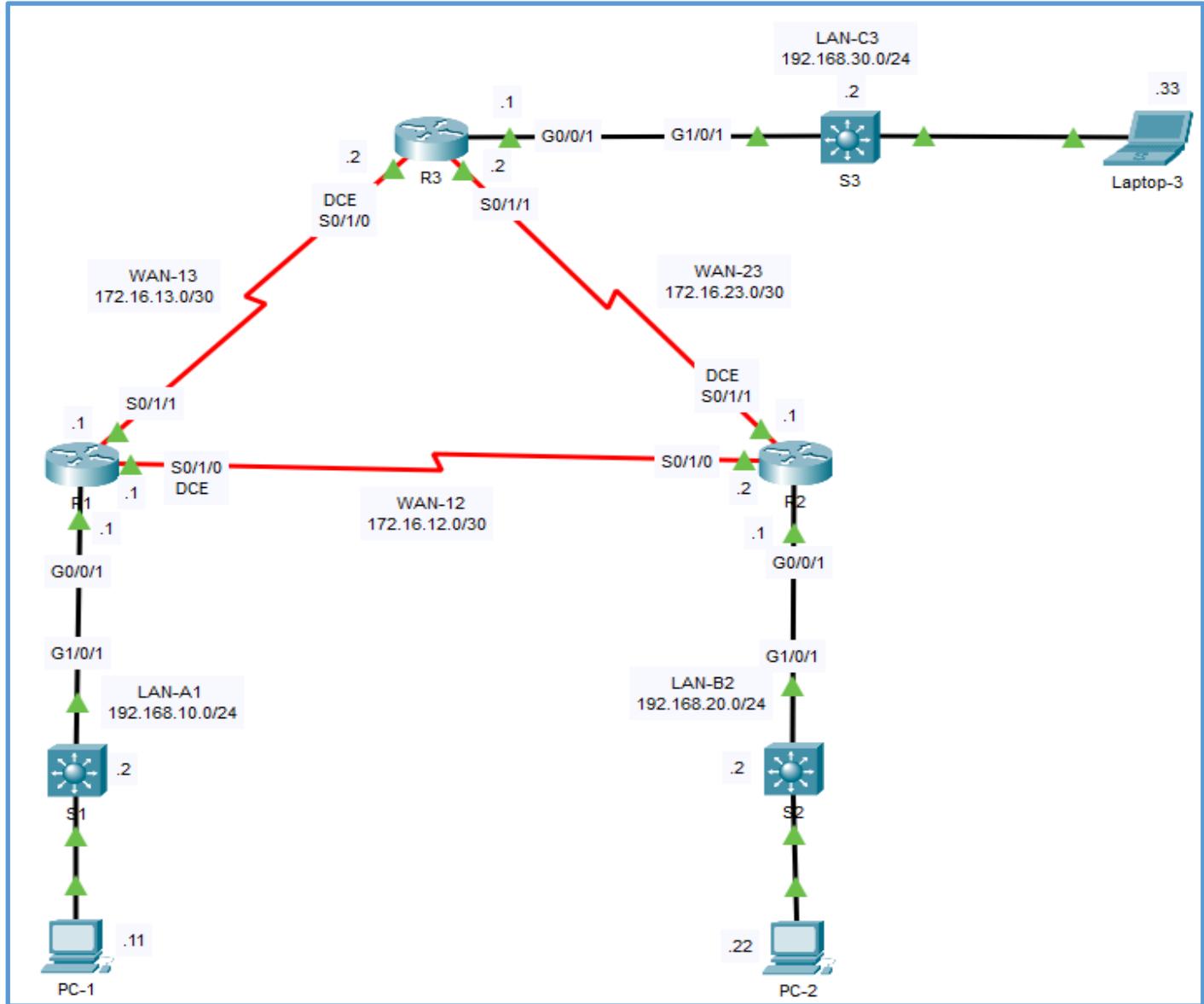


### Lab Activity – IP Routing (Static/Manual):

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



### Required Resources:

- Three Layer-3/Multilayer Switch (Cisco Catalyst 1000 Series with Cisco IOS Release 15.1+ image)
- Three Routers (Cisco 4221 with Cisco IOS Release 17.6+ image)
- One Laptop (Windows with Terminal Emulation Program)
- Two Desktops (Windows with Terminal Emulation Program)
- Cables:

- Console cables to configure the Cisco IOS devices through the console port.
- Ethernet cables as shown in the topology.

Addressing Table:

Device	Interface	IP Address	Subnet Mask / CIDR	Default Gateway
S1	VLAN1	192.168.10.2	255.255.255.0	192.168.10.1
S2	VLAN1	192.168.20.2	255.255.255.0	192.168.20.1
S3	VLAN1	192.168.30.2	255.255.255.0	192.168.30.1
R1	G0/0/1	192.168.10.1	255.255.255.0 or /24	N/A
	S0/1/0	172.16.12.1	/30	N/A
	S0/1/1	172.16.13.1	/30	N/A
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	
	S0/1/0	172.16.13.2	/30	N/A
	S0/1/1	172.16.23.2	/30	N/A
PC-1	NIC	DHCP Client (Local DHCP Server)		
PC-2	NIC	DHCP Client (Remote DHCP Server)		
Laptop-3	NIC	DHCP Client (Local DHCP Server)		

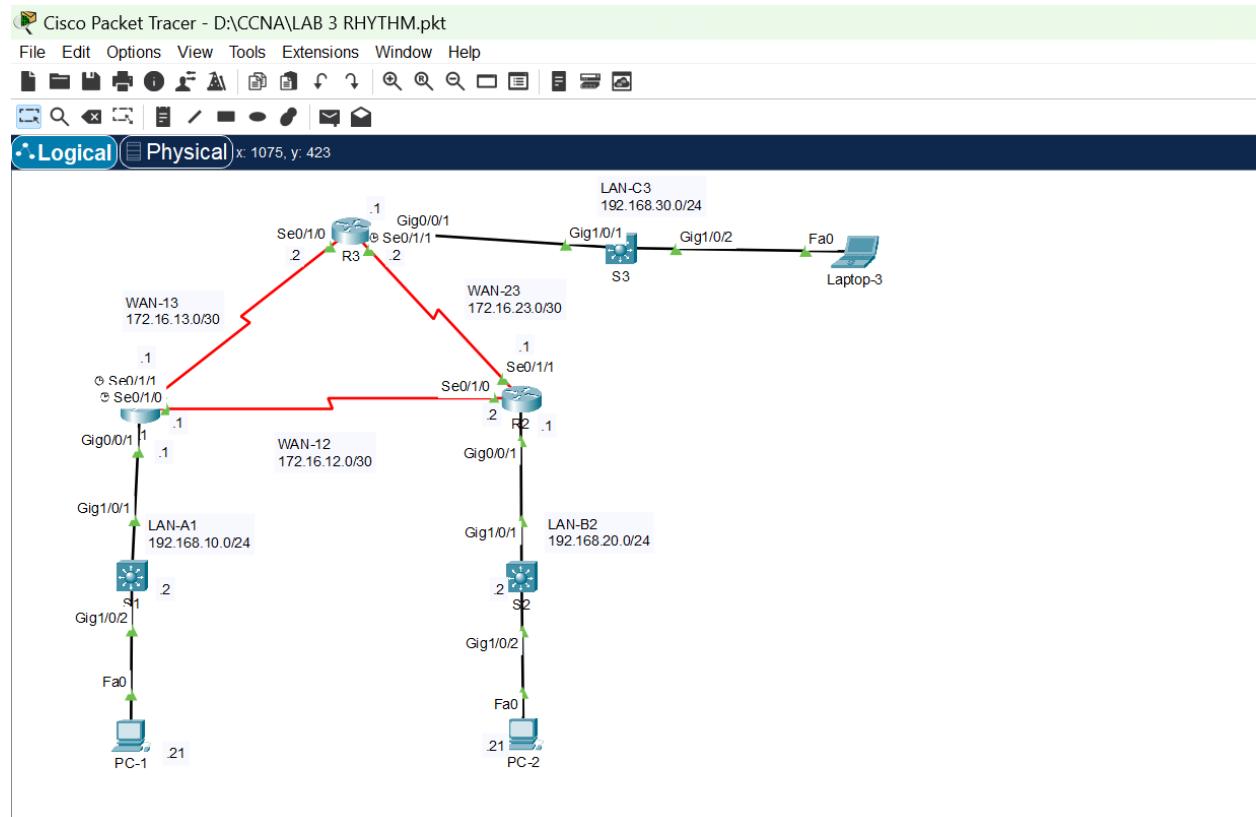
Lab Description:

- In this lab, please build a LAN and WAN based simple network.
  - LAN-A1 with one switch and one host.
  - LAN-B2 with one switch and one host.
  - LAN-C3 with one switch and one host.
  - Three WANs with three routers.
- You are also required to do basic configuration on the following devices:
  - Switch:
    - Hostnames, SVI, default gateway, DNS lookup (disable), and so on.
  - Routers:
    - Hostnames, IP addressing, DNS lookup (disable), and so on.

## Solution:

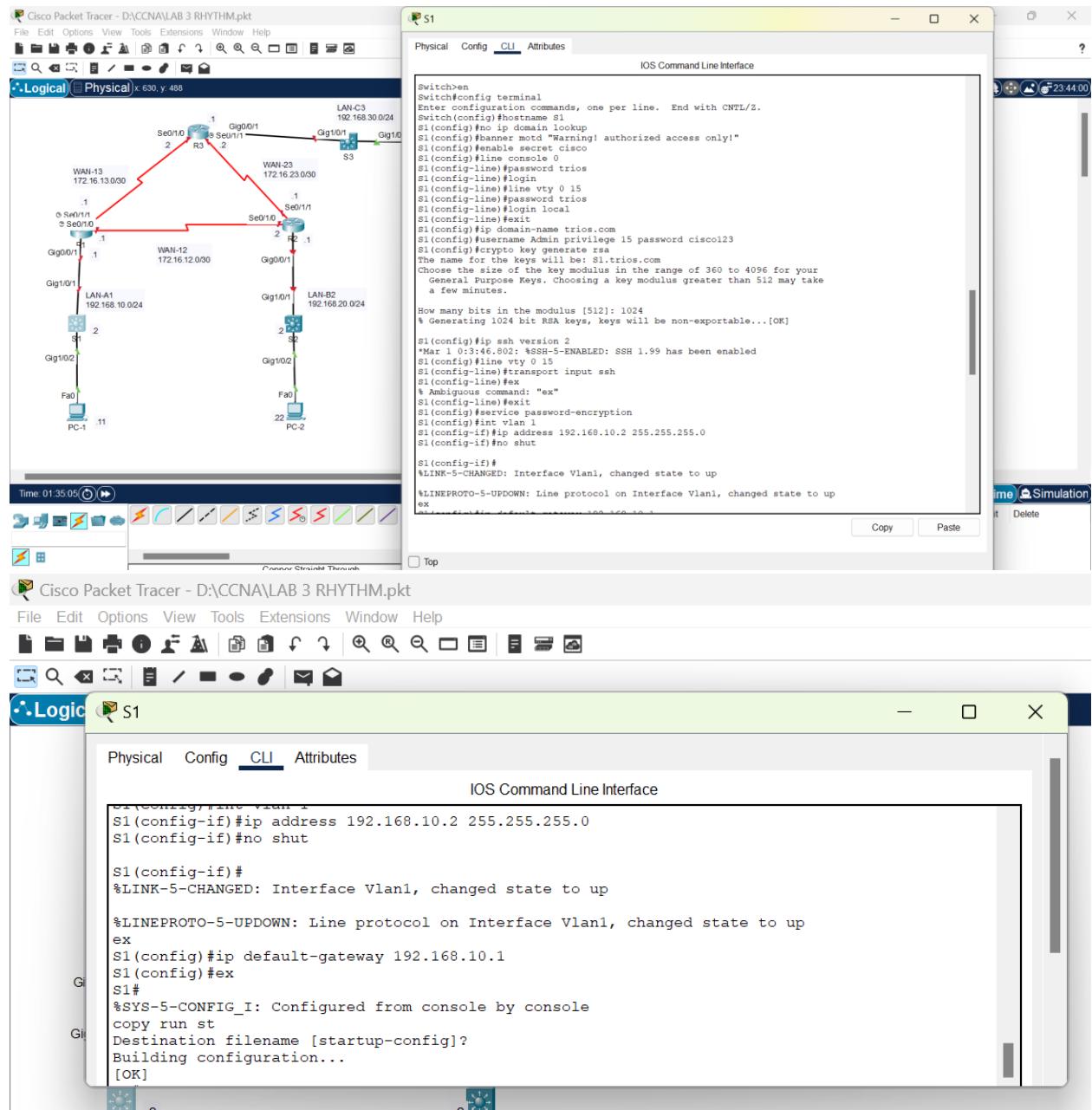
Step 1: Set up the network topology.

- 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, and laptops are green.

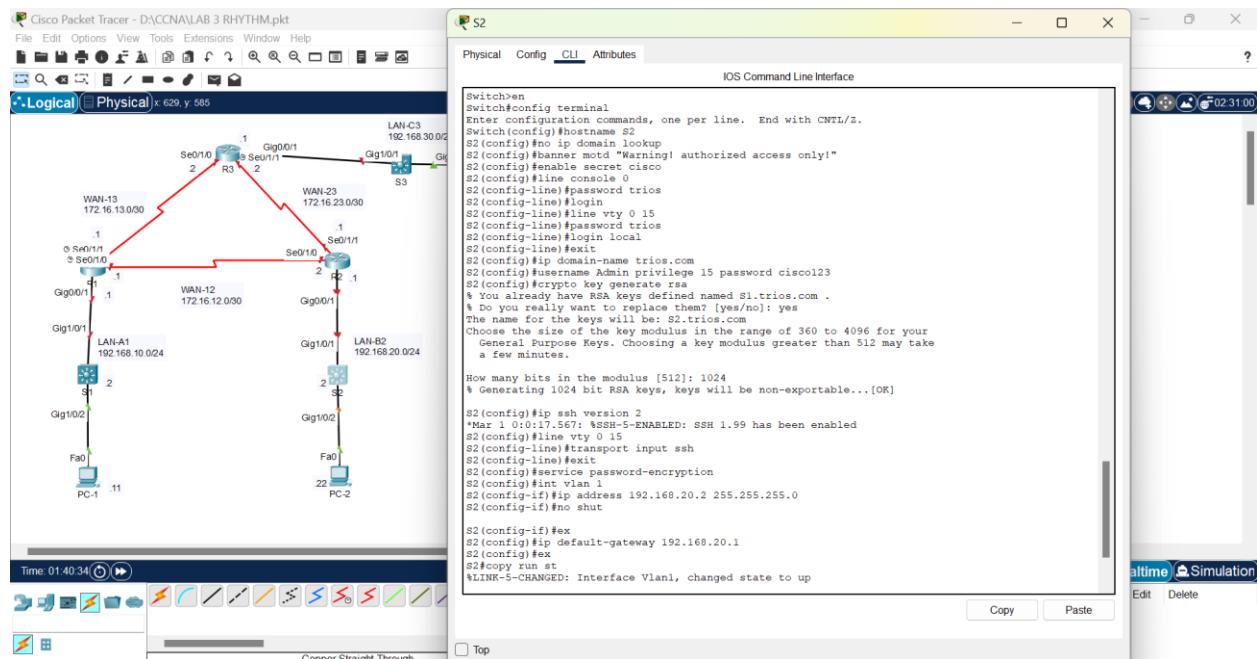


**Step 2: Configure and verify basic switch settings on all switches.**

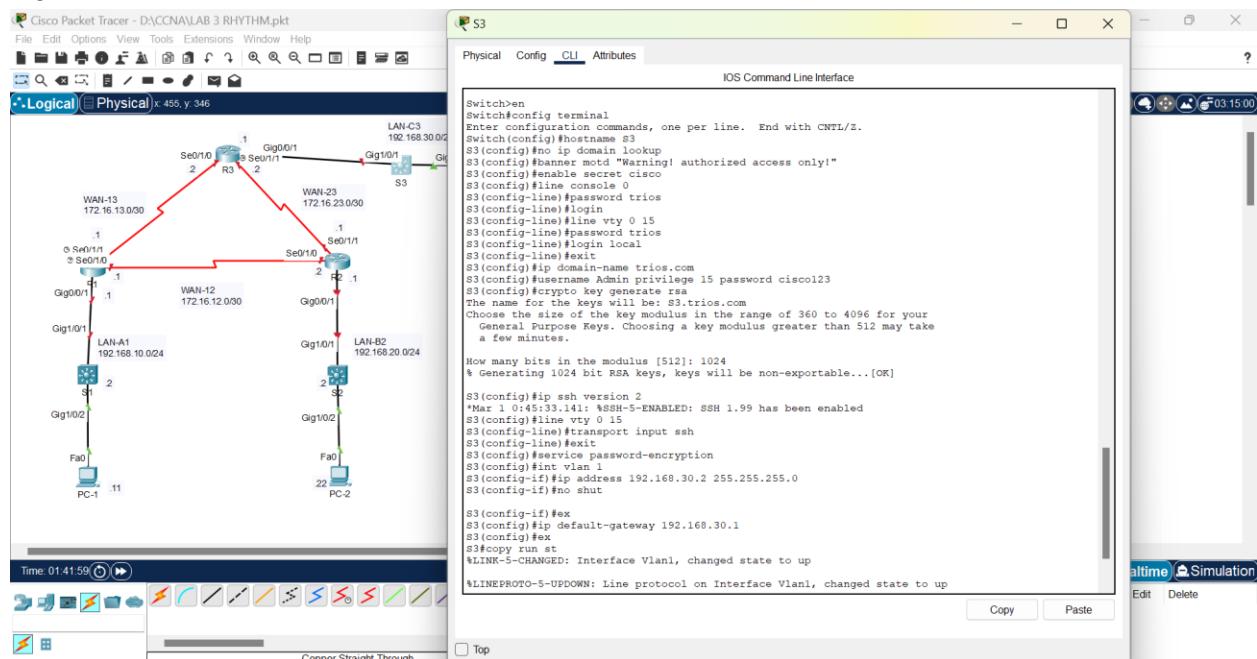
S1



## S2

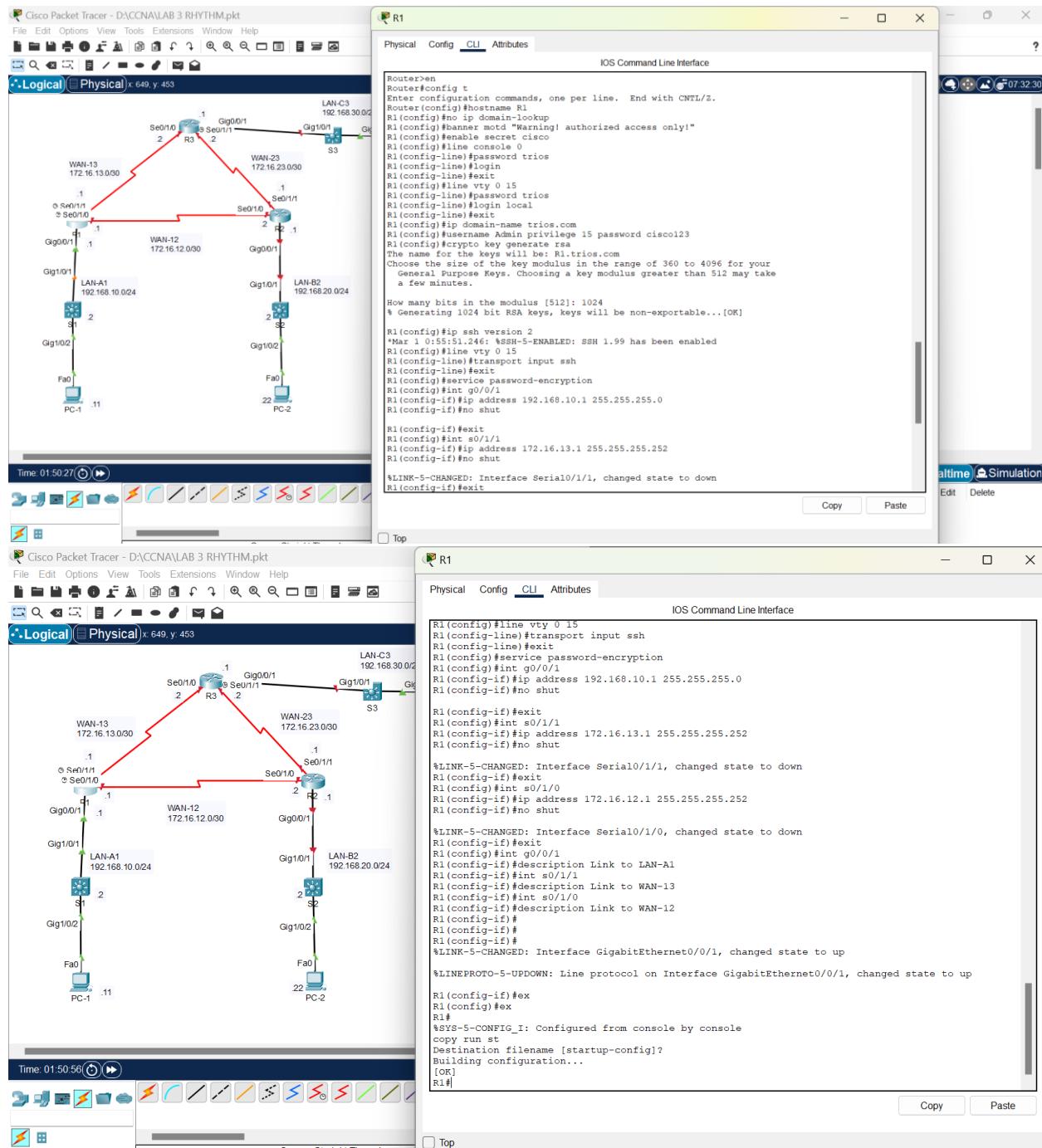


## S3

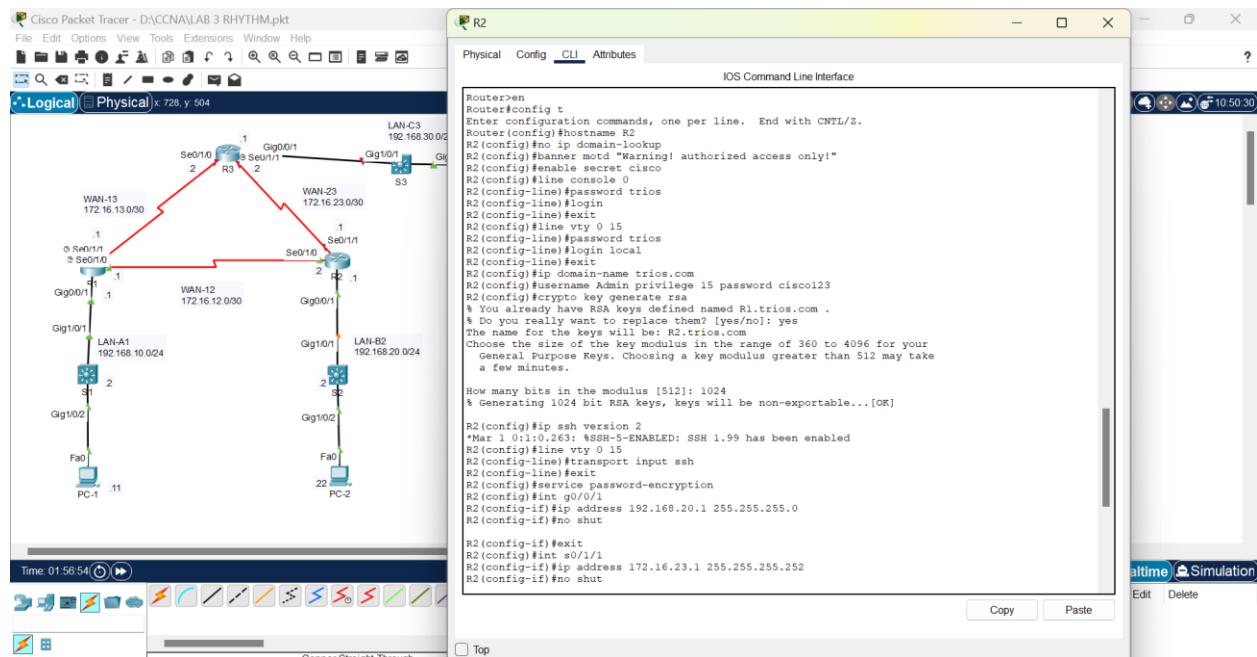


### Step 3: Configure and verify basic router settings on all routers

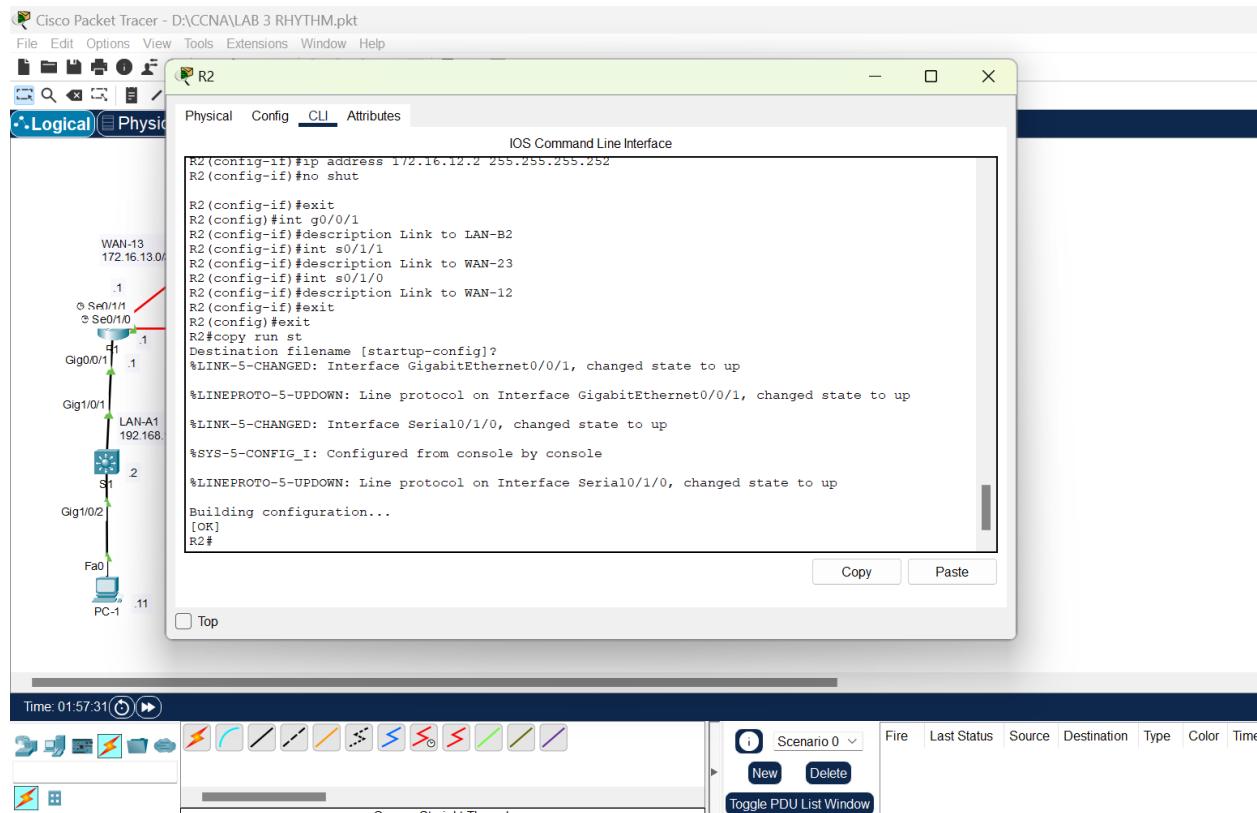
R1



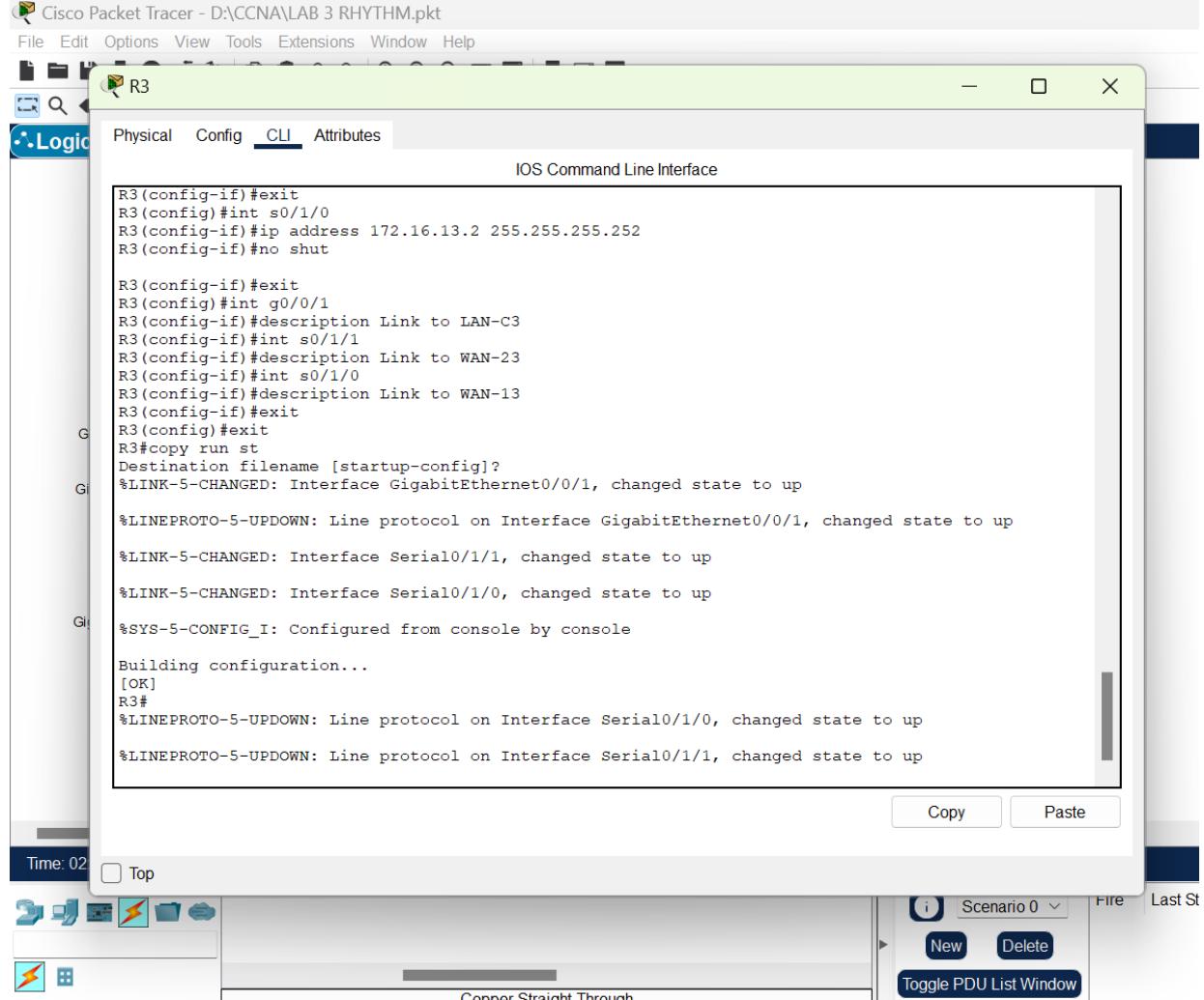
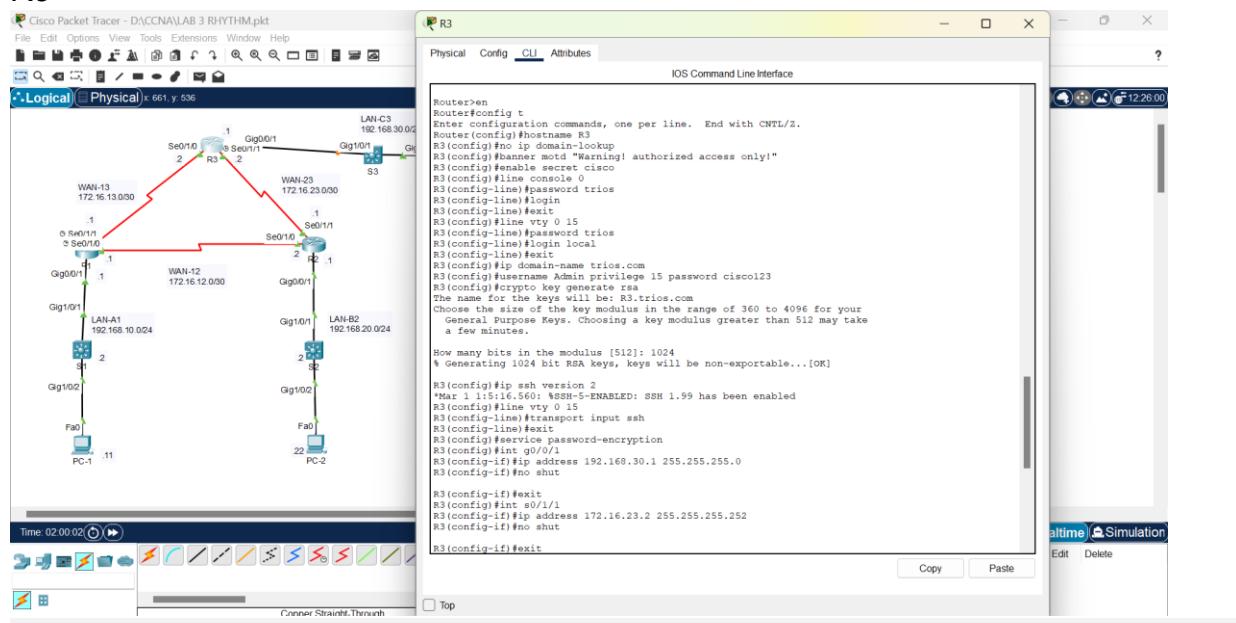
## R2



## Interface s0/1/0



### R3

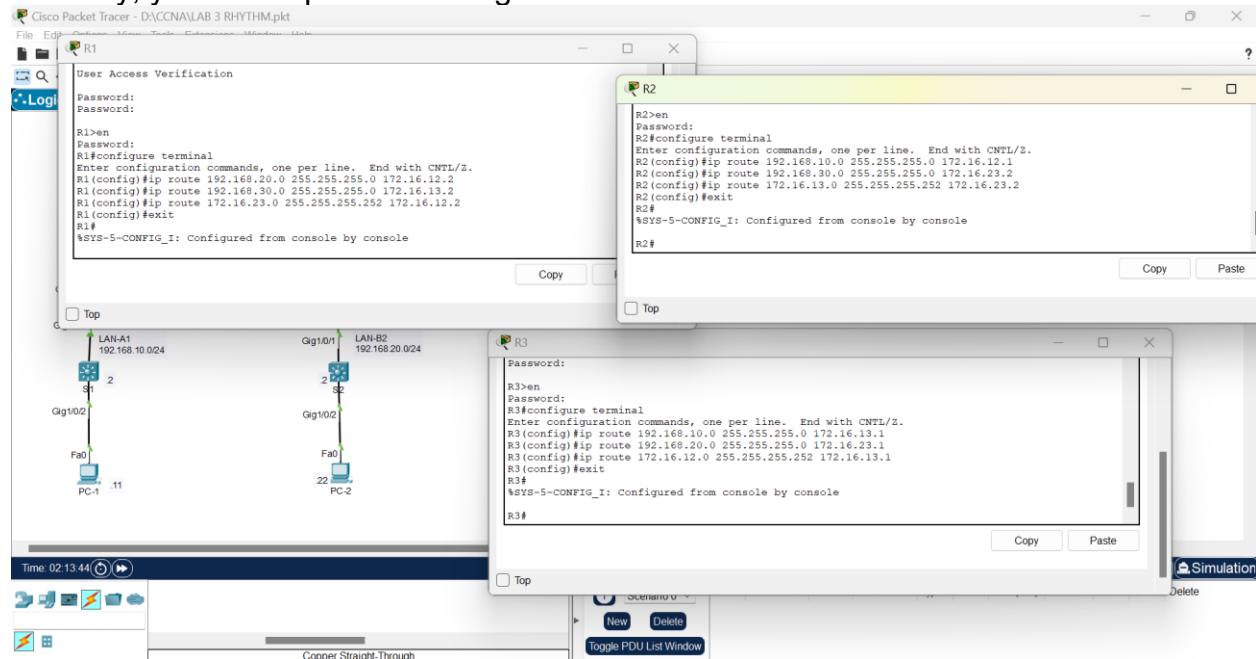


Step 4: Configure static routing between all routers so all hosts can communicate with every host in all LANs and WANs.

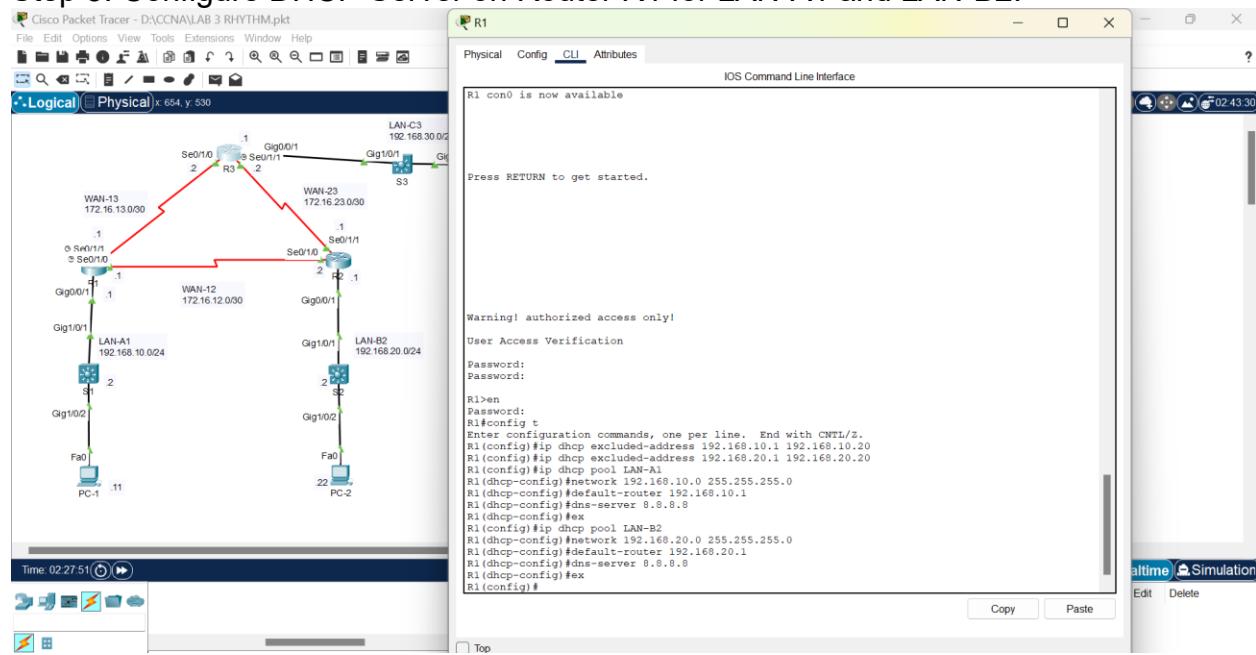
- You are required to configure sufficient static routes on router R1.

(Hint: Three static routes for LAN-B2, LAN-C3 and WAN-23)

Similarly, you are required to configure static routes on routers R2 and R3.



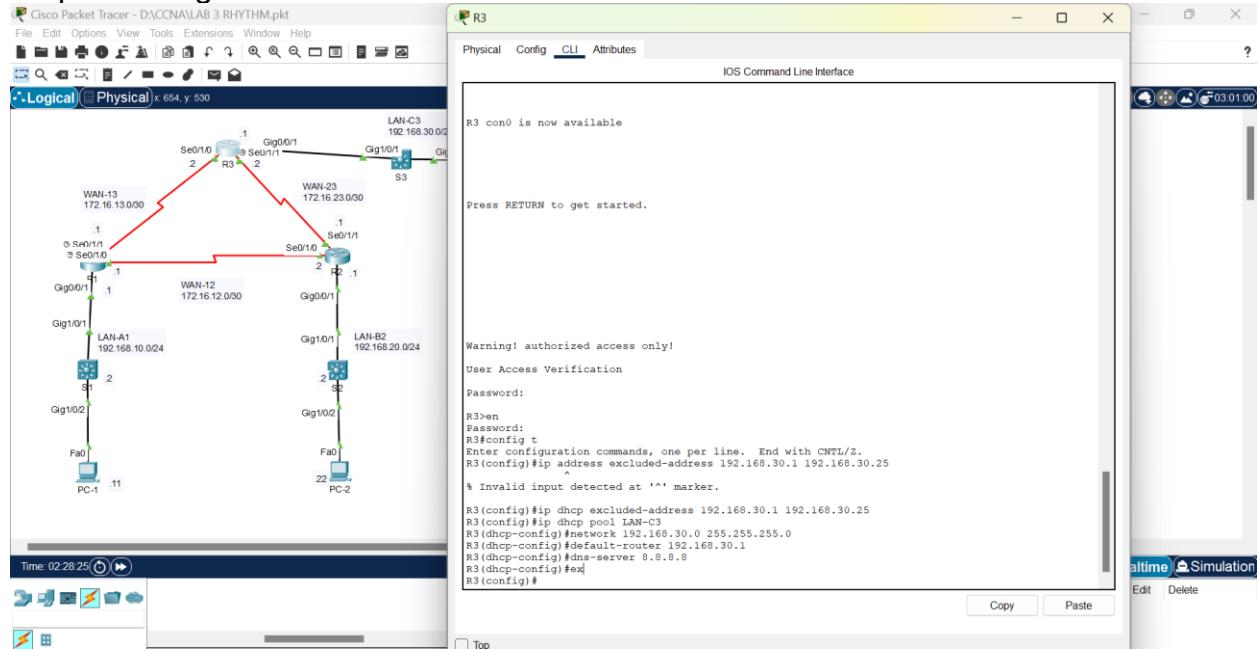
Step 5: Configure DHCP Server on Router R1 for LAN-A1 and LAN-B2.



- o Exclude the first 20 addresses from the pools, so these excluded addresses may be assigned as static IP addresses to the intermediary devices, servers, printers and so on within LANs.

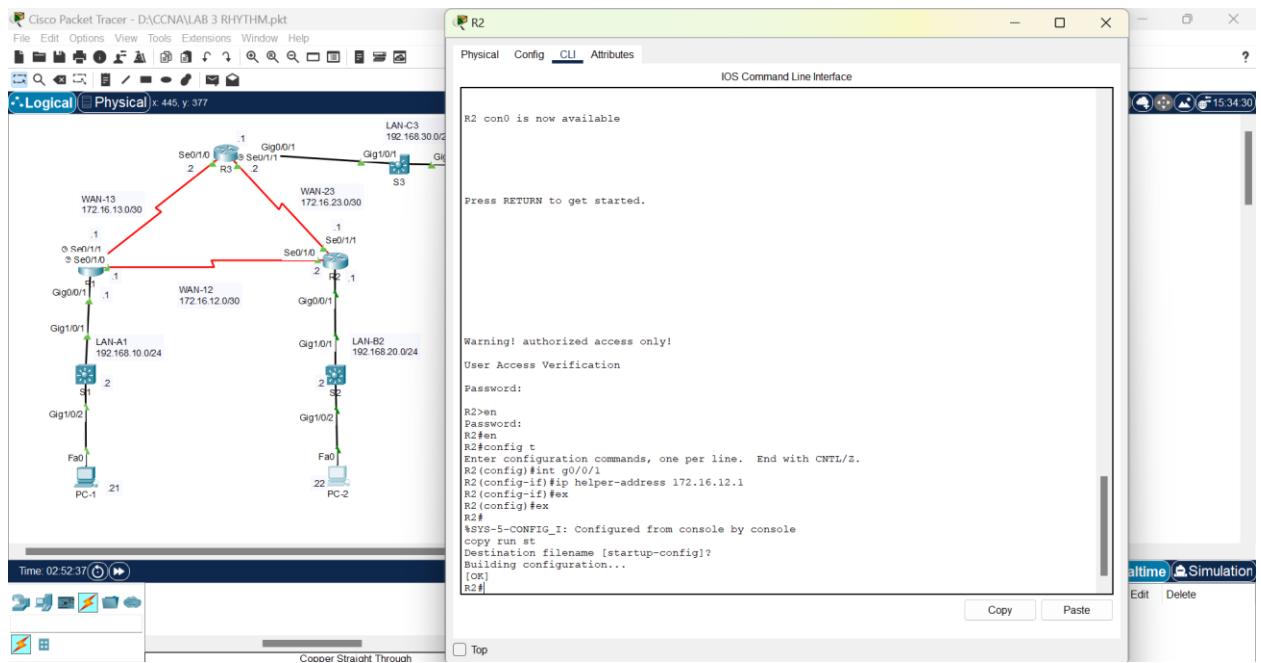
- Create DHCP Pool for LAN-A1 and LAN-B2:
  - Configure the LAN Network.
  - Configure the default router.
  - Configure the DNS server (8.8.8.8).

### Step 6: Configure DHCP Server on router R3 for LAN-C3.

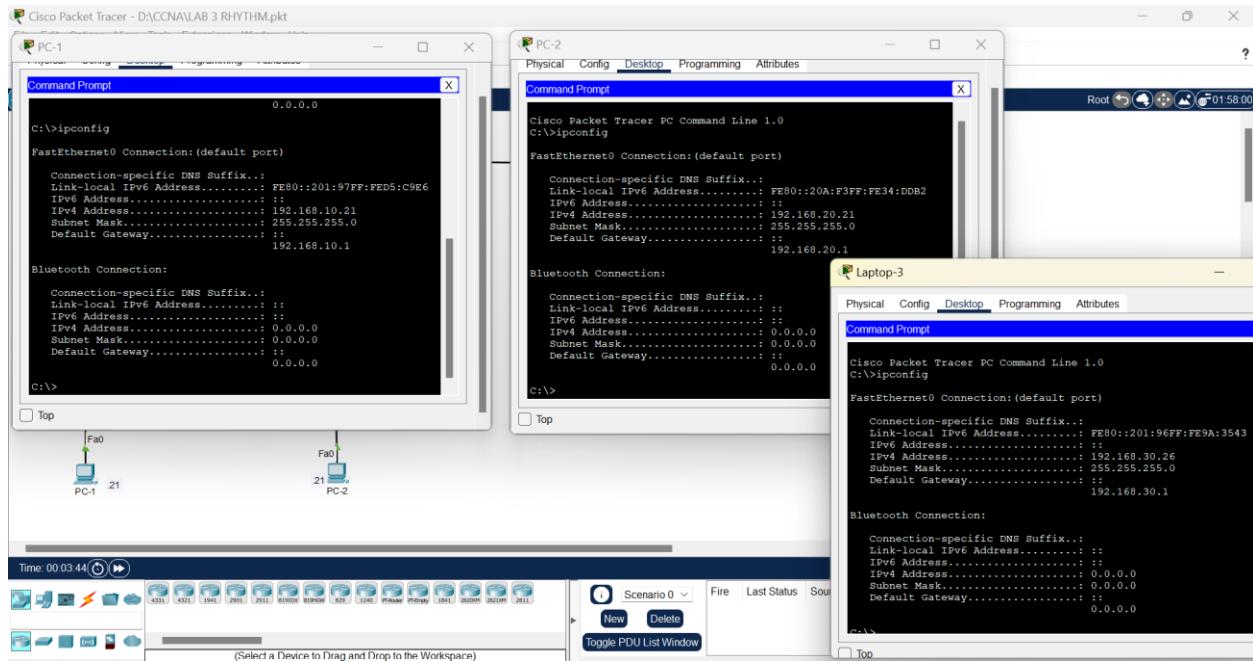


- Exclude the first 25 addresses from the pool, so that these excluded addresses may be assigned as static IP addresses to the intermediary devices, servers, printers and so on within LANs.
- Create DHCP Pool for LAN-C3:
  - Configure the LAN Network.
  - Configure the default router.
  - Configure the DNS server (8.8.8.8).

(Note: R1 is a remote router and DHCP Server for LAN-B2. It is important to make sure to configure the appropriate IP Helper address on the appropriate interface for R2.)

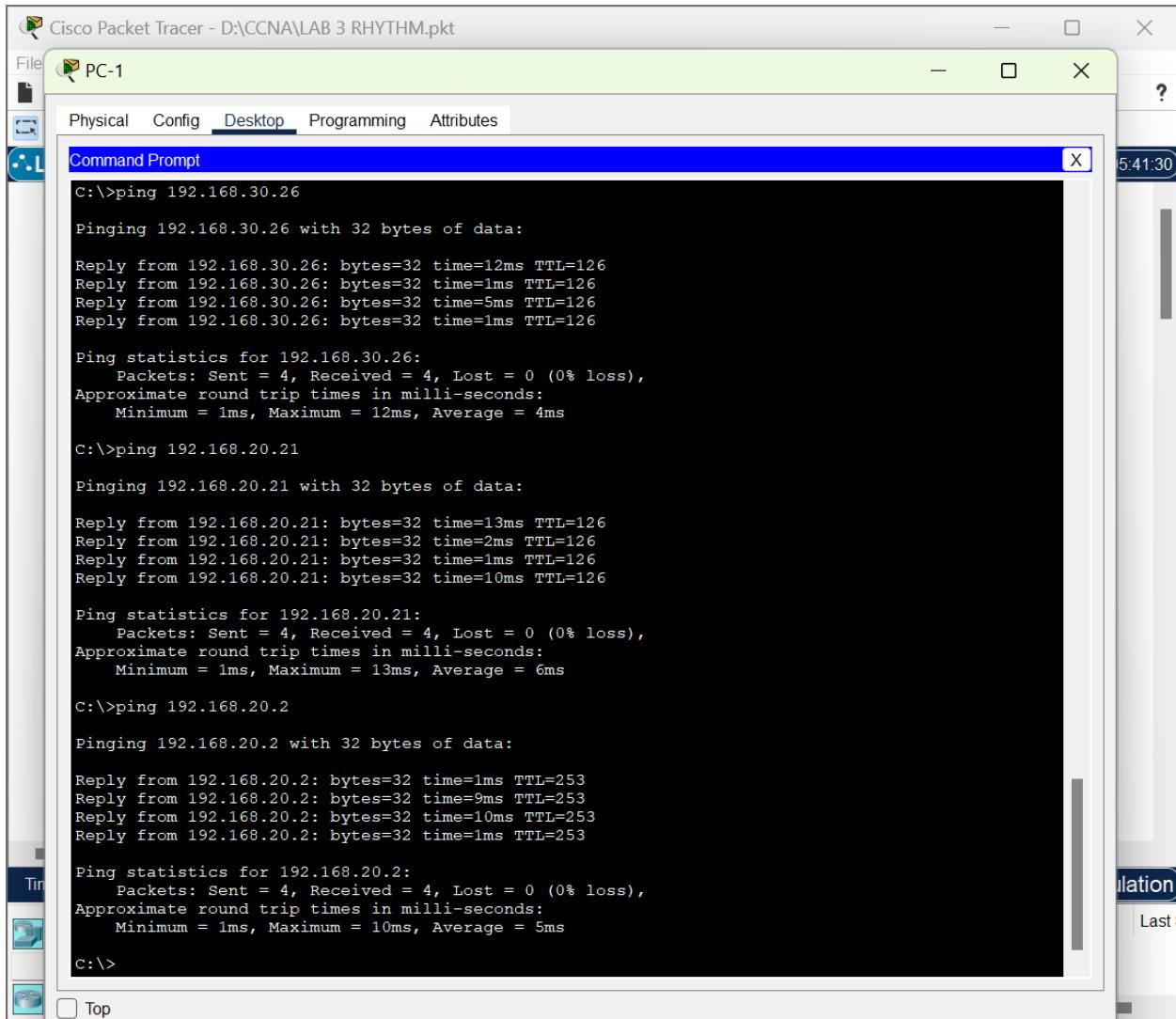


Step 7: Check and verify the IP address, subnet mask, and default gateway at PC-1, PC-2, and Laptop-3 by typing the command "ipconfig" at command prompt.



## Step 8: Verify the connectivity.

- Using the command line at PC-1, ping the IP address of:
  - Laptop-3
  - PC-2
  - SVI of switch S2



The screenshot shows the Cisco Packet Tracer interface with a window titled "PC-1". The "Command Prompt" tab is selected, displaying the following terminal session:

```
C:\>ping 192.168.30.26
Pinging 192.168.30.26 with 32 bytes of data:
Reply from 192.168.30.26: bytes=32 time=12ms TTL=126
Reply from 192.168.30.26: bytes=32 time=1ms TTL=126
Reply from 192.168.30.26: bytes=32 time=5ms TTL=126
Reply from 192.168.30.26: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.30.26:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 12ms, Average = 4ms

C:\>ping 192.168.20.21
Pinging 192.168.20.21 with 32 bytes of data:
Reply from 192.168.20.21: bytes=32 time=13ms TTL=126
Reply from 192.168.20.21: bytes=32 time=2ms TTL=126
Reply from 192.168.20.21: bytes=32 time=1ms TTL=126
Reply from 192.168.20.21: bytes=32 time=10ms TTL=126

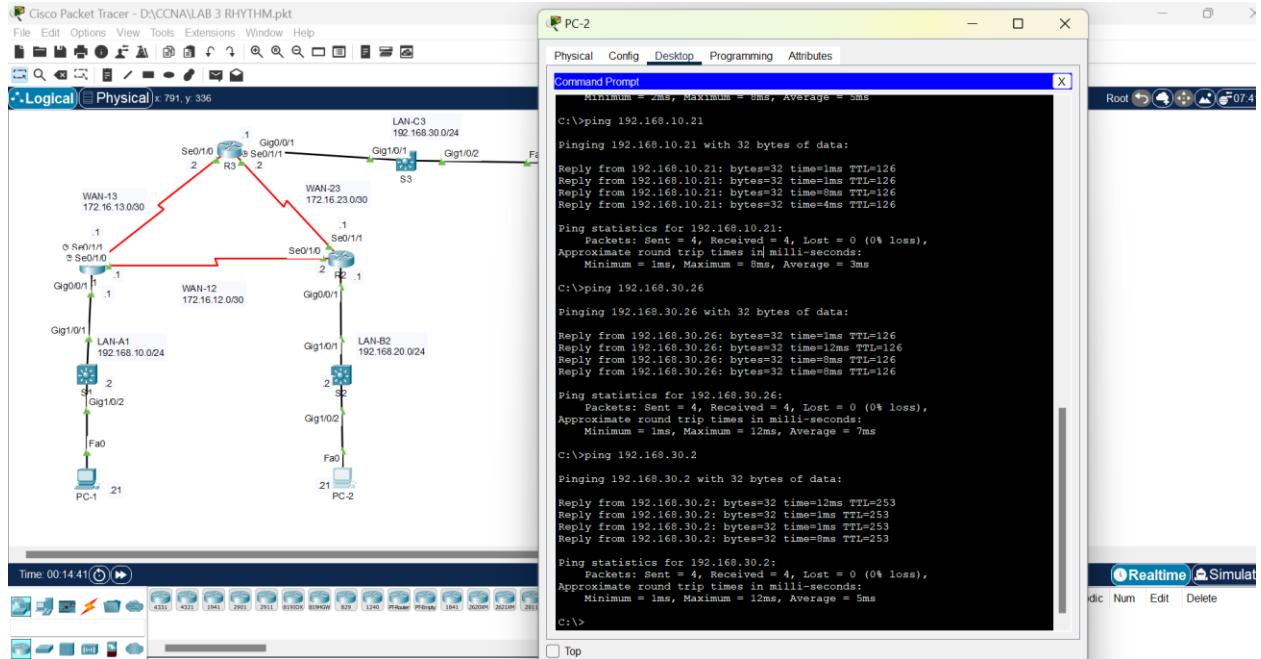
Ping statistics for 192.168.20.21:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 13ms, Average = 6ms

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=253
Reply from 192.168.20.2: bytes=32 time=9ms TTL=253
Reply from 192.168.20.2: bytes=32 time=10ms TTL=253
Reply from 192.168.20.2: bytes=32 time=1ms TTL=253

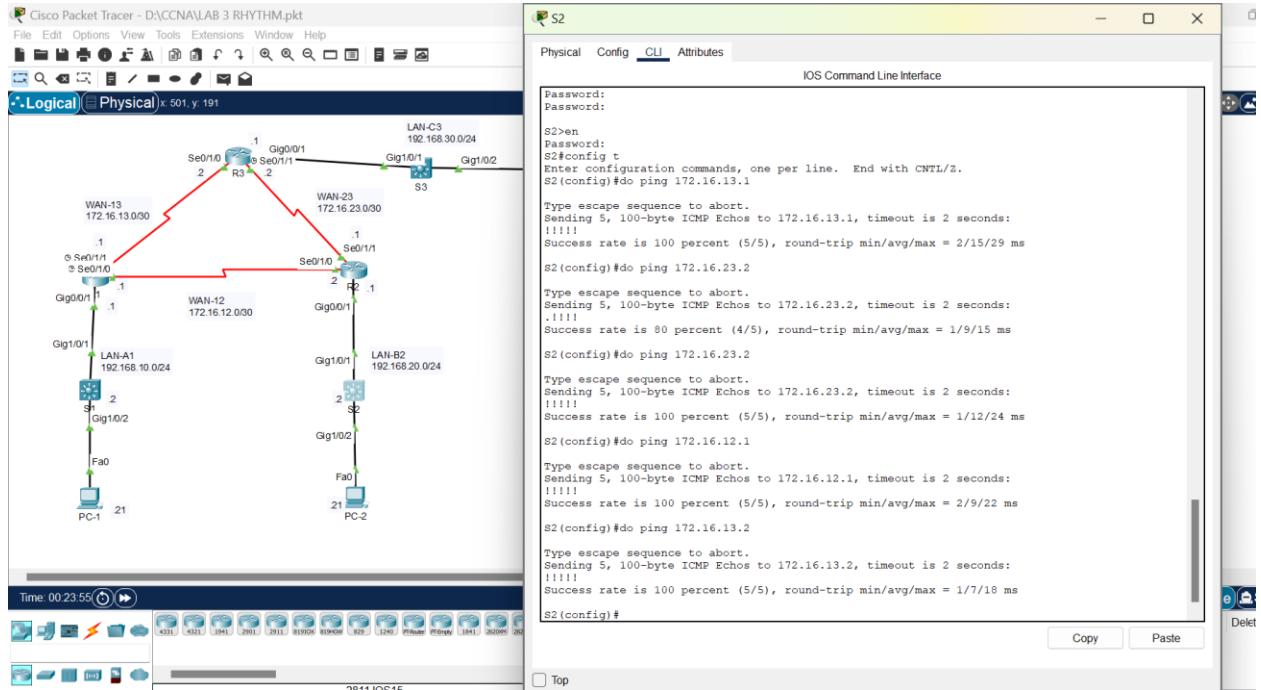
Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 5ms

C:\>
```

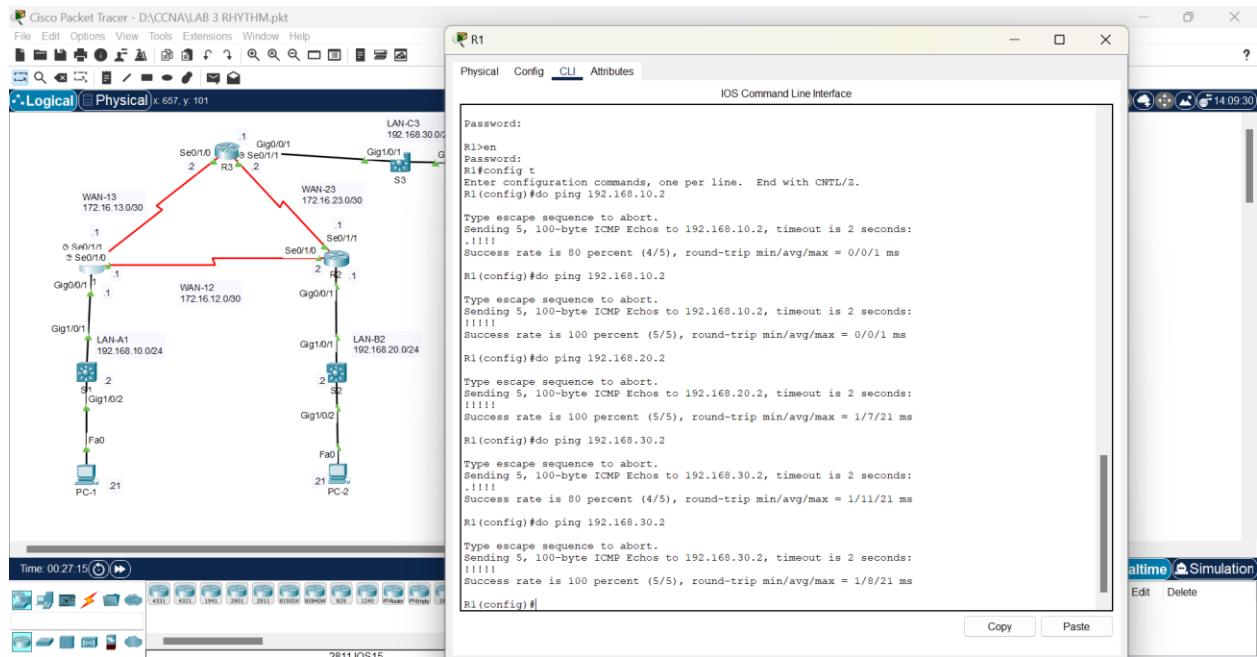
- Using the command line at PC-2, ping the IP address of:
  - PC-1
  - Laptop-3
  - SVI of switch S3



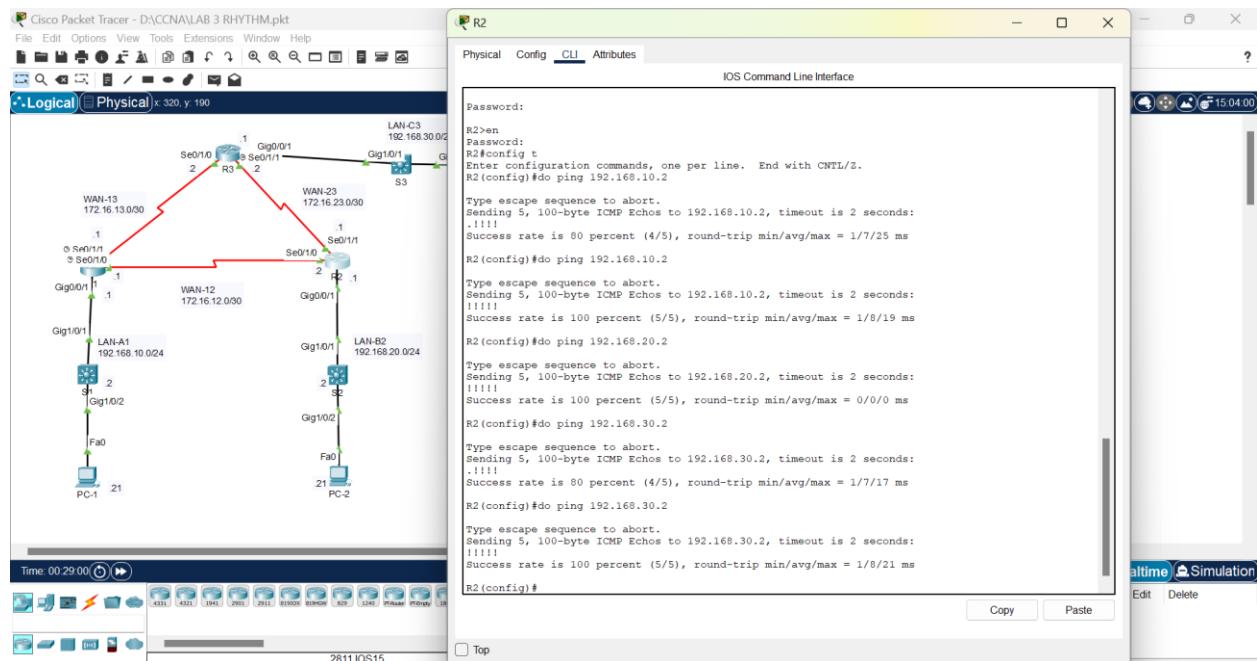
- Using the switch S2, ping the S0/1/1 interface of router R1 and R3.
- Using the switch S2, ping the S0/1/0 interface of router R1 and R3.



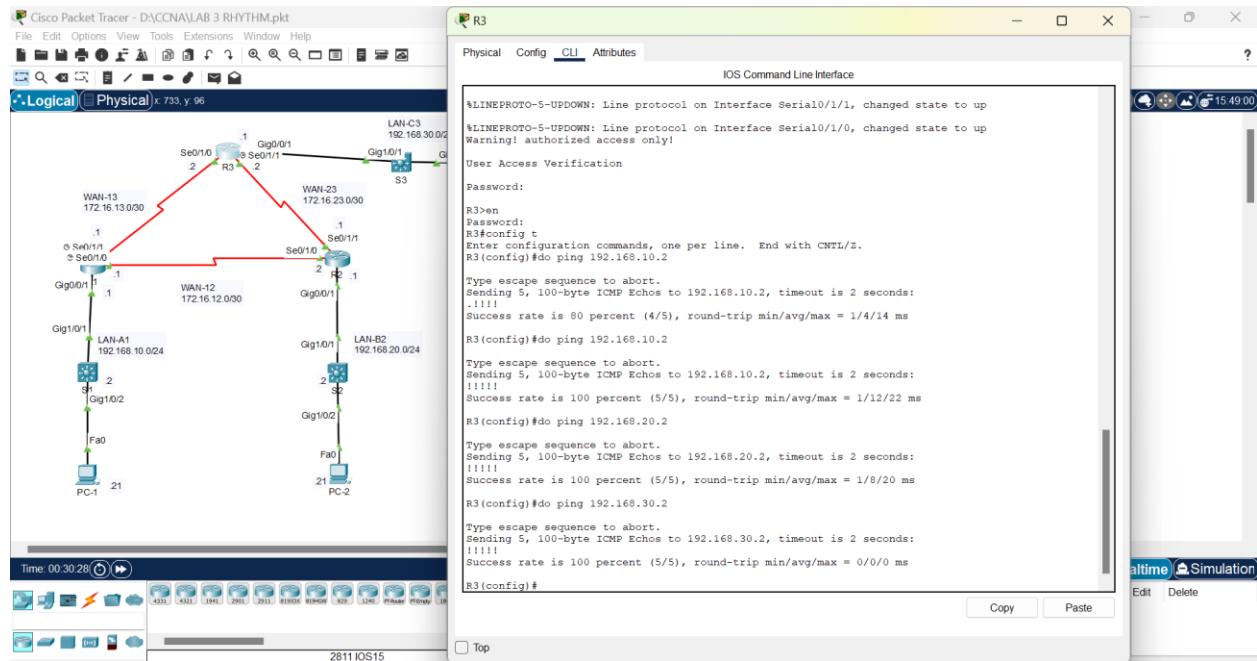
- Using the router R1, ping the switch virtual interface of S1, S2, and S3.



- Using the router R2, ping the switch virtual interface of S1, S2, and S3.



- Using the router R3, ping the switch virtual interface of S1, S2, and S3.



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