(7th Semester, 3rd Year) LAB EXPERIMENT # 10

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Score:_____ Signature of the Lab Tutor:_____ Date:

OBJECTIVES

#	Topic	#. Of Lectures	CLO	Taxonomy level
9	To **understand** static and default routing. Design the required network and **configure** the static and default routing.	3	1,2	C3, P2

OUTCOME(S)

a. An ability to apply knowledge of math, science, and engineering	**PLO1**: Engineering Knowledge:

RUBRICS:

Performance Metric	Exceeds expectation (4-5)	Meets expectations (2-3)	Does not meet expectations (0-1)	Score
Knowledge and application [PLO1]	Applies the appropriate knowledge and concepts to the problem with accuracy and proficiency; shows precise understanding of these knowledge and concepts.	Applies the relevant knowledge and concept to the problem, possibly in a roundabout way; understands the major points of the knowledge, with possible misunderstanding or failure to recall minor points;	Fails to apply relevant knowledge and concepts to the problem; misunderstands or fails to recall critical points.	
			Total Score	

LEARNING OBJECTIVES

Upon completion of this lab, you will be able to:.

- Configure and activate Serial and Ethernet interfaces.
- Test connectivity.
- Configure a static route using an intermediate address.
- Configure a static route using an exit interface.
- Compare a static route with intermediate address to a static route with exit interface.

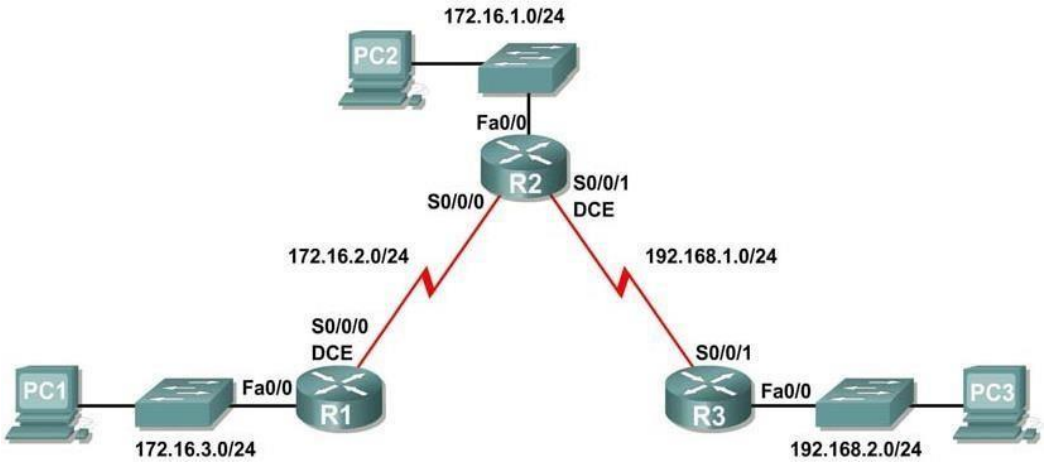
- Document the network implementation.

Scenario

In this lab activity, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram.

You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Addressing Table to apply an addressing scheme to the network devices. After completing the basic configuration, test connectivity between the devices on the network. First test the connections between directly connected devices, and then test connectivity between devices that are not directly connected. Static routes must be configured on the routers for end-to-end communication to take place between the network hosts. You will configure the static routes that are needed to allow communication between the hosts. View the routing table after each static route is added to observe how the routing table has changed.

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R 1	**Fa0/0**	172.16.3.1	255.255.255.0	N/A
	S0/0/0	172.16.2.1	255.255.255.0	N/A
R 2	**Fa0/0**	172.16.1.1	255.255.255.0	N/A
	S0/0/0	172.16.2.2	255.255.255.0	N/A
	S0/0/1	192.168.1.2	255.255.255.0	N/A
R 3	**FA0/0**	192.168.2.1	255.255.255.0	N/A
	S0/0/1	192.168.1.1	255.255.255.0	N/A
PC1	**NIC**	172.16.3.10	255.255.255.0	172.16.3.1

PC2	**NIC**	172.16.1.10	255.255.255.0	172.16.1.1
PC3	**NIC**	192.168.2.10	255.255.255.0	192.168.2.1

Task 1: Cable, Erase, and Reload the Routers.

Step 1: Cable a network that is similar to the one in the Topology

Diagram. Step 2: Clear the configuration on each router.

Clear the configuration on each of the routers using the **erase startup-config** command and then **reload** the routers. Answer **no** if asked to save changes.

Task 2: Perform Basic Router Configuration.

Note: If you have difficulty with any of the commands in this task, see last lab of router config **Cabling a Network and Basic Router Configuration**.

Step 1: Use global configuration commands.

On the routers, enter global configuration mode and configure the basic global configuration commands including: ***hostname*** **no ip domain-lookup enable secret**

Step 2: Configure the console and virtual terminal line passwords on each of the routers. password login

Step 3: Configure the LAN interface IP address for R1 as specified in the Topology Diagram Step 4: Enter the command necessary to install the route in the routing table.

If you do not see the route added to the routing table, the interface did not come up. Use the following systematic process to troubleshoot your connection:

1. Check your physical connections to the LAN interface. Is the correct interface attached? YES
   Your router may have more than one LAN interface. Did you connect the correct LAN interface?
   YES
   An interface will not come up unless it detects a carrier detect signal at the Physical layer from another device. Is the interface connected to another device such as a hub, switch, or PC? IT IS CONNECTED TO SWITCH
2. Check link lights. Are all link lights blinking? YES LIGHT IS BLINKING WITH RED COLOUR.
3. Check the cabling. Are the correct cables connected to the devices? YES CABLES ARE CONNECTED CORRECTLY
4. Has the interface been activated or enabled? Initially they are shutdown I have enabled them using CLI

If you can answer **yes** to all the proceeding questions, the interface should come up.

Step 5: Enter the command to verify that the new route is now in the routing table.

Your output should look similar to the following output. There should now be one route in the table for R1. What command did you use?

R1#_____

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR P - periodic downloaded static route

Gateway of last resort is not set

172.16.0.0/24 is subnetted, 1 subnets

C 172.16.3.0 is directly connected, FastEthernet0/0

Step 6: Enter interface configuration mode for R1's WAN interface connected to R2.

R1#**configure terminal**
Enter configuration commands, one per line. End with CNTL/Z. R1(config)#**interface Serial 0/0/0**

Configure the IP address as specified in the Topology Diagram.

R1(config-if)#**ip address 172.16.2.1 255.255.255.0**
R1(config-if)#**no shut down**

Step 7: Enter the clock rate command on R1.

You can specify any valid clocking speed. Use the **?** to find the valid rates. Here, we used 64000 bps.

R1(config-if)#**clock rate 64000**

Step 8: Enter the command necessary to ensure that the interface is fully configured.

Unlike configuring the LAN interface, fully configuring the WAN interface does not always guarantee that the route will be entered in the routing table, even if your cable connections are correct. The other side of the WAN link must also be configured.

Enter interface configuration mode for R2's WAN interface connected to R1.

*R2#**configure terminal***

Enter configuration commands, one per line. End with CNTL/Z. R2(config)#**interface serial 0/0/0**

Configure the IP address as specified in the Topology Diagram.

R2(config-if)#**ip address 172.16.2.2 255.255.255.0**

R2(config-if)#**no shut down** ***Step 9: Enter the command necessary to ensure that the interface is fully configured.***

The new network that you configured on the WAN interface is now added to the routing table, as shown in the highlighted output.

If you do not see the route added to the routing table, the interface did not come up. Use the following systematic process to troubleshoot your connection:

1. Check your physical connections between the two WAN interfaces for R1 and R2. Is the correct interface attached?

   Your router has more than one WAN interface. Did you connect the correct WAN interface? Interfaces are interconnected
   An interface will not come up unless it detects a link beat at the Physical layer from another device. Is the interface connected to the other router's interface?
2. Check link lights. Are all link lights blinking? Yes lights are blinking green
3. Check the cabling. R1 must have the DCE side of the cable attached and R2 must have the DTE side of the cable attached. Are the correct cables connected to the routers? YES
4. Has the interface been activated or enabled? Yes interface is enabled.

If you can answer **yes** to all the proceeding questions, the interface should come up.

Step 10: Enter the command to verify that the new route is now in the routing table for R1 and R2.

Your output should look similar to the following output. There should now be two routes in the routing table for R1 and one route in the table for R2. What command did you use?

R1#

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, * - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route

Gateway of last resort is not set 172.16.0.0/24 is

subnetted, 2

subnets

```
C    172.16.2.0 is directly connected, Serial0/0/0
C    172.16.3.0 is directly connected, FastEthernet0/0

R2#
Codes: C - connected, S - static, I - IGRP, R - RIP, M -
    mobile, B - BGP D - EIGRP, EX - EIGRP external, O
    - OSPF, IA - OSPF inter area N1 - OSPF NSSA
    external type 1, N2 - OSPF NSSA external type 2 E1
    - OSPF external type 1, E2 - OSPF external type 2, E
    - EGP
    i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
    * - candidate default, U - per-user static
    route, o - ODR P - periodic downloaded
    static route

Gateway of last resort is not set 172.16.0.0/24

   is subnetted, 1

   subnets
C    172.16.2.0 is directly connected, Serial0/0/0
```

Task 3: Finish Configuring Router Interfaces

Step 1: Configure Remaining R2 Interfaces

Finish configuring the remaining interfaces on R2 according to the Topology Diagram and Addressing Table.

Step 2: Configure R3 Interfaces

Console into R3 and configure the necessary interfaces according to the Topology Diagram and Addressing Table.

Task 4: Configure IP Addressing on the Host PCs.

Step 1: Configure the host PC1.

Configure the host PC1 with an IP address of 172.16.3.10/24 and a default gateway of 172.16.3.1.

Step 2: Configure the host PC2.

Configure the host PC2 with an IP address of 172.16.1.10/24 and a default gateway of 172.16.1.1.

Step 3: Configure the host PC3.

Configure the host PC3 with an IP address of 192.168.2.10/24 and a default gateway of 192.168.2.1.

Task 5: Test and Verify the Configurations.

Step 1: Test connectivity.

Test connectivity by pinging from each host to the default gateway that has been configured for that host. From the host PC1, is it possible to ping the default gateway? Yes from PC1 to its default gateway the ping is successful From the host PC2, is it possible to ping the default gateway?

From the host PC3, is it possible to ping the default gateway?

If the answer is **no** for any of these questions, troubleshoot the configurations to find the error using the following systematic process:

1. Check the cabling.
   Are the PCs physically connected to the correct router?
   (Connection could be through a switch or directly) Are
   link lights blinking on all relevant ports?
2. Check the PC configurations. Do they match the Topology Diagram? _____
3. Check the router interfaces using the **show ip interface brief** command. Are all relevant interfaces **up** and **up**?

If your answer to all three steps is **yes**, you should be able to successfully ping the default gateway.

Step 2: Use the ping command to test connectivity between directly connected routers.

From the router R2, is it possible to ping R1 at 172.16.2.1? From

the router R2, is it possible to ping R3 at 192.168.1.1? ____

If the answer is **no** for any of these questions, troubleshoot the configurations to find the error using the following systematic process:

1. Check the cabling.
   Are the routers physically connected? YES Are link
   lights blinking on all relevant ports? YES
2. Check the router configurations.
   Do they match the Topology Diagram?
   Did you configure the **clock rate** command on the DCE side of the link? YES
3. Has the interface been activated or enabled? YES
4. Check the router interfaces using the **show ip interface brief** command. Are the interfaces **up** and **up**? YES

If your answer to all three steps is **yes**, you should be able to successfully ping from R2 to R1 and from R2 to R3.

Step 3: Use ping to check connectivity between devices that are not directly connected.

From the host PC3, is it possible to ping the host PC1? No host is unreachable

From the host PC3, is it possible to ping the host PC2? RESQUEST TIMEOUT

From the host PC2, is it possible to ping the host PC1? No host is unreachable

From the router R1, is it possible to ping router R3? No degisnation host unreachable

These pings should all fail. Why?

it is because R3 doesn't contain the information about the networks connected to R2 and R1 and vise versa. Each router must be told about these network so that ping can be made successful.

Task 6: Gather Information.

Step 1: Check status of interfaces.

Check the status of the interfaces on each router with the command **show ip interface brief**. The following output is for R2. *R2#**show ip interface brief***

Interface	IP-Address	OK?	Method	Status	
	Protocol	FastEthernet0/0	172.16.1.1	YES	
	manual		up	up	FastEthernet0/1
	unassigned	YES	unset	administratively down	
down	Serial0/0/0		172.16.2.2	YES up	
	manual		up		
Serial0/0/1	192.168.1.2	YES	manual	up	up
Vlan1	unassigned	YES	manual	administratively down	
down					

Are all of the relevant interfaces on each router activated (that is, in the **up** and **up** state)?

How many interfaces are activated on R1 and R3?

Why are there three activated interfaces on R2?

Step 2: View the routing table information for all three routers.

R1#

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M -
    mobile, B - BGP D - EIGRP, EX - EIGRP external, O
    - OSPF, IA - OSPF inter area N1 - OSPF NSSA
    external type 1, N2 - OSPF NSSA external type 2 E1
    - OSPF external type 1, E2 - OSPF external type 2, E
    - EGP
    i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
    * - candidate default,  U - per-user static
    route, o - ODR P - periodic downloaded
    static route
Gateway of last resort is not set

   172.16.0.0/24 is subnetted, 2 subnets
C     172.16.2.0 is directly connected, Serial0/0/0
C     172.16.3.0 is directly connected, FastEthernet0/0
```

What networks are present in the Topology Diagram but not in the routing table for R1?

_____

```
R2#_____
Codes: C - connected, S - static, I - IGRP, R - RIP, M -
    mobile, B - BGP D - EIGRP, EX - EIGRP external, O
    - OSPF, IA - OSPF inter area N1 - OSPF NSSA
    external type 1, N2 - OSPF NSSA external type 2 E1
    - OSPF external type 1, E2 - OSPF external type 2, E
    - EGP
    i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate
    default U - per-user static route, o - ODR

Gateway of last resort is not set

   172.16.0.0/24 is subnetted, 2

   subnets
C      172.16.1.0      is      directly      connected,
FastEthernet0/0 C      172.16.2.0    is
directly connected, Serial0/0/0
C 192.168.1.0/24 is directly connected, Serial0/0/1
```

What networks are present in the Topology Diagram but not in the routing table for R2?

_____

```
R3# _____
Codes: C - connected, S - static, I - IGRP, R - RIP, M -
    mobile, B - BGP D - EIGRP, EX - EIGRP external, O
    - OSPF, IA - OSPF inter area N1 - OSPF NSSA
```

external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default U - per-user static route, o - ODR

Gateway of last resort is not set

C 192.168.1.0/24 is directly connected, Serial0/0/1
C 192.168.2.0/24 is directly connected, FastEthernet0/0

What networks are present in the Topology Diagram but not in the routing table for R3?
It doesn't contain the information of network 3 i.e. 172.16.3.1
Why are all the networks not in the routing tables for each of the routers?
Because router unable to fetch their information, because of their default gateways
What can be added to the network so that devices that are not directly connected can ping each other?

In order to make communication successful among devices that are not able to communicate we have to tell the information of the networks router doesn't has. Also known as the static routing.

Task 7: Configure a Static Route Using a Next-Hop Address.

Step 1: To configure static routes with a next-hop specified, use the following syntax:

Router(config)# **ip route** *network-address subnet-mask ip-addressnetwork-address*:— Destination network address of the remote network to be added to the routing table.
- *subnet-mask*—Subnet mask of the remote network to be added to the routing table. The subnet mask can be modified to summarize a group of networks.
- *ip-address*— Commonly referred to as the next-hop router's IP address.

On the R3 router, configure a static route to the 172.16.1.0 network using the Serial 0/0/1 interface of R2 as the next-hop address.

*R3(config)#**ip route 172.16.1.0 255.255.255.0 192.168.1.2***
R3(config)#

Step 2: View the routing table to verify the new static route entry.

Notice that the route is coded with an **S**, which means that the route is a **static** route.

R3# _____

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default U - per-user static route, o - ODR

Gateway of last resort is not set

172.16.0.0/24 is subnetted, 1 subnets

C 192.168.1.0/24 is directly connected, Serial0/0/1
C 192.168.2.0/24 is directly connected, FastEthernet0/0 R3#

With this route entered in the routing table, any packet that matches the first 24 left- most bits of 172.16.1.0/24 will be forwarded to the next-hop router at 192.168.1.2.

What interface will R3 use to forward packets to the 172.16.1.0/24 network?

Assume that the following packets have arrived at R3 with the indicated destination addresses. Will R3 discard the packet or forward the packet? If R3 forwards the packet, with what interface will R3 send the packet?

Packet	Destination IP	Discard or Forward?	Interface
1	172.16.2.1	_____	_____
2	172.16.1.10	_____	_____
3	192.168.1.2	_____	_____
4	172.16.3.10	_____	_____
5	192.16.2.10	_____	_____

Although R3 will forward packets to destinations for which there is a route, this does not mean that a packet will arrive safely at the final destination.

Step 3: Use ping to check connectivity between the host PC3 and the host PC2.

From the host PC3, is it possible to ping the host PC2?__

These pings should fail. The pings will arrive at PC2 if you have configured and verified all devices through Task 7, "Gather Information." PC2 will send a ping reply back to PC3. However, the ping reply will be discarded at R2 because the R2 does not have a return route to the 192.168.2.0 network in the routing table.

Step 4: On the R2 router, configure a static route to reach the 192.168.2.0 network.

What is the next-hop address to which R2 would send a packet destined for the 192.168.2.0/24 network?

R2(config)#**ip route 192.168.2.0 255.255.255.0** __ R2(config)#

Step 5: View the routing table to verify the new static route entry.

Notice that the route is coded with an **S**, which means the route is a **static** route.

R2# _____

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M -
    mobile, B - BGP D - EIGRP, EX - EIGRP external, O
    - OSPF, IA - OSPF inter area N1 - OSPF NSSA
    external type 1, N2 - OSPF NSSA external type 2 E1 -
    OSPF external type 1, E2 - OSPF external type 2, E
    - EGP
    i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate
    default U - per-user static route, o - ODR

Gateway of last resort is not set

   172.16.0.0/24 is subnetted, 2

   subnets
C     172.16.1.0 is directly connected, FastEthernet0/0
C     172.16.2.0 is directly connected, Serial0/0/0
C 192.168.1.0/24 is directly connected,
Serial0/0/1 S 192.168.2.0/24 [1/0] via
192.168.1.1 R2#
```

Step 6: Use ping to check connectivity between the host PC3 and the host PC2.

From the host PC3, is it possible to ping the host PC2?

This ping should be successful.

Task 8: Configure a Static Route Using an Exit Interface.

To configure static routes with an exit interface specified, use the following syntax: Router(config)# **ip route** *network-address subnet-mask exit-interface*

- *network-address*—Destination network address of the remote network to be added to the routing table.
- *subnet-mask*—Subnet mask of the remote network to be added to the routing table. The subnet mask can be modified to summarize a group of networks.
- *exit-interface*—Outgoing interface that would be used in forwarding packets to the destination network.

Step 1: On the R3 router, configure a static route.

On the R3 router, configure a static route to the 172.16.2.0 network using the Serial 0/0/1 interface of the R3 router as the exit interface.

```
R3(config)# ip route 172.16.2.0 255.255.255.0 Serial0/0/1
R3(config)#
```

Step 2: View the routing table to verify the new static route entry.

R3# _____

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M -
    mobile, B - BGP D - EIGRP, EX - EIGRP external, O
    - OSPF, IA - OSPF inter area N1 - OSPF  NSSA
    external type 1, N2 - OSPF NSSA external type 2 E1 -
    OSPF external type 1, E2 - OSPF external type 2, E
    - EGP
    i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate
    default U - per-user static route, o - ODR

Gateway of last resort is not set

   172.16.0.0/24 is subnetted, 2

   subnets
S     172.16.1.0 [1/0] via 192.168.1.2
S     172.16.2.0 is directly connected, Serial0/0/1
C 192.168.1.0/24 is directly connected, Serial0/0/1
C 192.168.2.0/24 is directly connected, FastEthernet0/0
```

Use the **show running-config** command to verify the static routes that are currently configured on R3.

*R3#**show running-config*** Building configuration...

<output omitted>
!
hostname R3
!
interface FastEthernet0/0 ip address 192.168.2.1 255.255.255.0
!
interface Serial0/0/0 no ip address
shutdown
!
interface Serial0/0/1 ip address 192.168.1.1 255.255.255.0
!
ip route 172.16.1.0 255.255.255.0 192.168.1.2
ip route 172.16.2.0 255.255.255.0 Serial0/0/1
!
end

How would you remove either of these routes from the configuration?

_____

Step 3: On the R2 router, configure a static route.

On the R2 router, configure a static route to the 172.16.3.0 network using the Serial 0/0/0 interface of the R2 router as the exit interface.

R2(config)# **ip route 172.16.3.0 255.255.255.0 Serial0/0/0**
R2(config)#

Step 4: View the routing table to verify the new static route entry.

R2# _____

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external

type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default U - per-user static route, o - ODR

Gateway of last resort is not set

172.16.0.0/24 is subnetted, 3

subnets

C 172.16.1.0 is directly connected, FastEthernet0/0 C 172.16.2.0 is directly connected, Serial0/0/0
S 172.16.3.0 is directly connected, Serial0/0/0
C 192.168.1.0/24 is directly connected, Serial0/0/1 S 192.168.2.0/24 [1/0] via 192.168.1.1 R2#

At this point, R2 has a complete routing table with valid routes to all five networks shown in the Topology Diagram.

Does this mean that R2 can receive ping replies from all destinations shown in the Topology Diagram?

Why or why not?

No still it doesn't know the exit route from 172.16.3.0 to 172.16.1.0

Step 5: Use ping to check connectivity between the host PC2 and PC1.

This ping should fail because the R1 router does not have a return route to the 172.16.1.0 network in the routing table.

Task 09: Summary, Reflection, and Documentation.

With the completion of this lab, you have:

- Configured your first network with a combination of static and default routing to provide full connectivity to all networks
- Observed how a route is installed in the routing table when you correctly configure and activate the interface
- Learned how to statically configure routes to destinations that are not directly connected
- Learned how to configure a default route that is used to forward packets to unknown destinations

Finally, you should document your network implementation. On each router, capture the following command output to a text (.txt) file and save for future reference.

- ***show running-config***
- **show ip route show ip**
- **interface brief**

DISCUSSION (Default Route)

A default route, also known as the *gateway of last resort*, is the network route used by a router when no other known route exists for a given IP packet's destination address. All the packets for destinations not known by the router's routing table are sent to the default route. This route generally leads to another router, which treats the packet the same way: If the route is known, the packet will get forwarded to the known route. If not, the packet is forwarded to the default-route of *that router* which generally leads to *another* router. And so on. Each router traversal adds a one-hop distance to the route.

Once the router with a known route to a host destination is reached, the router determines which route is valid by finding the "most specific match". The network with the longest subnet mask that matches the destination IP address wins.

The default route in IPv4 (in CIDR notation) is 0.0.0.0/0, often called the quad-zero route. Since the subnet mask given is /0, it effectively specifies no network, and is the "shortest" match possible. A route lookup that doesn't match anything will naturally fall back onto this route. Similarly, in IPv6 the default address is given by: /0.

Routers in an organization generally point the default route towards the router that has a connection to a network service provider. This way, packets with destinations outside the

organization's local area network (LAN)—typically to the Internet, WAN, or VPN—will be forwarded by the router with the connection to that provider.
Host devices in an organization generally refer to the default route as a default gateway which can be, and usually is, a filtration device such as a firewall or Proxy server.

(6th Semester, 3rd Year) LAB EXPERIMENT # 10

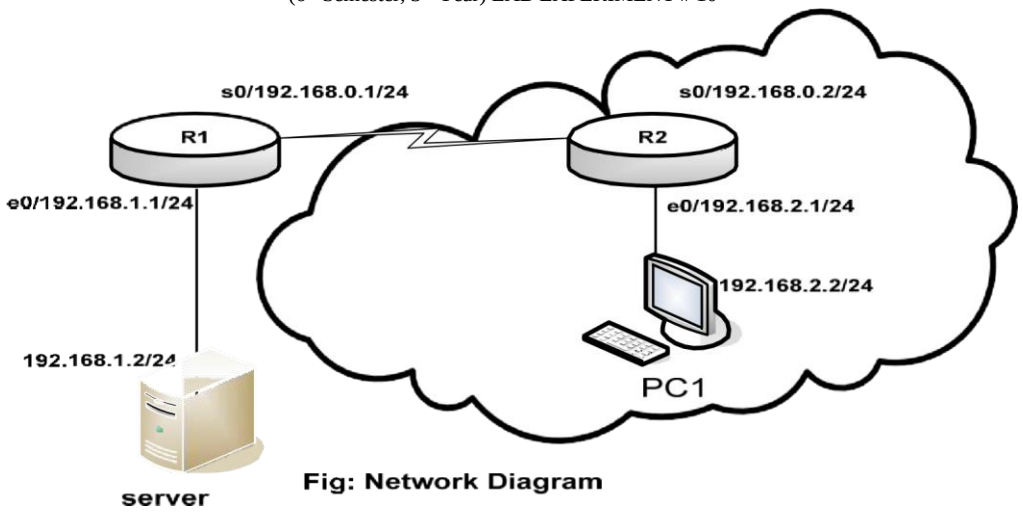


Fig: Network Diagram

Setup a network similar to the one in the diagram. Any router that meets the interface requirements may be used. And follow the steps required to achieve this lab activity.

Step 1: Configuring both Routers

For Router1

Press Enter to Start

Router>
Router>**en**
Router#**config t**
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#**hostname Router1**
Router1(config)#**int s0**
Router1(config-if)#**ip address 192.168.0.1 255.255.255.0**
Router1(config-if)#**clock rate 64000**
Router1(config-if)#**no shut**
%LINK-3-UPDOWN: Interface Serial0, changed state to up
%LINK-3-UPDOWN: Interface Serial0, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to down
Router1(config-if)#**exit**

Router1(config)#**int e0**
Router1(config-if)#**ip address 192.168.1.1 255.255.255.0**
Router1(config-if)#**no shut**
Router1(config-if)#**^Z**
%LINK-3-UPDOWN: Interface Ethernet0, changed state to up a.
How many interfaces are up on Router1? Mention names;

For Router2

Press Enter to Start

Router>
Router>**en**
Router#**config t**
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#**hostname Router2**
Router2(config)#**int s0**
Router2(config-if)#**ip address 192.168.0.2 255.255.255.0**
Router2(config-if)#**no shut**
%LINK-3-UPDOWN: Interface Serial0, changed state to up Router2(config-if)#**exit**

Router2(config)#**int e0**
Router2(config-if)#**ip address 192.168.2.1 255.255.255.0**
Router2(config-if)#**no shut**

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up
Router2(config-if)#^**Z**
%SYS-5-CONFIG_I: Configured from console by console

Step 2: Configuring the server and workstation

Configure the server and workstation with the proper IP address, subnet mask, and default gateway.

a. The configuration for the server connected to the Router1 is:
IP Address: **192.168.1.2**
IP subnet mask: **255.255.255.0**
Default gateway: **192.168.1.1**

b. The configuration for the host connected to the Router2 is:
IP Address: **192.168.2.2**
IP subnet mask: **255.255.255.0**
Default gateway: **192.168.2.1**

Step 3: Check the interface status

Router1#sh ip int brief

Interface	IP-Address	OK? Method Status	Protocol
Serial0	**192.168.0.1**	**YES unset up**	**up**
Ethernet0	**192.168.1.1**	**YES unset up**	**up**

Router2#sh ip int brief

Interface	IP-Address	OK? Method Status	Protocol
Serial0	**192.168.0.2**	**YES unset up**	**up**
Ethernet0	**192.168.2.1**	**YES unset up**	**up**

a. Check the interfaces on both routers with the commands **show ip interface brief** or **show interface.**

b. Are all the necessary interfaces up?

_____

Step 4: Check the routing table entries

Router1#sh ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default U - per-user static route

Gateway of last resort is not set

192.168.1.0/24 is subnetted, 1 subnets
C 192.168.1.0 is directly connected, Ethernet0
192.168.0.0/24 is subnetted, 1 subnets
C 192.168.0.0 is directly connected, Serial0

Router2#sh ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default U - per-user static route

Gateway of last resort is not set

192.168.0.0/24 is subnetted, 1 subnets

C 192.168.0.0 is directly connected, Serial0
192.168.2.0/24 is subnetted, 1 subnets
C 192.168.2.0 is directly connected, Ethernet0

a. What networks are displayed on R1?

b. What interfaces are directly connected on R2?

Step 5: Adding the Default routes

Router1(config)#**ip route 0.0.0.0 0.0.0.0 192.168.0.2**
Router2(config)#**ip route 0.0.0.0 0.0.0.0 192.168.0.1**

a**.** What does 0.0.0.0 showing here?

Step 6: Verify the new route

Router1#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP i -
IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default U -
per-user static route

Gateway of last resort is to network 0.0.0.0

192.168.1.0/24 is subnetted, 1 subnets
C 192.168.1.0 is directly connected, Ethernet0
192.168.0.0/24 is subnetted, 1 subnets
C 192.168.0.0 is directly connected, Serial0
S* 0.0.0.0 [1/0] via 192.168.0.2

Router2#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP i -

IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default U - per-user static route

Gateway of last resort is to network 0.0.0.0

192.168.0.0/24 is subnetted, 1 subnets
C 192.168.0.0 is directly connected, Serial0
192.168.2.0/24 is subnetted, 1 subnets
C 192.168.2.0 is directly connected, Ethernet0

S* 0.0.0.0 [1/0] via 192.168.0.1

---

a. List the routes listed in the routing table of R2?

---

b. What is the administrative distance?

Step 7: Check connectivity from host to host

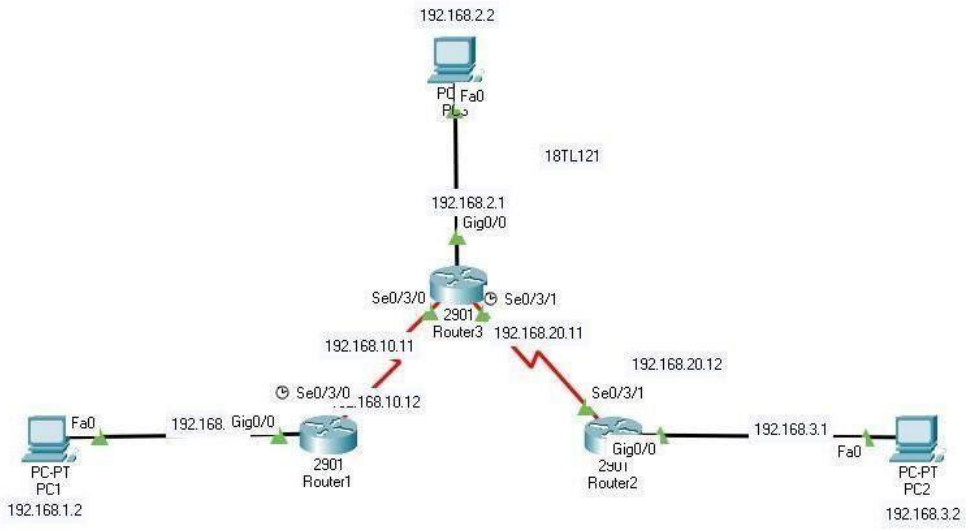
Ping host1 to server

C:>ping 192.168.2.1
Pinging 192.168.2.2 with 32 bytes of data:

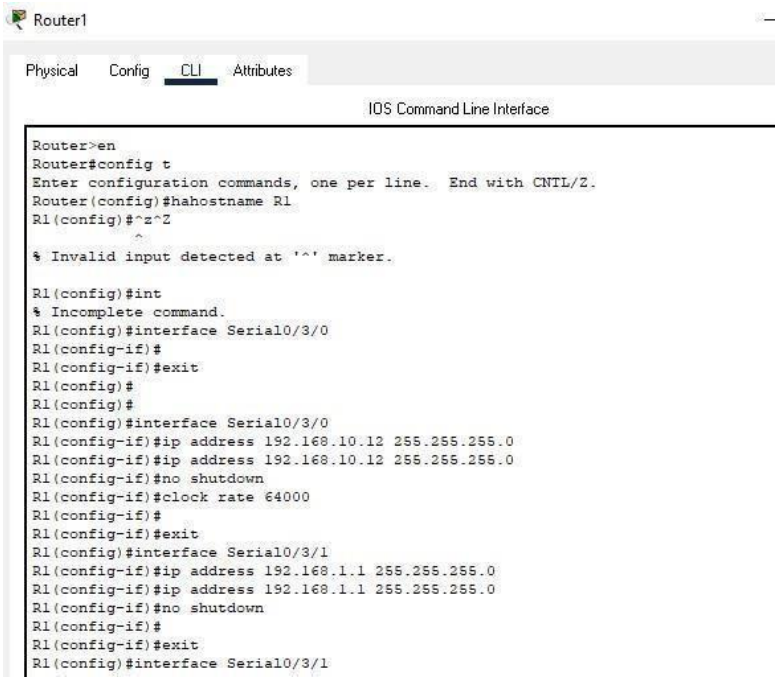
Reply from 192.168.2.1: bytes=32 time=60ms TTL=241 Reply from 192.168.2.1: bytes=32 time=60ms TTL=241 Reply from 192.168.2.1: bytes=32 time=60ms TTL=241 Reply from 192.168.2.1: bytes=32 time=60ms TTL=241
Reply from 192.168.2.1: bytes=32 time=60ms TTL=241

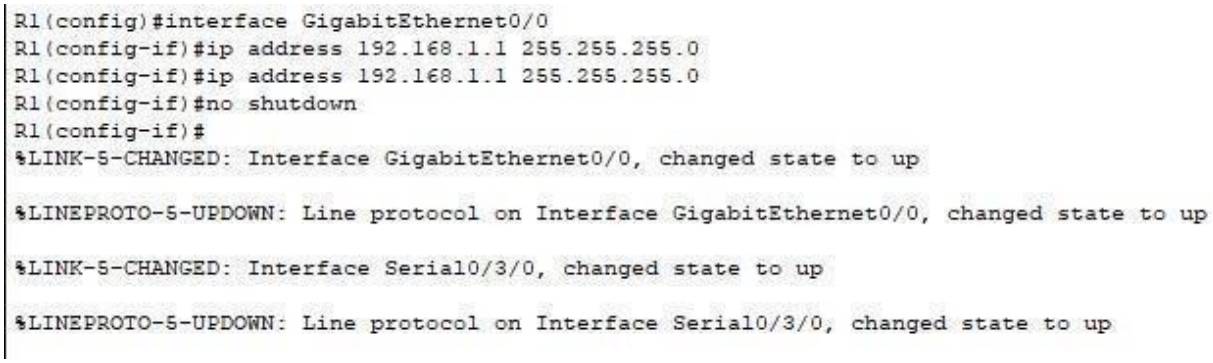
Ping statistics for 192.168.2.1: Packets: Sent = 5, Received = 5, Lost = 0 (0% loss), Approximate round trip times in milli-seconds:
Minimum = 50ms, Maximum = 60ms, Average = 55ms

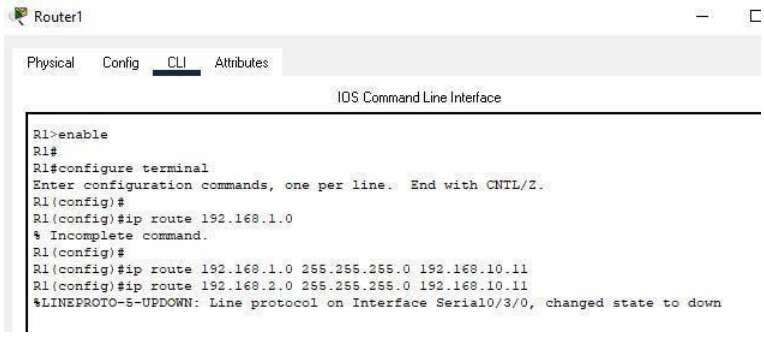
If the **ping** was not successful, check routing table to make sure default static routes are entered correctly



(6th Semester, 3rd Year) LAB EXPERIMENT # 10







(6th Semester, 3rd Year) LAB EXPERIMENT # 10

```
R1(config)#ip route 192.168.2.0 255.255.255.0 192.168.10.11
R1(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up
ip route 192.168.20.0 255.255.255.0 192.168.10.11
R1(config)#ip route 192.168.3.0 255.255.255.0 192.168.10.11
R1(config)#
```

Router2

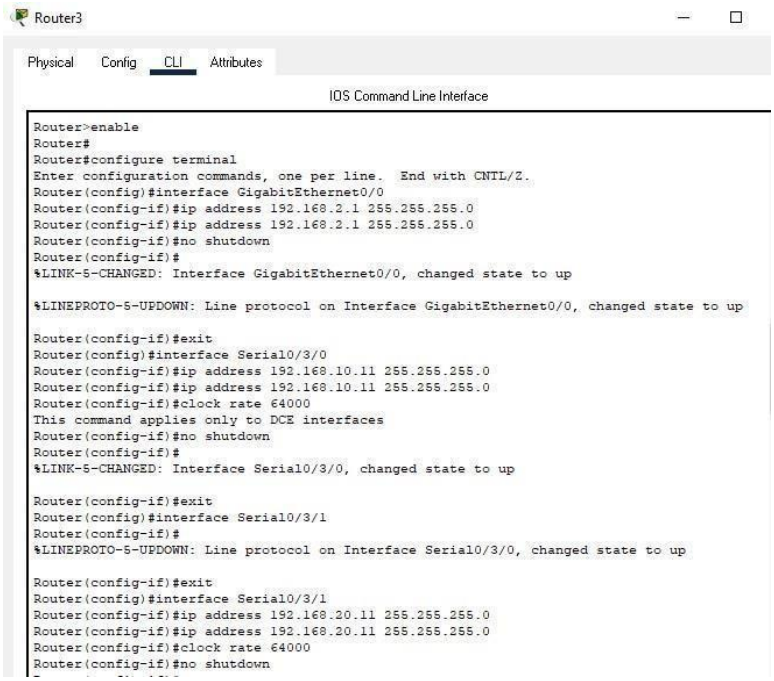
Physical Config CLI Attributes

IOS Command Line Interface

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#interface Serial0/3/1
Router(config-if)#ip address 192.168.20.12 255.255.255.0
Router(config-if)#ip address 192.168.20.12 255.255.255.0
Router(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/1, changed state to up
```

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#ip route 192.168.1.0 255.255.255.0 192.168.20.11
Router(config)#ip route 192.168.10.0 255.255.255.0 192.168.20.11
Router(config)#ip route 192.168.2.0 255.255.255.0 192.168.20.11
Router(config)#
```

(6th Semester, 3rd Year) LAB EXPERIMENT # 10




```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#ip route 192.168.1.0 255.255.255.0 192.168.10.12
Router(config)#ip route 192.168.3.0 255.255.255.0 192.168.20.12
Router(config)#
```

Check the interface status

(6th Semester, 3rd Year) LAB EXPERIMENT # 10

Router1

```
R1>en
R1#sh ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     192.168.1.1     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Serial0/3/0            192.168.10.12   YES manual up                    up
Serial0/3/1            unassigned      YES manual down                  down
Vlan1                  unassigned      YES unset  administratively down down
R1#
```

Router2

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#sh ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     192.168.3.1     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Serial0/3/0            unassigned      YES unset  administratively down down
Serial0/3/1            192.168.20.12   YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
```

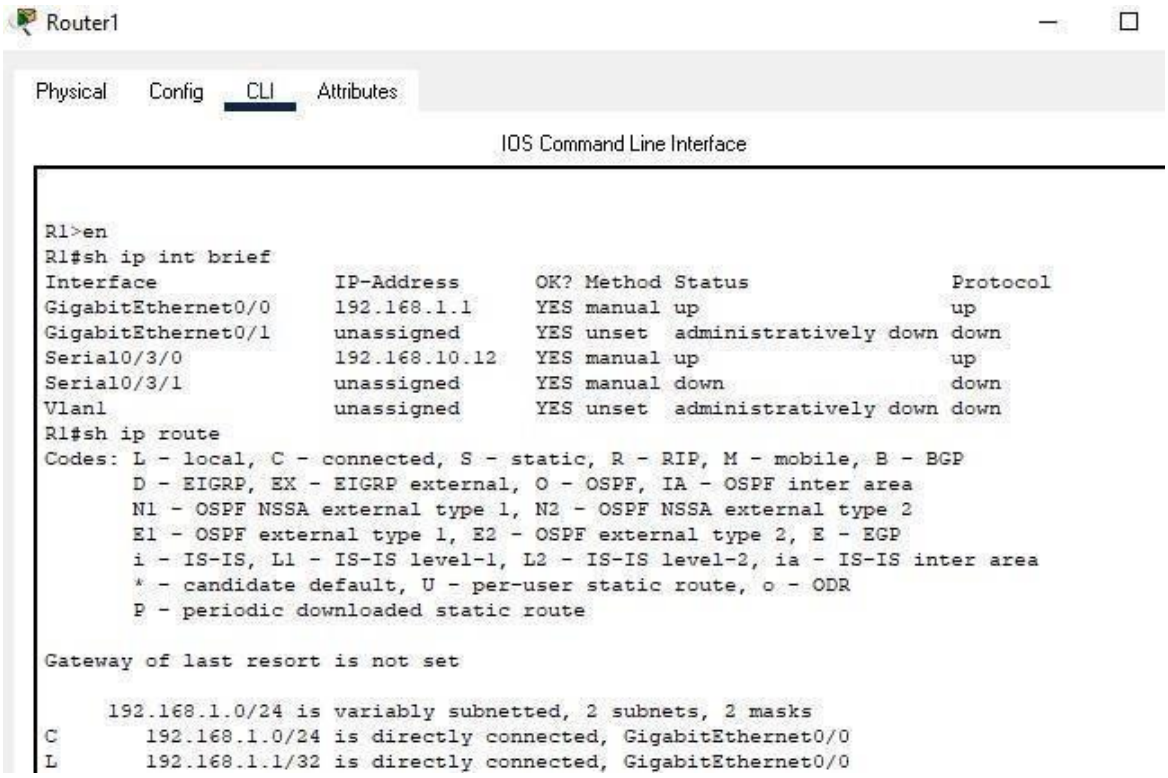
Router3

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#sh ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     192.168.2.1     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Serial0/3/0            192.168.10.11   YES manual up                    up
Serial0/3/1            192.168.20.11   YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
```

Check the routing table entries



(6th Semester, 3rd Year) LAB EXPERIMENT # 10

Router2

Physical Config CLI Attributes

IOS Command Line Interface

```
Router#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

S    192.168.1.0/24 [1/0] via 192.168.20.11
S    192.168.2.0/24 [1/0] via 192.168.20.11
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/0
L       192.168.3.1/32 is directly connected, GigabitEthernet0/0
S    192.168.10.0/24 [1/0] via 192.168.20.11
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, Serial0/3/1
L       192.168.20.12/32 is directly connected, Serial0/3/1
```

Router3

Physical Config CLI Attributes

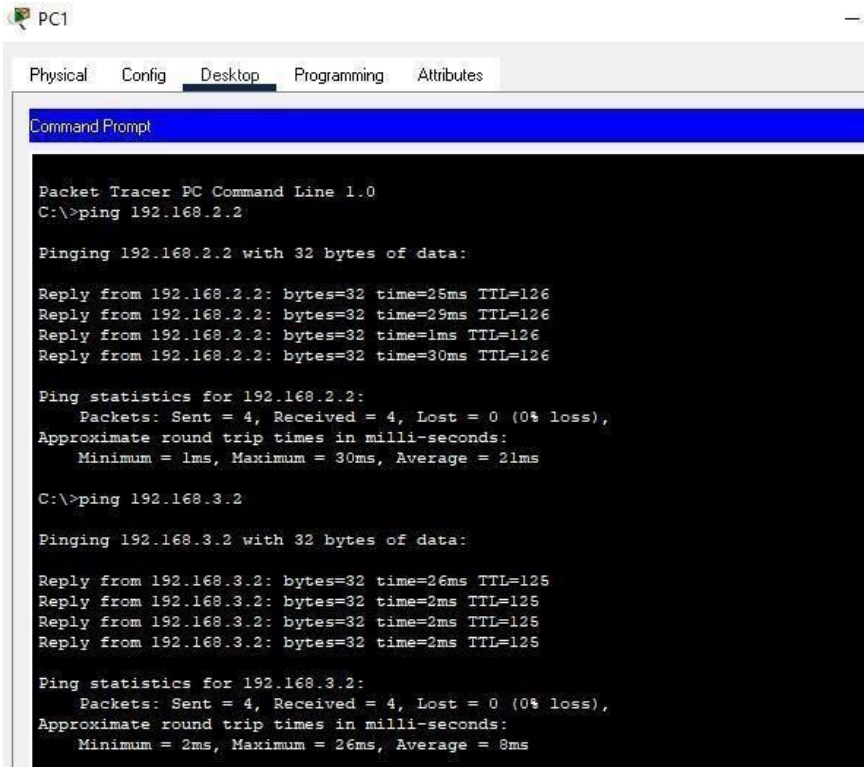
IOS Command Line Interface

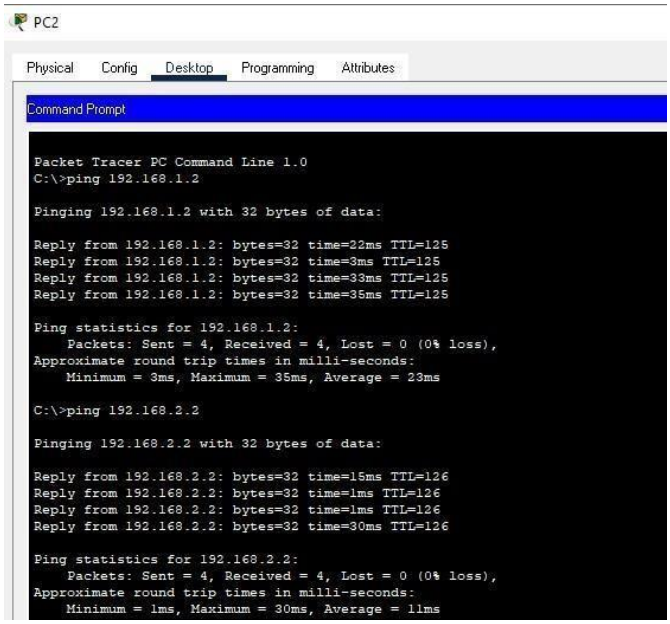
```
Router#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

S    192.168.1.0/24 [1/0] via 192.168.10.12
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.1/32 is directly connected, GigabitEthernet0/0
S    192.168.3.0/24 [1/0] via 192.168.20.12
     192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.10.0/24 is directly connected, Serial0/3/0
L       192.168.10.11/32 is directly connected, Serial0/3/0
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, Serial0/3/1
L       192.168.20.11/32 is directly connected, Serial0/3/1
```

Results:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	D
	Successful	PC1	PC2	ICMP		0.000	N	0	(edit)	
	Successful	PC3	PC1	ICMP		0.000	N	1	(edit)	
	Successful	PC2	PC3	ICMP		0.000	N	2	(edit)	

(6th Semester, 3rd Year) LAB EXPERIMENT # 10





DEPARTMENT OF ELECTRONICS ENGINEERING
MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO

FINAL CHECK LIST

1. Return all equipment and materials to their proper storage area.
2. Submit your answers to question, before the next laboratory.