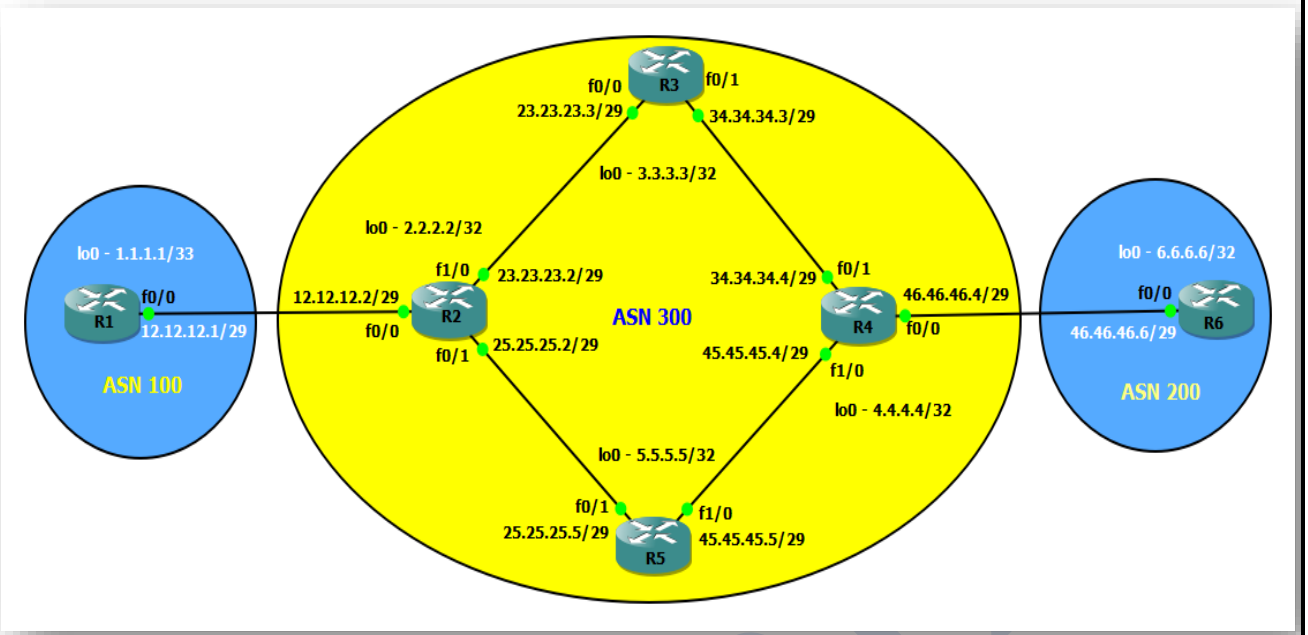
Border Gateway Protocol



Task

1. Configure routers with IP address as shown in topology and configure enable password as **ccna** & device access password as **cisco**
2. Configure OSPF process for single area-0 (backbone) on R2, R3, R4 and R5. Advertise loopback address and intra-AS links networks.
3. Configure iBGP with ASN 300 between R2 & R4 with source loopback
4. Configure eBGP between R1 with ASN 100 & R2 with ASN 300
5. Configure eBGP between R4 with ASN 300& R6 with ASN 200
6. Configure Route Reflector (RR) on R3 to removes the need of full mesh between iBGP speakers
7. R1 should ping R6's loopback and R6 should ping R1's loopback

Task-1: Routers Configuration:

R1 Router Configuration:

```
R1#config t
R1(config)#hostname R1
R1(config)#no ip domain-lookup
R1(config)#enable password ccna
R1(config)#int fa0/0
R1(config-if)#ip address 12.12.12.1 255.255.255.248
R1(config-if)#description Link to R2 on fa0/0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#int lo0
```

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```
R1(config-if)#ip address 1.1.1.1 255.255.255.255
R1(config-if)#exit
R1(config)#line vty 0 15
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#logging synchronous
R1(config-line)#exec-timeout 1 0
R1(config-line)#exit
R1(config)#line console 0
R1(config-line)#logging synchronous
R1(config-line)#exec-timeout 0 0
R1(config-line)#exit
R1(config)#exit
R1#
```

R2 Router Configuration:

```
R2#config t
R2(config)#hostname R2
R2(config)#no ip domain-lookup
R2(config)#enable password ccna
R2(config)#int fa0/0
R2(config-if)#ip address 12.12.12.2 255.255.255.248
R2(config-if)#description Link to R1 on fa0/0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#int fa1/0
R2(config-if)#ip address 23.23.23.2 255.255.255.248
R2(config-if)#description Link to R3 on fa0/0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#int fa0/1
R2(config-if)#ip address 25.25.25.2 255.255.255.248
R2(config-if)#description Link to R5 on fa0/1
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#int lo0
R2(config-if)#ip address 2.2.2.2 255.255.255.255
R2(config-if)#exit
R2(config)#line vty 0 15
R2(config-line)#password cisco
R2(config-line)#login
R2(config-line)#logging synchronous
R2(config-line)#exec-timeout 1 0
R2(config-line)#exit
R2(config)#line console 0
R2(config-line)#logging synchronous
R2(config-line)#exec-timeout 0 0
R2(config-line)#exit
R2(config)#exit
R2#
```

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R3 Router Configuration:

```
R3#config t
R3(config)#hostname R3
R3(config)#no ip domain-lookup
R3(config)#enable password ccna
R3(config)#int fa0/0
R3(config-if)#ip address 23.23.23.3 255.255.255.248
R3(config-if)#description Link to R2 on fa1/0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#int fa0/1
R3(config-if)#ip address 34.34.34.3 255.255.255.248
R3(config-if)#description Link to R4 on fa0/1
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#int lo0
R3(config-if)#ip address 3.3.3.3 255.255.255.255
R3(config-if)#exit
R3(config)#line vty 0 15
R3(config-line)#password cisco
R3(config-line)#login
R3(config-line)#logging synchronous
R3(config-line)#exec-timeout 1 0
R3(config-line)#exit
R3(config)#line console 0
R3(config-line)#logging synchronous
R3(config-line)#exec-timeout 0 0
R3(config-line)#exit
R3(config)#exit
R3#
```

R4 Router Configuration:

```
R4#config t
R4(config)#hostname R4
R4(config)#no ip domain-lookup
R4(config)#enable password ccna
R4(config)#int fa0/1
R4(config-if)#ip address 34.34.34.4 255.255.255.248
R4(config-if)#description Link to R3 on fa0/1
R4(config-if)#no shut
R4(config-if)#exit
R4(config)#int fa1/0
R4(config-if)#ip address 45.45.45.4 255.255.255.248
R4(config-if)#description Link to R6 on fa0/0
R4(config-if)#no shut
R4(config-if)#exit
R4(config)#int fa0/0
R4(config-if)#ip address 46.46.46.4 255.255.255.248
R4(config-if)#description Link to R5 on fa0/0
```

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```
R4(config-if)#no shut
R4(config-if)#exit
R4(config)#int lo0
R4(config-if)#ip address 4.4.4.4 255.255.255.255
R4(config-if)#exit
R4(config)#line vty 0 15
R4(config-line)#password cisco
R4(config-line)#login
R4(config-line)#logging synchronous
R4(config-line)#exec-timeout 1 0
R4(config-line)#exit
R4(config)#line console 0
R4(config-line)#logging synchronous
R4(config-line)#exec-timeout 0 0
R4(config-line)#exit
R4(config)#exit
R4#
```

R5 Router Configuration:

```
R5#config t
R5(config)#hostname R5
R5(config)#no ip domain-lookup
R5(config)#enable password ccna
R5(config)#int fa0/1
R5(config-if)#ip address 25.25.25.5 255.255.255.248
R5(config-if)#description Link to R2 on fa0/1
R5(config-if)#no shut
R5(config-if)#exit
R5(config)#int fa1/0
R5(config-if)#ip address 45.45.45.5 255.255.255.248
R5(config-if)#description Link to R5 on fa1/0
R5(config-if)#no shut
R5(config-if)#exit
R5(config)#int lo0
R5(config-if)#ip address 5.5.5.5 255.255.255.255
R5(config-if)#exit
R5(config)#line vty 0 15
R5(config-line)#password cisco
R5(config-line)#login
R5(config-line)#logging synchronous
R5(config-line)#exec-timeout 1 0
R5(config-line)#exit
R5(config)#line console 0
R5(config-line)#logging synchronous
R5(config-line)#exec-timeout 0 0
R5(config-line)#exit
R5(config)#exit
R5#
```

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R6 Router Configuration:

```
R6#config t
R6(config)#hostname R6
R6(config)#no ip domain-lookup
R6(config)#enable password ccna
R6(config)#int fa0/0
R6(config-if)#ip address 46.46.46.6 255.255.255.248
R6(config-if)#description Link to R4 on fa0/0
R6(config-if)#no shut
R6(config-if)#exit
R6(config)#int lo0
R6(config-if)#ip address 6.6.6.6 255.255.255.255
R6(config-if)#exit
R6(config)#line vty 0 15
R6(config-line)#password cisco
R6(config-line)#login
R6(config-line)#logging synchronous
R6(config-line)#exec-timeout 1 0
R6(config-line)#exit
R6(config)#line console 0
R6(config-line)#logging synchronous
R6(config-line)#exec-timeout 0 0
R6(config-line)#exit
R6(config)#exit
R6#
```

✓ Verification & Testing:

R1#sh ip int brief | exclude unassign

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	12.12.12.1	YES	manual	up	up
Loopback0	1.1.1.1	YES	manual	up	up

R2#sh ip int brief | exclude unassign

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	12.12.12.2	YES	manual	up	up
FastEthernet0/1	25.25.25.2	YES	manual	up	up
FastEthernet1/0	23.23.23.2	YES	manual	up	up
Loopback0	2.2.2.2	YES	manual	up	up

R3#sh ip int brief | exclude unassign

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	23.23.23.3	YES	manual	up	up
FastEthernet0/1	34.34.34.3	YES	manual	up	up
Loopback0	3.3.3.3	YES	manual	up	up

R4#sh ip int brief | exclude unassign

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	46.46.46.4	YES	manual	up	up
FastEthernet0/1	34.34.34.4	YES	manual	up	up

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```
FastEthernet1/0        45.45.45.4      YES manual up                    up
Loopback0              4.4.4.4         YES manual up                    up
```

R5#sh ip int brief | exclude unassign

```
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/1        25.25.25.5      YES manual up                    up
FastEthernet1/0        45.45.45.5      YES manual up                    up
Loopback0              5.5.5.5         YES manual up                    up
```

R6#sh ip int brief | exclude unassign

```
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        46.46.46.6      YES manual up                    up
Loopback0              6.6.6.6         YES manual up                    up
```

Task-2: Configure OSPF process for single area-0 (backbone) on R2, R3, R4 and R5. Advertise loopback address and intra-AS links networks.

R2 Router Configuration:

```
R2#config t
R2(config)#router ospf 2
R2(config-router)#network 23.23.23.0 0.0.0.7 area 0
R2(config-router)#network 25.25.25.0 0.0.0.7 area 0
R2(config-router)#network 2.2.2.2 0.0.0.0 area 0
R2(config-router)#exit
R2(config)#exit
R2#
```

R3 Router Configuration:

```
R3#config t
R3(config)#router ospf 3
R3(config-router)#network 23.23.23.0 0.0.0.7 area 0
R3(config-router)#network 34.34.34.0 0.0.0.7 area 0
R3(config-router)#network 3.3.3.3 0.0.0.0 area 0
R3(config-router)#exit
R3(config)#exit
R3#
```

R4 Router Configuration:

```
R4#config t
R4(config)#router ospf 4
R4(config-router)#network 34.34.34.0 0.0.0.7 area 0
R4(config-router)#network 45.45.45.0 0.0.0.7 area 0
R4(config-router)#network 4.4.4.4 0.0.0.0 area 0
R4(config-router)#exit
R4(config)#exit
R4#
```

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R5 Router Configuration:

```
R5#config t
R5(config)#router ospf 5
R5(config-router)#network 25.25.25.0 0.0.0.7 area 0
R5(config-router)#network 45.45.45.0 0.0.0.7 area 0
R5(config-router)#network 5.5.5.5 0.0.0.0 area 0
R5(config-router)#exit
R5(config)#exit
R5#
```

✓ Verification & Testing:

R2#sh ip protocols

```
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 2"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 2.2.2.2
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    2.2.2.2 0.0.0.0 area 0
    23.23.23.0 0.0.0.7 area 0
    25.25.25.0 0.0.0.7 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    5.5.5.5           110         00:02:55
    4.4.4.4           110         00:02:55
    3.3.3.3           110         00:03:17
  Distance: (default is 110)
```

R3#sh ip protocols

```
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 3"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 3.3.3.3
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    3.3.3.3 0.0.0.0 area 0
    23.23.23.0 0.0.0.7 area 0
    34.34.34.0 0.0.0.7 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    5.5.5.5           110         00:03:06
    4.4.4.4           110         00:03:16
    2.2.2.2           110         00:03:28
```

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Distance: (default is 110)

R4#sh ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 4"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Router ID 4.4.4.4
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Maximum path: 4
Routing for Networks:
4.4.4.4 0.0.0.0 area 0
34.34.34.0 0.0.0.7 area 0
45.45.45.0 0.0.0.7 area 0
Routing Information Sources:

Gateway	Distance	Last Update
5.5.5.5	110	00:03:08
2.2.2.2	110	00:03:08
3.3.3.3	110	00:03:18

Distance: (default is 110)

R5#sh ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 5"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Router ID 5.5.5.5
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Maximum path: 4
Routing for Networks:
5.5.5.5 0.0.0.0 area 0
25.25.25.0 0.0.0.7 area 0
45.45.45.0 0.0.0.7 area 0
Routing Information Sources:

Gateway	Distance	Last Update
2.2.2.2	110	00:03:13
3.3.3.3	110	00:03:13
4.4.4.4	110	00:03:13

Distance: (default is 110)

R2#sh ip route ospf | begin Gateway
Gateway of last resort is not set

```
     3.0.0.0/32 is subnetted, 1 subnets
O       3.3.3.3 [110/2] via 23.23.23.3, 00:01:12, FastEthernet1/0
     4.0.0.0/32 is subnetted, 1 subnets
O       4.4.4.4 [110/3] via 25.25.25.5, 00:00:50, FastEthernet0/1
                [110/3] via 23.23.23.3, 00:00:50, FastEthernet1/0
     5.0.0.0/32 is subnetted, 1 subnets
```

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```
O       5.5.5.5 [110/2] via 25.25.25.5, 00:00:50, FastEthernet0/1
     34.0.0.0/29 is subnetted, 1 subnets
O       34.34.34.0 [110/2] via 23.23.23.3, 00:01:00, FastEthernet1/0
     45.0.0.0/29 is subnetted, 1 subnets
O       45.45.45.0 [110/2] via 25.25.25.5, 00:00:50, FastEthernet0/1
```

R3#sh ip route ospf | begin Gateway

```
Gateway of last resort is not set

     2.0.0.0/32 is subnetted, 1 subnets
O       2.2.2.2 [110/2] via 23.23.23.2, 00:01:20, FastEthernet0/0
     4.0.0.0/32 is subnetted, 1 subnets
O       4.4.4.4 [110/2] via 34.34.34.4, 00:01:08, FastEthernet0/1
     5.0.0.0/32 is subnetted, 1 subnets
O       5.5.5.5 [110/3] via 34.34.34.4, 00:00:58, FastEthernet0/1
                [110/3] via 23.23.23.2, 00:00:58, FastEthernet0/0
     25.0.0.0/29 is subnetted, 1 subnets
O       25.25.25.0 [110/2] via 23.23.23.2, 00:00:58, FastEthernet0/0
     45.0.0.0/29 is subnetted, 1 subnets
O       45.45.45.0 [110/2] via 34.34.34.4, 00:00:58, FastEthernet0/1
```

R4#sh ip route ospf | begin Gateway

```
Gateway of last resort is not set

     2.0.0.0/32 is subnetted, 1 subnets
O       2.2.2.2 [110/3] via 45.45.45.5, 00:01:00, FastEthernet1/0
                [110/3] via 34.34.34.3, 00:01:10, FastEthernet0/1
     3.0.0.0/32 is subnetted, 1 subnets
O       3.3.3.3 [110/2] via 34.34.34.3, 00:01:10, FastEthernet0/1
     5.0.0.0/32 is subnetted, 1 subnets
O       5.5.5.5 [110/2] via 45.45.45.5, 00:01:00, FastEthernet1/0
     23.0.0.0/29 is subnetted, 1 subnets
O       23.23.23.0 [110/2] via 34.34.34.3, 00:01:10, FastEthernet0/1
     25.0.0.0/29 is subnetted, 1 subnets
O       25.25.25.0 [110/2] via 45.45.45.5, 00:01:00, FastEthernet1/0
```

R5#sh ip route ospf | begin Gateway

```
Gateway of last resort is not set

     2.0.0.0/32 is subnetted, 1 subnets
O       2.2.2.2 [110/2] via 25.25.25.2, 00:01:04, FastEthernet0/1
     3.0.0.0/32 is subnetted, 1 subnets
O       3.3.3.3 [110/3] via 45.45.45.4, 00:01:04, FastEthernet1/0
                [110/3] via 25.25.25.2, 00:01:04, FastEthernet0/1
     4.0.0.0/32 is subnetted, 1 subnets
O       4.4.4.4 [110/2] via 45.45.45.4, 00:01:04, FastEthernet1/0
     23.0.0.0/29 is subnetted, 1 subnets
O       23.23.23.0 [110/2] via 25.25.25.2, 00:01:04, FastEthernet0/1
     34.0.0.0/29 is subnetted, 1 subnets
O       34.34.34.0 [110/2] via 45.45.45.4, 00:01:04, FastEthernet1/0
R5#
```

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R2#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
5.5.5.5	1	FULL/DR	00:00:39	25.25.25.5	FastEthernet0/1
3.3.3.3	1	FULL/DR	00:00:38	23.23.23.3	FastEthernet1/0

R3#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
4.4.4.4	1	FULL/DR	00:00:31	34.34.34.4	FastEthernet0/1
2.2.2.2	1	FULL/BDR	00:00:32	23.23.23.2	FastEthernet0/0

R4#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
5.5.5.5	1	FULL/DR	00:00:35	45.45.45.5	FastEthernet1/0
3.3.3.3	1	FULL/BDR	00:00:33	34.34.34.3	FastEthernet0/1

R5#sh ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
4.4.4.4	1	FULL/BDR	00:00:33	45.45.45.4	FastEthernet1/0
2.2.2.2	1	FULL/BDR	00:00:34	25.25.25.2	FastEthernet0/1

Ping loopback IP of R3, R4 & R5 from R2

R2#ping 3.3.3.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/56/60 ms

R2#ping 4.4.4.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/74/84 ms

R2#ping 5.5.5.5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.5.5.5, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/56/64 ms

Ping loopback IP of R2, R4 & R5 from R3

R3#ping 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms

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R3#ping 4.4.4.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/62/80 ms

R3#ping 5.5.5.5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.5.5.5, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/81/88 ms

Ping loopback IP of R2, R3 & R5 from R4

R4#ping 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 80/85/104 ms

R4#ping 3.3.3.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/56/60 ms

R4#ping 5.5.5.5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.5.5.5, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/53/56 ms

Ping loopback IP of R2, R3 & R4 from R5

R5#ping 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/56/64 ms

R5#ping 3.3.3.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/80/84 ms

R5#ping 4.4.4.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/54/56 ms

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Task-3: Configure iBGP between R2 & R4 with source loopback

R2 Router Configuration:

```
R2#config t
R2(config)#router bgp 300
R2(config-router)#neighbor 4.4.4.4 remote-as 300
R2(config-router)#neighbor 4.4.4.4 update-source lo0
R2(config-router)#network 12.12.12.0 mask 255.255.255.248
R2(config-router)#exit
R2(config)#exit
R2#
```

R4 Router Configuration:

```
R4#config t
R4(config)#router bgp 300
R4(config-router)#neighbor 2.2.2.2 remote-as 300
R4(config-router)#neighbor 2.2.2.2 update-source lo0
R4(config-router)#network 46.46.46.0 mask 255.255.255.248
R4(config-router)#exit
R4(config)#exit
R4#

R2#
*Nov 28   14:53:36.531: %BGP-5-ADJCHANGE: neighbor 4.4.4.4 Up
R2#

R4#
*Nov 28   14:53:33.767: %BGP-5-ADJCHANGE: neighbor 2.2.2.2 Up
R4#
```

✓ Verification & Testing:

R2#sh ip bgp

```
BGP table version is 3, local router ID is 2.2.2.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 *>  12.12.12.0/29   0.0.0.0                  0         32768 i
 *>i 46.46.46.0/29   4.4.4.4                  0    100      0 i
```

R4#sh ip bgp

```
BGP table version is 3, local router ID is 4.4.4.4
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
```

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```
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 *>i 12.12.12.0/29    2.2.2.2                  0    100      0 i
 *>  46.46.46.0/29    0.0.0.0                  0             32768 i
```

R2#sh ip bgp summary

```
BGP router identifier 2.2.2.2, local AS number 300
BGP table version is 3, main routing table version 3
2 network entries using 296 bytes of memory
2 path entries using 128 bytes of memory
2/2 BGP path/bestpath attribute entries using 272 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
BGP using 696 total bytes of memory
BGP activity 2/0 prefixes, 2/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
4.4.4.4         4          300       7       7        3    0    0 00:03:20        1
```

R4#sh ip bgp summary

```
BGP router identifier 4.4.4.4, local AS number 300
BGP table version is 3, main routing table version 3
2 network entries using 296 bytes of memory
2 path entries using 128 bytes of memory
2/2 BGP path/bestpath attribute entries using 272 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
BGP using 696 total bytes of memory
BGP activity 2/0 prefixes, 2/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
2.2.2.2         4          300       8       8        3    0    0 00:03:57        1
R4#
```

R2#sh ip route bgp

```
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      46.0.0.0/29 is subnetted, 1 subnets
B        46.46.46.0 [200/0] via 4.4.4.4, 00:03:41
R2#
```

Kalan

R4#sh ip route bgp
Codes: L - local, 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, H - NHRP, l - LISP
+ - replicated route, % - next hop override

Gateway of last resort is not set

12.0.0.0/29 is subnetted, 1 subnets
B 12.12.12.0 [200/0] via 2.2.2.2, 00:04:08
R4#

Task-4: Configure eBGP between R1 & R2

R1 Router Configuration:

```
R1#config t
R1(config)#router bgp 100
R1(config-router)#neighbor 12.12.12.2 remote-as 300
R1(config-router)#network 1.1.1.1 mask 255.255.255.255
R1(config-router)#exit
R1(config)#exit
R1#
```

R2 Router Configuration:

```
R2#config t
R2(config)#router bgp 300
R2(config-router)#neighbor 12.12.12.1 remote-as 100
R2(config-router)#exit
R2(config)#exit
R2#
```

```
R1#
*Nov 28   15:29:00.383: %BGP-5-ADJCHANGE: neighbor 12.12.12.2 Up
R1#
```

```
R2#
*Nov 28   15:30:15.131: %BGP-5-ADJCHANGE: neighbor 12.12.12.1 Up
R2#
```

✓ Verification & Testing:

R1#sh ip bgp
BGP table version is 4, local router ID is 1.1.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,

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```
          x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 *>  1.1.1.1/32       0.0.0.0                  0         32768 i
 r>  12.12.12.0/29    12.12.12.2               0             0 300 i
 *>  46.46.46.0/29    12.12.12.2                             0 300 i
R1#
```

R2#sh ip bgp

```
BGP table version is 4, local router ID is 2.2.2.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 *>  1.1.1.1/32       12.12.12.1               0             0 100 i
 *>  12.12.12.0/29    0.0.0.0                  0         32768 i
 *>i 46.46.46.0/29    4.4.4.4                  0    100      0 i
R2#
```

R1#sh ip bgp summary

```
BGP router identifier 1.1.1.1, local AS number 100
BGP table version is 4, main routing table version 4
3 network entries using 444 bytes of memory
3 path entries using 192 bytes of memory
3/3 BGP path/bestpath attribute entries using 408 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
BGP using 1068 total bytes of memory
BGP activity 3/0 prefixes, 3/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
12.12.12.2      4          300       9       8        4    0    0 00:03:03        2
R1#
```

R2#sh ip bgp summary

```
BGP router identifier 2.2.2.2, local AS number 300
BGP table version is 4, main routing table version 4
3 network entries using 444 bytes of memory
3 path entries using 192 bytes of memory
3/3 BGP path/bestpath attribute entries using 408 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
BGP using 1068 total bytes of memory
BGP activity 3/0 prefixes, 3/0 paths, scan interval 60 secs
```

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```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
4.4.4.4         4          300      48      48        4    0    0 00:39:56        1
12.12.12.1      4          100       8       9        4    0    0 00:03:18        1
R2#
```

R1#sh ip route bgp

```
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      46.0.0.0/29 is subnetted, 1 subnets
B        46.46.46.0 [20/0] via 12.12.12.2, 00:03:55
R1#
```

R2#sh ip route bgp

```
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      1.0.0.0/32 is subnetted, 1 subnets
B        1.1.1.1 [20/0] via 12.12.12.1, 00:04:18
      46.0.0.0/29 is subnetted, 1 subnets
B        46.46.46.0 [200/0] via 4.4.4.4, 00:40:02
R2#
```

Task-5: Configure eBGP between R4 & R6

R4 Router Configuration:

```
R4#config t
R4(config)#router bgp 300
R4(config-router)#neighbor 46.46.46.6 remote-as 200
R4(config-router)#exit
R4(config)#exit
R4#
```

R6 Router Configuration:

```
R6#config t
R6(config)#router bgp 200
R6(config-router)#neighbor 46.46.46.4 remote-as 300
R6(config-router)#network 6.6.6.6 mask 255.255.255.255
R6(config-router)#exit
R6(config)#exit
R6#

R4#
*Nov 28   15:35:42.975: %BGP-5-ADJCHANGE: neighbor 46.46.46.6 Up
R4#

R6#
*Nov 28   15:34:15.947: %BGP-5-ADJCHANGE: neighbor 46.46.46.4 Up
R6#
```

✓ Verification & Testing:

R4#sh ip bgp

```
BGP table version is 5, local router ID is 4.4.4.4
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 *>i 1.1.1.1/32       12.12.12.1               0    100      0 100 i
 *>  6.6.6.6/32       46.46.46.6               0             0 200 i
 *>i 12.12.12.0/29    2.2.2.2                  0    100      0 i
 *>  46.46.46.0/29    0.0.0.0                  0             32768 i
R4#
```

R6#sh ip bgp

```
BGP table version is 5, local router ID is 6.6.6.6
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 *>  1.1.1.1/32       46.46.46.4                             0 300 100 i
 *>  6.6.6.6/32       0.0.0.0                  0             32768 i
 *>  12.12.12.0/29    46.46.46.4                             0 300 i
 r>  46.46.46.0/29    46.46.46.4               0             0 300 i
R6#
```

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R4#sh ip bgp summary
BGP router identifier 4.4.4.4, local AS number 300
BGP table version is 5, main routing table version 5
4 network entries using 592 bytes of memory
4 path entries using 256 bytes of memory
4/4 BGP path/bestpath attribute entries using 544 bytes of memory
2 BGP AS-PATH entries using 48 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
BGP using 1440 total bytes of memory
BGP activity 4/0 prefixes, 4/0 paths, scan interval 60 secs

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
2.2.2.2	4	300	54	55	5	0	0	00:45:08	2
46.46.46.6	4	200	8	10	5	0	0	00:02:59	1

R4#

R6#sh ip bgp summary
BGP router identifier 6.6.6.6, local AS number 200
BGP table version is 5, main routing table version 5
4 network entries using 592 bytes of memory
4 path entries using 256 bytes of memory
4/4 BGP path/bestpath attribute entries using 544 bytes of memory
2 BGP AS-PATH entries using 48 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
BGP using 1440 total bytes of memory
BGP activity 4/0 prefixes, 4/0 paths, scan interval 60 secs

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
46.46.46.4	4	300	10	8	5	0	0	00:03:05	3

R6#

R4#sh ip route bgp
Codes: L - local, 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, H - NHRP, l - LISP
+ - replicated route, % - next hop override

Gateway of last resort is not set

1.0.0.0/32 is subnetted, 1 subnets
B 1.1.1.1 [200/0] via 12.12.12.1, 00:09:21
6.0.0.0/32 is subnetted, 1 subnets
B 6.6.6.6 [20/0] via 46.46.46.6, 00:03:47
12.0.0.0/29 is subnetted, 1 subnets
B 12.12.12.0 [200/0] via 2.2.2.2, 00:45:03

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R4#

R6#sh ip route bgp
Codes: L - local, 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, H - NHRP, l - LISP
+ - replicated route, % - next hop override

Gateway of last resort is not set

1.0.0.0/32 is subnetted, 1 subnets
B 1.1.1.1 [20/0] via 46.46.46.4, 00:04:05
12.0.0.0/29 is subnetted, 1 subnets
B 12.12.12.0 [20/0] via 46.46.46.4, 00:04:05
R6#

R1#sh ip bgp 6.6.6.6
BGP routing table entry for 6.6.6.6/32, version 5
Paths: (1 available, best #1, table default)
Not advertised to any peer
Refresh Epoch 1
300 200
12.12.12.2 from 12.12.12.2 (2.2.2.2)
Origin IGP, localpref 100, valid, external, best
R1#

R6#sh ip bgp 1.1.1.1
BGP routing table entry for 1.1.1.1/32, version 2
Paths: (1 available, best #1, table default)
Not advertised to any peer
Refresh Epoch 1
300 100
46.46.46.4 from 46.46.46.4 (4.4.4.4)
Origin IGP, localpref 100, valid, external, best
R6#

PING R6's loopback from R1 with source loopback and R1's loopback from R6 with source loopback.

R1#ping 6.6.6.6 source lo0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 6.6.6.6, timeout is 2 seconds:
Packet sent with a source address of 1.1.1.1
.....
Success rate is 0 percent (0/5)
R1#

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R6#ping 1.1.1.1 source lo0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
Packet sent with a source address of 6.6.6.6
.....
Success rate is 0 percent (0/5)
R6#

Task-7: Configure Route Reflector (RR) on R3 to removes the need of full mesh between iBGP speakers

R2 Router Configuration:

```
R2#config t
R2(config)#router bgp 300
R2(config-router)#neighbor 3.3.3.3 remote-as 300
R2(config-router)#neighbor 3.3.3.3 update-source lo0
R2(config-router)#exit
R2(config)#exit
R2#exit
```

R3 Router Configuration as RR:

```
R3#config t
R3(config)#router bgp 300
R3(config-router)#neighbor 2.2.2.2 remote-as 300
R3(config-router)#neighbor 2.2.2.2 update-source lo0
R3(config-router)#neighbor 2.2.2.2 route-reflector-client
R3(config-router)#neighbor 4.4.4.4 remote-as 300
R3(config-router)#neighbor 4.4.4.4 update-source lo0
R3(config-router)#neighbor 4.4.4.4 route-reflector-client
R3(config-router)#exit
R3(config)#exit
R3#
```

R4 Router Configuration:

```
R4#config t
R4(config)#router bgp 300
R4(config-router)#neighbor 3.3.3.3 remote-as 300
R4(config-router)#neighbor 3.3.3.3 update-source lo0
R4(config-router)#exit
R4(config)#exit
R4#
```

- ✓ **Verification & Testing:**

R3#sh ip route bgp
Codes: L - local, 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

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```
      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, H - NHRP, l - LISP
      + - replicated route, % - next hop override

Gateway of last resort is not set

     1.0.0.0/32 is subnetted, 1 subnets
B       1.1.1.1 [200/0] via 12.12.12.1, 00:08:05
     6.0.0.0/32 is subnetted, 1 subnets
B       6.6.6.6 [200/0] via 46.46.46.6, 00:08:05
     12.0.0.0/29 is subnetted, 1 subnets
B       12.12.12.0 [200/0] via 2.2.2.2, 00:08:05
     46.0.0.0/29 is subnetted, 1 subnets
B       46.46.46.0 [200/0] via 4.4.4.4, 00:08:05
R3#
```

R3#sh ip bgp

```
BGP table version is 1, local router ID is 3.3.3.3
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 * i 1.1.1.1/32      12.12.12.1               0    100      0    100 i
 * i 6.6.6.6/32      46.46.46.6               0    100      0    200 i
 * i 12.12.12.0/29   2.2.2.2                  0    100      0      i
 * i 46.46.46.0/29   4.4.4.4                  0    100      0      i
R3#
```

R3#sh ip bgp summary

```
BGP router identifier 3.3.3.3, local AS number 300
BGP table version is 7, main routing table version 7
4 network entries using 592 bytes of memory
4 path entries using 256 bytes of memory
3/3 BGP path/bestpath attribute entries using 408 bytes of memory
2 BGP AS-PATH entries using 48 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
BGP using 1304 total bytes of memory
BGP activity 4/0 prefixes, 4/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
2.2.2.2         4          300       8       8        7    0    0 00:01:27        2
4.4.4.4         4          300       7       8        7    0    0 00:01:12        2
R3#
```

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R2#sh ip bgp 6.6.6.6
BGP routing table entry for 6.6.6.6/32, version 4
Paths: (2 available, best #2, table default)
  Advertised to update-groups:
    2
  Refresh Epoch 1
  200
    46.46.46.6 (metric 3) from 3.3.3.3 (3.3.3.3)
      Origin IGP, metric 0, localpref 100, valid, internal
      Originator: 4.4.4.4, Cluster list: 3.3.3.3
  Refresh Epoch 1
  200
    46.46.46.6 (metric 3) from 4.4.4.4 (4.4.4.4)
      Origin IGP, metric 0, localpref 100, valid, internal, best
R2#

R3#sh ip bgp 1.1.1.1
BGP routing table entry for 1.1.1.1/32, version 6
Paths: (1 available, best #1, table default)
  Advertised to update-groups:
    1
  Refresh Epoch 2
  100, (Received from a RR-client)
    12.12.12.1 (metric 2) from 2.2.2.2 (2.2.2.2)
      Origin IGP, metric 0, localpref 100, valid, internal, best
R3#

R3#sh ip bgp 6.6.6.6
BGP routing table entry for 6.6.6.6/32, version 7
Paths: (1 available, best #1, table default)
  Advertised to update-groups:
    1
  Refresh Epoch 2
  200, (Received from a RR-client)
    46.46.46.6 (metric 2) from 4.4.4.4 (4.4.4.4)
      Origin IGP, metric 0, localpref 100, valid, internal, best
R3#

R4#sh ip bgp 1.1.1.1
BGP routing table entry for 1.1.1.1/32, version 5
Paths: (2 available, best #2, table default)
  Advertised to update-groups:
    2
  Refresh Epoch 1
  100
    12.12.12.1 (metric 3) from 3.3.3.3 (3.3.3.3)
      Origin IGP, metric 0, localpref 100, valid, internal
      Originator: 2.2.2.2, Cluster list: 3.3.3.3
  Refresh Epoch 1
  100
    12.12.12.1 (metric 3) from 2.2.2.2 (2.2.2.2)

Ratan

We Make Learning Simplified..

Origin IGP, metric 0, localpref 100, valid, internal, best
R4#

PING R6's loopback from R1 with source loopback and R1's loopback from R6 with source loopback.

R1#ping 6.6.6.6 source lo0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 6.6.6.6, timeout is 2 seconds:
Packet sent with a source address of 1.1.1.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/116/156 ms
R1#

R6#ping 1.1.1.1 source lo0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
Packet sent with a source address of 6.6.6.6
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 112/115/124 ms
R6#

Ratan

info@rsatechforum.in

Important Commands:

sh ip int brief | exclude unassign
sh ip protocols
sh ip route ospf | begin Gateway
sh ip ospf neighbor
sh ip bgp
sh ip bgp summary
sh ip route bgp
sh ip bgp x.x.x.x

Ratan