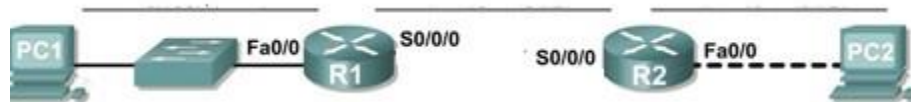


## CEL 51, DCCN, Monsoon 2020

### Lab 6: Subnet and Router Configuration

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#### 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
PC1	NIC			
PC2	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.

1. How many subnets are needed for this network?

Ans: 3 subnets are needed for this network-

1. For network connected to router R1
2. For network connected to router R2
3. For link between router R1 and router R2

2. 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 =  $2^n - 2 = 2^8 - 2 = 254$

We need 3 subnets for this network

Hence borrowing 2 bits from the host portion

We get  $2^2 = 4$  subnets

So, the subnet mask becomes: **11111111.11111111.11111111.1100000000**

i.e. **255.255.255.192**

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

Ans: The subnet mask for the network in slash format is the number of ones in the subnet mask written in dot separated format

Hence, subnet mask for the network in slash format is **/26**

4. 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.

Hence, the number of usable hosts is given as  $2^H - 2$  where H is host bits

Therefore  $2^6 - 2 = \mathbf{62}$  usable hosts per subnet.

### **Step 3: Assign sub-network addresses to the Topology Diagram.**

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

Subnet 1: 11000000.10101000.00000001.01000000 = 192.168.1.64

Network ID: 11000000.10101000.00000001.01000000 = 192.168.1.64/26

1<sup>st</sup> usable IP: 11000000.10101000.00000001.01000001 = 192.168.1.65/26

Last usable IP: 11000000.10101000.00000001.01111110 = 192.168.1.126/26

Broadcast IP: 11000000.10101000.00000001.01111111 = 192.168.1.127/26

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

Subnet 2: 11000000.10101000.00000001.10000000 = 192.168.1.128

Network ID: 11000000.10101000.00000001.10000000 = 192.168.1.128/26

1<sup>st</sup> usable IP: 11000000.10101000.00000001.10000001 = 192.168.1.129/26

Last usable IP: 11000000.10101000.00000001.10111110 = 192.168.1.190/26

Broadcast IP: 11000000.10101000.00000001.10111111 = 192.168.1.191/26

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

Subnet 3: 11000000.10101000.00000001.11000000 = 192.168.1.192

Network ID: 11000000.10101000.00000001.11000000 = 192.168.1.192/26

1<sup>st</sup> usable IP: 11000000.10101000.00000001.11000001 = 192.168.1.193/26

Last usable IP: 11000000.10101000.00000001.11111110 = 192.168.1.254/26

Broadcast IP: 11000000.10101000.00000001.11111111 = 192.168.1.255/26

### **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: 192.168.1.65

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

Ans: 192.168.1.126

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

Ans: 192.168.1.129

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

Ans: 192.168.1.190

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

Ans: 192.168.1.193

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

Ans: 192.168.1.254

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

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0	192.168.1.65	255.255.255.192	N/A
	S0/0/0	192.168.1.129	255.255.255.192	N/A
R2	Fa0/0	192.168.1.193	255.255.255.192	N/A
	S0/0/0	192.168.1.190	255.255.255.192	N/A
PC1	NIC	192.168.1.126	255.255.255.192	192.168.1.65
PC2	NIC	192.168.1.254	255.255.255.192	192.168.1.193

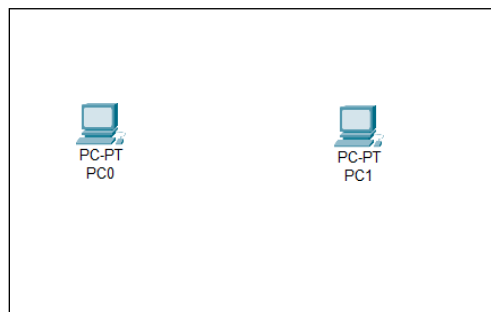
**Task 3: Configure the Serial and FastEthernet Addresses.**

**Step 1: Configure the router interfaces.**

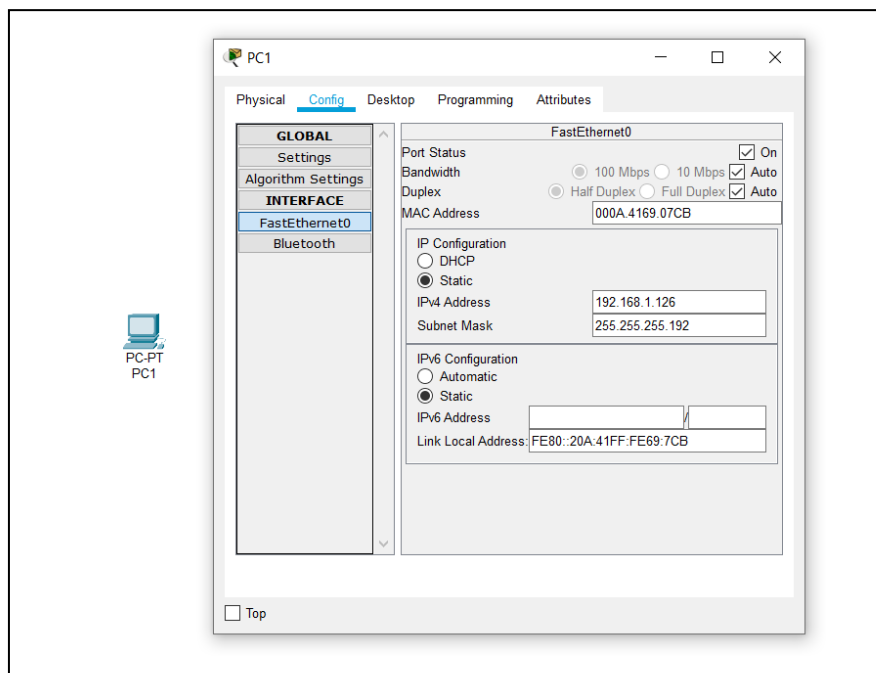
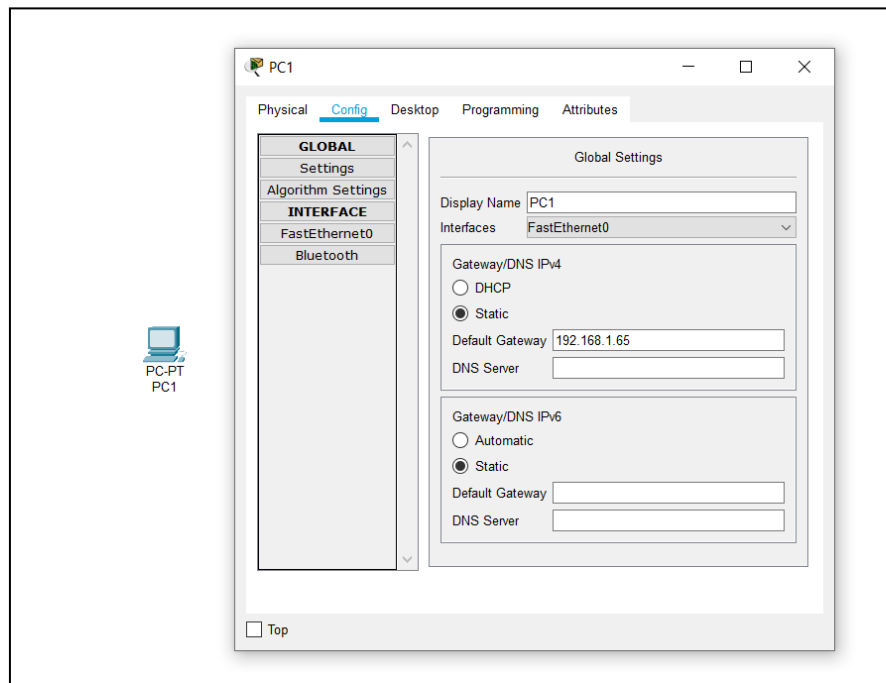
Configure the interfaces on the R1 and R2 routers with the IP addresses from your network design. Please note, to complete the activity in Packet Tracer you will be using the Config Tab. When you have finished, be sure to save the running configuration to the NVRAM of the router.

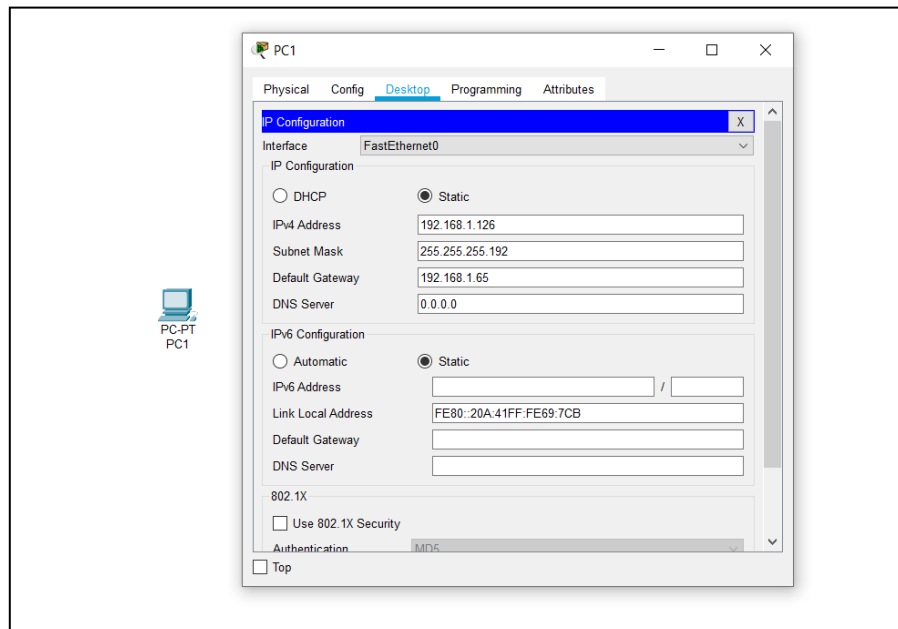
**Step 2: Configure the PC interfaces.**

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

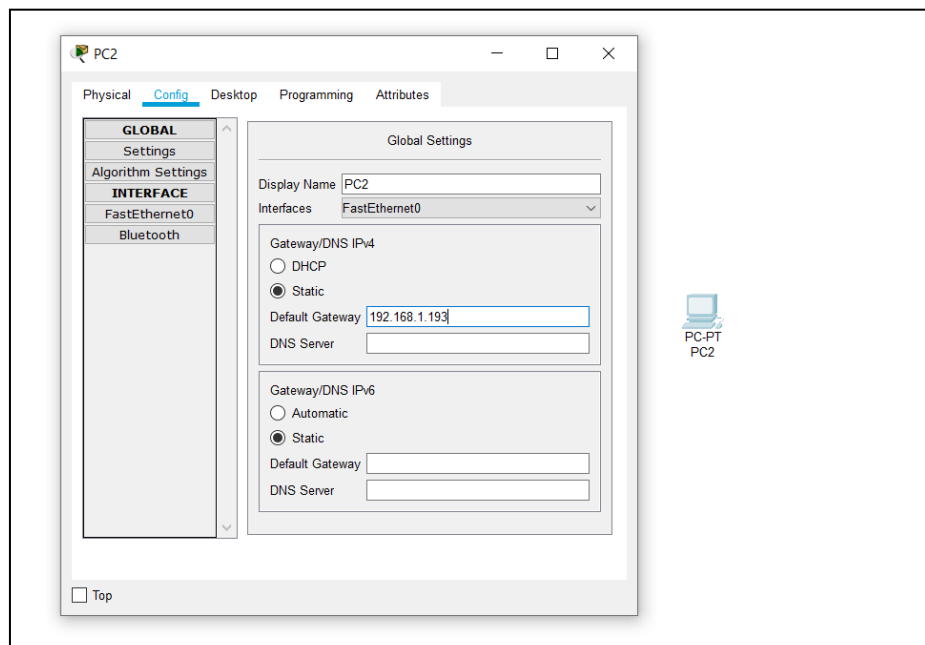


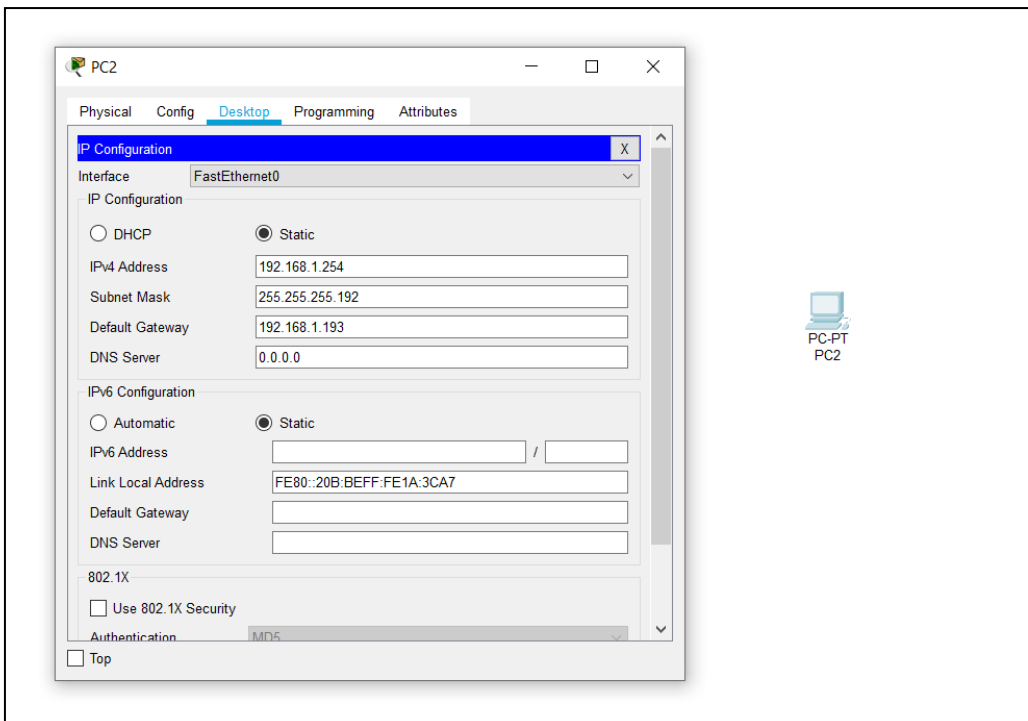
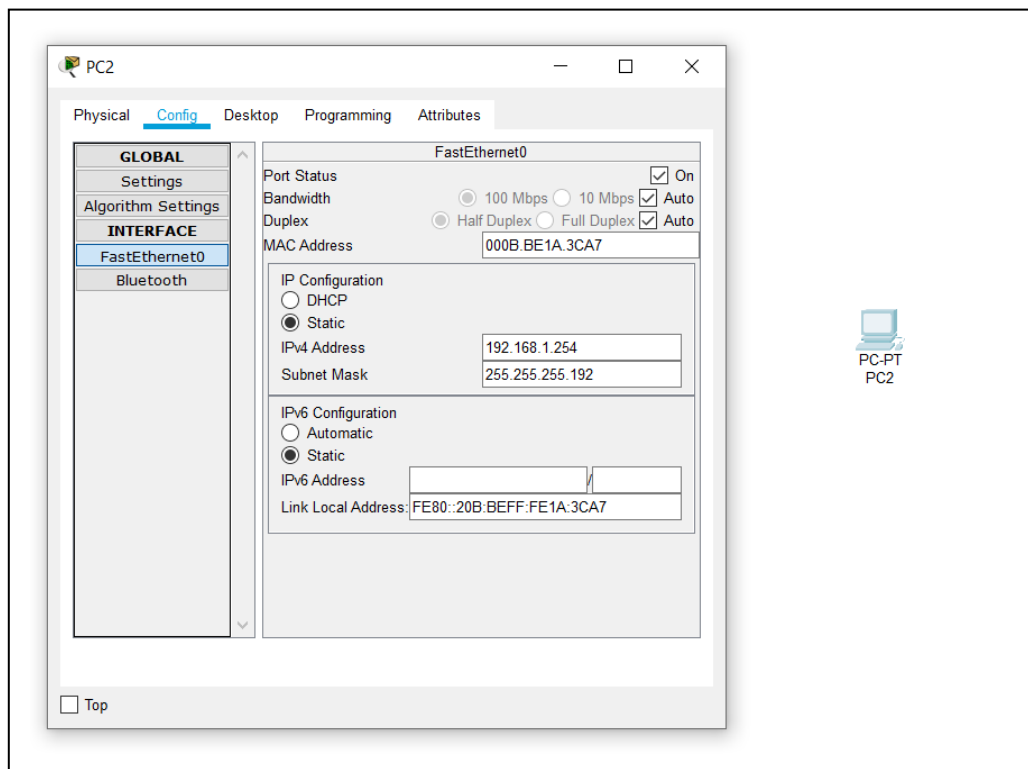
## Configuration of PC1



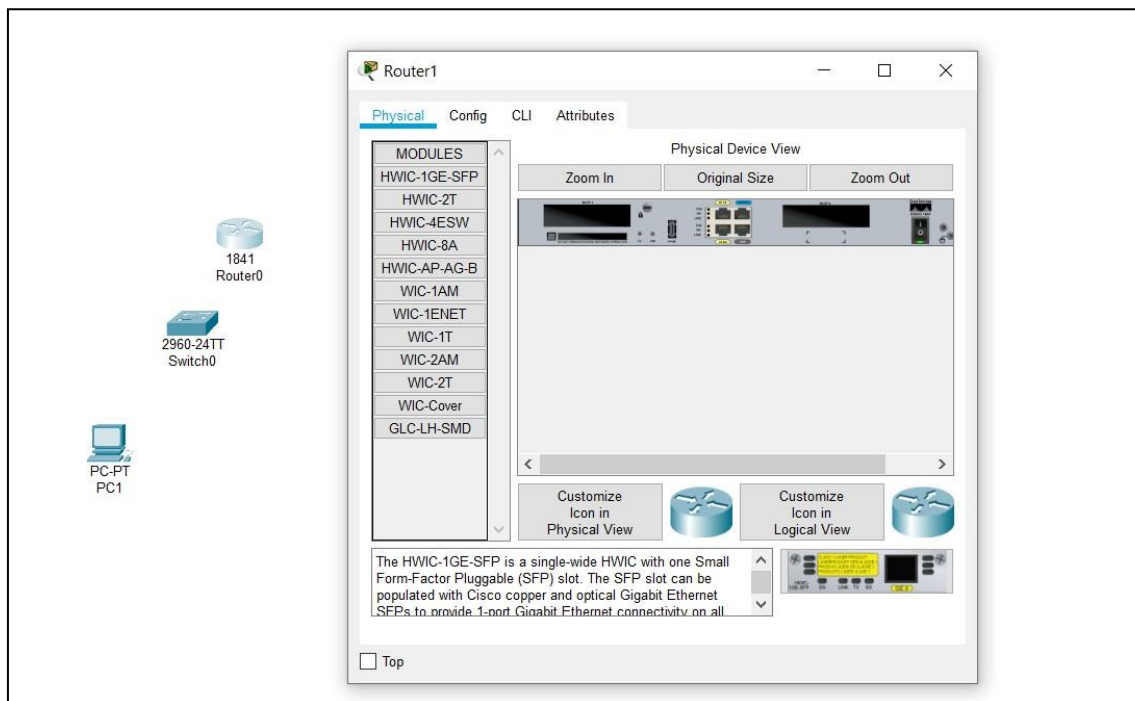
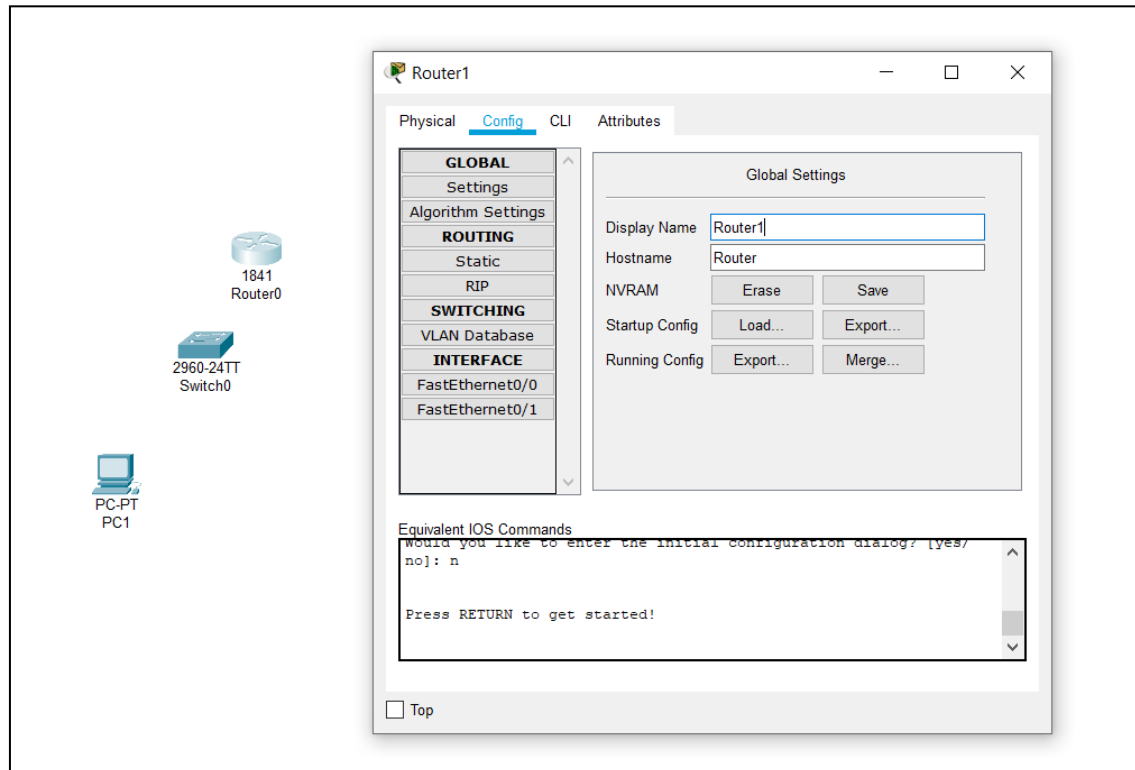


## Configuration of PC2



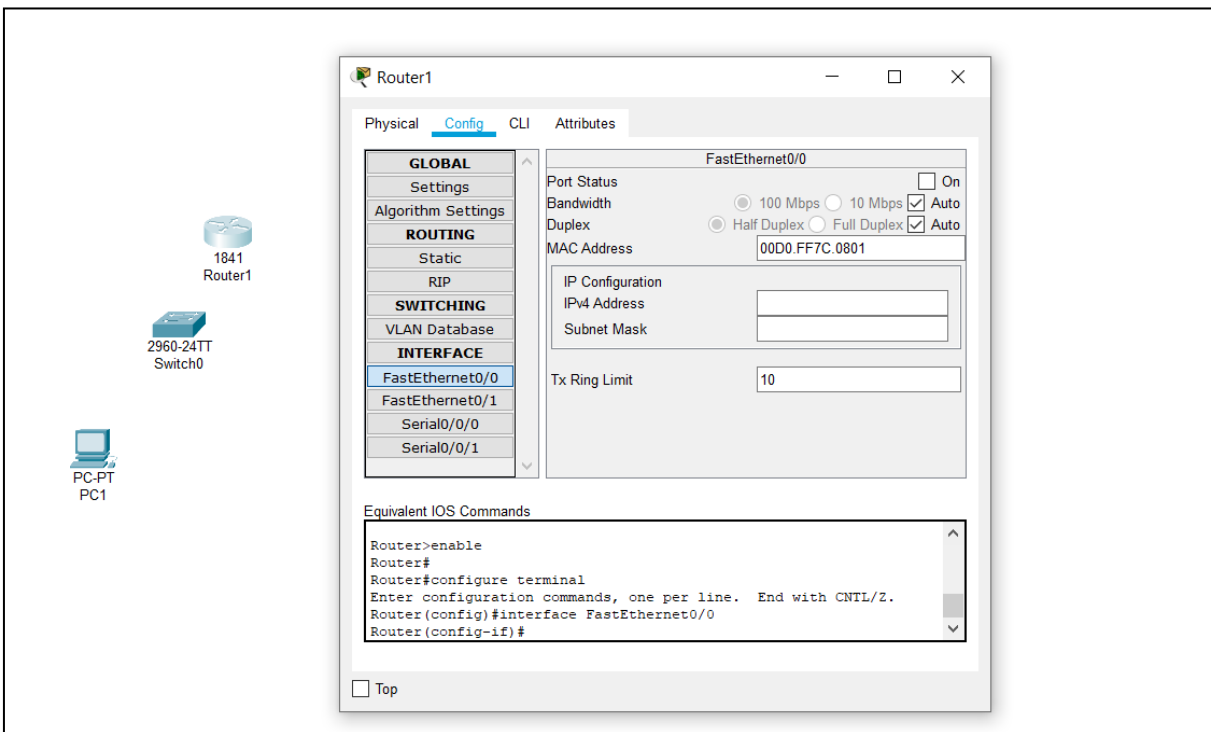
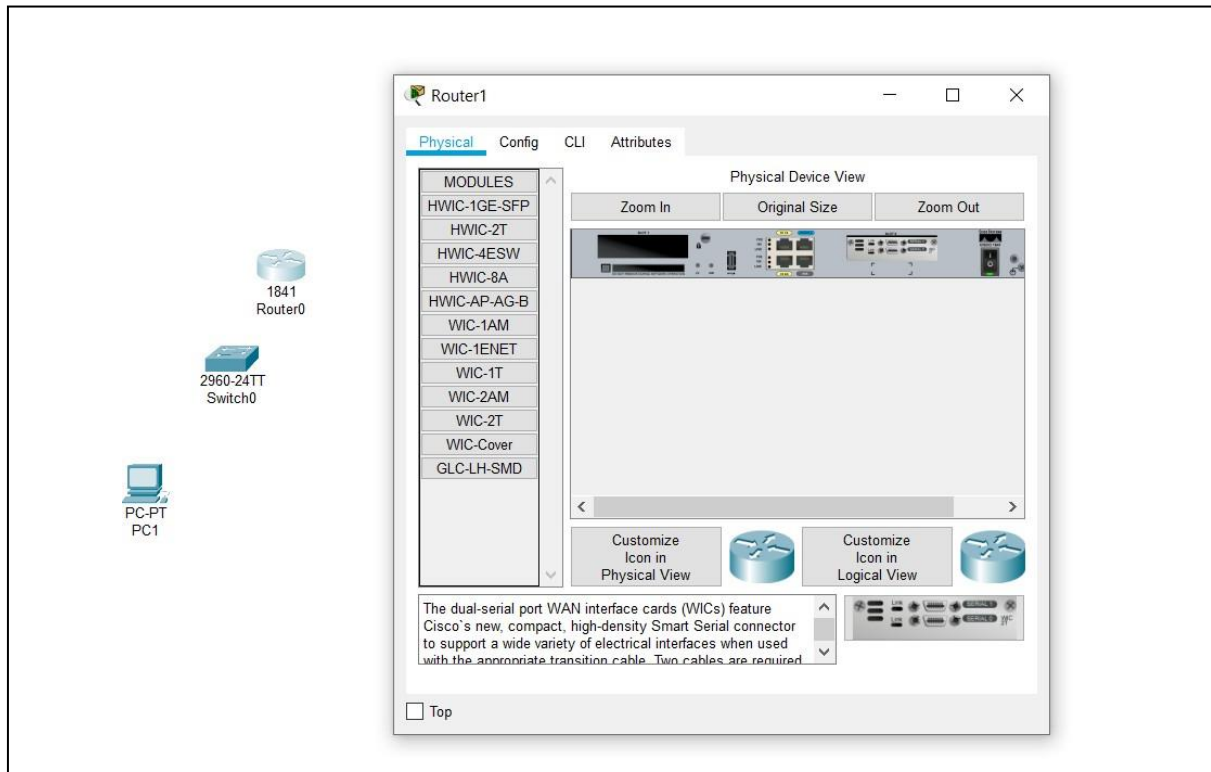


## Configuration of Router 1

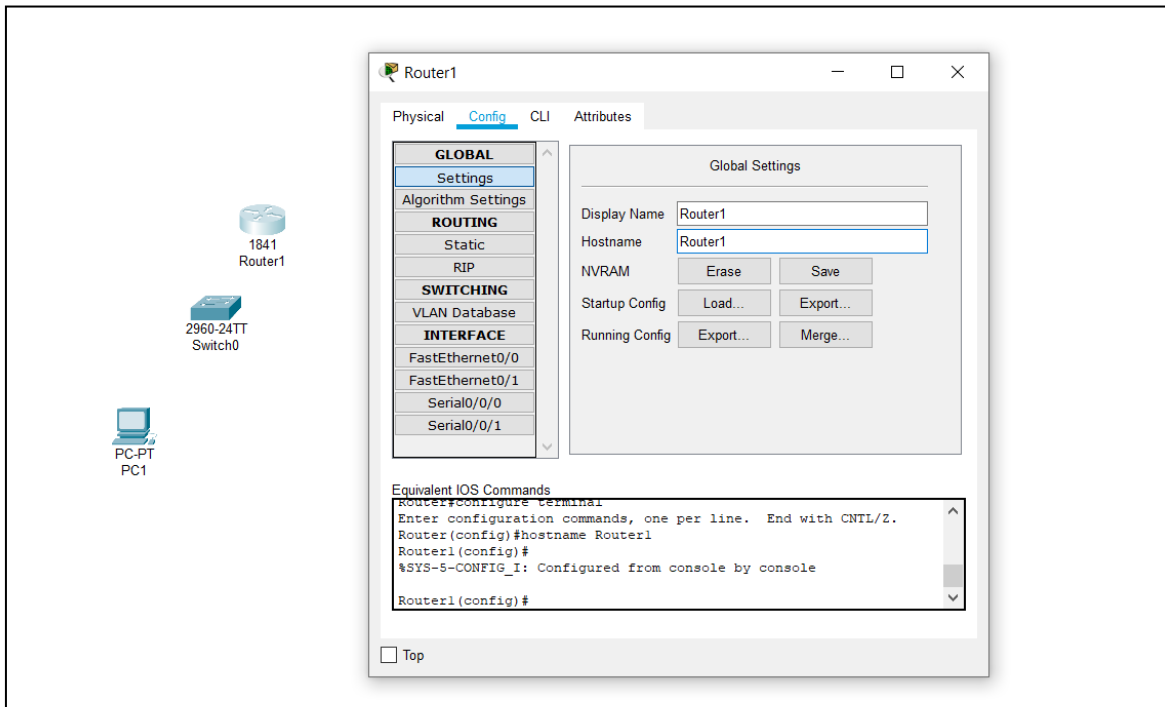




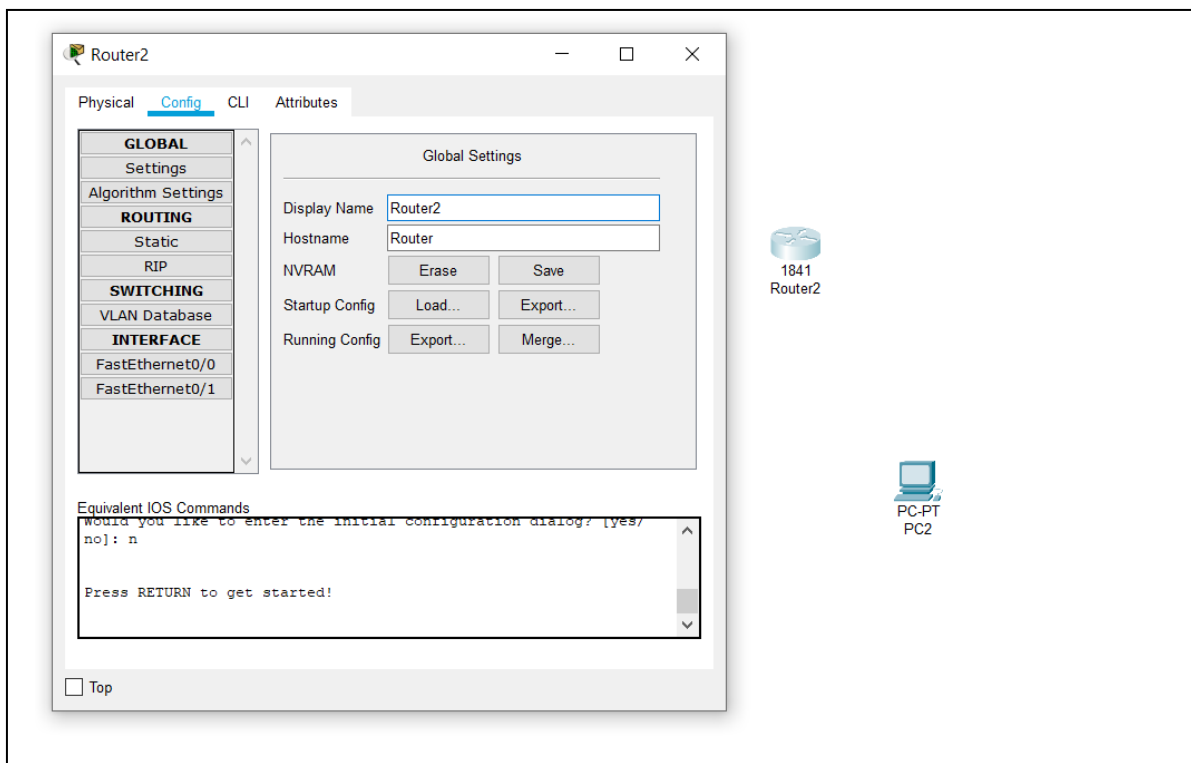
## Adding WIC-2T card for serial port

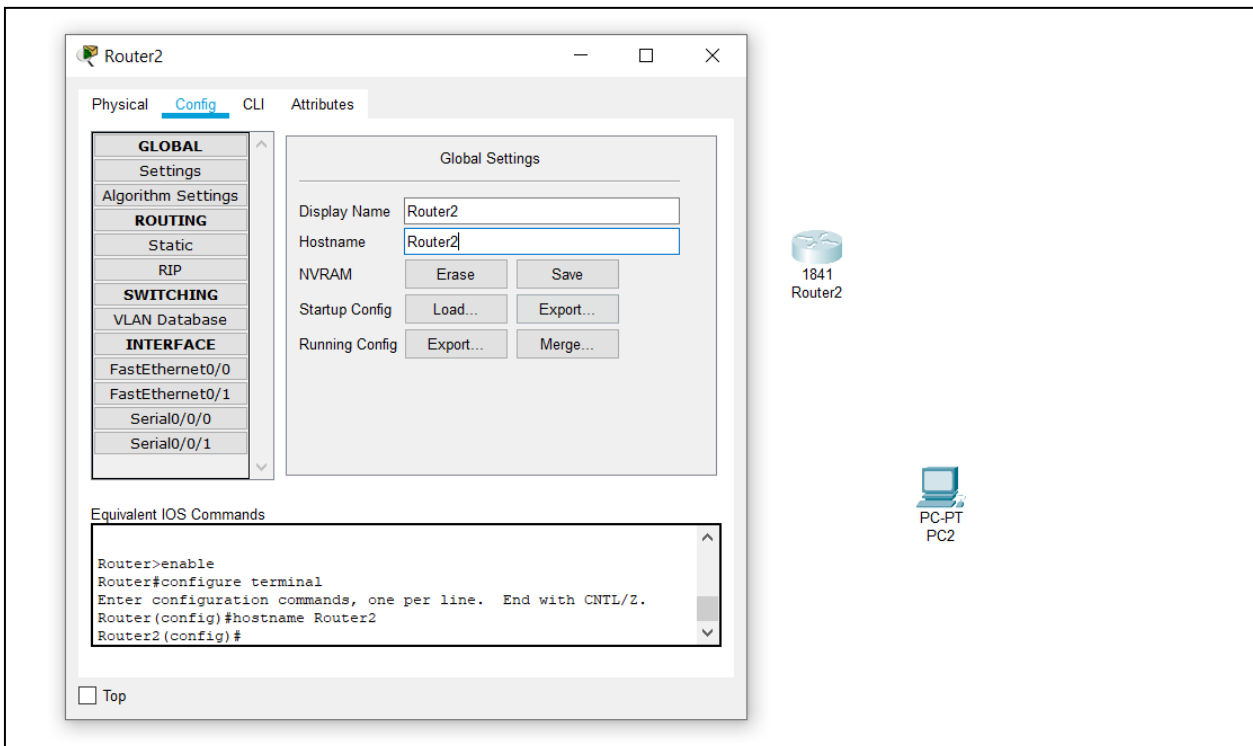
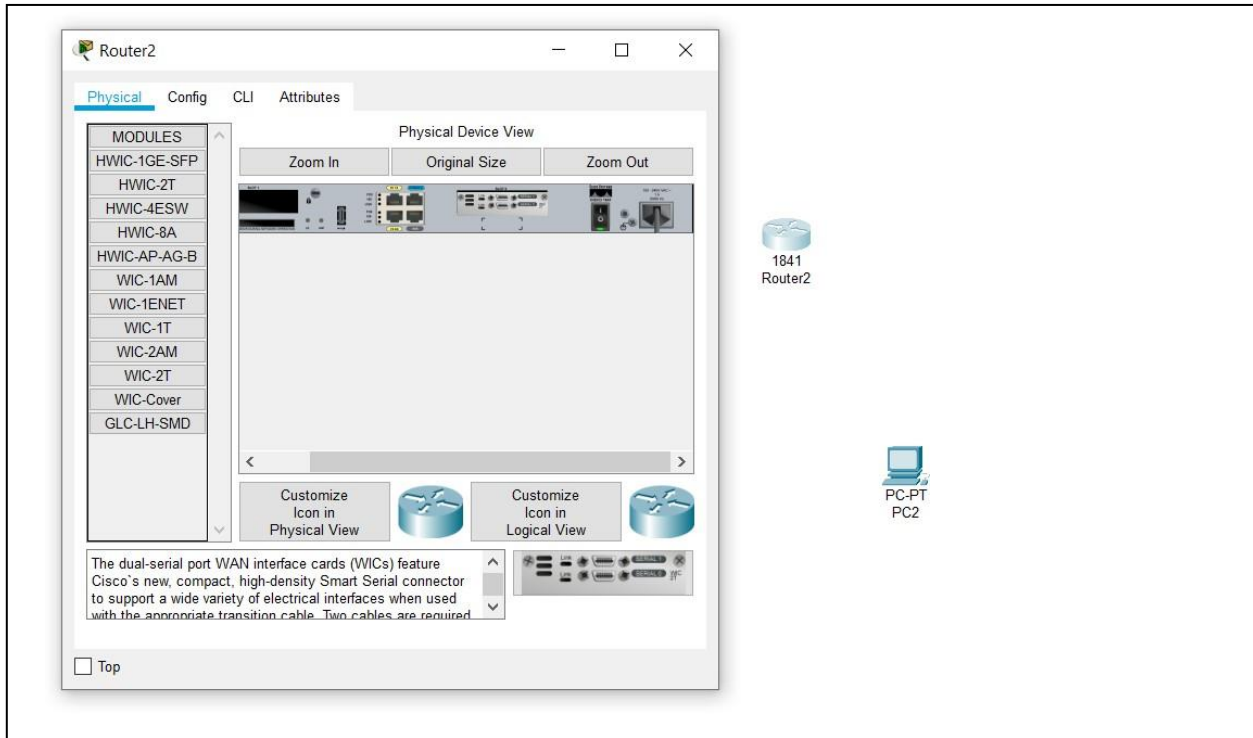


## Changing hostname to Router1

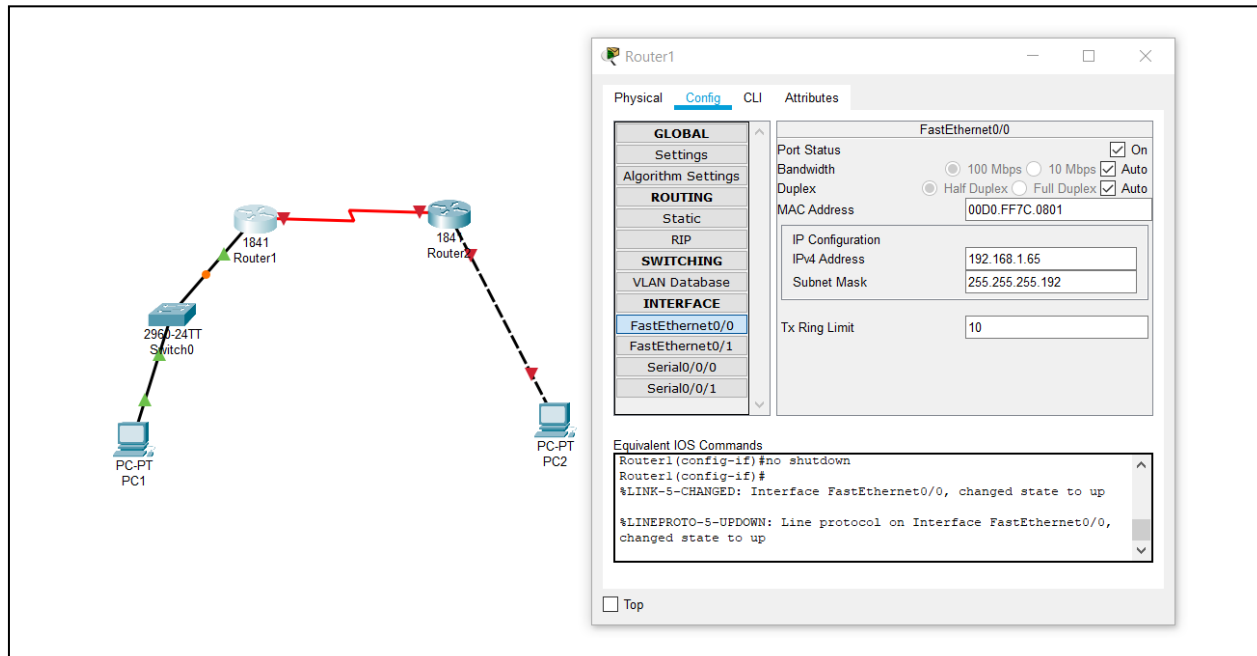


## Configuration of Router 2





## Assigning IP addresses to Router 1



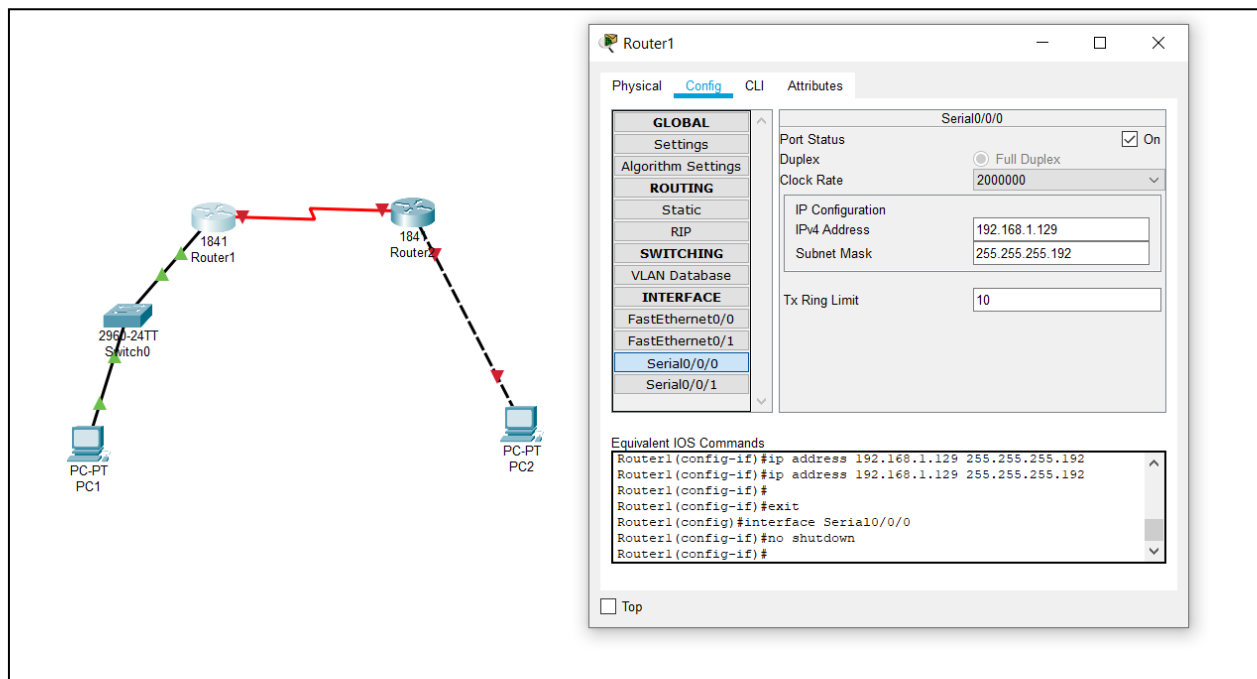
The network diagram shows PC-PT PC1 connected to a 2960-24TT Switch0, which is connected to Router1 (1841). Router1 is connected to Router2 (1841), which is connected to PC-PT PC2. The configuration window for Router1 shows the FastEthernet0/0 interface settings.

**Router1 Configuration - FastEthernet0/0**

- Port Status: ☒ On
- Bandwidth: ☐ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 00D0.FF7C.0801
- IP Configuration:
  - IPv4 Address: 192.168.1.65
  - Subnet Mask: 255.255.255.192
- Tx Ring Limit: 10

**Equivalent IOS Commands**

```
Router1(config-if)#no shutdown
Router1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0,
changed state to up
```



The network diagram shows PC-PT PC1 connected to a 2960-24TT Switch0, which is connected to Router1 (1841). Router1 is connected to Router2 (1841), which is connected to PC-PT PC2. The configuration window for Router1 shows the Serial0/0/0 interface settings.

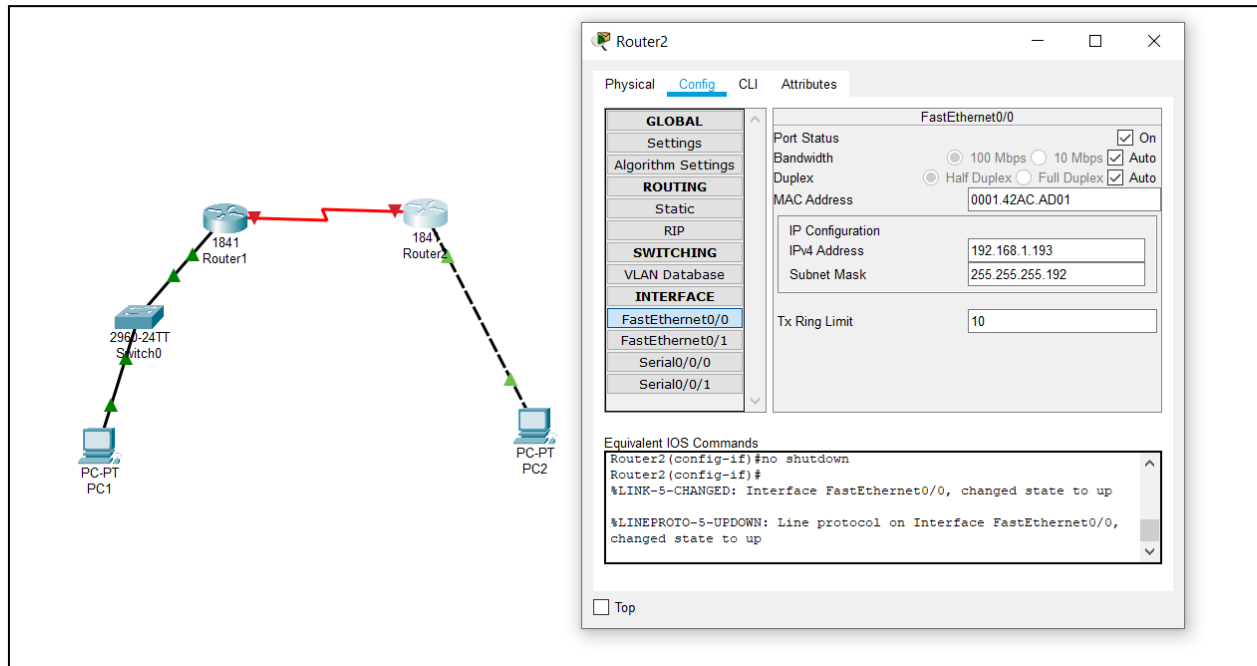
**Router1 Configuration - Serial0/0/0**

- Port Status: ☒ On
- Duplex: ☒ Full Duplex
- Clock Rate: 2000000
- IP Configuration:
  - IPv4 Address: 192.168.1.129
  - Subnet Mask: 255.255.255.192
- Tx Ring Limit: 10

**Equivalent IOS Commands**

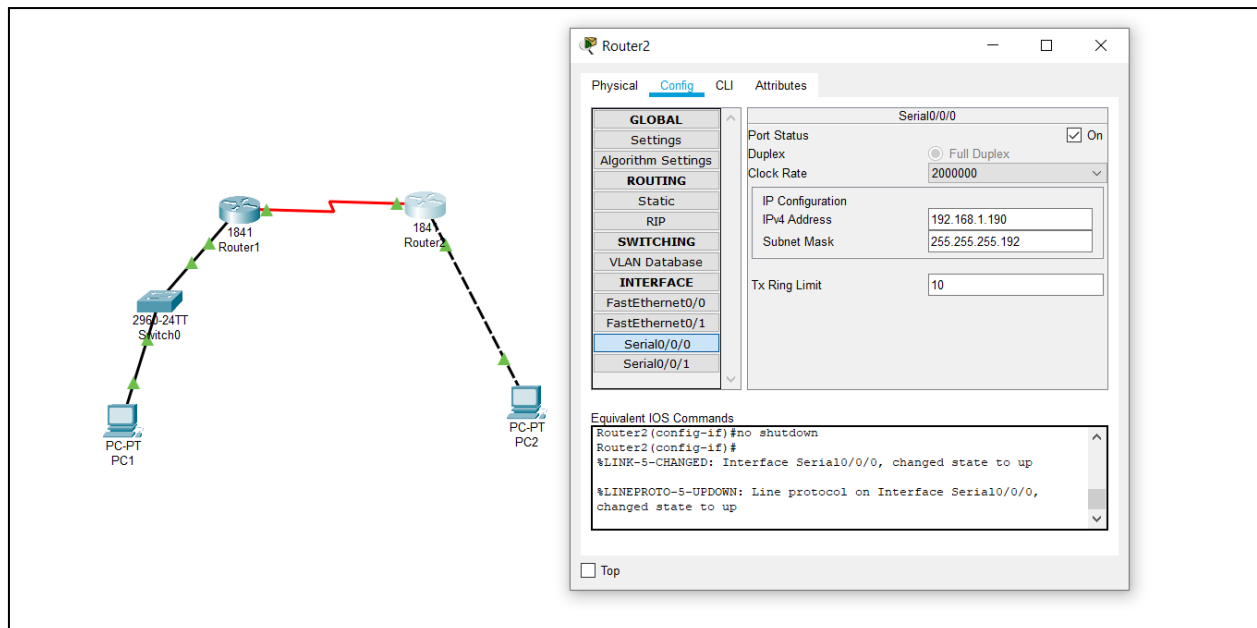
```
Router1(config-if)#ip address 192.168.1.129 255.255.255.192
Router1(config-if)#ip address 192.168.1.129 255.255.255.192
Router1(config-if)#
Router1(config-if)#exit
Router1(config)#interface Serial0/0/0
Router1(config-if)#no shutdown
Router1(config-if)#
```

## Assigning IP addresses to Router 2



The network diagram shows a topology with two routers, Router1 and Router2, connected by a red link. Router1 is connected to a 2960-24TT Switch0, which is connected to PC-PT PC1. Router2 is connected to PC-PT PC2. The configuration window for Router2 is open, showing the configuration for the FastEthernet0/0 interface. The interface is configured with an IP address of 192.168.1.193 and a subnet mask of 255.255.255.192. The port status is set to On, and the duplex is set to Auto. The equivalent IOS commands are displayed at the bottom of the window.

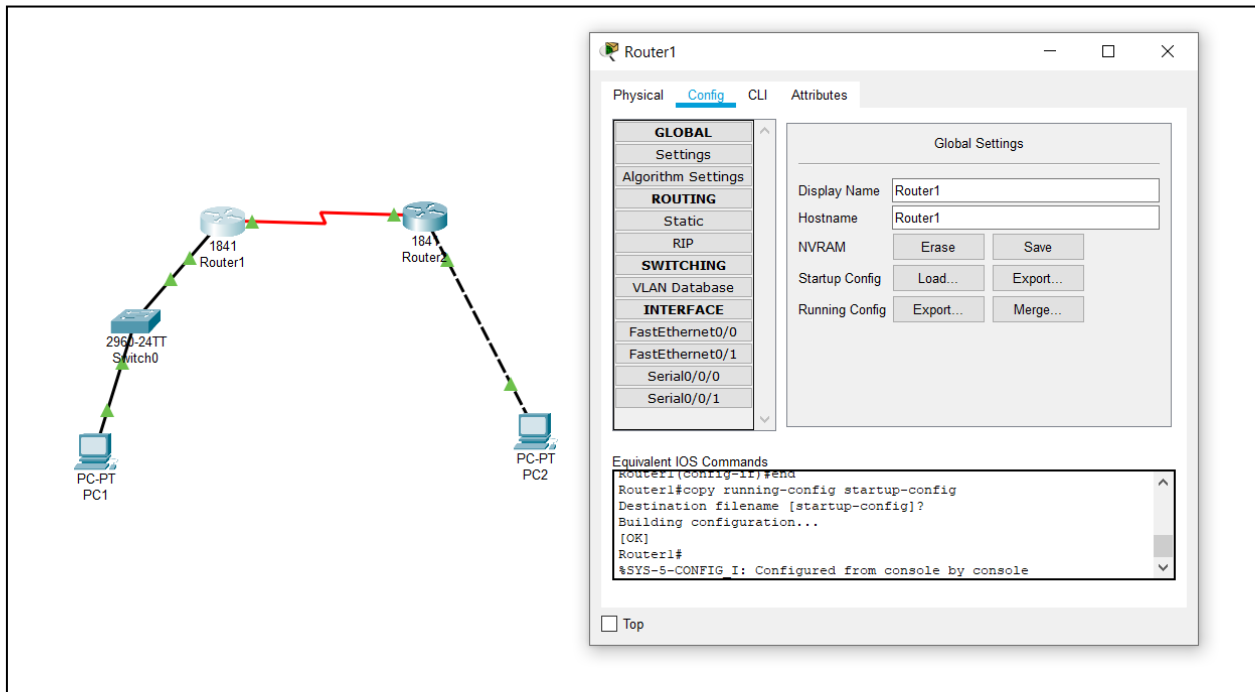
```
Router2 (config-if)#no shutdown
Router2 (config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0,
changed state to up
```



The network diagram is identical to the one above. The configuration window for Router2 is open, showing the configuration for the Serial0/0/0 interface. The interface is configured with an IP address of 192.168.1.190 and a subnet mask of 255.255.255.192. The port status is set to On, and the duplex is set to Full Duplex. The clock rate is set to 2000000. The equivalent IOS commands are displayed at the bottom of the window.

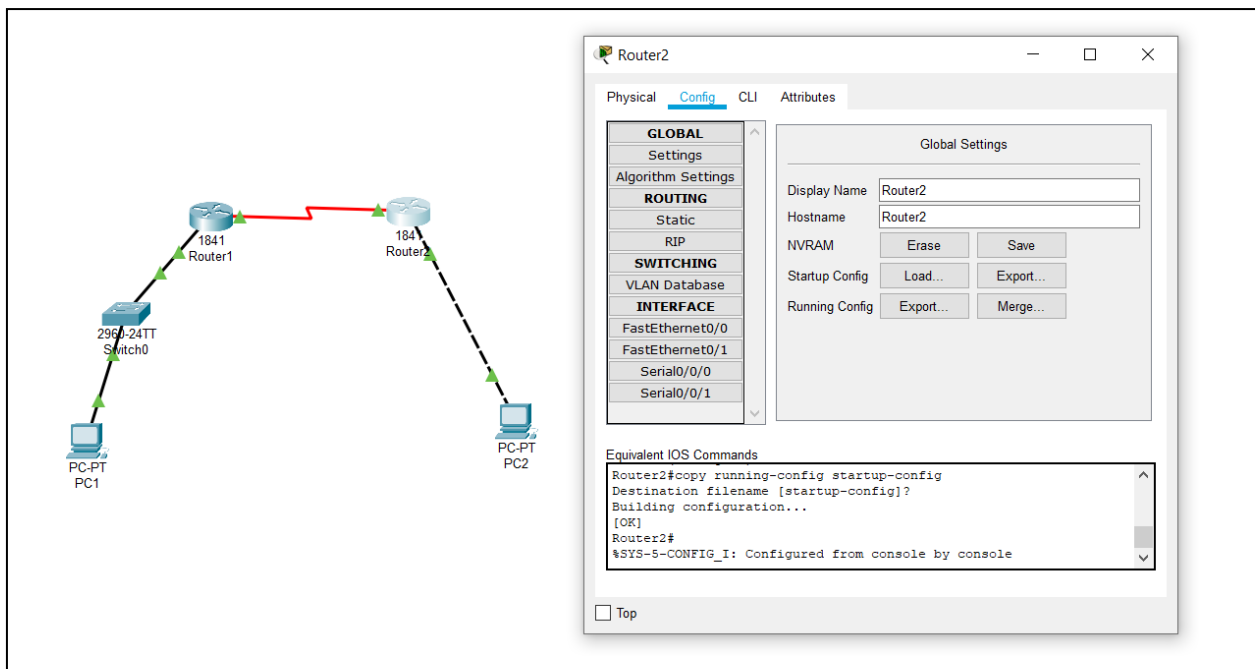
```
Router2 (config-if)#no shutdown
Router2 (config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0,
changed state to up
```

## Saving the running configuration to NVRAM of Router 1



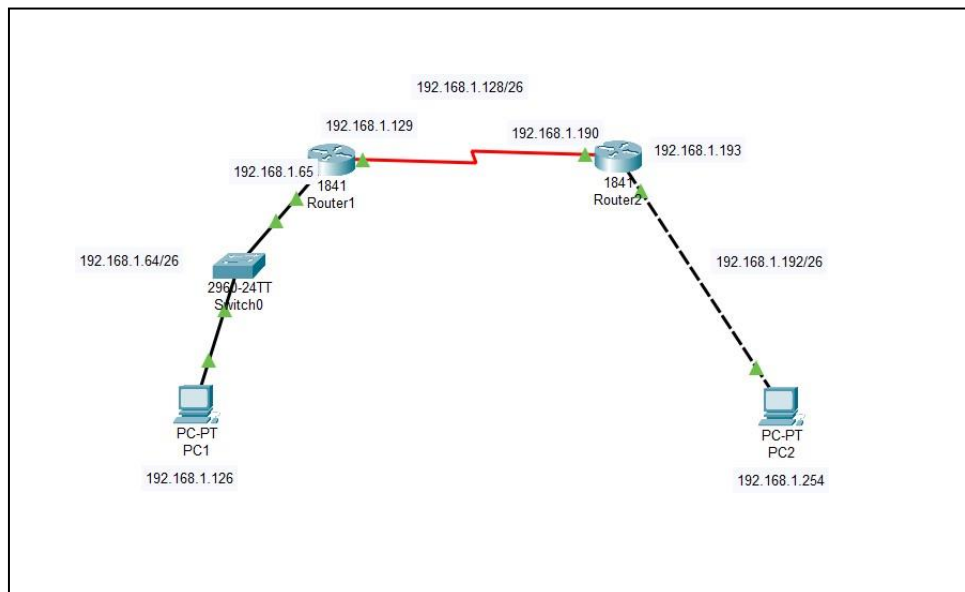
The network diagram shows a topology with two routers, Router1 and Router2, connected by a red link. Router1 is connected to a 2960-24TT Switch0, which is connected to PC-PT PC1. Router2 is connected to PC-PT PC2. The configuration window for Router1 is open, showing the 'Config' tab. The 'Global Settings' section is visible, with 'Display Name' set to 'Router1' and 'Hostname' set to 'Router1'. The 'NVRAM' section has 'Erase' and 'Save' buttons. The 'Startup Config' section has 'Load...' and 'Export...' buttons. The 'Running Config' section has 'Export...' and 'Merge...' buttons. The 'Equivalent IOS Commands' section shows the command: `Router1#copy running-config startup-config` followed by prompts for destination filename and building configuration, resulting in the command: `%SYS-5-CONFIG I: Configured from console by console`.

## Saving the running configuration to NVRAM of Router 2



The network diagram is identical to the one above. The configuration window for Router2 is open, showing the 'Config' tab. The 'Global Settings' section is visible, with 'Display Name' set to 'Router2' and 'Hostname' set to 'Router2'. The 'NVRAM' section has 'Erase' and 'Save' buttons. The 'Startup Config' section has 'Load...' and 'Export...' buttons. The 'Running Config' section has 'Export...' and 'Merge...' buttons. The 'Equivalent IOS Commands' section shows the command: `Router2#copy running-config startup-config` followed by prompts for destination filename and building configuration, resulting in the command: `%SYS-5-CONFIG_I: Configured from console by console`.

## Complete Network



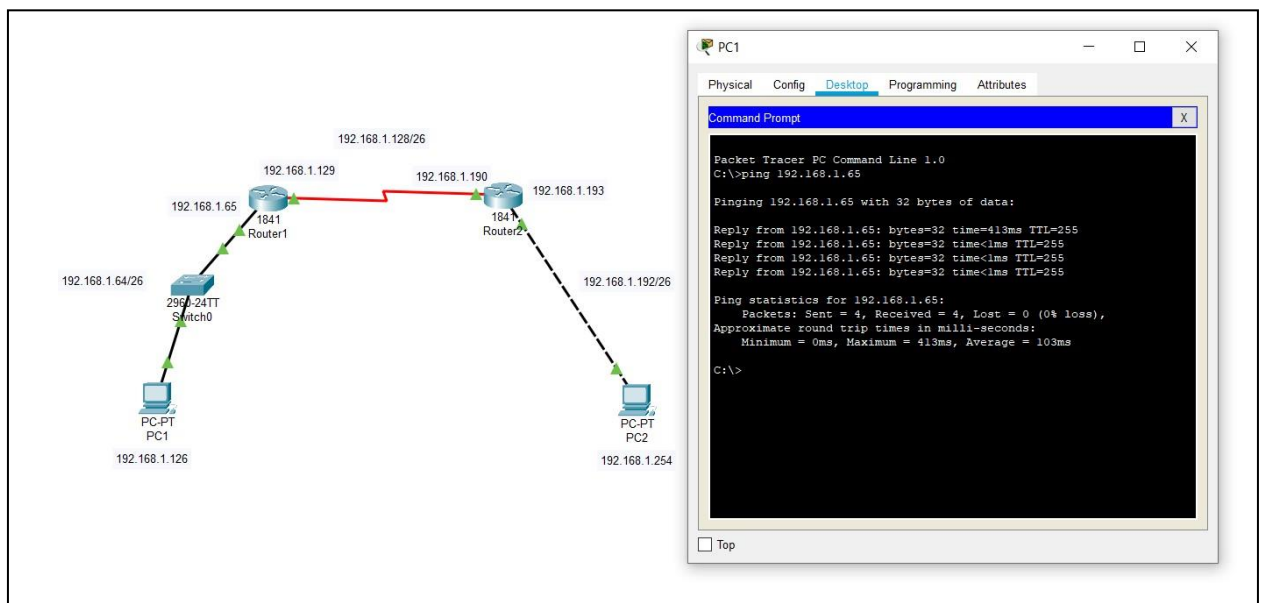
### Task 4: Verify the Configurations.

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

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

Ans: Yes

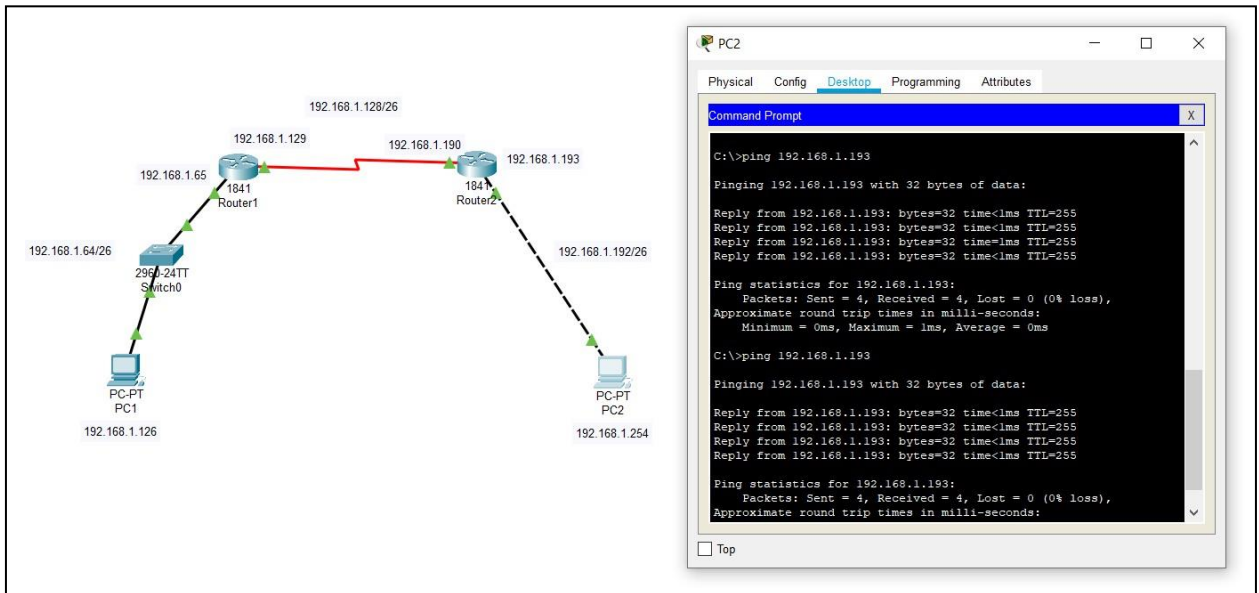
Pinging the default gateway from PC1



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

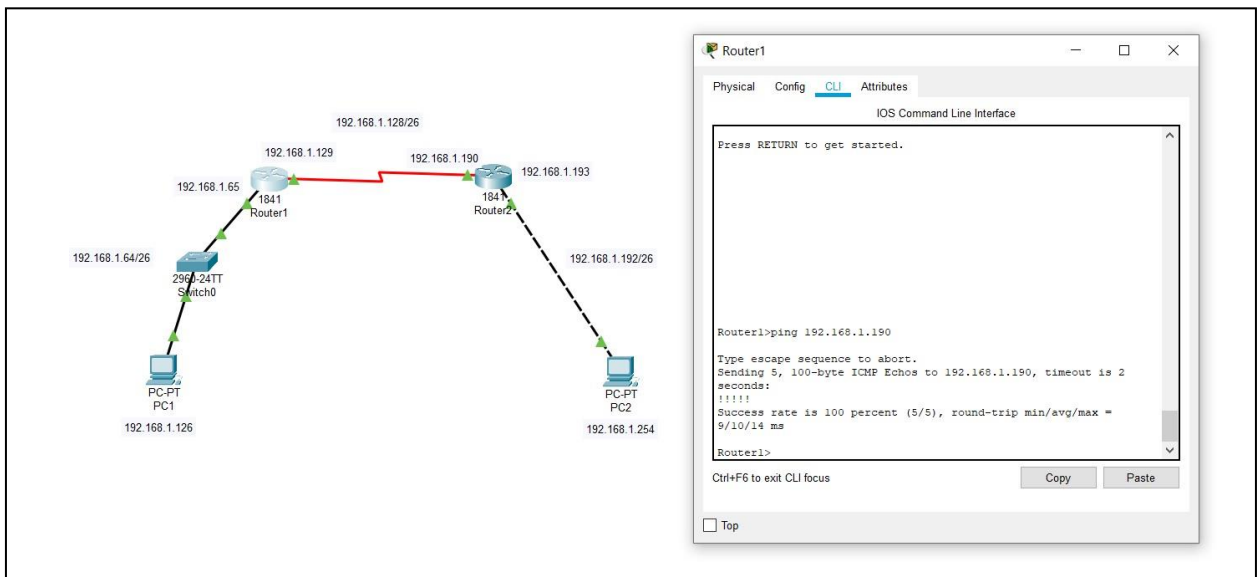
Ans: Yes

Pinging the default gateway from PC2



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

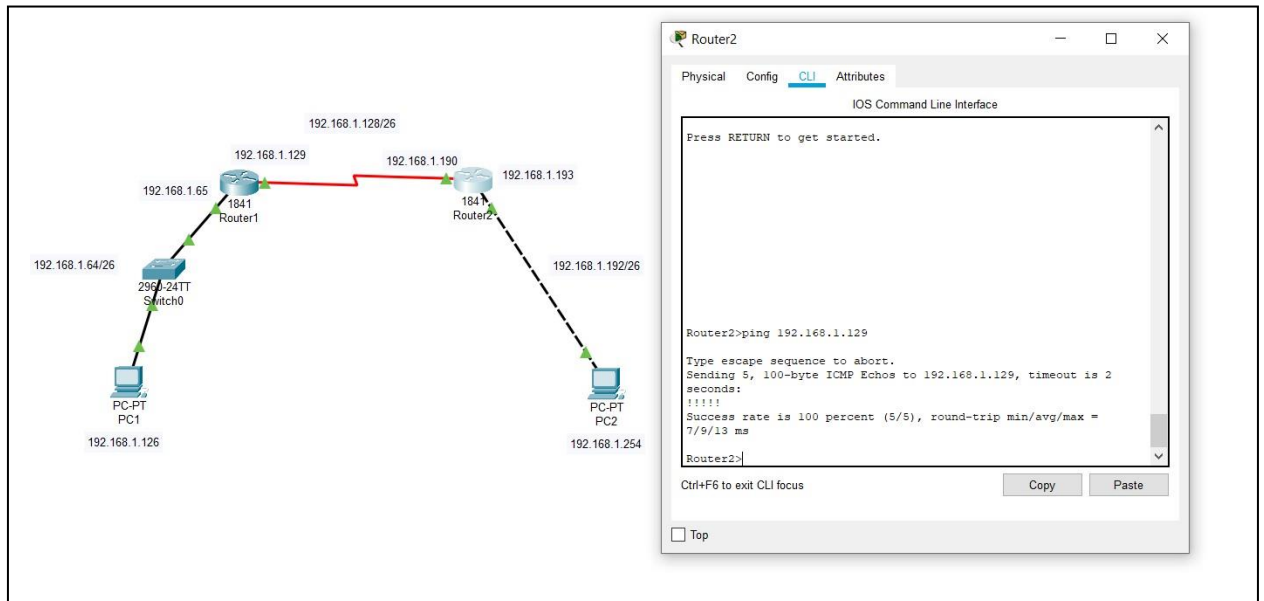
Ans: Yes





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

Ans: Yes

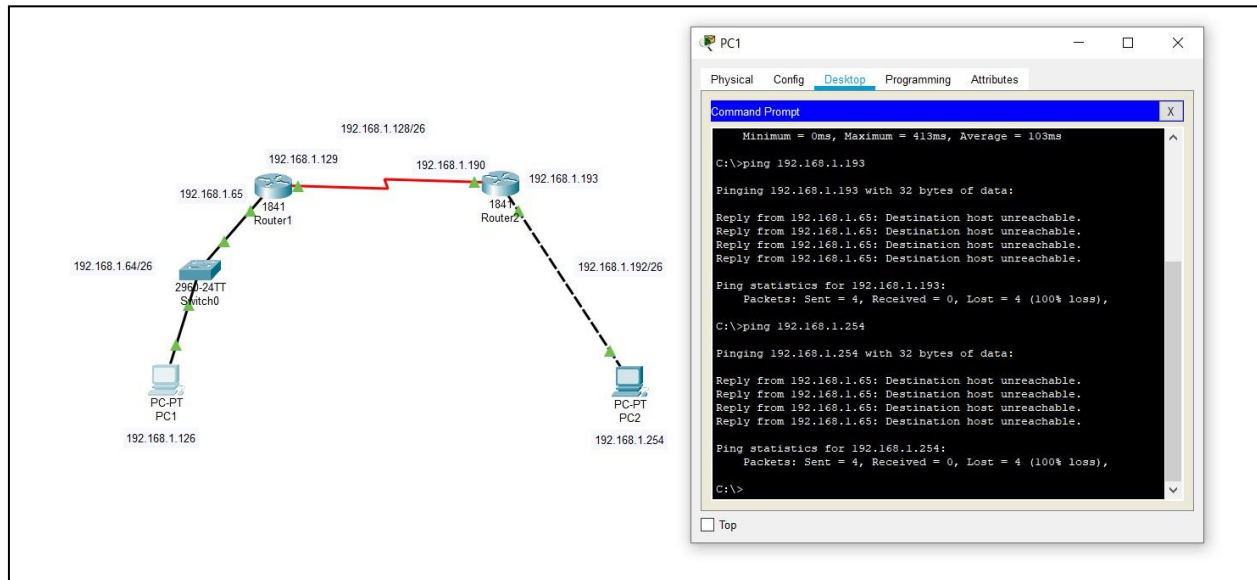


The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations.

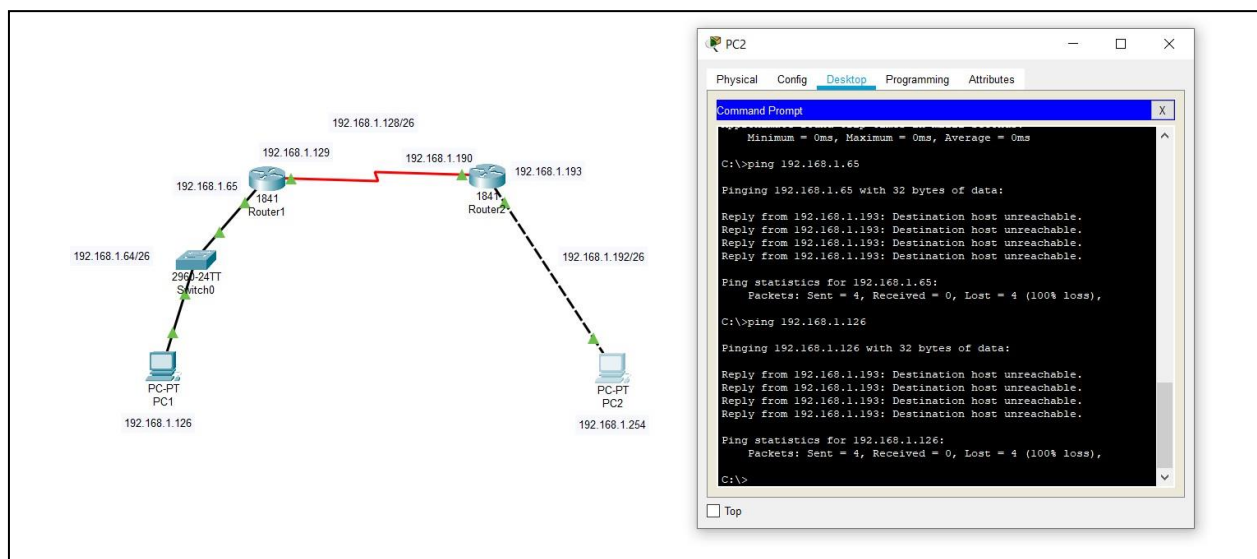
## Task 5: Reflection

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

Ans: PC1 cannot ping FastEthernet port of Router2 and PC2

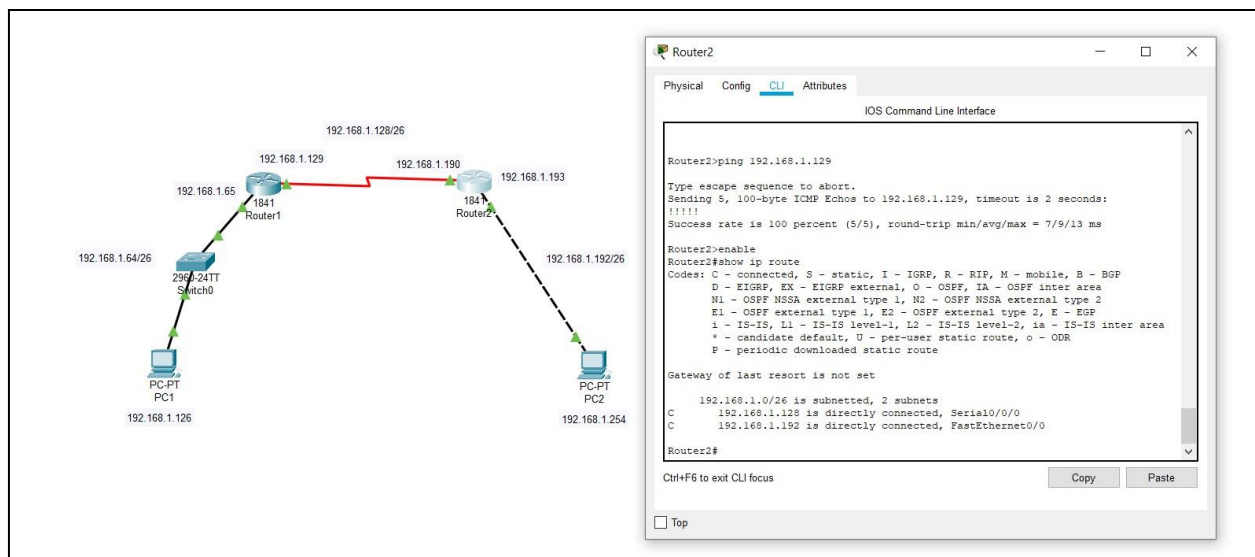
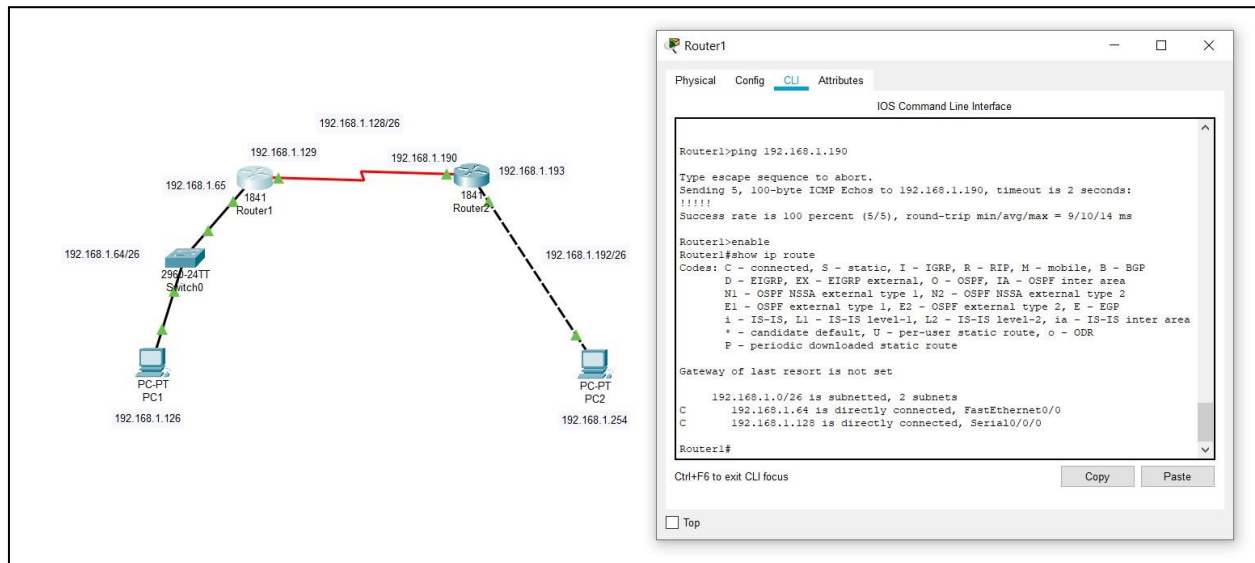


PC2 cannot ping FastEthernet port of Router1 and PC1



2. 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.

Hence static or dynamic routing is not present. Therefore, over here we cannot ping devices on another subnet.

### Conclusion:

1. In this experiment, I learned about subnetting a given address space and assigning subnets to various networks according to their mentioned need.
2. I learned to configure serial port on router and established connection between two routers using Serial connection.