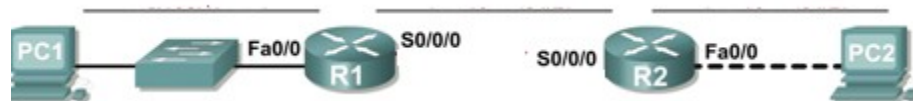


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Batch: D

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 Fast Ethernet 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. The R2 network has 30 hosts which is highest so we will need $5(2^5 = 32)$ host bits. Therefore **3 subnets** are needed.

- The network connected to router R1
- The network connected to router R2
- Link between router R1 and R2

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

Ans. Class C network as the IP address is 192.168.1.0. The default subnet mask for class C is 255.255.255.0. The first three octets are dedicated to network and don't change. Since we need 3 subnets, the subnet mask is: $2^n \geq 3$

Therefore, **n=2**

Thus, last 2 bits for subnet and 6 bits as host bits will make the 8 bits of the IP Address.

Converting this to dotted decimal format – **255.255.255.192**

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

Ans. It is the total number of 1's in the binary form of the subnet mask. So, the subnet mask for the network in slash format is **/26**.

4. How many usable hosts are there per subnet?

Ans. Usable hosts = $2^h - 2 = 2^6 - 2 = 62$

h = number of zero in the binary form of subnet mask = 6

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

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

Subnet 1: 192.168.1.64-198.162.1.127

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

Subnet 2: 192.168.1.128-198.162.1.191

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

Subnet 3: 192.168.1.192-198.162.1.255

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.

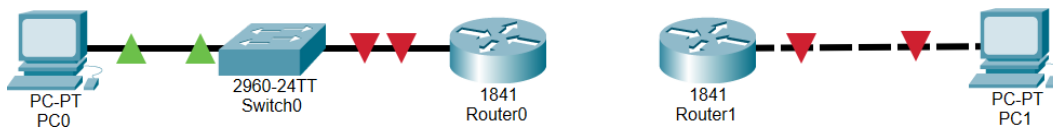
Ans. 192.168.1.254

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

Task 3: Configure the Serial and FastEthernet Addresses.

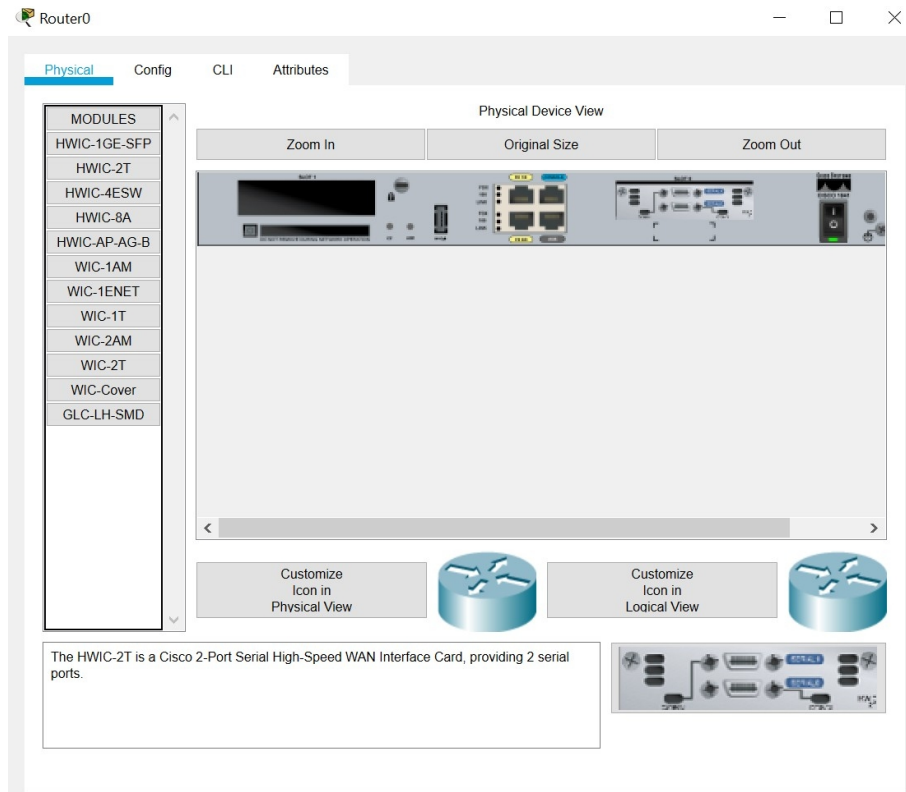
Step 1: Configure the router interfaces.

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.

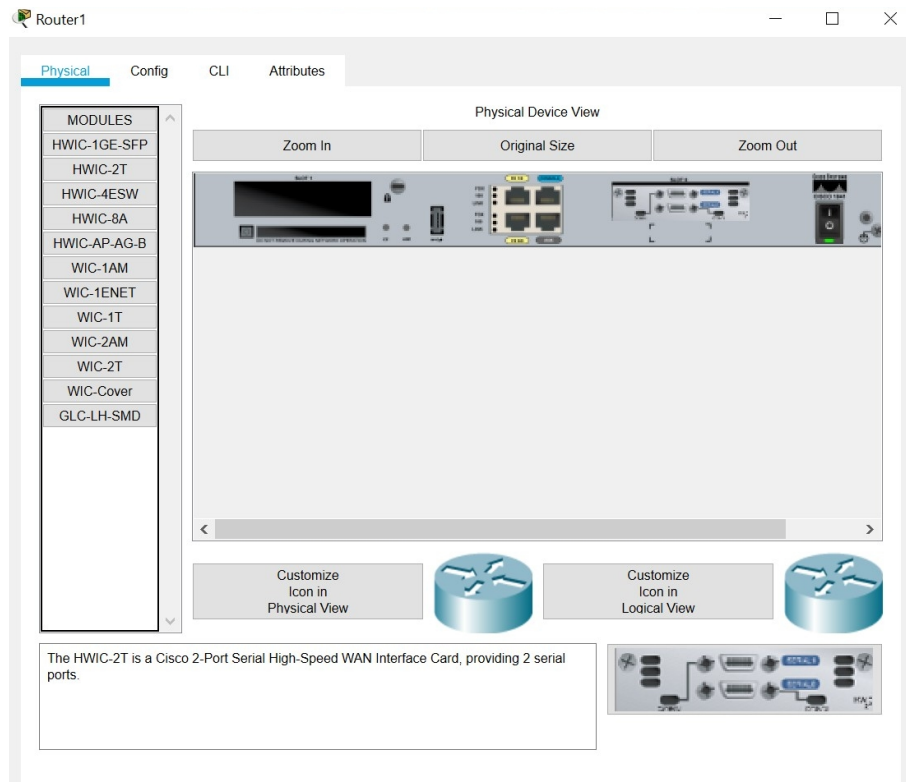


Adding Serial Ports to Router

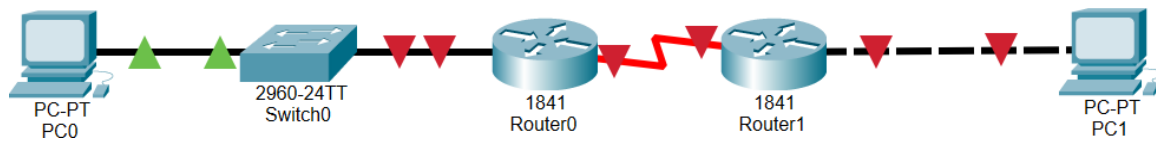
Click on HWIC-2T tab and drag HWIC-2T 2-Port Serial WAN Interface Card to router and turn the Router0 on



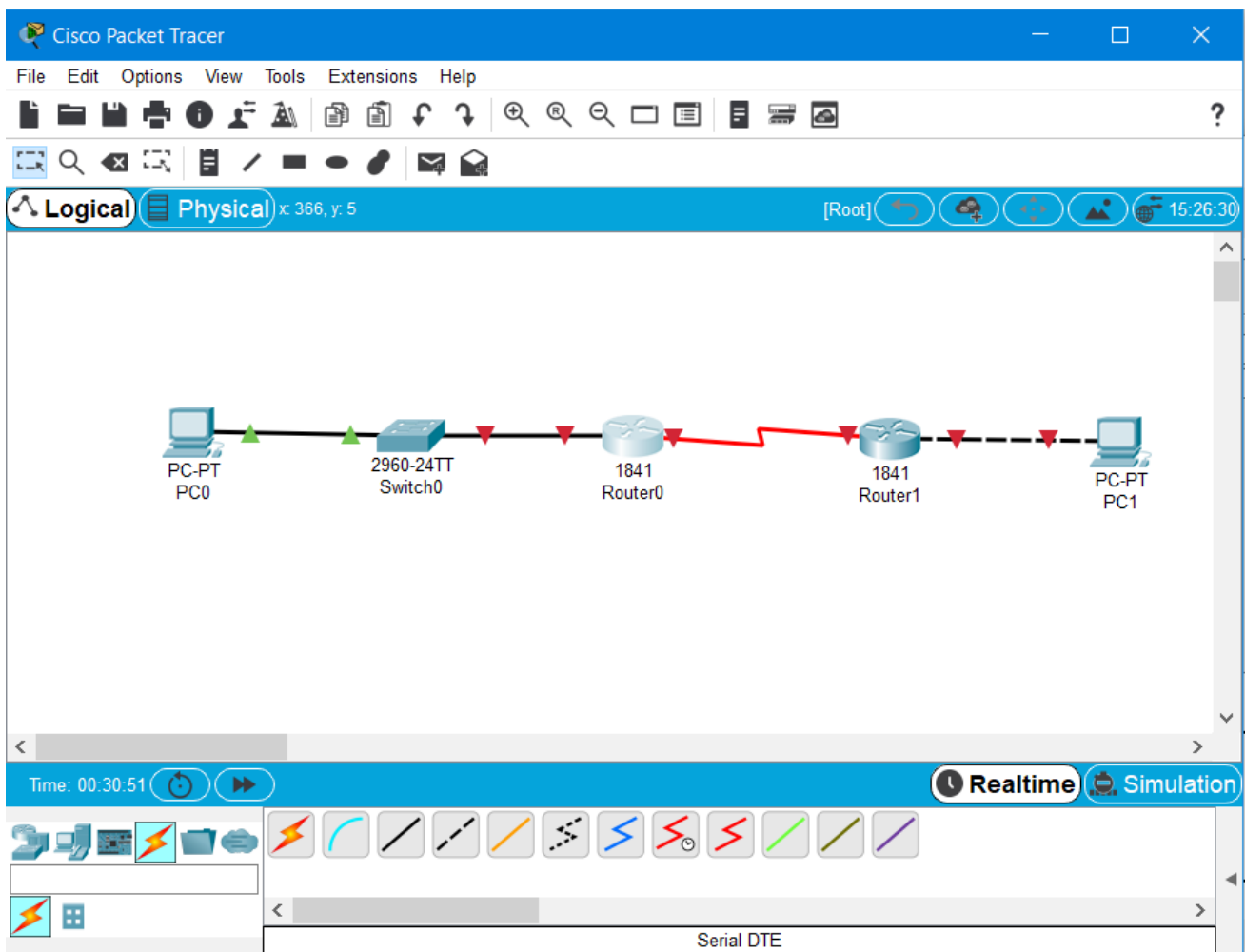
Click on HWIC-2T tab and drag HWIC-2T 2-Port Serial WAN Interface Card to router and turn the Router1 on



Now we are able to connect R0 and R1 using serial DTE



Network after connecting Router0 and Router1 using serial DTE.



Router Configuration

Router0 Configuration for FastEthernet0/0

The screenshot shows the configuration window for the FastEthernet0/0 interface on Router0. The left sidebar contains a tree view with categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, FastEthernet0/0 is selected. The main configuration area for FastEthernet0/0 includes: Port Status (checked On), Bandwidth (100 Mbps selected, 10 Mbps unselected, Auto checked), Duplex (Half Duplex unselected, Full Duplex selected, Auto checked), MAC Address (0002.4A4E.EC01), IP Configuration (IPv4 Address: 192.168.1.65, Subnet Mask: 255.255.255.192), and Tx Ring Limit (10). Below the configuration area, the 'Equivalent IOS Commands' section displays the following commands:

```
Router(config)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.129 255.255.255.224
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)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 192.168.1.65 255.255.255.192
Router(config-if)#ip address 192.168.1.65 255.255.255.192
Router(config-if)#ip address 192.168.1.65 255.255.255.192
Router(config-if)#
Router(config-if)#
```

Router0 Configuration for Serial0/0/0

The screenshot shows the configuration window for the Serial0/0/0 interface on Router0. The left sidebar is the same as in the previous screenshot, with Serial0/0/0 selected under the INTERFACE category. The main configuration area for Serial0/0/0 includes: Port Status (checked On), Duplex (Full Duplex selected), Clock Rate (2000000), IP Configuration (IPv4 Address: 192.168.1.129, Subnet Mask: 255.255.255.192), and Tx Ring Limit (10). Below the configuration area, the 'Equivalent IOS Commands' section displays the following commands:

```
Router(config-if)#no ip address
Router(config-if)#ip address
% Incomplete command.
Router(config-if)#no ip address
Router(config-if)#ip address
% Incomplete command.
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.129 255.255.255.224
Router(config-if)#ip address 192.168.1.129 255.255.255.192
Router(config-if)#
```

Router1 Configuration for FastEthernet0/0

Router1

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 00E0.8FBC.7701

IP Configuration

IPv4 Address 192.168.1.193

Subnet Mask 255.255.255.192

Tx Ring Limit 10

Equivalent IOS Commands

```
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.190 255.255.255.224
Router(config-if)#ip address 192.168.1.190 255.255.255.192
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)#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)#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)#ip address 192.168.1.190 255.255.255.192
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
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)#
```

Router1 Configuration for Serial0/0/0

Router1

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

```
%LINK-3-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.190 255.255.255.224
Router(config-if)#ip address 192.168.1.190 255.255.255.192
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)#
```

Step 2: Configure the PC interfaces.

PC0 Configuration

The screenshot shows the configuration window for PC0. The 'Desktop' tab is selected, displaying the 'IP Configuration' section. The interface is set to 'FastEthernet0'. Under 'IP Configuration', the 'Static' radio button is selected. The IPv4 address is set to 192.168.1.126, the subnet mask to 255.255.255.192, the default gateway to 192.168.1.65, and the DNS server to 0.0.0.0. The 'IPv6 Configuration' section shows the 'Static' radio button selected, with the IPv6 address field empty, the link local address set to FE80::260:2FFF:FE80:52D8, and the default gateway and DNS server fields empty. The '802.1X' section has the 'Use 802.1X Security' checkbox unchecked, the authentication method set to MD5, and the username field empty.

PC0

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::260:2FFF:FE80:52D8

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

PC1 Configuration

PC1

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::201:96FF:FE7B:3888

Default Gateway:

DNS Server:

802.1X

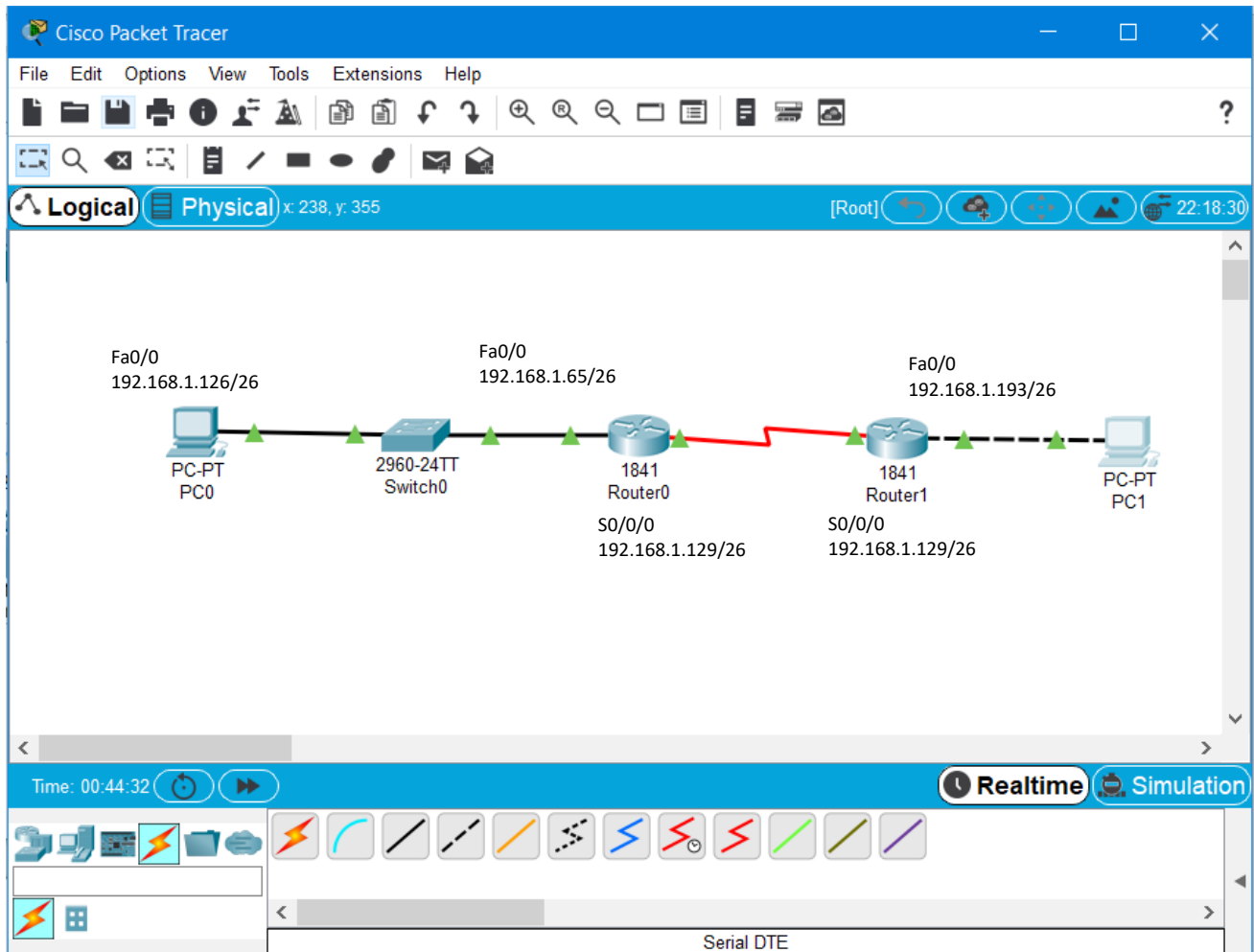
☐ Use 802.1X Security

Authentication: MD5

Username:

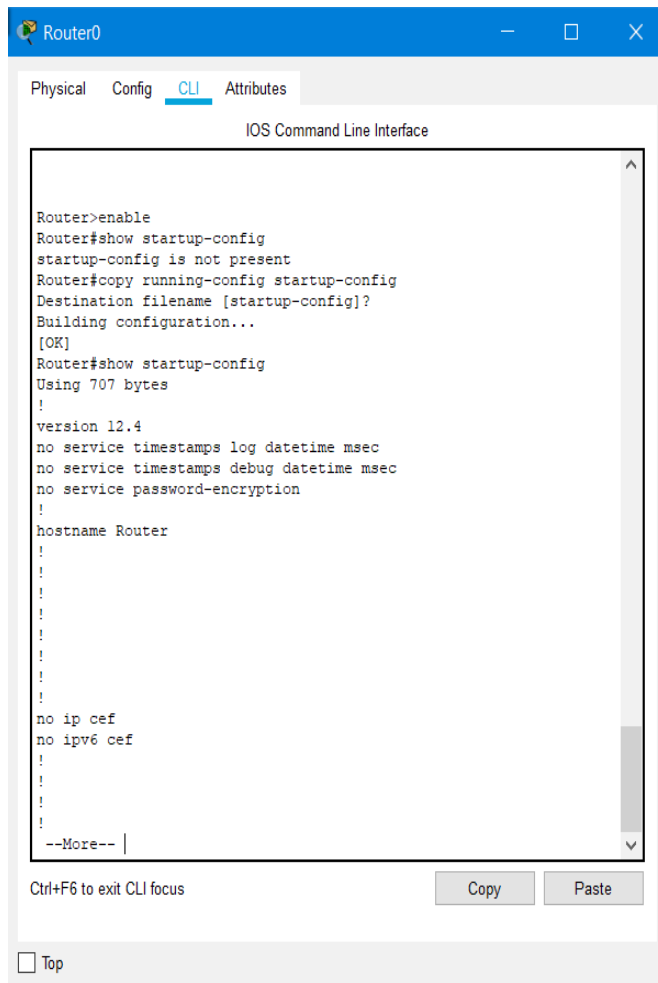
Password:

Final Network after Router and PC configurations



To save the running-config as startup-config

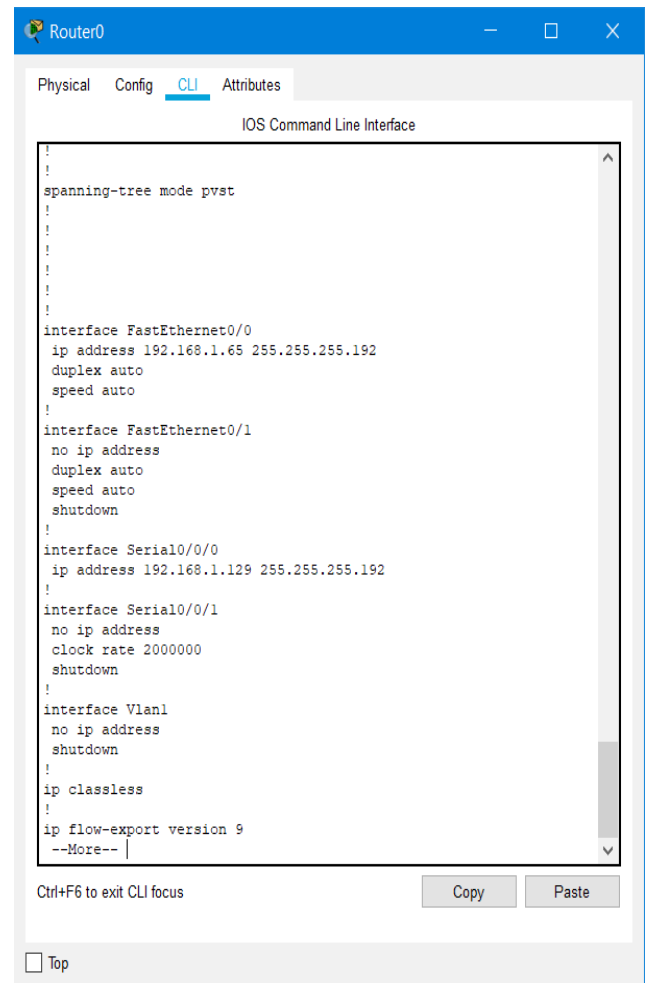
For Router0



The screenshot shows the Router0 CLI interface with the 'CLI' tab selected. The command history shows the following sequence of commands and outputs:

```
Router>enable
Router#show startup-config
startup-config is not present
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#show startup-config
Using 707 bytes
!
version 12.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
--More--
```

At the bottom of the window, there is a 'Ctrl+F6 to exit CLI focus' message and 'Copy' and 'Paste' buttons. A 'Top' button is also visible at the bottom left.



The screenshot shows the Router0 CLI interface with the 'CLI' tab selected. The command history shows the following sequence of commands and outputs:

```
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.1.65 255.255.255.192
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
ip address 192.168.1.129 255.255.255.192
!
interface Serial0/0/1
no ip address
clock rate 2000000
shutdown
!
interface Vlan1
no ip address
shutdown
!
ip classless
!
ip flow-export version 9
--More--
```

At the bottom of the window, there is a 'Ctrl+F6 to exit CLI focus' message and 'Copy' and 'Paste' buttons. A 'Top' button is also visible at the bottom left.

For Router1

Router1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
!
spanning-tree mode pvst
!
!
!
!
!
!
interface FastEthernet0/0
ip address 192.168.1.193 255.255.255.192
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
ip address 192.168.1.190 255.255.255.192
clock rate 2000000
!
interface Serial0/0/1
no ip address
clock rate 2000000
shutdown
!
interface Vlan1
no ip address
shutdown
!
ip classless
!
ip flow-export version 9
--More-- |
```

Ctrl+F6 to exit CLI focus

Copy Paste

☐ Top

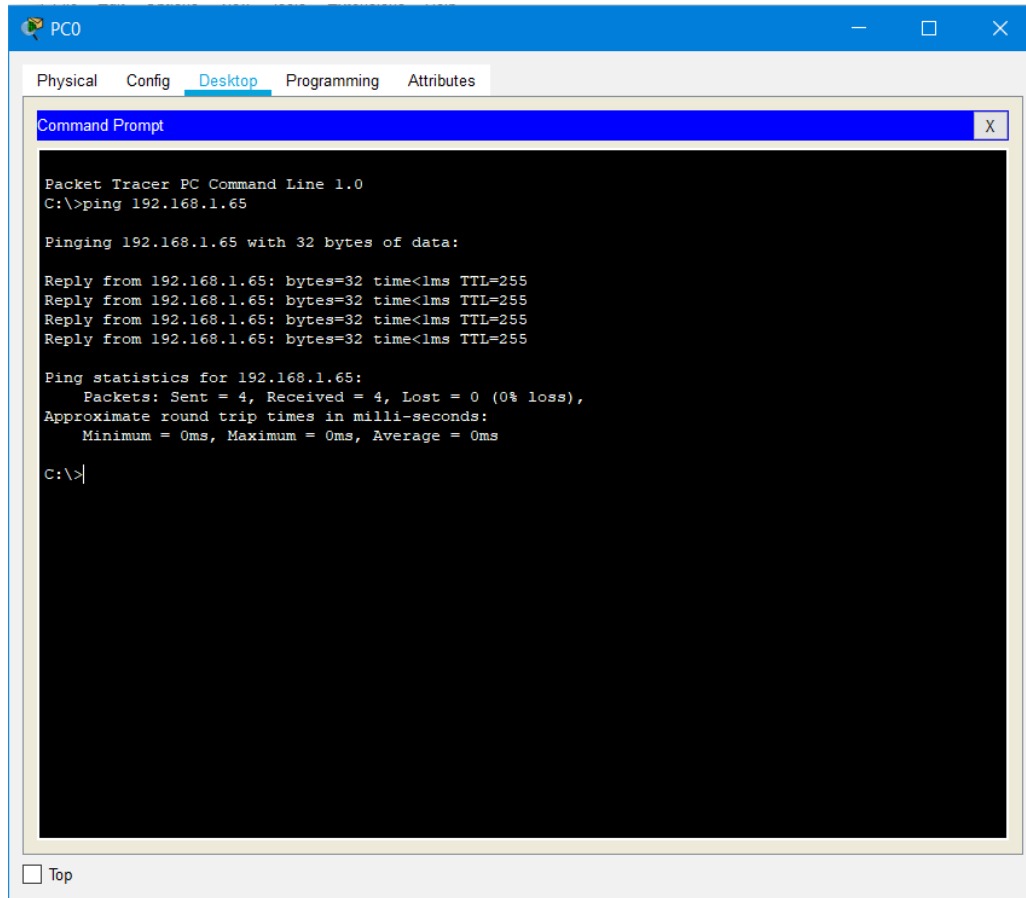
Task 4: Verify the Configurations.

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?

Ans: Yes

Pinging default gateway from PC0



The screenshot shows a Packet Tracer PC window for PC0. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The command prompt shows the execution of the command 'ping 192.168.1.65'. The output indicates that the ping was successful, with four replies received from 192.168.1.65, each with a time of less than 1ms and a TTL of 255. The ping statistics show that 4 packets were sent, 4 were received, and there was 0% loss. The approximate round trip times in milliseconds are: Minimum = 0ms, Maximum = 0ms, and Average = 0ms.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.65

Pinging 192.168.1.65 with 32 bytes of data:

Reply from 192.168.1.65: bytes=32 time<1ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255

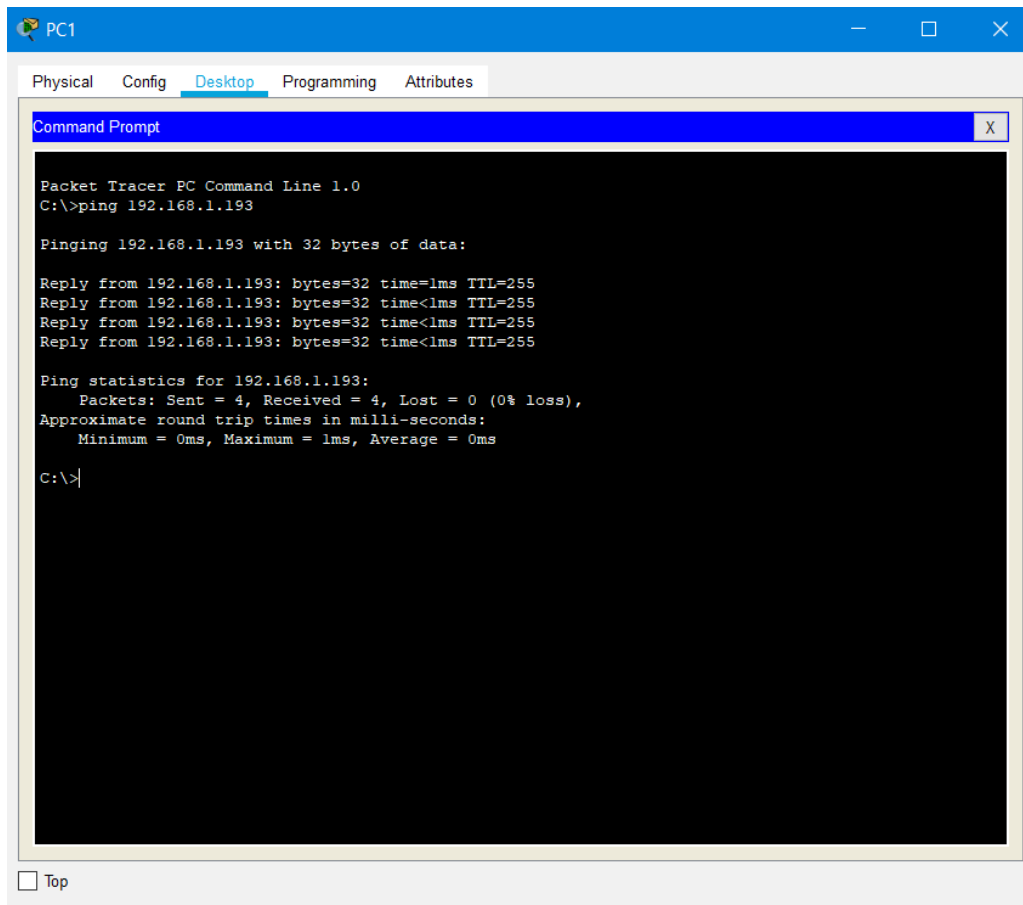
Ping statistics for 192.168.1.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

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

Ans: Yes

Pinging default gateway from PC1



The screenshot shows a Packet Tracer PC window for PC1. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The command prompt shows the execution of the 'ping 192.168.1.193' command, which is successful. The output includes the number of bytes, time, and TTL for each of the four replies, as well as the overall ping statistics showing 0% loss.

```
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:\>
```

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

Ans: Yes



The screenshot shows the CLI of Router0. The interface has tabs for Physical, Config, CLI (selected), and Attributes. The main window displays the following text:

```
Router con0 is now available

Press RETURN to get started.

Router>enable
Router#ping 192.168.1.190

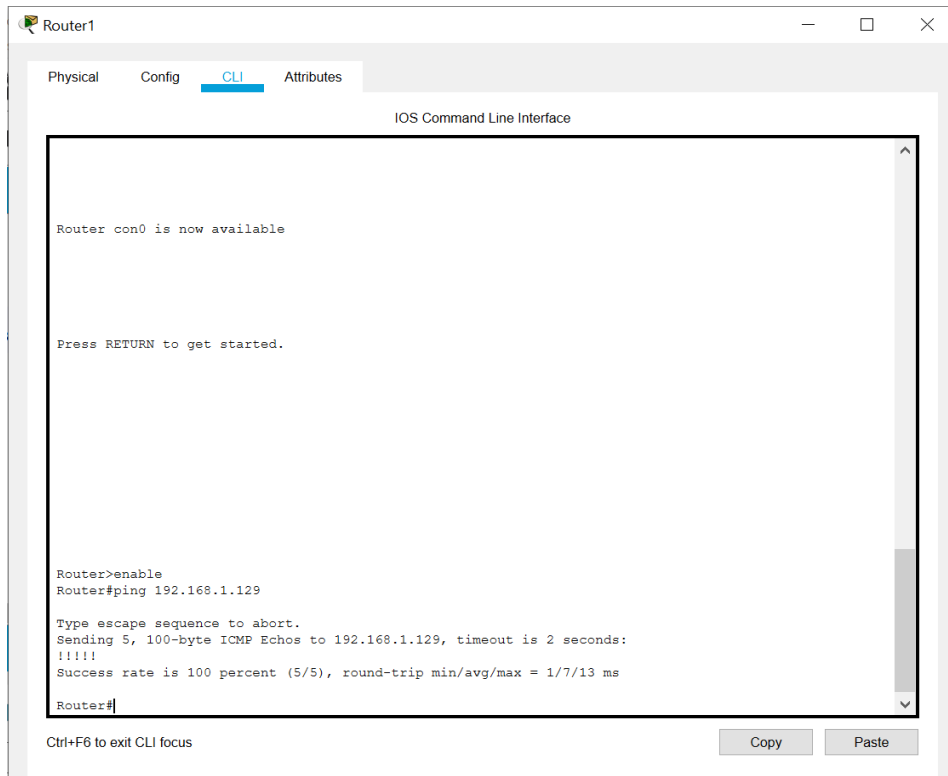
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.190, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/11 ms

Router#
```

At the bottom, there is a status bar with the text "Ctrl+F6 to exit CLI focus" and two buttons: "Copy" and "Paste".

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

Ans: Yes



The screenshot shows the CLI of Router1. The interface has tabs for Physical, Config, CLI (selected), and Attributes. The main window displays the following text:

```
Router con0 is now available

Press RETURN to get started.

Router>enable
Router#ping 192.168.1.129

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.129, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/13 ms

Router#
```

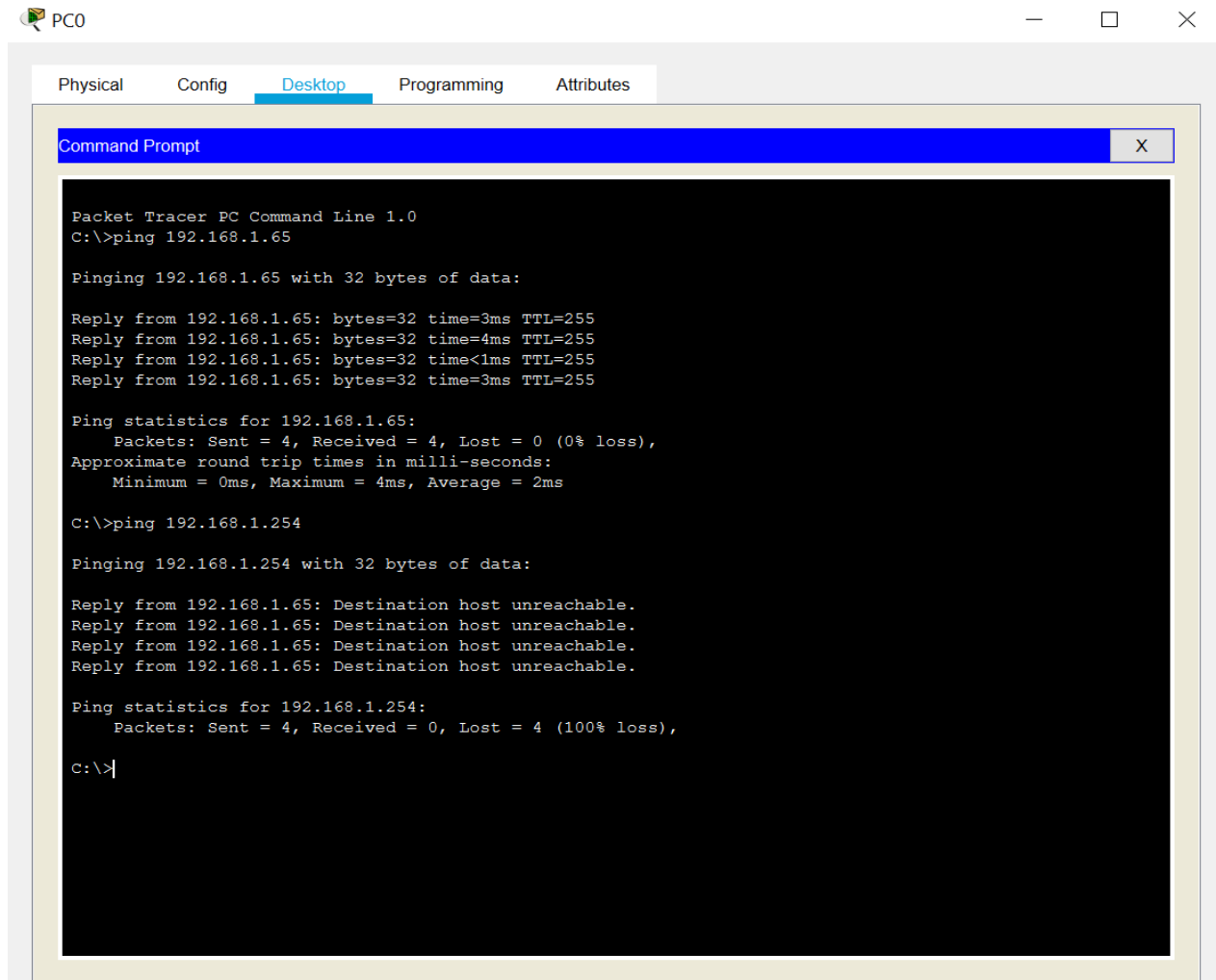
At the bottom, there is a status bar with the text "Ctrl+F6 to exit CLI focus" and two buttons: "Copy" and "Paste".

Task 5: Reflection

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

Ans: Yes, the devices that are not a part of the same network cannot ping each other.

Pinging Router0 from PC0 was successful where as pinging PC1 from PC0 was not successful



The screenshot shows the Packet Tracer interface for PC0. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The window contains the following text:

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.65

Pinging 192.168.1.65 with 32 bytes of data:

Reply from 192.168.1.65: bytes=32 time=3ms TTL=255
Reply from 192.168.1.65: bytes=32 time=4ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255
Reply from 192.168.1.65: bytes=32 time=3ms TTL=255

Ping statistics for 192.168.1.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 2ms

C:\>ping 192.168.1.254

Pinging 192.168.1.254 with 32 bytes of data:

Reply from 192.168.1.65: Destination host unreachable.
Reply from 192.168.1.65: Destination host unreachable.
Reply from 192.168.1.65: Destination host unreachable.
Reply from 192.168.1.65: Destination host unreachable.

Ping statistics for 192.168.1.254:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>|
```

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

Ans: A Switch is missing in the network for the communication between the two PC's. In the above network routers only have address of devices which are directly connected to its interfaces.

CONCLUSION:

1) From the above experiment I learnt about subnets and router configuration by configuring serial port on router and established a connection between two routers using serial DTE.