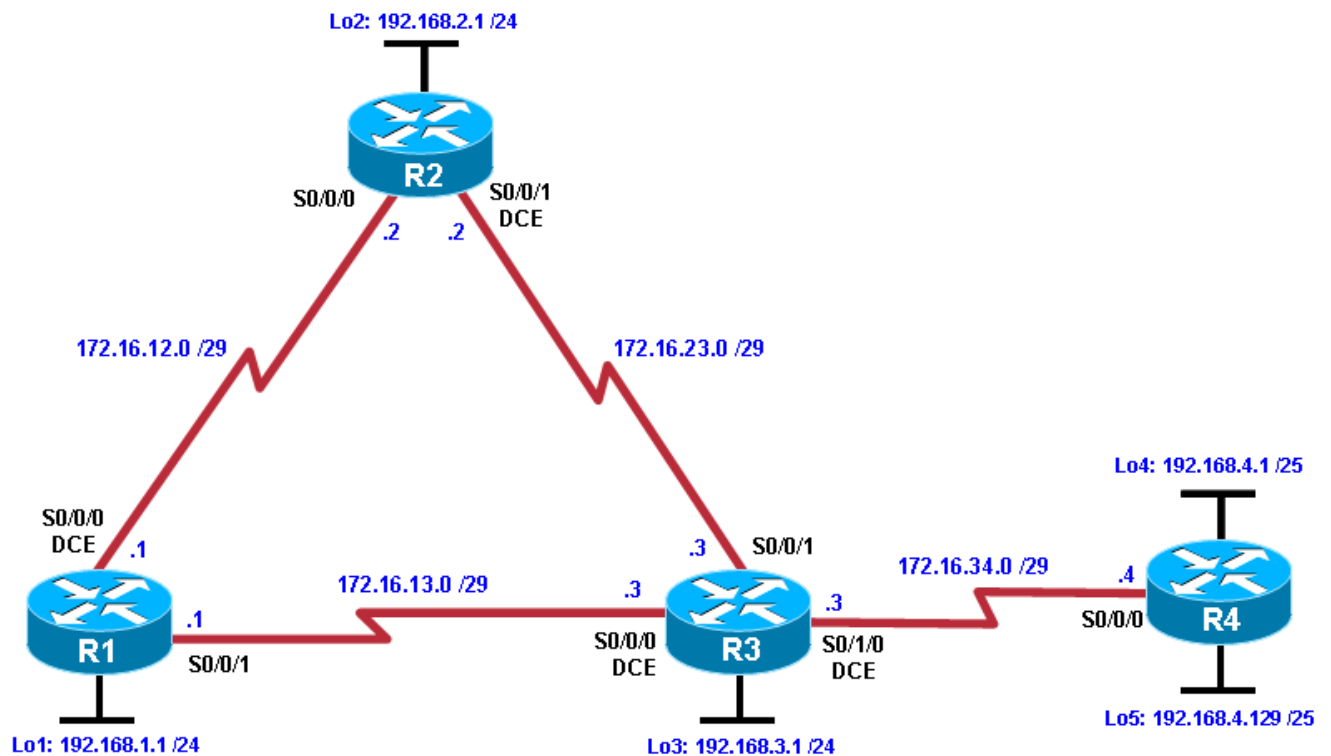


CCNPv7 ROUTE

Chapter 5 Lab 5-1, Configure and Verify Path Control Using PBR

Instructor Version

Topology



Objectives

- Configure and verify policy-based routing.
- Select the required tools and commands to configure policy-based routing operations.
- Verify the configuration and operation by using the proper show and debug commands.

Background

You want to experiment with policy-based routing (PBR) to see how it is implemented and to study how it could be of value to your organization. To this end, you have interconnected and configured a test network with four routers. All routers are exchanging routing information using EIGRP.

Note: This lab uses Cisco 1941 routers with Cisco IOS Release 15.2 with IP Base. Depending on the router or switch model and Cisco IOS Software version, the commands available and output produced might vary from what is shown in this lab.

Required Resources

- 4 routers (Cisco IOS Release 15.2 or comparable)
- Serial and Ethernet cables

Step 1: Configure loopbacks and assign addresses.

- a. Cable the network as shown in the topology diagram. Erase the startup configuration, and reload each router to clear previous configurations.
- b. Using the addressing scheme in the diagram, create the loopback interfaces and apply IP addresses to these and the serial interfaces on R1, R2, R3, and R4. On the serial interfaces connecting R1 to R3 and R3 to R4, specify the bandwidth as 64 Kb/s and set a clock rate on the DCE using the **clock rate 64000** command. On the serial interfaces connecting R1 to R2 and R2 to R3, specify the bandwidth as 128 Kb/s and set a clock rate on the DCE using the **clock rate 128000** command.

You can copy and paste the following configurations into your routers to begin.

Note: Depending on the router model, interfaces might be numbered differently than those listed. You might need to alter them accordingly.

Router R1

```
hostname R1
!
interface Lo1
  description R1 LAN
  ip address 192.168.1.1 255.255.255.0
!
interface Serial0/0/0
  description R1 --> R2
  ip address 172.16.12.1 255.255.255.248
  clock rate 128000
  bandwidth 128
  no shutdown
!
interface Serial0/0/1
  description R1 --> R3
  ip address 172.16.13.1 255.255.255.248
  bandwidth 64
  no shutdown
!
end
```

Router R2

```
hostname R2
!
interface Lo2
  description R2 LAN
  ip address 192.168.2.1 255.255.255.0
!
interface Serial0/0/0
  description R2 --> R1
  ip address 172.16.12.2 255.255.255.248
  bandwidth 128
  no shutdown

interface Serial0/0/1
```

```
description R2 --> R3
ip address 172.16.23.2 255.255.255.248
clock rate 128000
bandwidth 128
no shutdown
!
end
```

Router R3

```
hostname R3
!
interface Lo3
description R3 LAN
ip address 192.168.3.1 255.255.255.0
!
interface Serial0/0/0
description R3 --> R1
ip address 172.16.13.3 255.255.255.248
clock rate 64000
bandwidth 64
no shutdown
!
interface Serial0/0/1
description R3 --> R2
ip address 172.16.23.3 255.255.255.248
bandwidth 128
no shutdown
!
interface Serial0/1/0
description R3 --> R4
ip address 172.16.34.3 255.255.255.248
clock rate 64000
bandwidth 64
no shutdown
!
end
```

Router R4

```
hostname R4
!
interface Lo4
description R4 LAN A
ip address 192.168.4.1 255.255.255.128
!
interface Lo5
description R4 LAN B
ip address 192.168.4.129 255.255.255.128
!
interface Serial0/0/0
description R4 --> R3
ip address 172.16.34.4 255.255.255.248
bandwidth 64
no shutdown
!
end
```

- c. Verify the configuration with the **show ip interface brief**, **show protocols**, and **show interfaces description** commands. The output from router R3 is shown here as an example.

```

R3# show ip interface brief | include up
Serial0/0/0          172.16.13.3      YES manual up      up
Serial0/0/1          172.16.23.3      YES manual up      up
Serial0/1/0          172.16.34.3      YES manual up      up
Loopback3            192.168.3.1      YES manual up      up
R3#
R3# show protocols
Global values:
  Internet Protocol routing is enabled
  Embedded-Service-Engine0/0 is administratively down, line protocol is down
  GigabitEthernet0/0 is administratively down, line protocol is down
  GigabitEthernet0/1 is administratively down, line protocol is down
  Serial0/0/0 is up, line protocol is up
    Internet address is 172.16.13.3/29
  Serial0/0/1 is up, line protocol is up
    Internet address is 172.16.23.3/29
  Serial0/1/0 is up, line protocol is up
    Internet address is 172.16.34.3/29
  Serial0/1/1 is administratively down, line protocol is down
  Loopback3 is up, line protocol is up
    Internet address is 192.168.3.1/24
R3#
R3# show interfaces description | include up
Se0/0/0              up                up                R3 --> R1
Se0/0/1              up                up                R3 --> R2
Se0/1/0              up                up                R3 --> R4
Lo3                  up                up                R3 LAN
R3#

```

Step 3: Configure basic EIGRP.

- Implement EIGRP AS 1 over the serial and loopback interfaces as you have configured it for the other EIGRP labs.
- Advertise networks 172.16.12.0/29, 172.16.13.0/29, 172.16.23.0/29, 172.16.34.0/29, 192.168.1.0/24, 192.168.2.0/24, 192.168.3.0/24, and 192.168.4.0/24 from their respective routers.

You can copy and paste the following configurations into your routers.

Router R1

```

router eigrp 1
 network 192.168.1.0
 network 172.16.12.0 0.0.0.7
 network 172.16.13.0 0.0.0.7
 no auto-summary

```

Router R2

```

router eigrp 1
 network 192.168.2.0
 network 172.16.12.0 0.0.0.7
 network 172.16.23.0 0.0.0.7
 no auto-summary

```

Router R3

```

router eigrp 1
 network 192.168.3.0
 network 172.16.13.0 0.0.0.7

```

```

network 172.16.23.0 0.0.0.7
network 172.16.34.0 0.0.0.7
no auto-summary

```

Router R4

```

router eigrp 1
network 192.168.4.0
network 172.16.34.0 0.0.0.7
no auto-summary

```

You should see EIGRP neighbor relationship messages being generated.

Step 4: Verify EIGRP connectivity.

- a. Verify the configuration by using the **show ip eigrp neighbors** command to check which routers have EIGRP adjacencies.

```
R1# show ip eigrp neighbors
```

```
EIGRP-IPv4 Neighbors for AS(1)
```

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
1	172.16.13.3	Se0/0/1	10	00:01:55	27	2340	0	9
0	172.16.12.2	Se0/0/0	13	00:02:07	8	1170	0	11

```
R1#
```

```
R2# show ip eigrp neighbors
```

```
EIGRP-IPv4 Neighbors for AS(1)
```

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
1	172.16.23.3	Se0/0/1	12	00:02:15	12	1170	0	10
0	172.16.12.1	Se0/0/0	11	00:02:27	9	1170	0	13

```
R2#
```

```
R3# show ip eigrp neighbors
```

```
EIGRP-IPv4 Neighbors for AS(1)
```

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
2	172.16.34.4	Se0/1/0	12	00:02:14	44	2340	0	3
1	172.16.23.2	Se0/0/1	11	00:02:23	10	1170	0	10
0	172.16.13.1	Se0/0/0	10	00:02:23	1031	5000	0	12

```
R3#
```

```
R4# show ip eigrp neighbors
```

```
EIGRP-IPv4 Neighbors for AS(1)
```

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
0	172.16.34.3	Se0/0/0	10	00:02:22	37	2340	0	11

```
R4#
```

Did you receive the output you expected?

The output should be similar to that shown above.

- b. Run the following Tcl script on all routers to verify full connectivity.

```
R1# tclsh
```

```
foreach address {
```

```

172.16.12.1
172.16.12.2
172.16.13.1
172.16.13.3
172.16.23.2
172.16.23.3
172.16.34.3
172.16.34.4
192.168.1.1
192.168.2.1
192.168.3.1
192.168.4.1
192.168.4.129
} { ping $address }

```

You should get ICMP echo replies for every address pinged. Make sure to run the Tcl script on each router.

Step 5: Verify the current path.

Before you configure PBR, verify the routing table on R1.

- On R1, use the **show ip route** command. Notice the next-hop IP address for all networks discovered by EIGRP.

```

R1# show ip route | begin Gateway
Gateway of last resort is not set

    172.16.0.0/16 is variably subnetted, 6 subnets, 2 masks
C       172.16.12.0/29 is directly connected, Serial0/0/0
L       172.16.12.1/32 is directly connected, Serial0/0/0
C       172.16.13.0/29 is directly connected, Serial0/0/1
L       172.16.13.1/32 is directly connected, Serial0/0/1
D       172.16.23.0/29 [90/21024000] via 172.16.12.2, 00:07:22, Serial0/0/0
D       172.16.34.0/29 [90/41024000] via 172.16.13.3, 00:07:22, Serial0/0/1
    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, Loopback1
L       192.168.1.1/32 is directly connected, Loopback1
D       192.168.2.0/24 [90/20640000] via 172.16.12.2, 00:07:22, Serial0/0/0
D       192.168.3.0/24 [90/21152000] via 172.16.12.2, 00:07:22, Serial0/0/0
    192.168.4.0/25 is subnetted, 2 subnets
D       192.168.4.0 [90/41152000] via 172.16.13.3, 00:07:14, Serial0/0/1
D       192.168.4.128 [90/41152000] via 172.16.13.3, 00:07:14, Serial0/0/1
R1#

```

- On R4, use the **traceroute** command to the R1 LAN address and source the ICMP packet from R4 LAN A and LAN B.

Note: You can specify the source as the interface address (for example 192.168.4.1) or the interface designator (for example, Fa0/0).

```

R4# traceroute 192.168.1.1 source 192.168.4.1
Type escape sequence to abort.
Tracing the route to 192.168.1.1
VRF info: (vrf in name/id, vrf out name/id)
 1 172.16.34.3 12 msec 12 msec 16 msec
 2 172.16.23.2 20 msec 20 msec 20 msec
 3 172.16.12.1 24 msec * 24 msec
R4#
R4# traceroute 192.168.1.1 source 192.168.4.129

```

```
Type escape sequence to abort.
Tracing the route to 192.168.1.1
VRF info: (vrf in name/id, vrf out name/id)
  1 172.16.34.3 12 msec 16 msec 12 msec
  2 172.16.23.2 28 msec 20 msec 16 msec
  3 172.16.12.1 24 msec * 24 msec
R4#
```

Notice that the path taken for the packets sourced from the R4 LANs are going through R3 --> R2 --> R1.
Why are the R4 interfaces not using the R3 --> R1 path?

Because the serial interfaces between routers R1 and R3 have been configured with a lower bandwidth of 64 Kb/s, giving it a higher metric. All other serial interfaces are using the bandwidth setting of 128 Kb/s. R3 chooses to send all packets to R2 because of its lower metric.

- c. On R3, use the **show ip route** command and note that the preferred route from R3 to R1 LAN 192.168.1.0/24 is via R2 using the R3 exit interface S0/0/1.

```
R3# show ip route | begin Gateway
Gateway of last resort is not set

    172.16.0.0/16 is variably subnetted, 7 subnets, 2 masks
D       172.16.12.0/29 [90/21024000] via 172.16.23.2, 00:10:54, Serial0/0/1
C       172.16.13.0/29 is directly connected, Serial0/0/0
L       172.16.13.3/32 is directly connected, Serial0/0/0
C       172.16.23.0/29 is directly connected, Serial0/0/1
L       172.16.23.3/32 is directly connected, Serial0/0/1
C       172.16.34.0/29 is directly connected, Serial0/1/0
L       172.16.34.3/32 is directly connected, Serial0/1/0
D       192.168.1.0/24 [90/21152000] via 172.16.23.2, 00:10:54, Serial0/0/1
D       192.168.2.0/24 [90/20640000] via 172.16.23.2, 00:10:54, Serial0/0/1
    192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, Loopback3
L       192.168.3.1/32 is directly connected, Loopback3
    192.168.4.0/25 is subnetted, 2 subnets
D       192.168.4.0 [90/40640000] via 172.16.34.4, 00:10:47, Serial0/1/0
D       192.168.4.128 [90/40640000] via 172.16.34.4, 00:10:47, Serial0/1/0
R3#
```

- d. On R3, use the **show interfaces serial 0/0/0** and **show interfaces s0/0/1** commands.

```
R3# show interfaces serial0/0/0
Serial0/0/0 is up, line protocol is up
  Hardware is WIC MBRD Serial
  Description: R3 --> R1
  Internet address is 172.16.13.3/29
  MTU 1500 bytes, BW 64 Kbit/sec, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:01, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
```

```

Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
 399 packets input, 29561 bytes, 0 no buffer
Received 186 broadcasts (0 IP multicasts)
 0 runts, 0 giants, 0 throttles
 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
393 packets output, 29567 bytes, 0 underruns
 0 output errors, 0 collisions, 3 interface resets
 0 unknown protocol drops
 0 output buffer failures, 0 output buffers swapped out
 0 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up

```

```

R3# show interfaces serial0/0/0 | include BW
  MTU 1500 bytes, BW 64 Kbit/sec, DLY 20000 usec,
R3# show interfaces serial0/0/1 | include BW
  MTU 1500 bytes, BW 128 Kbit/sec, DLY 20000 usec,
R3#

```

Notice that the bandwidth of the serial link between R3 and R1 (S0/0/0) is set to 64 Kb/s, while the bandwidth of the serial link between R3 and R2 (S0/0/1) is set to 128 Kb/s.

- e. Confirm that R3 has a valid route to reach R1 from its serial 0/0/0 interface using the **show ip eigrp topology 192.168.1.0** command.

```

R3# show ip eigrp topology 192.168.1.0
EIGRP-IPv4 Topology Entry for AS(1)/ID(192.168.3.1) for 192.168.1.0/24
  State is Passive, Query origin flag is 1, 1 Successor(s), FD is 21152000
  Descriptor Blocks:
  172.16.23.2 (Serial0/0/1), from 172.16.23.2, Send flag is 0x0
    Composite metric is (21152000/20640000), route is Internal
    Vector metric:
      Minimum bandwidth is 128 Kbit
      Total delay is 45000 microseconds
      Reliability is 255/255
      Load is 1/255
      Minimum MTU is 1500
      Hop count is 2
      Originating router is 192.168.1.1
  172.16.13.1 (Serial0/0/0), from 172.16.13.1, Send flag is 0x0
    Composite metric is (40640000/128256), route is Internal
    Vector metric:
      Minimum bandwidth is 64 Kbit
      Total delay is 25000 microseconds
      Reliability is 255/255
      Load is 1/255
      Minimum MTU is 1500
      Hop count is 1
      Originating router is 192.168.1.1
R3#

```

As indicated, R4 has two routes to reach 192.168.1.0. However, the metric for the route to R1 (172.16.13.1) is much higher (40640000) than the metric of the route to R2 (21152000), making the route through R2 the successor route.

Step 6: Configure PBR to provide path control.

Now you will deploy source-based IP routing by using PBR. You will change a default IP routing decision based on the EIGRP-acquired routing information for selected IP source-to-destination flows and apply a different next-hop router.

Recall that routers normally forward packets to destination addresses based on information in their routing table. By using PBR, you can implement policies that selectively cause packets to take different paths based on source address, protocol type, or application type. Therefore, PBR overrides the router's normal routing behavior.

Configuring PBR involves configuring a route map with **match** and **set** commands and then applying the route map to the interface.

The steps required to implement path control include the following:

- Choose the path control tool to use. Path control tools manipulate or bypass the IP routing table. For PBR, **route-map** commands are used.
- Implement the traffic-matching configuration, specifying which traffic will be manipulated. The **match** commands are used within route maps.
- Define the action for the matched traffic using **set** commands within route maps.
- Apply the route map to incoming traffic.

As a test, you will configure the following policy on router R3:

- All traffic sourced from R4 LAN A must take the R3 --> R2 --> R1 path.
 - All traffic sourced from R4 LAN B must take the R3 --> R1 path.
- a. On router R3, create a standard access list called **PBR-ACL** to identify the R4 LAN B network.

```
R3(config)# ip access-list standard PBR-ACL
R3(config-std-nacl)# remark ACL matches R4 LAN B traffic
R3(config-std-nacl)# permit 192.168.4.128 0.0.0.127
R3(config-std-nacl)# exit
R3(config)#
```

- b. Create a route map called **R3-to-R1** that matches PBR-ACL and sets the next-hop interface to the R1 serial 0/0/1 interface.

```
R3(config)# route-map R3-to-R1 permit
R3(config-route-map)# description RM to forward LAN B traffic to R1
R3(config-route-map)# match ip address PBR-ACL
R3(config-route-map)# set ip next-hop 172.16.13.1
R3(config-route-map)# exit
R3(config)#
```

- c. Apply the R3-to-R1 route map to the serial interface on R3 that receives the traffic from R4. Use the **ip policy route-map** command on interface S0/1/0.

```
R3(config)# interface s0/1/0
R3(config-if)# ip policy route-map R3-to-R1
R3(config-if)# end
R3#
```

- d. On R3, display the policy and matches using the **show route-map** command.

```
R3# show route-map
route-map R3-to-R1, permit, sequence 10
```

```

Match clauses:
  ip address (access-lists): PBR-ACL
Set clauses:
  ip next-hop 172.16.13.1
Policy routing matches: 0 packets, 0 bytes
R3#

```

Note: There are currently no matches because no packets matching the ACL have passed through R3 S0/1/0.

Step 7: Test the policy.

Now you are ready to test the policy configured on R3. Enable the **debug ip policy** command on R3 so that you can observe the policy decision-making in action. To help filter the traffic, first create a standard ACL that identifies all traffic from the R4 LANs.

- On R3, create a standard ACL which identifies all of the R4 LANs.

```

R3# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)# access-list 1 permit 192.168.4.0 0.0.0.255
R3(config)# exit

```

- Enable PBR debugging only for traffic that matches the R4 LANs.

```

R3# debug ip policy ?
<1-199>  Access list
dynamic  dynamic PBR
<cr>

```

```

R3# debug ip policy 1
Policy routing debugging is on for access list 1

```

- Test the policy from R4 with the **traceroute** command, using R4 LAN A as the source network.

```

R4# traceroute 192.168.1.1 source 192.168.4.1

```

Type escape sequence to abort.
Tracing the route to 192.168.1.1

```

 1 172.16.34.3 0 msec 0 msec 4 msec
 2 172.16.23.2 0 msec 0 msec 4 msec
 3 172.16.12.1 4 msec 0 msec *

```

Notice the path taken for the packet sourced from R4 LAN A is still going through R3 --> R2 --> R1.

As the traceroute was being executed, router R3 should be generating the following debug output.

```

R3#
Jan 10 10:49:48.411: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
policy rejected -- normal forwarding
Jan 10 10:49:48.427: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
policy rejected -- normal forwarding
Jan 10 10:49:48.439: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
policy rejected -- normal forwarding
Jan 10 10:49:48.451: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
FIB policy rejected(no match) - normal forwarding
Jan 10 10:49:48.471: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
FIB policy rejected(no match) - normal forwarding
Jan 10 10:49:48.491: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
FIB policy rejected(no match) - normal forwarding

```

```

Jan 10 10:49:48.511: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
FIB policy rejected(no match) - normal forwarding
Jan 10 10:49:48.539: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
FIB policy rejected(no match) - normal forwarding
Jan 10 10:49:51.539: IP: s=192.168.4.1 (Serial0/1/0), d=192.168.1.1, len 28,
FIB policy rejected(no match) - normal forwarding
R3#

```

Why is the traceroute traffic not using the R3 --> R1 path as specified in the R3-to-R1 policy?

It does not take the PBR-specified path because LAN A does not meet the criteria specified in the PBR-ACL access list.

- d. Test the policy from R4 with the **traceroute** command, using R4 LAN B as the source network.

```
R4# traceroute 192.168.1.1 source 192.168.4.129
```

```

Type escape sequence to abort.
Tracing the route to 192.168.1.1

```

```

 1 172.16.34.3 12 msec 12 msec 16 msec
 2 172.16.13.1 28 msec 28 msec *

```

Now the path taken for the packet sourced from R4 LAN B is R3 --> R1, as expected.

The debug output on R3 also confirms that the traffic meets the criteria of the R3-to-R1 policy.

```

R3#
R3#
Jan 10 10:50:04.283: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, policy match
Jan 10 10:50:04.283: IP: route map R3-to-R1, item 10, permit
Jan 10 10:50:04.283: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1
(Serial0/0/0), len 28, policy routed
Jan 10 10:50:04.283: IP: Serial0/1/0 to Serial0/0/0 172.16.13.1
Jan 10 10:50:04.295: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, policy match
Jan 10 10:50:04.295: IP: route map R3-to-R1, item 10, permit
Jan 10 10:50:04.295: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1
(Serial0/0/0), len 28, policy routed
Jan 10 10:50:04.295: IP: Serial0/1/0 to Serial0/0/0 172.16.13.1
Jan 10 10:50:04.311: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, policy match
Jan 10 10:50:04.311: IP: route map R3-to-R1, item 10, permit
Jan 10 10:50:04.311: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1
(Serial0/0/0), len 28, policy routed
Jan 10 10:50:04.311: IP: Serial0/1/0 to Serial0/0/0 172.16.13.1
Jan 10 10:50:04.323: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, FIB policy match
Jan 10 10:50:04.323: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, PBR Counted
Jan 10 10:50:04.323: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1,
g=172.16.13.1, len 28, FIB policy routed
Jan 10 10:50:04.351: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, FIB policy match

```

```
Jan 10 10:50:04.351: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, PBR Counted
Jan 10 10:50:04.351: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1,
g=172.16.13.1, len 28, FIB policy routed
Jan 10 10:50:07.347: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, FIB policy match
Jan 10 10:50:07.347: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1, len
28, PBR Counted
Jan 10 10:50:07.347: IP: s=192.168.4.129 (Serial0/1/0), d=192.168.1.1,
g=172.16.13.1, len 28, FIB policy routed
R3#
```

- e. On R3, display the policy and matches using the **show route-map** command.

```
R3# show route-map
route-map R3-to-R1, permit, sequence 10
  Match clauses:
    ip address (access-lists): PBR-ACL
  Set clauses:
    ip next-hop 172.16.13.1
Nexthop tracking current: 0.0.0.0
172.16.13.1, fib_nh:0,oce:0,status:0

  Policy routing matches: 12 packets, 384 bytes
R3#
```

Note: There are now matches to the policy because packets matching the ACL have passed through R3 S0/1/0.

Device Configurations (Instructor version)**Router R1**

```
hostname R1
!
interface Lo1
  description R1 LAN
  ip address 192.168.1.1 255.255.255.0
!
interface Serial0/0/0
  description R1 --> R2
  ip address 172.16.12.1 255.255.255.248
  clock rate 128000
  bandwidth 128
  no shutdown
!
interface Serial0/0/1
  description R1 --> R3
  ip address 172.16.13.1 255.255.255.248
  bandwidth 64
  no shutdown
!
router eigrp 1
  network 192.168.1.0
  network 172.16.12.0 0.0.0.7
  network 172.16.13.0 0.0.0.7
  no auto-summary
!
end
```

Router R2

```
hostname R2
!
interface Lo2
  description R2 LAN
  ip address 192.168.2.1 255.255.255.0
!
interface Serial0/0/0
  description R2 --> R1
  ip address 172.16.12.2 255.255.255.248
  bandwidth 128
  no shutdown

interface Serial0/0/1
  description R2 --> R3
  ip address 172.16.23.2 255.255.255.248
  clock rate 128000
  bandwidth 128
  no shutdown
!
router eigrp 1
  network 192.168.2.0
  network 172.16.12.0 0.0.0.7
  network 172.16.23.0 0.0.0.7
  no auto-summary
end
```

Router R3

```
hostname R3
!
interface Lo3
  description R3 LAN
  ip address 192.168.3.1 255.255.255.0
!
interface Serial0/0/0
  description R3 --> R1
  ip address 172.16.13.3 255.255.255.248
  clock rate 64000
  bandwidth 64
  no shutdown
!
interface Serial0/0/1
  description R3 --> R2
  ip address 172.16.23.3 255.255.255.248
  bandwidth 128
  no shutdown
!
interface Serial0/1/0
  description R3 --> R4
  ip address 172.16.34.3 255.255.255.248
  ip policy route-map R3-to-R1
  clock rate 64000
  bandwidth 64
  no shutdown
!
router eigrp 1
  network 192.168.3.0
  network 172.16.13.0 0.0.0.7
  network 172.16.23.0 0.0.0.7
  network 172.16.34.0 0.0.0.7
  no auto-summary
!
ip access-list standard PBR-ACL
  remark ACL matches R4 LAN B traffic
  permit 192.168.4.128 0.0.0.127
!
access-list 1 permit 192.168.4.0 0.0.0.255
!
route-map R3-to-R1 permit 10
  description RM to forward LAN B traffic to R1
  match ip address PBR-ACL
  set ip next-hop 172.16.13.1
!
end
```

Router R4

```
hostname R4
!
interface Lo4
  description R4 LAN A
  ip address 192.168.4.1 255.255.255.128
!
interface Lo5
  description R4 LAN B
  ip address 192.168.4.129 255.255.255.128
!
interface Serial0/0/0
  description R4 --> R3
  ip address 172.16.34.4 255.255.255.248
  bandwidth 64
  no shutdown
!
router eigrp 1
  network 192.168.4.0
  network 172.16.34.0 0.0.0.7
  no auto-summary
!
end
```