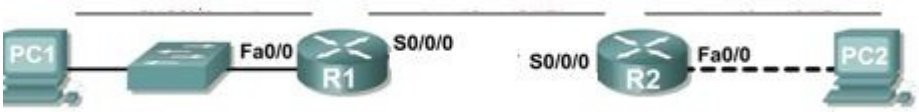
CEL 51, DCCN, Monsoon 2020
Lab 6: Subnet and Router Configuration

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0			N/A
	S0/0/0			N/A
R2	Fa0/0			N/A
	S0/0/0			N/A
PC 1	NIC			
PC 2	NIC			

Learning Objectives

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

- Subnet an address space given requirements.
- Assign appropriate addresses to interfaces and document.
- Configure and activate Serial and FastEthernet interfaces.
- Test and verify configurations.
- Reflect upon and document the network implementation.

Scenario

In this lab activity, you will design and apply an IP addressing scheme for the topology shown in the Topology Diagram. You will be given one address block that you must subnet to provide a logical addressing scheme for the network. The routers will then be ready for interface address configuration according to your IP addressing scheme. When the configuration is complete, verify that the network is working properly.

Task 1: Subnet the Address Space.

Step 1: Examine the network requirements.

You have been given the 192.168.1.0/24 address space to use in your network design. The network consists of the following segments:

- The network connected to router R1 will require enough IP addresses to support 15 hosts.
- The network connected to router R2 will require enough IP addresses to support 30 hosts.
- The link between router R1 and router R2 will require IP addresses at each end of the link.

Step 2: Consider the following questions when creating your network design.
How many subnets are needed for this network?

Ans: **3 subnets** are needed for this network.

First subnet - the network connected to router R1
Second subnet - the link between R1 and R2
Third subnet - the network connected to router R2

What is the subnet mask for this network in dotted decimal format?

Ans: The given address block is 192.168.1.0/24

Network: 11000000.10101000.00000001.00000000
Subnet mask: 11111111.11111111.11111111.00000000
The number of usable host IPs = $2^n - 2 = 2^8 - 2 = 254$
The network connected to R2 requires maximum number of hosts i.e. 30
Hence borrowing three bits from the host portion
So, binary form of the subnet mask is 11111111.11111111.11111111.11100000
Subnet mask in dotted decimal notation is **255.255.255.224**

What is the subnet mask for the network in slash format?

Ans: The binary form of the subnet mask is 11111111.11111111.11111111.11100000
The total number of ones in the binary form of the subnet mask is 27.
Subnet mask in slash format is **/27**

How many usable hosts are there per subnet?

Ans: In IPv4, there are two IPs that cannot be assigned to any devices. These are the Network ID and the Broadcast IP address. Therefore, you need to subtract two addresses from the total IP formula.
Usable hosts = $2^h - 2$, where h = number of zeros in binary form of subnet mask
The binary form of the subnet mask is 11111111.11111111.11111111.11100000, hence h = 5. Each subnet has 32 addresses.
Usable hosts are 32-2 = **30 hosts**

Step 3: Assign subnetwork addresses to the Topology Diagram.

1. Assign subnet 1 to the network attached to R1.

Ans: Subnet 1: 11000000.10101000.00000001.00000000 = 192.168.1.0

Network ID: 11000000.10101000.00000001.00000000 = 192.168.1.0/27

1st usable IP: 11000000.10101000.00000001.00000001 = 192.168.1.1/27

Last usable IP: 11000000.10101000.00000001.00011110 = 192.168.1.30/27

Broadcast IP: 11000000.10101000.00000001.00011111 = 192.168.1.31/27

2. Assign subnet 2 to the link between R1 and R2.

Ans: Subnet 2: 11000000.10101000.00000001.00100000 = 192.168.1.32

Network ID: 11000000.10101000.00000001.00100000 = 192.168.1.32/27

1st usable IP: 11000000.10101000.00000001.00100001 = 192.168.1.33/27

Last usable IP: 11000000.10101000.00000001.00111110 = 192.168.1.62/27

Broadcast IP: 11000000.10101000.00000001.00111111 = 192.168.1.63/27

3. Assign subnet 3 to the network attached to R2.

Ans: Subnet 3: 11000000.101010000.00000001.0100000 = 192.168.1.64

Network ID: 11000000.10101000.00000001.01000000 = 192.168.1.64/27

1st usable IP: 11000000.10101000.00000001.01000001 = 192.168.1.65/27

Last usable IP: 11000000.10101000.00000001.01011110 = 192.168.1.94/27

Broadcast IP: 11000000.10101000.00000001.01011111 = 192.168.1.95/27

Task 2: Determine Interface Addresses.

Step 1: Assign appropriate addresses to the device interfaces.

1. Assign the first valid host address in subnet 1 to the LAN interface on R1.

Ans: **R1 - Fa0/0 = 192.168.1.1**

2. Assign the last valid host address in subnet 1 to PC1.

Ans: **PC1 - 192.168.1.30**

3. Assign the first valid host address in subnet 2 to the WAN interface on R1.

Ans: **R1 - S0/0/0 = 192.168.1.33**

4. Assign the last valid host address in subnet 2 to the WAN interface on R2.

Ans: **R2 - S0/0/0 = 192.168.1.62**

5. Assign the first valid host address in subnet 3 to the LAN interface of R2.

Ans: **R2 - Fa0/0 = 192.168.1.65**

6. Assign the last valid host address in subnet 3 to PC2.

Ans: **PC2 - 192.168.1.94**

Step 2: Document the addresses to be used in the table provided under the Topology Diagram.

Addressing Table

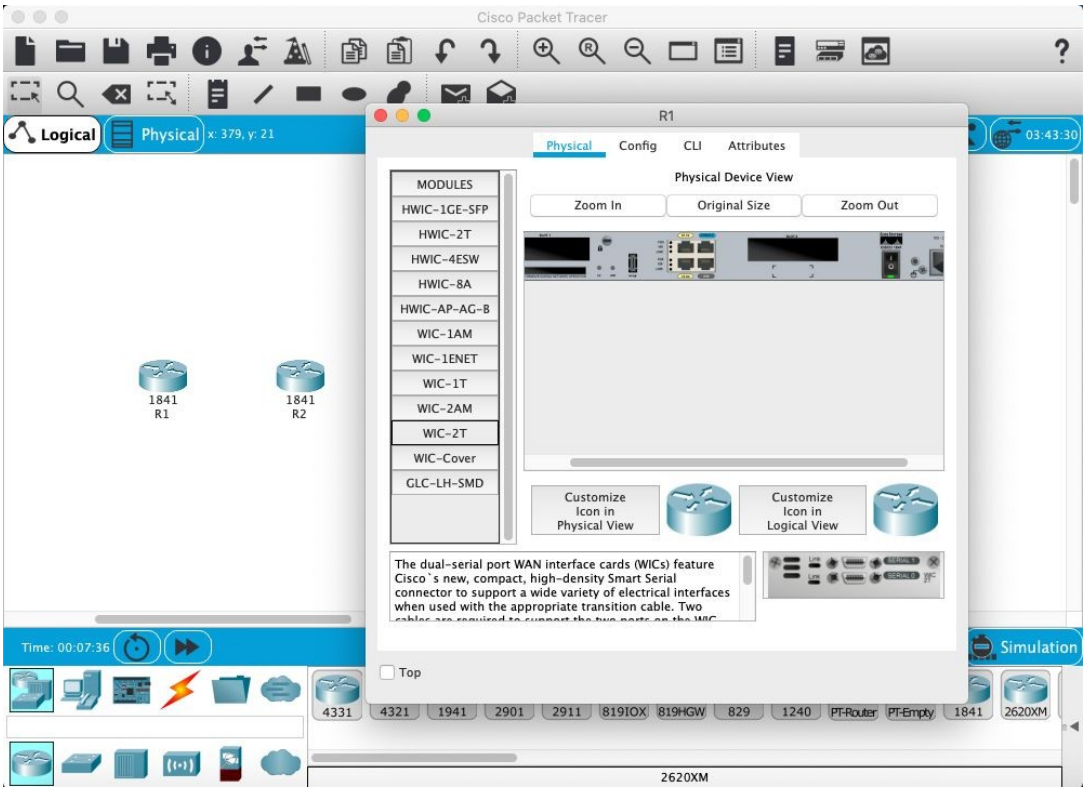
Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0	192.168.1.1	255.255.255.2 24	N/A
	S0/0/0	192.168.1.33	255.255.255.2 24	N/A
R2	Fa0/0	192.168.1.65	255.255.255.2 24	N/A
	S0/0/0	192.168.1.62	255.255.255.2 24	N/A
PC 1	NIC	192.168.1.30	255.255.255.2 24	192.168.1. 1
PC 2	NIC	192.168.1.94	255.255.255.2 24	192.168.1. 65

Task 3: Configure the Serial and FastEthernet Addresses.

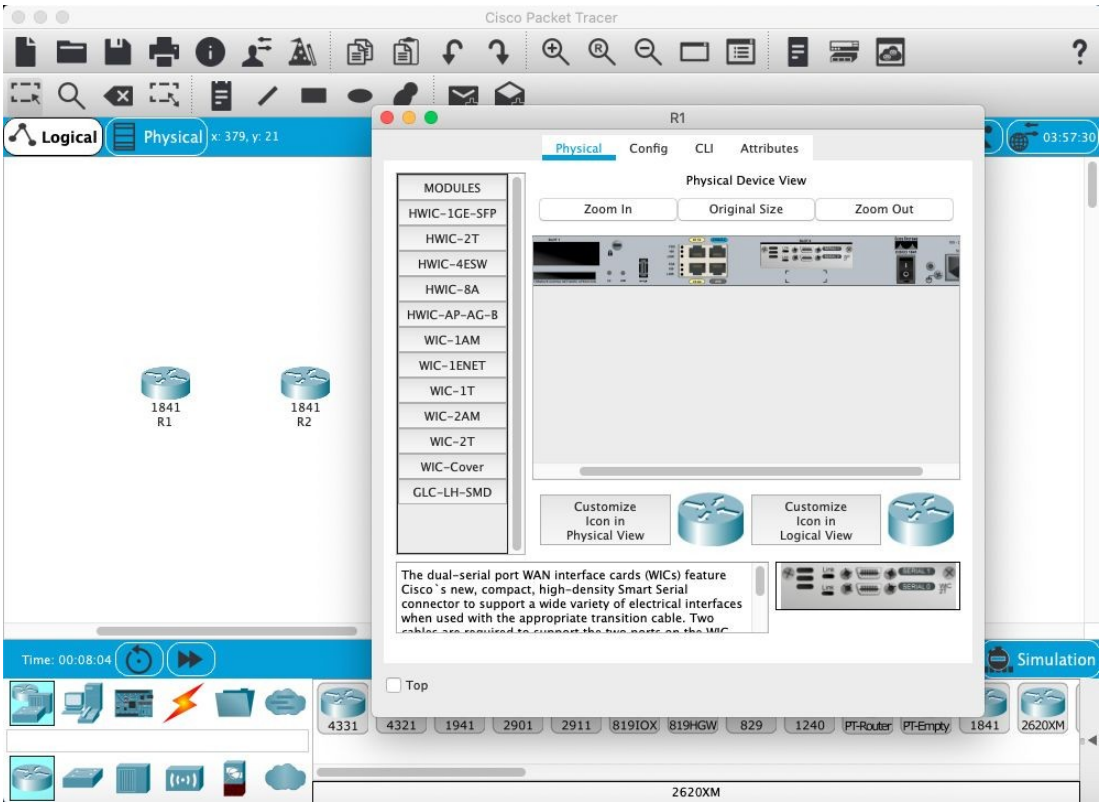
Step 1: Configure the router interfaces.

Configure the interfaces on the R1 and R2 routers with the IP addresses from your network design. Please note, to complete the activity in Packet Tracer you will be using the Config Tab. When you have finished, be sure to save the running configuration to the NVRAM of the router.

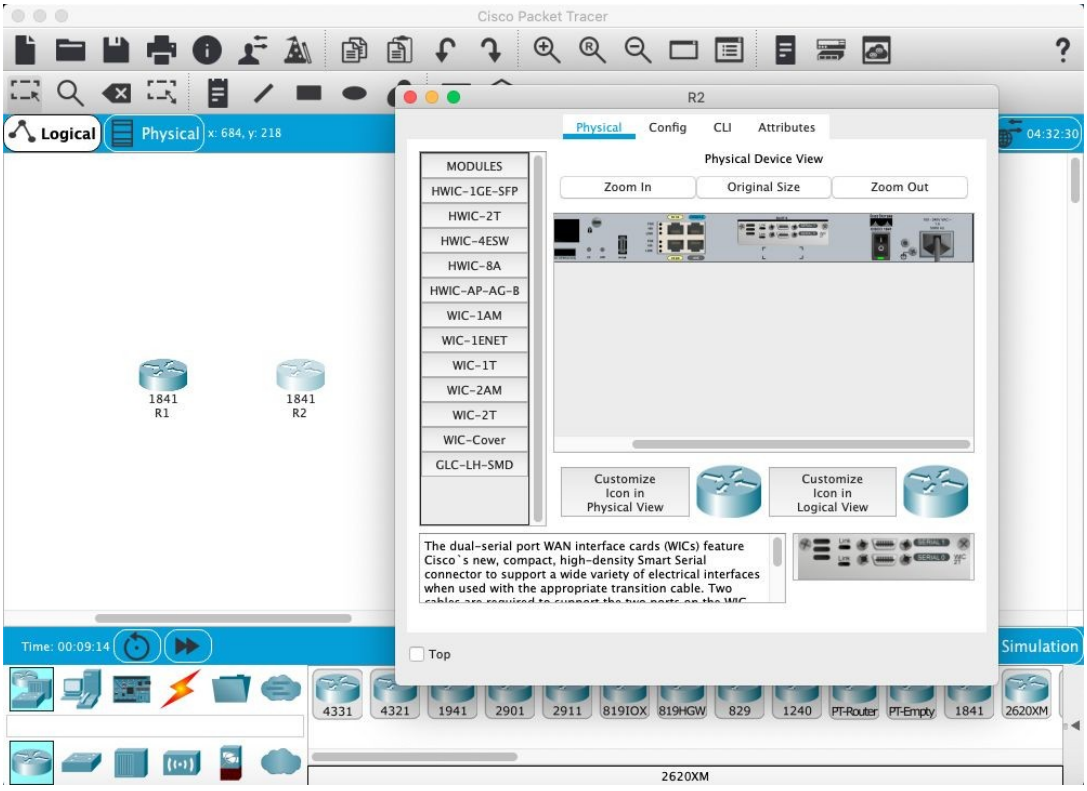
To add the serial port to the router, click on router R1 and select the physical tab->WIC-2T



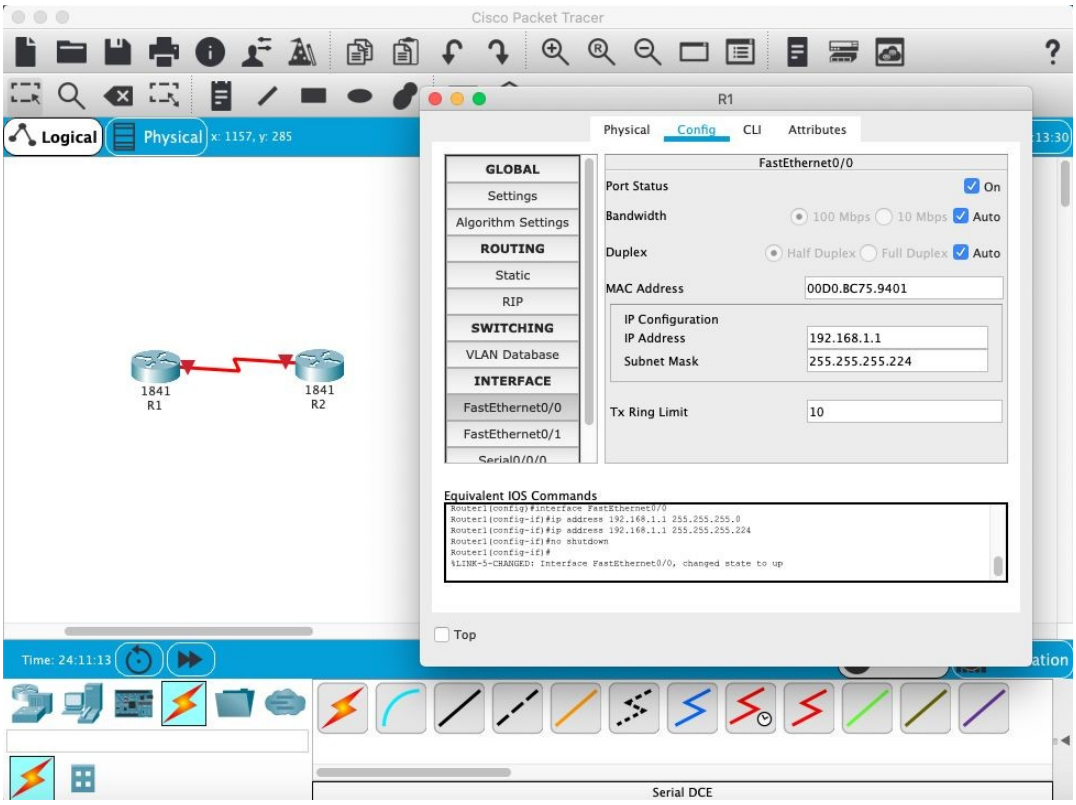
Turn off the main switch, drag and drop the serial port and then the switch back on again.



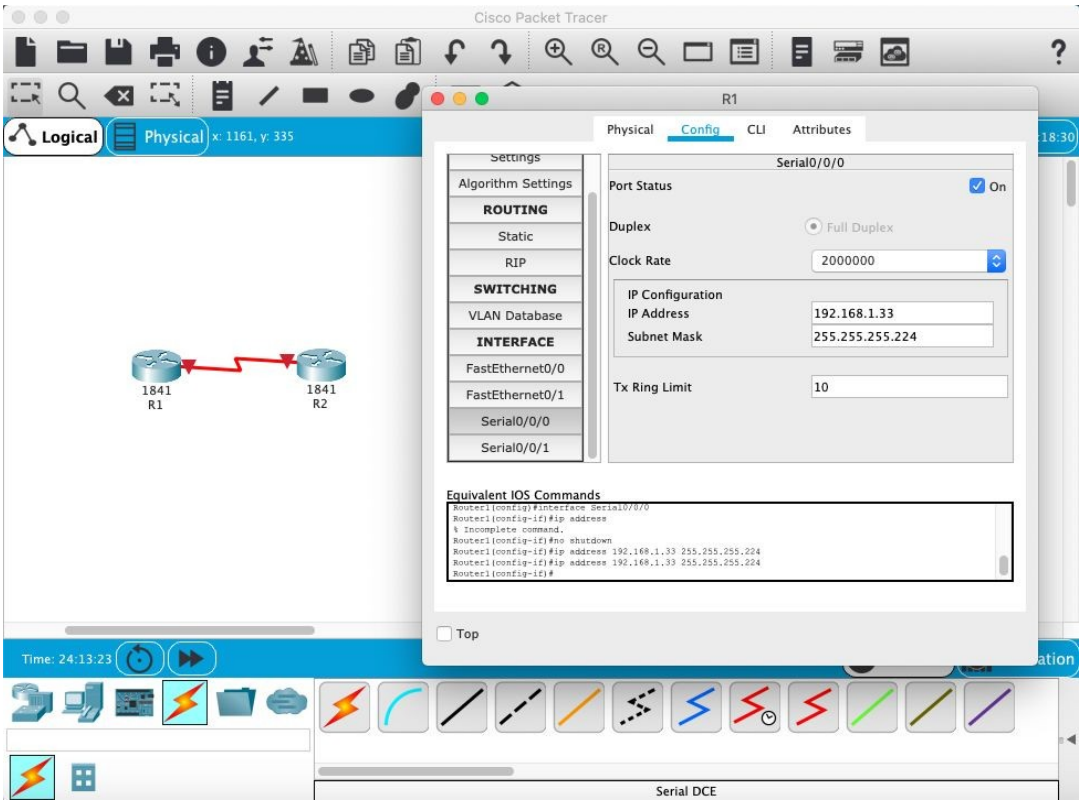
Repeat the above steps for router R2.



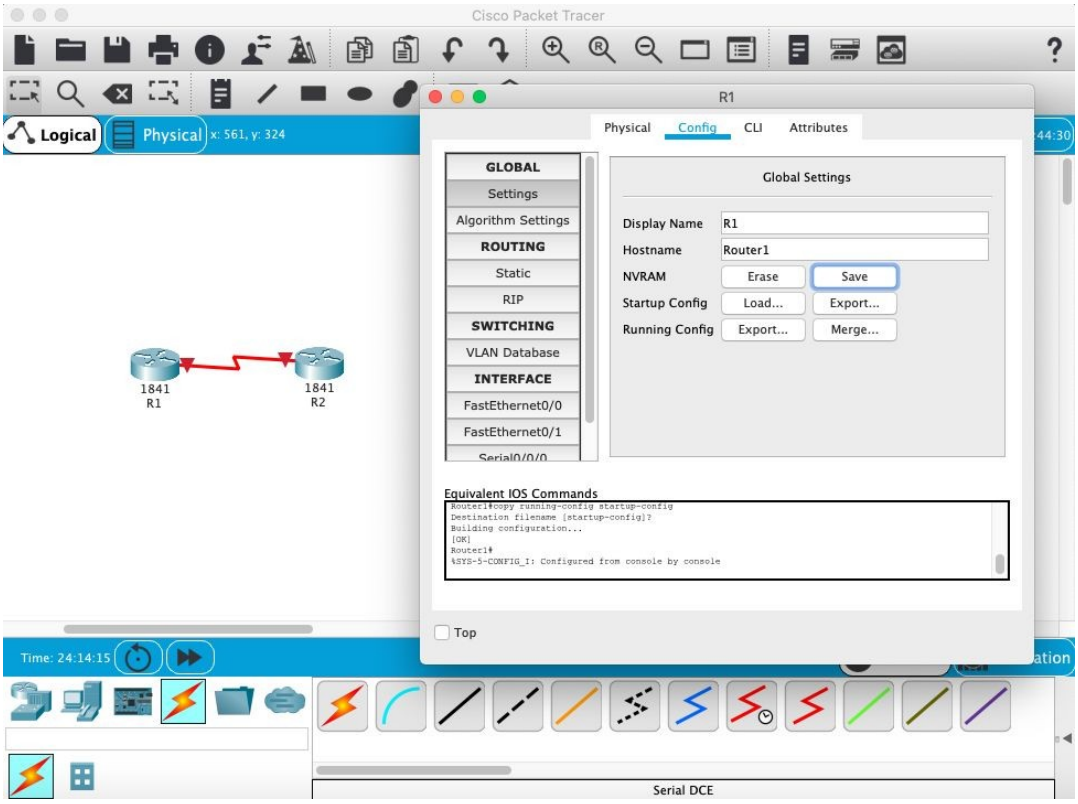
Configured R1 - Interface FastEthernet 0/0 as followed.



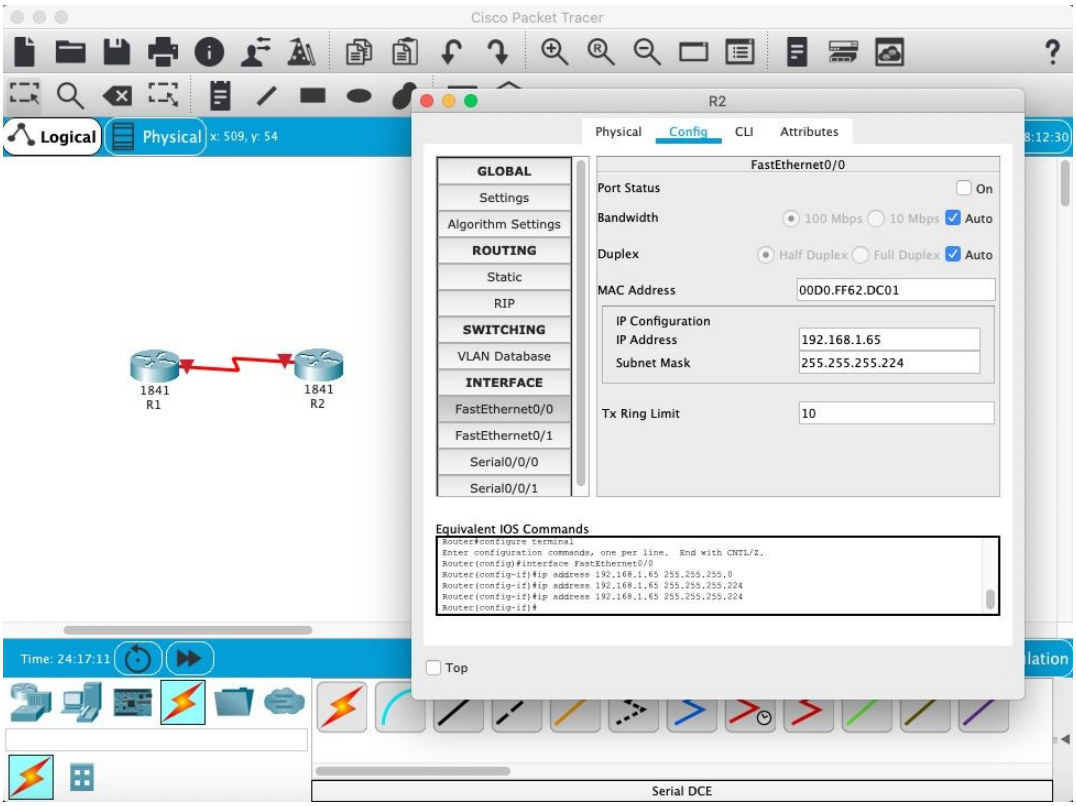
Configured R1 Interface Serial0/0/0 as followed.



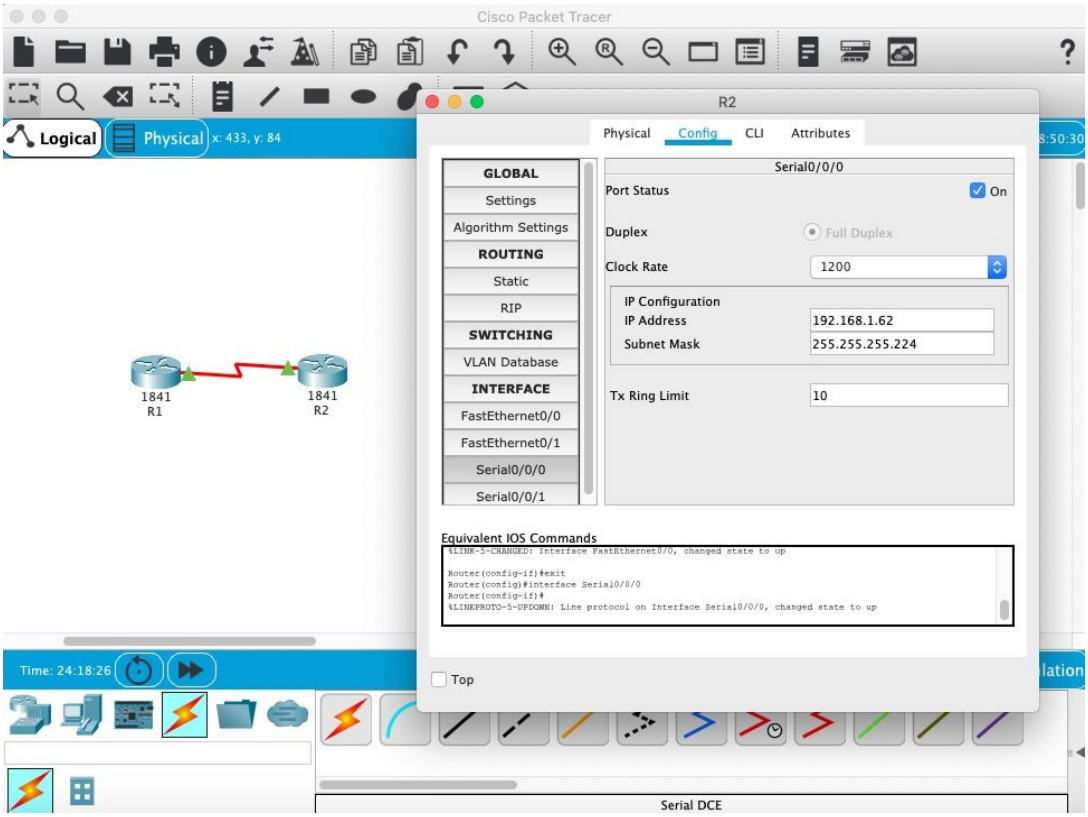
Saved the running configuration to the NVRAM of the router R1.



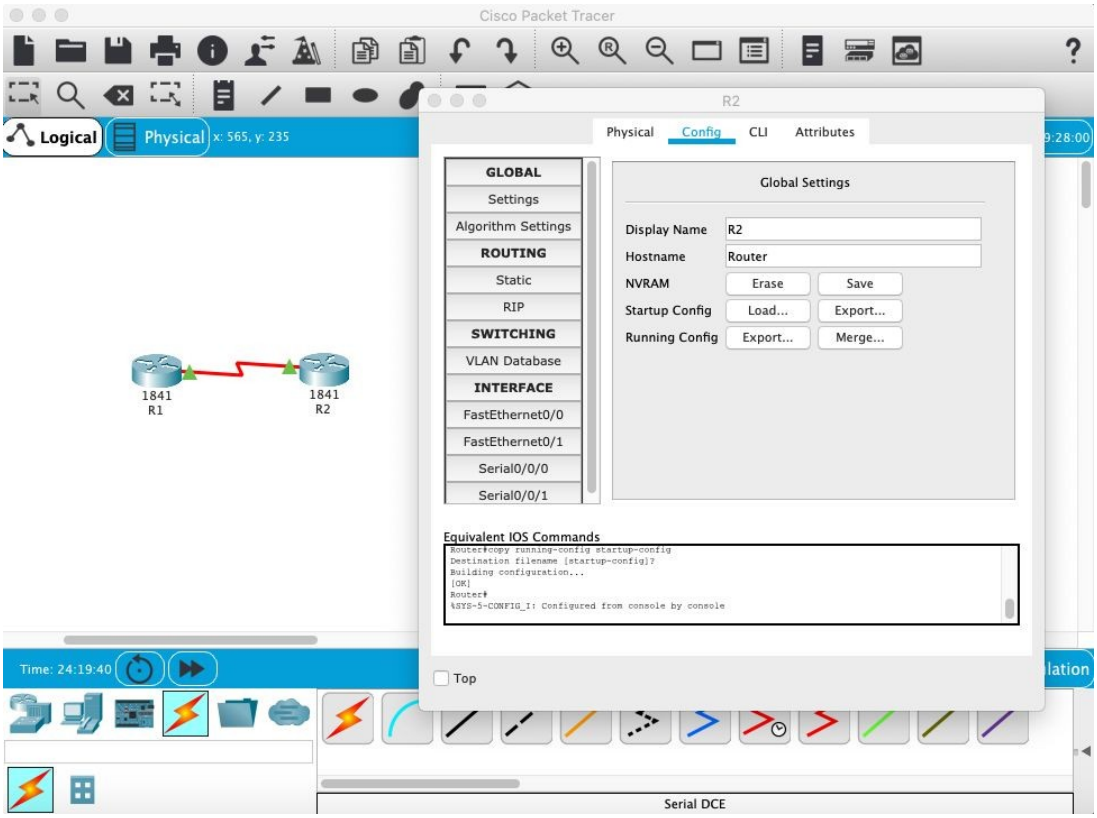
Configured R2 - Interface FastEthernet 0/0 as followed.



Configured R2 Interface Serial0/0/0 as followed.



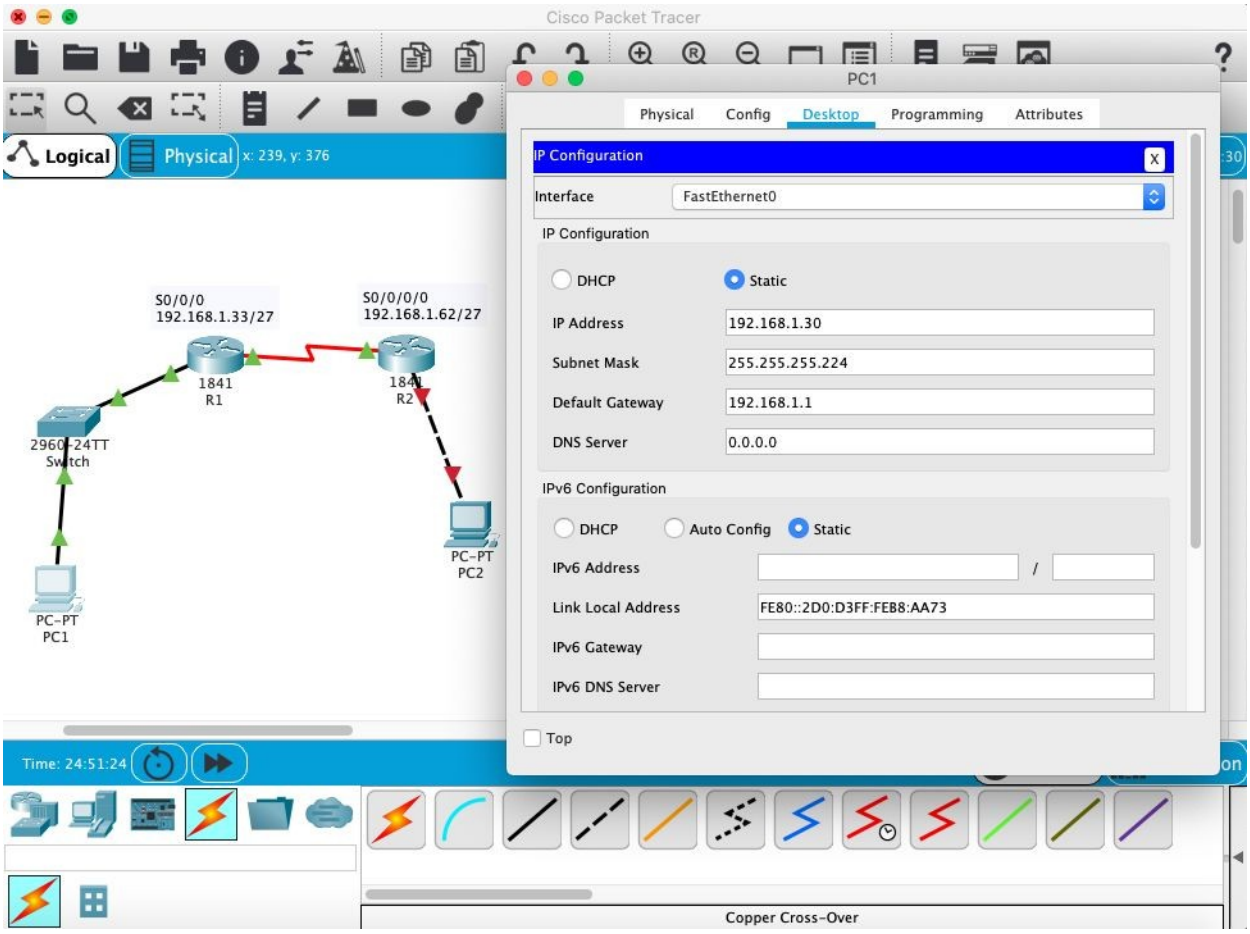
Saved the running configuration to the NVRAM of the router R1.



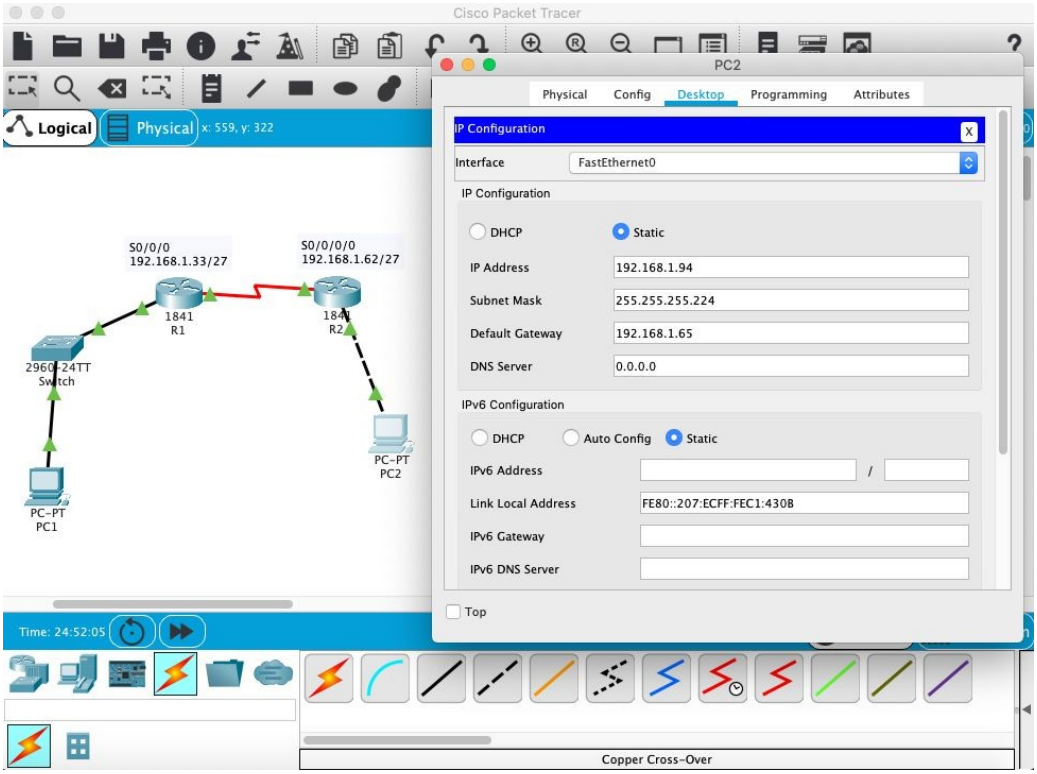
Step 2: Configure the PC interfaces.

Configure the Ethernet interfaces of PC1 and PC2 with the IP addresses and default gateways from your network design.

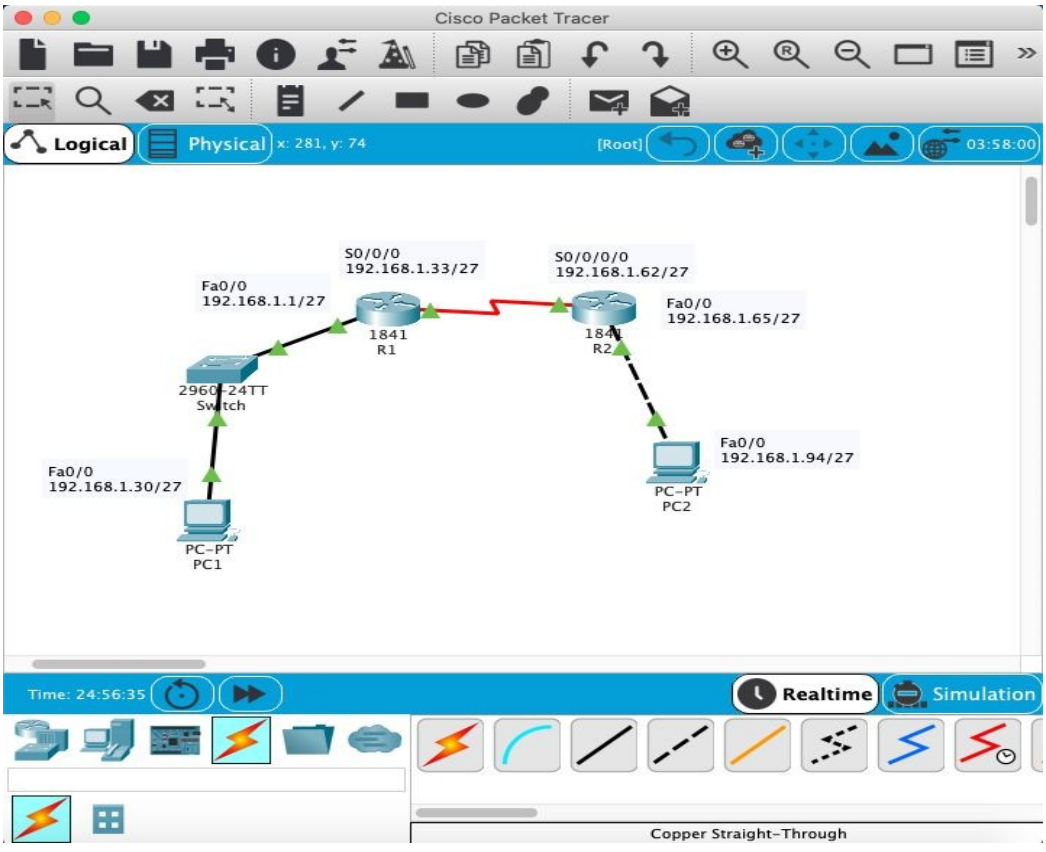
Configuration of PC1 - Ethernet interface.



Configuration of PC2 - Ethernet interface.



Final Topology Diagram.

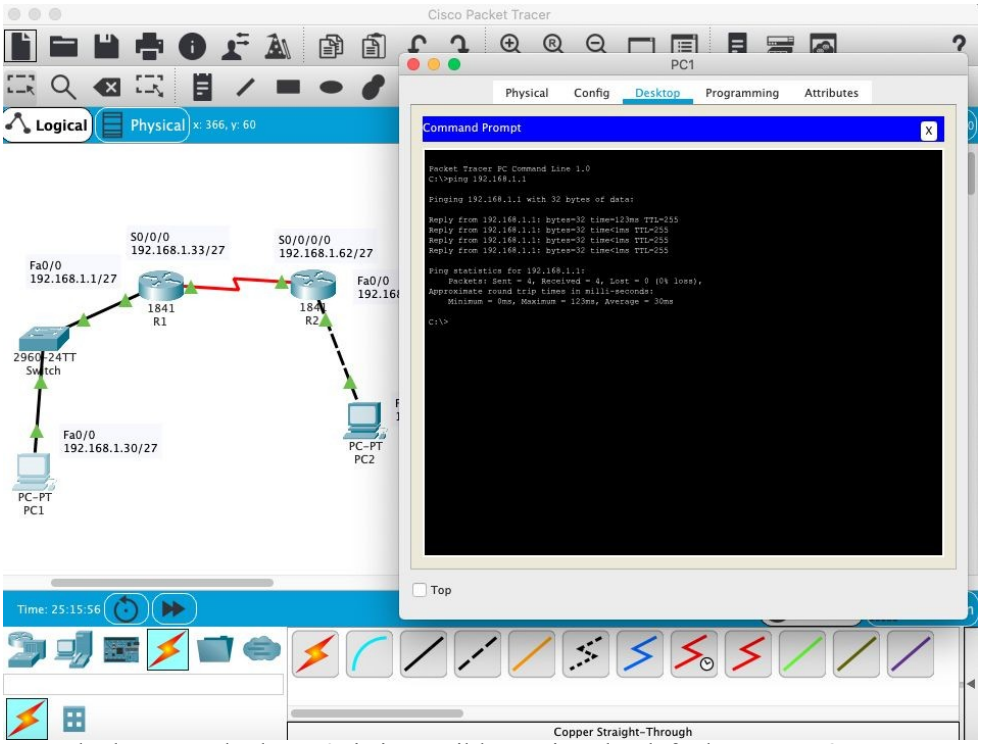


Task 4: Verify the Configurations.

Answer the following questions to verify that the network is operating as expected.

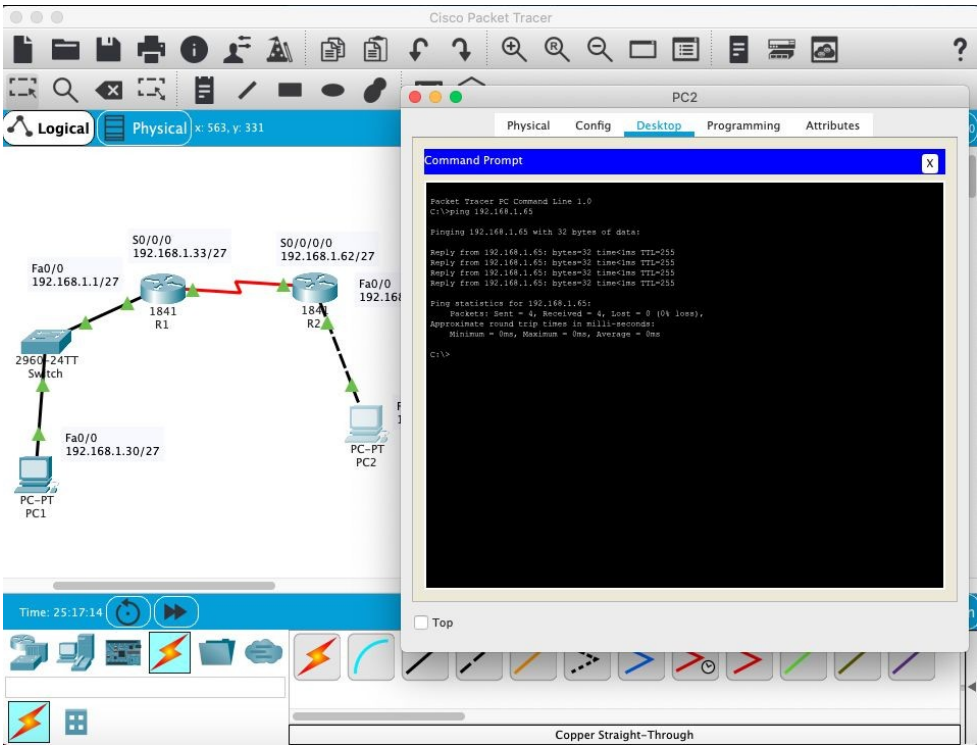
From the host attached to R1, is it possible to ping the default gateway?

Yes, Pinging the default gateway from PC1



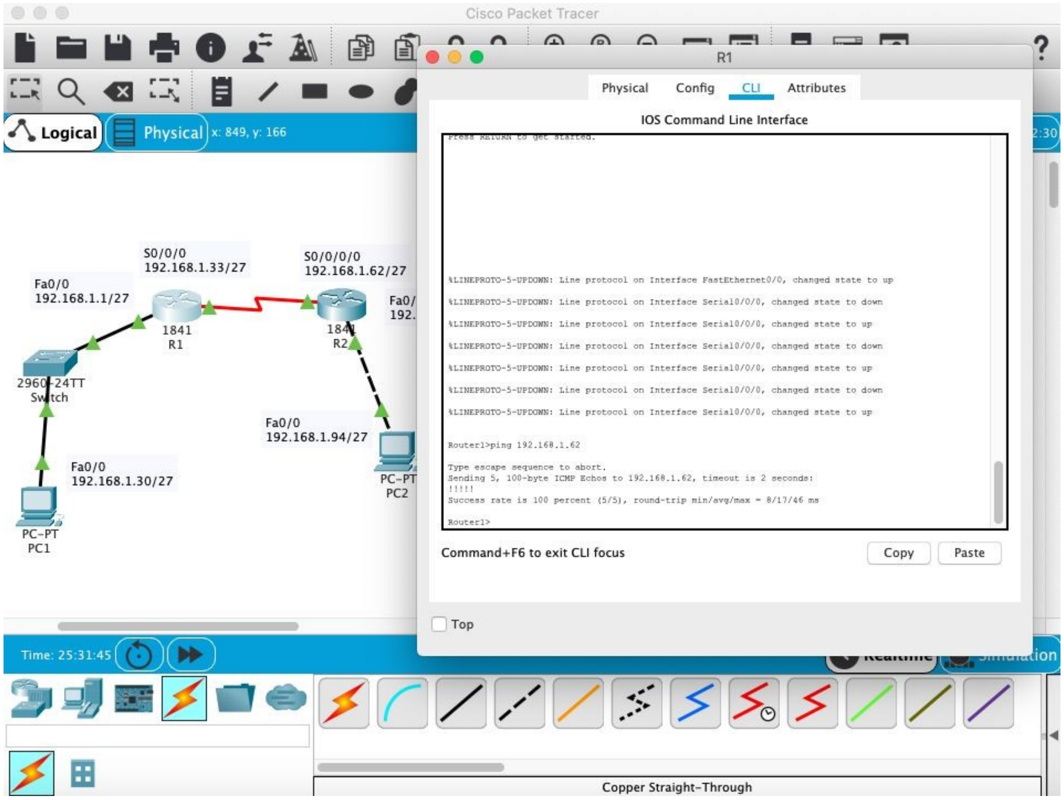
From the host attached to R2, is it possible to ping the default gateway?

Yes, Pinging the default gateway from PC2



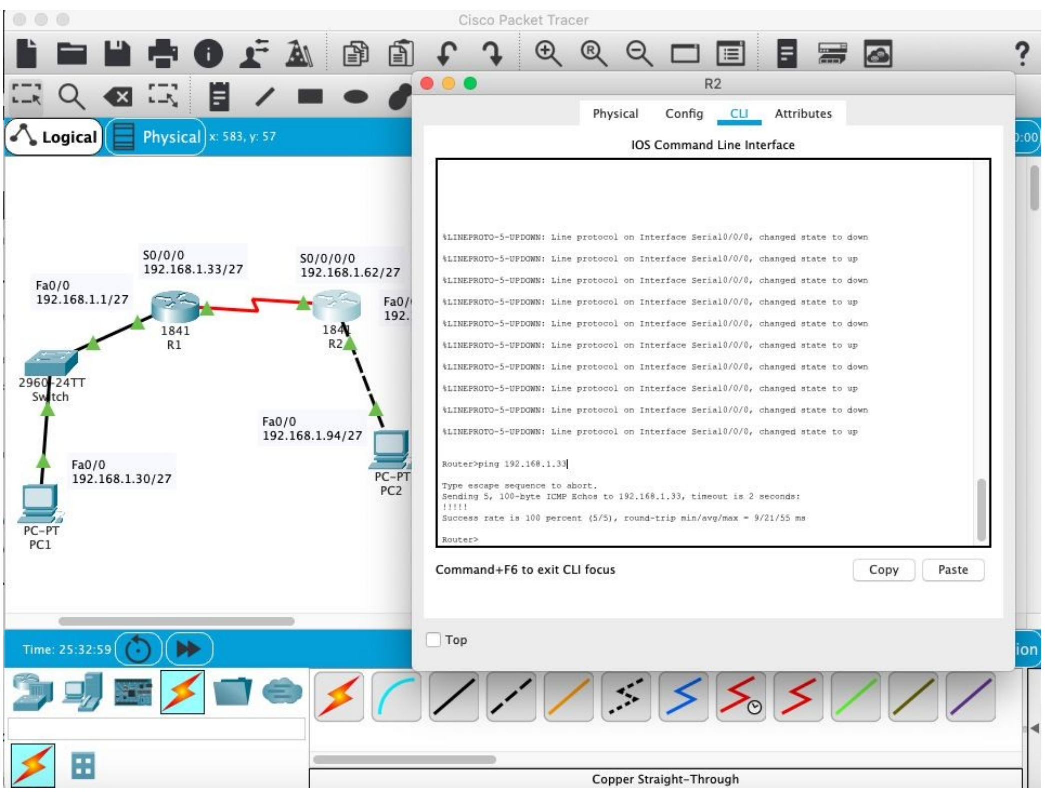
From the router R1, is it possible to ping the Serial 0/0/0 interface of R2?

Yes



From the router R2, is it possible to ping the Serial 0/0/0 interface of R1?

Yes

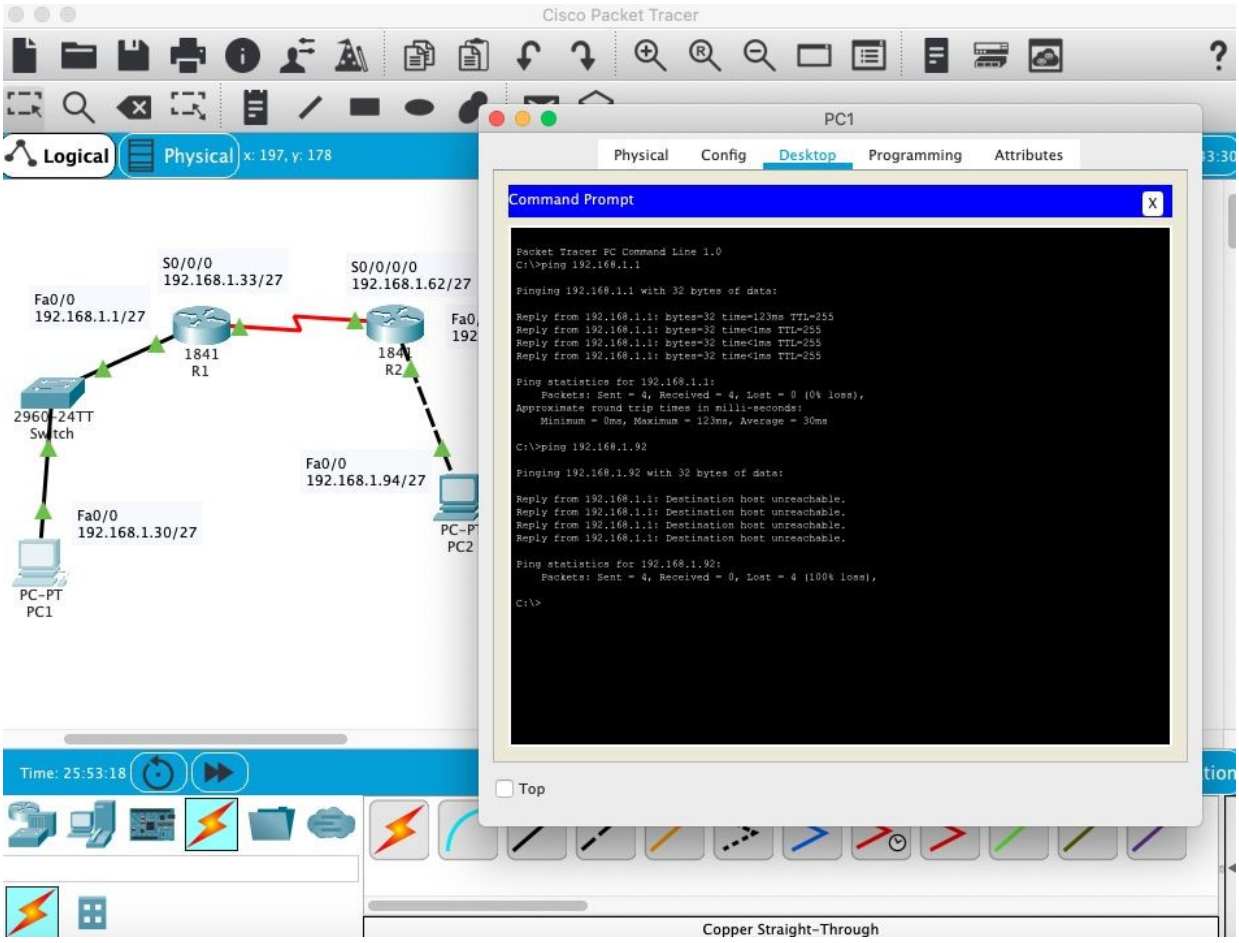


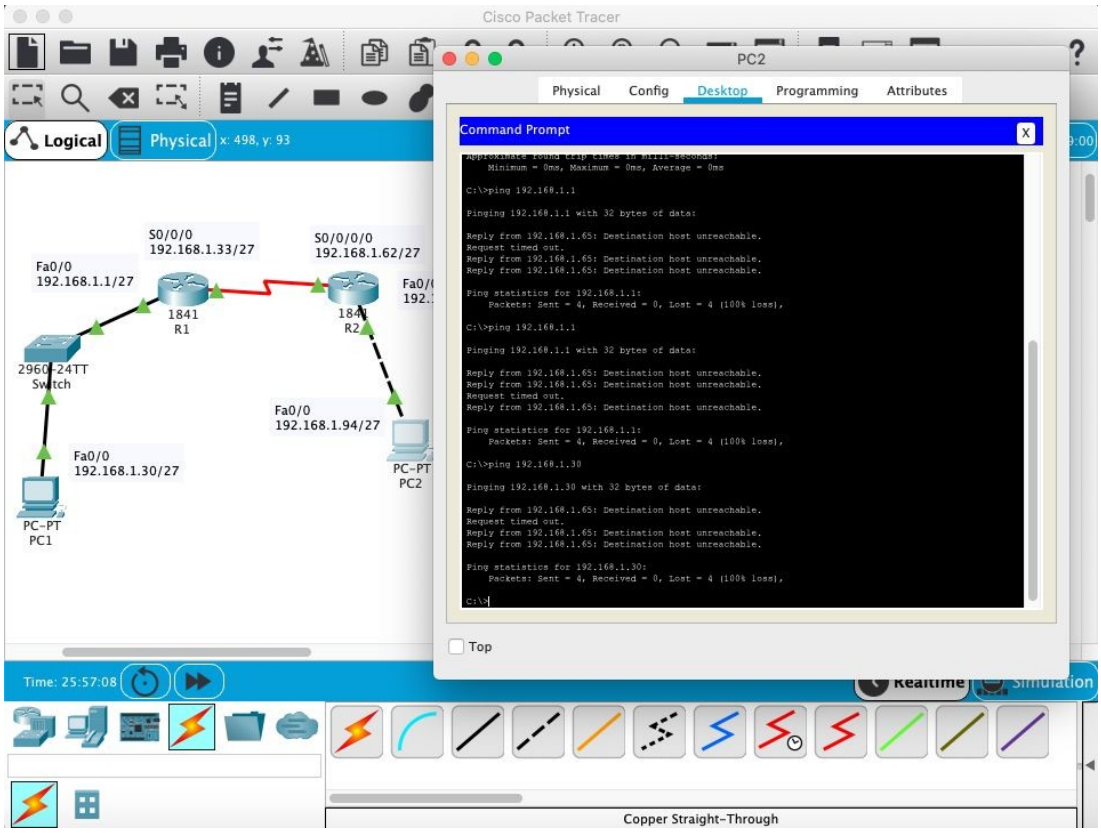
The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations.

Task 5: Reflection

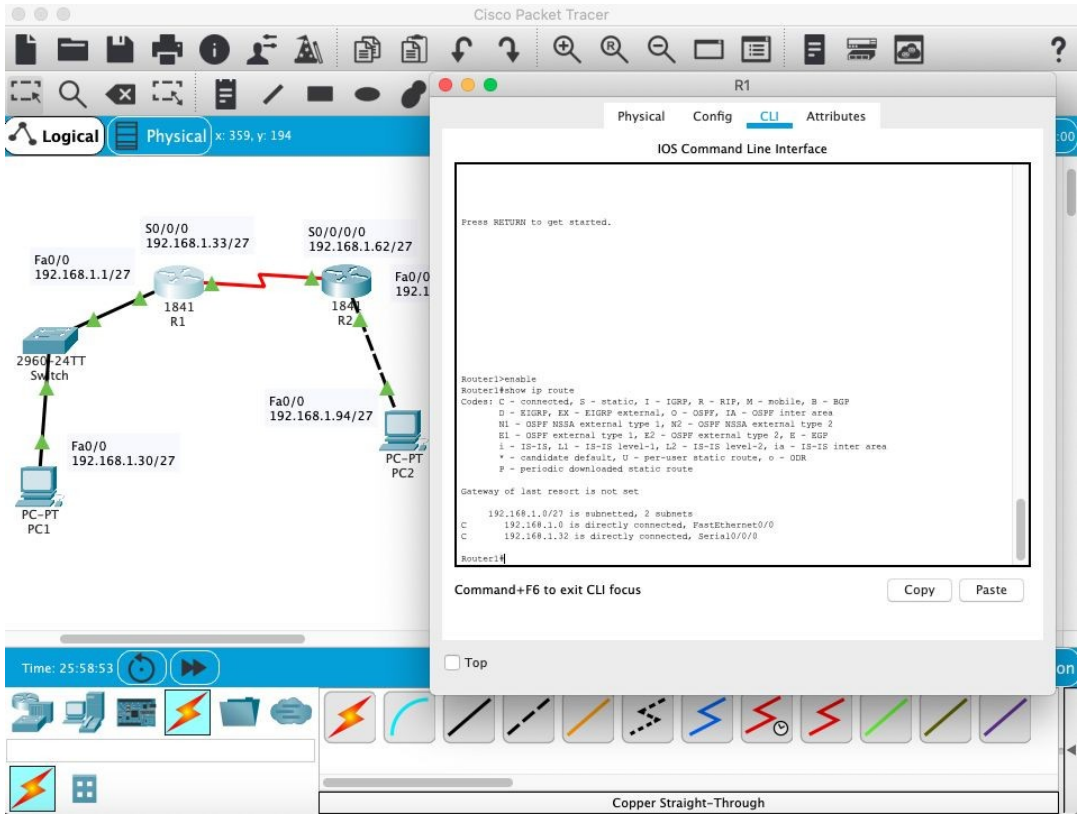
Are there any devices on the network that cannot ping each other?

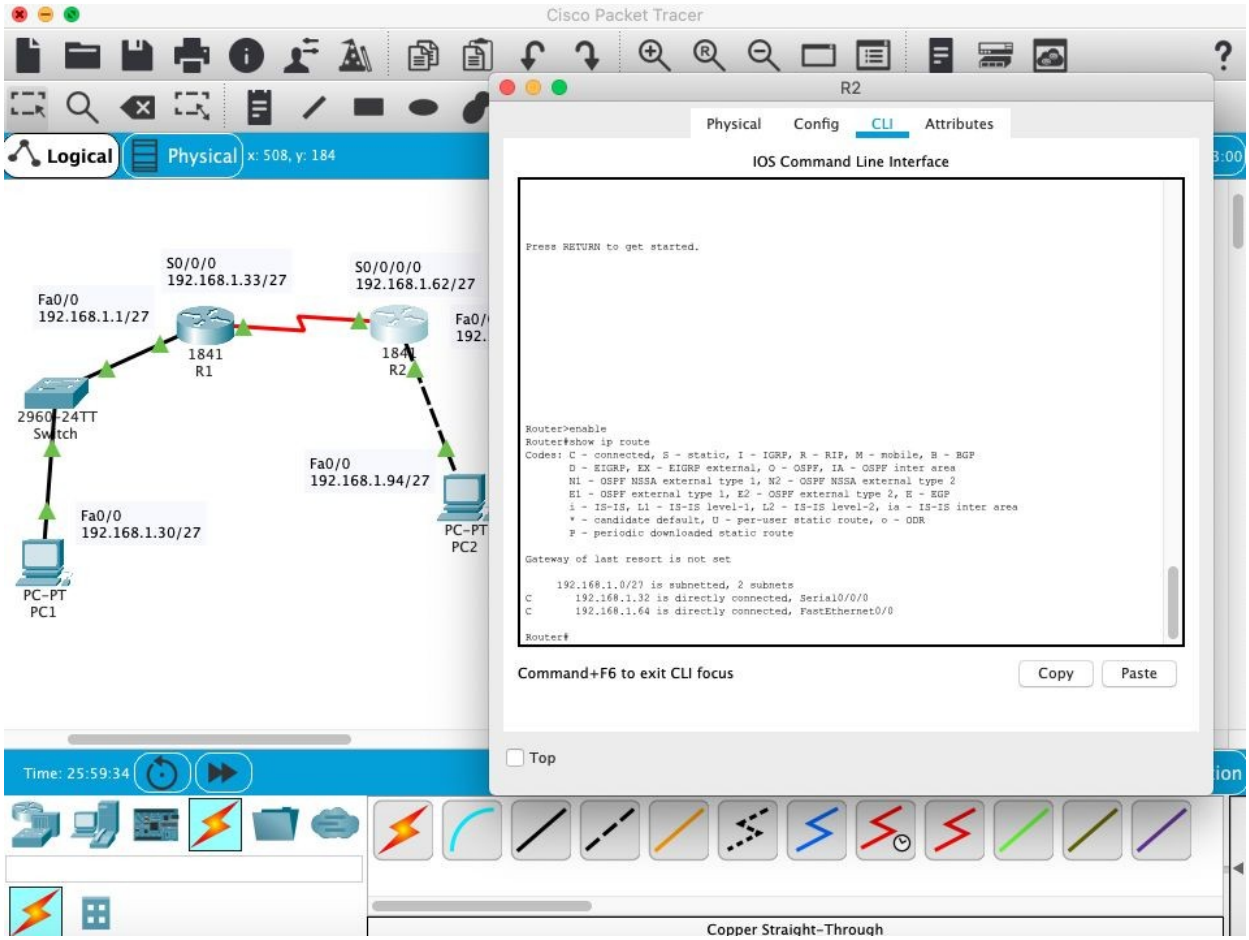
Ans: R1 cannot ping the FastEthernet interface on R2.Devices from different networks cannot ping each other. Therefore, PC1 cannot ping FastEthernet port of Router2 and PC2 and PC2 cannot ping FastEthernet port of Router1 and PC1.





What is missing from the network that is preventing communication between these devices?





Ans: From the above routing table, we can see that the routers in our network only have the addresses of devices which are directly connected to its interfaces in their routing table.
Network is preventing communication between these devices and we cannot ping these devices because we have not configured routing, either static or dynamic. This network is missing either static or dynamic routing or both.