Computer Networks

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

Requirements:

- Network simulation tool: Packet Tracer

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

Example:

- `R1> enable`
- `R1# configure terminal`
- `R1(config)# router bgp 100`
- `R1(config-router)# neighbor 200.2.2.2 remote-as 200`
- `R1(config-router)# network 200.1.1.0 mask 255.255.255.0`
- `R1(config-router)# network …… mask ……`
- `R1(config-router)# end`

We can distribute the route obtained from BGP to other routers within same AS via redistribute command in OSPF configuration mode as:

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

Similarly, we can also distribute the route obtained from IGPs such as OSPF to the peer AS via redistribute command in bgp configuration mode as:

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

Saving Configurations of Router

The startup config is the configuration stored in NVRAM and the running config is the current running configuration in the RAM. We can also store the configurations in external servers like TFTP for backup purposes. To store and retrieve the configuration we can use the copy command with following syntax.

```
Router#copy source destination
```

Once the configuration is done, it needs to be saved, otherwise the configuration will be lost when power is down or the router is rebooted. The current running configuration can be saved into the router as a startup configuration with the following command.

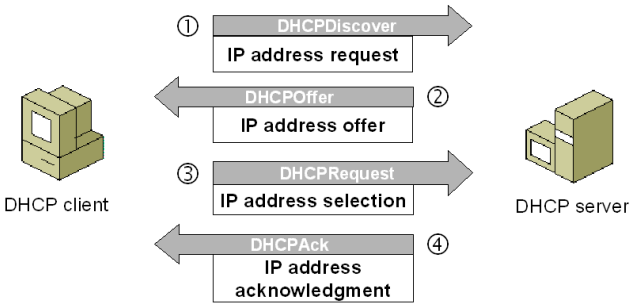
```
copy running-config startup-config
```

Similarly, if the current running configuration needs to be overwritten with the startup configuration, we have to use the following command.

```
copy startup-config running-config
```

DHCP

- When a host (DHCP client) needs an IP configuration, it connects to a DHCP server and requests for an IP configuration. A DHCP server contains several pre-configured IP configurations. When it receives a DHCP request from a DHCP client, it provides an IP configuration to the client from available IP configurations.
- IP configuration consists of different configurations such as:
    - IP address & subnet mask for requesting client
    - Default gateway
    - DNS server
- This entire process goes through the four steps as:
    - DHCP Discover
    - DHCP Offer
    - DHCP Request
    - DHCP Acknowledgment



Configuration of DHCP Server

We can configure the DHCP server on any server computer as well as Cisco Router. While configuring a DHCP server, we have to define a DHCP pool of IP addresses with subnet mask to be assigned to hosts, a Default gateway for the network and a DNS Server. The packet tracer server can also be configured for the DHCP server.

Configuring a DHCP server in a Cisco router:

```
Router>enable
Router#configure terminal
Router(config)#
Router(config)#ip dhcp pool My_Net_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
```

Excluding some IP addresses in given range:

We can add ip dhcp excluded-address command to our configuration to configure the router to exclude addresses 192.168.1.1 through 192.168.1.10 when assigning addresses to clients. This command may be used to reserve addresses that are statically assigned to key hosts/servers.

```
Router> enable
Router# configure terminal
Router(config)#ip dhcp excluded-address 192.168.1.1 192.168.1.10
```

Note: You can try to configure the DHCP server in **Packet-Tracer Server** also.

DNS

- Like a phonebook on the Internet.
- A hierarchical and decentralized naming system for computers, services, or other resources connected to the Internet or a private network
- It is convenient for us to access online information through domain names, like cisco.com or google.com, pcampus.edu.np, ioe.edu.np etc.
- The Domain Name System (DNS) is a hierarchical and decentralized naming system for computers, services, or other resources connected to the Internet or a private network
- You can configure the DNS server in Packet-Tracer Server

Web

- A web server uses HTTP (Hypertext Transfer Protocol) to respond to client requests made over the World Wide Web. The main job of a web server is to display website content through storing, processing and delivering web pages to users. A sample version of the web server can be configured in a packet tracer.

Activities:

Configuration of BGP

A. Create the network topology as shown in figure 1 and perform the following activities:

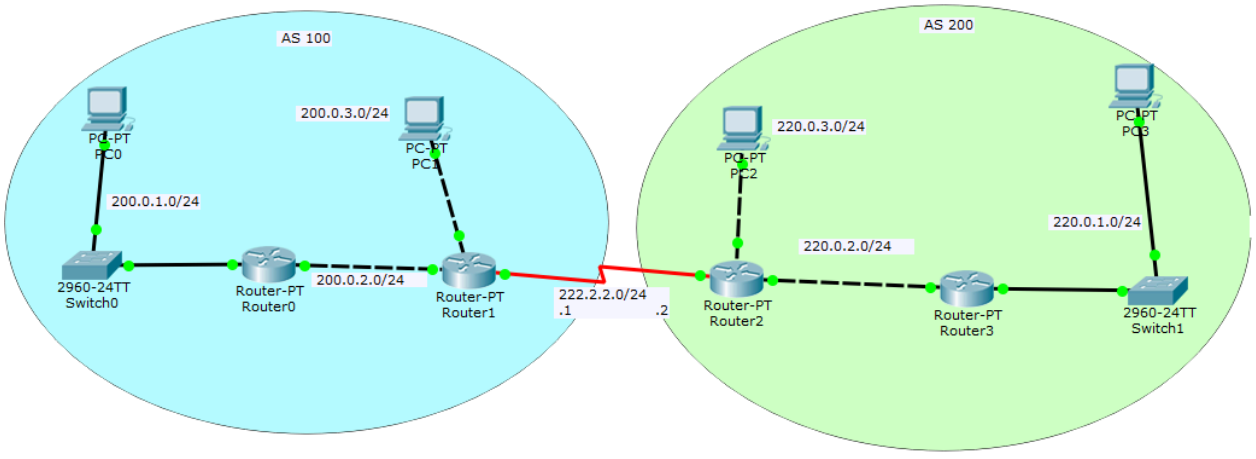


Figure 1: Network Topology 1

1. Set the appropriate IP address of the corresponding router interface. Also set the IP address, subnet mask & default gateway of each PC as shown in figure above.
2. To interconnect two different ASes you have to use the IP addresses given in figure.
3. Configure OSPF routing in each AS, but remember that **never pass OSPF in another AS**.
4. Test the connectivity from each PC to each other PC and note down the result.

5. Now configure 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, configure BGP in Router2 to advertise the all networks of AS 200 to another AS.
7. Test the connectivity from each PC to each other PC and note down the result.
8. Now, use the default route in Router0 to forward traffic towards Router1. Similarly, use the default route in Router3 to forward traffic towards Router2.
9. Test the connectivity from each PC to each other PC and note down the result. Compare the result with that of step 7.
10. Now, remove the default routes in all routers of both AS.
11. Configure Router1 to redistribute the BGP route information in OSPF. Similarly, configure the Router2 to redistribute the BGP route information in OSPF.
12. Test the connectivity from each PC to each other PC and note down the result.
13. Save the configurations in each router.
14. Restart all routers.
15. Test the connectivity from PC0 to all other PCs and routers, and note down the result.

Configuration of DHCP

B. Create the network topology as shown in figure below and perform the following activities:

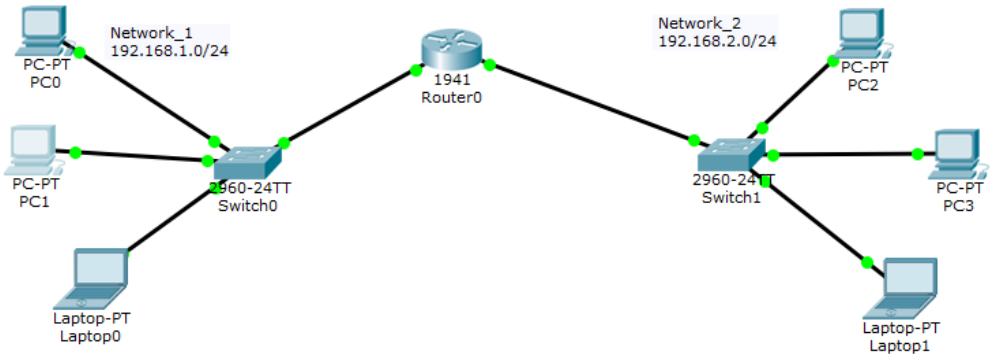


Figure 2: Network Topology 2

1. Connect the computers, switches and router as shown in figure:
   - Connect GigabitEthernet 0/0 (IP address 192.168.1.1/24) of Router0 to Switch0 .
   - Similarly, connect GigabitEthernet 0/1 (IP address 192.168.2.1/24) of Router0 to Switch1.
2. Try to obtain IP configurations in PC0 and PC2 using DHCP and note down the result.
3. Configure DHCP server in Router0 for Network_1.
4. Try to obtain IP configurations in PC0 and PC2 using DHCP and note down the result.

5. Configure DHCP server in Router0 for Network_2.
6. Obtain IP configurations in PC0 and PC2 using DHCP and note down the result.
7. Exclude the ranges of IP address from 192.168.1.1 192.168.1.20
8. Obtain IP configurations in PC1 and PC3 using DHCP and note down the result.
9. Exclude the ranges of IP address from 192.168.2.1 to 192.168.2.40
10. Obtain IP configurations in Laptop0 and Laptop1 using DHCP and note down the IP addresses obtained by laptops.
11. Observe the output of show ip dhcp pool in privileged access mode.
12. Also observe the lease information of using `show ip dhcp binding` command.

Note: You have to choose the IP address of the corresponding interface of the router as a default gateway and you can put an IP address as a DNS.

Optional Activity: Add a Server-PT in Network_1 and configure it as a DHCP server and test it by removing DHCP configuration in Router0.

Configuration of Web & DNS servers

C. Create a network topology that is similar to figure below to perform the following activities:

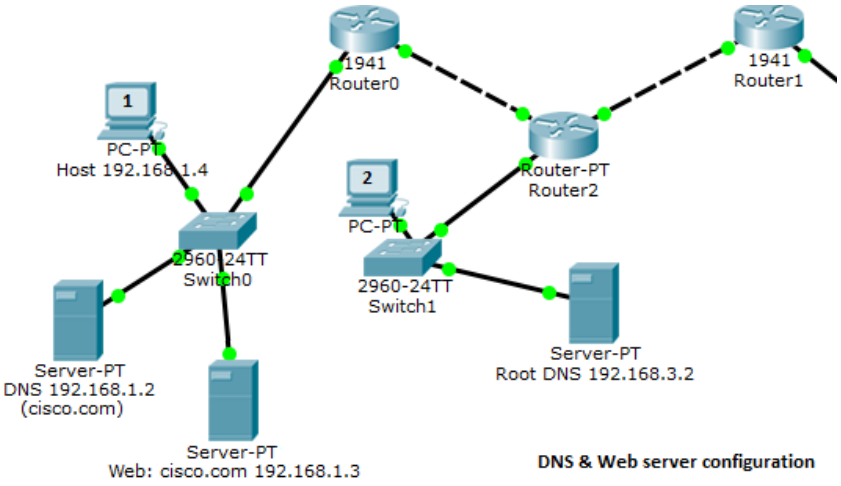


Figure 3: Network Topology 3

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. Configure a web server for cisco.com in the server with IP address of 192.168.1.3
2. Configure a DNS server (DNS 192.168.1.2) to resolve the domain cisco.com to corresponding IP.
3. Browse 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.
5. Add a new PC and connect it with Switch0. Use DHCP to obtain IP configurations and note down it.
6. Browse the cisco.com from the new PC and note down the observation.
7. Configure the necessary routing.
8. Configure the PC2 with appropriate IP configurations and browse the cisco.com from it.
9. Also try to configure the DNS server (DNS 192.168.1.2) to forward the DNS resolution requests towards Root DNS (192.168.3.2) if necessary.

Note: You can choose suitable IP address ranges wherever necessary.

Exercises:

I. Why is BGP necessary to route network traffic between ASes? Explain.
II. What is DHCP? Why is it used? Explain its importance.
III. What is DNS? Why is it used? Explain its importance in the Internet system.
IV. Note down the results of each and step of above activities with explanation.

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