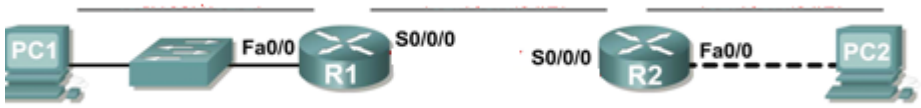
CEL 51, DCCN, Monsoon 2020
Lab 6: Subnet and Router Configuration

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0	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

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?

3 subnets are required for this network. One subnet for the network connected to router R1, second subnet for the link between R1 and R2, third subnet for the network connected to router R2.

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

Given Network address:- 192.168.1.0/24

Last 8 bits can be used to identify host

Therefore number of usable hosts are: 2^n-2= 2^8 – 2 = 256-2= 254

We need 3 subnets in this network. So we can use 2 subnet bits to get 2^2 = 4 subnets.

First 24 bits are required for network identification.

Next 2 bits will be subnet bits

Next 6 bits will be host bits. Therefore each subnet can have maximum 2^6 = 64 addresses.

Therefore remaining 6 bits will be used as host bits.

Subnet mask in dotted binary notation is 11111111.11111111.11111111.11000000

Therefore subnet mask in dotted decimal notation is 255.255.255.192

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

Subnet mask in slash format is /26

How many usable hosts are there per subnet?

We have six bits for identifying the hosts. Therefore from 6 bits we can have 2^6 =64 addresses.

Therefore each subnet has 64 addresses.

The first address of the subnet is used as network identification and last one is the broadcast.

Each subnet has 64 addresses. Therefore the usable hosts are 64-2 = 62 hosts

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

1. Assign subnet 1 to the network attached to R1 = 192.168.1.64/26
2. Assign subnet 2 to the link between R1 and R2 = 192.168.1.128/26
3. Assign subnet 3 to the network attached to R2 = 192.168.1.192/26

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.
   Fa0/0 = 192.168.1.65
2. Assign the last valid host address in subnet 1 to PC1.
   192.168.1.126
3. Assign the first valid host address in subnet 2 to the WAN interface on R1.
   S0/0/0 = 192.168.1.129

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

   S0/0/0 = 192.168.1.190

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

   Fa0/0 = 192.168.1.193

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

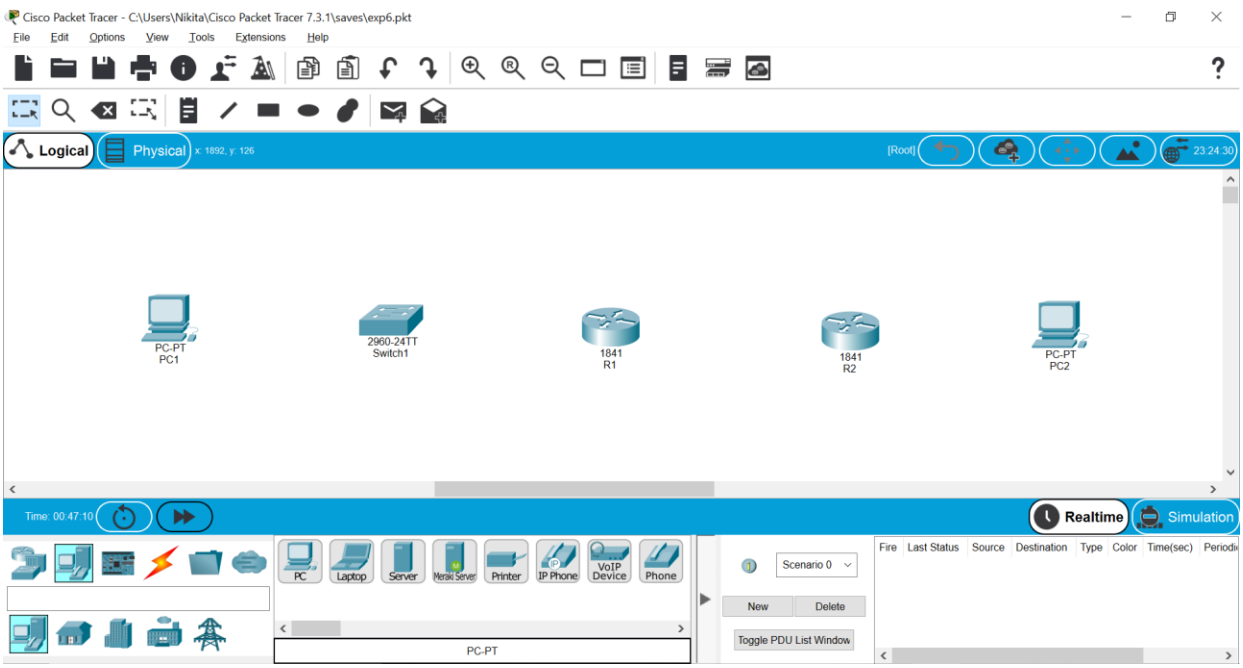
   192.168.1.254

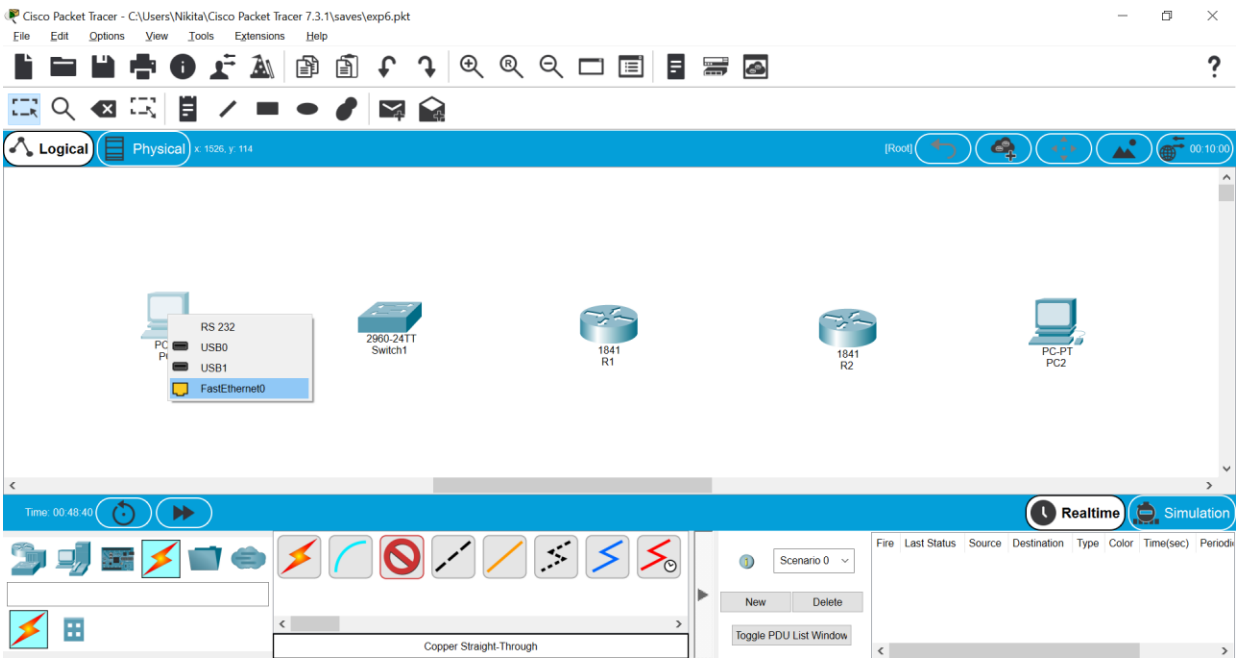
Network connected to router 1 requires 15 hosts. But subnet 1 can have 64 hosts. So in subnet 1 addresses from 192.168.1.65- 192.168.1.79 will be used.

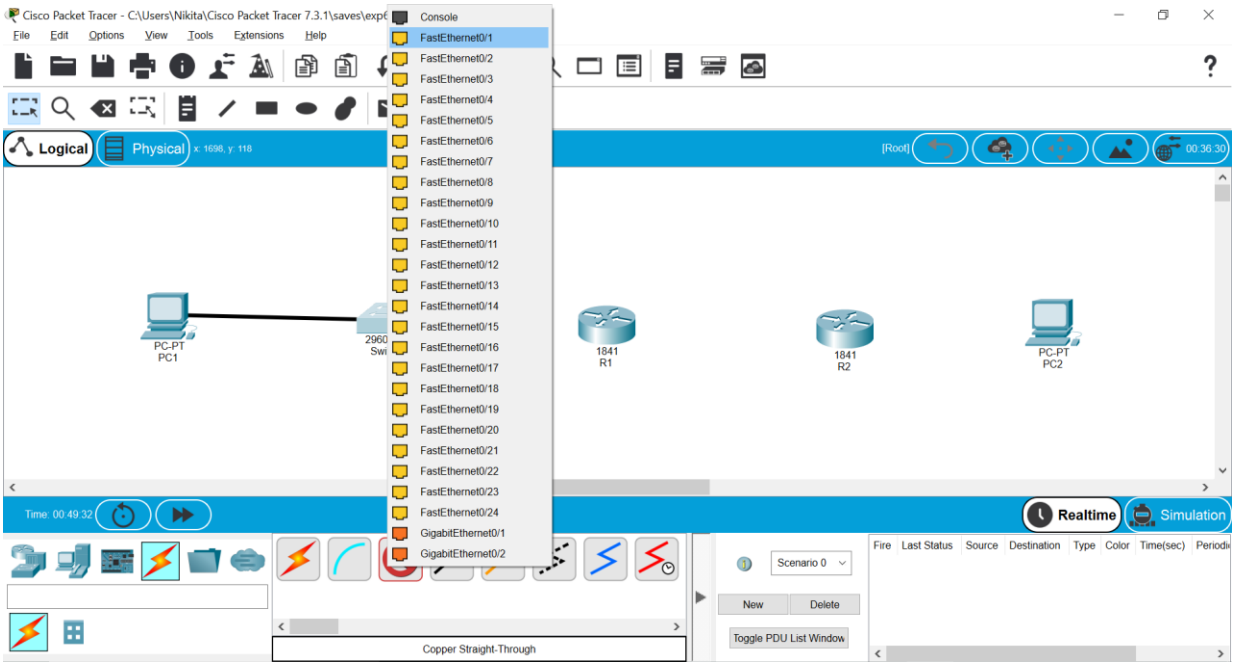
Network connected to router 2 requires 30 hosts. But subnet 3 can have 64 hosts. So in subnet 3 addresses from 192.168.1.193 - 192.168.1.222 will be used.

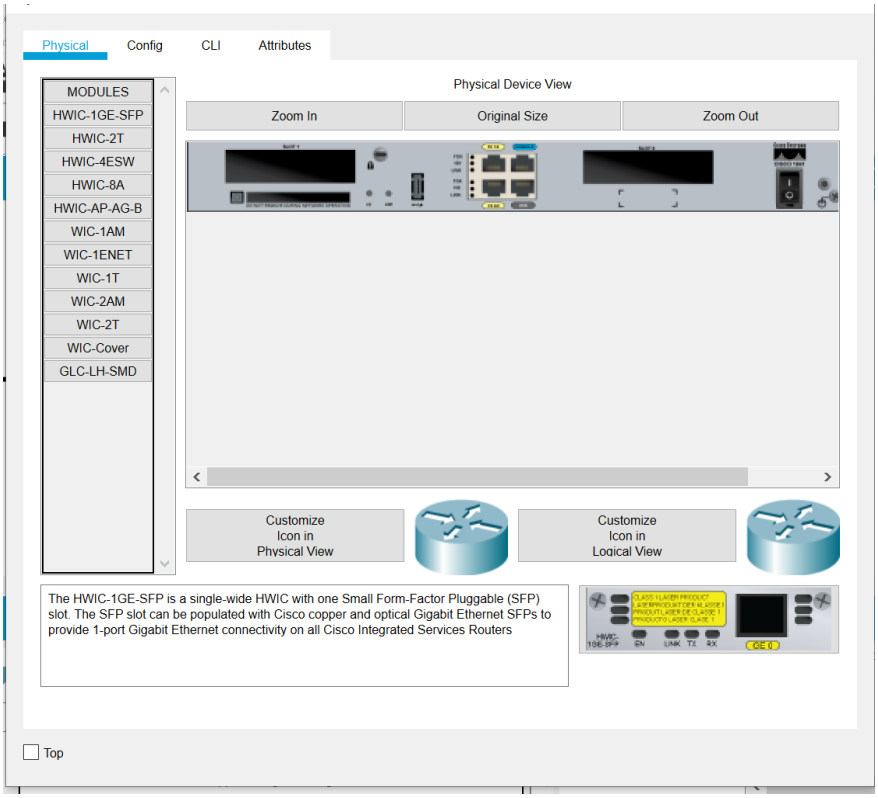
Step 2: Document the addresses to be used in the table provide under the Topology Diagram.

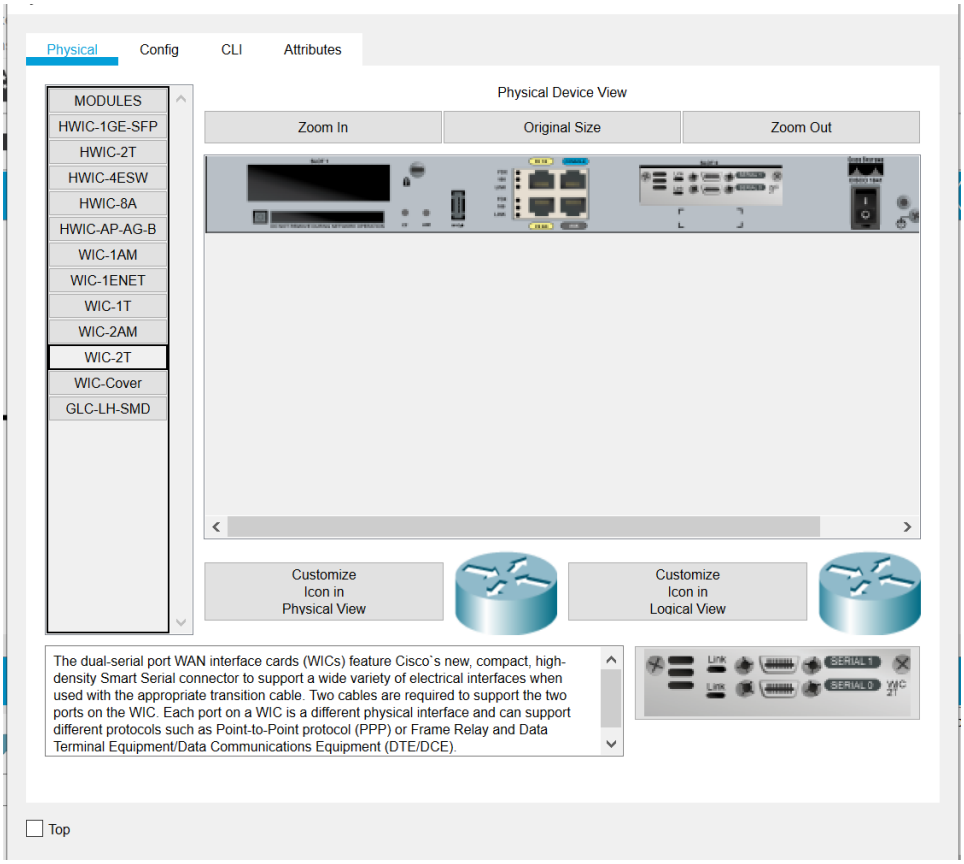
Task 3: Configure the Serial and FastEthernet Addresses.

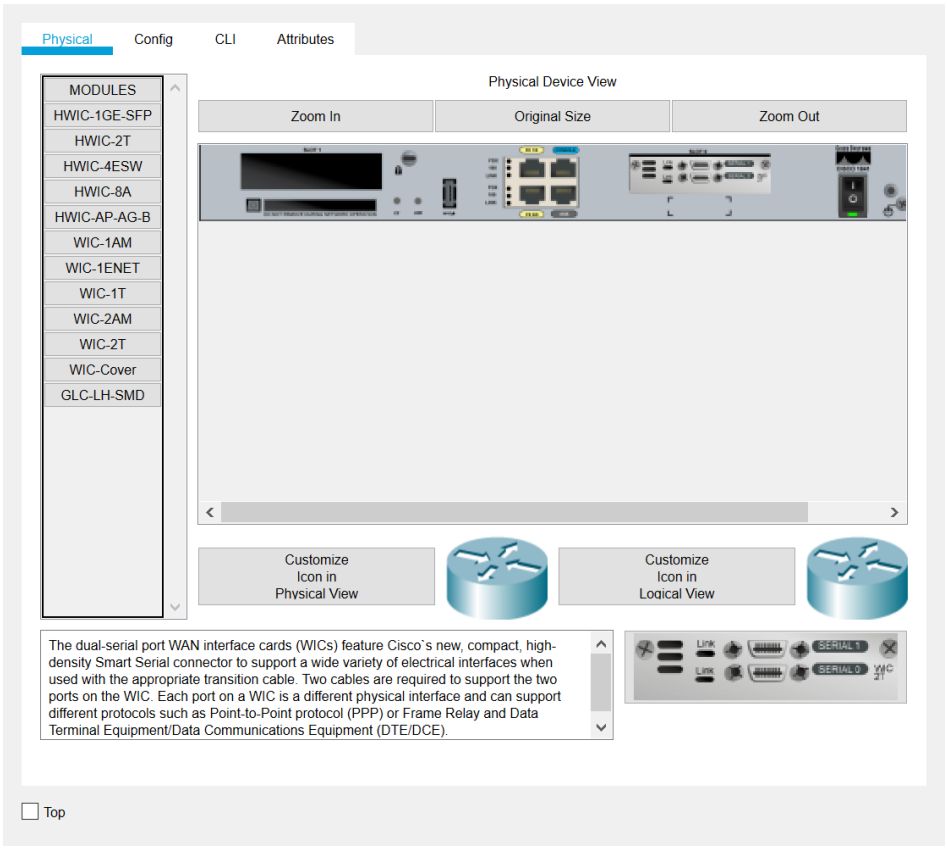



Cisco Packet Tracer - C:\Users\Nikita\Cisco Packet Tracer 7.3.1\saves\exp6.pkt
File Edit Options View Tools Extensions Help
Logical
Physical
RS 232
USB0
USB1
FastEthernet0
2960-24TT
Switch1
1841
R1
1841
R2
PC-PT
PC2
Realtime
Simulation
Scenario 0
New
Delete
Toggle PDU List Window
Copper Straight-Through


Cisco Packet Tracer - C:\Users\Nikita\Cisco Packet Tracer 7.3.1\saves\exp6
File Edit Options View Tools Extensions Help
Logical
Physical
Console
FastEthernet0/1
FastEthernet0/2
FastEthernet0/3
FastEthernet0/4
FastEthernet0/5
FastEthernet0/6
FastEthernet0/7
FastEthernet0/8
FastEthernet0/9
FastEthernet0/10
FastEthernet0/11
FastEthernet0/12
FastEthernet0/13
FastEthernet0/14
FastEthernet0/15
FastEthernet0/16
FastEthernet0/17
FastEthernet0/18
FastEthernet0/19
FastEthernet0/20
FastEthernet0/21
FastEthernet0/22
FastEthernet0/23
FastEthernet0/24
GigabitEthernet0/1
GigabitEthernet0/2
PC-PT
PC1
1841
R1
1841
R2
PC-PT
PC2
Realtime
Simulation
Scenario 0
New
Delete
Toggle PDU List Window
Copper Straight-Through


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 HWIC-1GE-SFP is a single-wide HWIC with one Small Form-Factor Pluggable (SFP) slot. The SFP slot can be populated with Cisco copper and optical Gigabit Ethernet SFPs to provide 1-port Gigabit Ethernet connectivity on all Cisco Integrated Services Routers
Top


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 with the appropriate transition cable. Two cables are required to support the two ports on the WIC. Each port on a WIC is a different physical interface and can support different protocols such as Point-to-Point protocol (PPP) or Frame Relay and Data Terminal Equipment/Data Communications Equipment (DTE/DCE).
Top


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
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Physical Device View
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Original Size
Zoom Out
Customize Icon in Physical View
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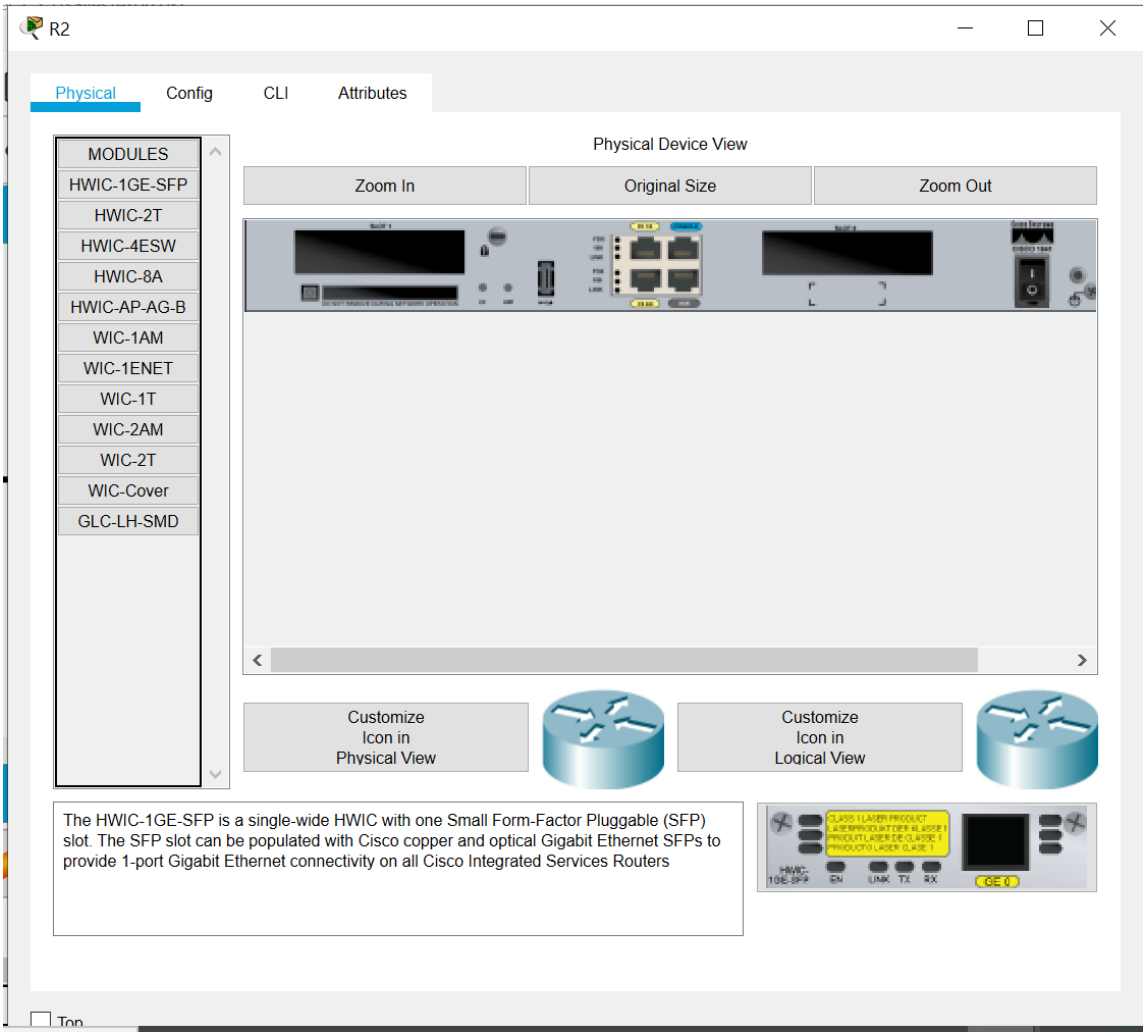
SERIAL 1
SERIAL 0
Top


R2
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
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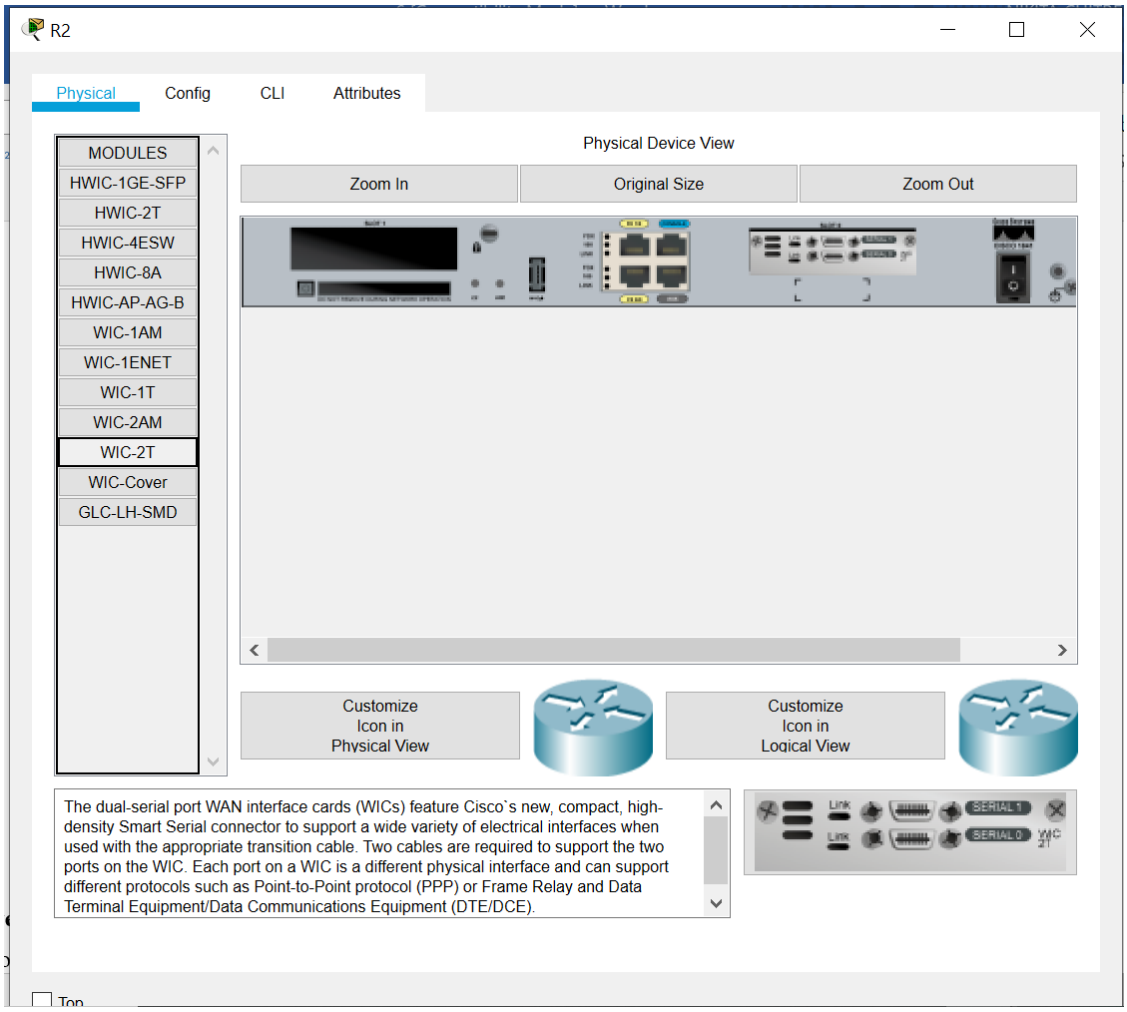
Top


R2
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
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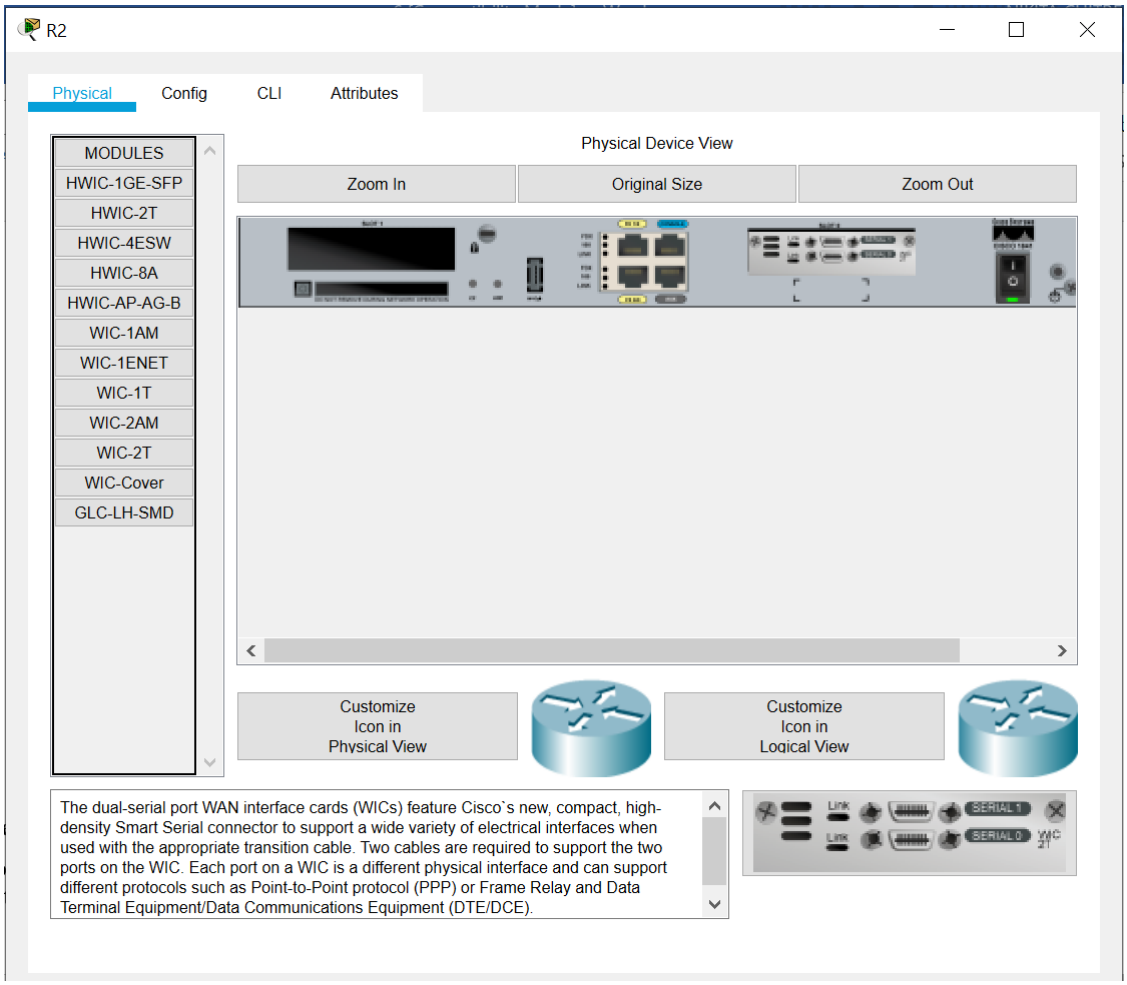
Link
Link
SERIAL 1
SERIAL 0
Top


R2
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
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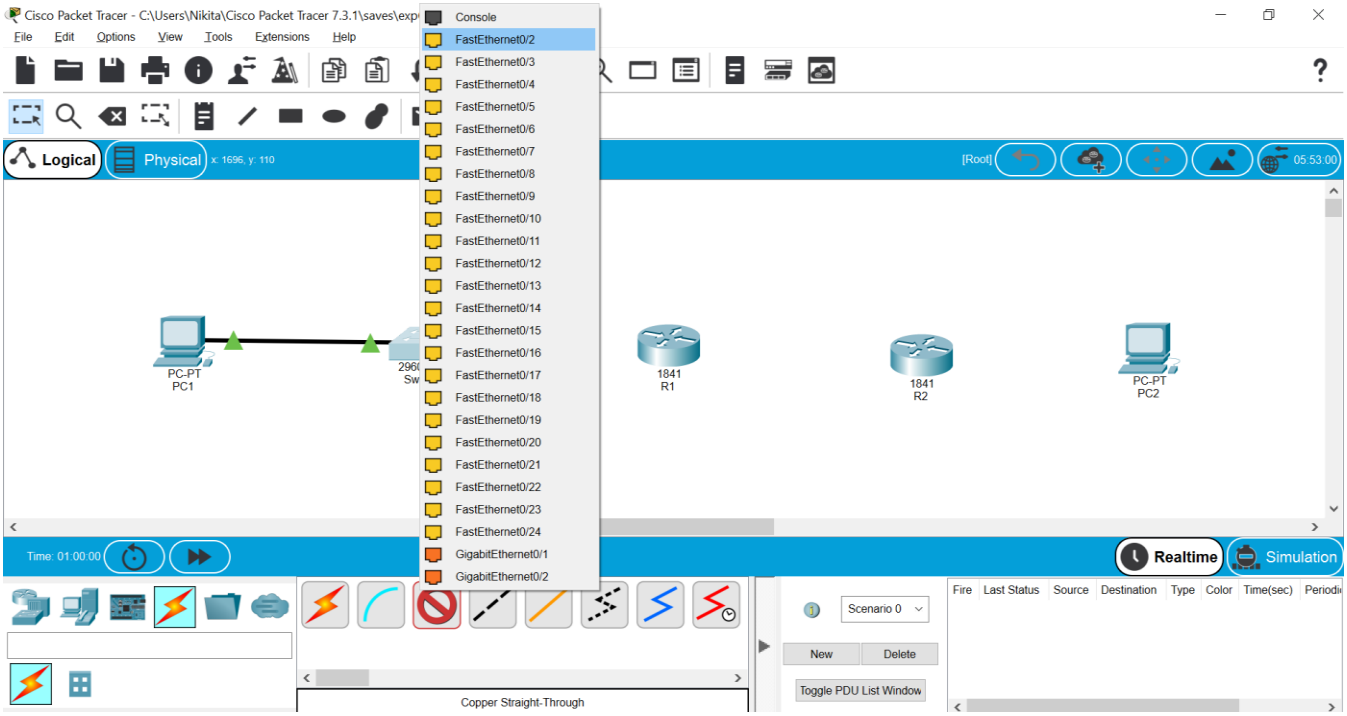
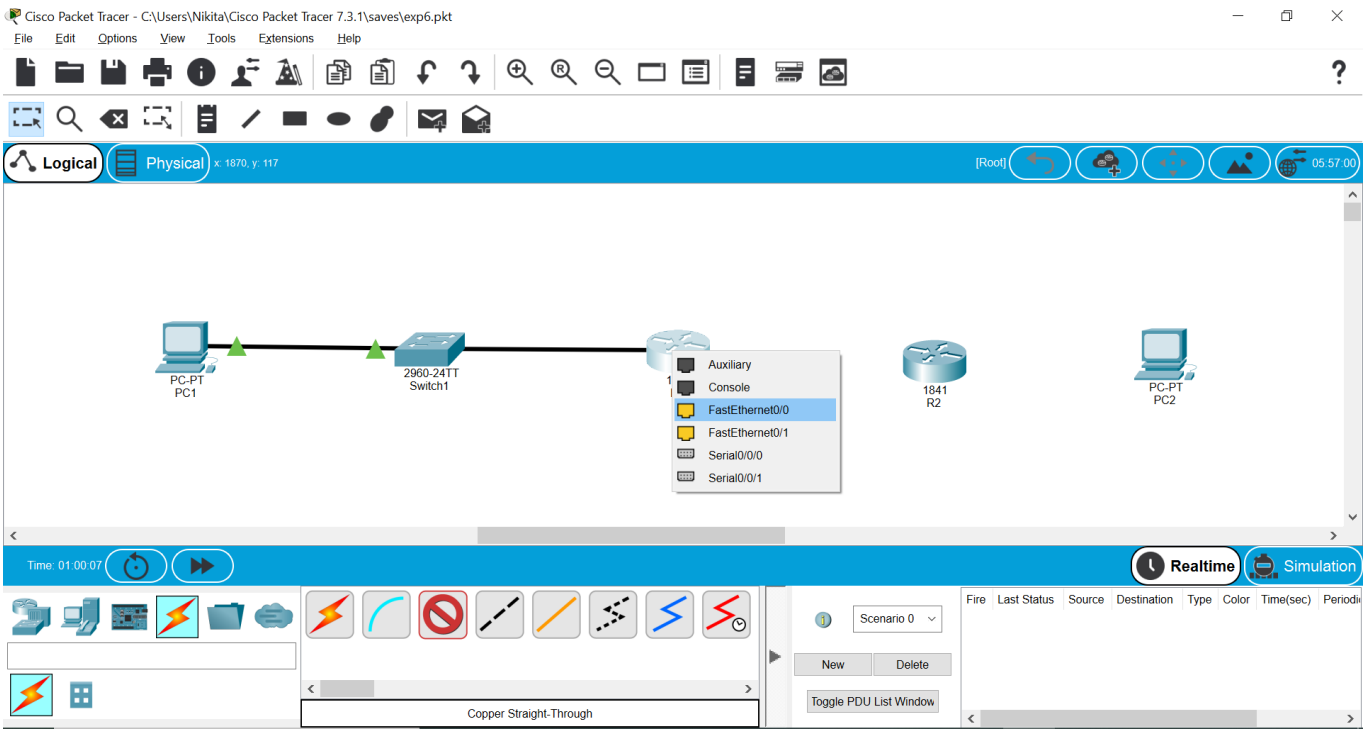
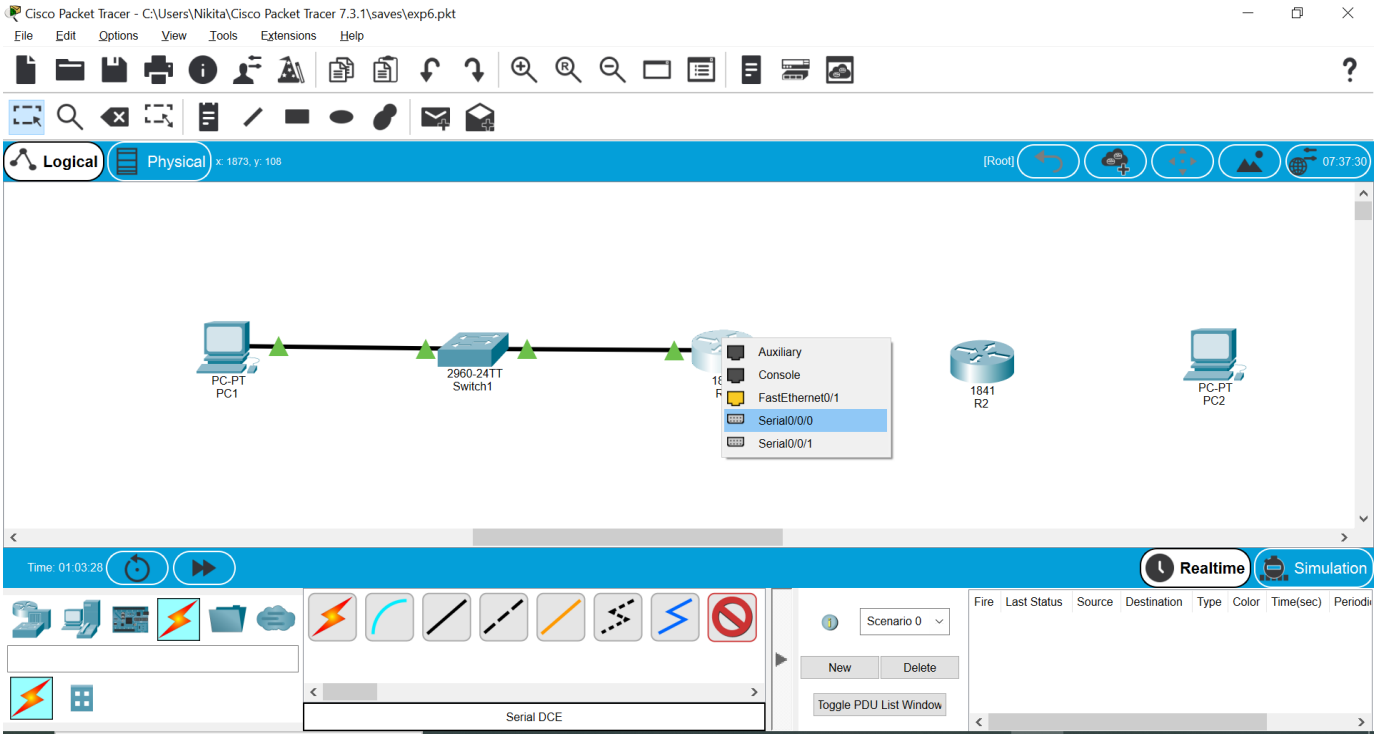
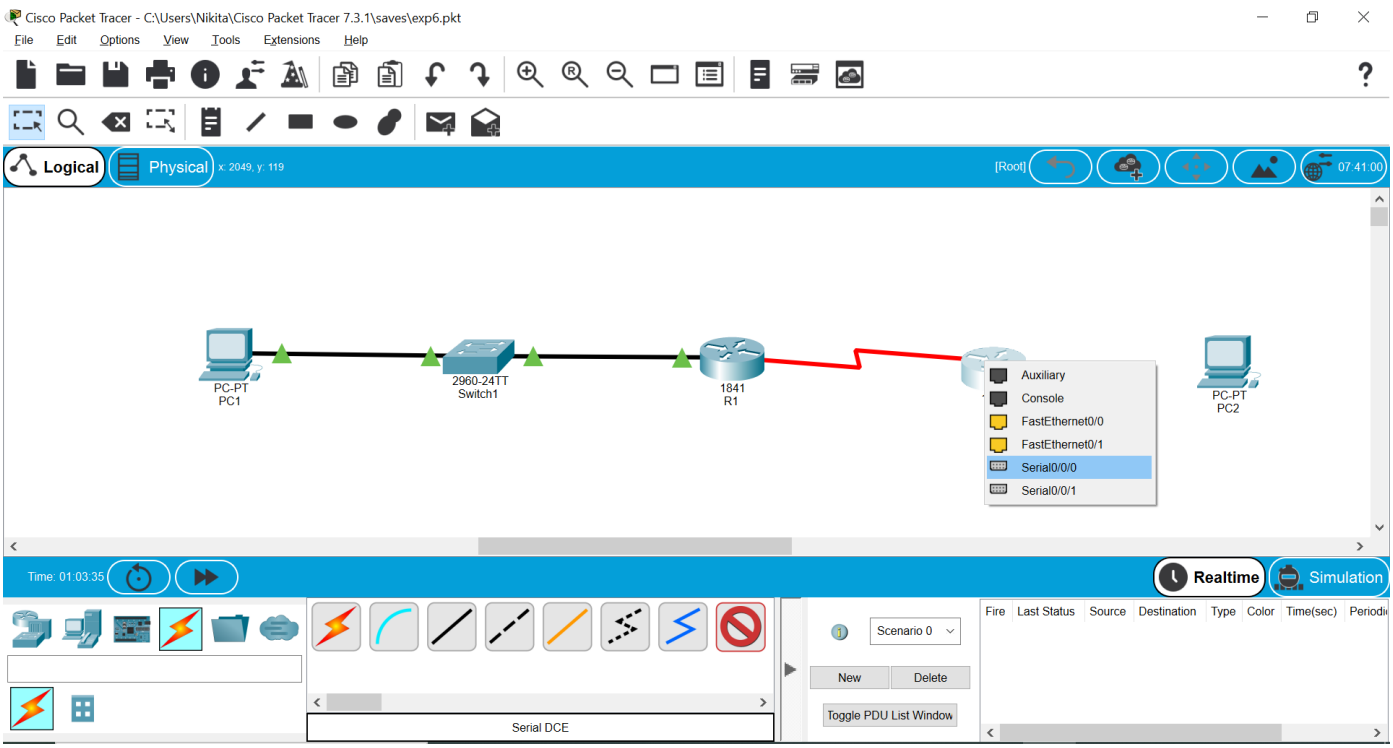
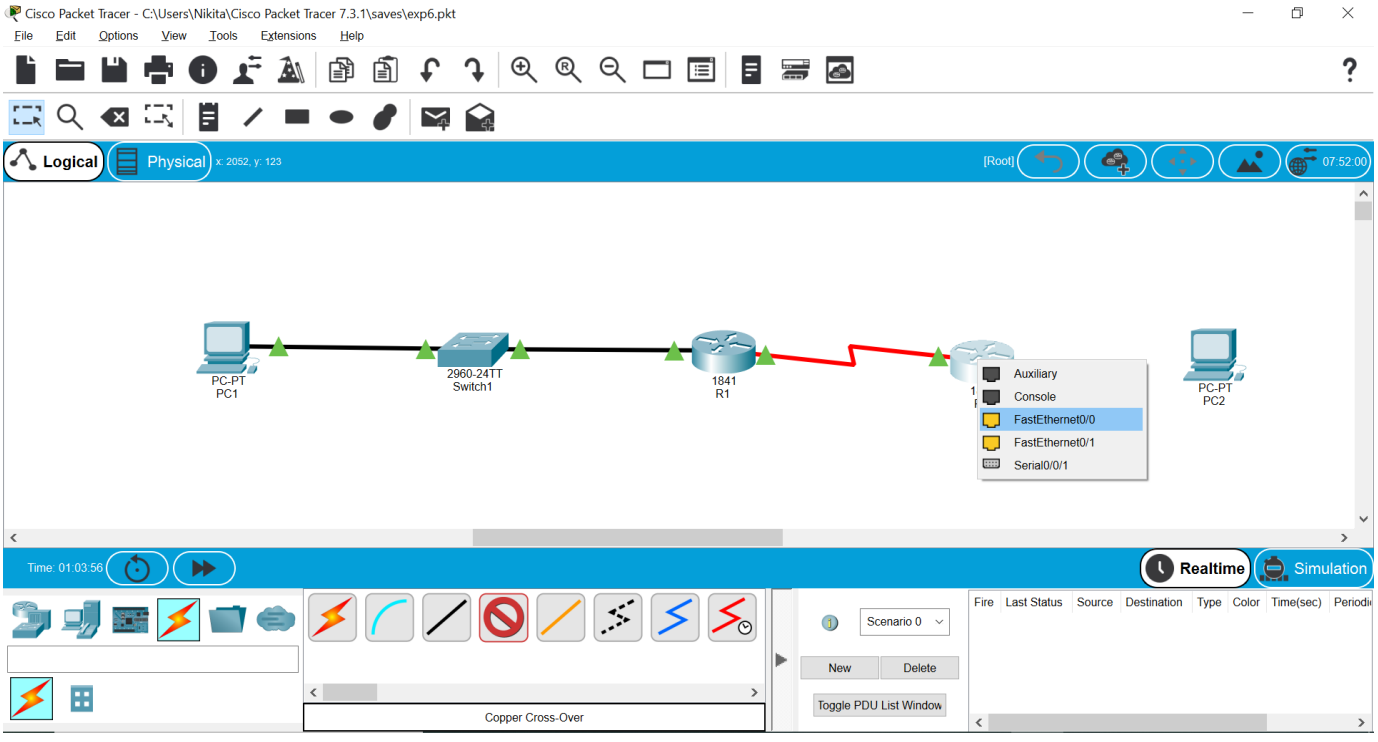
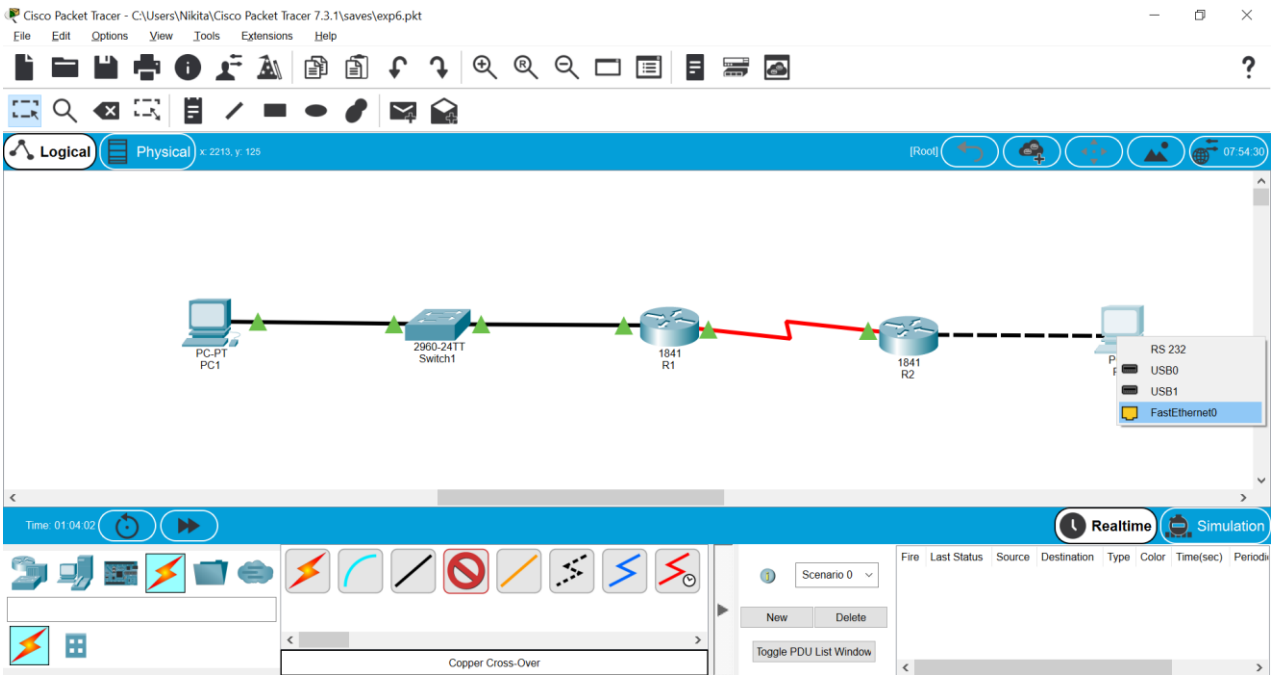

Cisco Packet Tracer - C:\Users\Nikita\Cisco Packet Tracer 7.3.1\saves\exp
File Edit Options View Tools Extensions Help
Logical
Physical
Console
FastEthernet0/2
FastEthernet0/3
FastEthernet0/4
FastEthernet0/5
FastEthernet0/6
FastEthernet0/7
FastEthernet0/8
FastEthernet0/9
FastEthernet0/10
FastEthernet0/11
FastEthernet0/12
FastEthernet0/13
FastEthernet0/14
FastEthernet0/15
FastEthernet0/16
FastEthernet0/17
FastEthernet0/18
FastEthernet0/19
FastEthernet0/20
FastEthernet0/21
FastEthernet0/22
FastEthernet0/23
FastEthernet0/24
GigabitEthernet0/1
GigabitEthernet0/2
PC-PT PC1
1841 R1
1841 R2
PC-PT PC2
Realtime
Simulation
Scenario 0
New
Delete
Toggle PDU List Window
Copper Straight-Through


Cisco Packet Tracer - C:\Users\Nikita\Cisco Packet Tracer 7.3.1\saves\exp6.pkt
File Edit Options View Tools Extensions Help
Logical
Physical
x: 1870, y: 117
[Root]
05:57:00
PC-PT
PC1
2960-24TT
Switch1
Auxiliary
Console
FastEthernet0/0
FastEthernet0/1
Serial0/0/0
Serial0/0/1
1841
R2
PC-PT
PC2
Time: 01:00:07
Realtime
Simulation
Scenario 0
New
Delete
Toggle PDU List Window
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Copper Straight-Through


Cisco Packet Tracer - C:\Users\Nikita\Cisco Packet Tracer 7.3.1\saves\exp6.pkt
File Edit Options View Tools Extensions Help
Logical
Physical
x: 1873, y: 108
[Root]
07:37:30
PC-PT
PC1
2960-24TT
Switch1
Auxiliary
Console
FastEthernet0/1
Serial0/0/0
Serial0/0/1
1841
R2
PC-PT
PC2
Time: 01:03:28
Realtime
Simulation
Scenario 0
New
Delete
Toggle PDU List Window
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Serial DCE

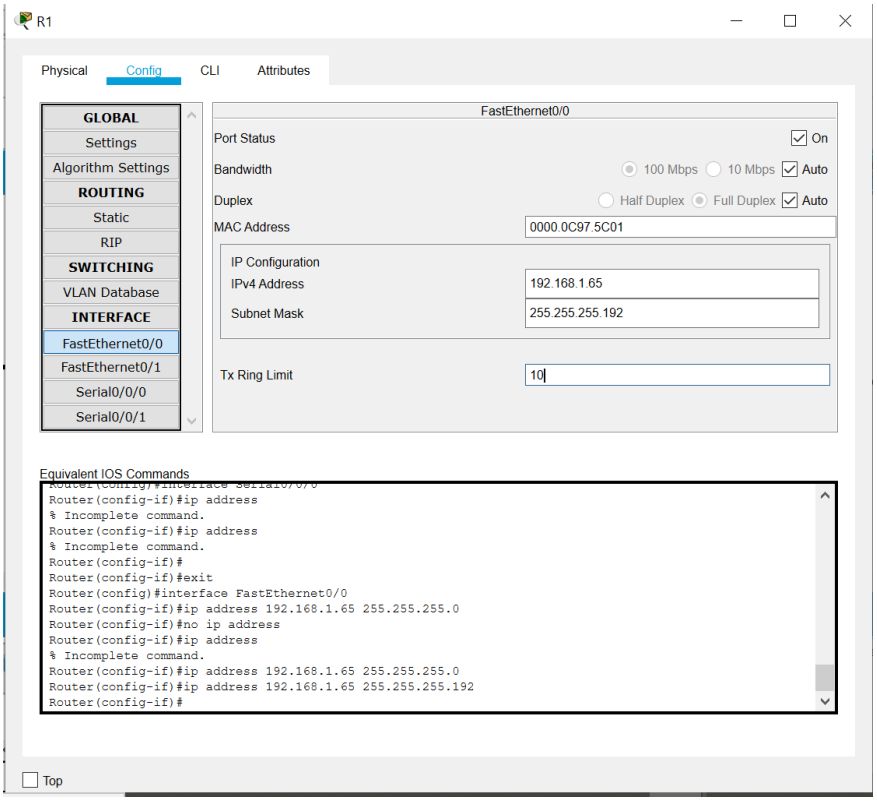

Cisco Packet Tracer - C:\Users\Nikita\Cisco Packet Tracer 7.3.1\saves\exp6.pkt
File Edit Options View Tools Extensions Help
Logical
Physical
x: 2049, y: 119
[Root]
07:41:00
PC-PT
PC1
2960-24TT
Switch1
1841
R1
PC-PT
PC2
Auxiliary
Console
FastEthernet0/0
FastEthernet0/1
Serial0/0/0
Serial0/0/1
Time: 01:03:35
Realtime
Simulation
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Scenario 0
New
Delete
Toggle PDU List Window
Serial DCE

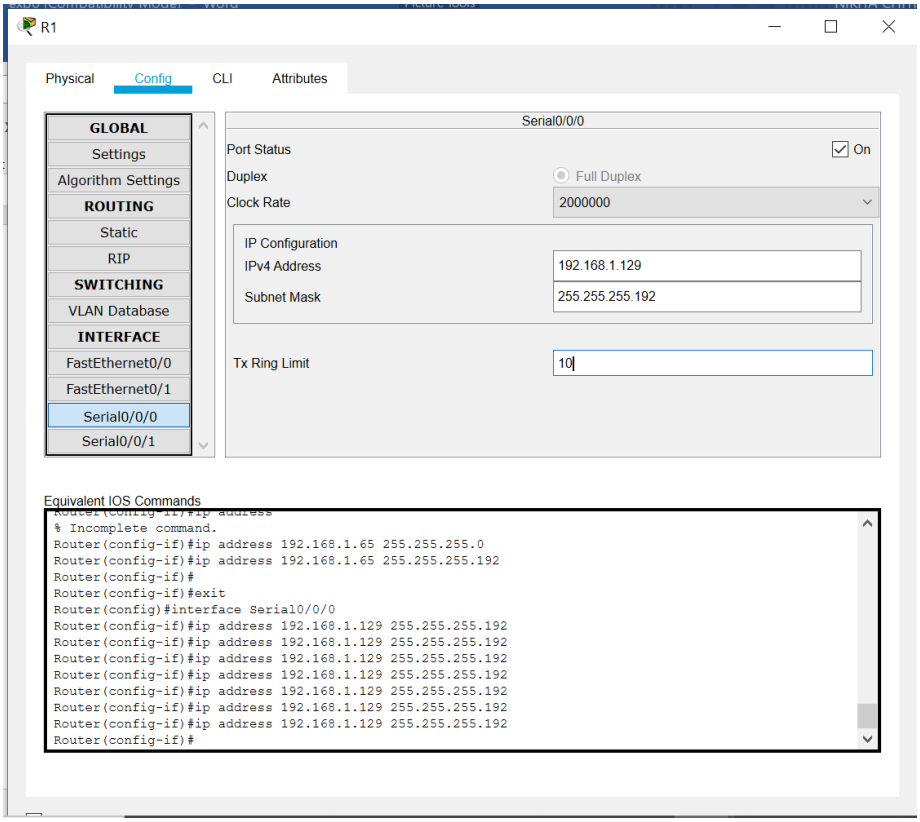

Cisco Packet Tracer - C:\Users\Nikita\Cisco Packet Tracer 7.3.1\saves\exp6.pkt
File Edit Options View Tools Extensions Help
Logical
Physical
x: 2052, y: 123
[Root]
07:52:00
PC-PT
PC1
2960-24TT
Switch1
1841
R1
PC-PT
PC2
Auxiliary
Console
FastEthernet0/0
FastEthernet0/1
Serial0/0/1
Time: 01:03:56
Realtime
Simulation
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Scenario 0
New
Delete
Toggle PDU List Window
Copper Cross-Over

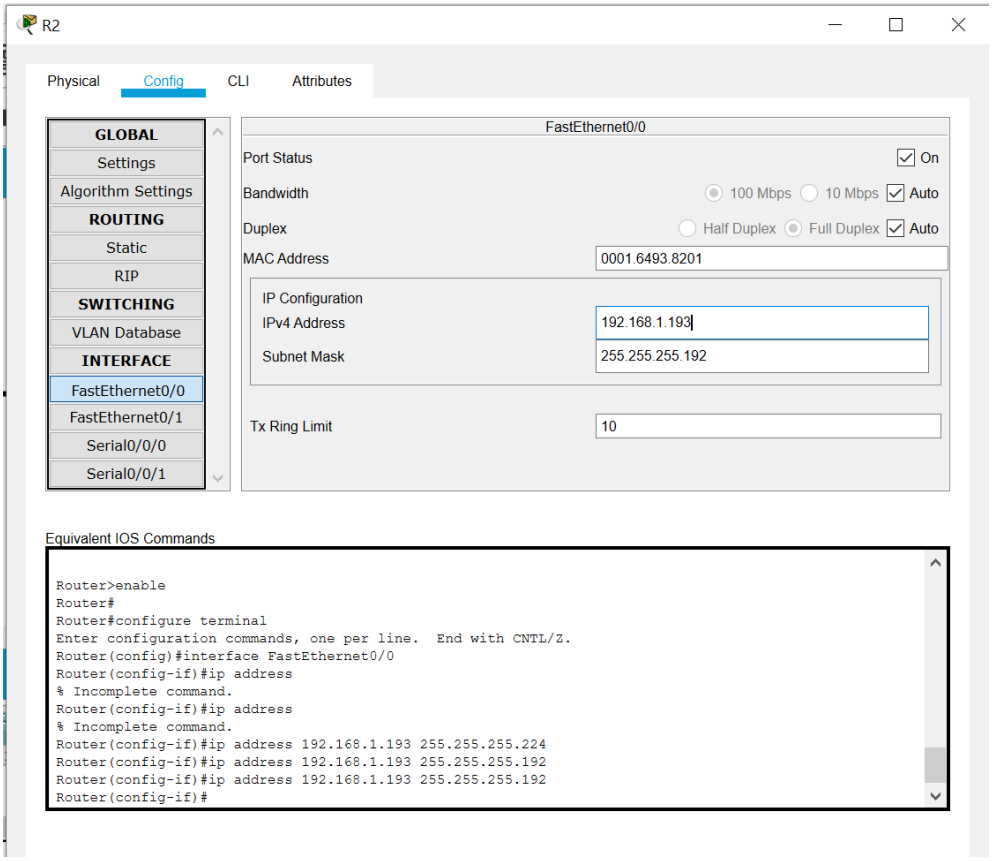


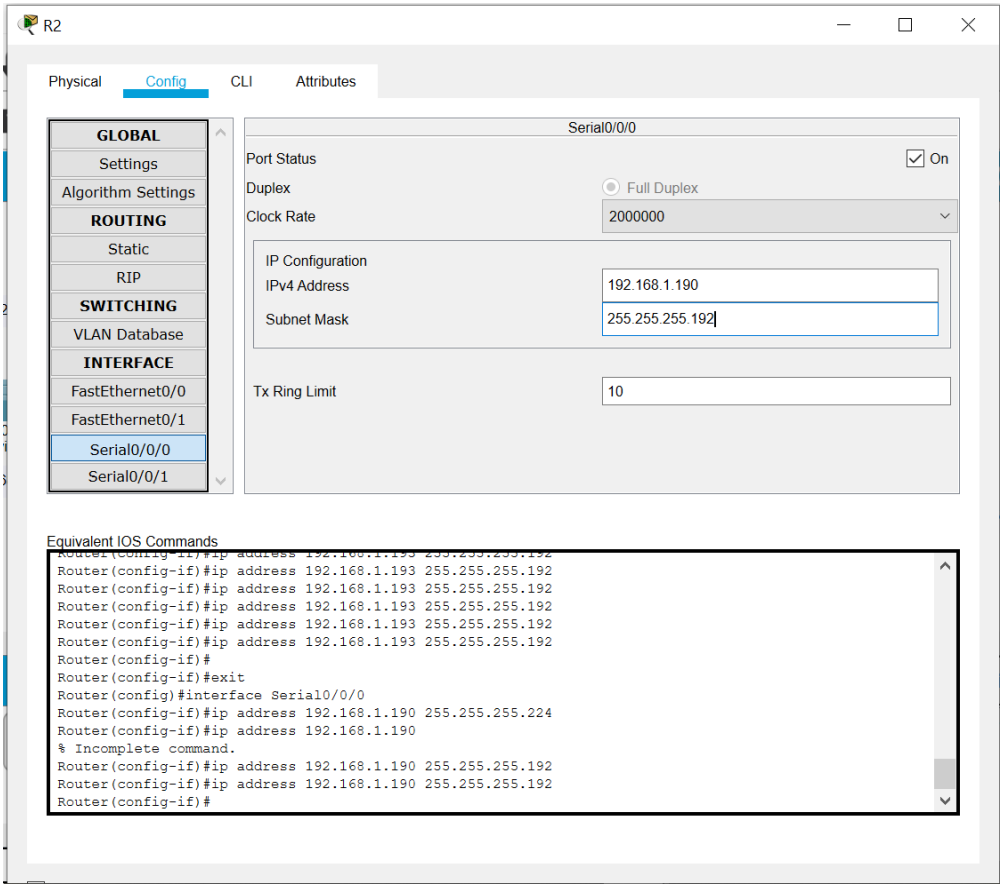
Step 1: Configure the router interfaces.

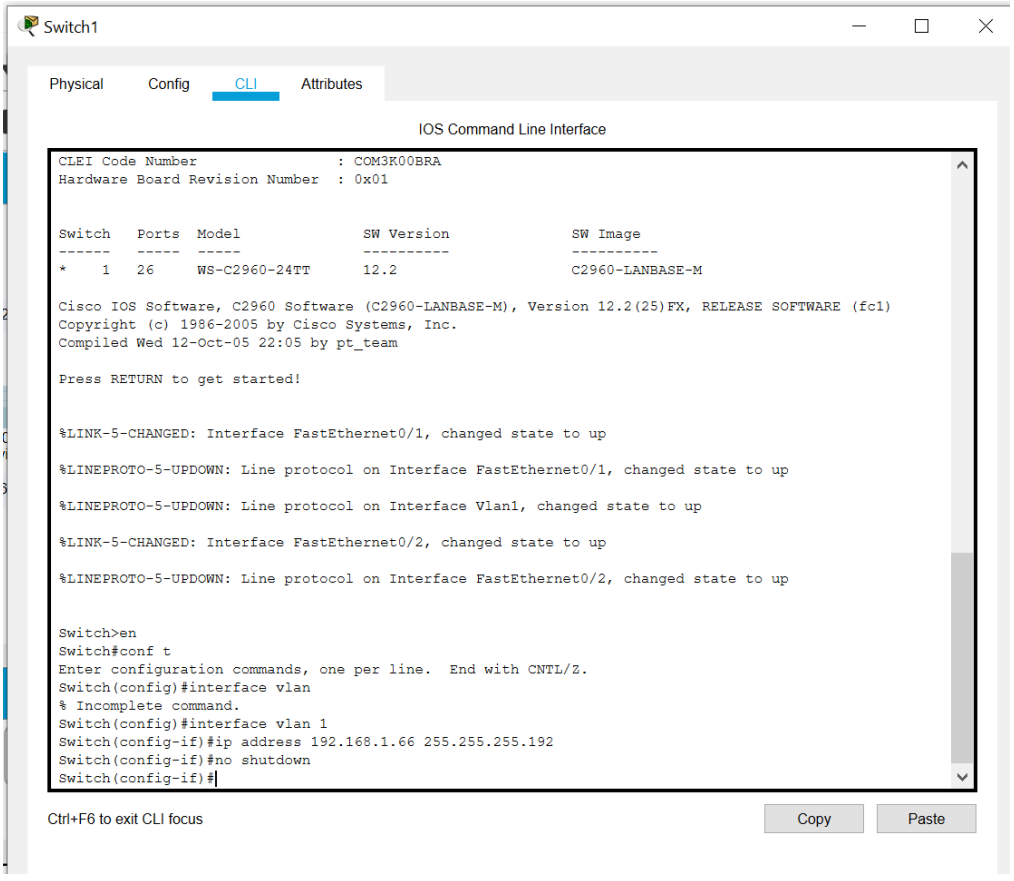
Configure the interfaces on the R1 and R2 routers with the IP addresses from your network design. Please note, to complete the activity in Packet Tracer you will be using the Config Tab. When you have finished, be sure to save the running configuration to the NVRAM of the router.




R1
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
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
% Incomplete command.
Router(config-if)#ip address 192.168.1.65 255.255.255.0
Router(config-if)#ip address 192.168.1.65 255.255.255.192
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#


R2
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
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.6493.8201
IP Configuration
IPv4 Address
192.168.1.193
Subnet Mask
255.255.255.192
Tx Ring Limit
10
Equivalent IOS Commands
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address
% Incomplete command.
Router(config-if)#ip address
% Incomplete command.
Router(config-if)#ip address 192.168.1.193 255.255.255.224
Router(config-if)#ip address 192.168.1.193 255.255.255.192
Router(config-if)#ip address 192.168.1.193 255.255.255.192
Router(config-if)#

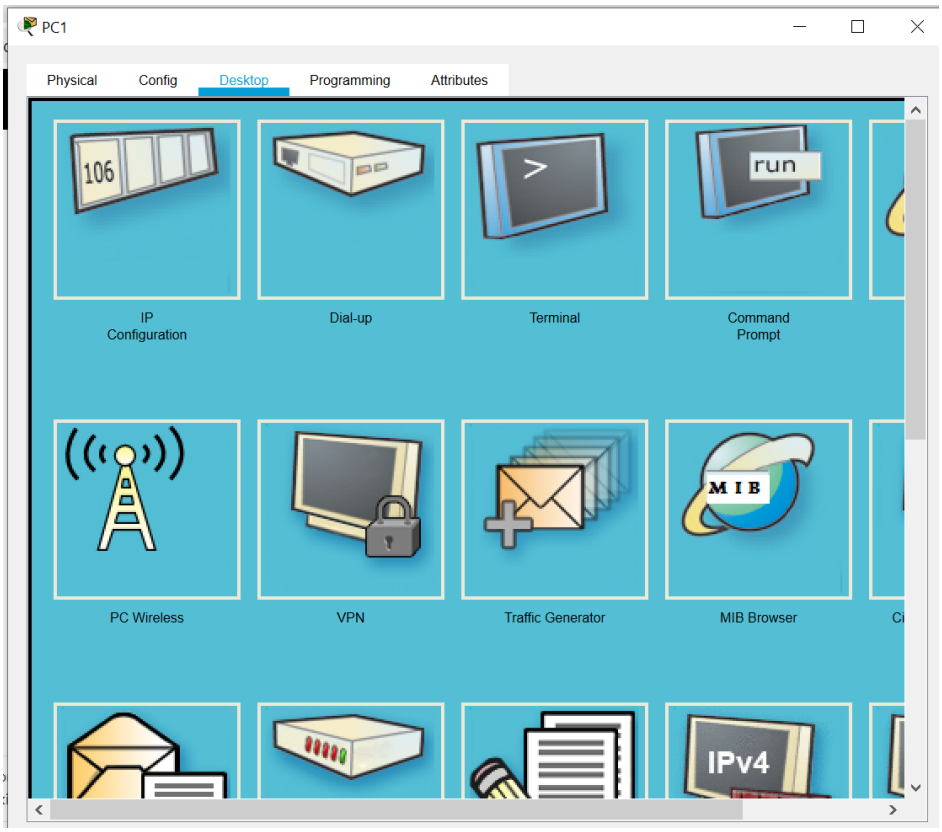

R2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
FastEthernet0/0
FastEthernet0/1
Serial0/0/0
Serial0/0/1
Serial0/0/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
192.168.1.190
Subnet Mask
255.255.255.192
Tx Ring Limit
10
Equivalent IOS Commands
Router(config-if)#ip address 192.168.1.193 255.255.255.192
Router(config-if)#ip address 192.168.1.193 255.255.255.192
Router(config-if)#ip address 192.168.1.193 255.255.255.192
Router(config-if)#ip address 192.168.1.193 255.255.255.192
Router(config-if)#ip address 192.168.1.193 255.255.255.192
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.190 255.255.255.224
Router(config-if)#ip address 192.168.1.190
% Incomplete command.
Router(config-if)#ip address 192.168.1.190 255.255.255.192
Router(config-if)#ip address 192.168.1.190 255.255.255.192
Router(config-if)#

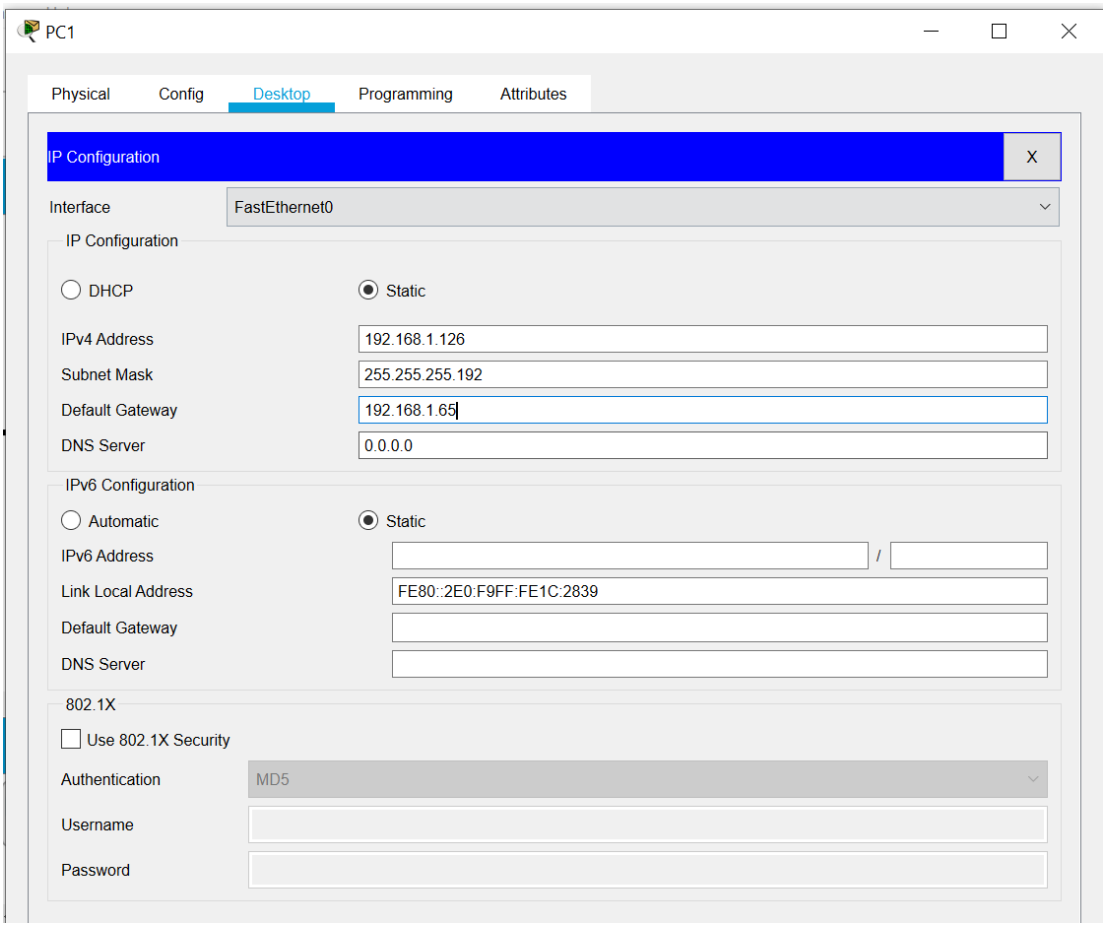

Switch1
Physical
Config
CLI
Attributes
IOS Command Line Interface
CLEI Code Number : COM3K00BRA
Hardware Board Revision Number : 0x01
Switch Ports Model SW Version SW Image
* 1 26 WS-C2960-24TT 12.2 C2960-LANBASE-M
Cisco IOS Software, C2960 Software (C2960-LANBASE-M), Version 12.2(25)FX, RELEASE SOFTWARE (fc1)
Copyright (c) 1986-2005 by Cisco Systems, Inc.
Compiled Wed 12-Oct-05 22:05 by pt_team
Press RETURN to get started!
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#interface vlan
% Incomplete command.
Switch(config)#interface vlan 1
Switch(config-if)#ip address 192.168.1.66 255.255.255.192
Switch(config-if)#no shutdown
Switch(config-if)#
Ctrl+F6 to exit CLI focus
Copy
Paste

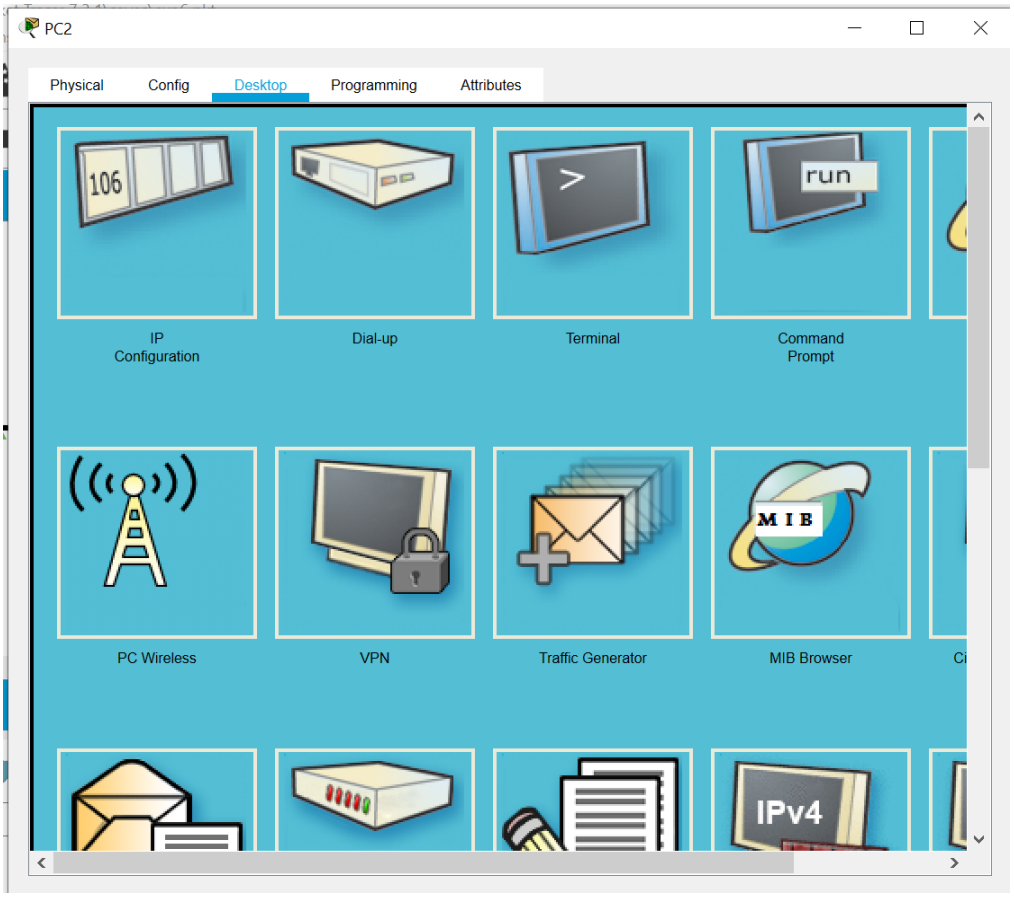
```
Switch#en
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#ip default-gateway 192.168.1.65
Switch(config)#
```

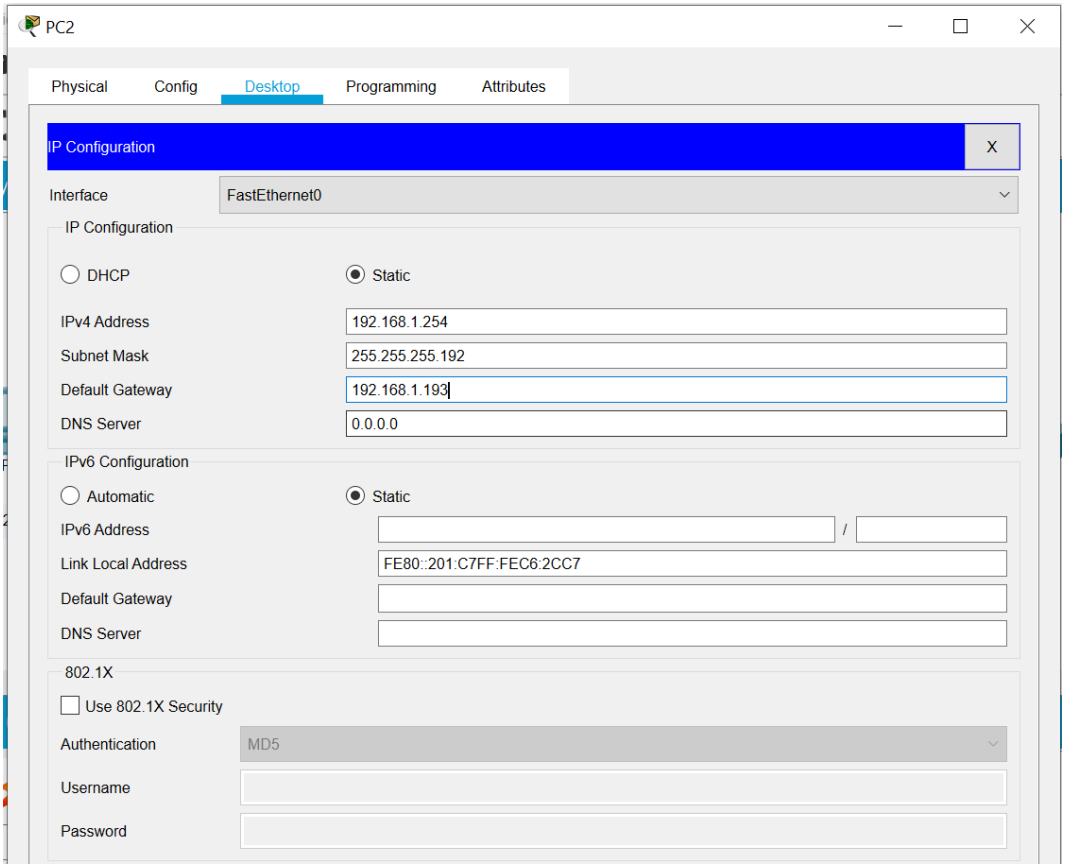
Step 2: Configure the PC interfaces.

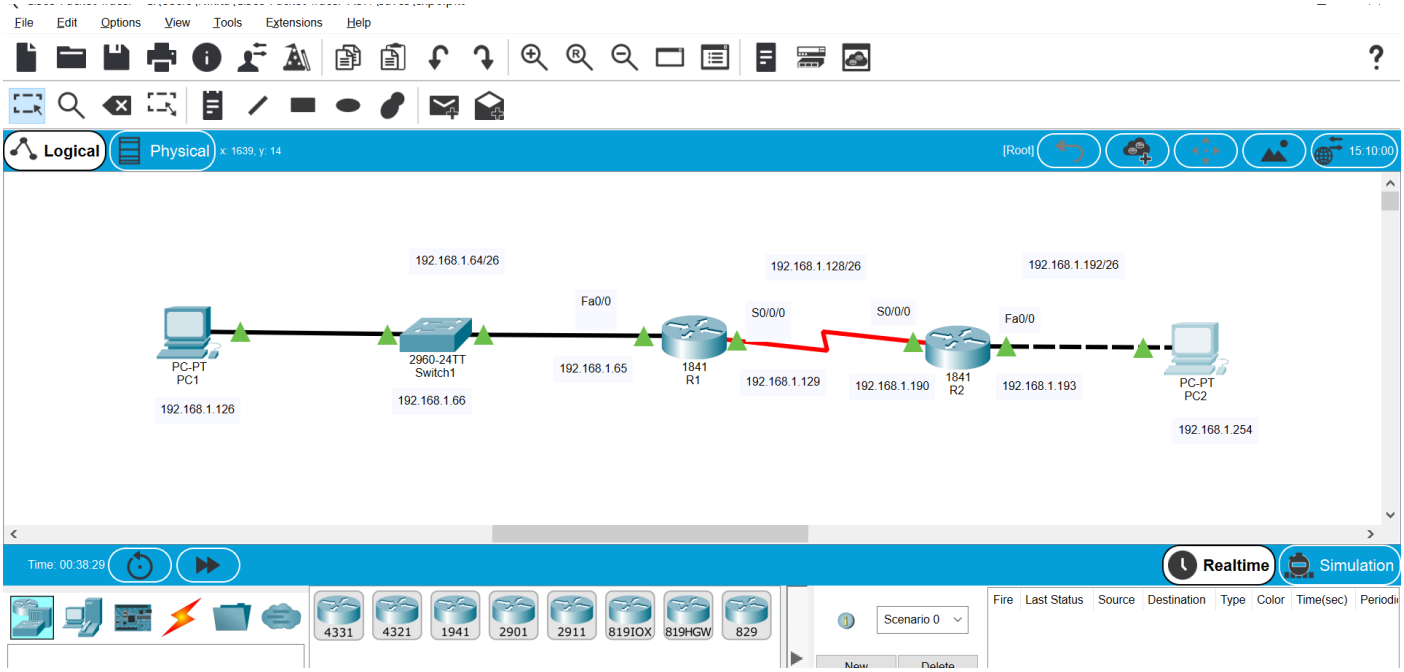
Configure the Ethernet interfaces of PC1 and PC2 with the IP addresses and default gateways from your network design.




PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.126
Subnet Mask
255.255.255.192
Default Gateway
192.168.1.65
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::2E0:F9FF:FE1C:2839
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password


PC2
Physical
Config
Desktop
Programming
Attributes
106
IP Configuration
Dial-up
Terminal
run
Command Prompt
PC Wireless
VPN
Traffic Generator
MIB
MIB Browser
IPv4


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::201:C7FF:FEC6:2CC7
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password

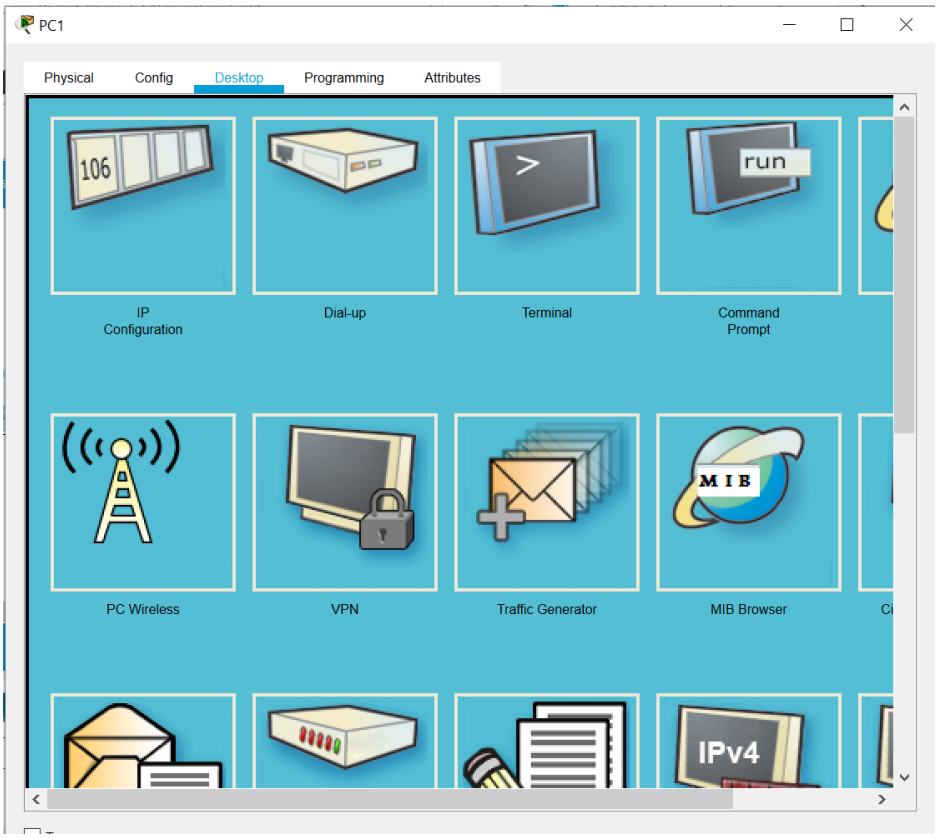


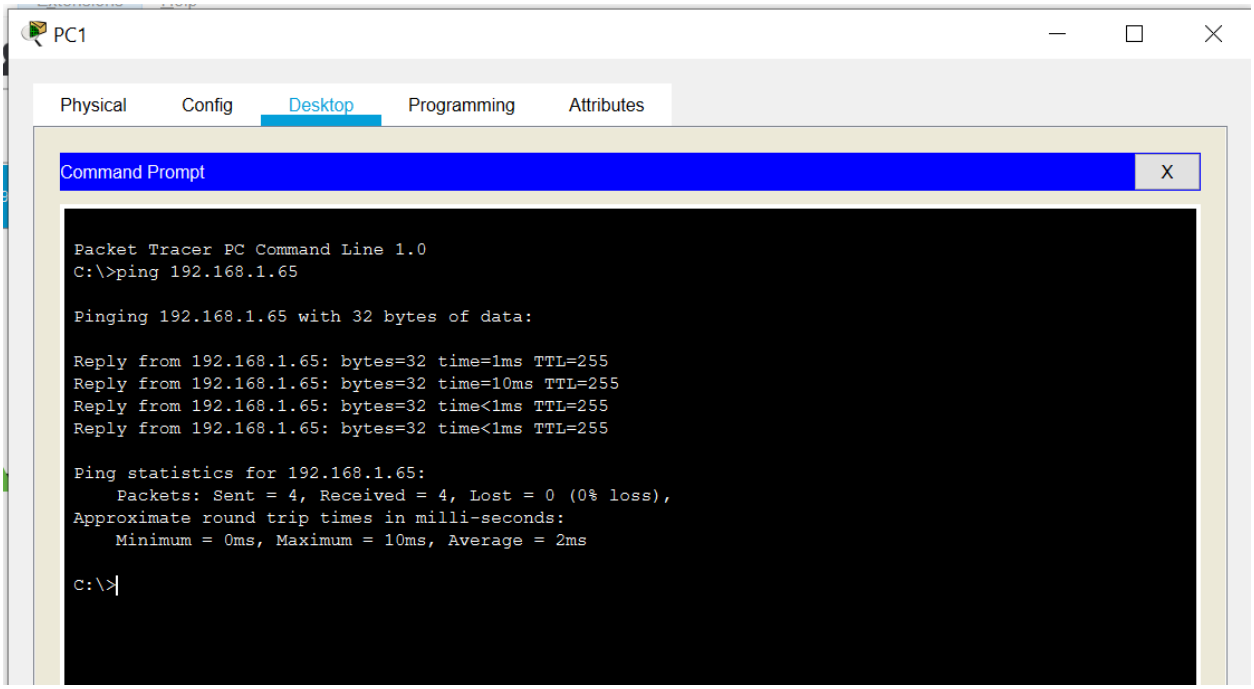
Task 4: Verify the Configurations.

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?

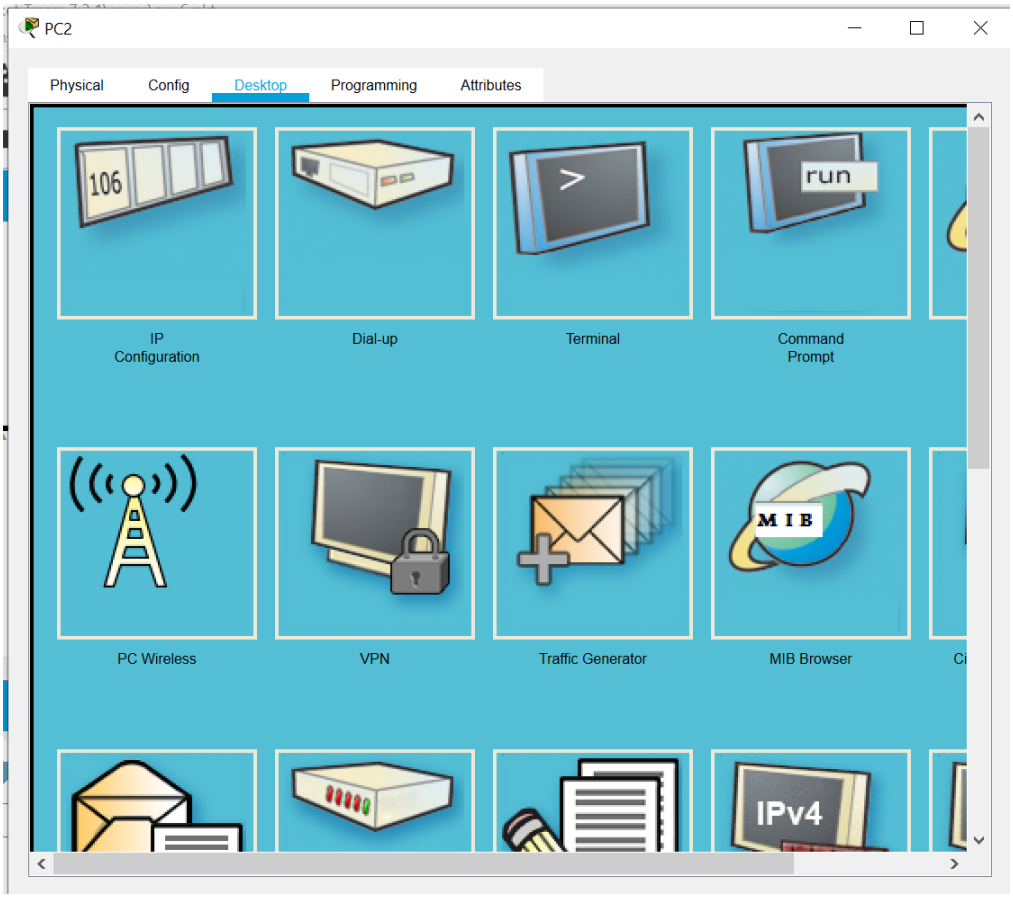
Yes, it is possible

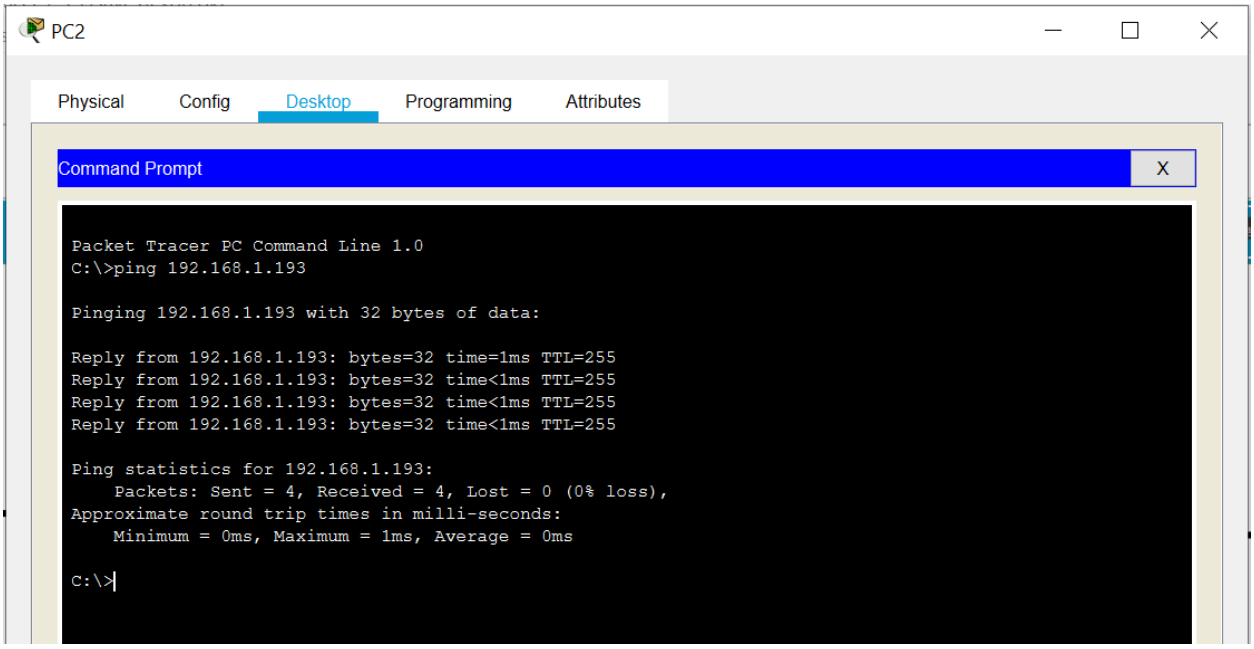




From the host attached to R2, is it possible to ping the default gateway?

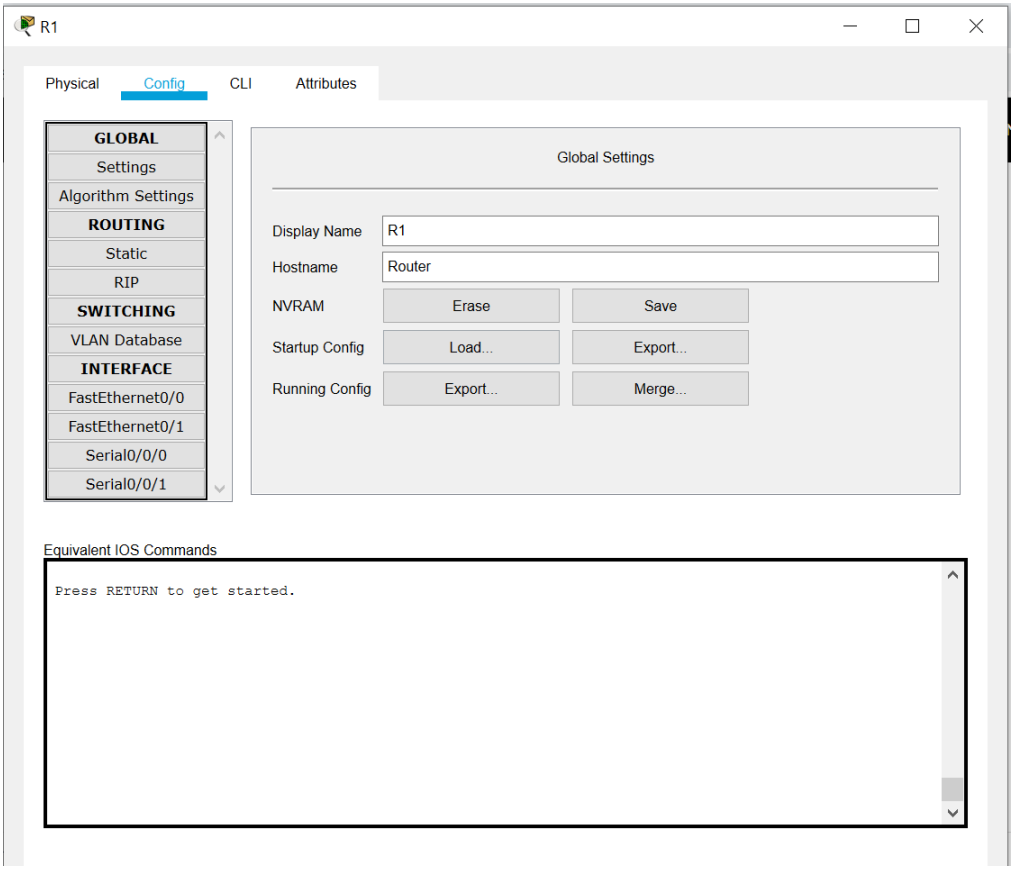
Yes, it is possible





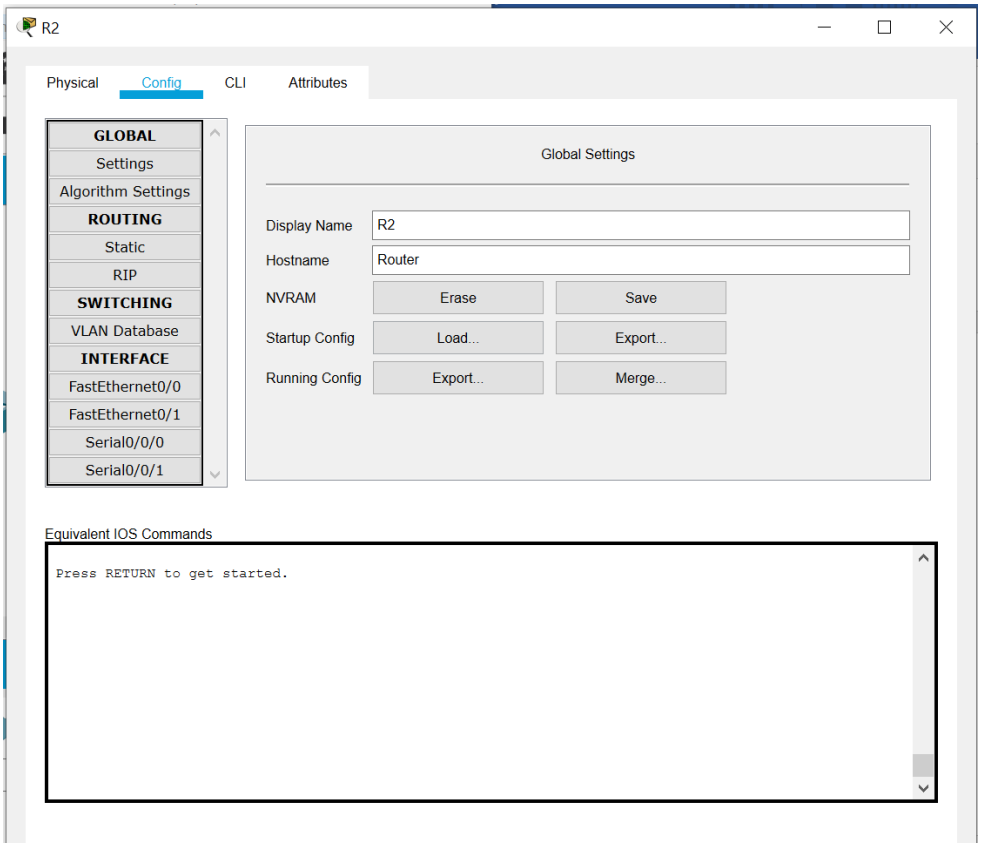
From the router R1, is it possible to ping the Serial 0/0/0 interface of R2?

Yes, it is possible



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

Yes, it is possible

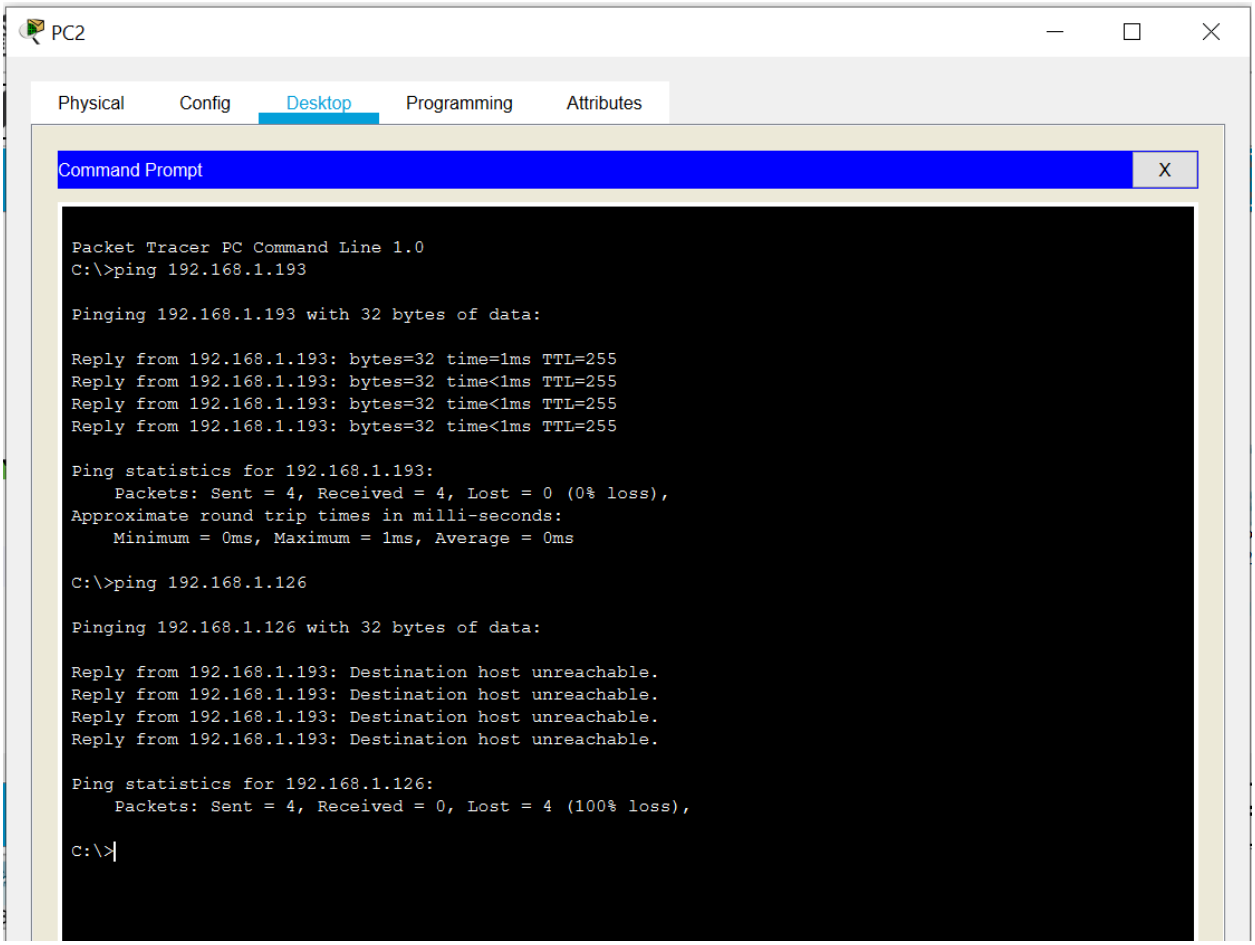


The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations.

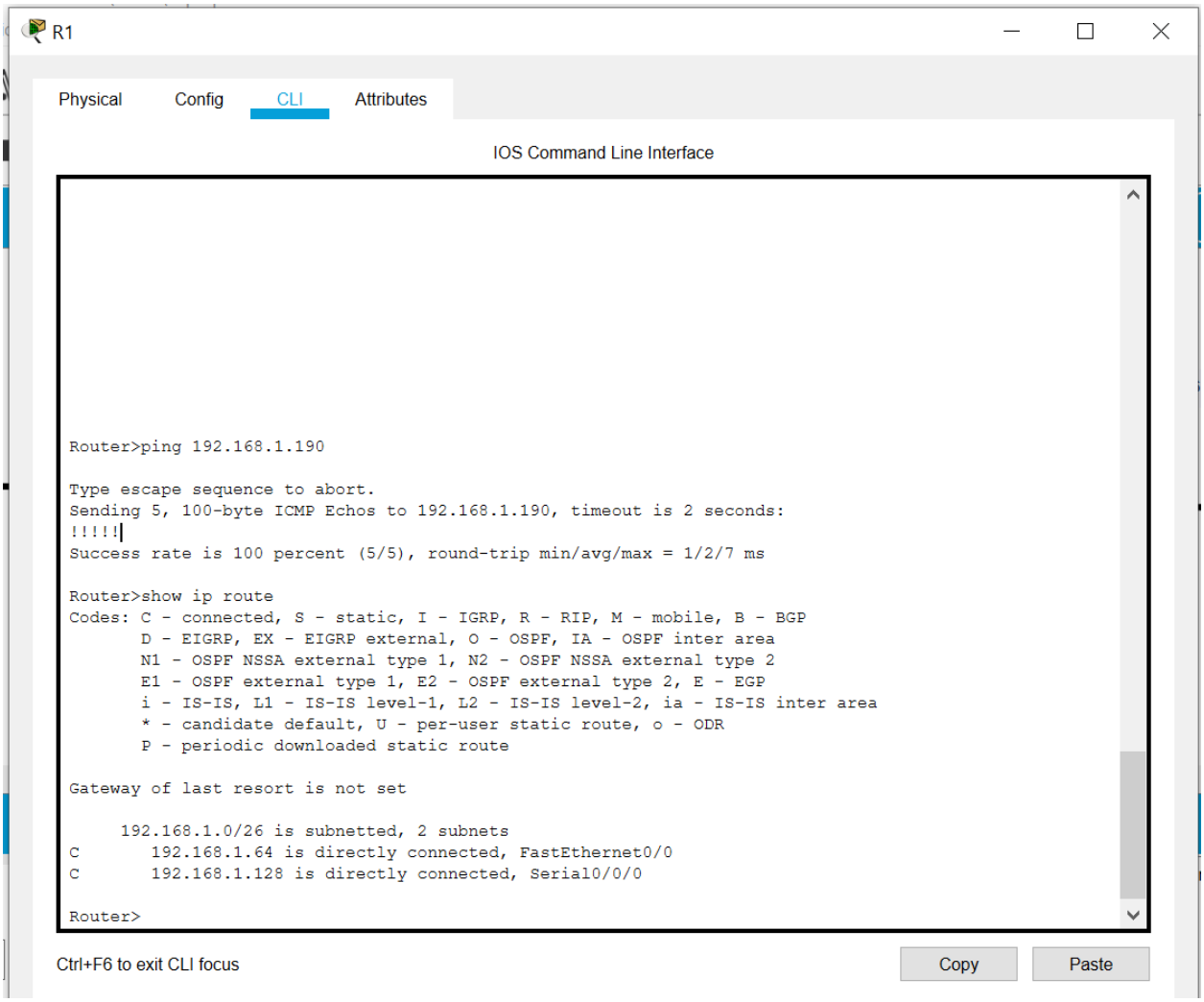
Task 5: Reflection

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

Devices form different networks cannot ping each other.


PC2
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.193
Pinging 192.168.1.193 with 32 bytes of data:
Reply from 192.168.1.193: bytes=32 time=1ms TTL=255
Reply from 192.168.1.193: bytes=32 time<1ms TTL=255
Reply from 192.168.1.193: bytes=32 time<1ms TTL=255
Reply from 192.168.1.193: bytes=32 time<1ms TTL=255
Ping statistics for 192.168.1.193:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 192.168.1.126
Pinging 192.168.1.126 with 32 bytes of data:
Reply from 192.168.1.193: Destination host unreachable.
Reply from 192.168.1.193: Destination host unreachable.
Reply from 192.168.1.193: Destination host unreachable.
Reply from 192.168.1.193: Destination host unreachable.
Ping statistics for 192.168.1.126:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>

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



The above routing table only has addresses of devices which are directly connected to the router's interface

We cannot ping these devices because we have not configured routing.

The routing needs to have either static or dynamic routing to determine path to which the packet is to be forwarded.

Static Routing:- Routing table is not changed until network administrator changes it.

Dynamic Routing:- Routing table is changed once any changes to network occurs or network topology changes.