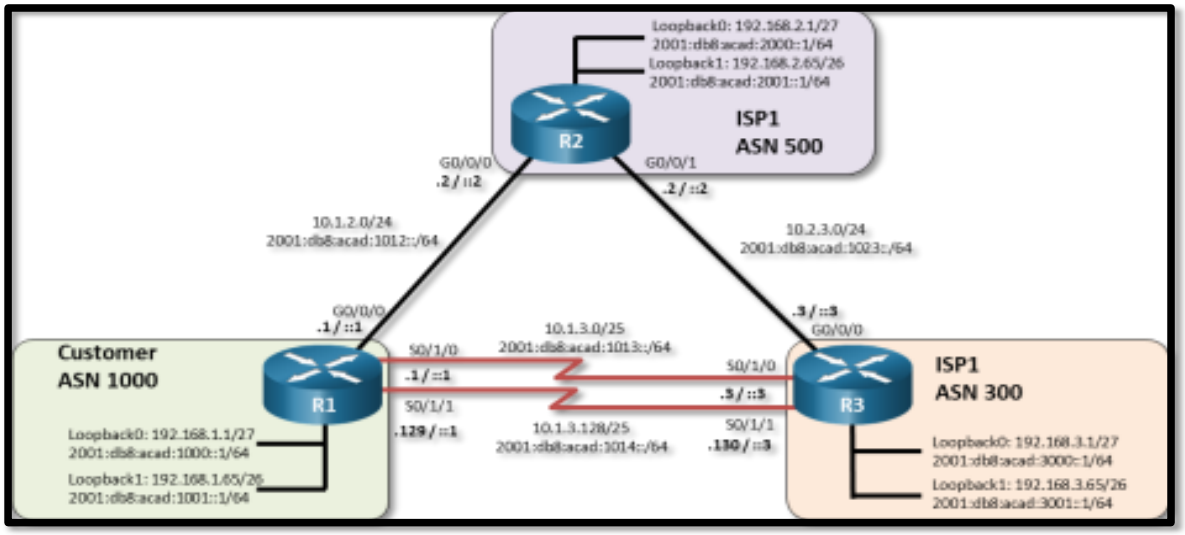
PRACTICAL 9

11.1.3 Lab - Implement MP-BGP

Topology



Addressing Table

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link- Local
R1	G0/0/0	10.1.2.1/24	2001:db8:acad:1012::1/64	fe80::1:1
	S0/1/0	10.1.3.1/25	2001:db8:acad:1013::1/64	fe80::1:2
	S0/1/1	10.1.3.129/25	2001:db8:acad:1014::1/64	fe80::1:3
	Loopback0	192.168.1.1/27	2001:db8:acad:1000::1/64	fe80::1:4
	Loopback1	192.168.1.65/26	2001:db8:acad:1001::1/64	fe80::1:5
R2	G0/0/0	10.1.2.2/24	2001:db8:acad:1012::2/64	fe80::2:1
	G0/0/1	10.2.3.2/24	2001:db8:acad:1023::2/64	fe80::2:2
	Loopback0	192.168.2.1/27	2001:db8:acad:2000::1/64	fe80::2:3
	Loopback1	192.168.2.65/26	2001:db8:acad:2001::1/64	fe80::2:4
R3	G0/0/0	10.2.3.3/24	2001:db8:acad:1023::3/64	fe80::3:1
	S0/1/0	10.1.3.3/25	2001:db8:acad:1013::3/64	fe80::3:2
	S0/1/1	10.1.3.130/25	2001:db8:acad:1014::3/64	fe80::3:3
	Loopback0	192.168.3.1/27	2001:db8:acad:3000::1/64	fe80::3:4
	Loopback1	192.168.3.65/26	2001:db8:acad:3001::1/64	fe80::3:5

Objectives

Part 1: Build the Network and Configure Basic Device Settings and Interface Addressing

Part 2: Configure MP-BGP on all Routers
Part 3: Verify MP-BGP

Part 4: Configure and Verify IPv6 Summarization

What is BGP?

Border Gateway Protocol (BGP) refers to a gateway protocol that enables the internet to exchange routing information between autonomous systems (AS). As networks interact with each other, they need a way to communicate. This is accomplished through peering. BGP makes peering possible. Without it, networks would not be able to send and receive information with each other.

How Does BGP Work?

When you have a network router that connects to other networks, it does not know which network is the best one to send its data to. BGP takes into consideration all the different peering options a router has and chooses the one closest to where the router is. Each potential peer communicates the routing information it has and that gets stored within a routing information base (RIB). BGP can access this information and use it to choose the best peering option.

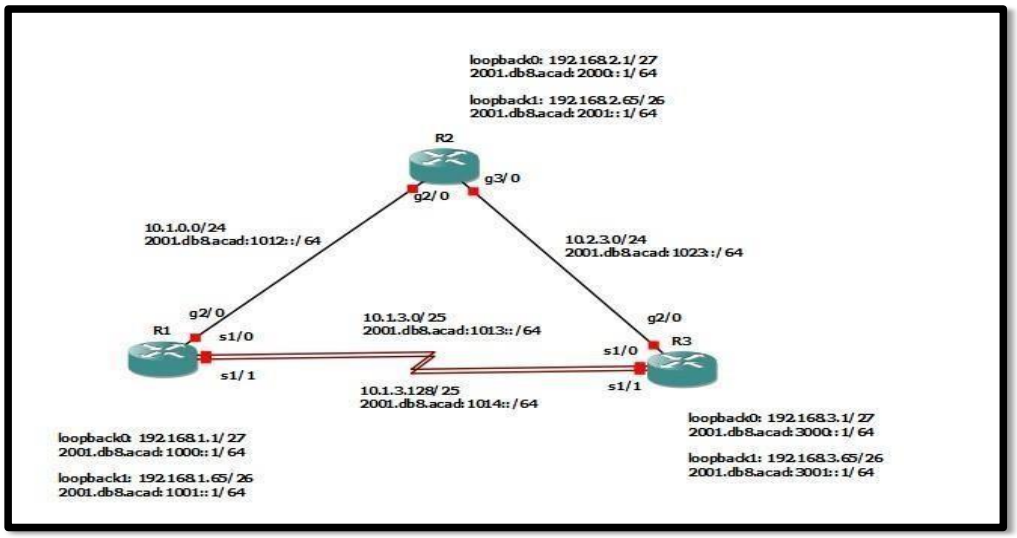
Instructions

Part 1: Build the Network and Configure Basic Device Settings and Interface Addressing

In Part 1, you will set up the network topology and configure basic settings and interface addressing on routers.

Step 1: Cable the network as shown in the topology.

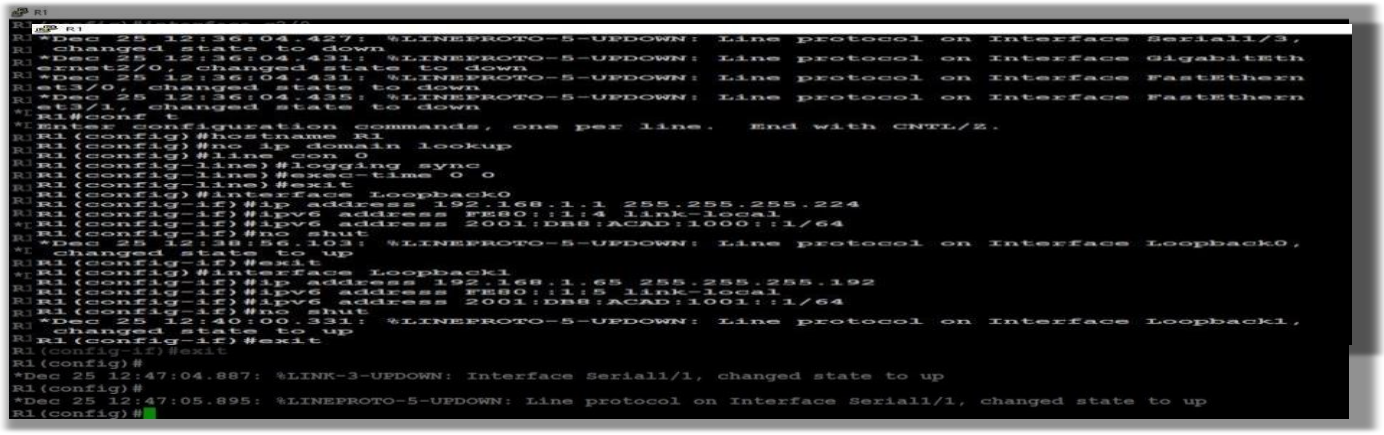
Attach the devices as shown in the topology diagram, and cable as necessary.



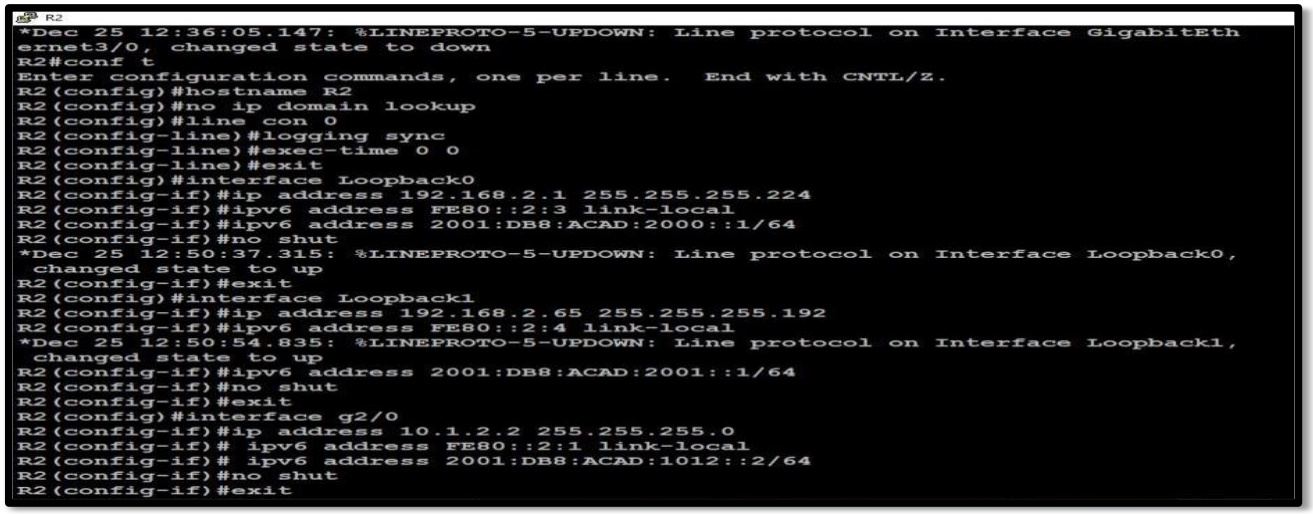
Step 2: Configure basic settings for each router.

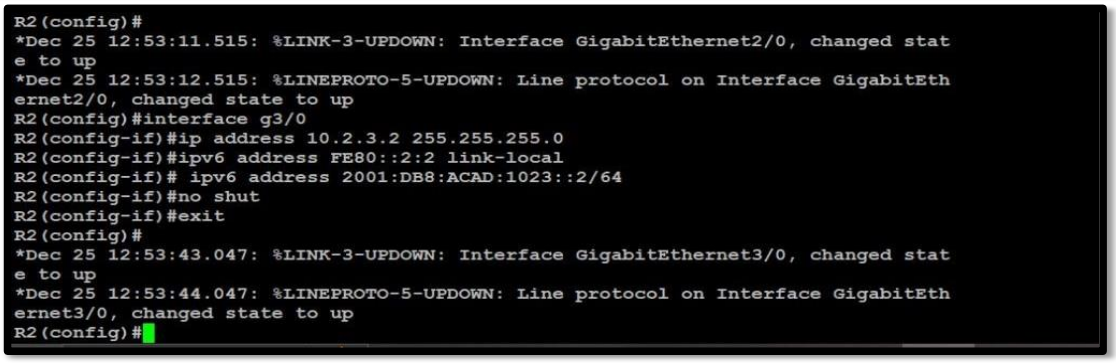
a. Console into each router, enter global configuration mode, and apply the basic settings and interface addressing. A command list for each router is listed below to perform initial configuration.

Router R1



Router R2





Router R3

```
R3
ernet2/0, changed state to down
*Dec 25 12:36:06.283: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et3/0, changed state to down
*Dec 25 12:36:06.287: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et3/1, changed state to down
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#hostname R3
R3(config)#no ip domain lookup
R3(config)#line con 0
R3(config-line)#logging sync
R3(config-line)#exec-time 0 0
R3(config-line)#exit
R3(config)#interface Loopback0
R3(config-if)#ip address 192.168.3.1 255.255.255.224
R3(config-if)#ipv6 address FE80::3:4 link-local
R3(config-if)#ipv6 address 2001:DB8:ACAD:3000::1/64
R3(config-if)#no shut
*Dec 25 12:57:40.519: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0,
 changed state to up
R3(config-if)#exit
R3(config)#interface Loopback1
R3(config-if)#ip address 192.168.3.65 255.255.255.192
R3(config-if)#ipv6 address FE80::3:5 link-local
R3(config-if)#ipv6 address 2001:DB8:ACAD:3001::1/64
R3(config-if)#no shut
*Dec 25 12:57:57.135: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback1,
 changed state to up
R3(config-if)#exit
R3(config)#interface g2/0
R3(config-if)#ip address 10.2.3.3 255.255.255.0
R3(config-if)#negotiation auto
```

```
R3
R3(config-if)#ip address 10.2.3.3 255.255.255.0
R3(config-if)#negotiation auto
R3(config-if)#ipv6 address FE80::3:1 link-local
R3(config-if)#ipv6 address 2001:DB8:ACAD:1023::3/64
R3(config-if)#no shut
R3(config-if)#exi
*Dec 25 13:01:37.139: %LINK-3-UPDOWN: Interface GigabitEthernet2/0, changed stat
e to up
*Dec 25 13:01:38.139: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEth
ernet2/0, changed state to up
R3(config-if)#exit
R3(config)#interface Serial1/0
R3(config-if)#ip address 10.1.3.3 255.255.255.128
R3(config-if)#ipv6 address FE80::3:2 link-local
R3(config-if)# ipv6 address 2001:DB8:ACAD:1013::3/64
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#
*Dec 25 13:01:59.195: %LINK-3-UPDOWN: Interface Serial1/0, changed state to up
R3(config)#
*Dec 25 13:02:00.203: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/0,
 changed state to up
R3(config)#interface Serial1/1
R3(config-if)#ip address 10.1.3.130 255.255.255.128
R3(config-if)#ipv6 address FE80::3:3 link-local
R3(config-if)#ipv6 address 2001:DB8:ACAD:1014::3/64
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#
*Dec 25 13:02:20.439: %LINK-3-UPDOWN: Interface Serial1/1, changed state to up
R3(config)#
*Dec 25 13:02:21.447: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1,
```

```
R3
R3#sh ip int bri
Interface                  IP-Address      OK? Method Stat
FastEthernet0/0            unassigned      YES unset  admi
Serial1/0                  10.1.3.3        YES manual up
Serial1/1                  10.1.3.130      YES manual up
Serial1/2                  unassigned      YES unset  admi
Serial1/3                  unassigned      YES unset  admi
GigabitEthernet2/0         10.2.3.3        YES manual up
FastEthernet3/0            unassigned      YES unset  admi
FastEthernet3/1            unassigned      YES unset  admi
Loopback0                  192.168.3.1     YES manual up
Loopback1                  192.168.3.65    YES manual up
R3#
```

b. Save the running configuration to startup-config.

Part 2: Configure MP-BGP on all Routers

Step 1: Implement eBGP and neighbor relationships on R1 for IPv4 and IPv6.

a. Enable IPv6 routing.

R1(config)# **ipv6 unicast-routing**

b. Enter BGP configuration mode from global configuration mode, specifying AS 1000 and configure the router ID.

R1(config)# **router bgp 1000**

R1(config-router)# **bgp router-id 1.1.1.1**

c. Based on the topology diagram, configure all the designated IPv4 neighbors for R1.

R1(config-router)# **neighbor 10.1.2.2 remote-as 500** R1(config-router)# **neighbor 10.1.3.3 remote-as 300**

R1(config-router)# **neighbor 10.1.3.130 remote-as 300**

d. Based on the topology diagram, configure all the designated IPv6 neighbors for R1.

R1(config-router)# **neighbor 2001:db8:acad:1012::2 remote-as 500**
R1(config-router)# **neighbor 2001:db8:acad:1013::3 remote-as 300**

R1(config-router)# **neighbor 2001:db8:acad:1014::3 remote-as 300**

e. Enter address family configuration mode for IPv4 and activate each of the IPv4 neighbors. R1(config-router)# **address-family ipv4 unicast**

R1(config-router-af)# **neighbor 10.1.2.2 activate**

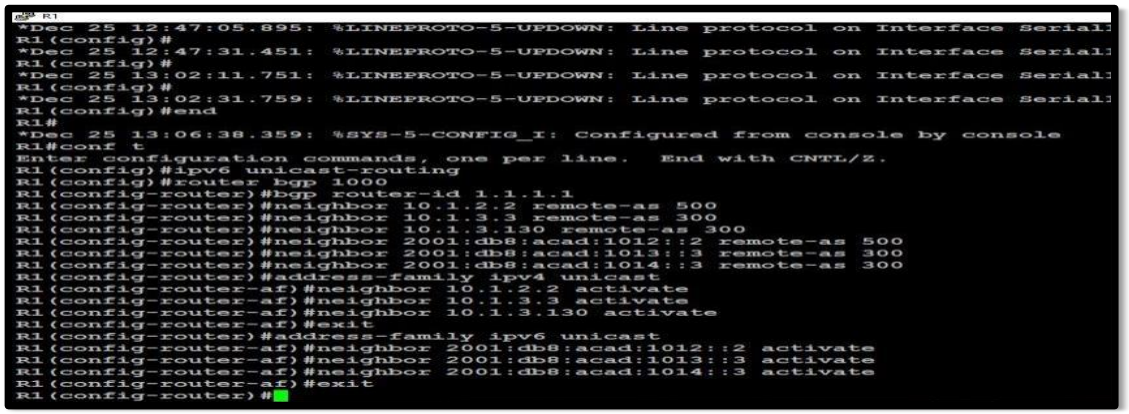
R1(config-router-af)# **neighbor 10.1.3.3 activate**

R1(config-router-af)# **neighbor 10.1.3.130 activate**

R1(config-router-af)# **exit**

f. Enter address family configuration mode for IPv6 and activate each of the IPv6 neighbors.

R1(config-router)# **address-family ipv6 unicast** R1(config-router-af)# **neighbor 2001:db8:acad:1012::2 activate**
R1(config-router-af)# **neighbor 2001:db8:acad:1013::3 activate**
R1(config-router-af)# **neighbor 2001:db8:acad:1014::3 activate**
R1(config-router-af)# **exit**



Step 2: Implement eBGP and neighbor relationships on R2 for IPv4 and IPv6.

a. Enable IPv6 routing.

R2(config)# **ipv6 unicast-routing**

b. Enter BGP configuration mode from global configuration mode, specifying AS 500 and configure the router ID.

R2(config)# **router bgp 500**

R2(config-router)# **bgp router-id 2.2.2.2**

c. Based on the topology diagram, configure all the designated IPv4 neighbors for R1.

R2(config-router)# **neighbor 10.1.2.1 remote-as 1000**
R2(config-router)# **neighbor 10.2.3.3 remote-as 300**

d. Based on the topology diagram, configure all the designated IPv6 neighbors for R1.

R2(config-router)# **neighbor 2001:db8:acad:1012::1 remote-as 1000**
R2(config-router)# **neighbor 2001:db8:acad:1023::3 remote-as 300**

e. Enter address family configuration mode for IPv4 and activate each of the IPv4 neighbors.

R2(config-router)# **address-family ipv4 unicast** R2(config-router-af)# **neighbor 10.1.2.1 activate**

R2(config-router-af)# **neighbor 10.2.3.3 activate**

R2(config-router-af)# **exit**

f. Enter address family configuration mode for IPv6 and activate each of the IPv6 neighbors.

R2(config-router)# **address-family ipv6 unicast** R2(config-router-af)# **neighbor 2001:db8:acad:1012::1 activate**
R2(config-router-af)# **neighbor 2001:db8:acad:1023::3 activate**
R2(config -router-af)# **exit**

```
R2
R2(config-if)#ipv6 address FE80::2:2 link-local
R2(config-if)# ipv6 address 2001:DB8:ACAD:1023::2/64
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#
*Dec 25 12:53:43.047: %LINK-3-UPDOWN: Interface GigabitEthernet3/0, changed stat
e to up
*Dec 25 12:53:44.047: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEth
ernet3/0, changed state to up
R2(config)#end
R2#
*Dec 25 13:06:42.779: %SYS-5-CONFIG_I: Configured from console by console
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ipv6 unicast-routing
R2(config)#router bgp 500
R2(config-router)#bgp router-id 2.2.2.2
R2(config-router)#neighbor 10.1.2.1 remote-as 1000
R2(config-router)#neighbor 10.2.3.3 remote-as 300
R2(config-router)#neighbor 2001:db8:acad:1012::1 remote-as 1000
R2(config-router)#neighbor 2001:db8:acad:1023::3 remote-as 300
R2(config-router)#address-family ipv4 unicast
R2(config-router-af)#neighbor 10.1.2.1 activate
R2(config-router-af)#neighbor 10.2.3.3 activate
R2(config-router-af)#exit
R2(config-router)#address-family ipv6 unicast
R2(config-router-af)#neighbor 2001:db8:acad:1012::1 activate
R2(config-router-af)#neighbor 2001:db8:acad:1023::3 activate
R2(config-router-af)#exit
R2(config-router)#
*Dec 25 13:21:45.115: %BGP-5-ADJCHANGE: neighbor 2001:DB8:ACAD:1012::1 Up
R2(config-router)#
```

Step 3: Implement eBGP and neighbor relationships on R3 for IPv4 and IPv6.

a. Enable IPv6 routing.

R3(config)# **ipv6 unicast-routing**

b. Enter BGP configuration mode from global configuration mode, specifying AS 300 and configure the router ID.

R3(config)# **router bgp 300**

R3(config-router)# **bgp router-id 3.3.3.3**

c. Based on the topology diagram, configure all the designated IPv4 neighbors for R1. R3(config-router)# **neighbor 10.2.3.2 remote-as 500**

R3(config-router)# **neighbor 10.1.3.1 remote-as 1000**

R3(config-router)# **neighbor 10.1.3.129 remote-as 1000**

d. Based on the topology diagram, configure all the designated IPv6 neighbors for R1.

R3(config-router)# **neighbor 2001:db8:acad:1023::2 remote-as 500**

R3(config-router)# **neighbor 2001:db8:acad:1013::1 remote-as 1000**

R3(config-router)# **neighbor 2001:db8:acad:1014::1 remote-as 1000**

e. Enter address family configuration mode for IPv4 and activate each of the IPv4 neighbors.

R3(config-router)# **address-family ipv4 unicast**

R3(config-router-af)# **neighbor 10.1.3.1 activate**

R3(config-router-af)# **neighbor 10.1.3.129 activate**

R3(config-router-af)# **neighbor 10.2.3.2 activate**

R3(config-router-af)# **exit**

f. Enter address family configuration mode for IPv6 and activate each of the IPv6 neighbors.

R3(config-router)# **address-family ipv6 unicast** R3(config-router-af)# **neighbor 2001:db8:acad:1023::2 activate**
R3(config-router-af)# **neighbor 2001:db8:acad:1013::1 activate**
R3(config-router-af)# **neighbor 2001:db8:acad:1014::1 activate**
R3(config-router-af)# **exit**

```
R3
FastEthernet3/0            unassigned      YES unset  administratively down down
FastEthernet3/1            unassigned      YES unset  administratively down down
Loopback0                  192.168.3.1     YES manual up                    up
Loopback1                  192.168.3.65    YES manual up                    up
R3#
R3#
R3#
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#ipv6 unicast-routing
R3(config)#router bgp 300
R3(config-router)#bgp router-id 3.3.3.3
R3(config-router)#neighbor 10.1.3.1 remote-as 1000
R3(config-router)#neighbor 10.1.3.129 remote-as 1000
R3(config-router)#neighbor 2001:db8:acad:1023::2 remote-as 500
R3(config-router)#neighbor 2001:db8:acad:1013::1 remote-as 1000
R3(config-router)#neighbor 2001:db8:acad:1014::1 remote-as 1000
R3(config-router)#address-family ipv4 unicast
R3(config-router-af)#neighbor 10.1.3.1 activate
R3(config-router-af)#neighbor 10.1.3.129 activate
R3(config-router-af)#neighbor 10.2.3.2 activate
% Specify remote-as or peer-group commands first
R3(config-router-af)#exit
R3(config-router)#address-family ipv6 unicast
R3(config-router-af)#neighbor 2001:db8:acad:1023::2 activate
R3(config-router-af)#neighbor 2001:db8:acad:1013::1 activate
R3(config-router-af)#neighbor 2001:db8:acad:1014::1 activate
R3(config-router-af)#exit
R3(config-router)#
R3(config-router)#
*Dec 25 13:25:50.155: %BGP-5-ADJCHANGE: neighbor 2001:DB8:ACAD:1023::2 Up
R3(config-router)#
```

Step 4: Advertise IPv4 and IPv6 prefixes on R1.

a. Enter address family configuration mode for IPv4 and advertise the IPv4 prefixes.

R1(config-router)# **address-family ipv4 unicast**
R1(config-router-af)# **network 192.168.1.0 mask 255.255.255.224**
R1(config-router-af)# **network 192.168.1.64 mask 255.255.255.192**
R1(config -router-af)# **exit**

```
R1
R1(config-router)#
*Dec 25 13:26:17.195: %BGP-5-ADJCHANGE: neighbor 2001:DB8:ACAD:1013::3 Up
R1(config-router)#address-family ipv4 unicast
R1(config-router-af)#network 192.168.1.0 mask 255.255.255.224
R1(config-router-af)#network 192.168.1.64 mask 255.255.255.192
R1(config-router-af)#exit
```

b. Enter address family configuration mode for IPv6 and advertise the IPv6 prefixes.

R1(config-router)# **address-family ipv6 unicast**
R1(config-router-af)# **network 2001:db8:acad:1000::/64**
R1(config-router-af)# **network 2001:db8:acad:1001::/64**
R1(config-router-af)# **exit**

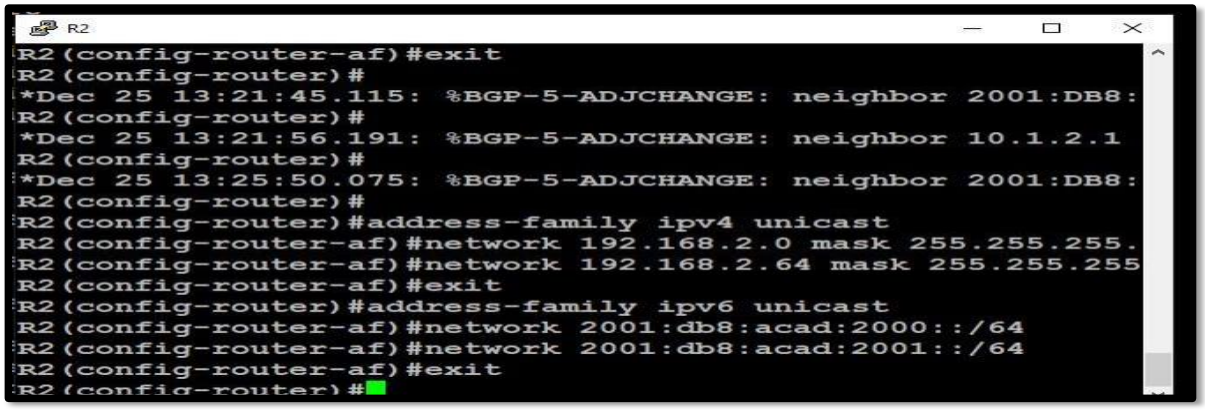
```
R1
R1(config-router)#address-family ipv6 unicast
R1(config-router-af)#network 2001:db8:acad:1000::/64
R1(config-router-af)#network 2001:db8:acad:1001::/64
R1(config-router-af)#exit
R1(config-router)#
```

Step 5: Advertise IPv4 and IPv6 prefixes on R2.

a. Enter address family configuration mode for IPv4 and advertise the IPv4 prefixes.

R2(config-router)# **address-family ipv4 unicast**
R2(config-router-af)# **network 192.168.2.0 mask 255.255.255.224**
R2(config-router-af)# **network 192.168.2.64 mask 255.255.255.192**
R2(config-router-af)# **exit**

b. Enter address family configuration mode for IPv6 and advertise the IPv6 prefixes. R2(config-router)# **address-family ipv6 unicast**
R2(config-router-af)# **network 2001:db8:acad:2000::/64**
R2(config-router-af)# **network 2001:db8:acad:2001::/64** R2(config-router-af)# **exit**



Step 6: Advertise IPv4 and IPv6 prefixes on R3.

a. Enter address family configuration mode for IPv4 and advertise the IPv4 prefixes.

R3(config-router)# **address-family ipv4 unicast**

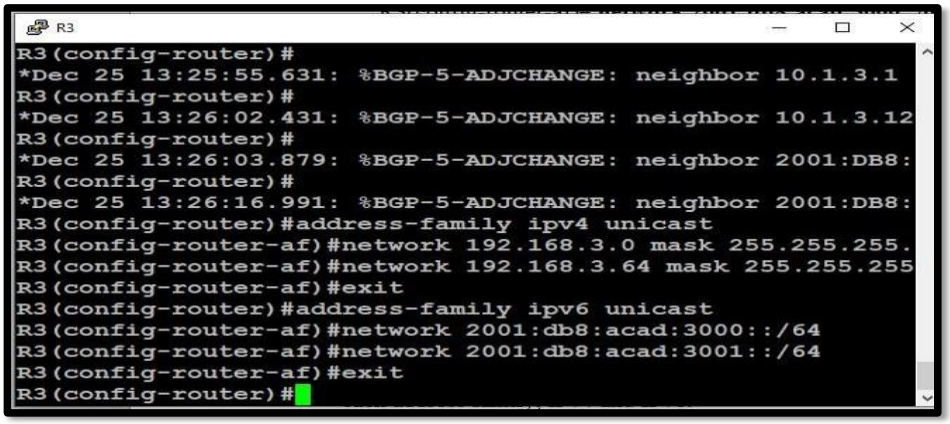
R3(config-router-af)# **network 192.168.3.0 mask 255.255.255.224** R3(config-router-af)# **network 192.168.3.64 mask 255.255.255.192**

R3(config-router-af)# **exit**

b. Enter address family configuration mode for IPv6 and advertise the IPv6 prefixes. R3(config-router)# **address-family ipv6 unicast**

R3(config-router-af)# **network 2001:db8:acad:3000::/64**

R3(config-router-af)# **network 2001:db8:acad:3001::/64** R3(config-router-af)# **exit**



Part 3: Verify MP-BGP

Step 1: Display detailed neighbor adjacency information.

Use the **show bgp all neighbors** command on R2 to display detailed information about BGP connections to neighbors for all (IPv4 and IPv6) address families. Each neighbor shows that it is in the "Established" state. This indicates that the router can send and receive BGP messages. R2 has two neighbor addresses, R1 and R3, for each address family, IPv4 and IPv6.

R2# **show bgp all neighbors**

```
R2
R2(config-router-af)#exit
R2(config-router)#exit
R2(config)#exit
R2#
*Dec 25 13:40:18.339: %SYS-5-CONFIG_I: Configured from con
sole by console
R2#show bgp all neighbors
For address family: IPv4 Unicast
BGP neighbor is 10.1.2.1,  remote AS 1000, external link
  BGP version 4, remote router ID 1.1.1.1
  BGP state = Established, up for 00:18:26
  Last read 00:00:52, last write 00:00:52, hold time is 18
0, keepalive interval is 60 seconds
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    New ASN Capability: advertised and received
    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:                5          5
    Keepalives:            16         16
    Route Refresh:          0          0
    Total:                 22         22
  Default minimum time between advertisement runs is 30 se
conds

 --More--
```

Step 2: Display summary neighbor adjacency information.

R2# **show bgp ipv4 unicast summary**

```
R2#show bgp ipv4 unicast summary
BGP router identifier 2.2.2.2, local AS number 500
BGP table version is 7, main routing table version 7
6 network entries using 792 bytes of memory
14 path entries using 728 bytes of memory
6/3 BGP path/bestpath attribute entries using 1008 bytes of memory
4 BGP AS-PATH entries using 96 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 1 (at peak 1) using 32 bytes of memory
BGP using 2656 total bytes of memory
BGP activity 12/0 prefixes, 24/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.1.2.1        4         1000      25      25        7    0    0 00:20:36        4
10.2.3.3        4          300       0       0        0    0    0 never    Active
2001:DB8:ACAD:1012::1
                4         1000      28      28        7    0    0 00:20:47        4
2001:DB8:ACAD:1023::3
                4          300      25      25        7    0    0 00:16:42        4
R2#
```

R2# **show bgp ipv6 unicast summary**

```
R2#show bgp ipv6 unicast summary
BGP router identifier 2.2.2.2, local AS number 500
BGP table version is 7, main routing table version 7
6 network entries using 936 bytes of memory
10 path entries using 760 bytes of memory
6/3 BGP path/bestpath attribute entries using 1008 bytes of memory
4 BGP AS-PATH entries using 96 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 1 (at peak 1) using 32 bytes of memory
BGP using 2832 total bytes of memory
BGP activity 12/0 prefixes, 24/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:DB8:ACAD:1012::1
                4         1000      28      28        7    0    0 00:21:43        4
2001:DB8:ACAD:1023::3
                4          300      26      25        7    0    0 00:17:38        4
R2#
```

The local AS is the AS that this router belongs to. The AS in the list of BGP neighbors is the AS of the remote neighbor.

Step 3: Verify BGP tables for IPv4 and IPv6.

a. Use the **show bgp ipv4 unicast** command on R2 to display its IPv4 BGP table. This command is equivalent to the **show ip bgp** command and either command can be used. Notice that R1 shows six IPv4 networks in its IPv4 BGP table. Each network is valid "*" and has one path which is the best path ">". Amongst other information, the next hop IPv4 address and the AS path are included.

R2# **show bgp ipv4 unicast**

```
R2#show bgp ipv4 unicast
BGP table version is 7, 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
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  192.168.1.0/27   32.1.13.184                           0 300 1000 i
*                   32.1.13.184                0          0 1000 i
*>                  10.1.2.1                   0          0 1000 i
*  192.168.1.64/26  32.1.13.184                           0 300 1000 i
*                   32.1.13.184                0          0 1000 i
*>                  10.1.2.1                   0          0 1000 i
*> 192.168.2.0/27   0.0.0.0                     0      32768 i
*> 192.168.2.64/26  0.0.0.0                     0      32768 i
*  192.168.3.0/27   32.1.13.184                           0 1000 300 i
*>                  10.1.2.1                               0 1000 300 i
*                   32.1.13.184                0          0 300 i
*  192.168.3.64/26  32.1.13.184                           0 1000 300 i
*>                  10.1.2.1                               0 1000 300 i
*                   32.1.13.184                0          0 300 i
R2#
```

b. Use the **show bgp ipv6 unicast** command on R2 to display similar information for its IPv6 BGP table.

R2# **show bgp ipv6 unicast**

```
R2#show bgp ipv6 unicast
BGP table version is 7, 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
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  2001:DB8:ACAD:1000::/64
                    2001:DB8:ACAD:1023::3
                                                           0 300 1000 i
*>                  2001:DB8:ACAD:1012::1
                                               0           0 1000 i
*  2001:DB8:ACAD:1001::/64
                    2001:DB8:ACAD:1023::3
                                                           0 300 1000 i
*>                  2001:DB8:ACAD:1012::1
                                               0           0 1000 i
*> 2001:DB8:ACAD:2000::/64
                    ::                         0       32768 i
*> 2001:DB8:ACAD:2001::/64
                    ::                         0       32768 i
*  2001:DB8:ACAD:3000::/64
                    2001:DB8:ACAD:1012::1
                                                           0 1000 300 i
 --More--
```

Step 4: Viewing explicit routes and path attributes.

a. Use the **show bgp ipv4 unicast** *ipv4-prefix subnet-mask* command on R2 to display all the paths for a specific route and BGP path attributes for that route. R2# **show bgp ipv4 unicast 192.168.1.0 255.255.255.224**

```
R2#show bgp ipv4 unicast 192.168.1.0 255.255.255.224
BGP routing table entry for 192.168.1.0/27, version 2
Paths: (3 available, best #3, table Default-IP-Routing-Table)
  Advertised to update-groups:
        2
  300 1000
    32.1.13.184 (inaccessible) from 2001:DB8:ACAD:1023::3 (3.3.3.3)
      Origin IGP, localpref 100, valid, external
  1000
    32.1.13.184 (inaccessible) from 2001:DB8:ACAD:1012::1 (1.1.1.1)
      Origin IGP, metric 0, localpref 100, valid, external
  1000
    10.1.2.1 from 10.1.2.1 (1.1.1.1)
      Origin IGP, metric 0, localpref 100, valid, external, best
R2#
```

R2# **show bgp ipv6 unicast 2001:db8:acad:1000::/64**

```
*> 2001:DB8:ACAD:2001::/64
                    ::                         0       32768 i
*  2001:DB8:ACAD:3000::/64
                    2001:DB8:ACAD:1012::1
                                                           0 1000 300 i

R2#show bgp ipv4 unicast 192.168.1.0 255.255.255.224
BGP routing table entry for 192.168.1.0/27, version 2
Paths: (3 available, best #3, table Default-IP-Routing-Table)
  Advertised to update-groups:
        2
  300 1000
    32.1.13.184 (inaccessible) from 2001:DB8:ACAD:1023::3 (3.3.3.3)
      Origin IGP, localpref 100, valid, external
  1000
    32.1.13.184 (inaccessible) from 2001:DB8:ACAD:1012::1 (1.1.1.1)
      Origin IGP, metric 0, localpref 100, valid, external
  1000
    10.1.2.1 from 10.1.2.1 (1.1.1.1)
      Origin IGP, metric 0, localpref 100, valid, external, best
R2#show bgp ipv6 unicast 2001:db8:acad:1000::/64
BGP routing table entry for 2001:DB8:ACAD:1000::/64, version 2
Paths: (2 available, best #2, table Default)
  Advertised to update-groups:
        2
  300 1000
    2001:DB8:ACAD:1023::3 (FE80::3:1) from 2001:DB8:ACAD:1023::3 (3.3.3.3)
      Origin IGP, localpref 100, valid, external
  1000
    2001:DB8:ACAD:1012::1 (FE80::1:1) from 2001:DB8:ACAD:1012::1 (1.1.1.1)
      Origin IGP, metric 0, localpref 100, valid, external, best
R2#
```

b. Use the **show bgp ipv4 unicast neighbors** *ipv4-prefix* **advertised-routes** command on R2 to display IPv4 routes advertised to a specific neighbor.

R2# **show bgp ipv4 unicast neighbors 10.1.2.1 advertised-routes**

```
R2#show bgp ipv4 unicast neighbors 10.1.2.1 advertised-routes
BGP table version is 7, 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
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 192.168.1.0/27   10.1.2.1                 0             0 1000 i
*> 192.168.1.64/26  10.1.2.1                 0             0 1000 i
*> 192.168.2.0/27   0.0.0.0                  0         32768 i
*> 192.168.2.64/26  0.0.0.0                  0         32768 i
*> 192.168.3.0/27   10.1.2.1                               0 1000 300 i
*> 192.168.3.64/26  10.1.2.1                               0 1000 300 i

Total number of prefixes 6
R2#
```

c. Use the **show bgp ipv6 unicast** *ipv5-prefix prefix-length* command to display similar information for IPv6 advertised routes.

R2# **show bgp ipv6 unicast neighbors 2001:db8:acad:1012::1 advertised- routes**

```
R2#show bgp ipv6 unicast neighbors 2001:db8:acad:1012::1 advertised-routes
BGP table version is 7, 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
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 2001:DB8:ACAD:1000::/64
                    2001:DB8:ACAD:1012::1
                                             0             0 1000 i
*> 2001:DB8:ACAD:1001::/64
                    2001:DB8:ACAD:1012::1
                                             0             0 1000 i
*> 2001:DB8:ACAD:2000::/64
                    ::                       0         32768 i
*> 2001:DB8:ACAD:2001::/64
                    ::                       0         32768 i
*> 2001:DB8:ACAD:3000::/64
                    2001:DB8:ACAD:1023::3
                                             0             0 300 i
*> 2001:DB8:ACAD:3001::/64
                    2001:DB8:ACAD:1023::3
                                             0             0 300 i

 --More--
```

Step 5: Verifying the IP routing tables for IPv4 and IPv6.

a. By examining the IPv4 and IPv6 routing tables on R2, you can verify that BGP is receiving the IPv4 and IPv6 prefixes from R1 and R3. R2# **show ip route bgp | begin Gateway**

Part 4: Configure and Verify IPv6 Route Summarization

Summarizing prefixes conserves router resources and accelerates best-path calculation by reducing the size of the table. Summarization can be configured either for prefixes originated by the AS or prefixes received from downstream providers. Summarization also provides the benefits of stability by hiding flapping routes or having to install new prefixes when they are contained within a summary.

a. Verify R2 and R3 are receiving 2001:db8:acad:1000::/64 and 2001:db8:acad:1001::/64 from R1.

R2# **show ipv6 route bgp | section 2001**

```
R2#
R2#show ip route bgp | begin Gateway
R2#
R2#show ipv6 route bgp | section 2001
B    2001:DB8:ACAD:1000::/64 [20/0]
     via FE80::1:1, GigabitEthernet2/0
B    2001:DB8:ACAD:1001::/64 [20/0]
     via FE80::1:1, GigabitEthernet2/0
B    2001:DB8:ACAD:3000::/64 [20/0]
     via FE80::3:1, GigabitEthernet3/0
B    2001:DB8:ACAD:3001::/64 [20/0]
     via FE80::3:1, GigabitEthernet3/0
R2#
```

b. Although AS 1000 only has two IPv6 prefixes - 2001:db8:acad:1000::/64 and 2001:db8:acad:1001::/64, this customer has been allocated the entire 2001:db8:acad:1000::/52 prefix (2001:db8:acad:1xxx).

R1(config)# **router bgp 1000**

R1(config-router)# **address-family ipv6 unicast**

R1(config-router-af)# **aggregate-address 2001:db8:acad:1000::/52 summary- only**

```
R1(config-router)#
R1(config-router)#exit
R1(config)#router bgp 1000
R1(config-router)#address-family ipv6 unicast
R1(config-router-af)#aggregate-address 2001:db8:acad:1000:
R1(config-router-af)#
```

c. Verify that R2 and R3 are now receiving the aggregate route and installing it in the IPv6 BGP table.

R2# **show bgp ipv6 unicast | begin Network**

```
R2#show  bgp ipv6 unicast | begin Network
   Network          Next Hop            Metric LocPrf Weight Path
*  2001:DB8:ACAD:1000::/52
                    2001:DB8:ACAD:1023::3
                                                   0 300 1000 i
*>                  2001:DB8:ACAD:1012::1
                                         0         0 1000 i
*> 2001:DB8:ACAD:2000::/64
                    ::                   0     32768 i
*> 2001:DB8:ACAD:2001::/64
                    ::                   0     32768 i
*  2001:DB8:ACAD:3000::/64
                    2001:DB8:ACAD:1012::1
                                                   0 1000 300 i
*>                  2001:DB8:ACAD:1023::3
                                         0         0 300 i
*  2001:DB8:ACAD:3001::/64
                    2001:DB8:ACAD:1012::1
                                                   0 1000 300 i
*>                  2001:DB8:ACAD:1023::3
                                         0         0 300 i
```

R3# **show bgp ipv6 unicast | begin Network**

```
R3#show bgp ipv6 unicast | begin Network
*Dec 25 13:49:42.123: %SYS-5-CONFIG_I: Configured from console by console
R3#show bgp ipv6 unicast | begin Network
   Network          Next Hop            Metric LocPrf Weight Path
*  2001:DB8:ACAD:1000::/52
                    2001:DB8:ACAD:1023::2
                                                   0 500 1000 i
*                   2001:DB8:ACAD:1014::1
                                         0         0 1000 i
*>                  2001:DB8:ACAD:1013::1
                                         0         0 1000 i
*  2001:DB8:ACAD:2000::/64
                    2001:DB8:ACAD:1014::1
                                                   0 1000 500 i
*                   2001:DB8:ACAD:1013::1
                                                   0 1000 500 i
*>                  2001:DB8:ACAD:1023::2
                                         0         0 500 i
*  2001:DB8:ACAD:2001::/64
                    2001:DB8:ACAD:1014::1
                                                   0 1000 500 i
*                   2001:DB8:ACAD:1013::1
                                                   0 1000 500 i
*>                  2001:DB8:ACAD:1023::2
                                         0         0 500 i
*> 2001:DB8:ACAD:3000::/64
 --More--
```

d. Verify that R2 and R3 are now receiving the aggregate route and it is installed in the IPv6 routing table.

R2# **show ipv6 route bgp | section 2001**

Router Interface Summary Table

Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
4221	Gigabit Ethernet 0/0/0 (G0/0/0)	Gigabit Ethernet 0/0/1 (G0/0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
4300	Gigabit Ethernet 0/0/0 (G0/0/0)	Gigabit Ethernet 0/0/1 (G0/0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)