Kk;

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BGP 3 Modifiers and IPv6 Lab

**Purpose:**

The purpose of this lab was to expand our knowledge of BGP with the use of iBGP. Our previous hands-on lab was configuring a BGP connection connecting different groups of internal routing protocols like OSPF, RIP, and EIGRP. It also taught us a common use of iBGP and made us learn how to configure it and how its use case differs from BGP and IGPs.

**Background Information on lab concepts:**

* **­iBGP**
  + **What**:
    - In the previous labs we explained what BGP was and how it functions but iBGP differs in some ways. If BGP is the USPS we can think of iBGP as a city’s postal service. When the mail gets to your city (our AS), every driver (the routers) knows every route to get to the destination within the city. This lets them get to the destination as efficiently as possible depending on if there’s traffic on another route. iBGP can do this because it routes within the same Autonomous System area instead of across separate AS. This means that it can know every route in their AS and not every route on the Internet which would take too much processing power to look through every time traffic comes in. Another difference is how configurable it is over BGP. It also allows differing configurations in different AS areas which change how data is routed internally. Each AS can configure different BGP modifiers for how that AS wants to handle data.
  + **Why use**
    - Technically you could not use iBGP and use IGP protocols. at all One reason to use iBGP over IGP protocols like OPSF or EIGRP is its scalability and redundancy. BGP can handle many more routes than IGP protocols because it doesn’t carry the entire internet in a routing table like an IGP would. Imagine that you're receiving 900,000 routes through the internet to process, an IGP wouldn’t be able to handle that because it’s not designed to. iBGP is designed to process these routes accompanied by BGP. This is why it is commonly used by ISPs with BGP between ISPs to connect to the Internet. It is also better than IGPs with its greater Enforce boundaries capability due to BGP having more ways to filter peers than IGPs (for controlling what you advertise and receive). It is full mesh which helps with redundancy in a network.
* **IGP:** 
  + Interior gateway protocols like EIGRP, OSPF, or RIP are dynamic routing protocols within a network. They do this using a TCP/IP model meaning that they use IP addresses to figure out and exchange routes to other routers. These protocols aim to always have their routing tables up to date to allow efficiency on the network they’re in. This process is called convergence. Another benefit is its scalability over using static routes to have data be transmitted which would be required if not using an IGP.

**Lab Summary:**

First, we analyzed our instructor’s diagram of the iBGP setup he drew as a starting guide and realized we configured something very closely related to our BGP configuration. From there we went into packet tracer and rearranged the routers’ position and Ip schemes to set up for iBGP. After configuring that we went straight to the physical routers since we knew iBGP did not function in our version of packet tracer. We finished the lab with relative ease because we had configured it partially in our previous lab and copied much of the configuration with different IPs AS numbers. Our problems gave us a little trouble, but we could solve them within a day with some research and isolation of what the problems could be. We showed multiple ways to confirm iBGP routes with the use of a packet sniffer and show commands.

**Lab Commands:**

**Router:**

Show ip bgp – shows the IP routes given by BGP.

Router bgp [AS number] – enters BGP configuration with a certain autonomous system ID.

Neighbor [x.x.x.x] (address of directly connected neighbor) remote-as [as number of neighbor] – enables BGP connection between routers.

Network [x.x.x.x] mask [x.x.x.x] – advertises that network over BGP.

Address-family ipv4 – if you have address-family ipv6 you must also use this command to reenable ipv4

Neighbor [x.x.x.x] activate – activates a neighbor that has already been defined with neighbor [x.x.x.x] remote-as [x].

Network [x.x.x.x] mask [x.x.x.x] – advertises ipv4 address.

Redistribute [ospf x/eigrp x/rip] – converts routes learned from these protocols to bgp routes to advertise.

Redistribute [ospf x/eigrp x/rip] match external – converts externally learned routes from these protocols to bgp routes to advertise.

Router ospf [process id] – lets us configure ospf on a certain process id.

Network [network address] [wild card mask] area [area id] -advertises what Ip addresses are connected to the router.

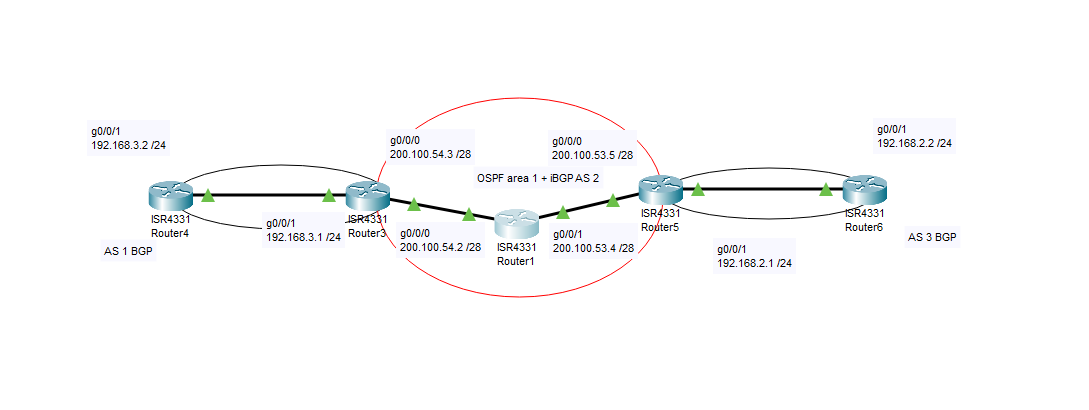
Redistribute [bgp] [AS] – converts BGP routes into OSPF routes.

**Switch:**

Monitor session [x] [source] [interface] – Captures all traffic received from the source interface using the SPAN session of X number.

Monitor session [x] [destination] [face] – sends all captured traffic to the destination interface using the SPAN session of X number.

**Network Diagram with IP’s:**



**Configurations:**

**R1 Running Config:**

Current configuration : 2687 bytes

Last configuration change at 18:53:07 UTC Thu Feb 1 2024

version 16.7

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

platform qfp utilization monitor load 80

no platform punt-keepalive disable-kernel-core

hostname R1

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

enable secret 5 $1$5EPE$BHxcalPC4gbd0IxRDOQNO.

no aaa new-model

no ip domain lookup

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO220523GF

license boot level appxk9

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 1.1.1.1 255.255.255.0

interface GigabitEthernet0/0/0

ip address 200.100.54.2 255.255.255.240

negotiation auto

interface GigabitEthernet0/0/1

ip address 200.100.53.4 255.255.255.240

negotiation auto

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

interface GigabitEthernet0/2/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/2/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

network 1.1.1.0 0.0.0.255 area 1

network 3.3.3.0 0.0.0.255 area 1

network 5.5.5.0 0.0.0.255 area 1

network 200.100.53.0 0.0.0.15 area 1

network 200.100.54.0 0.0.0.15 area 1

router bgp 2

bgp log-neighbor-changes

neighbor 3.3.3.3 remote-as 2

neighbor 3.3.3.3 update-source Loopback0

neighbor 5.5.5.5 remote-as 2

neighbor 5.5.5.5 update-source Loopback0

address-family ipv4

network 1.1.1.0 mask 255.255.255.0

network 3.3.3.0 mask 255.255.255.0

network 5.5.5.0 mask 255.255.255.0

network 200.100.53.0 mask 255.255.255.240

network 200.100.54.0 mask 255.255.255.240

redistribute ospf 1

neighbor 3.3.3.3 activate

neighbor 5.5.5.5 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

banner motd ^Cno unauthorized access^C

line con 0

password 7 13061E010803

logging synchronous

login

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

password 7 060506324F4149

login

line vty 5 15

password 7 060506324F4149

login

wsma agent exec

wsma agent config

wsma agent filesys

wsma agent notify

end

**R1 Ip Routes:**

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

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 1.1.1.0/24 is directly connected, Loopback0

L 1.1.1.1/32 is directly connected, Loopback0

3.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 3.3.3.0/24 [200/0] via 3.3.3.3, 01:17:48

O 3.3.3.3/32 [110/2] via 200.100.54.3, 01:41:38, GigabitEthernet0/0/0

4.0.0.0/24 is subnetted, 1 subnets

O E2 4.4.4.0 [110/1] via 200.100.54.3, 01:33:35, GigabitEthernet0/0/0

5.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 5.5.5.0/24 [200/0] via 5.5.5.5, 01:17:48

O 5.5.5.5/32 [110/2] via 200.100.53.5, 01:23:55, GigabitEthernet0/0/1

6.0.0.0/24 is subnetted, 1 subnets

O E2 6.6.6.0 [110/1] via 200.100.53.5, 01:17:48, GigabitEthernet0/0/1

O 192.168.2.0/24 [110/2] via 200.100.53.5, 01:23:55, GigabitEthernet0/0/1

O 192.168.3.0/24 [110/2] via 200.100.54.3, 01:41:38, GigabitEthernet0/0/0

200.100.53.0/24 is variably subnetted, 2 subnets, 2 masks

C 200.100.53.0/28 is directly connected, GigabitEthernet0/0/1

L 200.100.53.4/32 is directly connected, GigabitEthernet0/0/1

200.100.54.0/24 is variably subnetted, 2 subnets, 2 masks

C 200.100.54.0/28 is directly connected, GigabitEthernet0/0/0

L 200.100.54.2/32 is directly connected, GigabitEthernet0/0/0

**R1 BGP routes:**

Network Next Hop Metric LocPrf Weight Path

\*> 1.1.1.0/24 0.0.0.0 0 32768 i

\*>i 3.3.3.0/24 3.3.3.3 0 100 0 i

\*> 3.3.3.3/32 200.100.54.3 2 32768 ?

r>i 4.4.4.0/24 192.168.3.2 0 100 0 1 i

\*>i 5.5.5.0/24 5.5.5.5 0 100 0 i

**\*> 5.5.5.5/32 200.100.53.5 2 32768 ?**

**r>i 6.6.6.0/24 192.168.2.2 0 100 0 3 i**

**\* i 192.168.2.0 5.5.5.5 0 100 0 i**

**\*> 200.100.53.5 2 32768 ?**

**\*> 192.168.3.0 200.100.54.3 2 32768 ?**

**\* i 3.3.3.3 0 100 0 i**

**\* i 200.100.53.0/28 5.5.5.5 0 100 0 i**

**\*> 0.0.0.0 0 32768 i**

**Network Next Hop Metric LocPrf Weight Path**

**\*> 200.100.54.0/28 0.0.0.0 0 32768 i**

**\* i 3.3.3.3 0 100 0 i**

**R3 Running config:**

Current configuration : 4926 bytes

Last configuration change at 18:43:56 UTC Thu Feb 1 2024

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R3

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

enable secret 5 $1$qNGB$26XTLIoGcGM91.2ebATaE0

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-2557841031

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-2557841031

revocation-check none

rsakeypair TP-self-signed-2557841031

crypto pki certificate chain TP-self-signed-2557841031

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 32353537 38343130 3331301E 170D3234 30323031 31383030

32315A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 35353738

34313033 31308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100B4DC 1CB26A5A 47033FB0 D05320D2 B76CA79B E30F968E 33F09120

28BA988D 52284A2F D40F48F6 95E05A17 D5CECF65 A254D1A6 763FD491 CD0CB085

D3AF18CA 2E6C3CA7 904DA520 32324F9A D5523E1A 65EFA5A2 9CDD0EB3 C7C6A18B

55D0F0C3 E8EAD3B3 D11840E1 AFE21AFC 9A3ED0FF 447F2DBF 8896885B A1E6E0A3

BBD78AB6 4669D587 F10CE3F3 435A4581 AE8D31B7 15A5AA5C 17C3AF2B 99664270

D9018CD5 48CB8EBF CD5372CD 36B87BE3 2520064A 98164243 52DAEFE5 645C578D

6C9E1804 E045EADA 5B441E56 0530975B C4E9C0DE 988BA7EC 4772597D 28DF3980

244BEB25 6ED8F55C 2A345EA5 F6BC87F0 F970561C DE8C0076 A6BDBE73 F8C75F06

058207A2 4F970203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 1450E7A6 8A20EF2F 5DF47D37 7F7FA26C 47729B30

5F301D06 03551D0E 04160414 50E7A68A 20EF2F5D F47D377F 7FA26C47 729B305F

300D0609 2A864886 F70D0101 05050003 82010100 9ABC5729 C144CF22 A3A7180A

5C83E40F 35834DB8 308A1848 14BDC4CE 609AF262 4969D523 B3FB655B B9FA1146

F9754FCB 477EB36C 1CAC055C 46BF5ACF CCCA4BE3 F4B36EFA 625FAD06 7D4E9617

07BA6036 3B59DB80 F4A99035 1F0774D0 487CACED D35303F5 B4441352 5804C84E

215AE528 04D12980 FACBBC90 84AD20D4 326E733B 84DC6527 B2818B78 1E068E00

53F07311 D33AC44B C45C271D E1528786 000490DD F18B503E D5D3A2B5 7082F14B

A27B2928 2E2D04D8 8F3F37D9 E5ADC76A CE3D5D21 C75853D8 C71622D9 89D39010

64305A82 902CA706 3663501B 79FE3BEF 5124A124 7767E129 07DB4FCE E458A505

2271E592 2EB3DE0B 489117C1 1DB669AB 92EF0CBC

quit

license udi pid ISR4321/K9 sn FDO21500G1N

license boot level appxk9

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 3.3.3.3 255.255.255.0

interface GigabitEthernet0/0/0

ip address 200.100.54.3 255.255.255.240

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.3.1 255.255.255.0

negotiation auto

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

interface GigabitEthernet0/2/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/2/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

redistribute bgp 2 subnets

network 1.1.1.0 0.0.0.255 area 1

network 3.3.3.0 0.0.0.255 area 1

network 4.4.4.0 0.0.0.255 area 1

network 192.168.3.0 0.0.0.255 area 1

network 200.100.54.0 0.0.0.15 area 1

router bgp 2

bgp log-neighbor-changes

neighbor 1.1.1.1 remote-as 2

neighbor 1.1.1.1 update-source Loopback0

neighbor 4.4.4.4 remote-as 1

neighbor 192.168.3.2 remote-as 1

neighbor 200.100.54.2 remote-as 2

address-family ipv4

network 3.3.3.0 mask 255.255.255.0

network 4.4.4.0 mask 255.255.255.0

network 192.168.3.0

network 200.100.54.0 mask 255.255.255.240

redistribute ospf 1 match internal external 1 external 2

neighbor 1.1.1.1 activate

neighbor 4.4.4.4 activate

neighbor 192.168.3.2 activate

neighbor 200.100.54.2 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

banner motd ^Cno unauthorized access^C

line con 0

password 7 05080F1C2243

logging synchronous

login

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

password 7 110A1016141D4B

login

line vty 5 15

password 7 110A1016141D4B

login

end

**R3 Ip routes:**

1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 1.1.1.0/24 [200/0] via 1.1.1.1, 01:19:13

O 1.1.1.1/32 [110/2] via 200.100.54.2, 01:43:04, GigabitEthernet0/0/0

3.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 3.3.3.0/24 is directly connected, Loopback0

L 3.3.3.3/32 is directly connected, Loopback0

4.0.0.0/24 is subnetted, 1 subnets

B 4.4.4.0 [20/0] via 192.168.3.2, 01:35:01

5.0.0.0/32 is subnetted, 1 subnets

O 5.5.5.5 [110/3] via 200.100.54.2, 01:25:15, GigabitEthernet0/0/0

6.0.0.0/24 is subnetted, 1 subnets

O E2 6.6.6.0 [110/1] via 200.100.54.2, 01:19:13, GigabitEthernet0/0/0

O 192.168.2.0/24 [110/3] via 200.100.54.2, 01:25:15, GigabitEthernet0/0/0

192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.3.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.3.1/32 is directly connected, GigabitEthernet0/0/1

200.100.53.0/28 is subnetted, 1 subnets

O 200.100.53.0 [110/2] via 200.100.54.2, 01:25:20, GigabitEthernet0/0/0

200.100.54.0/24 is variably subnetted, 2 subnets, 2 masks

C 200.100.54.0/28 is directly connected, GigabitEthernet0/0/0

L 200.100.54.3/32 is directly connected, GigabitEthernet0/0/0

**R3 BGP routes:**

Network Next Hop Metric LocPrf Weight Path

\*>i 1.1.1.0/24 1.1.1.1 0 100 0 i

\*> 1.1.1.1/32 200.100.54.2 2 32768 ?

\*> 3.3.3.0/24 0.0.0.0 0 32768 i

\*> 4.4.4.0/24 192.168.3.2 0 0 1 i

\* i 5.5.5.5/32 200.100.53.5 2 100 0 ?

\*> 200.100.54.2 3 32768 ?

\*> 6.6.6.0/24 200.100.54.2 1 32768 ?

\* i 192.168.2.0 200.100.53.5 2 100 0 ?

\*> 200.100.54.2 3 32768 ?

\* 192.168.3.0 192.168.3.2 0 0 1 i

\*> 0.0.0.0 0 32768 i

\* i 200.100.53.0/28 1.1.1.1 0 100 0 i

\*> 200.100.54.2 2 32768 ?

Network Next Hop Metric LocPrf Weight Path

\* i 200.100.54.0/28 1.1.1.1 0 100 0 i

\*> 0.0.0.0 0 32768 i

**R4 running config:**

Current configuration : 4110 bytes

Last configuration change at 18:22:36 UTC Thu Feb 1 2024

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R4

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

enable secret 5 $1$8mf3$oV8zPvzJ42A/GZIa.Hsk.1

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-1457377718

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-1457377718

revocation-check none

rsakeypair TP-self-signed-1457377718

crypto pki certificate chain TP-self-signed-1457377718

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 31343537 33373737 3138301E 170D3234 30323031 31383137

34365A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D31 34353733

37373731 38308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100946B F6741C7F 8B20EA59 C8E3F252 A4524AF2 FCC6C359 07550BEF

BA907EED E2939A08 A7AA87CA CE6D110F 7F1300CF 1B9518D2 ACD175CC 4F722192

76F601C6 CDCA99C2 E4DE6136 9E323866 81BF4A0F 545F4C26 C12CCC98 BC4A26C4

C022D4B8 CF9C22D4 D5D6CC74 A2551429 A6A4E5F2 BF58B211 824E3B74 36037D2F

2A42E624 B6EE8F27 49DD5DA9 478BAFF3 BF4BC4F1 C38BFB9E CF8CD99D 0C7394D5

BD35DF99 2341B0F4 1D37B51A 53A0C22B 47A04C32 0500E1B7 A00081A7 3A24C755

B3E9A730 8C572AB7 B700C12B F5F59D5E 2C350A1D 9E53353F 8B7010A6 A06CCDCD

1AB1CD97 22AC4E51 D7136CDC C4E246EA 763FC548 93FDF355 A97CAD42 B7D217DA

9B5DC3C6 37D30203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 14E1482E E82F13AC A2D9A818 599D06A4 E8A2E1C0

06301D06 03551D0E 04160414 E1482EE8 2F13ACA2 D9A81859 9D06A4E8 A2E1C006

300D0609 2A864886 F70D0101 05050003 82010100 25AC9399 E811C36A 02E89633

4AC5F7A8 6565C944 4B404DC5 956224B8 5F97C6AC 5452CBFB DC9AAC42 DEF2C4B1

16AD4B59 B6883291 2E5889D7 C04DAD72 1D534C00 F44AE28C 215D18B6 D2B536D4

2E49EE95 F0178F40 F5F9A756 04EDBC1C 8564EC3D 3B5ED4B6 1D6F09F1 D228FFC1

2662FC36 D3219912 BB314253 E683F16A 6342C8A4 B3F4397C 9D65EFB8 A858604D

6B0D37E4 A5D38132 9EB2FDA1 EB962418 6210FD1C B2963A7A 2EC9EA9B 03A6BBCE

E14A4919 150751D5 F063FC8A 72DCDF7E 0438CC32 59358619 B2D611CE B8583954

33131BE9 65B2DC84 8F61FF57 895E2A03 06203B15 4E6F7B9F 796F2D0E 343EE632

48B67B01 EE4BD98F 3A3F84E3 6D8617D2 1E0B4199

quit

license udi pid ISR4321/K9 sn FDO21441WDF

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 4.4.4.4 255.255.255.0

interface GigabitEthernet0/0/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.3.2 255.255.255.0

negotiation auto

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router bgp 1

bgp log-neighbor-changes

neighbor 192.168.3.1 remote-as 2

address-family ipv4

network 4.4.4.0 mask 255.255.255.0

network 192.168.3.0

neighbor 192.168.3.1 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

banner motd ^Cno unauthorized access^C

line con 0

password 7 13061E010803

logging synchronous

login

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

password 7 14141B180F0B6A

login

line vty 5 15

password 7 14141B180F0B6A

login

end

**R4 Ip routes:**

Gateway of last resort is not set

1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 1.1.1.0/24 [20/0] via 192.168.3.1, 01:22:03

B 1.1.1.1/32 [20/2] via 192.168.3.1, 01:38:21

3.0.0.0/24 is subnetted, 1 subnets

B 3.3.3.0 [20/0] via 192.168.3.1, 01:38:21

4.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 4.4.4.0/24 is directly connected, Loopback0

L 4.4.4.4/32 is directly connected, Loopback0

5.0.0.0/32 is subnetted, 1 subnets

B 5.5.5.5 [20/3] via 192.168.3.1, 01:28:07

6.0.0.0/24 is subnetted, 1 subnets

B 6.6.6.0 [20/1] via 192.168.3.1, 01:22:34

B 192.168.2.0/24 [20/3] via 192.168.3.1, 01:28:07

192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.3.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.3.2/32 is directly connected, GigabitEthernet0/0/1

200.100.53.0/28 is subnetted, 1 subnets

B 200.100.53.0 [20/2] via 192.168.3.1, 01:29:08

200.100.54.0/28 is subnetted, 1 subnets

B 200.100.54.0 [20/0] via 192.168.3.1, 01:38:21

**R4 BGP routes:**

Network Next Hop Metric LocPrf Weight Path

\*> 1.1.1.0/24 192.168.3.1 0 2 i

\*> 1.1.1.1/32 192.168.3.1 2 0 2 ?

\*> 3.3.3.0/24 192.168.3.1 0 0 2 i

\*> 4.4.4.0/24 0.0.0.0 0 32768 i

\*> 5.5.5.5/32 192.168.3.1 3 0 2 ?

\*> 6.6.6.0/24 192.168.3.1 1 0 2 ?

\*> 192.168.2.0 192.168.3.1 3 0 2 ?

\* 192.168.3.0 192.168.3.1 0 0 2 i

\*> 0.0.0.0 0 32768 i

\*> 200.100.53.0/28 192.168.3.1 2 0 2 ?

\*> 200.100.54.0/28 192.168.3.1 0 0 2 i

**R5 running config:**

Current configuration : 2417 bytes

Last configuration change at 18:51:16 UTC Thu Feb 1 2024

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R5

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

enable secret 5 $1$00qB$FXETCr1JSIcaaO4IN7TVg.

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO215009QY

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 5.5.5.5 255.255.255.0

interface GigabitEthernet0/0/0

ip address 200.100.53.5 255.255.255.240

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.2.1 255.255.255.0

negotiation auto

interface Serial0/1/0

no ip address

interface Serial0/1/1

no ip address

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

negotiation auto

router ospf 1

redistribute bgp 2 subnets

network 1.1.1.0 0.0.0.255 area 1

network 5.5.5.0 0.0.0.255 area 1

network 6.6.6.0 0.0.0.255 area 1

network 192.168.2.0 0.0.0.255 area 1

network 200.100.53.0 0.0.0.15 area 1

router bgp 2

bgp log-neighbor-changes

neighbor 1.1.1.1 remote-as 2

neighbor 1.1.1.1 update-source Loopback0

neighbor 6.6.6.6 remote-as 3

neighbor 192.168.2.2 remote-as 3

neighbor 200.100.53.4 remote-as 2

address-family ipv4

network 5.5.5.0 mask 255.255.255.0

network 6.6.6.0 mask 255.255.255.0

network 192.168.2.0

network 200.100.53.0 mask 255.255.255.240

redistribute ospf 1 match internal external 1 external 2

neighbor 1.1.1.1 activate

neighbor 6.6.6.6 activate

neighbor 192.168.2.2 activate

neighbor 200.100.53.4 activate

exit-address-family

ip forward-protocol nd

no ip http server

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

banner motd ^Cno unauthorized access^C

line con 0

password 7 030752180500

logging synchronous

login

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

password 7 1511021F07256B

login

line vty 5 15

password 7 1511021F07256B

login

end

**R5 Ip Routes:**

1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 1.1.1.0/24 [200/0] via 1.1.1.1, 01:24:00

O 1.1.1.1/32 [110/2] via 200.100.53.4, 01:30:07, GigabitEthernet0/0/0

3.0.0.0/32 is subnetted, 1 subnets

O 3.3.3.3 [110/3] via 200.100.53.4, 01:30:07, GigabitEthernet0/0/0

4.0.0.0/24 is subnetted, 1 subnets

O E2 4.4.4.0 [110/1] via 200.100.53.4, 01:30:07, GigabitEthernet0/0/0

5.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 5.5.5.0/24 is directly connected, Loopback0

L 5.5.5.5/32 is directly connected, Loopback0

6.0.0.0/24 is subnetted, 1 subnets

B 6.6.6.0 [20/0] via 192.168.2.2, 01:24:00

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.2.1/32 is directly connected, GigabitEthernet0/0/1

O 192.168.3.0/24 [110/3] via 200.100.53.4, 01:30:07, GigabitEthernet0/0/0

200.100.53.0/24 is variably subnetted, 2 subnets, 2 masks

C 200.100.53.0/28 is directly connected, GigabitEthernet0/0/0

L 200.100.53.5/32 is directly connected, GigabitEthernet0/0/0

200.100.54.0/28 is subnetted, 1 subnets

O 200.100.54.0 [110/2] via 200.100.53.4, 01:30:07, GigabitEthernet0/0/0

**R5 BGP Routes:**

Network Next Hop Metric LocPrf Weight Path

\*>i 1.1.1.0/24 1.1.1.1 0 100 0 i

\*> 1.1.1.1/32 200.100.53.4 2 32768 ?

\* i 3.3.3.3/32 200.100.54.3 2 100 0 ?

\*> 200.100.53.4 3 32768 ?

\*> 4.4.4.0/24 200.100.53.4 1 32768 ?

\*> 5.5.5.0/24 0.0.0.0 0 32768 i

\*> 6.6.6.0/24 192.168.2.2 0 0 3 i

\*> 192.168.2.0 0.0.0.0 0 32768 i

\* 192.168.2.2 0 0 3 i

\* i 192.168.3.0 200.100.54.3 2 100 0 ?

\*> 200.100.53.4 3 32768 ?

\* i 200.100.53.0/28 1.1.1.1 0 100 0 i

\*> 0.0.0.0 0 32768 i

Network Next Hop Metric LocPrf Weight Path

\* i 200.100.54.0/28 1.1.1.1 0 100 0 i

\*> 200.100.53.4 2 32768 ?

**R6 Running Config:**

Current configuration : 4139 bytes

Last configuration change at 18:23:10 UTC Thu Feb 1 2024

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R6

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

enable secret 5 $1$E6.2$dXdEIa2nNqcLkTGWtk1/w1

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-318861592

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-318861592

revocation-check none

rsakeypair TP-self-signed-318861592

crypto pki certificate chain TP-self-signed-318861592

certificate self-signed 01

3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 33313838 36313539 32301E17 0D323430 32303131 38313833

305A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F

532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3331 38383631

35393230 82012230 0D06092A 864886F7 0D010101 05000382 010F0030 82010A02

82010100 A499DB87 766B2AFF 10375E36 A61C9685 2CD389C6 51237E5B 166741CA

00D4FE48 1408F254 52951385 68FB1624 E02AB342 20285044 C5552D81 E94EF5CE

FC901BDD 936CE9A7 A83F3F4E CD46B8AD F94778FA 7397785F 884766E6 88C03860

463BF67A 49AD6F67 3662DB0A BC47CF11 7F21D4FA 569B4B5E 2FEF16E3 25B8AE09

D79E8932 896FFAA3 CAABD95E D14C5D08 5E644028 7318D884 F0D20850 8CB6D1D5

7FB20F0C 71C7E057 AE82C3A0 FC23BE05 3A04A7DD 67827B7C B3F4E6C3 1D6A5121

5D837534 F08650B5 5F2B3C1C E7170200 4FF7DC75 42E92F18 67593A17 F39FFA98

43204A6F 5B1A9F5F 01085860 22012972 A80A64D2 BFC12582 35AA20D4 A16DF6C1

503CC54B 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F

0603551D 23041830 168014D7 E3E988D2 E8415B5F B45C8687 08AF3A65 99651B30

1D060355 1D0E0416 0414D7E3 E988D2E8 415B5FB4 5C868708 AF3A6599 651B300D

06092A86 4886F70D 01010505 00038201 0100663F 45B86EF9 56FA67BA 5D516071

025128D0 416BBCC2 4768F7EE 7B02ECC6 1601AB49 32A3E39E E0A8112D 2817F8F0

BAD5B47E 7F6D0A74 2184F1E3 647603A9 79D38B8D A27F2B84 5903A133 B7B072F2

4C975AD5 AB6F6E62 65911222 868B61A7 6AFC22C2 82CBBCE4 FDCB1630 324EAEB3

080F7872 6E79D992 E84AD36E F5663E30 A0161D0B D4E79B6E 30465362 8FC6D232

4E9839F2 E21140E6 1E36C702 86944DE6 C968175E E1269659 33400BFA 96C7790D

DF82736A 32405D15 227640CB D439DA9D 685F41F9 826758E2 A5D9A4AF 34F66E8E

A8EA2C46 798E474A B438E2D2 F098A75A 38485569 C5215D2A 0366898D E0FEEE8B

C19B8B7D B6BF1708 B3A9EA5D DC3475C7 24DC

quit

license udi pid ISR4321/K9 sn FDO214420HM

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 6.6.6.6 255.255.255.0

interface GigabitEthernet0/0/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.2.2 255.255.255.0

negotiation auto

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router bgp 3

bgp log-neighbor-changes

neighbor 192.168.2.1 remote-as 2

address-family ipv4

network 5.5.5.0 mask 255.255.255.0

network 6.6.6.0 mask 255.255.255.0

network 192.168.2.0

neighbor 192.168.2.1 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

banner motd ^Cno unauthorized access^C

line con 0

password 7 121A0C041104

logging synchronous

login

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

password 7 045802150C2E0C

login

line vty 5 15

password 7 045802150C2E0C

login

end

**R6 Ip Route:**

1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

B 1.1.1.0/24 [20/0] via 192.168.2.1, 01:23:41

B 1.1.1.1/32 [20/2] via 192.168.2.1, 01:24:12

3.0.0.0/32 is subnetted, 1 subnets

B 3.3.3.3 [20/3] via 192.168.2.1, 01:24:12

4.0.0.0/24 is subnetted, 1 subnets

B 4.4.4.0 [20/1] via 192.168.2.1, 01:24:12

5.0.0.0/24 is subnetted, 1 subnets

B 5.5.5.0 [20/0] via 192.168.2.1, 01:24:12

6.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 6.6.6.0/24 is directly connected, Loopback0

L 6.6.6.6/32 is directly connected, Loopback0

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.2.2/32 is directly connected, GigabitEthernet0/0/1

B 192.168.3.0/24 [20/3] via 192.168.2.1, 01:24:12

200.100.53.0/28 is subnetted, 1 subnets

B 200.100.53.0 [20/0] via 192.168.2.1, 01:24:12

200.100.54.0/28 is subnetted, 1 subnets

B 200.100.54.0 [20/2] via 192.168.2.1, 01:24:12

**R6 BGP Route:**

Network Next Hop Metric LocPrf Weight Path

\*> 1.1.1.0/24 192.168.2.1 0 2 i

\*> 1.1.1.1/32 192.168.2.1 2 0 2 ?

\*> 3.3.3.3/32 192.168.2.1 3 0 2 ?

\*> 4.4.4.0/24 192.168.2.1 1 0 2 ?

\*> 5.5.5.0/24 192.168.2.1 0 0 2 i

\*> 6.6.6.0/24 0.0.0.0 0 32768 i

\* 192.168.2.0 192.168.2.1 0 0 2 i

\*> 0.0.0.0 0 32768 i

\*> 192.168.3.0 192.168.2.1 3 0 2 ?

\*> 200.100.53.0/28 192.168.2.1 0 0 2 i

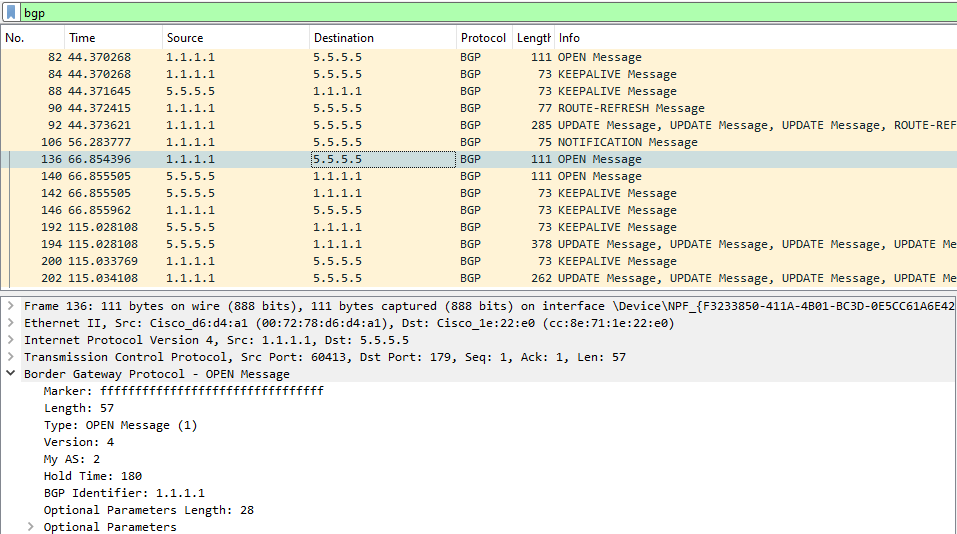
\*> 200.100.54.0/28 192.168.2.1 2 0 2 ?

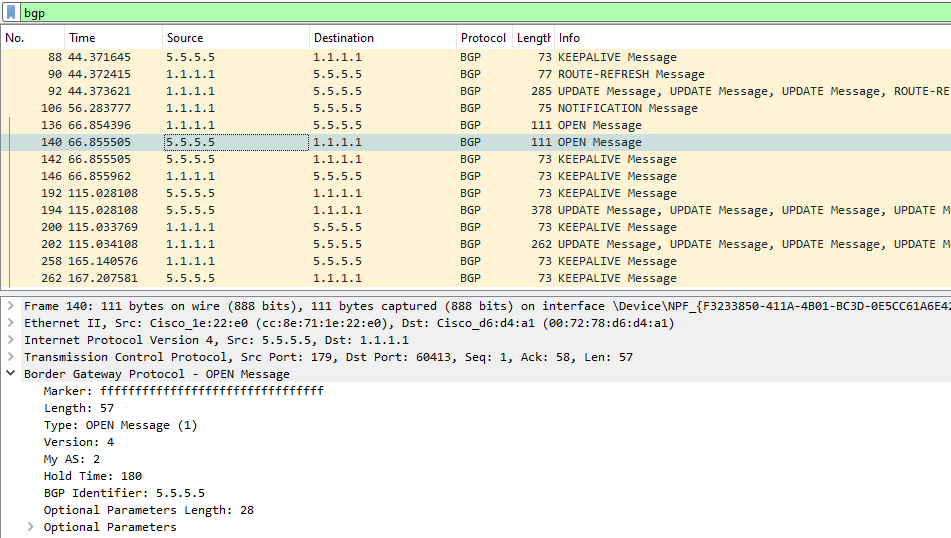
**Problems:**

* The IPs were set up wrong in the OSPF area.
  + Changing IPs on router 3 and router 1 to be a different subnet than router 5 allowed configuration.
* Could not configure routers because of Rommon mode.
  + Reloaded routers fixed solution.
* The network address had a host address while configuring BGP.
  + Entered network address instead.
* Could not ping loopbacks of end routers.
  + Found the loopback addresses were not being transferred through OSPF in routing tables.
    - Error in Router 5 and 3 BGP config.
      * Attempted adding neighbor and network commands in BGP, added redistribute BGP in OSPF.
      * Successfully got route into routing tables of iBGP-BGP routers, could not ping end to end.
      * Figured out on our iBGP to BGP routers the OSPF routes were not being put into the BGP table.
      * We researched and found we needed a **redistribute OSPF 1 match external** to put the externally inputted routes to OSPF into BGP.

**Evidence of iBGP:**

**Packet Sniffer (WireShark):**

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One way we confirmed iBGP was running was the use of a packet sniffer like WireShark. We looked to see what the AS area was for both the sender IP’s packet and the destination IP’s packet. In this case, they were both the AS of 2. This shows that iBGP is up and running because to be in the same area and sending BGP packets to each other means iBGP must be in use. BGP is only for different AS area values when in use.

**BGP Table:**

BGP table version is 12, 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,

x best-external, a additional-path, c RIB-compressed,

t secondary path, L long-lived-stale,

Origin codes: i - IGP, e - EGP, ? - incomplete

RPKI validation codes: V valid, I invalid, N Not found

Network Next Hop Metric LocPrf Weight Path

\*> 1.1.1.0/24 192.168.3.1 0 2 i

\*> 1.1.1.1/32 192.168.3.1 2 0 2 ?

\*> 3.3.3.0/24 192.168.3.1 0 0 2 i

\*> 4.4.4.0/24 0.0.0.0 0 32768 i

\*> 5.5.5.5/32 192.168.3.1 3 0 2 ?

\*> 6.6.6.0/24 192.168.3.1 1 0 2 ?

\*> 192.168.2.0 192.168.3.1 3 0 2 ?

\* 192.168.3.0 192.168.3.1 0 0 2 i

\*> 0.0.0.0 0 32768 i

\*> 200.100.53.0/28 192.168.3.1 2 0 2 ?

\*> 200.100.54.0/28 192.168.3.1 0 0 2 i

Our third way to confirm iBGP was to use a show BGP command. We know iBGP is up using this because of the I under the path column. This tells us iBGP is running and those routes are using iBGP.

**Conclusion:**

In this lab, we learned the differences between iBGP and BGP while understanding how the use cases of iBGP and IGPs differ as well. The most important part of this lab was understanding the concepts as BGP is the standard for inter-ISP communication and iBGP is a part of that system. Overall, this lab was a quick one for me and my partner because we used iBGP in a previous lab by coincidence, so we had a great basis to modify to our new lab requirements. This helped us write the config files to fit in the new scenario we were provided. The few problems we had were relatively simple usually just an IP mix-match or a faulty config we had to look for. This lab was very useful as it is more hands-on work using BGP and iBGP which will be very critical for work around networking in the future.