BGP

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Purpose: -

*Border Gateway Protocol (BGP)* is a *standardized exterior gateway protocol* that exchanges routing information using the Autonomous system numbers. The protocol is also classified as a path vector protocol. EIGRP is an example of a path vector protocol. The purpose of this project was to learn and execute the both, *iBGP* and *eBGP* protocols in our LAN. An even bigger skill that we would learn to use from doing this project was configuring BGP neighbors using an IPv6 addressing scheme and we would also learn to redistribute OSPF, EIGRP into BGP.

Background Information: -

Border Gateway Protocol (BGP) is a standardized exterior gateway protocol that exchanges routing information using the Autonomous system numbers. The protocol is also classified as a path vector protocol, i.e. it was designed to provide loop-free routing. Path vector protocols generally operate in the presence of Autonomous System numbers, and so is the case with BGP. AS numbers (or Autonomous System numbers) are the act as a foundation of formations of links in a path vector protocols. Another example of a path vector protocol is EIGRP. BGP is like EIGRP regarding their methodology, but it differs when it comes to configuring neighbors. Unlike EIGRP, where the network administrator would just have to configure the AS number and configure their networks to be broadcasted on that AS number, in BGP, not only would the network administrator have to configure the network statements, but also manually configure the next hop IP address in order to form a successful connection between the two peers. In this lab, we would use extensions of BGP known as *eBGP (Exterior BGP)* and *iBGP (Internal BGP).*

eBGP is an extension of BGP, that utilizes routing exchanges between different autonomous system numbers. In simple words, eBGP is a formation of links between different AS numbers. iBGP, however, utilizes the same AS numbers to communicate between peers. Although BGP is capable of routing IPv6 traffic, the methodology to complete the IPv6 routing on the protocol differs from that of OSPF and EIGRP, where the user must enable the protocol on the interfaces. eBGP has an administrative distance of 20 while iBGP utilizes an administrative distance of 200. Administrative distance (or AD) is a unit that determines routing speed in protocols. The lower the AD, the faster the route is. BGP uses the *Address-family* commands to enable IPv6 routing.

The address-family in the BGP configuration allows you to define a specific behavior of BGP with regards to many supported Layer 3 protocols like IPv4 networks for unicast, IPv4 networks for multicast, IPv6 networks for unicast, IPv6 networks for multicast. The BGP treats all these address families individually, as if it has been configured in a separate instance for each of them. These individual instances do not leak one into each other (even if they are of the same basic type). This way, the user can configure a single BGP process to maintain several databases of different networks. Redistributing various protocols into BGP requires additional steps. Redistribution of BGP routes is far more complicated than any other routing protocol, and it is possibly because everything in BGP must be manually set up. BGP, unlike other protocols like EIGRP and OSPF, does not make an assumption while forming its routing table. In this instance, we would redistribute OSPF and EIGRP into BGP.

We would need to change some EIGRP metric while redistributing it into EIGRP. EIGRP and BGP are exterior gateway protocols. EIGRP needs to change the metrics to redistribute its routes to another exterior gateway protocol. Unlike EIGRP-BGP redistribution, OSPF-BGP redistribution happens with a simple “redistribute” command in the protocol’s configs. There, however, is a special command, which is explained further in the report, that we would need to perform in order to redistribute external OSPF routes through BGP.

Lab Summary

We were given a topology by our instructor and we began by replicating it on our rack. After assigning each node an IP address, we started configuring BGP. The routers that were operating iBGP, were also supposed to operate on OSPF area 0. Our instructor demanded to have the IBGP routers to run OSPF to exhibit the differences in the two protocols’ administrative distance using the routing table. After that was done, we configured we executed EIGRP and OSPF on their respective router to form neighbor adjacencies. The last step in this process was to redistribute all the protocols into BGP. We used a few BGP specific commands to complete the redistribution process. We, later, ensured that all the nodes could exchange ICMP packets with each other. That marked the ending of the first part of the lab. Then, we did the entire process over again on IPv6.

Topology and IP Address table

A screenshot of a cell phone

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## procedure and results

## Step 1: -

Replicate the topology and configure IP and IPv6 addresses as exhibited in the image.

## Step 2: -

Begin by configuring IBGP, which will run across AS number 1: router bgp *{AS number (which is 1 in this case)}*. Unlike other protocols, BGP requires the user to manually feed the IP address of the next hop in the BGP configuration process. To execute that process, the user must use the command: neighbor *{neighbor’s (or next hop’s) IP address}* remote-as *{next hop’s AS number (which, in this case, is 1)}*. Apart from configuring the neighbor’s IP address in the BGP linking process, the user must also configure all of router’s connected networks to be advertised by using the network *{network address} netmask {subnet}*. Implement this step on R1, R2 and R3.

## Step 3: -

R1, R2 and R3 would already be exchanging routing information using iBGP. The next step is to configure the routers to exchange routing tables on OSPF area 0. The user must enter OSPF router config mode by entering the router ospf *{OSPF process ID}* command. In the router-config mode, the user must enter the network statements by using the network *{network address} {wildcard bits}* area *{area-id (which is 0 in this case}* command.

## Step 4: -

Now that OSPF and IBGP area operating on the routers, it is time to redistribute the protocols into one another. In the BGP router-config mode, enter the command, redistribute OSPF *{OSPF process ID}* and in the OSPF router config, type in redistribute BGP *{AS number}*. These two commands would redistribute OSPF and IBGP into each other on Routers 1, 2 and 3.

## Step 5: -

After the IBGP process is completed, it would be time to start executing the EBGP commands. R2, R3, R4 and R5 will exchange routing information using EBGP. Since a router cannot operate BGP on more than one autonomous system, R2 and R3 will be using the same AS number. Because the process to form EBGP links is almost similar to that in IBGP, the user would need to repeat STEP 2 on those four routers. The neighbors’ AS number, however, will not remain the same as EBGP runs on different AS numbers. Due to that reason, the user would need to change the AS number configuration in the neighbor commands.

## STEP 6: -

Now, the user must form an OSPF link between R4 and R6. The user would need to repeat STEP 3 on the two routers in order to form a successful OSPF link between them. The user must note, however, that the area id used to form a connection between R4 and R6 cannot be 0 as that area id is already being utilized in R1, R2 and R3. At this point, the user would need to R4 to redistribute OSPF into EBGP and vice-versa. The user would need to repeat STEP 4 on R4 to accomplish that.

## Step 7: -

EIGRP, being an exterior gateway protocol like BGP, uses AS number to recognize its neighbors. Unlike BGP, however, EIGRP does not a version, where it can form links on different autonomous systems. That is why routers forming a connection with EIGRP, would need to have the same AS number. In this scenario, R5 and R7 are going to be running EIGRP. The user would need to enter the EIGRP router-config mode by entering the router EIGRP *{AS number}*. Once the user make is to the EIGRP router-config mode, they would need to enter network statements by using the network *{network address} {wildcard bits}* command. The user would need to enter these commands on both the routers in order to form an EIGRP connection. Once a successful EIGRP connection is built, the user would need to redistribute EIGRP into EBGP and vice-versa on R5. They would do that by first entering the BGP router-config mode and typing in the redistribute EIGRP *{EIGRP AS number}* command, and then entering the EIGRP router-config mode and use the redistribute BGP *{BPG AS number}* metric 100 1 255 1 1500. The user must ensure that the metric values are changed to the ones mentioned in the command above, as it is essential to redistribute BGP into EIGRP.

## Step 8: -

The redistribution process does not end here as R2 and R3 would need to redistribute the external OSPF routes, contained in their routing tables, into BGP. The user would need to enter the BGP router-config mode and enter the following command: redistribute OSPF *{OSPF process id}* match internal external. This command enables the router to redistribute any kind of internal and/or external OSPF route, that it obtains, into BGP. This command needs to be entered on R2 and R3, but not on any other router.

## Step 9: -

At this point, the IPv4 portion of the lab is completed and user should be able to ping all the routers from any given router in the topology. Although the IPv6 configuration in the lab looks strikingly similar to that of IPv4, it has a few differences. The user should hop on to R1, R2 and R3 and enter the routers’ BGP router-config mode. To begin configuring BGPv6, the user must use the address-family IPv6 command in the BGP router-config mode. This command will guide the user to BGP address-family mode. Unlike in BGPv4, where any command executed in the BGP router-config mode is automatically transferred to IPv4 address family mode, the user must manually configure everything in the IPv6 address-family mode for BGPv6 to work. After entering the BGP address-family mode, the user should repeat STEP 2 on R1, 2 and 3 to form IPv6 IBGP connections.

## Step 10: -

OSPFv3 is an extension of OSPF, which works only on IPv6. As Routers 1, 2 and 3 were operating OSPF, they would also need to operate OSPFv3. Unlike OSPF, which is configured in the OSPF router-config mode, OSPFv3 is, for the most part, configured on the interfaces. To form an OSPFv3 link, the user must hop on to the interface configuration mode and enable the ipv6 ospf *{OSPFv3 process id}* area *{area id (which is 1 in this case)}* command. This command must be enabled on all the interfaces that need to operate OSPF and on R1, R2, and R3.

## STEP 11: -

This step involves with redistribution of OSPFv3 and BGPv6 into each other, and it must be done on R1, R2 and R3. To redistribute OSPFv3 into BGP, the user must enter the IPv6 BGP address-family mode and type in the redistribute OSPF *{OSPF process id}* command, and to redistribute BGPv6 into OSPFv3, the user would need to enter the OSPFv3 router-config mode by typing the ipv6 router OSPF *{OSPF process id}* command in the global-config mode. Once they make it to the OSPFv3 router-config mode, they would need to enter the redistribute BGP *{BGP AS number}* command to redistribute BGPv6 into OSPFv3.

## Step 12: -

Now that IBGPv6 is completed, the user would need to execute EBGPv6 on R2, R3, R4 and R5. The user must repeat STEP 9, but would need to change the AS numbers in the neighbor statements in the BGP address-family mode to form an EBGPv6 neighbor connection.

## Step 13: -

The user would, then, need to repeat STEP 10 on R4 and R6 and STEP 11 on R4 to form OSPFv3 adjacencies between R4 and R6 and redistribute OSPFv3 routes and BGPv6 routes into each other.

## Step 14: -

In this step, the user would need to form IPv6 EIGRP connection between R5 and R7 and redistribute it into BGPv6. Like OSPFv3, EIGRPv6 (IPv6 EIGRP) is configured on the interfaces. To form and EIGRPv6 link, the user must enter the required interface and type in the ipv6 EIGRP *{EIGRP AS number}* command. This process needs to be completed on R5 and R7. To redistribute EIGRPv6 into BGPv6 and vice-versa, the user would need to hop in to R5 and enter the IPv6 BGP address-family mode. Once the user reaches there, they must enable the redistribute EIGRP *{EIGRP AS number}* command. Afterwards, the user would need to enter the EIGRPv6 router-config mode by using the ipv6 router EIGRP *{EIGRP AS number}* command in the global-config mode. After that, they would need to enter the redistribute BGP *{BPG AS number}* metric 100 1 255 1 1500 command. The metric values are essential in this process too.

## STEP 15: -

The user would, then, need to repeat STEP 8 in the IPv6 BGP address-family mode on R2 and R3 to finish the lab.

## Results: -

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This image shows R1’s routing table. Although we configured IBGP and OSPF on this router, it just shows the routes that it learned through OSPF. A valid reason for that is that it only shows routes learned from OSPF on the routing table because OSPF has a lower AD than IBGP. Therefore, R1 uses OSPF to connect to the other routers as that is the fastest method that R1 knows.

A close up of text on a black background

Description automatically generated

This is another screenshot taken on R1, which shows that IBGP was configured, but was not visible in the routing table.

## Configuration

## R1: -

hostname R1

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

no ip domain lookup

ip cef

ipv6 unicast-routing

ipv6 cef

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

interface Serial1/0

no ip address

shutdown

serial restart-delay 0

interface Serial1/1

no ip address

shutdown

serial restart-delay 0

interface Serial1/2

no ip address

shutdown

serial restart-delay 0

interface Serial1/3

no ip address

shutdown

serial restart-delay 0

interface Serial2/0

no ip address

shutdown

serial restart-delay 0

interface Serial2/1

no ip address

shutdown

serial restart-delay 0

interface Serial2/2

no ip address

shutdown

serial restart-delay 0

interface Serial2/3

no ip address

shutdown

serial restart-delay 0

interface Ethernet3/0

ip address 192.168.1.1 255.255.255.0

duplex half

ipv6 address FE80::1 link-local

ipv6 address 1::1/64

ipv6 ospf 1 area 0

interface Ethernet3/1

ip address 192.168.2.1 255.255.255.0

duplex half

ipv6 address FE80::1 link-local

ipv6 address 2::1/64

ipv6 ospf 1 area 0

interface Ethernet3/2

no ip address

shutdown

duplex half

interface Ethernet3/3

no ip address

shutdown

duplex half

interface Ethernet3/4

no ip address

shutdown

duplex half

interface Ethernet3/5

no ip address

shutdown

duplex half

interface Ethernet3/6

no ip address

shutdown

duplex half

interface Ethernet3/7

no ip address

shutdown

duplex half

interface FastEthernet4/0

no ip address

shutdown

duplex auto

speed auto

interface FastEthernet4/1

no ip address

shutdown

duplex auto

speed auto

interface Serial5/0

no ip address

shutdown

serial restart-delay 0

interface Serial5/1

no ip address

shutdown

serial restart-delay 0

interface Serial5/2

no ip address

shutdown

serial restart-delay 0

interface Serial5/3

no ip address

shutdown

serial restart-delay 0

interface POS6/0

no ip address

shutdown

router ospf 1

router-id 1.1.1.1

redistribute connected

redistribute static

redistribute bgp 1

network 192.168.1.0 0.0.0.255 area 0

network 192.168.2.0 0.0.0.255 area 0

default-information originate

router bgp 1

bgp log-neighbor-changes

neighbor 1::2 remote-as 1

neighbor 2::2 remote-as 1

neighbor 192.168.1.2 remote-as 1

neighbor 192.168.2.2 remote-as 1

address-family ipv4

network 192.168.1.0

network 192.168.2.0

redistribute connected

redistribute static

redistribute ospf 1

no neighbor 1::2 activate

no neighbor 2::2 activate

neighbor 192.168.1.2 activate

neighbor 192.168.2.2 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 1

redistribute static

network 1::/64

network 2::/64

neighbor 1::2 activate

neighbor 2::2 activate

exit-address-family

ip forward-protocol nd

no ip http server

no ip http secure-server

no cdp log mismatch duplex

ipv6 router ospf 1

router-id 1.1.1.1

default-information originate

redistribute connected

redistribute bgp 1

redistribute static

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

## R2: -

hostname R2

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

no ip domain lookup

ip cef

ipv6 unicast-routing

ipv6 cef

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

interface Serial1/0

no ip address

shutdown

serial restart-delay 0

interface Serial1/1

no ip address

shutdown

serial restart-delay 0

interface Serial1/2

no ip address

shutdown

serial restart-delay 0

interface Serial1/3

no ip address

shutdown

serial restart-delay 0

interface Serial2/0

no ip address

shutdown

serial restart-delay 0

interface Serial2/1

no ip address

shutdown

serial restart-delay 0

interface Serial2/2

no ip address

shutdown

serial restart-delay 0

interface Serial2/3

no ip address

shutdown

serial restart-delay 0

interface Ethernet3/0

ip address 192.168.1.2 255.255.255.0

duplex half

ipv6 address FE80::2 link-local

ipv6 address 1::2/64

ipv6 ospf 1 area 0

interface Ethernet3/1

ip address 192.168.3.1 255.255.255.0

duplex half

ipv6 address FE80::2 link-local

ipv6 address 3::1/64

interface Ethernet3/2

no ip address

shutdown

duplex half

interface Ethernet3/3

no ip address

shutdown

duplex half

interface Ethernet3/4

no ip address

shutdown

duplex half

interface Ethernet3/5

no ip address

shutdown

duplex half

interface Ethernet3/6

no ip address

shutdown

duplex half

interface Ethernet3/7

no ip address

shutdown

duplex half

interface FastEthernet4/0

no ip address

shutdown

duplex auto

speed auto

interface FastEthernet4/1

no ip address

shutdown

duplex auto

speed auto

interface Serial5/0

no ip address

shutdown

serial restart-delay 0

interface Serial5/1

no ip address

shutdown

serial restart-delay 0

interface Serial5/2

no ip address

shutdown

serial restart-delay 0

interface Serial5/3

no ip address

shutdown

serial restart-delay 0

interface POS6/0

no ip address

shutdown

router ospf 1

router-id 2.2.2.2

redistribute connected

redistribute static

redistribute bgp 1

network 192.168.1.0 0.0.0.255 area 0

default-information originate

router bgp 1

bgp log-neighbor-changes

neighbor 1::1 remote-as 1

neighbor 3::2 remote-as 2

neighbor 192.168.1.1 remote-as 1

neighbor 192.168.3.2 remote-as 2

address-family ipv4

network 192.168.1.0

network 192.168.3.0

redistribute connected

redistribute static

redistribute ospf 1 match internal external 1 external 2

no neighbor 1::1 activate

no neighbor 3::2 activate

neighbor 192.168.1.1 activate

neighbor 192.168.3.2 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 1 match internal external 1 external 2

redistribute static

network 1::/64

network 3::/64

neighbor 1::1 activate

neighbor 3::2 activate

exit-address-family

ip forward-protocol nd

no ip http server

no ip http secure-server

no cdp log mismatch duplex

ipv6 router ospf 1

router-id 2.2.2.2

default-information originate

redistribute connected

redistribute bgp 1

redistribute static

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

## R3: -

hostname R3

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

no ip domain lookup

ip cef

ipv6 unicast-routing

ipv6 cef

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

interface Serial1/0

no ip address

shutdown

serial restart-delay 0

interface Serial1/1

no ip address

shutdown

serial restart-delay 0

interface Serial1/2

no ip address

shutdown

serial restart-delay 0

interface Serial1/3

no ip address

shutdown

serial restart-delay 0

interface Serial2/0

no ip address

shutdown

serial restart-delay 0

interface Serial2/1

no ip address

shutdown

serial restart-delay 0

interface Serial2/2

no ip address

shutdown

serial restart-delay 0

interface Serial2/3

no ip address

shutdown

serial restart-delay 0

interface Ethernet3/0

ip address 192.168.2.2 255.255.255.0

duplex half

ipv6 address FE80::3 link-local

ipv6 address 2::2/64

ipv6 ospf 1 area 0

interface Ethernet3/1

ip address 192.168.4.1 255.255.255.0

duplex half

ipv6 address FE80::3 link-local

ipv6 address 4::1/64

interface Ethernet3/2

no ip address

shutdown

duplex half

interface Ethernet3/3

no ip address

shutdown

duplex half

interface Ethernet3/4

no ip address

shutdown

duplex half

interface Ethernet3/5

no ip address

shutdown

duplex half

interface Ethernet3/6

no ip address

shutdown

duplex half

interface Ethernet3/7

no ip address

shutdown

duplex half

interface FastEthernet4/0

no ip address

shutdown

duplex auto

speed auto

interface FastEthernet4/1

no ip address

shutdown

duplex auto

speed auto

interface Serial5/0

no ip address

shutdown

serial restart-delay 0

interface Serial5/1

no ip address

shutdown

serial restart-delay 0

interface Serial5/2

no ip address

shutdown

serial restart-delay 0

interface Serial5/3

no ip address

shutdown

serial restart-delay 0

interface POS6/0

no ip address

shutdown

router ospf 1

router-id 3.3.3.3

redistribute connected

redistribute static

redistribute bgp 1

network 192.168.2.0 0.0.0.255 area 0

default-information originate

router bgp 1

bgp log-neighbor-changes

neighbor 2::1 remote-as 1

neighbor 4::2 remote-as 3

neighbor 192.168.2.1 remote-as 1

neighbor 192.168.4.2 remote-as 3

address-family ipv4

network 192.168.2.0

network 192.168.4.0

redistribute connected

redistribute static

redistribute ospf 1 match internal external 1 external 2

no neighbor 2::1 activate

no neighbor 4::2 activate

neighbor 192.168.2.1 activate

neighbor 192.168.4.2 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 1 match internal external 1 external 2

redistribute static

network 2::/64

network 4::/64

neighbor 2::1 activate

neighbor 4::2 activate

exit-address-family

ip forward-protocol nd

no ip http server

no ip http secure-server

no cdp log mismatch duplex

ipv6 router ospf 1

router-id 3.3.3.3

default-information originate

redistribute connected

redistribute bgp 1

redistribute static

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

## R4: -

hostname R4

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

no ip domain lookup

ip cef

ipv6 unicast-routing

ipv6 cef

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

interface Serial1/0

no ip address

shutdown

serial restart-delay 0

interface Serial1/1

no ip address

shutdown

serial restart-delay 0

interface Serial1/2

no ip address

shutdown

serial restart-delay 0

interface Serial1/3

no ip address

shutdown

serial restart-delay 0

interface Serial2/0

no ip address

shutdown

serial restart-delay 0

interface Serial2/1

no ip address

shutdown

serial restart-delay 0

interface Serial2/2

no ip address

shutdown

serial restart-delay 0

interface Serial2/3

no ip address

shutdown

serial restart-delay 0

interface Ethernet3/0

ip address 192.168.3.2 255.255.255.0

duplex half

ipv6 address FE80::4 link-local

ipv6 address 3::2/64

interface Ethernet3/1

ip address 192.168.5.1 255.255.255.0

duplex half

ipv6 address FE80::4 link-local

ipv6 address 5::1/64

ipv6 ospf 2 area 1

interface Ethernet3/2

no ip address

shutdown

duplex half

interface Ethernet3/3

no ip address

shutdown

duplex half

interface Ethernet3/4

no ip address

shutdown

duplex half

interface Ethernet3/5

no ip address

shutdown

duplex half

interface Ethernet3/6

no ip address

shutdown

duplex half

interface Ethernet3/7

no ip address

shutdown

duplex half

interface FastEthernet4/0

no ip address

shutdown

duplex auto

speed auto

interface FastEthernet4/1

no ip address

shutdown

duplex auto

speed auto

interface Serial5/0

no ip address

shutdown

serial restart-delay 0

interface Serial5/1

no ip address

shutdown

serial restart-delay 0

interface Serial5/2

no ip address

shutdown

serial restart-delay 0

interface Serial5/3

no ip address

shutdown

serial restart-delay 0

interface POS6/0

no ip address

shutdown

router ospf 2

router-id 4.4.4.4

redistribute connected

redistribute static

redistribute bgp 2

network 192.168.5.0 0.0.0.255 area 1

default-information originate

router bgp 2

bgp log-neighbor-changes

neighbor 3::1 remote-as 1

neighbor 192.168.3.1 remote-as 1

address-family ipv4

network 192.168.3.0

redistribute connected

redistribute static

redistribute ospf 2

no neighbor 3::1 activate

neighbor 192.168.3.1 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 2

redistribute static

network 3::/64

neighbor 3::1 activate

exit-address-family

ip forward-protocol nd

no ip http server

no ip http secure-server

no cdp log mismatch duplex

ipv6 router ospf 2

router-id 4.4.4.4

default-information originate

redistribute connected

redistribute static

redistribute bgp 2

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

## R5: -

hostname R5

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

no ip domain lookup

ip cef

ipv6 unicast-routing

ipv6 cef

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

interface Serial1/0

no ip address

shutdown

serial restart-delay 0

interface Serial1/1

no ip address

shutdown

serial restart-delay 0

interface Serial1/2

no ip address

shutdown

serial restart-delay 0

interface Serial1/3

no ip address

shutdown

serial restart-delay 0

interface Serial2/0

no ip address

shutdown

serial restart-delay 0

interface Serial2/1

no ip address

shutdown

serial restart-delay 0

interface Serial2/2

no ip address

shutdown

serial restart-delay 0

interface Serial2/3

no ip address

shutdown

serial restart-delay 0

interface Ethernet3/0

ip address 192.168.4.2 255.255.255.0

duplex half

ipv6 address FE80::5 link-local

ipv6 address 4::2/64

interface Ethernet3/1

ip address 192.168.6.1 255.255.255.0

duplex half

ipv6 address FE80::5 link-local

ipv6 address 6::1/64

ipv6 eigrp 1

interface Ethernet3/2

no ip address

shutdown

duplex half

interface Ethernet3/3

no ip address

shutdown

duplex half

interface Ethernet3/4

no ip address

shutdown

duplex half

interface Ethernet3/5

no ip address

shutdown

duplex half

interface Ethernet3/6

no ip address

shutdown

duplex half

interface Ethernet3/7

no ip address

shutdown

duplex half

interface FastEthernet4/0

no ip address

shutdown

duplex auto

speed auto

interface FastEthernet4/1

no ip address

shutdown

duplex auto

speed auto

interface Serial5/0

no ip address

shutdown

serial restart-delay 0

interface Serial5/1

no ip address

shutdown

serial restart-delay 0

interface Serial5/2

no ip address

shutdown

serial restart-delay 0

interface Serial5/3

no ip address

shutdown

serial restart-delay 0

interface POS6/0

no ip address

shutdown

router eigrp 1

network 192.168.6.0

redistribute static

redistribute connected

redistribute bgp 3 metric 100 1 255 1 1500

eigrp router-id 5.5.5.5

router bgp 3

bgp log-neighbor-changes

neighbor 4::1 remote-as 1

neighbor 192.168.4.1 remote-as 1

address-family ipv4

network 192.168.4.0

redistribute connected

redistribute static

redistribute eigrp 1

no neighbor 4::1 activate

neighbor 192.168.4.1 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute eigrp 1

redistribute static

network 4::/64

neighbor 4::1 activate

exit-address-family

ip forward-protocol nd

no ip http server

no ip http secure-server

no cdp log mismatch duplex

ipv6 router eigrp 1

eigrp router-id 5.5.5.5

redistribute static

redistribute connected

redistribute bgp 3 metric 100 1 255 1 1500

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

## R6: -

hostname R6

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

no ip domain lookup

ip cef

ipv6 unicast-routing

ipv6 cef

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

interface Serial1/0

no ip address

shutdown

serial restart-delay 0

interface Serial1/1

no ip address

shutdown

serial restart-delay 0

interface Serial1/2

no ip address

shutdown

serial restart-delay 0

interface Serial1/3

no ip address

shutdown

serial restart-delay 0

interface Serial2/0

no ip address

shutdown

serial restart-delay 0

interface Serial2/1

no ip address

shutdown

serial restart-delay 0

interface Serial2/2

no ip address

shutdown

serial restart-delay 0

interface Serial2/3

no ip address

shutdown

serial restart-delay 0

interface Ethernet3/0

ip address 192.168.5.2 255.255.255.0

duplex half

ipv6 address FE80::6 link-local

ipv6 address 5::2/64

ipv6 ospf 2 area 1

interface Ethernet3/1

no ip address

shutdown

duplex half

interface Ethernet3/2

no ip address

shutdown

duplex half

interface Ethernet3/3

no ip address

shutdown

duplex half

interface Ethernet3/4

no ip address

shutdown

duplex half

interface Ethernet3/5

no ip address

shutdown

duplex half

interface Ethernet3/6

no ip address

shutdown

duplex half

interface Ethernet3/7

no ip address

shutdown

duplex half

interface FastEthernet4/0

no ip address

shutdown

duplex auto

speed auto

interface FastEthernet4/1

no ip address

shutdown

duplex auto

speed auto

interface Serial5/0

no ip address

shutdown

serial restart-delay 0

interface Serial5/1

no ip address

shutdown

serial restart-delay 0

interface Serial5/2

no ip address

shutdown

serial restart-delay 0

interface Serial5/3

no ip address

shutdown

serial restart-delay 0

interface POS6/0

no ip address

shutdown

router ospf 2

router-id 6.6.6.6

redistribute connected

redistribute static

network 192.168.5.0 0.0.0.255 area 1

default-information originate

ip forward-protocol nd

no ip http server

no ip http secure-server

no cdp log mismatch duplex

ipv6 router ospf 2

router-id 6.6.6.6

default-information originate

redistribute connected

redistribute static

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

## R7: -

hostname R7

boot-start-marker

boot-end-marker

no aaa new-model

no ip icmp rate-limit unreachable

no ip domain lookup

ip cef

ipv6 unicast-routing

ipv6 cef

multilink bundle-name authenticated

redundancy

ip tcp synwait-time 5

interface FastEthernet0/0

no ip address

shutdown

duplex half

interface Serial1/0

no ip address

shutdown

serial restart-delay 0

interface Serial1/1

no ip address

shutdown

serial restart-delay 0

interface Serial1/2

no ip address

shutdown

serial restart-delay 0

interface Serial1/3

no ip address

shutdown

serial restart-delay 0

interface Serial2/0

no ip address

shutdown

serial restart-delay 0

interface Serial2/1

no ip address

shutdown

serial restart-delay 0

interface Serial2/2

no ip address

shutdown

serial restart-delay 0

interface Serial2/3

no ip address

shutdown

serial restart-delay 0

interface Ethernet3/0

ip address 192.168.6.2 255.255.255.0

duplex half

ipv6 address FE80::7 link-local

ipv6 address 6::2/64

ipv6 eigrp 1

interface Ethernet3/1

no ip address

shutdown

duplex half

interface Ethernet3/2

no ip address

shutdown

duplex half

interface Ethernet3/3

no ip address

shutdown

duplex half

interface Ethernet3/4

no ip address

shutdown

duplex half

interface Ethernet3/5

no ip address

shutdown

duplex half

interface Ethernet3/6

no ip address

shutdown

duplex half

interface Ethernet3/7

no ip address

shutdown

duplex half

interface FastEthernet4/0

no ip address

shutdown

duplex auto

speed auto

interface FastEthernet4/1

no ip address

shutdown

duplex auto

speed auto

interface Serial5/0

no ip address

shutdown

serial restart-delay 0

interface Serial5/1

no ip address

shutdown

serial restart-delay 0

interface Serial5/2

no ip address

shutdown

serial restart-delay 0

interface Serial5/3

no ip address

shutdown

serial restart-delay 0

interface POS6/0

no ip address

shutdown

router eigrp 1

network 192.168.6.0

redistribute static

redistribute connected

eigrp router-id 7.7.7.7

ip forward-protocol nd

no ip http server

no ip http secure-server

no cdp log mismatch duplex

ipv6 router eigrp 1

eigrp router-id 7.7.7.7

redistribute static

redistribute connected

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

transport input all

end

## Problems

There were a few problems that I ran into while completing this lab. The first problem that I had was that my topology was divided into two parts: -

1. To the left of R1
2. To the right of R1

and neither node in one section could connect/ping to any other node in the other section. It was as if something was wrong in R1 due to which the ICMP packets would not go through R1. Although it seemed as if something was wrong in R1, it turned out to be a problem in R2 and R3. I had to do a little bit of research and after that, I figured out that I needed to put the redistribute ospf 1 match internal external command on those routers.

While doing OSPFv3, I forgot to put router-ids on a few routers, due to which, those routers could not form a connection with their peers. After doing a show run on all the routers, I figured out the cause of this problem and fixed it by entering the router-id command in the OSPFv3 router-config mode on those routers.

## Conclusion

BGP is the new age routing protocol. Although it was made prior to the invention of IPv6 addressing scheme, it is probably the most used protocol on the internet. It basically is the protocol that makes the internet work. IT Networking in a broader term, is associated with the internet. Only a few, however, know how the internet works. It is extremely important for a network genius to know about the internet, and therefore, know about BGP! With such an important protocol, comes a few challenges. One mistake from the ISP while configuring BGP can result in the entire world’s internet to shut down, and it has happened before. In 2004 a Turkish Internet service provider (ISP) called TTNet accidentally advertised bad BGP routes to its neighbors. These routes claimed that TTNet itself was the best destination for all traffic on the Internet. As these routes spread further and further to more autonomous systems, a massive disruption occurred, creating a 1-day crisis where many people across the world were not able to access some or all of the Internet. However, in this lab, we dove into the principles of BGP and furthered our understanding of the protocol.