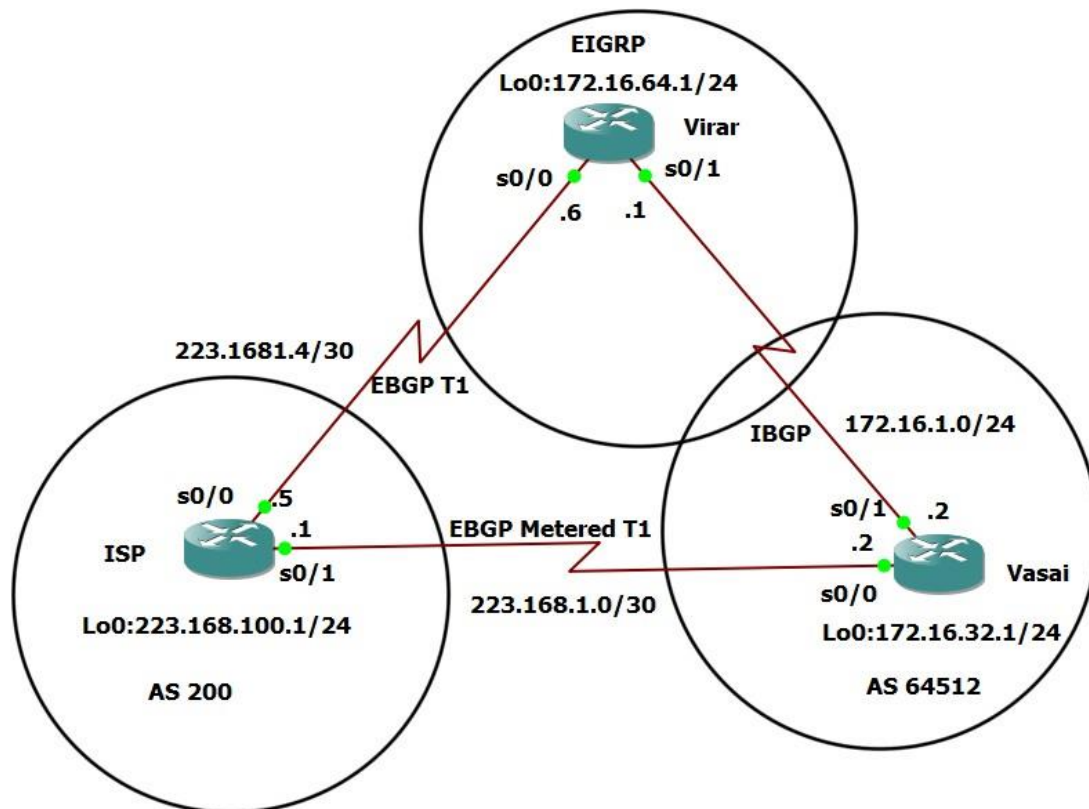


Practical No – 3

Aim: Configure IBGP and EBGp Sessions, Local Preference, and MED.

Topology:



Objectives:

- For IBGP peers to correctly exchange routing information, use the **next-hop-self** command the local Preference and MED attributes.
- Ensure that the flat-rate, unlimited-use T1 link is used for sending and receiving data to and from the AS 200 on ISP and that the metered T1 only be used in the event that primary T1 link has failed.

Step 1: Configure interface addresses.

Router R1(hostname ISP)

```
ISP (config)# interface Loopback 0
```

```
ISP (config-if) #ip address 223.168.100.1 255.255.255.0
```

```
ISP (config-if) #exit
ISP (config) #interface Serial 0/0/0
ISP (config-if) #ip address 223.168.1.5 255.255.255.252
ISP (config-if) #exit
ISP (config) #interface Serial 0/0/1
ISP (config-if) #ip address 223.168.1.1 255.255.255.252
ISP (config-if) #no shutdown
ISP (config-if) #end
```

```
ISP#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ISP(config)#interface Loopback 0
ISP(config-if)#ip addr
*Mar 1 00:01:29.551: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0,
changed state to up
ISP(config-if)#ip address 223.168.100.1 255.255.255.0
ISP(config-if)#exit
ISP(config)#
ISP(config)#int s0/0
ISP(config-if)#ip address 223.168.1.5 255.255.255.252
ISP(config-if)#no shutdown
ISP(config-if)#exit
ISP(config)#
ISP(config)#
*Mar 1 00:02:40.175: %LINK-3-UPDOWN: Interface Serial0/0, changed state to up
ISP(config)#
*Mar 1 00:02:41.179: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
changed state to up
ISP(config)#int s0/1
ISP(config-if)#ip address 223.168.1.1
*Mar 1 00:03:03.143: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
changed state to down
ISP(config-if)#ip address 223.168.1.1 255.255.255.252
ISP(config-if)#no shutdown
```

Router R2(hostname Virar)

```
Virar(config) #interface Loopback 0
Virar(config-if) #ip address 172.16.64.1 255.255.255.0
Virar(config) #exit
Virar(config) #interface Serial 0/0/0
Virar(config-if) #ip address 223.168.1.6 255.255.255.252
Virar(config-if) #no shutdown
Virar(config-if) #exit
```

Virar(config) interface Serial 0/0/1

Virar(config-if) #ip address 172.16.1.1 255.255.255.0

Virar(config-if) #no shutdown

Virar(config-if) #end

```
Virar#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Virar(config)#interface Loopback 0
Virar(config-if)#
*Mar  1 00:03:08.551: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0,
  changed state to up
Virar(config-if)#ip address 172.16.64.1 255.255.255.0
Virar(config-if)#exit
Virar(config)#
Virar(config)#int s0/0
Virar(config-if)#ip address 223.168.1.6 255.255.255.252
Virar(config-if)#no shutdown
Virar(config-if)#exit
*Mar  1 00:04:55.299: %LINK-3-UPDOWN: Interface Serial0/0, changed state to up
Virar(config-if)#exit
Virar(config)#
Virar(config)#
*Mar  1 00:04:56.303: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
  changed state to up
Virar(config)#int s0/1
Virar(config-if)#ip address 172.16.1.1 255.255.255.0
Virar(config-if)#no shutdown
```

Router R3(hostname Vasai)

Vasai(config) #interface Loopback 0

Vasai(config-if) #ip address 172.16.32.1 255.255.255.0

Vasai(config-if) #exit

Vasai(config) #interface Serial 0/0/0

Vasai(config-if) #ip address 223.168.1.2 255.255.255.252

Vasai(config-if) #no shutdown

Vasai(config-if) #exit

Vasai(config) #interface Serial 0/0/1

Vasai(config-if) #ip address 172.16.1.2 255.255.255.0

Vasai(config-if) #no shutdown

Vasai(config-if) #end

```
Vasai#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Vasai(config)#interface Loopback 0
Vasai(config-if)#
Vasai(config-if)#
*Mar  1 00:05:19.075: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0,
  changed state to up
Vasai(config-if)#ip address 172.16.32.1 255.255.255.0
Vasai(config-if)#exit
Vasai(config)#
Vasai(config)#int s0/0
Vasai(config-if)#ip address 223.168.1.2 255.255.255.252
Vasai(config-if)#no shutdown
Vasai(config-if)#exit
Vasai(config)#
*Mar  1 00:06:34.007: %LINK-3-UPDOWN: Interface Serial0/0, changed state to up
Vasai(config)#
*Mar  1 00:06:35.011: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
  changed state to up
Vasai(config)#int s0/1
Vasai(config-if)#ip address 172.16.1.2 255.255.255.0
Vasai(config-if)#no shutdown
```

Step 2: Configure EIGRP.

Configure EIGRP between the Virar and Vasai routers. (Note: if using an IOS prior to 15.0, use the no auto-summary router configuration command to disable automatic summary this command is the default beginning with IOS 15)

```
Virar(config) #router eigrp 1
```

```
Virar(config-router) #network 172.16.0.0
```

```
Virar(config) #
Virar(config) #router eigrp 1
Virar(config-router) #network 172.16.0.0
Virar(config-router) #
```

```
Vasai(config) #router eigrp 1
```

```
Vasai(config-router) #network 172.16.0.0
```

```
Vasai(config) #
Vasai(config) #router eigrp 1
Vasai(config-router) #network 172.16.0.0
Vasai(config-router) #
```

Step 3: Configure IBGP and Verify BGP neighbors.

- Configure IBGP between the Virar and Vasai routers. On the Virar router, enter the following configuration.

```
Virar(config) #router bgp 64512
```

```
Virar(config-router) #neighbor 172.16.32.1 remote-as 64512
```

Virar(config-router) #neighbor 172.16.32.1 update-source Lo0

```
Virar(config)#
Virar(config)#router bgp 64512
Virar(config-router)#neighbor 172.16.32.1 remote-as 64512
Virar(config-router)#neighbor 172.16.32.1 update-source lo0
Virar(config-router)#
```

If multiple pathways to the BGP neighbor exist, the router can use multiple IP interfaces to communicate with the neighbor. The source IP address therefore depends on the outgoing interface. The update-source Lo0 command instructs the router to use the IP address of the interface Loopback 0 as the source IP address for all BGP messages sent to that neighbor.

- b. Complete the IBGP configuration on Vasai using the Following commands.

Vasai(config) #router bgp 64512

Vasai(config-router) # neighbor 172.16.64.1 remote-as 64512

Vasai(config-router) #neighbor 172.16.64.1 update-source Lo0

```
Vasai(config)#router bgp 64512
Vasai(config-router)#neighbor 172.16.64.1 remote-as 64512
Vasai(config-router)#neighbor
*Mar  1 00:19:55.075: %BGP-5-ADJCHANGE: neighbor 172.16.64.1 Up
Vasai(config-router)#neighbor 172.16.64.1 update-source lo0
Vasai(config-router)#
```

- c. Verify that Virar and Vasai become BGP neighbors by issuing the show ip bgp neighbors command on Virar. View the following partial output. If the BGP state is not established, troubleshoot the connection.

```
Vasai#show ip bgp neighbors
BGP neighbor is 172.16.64.1, remote AS 64512, internal link
  BGP version 4, remote router ID 172.16.64.1
  BGP state = Established, up for 00:03:37
  Last read 00:00:36, last write 00:00:36, hold time is 180, keepalive interval
  is 60 seconds
  Neighbor capabilities:
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    OutQ depth is 0

      Sent      Rcvd
  Opens:          1         1
  Notifications:  0         0
  Updates:        0         0
  Keepalives:     5         5
  Route Refresh:  0         0
  Total:          6         6
```

Step 4: Configure EBGp and Verify BGP neighbors.

- d. Configure ISP to run EBGp with Virar and Vasai. Enter the following commands on ISP.

ISP (config) #router bgp 200

ISP (config-router) #neighbor 223.168.1.6 remote-as 64512

ISP (config-router) #neighbor 223.168.1.2 remote-as 64512

ISP (config-router) #network 223.168.100.0

```
ISP(config)#
ISP(config)#router bgp 200
ISP(config-router)#neighbor 223.168.1.6 remote-as 64512
ISP(config-router)#neighbor 223.168.1.2 remote-as 64512
ISP(config-router)#network 223.168.100.0
ISP(config-router)#
```

- e. Configure a discard static route for the 172.16.0.0/16 network. Any packets that do not have a more specific match (longer match) for a 172.16.0.0 subnet will be dropped instead of sent to the ISP. Later in this lab we will configure a default route to the ISP.

Virar(config) #ip route 172.16.0.0 255.255.0.0 null0

```
Virar(config)#
Virar(config)#ip route 172.16.0.0 255.255.0.0 null0
Virar(config)#
```

- f. Configure Virar as an EBGp peer to ISP

Virar(config) #router bgp 64512

Virar(config-router) #neighbor 223.168.1.5 remote-as 200

Virar(config-router) #network 172.16.0.0

```
Virar(config)#router bgp 64512
Virar(config-router)#neighbor 223.168.1.5 remote-as 200
Virar(config-router)#network 172.16.0.0
*Mar 1 00:39:55.947: %BGP-5-ADJCHANGE: neighbor 223.168.1.5 Up
Virar(config-router)#network 172.16.0.0
Virar(config-router)#exit
```

- g. Use the show ip bgp neighbors command to verify that Virar and ISP have reached the established state. Troubleshoot if necessary.

Virar# show ip bgp neighbors

```
Virar#show ip bgp neighbors
BGP neighbor is 172.16.32.1, remote AS 64512, internal link
  BGP version 4, remote router ID 172.16.32.1
  BGP state = Established, up for 00:21:28
  Last read 00:00:27, last write 00:00:27, hold time is 180, keepalive interval
  is 60 seconds
  Neighbor capabilities:
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    OutQ depth is 0

      Sent      Rcvd
Opens:          1         1
Notifications:  0         0
Updates:        2         0
Keepalives:    23        23
Route Refresh:  0         0
Total:         26        24
```

Configure a discard static route for 172.16.0.0/16 on Vasai and an EBGp peer to ISP.

```
Vasai(config) #ip route 172.16.0.0 255.255.0.0 null0
Vasai(config) #router bgp 64512
Vasai(config-router) #neighbor 223.168.1.1 remote-as 200
Vasai(config-router) #network 172.16.0.0
```

```
Vasai#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Vasai(config)#ip route 172.16.0.0 255.255.0.0 null0
Vasai(config)#router bgp 64512
Vasai(config-router)#neighbor 223.168.1.1 remote-as 200
Vasai(config-router)#network
*Mar  1 00:47:00.451: %BGP-5-ADJCHANGE: neighbor 223.168.1.1 Up
Vasai(config-router)#network 172.16.0.0
```

Step 5: View BGP summary output.

In Step 4, the show ip bgp neighbors command was used to verify that Virar and ISP had reached the established state. A useful alternative command is show ip bgp summary. The output should be similar to the following.

Vasai# show ip bgp summary

```
Vasai#show ip bgp summary
BGP router identifier 172.16.32.1, local AS number 64512
BGP table version is 5, main routing table version 5
2 network entries using 240 bytes of memory
4 path entries using 208 bytes of memory
5/2 BGP path/bestpath attribute entries using 620 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 2 (at peak 3) using 64 bytes of memory
BGP using 1156 total bytes of memory
BGP activity 2/0 prefixes, 4/0 paths, scan interval 60 secs

Neighbor      V    AS MsgRcvd MsgSent   TblVer  InQ  OutQ  Up/Down  State/PfxRcd
172.16.64.1    4  64512    34     34       5    0    0 00:29:29        2
223.168.1.1    4   200     8      8       5    0    0 00:02:24        1
Vasai#
```

Step 6: Verify which path the traffic takes.

- f. Clear the IP BGP conversation with the clear ip bgp * command on ISP. Wait for the conversation to re-establish with each Virar router.

ISP# clear ip bgp *

```
ISP#clear ip bgp *
ISP#
*Mar  1 00:53:35.899: %BGP-5-ADJCHANGE: neighbor 223.168.1.2 Down User reset
*Mar  1 00:53:35.903: %BGP-5-ADJCHANGE: neighbor 223.168.1.6 Down User reset
*Mar  1 00:53:36.435: %BGP-5-ADJCHANGE: neighbor 223.168.1.6 Up
*Mar  1 00:53:36.791: %BGP-5-ADJCHANGE: neighbor 223.168.1.2 Up
ISP#
```

- g. Test whether ISP can ping the Loopback 0 address of 172.16.64.1 on Virar and the serial link between Virar and Vasai, 172.16.1.1

ISP# ping 172.16.64.1

```
ISP#
ISP#ping 172.16.64.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.64.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
```

ISP# ping 172.16.1.1

```
ISP#
ISP#ping 172.16.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
```


- h. Now ping from ISP to the Loopback 0 address of 172.16.32.1 on Vasai and the Serial link between Virar and Vasai, 172.16.1.2.

ISP# ping 172.16.32.1

```
ISP#ping 172.16.32.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.32.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/8 ms
ISP#
```

ISP# ping 172.16.1.2

```
ISP#ping 172.16.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/16 ms
ISP#
```

- I. Issue the show ip bgp command on ISP to verify BGP routes and metrics.

ISP# show ip bgp

```
ISP#show ip bgp
BGP table version is 11, local router ID is 223.168.100.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
* 172.16.0.0        223.168.1.2            0           0 64512 i
*>                 223.168.1.6            0           0 64512 i
*> 223.168.100.0    0.0.0.0                0          32768 i
```

- i. At this point, the ISP router should be able to get to each network connected to Virar and Vasai from the Loopback address 223.168.100.1. Use the extended ping command and specify the source address of ISP Lo0 to test.

ISP# ping 172.16.1.1 source 223.168.100.1

```
ISP#ping 172.16.1.1 source 223.168.100.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
Packet sent with a source address of 223.168.100.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/6/16 ms
ISP#
```

ISP# ping 172.16.32.1 source 223.168.100.1

```
ISP#ping 172.16.32.1 source 223.168.100.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.32.1, timeout is 2 seconds:
Packet sent with a source address of 223.168.100.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/12 ms
ISP#
```

ISP# ping 172.16.1.2 source 223.168.100.1

```
ISP#ping 172.16.1.2 source 223.168.100.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
Packet sent with a source address of 223.168.100.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
ISP#
```

ISP# ping 172.16.64.1 source 223.168.100.1

```
ISP#ping 172.16.64.1 source 223.168.100.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.64.1, timeout is 2 seconds:
Packet sent with a source address of 223.168.100.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/12 ms
ISP#
```

Step 7: Configure the BGP next-hop-self feature.

- j. Issue the following commands on the ISP router.

ISP (config) # router bgp 200

ISP (config-router) # network 223.168.1.0 mask 255.255.255.252

ISP (config-router) # network 223.168.1.4 mask 255.255.255.252

```
ISP#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ISP(config)#router bgp 200
ISP(config-router)#network 223.168.1.0 mask 255.255.255.252
ISP(config-router)#network 223.168.1.4 mask 255.255.255.252
ISP(config-router)#exit
```

- k. Issue the show ip bgp command to verify that ISP is Correctly injecting its own WAN links into BGP.

ISP# show ip bgp

```
ISP#show ip bgp
BGP table version is 5, local router ID is 223.168.100.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 172.16.0.0        223.168.1.2              0           0 64512 i
*                   223.168.1.6              0           0 64512 i
*> 223.168.1.0/30    0.0.0.0                  0          32768 i
*> 223.168.1.4/30    0.0.0.0                  0          32768 i
*> 223.168.100.0     0.0.0.0                  0          32768 i
```

- l. Verify on Virar and Vasai that opposite WAN link is included in the routing table. The output from Vasai is as follows.

Vasai# show ip route

```
Vasai#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, 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

   172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       172.16.32.0/24 is directly connected, Loopback0
S       172.16.0.0/16 is directly connected, Null0
C       172.16.1.0/24 is directly connected, Serial0/1
D       172.16.64.0/24 [90/2297856] via 172.16.1.1, 01:24:13, Serial0/1
```

- m. To better understand the **next-hop-self** command we will remove ISP advertising its two WAN links and shutdown the WAN link between ISP and Vasai. The only possible path from to ISP's 223.168.100.0/24 through Virar.

ISP (config) **#router bgp 200**

ISP (config-router) **#no network 223.168.1.0 mask 255.255.255.252**

ISP (config-router) **#no network 223.168.1.4 mask 255.255.255.252**

ISP (config-router) **#exit**

ISP (config) **#interface serial 0/0/1**

ISP (config-if) **#shutdown**

```
ISP#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ISP(config)#router bgp 200
ISP(config-router)#no network 223.168.1.0 mask 255.255.255.252
ISP(config-router)#no network 223.168.1.4 mask 255.255.255.252
ISP(config-router)#exit
ISP(config)#int s0/1
ISP(config-if)#shutdown
ISP(config-if)#
*Mar 1 01:34:41.871: %BGP-5-ADJCHANGE: neighbor 223.168.1.2 Down Interface flap
ISP(config-if)#
*Mar 1 01:34:43.863: %LINK-5-CHANGED: Interface Serial0/1, changed state to administratively down
*Mar 1 01:34:44.863: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1, changed state to down
```

- n. Display Vasai BGP table using the **show ip bgp** command and the IPv4 routing table with **show ip route**.

Vasai# show ip bgp

```
Vasai#show ip bgp
BGP table version is 15, local router ID is 172.16.32.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 172.16.0.0        0.0.0.0              0           32768 i
* i                  172.16.64.1          0           100    0 i
* i223.168.100.0     223.168.1.5          0           100    0 200 i
```

Vasai# show ip route

```
Vasai#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, 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

B    223.168.100.0/24 [20/0] via 223.168.1.1, 00:34:46
     223.168.1.0/30 is subnetted, 2 subnets
B    223.168.1.4 [20/0] via 223.168.1.1, 00:04:58
C    223.168.1.0 is directly connected, Serial0/0
     172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C    172.16.32.0/24 is directly connected, Loopback0
S    172.16.0.0/16 is directly connected, Null0
C    172.16.1.0/24 is directly connected, Serial0/1
D    172.16.64.0/24 [90/2297856] via 172.16.1.1, 01:14:18, Serial0/1
```

Virar(config) #router bgp 64512

Virar(config-router) #neighbor 172.16.32.1 next-hop-self

```
Virar#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Virar(config)#router bgp 64512
Virar(config-router)#neighbor 172.16.32.1 next-hop-self
Virar(config-router)#exit
```

Vasai(config) # router bgp 64512

Vasai(config-router) #neighbor 172.16.64.1 next-hop-self

```
Vasai#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Vasai(config)#router bgp 64512
Vasai(config-router)#
Vasai(config-router)#neighbor 172.16.64.1 next-hop-self
Vasai(config-router)#
```

- o. Reset BGP operation on either router with the **clear ip bgp *** command.

Virar# clear ip bgp *

```
Virar#clear ip bgp *
Virar#
*Mar 1 01:56:41.131: %BGP-5-ADJCHANGE: neighbor 172.16.32.1 Down User reset
*Mar 1 01:56:41.131: %BGP-5-ADJCHANGE: neighbor 223.168.1.5 Down User reset
*Mar 1 01:56:41.199: %BGP-5-ADJCHANGE: neighbor 172.16.32.1 Up
*Mar 1 01:56:42.023: %BGP-5-ADJCHANGE: neighbor 223.168.1.5 Up
Virar#
```

Vasai# clear ip bgp *

```
Vasai#clear ip bgp *
Vasai#
*Mar 1 01:54:37.299: %BGP-5-ADJCHANGE: neighbor 172.16.64.1 Down User reset
*Mar 1 01:54:37.835: %BGP-5-ADJCHANGE: neighbor 172.16.64.1 Up
Vasai#
```

- p. After the routers have returned to established BGP Speakers, issues the **show ip bgp** command on Vasai and notice that the next hop is now Virar instead of ISP.

```

Vasai#show ip bgp
BGP table version is 15, local router ID is 172.16.32.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop           Metric LocPrf Weight Path
*> 172.16.0.0      0.0.0.0              0         32768 i
* i               172.16.64.1          0         100      0 i
* i223.168.100.0  223.168.1.5          0         100      0 200 i

```

- q. The **show ip route** command on Vasai now displays the 223.168.100.0/24 network because Virar is the next hop, 172.16.64.1, which is reachable from Vasai.

Vasai# **show ip route**

```

Vasai#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, 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

B    223.168.100.0/24 [200/0] via 172.16.64.1, 00:03:40
     172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C     172.16.32.0/24 is directly connected, Loopback0
S     172.16.0.0/16 is directly connected, Null0
C     172.16.1.0/24 is directly connected, Serial0/1
D     172.16.64.0/24 [90/2297856] via 172.16.1.1, 01:46:56, Serial0/1

```

- r. Before configuring the next BGP attribute, restore the WAN link between ISP and Vasai. This will change the BGP table and routing table on both routers. For example, Vasai routing table shows 223.168.100.0/24 will now have a better path through ISP.

ISP (config)# interface serial 0/0/1

ISP (config-if) #no shutdown

Vasai # **show ip route**

```
Vasai#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, 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 223.168.1.1 to network 0.0.0.0

B    223.168.100.0/24 [20/0] via 223.168.1.1, 00:21:28
     223.168.1.0/30 is subnetted, 1 subnets
C      223.168.1.0 is directly connected, Serial0/0
     172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C      172.16.32.0/24 is directly connected, Loopback0
S      172.16.0.0/16 is directly connected, Null0
C      172.16.1.0/24 is directly connected, Serial0/1
D      172.16.64.0/24 [90/2297856] via 172.16.1.1, 03:40:49, Serial0/1
B*   0.0.0.0/0 [20/0] via 223.168.1.1, 00:21:30
```

Step 8: Set BGP local Preference.

- s. Because the Local preference value is shared between IBGP neighbors, configure a simple route map that references the local preference value on Virar and Vasai. This policy adjusts outbound traffic to prefer the link off the Virar router instead of the metered T1 off Vasai.

Virar(config) # **route-map PRIMARY_T1_IN permit 10**

Virar(config-route-map) # **set local-preference 150**

Virar(config-route-map) #**exit**

Virar(config) # **router bgp 64512**

Virar(config-router) #**neighbor 223.168.1.5 route-map PRIMARY_T1_IN in**

```
Virar#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Virar(config)#route-map PRIMARY_T1_IN permit 10
Virar(config-route-map)#set local-preference 150
Virar(config-route-map)#exit
Virar(config)#router bgp 64512
Virar(config-router)#neighbor 223.168.1.5 route-map PRIMARY_T1_IN in
Virar(config-router)#
```

Vasai(config) # **route-map SECONDARY_T1_IN permit 10**

Vasai(config-route-map) # **set local-preference 125**

Vasai(config-router-map) #**exit**

Vasai(config) # **router bgp 64512**

Vasai(config-router) #**neighbor 223.168.1.1 route-map SECONDARY_T1_IN in**

```
Vasai#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Vasai(config)#route-map SECONDARY_T1_IN permit 10
Vasai(config-route-map)#set local-preference 125
Vasai(config-route-map)#exit
Vasai(config)#router bgp 64512
Vasai(config-router)#neighbor 223.168.1.1 route-map SECONDARY_T1_IN in
Vasai(config-router)#
```

- t. Use the `clear ip bgp *` soft command after configuring this new policy. When the Conversations have been re-established, issue the `show ip bgp` command on Virar and Vasai.

Virar# **clear ip bgp * soft**

```
Virar#
Virar#clear ip bgp * soft
Virar#
```

Vasai# **clear ip bgp * soft**

```
Vasai#
*Mar 1 02:20:39.671: %SYS-5-CONFIG_I: Configured from console by console
Vasai#clear ip bgp * soft
Vasai#
```

Virar# **show ip bgp**

```
Virar#show ip bgp
BGP table version is 6, local router ID is 172.16.64.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop           Metric LocPrf Weight Path
* i172.16.0.0      172.16.32.1          0      100      0 i
*>                0.0.0.0              0           32768 i
*> 223.168.100.0   223.168.1.5          0      150      0 200 i
```


Vasai# show ip bgp

```
Vasai#show ip bgp
BGP table version is 5, local router ID is 172.16.32.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 172.16.0.0        0.0.0.0              0         32768 i
* i 172.16.64.1      172.16.64.1          0         100      0 i
* 223.168.100.0     223.168.1.1          0         125      0 200 i
*>i 172.16.64.1      172.16.64.1          0         150      0 200 i
```

Step 9: BGP MED.

- u. In this previous step we saw that Virar and Vasai will route traffic for 223.168.100.0/24 using the link between Virar and ISP. Examine what the return path ISP takes to reach AS 64512. Notice that the path is different from the original path. This is known as asymmetric routing and is not necessarily an unwanted trait.

ISP# show ip bgp

```
ISP#show ip bgp
BGP table version is 11, local router ID is 223.168.100.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
* 172.16.0.0        223.168.1.2          0             0 64512 i
*> 223.168.1.6      223.168.1.6          0             0 64512 i
*> 223.168.100.0    0.0.0.0              0         32768 i
```

ISP# show ip route.

```
ISP#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, 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    223.168.100.0/24 is directly connected, Loopback0
    223.168.1.0/30 is subnetted, 2 subnets
C      223.168.1.4 is directly connected, Serial0/0
C      223.168.1.0 is directly connected, Serial0/1
B    172.16.0.0/16 [20/0] via 223.168.1.6, 00:34:06
```

- a. Use an extended ping command to verify this situation. Specify the record option and compare your output to following. Notice the return path using the exit interface 223.168.1.1 to Vasai.

```

Vasai#
Vasai#ping
Protocol [ip]:
Target IP address: 223.168.100.1
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface: 172.16.32.1
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]: record
Number of hops [ 9 ]:
Loose, Strict, Record, Timestamp, Verbose[RV]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 223.168.100.1, timeout is 2 seconds:
Packet sent with a source address of 172.16.32.1
Packet has IP options: Total option bytes= 39, padded length=40
Record route: <*>
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)

```

```

Reply to request 4 (1 ms). Received packet has options
Total option bytes= 40, padded length=40
Record route:
(172.16.1.2)
(223.168.1.6)
(223.168.100.1)
(223.168.1.5)
(172.16.1.1)
(172.16.32.1) <*>
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
End of list

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/9/24 ms

```

if you are unfamiliar with the record option, the important thing to note is that each ip address in brackets is an outgoing interface. The output can be interpreted as follows:

1. A ping that is sourced from 172.16.32.1 exits Vasai through s0/0/1, 172.16.1.2. then it at the s0/0/1 interface for Virar.

2. Virar s0/0/0, 223.168.1.6, routes the packet out to arrive at the s0/0/0 interface of ISP.
3. The target of 223.168.100.1 is reached: 223.168.100.1.
4. The packet is next forwarded out the s0/0/1, s0/0/1, 223.168.1.1 interface for ISP and arrives at the s0/0/0 interface for Vasai.
5. Vasai then forwards the packet out the last interface, loopback 0, 172.16.32.1.

Although the unlimited use of the T1 from Virar is preferred here, ISP currently takes the link from Vasai for all return traffic.

- b. Create a new policy to force the ISP router to return all traffic via Virar. Create a second route map utilizing the MED (metric) that is shared between EBGp neighbors.

Virar(config) #route-map PRIMARY_T1_MED_OUT permit 10

Virar(config-route-map) #set Metric 50

Virar(config-router-map) # exit

Virar(config) #router bgp 64512

Virar(config-router) #neighbor 223.168.1.5 route-map PRIMARY_T1_MED_OUT out

```
Virar#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Virar(config)#route-map PRIMARY_T1_MED_OUT permit 10
Virar(config-route-map)#set Metric 50
Virar(config-route-map)#exit
Virar(config)#router bgp 64512
Virar(config-router)#neighbor 223.168.1.5 route-map PRIMARY_T1_MED_OUT out
```

Vasai(config) #route-map SECONDARY_T1_MED_OUT permit 10

Vasai(config-route-map) # set metric 75

Vasai(config-route-map) # exit

Vasai(config) #router bgp 64512

Vasai(config-router) #neighbor 223.168.1.1 route-map SECONDARY_T1_MED_OUT out

```
Vasai#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Vasai(config)#route-map SECONDARY_T1_MED_OUT permit 10
Vasai(config-route-map)#set Metric 75
Vasai(config-route-map)#exit
Vasai(config)#router bgp 64512
Vasai(config-router)#neighbor 223.168.1.1 route-map SECONDARY_T1_MED_OUT out
% Specify remote-as or peer-group commands first
Vasai(config-router)#
```

- v. Use the clear ip bgp * soft command after issuing this new policy. Issuing the show ip bgp command as follows on Virar or Vasai does not indicate anything about this newly defined policy.

Virar# show ip bgp * soft

```
Virar#
Virar#clear ip bgp * soft
Virar#
```

Vasai# show ip bgp * soft

```
Vasai#
*Mar  1 02:20:39.671: %SYS-5-CONFIG_I: Configured from console by console
Vasai#clear ip bgp * soft
Vasai#
```

Virar# show ip bgp

```
Virar#show ip bgp
BGP table version is 6, local router ID is 172.16.64.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop           Metric LocPrf Weight Path
* i172.16.0.0      172.16.32.1             0    100      0 i
*>                0.0.0.0                 0           32768 i
*> 223.168.100.0   223.168.1.5             0    150      0 200 i
```

Vasai# show ip bgp

```
Vasai#show ip bgp
BGP table version is 5, local router ID is 172.16.32.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop           Metric LocPrf Weight Path
*> 172.16.0.0      0.0.0.0                 0           32768 i
* i               172.16.64.1             0    100      0 i
* 223.168.100.0    223.168.1.1             0    125      0 200 i
*>i               172.16.64.1             0    150      0 200 i
```

Reissue an extended **ping** command with the record command. Notice the change in return path using the exit interface 223.168.1.5 to Virar.

```
Vasai#ping
Protocol [ip]:
Target IP address: 223.168.100.1
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface: 172.16.32.1
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]: record
Number of hops [ 9 ]:
Loose, Strict, Record, Timestamp, Verbose[RV]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 223.168.100.1, timeout is 2 seconds:
Packet sent with a source address of 172.16.32.1
Packet has IP options: Total option bytes= 39, padded length=40
Record route: <*>
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
Reply to request 4 (1 ms). Received packet has options
Total option bytes= 40, padded length=40
Record route:
(172.16.1.2)
(223.168.1.6)
(223.168.100.1)
(223.168.1.1)
(172.16.32.1) <*>
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
(0.0.0.0)
End of list
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/8/24 ms
```

ISP# show ip bgp

```
ISP#show ip bgp
BGP table version is 12, local router ID is 223.168.100.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop        Metric LocPrf Weight Path
*> 172.16.0.0        223.168.1.2            0           0 64512 i
*                   223.168.1.6           50           0 64512 i
*> 223.168.100.0     0.0.0.0                0           32768 i
```

Step 10: Establish a default route.

The final step is to establish a default route that uses a policy statement that adjusts to changes in the network.

- Configure ISP to inject a default route to both Virar and Vasai using BGP using the **Default-originate** command. This command does not require the presence of 0.0.0.0 in the ISP router. Configure the 10.0.0.0/8 network which will not be advertised using BGP. This will be used to test the default route on Virar and Vasai.

```
ISP (config)# router bgp 200
```

```
ISP (config-router) #neighbor 223.168.1.6 default-originate
```

```
ISP (config-router) #neighbor 223.168.1.2 default-originate
```

```
ISP (config-router) # exit
```

```
ISP (config) # interface Loopback 10
```

```
ISP (config-if) #ip address 10.0.0.1 255.255.255.0
```

```
ISP#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ISP(config)#router bgp 200
ISP(config-router)#neighbor 223.168.1.6 default-originate
^
% Invalid input detected at '^' marker.

ISP(config-router)#neighbor 223.168.1.6 default-originate
ISP(config-router)#neighbor 223.168.1.2 default-originate
ISP(config-router)#exit
```

```
ISP(config)#interface loopback 10
ISP(config-if)#i
*Mar 1 03:13:58.167: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback10, changed state to up
ISP(config-if)#ip address 10.0.0.1 255.255.255.0
ISP(config-if)#exit
```

- b. Verify that both routers have received the default route by examining the routing tables on Virar and Vasai. Notice that both routers prefer the route between Virar and ISP.

Virar# show ip route

```
Virar#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, 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 172.16.32.1 to network 0.0.0.0

B    223.168.100.0/24 [200/0] via 172.16.32.1, 00:02:02
     172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
D    172.16.32.0/24 [90/2297856] via 172.16.1.2, 03:22:07, Serial0/1
S    172.16.0.0/16 is directly connected, Null0
C    172.16.1.0/24 is directly connected, Serial0/1
C    172.16.64.0/24 is directly connected, Loopback0
B*   0.0.0.0/0 [200/0] via 172.16.32.1, 00:02:02
```

Vasai# show ip route

```
Vasai#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, 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 223.168.1.1 to network 0.0.0.0

B    223.168.100.0/24 [20/0] via 223.168.1.1, 00:21:28
     223.168.1.0/30 is subnetted, 1 subnets
C    223.168.1.0 is directly connected, Serial0/0
     172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C    172.16.32.0/24 is directly connected, Loopback0
S    172.16.0.0/16 is directly connected, Null0
C    172.16.1.0/24 is directly connected, Serial0/1
D    172.16.64.0/24 [90/2297856] via 172.16.1.1, 03:40:49, Serial0/1
B*   0.0.0.0/0 [20/0] via 223.168.1.1, 00:21:30
```

- c. The preferred default route is by way of Virar because of the higher local preference attribute configured on Virar earlier.

Vasai# show ip bgp

```
Vasai#show ip bgp
BGP table version is 5, local router ID is 172.16.32.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 172.16.0.0        0.0.0.0              0         32768 i
* i                 172.16.64.1          0         100      0 i
* 223.168.100.0     223.168.1.1          0         125      0 200 i
*>i                 172.16.64.1          0         150      0 200 i
```

- d. Using the traceroute command verify that packets to 10.0.0.1 is using the default route through Virar.

Vasai# traceroute 10.0.0.1

```
Vasai#traceroute 10.0.0.1

Type escape sequence to abort.
Tracing the route to 10.0.0.1

 0 172.16.1.1 16 msec 0 msec 0 msec
 1 172.16.1.1 16 msec 0 msec 0 msec
 2 223.168.1.5 [AS 200] 0 msec 12 msec 0 msec
```

- e. Next, test how BGP adapts to using a different default route when the path between Virar and ISP goes down.

ISP (config)# interface serial 0/0/0

```
ISP(config)#int s0/0
ISP(config-if)#shutdown
ISP(config-if)#
```

- f. Verify that both routers are modified their routing tables with the default route using the path between Vasai and ISP.

Virar# show ip route

```

Virar#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, 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 172.16.32.1 to network 0.0.0.0

B    223.168.100.0/24 [200/0] via 172.16.32.1, 00:02:02
     172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
D    172.16.32.0/24 [90/2297856] via 172.16.1.2, 03:22:07, Serial0/1
S    172.16.0.0/16 is directly connected, Null0
C    172.16.1.0/24 is directly connected, Serial0/1
C    172.16.64.0/24 is directly connected, Loopback0
B*   0.0.0.0/0 [200/0] via 172.16.32.1, 00:02:02

```

Vasai# show ip route

```

Vasai#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, 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 223.168.1.1 to network 0.0.0.0

B    223.168.100.0/24 [20/0] via 223.168.1.1, 00:21:28
     223.168.1.0/30 is subnetted, 1 subnets
C    223.168.1.0 is directly connected, Serial0/0
     172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
C    172.16.32.0/24 is directly connected, Loopback0
S    172.16.0.0/16 is directly connected, Null0
C    172.16.1.0/24 is directly connected, Serial0/1
D    172.16.64.0/24 [90/2297856] via 172.16.1.1, 03:40:49, Serial0/1
B*   0.0.0.0/0 [20/0] via 223.168.1.1, 00:21:30

```

- g. Verify the new path using the traceroute command to 10.0.0.1 from Virar. Notice default route is now through Vasai.

Vasai# trace 10.0.0.1

```
Vasai#traceroute 10.0.0.1
Type escape sequence to abort.
Tracing the route to 10.0.0.1
 1 223.168.1.1 [AS 200] 16 msec 12 msec 0 msec
```