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Computer Network

Lab 10: Configuration of BGP and Servers

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LAB No: 10

Configuration of BGP & Servers (DHCP, DNS & Web)

Objectives:

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

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Environmental Setup:

- Network simulation tool: Packet Tracer

Theory:

BGP:

An Exterior Gateway Protocol (EGP) that uses Path-Vector routing.

Configuration of BGP:

Enable BGP on a router by using the router bgp AS-No. global configuration command.

Configure the information of the neighbor that is directly connected in the peer AS using neighbor command.

Inside bgp configuration mode you can configure the networks that you want to advertise to your peer AS. Here it is better to use CIDR prefix to minimize route information.

Steps:

● enable

● configure terminal

● router bgp AS-no.

● neighbor <ip-address of neighbor> remote-as <AS no. of connected neighbor> ● network ip-address mask subnet-mask

● end

[Activity A]

Configuration of BGP

Created the network topology as shown in figure 1:

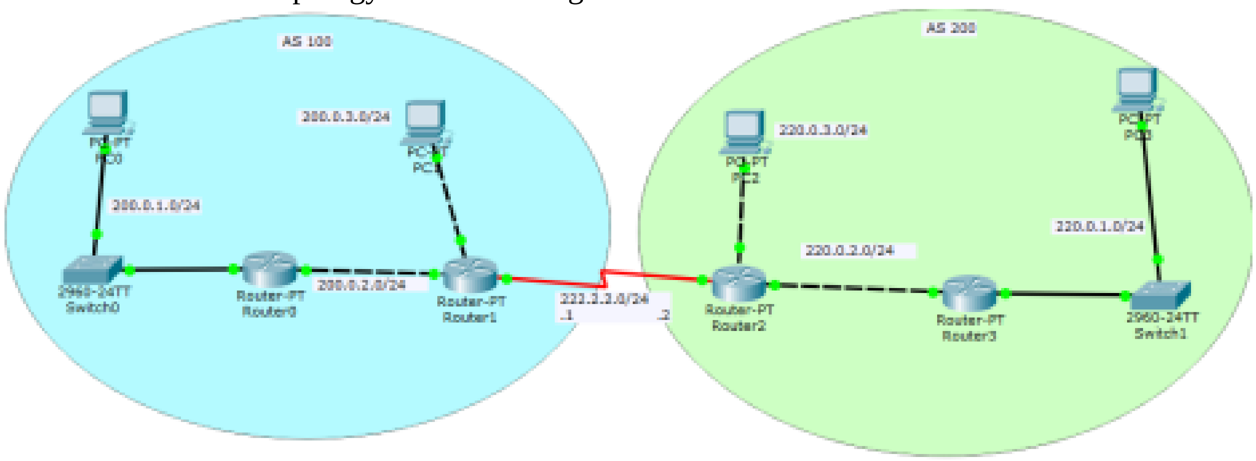


Figure 1: Network Topology 1

1. Configured the appropriate IP address of the corresponding router interface. Also configured the IP address, subnet mask & default gateway of each PC as directed in the labsheet.
2. Used the ip address configurations as directed for all the routing devices.
3. Configured OSPF routing in each AS, but remember that **never passed OSPF in another AS**.
4. Tested the connectivity from each PC to each other PC :

```
C:\>ping 200.0.3.2

Pinging 200.0.3.2 with 32 bytes of data:

Request timed out.
Reply from 200.0.3.2: bytes=32 time<1ms TTL=126
Reply from 200.0.3.2: bytes=32 time<1ms TTL=126
Reply from 200.0.3.2: bytes=32 time<1ms TTL=126

Ping statistics for 200.0.3.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 220.0.3.2

Pinging 220.0.3.2 with 32 bytes of data:

Reply from 200.0.1.1: Destination host unreachable.
Request timed out.
```

```
Reply from 200.0.1.1: Destination host unreachable.
Reply from 200.0.1.1: Destination host unreachable.

Ping statistics for 220.0.3.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

There was communication within the AS but there was no communication in between the AS 100 and AS 200.

5. Now configured BGP in Router1 to advertise all the networks of AS 100 to another AS as:

```
Router1(config)# router bgp 100
Router1(config-router)# neighbor 222.2.2.2 remote-as 200
Router1(config-router)# network 200.0.1.0 mask 255.255.255.0
Router1(config-router)# network 200.0.2.0 mask 255.255.255.0
Router1(config-router)# network 200.0.3.0 mask 255.255.255.0
```

6. Similarly, configured BGP in Router2 to advertise the all networks of AS 200 to another AS 100.

```
Router(config)#router bgp 200
Router(config-router)#neighbor 222.2.2.1 remote-as 100
Router(config-router)#%BGP-5-ADJCHANGE: neighbor 222.2.2.1 Up
Router(config-router)#network 220.0.1.0 mask 255.255.255.0
Router(config-router)#network 220.0.2.0 mask 255.255.255.0
Router(config-router)#network 220.0.3.0 mask 255.255.255.0
```

7. Tested the connectivity from each PC to each other PC:

```
C:\>ping 222.2.2.2
Pinging 222.2.2.2 with 32 bytes of data:
Reply from 200.0.1.1: Destination host unreachable.
Request timed out.
Reply from 200.0.1.1: Destination host unreachable.
Request timed out.
Ping statistics for 222.2.2.2:
   Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

8. Since the router 0 does not know the network os AS 200, configured the default route on this router towards the border router port.

```
Router(config)#ip route 0.0.0.0 0.0.0.0 200.0.2.2
```

9.Now the packets from the PCs of AS 1 are forwarded to the AS 2.

```
C:\>ping 220.0.3.2
Pinging 220.0.3.2 with 32 bytes of data:
Request timed out.
```

```
Reply from 220.0.3.2: bytes=32 time=2ms TTL=125
Reply from 220.0.3.2: bytes=32 time=1ms TTL=125
Reply from 220.0.3.2: bytes=32 time=2ms TTL=125
Ping statistics for 220.0.3.2:
   Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
   Minimum = 1ms, Maximum = 2ms, Average = 1ms
```

10. Now, removed the default routes in all routers of both AS.
11. Configured Router1 to redistribute the BGP route information in OSPF. Similarly, configured the Router2 to redistribute the BGP route information in OSPF.

```
Router(config)#router ospf 1
Router(config-router)#redistribute bgp 100
% Only classful networks will be redistributed
Router(config-router)#redistribute bgp 10
BGP is already running; AS is 100
Router(config-router)#end

Router(config)#router ospf 1
Router(config-router)#redistribute bgp 200
% Only classful networks will be redistributed
Router(config-router)#end
```

12. Now there was connection between all the PCs in both the AS

```
C:\>ping 220.0.3.2
Pinging 220.0.3.2 with 32 bytes of data:
Reply from 220.0.3.2: bytes=32 time=1ms TTL=125
Reply from 220.0.3.2: bytes=32 time=1ms TTL=125
Reply from 220.0.3.2: bytes=32 time=1ms TTL=125
Reply from 220.0.3.2: bytes=32 time=52ms TTL=125
Ping statistics for 220.0.3.2:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
   Minimum = 1ms, Maximum = 52ms, Average = 13ms
```

13. Saved the configurations in each router.
14. Restart all routers.

```
C:\>ping 220.0.3.2
Pinging 220.0.3.2 with 32 bytes of data:
Request timed out.
Reply from 200.0.1.1: Destination host unreachable.
Request timed out.
Reply from 200.0.1.1: Destination host unreachable.
Ping statistics for 220.0.3.2:
   Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

```
After overwriting all the startup-config with the saved running config.

C:\>ping 220.0.3.2
Pinging 220.0.3.2 with 32 bytes of data:
Request timed out.
Reply from 220.0.3.2: bytes=32 time=52ms TTL=125
Reply from 220.0.3.2: bytes=32 time=1ms TTL=125
Reply from 220.0.3.2: bytes=32 time=1ms TTL=125
Ping statistics for 220.0.3.2:
   Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
   Minimum = 1ms, Maximum = 52ms, Average = 18ms
```

Hence, the connectivity was reestablished to how it was.

[Activity B]

Configuration of DHCP

Created the network topology as shown in figure below:

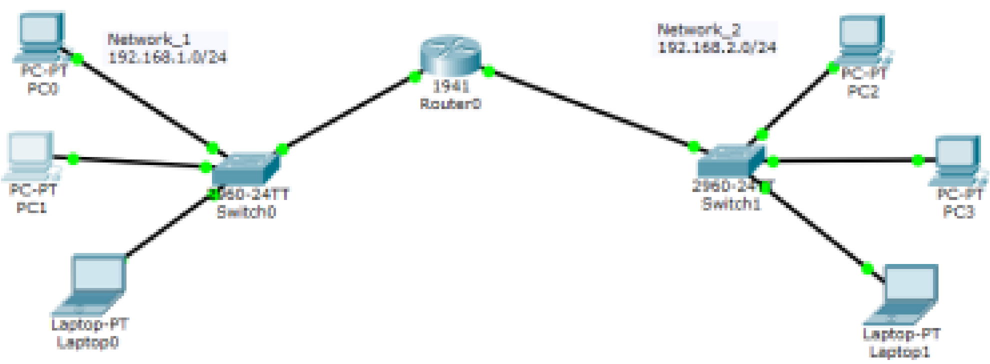


Figure 2: Network Topology 2

1. Connected the computers, switches and router as shown in figure:
   - ➢ Connected GigabitEthernet 0/0 (IP address 192.168.1.1/24) of Router0 to Switch0 . ➢ Similarly, connected GigabitEthernet 0/1 (IP address 192.168.2.1/24) of Router0 to Switch1.
2. Tried to obtain IP configurations in PC0 and PC2 using DHCP but couldn't really obtain any address
3. Configured DHCP server in Router0 for Network_1.
4. Tried to obtain IP configurations in PC0 and PC2 using DHCP and the PC 0 obtained the addresses configured on the DHCP server in Router0 but there were no addresses in PC 1.
5. Configured DHCP server in Router0 for Network_2.
6. Obtained IP configurations in PC0 and PC2 using DHCP and they were same as the ones mentioned in the command for DNS.
7. Excluded the ranges of IP address from 192.168.1.1 192.168.1.20
8. Obtain IP configurations in PC1as 192.168.1.21 and PC3 as 192.168.2.3

using DHCP.

9. Excluded the ranges of IP address from 192.168.2.1 to 192.168.2.40

10. Obtained IP configurations in Laptop0 as 192.168.1.22 and Laptop1 as 192.168.2.41 using DHCP.

11. Observed the output of show ip dhcp pool in privileged access mode.

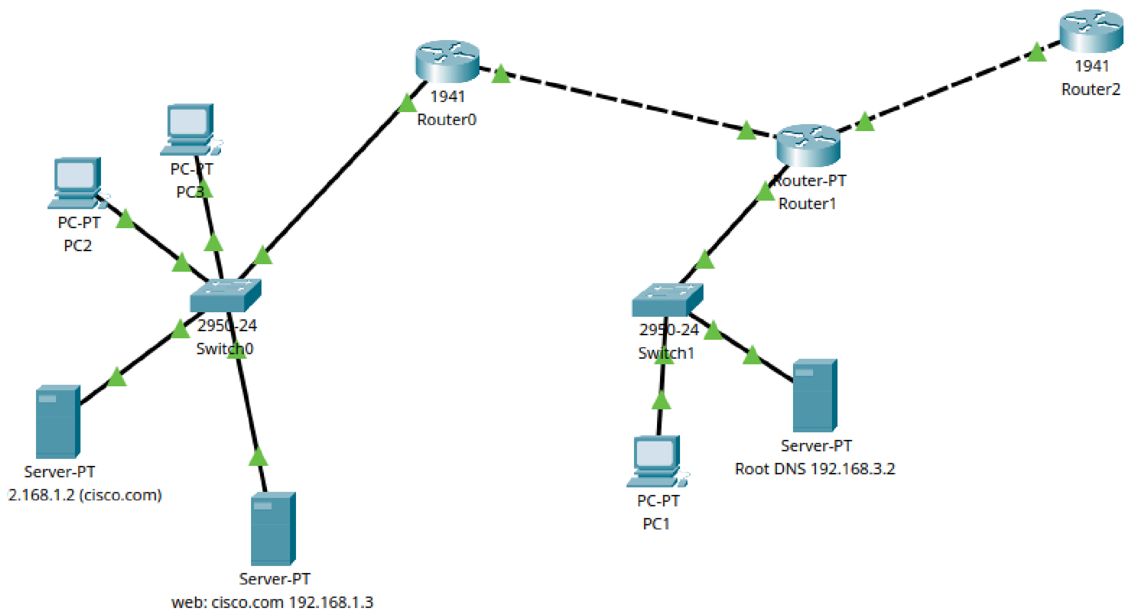
```
Pool Mavis021 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 0
 Excluded addresses             : 2
 Pending event                  : none

 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     0    / 2     / 254

Pool Mavis021_2 :
 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. Also observed the lease information of using `show ip dhcp binding` command.

```
Router#show ip dhcp binding
IP address       Client-ID/              Lease expiration        Type
                 Hardware address
192.168.1.2      0007.EC71.CA1C           --                     Automatic
192.168.1.4      0000.0C50.9CAB           --                     Automatic
192.168.1.21     000A.F3C8.6550           --                     Automatic
192.168.1.22     00E0.B0AB.0776           --                     Automatic
192.168.2.2      00E0.F993.0B8A           --                     Automatic
192.168.2.3      0001.4384.1481           --                     Automatic
192.168.2.41     0001.969B.834A           --                     Automatic
```

[Activity C]

Configuration of DHCP DNS

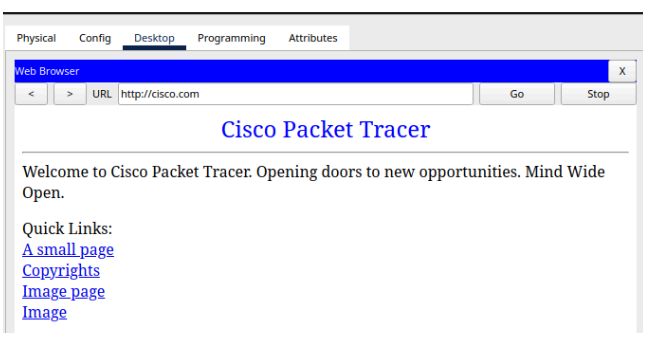


The network topology shown in figure 3 has a DNS server and a web server in the network 192.168.1.0/24. There is a Root DNS in the different network of 192.168.3.0/24.

1. Configured a web server for cisco.com in the server with IP address of 192.168.1.3

2. Configured a DNS server (DNS 192.168.1.2) to resolve the domain cisco.com to corresponding IP.

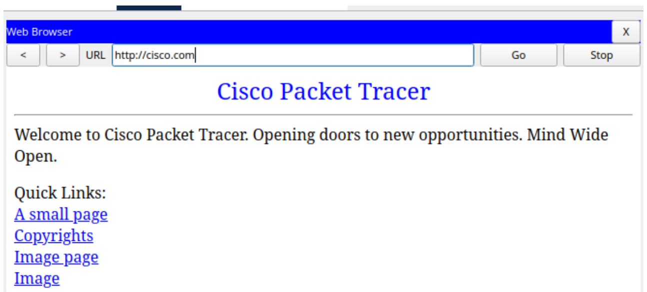
3. Browsed the cisco.com from PC and note down the observation.



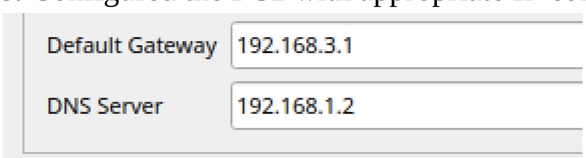
4. Configure the DHCP in Router0 for 192.168.1.0/24 network to provide the IP address, subnet mask, default gateway and DNS server to any computer connected with Switch0. Reserve the IP addresses from 1 to 30 for specific servers and router interfaces while configuring DHCP.

```
Router(config)#ip dhcp pool Mavis021_01
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 192.168.1.2
Router(dhcp-config)#ip dhcp excluded-address 192.168.1.1 192.168.1.30
```

5. Added a new PC and connected it with Switch0. Used DHCP to obtain IP configurations as 192.168.1.31.
6. Browsed the cisco.com from the new PC



7. Configured the necessary routing.
8. Configured the PC2 with appropriate IP configurations



And it was able to get the web page cisco.com.
9. Configured the DNS server (DNS 192.168.1.2) to forward the DNS resolution requests towards Root DNS (192.168.3.2) for helloworld.com which was hosted on the same web server as of cisco.com.
Hence, the packet from PC 0 first traveled the local DNS and then sent it to the Root DNS then the root DNS forwarded it to the web server.

```
C:\>ping helloworld.com
Pinging 192.168.1.3 with 32 bytes of data:
Reply from 192.168.1.3: bytes=32 time=4ms TTL=128
Reply from 192.168.1.3: bytes=32 time=4ms TTL=128
Reply from 192.168.1.3: bytes=32 time=4ms TTL=128
Reply from 192.168.1.3: bytes=32 time=4ms TTL=128
Ping statistics for 192.168.1.3:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
   Minimum = 4ms, Maximum = 4ms, Average = 4ms
```

Exercise:

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

   BGP (Border Gateway Protocol) is crucial for routing network traffic between Autonomous Systems (ASes) on the Internet because it enables the sharing of routing information across different ASes. This is essential due to the Internet's structure, which comprises numerous independently managed networks. BGP supports scalability by summarizing routing information and selecting efficient routes, which is vital given the Internet's vastness. Additionally, it allows for policy-based routing, enabling ASes to prioritize certain paths based on commercial agreements or performance metrics. BGP also helps prevent routing loops through its path vector mechanism and ensures network redundancy by allowing multiple connections with different ASes, providing alternative routes in case of failures. This protocol's ability to manage routing at such a scale and complexity is what makes it indispensable for the Internet's operation.

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

   DHCP (Dynamic Host Configuration Protocol) is a network protocol that automates the assignment of IP addresses and other network settings to devices on a network. This automation eliminates the need for manual IP configuration, which is particularly beneficial in large networks. By centralizing IP address management, DHCP simplifies network administration, ensuring efficient use of IP addresses through its leasing system. This not only prevents address conflicts but also makes the process of adding and moving devices seamless. DHCP's ability to provide consistent network settings, such as default gateways and DNS servers, ensures that devices are correctly configured for network communication. Its support for dynamic and mobile devices, which frequently change networks, makes it an essential protocol for modern networking environments.

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

   DNS (Domain Name System) is a foundational component of the Internet that translates human-readable domain names into machine-readable IP addresses. This system allows users to access websites using easily memorable names instead of complex IP addresses, making the Internet more accessible and user-friendly. DNS operates as a decentralized and hierarchical database, ensuring robustness and scalability without a single point of failure. It plays a critical role in load balancing by distributing traffic across multiple servers and providing redundancy to maintain service availability. DNS also supports various Internet services, such as email, through specific records like MX records. Moreover, security enhancements like DNSSEC help protect against threats such as DNS spoofing. In essence, DNS is indispensable for efficient navigation and functionality across the Internet, supporting a wide range of services and applications.

Conclusion

This lab helped understand the working of a web service through the network and also the ease of providing ip addresses to devices through DHCP servers.Exercise: