Department of Computer Science and Engineering

Islamic University of Technology (IUT)

A subsidiary organ of OIC

Laboratory Report

CSE 4412: Data Communication and Networking Lab

Name : **Mashrur Ahsan**

Student ID : **200042115**

Section : **1 (SWE)**

Semester : **Winter (4th)**

Academic Year : **2021-22**

Date of Submission : **07/02/2023**

Lab No : **5**

Title: Router Configuration and using static routing to connect multiple LANs in CISCO Packet Tracer.

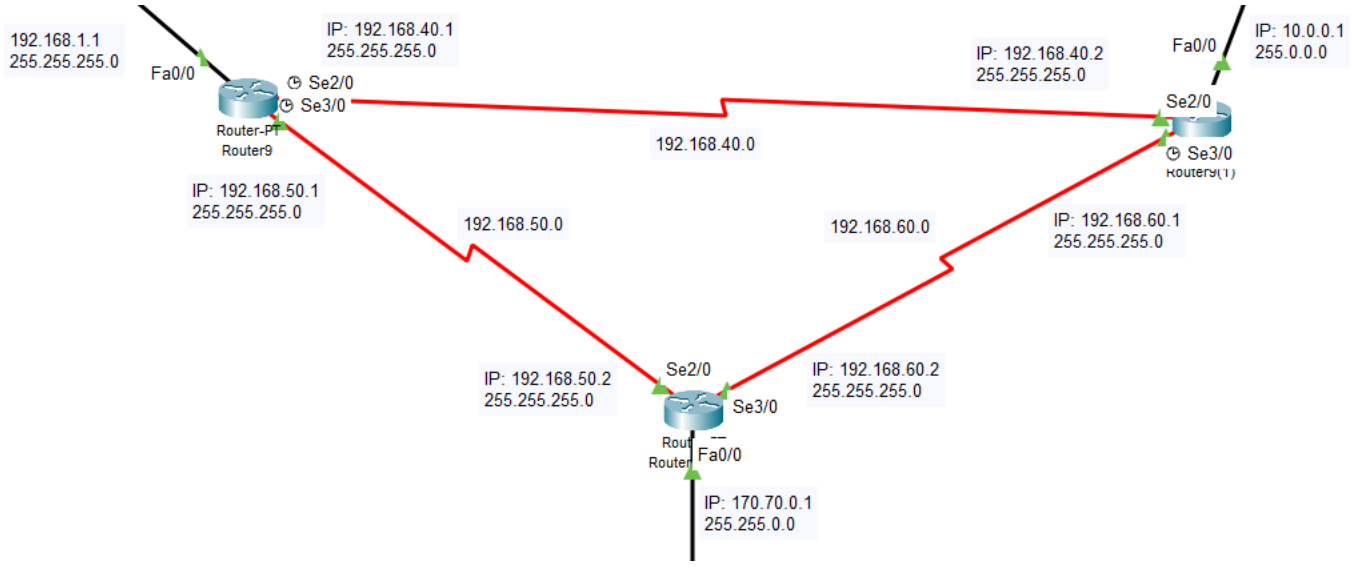
Objective:

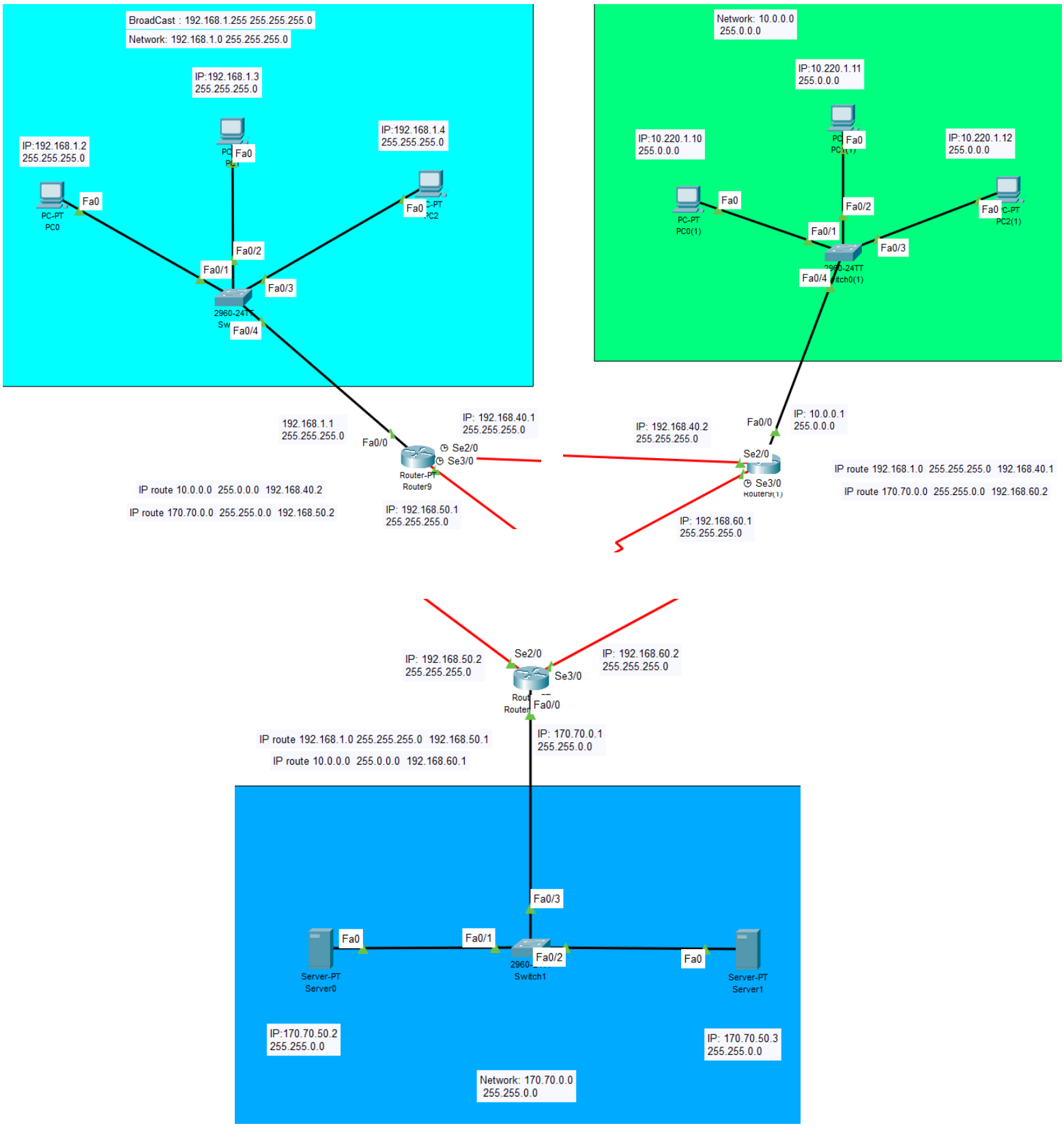
1. Understand Default Gateway
2. Difference between Switch and Router.
3. Router to Router Wiring [Using DCE and DTE Cables]
4. Static Routing Configuration
5. Default Route

Devices/ Software Used:

1. Cisco Packet Tracer (Software)
2. Virtual PCs (PC-PT), Routers (Router-PT), Servers (Server-PT), Switches (2960-24TT)
3. Virtual Serial DCE, Copper Straight Through cables

Diagram of the experiment:




BroadCast : 192.168.1.255 255.255.255.0
Network: 192.168.1.0 255.255.255.0
IP:192.168.1.3
255.255.255.0
IP:192.168.1.2
255.255.255.0
IP:192.168.1.4
255.255.255.0
Fa0
PC-PT
PC0
Fa0/2
Fa0/1
Fa0/3
Fa0/4
Network: 10.0.0.0
255.0.0.0
IP:10.220.1.11
255.0.0.0
IP:10.220.1.10
255.0.0.0
IP:10.220.1.12
255.0.0.0
PC-PT
PC0(1)
PC-PT
PC2(1)
192.168.1.1
255.255.255.0
Fa0/0
IP: 192.168.40.1
255.255.255.0
Se2/0
Se3/0
Router-PT
Router9
IP: 192.168.40.2
255.255.255.0
IP: 10.0.0.1
255.0.0.0
IP route 10.0.0.0 255.0.0.0 192.168.40.2
IP route 170.70.0.0 255.255.0.0 192.168.50.2
IP: 192.168.50.1
255.255.255.0
IP: 192.168.60.1
255.255.255.0
IP route 192.168.1.0 255.255.255.0 192.168.40.1
IP route 170.70.0.0 255.255.0.0 192.168.60.2
IP: 192.168.50.2
255.255.255.0
IP: 192.168.60.2
255.255.255.0
IP route 192.168.1.0 255.255.255.0 192.168.50.1
IP route 10.0.0.0 255.0.0.0 192.168.60.1
IP: 170.70.0.1
255.255.0.0
Server-PT
Server0
Switch1
Server-PT
Server1
IP:170.70.50.2
255.255.0.0
IP: 170.70.50.3
255.255.0.0
Network: 170.70.0.0
255.255.0.0

Theory:

Default Gateway:

The default gateway is the path used to pass information when the device doesn't know where the destination is. Simply, a default gateway is a router that connects your host to remote network segments. It's the **exit point** for all the packets in your network that have destinations outside your network.

The job of the gateway is to act as a **logical bridge** between different networks and systems over common protocols- In simplest terms, the gateway is a connection point between a network and the rest of the Internet.

If your default gateway IP address is **changed or not set up properly**, all devices on the network will be unable to communicate with any remote network hosts, regardless of the protocol being used.

A default gateway on a wireless network is an important function that allows traffic to be sent over the network from a wireless device to another wireless device or the wired equivalent on the same network. If the wireless router does not act as the default gateway, then this function **will not work**.

Difference between Switch and Router:

They operate at different layers of the OSI model. Switches operate at the data link layer (**layer 2**) and Routers operate at the network layer (**layer 3**) of the OSI model.

Switches are used for **local network** communication and routers are used for **inter-network** communications.

Switches are used only in **LAN** whereas Routers are used in **LAN and WAN**.

Switches send data in the form of **packets and frames** but Routers send data in the form of **just packets**.

Switches enable communication between local devices by forwarding data based on the destination **MAC** address. Routers establishes communication between multiple networks by forwarding data based on the destination **IP** address.

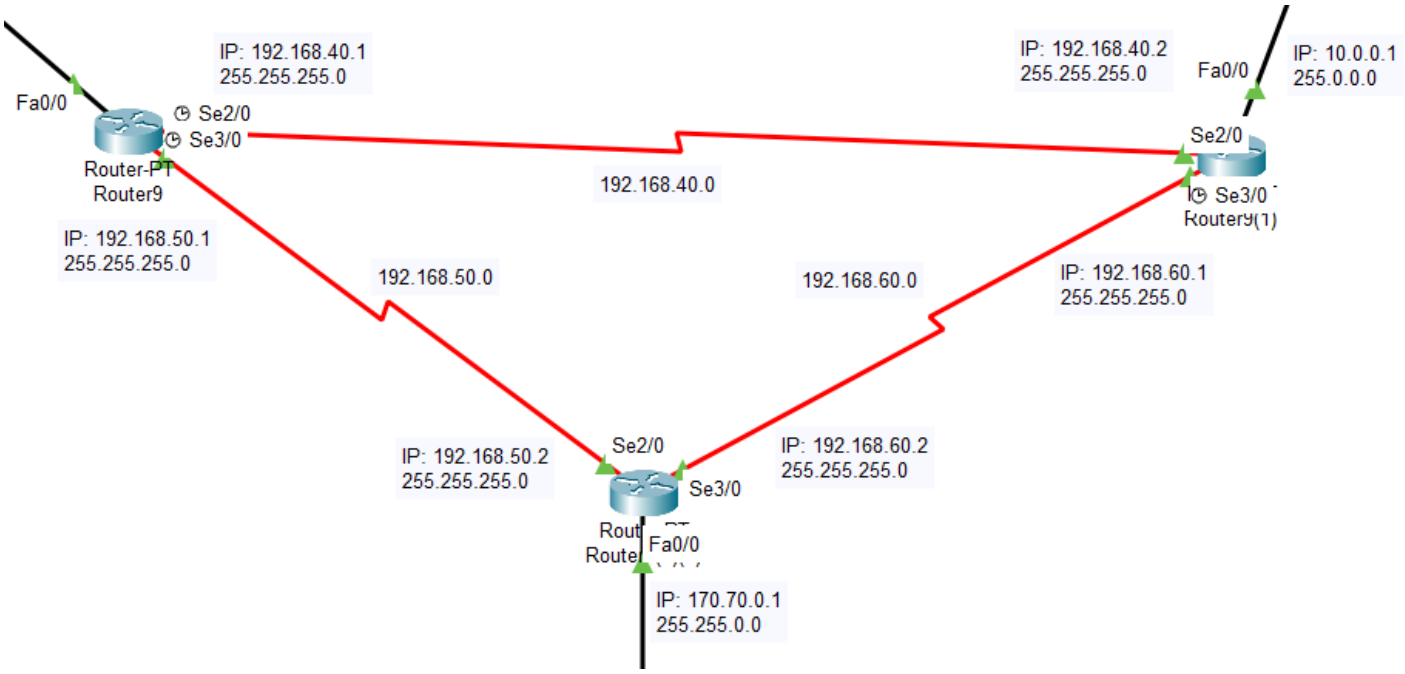
Routers are **more secure** than Switches because they allow features like firewalls and access control lists.

Switches are used to segment a large network into smaller, more manageable sub-networks. Routers connect multiple networks.

Router to Router Wiring [Using DCE and DTE Cables]:

Router-to-router wiring using DCE (Data Communications Equipment) and DTE (Data Terminal Equipment) cables involves connecting two routers using serial cables and configuring them as either a DCE or DTE device. The DCE device provides a clock signal to the DTE device, which is used to synchronize data transmission. There are two types of devices that can communicate over a serial interface: DCE and DTE. A DCE provides a physical connection to a network and forward's traffic. A DTE connects to a network through a DCE device. Typically, a DTE device is connected to a DCE device (or vice versa) rather than another DTE device.

In this experiment, to connect 3 routers, serial DCE cables were used. Every connection that was made with the DCE cables contributed to a Network. Every two routers are part of the same network. As we can see from the picture below, these 3 inter-connected routers contributing to 3 separate networks. (192.168.40.0, 192.168.50.0 and 192.168.60.0)



Static Route

Routing is the process of creating the path for the data packets. It operates in the network layer of the OSI model. There are mainly two types of routing: Static routing and Dynamic routing. **Static routing** is the route that the network administrator manually enters into the routing table. It is a one-way communication and here we **don't use any routing protocols**.

```
IP route 10.0.0.0  255.0.0.0  192.168.40.2
IP route 170.70.0.0  255.255.0.0  192.168.50.2
```

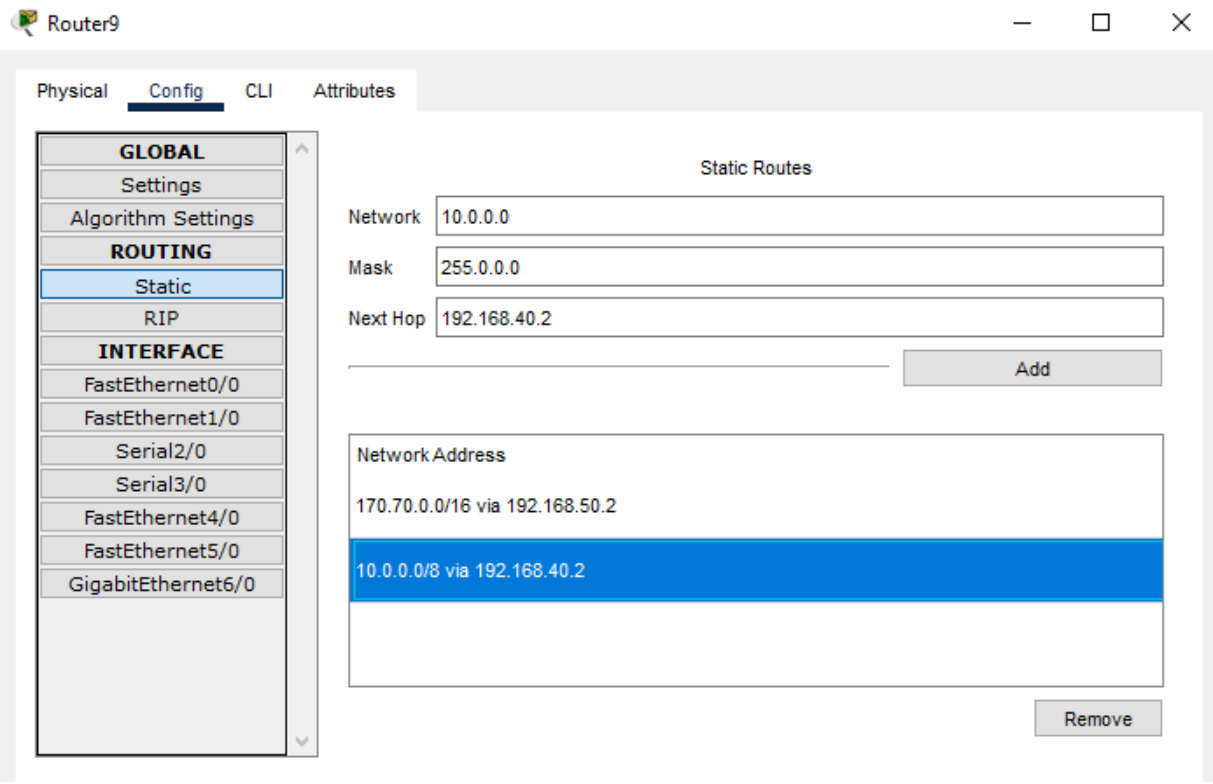
```
IP route 192.168.1.0  255.255.255.0  192.168.40.1
IP route 170.70.0.0  255.255.0.0  192.168.60.2
```

```
IP route 192.168.1.0 255.255.255.0  192.168.50.1
IP route 10.0.0.0  255.0.0.0  192.168.60.1
```

These are the routes that were manually added into the routing tables of different routers. If we go into the CLI, we can add these routes just by writing:

```
Router(config)#ip route 10.0.0.0 255.0.0.0 192.168.40.2
```

Or, we can configure it manually:



Default Route

A default route is the route that takes effect when **no other route is available** for an IP destination address. Normally, if a specific route to a particular network does not exist, a router will drop all traffic destined to that network. A **default route**, or gateway of last resort, allows traffic to be forwarded, even without a specific route to a particular network. The default route is identified by all zeros in both the network and subnet mask (0.0.0.0 0.0.0.0). It is the least specific route possible, and thus will only be used if a more specific route does not exist (hence "gateway of last resort").
To configure a default route (having the source port number):

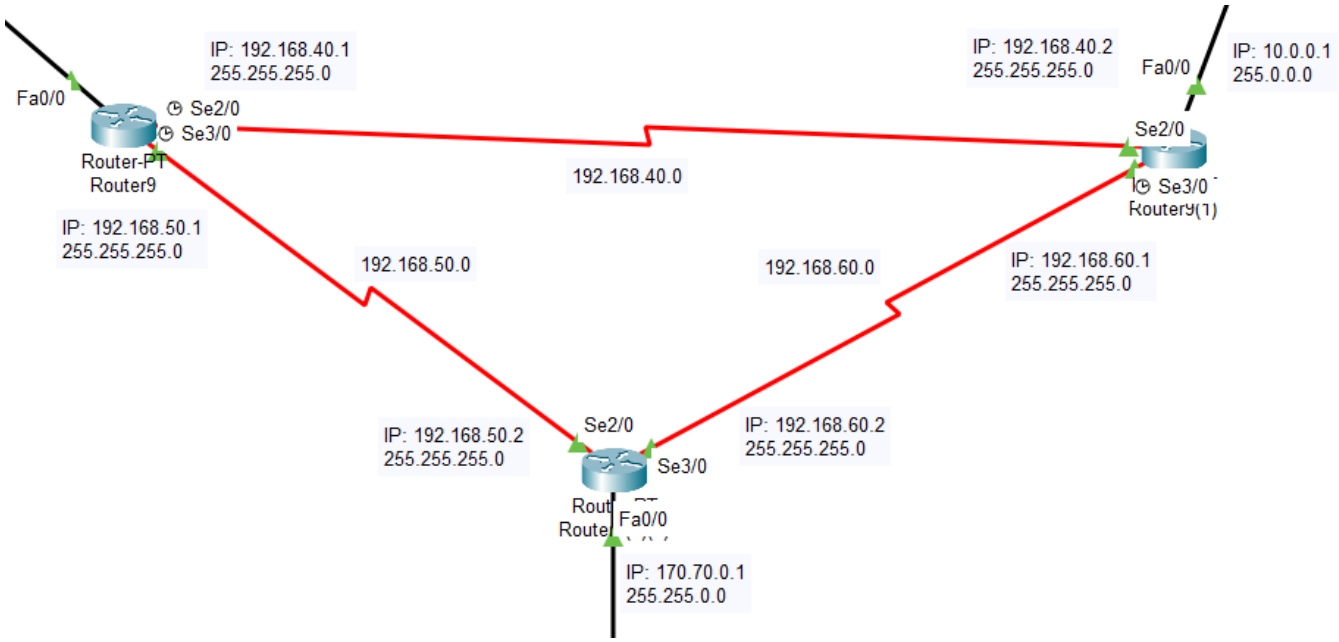
```
Router(config)#ip route 0.0.0.0 0.0.0.0 serial 3/0
```

To configure a default route (having the destination IP address):

```
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.60.1
```

Configuration of Routers:

- The Fa0/0 of the routers will have to be set up in such a way that the IP address of the Fa0/0 will be the default gateways of the LAN they are connected with.
- The IP addresses of the source ports of the routers will be according to the network that they are part of. Just like the picture below:



- Then we have to set up IP routes manually into the routing tables of each router. Just like the picture below:

IP route 10.0.0.0 255.0.0.0 192.168.40.2

IP route 192.168.1.0 255.255.255.0 192.168.40.1

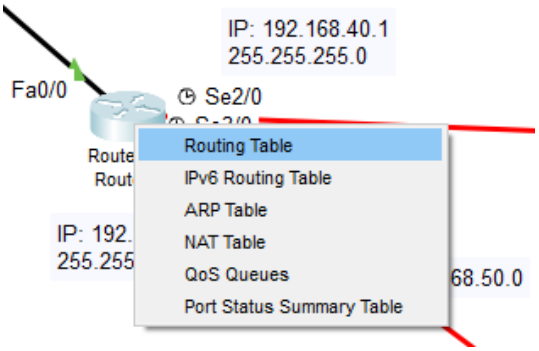
IP route 170.70.0.0 255.255.0.0 192.168.50.2

IP route 170.70.0.0 255.255.0.0 192.168.60.2

IP route 192.168.1.0 255.255.255.0 192.168.50.1

IP route 10.0.0.0 255.0.0.0 192.168.60.1

- We can check the routing table for each router by clicking the Inspect icon  Then clicking one of the routers and clicking "routing tables". After that, a table will pop up on screen, showing all the routes of that particular router. Just like the picture below:



Routing Table for Router9

Type	Network	Port	Next Hop IP	Metric
S	10.0.0.0/8	---	192.168.40.2	1/0
S	170.70.0.0/16	---	192.168.50.2	1/0
C	192.168.1.0/24	FastEthernet0/0	---	0/0
C	192.168.40.0/24	Serial2/0	---	0/0
C	192.168.50.0/24	Serial3/0	---	0/0

- Now, if we want to check if the configuration was correct or not, we can add simple PDUs and check if the last status was successful or not. Here's an example of a sequence of successful connections:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete	
	Successful	PC0	Server0	ICMP		0.000	N	0	(edit)		(delete)
	Successful	PC0(1)	PC2	ICMP		0.000	N	1	(edit)		(delete)
	Successful	PC2(1)	Server1	ICMP		0.000	N	2	(edit)		(delete)

Observation:

- The IP addresses of the Fa0/0 cables were the same as the default gateway of the networks that those were connected to.

- After inter-connecting the routers, a device from one network can now send data to a different network.

- While manually setting up the static routes, the “Next Hop” is always the IP address of the destination Serial cable.

- When a router connects to another router, a new network (with a unique Network ID) is created among themselves. That’s why in this experiment, we had 3 different networks for 3 different connections.

- First few simulations might fail because the routers take a bit of time to configure themselves after a change is applied.

Challenges:

- Didn’t notice there was a “port status” for every router that we had to turn on to establish a proper connection.

- Every time when there was a change applied to any of the routers, it took quite a bit of time to change its status to “up”. So, I encountered a lot of failed connections when I was adding simple PDUs and verifying the connections. The connections came up as “failed” because the routers were still configuring the changes that were applied to them.