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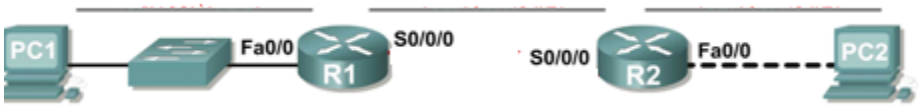
# CEL 51, DCCN, Monsoon 2020
# Lab 6: Subnet and Router Configuration

### 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** |
| **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: **11111111.11111111.11111111.11000000000**

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 $2^6 - 2 =$ **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
   1st 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
   1st 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: 11000000.101010000.00000001.1100000 = 192.168.1.192
   Network ID: 11000000.10101000.00000001.11000000 = 192.168.1.192/26
   1st 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 |

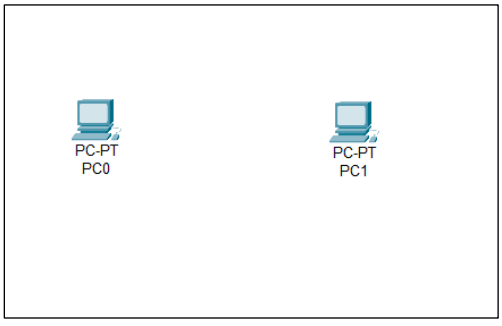
## Task 3: Configure the Serial and FastEthernet Addresses.

### Step 1: Configure the router interfaces.

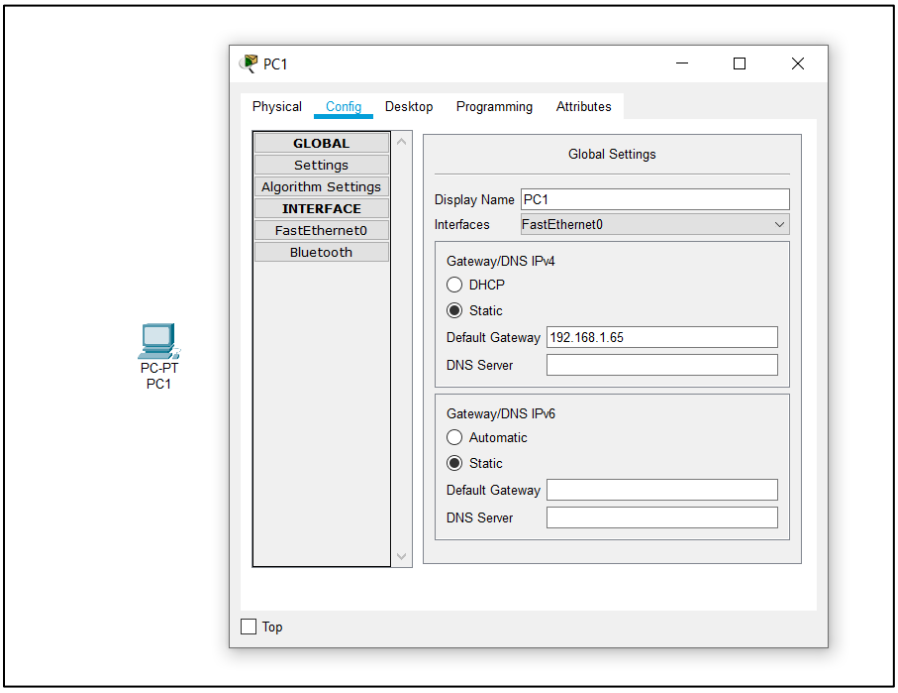
Configure the interfaces on the R1 and R2 routers with the IP addresses from your network design. Please note, to complete the activity in Packet Tracer you will be using the Config Tab. When you have finished, be sure to save the running configuration to the NVRAM of the router.

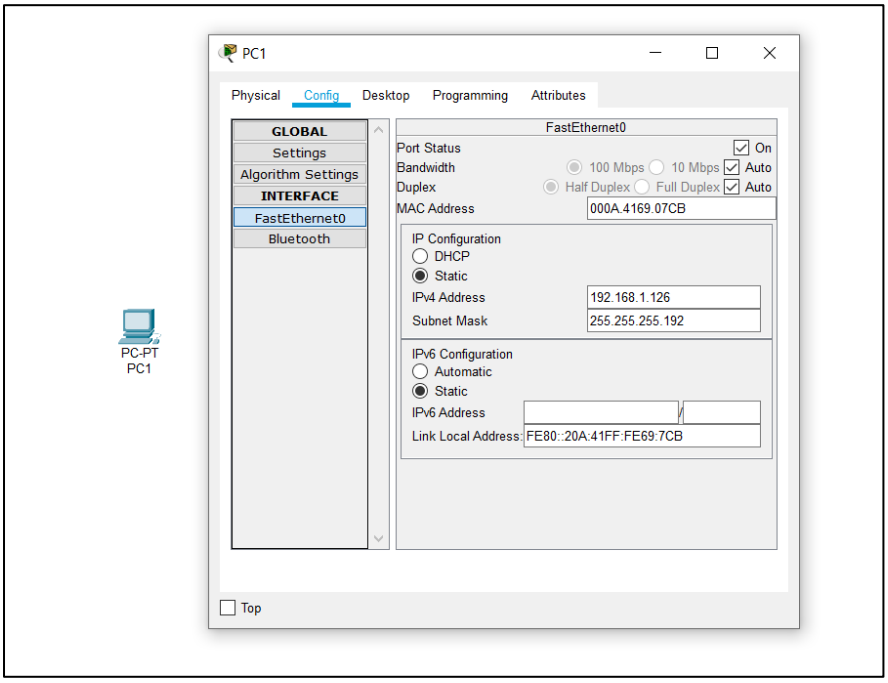
### Step 2: Configure the PC interfaces.

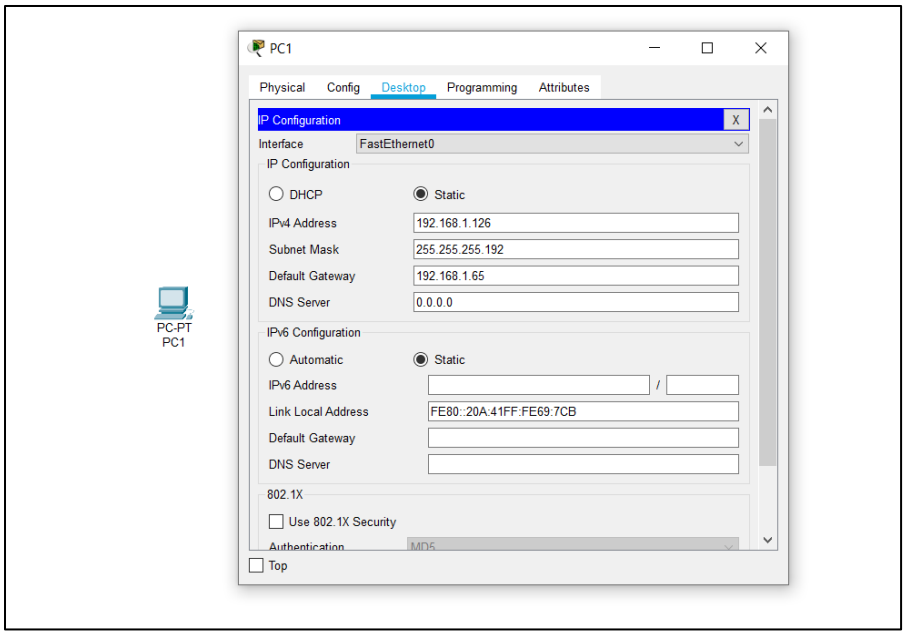
Configure the Ethernet interfaces of PC1 and PC2 with the IP addresses and default gateways from your network design.



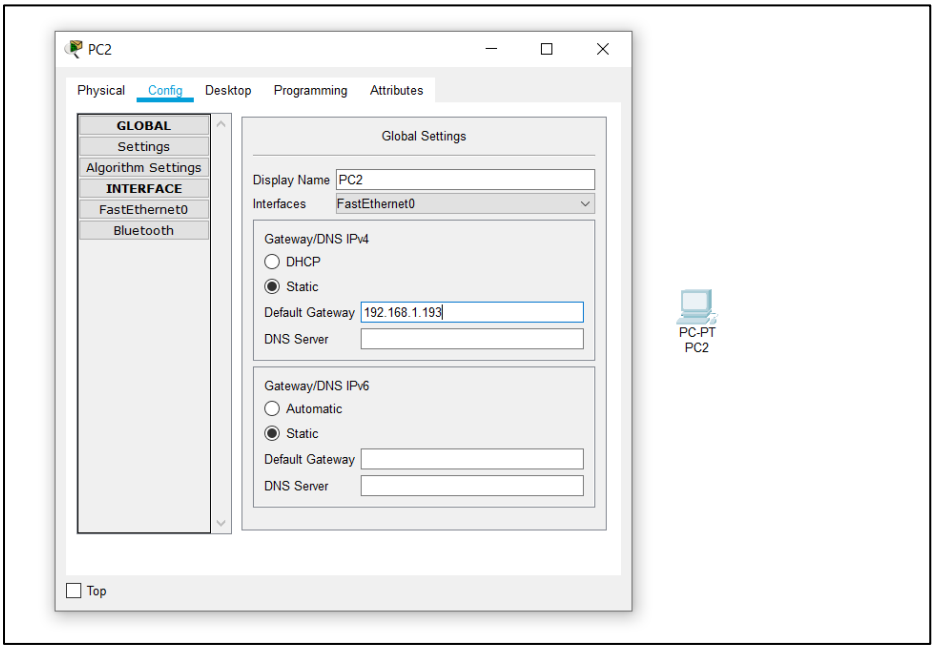
Configuration of PC1

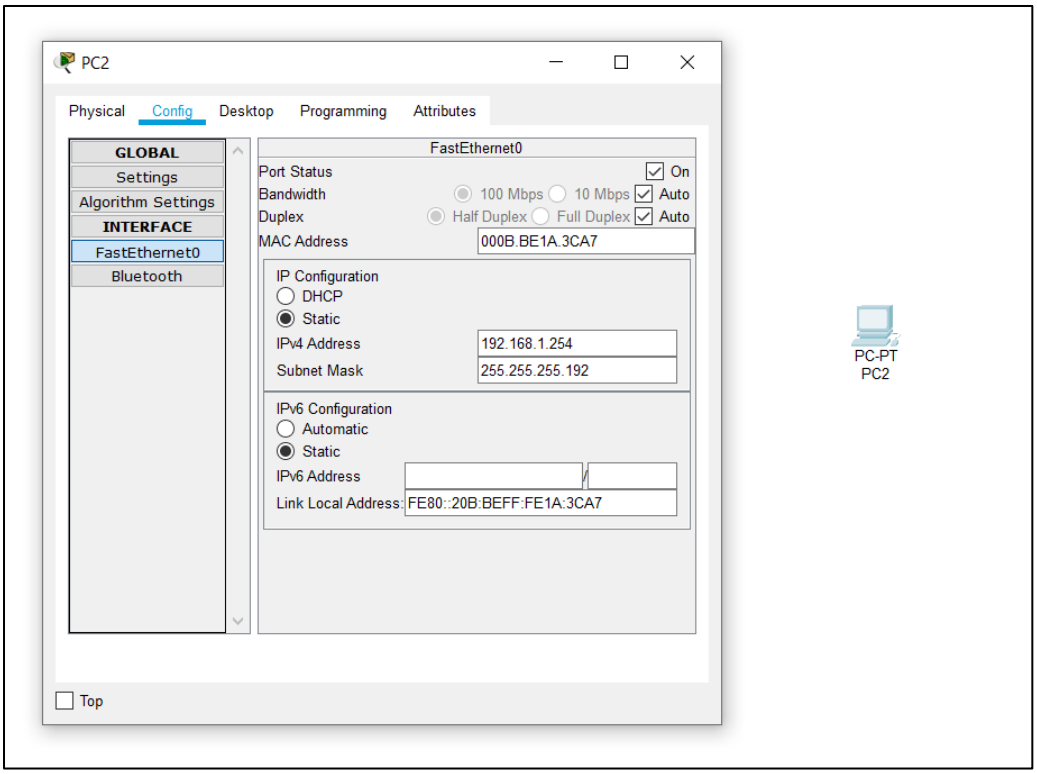


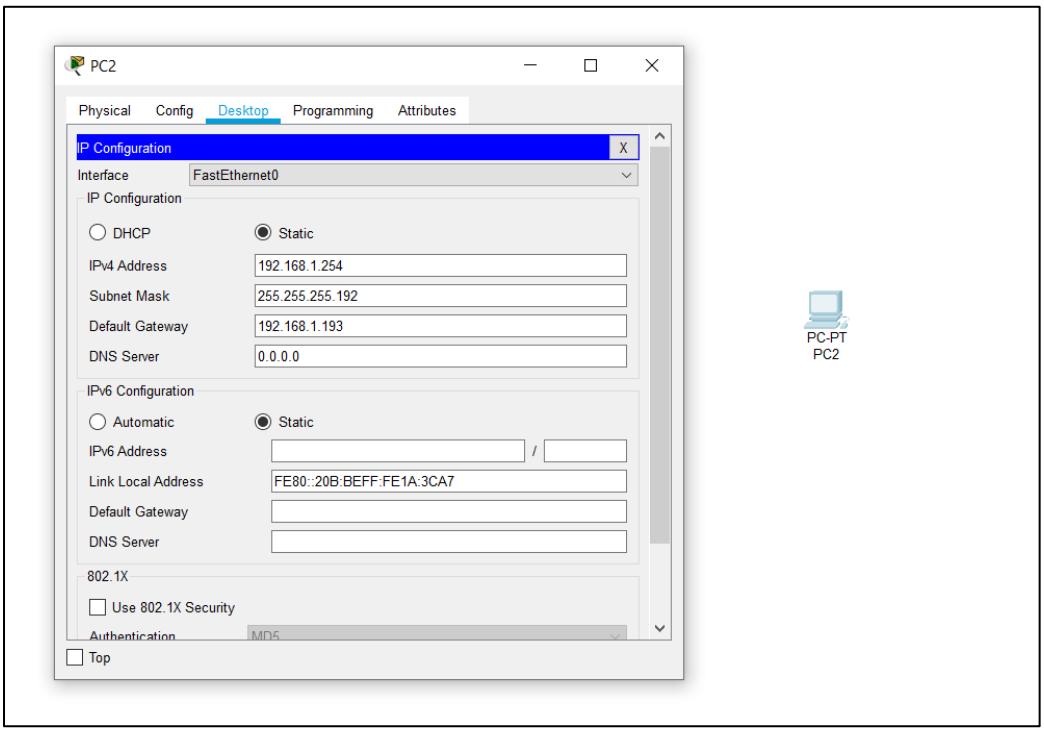





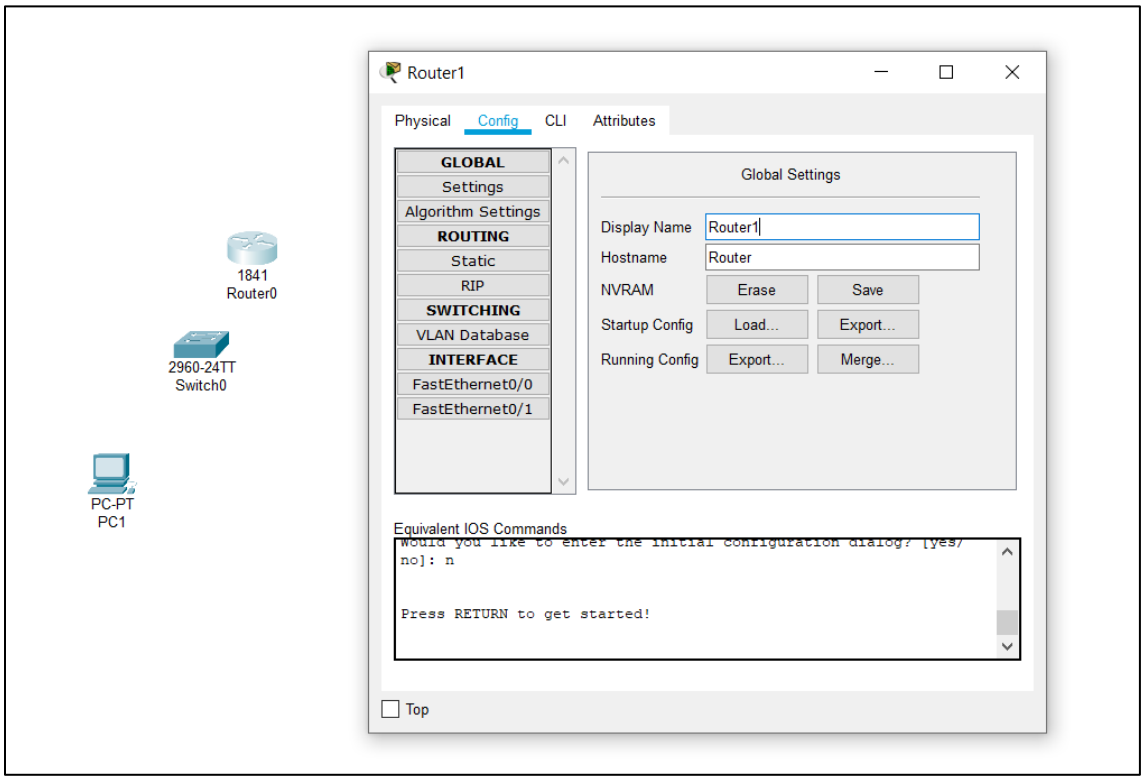

Configuration of PC2

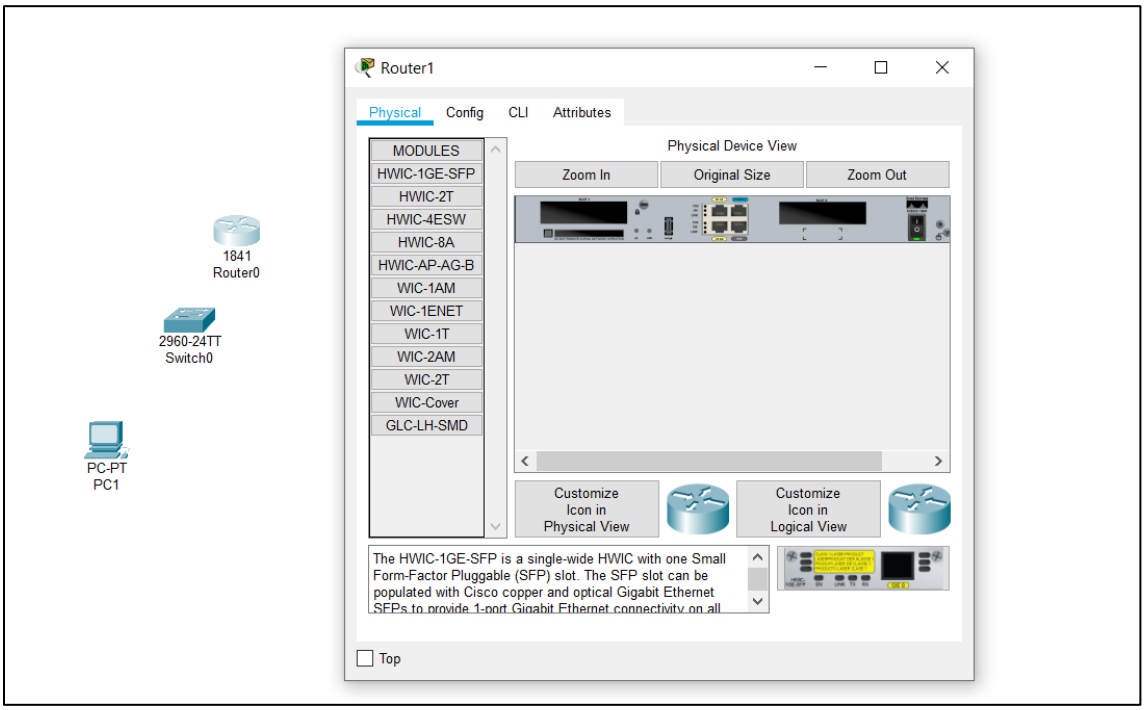



PC2
Physical
Config
Desktop
Programming
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
FastEthernet0
Bluetooth
FastEthernet0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
000B.BE1A.3CA7
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.254
Subnet Mask
255.255.255.192
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::20B:BEFF:FE1A:3CA7
Top
PC-PT
PC2

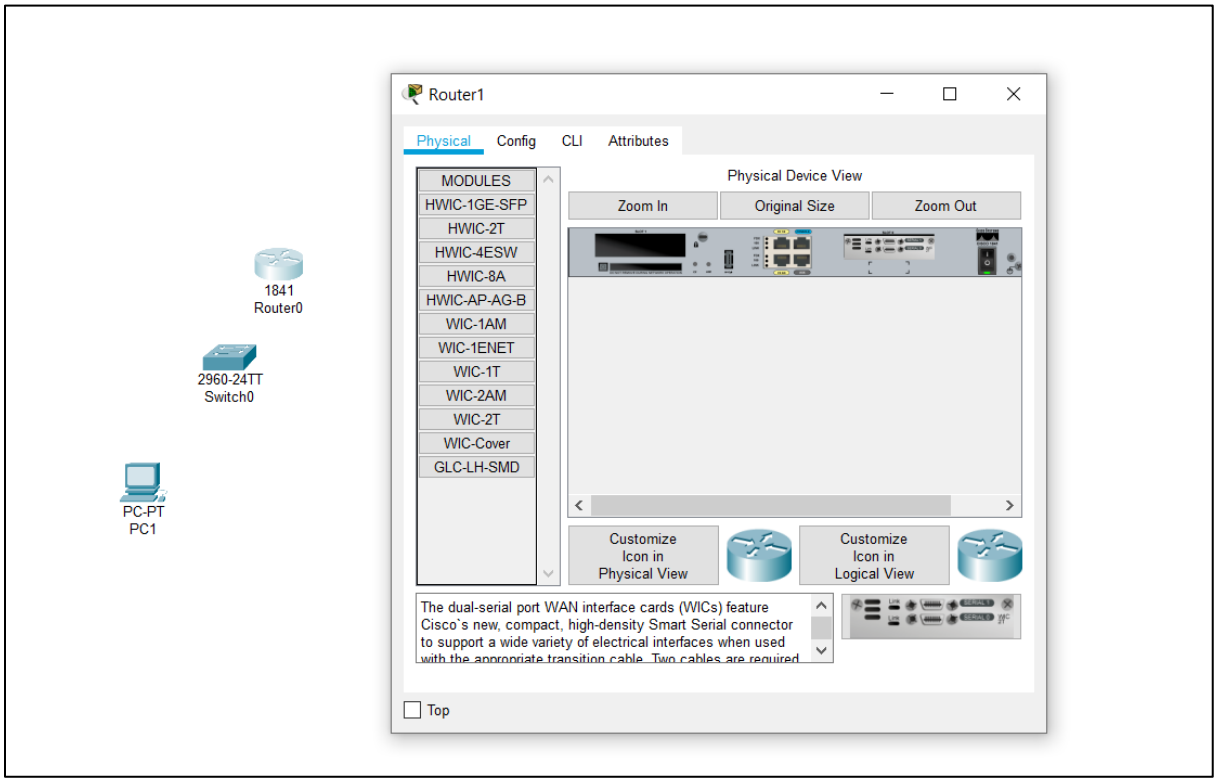

PC2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.254
Subnet Mask
255.255.255.192
Default Gateway
192.168.1.193
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::20B:BEFF:FE1A:3CA7
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Top
PC-PT
PC2

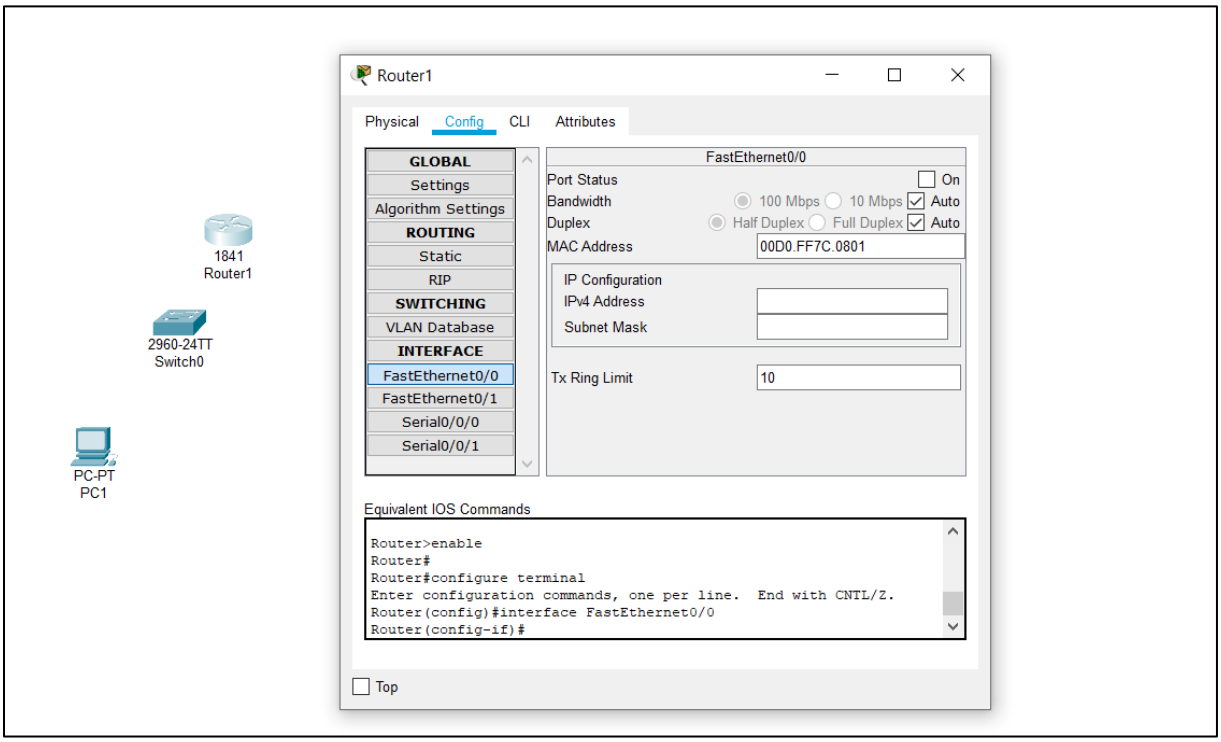
Configuration of Router 1



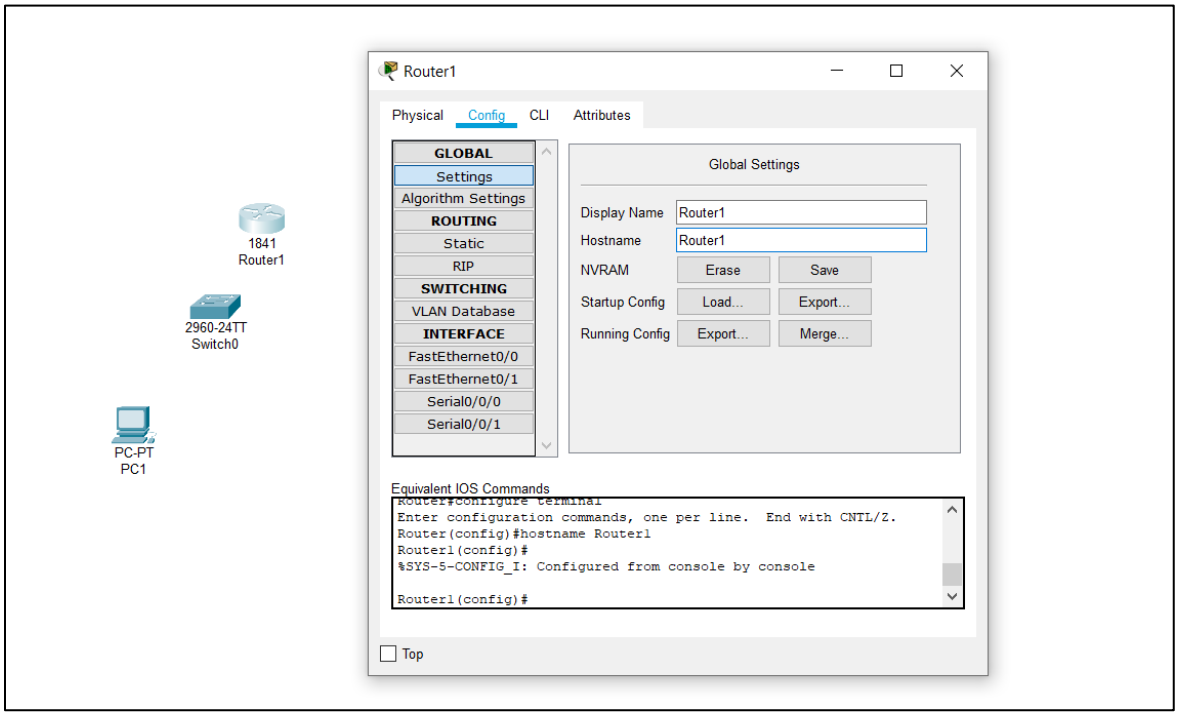



Adding WIC-2T card for serial port

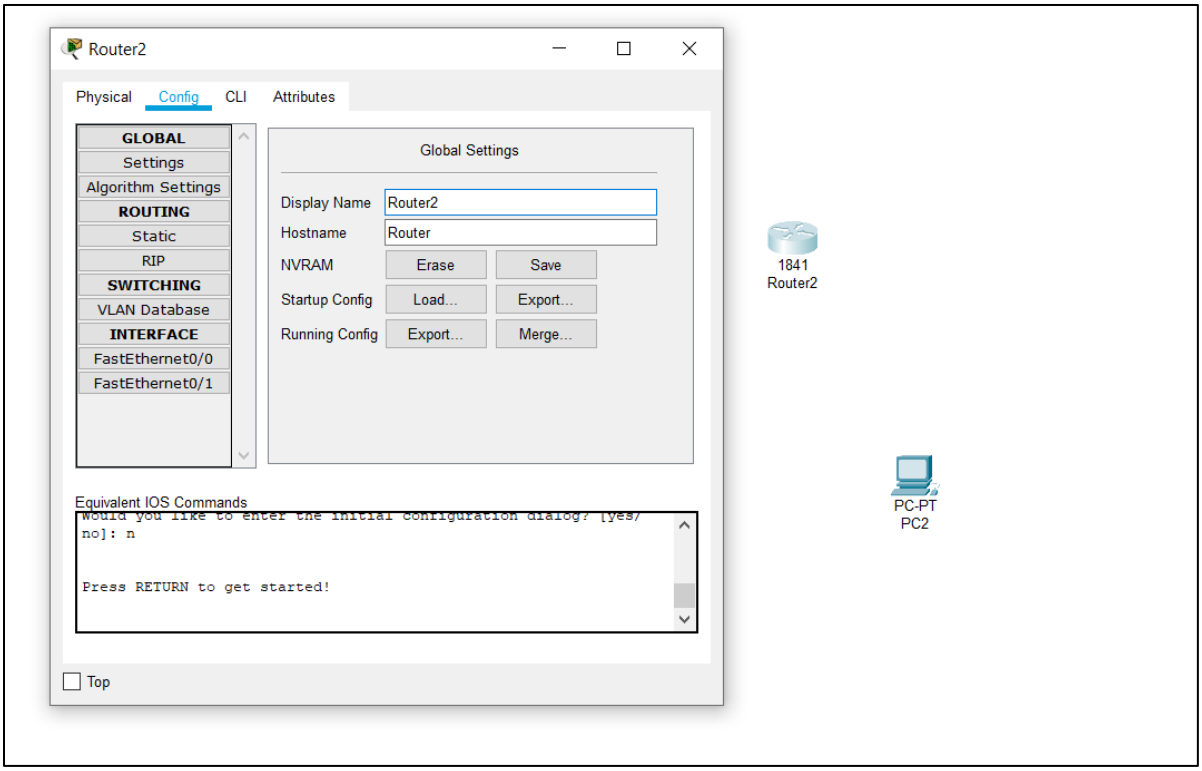


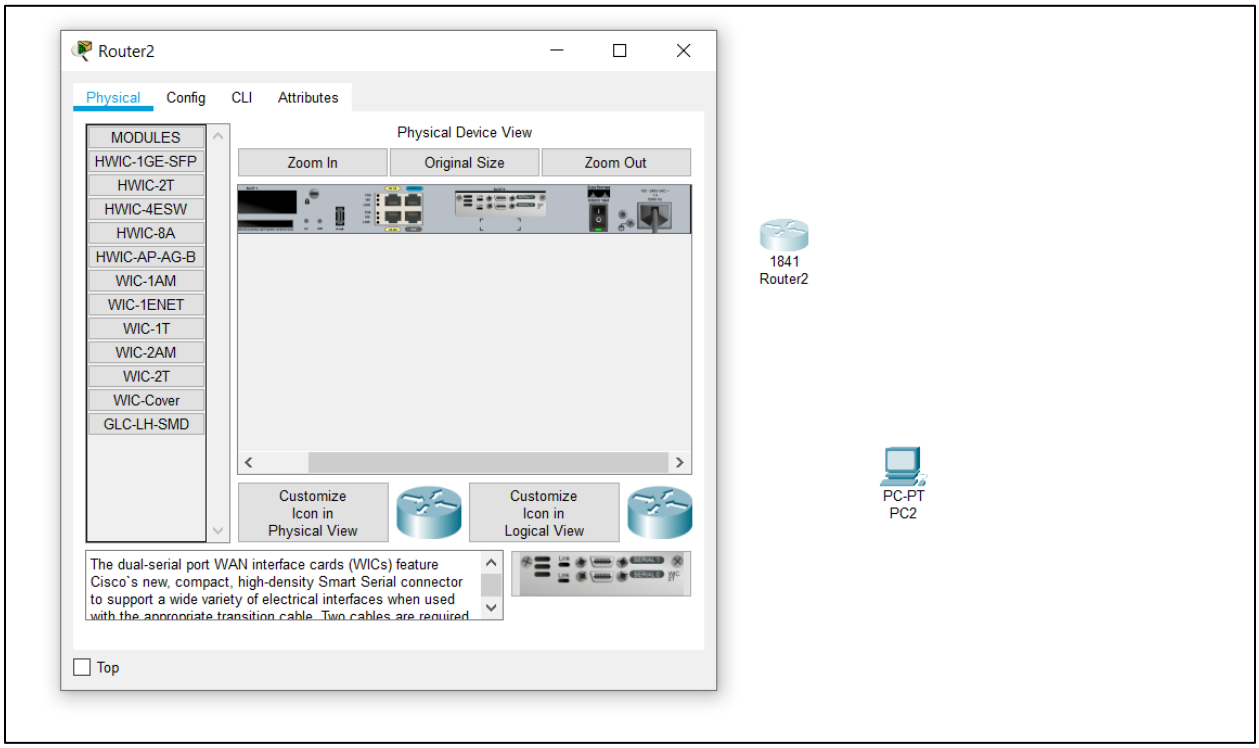



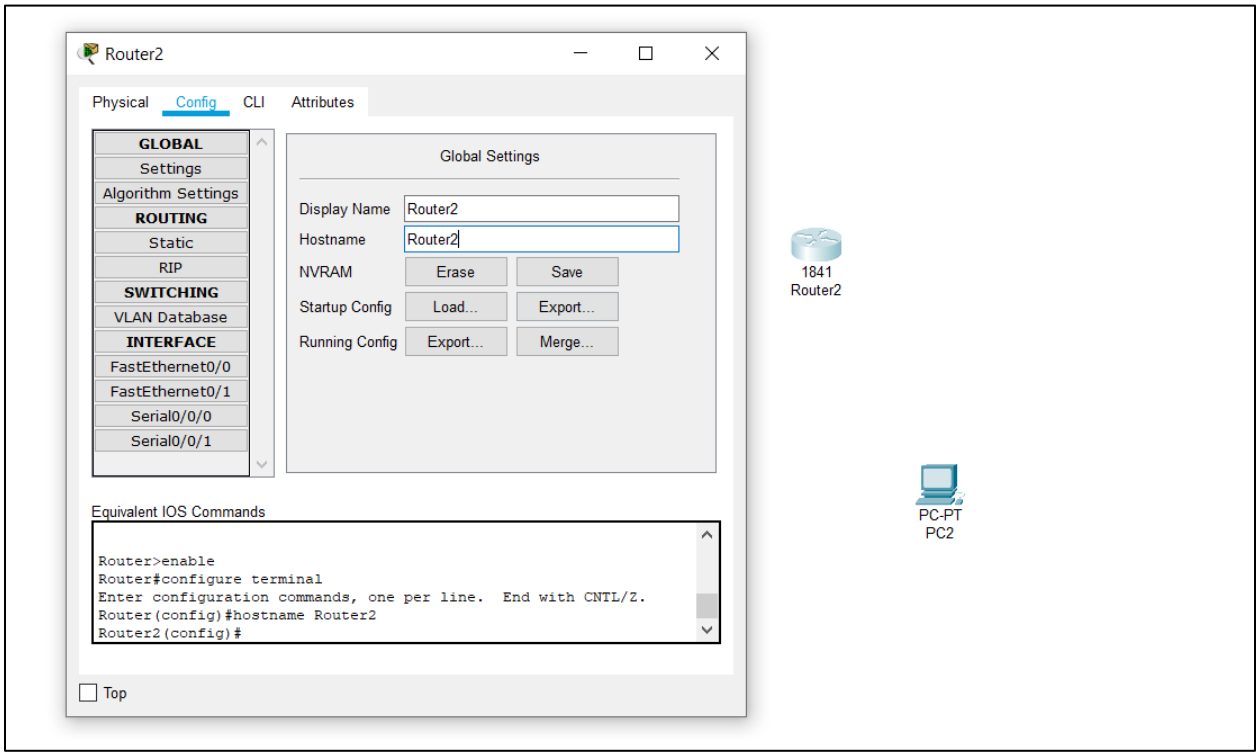
Changing hostname to Router1



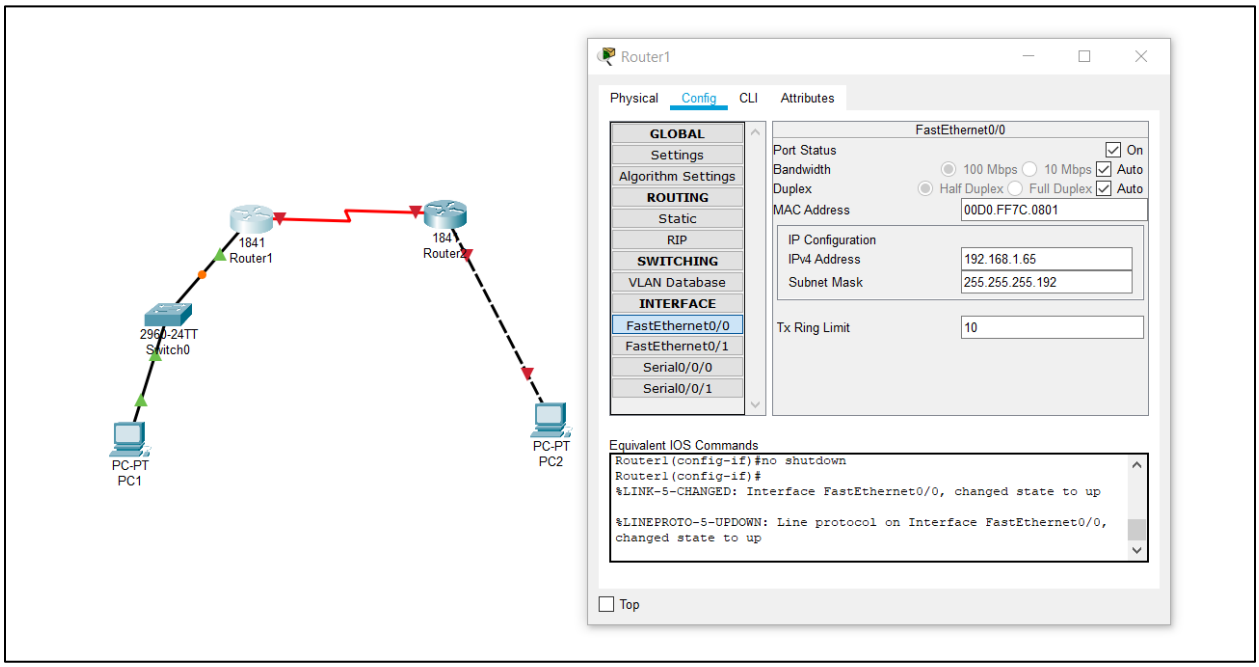

Configuration of Router 2

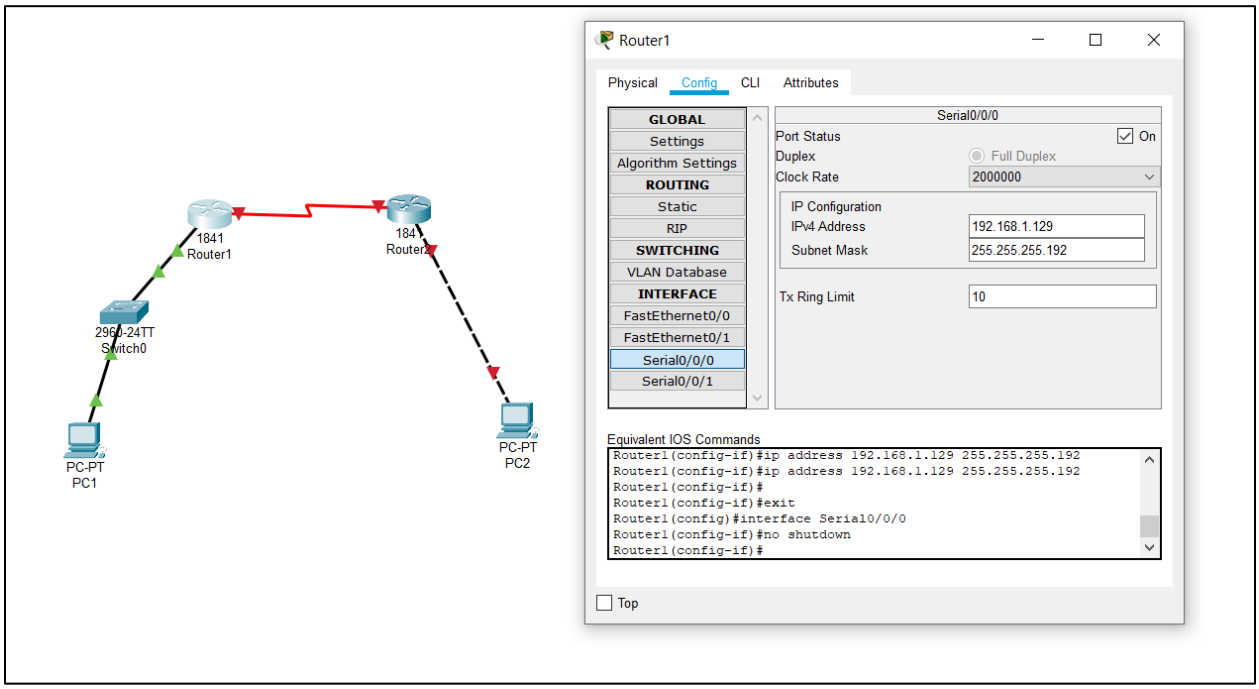



Router2
Physical
Config
CLI
Attributes
MODULES
HWIC-1GE-SFP
HWIC-2T
HWIC-4ESW
HWIC-8A
HWIC-AP-AG-B
WIC-1AM
WIC-1ENET
WIC-1T
WIC-2AM
WIC-2T
WIC-Cover
GLC-LH-SMD
Physical Device View
Zoom In
Original Size
Zoom Out
Customize Icon in Physical View
Customize Icon in Logical View
The dual-serial port WAN interface cards (WICs) feature Cisco`s new, compact, high-density Smart Serial connector to support a wide variety of electrical interfaces when used
Top
1841
Router2
PC-PT
PC2

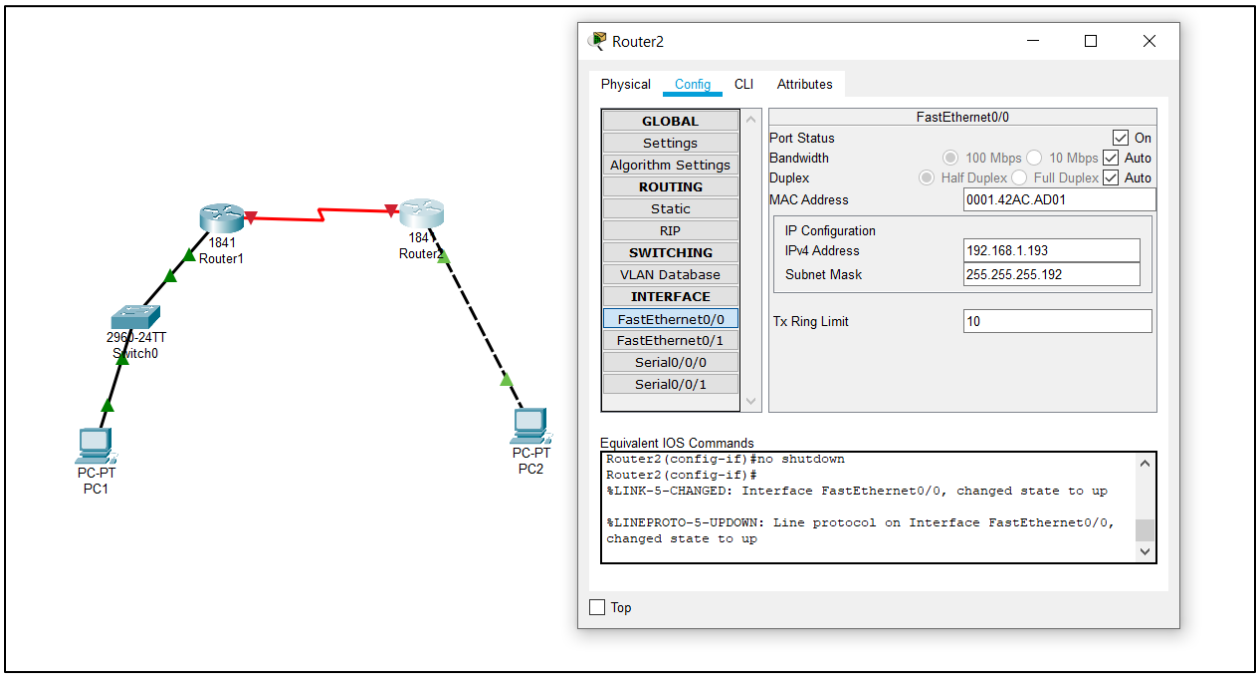

Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
FastEthernet0/0
FastEthernet0/1
Serial0/0/0
Serial0/0/1
Global Settings
Display Name
Router2
Hostname
Router2
NVRAM
Erase
Save
Startup Config
Load...
Export...
Running Config
Export...
Merge...
Equivalent IOS Commands
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname Router2
Router2(config)#
Top
1841
Router2
PC-PT
PC2

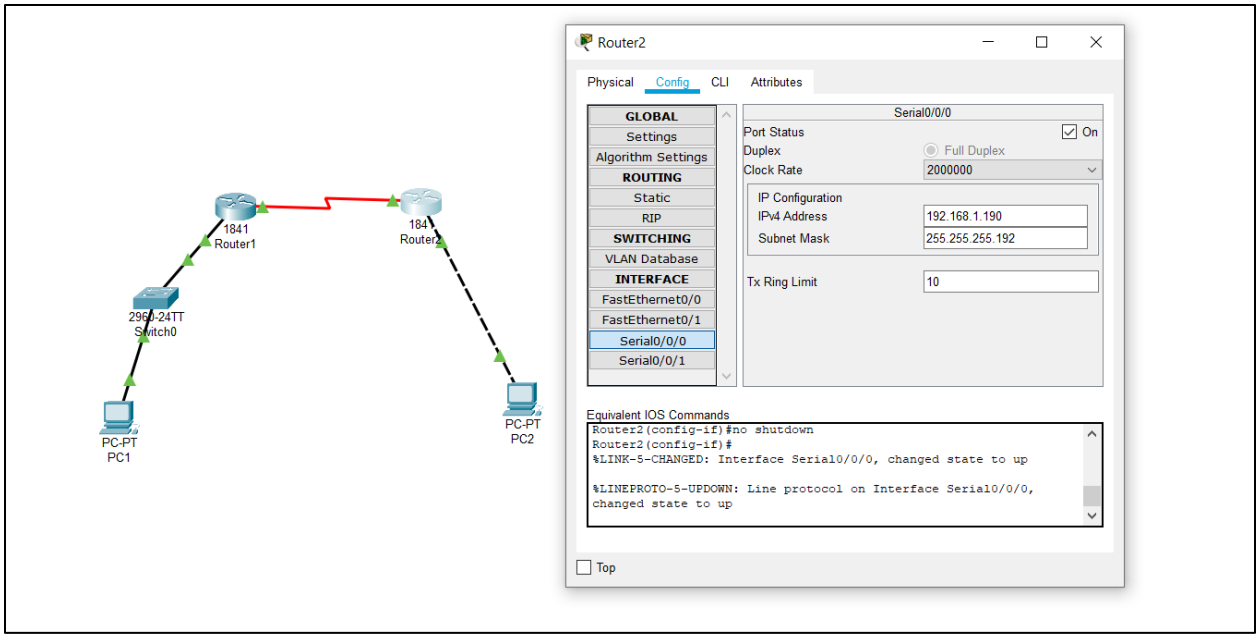
Assigning IP addresses to Router 1



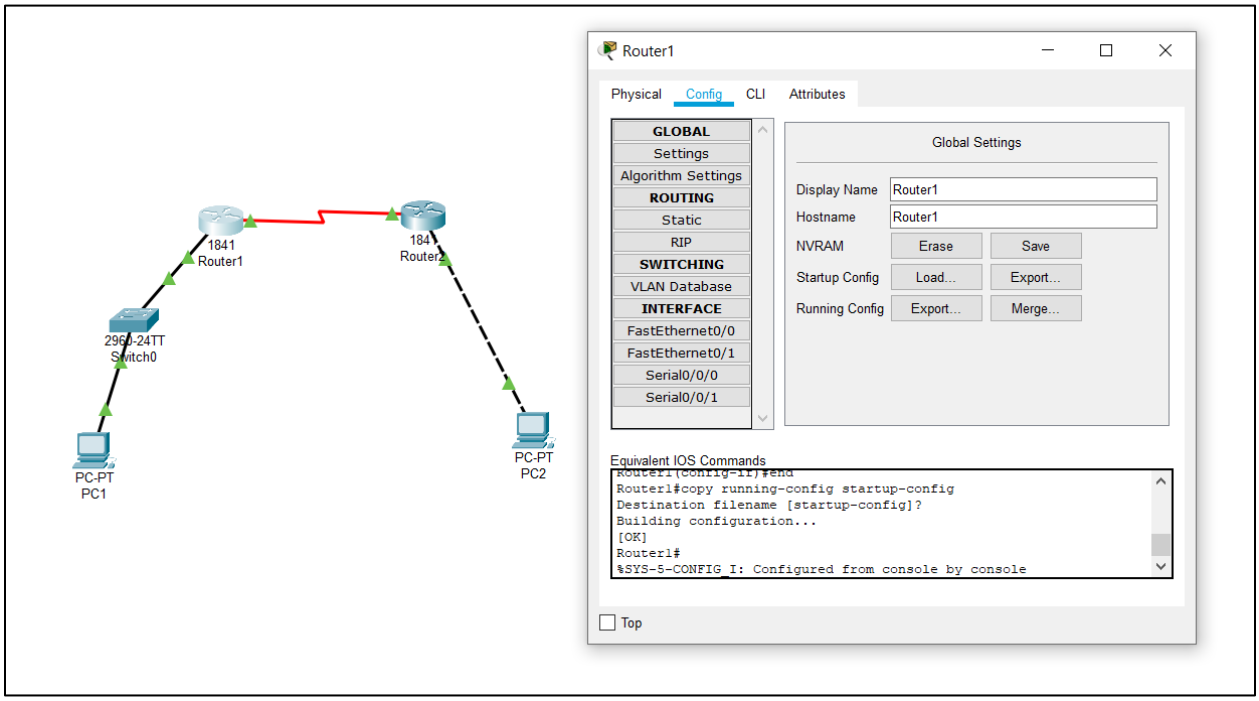



Assigning IP addresses to Router 2

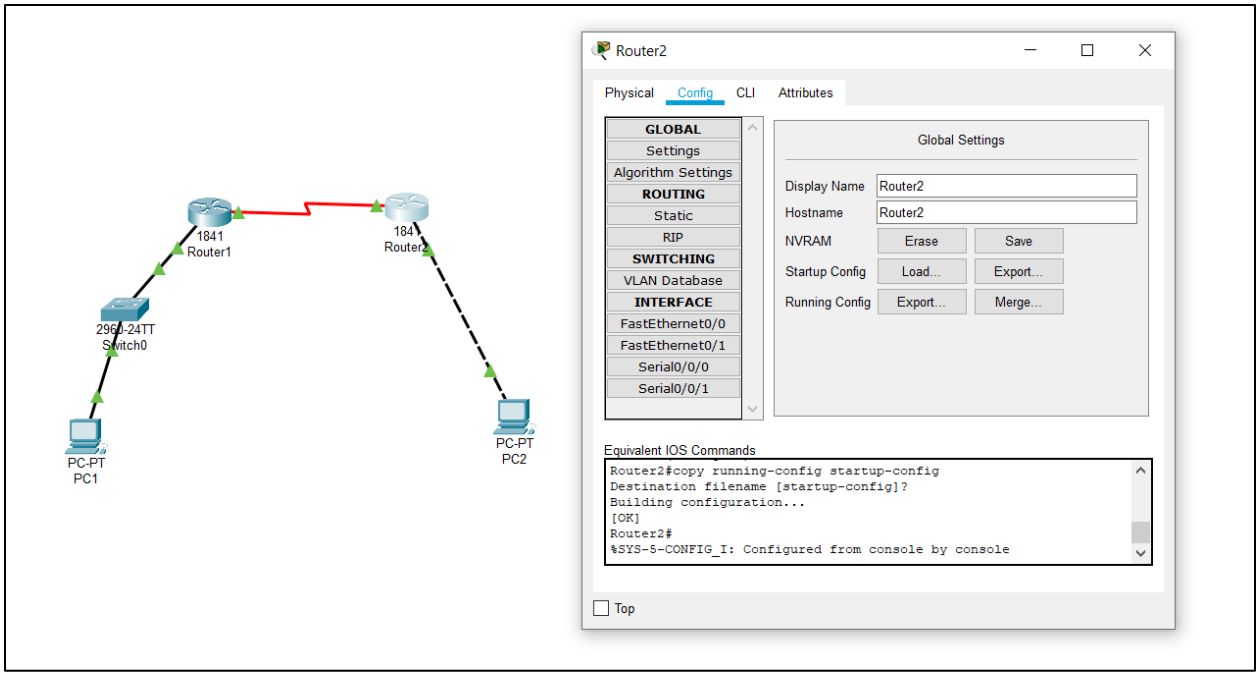


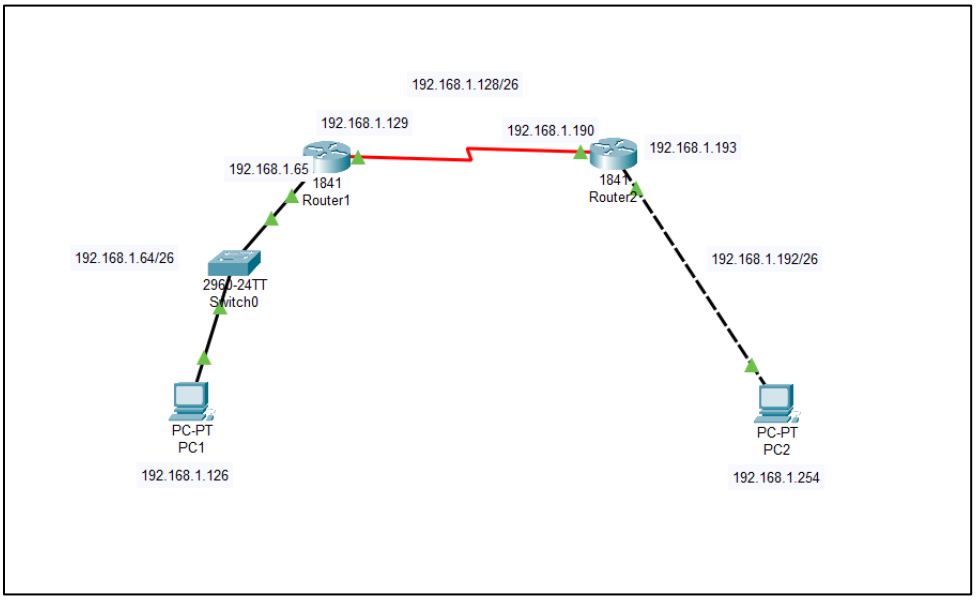
Saving the running configuration to NVRAM of Router 1




Saving the running configuration to NVRAM of Router 2



Complete Network



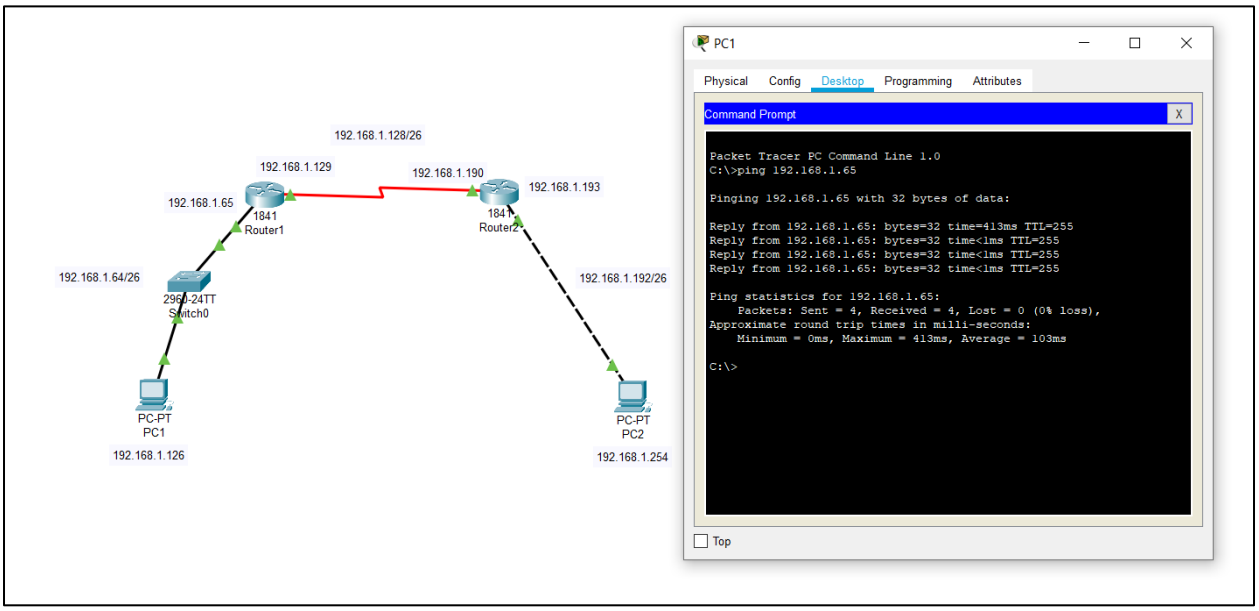

**Task 4: Verify the Configurations.**

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

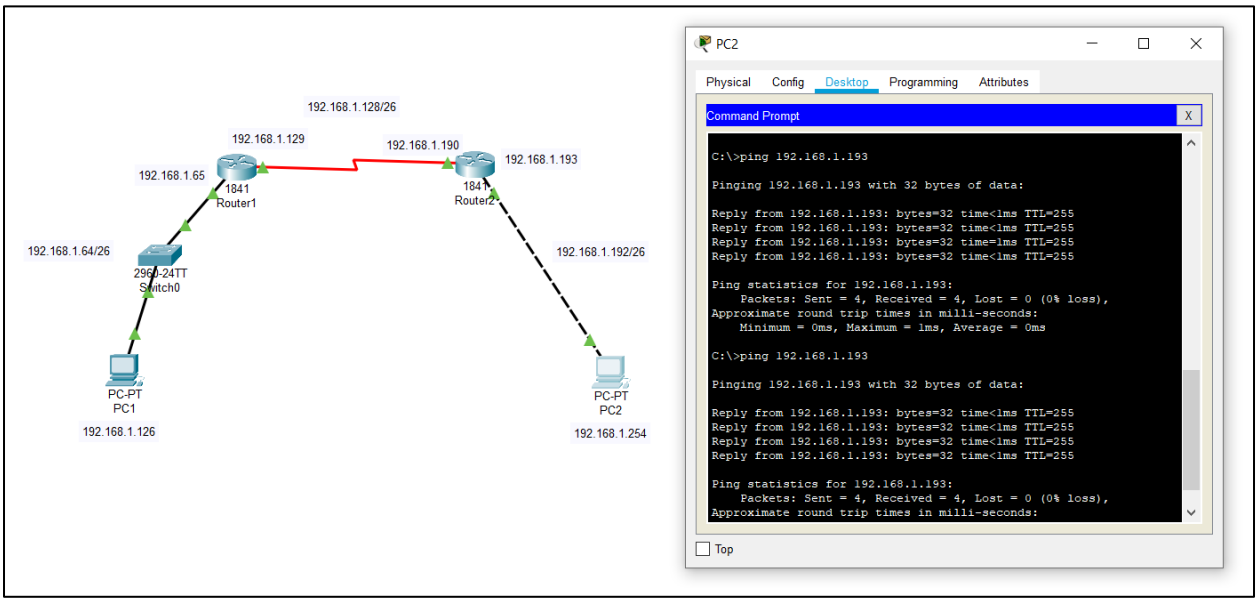
   Pinging the default gateway from PC1



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

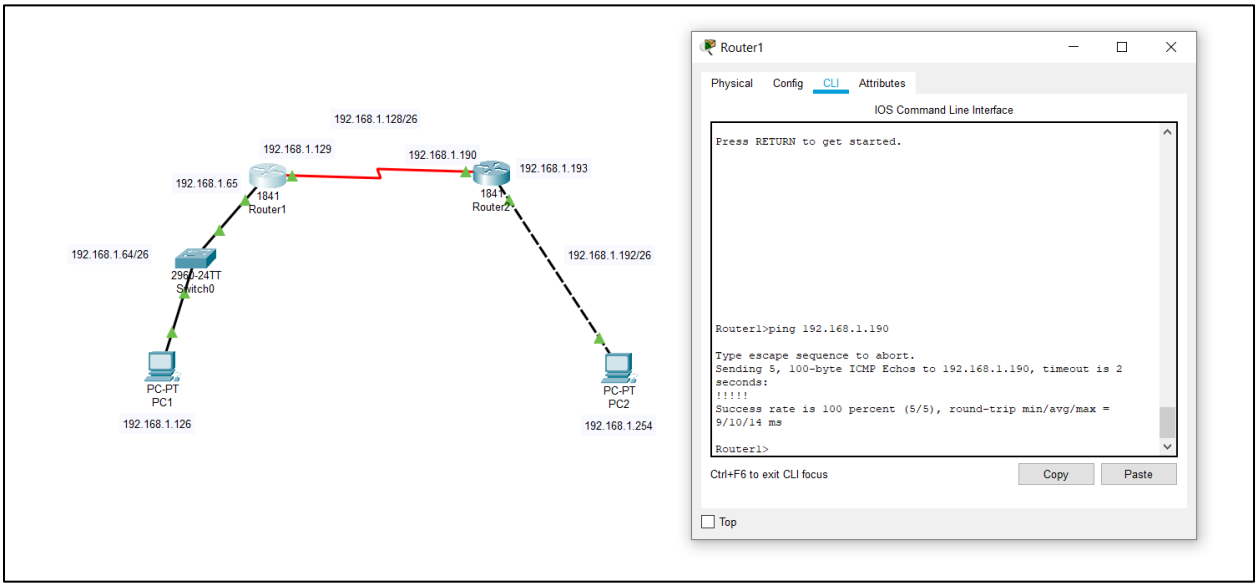
   Ans: Yes

   Pinging the default gateway from PC2



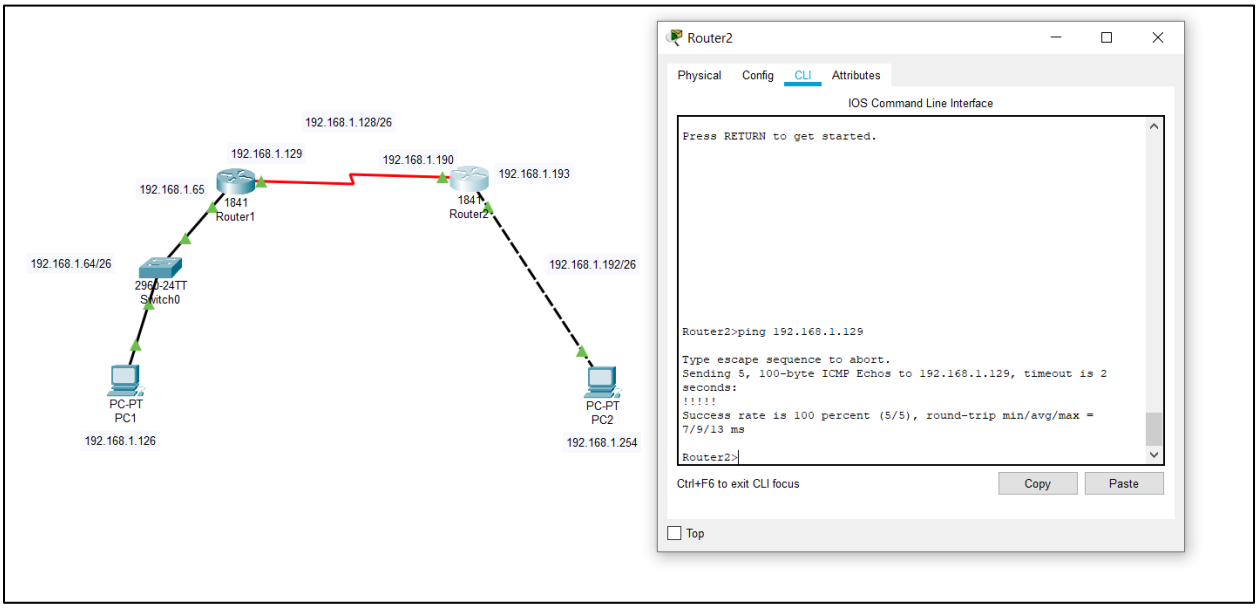

3. From the router R1, is it possible to ping the Serial 0/0/0 interface of R2?

   Ans: Yes



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

   Ans: Yes

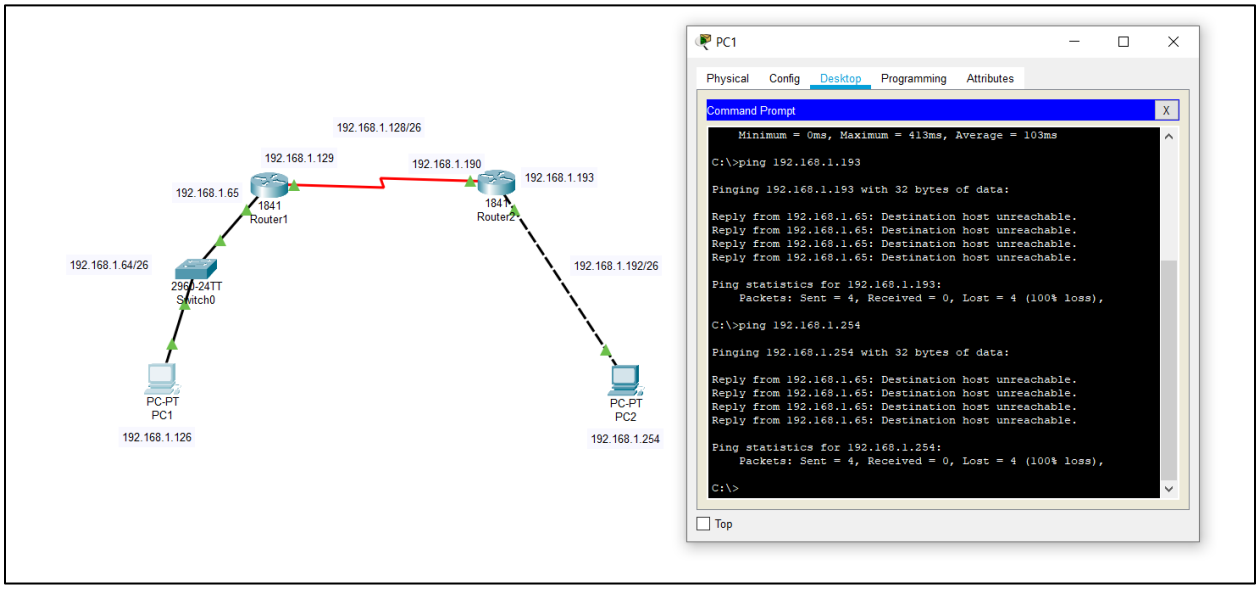



The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations.

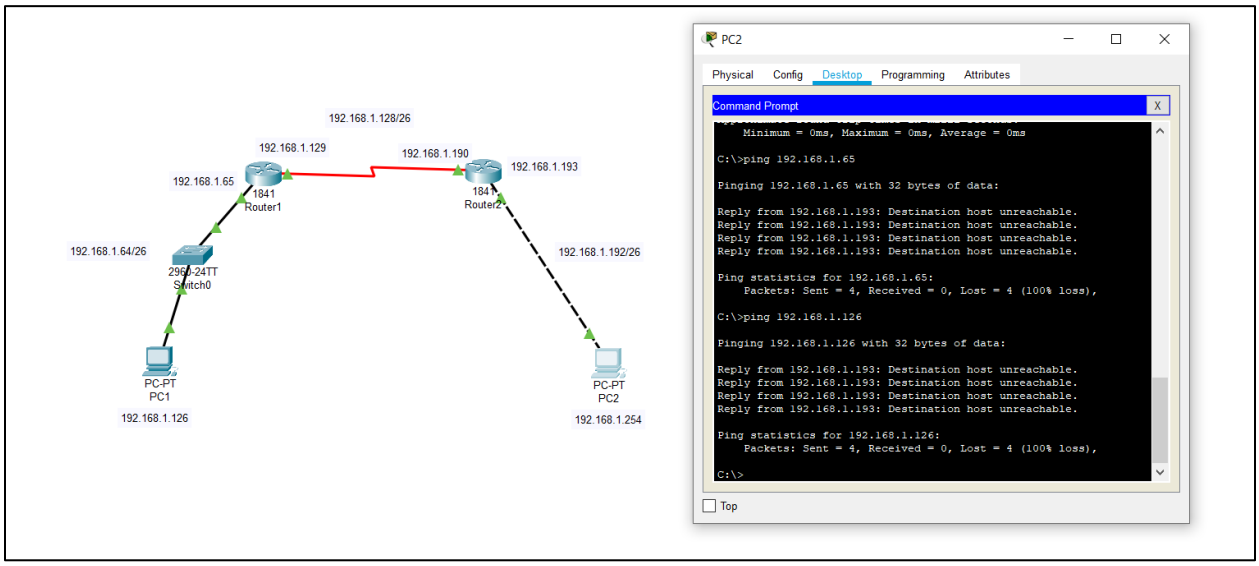
## Task 5: Reflection

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

   Ans: PC1 cannot ping FastEthernet port of Router2 and PC2

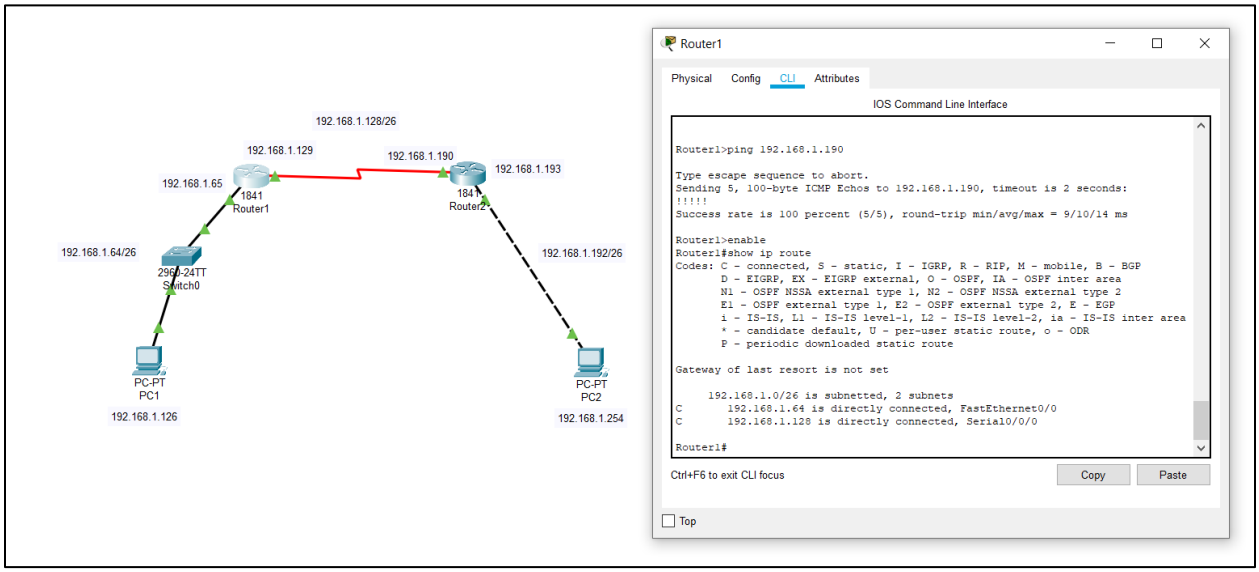


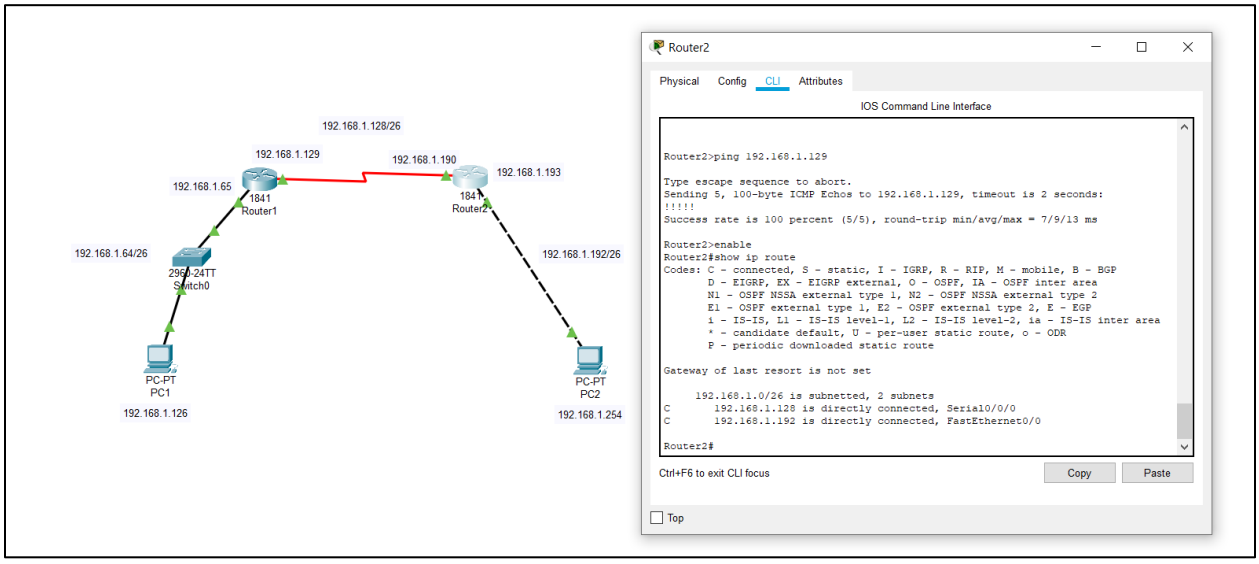

PC2 cannot ping FastEthernet port of Router1 and PC1



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.