FACULTY OF COMPUTING
SEMESTER 1/20222023

SECR1213– NETWORK COMMUNICATION
SECTION 04

LAB 3

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Lab 3 - Routing Protocol

Introduction

You are given a Packet Tracer file, which requires some work IP addressing and routing protocol configuration. You must follow all the steps carefully and answer the given questions.
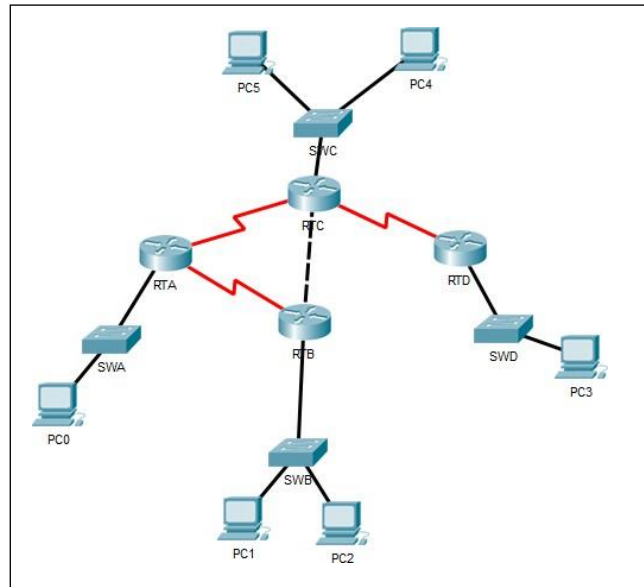

Figure 1

Task 1: IP addressing

Step 1: Fill in Table 1 below with the correct information. Note: The information may be found under the **Config** tab of each router (refer to Figure2).
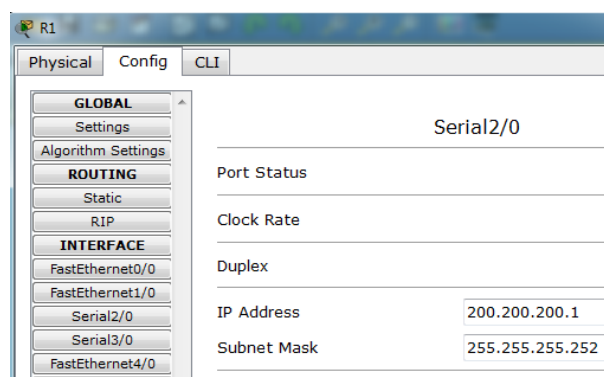

Figure 2

Table 1

#	Device Name	Interface	IP Address	Subnet Mask
1	RTA	Se2/0	172.16.230.5	255.255.255.252
2		Se3/0	172.16.230.1	255.255.255.252
3		Fa0/0	172.16.224.255	255.255.254.0
4	RTB	Se2/0	172.16.230.2	255.255.255.252
5		Fa0/0	172.16.230.9	255.255.255.252
6		Fa1/0	172.16.226.11	255.255.254.0
7	RTC	Se2/0	172.16.230.6	255.255.255.252
8		Se3/0	172.16.230.13	255.255.255.252
9		Fa0/0	172.16.230.10	255.255.255.252
10		Fa1/0	172.16.228.11	255.255.255.0
10	RTD	Se2/0	172.16.230.14	255.255.255.252
11		Fa0/0	172.16.229.222	255.255.255.0

Step 2: Given the information in file, answer the following questions:

a. How many different subnets are there? <u>4 different subnets</u>
b. What is the network address of each of these subnets? (*Hint: Given the IP address and the subnet mask, you can calculate the network address using AND operation*). Label the subnets in the topology given in Figure 1, and complete Table 2 below.

Table 2

| Subnet #	Network Address	Broadcast Address	Range of usable addresses
1	172.16.224.0	172.16.225.255	172.16.224.1 - 172.16.225.254
2	172.16.230.0	172.16.230.3	172.16.230.1 - 172.16.230.2
3	172.16.230.8	172.16.230.11	172.16.230.9 – 172.16.230.10
4	172.16.229.0	172.16.229.255	172.16.229.1 – 172.16.229.254

c. Provided that all PC will use the last usable address in its subnet, fill in Table 3 below with the correct information.

Table 3

#	Device Name	IP Address	Subnet Mask	Default Gateway
1	PCA	172.16.225.254	255.255.254.0	172.16.224.255
2	PCB	172.16.230.2	255.255.255.252	172.16.230.9
3	PCC	172.16.230.10	255.255.255.252	172.16.230.10
4	PCD	172.16.229.254	255.255.255.0	172.16.229.222

Step 3: Complete the IP addressing information on all the PCs in the topology. (Hint: Click on the PC, choose the **Desktop** tab, then click **IP Configuration**).

Step 4: Open the routing table for each router. *(Hint: you can use the 'magnifying glass' icon, then point to a router and choose 'Routing Table'. See Figure 3 below.)*
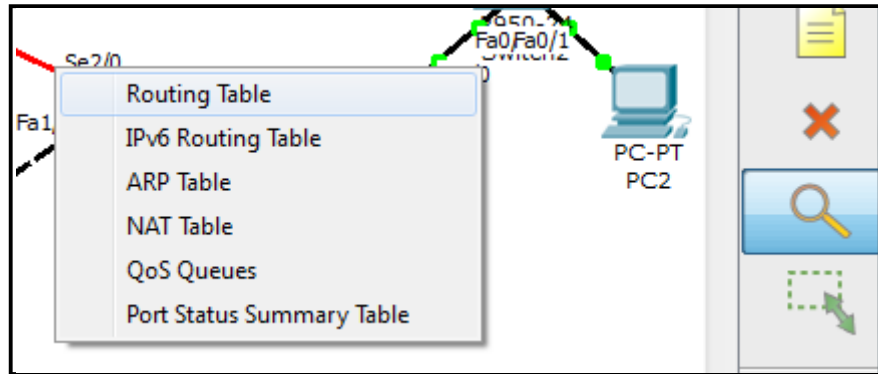
(a)
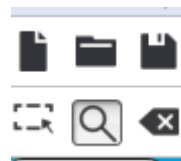
(b)

Figure 3

Step 5: Copy the image of the routing table for each router. *(Hint: You can use 'Snipping Tool' to copy the image.)*

Routing Table for Router-PT RTA

| Routing Table for RTA | | | | |
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

Routing Table for Router-PT RTB

| Routing Table for RTB | | | | |
Type	Network	Port	Next Hop IP	Metric
C	172.16.226.0/23	FastEthernet1/0	---	0/0
C	172.16.230.0/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0

Routing Table for Router-PT RTC

| Routing Table for RTC | | | | |
Type	Network	Port	Next Hop IP	Metric
C	172.16.228.0/24	FastEthernet1/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial3/0	---	0/0

Routing Table for Router-PT RTD

Routing Table for RTD

Type	Network	Port	Next Hop IP	Metric
C	172.16.229.0/24	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial2/0	---	0/0

Step 6: Answer the questions below.

    a. Do all the routers have the same information in its routing table?

    No. All the router have their own routing table.

    b. What is the difference that can be seen?

    Each of the network address on the routing table are different to each other.

    c. Can all the PCs ping each other successfully? (Fill in the Table 4 below)

Table 4

#	Ping between devices	Successful (✓)	Unsuccessful (✗)
1	PCA-PCB		x
2	PCA-PCC		x
3	PCA-PCD		x
4	PCB-PCC		x
5	PCB-PCD		x
6	PCC-PCD		x

    d. Reflection: what is the reason for your answer in (c)?

    It is because the devices are not interconnected to each other in order to establish the connection

Task 2: Dynamic routing configuration – RIP

Dynamic routing allows the network to be more flexible to changes. It can help the routers adapt to the changes in the pathways without much intervention from network administrators.

In this part of the lab, you will learn how to configure RIP routing protocol, and see how changes happen in the routing tables. Routers R1 and R4 is already configured for you.

Step 1: Choose Router RTA. Click the CLI tab. Copy the following text into the command line interface.

```
RTA>enable
RTA#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTA(config)#router rip
RTA(config-router)#version 2
RTA(config-router)#network 172.16.0.0
RTA(config-router)#no auto-summary
RTA(config-router)#exit
RTA(config)#exit
RTA#
%SYS-5-CONFIG_I: Configured from console by console
RTA#copy running-config startup-config
Destination filename [startup-config]?          When asked this
Building configuration...                        just press ENTER
[OK]
RTA#
```

Task 1.1:

(a) Copy (paste image) of the RTA routing table here.

| Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

Step 2: Choose Router RTB. Click the CLI tab. Copy the following text into the command line interface.

```
RTB>enable
RTB#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
RTB(config)#router rip
RTB(config-router)#version 2
RTB(config-router)#network 172.16.0.0
RTB(config-router)#no auto-summary
RTB(config-router)#exit
RTB(config)#exit
RTB#
%SYS-5-CONFIG_I: Configured from console by console
RTB#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
RTB#
```

Task 2.1:

(a) Copy (paste image) of the RTB routing table and a new look into RTA routing table here.

Routing Table of RTB

Type	Network	Port	Next Hop IP	Metric
R	172.16.224.0/23	Serial2/0	172.16.230.1	120/1
C	172.16.226.0/23	FastEthernet1/0	---	0/0
C	172.16.230.0/30	Serial2/0	---	0/0
R	172.16.230.4/30	Serial2/0	172.16.230.1	120/1
C	172.16.230.8/30	FastEthernet0/0	---	0/0

Routing Table of RTA

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
R	172.16.226.0/23	Serial3/0	172.16.230.2	120/1
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0
R	172.16.230.8/30	Serial3/0	172.16.230.2	120/1

(b) **Reflection:** what difference do you see between routing tables of RTA and RTB?

The difference from both of these routing table is that the Next Hop Ip for RTA and RTB are different to each other as their IP are 172.16.230.1 (RTA) and 172.16.230.2 for RTB. Meanwhile, their network address are the same.

Step 3: Copy the same configuration instructions to RTC and RTD

Routing Table for RTC

Routing Table for RTC				
Type	Network	Port	Next Hop IP	Metric
R	172.16.224.0/23	Serial2/0	172.16.230.5	120/1
R	172.16.226.0/23	FastEthernet0/0	172.16.230.9	120/1
C	172.16.228.0/24	FastEthernet1/0	---	0/0
R	172.16.229.0/24	Serial3/0	172.16.230.14	120/1
R	172.16.230.0/30	Serial2/0	172.16.230.5	120/1
R	172.16.230.0/30	FastEthernet0/0	172.16.230.9	120/1
C	172.16.230.4/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial3/0	---	0/0

Routing Table for RTD

Routing Table for RTD

Type	Network	Port	Next Hop IP	Metric
R	172.16.224.0/23	Serial2/0	172.16.230.13	120/2
R	172.16.226.0/23	Serial2/0	172.16.230.13	120/2
R	172.16.228.0/24	Serial2/0	172.16.230.13	120/1
C	172.16.229.0/24	FastEthernet0/0	---	0/0
R	172.16.230.0/30	Serial2/0	172.16.230.13	120/2
R	172.16.230.4/30	Serial2/0	172.16.230.13	120/1
R	172.16.230.8/30	Serial2/0	172.16.230.13	120/1
C	172.16.230.12/30	Serial2/0	---	0/0

Step 4: Answer the questions below.

a. Do all the routers have the same information in its routing table?

Nope. All the routers have different information in their own routing table.

b. Write down what RTC and RTD routing table information (Next Hop IP, Metric) to the networ'k 172.16.224.0/24.

Router	Next Hop IP	Metric
RTC	172.16.230.14	120/1
RTD	172.16.230.13	120/1

c. What is the difference that can be seen? Why is this?

The difference that can be seen from above table is that the Next Hop IP for both RTC and RTD are different due to different port used. RTC used Serial 3/0 while RTD used Serial 2/0 for network 172.16.224.0 /24

d. Can all the PCs ping each other successfully?

Table 5

#	Ping between devices	Successful (✓)	Unsuccessful (✗)
1	PCA-PCB	/	
2	PCA-PCC	/	
3	PCA-PCD	/	
4	PCB-PCC	/	
5	PCB-PCD	/	
6	PCC-PCD	/	

e. Reflection: what is the reason for your answer in (d)?

It is because before this all the routers already configured accordingly via switches and they are actually connected to each other. This action will allow the communication and ping between the end devices

Step 5: Switch off router RTA. What are the changes noted in the routing tables?

The routing table displayed nothing.

Type	Network	Port	Next Hop IP	Metric

Routing Table for RTA

Step 6: Switch on router RTA. What are the changes noted in the routing tables?

The routing table displayed all the information just like before turn off the router RTA

Routing Table for RTA

Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
R	172.16.226.0/23	Serial3/0	172.1...	120/1
R	172.16.228.0/24	Serial2/0	172.1...	120/1
R	172.16.229.0/24	Serial2/0	172.1...	120/2
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0
R	172.16.230.8/30	Serial2/0	172.1...	120/1
R	172.16.230.8/30	Serial3/0	172.1...	120/1
R	172.16.230.1...	Serial2/0	172.1...	120/1

Step 7: Reflection: What have you learned in this task?

The router configuration are saved in NVRAM where settings are preserved eventhough there is no power supply.

Task 3: Dynamic routing configuration – OSPF

Make sure that you have all the routing tables on display on one side (as before). As you go through the steps, look at the changes happening in the routing tables.

Step 1: On **all** the routers, do the following.

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#no router rip
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#copy running-config startup-config
Destination filename [startup-config]?
```

Step 2: Copy the image of the routing table for each router.

Routing Table for RTA

Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

Routing Table RTA

Routing Table for RTC

Type	Network	Port	Next Hop IP	Metric
C	172.16.228.0/24	FastEthernet1/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial3/0	---	0/0

Routing Table RTC

Routing Table for RTB

Type	Network	Port	Next Hop IP	Metric
C	172.16.226.0/23	FastEthernet1/0	---	0/0
C	172.16.230.0/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0

Routing Table RTB

Routing Table for RTD

Type	Network	Port	Next Hop IP	Metric
C	172.16.229.0/24	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial2/0	---	0/0

Routing Table RTD

Step 3: For Router RTA, Click the CLI tab. Copy the following text into the command line interface.

```
RTA# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTA(config)#router ospf 1
RTA(config-router)#network 172.16.224.0 0.0.1.255 area 0
RTA(config-router)#network 172.16.230.0 0.0.0.3 area 0
RTA(config-router)#network 172.16.230.4 0.0.0.3 area 0
RTA(config-router)#end
RTA# copy running-config startup-config
Destination filename [startup-config]?
%SYS-5-CONFIG_I: Configured from console by console

Building configuration...
[OK]
RTA#
```

Task 3.1: paste the image of RTA's routing table here.

Routing Table for RTA				
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0

Task 3.2:

a. Does RTA have a path to ALL the different subnet?

Yes, it does.

b. Try pinging the different PCs and jot down your result (Fill in the Table 6 below)

Table 6

#	Ping between devices	Successful(✓)	Unsuccessful (✗)
1	PCA-PCB		X
2	PCA-PCC		X
3	PCA-PCD		X

Step 4: Configure the other routers with OSPF routing algorithm.

Step 4.1: For Router RTB, Click the CLI tab. Copy the following text into the command line interface.

```
RTB# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTB(config)#router ospf 1
RTB(config-router)#network 172.16.226.0 0.0.1.255 area 0
RTB(config-router)#network 172.16.230.0 0.0.0.3 area 0
RTB(config-router)#network 172.16.230.8 0.0.0.3 area 0
RTB(config-router)#end
RTB# copy running-config startup-config
Destination filename [startup-config]?
%SYS-5-CONFIG_I: Configured from console by console
Building configuration...
[OK]
RTB#
```

Step 4.2: For Router RTC, Click the CLI tab. Copy the following text into the command line interface.

```
RTC# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTC(config)#router ospf 1
RTC(config-router)#network 172.16.228.0 0.0.0.255 area 0
RTC(config-router)#network 172.16.230.4 0.0.0.3 area 0
RTC(config-router)#network 172.16.230.8 0.0.0.3 area 0
RTC(config-router)#network 172.16.230.12 0.0.0.3 area 0
RTC(config-router)#end
RTC# copy running-config startup-config
Destination filename [startup-config]?
%SYS-5-CONFIG_I: Configured from console by console
Building configuration...
[OK]
RTC#
```

Step 4.3: For Router RTD, Click the CLI tab. Copy the following text into the command line interface.

```
RTD# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RTD(config)#
RTD(config)#router ospf 1
RTD(config-router)#network 172.16.229.0 0.0.0.255 area 0
RTD(config-router)#network 172.16.230.12 0.0.0.3 area 0
RTD(config-router)#end
RTD# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
RTD#
%SYS-5-CONFIG_I: Configured from console by console
RTD#
```

Step 5: Copy the image of the routing table for each router and paste it here.

Routing Table for RTA

	Routing Table for RTA			
Type	Network	Port	Next Hop IP	Metric
C	172.16.224.0/23	FastEthernet0/0	---	0/0
O	172.16.226.0/23	Serial3/0	172.16.230.2	110/65
O	172.16.228.0/24	Serial2/0	172.16.230.6	110/65
O	172.16.229.0/24	Serial2/0	172.16.230.6	110/129
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0
O	172.16.230.8/30	Serial3/0	172.16.230.2	110/65
O	172.16.230.8/30	Serial2/0	172.16.230.6	110/65
O	172.16.230.12/30	Serial2/0	172.16.230.6	110/128

Routing Table for RTB

Type	Network	Port	Next Hop IP	Metric
O	172.16.224.0/23	Serial2/0	172.16.230.1	110/65
C	172.16.226.0/23	FastEthernet1/0	---	0/0
O	172.16.228.0/24	FastEthernet0/0	172.16.230.10	110/2
O	172.16.229.0/24	FastEthernet0/0	172.16.230.10	110/66
C	172.16.230.0/30	Serial2/0	---	0/0
O	172.16.230.4/30	FastEthernet0/0	172.16.230.10	110/65
C	172.16.230.8/30	FastEthernet0/0	---	0/0
O	172.16.230.12/30	FastEthernet0/0	172.16.230.10	110/65

Routing Table for RTC

Type	Network	Port	Next Hop IP	Metric
O	172.16.224.0/23	Serial2/0	172.16.230.5	110/65
O	172.16.226.0/23	FastEthernet0/0	172.16.230.9	110/2
C	172.16.228.0/24	FastEthernet1/0	---	0/0
O	172.16.229.0/24	Serial3/0	172.16.230.14	110/65
O	172.16.230.0/30	FastEthernet0/0	172.16.230.9	110/65
C	172.16.230.4/30	Serial2/0	---	0/0
C	172.16.230.8/30	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial3/0	---	0/0

Routing Table for RTD

Type	Network	Port	Next Hop IP	Metric
O	172.16.224.0/23	Serial2/0	172.16.230.13	110/129
O	172.16.226.0/23	Serial2/0	172.16.230.13	110/66
O	172.16.228.0/24	Serial2/0	172.16.230.13	110/65
C	172.16.229.0/24	FastEthernet0/0	---	0/0
O	172.16.230.0/30	Serial2/0	172.16.230.13	110/129
O	172.16.230.4/30	Serial2/0	172.16.230.13	110/128
O	172.16.230.8/30	Serial2/0	172.16.230.13	110/65
C	172.16.230.12/30	Serial2/0	---	0/0

Step 6: Switch off router RTA. What are the changes noted in the routing tables?

Routing Table for RTA

Type	Network	Port	Next Hop IP	Metric

Routing Table RTA

The information in routing table RTA is not displayed

Routing Table for RTB

Type	Network	Port	Next Hop IP	Metric
C	172.16.226.0/23	FastEthernet1/0	---	0/0
O	172.16.228.0/24	FastEthernet0/0	172.16.230.10	110/2
O	172.16.229.0/24	FastEthernet0/0	172.16.230.10	110/66
C	172.16.230.8/30	FastEthernet0/0	---	0/0
O	172.16.230.12/30	FastEthernet0/0	172.16.230.10	110/65

Routing Table RTB

Routing Table for RTC

Type	Network	Port	Next Hop IP	Metric
O	172.16.226.0/23	FastEthernet0/0	172.16.230.9	110/2
C	172.16.228.0/24	FastEthernet1/0	---	0/0
O	172.16.229.0/24	Serial3/0	172.16.230.14	110/65
C	172.16.230.8/30	FastEthernet0/0	---	0/0
C	172.16.230.12/30	Serial3/0	---	0/0

Routing Table RTC

Routing Table for RTD

Type	Network	Port	Next Hop IP	Metric
O	172.16.226.0/23	Serial2/0	172.16.230.13	110/66
O	172.16.228.0/24	Serial2/0	172.16.230.13	110/65
C	172.16.229.0/24	FastEthernet0/0	---	0/0
O	172.16.230.8/30	Serial2/0	172.16.230.13	110/65
C	172.16.230.12/30	Serial2/0	---	0/0

Routing Table RTD

Step 7: Switch on router RTA. Wait a few minutes. What are the changes noted in the routing tables?

All the information were displayed just like before switch off the router

Type	Network	Port	Next Hop IP	Metric
	Routing Table for RTA			
C	172.16.224.0/23	FastEthernet0/0	---	0/0
O	172.16.226.0/23	Serial3/0	172.16.230.2	110/65
O	172.16.228.0/24	Serial2/0	172.16.230.6	110/65
O	172.16.229.0/24	Serial2/0	172.16.230.6	110/129
C	172.16.230.0/30	Serial3/0	---	0/0
C	172.16.230.4/30	Serial2/0	---	0/0
O	172.16.230.8/30	Serial3/0	172.16.230.2	110/65
O	172.16.230.8/30	Serial2/0	172.16.230.6	110/65
O	172.16.230.12/30	Serial2/0	172.16.230.6	110/128

Step 8: Reflection: What have you learned in this task?

OSPF configuration brings back the connection back to the normal without having to configure the router after it turned off.

……END……