Lab 10: Configuration of BGP & Servers (DNS, Web & DHCP)

Objectives:

- To be familiar with BGP for inter-AS routing and its configuration
- To be familiar with different servers & their configuration: DHCP, Web, DNS

Requirements:

- Computer with Cisco Packet Tracer installed.

Exercises:

1. Why is BGP necessary to route network traffic between ASes? Explain.

=> BGP is required to route network traffic between ASes on the basis of policy based routing instead of simple physical characteristics. These policies can be based on various attributes such as the AS path, prefix length and the next-hop IP address. Since each AS may enforce its own policy, BGP allows the network traffic to align with the intention of each of the AS present. And as an added bonus, an outside wouldn't know about the internal topology of an AS.

2. What is DHCP? Why is it used? Explain its importance.

=> DHCP (Dynamic Host Configuration Protocol) is a network protocol used to automatically assign IP addresses and other configuration parameters, like the DNS server, the default gateway to devices present in a network. Since most devices are mobile in nature, they can leave the network premises and return back, it is not feasible to assign these parameters manually.

3. What is DNS? Why is it used? Explain its importance in the Internet system.

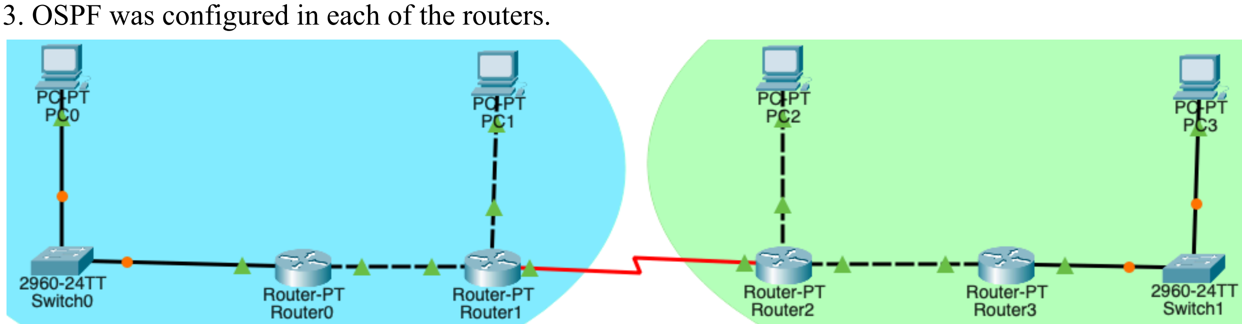
=> DNS (Domain Name System) is the phonebook of the internet. Like how a regular phonebook maps names to phone numbers, DNS maps domain names to IP addresses. It is extremely important because there are billions of websites and remembering IP addresses for the ones we use is not feasible.

Procedure:

Activity A.

The given network topology was created. IP address for Routers and PCs, and Default gateway and Subnet mask for PCs were configured. 2 different ASes were connected using the addresses given.

3. OSPF was configured in each of the routers.



4. Upon testing the connectivity among the PCs, all the PCs in the same AS could ping each other.

5. Configuring BGP in router1 to advertise networks of area 100 to area 200:
In router1,

```
Router(config)#router bgp 100
Router(config-router)#neighbor 222.2.2.2 remote-as 200
Router(config-router)#network 200.0.1.0 mask 255.255.255.0
Router(config-router)#network 200.0.12.0 mask 255.255.255.0
Router(config-router)#no network 200.0.12.0 mask 255.255.255.0
Router(config-router)#network 200.0.2.0 mask 255.255.255.0
Router(config-router)#network 200.0.3.0 mask 255.255.255.0
Router(config-router)#%BGP-5-ADJCHANGE: neighbor 222.2.2.2 Up
```

6. Similar configuration was done for Router2 to advertise networks in area 200 to area 100.

7. Inter AS ping was unsuccessful as the non BGP setup routers didn't know about the other AS. Pinging from PC1 to PC2 was successful though.

8. Using the default route in Router0 to forward traffic towards Router1:

```
Router(config)#ip route 0.0.0.0 0.0.0.0 Fa1/0
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inte
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

C    200.0.1.0/24 is directly connected, FastEthernet0/0
C    200.0.2.0/24 is directly connected, FastEthernet1/0
O    200.0.3.0/24 [110/2] via 200.0.2.2, 00:16:26, FastEthernet1/0
S*   0.0.0.0/0 is directly connected, FastEthernet1/0
```

In router3, a similar process was followed to set up a static route.

9. Inter AS ping is now successful.

10. Removed the static routes in Router 0 and Router 3 both. In Router0,

```
Router(config)#no ip route 0.0.0.0 0.0.0.0 Fa0/0
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

Gateway of last resort is not set

C    220.0.1.0/24 is directly connected, FastEthernet1/0
C    220.0.2.0/24 is directly connected, FastEthernet0/0
O    220.0.3.0/24 [110/2] via 220.0.2.1, 00:10:11, FastEthernet0/0
```

Only router 1 and 2 have all information about the networks. Other routers inside the area only know information about their own area only.

11. We configured Router1 to redistribute the BGP route information in OSPF. Similarly, we even configured Router2 to redistribute the BGP route information in OSPF.

- R1(config)# router osfp 1
- R1(config-router)# redistribute bgp 10
- R1(config-router)# end

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP

Gateway of last resort is not set

O E2 200.0.1.0/24 [110/20] via 220.0.2.1, 00:00:08, FastEthernet0/0
O E2 200.0.2.0/24 [110/20] via 220.0.2.1, 00:00:08, FastEthernet0/0
O E2 200.0.3.0/24 [110/20] via 220.0.2.1, 00:00:08, FastEthernet0/0
C    220.0.1.0/24 is directly connected, FastEthernet1/0
C    220.0.2.0/24 is directly connected, FastEthernet0/0
O    220.0.3.0/24 [110/2] via 220.0.2.1, 00:21:42, FastEthernet0/0
```

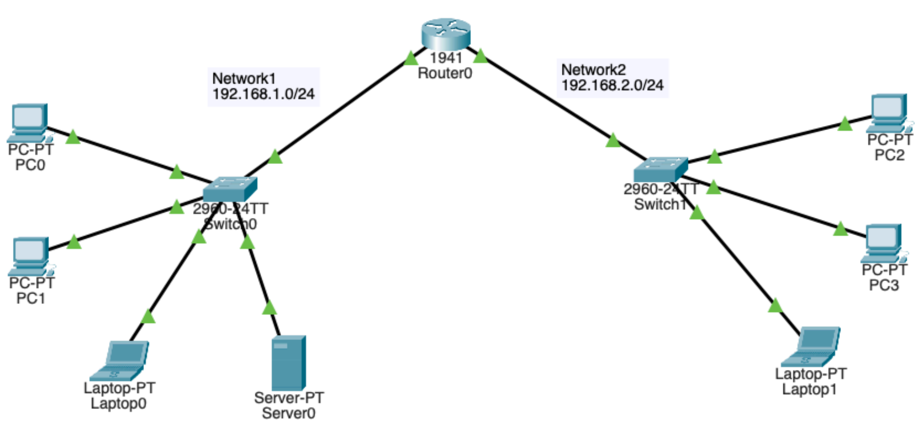
12. All the pings are now possible, even the inter-AS ones.

13. Saving the router configurations,

```
Router>enable
Router#copy running-config startup-config
Destination filename [startup-config]? startup-config
Building configuration...
[OK]
Router#
```

14. After saving router configurations, all pings within and between the AS'es were successful. Now, even if the routers reboot, or restart, the configurations won't be lost.

Activity B.



The given network was created, with computers, switches and router as shown in figure. Gig 0/0 (IP address 192.168.1.1/24) of Router0 was connected to Switch0. Gig 0/1 (IP address 192.168.2.1/24) of Router0 was connected to Switch1.

2. When trying to obtain IP configurations in PC0 and PC2 using DHCP, the PCs got an IP based on APIPA but those IPs didn't correspond to the IP that the PCs are a part of since we don't have a running DHCP server.

3. The DHCP server was configured in Router0 for Network_1.

```
Router(config)#ip dhcp pool Network_1
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#dns-server 192.168.1.10
```

4. Upon trying to obtain IP configurations in PC0 and PC2 using DHCP, PC0 got an IP of 192.168.1.2 and PC2 got an IP based on APIPA.

5. We configured the DHCP server in Router0 for Network_2. Now, we can obtain IP addresses in both PCs of the desired range.

6. We obtained IP configurations in PC0 and PC2 using DHCP. For PC2,

DHCP	Static	DHCP request successful.
IPv4 Address	192.168.2.2	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.2.1	
DNS Server	192.168.1.10	

DNS server: 192.168.1.10

7. Excluding the ranges of IP addresses from 192.168.1.1 192.168.1.20,

```
Router(config)#ip dhcp excluded-address 192.168.1.1 192.168.1.20
```

8. After requesting the PC1 and PC3 for DHCP, the PCs got the IP addresses that haven't been excluded, but even after changing the DHCP exclusion range, once we've already assigned the IP, it doesn't change unless we try to re-assign it.

In PC1,

DHCP	Static	DHCP request successful.
IPv4 Address	192.168.1.21	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.1.1	
DNS Server	192.168.1.10	

9. Excluding the ranges of IP addresses from 192.168.2.1 192.168.2.40,

```
Router(config)#ip dhcp excluded-address 192.168.2.1 192.168.2.40
```

In PC3,

DHCP	Static	DHCP request successful.
IPv4 Address	192.168.2.3	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.2.1	
DNS Server	192.168.1.10	

10. After requesting for DHCP in the laptops, the IP addresses received were: Laptop0: 192.168.1.22 and for Laptop1, 192.168.2.41.

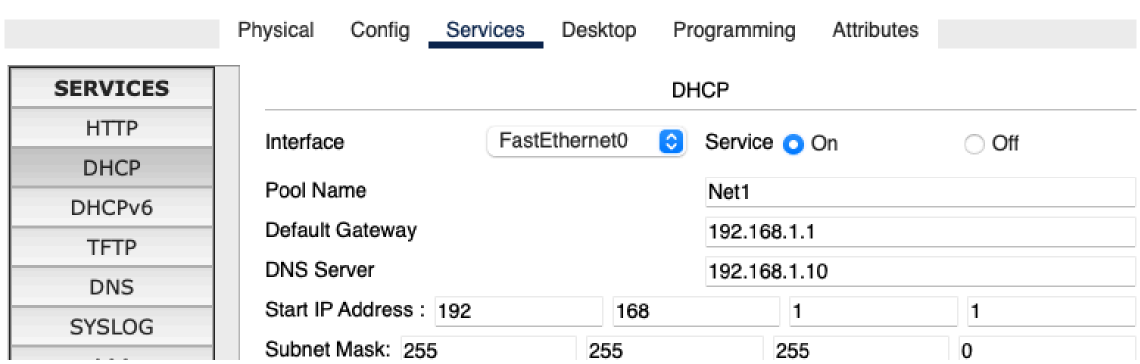
11. The command show ip dhcp pool in privileged access mode displays the DHCP pools which are Net1 and Net2. Other useful information is also displayed which include the leased addresses, excluded addresses and the range that is present in the pool.

```
%SYS-5-CONFIG_I: Configured from console by console
show ip dhcp pool

Pool Net1 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 3
 Excluded addresses             : 2
 Pending event                  : none

 1 subnet is currently in the pool
 Current index        IP address range                    Leased/Excluded/Total
 192.168.1.1          192.168.1.1      - 192.168.1.254     3    / 2     / 254

Pool Net2 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 3
 Excluded addresses             : 2
 Pending event                  : none

 1 subnet is currently in the pool
 Current index        IP address range                    Leased/Excluded/Total
 192.168.2.1          192.168.2.1      - 192.168.2.254     3    / 2     / 254
```

12. Observing the lease information using show ip dhcp binding command, it shows the mapping of IP assigned to their corresponding MAC addresses. Since there is no value for their lease expiration, the PCs will own the IP until they're restarted.

```
Router#show ip dhcp binding
IP address       Client-ID/              Lease expiration        Type
                 Hardware address
192.168.1.2      0001.6306.0322           --                     Automatic
192.168.1.21     0005.5E2B.9AD4           --                     Automatic
192.168.1.22     00E0.8F96.E9A1           --                     Automatic
192.168.2.2      000C.CF04.233A           --                     Automatic
192.168.2.3      0060.473E.E736           --                     Automatic
192.168.2.41     0001.43D8.A950           --                     Automatic
```

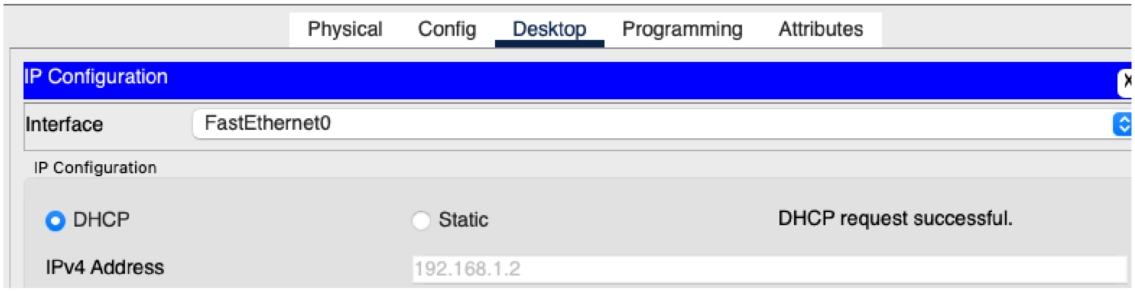
Optional. 13. A server was added in Net1 and configured as a DHCP server. After configuring the server, even if the DHCP configuration in the router was removed, the PCs had their IP addresses fine.



Removed the DHCP configuration in the Router,

```
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#no ip dhcp pool Net1
Router(config)#
```

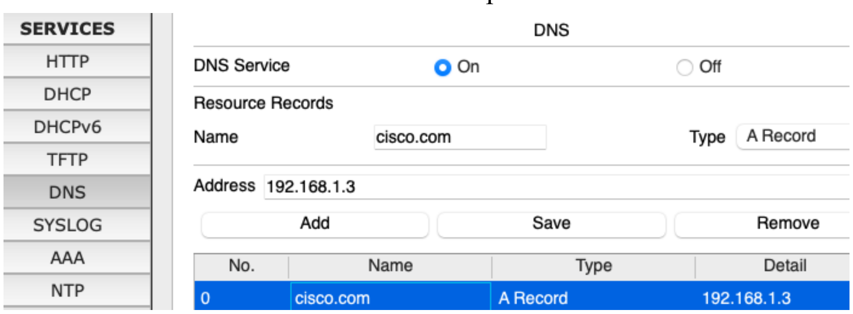
PC0 still has its original IP configuration.



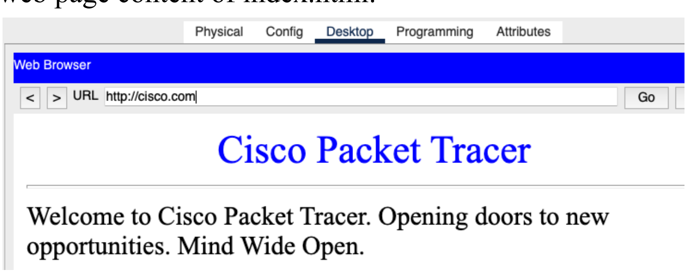
Activity C.

The topology was created, and the ip address of the Interface 0(192.168.1.1) of the router0 was set.
1. In the *services* of web server, we turned the http on and configured the IP addresses and gateway. In the HTTP service tab, you can modify the default web page content (index.html file) to indicate it is for cisco.com.

2. In the DNS server, we added a DNS record for cisco.com, giving the address of the Web server and turned DNS on & added its IP addresses at the Desktop tab.



3. Then, in PC1, we configured its IP addresses, DNS server(192.168.1.2) and then the PC could browse cisco.com. The process works like this: when a PC requests for cisco.com, DNS maps the request to the ip address, 192.168.1.3(web server). Then, the browser sends an HTTP request to 192.168.1.3 and the Web server displays the web page content of index.html.



4. DHCP was configured in Router 0 for 192.168.1.0/24 network to provide the IP address, subnet mask, default gateway and DNS server to any computer connected with Switch0. Also, we reserved the IP addresses from 1 to 30 for specific servers and router interfaces while configuring DHCP.

Router0(config)#ip dhcp pool Net1
Router0(dhcp-config)#network 192.168.1.0 255.255.255.0
Router0(dhcp-config)#default-router 192.168.1.1
Router0(dhcp-config)#dns-server 192.168.1.2
Router0(dhcp-config)#exit
Router0(config)#ip dhcp excluded-address 192.168.1.1 192.168.1.30

5. Upon adding a new PC connected to Switch0, the obtained IP address was 192.168.1.31/24 with Default Router IP Address 192.168.1.1 and DNS server IP address 192.168.1.2.

6. We can browse "cisco.com" from the New PC properly.

7. Necessary routing configurations for Network2 and 3 were set up. IP Address, subnet mask, DNS server (192.168.3.2) and default gateway were set up in Router2, Root DNS and PC2. Then, OSPF routing was done in R0 and R2.

8. In order to browse cisco.com from PC2, the DNS server was configured to add a dns record with cisco.com, forwarding it to the web server at Net1.

9. Configuring the DNS server (DNS 192.168.1.2) to forward the DNS resolution requests to Root DNS. After setting up the records for the TLD com to point to root and root to point to 192.168.1.3, we can browse cisco.com from all the PCs. The DNS records are as follows, for setting the Multilevel DNS:

In DNS of network1 (192.168.1.2):

No.	Name	Type	Detail
0	cisco.com	A Record	192.168.1.3
1	com	NS	root
2	root	A Record	192.168.3.2
3	roshni.net1	A Record	192.168.1.3

In root (192.168.3.2):

No.	Name	Type	Detail
0	cisco.com	A Record	192.168.1.3

Conclusion

The lab effectively implemented and tested network configurations and routing protocols. Initially, OSPF was configured within each AS, ensuring local PC communication. BGP was then set up to advertise networks between ASes. While inter-AS communication initially failed, adding default routes resolved the issue. Redistribution of BGP routes into OSPF further facilitated connectivity. In Activity B, DHCP was configured on Router0, successfully assigning IP addresses and managing exclusions, though reassignments required manual updates. Activity C involved setting up a web server and DNS server, with successful domain resolution and web access from PCs. Overall, the lab confirmed the successful deployment and troubleshooting of network services and protocols. More Notes in laptop Notes app.