Name & ID:_____Basil khowaja__bk08432_____ Date: 29/10/24

EE-424L Data Communication & Networking
Fall 2024

Habib University

Dhanani School of Science & Engineering

LAB 8: Static and Dynamic Routing Protocols

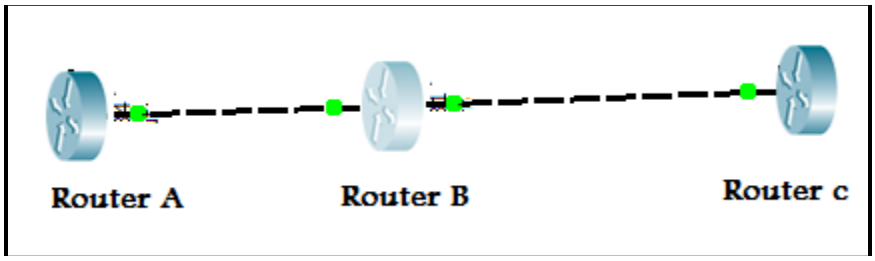
Lab #8 Marks distribution:

		LR2=20	LR4=10	LR5=40	LR9=10	AR4=20
In-Lab Tasks	**Task 1**	/5		/10	/10	/20
	Task 2	/5	/10	/10		
	Task 3	/5		/10		
	Task 4	/5		/10		
Marks Obt.	**/100**					

Objectives	**The objective of this lab is to learn about Static and Dynamic Routing protocols and configure them on Routers.**

Introduction:

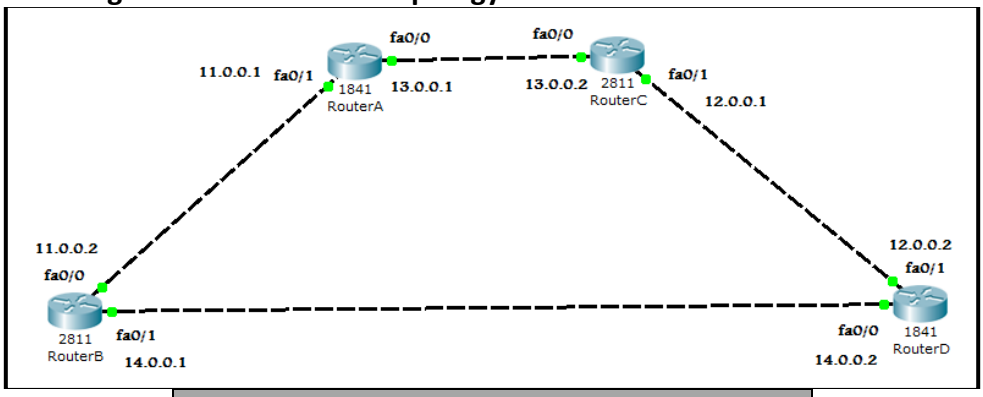
We saw in lab 6 how to connect two routers all you did was to assign IP address to the interfaces that are responsible for connecting two routers. But when more than two routers are involved things change. Directly connected routers only require IP address assignment at their specific interface (ports) but to learn the existence of routers that are not directly connected we need to specify their **Network Address** so the two routers that are beyond the reach can recognize each other.



This concept should get clear by observing the above diagram where you can see that Router A and Router B are directly Connected and Router B and Router C are directly connected but Router A and Router C are not so for Router A to reach Router C it should have information of the Network that exist between Router B and Router C similarly for Router C to reach Router A it should have information of Network between Router A and Router B.

Task 1: [20]

Today's task is to interconnect all the routers so that communication can happen between them for this purpose out of many options one is to create Staticx Route which we will explore in this Lab given below is the network along with the IP addresses to be assigned to each port. As it is quite obvious from the screen shot given below that there are **"four"** different Networks present **11.0.0.0**, **12.0.0.0**, **13.0.0.0** and **14.0.0.0** . **Configure below network topology on Router in Packet Tracer.**



Directly Connected Routers		
Router A	Router B	
Router A	Router C	

Router B	**Router D**	
Router C	**Router D**	

Table 1: Showing Directly Connected Router Information

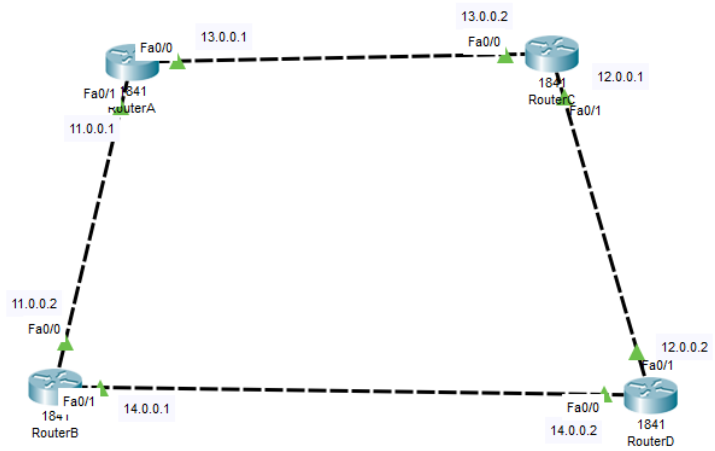
Above table shows that:

Router A is connected to Network _____11_____ and ___13_____
Router B is connected to Network _____11_____and____14_____
Router C is connected to Network _____13_____ and ____12_____
Router D is connected to Network _____12_____ and ____14_____

ROUTER A

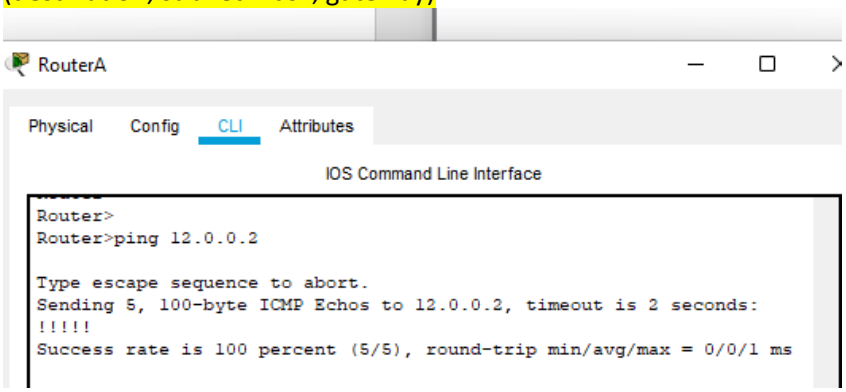
```
Router>en                                   \\use en or enable to go to privilege mode
Router#config t                             \\ use config t to move to configuration mode
Router(config)#interface fa0/0
Router(config-if)#ip address 13.0.0.1 255.0.0.0  \\assigning IP address to this port
Router(config-if)#no shut                        \\ bringing the port to UP state
Router(config-if)#exit

Router(config)#interface fa0/1
Router(config-if)#ip address 11.0.0.1 255.0.0.0
Router(config-if)#no shut
Router(config-if)# exit
```

Now comes the part of telling Router A about those Router Networks that are not directly Connected to Router A. This is done through specifying “STATIC ROUTES” shown below:

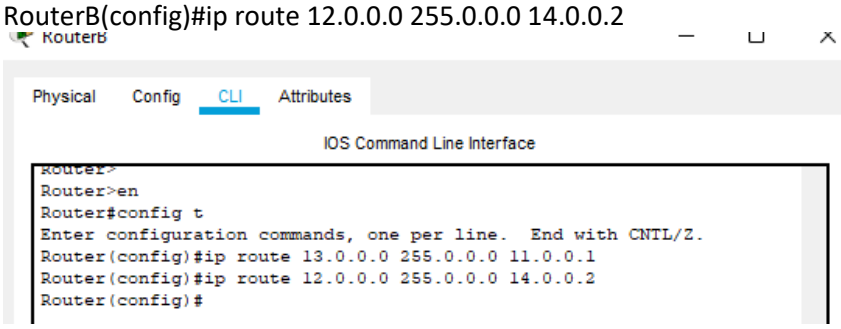


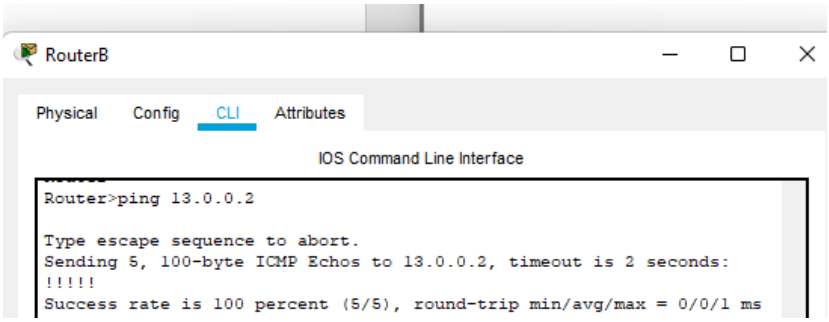
RouterA(config)#ip route 12.0.0.0 255.0.0.0 13.0.0.2
RouterA(config)#ip route 14.0.0.0 255.0.0.0 11.0.0.2

(destination, subnet mask, gateway)

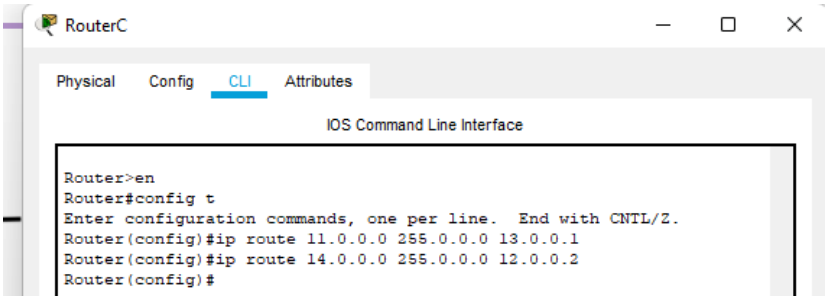


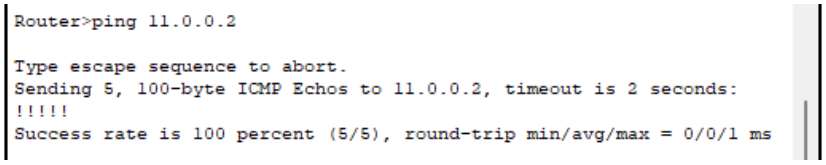
RouterB(config)#ip route 13.0.0.0 255.0.0.0 11.0.0.1
RouterB(config)#ip route 12.0.0.0 255.0.0.0 14.0.0.2



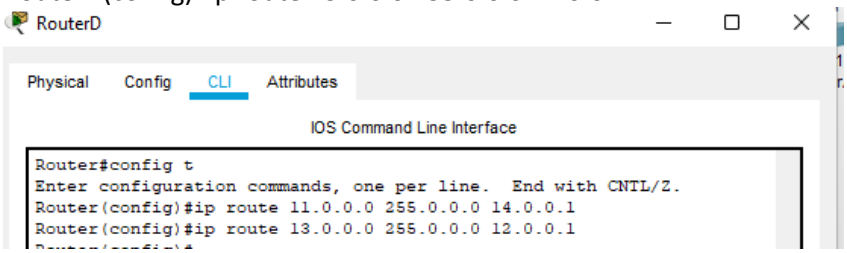


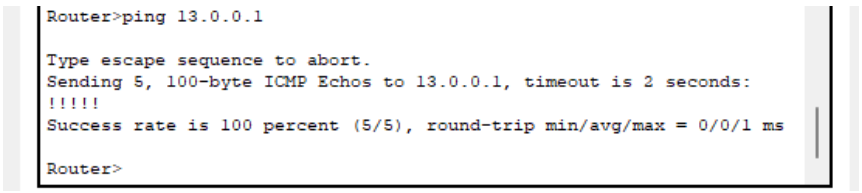
RouterC(config)#ip route 11.0.0.0 255.0.0.0 13.0.0.1
RouterC(config)#ip route 14.0.0.0 255.0.0.0 12.0.0.2





RouterD(config)#ip route 11.0.0.0 255.0.0.0 14.0.0.1
RouterD(config)#ip route 13.0.0.0 255.0.0.0 12.0.0.1





Here **ip route** is key word for specifying “Static Routes” after this key word mention the network address that is not directly connected to router then comes subnet mask after subnet mask is the address through which this router will access network 12.0.0.0 and in the end gateway for Router A i.e 13.0.0.2

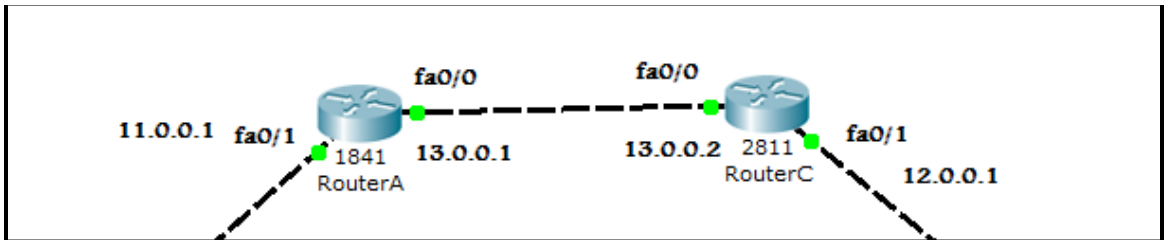
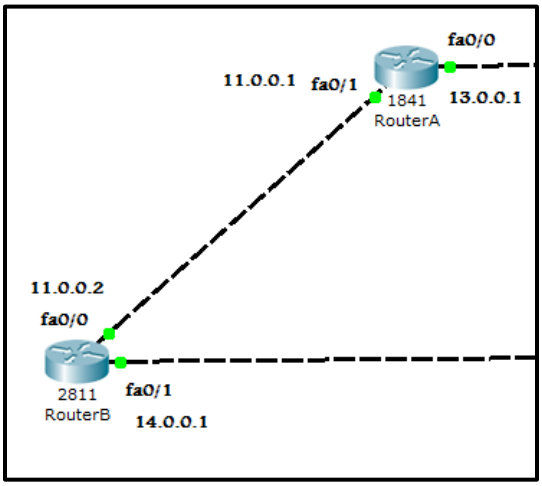


Fig: Showing Router A's gateway (13.0.0.2 at Router C) for network 12.0.0.0

Similarly,

Router(config)#ip route 14.0.0.0 255.0.0.0 11.0.0.2



Router A use _11.0.0.2____ as gateway for network 14.0.0.0

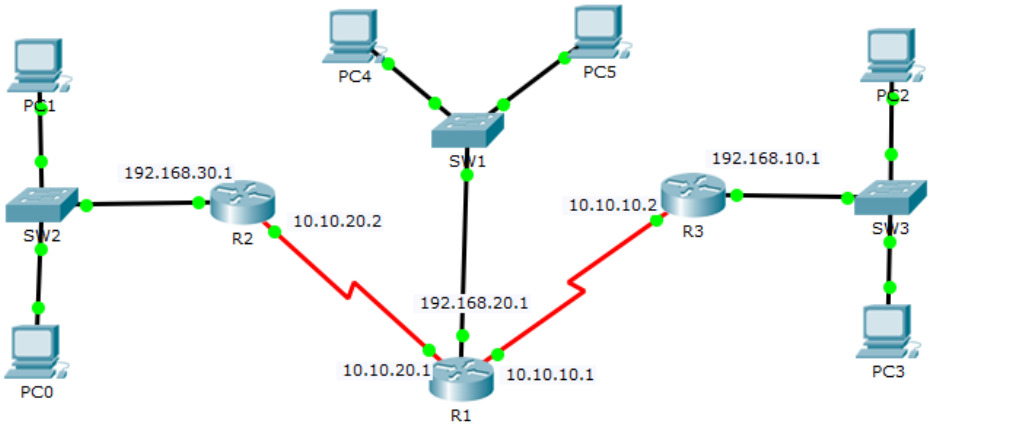
Repeat the above steps for Router B, C and D. . **(Screenshots attached above)**

Attach the screenshot of your Network topology and configuration of static routes in Router B, C and D.

View the Routing and ARP table by using Inspect Tool. Attach the screenshot and discuss the results.

Task 2: Configure Static Routing [25]

Configure Static Routing on given below network topology. Use Automatic Connection cable to make connections between routers. Ignore red link (serial cable) established between routers.



Fill the below table using information provided in above topology.

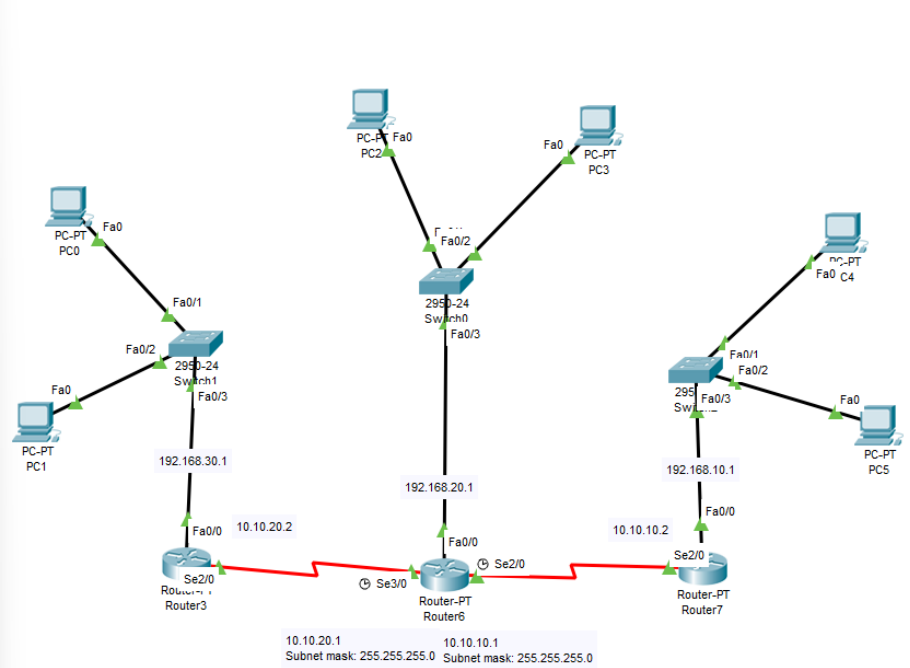
	Static Routes	Gateways for Static Routes
R1	192.168.10.0,192.168.30.0	10.10.10.2,10.10.20.2
R2	192.168.20.0,192.168.10.0 ,10.10.10.0	10.10.20.1
R3	192.168.20.0,10.10.20.0,1 92.168.30.0	10.10.10.1

Attach the screenshot of your Network topology and configuration of static routes in Router 1,2 and 3.

Ping PC1 to PC5 and PC0 to PC2 and attach its Screenshot.

Discuss and attach the screenshot of Routing and ARP table for R1, R2 and R3.
We did a similar thing in this task as we did in task 1(static routing). The thing that was different here was that even the shortest route between some of the routers had an additional router in between the path. Example when we had to connect router 3 and router 7 (naming convention according to the snippet I attached) we had to edit the command a little.

Router3(config)#ip route 192.168.10.0 255.255.255.0 10.10.10.0



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Router3	Router7	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Router7	Router3	ICMP		0.000	N	1	(edit)	(delete)

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC4	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC0	PC5	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC5	PC1	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC5	PC0	ICMP		0.000	N	3	(edit)	(delete)

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC2	PC5	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC3	PC1	ICMP		0.000	N	1	(edit)	(delete)

Task 3: Routing Information Protocol (RIP) [10]

RIP (**R**outing **I**nformation **P**rotocol):

1) RIP is a Distance Vector Protocol
2) A Distance Vector Protocol is the one that select the best possible path by calculating the Distance and direction to its destination.
3) RIP uses the concept of “HOP COUNT”
4) HOP means “To Jump”. RIP calculates how many Networks (Routers) exist between source and destination.
5) Maximum Hop count of RIP is 15.

6) By default it sends updates after every 30 seconds
7) These updates are important to cater for new updates in the network.

Configure Task 1 network topology using RIP protocol.

For Router A:

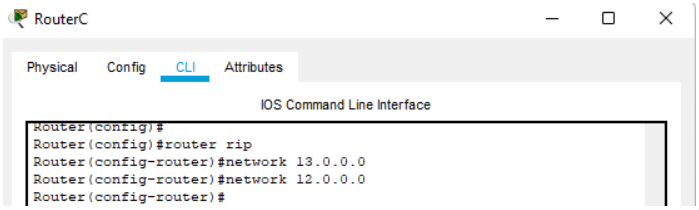
Router(config)#interface fa0/0 \\ to configure fa0/0 port first access it
Router(config-if)#ip address 13.0.0.1 255.0.0.0 \\assigning IP address to this port
Router(config-if)#no shut \\ bringing the port to UP state
Router(config-if)#exit \\ exiting interface after configuration

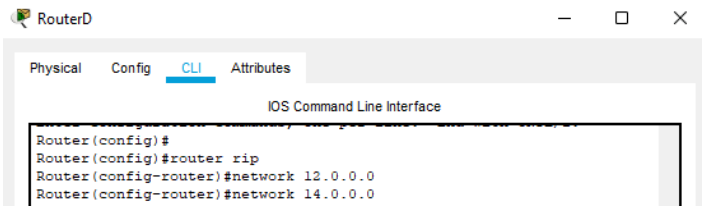
Router(config)#interface fa0/1 \\ to configure fa0/1 port first access it
Router(config-if)#ip address 11.0.0.1 255.0.0.0 \\assigning IP address to this port
Router(config-if)#no shut \\ bringing the port to UP state
Router(config-if)# exit \\ exiting interface after configuration

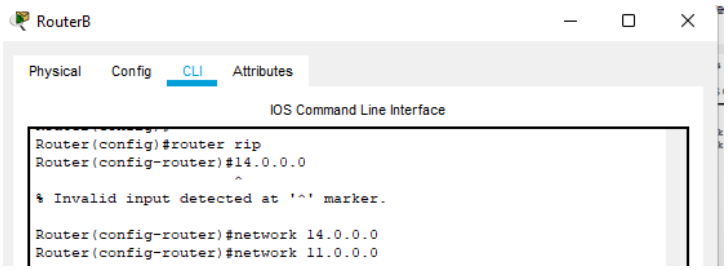
Router(config)# router rip \\ **RIP** (**R**outing **I**nformation **P**rotocol)
Router(config)#network 13.0.0.0 \\ Assigning network
Router(config)#network 11.0.0.0 \\ Assigning network

For router A:

```
Router(config)#router rip
Router(config-router)#network 13.0.0.0
Router(config-router)#network 11.0.0.0
```







For all Routers (just change only IP addresses & respective Networks in RIP). Attach screenshots of configuration for each Router.

1. To verify which routing protocol is configured, use the **show ip protocols** command. Use the **debug ip rip** command to view the RIP messages being sent and received. Rip updates are sent every 30 seconds so you may have to wait for debug information to be displayed. Attach its screenshot below.

```
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip protocol
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 25 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 1, receive any version
  Interface             Send  Recv  Triggered RIP  Key-chain
  FastEthernet0/0       1     2 1
  FastEthernet0/1       1     2 1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
            11.0.0.0
            13.0.0.0
Passive Interface(s):
Routing Information Sources:
            Gateway         Distance      Last Update
Distance: (default is 120)
Router#
```

2. Discontinue the debug output with the **undebug all** command.

```
Router#debug ip rip
RIP protocol debugging is on
```

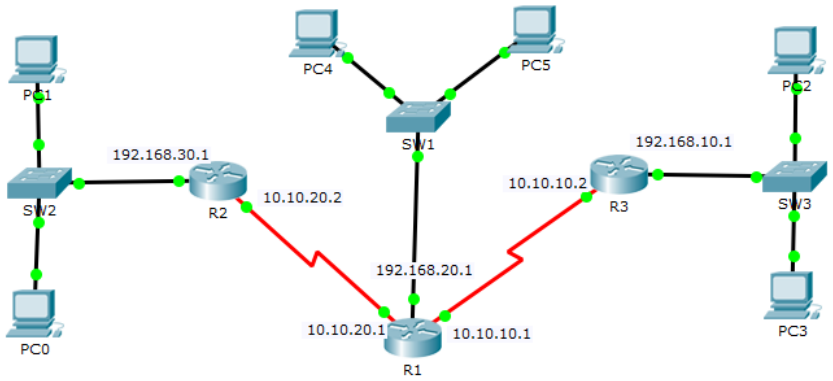
3. After the configuration, all the routers should be able to ping all the other routers. Check the routing table using show ip route command at each router and attach its screen shots.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	RouterA	RouterB	ICMP		0.000	N	0	(edit)	(delete)
	Successful	RouterA	RouterC	ICMP		0.000	N	1	(edit)	(delete)
	Successful	RouterA	RouterD	ICMP		0.000	N	2	(edit)	(delete)

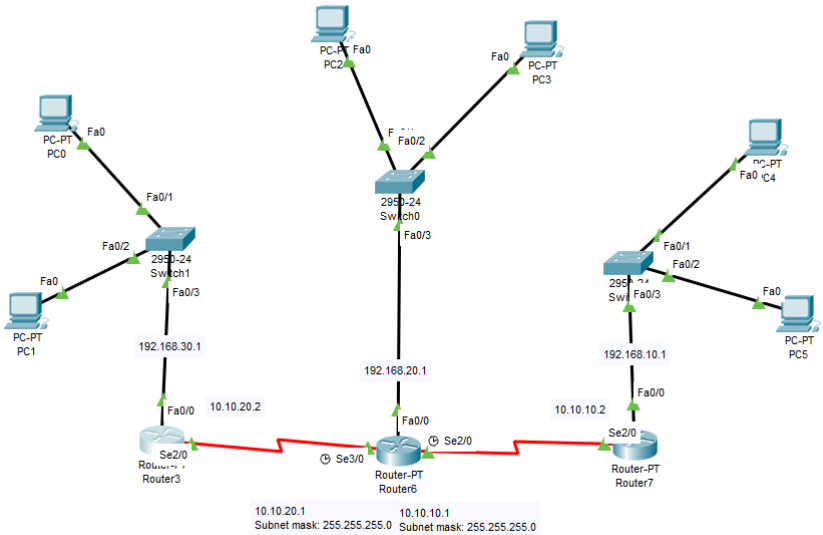
All routers were able to ping each other successfully

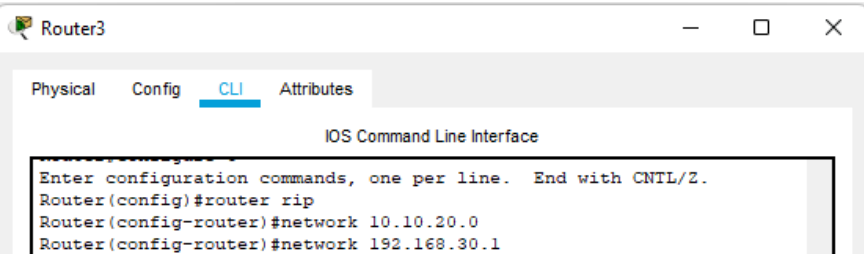
Task 4: [15]

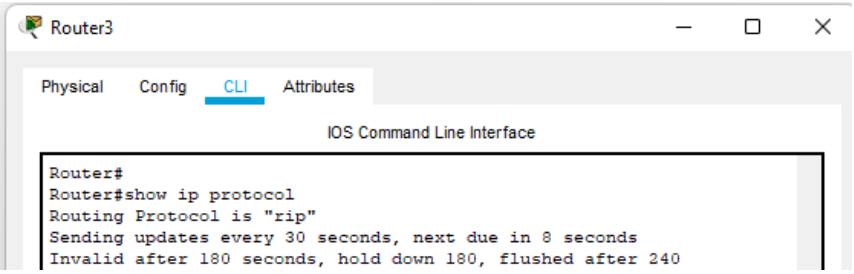
Configure RIP Routing on below network topology.



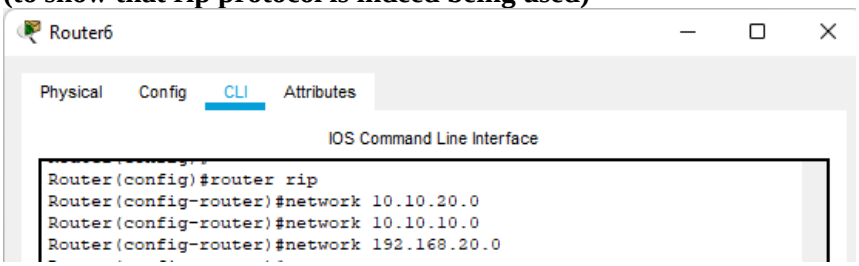
Attach the screen shots of Network model and configuration commands for RIP routing on R1, R2 and R3. Also, check the routing table on each Router and attach its screenshot.

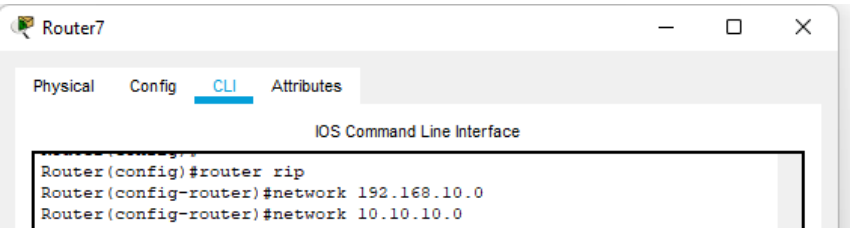






(to show that rip protocol is indeed being used)





Connectivity:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Router3	Router6	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Router3	Router7	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Router3	PC2	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Router3	PC5	ICMP		0.000	N	3	(edit)	(delete)

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Router6	Router3	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Router6	Router7	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Router6	PC0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Router6	PC5	ICMP		0.000	N	3	(edit)	(delete)

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Router7	Router6	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Router7	Router3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Router7	PC3	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Router7	PC1	ICMP		0.000	N	3	(edit)	(delete)

Lab Evaluation Assessment Rubric
EE-424 Lab 8

#	Assessment Elements	Level 1: Unsatisfactory Points 0-1	Level 2: Developing Points 2	Level 3: Good Points 3	Level 4: Exemplary Points 4

LR2	**Program/Code/ Simulation Model/ Network Model**	Program/code/simulation model/network model does not implement the required functionality and has several errors. The student is not able to utilize even the basic tools of the software.	Program/code/simulation model/network model has some errors and does not produce completely accurate results. Student has limited command on the basic tools of the software.	Program/code/simulation model/network model gives correct output but not efficiently implemented or implemented by computationally complex routine.	Program/code/simulation /network model is efficiently implemented and gives correct output. Student has full command on the basic tools of the software.
LR4	**Data Collection**	Measurements are incomplete, inaccurate and imprecise. Observations are incomplete or not included. Symbols, units and significant figures are not included.	Measurements are somewhat inaccurate and imprecise. Observations are incomplete or vague. Major errors are there in using symbols, units and significant digits.	Measurements are mostly accurate. Observations are generally complete. Minor errors are present in using symbols, units and significant digits.	Measurements are both accurate and precise. Data collection is systematic. Observations are very thorough and include appropriate symbols, units and significant digits and task completed in due time.
LR5	**Results & Plots**	Figures/ graphs / tables are not developed or are poorly constructed with erroneous results. Titles, captions, units are not mentioned. Data is presented in an obscure manner.	Figures, graphs and tables are drawn but contain errors. Titles, captions, units are not accurate. Data presentation is not too clear.	All figures, graphs, tables are correctly drawn but contain minor errors or some of the details are missing.	Figures / graphs / tables are correctly drawn and appropriate titles/captions and proper units are mentioned. Data presentation is systematic.
LR9	**Report**	All the in-lab tasks are not included in report.	Most of the tasks are included in report but are not well explained. All the necessary figures / plots are not included.	Good summary of most of the in-lab tasks is included in report. The work is supported by figures and plots with explanations.	Detailed summary of the in-lab tasks is provided. All tasks are included and explained well. Data is presented clearly including all the necessary figures, plots and tables.
AR4	***Report Submission**	Late submission after 1 week and in between 2 weeks.	Late submission after 2 days and within a week.	Late submission after the lab timing and within 2 days of the	Timely submission of the report and in the lab time.

				due date.	

***Report:** Report will not be accepted after 1 week of due date