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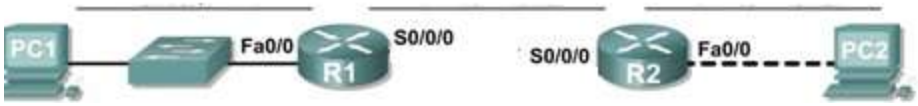
CEL 51, DCCN, Monsoon 2020
Lab 6: Subnet and Router Configuration

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

The network connected to R2 requires maximum number of hosts i.e. 30

Hence borrowing three bits from the host portion

So, the subnet mask becomes: **11111111.11111111.11111111.11100000000**

i.e. **255.255.255.224**

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 **/27**

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 $2^5 - 2 =$ **30** 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: 11000000.10101000.00000001.00000000 = 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.
   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.
   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: 192.168.1.1
2. Assign the last valid host address in subnet 1 to PC1.
   Ans: 192.168.1.30
3. Assign the first valid host address in subnet 2 to the WAN interface on R1.
   Ans: 192.168.1.33

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

   Ans: 192.168.1.62

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

   Ans: 192.168.1.65

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

   Ans: 192.168.1.94

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**	192.168.1.1	255.255.255.224	**N/A**
	S0/0/0	192.168.1.33	255.255.255.224	**N/A**
R2	**Fa0/0**	192.168.1.65	255.255.255.224	**N/A**
	S0/0/0	192.168.1.62	255.255.255.224	**N/A**
PC1	**NIC**	192.168.1.30	255.255.255.224	192.168.1.1
PC2	**NIC**	192.168.1.94	255.255.255.224	192.168.1.65

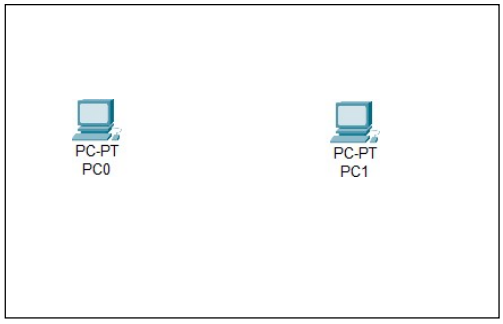
Task 3: Configure the Serial and FastEthernet Addresses.

Step 1: Configure the router interfaces.

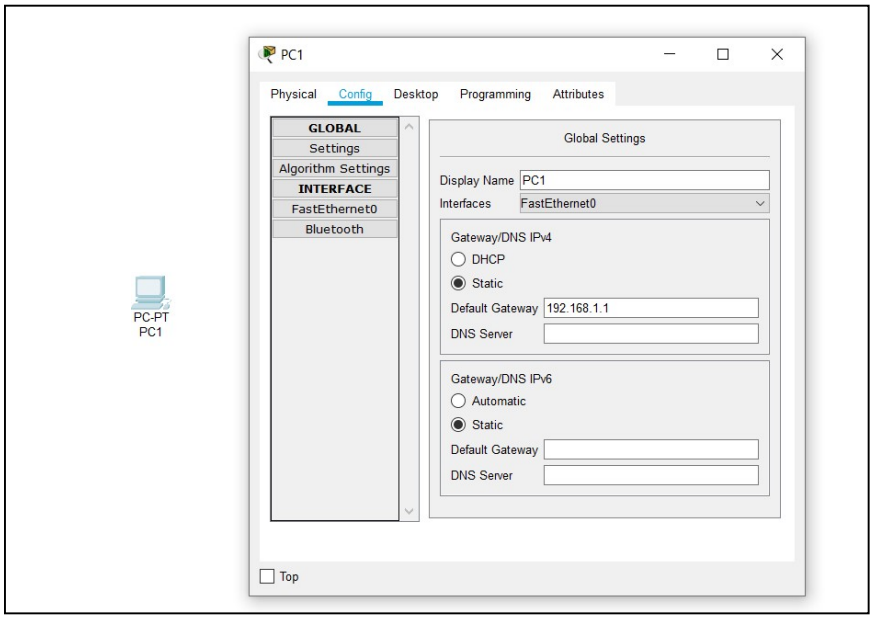
Configure the interfaces on the R1 and R2 routers with the IP addresses from your network design. Please note, to complete the activity in Packet Tracer you will be using the Config Tab. When you have finished, be sure to save the running configuration to the NVRAM of the router.

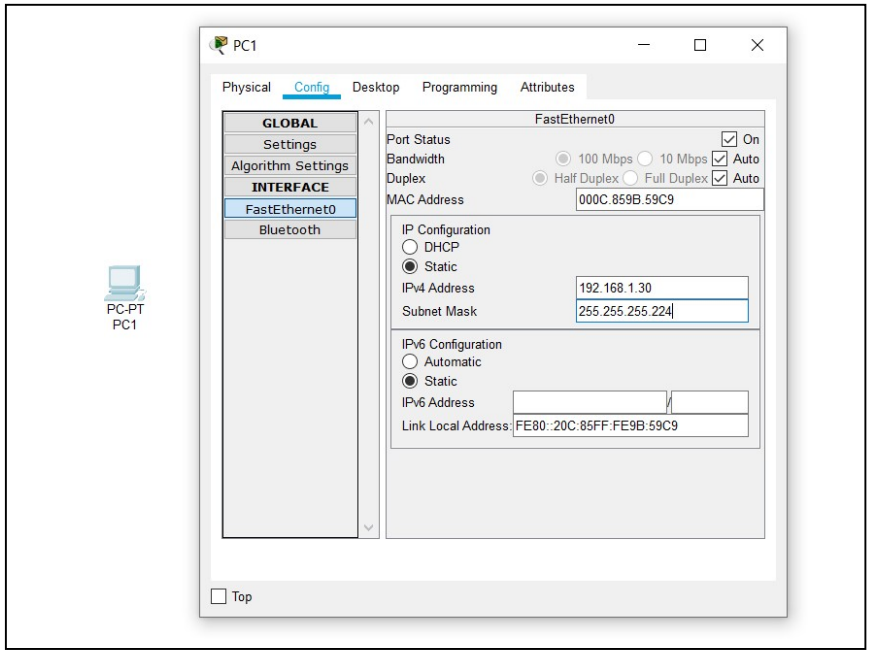
Step 2: Configure the PC interfaces.

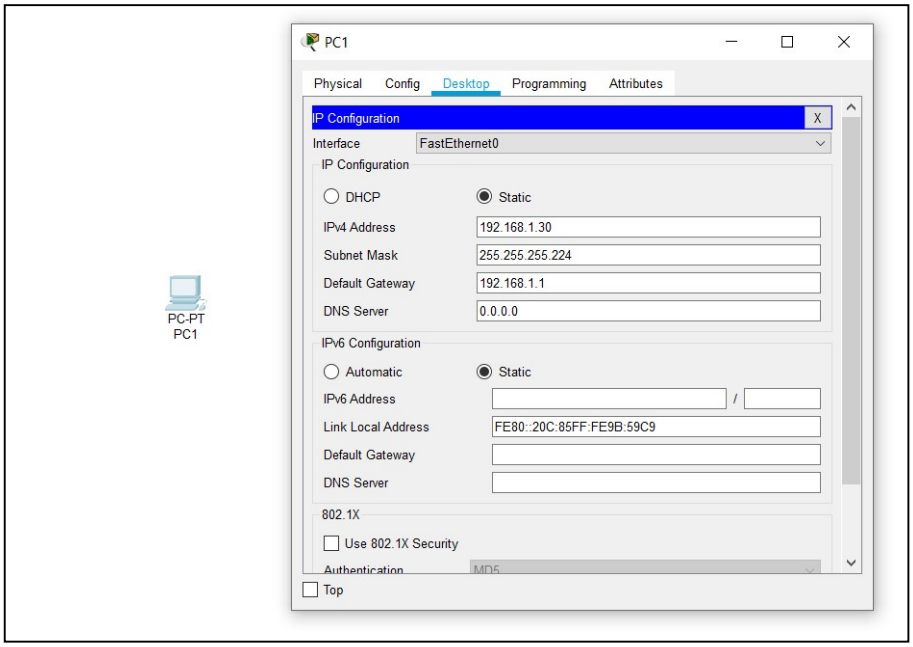
Configure the Ethernet interfaces of PC1 and PC2 with the IP addresses and default gateways from your network design.



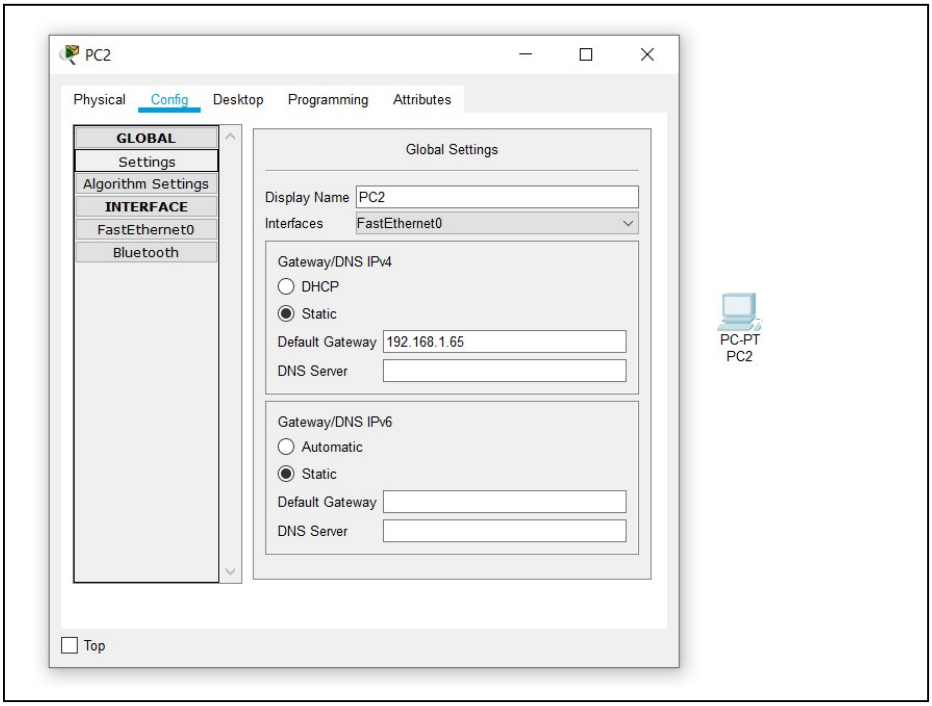
Configuration of PC1

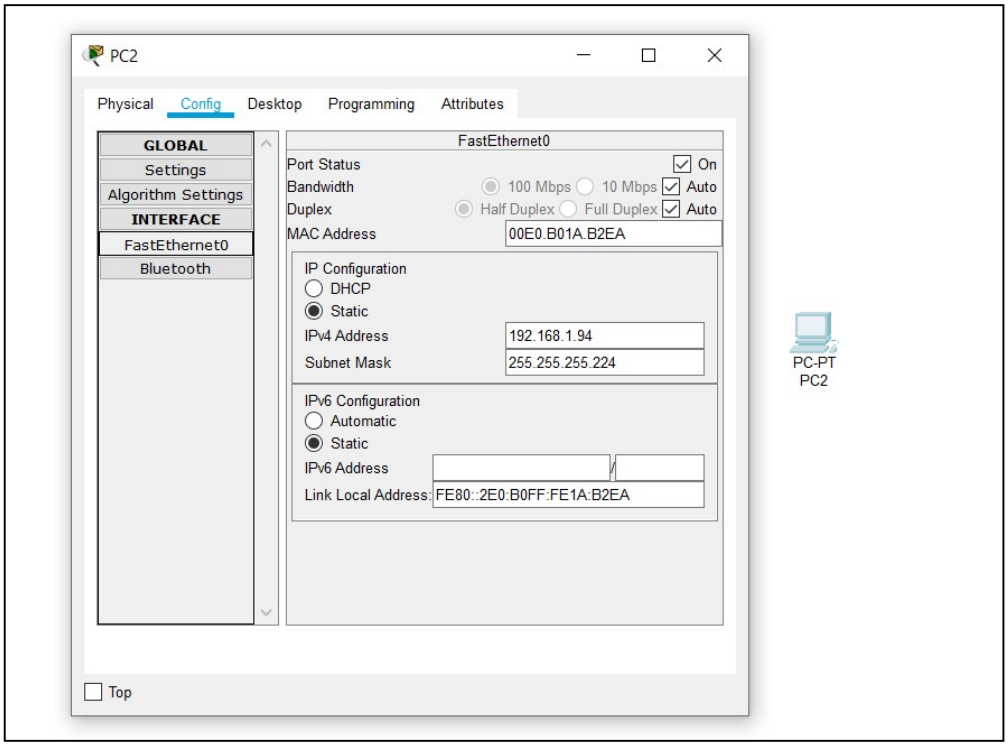


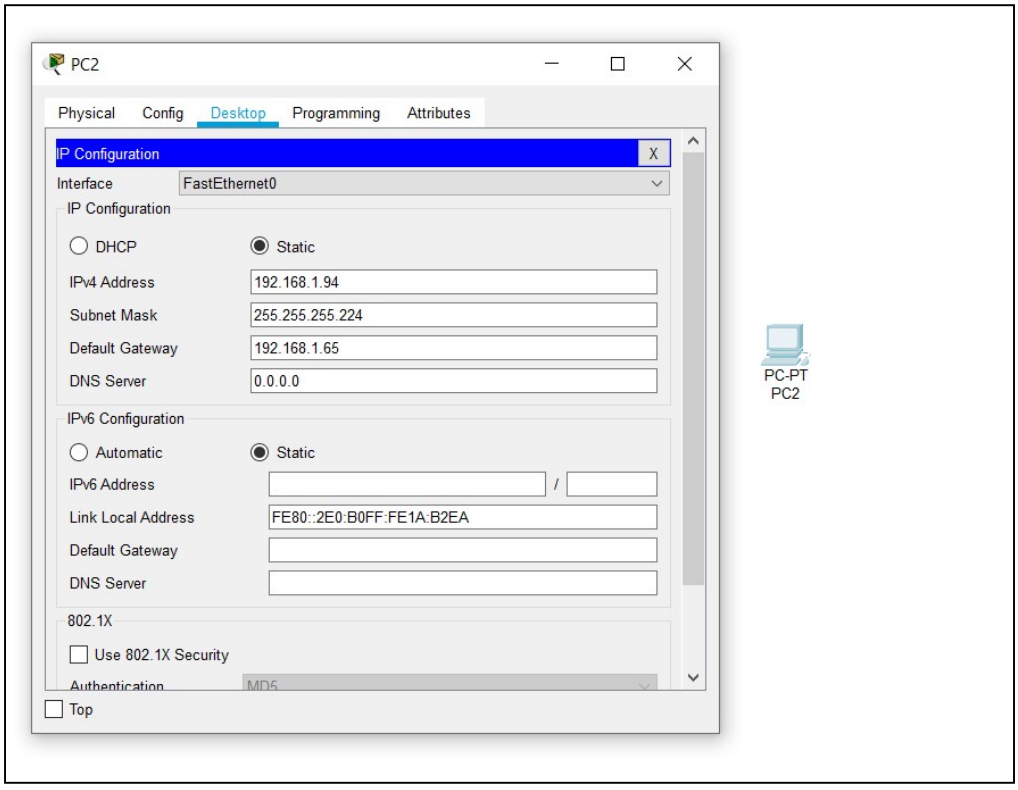




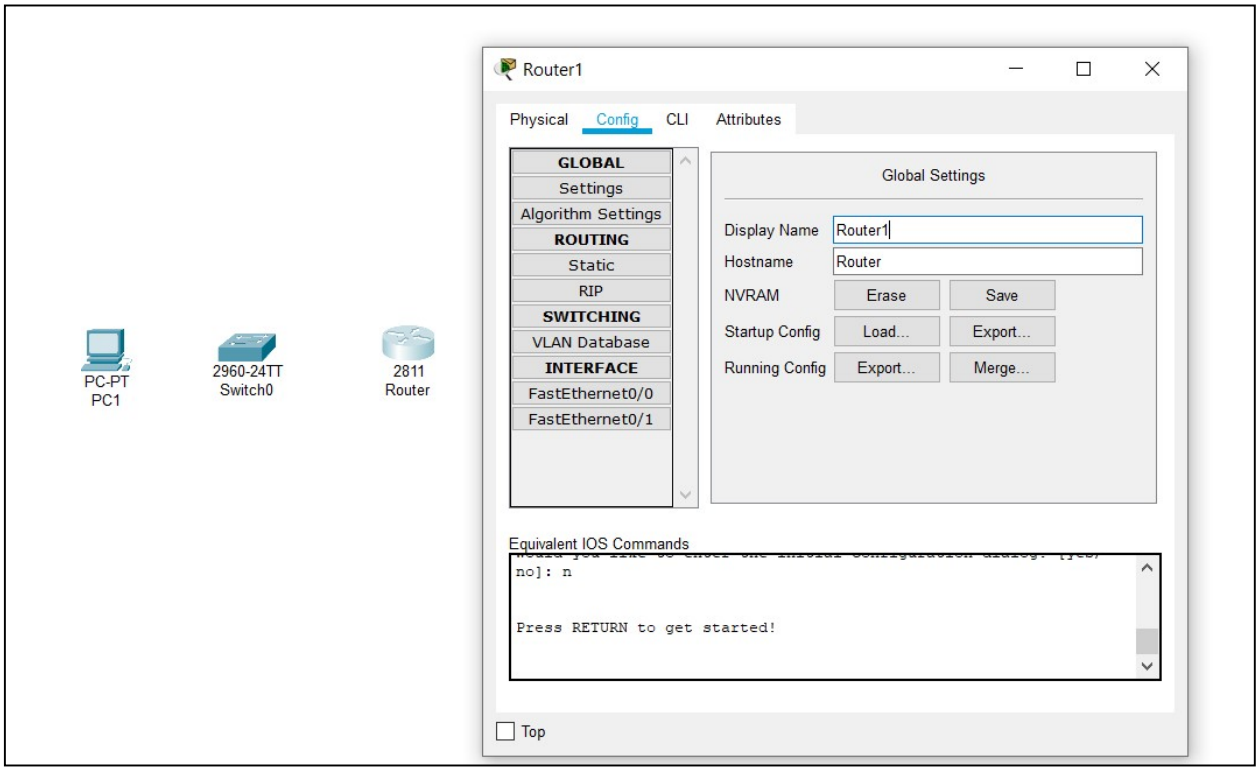
Configuration of PC2

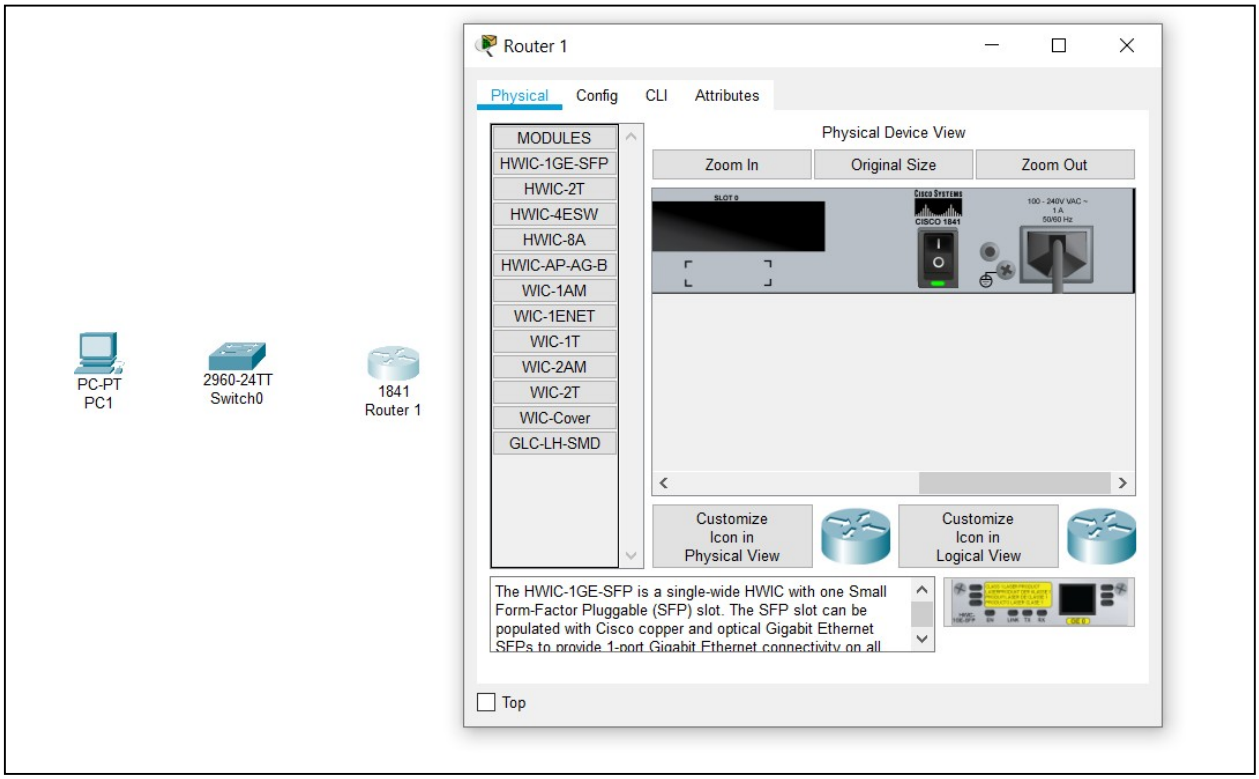



PC2
Physical
Config
Desktop
Programming
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
FastEthernet0
Bluetooth
FastEthernet0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00E0.B01A.B2EA
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.94
Subnet Mask
255.255.255.224
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::2E0:B0FF:FE1A:B2EA
Top
PC-PT
PC2

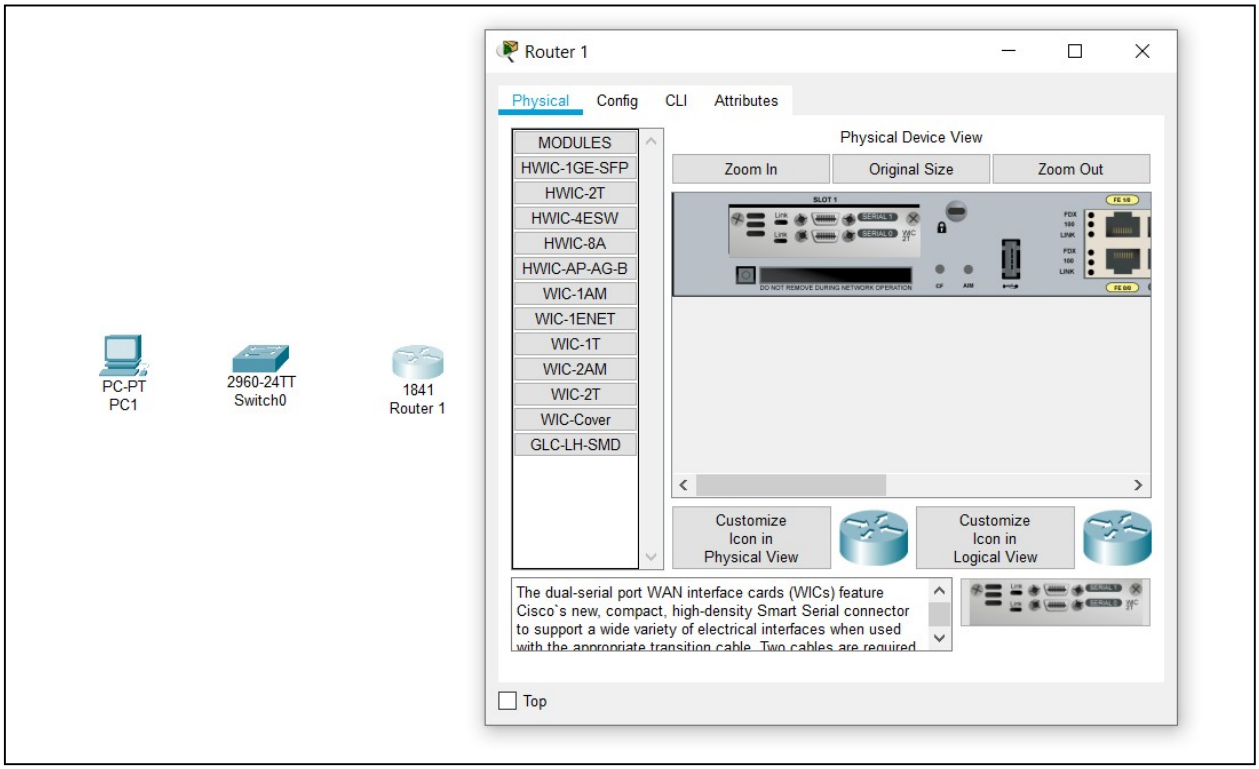

PC2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.94
Subnet Mask
255.255.255.224
Default Gateway
192.168.1.65
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::2E0:B0FF:FE1A:B2EA
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Top
PC-PT
PC2

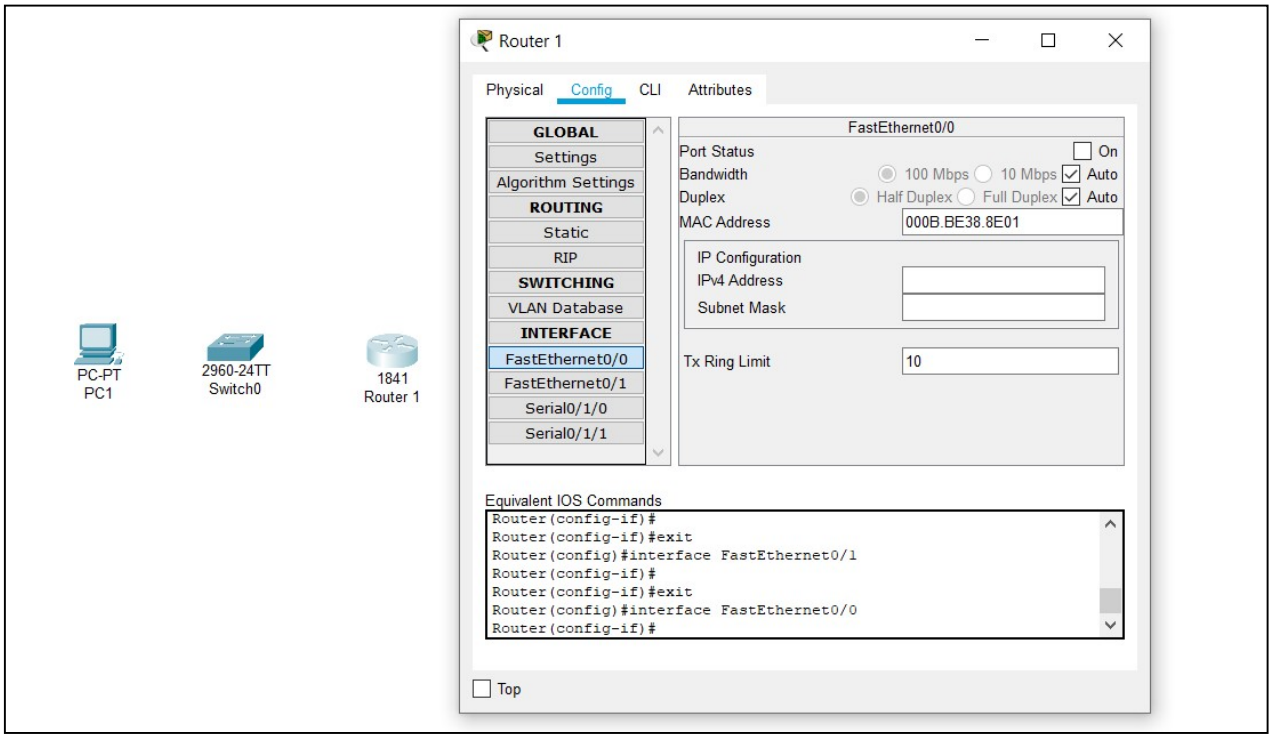
Configuration of Router 1



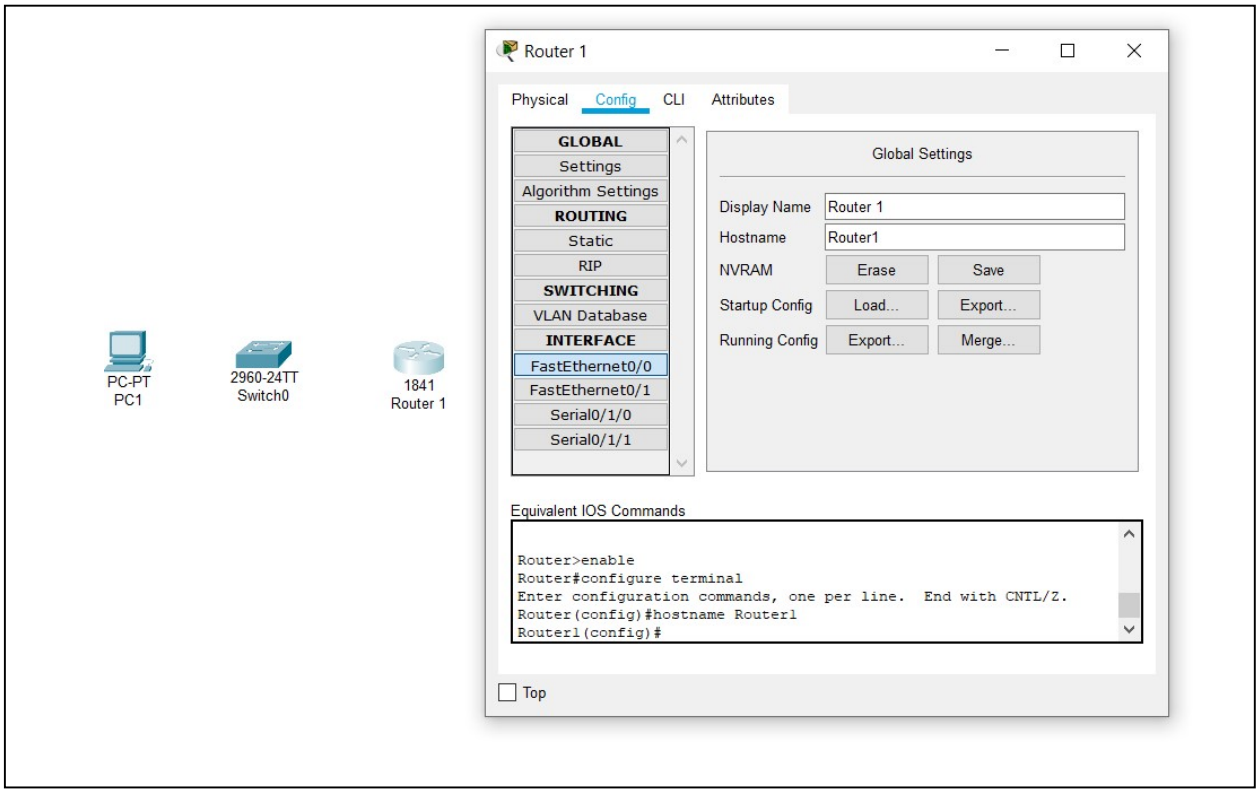


Adding WIC-1T card for serial port

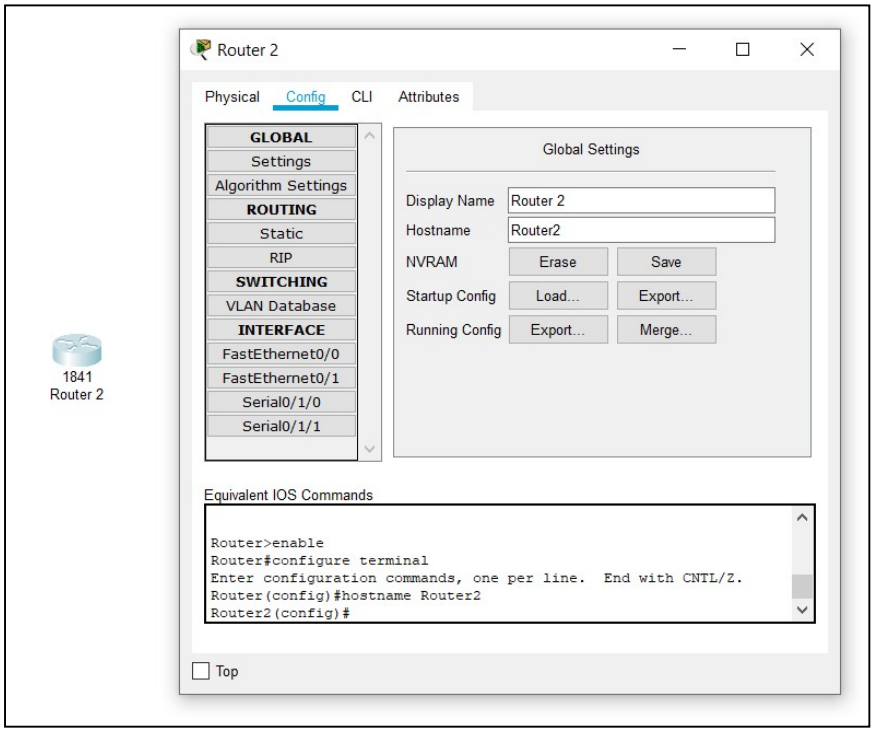


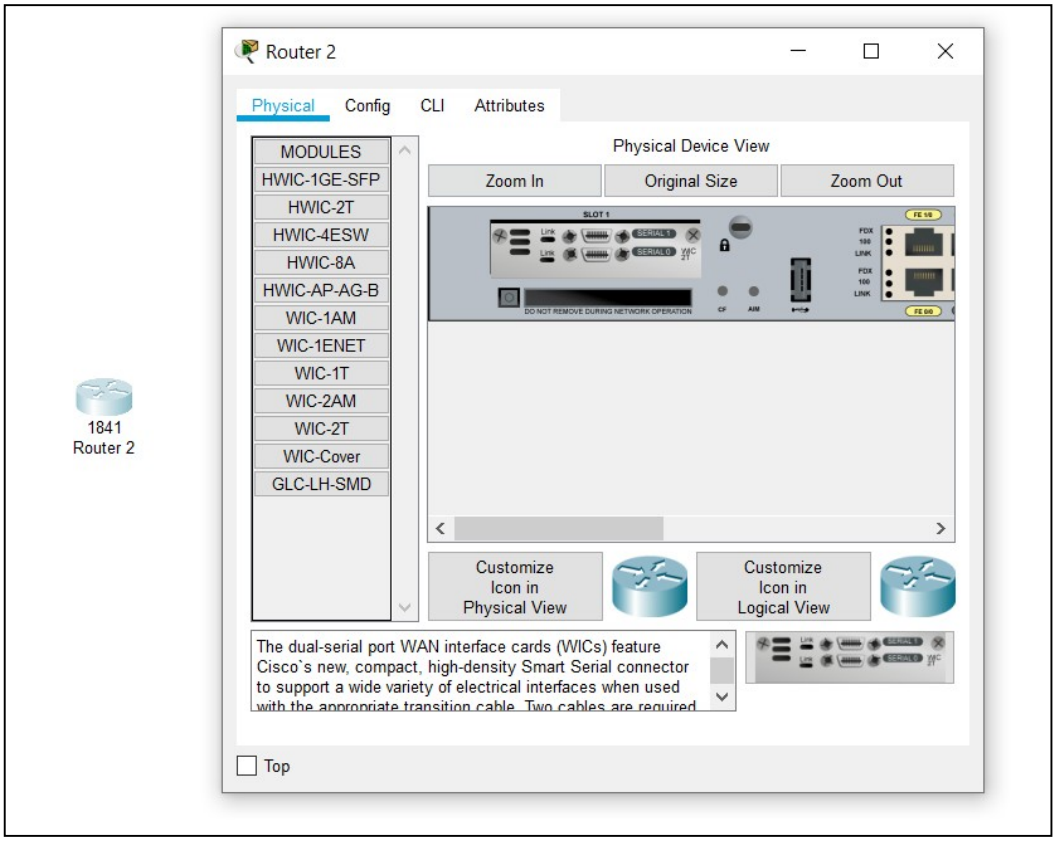


Changing hostname to Router1

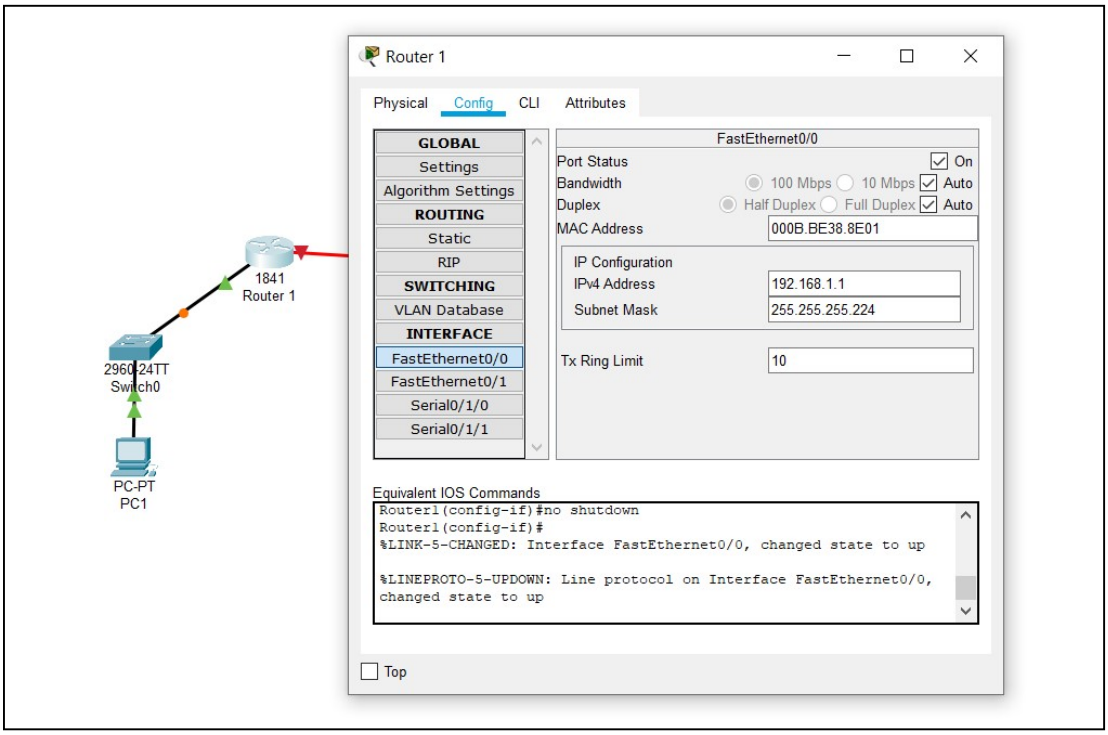


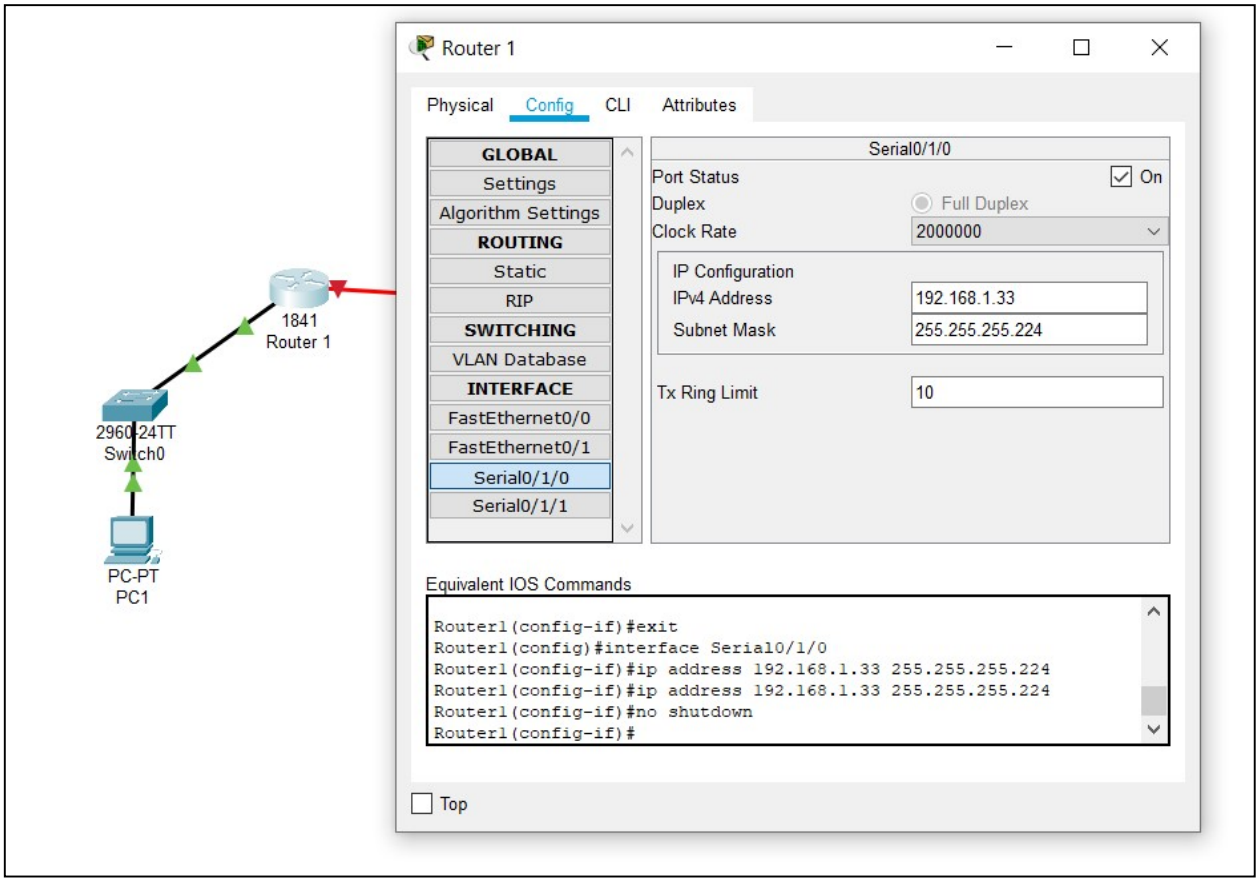
Configuration of Router 2



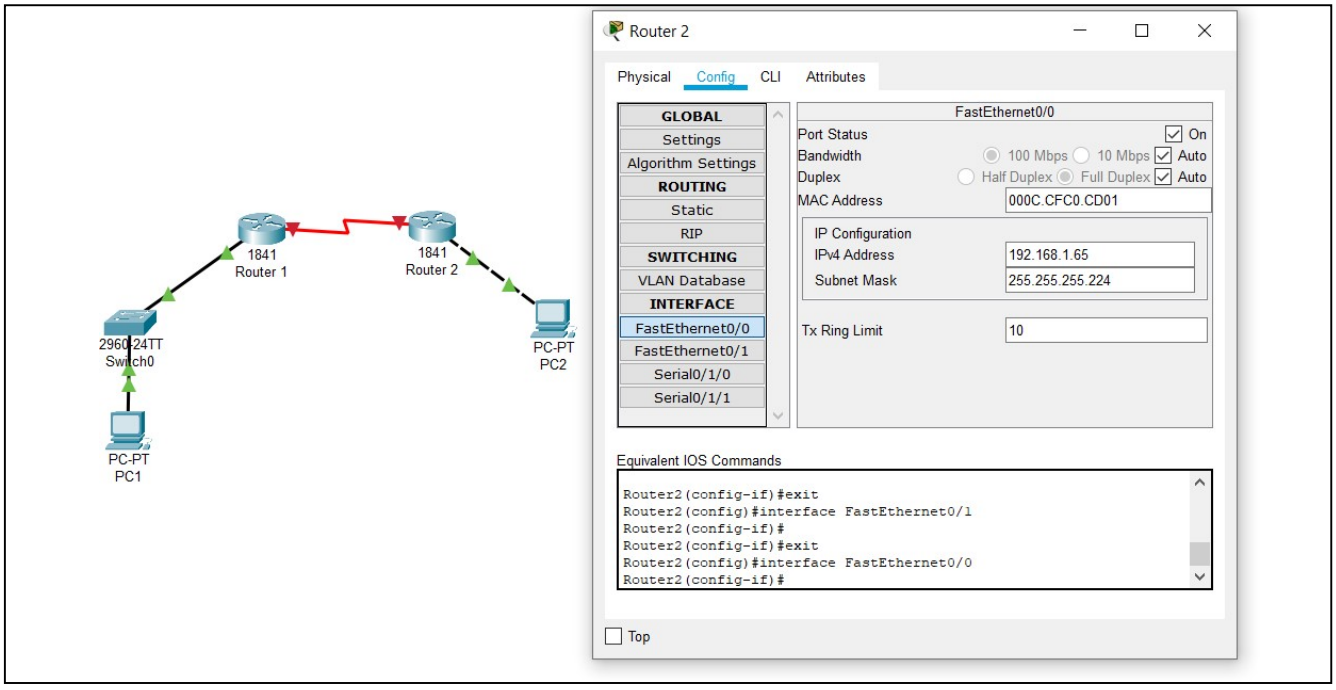


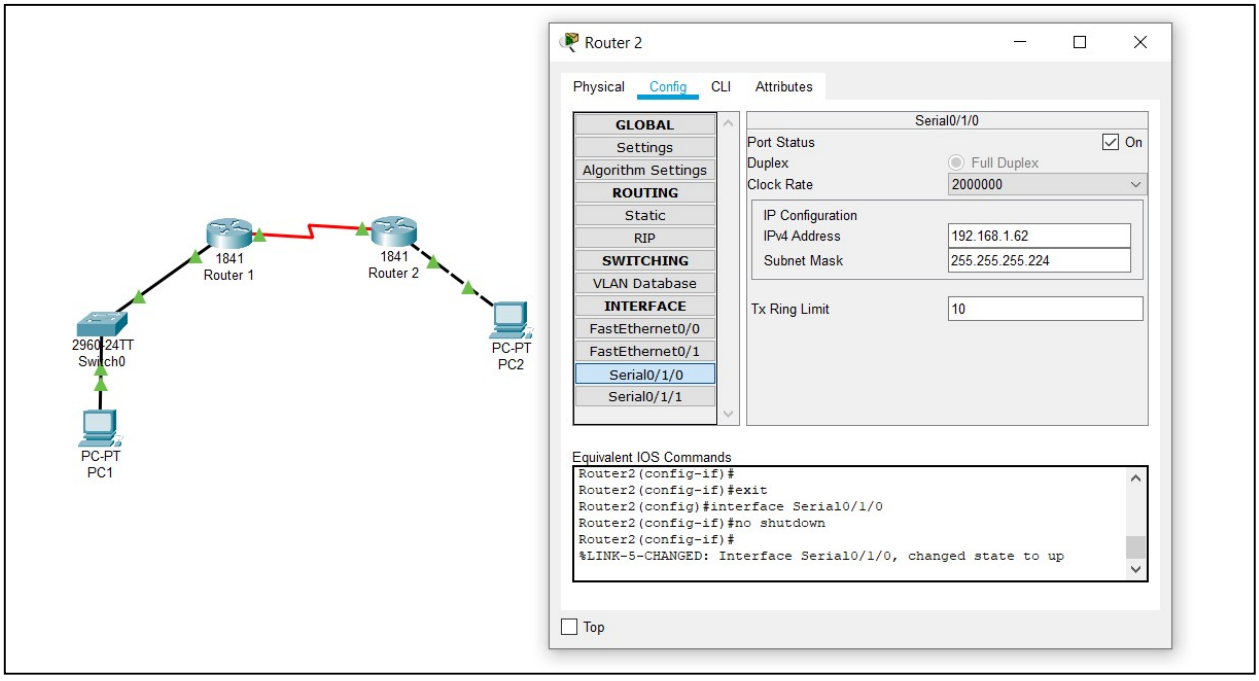
Assigning IP addresses to Router 1



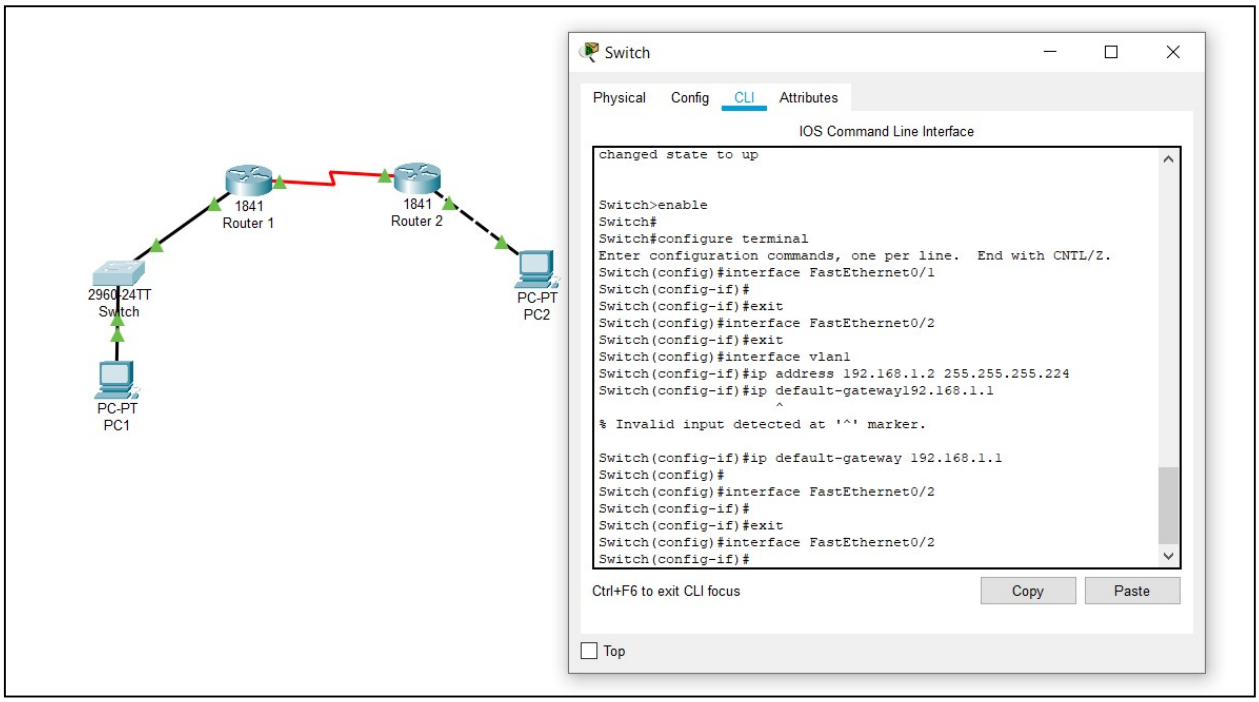


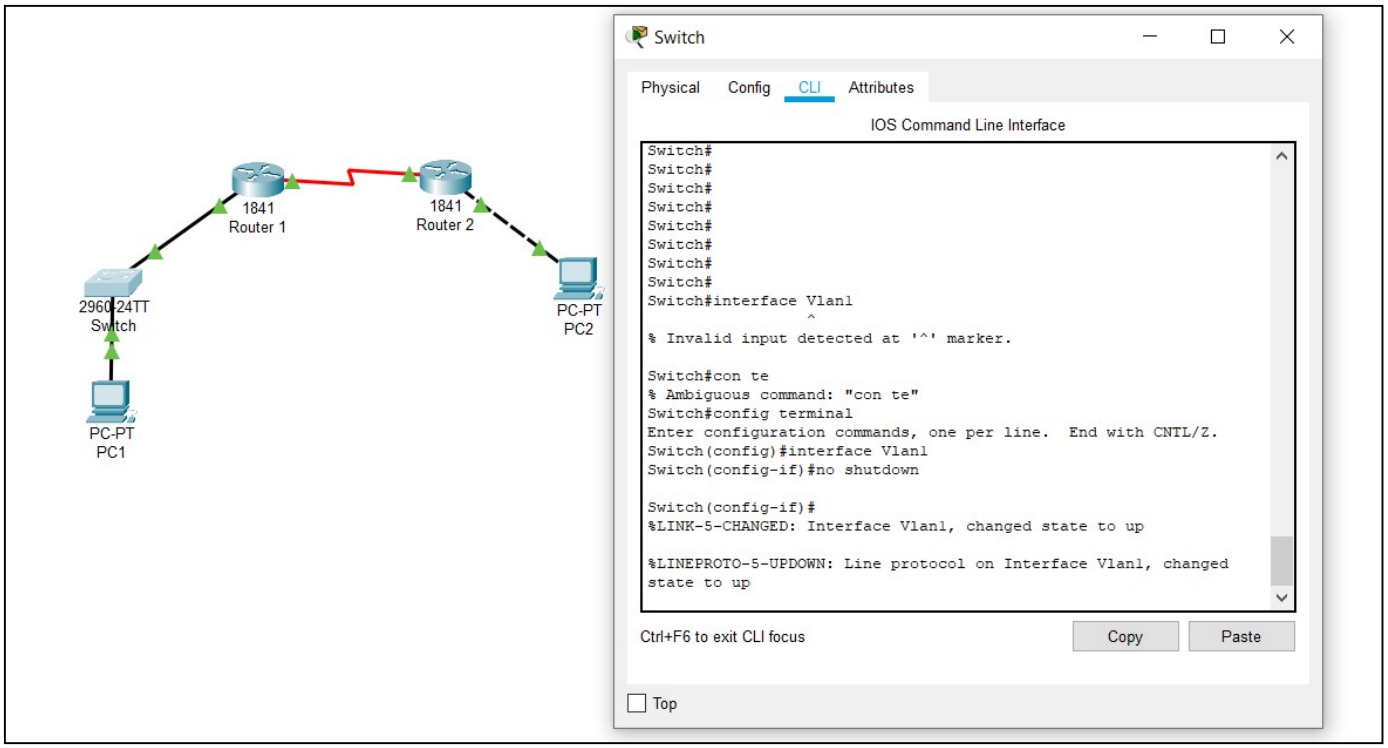
Assigning IP addresses to Router 2

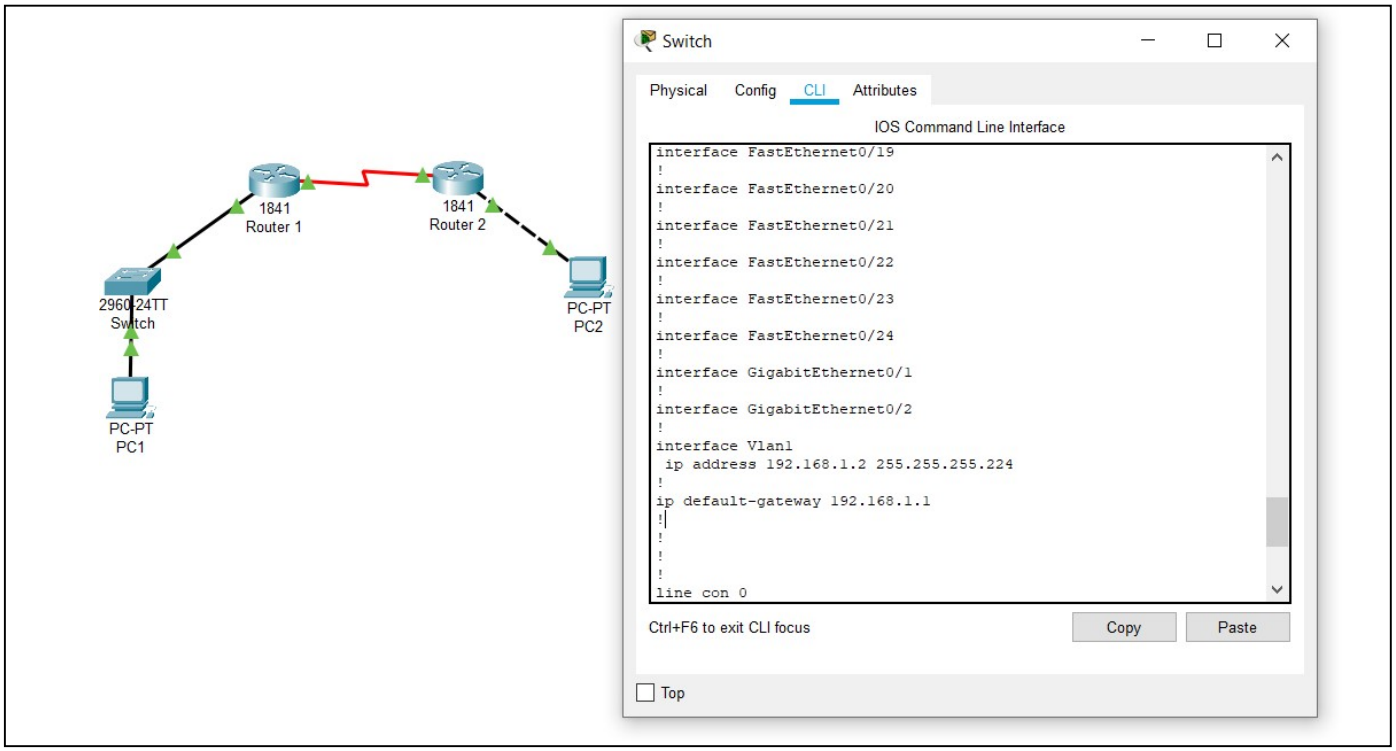


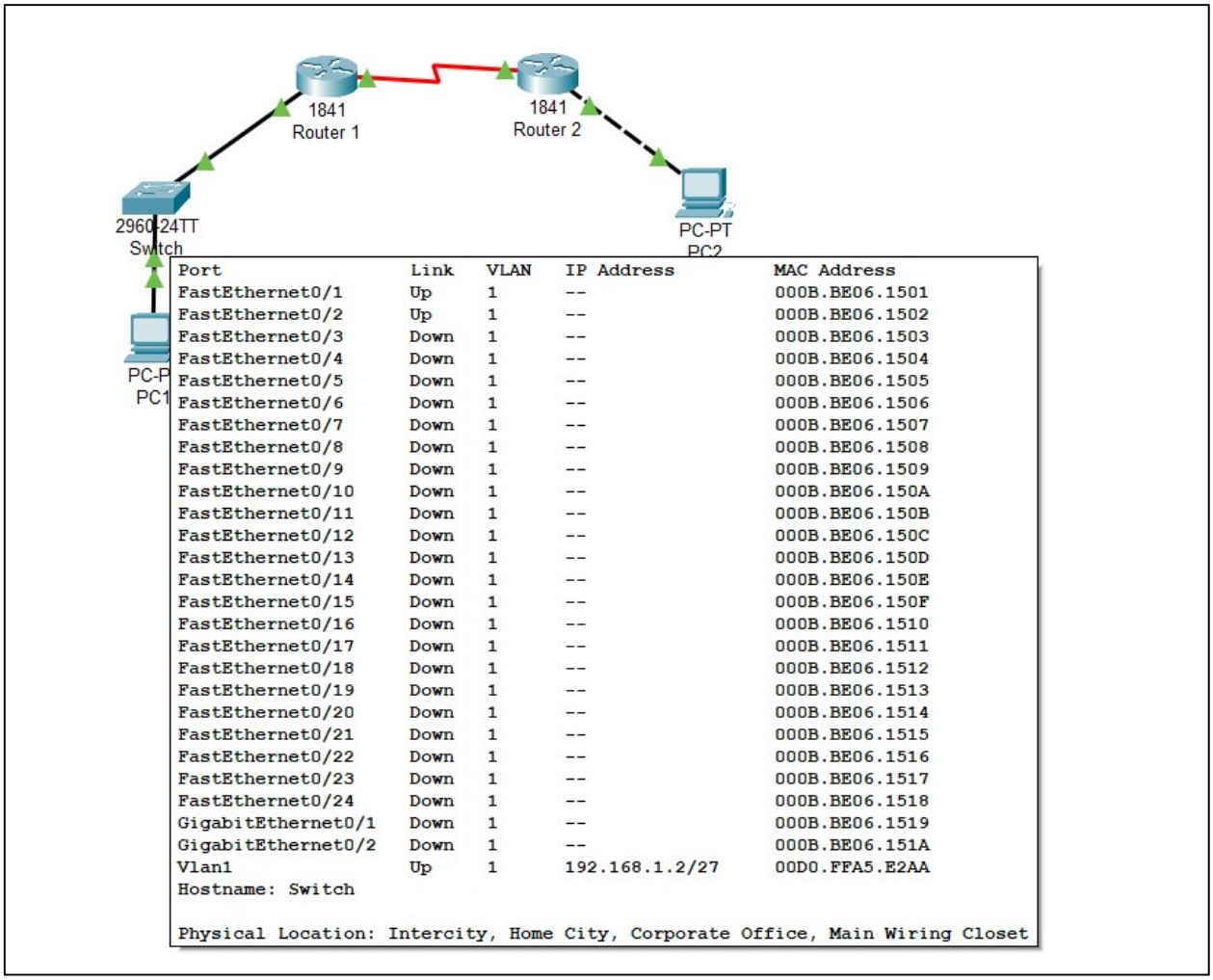


Assigning IP address and default gateway to switch




1841
Router 1
1841
Router 2
2960-24TT
Switch
PC-PT
PC1
PC-PT
PC2
Switch
Physical
Config
CLI
Attributes
IOS Command Line Interface
Switch#
Switch#
Switch#
Switch#
Switch#
Switch#
Switch#
Switch#
Switch#interface Vlan1
^
% Invalid input detected at '^' marker.
Switch#con te
% Ambiguous command: "con te"
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#interface Vlan1
Switch(config-if)#no shutdown
Switch(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


1841
Router 1
1841
Router 2
2960-24TT
Switch
PC-PT
PC1
PC-PT
PC2
Switch
Physical
Config
CLI
Attributes
IOS Command Line Interface
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
!
interface Vlan1
ip address 192.168.1.2 255.255.255.224
!
ip default-gateway 192.168.1.1
!
!
!
!
line con 0
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

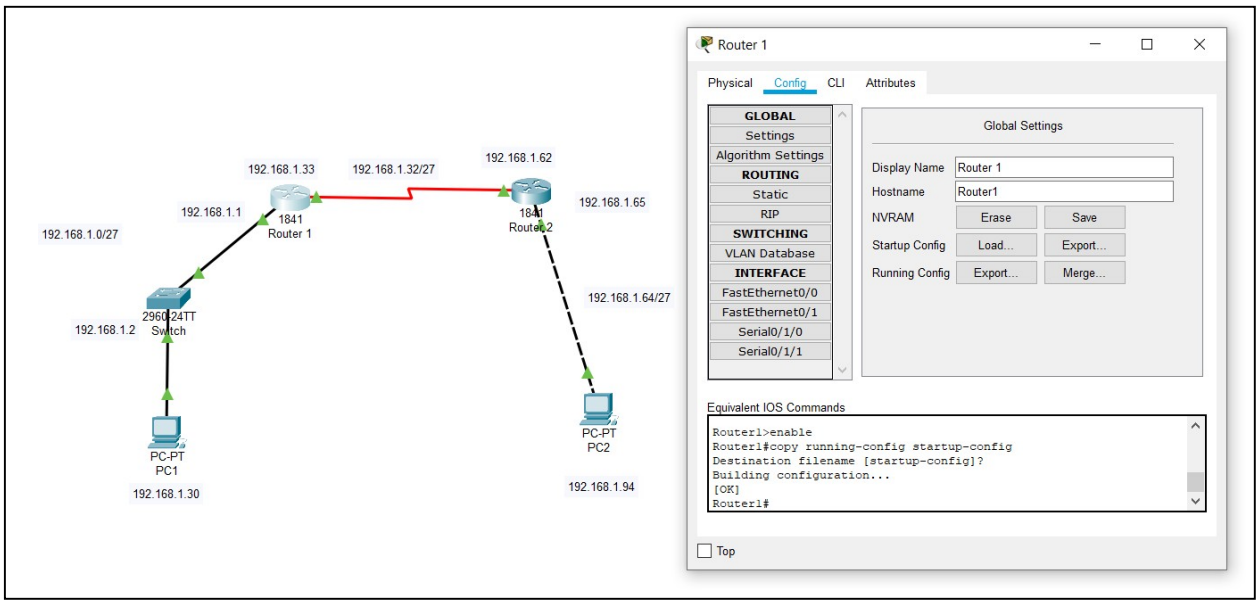


Port	Link	VLAN	IP Address	MAC Address
FastEthernet0/1	Up	1	--	000B.BE06.1501
FastEthernet0/2	Up	1	--	000B.BE06.1502
FastEthernet0/3	Down	1	--	000B.BE06.1503
FastEthernet0/4	Down	1	--	000B.BE06.1504
FastEthernet0/5	Down	1	--	000B.BE06.1505
FastEthernet0/6	Down	1	--	000B.BE06.1506
FastEthernet0/7	Down	1	--	000B.BE06.1507
FastEthernet0/8	Down	1	--	000B.BE06.1508
FastEthernet0/9	Down	1	--	000B.BE06.1509
FastEthernet0/10	Down	1	--	000B.BE06.150A
FastEthernet0/11	Down	1	--	000B.BE06.150B
FastEthernet0/12	Down	1	--	000B.BE06.150C
FastEthernet0/13	Down	1	--	000B.BE06.150D
FastEthernet0/14	Down	1	--	000B.BE06.150E
FastEthernet0/15	Down	1	--	000B.BE06.150F
FastEthernet0/16	Down	1	--	000B.BE06.1510
FastEthernet0/17	Down	1	--	000B.BE06.1511
FastEthernet0/18	Down	1	--	000B.BE06.1512
FastEthernet0/19	Down	1	--	000B.BE06.1513
FastEthernet0/20	Down	1	--	000B.BE06.1514
FastEthernet0/21	Down	1	--	000B.BE06.1515
FastEthernet0/22	Down	1	--	000B.BE06.1516
FastEthernet0/23	Down	1	--	000B.BE06.1517
FastEthernet0/24	Down	1	--	000B.BE06.1518
GigabitEthernet0/1	Down	1	--	000B.BE06.1519
GigabitEthernet0/2	Down	1	--	000B.BE06.151A
Vlan1	Up	1	192.168.1.2/27	00D0.FFA5.E2AA

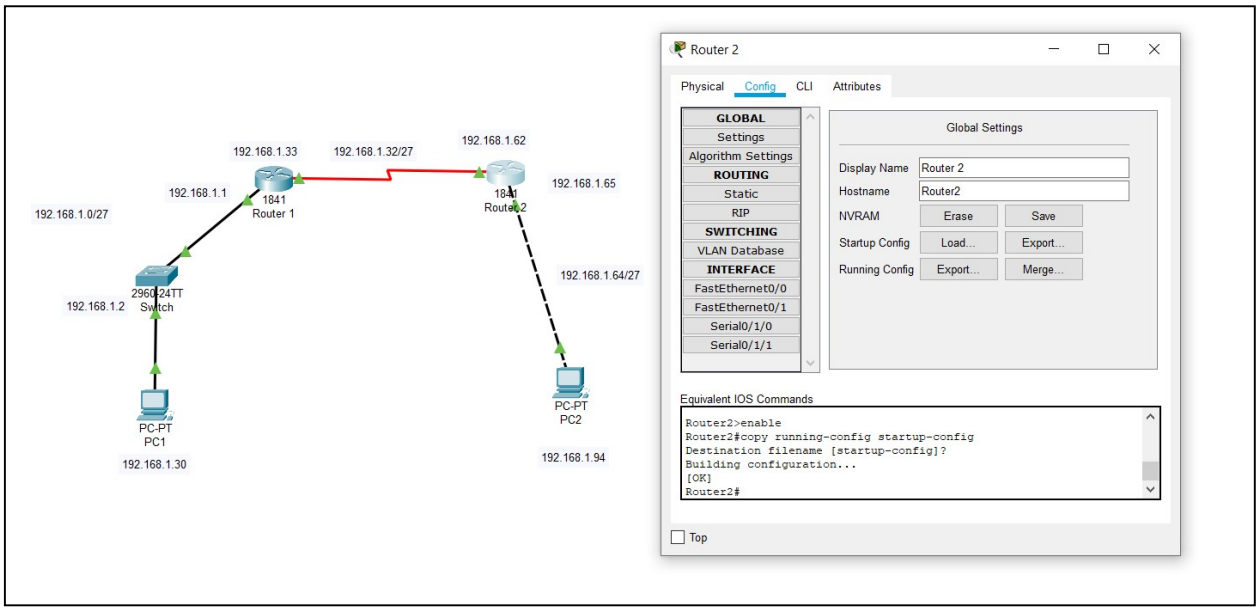
Hostname: Switch

Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet

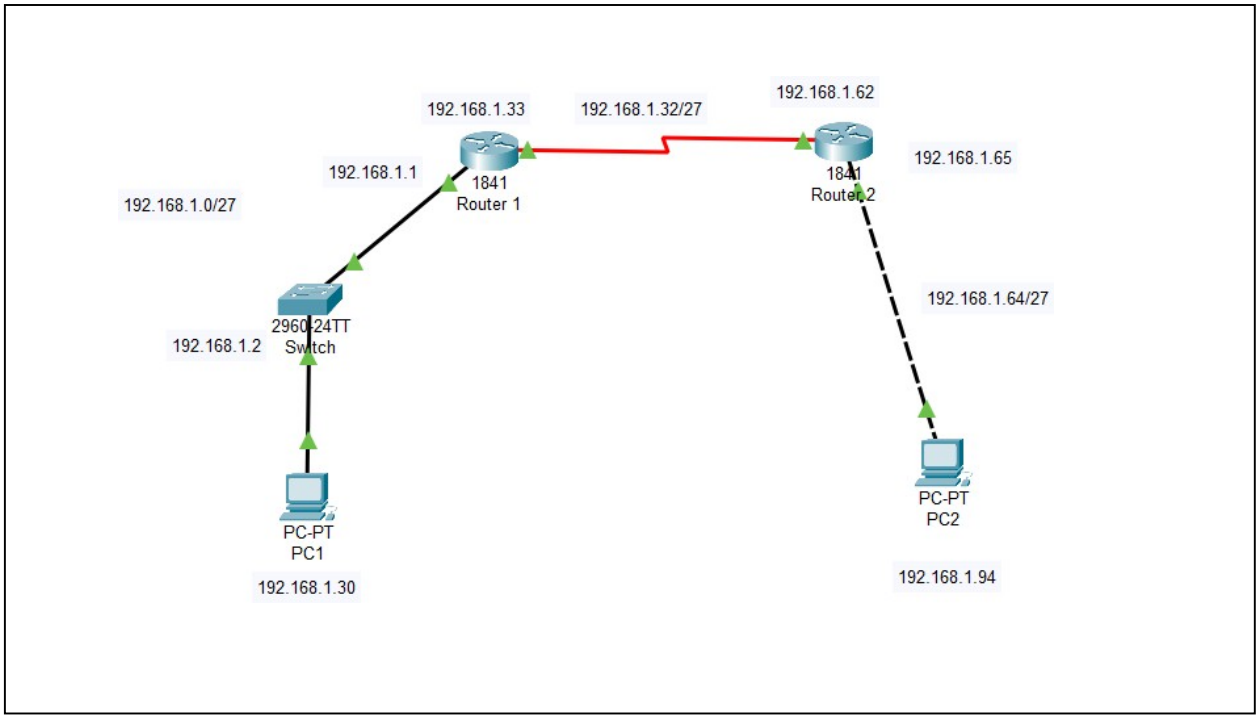
Saving the running configuration to NVRAM of Router 1



Saving the running configuration to NVRAM of Router 2



Complete Network



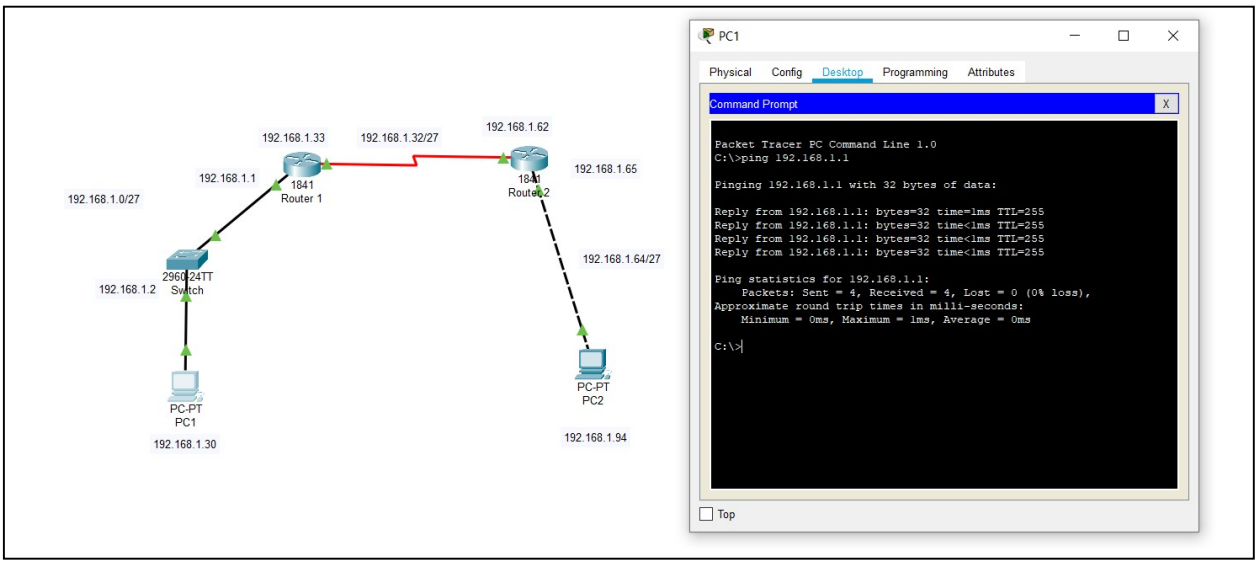
Task 4: Verify the Configurations.

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

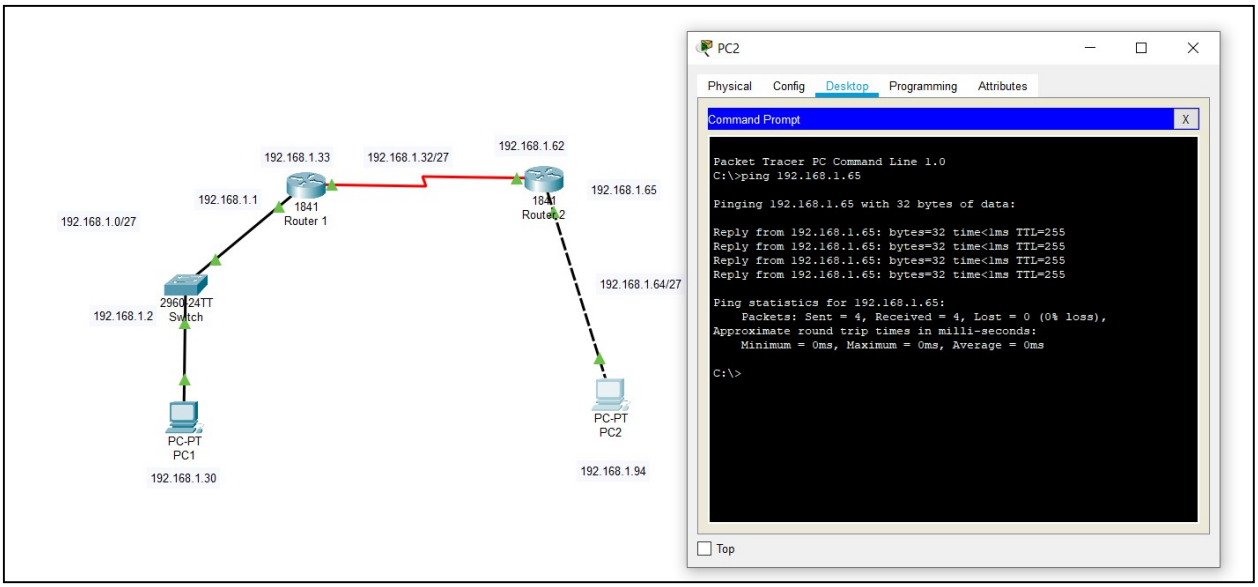
   Pinging the default gateway from PC1



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

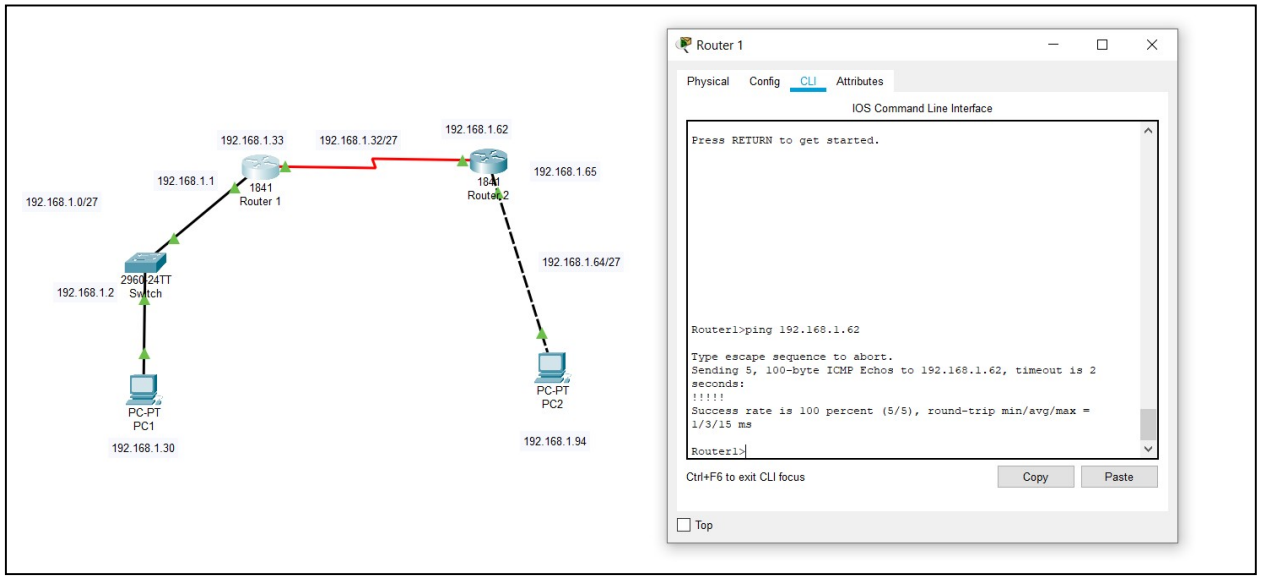
   Ans: Yes

   Pinging the default gateway from PC2



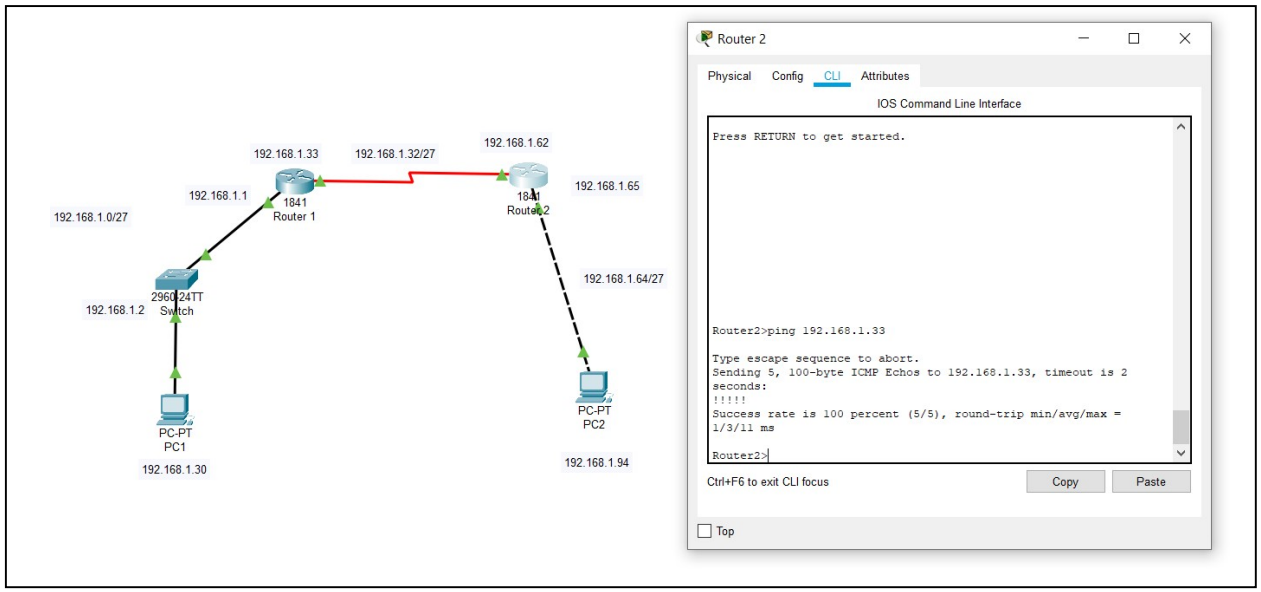
3. From the router R1, is it possible to ping the Serial 0/0/0 interface of R2?

   Ans: Yes



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

   Ans: Yes

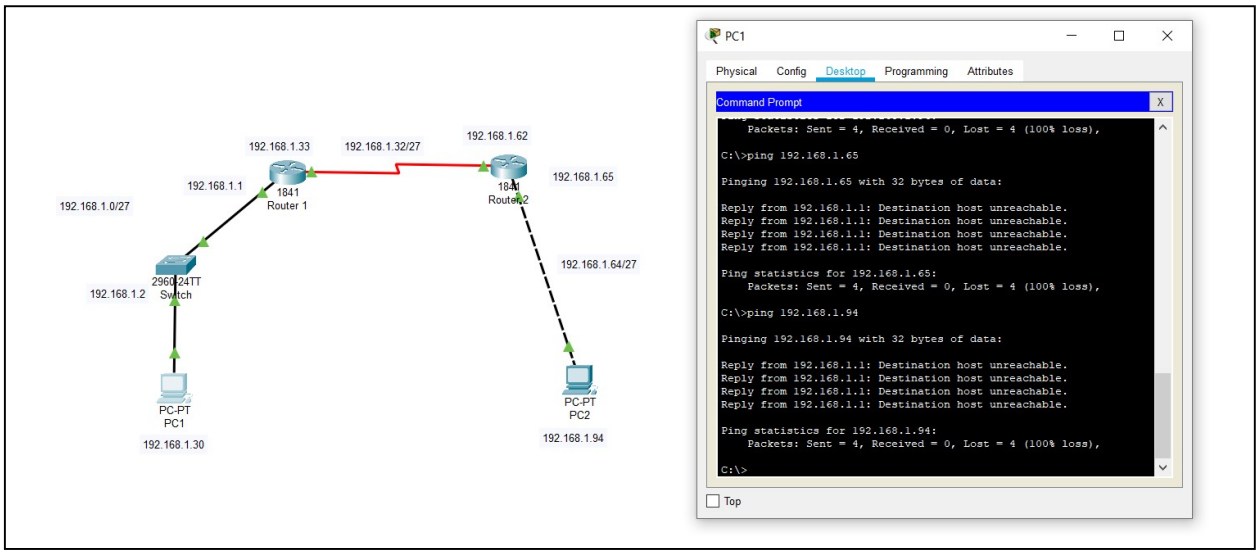


The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations.

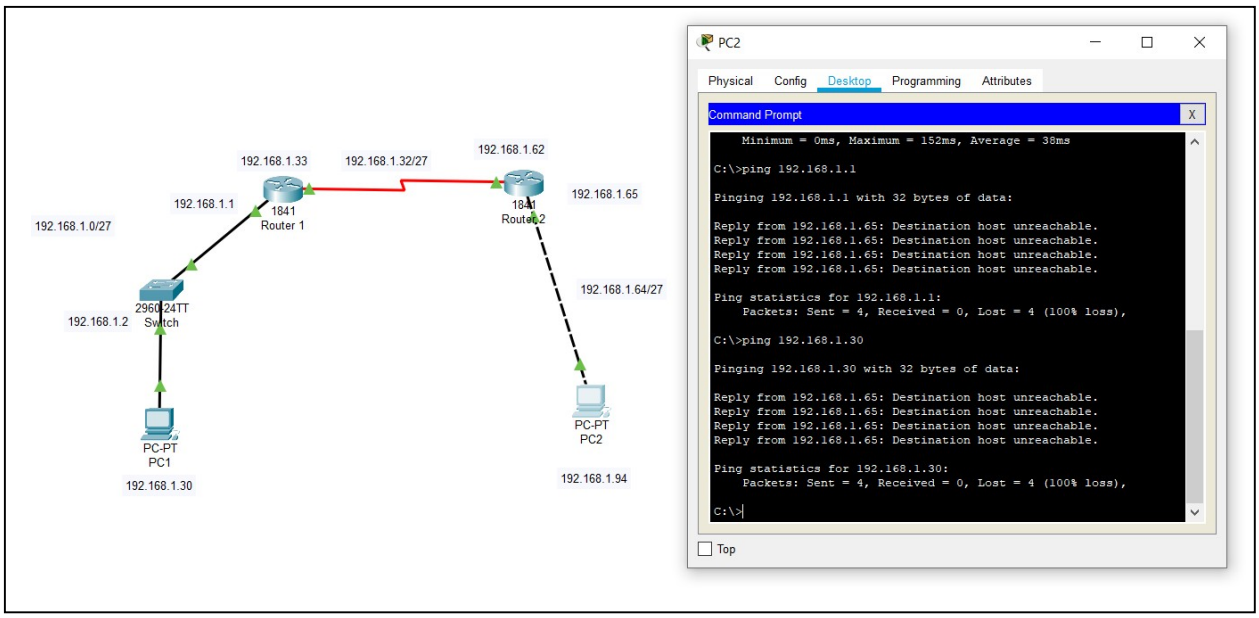
Task 5: Reflection

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

   Ans: PC1 cannot ping FastEthernet port of Router2 and PC2

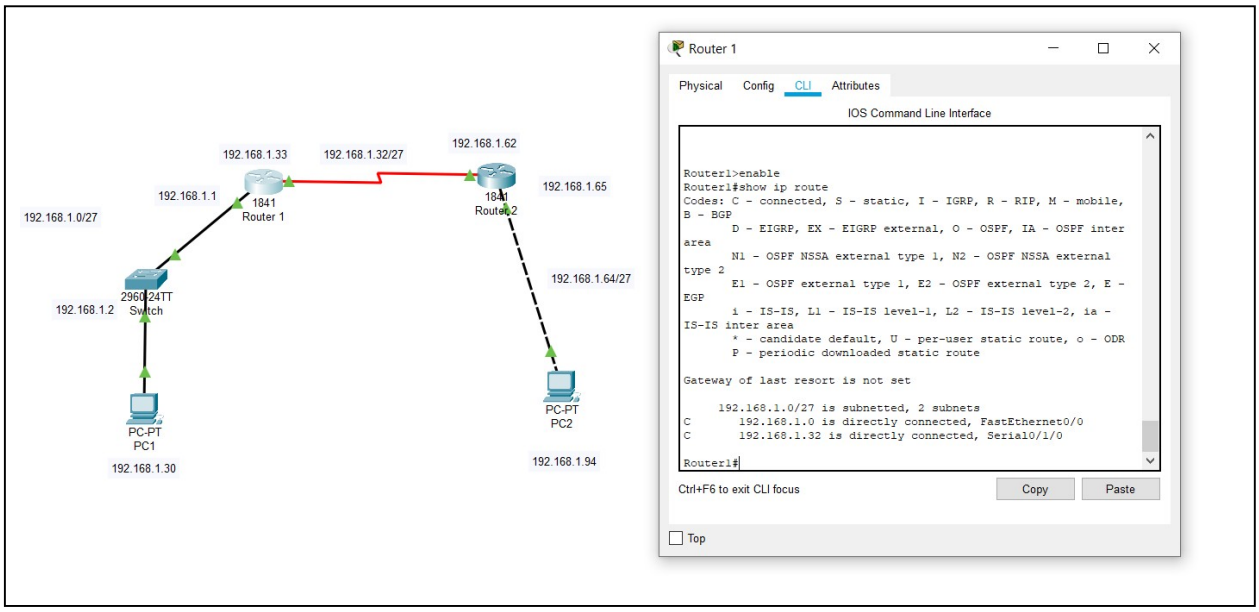


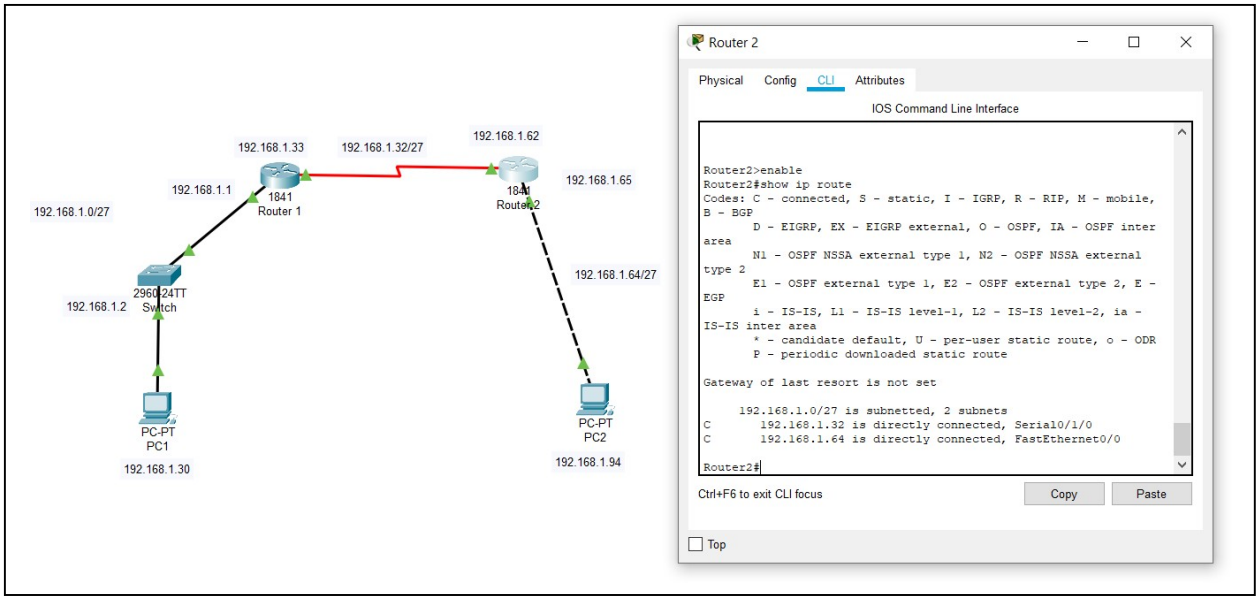
PC2 cannot ping FastEthernet port of Router1 and PC1



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.