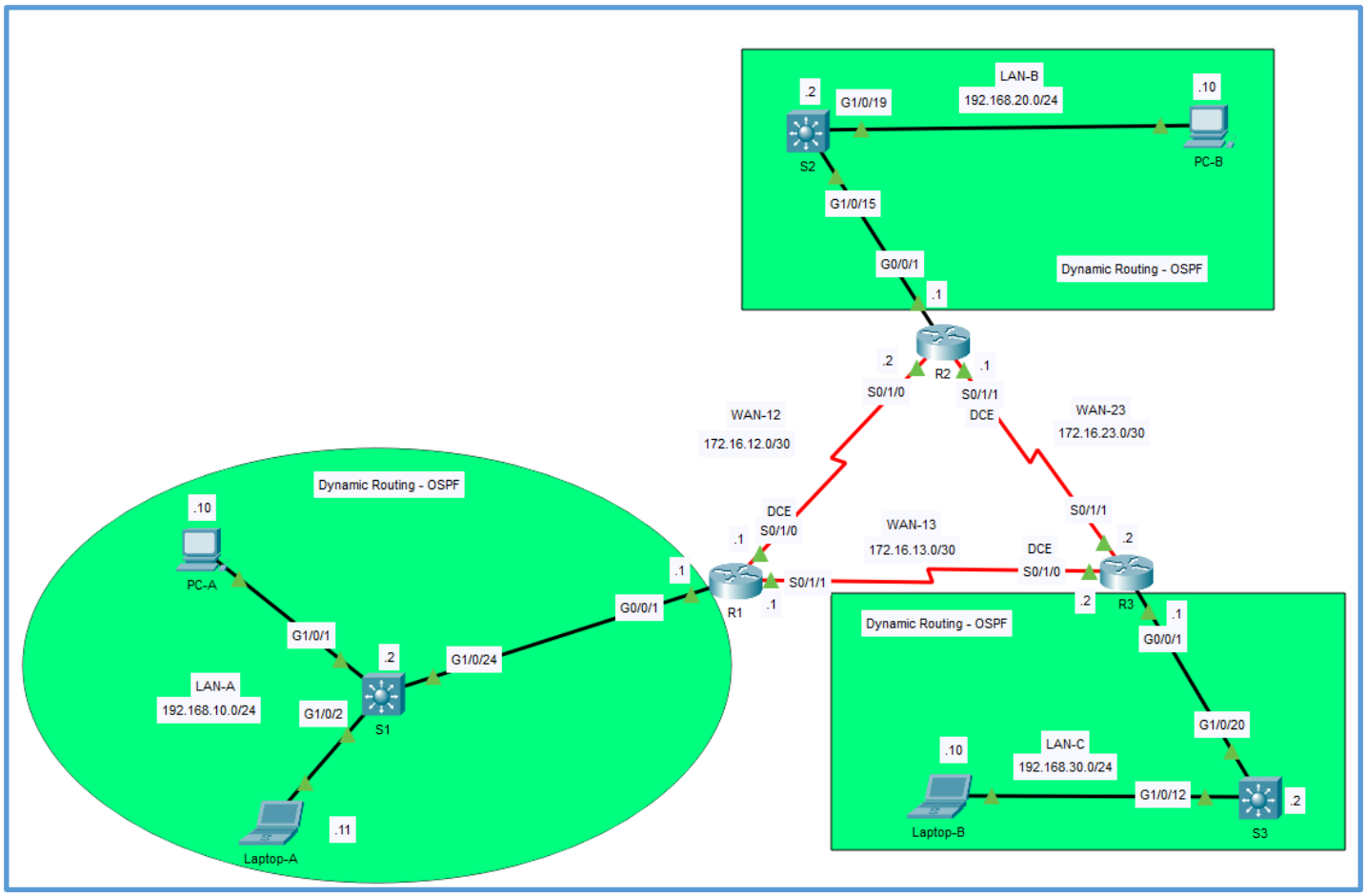
Lab Activity – Dynamic Routing (OSPF):

- There are three LANs and three WANs in the topology below. Please develop the following topology on the physical pod/rack in the lab room.



Required Resources:

- Three Layer-3/Multilayer Switches (Cisco Catalyst 1000 Series with Cisco IOS Release 15.1+ image)
- Three Routers (Cisco 4221 with Cisco IOS Release 17.6+ image)
- Two Laptops and two PCs (Windows with Terminal Emulation Program)
- Cables:
    - Console cables to configure the Cisco IOS devices through the console port.
    - Ethernet and Serial cables as shown in the topology.

Addressing Table:

Device	Interface	IP Address	Subnet Mask / CIDR	Default Gateway
S1	VLAN55	192.168.10.2	255.255.255.0	192.168.10.1
S2	VLAN55	192.168.20.2	255.255.255.0	192.168.20.1
S3	VLAN55	192.168.30.2	255.255.255.0	192.168.30.1
R1	G0/0/1	192.168.10.1	255.255.255.0	N/A
	S0/1/0	172.16.12.1	/30	N/A
	S0/1/1	172.16.13.1	/30	NA
R2	G0/0/1	192.168.20.1	/24	N/A
	S0/1/0	172.16.12.2	/30	N/A
	S0/1/1	172.16.23.1	/30	N/A
R3	G0/0/1	192.168.30.1	/24	N/A
	S0/1/1	172.16.23.2	/30	N/A
	S0/1/0	172.16.13.2	/30	N/A
PC-A	NIC	192.168.10.10	255.255.255.0	192.168.10.1
Laptop-A	NIC	192.168.10.11	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.20.10	255.255.255.0	192.168.20.1
Laptop-B	NIC	192.168.30.10	255.255.255.0	192.168.30.1

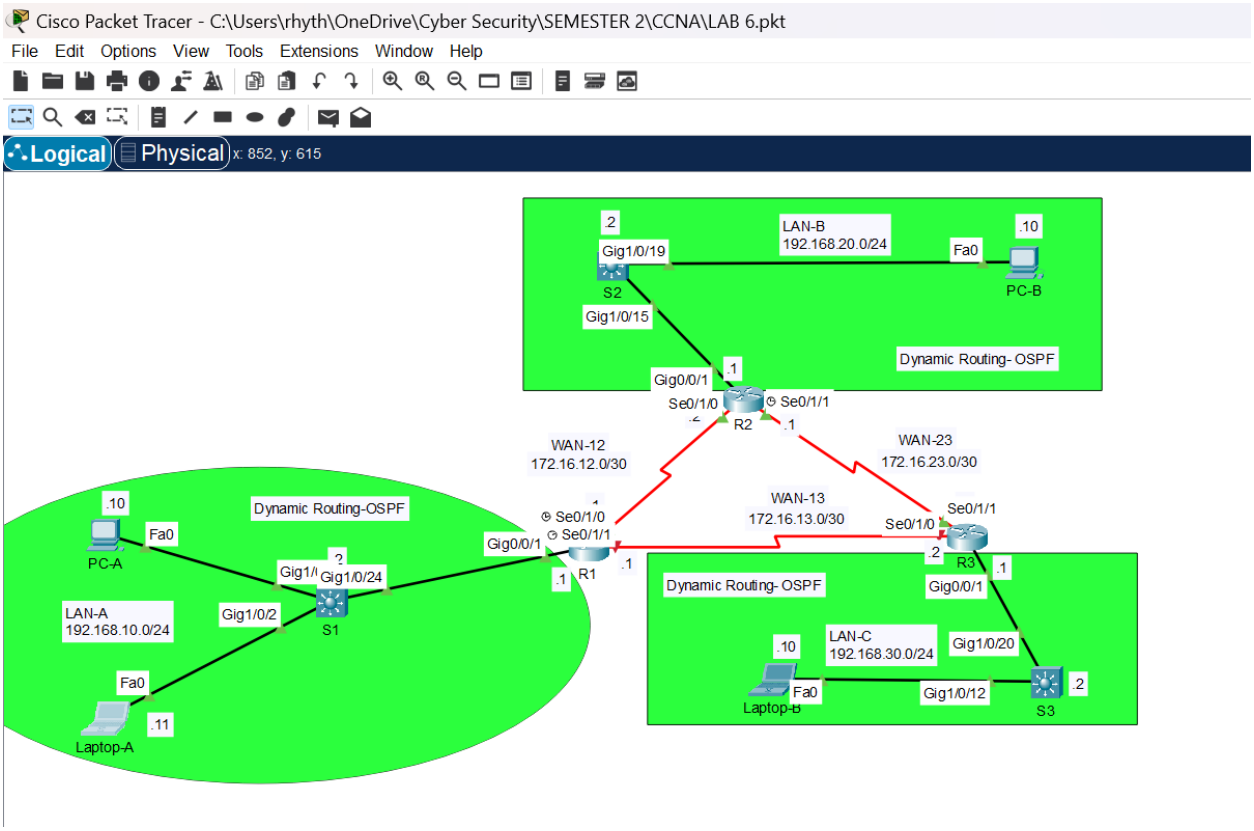
Lab Description:

- In this lab, please build three LANs and three WANs.
  - LAN A with one switch and two hosts.
  - LAN B with one switch and one host.
  - LAN C with one switch and one host.
  - WAN-12, WAN-13, WAN-23 with two routers each.
- You are also required to do the basic configuration on the following devices:
  - Switches:
    - Hostnames
    - SVI
    - Default gateway
    - Login banner
    - DNS lookup (disable)
  - PCs, Laptops, and Server:
    - IP addressing
    - Default gateway
  - Routers:
    - Hostnames
    - IP addressing
    - Login banner
    - DNS lookup (disable)

Solution:

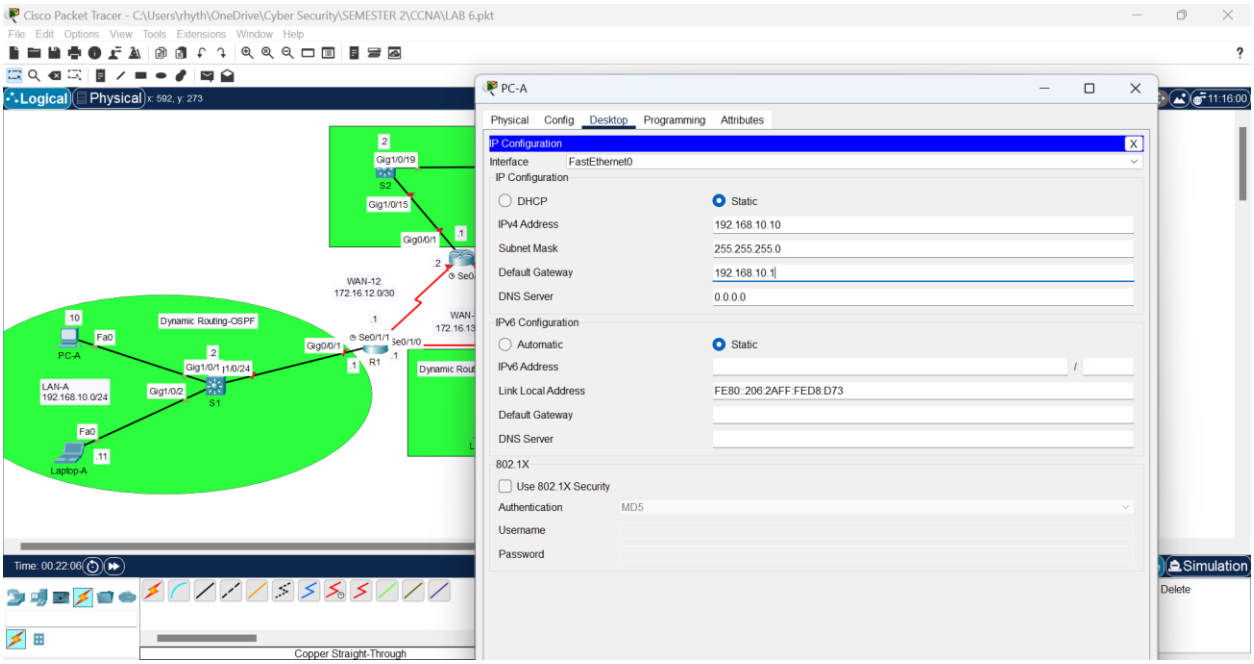
Step 1: Set up the network topology.

- Develop the topology on the physical rack/pod by using all the devices mentioned above and then cable all the devices together:
  - Turn on the devices.
  - Connect the switches with their default gateway.
  - Connect the PCs and laptops with their respective switches.
  - Make sure all the lights between switches and PCs or laptops are green.

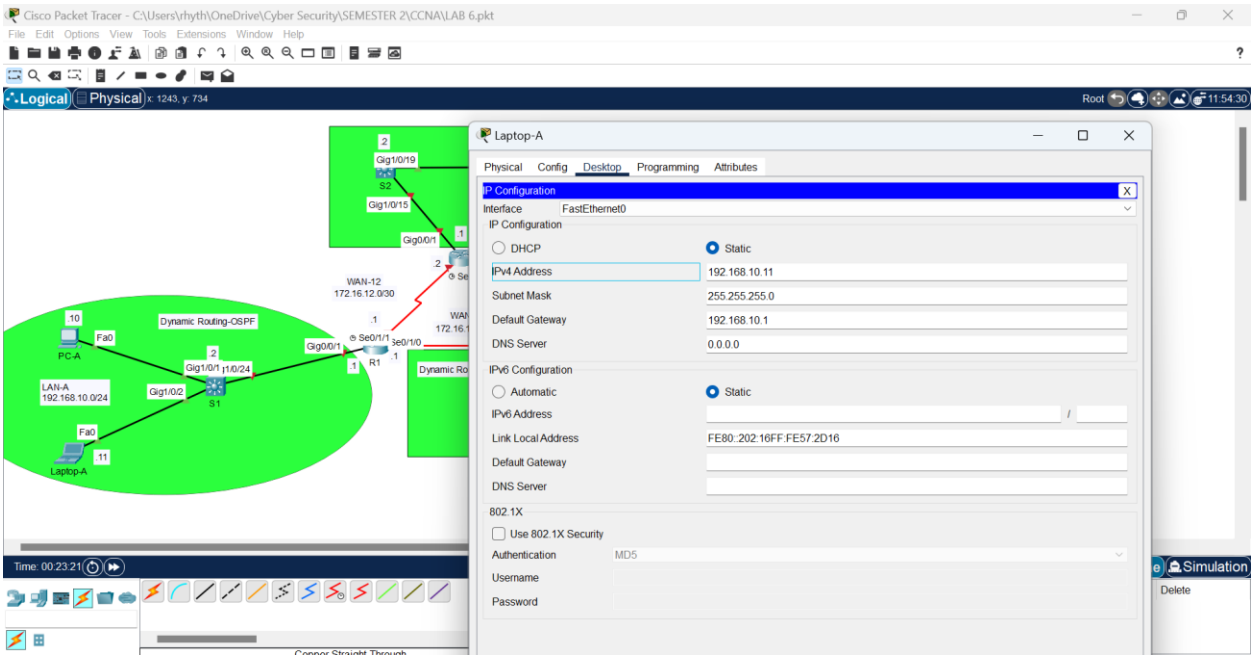


Step 2: Configure PC, laptop hosts.

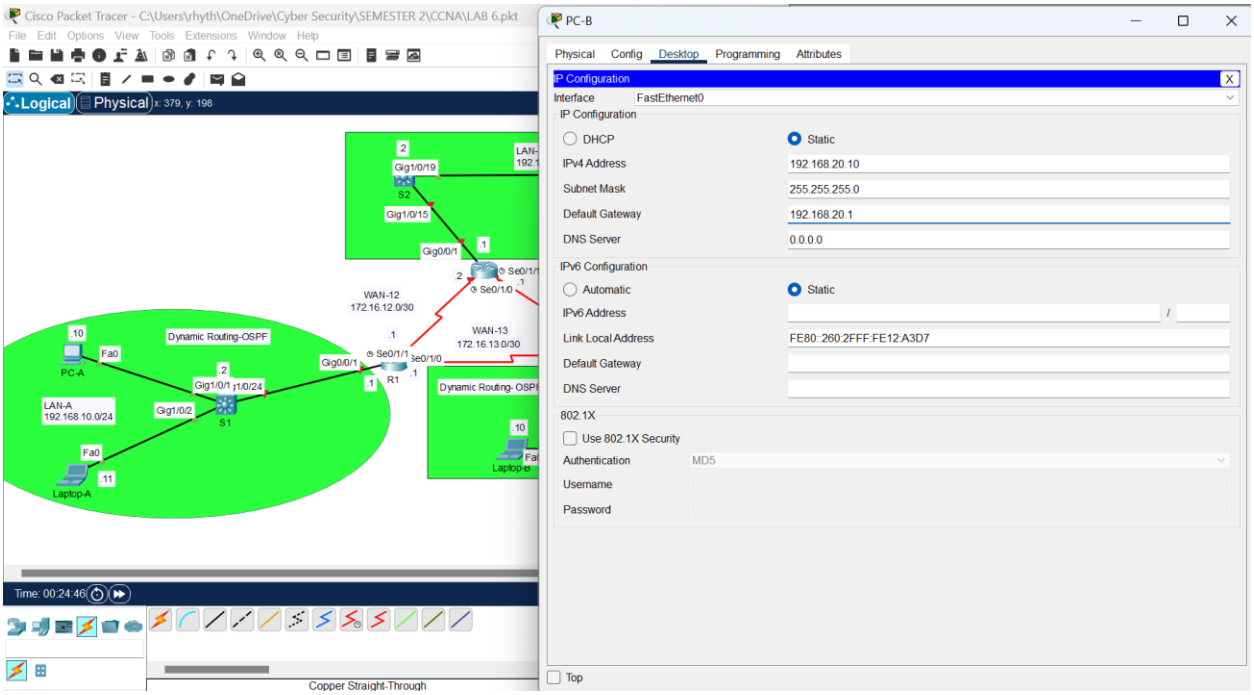
PC-A



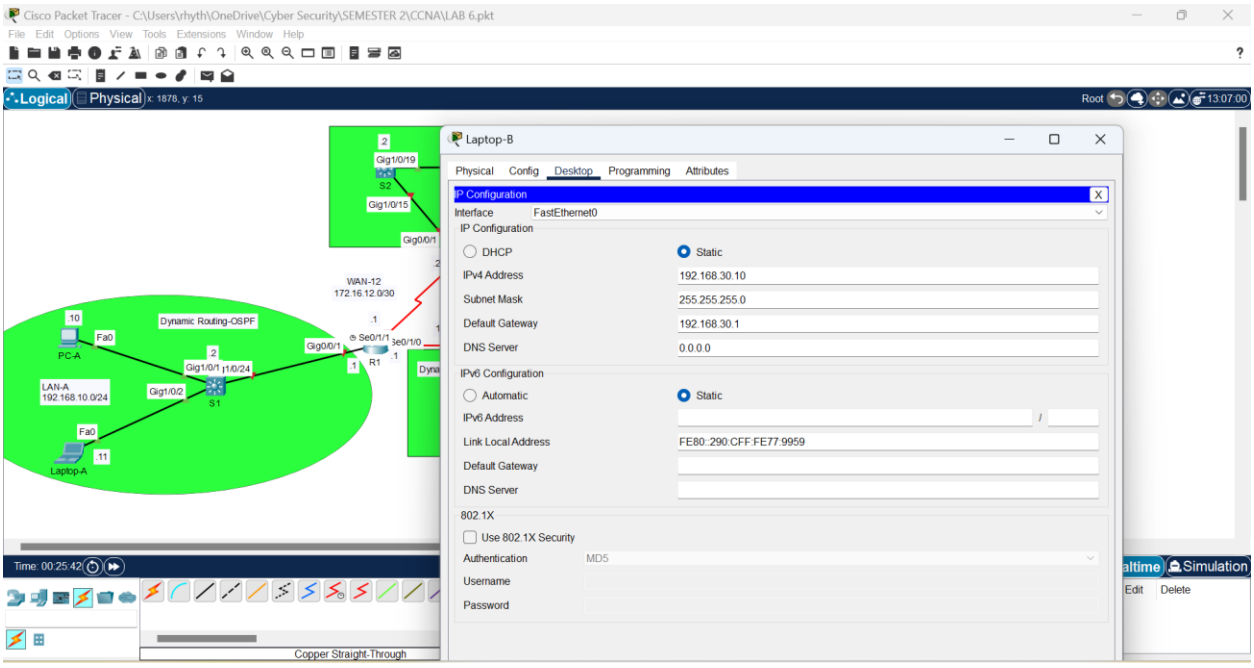
LAPTOP-A



PC-B



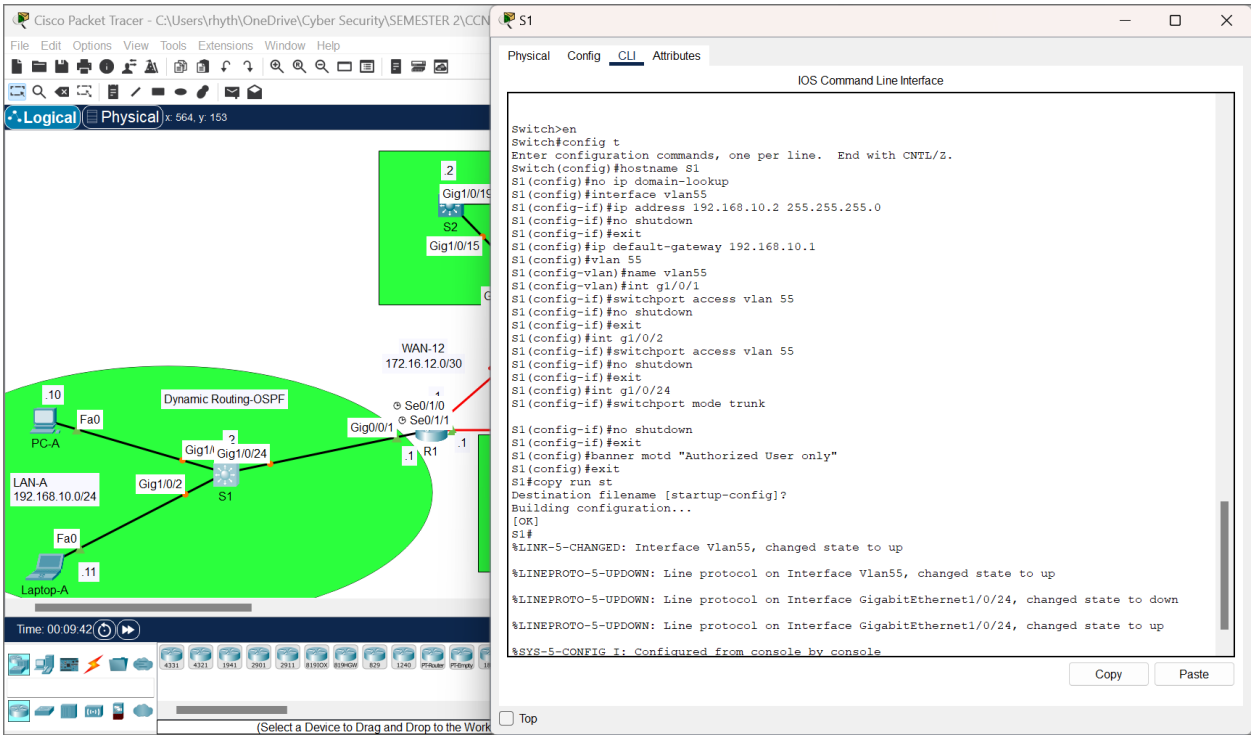
LAPTOP-B



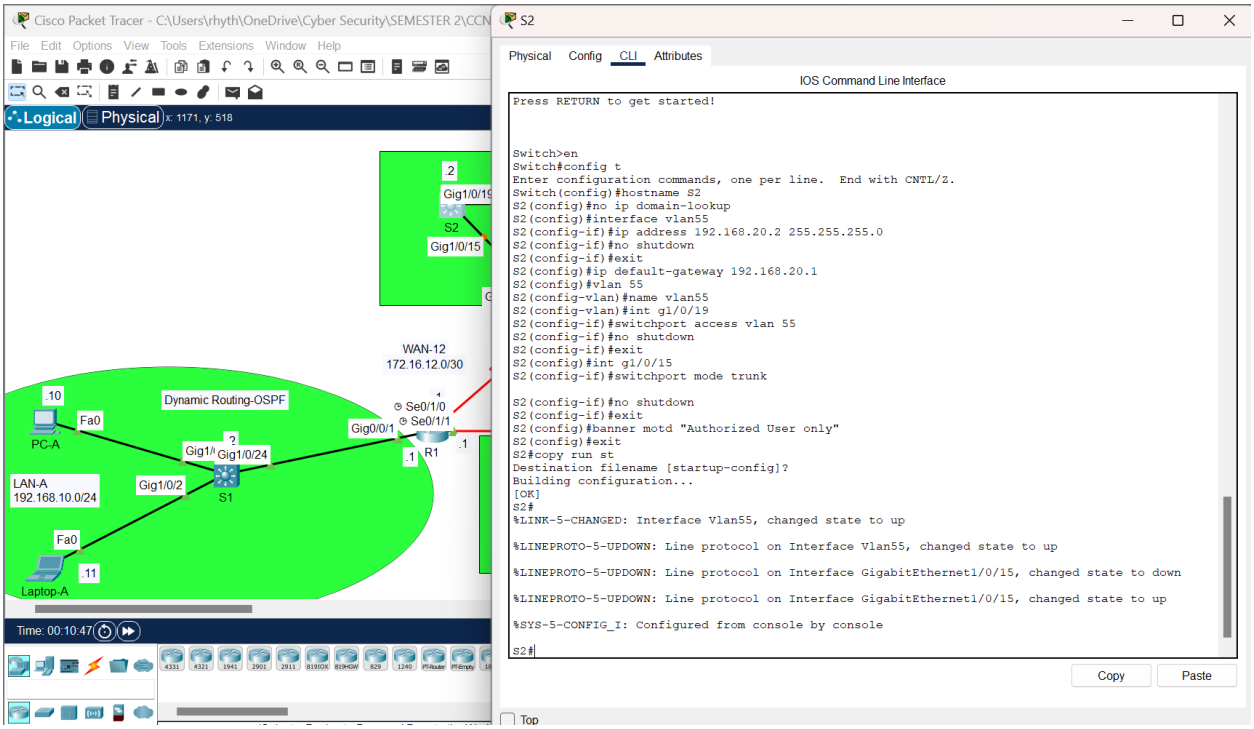
- Configure the following on PCs and laptops appropriately according to the addressing table:
    - IP address
    - Subnet mask
    - Default gateway

Step 3: Configure and verify basic switch settings.

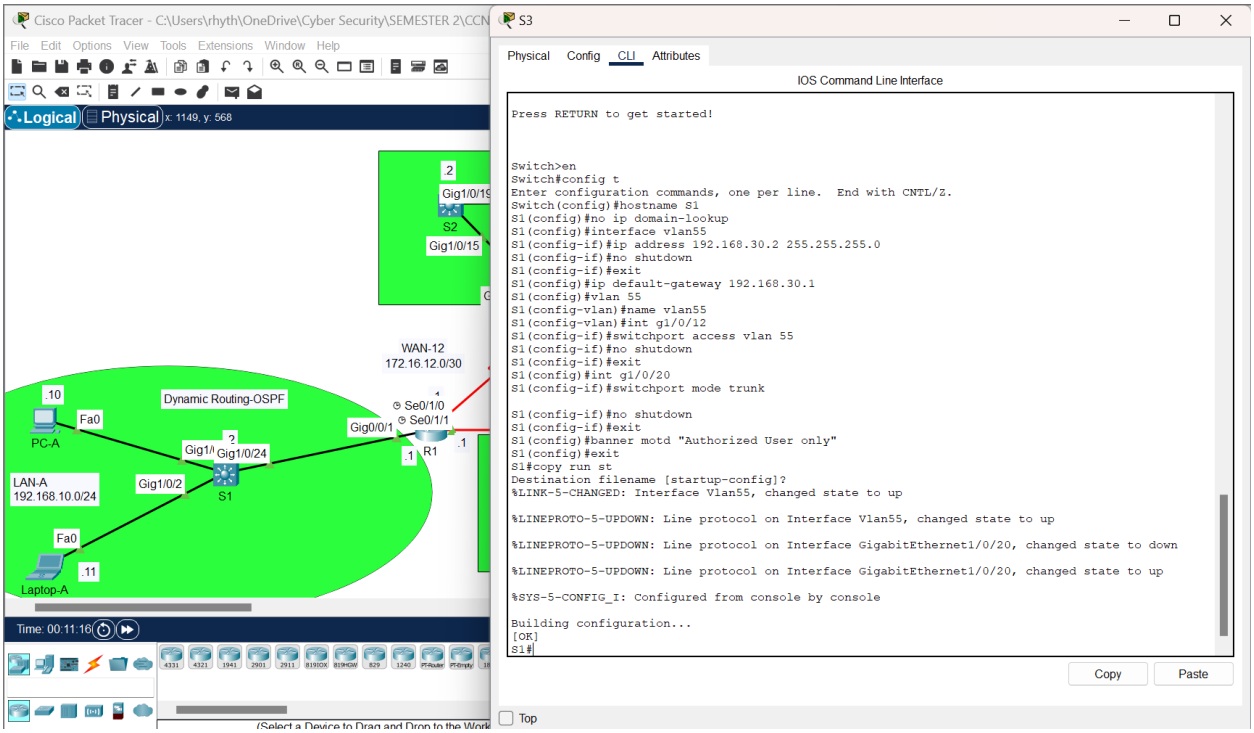
SW1



SW2



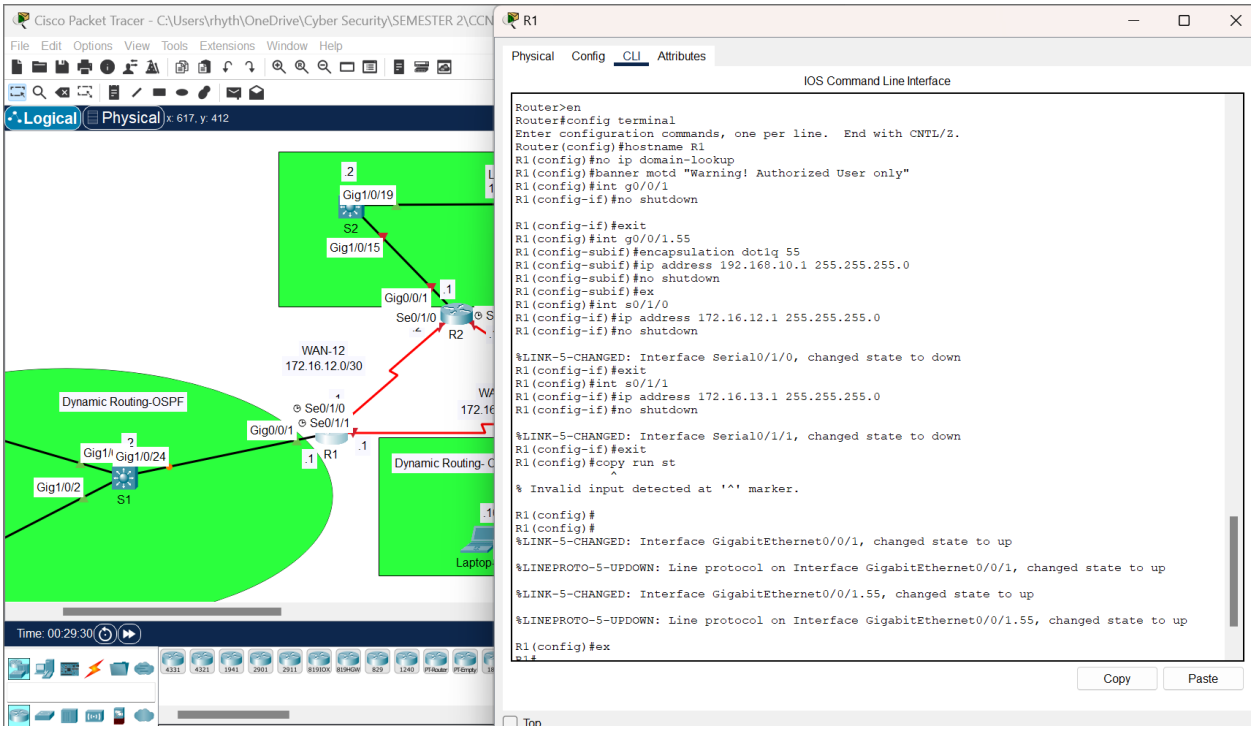
SW3



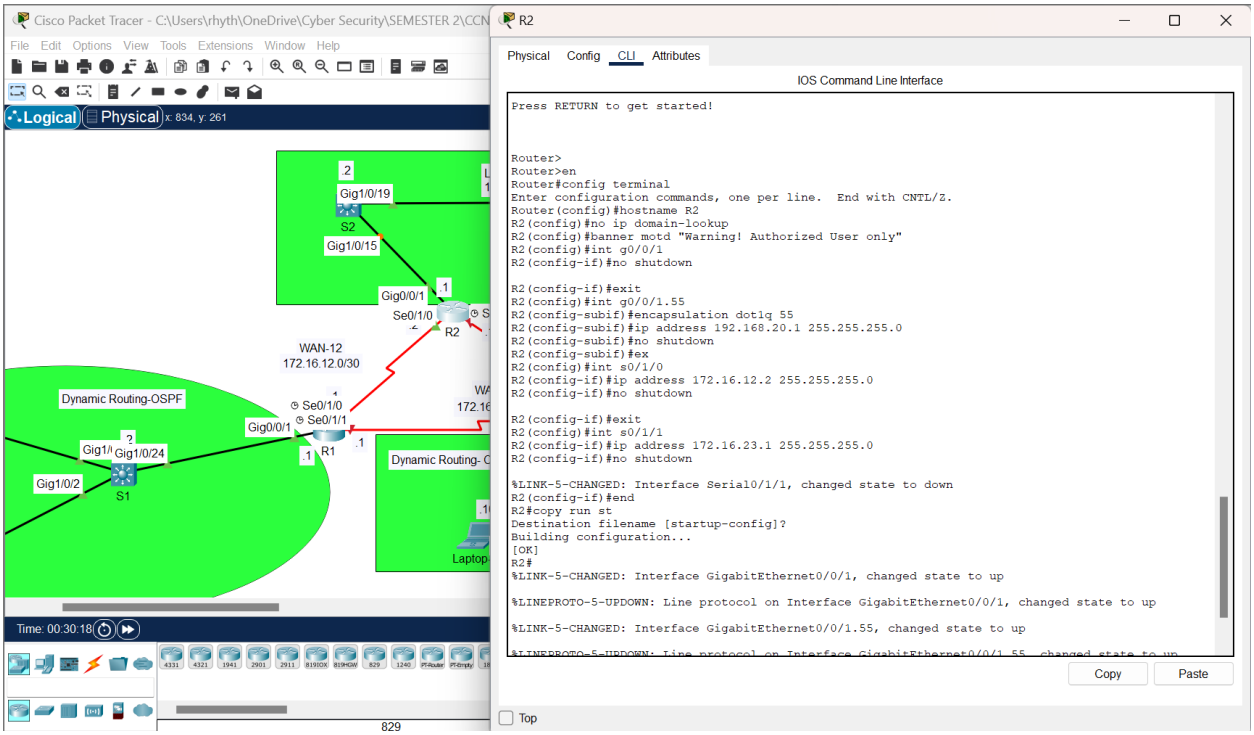
- Console into the switch and enter the global configuration mode:
  - Assign the switch with a name according to the addressing table.
  - Disable unwanted DNS lookup.
  - Configure and activate SVI according to the addressing table.
  - Enter a login MOTD banner to warn about illegal access.
  - Configure default gateway according to the addressing table.
  - Save the configuration.

Step 4: Configure and verify basic router settings.

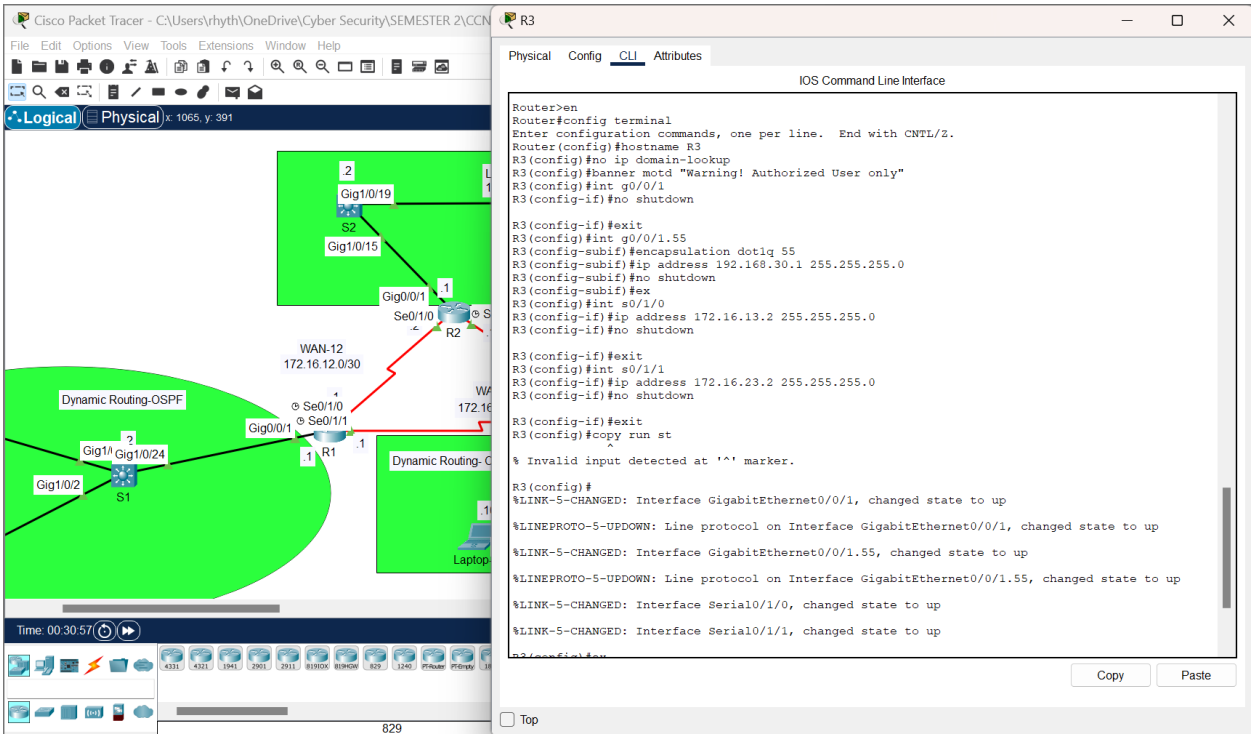
R1



R2



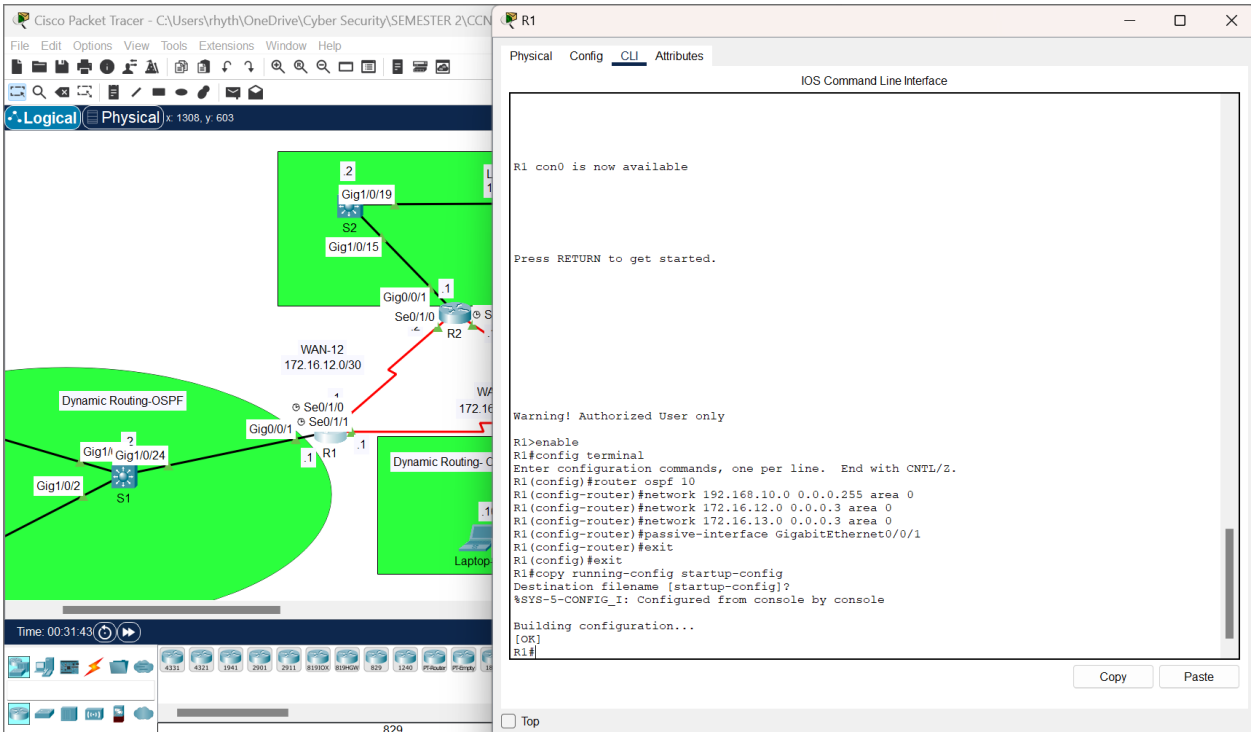
R3



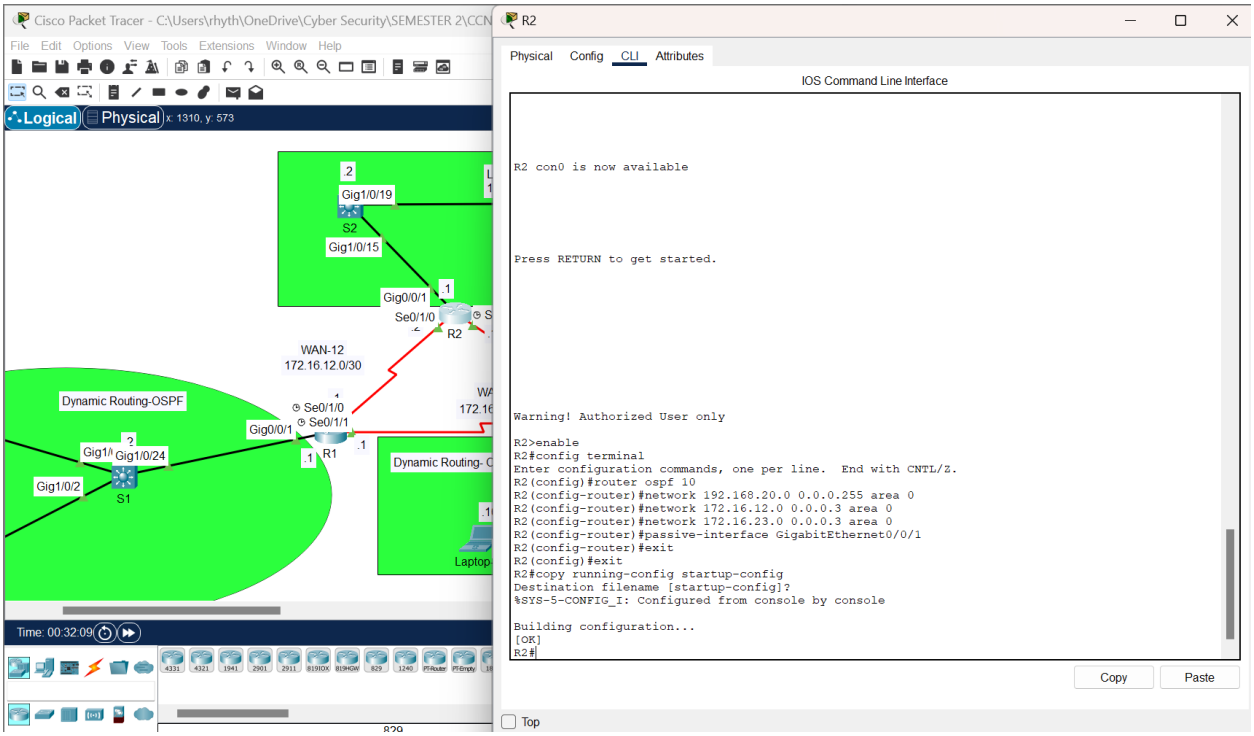
- Console into the router and enter the global configuration mode:
  - Assign the router with a name according to the addressing table.
  - Disable unwanted DNS lookup.
  - Enter a login MOTD banner to warn about illegal access.
  - Configure and activate all interfaces according to the addressing table.
  - Save the configuration.

Step 5: Configure dynamic routing (OSPF) on all routers.

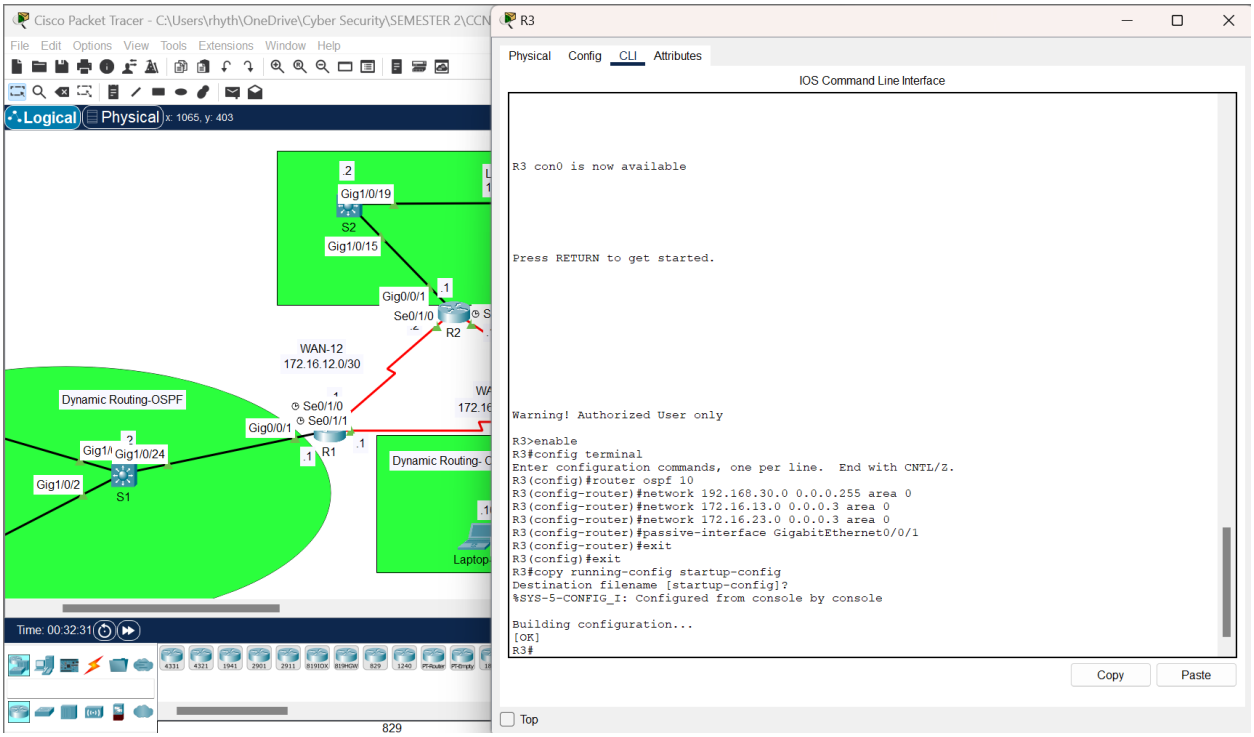
R1



R2



R3

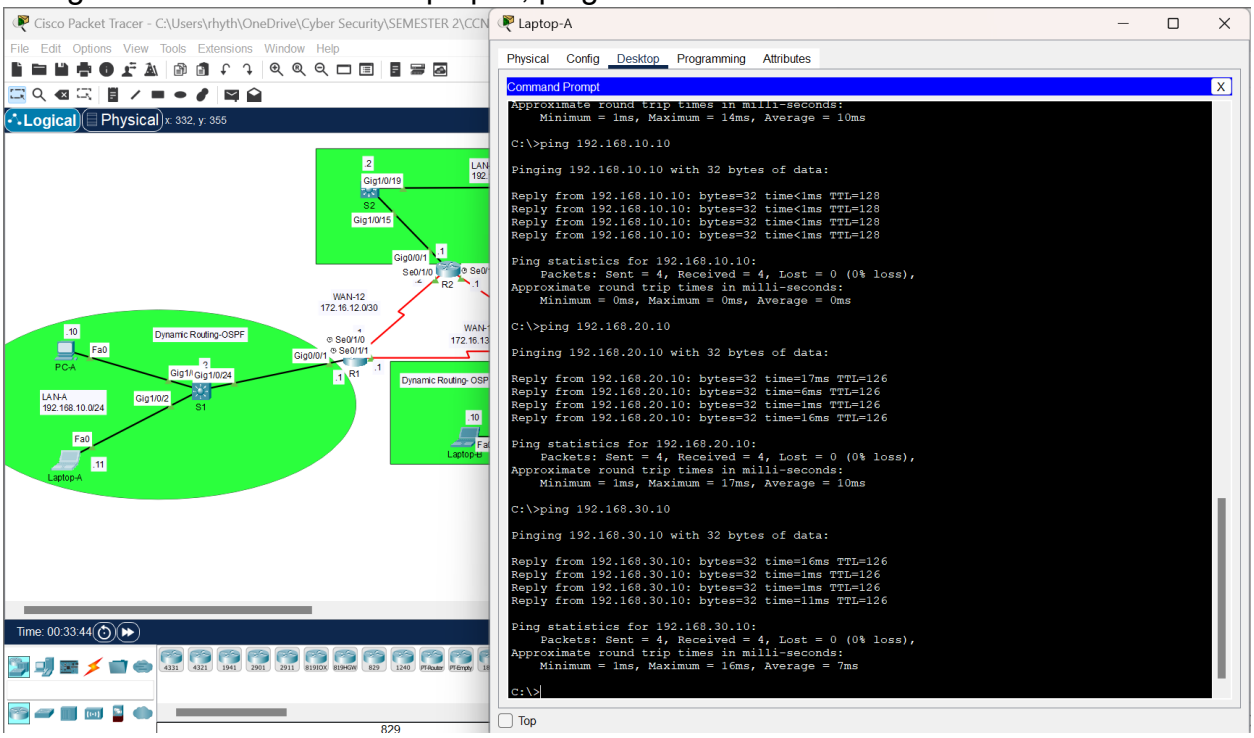
- 

  Enter into OSPF routing mode at (in the case of R1/R2/R3):
  - *enable*
  - *config terminal*
  - *router ospf 10* (10 is the local process id)
- Configure/Advertise all directly connected networks under OSPF with area ID 0.
  - In the case of Router R1:
    - *network 192.168.10.0 0.0.0.255 area 0*
    - *network 172.16.12.0 0.0.0.3 area 0*
    - *network 172.16.13.0 0.0.0.3 area 0*
  - Disable routing updates towards LANs using passive interface command.
  - Save the configuration.
    - *exit*
    - *exit*
    - *copy running-config startup-config*

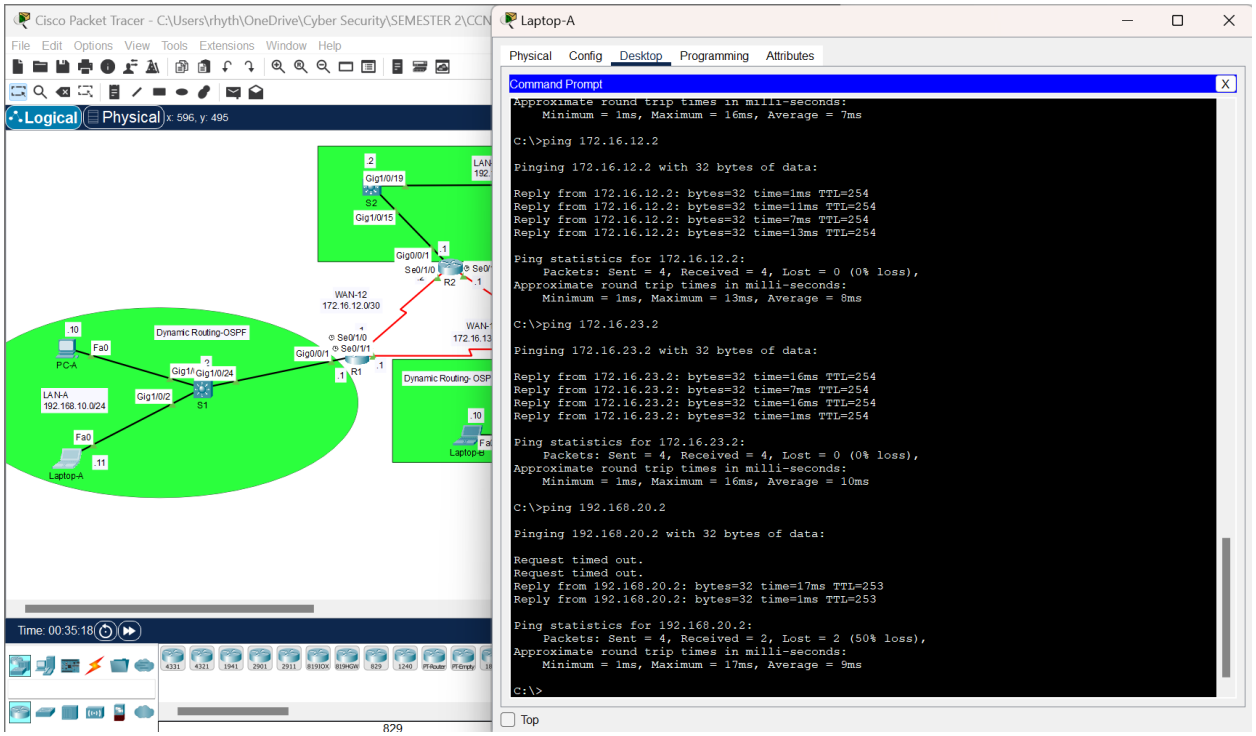
NOTE: Repeat Step 5 above for all the routers. While doing that, make sure to advertise only directly connected networks at each router.

Step 6: Verify network connectivity.

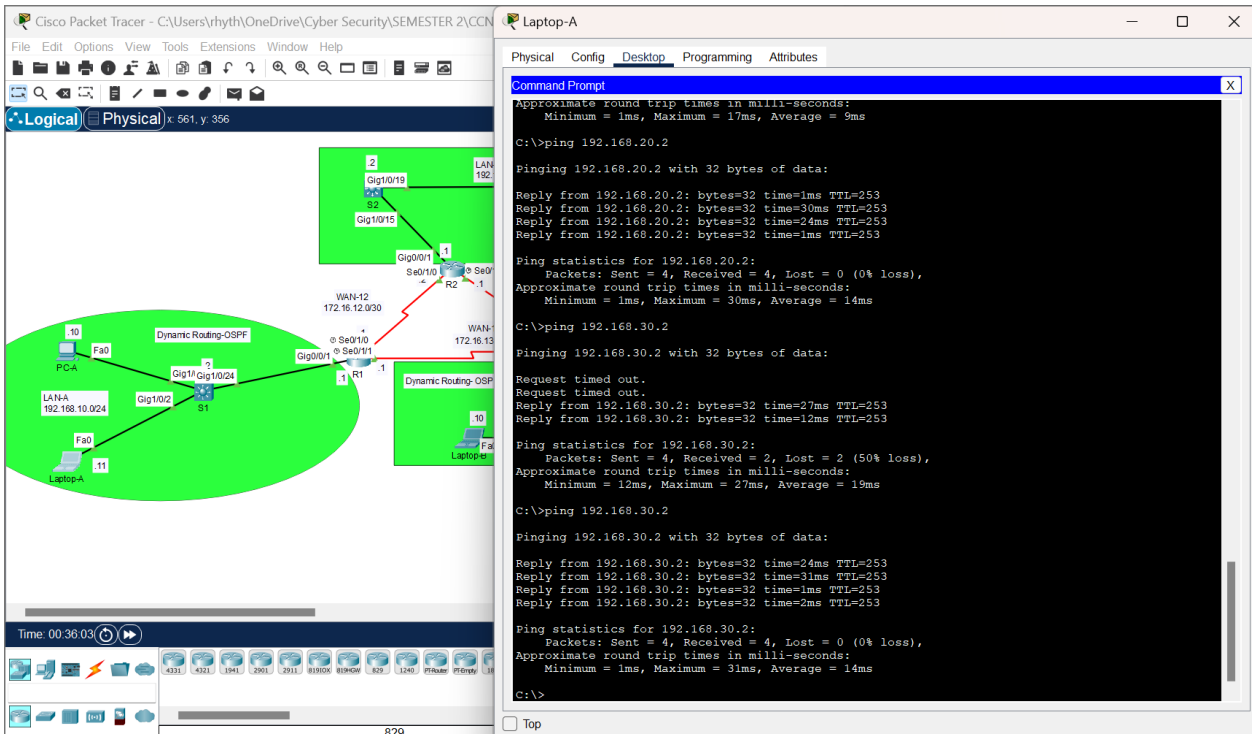
- Using the command line at Laptop-A, ping the IP address of PC-A.
- Using the command line at Laptop-A, ping the IP address of Laptop-B.
- Using the command line at Laptop-A, ping the IP address of PC-B.



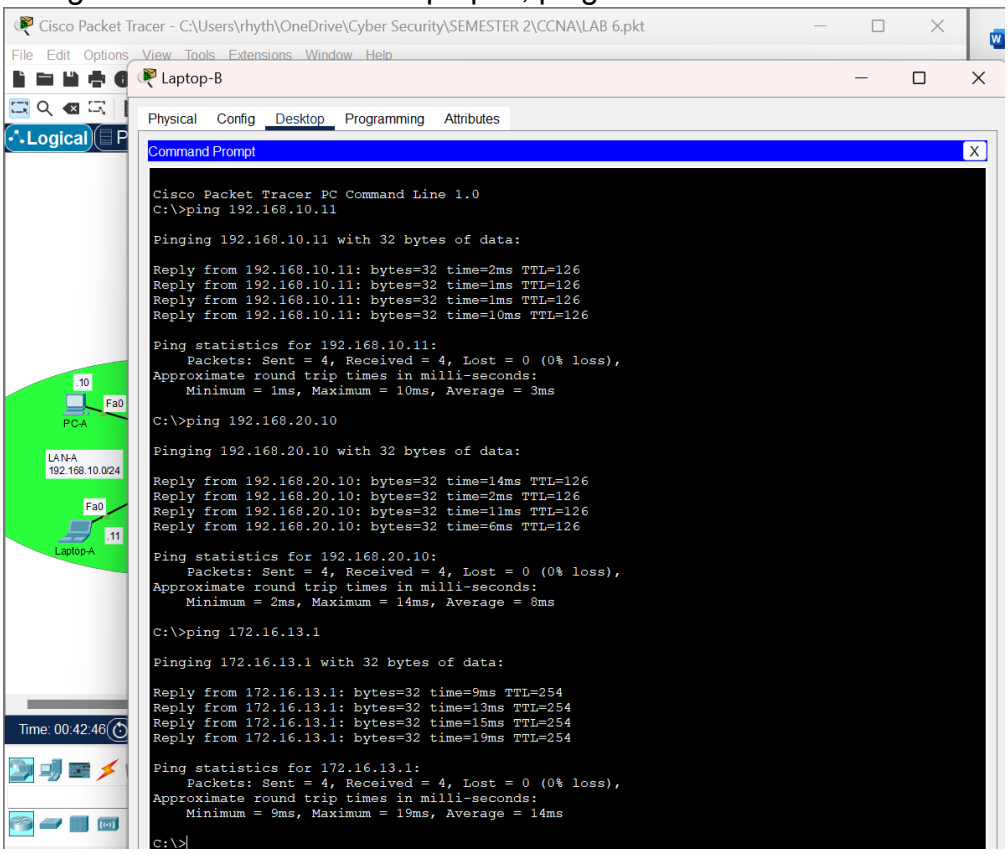
- Using the command line at Laptop-A, ping the IP address of S0/1/0 of R2.
- Using the command line at Laptop-A, ping the IP address of S0/1/1 of R3.



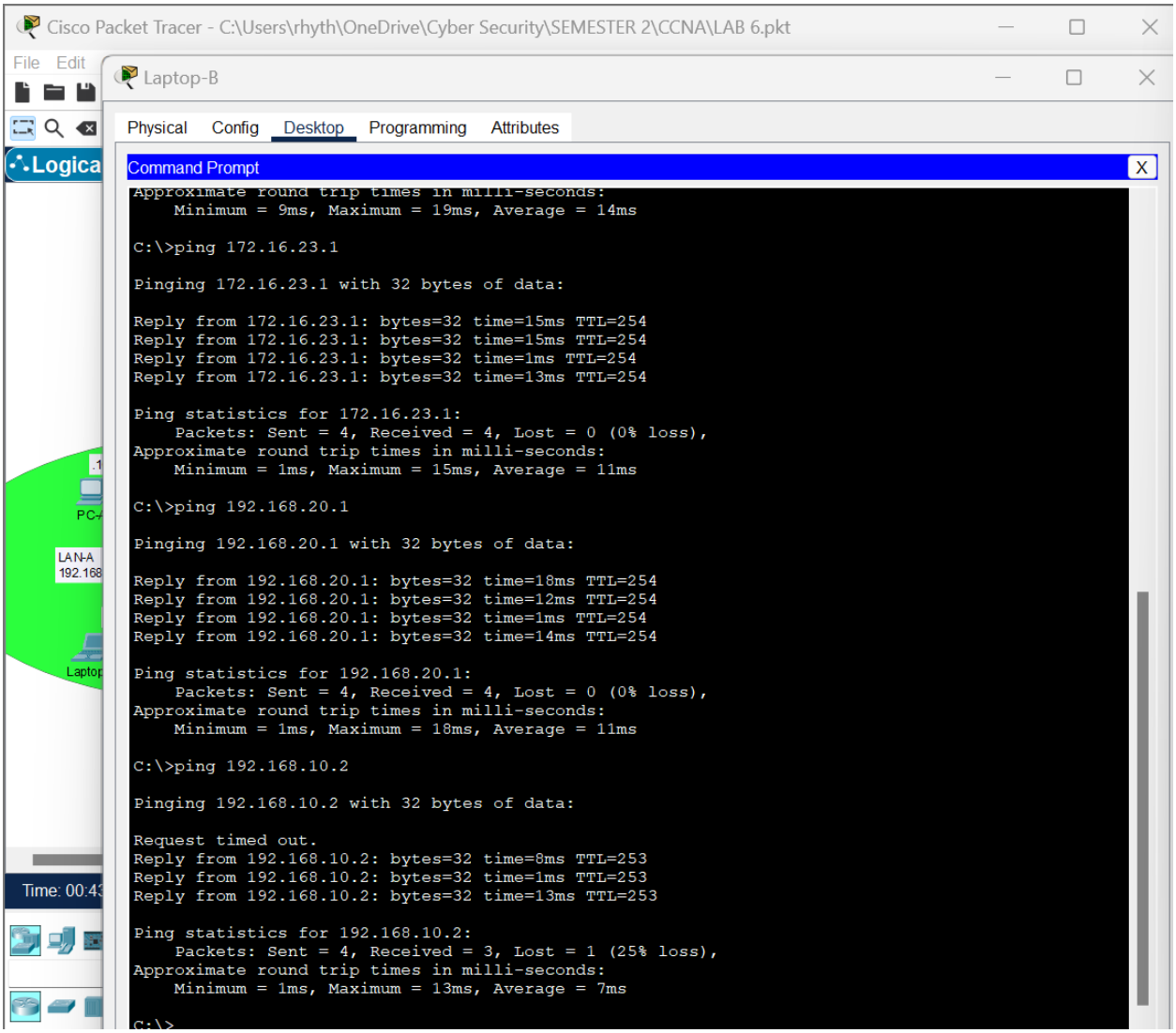
- Using the command line at Laptop-A, ping the IP address of the SVI interface of switch S2.
- Using the command line at Laptop-A, ping the IP address of the SVI interface of switch S3.



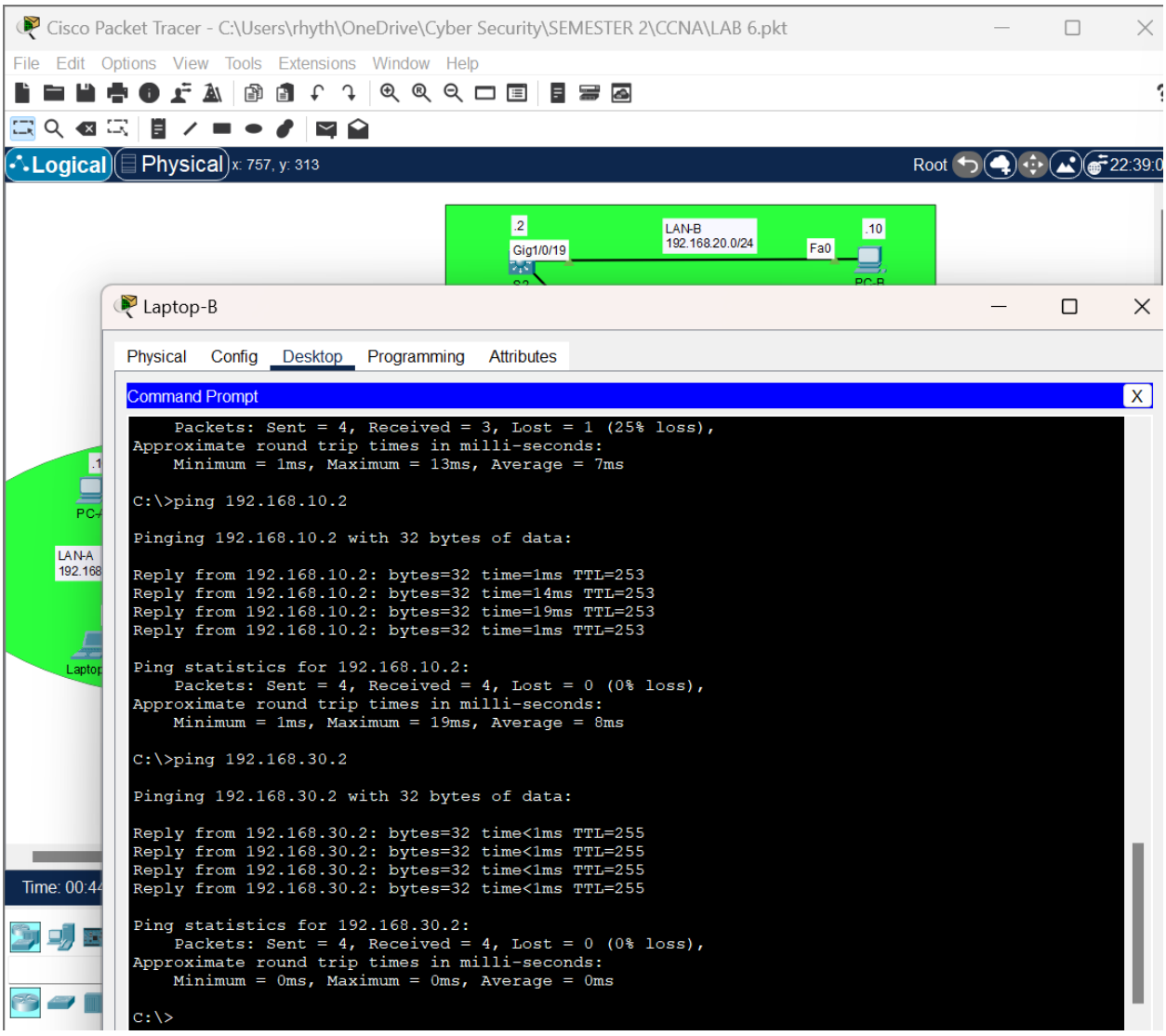
- Using the command line at Laptop-B, ping the IP address of Laptop-A.
- Using the command line at Laptop-B, ping the IP address of PC-B.
- Using the command line at Laptop-B, ping the IP address of S0/1/1 of router R1.



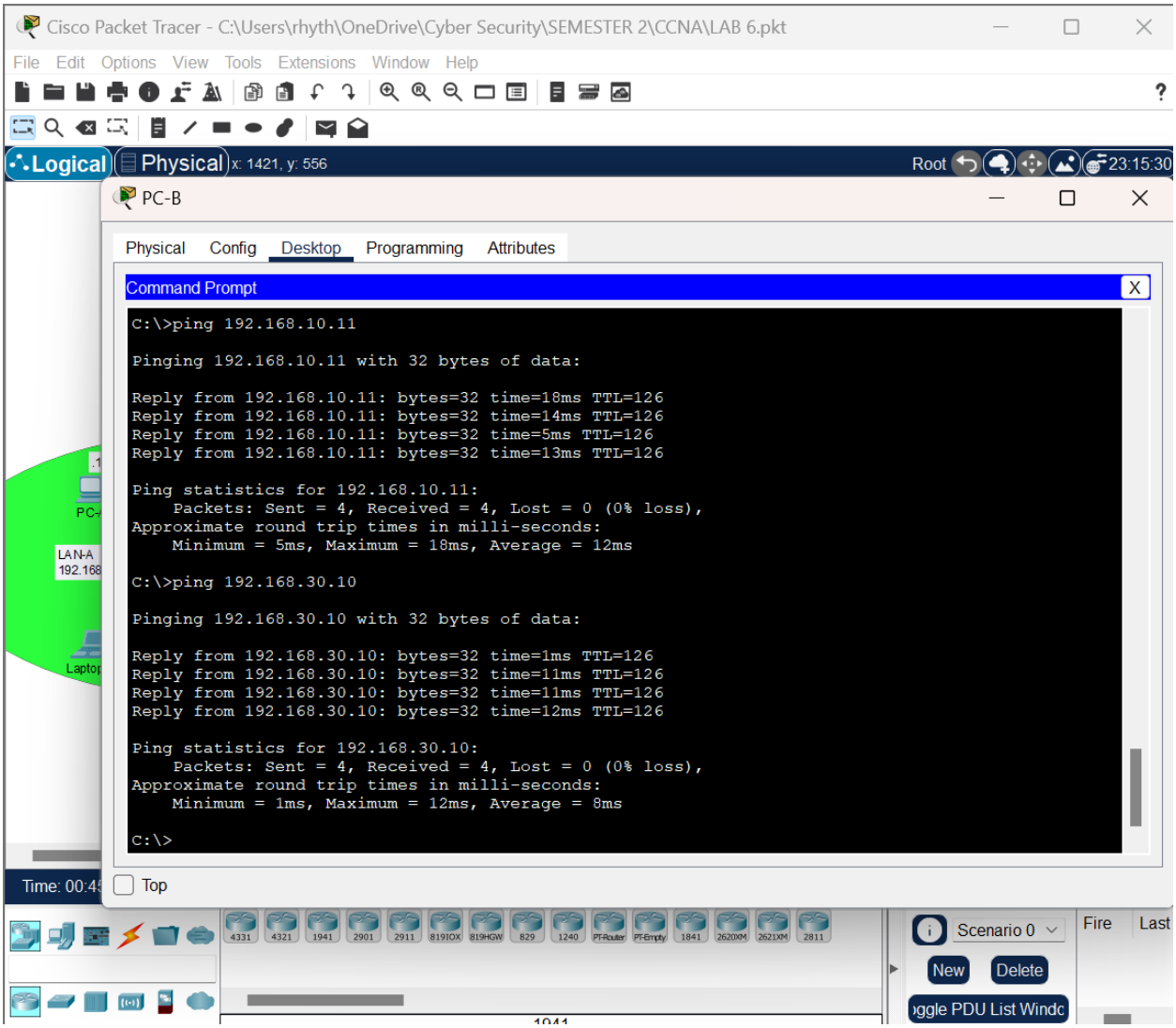
- Using the command line at Laptop-B, ping the IP address of S0/1/1 of router R2.
- Using the command line at Laptop-B, ping the IP address of G0/0/1 of router R2.


Cisco Packet Tracer - C:\Users\rhyth\OneDrive\Cyber Security\SEMESTER 2\CCNA\LAB 6.pkt
File Edit
Laptop-B
Physical Config Desktop Programming Attributes
Command Prompt
Approximate round trip times in milli-seconds:
Minimum = 9ms, Maximum = 19ms, Average = 14ms
C:\>ping 172.16.23.1
Pinging 172.16.23.1 with 32 bytes of data:
Reply from 172.16.23.1: bytes=32 time=15ms TTL=254
Reply from 172.16.23.1: bytes=32 time=15ms TTL=254
Reply from 172.16.23.1: bytes=32 time=1ms TTL=254
Reply from 172.16.23.1: bytes=32 time=13ms TTL=254
Ping statistics for 172.16.23.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 15ms, Average = 11ms
C:\>ping 192.168.20.1
Pinging 192.168.20.1 with 32 bytes of data:
Reply from 192.168.20.1: bytes=32 time=18ms TTL=254
Reply from 192.168.20.1: bytes=32 time=12ms TTL=254
Reply from 192.168.20.1: bytes=32 time=1ms TTL=254
Reply from 192.168.20.1: bytes=32 time=14ms TTL=254
Ping statistics for 192.168.20.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 18ms, Average = 11ms
C:\>ping 192.168.10.2
Pinging 192.168.10.2 with 32 bytes of data:
Request timed out.
Reply from 192.168.10.2: bytes=32 time=8ms TTL=253
Reply from 192.168.10.2: bytes=32 time=1ms TTL=253
Reply from 192.168.10.2: bytes=32 time=13ms TTL=253
Ping statistics for 192.168.10.2:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 13ms, Average = 7ms
C:\>

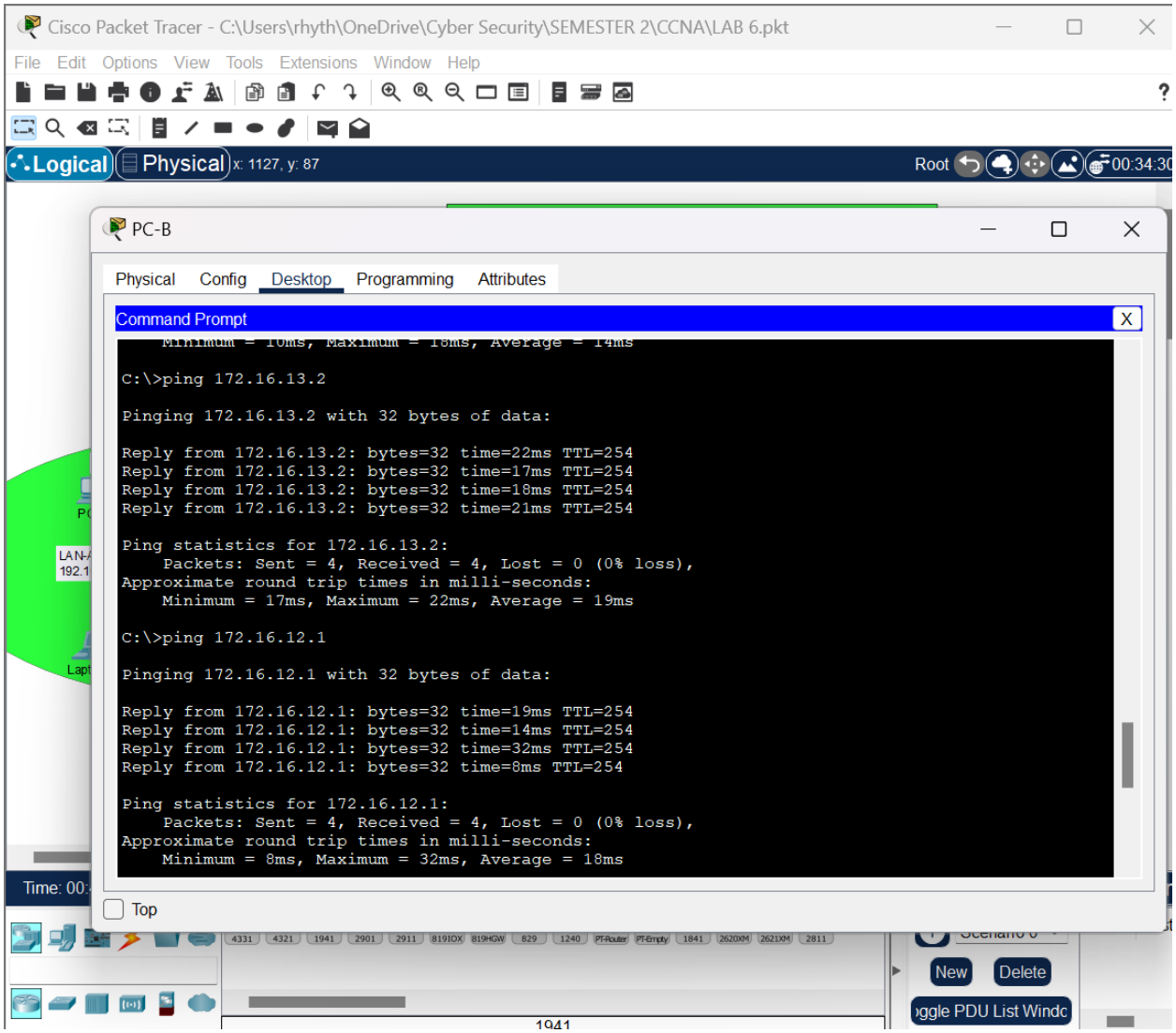
- Using the command line at Laptop-B, ping the IP address of the SVI interface of switch S1.
- Using the command line at Laptop-B, ping the IP address of the SVI interface of switch S3.



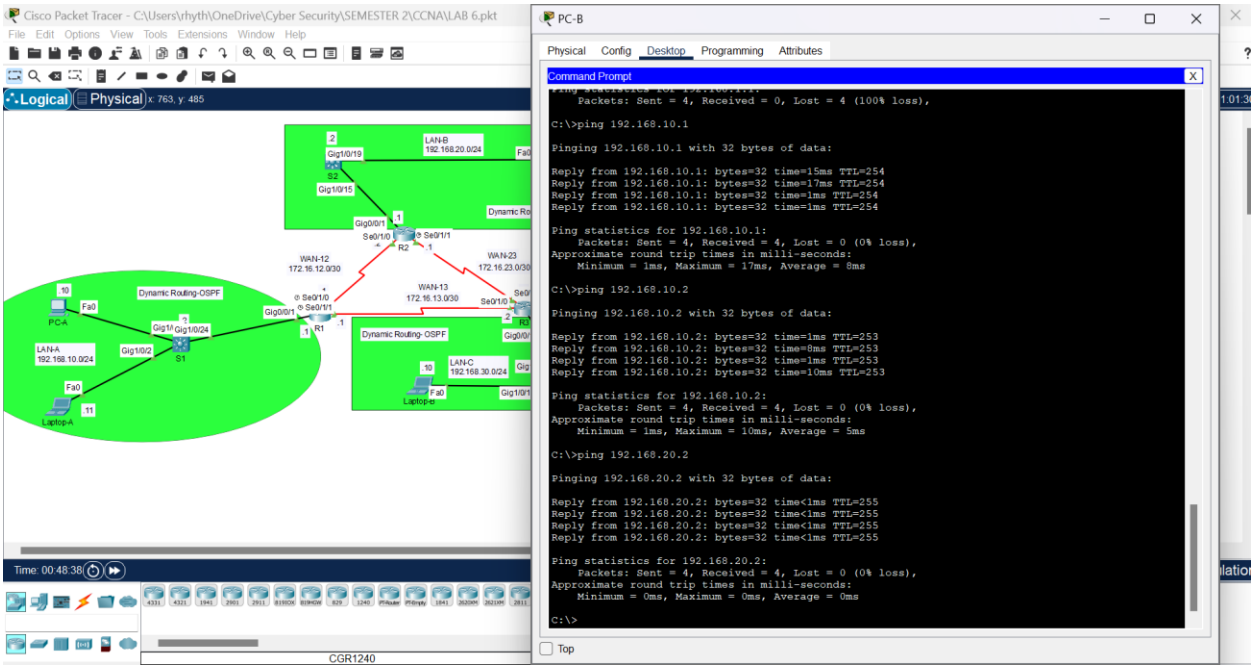
- Using the command line at PC-B, ping the IP address of Laptop-A.
- Using the command line at PC-B, ping the IP address of Laptop-B.



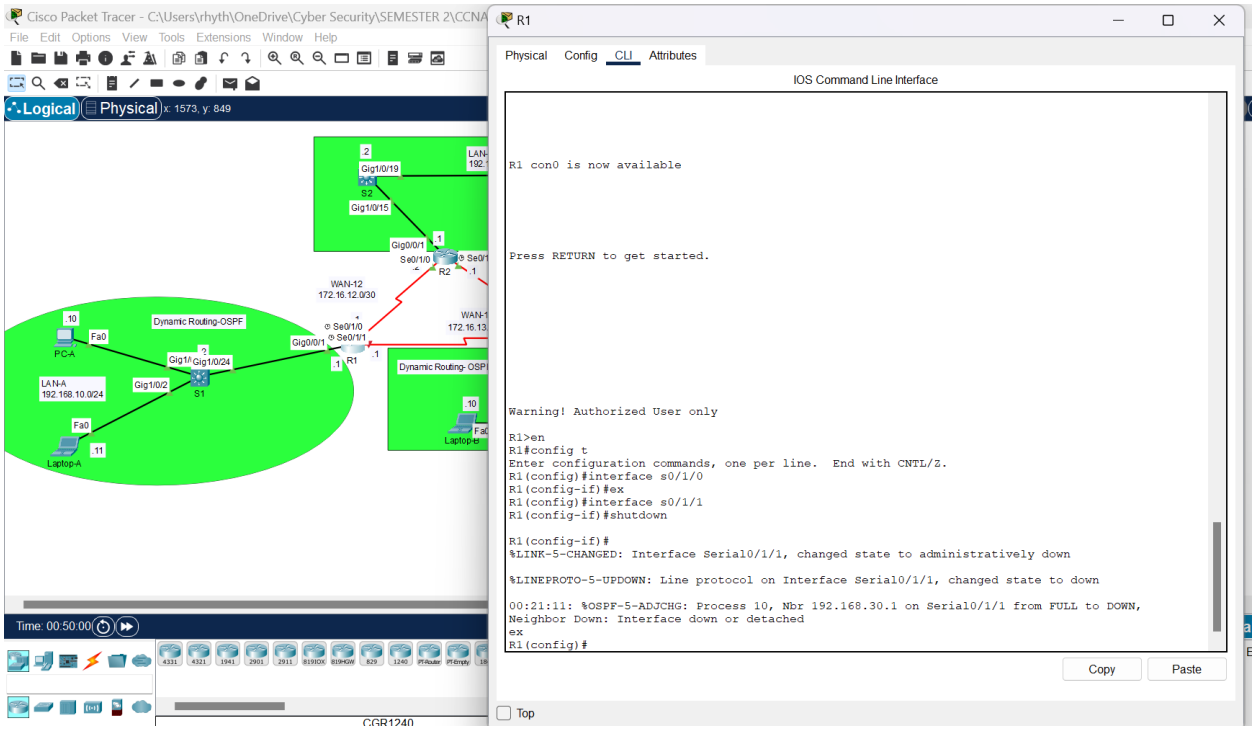
- Using the command line at PC-B, ping the IP address of S0/1/0 of router R3.
- Using the command line at PC-B, ping the IP address of S0/1/0 of router R1.



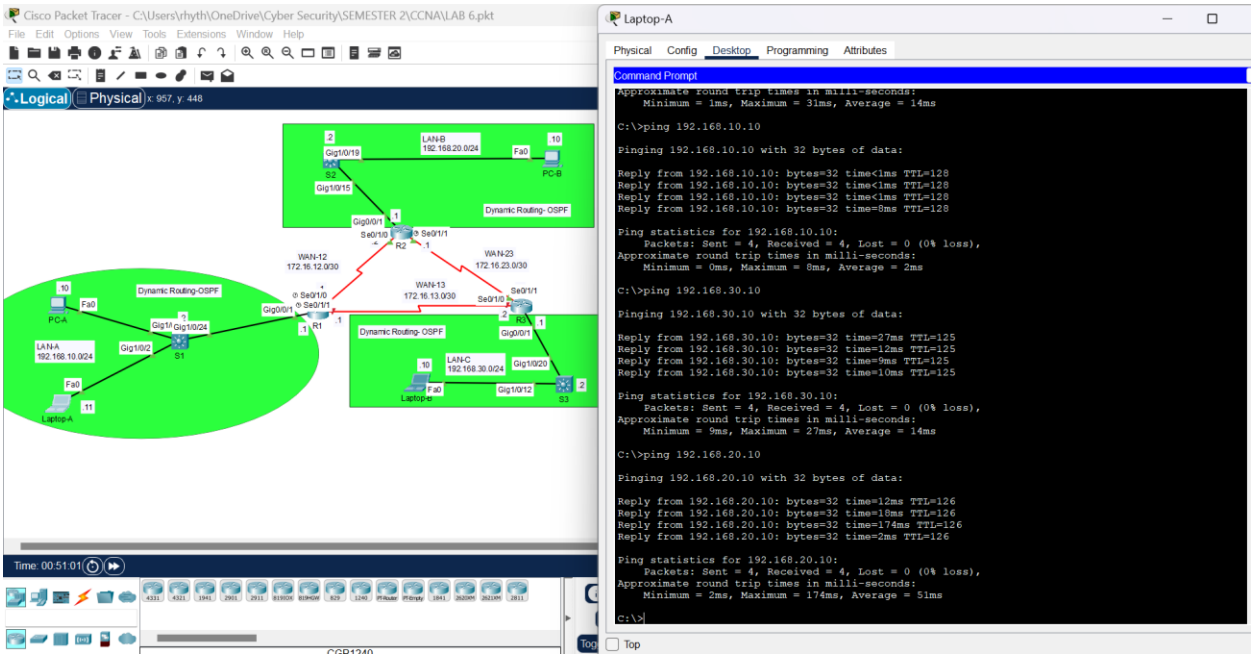
- Using the command line at PC-B, ping the IP address of G0/0/1 of router R1.
- Using the command line at PC-B, ping the IP address of the SVI interface of switch S1.
- Using the command line at PC-BA, ping the IP address of the SVI interface of switch S2.

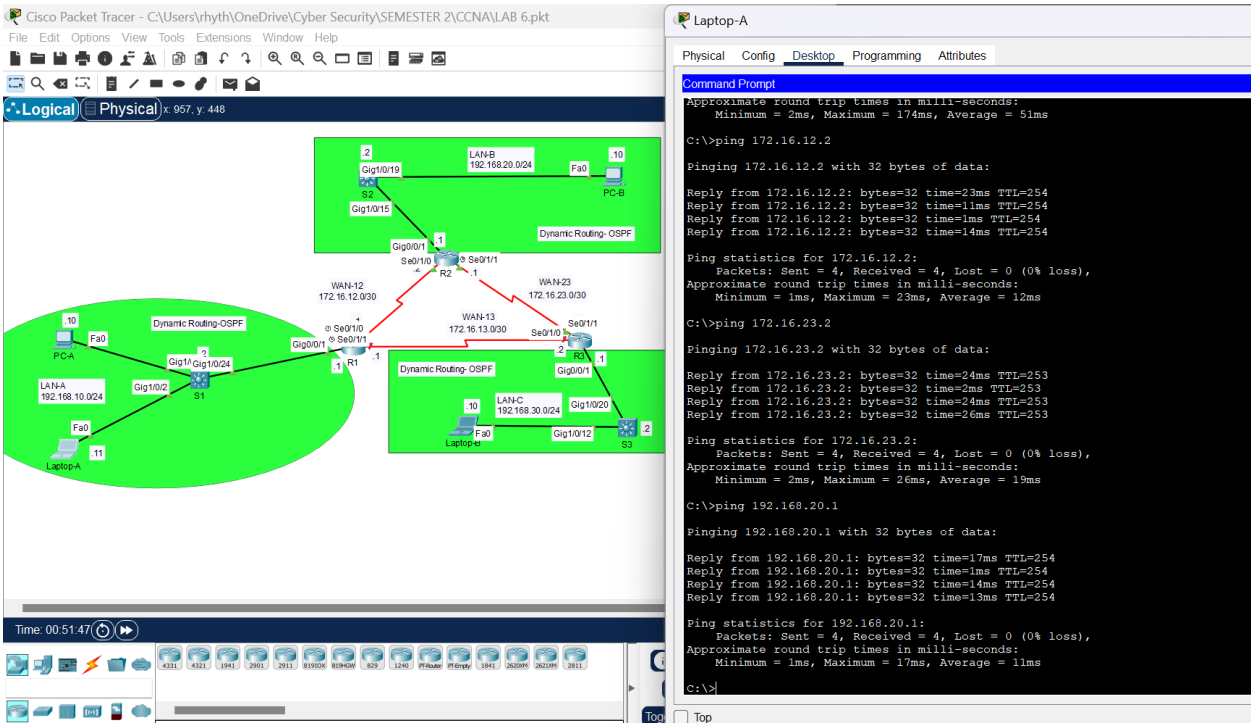

Cisco Packet Tracer - C:\Users\rhyth\OneDrive\Cyber Security\SEMESTER 2\CCNA\LAB 6.pkt
File Edit Options View Tools Extensions Window Help
Logical Physical x: 763, y: 485
LAN-B 192.168.20.0/24
Gig1/0/19
S2
Gig1/0/15
Gig0/0/1
Se0/1/0
R2
Se0/1/1
WAN-12 172.16.12.0/30
WAN-23 172.16.23.0/30
WAN-13 172.16.13.0/30
Dynamic Routing-OSPF
PC-A
Fa0
Gig1/0/24
Gig1/0/2
S1
LAN-A 192.168.10.0/24
R1
Laptop-A
LAN-C 192.168.30.0/24
Laptop-B
Time: 00:48:38
CGR1240
PC-B
Physical Config Desktop Programming Attributes
Command Prompt
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>ping 192.168.10.1
Pinging 192.168.10.1 with 32 bytes of data:
Reply from 192.168.10.1: bytes=32 time=15ms TTL=254
Reply from 192.168.10.1: bytes=32 time=17ms TTL=254
Reply from 192.168.10.1: bytes=32 time=1ms TTL=254
Reply from 192.168.10.1: bytes=32 time=1ms TTL=254
Ping statistics for 192.168.10.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 17ms, Average = 8ms
C:\>ping 192.168.10.2
Pinging 192.168.10.2 with 32 bytes of data:
Reply from 192.168.10.2: bytes=32 time=1ms TTL=253
Reply from 192.168.10.2: bytes=32 time=8ms TTL=253
Reply from 192.168.10.2: bytes=32 time=1ms TTL=253
Reply from 192.168.10.2: bytes=32 time=10ms TTL=253
Ping statistics for 192.168.10.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 10ms, Average = 5ms
C:\>ping 192.168.20.2
Pinging 192.168.20.2 with 32 bytes of data:
Reply from 192.168.20.2: bytes=32 time<1ms TTL=255
Reply from 192.168.20.2: bytes=32 time<1ms TTL=255
Reply from 192.168.20.2: bytes=32 time<1ms TTL=255
Reply from 192.168.20.2: bytes=32 time<1ms TTL=255
Ping statistics for 192.168.20.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
Top

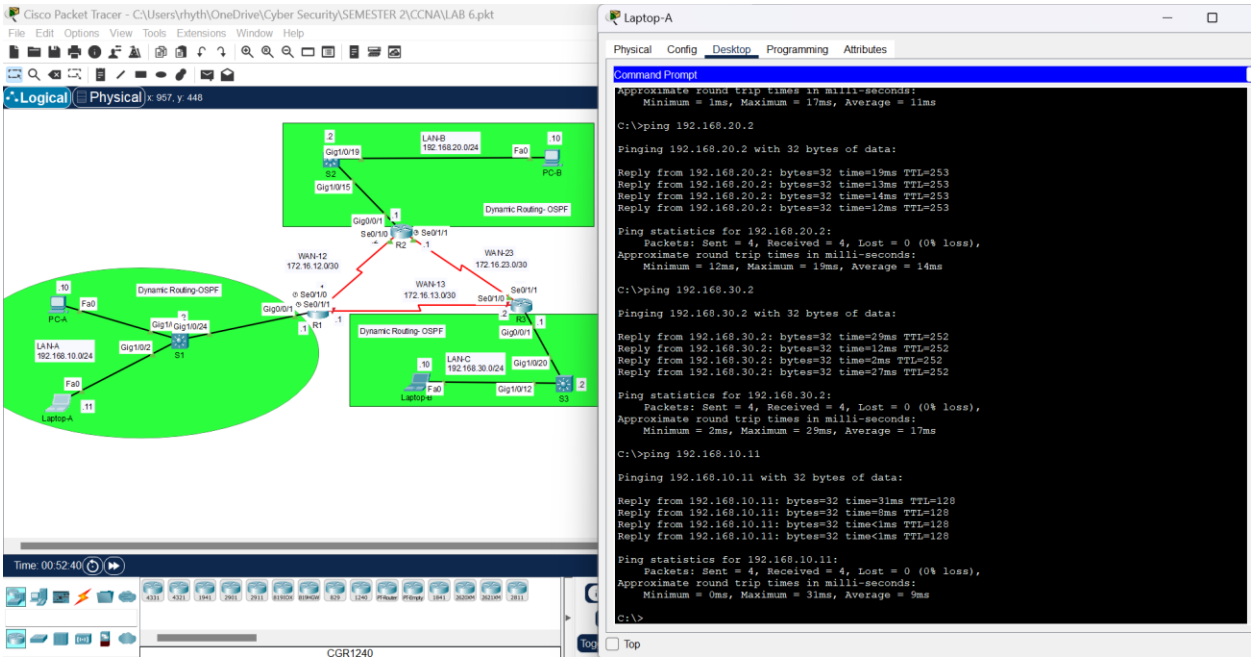
Step 7: Verify the dynamic approach of OSPF routing.

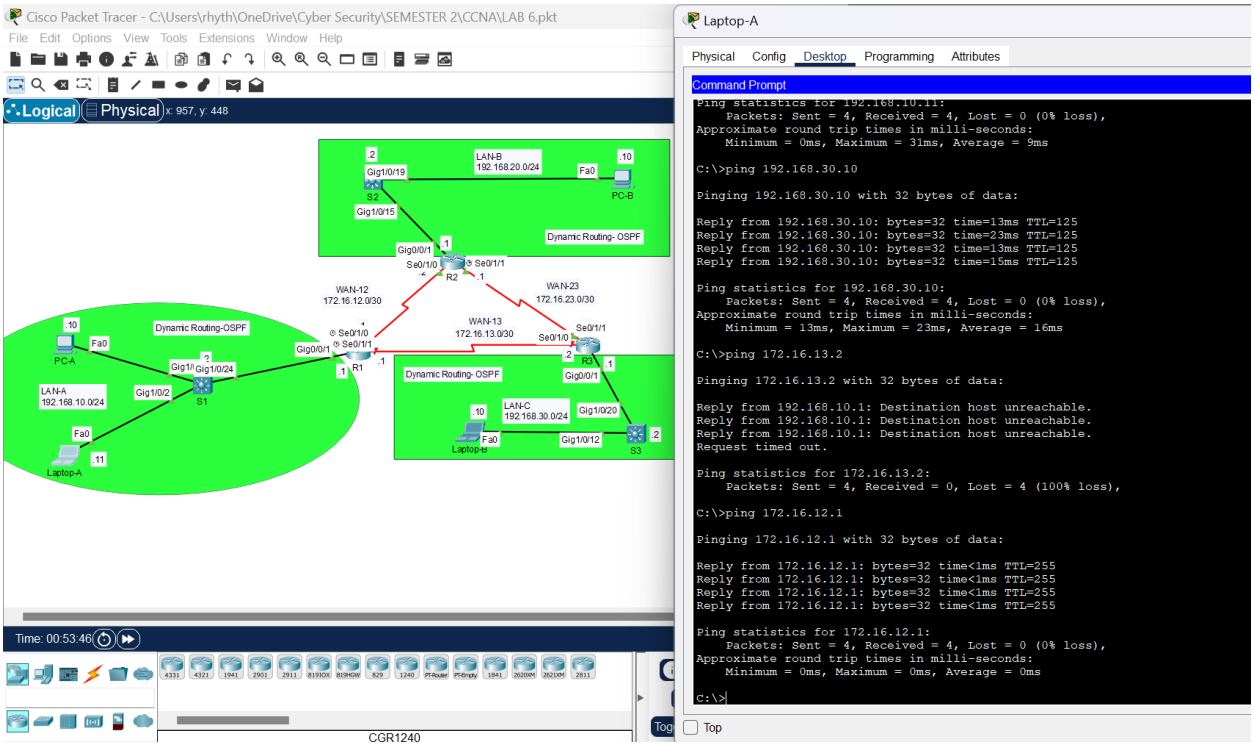


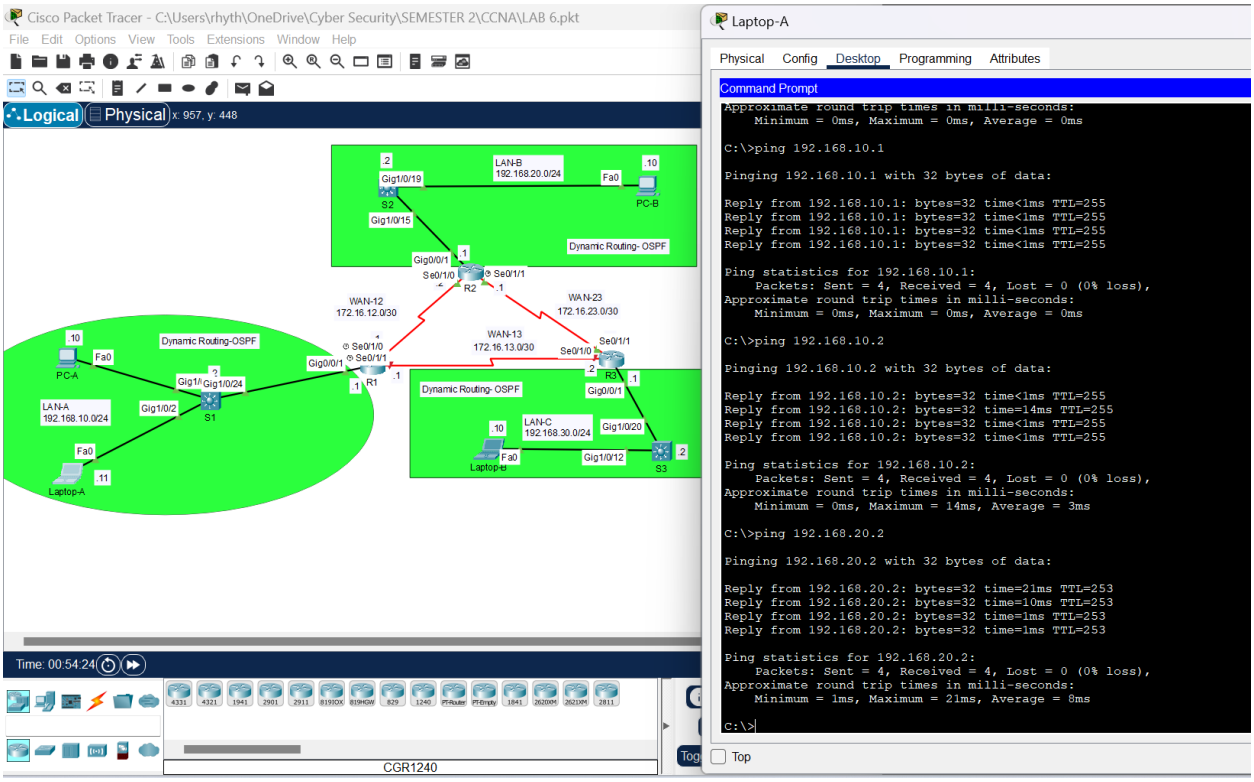
- Shut down the interface S0/1/1 at router R1 and repeat Step 6 above.




Cisco Packet Tracer - C:\Users\rhyth\OneDrive\Cyber Security\SEMESTER 2\CCNA\LAB 6.pkt
File Edit Options View Tools Extensions Window Help
Logical Physical x: 957, y: 448
LAN-B 192.168.20.0/24
Gig1/0/19
Fa0
PC-B
S2
Gig1/0/15
Dynamic Routing- OSPF
Gig0/0/1
Se0/1/0
Se0/1/1
R2
WAN-12 172.16.12.0/30
WAN-23 172.16.23.0/30
WAN-13 172.16.13.0/30
Dynamic Routing-OSPF
PC-A
Gig1/0/24
Gig1/0/2
S1
LAN-A 192.168.10.0/24
Laptop-A
R1
R3
Gig0/0/1
LAN-C 192.168.30.0/24
Gig1/0/20
Gig1/0/12
S3
Time: 00:51:47
Laptop-A
Physical Config Desktop Programming Attributes
Command Prompt
Approximate round trip times in milli-seconds:
Minimum = 2ms, Maximum = 174ms, Average = 51ms
C:\>ping 172.16.12.2
Pinging 172.16.12.2 with 32 bytes of data:
Reply from 172.16.12.2: bytes=32 time=23ms TTL=254
Reply from 172.16.12.2: bytes=32 time=11ms TTL=254
Reply from 172.16.12.2: bytes=32 time=1ms TTL=254
Reply from 172.16.12.2: bytes=32 time=14ms TTL=254
Ping statistics for 172.16.12.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 23ms, Average = 12ms
C:\>ping 172.16.23.2
Pinging 172.16.23.2 with 32 bytes of data:
Reply from 172.16.23.2: bytes=32 time=24ms TTL=253
Reply from 172.16.23.2: bytes=32 time=2ms TTL=253
Reply from 172.16.23.2: bytes=32 time=24ms TTL=253
Reply from 172.16.23.2: bytes=32 time=26ms TTL=253
Ping statistics for 172.16.23.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 2ms, Maximum = 26ms, Average = 19ms
C:\>ping 192.168.20.1
Pinging 192.168.20.1 with 32 bytes of data:
Reply from 192.168.20.1: bytes=32 time=17ms TTL=254
Reply from 192.168.20.1: bytes=32 time=1ms TTL=254
Reply from 192.168.20.1: bytes=32 time=14ms TTL=254
Reply from 192.168.20.1: bytes=32 time=13ms TTL=254
Ping statistics for 192.168.20.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 17ms, Average = 11ms
C:\>
Top


Cisco Packet Tracer - C:\Users\rhyth\OneDrive\Cyber Security\SEMESTER 2\CCNA\LAB 6.pkt
File Edit Options View Tools Extensions Window Help
Logical Physical x: 957, y: 448
LAN-B 192.168.20.0/24
Gig1/0/19
Fa0
PC-B
S2
Gig1/0/15
Dynamic Routing- OSPF
Gig0/0/1
Se0/1/0
Se0/1/1
R2
WAN-12 172.16.12.0/30
WAN-23 172.16.23.0/30
WAN-13 172.16.13.0/30
Dynamic Routing-OSPF
PC-A
Gig1/0/24
Gig1/0/2
S1
LAN-A 192.168.10.0/24
Laptop-A
R1
R3
Gig0/0/1
LAN-C 192.168.30.0/24
Gig1/0/20
Gig1/0/12
S3
Time: 00:52:40
CGR1240
Laptop-A
Physical Config Desktop Programming Attributes
Command Prompt
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 17ms, Average = 11ms
C:\>ping 192.168.20.2
Pinging 192.168.20.2 with 32 bytes of data:
Reply from 192.168.20.2: bytes=32 time=19ms TTL=253
Reply from 192.168.20.2: bytes=32 time=13ms TTL=253
Reply from 192.168.20.2: bytes=32 time=14ms TTL=253
Reply from 192.168.20.2: bytes=32 time=12ms TTL=253
Ping statistics for 192.168.20.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 12ms, Maximum = 19ms, Average = 14ms
C:\>ping 192.168.30.2
Pinging 192.168.30.2 with 32 bytes of data:
Reply from 192.168.30.2: bytes=32 time=29ms TTL=252
Reply from 192.168.30.2: bytes=32 time=12ms TTL=252
Reply from 192.168.30.2: bytes=32 time=2ms TTL=252
Reply from 192.168.30.2: bytes=32 time=27ms TTL=252
Ping statistics for 192.168.30.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 2ms, Maximum = 29ms, Average = 17ms
C:\>ping 192.168.10.11
Pinging 192.168.10.11 with 32 bytes of data:
Reply from 192.168.10.11: bytes=32 time=31ms TTL=128
Reply from 192.168.10.11: bytes=32 time=8ms TTL=128
Reply from 192.168.10.11: bytes=32 time<1ms TTL=128
Reply from 192.168.10.11: bytes=32 time<1ms TTL=128
Ping statistics for 192.168.10.11:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 31ms, Average = 9ms
C:\>
Top





NOTE: All pings mentioned in Step 6 will still be successful except the following:

- When trying to ping the interface S0/1/1 at Router R1 because the link between Router R1 and R3 is down.

- When trying to ping the interface S0/1/0 at Router R3 because the link between Router R1 and R3 is down.