A white rectangular sign with black text

Description automatically generated

**Purpose**

Through completing this lab, we further developed our routing knowledge and practical skills from the past OSPF-based labs by learning how BGP (Border Gateway Protocol) functions and interacts with external protocols like OSPF, RIP, and EIGRP. We also learned how to implement BGP in both IPv4 and IPv6 configurations.  
  
**Background Information**

BGP (Border Gateway Protocol) is one of the many routing protocols used among the thousands of networks that exist on the Internet. The protocol helps determine the best route for data traveling on the Internet by analyzing all the available paths and optimizing the quickest and most efficient path.

BGP is crucial in a network since the Internet is virtually made up of autonomous systems, which are smaller networks through which data travel when going from a source to a destination. Autonomous systems use the protocol to communicate with one another and advertise their routes to outside networks and compare reachability. Each autonomous system has their own ASN (AS number) to uniquely identify one another. BGP also focuses on high scalability and adding security to the network, making it a slower routing protocol compared to other protocols.

It uses the Best Path Algorithm, which looks at various path attributes to finalize the best route. Each attribute retains its own metric, which assigns different route priority in the routing table. Some attributes we worked with in this lab include weight and AS (autonomous system) paths. Weight is an easy attribute to identify in every router; it’s Cisco proprietary and can be configured manually or set to 0 by default. AS Paths can be configured to set priorities of routes, with each repeat of the AS number resulting in a longer path. In addition, we set up BGP scan timer which checks BGP prefix tables for a set amount of time and calculates the best path before cleaning up the BGP database.

In this lab we also covered OSPF, RIP, and EIGRP routing concepts using what we learned in the CCNA course and previous labs. We knew how to configure OSPF from the previous two labs; it was a much simpler configuration compared to BGP. RIP and EIGRP required very similar commands to OSPF and were easily learned. While BGP uses TCP and unicast communication as its transportation method, internal routing protocols like OSPF, RIP, and EIGRP use UDP or plain IP. These are transport layer protocols we learned in the CCNA course.  
  
**Lab Summary**

To complete this lab, we followed these procedures:

1. Designed a topology with a switch connecting 3 routers with loopbacks. We assigned each respective router to be configured in its own OSPF, EIGRP, or RIP network in addition to BGP.
2. Used the new topology (shown below) to set up a physical router network with 3 routers and 1 switch.
3. Configured IPv4 and IPv6 addresses on router Gigabit Ethernet interfaces.
4. Assigned OSPF on router 1, EIGRP on router 2, and RIP on router 3.
5. Configured BGP on each of the three ABS routers in order to redistribute routes and connect traffic from the separate networks.
6. Tested connectivity and troubleshooted.

**Lab Commands**

**router bgp** [autonomous-system-number]Enables BGP configuration mode.  
  
**address-family ipv4**Enables address family configuration mode. Creates a BGP IPv4 unicast address family that specifies neighbors to exchange IPv4 unicast routes with.  
  
**address-family ipv6**Enables address family configuration mode, except for IPv6. Creates a BGP IPv6 unicast address family that specifies neighbors to exchange IPv6 unicast routes with. **neighbor** [ipv4 address] **remote-as** [autonomous-system-number]Configured in address family mode. Redistributes and receives BGP routes through neighbors.  
  
**neighbor** [ipv6 address] **remote-as** [autonomous-system-number]Configured in address family mode. Redistributes and receives BGP routes through neighbors.  
  
**neighbor** [ipv4 address] **activate**Configured in address family mode. Allows neighbors to receive and redistribute BGP routes.  
  
**neighbor** [ipv6 address] **activate**Configured in address family mode. Allows neighbors to receive and redistribute BGP routes.  
  
**neighbor** [ipv4 address] **weight** [weight value]  
Sets a weight to routes learned from a neighbor. The higher the weight value, the higher the preference for that path is.  
  
**neighbor** [ipv4 address] **advertisement-interval** [interval]  
Sets the minimum time between BGP routing updates to a neighbor in order to maintain a stable routing table.  
  
**neighbor** [ipv4 address] **route-map ASPREPEND out  
set as-path prepend** [ASN]  
Deprioritizes a route by increasing the length of the AS-PATH attribute by artificially repeating the autonomous system number (ASN) in the command.  
  
**bgp scan-time** <5-60>  
Changes the BGP scanner interval to between 5 and 60 seconds. **router rip**Enters RIP configuration mode.  
  
**router eigrp** [number]Enters EIGRP configuration mode.  
  
**redistribute bgp** [process-id] **metric** [metric numbers]Helps redistribute BGP routes using metric numbers to specify to which routing domain it is going to.

**Topology & IP Scheme**

A diagram of a router

Description automatically generated

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | g0/0/0 IPv4 | g0/0/0 IPv6 | Lo0 IPv4 | Lo0 IPv6 |
| R1 | 10.0.0.1 /24 | 10::1 /64 | 192.168.1.1 /32 | 1::1 /64 |
| R2 | 10.0.0.2 /24 | 10::2 /64 | 192.168.2.1 /32 | 2::2 /64 |
| R3 | 10.0.0.3 /24 | 10::3 /64 | 192.168.3.1 /32 | 3::3 /64 |

**Configurations**

**R1**

Show run:

Current configuration : 2934 bytes

! Last configuration change at 18:41:07 UTC Mon Nov 13 2023

version 16.7

service timestamps debug datetime msec

service timestamps log datetime msec

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

no aaa new-model

subscriber templating

vtp domain cisco

vtp mode transparent

ipv6 unicast-routing

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 192.168.1.1 255.255.255.255

ipv6 address 1::1/64

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/0

ip address 10.0.0.1 255.255.255.0

negotiation auto

ipv6 address 10::1/64

interface GigabitEthernet0/0/1

no ip address

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 ospfv3 1

router-id 1.1.1.1

address-family ipv6 unicast

exit-address-family

router ospf 1

router-id 1.1.1.1

network 192.168.1.0 0.0.0.255 area 1

router bgp 65001

bgp router-id 1.1.1.1

bgp log-neighbor-changes

timers bgp 5 20

neighbor 10::2 remote-as 65002

neighbor 10::3 remote-as 65003

neighbor 10.0.0.2 remote-as 65002

neighbor 10.0.0.3 remote-as 65003

address-family ipv4

bgp scan-time 20

network 10.0.0.0 mask 255.255.255.0

redistribute connected

redistribute ospf 1

no neighbor 10::2 activate

no neighbor 10::3 activate

neighbor 10.0.0.2 activate

neighbor 10.0.0.2 weight 200

neighbor 10.0.0.2 advertisement-interval 0

neighbor 10.0.0.2 route-map ASPREPEND1 out

neighbor 10.0.0.3 activate

neighbor 10.0.0.3 advertisement-interval 0

neighbor 10.0.0.3 route-map ASPREPEND1 out

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 1

network 10::/64

neighbor 10::2 activate

neighbor 10::3 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

access-list 1 permit 10.0.0.0 0.0.0.255

route-map ASPREPEND1 permit 10

match ip address 1

set as-path prepend 65001 65001

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

wsma agent exec

wsma agent config

wsma agent filesys

wsma agent notify

end

Show BGP Summary:

**A screenshot of a computer program

Description automatically generated**

IPv4 Route:

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

      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks  
C        10.0.0.0/24 is directly connected, GigabitEthernet0/0/0  
L        10.0.0.1/32 is directly connected, GigabitEthernet0/0/0  
      192.168.1.0/32 is subnetted, 1 subnets  
C        192.168.1.1 is directly connected, Loopback0  
      192.168.2.0/32 is subnetted, 1 subnets  
B        192.168.2.1 [20/0] via 10.0.0.2, 00:27:20  
      192.168.3.0/32 is subnetted, 1 subnets  
B        192.168.3.1 [20/0] via 10.0.0.3, 00:27:20

IPv6 Route:

IPv6 Routing Table - default - 7 entries  
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route  
       B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2  
       IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external  
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect  
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2  
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, la - LISP alt  
       lr - LISP site-registrations, ld - LISP dyn-eid, lA - LISP away  
       a – Application

C   1::/64 [0/0]  
     via Loopback0, directly connected  
L   1::1/128 [0/0]  
     via Loopback0, receive  
B   2::/64 [20/0]  
     via FE80::521C:B0FF:FE2C:5100, GigabitEthernet0/0/0  
B   3::/64 [20/0]  
     via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0  
C   10::/64 [0/0]  
     via GigabitEthernet0/0/0, directly connected  
L   10::1/128 [0/0]  
     via GigabitEthernet0/0/0, receive  
L   FF00::/8 [0/0]  
     via Null0, receive

**R2**

Show run:

Current configuration : 5163 bytes

! Last configuration change at 18:12:02 UTC Mon Nov 13 2023

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R2

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-2189345785

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-2189345785

revocation-check none

rsakeypair TP-self-signed-2189345785

crypto pki certificate chain TP-self-signed-2189345785

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

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

69666963 6174652D 32313839 33343537 3835301E 170D3233 31313133 31373137

30355A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 31383933

34353738 35308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100C469 84A078AD 8768CE16 D35CF51B B3B7D09B 2D0D1B42 FE6C5F8B

E2991709 7732E24A A08E248A 8F58FE50 B629E22C 2C00FC76 AE8B68DE FC58A696

7992BA99 377F89AC 6FA5B39B 56BA15E7 284D7E03 A4163C8F C2CDFB4A CC2AFF85

356E5D61 52D35D26 F2547161 0C7E3F3E E8E8F308 09665783 880D3187 7C35A6DA

0266523F 5A1E4026 15924D36 61B5519F 666B9CE4 021E8CA8 32AA1297 3B2CF342

315DA92C D63E555F 705A120D 74F745DC EC27341B 1BFC1803 38B896E4 C6F10C66

220B21E6 FC76468C 8AAE96DC F729E93B 574A2FD1 18617877 72501FB3 B1E6FFA3

F19F1968 60421A58 4A1D9F6F A46EE8ED 2AB68A95 899EFE1A 0F45A99C FC7B007A

08DC495D 6DF10203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 14F07468 69839C7F 648A0E98 EA351350 69B8D0F1

29301D06 03551D0E 04160414 F0746869 839C7F64 8A0E98EA 35135069 B8D0F129

300D0609 2A864886 F70D0101 05050003 82010100 AF4C7176 A0CA5D6A 80F3582D

F16E69D8 87B4E775 635CB666 6179C448 8F316D84 2568C820 D6E77499 4C219AB0

9050B812 7E1DA7E5 8C824C1B 6C7F11C8 44BC34B0 411AB5AF 98BF3716 CB0B34B9

D6CBE3DB 7E390E83 D90BBC29 A246CBB0 DECA54C3 6C70CC0B C0CE37B7 7C72975C

3F3EE123 097E9054 B381A5C3 8161C1F7 3277D918 A761F4C3 F87A839C A6A880D8

F3805726 8B78FB9C 6DB20340 D34F6DE1 F7F0F154 94D26EF4 2979D346 3432A44F

F09F92D9 B1732E9A 2976169E 866ACF08 F017803B 7C48884E FAB89444 A9D2FE5E

F4AF75A5 7B53E4CF 1147AB1D 2D7FBE91 9DB657CF D606DC72 E477F411 D0222A12

33553DAC A25DDDF3 E8DC116C F7F62CB6 DEA9DD52

quit

license udi pid ISR4321/K9 sn FDO21482DXE

license boot level appxk9

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 192.168.2.1 255.255.255.255

ipv6 address 2::2/64

ipv6 eigrp 1

interface GigabitEthernet0/0/0

ip address 10.0.0.2 255.255.255.0

negotiation auto

ipv6 address 10::2/64

interface GigabitEthernet0/0/1

no ip address

shutdown

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 eigrp 1

network 192.168.2.1 0.0.0.0

redistribute bgp 65002 metric 100 1 255 1 15

eigrp router-id 2.2.2.2

router bgp 65002

bgp router-id 2.2.2.2

bgp log-neighbor-changes

timers bgp 5 20

neighbor 10::1 remote-as 65001

neighbor 10::3 remote-as 65003

neighbor 10.0.0.1 remote-as 65001

neighbor 10.0.0.3 remote-as 65003

address-family ipv4

bgp scan-time 20

network 10.0.0.0 mask 255.255.255.0

redistribute connected

redistribute eigrp 1

no neighbor 10::1 activate

no neighbor 10::3 activate

neighbor 10.0.0.1 activate

neighbor 10.0.0.1 weight 100

neighbor 10.0.0.1 advertisement-interval 0

neighbor 10.0.0.1 route-map ASPREPEND2 out

neighbor 10.0.0.3 activate

neighbor 10.0.0.3 advertisement-interval 0

neighbor 10.0.0.3 route-map ASPREPEND2 out

exit-address-family

address-family ipv6

redistribute connected

redistribute eigrp 1

network 10::/64

neighbor 10::1 activate

neighbor 10::3 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

access-list 5 permit 10.0.0.0 0.0.0.255

ipv6 router eigrp 1

eigrp router-id 2.2.2.2

redistribute bgp 65002 metric 100 1 255 1 1500

route-map ASPREPEND2 permit 10

match ip address 5

set as-path prepend 65002

route-map ASPREPEND2 permit 20

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

Show BGP Summary:

**A computer screen shot of a black screen

Description automatically generated**

IPv4 Route:  
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

      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks  
C        10.0.0.0/24 is directly connected, GigabitEthernet0/0/0  
L        10.0.0.2/32 is directly connected, GigabitEthernet0/0/0  
      192.168.2.0/32 is subnetted, 1 subnets  
C        192.168.2.1 is directly connected, Loopback0  
      192.168.3.0/32 is subnetted, 1 subnets  
B        192.168.3.1 [20/0] via 10.0.0.3, 01:05:48

IPv6 Route

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route  
       B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2  
       IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external  
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect  
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2  
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, la - LISP alt  
       lr - LISP site-registrations, ld - LISP dyn-eid, lA - LISP away  
       le - LISP extranet-policy, a – Application  
  
B   1::/64 [20/0]  
     via FE80::272:78FF:FED6:D4A0, GigabitEthernet0/0/0  
C   2::/64 [0/0]  
     via Loopback0, directly connected  
L   2::2/128 [0/0]  
     via Loopback0, receive  
B   3::/64 [20/0]  
     via FE80::521C:B0FF:FE63:3830, GigabitEthernet0/0/0  
C   10::/64 [0/0]  
     via GigabitEthernet0/0/0, directly connected  
L   10::2/128 [0/0]  
     via GigabitEthernet0/0/0, receive  
L   FF00::/8 [0/0]  
     via Null0, receive

**R3**

Show run:

Current configuration : 5068 bytes

! Last configuration change at 17:51:39 UTC Mon Nov 13 2023

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

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

no aaa new-model

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

ipv6 unicast-routing

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 170D3233 31313133 31363439

32335A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

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

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

0A028201 0100B255 9B514A9C 60A24365 592DC9A5 907955AF 6DF6CA70 E0FEDBCA

DB500CE5 D2B52E89 272F09FD EEF290B9 8CD3B57B E3F5A5E5 AA4C6261 ABE7B7AF

70E47FB0 FCCB3336 FB30979D 7F61F40C ADAB1DEC 48A35286 384549E0 7DA2E5B9

9A325C6C 424A62AB 0D84C8C9 BE26B3BA A357CB89 AE67B9A8 711F0253 FD581178

29A525C0 A6B200EA FD2DD511 D3FFBA7F 44BFB9C0 2687549D A9DDDA59 5F076B8D

6C3E2B4A 4E707F73 48F4B98E 8A887D8C 0DBDEB2F 0FD878D3 B2D017EC 5458F609

68B8127E 1E617CE2 92795E84 7F1D9905 A01BE684 264B4865 DF70FD47 296D9F82

539D693A 279E033E 18744F7A D59F0C0D A9EF81E3 91E97601 E2D374E3 F05BFB20

6EF4619B 8CF70203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 1436FA18 E5661BD0 BCBEE39C DDA0F049 31BBCE3B

76301D06 03551D0E 04160414 36FA18E5 661BD0BC BEE39CDD A0F04931 BBCE3B76

300D0609 2A864886 F70D0101 05050003 82010100 31DA03B8 972ACD60 6CCDCB39

C5B2B696 CB7B8835 6D09BBC4 FA71C656 7E9C93D3 A33A5DD9 D3ADF6D6 B25F9B96

CEC42C4F CEB0F465 5C70D97E A1E2921D E2276671 CB90BFDC CA1C4416 0CFA5D82

811CD2C8 BC2AE58F 224F4BE6 7B1C34B2 E4602BBF FE700D67 6581A994 99DF251A

10396C51 F5DDB3E6 67302A29 04A10606 8458A94D E08841F1 BC83A68D 4D255C4F

DD8E75CF 00A88729 2B6DA3DF 48471CBC CD5B0B48 D8B57B21 166D86FF B3D16144

A864CD92 693CC74D 171ABB72 82C39247 1CC060B6 D64D41D1 198F1FC3 761A1F96

456ECAE9 4B677FD7 9F039F0B 7E25A0F6 A77BCB8F C556084C D9E0F514 08BDBDB2

24FB97A0 92298A6E F799AE54 BF23F315 7CF6C016

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 192.168.3.1 255.255.255.255

ipv6 address 3::3/64

interface GigabitEthernet0/0/0

ip address 10.0.0.3 255.255.255.0

negotiation auto

ipv6 address 10::3/64

interface GigabitEthernet0/0/1

no ip address

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 rip

redistribute connected

redistribute static

network 192.168.3.0

neighbor 10.0.0.2

neighbor 10.0.0.1

router bgp 65003

bgp log-neighbor-changes

timers bgp 5 20

neighbor 10::1 remote-as 65001

neighbor 10::2 remote-as 65002

neighbor 10.0.0.1 remote-as 65001

neighbor 10.0.0.2 remote-as 65002

address-family ipv4

bgp scan-time 20

network 10.0.0.0 mask 255.255.255.0

redistribute connected

redistribute rip

no neighbor 10::1 activate

no neighbor 10::2 activate

neighbor 10.0.0.1 activate

neighbor 10.0.0.1 weight 100

neighbor 10.0.0.1 advertisement-interval 0

neighbor 10.0.0.1 route-map ASPREPEND3 out

neighbor 10.0.0.2 activate

neighbor 10.0.0.2 weight 200

neighbor 10.0.0.2 advertisement-interval 0

neighbor 10.0.0.2 route-map ASPREPEND3 out

exit-address-family

address-family ipv6

redistribute connected

network 10::/64

neighbor 10::1 activate

neighbor 10::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

access-list 5 permit 10.0.0.0 0.0.0.255

route-map ASPREPEND permit 20

route-map ASPREPEND3 permit 10

match ip address 5

set as-path prepend 65003 65003 65003

route-map ASPREPEND3 permit 20

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

Show BGP Summary:

**A computer screen shot of a black screen

Description automatically generated**

IPv4 Route:

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

      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks  
C        10.0.0.0/24 is directly connected, GigabitEthernet0/0/0  
L        10.0.0.3/32 is directly connected, GigabitEthernet0/0/0  
      192.168.2.0/32 is subnetted, 1 subnets  
B        192.168.2.1 [20/0] via 10.0.0.2, 00:24:30  
      192.168.3.0/32 is subnetted, 1 subnets  
C        192.168.3.1 is directly connected, Loopback0  
  
IPv6 Route:

IPv6 Routing Table - default - 7 entries  
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route  
       B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2  
       IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external  
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect  
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2  
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, la - LISP alt  
       lr - LISP site-registrations, ld - LISP dyn-eid, lA - LISP away  
       le - LISP extranet-policy, a - Application  
  
B   1::/64 [20/0]  
     via FE80::272:78FF:FED6:D4A0, GigabitEthernet0/0/0  
B   2::/64 [20/0]  
     via FE80::521C:B0FF:FE2C:5100, GigabitEthernet0/0/0  
C   3::/64 [0/0]  
     via Loopback0, directly connected  
L   3::3/128 [0/0]  
     via Loopback0, receive  
C   10::/64 [0/0]  
     via GigabitEthernet0/0/0, directly connected  
L   10::3/128 [0/0]  
     via GigabitEthernet0/0/0, receive  
L   FF00::/8 [0/0]  
     via Null0, receive

**Pings**

All ipv4 and ipv6 interfaces from R1

A screenshot of a computer program

Description automatically generated

A screenshot of a computer program

Description automatically generated

All ipv4 and ipv6 interfaces from R2

A computer screen shot of a black screen

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Description automatically generated

All ipv4 and ipv6 interfaces from R3

A black screen with white text

Description automatically generated

A screenshot of a computer program

Description automatically generated

**Problems**

When we first followed our topology and procedure, BGP neighbors showed up but we could not ping from one router to another. We realized we had missed many BGP steps and decided to resume the lab again another day starting with the OSPF, EIGRP, and RIP configurations we already had ready.

Next thing we know, we could not get routes from any other routing protocols to propagate on the routing table to BGP. Turns out it was because it was not connected to BGP, so we used metrics to control the route exchange.

Later on in our configuration process, router 2 was suddenly flooding other router screens with notification updates. We solved this by correcting where the ipv6 address was configured—we changed it from ipv4 address family to ipv6 address family and the constant updates stopped.  
  
**Conclusion**

This lab taught us how to set up BGP and even have it interact with traffic from external routing protocols. We ran into many issues and lots of confusion but taking it step by step helped us ultimately complete the lab. Because of the time-consuming process of putting in all sorts of commands this lab required, we learned to copy the configurations we did each day, so we did not have to start over from scratch every time. All in all, the lab gave us more insight on how routers act and how to configure them to communicate in the most efficient way possible.  
  
**Lab Signoff**

A close-up of a document

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