

Computer Networks

Lab No.: 4

Static Routing & Default Route

Objectives:

- ❖ To be familiar with Static Routing and its configuration
- ❖ To be familiar with default route and its configuration
- ❖ To be familiar with route aggregation

Requirements:

- ❖ Network simulation tool: Packet Tracer

Routing:

- Routing is a set of directions to get from one network to another, and these directions are also known as routes
- A process that a router uses to forward packets toward the destination network
- Router makes decisions based upon the destination IP address of a packet using its routing table
- To make the correct decisions, routers must know how to reach remote destination networks, which can be done by different ways:
 - **Static Routing:** Network administrator(s) should configure the information about remote networks manually.
 - **Dynamic Routing:** The remote network information is learned by the router itself from other routers with the help of dynamic routing protocol(s). For this the routers should be configured with corresponding routing protocols.

Static Route Configuration:

- Administrator can configure static route by using `ip route` command in global configuration mode as:

ip route Destination_Network Subnet_Mask [next-hop-address or outgoing interface]

- For example:

We can provide the next-hop IP address of the adjacent router as:

```
Router(config)#ip route 172.16.3.0 255.255.255.0 172.16.4.1
```

We can also provide outgoing interface of router instead of next-hop IP address as:

```
Router(config)#ip route 172.16.3.0 255.255.255.0 Serial 0/0
```

Default Route and Configuration:

- Default routes are used to route packets with destinations that do not match any of the other routes in the routing table.
- Routers are typically configured with a default route for Internet-bound traffic, since it is often impractical and unnecessary to maintain routes to all networks in the Internet.
- A default route is a special static route that can be configured in global configuration mode as:

```
ip route 0.0.0.0 0.0.0.0 [next-hop-address or outgoing interface]
```

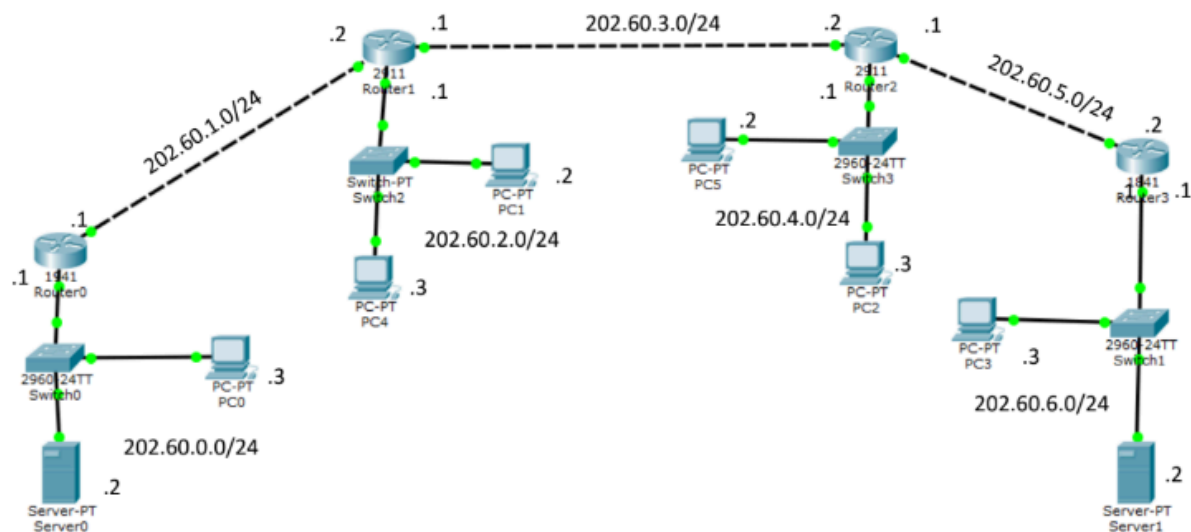
Viewing Route Configuration:

- The **show running-config** command can be used in privileged EXEC mode to view the active configurations in a router to verify that the route was entered correctly
- The **show ip route** command is used to make sure that the static route is present in the routing table

Activities:

Perform the **following activities sequentially** and note down the result by observing it.

A. Create the following network topology and perform the followings:



1. Configure the hostname, console password, vty password and enable password in both routers. Hostname of Router0 should be your **first name_0**, hostname of Router1 should be your **first name_1** and so on. Set console password as your **first name**, enable password as **cisco** and vty password as **class** for each router.
2. Configure each interface of the router with the given IP address and subnet mask.
3. Configure the IP address, subnet mask and default gateway on each computer as specified in figure above.

4. Observe the output of the command `show ip route` in each router and note down the result.
5. Observe the output while using the ping command from PC0 to PC1, PC2, PC3, Server0, Server1, Router0, Router1, Router2 and Router3.
6. Observe the output while using the ping command from PC1 to PC0, PC2, PC3, Server0, Server1, Router0, Router1, Router2 and Router3.
7. Observe the output while using the ping command from PC2 to PC0, PC1, PC3, Server0, Server1, Router0, Router1, Router2 and Router3.
8. Observe the output while using the ping command from PC3 to PC0, PC1, PC2, Server0, Server1, Router0, Router1, Router2 and Router3.
9. From Router0 use ping command to Router1, Router2, Router3, PC0, PC1, PC2, PC3 and observe the output
10. From Router1 use ping command to Router0, Router2, Router3, PC0, PC1, PC2, PC3 and observe the output
11. From Router2 use ping command to Router0, Router1, Router3, PC0, PC1, PC2, PC3 and observe the output
12. From Router3 use ping command to Router0, Router1, Router2, PC0, PC1, PC2, PC3 and observe the output
13. From PC0 enter into Router0 using telnet and configure the static route for each destination network as:

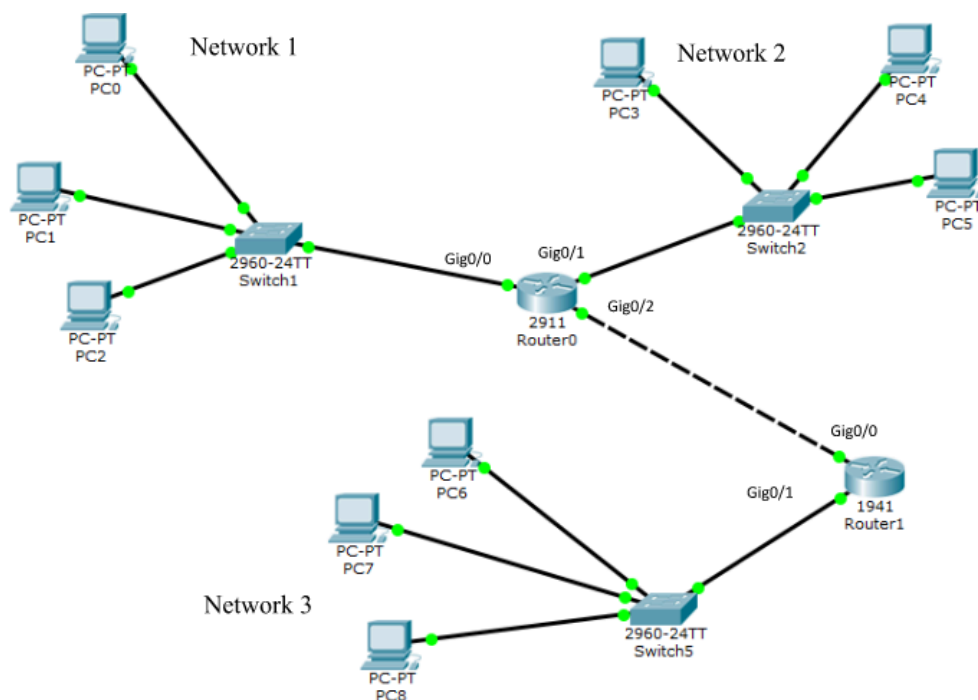
```
Router0(config)# ip route 202.60.2.0 255.255.255.0 202.60.1.2
Router0(config)# ip route 202.60.3.0 255.255.255.0 202.60.1.2
Router0(config)# ip route 202.60.4.0 255.255.255.0 202.60.1.2
Router0(config)# ip route 202.60.5.0 255.255.255.0 202.60.1.2
Router0(config)# ip route 202.60.6.0 255.255.255.0 202.60.1.2
```
14. From there enter into Router1 using telnet and configure the static route for each destination network as:

```
Router1(config)# ip route 202.60.0.0 255.255.255.0 202.60.1.1
Router1(config)# ip route 202.60.4.0 255.255.255.0 202.60.3.2
Router1(config)# ip route 202.60.5.0 255.255.255.0 202.60.3.2
Router1(config)# ip route 202.60.6.0 255.255.255.0 202.60.3.2
```
15. Similarly enter into Router2 using telnet and configure the static route for each destination network. Again enter into Router3 using telnet and configure the static route for each destination network.
16. Repeat the step from 4 to 12 and observe the output.
17. Observe the output of `tracert` command from PC0 to PC1, PC2 and PC3. Similarly, observe the output of `tracert` command from PC3 to PC0, PC1 and PC2.
18. What is observed while using `tracert` command from PC0 to a destination not mentioned in the above network such as 2.2.2.2?

B. Use the network topology given above in A and perform the followings:

1. Remove all static routes configured in activity A and configure the static routes to minimize the route entries by using the default route in each router.
2. Test the connectivity from PC0, PC1, PC2 and PC3 to each of the given PC and router using ping command and note down the result.
3. Observe the output of `show ip route` in each router and comment on the result.
4. Observe the output of `tracert` command from PC0 to PC1, PC2 & PC3
5. Similarly use `tracert` command from PC3 to PC0, PC1 & PC2 to observe how the packet traveled across the network to reach the destination
6. What is observed while using `tracert` command from PC0 to a destination not mentioned in the above network such as 2.2.2.2?

C. Create the following network using Packet Tracer and perform the followings:



1. Assign the IP Address and subnet mask of given computers as:

▪ PC0:	200.200.20.2	255.255.255.224
▪ PC1:	200.200.20.3	255.255.255.224
▪ PC2:	200.200.20.4	255.255.255.224
▪ PC3:	200.200.20.34	255.255.255.224
▪ PC4:	200.200.20.35	255.255.255.224
▪ PC5:	200.200.20.36	255.255.255.224
▪ PC6:	200.200.20.100	255.255.255.224
▪ PC7:	200.200.20.101	255.255.255.224
▪ PC8:	200.200.20.102	255.255.255.224

2. Configure the hostname, console password, vty password and enable password in both routers.

Hostname of Router0 should be your **first name** and the hostname of Router1 should be your **surname**.

Set console password as your **first name**, enable password as **cisco** and vty password as your **surname** for each router.

3. Configure the Interfaces of Routers with following IP addresses and turn on the corresponding interfaces:

Router0: GigabitEthernet 0/0 interface 200.200.20.1 255.255.255.224
GigabitEthernet 0/1 interface 200.200.20.33 255.255.255.224
GigabitEthernet 0/2 interface 200.200.20.65 255.255.255.224

Router1: GigabitEthernet 0/0 interface 200.200.20.66 255.255.255.224
GigabitEthernet 0/1 interface 200.200.20.99 255.255.255.224

4. Observe and note down the output of the command `show ip route` in each router.
5. Observe the output while using the ping command from PC0 to PC1, PC2, PC3, PC6, Router0 and Router1 (use each IP address of the router).
6. Observe the output while using the ping command from PC3 to PC0, PC4, PC5, PC6, Router0 and Router1 (use each IP address of router).
7. Observe the output while using the ping command from PC6 to PC0, PC3, PC7, PC8, Router0 and Router1 (use each IP address of router).
8. Observe the output while using the ping command from Router0 to PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8 and Router1 (use each IP address of Router1).
9. Observe the output while using the ping command from Router1 to PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8 and Router0 (use each IP address of Router0).
10. Assign the default gateway of each of the computer as:
 - For PC0, PC1 & PC2:- 200.200.20.1
 - For PC3, PC4 & PC5:- 200.200.20.33
 - For PC6, PC7 & PC8:- 200.200.20.99

11. Repeat steps 5 to 9 and observe the result.

12. From PC0 enter into Router0 using telnet and configure the static route for destination network of Network 3 as:

```
ip route 200.200.20.96 255.255.255.224 200.200.20.66
```

13. From there enter into Router1 using telnet and configure the static route for destination network of Network 1 and Network 2.

```
ip route 200.200.20.0 255.255.255.224 200.200.20.65
```

```
ip route 200.200.20.32 255.255.255.224 200.200.20.65
```

14. Repeat the step from 4 to 9 and observe the output. Compare the result with the previous step (i.e. activity number 11) and comment on it.
15. Remove the both routes added (into Router1) in step 12 by using **no ip route** command

16. Since the Network 1 and Network 2 are in consecutive addresses, we can aggregate them to use a single entry for the route as:

```
ip route 200.200.20.0 255.255.255.192 200.200.20.65
```

17. Again observe the output by repeating the step from 4 to 9 and observe the output. Compare the result with the previous step (i.e. activity number 14) and comment on it.
18. Remove the link between Router0 and Router1 and observe the connectivity between computers from network3 to network1 & network2 and vice versa. Note down the routing table of each router using `show ip route` command.

Exercises:

1. How does a sending host know whether the destination computer is on the same network or on a different network? Explain.
2. Explain, how the data is forwarded from sending host in each of the following cases:
 - a. When the destination computer is within the same network
 - b. When the destination computer is on the different network
3. What is routing? Discuss static routing and configuration of static routing in a router with its syntax briefly.
4. What information can we get from the routing table? How can we observe the routing table of a router? Explain.
5. What is a default route? What is its importance? State the default route configuration command with its syntax.
6. Note down the observation of each step with necessary commands specified in activities A, B and C mentioned above and comment on it.

Note: Briefly note down the observations. All detailed contents of observation are not essential.
