0.0.0/8 [120/1] via 10.0.0.5, 00:00:18, Serial0/0
C    10.0.0.0/8 is directly connected, Serial0/0

R4#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 10.0.0.1 to network 0.0.0.0

C    4.0.0.0/8 is directly connected, Ethernet0/0
C    10.0.0.0/8 is directly connected, Serial0/0
R*   0.0.0.0/0 [120/1] via 10.0.0.1, 00:00:17, Serial0/0

R5#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, 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, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 10.0.0.1 to network 0.0.0.0

C    5.0.0.0/8 is directly connected, Ethernet0/0
C    10.0.0.0/8 is directly connected, Serial0/0
R*   0.0.0.0/0 [120/1] via 10.0.0.1, 00:00:21, Serial0/0
```

📖 **Recommended Reading**

[Cisco IOS Command Reference: default-information originate](#)