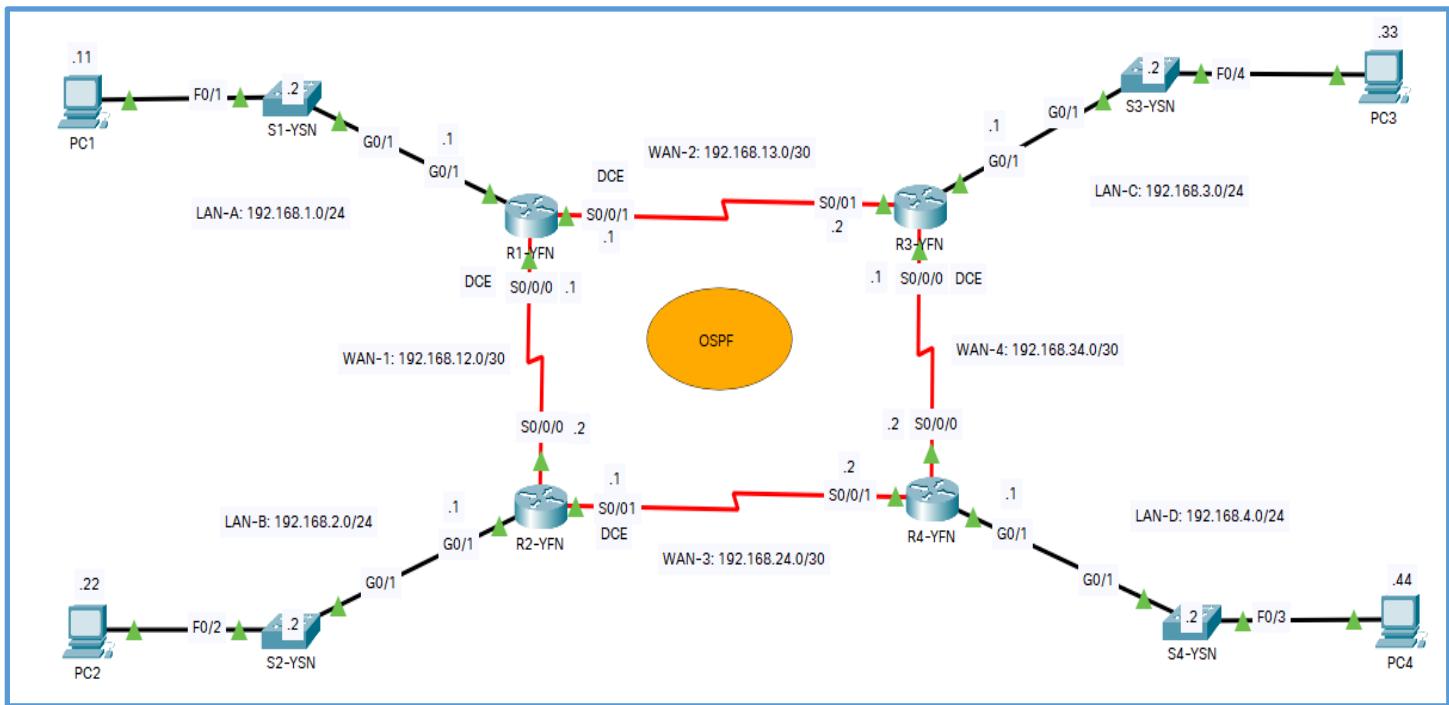


Lab Activity – OSPFv2 Routing (Dynamic):

- a. There are four LANs and four WANs in the topology below. Please simulate the following topology in any simulator, preferably Packet Tracer.

YFN → Your First Name

YSN → Your Last/Family Name



Required Resources:

- Four Switches (Cisco 2960 with Cisco IOS Release 15+ image)
- Four Routers (Cisco 1941 with Cisco IOS Release 15+ image)
- Four PCs (Windows with Terminal Emulation Program)
- Cables:
 - Console cables to configure the Cisco IOS devices via the console port.
 - Ethernet cables as shown in the topology.

Addressing Table:

Device	Interface	IP Address	Subnet Mask / CIDR	Default Gateway
S1-YSN	VLAN1	192.168.1.2	255.255.255.0	192.168.1.1
S2-YSN	VLAN1	192.168.2.2	255.255.255.0	192.168.2.1
S3-YSN	VLAN1	192.168.3.2	255.255.255.0	192.168.3.1
S4-YSN	VLAN1	192.168.4.2	255.255.255.0	192.168.4.1
R1-YFN	G0/1	192.168.1.1	/24	N/A
	S0/0/0	192.168.12.1	/30	N/A
	S0/0/1	192.168.13.1	/30	N/A
R2-YFN	G0/1	192.168.2.1	/24	N/A
	S0/0/0	192.168.12.2	/30	N/A
	S0/0/1	192.168.24.1	/30	N/A
R3-YFN	G0/1	192.168.3.1	/24	N/A
	S0/0/0	192.168.34.1	/30	N/A
	S0/0/1	192.168.13.2	/30	N/A
R4-YFN	G0/1	192.168.4.1	/24	N/A
	S0/0/0	192.168.34.2	/30	N/A
	S0/0/1	192.168.24.2	/30	N/A
PC1	NIC	192.168.1.11	/24	192.168.1.1
PC2	NIC	192.168.2.22	/24	192.168.2.1
PC3	NIC	192.168.3.33	/24	192.168.3.1
PC4	NIC	192.168.4.44	/24	192.168.4.1

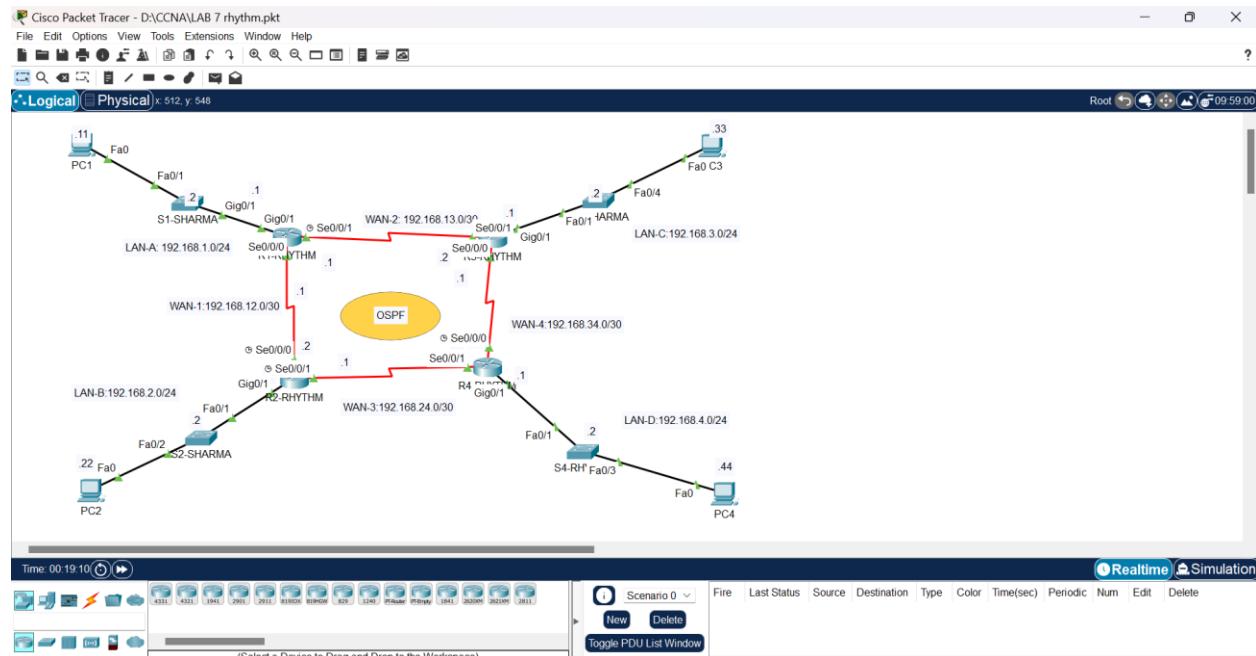
Lab. Description:

- a. In this lab, please build a LAN and WAN based simple network.
 - o LAN-A with one switch and one host
 - o LAN-B with one switch and one host
 - o LAN-C with one switch and one host
 - o LAN-D with one switch and one host
 - o Four WANs (WAN-1, WAN-2, WAN-3, and WAN-4) with four routers
- b. You are also required to do the basic configuration on the following devices:
 - o Switches: Hostnames, SVI, default gateway, DNS lookup (disable), and so on.
 - o Routers: Hostnames, IP addressing, DNS lookup (disable), and so on.

Instructions:

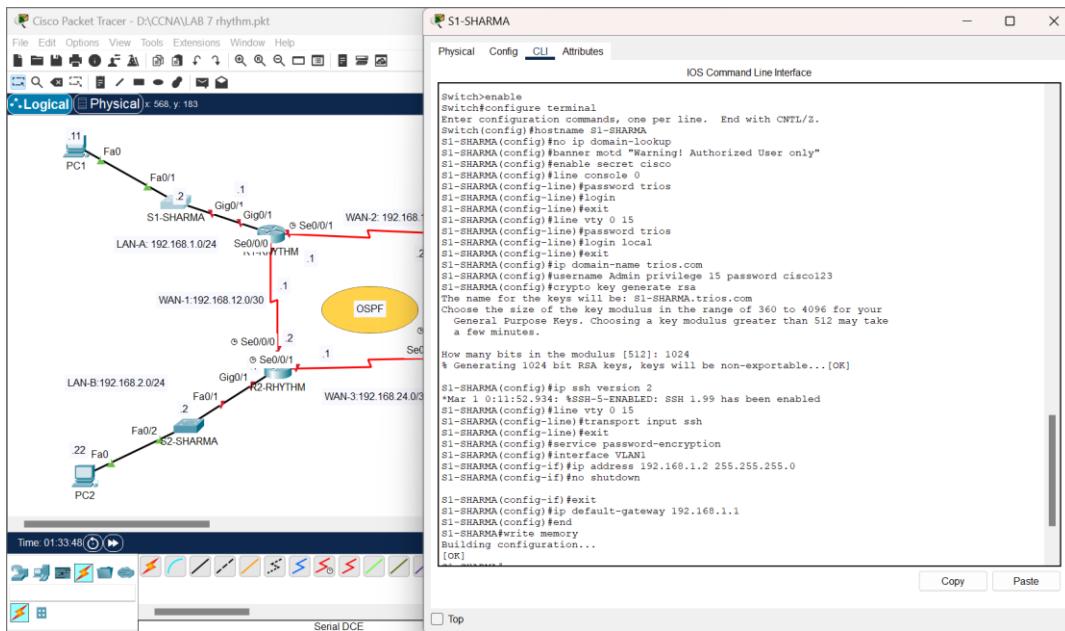
Step 1: Set up the network topology.

- Simulate the topology by using all the devices mentioned above and then cable them all together:
 - Turn on the devices.
 - Connect the switch with the default gateway.
 - Connect the PCs and server with their respective switch.
 - Make sure all the lights between switches, PCs, laptops, and servers are green.

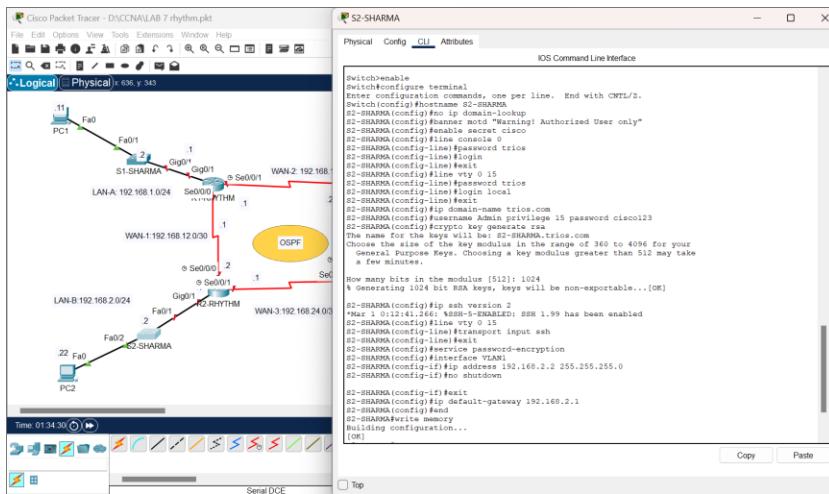


Step 2: Configure and verify basic switch settings on all switches.

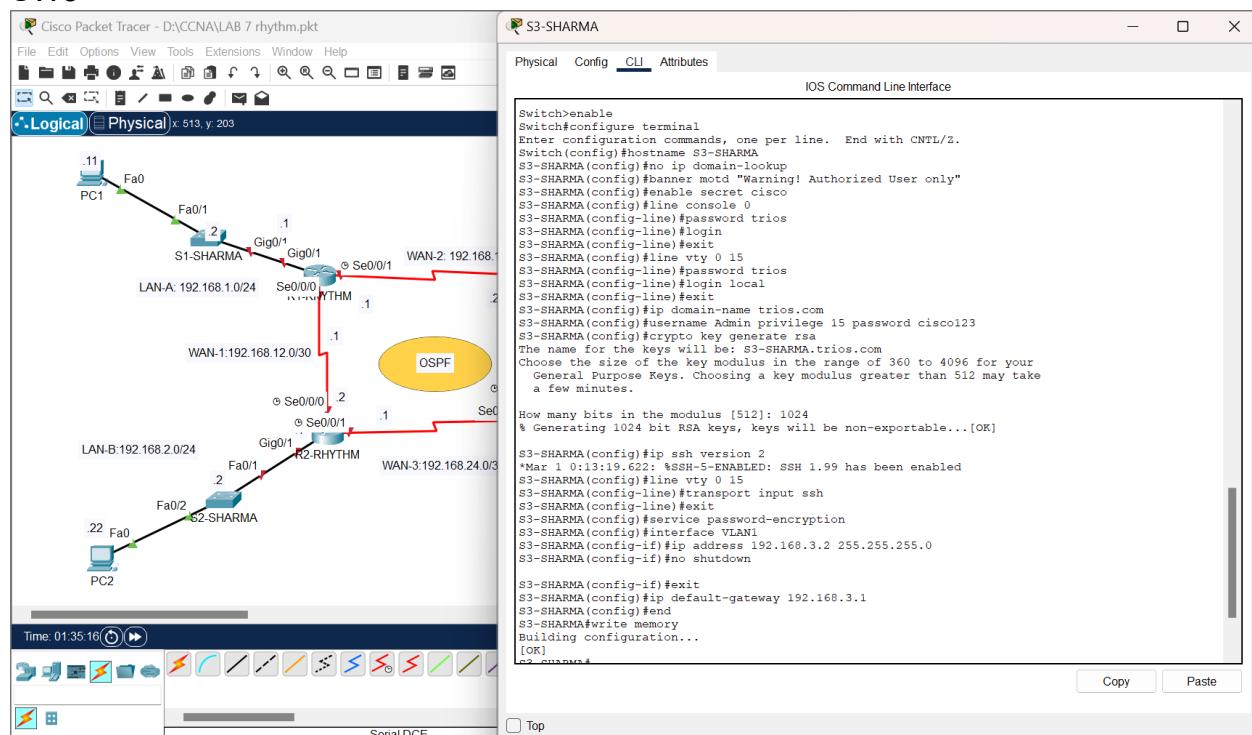
SW1



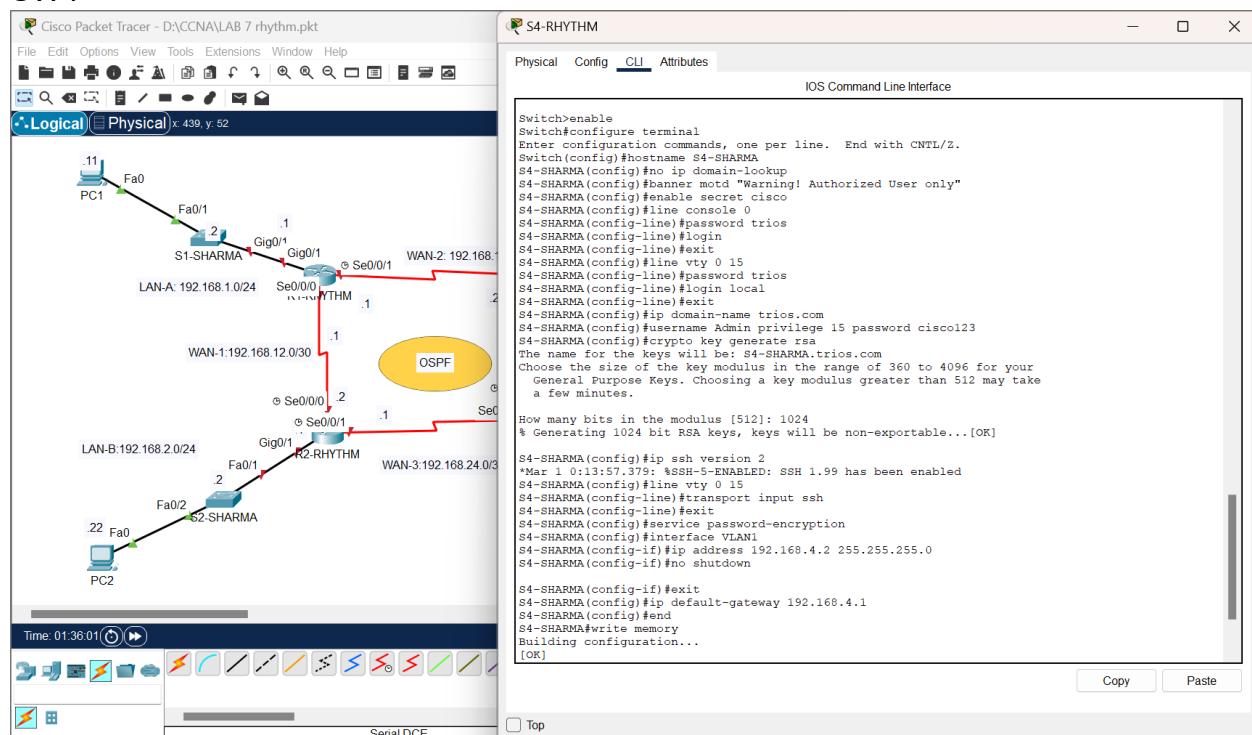
SW2



SW3



SW4

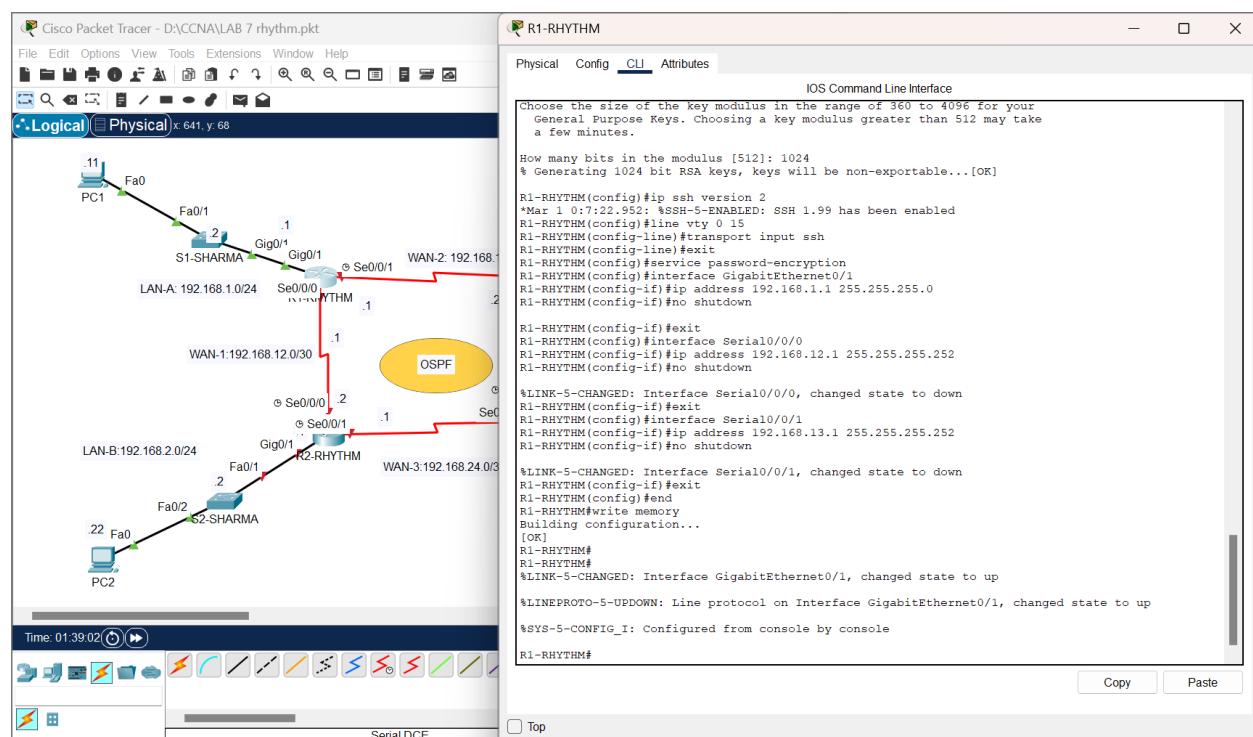
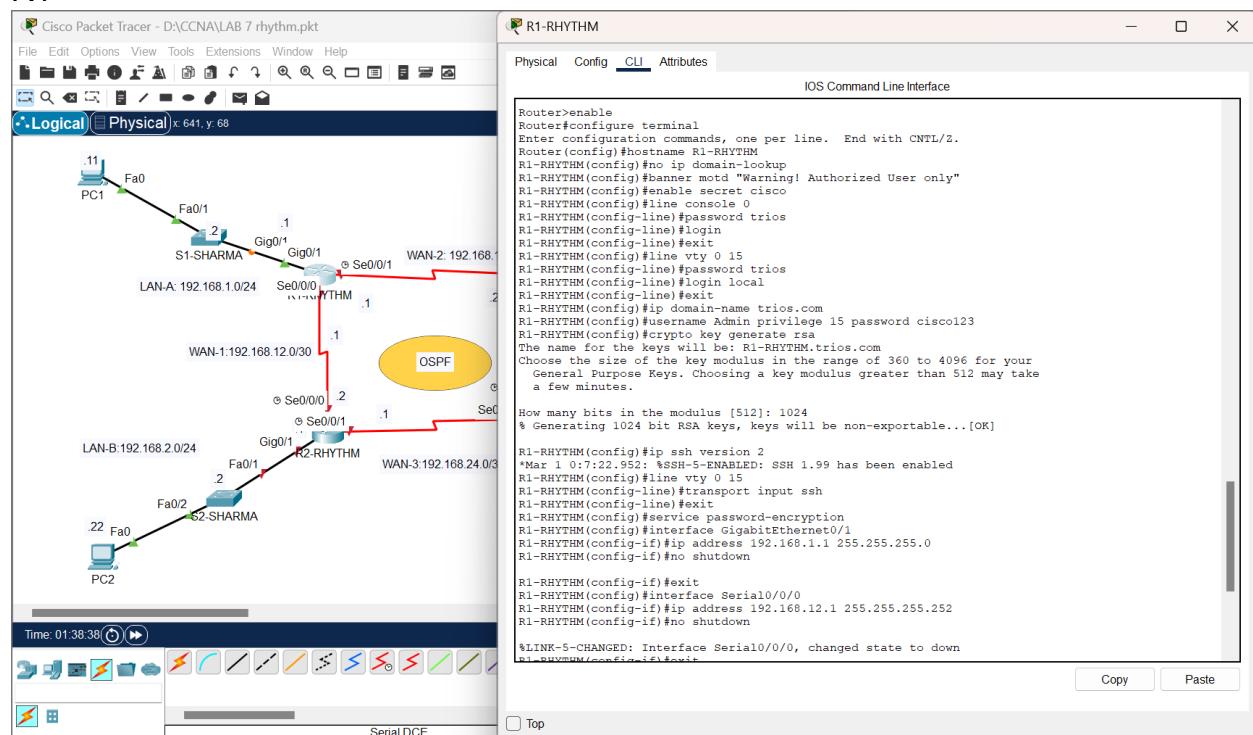


- Console into the switch and enter the global configuration mode:
 - Assign the switch with a host name according to the addressing table.

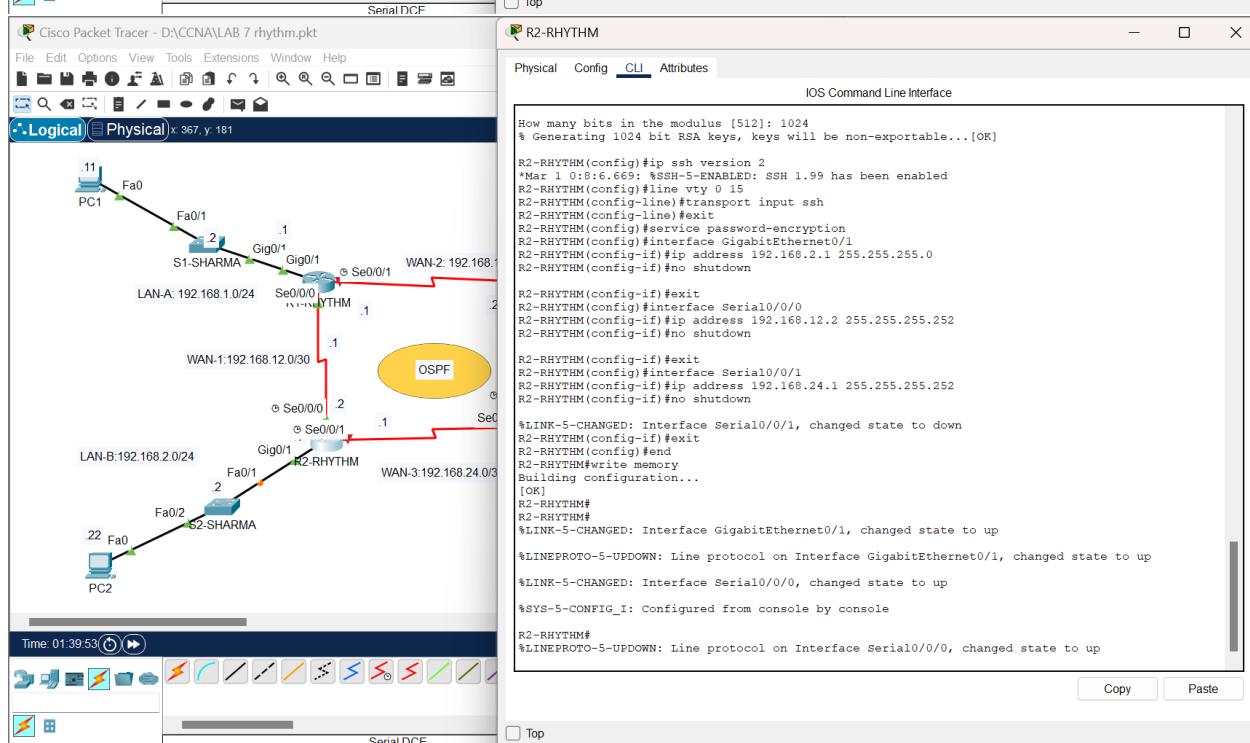
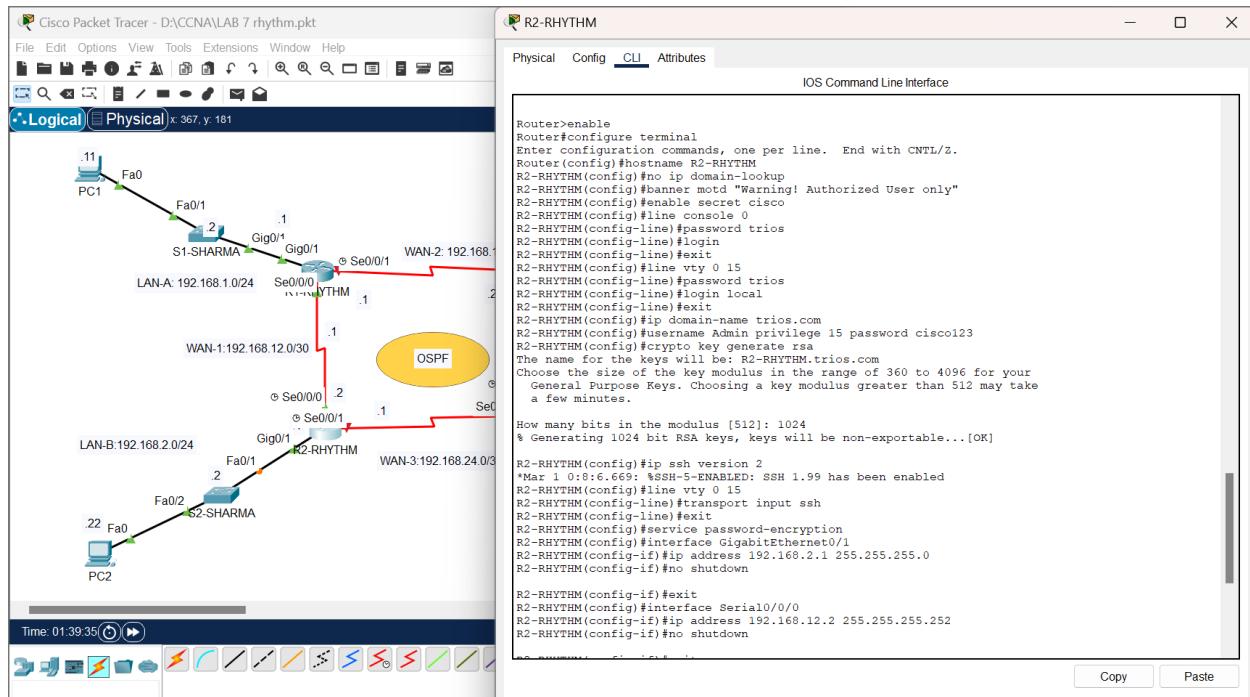
- Disable unwanted DNS lookup.
- Configure a login MOTD banner to warn about illegal access.
- Assign the encrypted password cisco to privilege exec mode (#).
- Protect the physical and virtual lines from having console access using the password trios and configure ***logging synchronous*** for the console line.
- Configure the domain name as trios.com (both the hostname and domain name are required for the encryption keys to be generated).
- Configure username, to access SSH client access, as Admin and password as cisco123.
- Generate the encryption keys (1024) for securing the session.
- Enable SSH version 2.
- Allow switch to be accessed remotely using only SSH.
- Encrypt all current and future passwords by enabling the required service.
- Configure and activate SVI according to the addressing table.
- Configure default gateway according to the addressing table.
- Save the configuration.

Step 3: Configure and verify basic router settings on all routers.

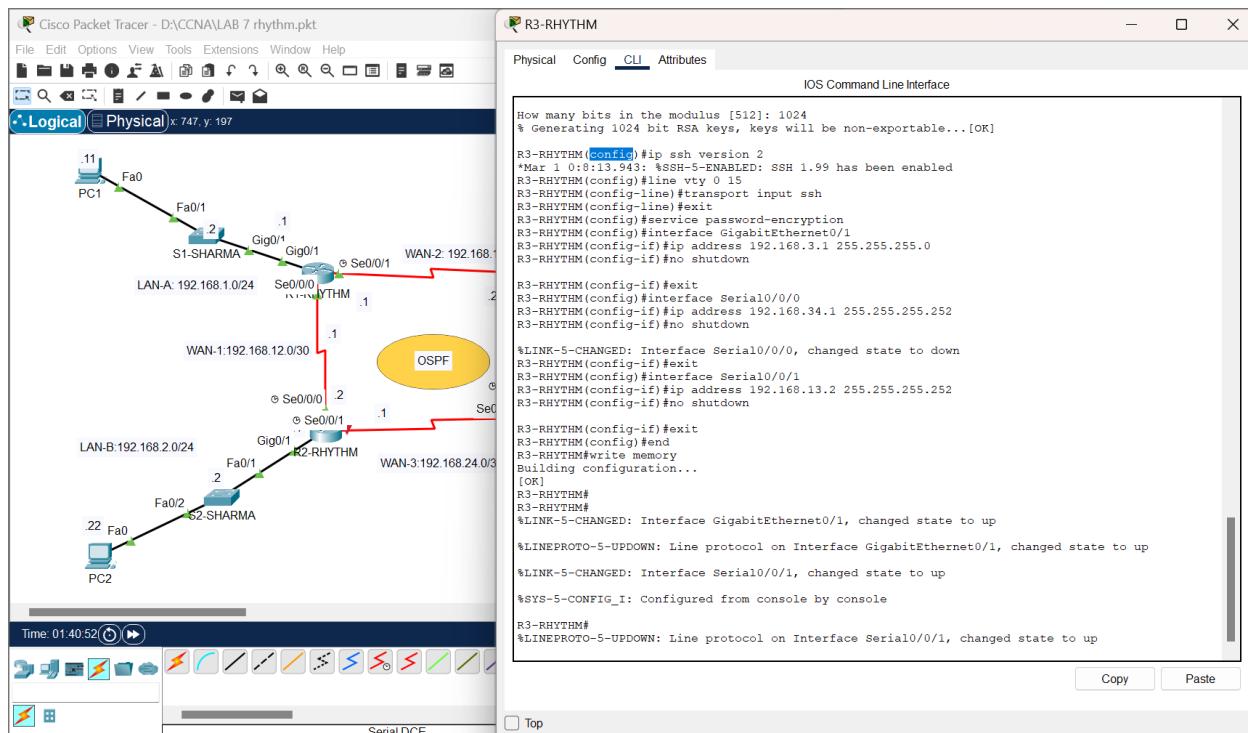
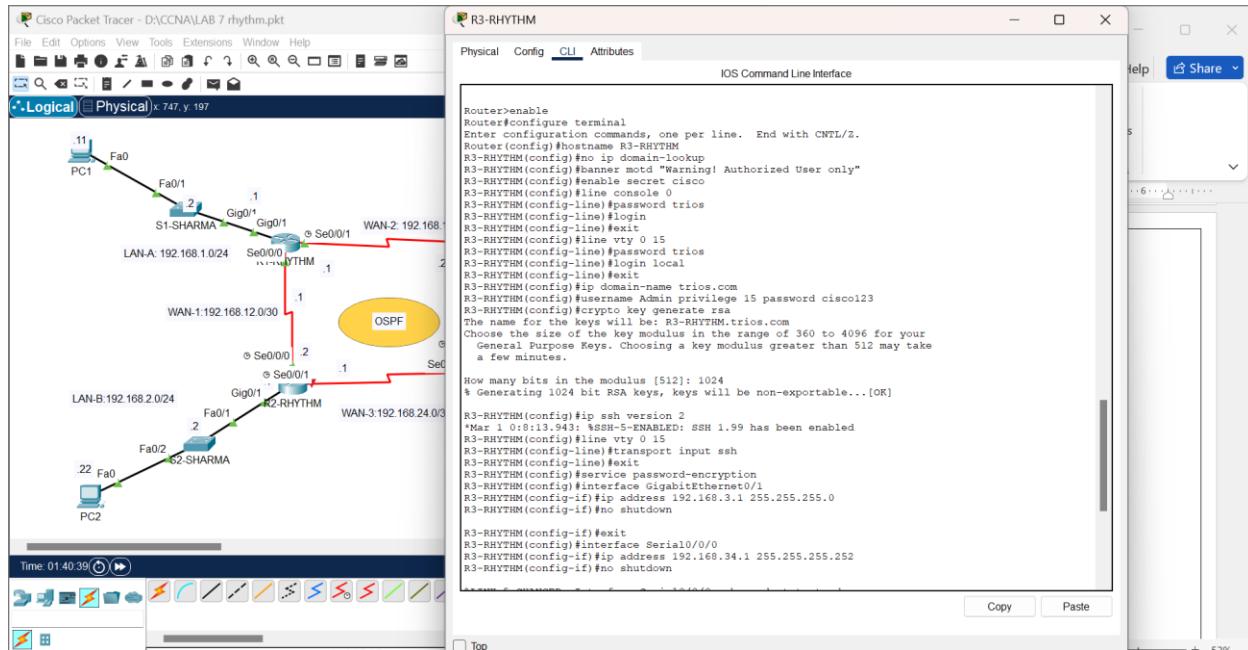
R1



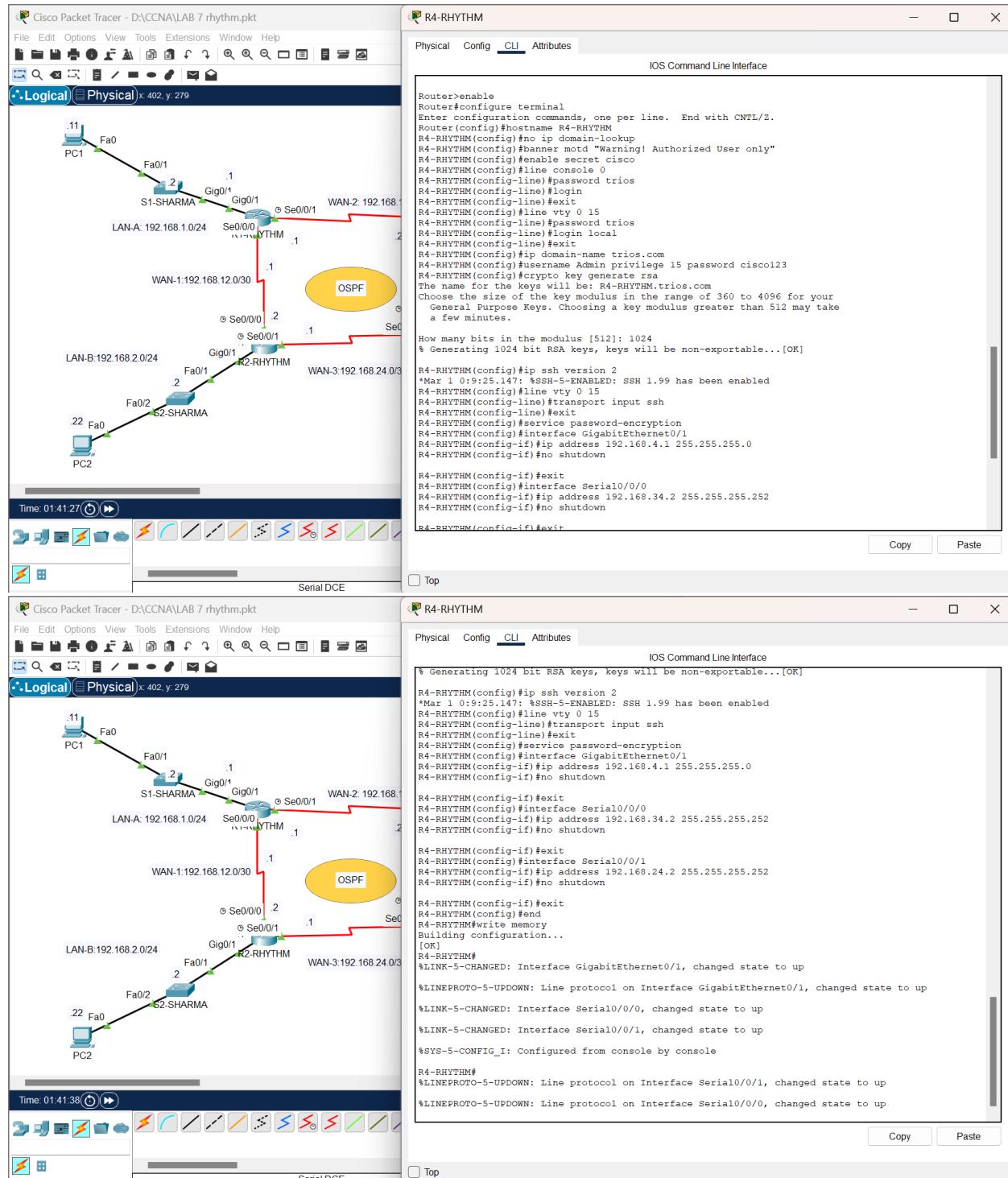
R2



R3



R4

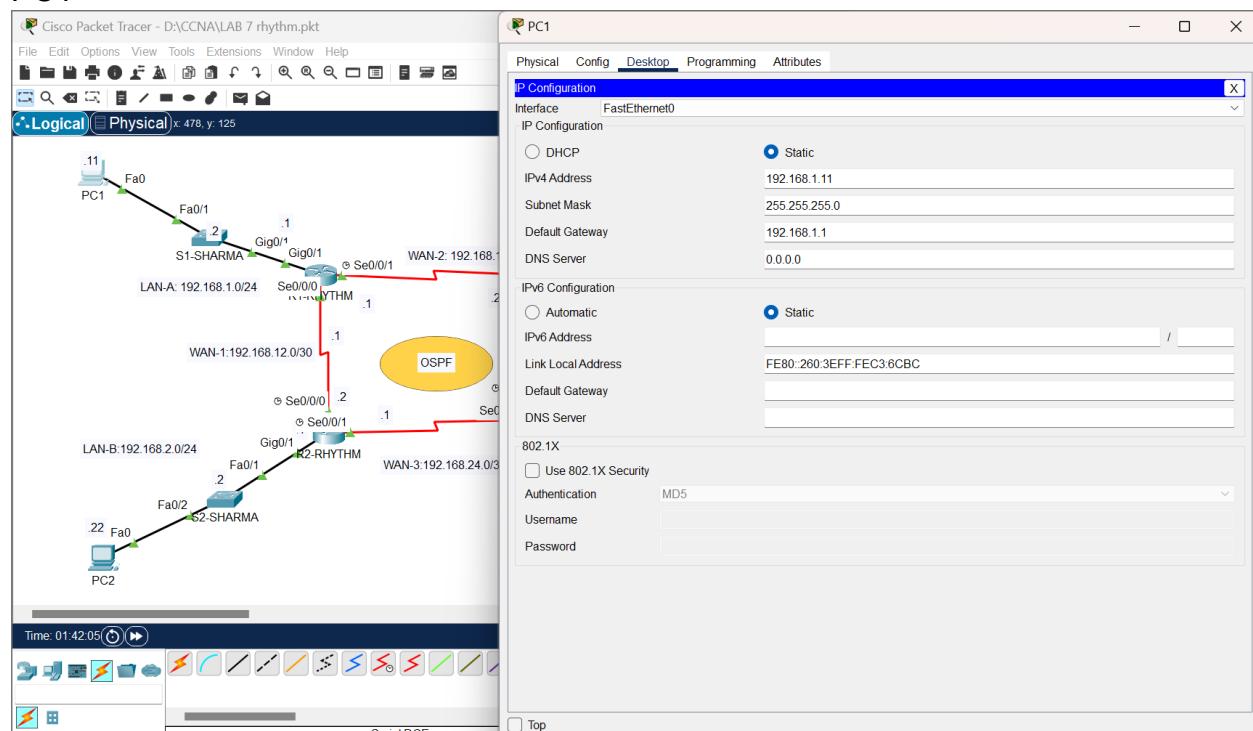


- Console into the router and enter the global configuration mode:
 - Assign the routers with host names according to the addressing table.
 - Disable unwanted DNS lookup.

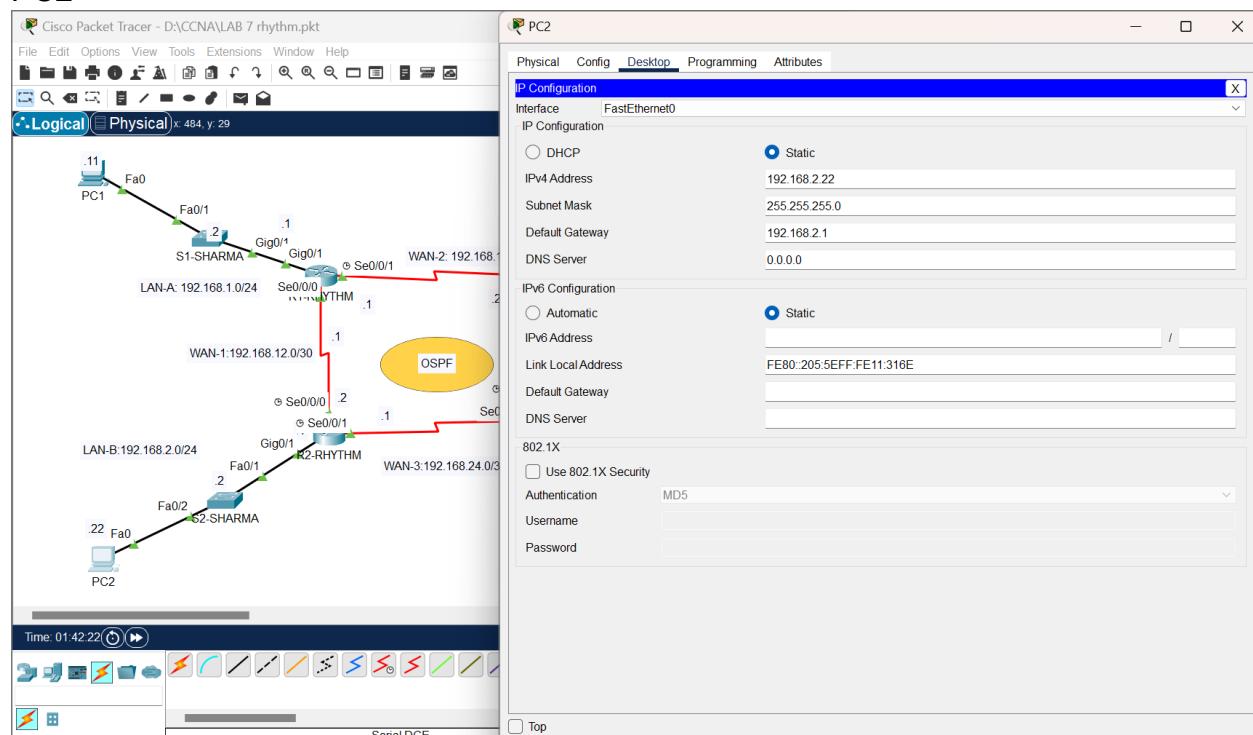
- Configure a login MOTD banner to warn about illegal access.
- Assign the encrypted password cisco to privilege exec mode (#).
- Protect the physical and virtual lines from having console access using the password trios and configure **logging synchronous** for the console line.
- Configure the domain name as trios.com (both the hostname and domain name are required for the encryption keys to be generated).
- Configure username, to access SSH client access, as Admin and password as cisco123.
- Generate the encryption keys (1024 bits) for securing the session.
- Enable SSH version 2.
- Allow router to be accessed remotely using only SSH.
- Encrypt all current and future passwords by enabling the required service.
- Configure and activate all the interfaces according to the addressing table.
- Set the clock rate for serial (DCE) interface at 128000.
- Provide appropriate description on all the active interfaces.
- Save the configuration.

Step 4: Configure all host devices.

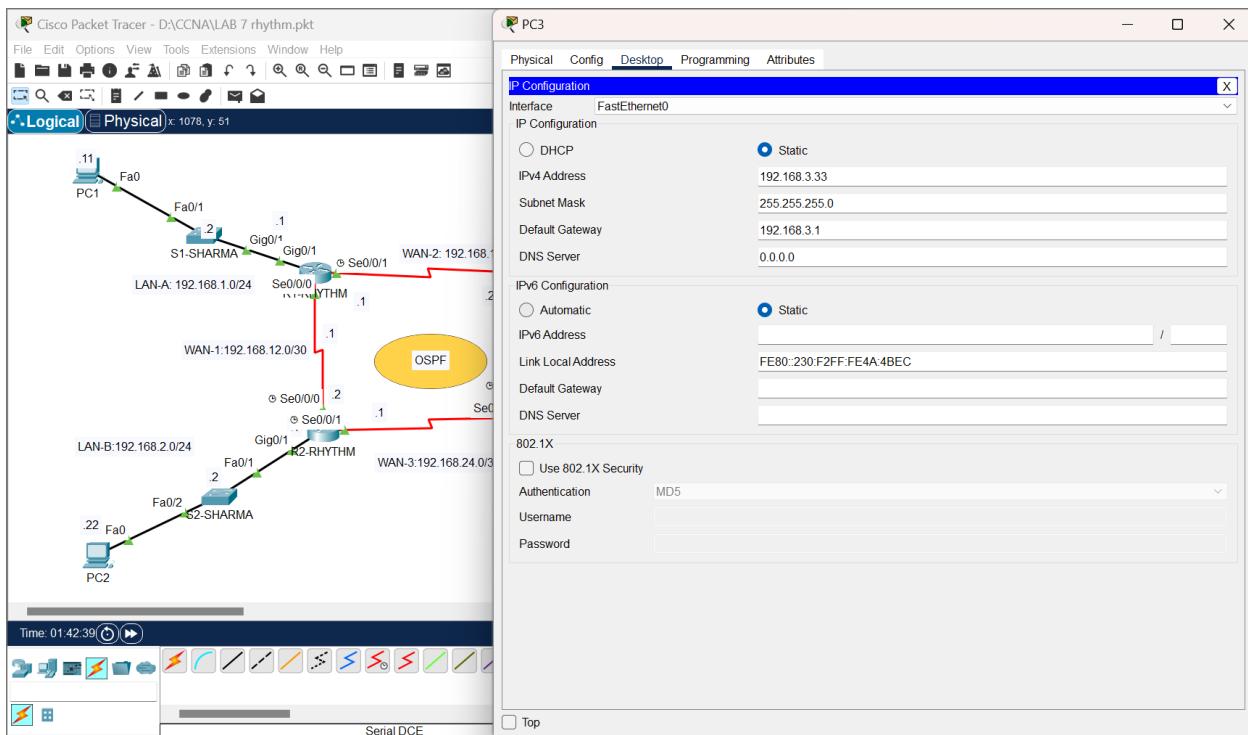
PC1



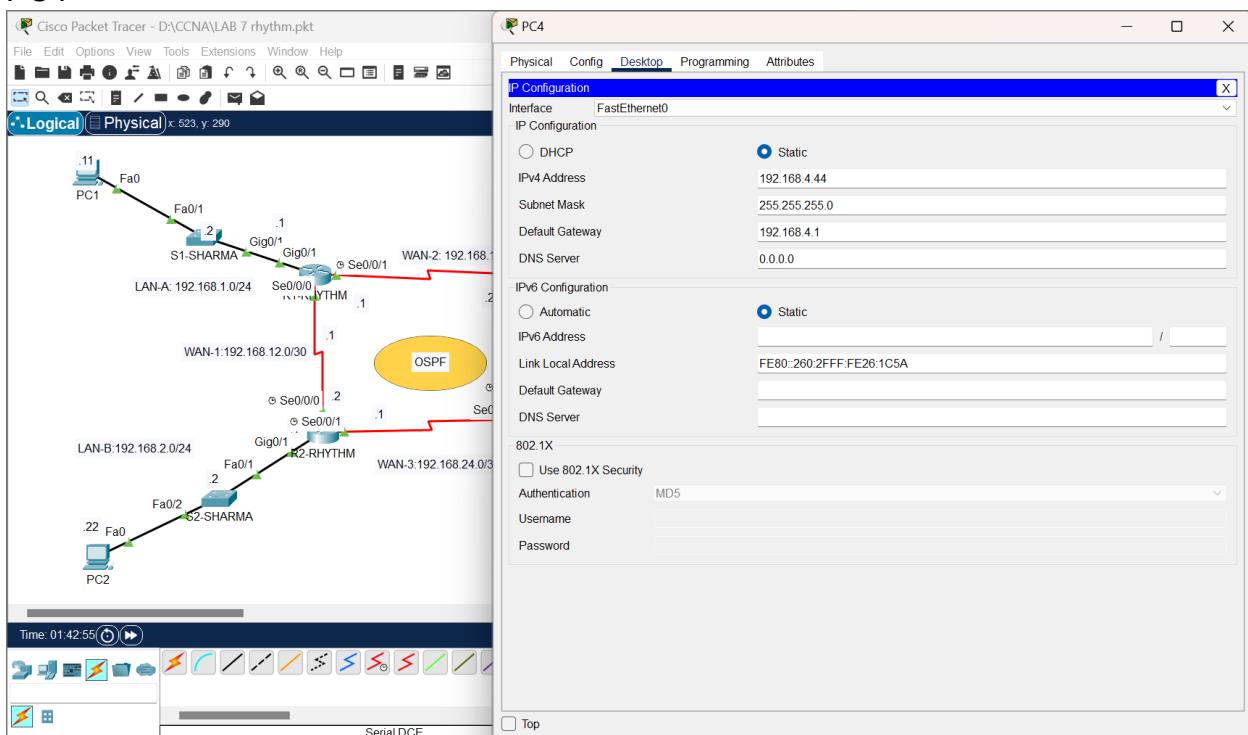
PC2



PC3



PC4



- a. Click to explore PC1.
- b. Select IP configuration under Desktop tab.
- c. Enter the IP address, subnet mask, and default gateway from the addressing table above.
- d. Repeat the above steps from a to c for all host devices.

Step 5: Verify connections.

- Every router should be able to ping its directly connected neighbour router.
Let's try with R2-Rhythm

The screenshot shows the Cisco Packet Tracer interface. The main window title is "Cisco Packet Tracer - D:\CCNA\LAB 7 rhythm.pkt". The tab bar has tabs for "Physical", "Config", "CLI" (which is selected), and "Attributes". Below the tabs is a sub-header "IOS Command Line Interface". The main pane displays the following text:

```
Building configuration...
[OK]
R2-RHYTHM#
R2-RHYTHM#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%SYS-5-CONFIG_I: Configured from console by console
R2-RHYTHM#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
R2-RHYTHM#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2-RHYTHM(config)#do ping 192.168.12.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.12.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/19/27 ms

R2-RHYTHM(config)#do ping 192.168.13.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.13.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

R2-RHYTHM(config)#do ping 192.168.24.2

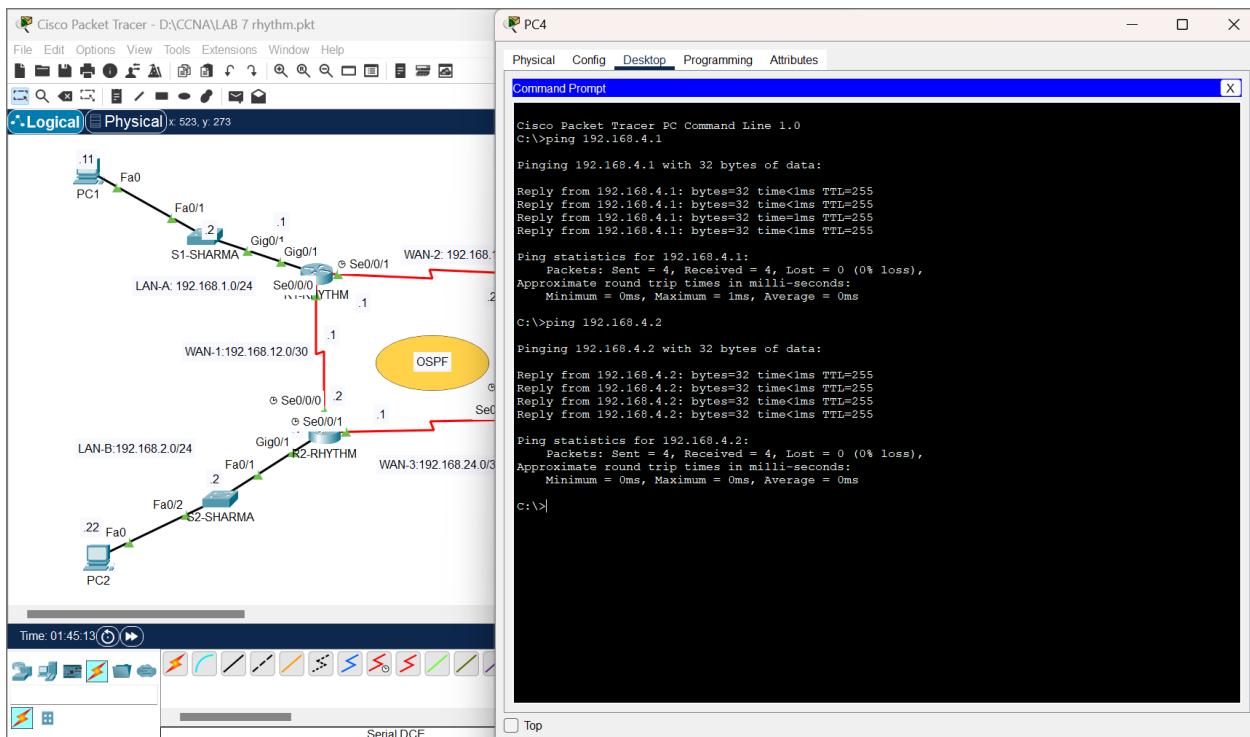
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.24.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/18/31 ms

R2-RHYTHM(config)#

```

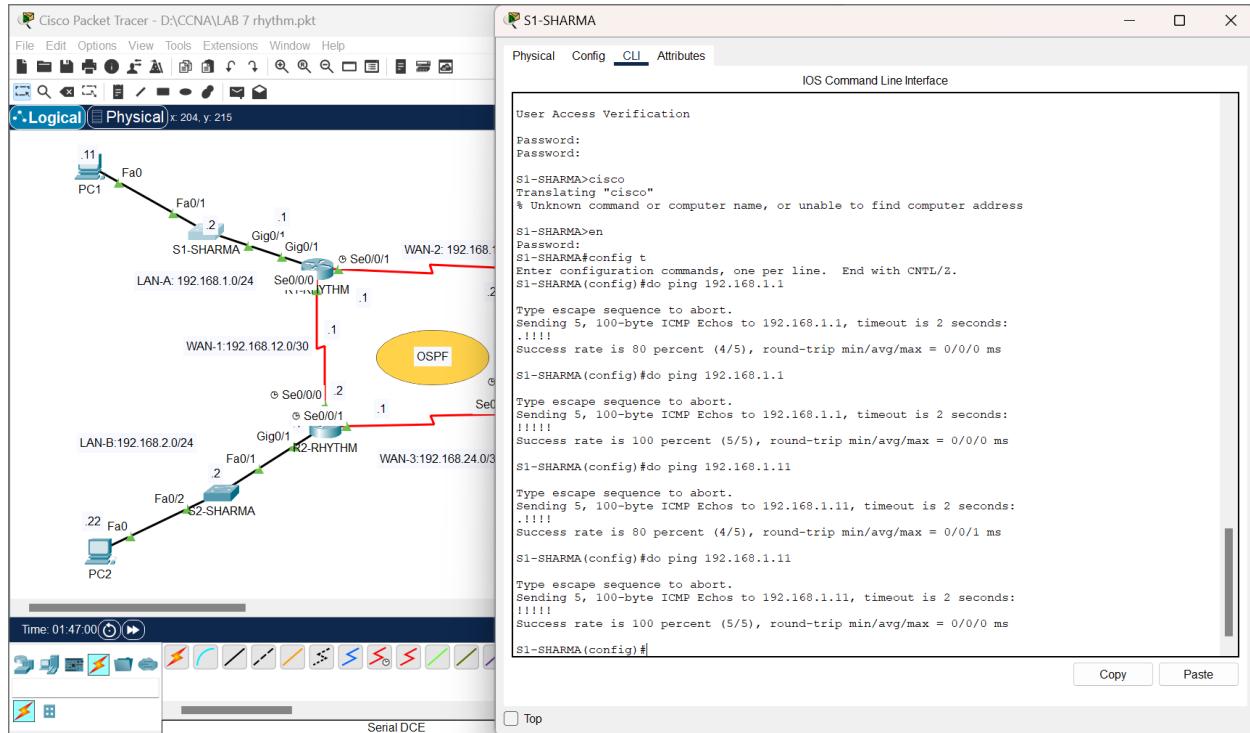
At the bottom right of the CLI window, there are "Copy" and "Paste" buttons. On the left side of the main window, there is a vertical toolbar with icons for file operations like Open, Save, and Print, and a "Logical" icon. The status bar at the bottom left shows "Time: 01:44".

- Every host device should be able to ping its switch SVI and default gateway
Let's try with PC4



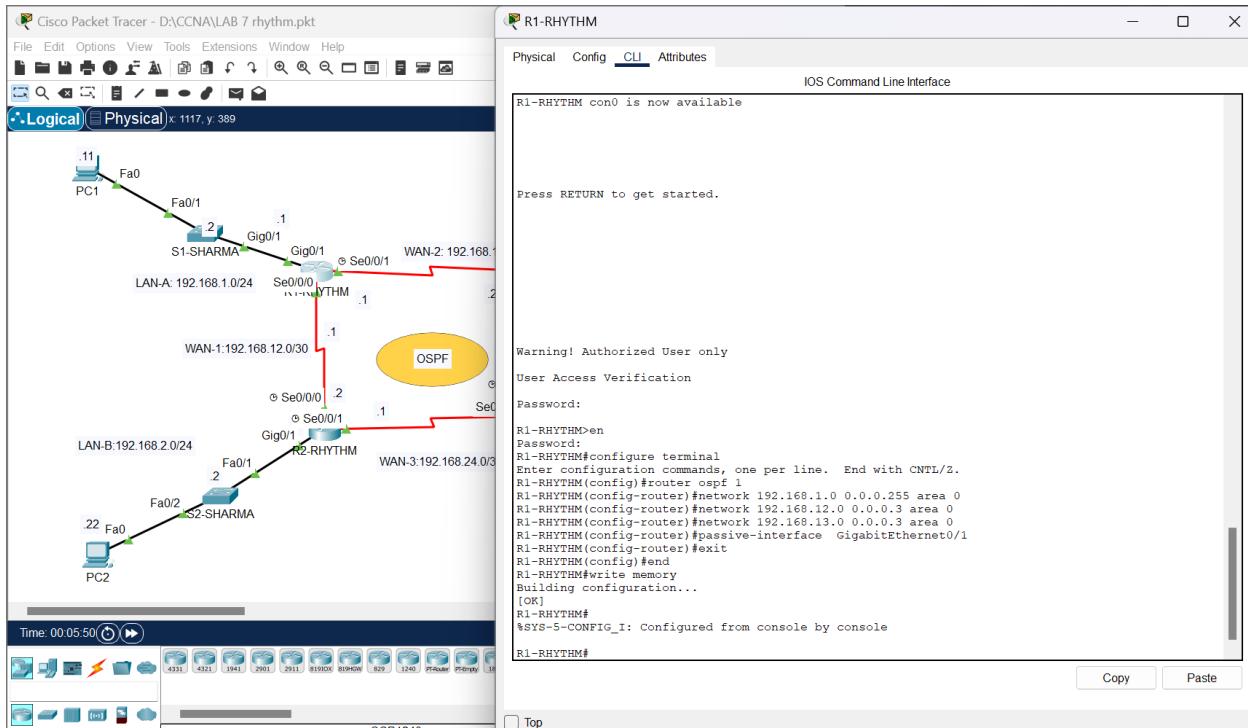
- c. Every switch should be able to ping its directly connected host device and default gateway.

Let's try with SW1

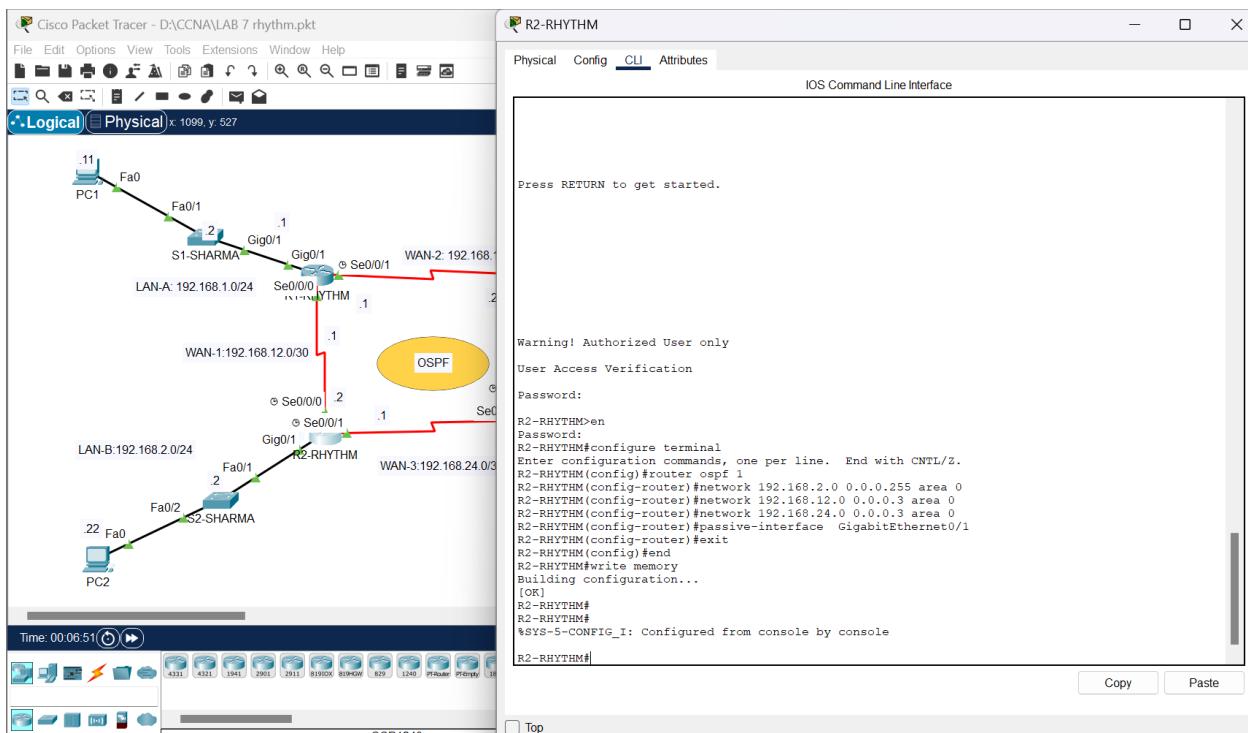


Step 6: Configure OSPF routing on all routers so all hosts can communicate with every host in all LANs and WANs. The below configuration is for R1-YFN.

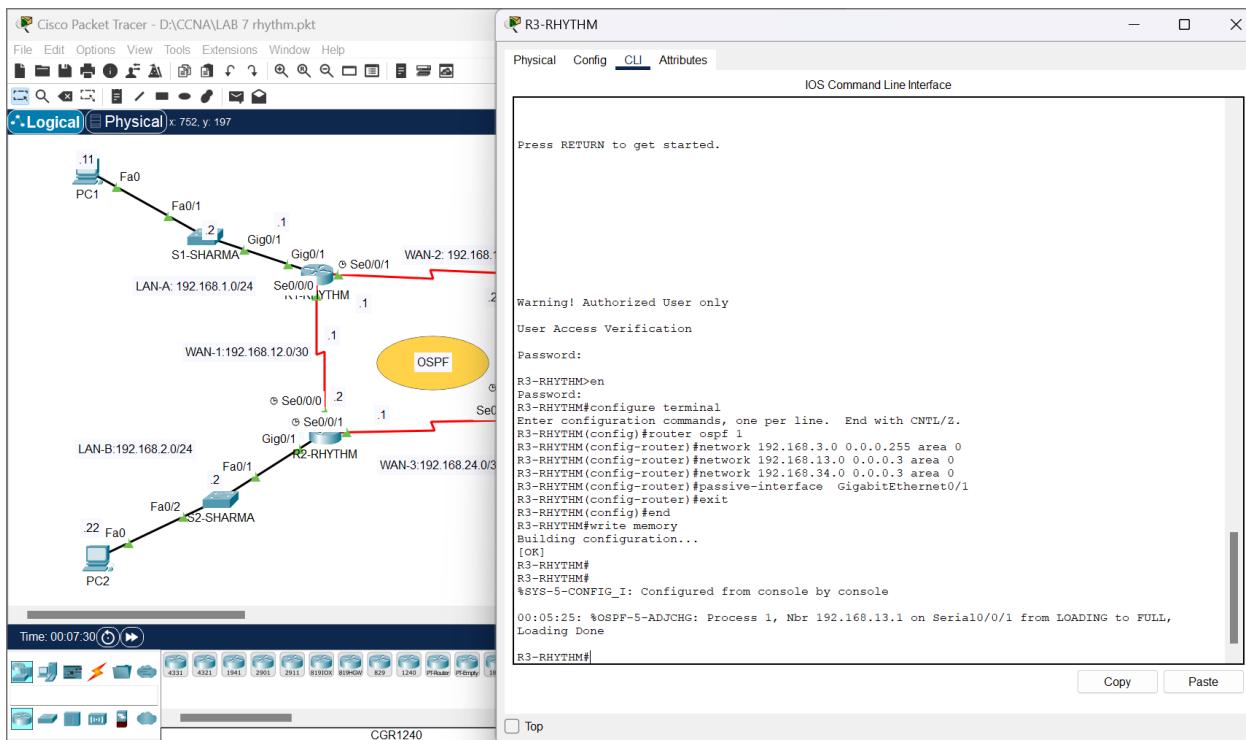
R1-RHYTHM



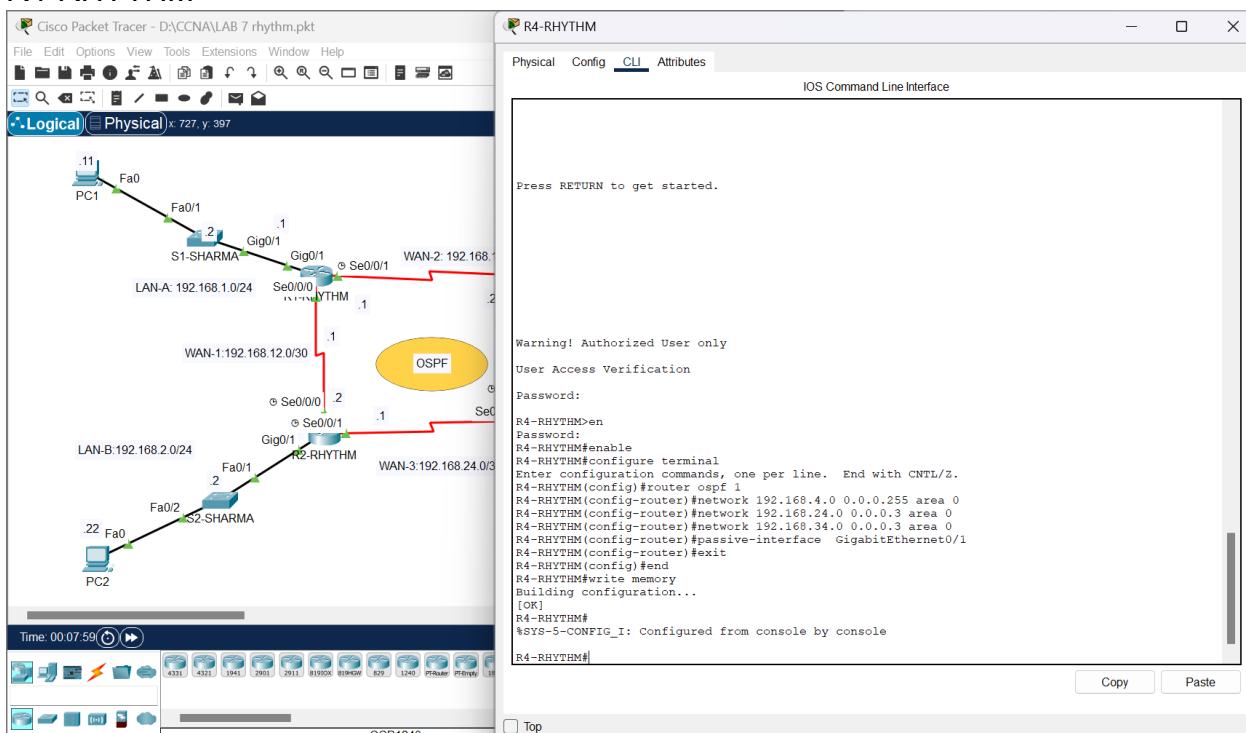
R2-RHYTHM



R3-RHYTHM



R4-RHYTHM

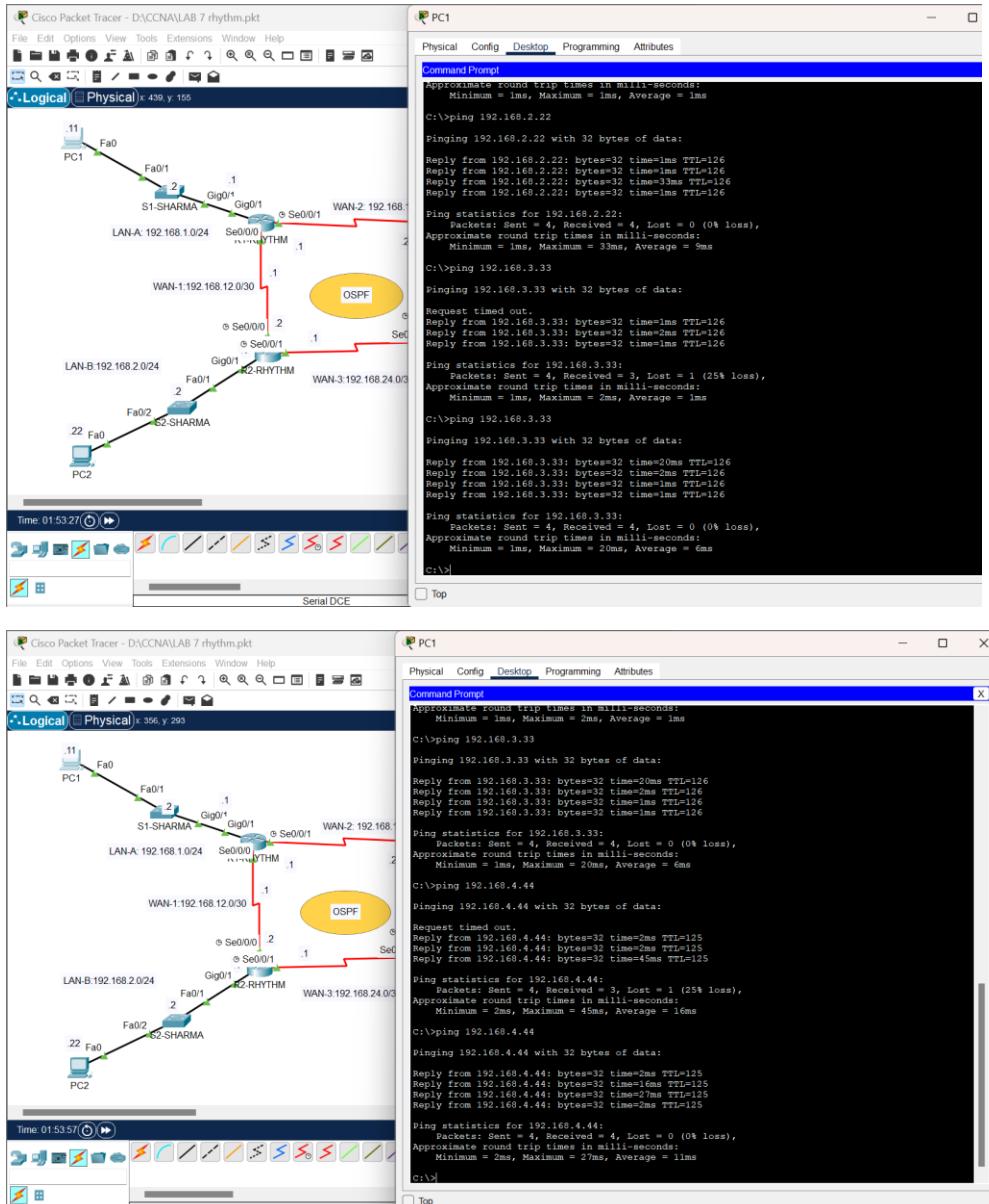


- Enter to OSPF routing configuration mode.
 - router ospf 1 (1 is the local process id)
- Configure to directly connected networks under OSPF with area ID.

- network 192.168.1.0 0.0.0.255 area 0
 - network 192.168.12.0 0.0.0.3 area 0
 - network 192.168.13.0 0.0.0.3 area 0
- c. Disable routing updates towards LANs using passive interface command.
- d. Save the configuration.
- e. Repeat the above steps from a to e for every router while changing router-id and directly connected networks with regards to the relevant router.

Step 7: Verify the connectivity.

- Using the command line at PC1, ping the IP address of:
 - PC2, PC3, and PC4



- Using the switch S1-YSN, ping the IP address of:

```

Cisco Packet Tracer - D:\CCNA\LAB 7 rhythm.pkt
File Edit Options
S1-SHARMA
Physical Config CLI Attributes
Logical

S1-SHARMA>en
Password:
S1-SHARMA#config t
Enter configuration commands, one per line. End with CNTL/Z.
S1-SHARMA(config)#do ping 192.168.34.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.34.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/11/27 ms

S1-SHARMA(config)#do ping 192.168.24.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.24.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/10/24 ms

S1-SHARMA(config)#do ping 192.168.24.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.24.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/23/45 ms

S1-SHARMA(config)#do ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

S1-SHARMA(config)#do ping 192.168.2.1
Translating "192.168.2.1"
% Unrecognized host or address or protocol not running.

S1-SHARMA(config)#do ping 192.168.2.1

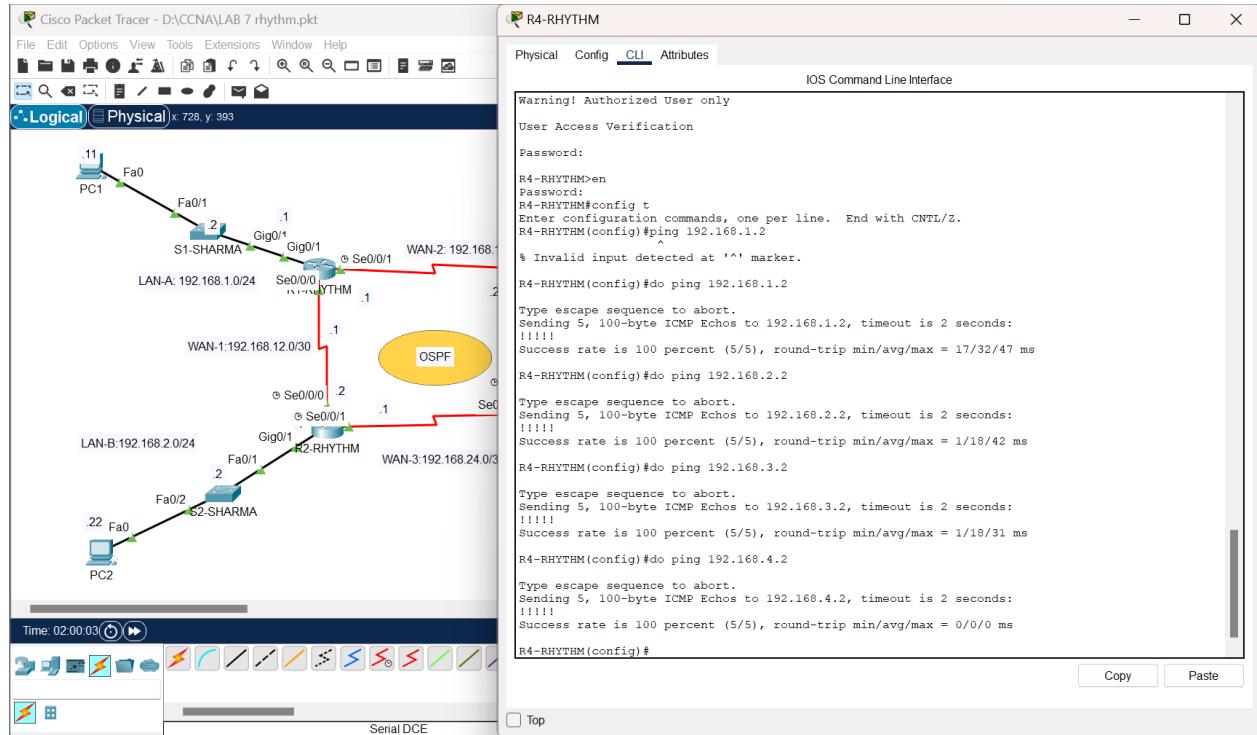
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/11/21 ms

```

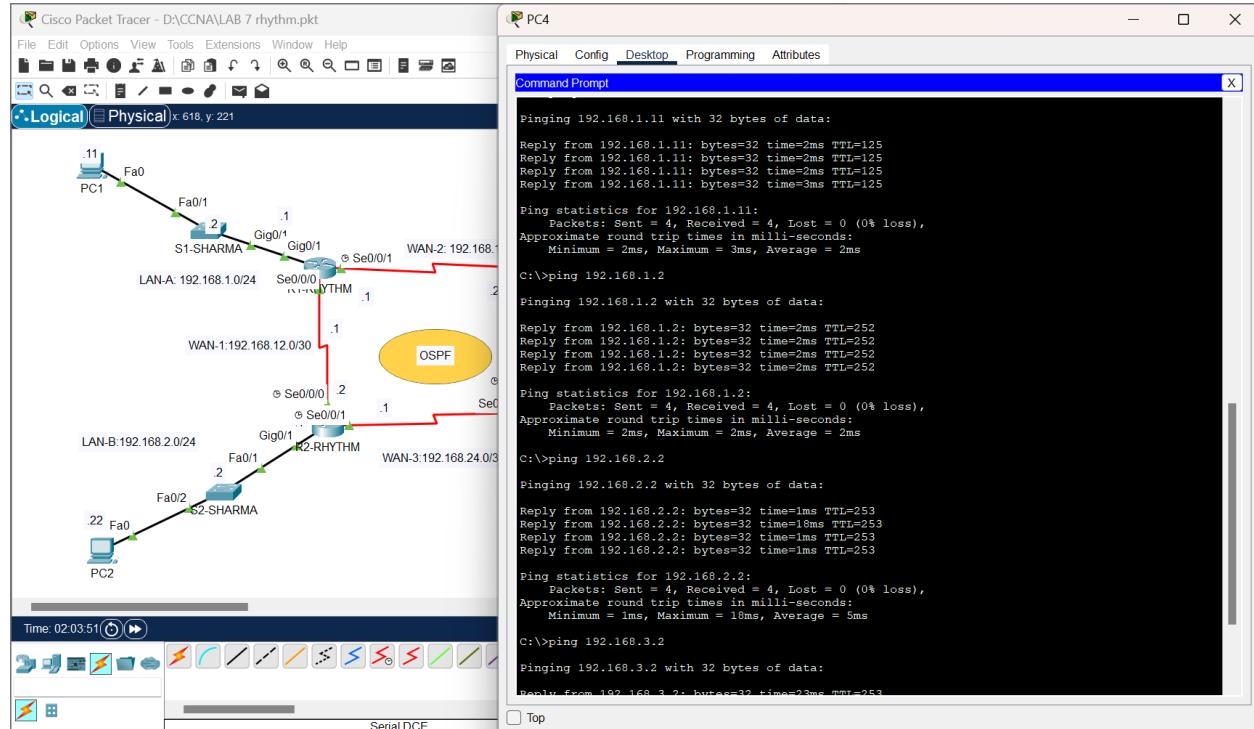
Copy Paste

- S0/0/0 interface of router R3-YFN
- S0/1/1 interface of router R4-YFN
- G0/1 interfaces of R1-YFN, R2-YFN, R3-YFN, and R4-YFN

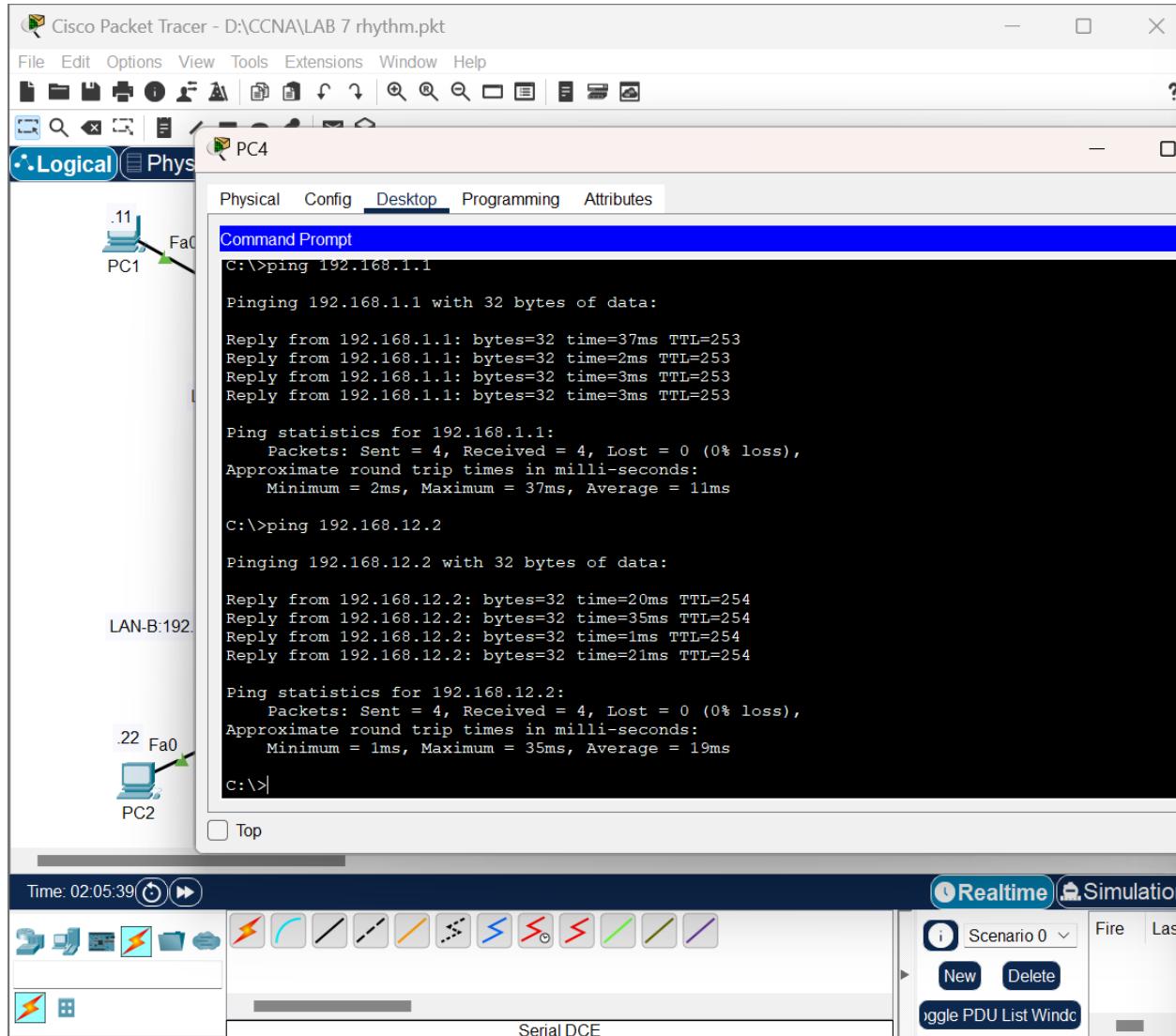
- Using the router R4-YFN, ping the SVI of S1-YSN, S2-YSN, S3-YSN, and S4-YSN.



- Using the command line at PC4, ping the IP address of:
 - PC1
 - SVI of S1-YSN, S2-YSN, and S3-YSN



- G0/1 of R1-YFN
- S0/0/0 of R2-YFN



NOTE: All the above-mentioned pings must work, otherwise troubleshoot the network.

Step 8: OSPF Verification. Sample output is provided for all the steps below. Please submit similar output for each router while highlighting the important information in the output, as displayed below.

- a. OSPF routing verification.
 - o Execute the following command on all routers and check that all the routes (four LANs, four WANs) are available from the entire network on every router.
 - *show ip route*

Sample Output for Router R1

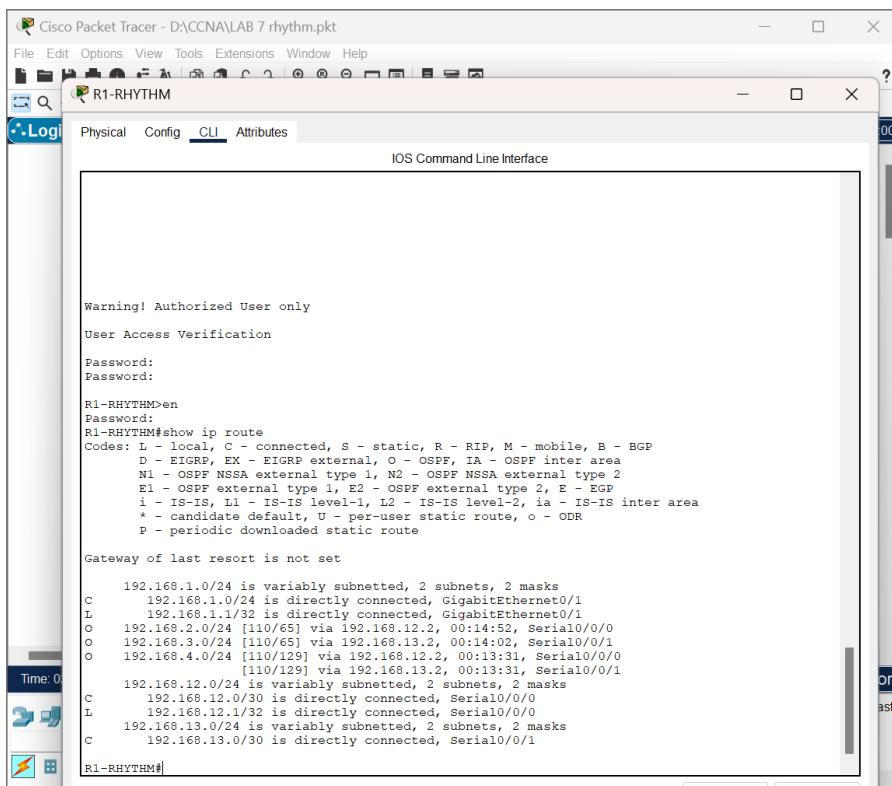
```
R1-Muhammad#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, 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

```
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/1
L        192.168.1.1/32 is directly connected, GigabitEthernet0/1
O        192.168.2.0/24 [110/65] via 192.168.12.2, 00:03:56, Serial0/0/0
O        192.168.3.0/24 [110/65] via 192.168.13.2, 00:03:56, Serial0/0/1
O        192.168.4.0/24 [110/129] via 192.168.13.2, 00:03:46, Serial0/0/1
                           [110/129] via 192.168.12.2, 00:03:46, Serial0/0/0
192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/30 is directly connected, Serial0/0/0
L        192.168.12.1/32 is directly connected, Serial0/0/0
192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/30 is directly connected, Serial0/0/1
L        192.168.13.1/32 is directly connected, Serial0/0/1
192.168.24.0/30 is subnetted, 1 subnets
O        192.168.24.0/30 [110/128] via 192.168.12.2, 00:03:56, Serial0/0/0
192.168.34.0/30 is subnetted, 1 subnets
O        192.168.34.0/30 [110/128] via 192.168.13.2, 00:03:56, Serial0/0/1
```

It can be clearly noticed from the above output that there are three directly connected routes and five OSPF routes, so this router R1 can reach all eight networks (four LANs and four WANs) in the mentioned topology.

R1



Cisco Packet Tracer - D:\CCNA\LAB 7 rhythm.pkt

File Edit Options View Tools Extensions Window Help

R1-RHYTHM

Physical Config **CLI** Attributes

IOS Command Line Interface

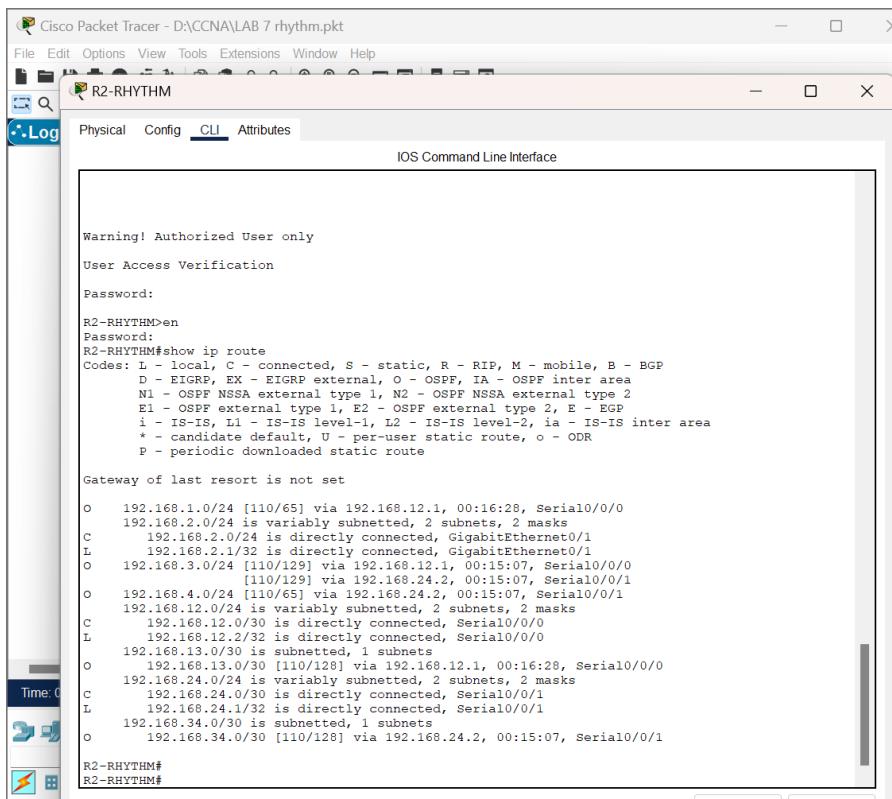
```
Warning! Authorized User only
User Access Verification
Password:
Password:
R1-RHYTHM>en
Password:
R1-RHYTHM#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 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

  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.1.0/24 is directly connected, GigabitEthernet0/1
L    192.168.1.1/32 is directly connected, GigabitEthernet0/1
O  192.168.2.0/24 [110/65] via 192.168.12.2, 00:14:52, Serial0/0/0
O  192.168.3.0/24 [110/65] via 192.168.13.2, 00:14:02, Serial0/0/1
O  192.168.4.0/24 [110/129] via 192.168.12.2, 00:13:31, Serial0/0/0
               [110/129] via 192.168.13.2, 00:13:31, Serial0/0/1
  192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.12.0/30 is directly connected, Serial0/0/0
L    192.168.12.1/32 is directly connected, Serial0/0/0
  192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.13.0/30 is directly connected, Serial0/0/1

R1-RHYTHM#
```

R2



Cisco Packet Tracer - D:\CCNA\LAB 7 rhythm.pkt

File Edit Options View Tools Extensions Window Help

R2-RHYTHM

Physical Config **CLI** Attributes

IOS Command Line Interface

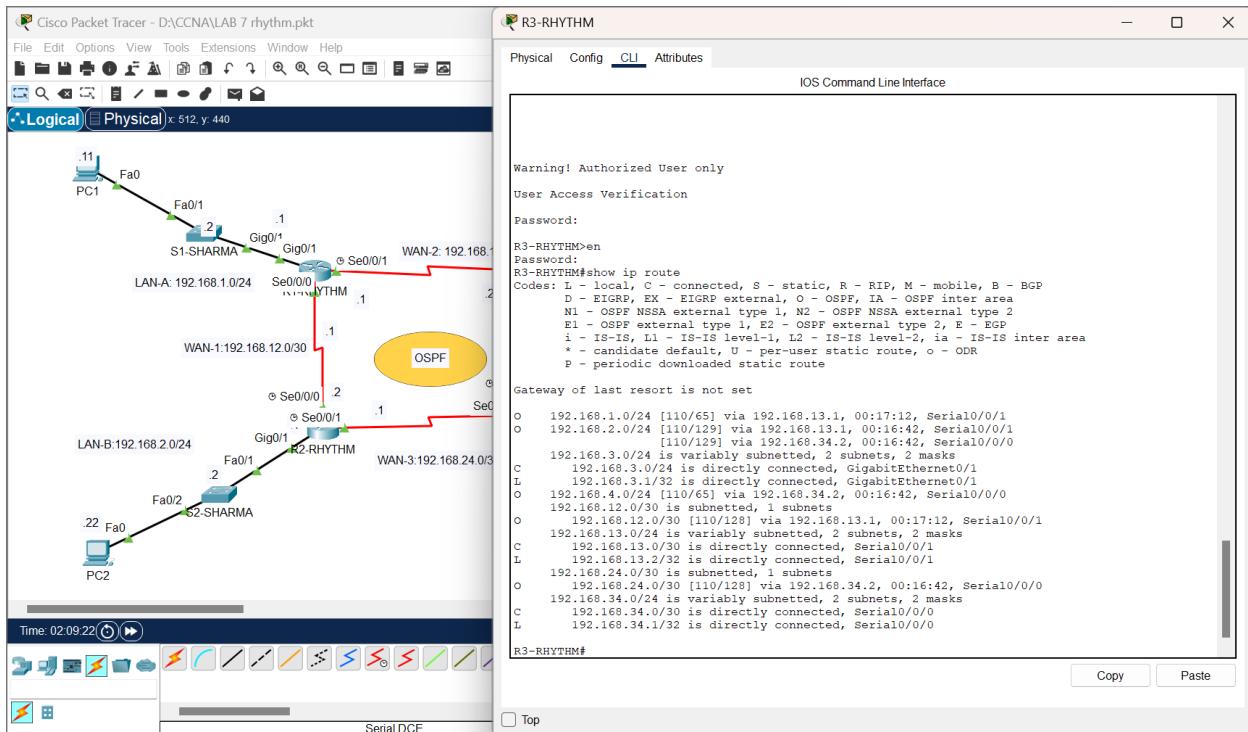
```
Warning! Authorized User only
User Access Verification
Password:
R2-RHYTHM>en
Password:
R2-RHYTHM#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - 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

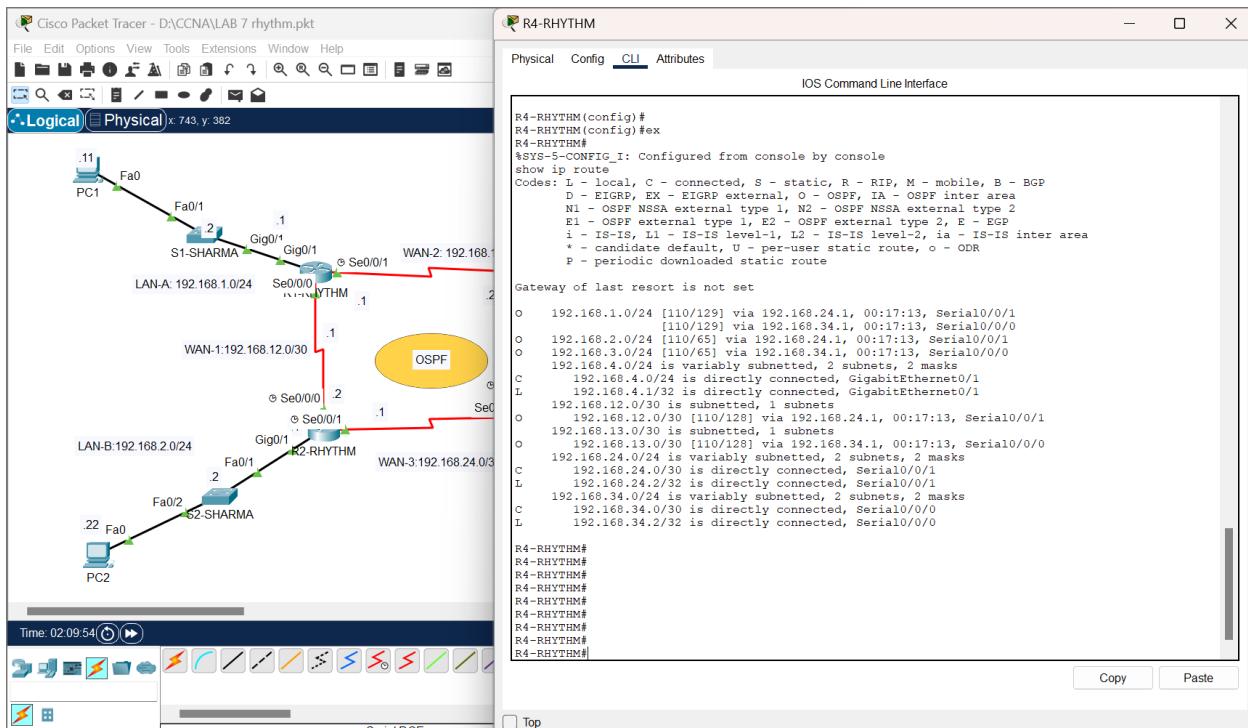
O  192.168.1.0/24 [110/65] via 192.168.12.1, 00:16:28, Serial0/0/0
  192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.2.0/24 is directly connected, GigabitEthernet0/1
L    192.168.2.1/32 is directly connected, GigabitEthernet0/1
O  192.168.3.0/24 [110/129] via 192.168.12.1, 00:15:07, Serial0/0/0
               [110/129] via 192.168.24.2, 00:15:07, Serial0/0/1
O  192.168.4.0/24 [110/65] via 192.168.24.2, 00:15:07, Serial0/0/1
  192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.12.0/30 is directly connected, Serial0/0/0
L    192.168.12.1/32 is directly connected, Serial0/0/0
  192.168.13.0/30 is subnetted, 1 subnets
O    192.168.13.0/30 [110/128] via 192.168.12.1, 00:16:28, Serial0/0/0
  192.168.24.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.24.0/30 is directly connected, Serial0/0/1
L    192.168.24.1/32 is directly connected, Serial0/0/1
  192.168.34.0/30 is subnetted, 1 subnets
O    192.168.34.0/30 [110/128] via 192.168.24.2, 00:15:07, Serial0/0/1

R2-RHYTHM#
R2-RHYTHM#
```

R3



R4

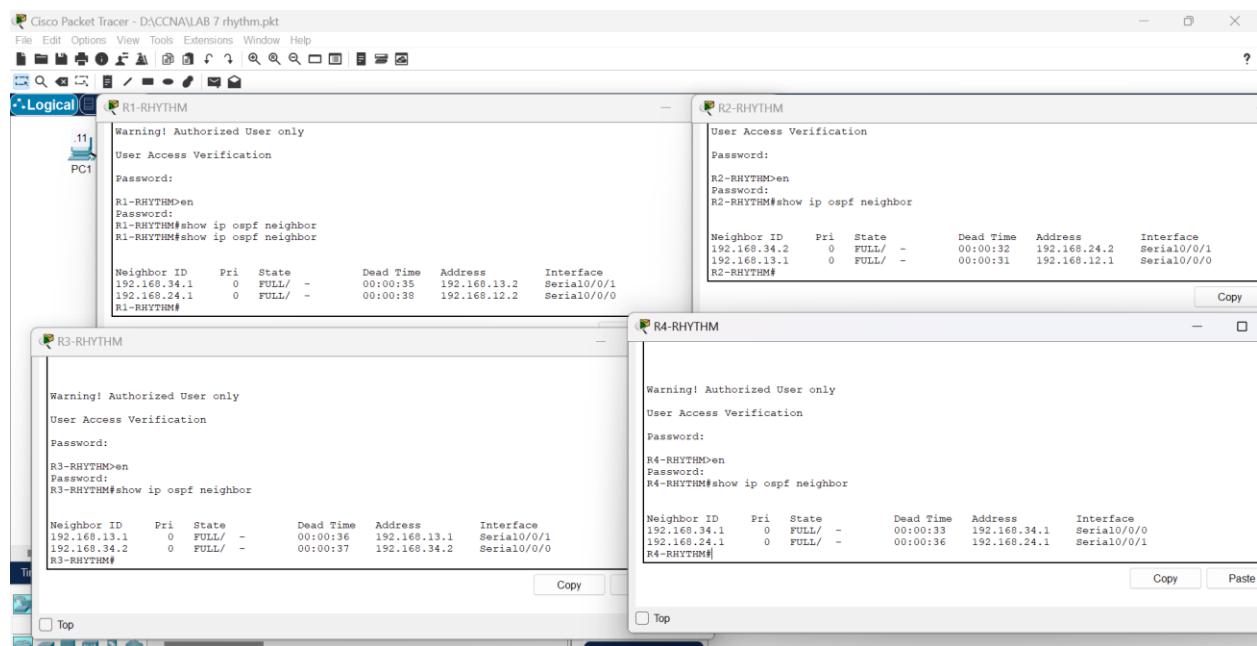


b. OSPF neighbour verification

- Execute the following command on all routers to check and verify that all the routers have two neighbours each.
 - *show ip ospf neighbor*

Sample Output for Router R2

R2-Muhammad#show ip ospf neighbor					
Neighbor ID	Pri	State	Dead Time	Address	Interface
192.168.13.1	0	FULL/ -	00:00:31	192.168.12.1	Serial0/0/0
192.168.34.2	0	FULL/ -	00:00:31	192.168.24.2	Serial0/0/1



c. sOSPF process information verification

- o Execute the following command on all routers to check and verify the process ID and router ID.
 - *show ip ospf*

Sample Output for Router R3

```
R3-Muhammad#show ip ospf
Routing Process "ospf 1" with ID 192.168.34.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
Number of interfaces in this area is 3
Area has no authentication
SPF algorithm executed 9 times
Area ranges are
Number of LSA 4. Checksum Sum 0x011730
Number of opaque link LSA 0. Checksum Sum 0x000000
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0
```

R1 and R2

R1-RHYTHM# show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
192.168.34.1	0	FULL/ -	00:00:35	192.168.13.2	Serial0/0/1
192.168.24.1	0	FULL/ -	00:00:38	192.168.12.2	Serial0/0/0

R2-RHYTHM# show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
192.168.34.2	0	FULL/ -	00:00:32	192.168.24.2	Serial0/0/1
192.168.13.1	0	FULL/ -	00:00:31	192.168.12.1	Serial0/0/0

R3 and R4

R3-RHYTHM# show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
192.168.13.1	0	FULL/ -	00:00:36	192.168.13.1	Serial0/0/1
192.168.34.2	0	FULL/ -	00:00:37	192.168.34.2	Serial0/0/0

R4-RHYTHM# show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
192.168.34.1	0	FULL/ -	00:00:36	192.168.34.2	Serial0/0/2
192.168.13.1	0	FULL/ -	00:00:37	192.168.13.1	Serial0/0/0

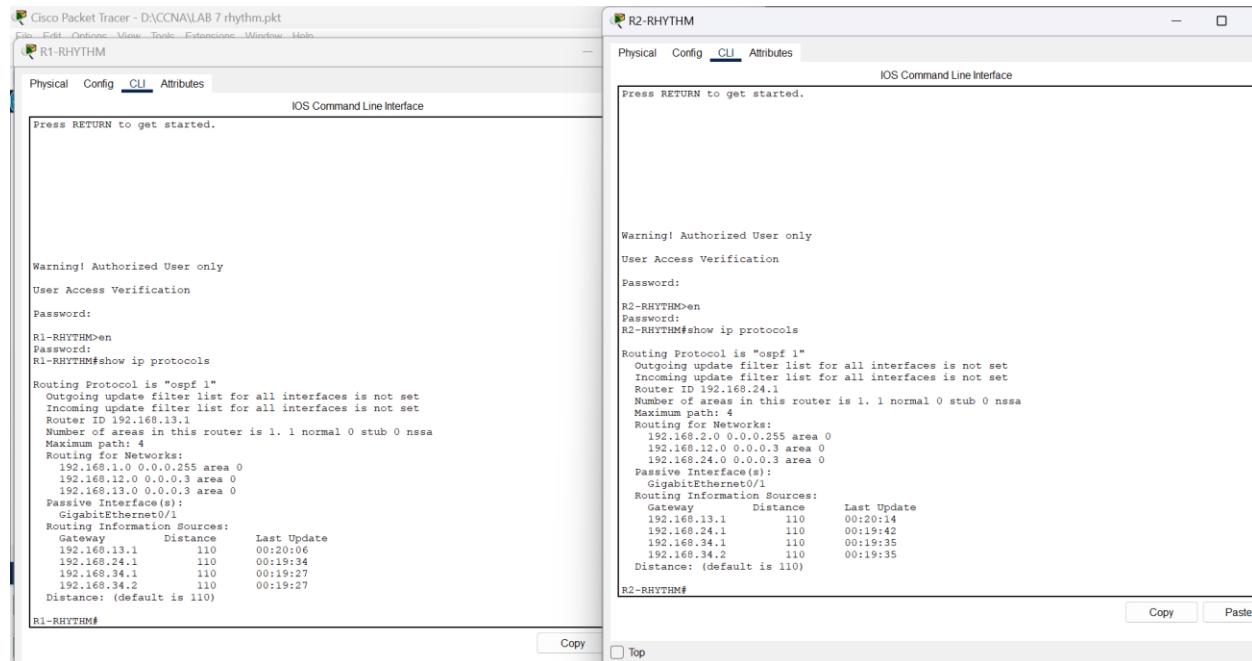
d. OSPF protocol settings verification

- o Execute the following command on all routers to check and verify the advertising networks, AD in addition to OSPF process ID, and router ID.
 - *show ip protocols*

Sample Output for Router R4

```
R4-Muhammad#show ip protocols
Routing Protocol is "ospf 1"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Router ID 192.168.34.2
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Maximum path: 4
Routing for Networks:
 192.168.4.0 0.0.0.255 area 0
 192.168.24.0 0.0.0.3 area 0
 192.168.34.0 0.0.0.3 area 0
Passive Interface(s):
GigabitEthernet0/1
Routing Information Sources:
Gateway          Distance      Last Update
192.168.13.1    110          00:27:16
192.168.24.1    110          00:27:14
192.168.34.1    110          00:27:16
192.168.34.2    110          00:27:15
Distance: (default is 110)
```

R1 and R2



R3 and R4

```

Cisco Packet Tracer - D:\CCNA\LAB 7\rhythm.pkt
File Edit Options View Tools Extensions Window Help
R3-RHYTHM
Physical Config CLI Attributes
Physical Config CLI Attributes
IOS Command Line Interface
SPT schedule delay 5 secs. Hold time between two SPTs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
  Number of interfaces in this area is 3
  Area ranges are 192.168.3.0 0.0.0.255
  SPT algorithm executed 2 times
  Area ranges are
    Number of external LSA 0. Checksum Sum 0x013043
    Number of opaque link LSA 0. Checksum Sum 0x000000
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0
R4-RHYTHM
R4-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.34.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path limit 4
  Routing for Networks:
    192.168.4.0 0.0.0.255 area 0
    192.168.3.0 0.0.0.3 area 0
    192.168.34.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/0
  Router Information Sources:
    Gateway      Distance   Last Update
    192.168.13.1        110  00:18:42
    192.168.34.1        110  00:18:03
    192.168.34.1        110  00:18:03
    192.168.34.2        110  00:18:03
  Distance: (default is 110)
R4-RHYTHM#

```

Step 9: Configure loopback interfaces on all routers.

- The OSPF router ID is derived in one of the three ways from Cisco devices.
 - Router-id command is configured. OR
 - Highest IP address on any of the router's loopback interface. OR
 - Highest IP address on any physical but active interface of router.
- Execute the following command on all routers (with different router ID) to configure loopback interfaces of each router.
 - *interface lo0*
 - *ip address 1.1.1.1 255.255.255.255*
 - *exit*

(Note: Loopback interface addresses for the other routers are R2→2.2.2.2, R3→3.3.3.3, R4→4.4.4.4 with full subnet mask as 255.255.255.255)

- Save the configuration.
- Reload the router.

R1 and R2

The image shows two Cisco Packet Tracer windows side-by-side. Both windows have a title bar 'Cisco Packet Tracer - D:\CCNA\LAB 7 rhythm.pkt' and a menu bar with File, Edit, Options, View, Tools, Extensions, Window, Help.

R1-RHYTHM:

- Physical Config **CLI** Attributes
- IOS Command Line Interface
- Press RETURN to get started.
- Warning! Authorized User only
- User Access Verification
- Password:
- R1-RHYTHM>en
- Password:
- R1-RHYTHM#config t
- Enter configuration commands, one per line. End with CNTL/Z.
- R1-RHYTHM(config)#router ospf 1
- R1-RHYTHM(config-router)#ex
- R1-RHYTHM(config)#interface lo0
- R1-RHYTHM(config-if)#
- %LINK-5-CHANGED: Interface Loopback0, changed state to up
- %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
- R1-RHYTHM(config-if)#ip address 1.1.1.1 255.255.255.255
- R1-RHYTHM(config-if)#exit
- R1-RHYTHM(config)#end
- R1-RHYTHM#
- %SYS-5-CONFIG_I: Configured from console by console
- copy run st
- Destination filename [startup-config]?
- Building configuration...
- [OK]
- R1-RHYTHM#

R2-RHYTHM:

- Physical Config **CLI** Attributes
- IOS Command Line Interface
- Press RETURN to get started.
- Warning! Authorized User only
- User Access Verification
- Password:
- R2-RHYTHM>en
- Password:
- R2-RHYTHM#config t
- Enter configuration commands, one per line. End with CNTL/Z.
- R2-RHYTHM(config)#interface lo0
- R2-RHYTHM(config-if)#
- %LINK-5-CHANGED: Interface Loopback0, changed state to up
- %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
- ip address 2.2.2.2 255.255.255.255
- R2-RHYTHM(config-if)#end
- R2-RHYTHM#
- %SYS-5-CONFIG_I: Configured from console by console
- copy run st
- Destination filename [startup-config]?
- Building configuration...
- [OK]
- R2-RHYTHM#

R3 and R4

The image shows two Cisco Packet Tracer windows side-by-side. Both windows have a title bar 'Cisco Packet Tracer - D:\CCNA\LAB 7 rhythm.pkt' and a menu bar with File, Edit, Options, View, Tools, Extensions, Window, Help.

R3-RHYTHM:

- Physical Config **CLI** Attributes
- IOS Command Line Interface
- Press RETURN to get started.
- Warning! Authorized User only
- User Access Verification
- Password:
- R3-RHYTHM>en
- Password:
- R3-RHYTHM#config t
- Enter configuration commands, one per line. End with CNTL/Z.
- R3-RHYTHM(config)#interface lo0
- R3-RHYTHM(config-if)#
- %LINK-5-CHANGED: Interface Loopback0, changed state to up
- %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
- ip address 3.3.3.3 255.255.255.255
- R3-RHYTHM(config-if)#end
- R3-RHYTHM#
- %SYS-5-CONFIG_I: Configured from console by console
- copy run st
- Destination filename [startup-config]?
- Building configuration...
- [OK]
- R3-RHYTHM#

R4-RHYTHM:

- Physical Config **CLI** Attributes
- IOS Command Line Interface
- Press RETURN to get started.
- Warning! Authorized User only
- User Access Verification
- Password:
- R4-RHYTHM>en
- Password:
- R4-RHYTHM#config t
- Enter configuration commands, one per line. End with CNTL/Z.
- R4-RHYTHM(config)#interface lo0
- R4-RHYTHM(config-if)#
- %LINK-5-CHANGED: Interface Loopback0, changed state to up
- %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
- ip address 4.4.4.4 255.255.255.255
- R4-RHYTHM(config-if)#end
- R4-RHYTHM#
- %SYS-5-CONFIG_I: Configured from console by console
- copy run st
- Destination filename [startup-config]?
- Building configuration...
- [OK]
- R4-RHYTHM#

- e. After the router reload process is complete, do the following:
- o Execute the following command on all routers to check and verify the advertising networks, AD in addition to OSPF process ID, and router ID.
 - *show ip protocols*

Sample Output for Router R1

```
R1-Muhammad#show ip protocols
Routing Protocol is "ospf 1"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Router ID 1.1.1.1
Number of areas in this router is 1. 1 normal 0 stub 0
nssa
Maximum path: 4
Routing for Networks:
 192.168.1.0 0.0.0.255 area 0
 192.168.12.0 0.0.0.3 area 0
 192.168.13.0 0.0.0.3 area 0
Passive Interface(s):
GigabitEthernet0/1
Routing Information Sources:
Gateway Distance Last Update
 1.1.1.1 110 00:00:08
 192.168.13.1 110 00:07:36
 192.168.24.1 110 00:00:08
 192.168.34.1 110 00:00:08
 192.168.34.2 110 00:07:36
Distance: (default is 110)
```

R1 and R2

```
R1-RHYTHM
Physical Config CLI Attributes
IOS Command Line Interface
00:00:20: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/1 from LOADING to FULL
Done
Warning! Authorized User only
User Access Verification
Password:
R1-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway   Distance   Last Update
    1.1.1.1      110  00:00:33
    2.2.2.2      110  00:00:32
    3.3.3.3      110  00:00:37
    4.4.4.4      110  00:00:33
    192.168.13.1 110  00:00:40
    192.168.24.1 110  00:00:57
    192.168.34.1 110  00:14:35
    192.168.34.2 110  00:03:02
  Distance: (default is 110)
R1-RHYTHM#
R2-RHYTHM
Physical Config CLI Attributes
IOS Command Line Interface
Password:
$LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
$LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
00:00:20: %OSPF-5-ADJCHG: Process 1, Nbr 4.4.4.4 on Serial0/0/1 from LOADING to FULL, Loading Done
00:00:20: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/0 from LOADING to FULL, Loading Done
Password:
R2-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 2.2.2.2
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.12.0 0.0.0.3 area 0
    192.168.24.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway   Distance   Last Update
    1.1.1.1      110  00:00:49
    2.2.2.2      110  00:00:49
    3.3.3.3      110  00:00:53
    4.4.4.4      110  00:00:50
    192.168.13.1 110  00:02:57
    192.168.24.1 110  00:04:14
    192.168.34.1 110  00:14:52
    192.168.34.2 110  00:03:18
  Distance: (default is 110)
R2-RHYTHM#
```

R3 and R4

R3-RHYTHM# show ip ospf neighbor

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
00:00:20: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.24.1 on Serial0/0/1 from LOADING to FULL, Loading Done
00:00:20: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/0 from LOADING to FULL, Loading Done
Warning! Authorized User only
User Access Verification
Password:
R4-RHYTHM# show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 4.4.4.4
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum metric 4
  Routing for Networks:
    192.168.4.0 0.0.0.255 area 0
    192.168.13.0 0.0.0.3 area 0
    192.168.34.0 0.0.0.3 area 0
  Passive interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    3.3.3.3          110          00:00:10
    4.4.4.4          110          00:00:10
    192.168.13.1    110          00:00:16
    192.168.24.1    110          00:00:10
    192.168.34.1    110          00:12:11
    192.168.34.2    110          00:00:38
  Distance: (default is 110)
R4-RHYTHM#
```

- show ip ospf neighbor*

Sample Output for Router R2

R2-Muhammad#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
4.4.4.4	0	FULL/ -	00:00:31	192.168.24.2	Serial0/0/1
1.1.1.1	0	FULL/ -	00:00:35	192.168.12.1	Serial0/0/0

R1-RHYTHM# show ip ospf neighbor

```
4.4.4.4          110          00:00:50
192.168.13.1    110          00:02:57
192.168.24.1    110          00:01:14
192.168.34.1    110          00:14:52
192.168.34.2    110          00:03:18
Distance: (default is 110)

R1-RHYTHM# show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
3.3.3.3	0	FULL/ -	00:00:38	192.168.13.2	Serial0/0/1
2.2.2.2	0	FULL/ -	00:00:31	192.168.12.2	Serial0/0/0

R2-RHYTHM# show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
4.4.4.4	0	FULL/ -	00:00:38	192.168.24.2	Serial0/0/1
1.1.1.1	0	FULL/ -	00:00:38	192.168.12.1	Serial0/0/0

R3-RHYTHM# show ip ospf neighbor

```
00:02:24: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/1 from LOADING to FULL, Loading Done
R3-RHYTHM# show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
1.1.1.1	0	FULL/ -	00:00:32	192.168.13.1	Serial0/0/1
4.4.4.4	0	FULL/ -	00:00:35	192.168.34.2	Serial0/0/0

R4-RHYTHM# show ip ospf neighbor

```
00:02:01: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.24.1 on Serial0/0/1 from FULL to DOWN
Neighbor Down: Interface down or detached
$LINK-5-CHANGED: Interface Serial0/0/1, changed state to up
$LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
00:02:21: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial0/0/1 from LOADING to FULL, Done
R4-RHYTHM# show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
3.3.3.3	0	FULL/ -	00:00:32	192.168.34.1	Serial0/0/0
2.2.2.2	0	FULL/ -	00:00:33	192.168.24.1	Serial0/0/1

- f. Configure router id using router-id on all routers under **router ospf** configuration mode.

```
R3-Muhammad(config)#router ospf 1
```

```
R3-Muhammad(config-router)# router-id 133.133.133.133
```

Reload or use "clear ip ospf process" command, for this to take effect

```
R3-Muhammad(config-router)#exit
```

```
R3-Muhammad(config)#exit
```

```
R3-Muhammad#clear ip ospf process
```

Reset ALL OSPF processes? [no]: yes

```
R3-Muhammad#
```

```
00:09:38: %OSPF-5-ADJCHG: Process 1, Nbr 4.4.4.4 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Adjacency forced to reset
00:09:38: %OSPF-5-ADJCHG: Process 1, Nbr 4.4.4.4 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached
00:09:38: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Adjacency forced to reset
00:09:38: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached
00:09:39: %OSPF-5-ADJCHG: Process 1, Nbr 4.4.4.4 on Serial0/0/0 from LOADING to FULL, Loading Done
00:09:55: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/1 from LOADING to FULL, Loading Done
```

- g. Configure the router-id command as mentioned in the above step on all routers while changing the router id as R1→ 111.111.111.111, R2→122.122.122.122, R4→144.144.144.144

Execute the command “clear ip ospf process” after the router id is changed using router-id command on all routers,

R1 and R2

The screenshot shows two Cisco Packet Tracer windows side-by-side. Both windows have tabs for Physical, Config, CLI, and Attributes, with the CLI tab selected. The windows are titled R1-RHYTHM and R2-RHYTHM respectively.

R1-RHYTHM Window:

- CLI Output (Router ID 111.111.111.111):


```
% Invalid input detected at '^' marker.
R1-RHYTHM#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1-RHYTHM(config)#router ospf 1
R1-RHYTHM(config-router)#router-id 111.111.111.111
% Invalid input detected at '^' marker.

R1-RHYTHM(config-router)#router-id 111.111.111.111
R1-RHYTHM(config-router)#Reload or use "clear ip ospf process" command, for this
exit
R1-RHYTHM(config)#exit
R1-RHYTHM#
SYS-5-CONFIG_I: Configured from console by console
R1-RHYTHM#clear ip process
% Invalid input detected at '^' marker.

R1-RHYTHM#clear ip ospf process
Reset ALL OSPF processes? [no]: yes

R1-RHYTHM#
00:07:12: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/1 from FULL to DOWN
Down: Adjacency forced to reset
00:07:12: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/1 from FULL to DOWN
Down: Interface down or detached
00:07:12: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial0/0/0 from FULL to DOWN
Down: Adjacency forced to reset
00:07:12: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial0/0/0 from FULL to DOWN
Down: Interface down or detached
00:07:17: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial0/0/1 from LOADING to F
Done
00:07:28: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial0/0/0 from LOADING to F
Done
```

R2-RHYTHM Window:

- CLI Output (Router ID 122.122.122.122):


```
Physical Config CLI Attributes
IOS Command Line Interface
192.168.34.2    110    00:03:18
Distance: (default is 110)
R2-RHYTHM#show ip ospf neighbor

Neighbor ID      Pri  State          Dead Time   Address           Interface
4.4.4.4          0    FULL/ -        00:00:38  192.168.24.2  Serial0/0/1
1.1.1.1          0    FULL/ -        00:00:38  192.168.12.1  Serial0/0/0
R2-RHYTHM#
00:07:25: %OSPF-5-ADJCHG: Process 1, Nbr 111.111.111.111 on Serial0/0/0 from LOADING to FULL,
Loading Done

R2-RHYTHM#config t
Enter configuration commands, one per line. End with CNTL/Z.
R2-RHYTHM(config)#router ospf 1
R2-RHYTHM(config-router)#router id 122.122.122.122
% Invalid input detected at '^' marker.

R2-RHYTHM(config-router)#router-id 122.122.122.122
R2-RHYTHM(config-router)#Reload or use "clear ip ospf process" command, for this to take effect

ex
R2-RHYTHM(config)#x
R2-RHYTHM#
SYS-5-CONFIG_I: Configured from console by console
clear ip process
Reset ALL OSPF processes? [no]: yes

R2-RHYTHM#
00:09:55: %OSPF-5-ADJCHG: Process 1, Nbr 4.4.4.4 on Serial0/0/1 from FULL to DOWN, Neighbor
Down: Adjacency forced to reset
00:09:55: %OSPF-5-ADJCHG: Process 1, Nbr 4.4.4.4 on Serial0/0/1 from FULL to DOWN, Neighbor
Down: Interface down or detached
00:09:55: %OSPF-5-ADJCHG: Process 1, Nbr 111.111.111.111 on Serial0/0/0 from FULL to DOWN,
Neighbor Down: Adjacency forced to reset
00:09:55: %OSPF-5-ADJCHG: Process 1, Nbr 111.111.111.111 on Serial0/0/0 from FULL to DOWN,
Neighbor Down: Interface down or detached
```

R3 and R4

R3 and R4 are configured with OSPF Process 1. Router R3 has neighbors 1.1.1.1 and 4.4.4.0. Router R4 has neighbors 3.3.3.3 and 2.2.2.2. All interfaces are in FULL state.

```

R3-RHYTHM# show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 144.144.144.144
    Number of areas in this router is 1. 1 normal 0 stub 0 nssa
    Maximum path: 4
    Routing for Networks:
      192.168.4.0 0.0.0.255 area 0
      192.168.24.0 0.0.0.3 area 0
      192.168.34.0 0.0.0.3 area 0
    Passive Interface(s):
      GigabitEthernet0/1
    Routing Information Sources:
      Gateway Distance Last Update
        1.1.1.1 110 00:11:42
        2.2.2.2 110 00:02:38
        3.3.3.3 110 00:20:07
        4.4.4.4 110 00:01:47
        111.111.111.111 110 00:02:03
        122.122.122.122 110 00:00:07
        133.133.133.133 110 00:00:07
        144.144.144.144 110 00:01:21
        192.168.13.1 110 00:33:02
        192.168.24.1 110 00:25:34
        192.168.34.1 110 00:25:34
        192.168.34.2 110 00:20:33
      Distance: (default is 110)

```

and then perform the following command *show ip protocols*

```

R4-Muhammad#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 144.144.144.144
    Number of areas in this router is 1. 1 normal 0 stub 0 nssa
    Maximum path: 4
    Routing for Networks:
      192.168.4.0 0.0.0.255 area 0
      192.168.24.0 0.0.0.3 area 0
      192.168.34.0 0.0.0.3 area 0
    Passive Interface(s):
      GigabitEthernet0/1
    Routing Information Sources:
      Gateway Distance Last Update
        1.1.1.1 110 00:11:42
        2.2.2.2 110 00:02:38
        3.3.3.3 110 00:20:07
        4.4.4.4 110 00:01:47
        111.111.111.111 110 00:02:03
        122.122.122.122 110 00:00:07
        133.133.133.133 110 00:00:07
        144.144.144.144 110 00:01:21
        192.168.13.1 110 00:33:02
        192.168.24.1 110 00:25:34
        192.168.34.1 110 00:25:34
        192.168.34.2 110 00:20:33
      Distance: (default is 110)

```

R1 and R2

The screenshot shows two Cisco routers, R1-RHYTHM and R2-RHYTHM, running OSPF protocol. Router R1 has a Serial0/0/0 interface down, while R2 has a Serial0/0/0 interface up. Both routers have four areas (0, 1, 2, 3) and a maximum path of 4.

```

R1-RHYTHM#
%LINK-3-UPDOWN: Interface Serial0/0/0, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
00:08:31: %OSPF-5-ADJCHG: Process 1, Nbr 122.122.122.122 on Serial0/0/0 fr
Neighbor Down: Interface down or detached
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
00:08:51: %OSPF-5-ADJCHG: Process 1, Nbr 122.122.122.122 on Serial0/0/0 fr
Loading Done
R1-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 111.111.111.111
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.3.0 0.0.0.3 area 0
    192.168.13.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    111.111.111.111           110          00:08:53
    122.122.122.122           110          00:11:32
    133.133.133.133           110          00:11:27
    144.144.144.144           110          00:02:53
  Distance: (default is 110)
R1-RHYTHM#
R2-RHYTHM#
%LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
00:08:31: %OSPF-5-ADJCHG: Process 1, Nbr 122.122.122.122 on Serial0/0/0 fr
Neighbor Up: Interface up
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
00:08:51: %OSPF-5-ADJCHG: Process 1, Nbr 122.122.122.122 on Serial0/0/0 fr
Loading Done
R2-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 122.122.122.122
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.3.0 0.0.0.3 area 0
    192.168.24.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    111.111.111.111           110          00:00:57
    122.122.122.122           110          00:09:36
    133.133.133.133           110          00:09:31
    144.144.144.144           110          00:00:57
  Distance: (default is 110)
R2-RHYTHM#

```

R3 and R4

The screenshot shows two Cisco routers, R3-RHYTHM and R4-RHYTHM, running OSPF protocol. Router R3 has a Serial0/0/1 interface up, while R4 has a Serial0/0/1 interface down. Both routers have four areas (0, 1, 2, 3) and a maximum path of 4.

```

R3-RHYTHM#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state
00:00:10: %OSPF-5-ADJCHG: Process 1, Nbr 144.144.144.144 on Serial0/0/0 fr
Loading Done
00:00:10: %OSPF-5-ADJCHG: Process 1, Nbr 111.111.111.111 on Serial0/0/1 fr
Loading Done
Warning! Authorized User only
User Access Verification
Password:
R3-RHYTHM>en
Password:
R3-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 133.133.133.133
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.3.0 0.0.0.255 area 0
    192.168.13.0 0.0.0.3 area 0
    192.168.34.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    111.111.111.111           110          00:05:37
    122.122.122.122           110          00:14:16
    133.133.133.133           110          00:14:15
    144.144.144.144           110          00:05:37
  Distance: (default is 110)
R3-RHYTHM#
R4-RHYTHM#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
00:08:31: %OSPF-5-ADJCHG: Process 1, Nbr 122.122.122.122 on Serial0/0/1 from FULL to DOWN,
Neighbor Down: Interface down or detached
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
00:08:51: %OSPF-5-ADJCHG: Process 1, Nbr 122.122.122.122 on Serial0/0/0 from LOADING to FULL,
Loading Done
Warning! Authorized User only
User Access Verification
Password:
R4-RHYTHM>en
Password:
R4-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 144.144.144.144
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.4.0 0.0.0.255 area 0
    192.168.13.0 0.0.0.3 area 0
    192.168.34.0 0.0.0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway         Distance      Last Update
    111.111.111.111           110          00:05:48
    122.122.122.122           110          00:14:27
    133.133.133.133           110          00:14:27
    144.144.144.144           110          00:05:48
  Distance: (default is 110)
R4-RHYTHM#

```

- *show ip ospf neighbor*

R1-Muhammad#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
122.122.122.122	0	FULL/-	00:00:37	192.168.12.2	Serial0/0/0
133.133.133.133	0	FULL/-	00:00:38	192.168.13.2	Serial0/0/1

R2-Muhammad#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
144.144.144.144	0	FULL/-	00:00:30	192.168.24.2	Serial0/0/1
111.111.111.111	0	FULL/-	00:00:33	192.168.12.1	Serial0/0/0

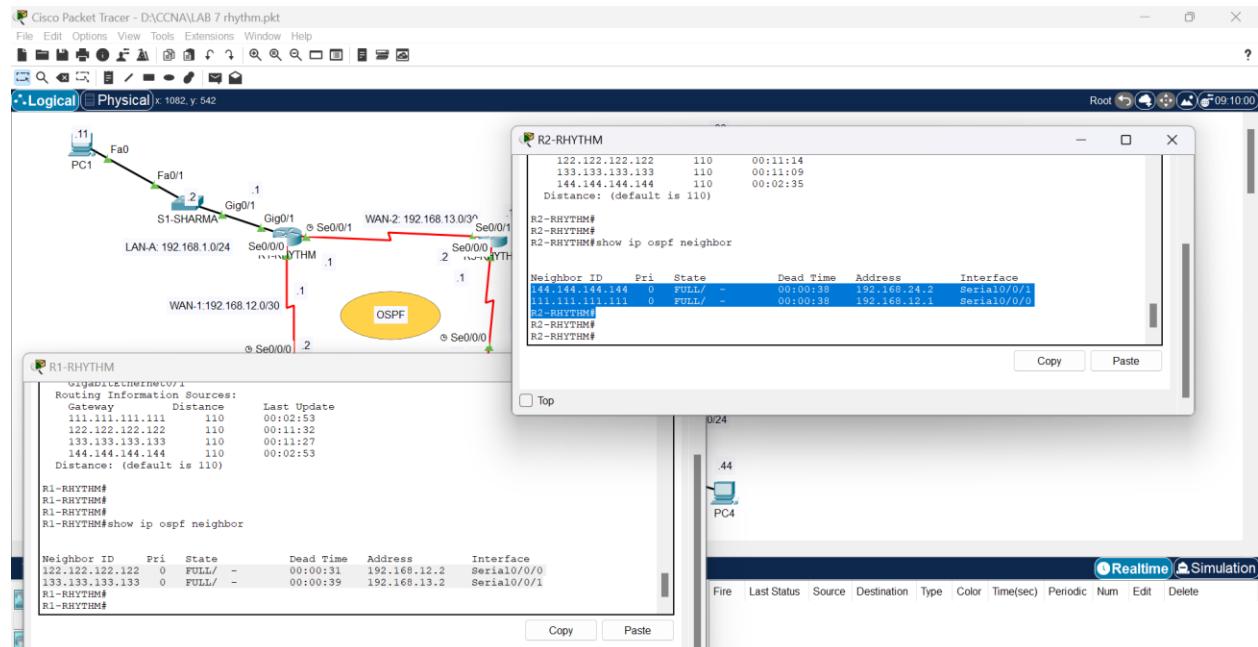
R3-Muhammad#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
144.144.144.144	0	FULL/-	00:00:38	192.168.34.2	Serial0/0/0
111.111.111.111	0	FULL/-	00:00:39	192.168.13.1	Serial0/0/1

R4-Muhammad#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
133.133.133.133	0	FULL/-	00:00:35	192.168.34.1	Serial0/0/0
122.122.122.122	0	FULL/-	00:00:35	192.168.24.1	Serial0/0/1

R1 and R2



R3 and R4

Cisco Packet Tracer - D:\CCNA\LAB 7 rhythm.pkt

File Edit Options... Movie... Tools... Enhancements... Monitor... Help

R3-RHYTHM

Physical Config **CLI** Attributes

IOS Command Line Interface

```
00:00:10: %OSPF-5-ADJCHG: Process 1, Nbr 144.144.144.144 on Serial0/0/0 from LO
Loading Done
00:00:10: %OSPF-5-ADJCHG: Process 1, Nbr 111.111.111.111 on Serial0/0/1 from LO
Loading Done
Warning! Authorized User only
User Access Verification
Password:
R3-RHYTHM#en
Password:
R3-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 133.133.133.133
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.3.0 0 0 0.255 area 0
    192.168.13.0 0 0 0.3 area 0
    192.168.24.0 0 0 0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway          Distance      Last Update
    111.111.111.111   110        00:05:37
    122.122.122.122   110        00:14:16
    133.133.133.133   110        00:14:15
    144.144.144.144   110        00:05:37
  Distance: (default is 110)
R3-RHYTHM#show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
144.144.144.144	0	FULL/ -	00:00:38	192.168.34.2	Serial0/0/0
111.111.111.111	0	FULL/ -	00:00:38	192.168.13.1	Serial0/0/1

R3-RHYTHM#
R3-RHYTHM#

R4-RHYTHM

Physical Config **CLI** Attributes

IOS Command Line Interface

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
00:08:51: %OSPF-5-ADJCHG: Process 1, Nbr 122.122.122.122 on Serial0/0/1 from LOADING to FULL,
Loading Done
Warning! Authorized User only
User Access Verification
Password:
R4-RHYTHM#en
Password:
R4-RHYTHM#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 144.144.144.144
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.4.0 0 0 0.255 area 0
    192.168.24.0 0 0 0.3 area 0
    192.168.34.0 0 0 0.3 area 0
  Passive Interface(s):
    GigabitEthernet0/1
  Routing Information Sources:
    Gateway          Distance      Last Update
    111.111.111.111   110        00:05:48
    122.122.122.122   110        00:14:27
    133.133.133.133   110        00:14:22
    144.144.144.144   110        00:05:48
  Distance: (default is 110)
R4-RHYTHM#show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
133.133.133.133	0	FULL/ -	00:00:39	192.168.34.1	Serial0/0/0
122.122.122.122	0	FULL/ -	00:00:32	192.168.24.1	Serial0/0/1

R4-RHYTHM#
R4-RHYTHM#

Top

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