

# Data Communication and Networks Lab

## Experiment 6

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**TE Comps**

**Batch : A**

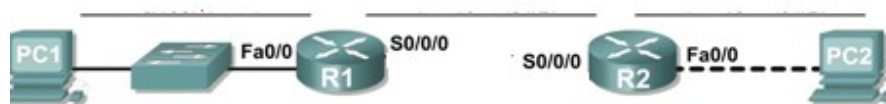
**UID : 2018130007**

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	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 -

1. One subnet to connect R1 to 15 hosts.
2. One subnet to connect R1 to R2.
3. And one subnet to connect R2 to 30 hosts.

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

Since we are assigned network given by 192.168.1.0/24. Hence we have the  $2^8$  devices that we can connect to this network.

We need to assign 3 subnets. Considering 'm' as the number of bits required to represent the subnet and 'n' as the number of subnets to be connected we get  $2^m = n$ .

m	$2^m$
1	2
2	4

$$n = 2^2 = 4$$

Therefore we can have 4 subnets

Therefore the subnet mask will have 2 more ones.

Therefore binary representation : 11111111.11111111.11111111.11000000

Therefore dotted decimal format : 255.255.255.192

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

Since the binary dotted representation is 11111111.11111111.11111111.11000000

Since the number of ones is 26 therefore the subnet mask is /26.

How many usable hosts are there per subnet?

The number of hosts is given by  $h = 2^n - 2$ ,  $n = 6$  therefore

$$m = 64 - 2$$

$$m = 62$$

### **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**

Network Address – **192.168.1.64**

Broadcast Address – **192.168.1.127**

**Assigned addresses are from 192.168.1.65 – 192.168.1.79 (15 hosts)**

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

**192.168.1.128/26**

Network Address – **192.168.1.128**

Broadcast Address – **192.168.1.191**

**Assigned addresses are from 192.168.1.129 – 192.168.1.158 (30 hosts)**

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

**192.168.1.192/26**

Network Address – **192.168.1.192**

Broadcast Address – **192.168.1.255**

### **Task 2: Determine Interface Addresses.**

#### **Step 1: Assign appropriate addresses to the device interfaces.**

**Note :** For the first and last valid address we will not consider the first and last address in the sub-network eg. 192.168.1.0 in subnet 1

1. Assign the first valid host address in subnet 1 to the LAN interface on R1.  
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.  
192.168.1.129
4. Assign the last valid host address in subnet 2 to the WAN interface on R2.  
192.168.1.190
5. Assign the first valid host address in subnet 3 to the LAN interface of R2.  
192.168.1.193

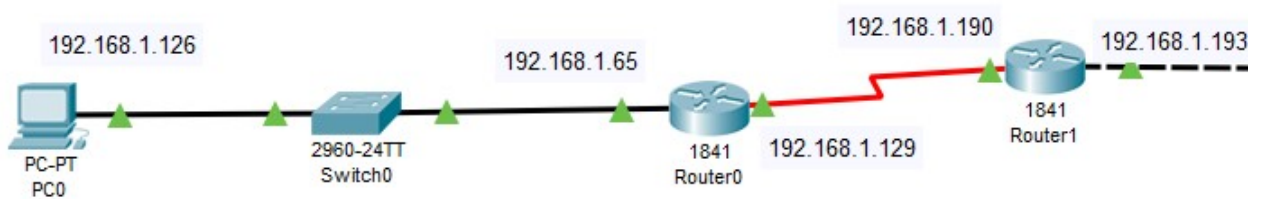
6. Assign the last valid host address in subnet 3 to PC2.  
192.168.1.254

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

Check the table above.

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

We first set up the connections :



Router0

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




<

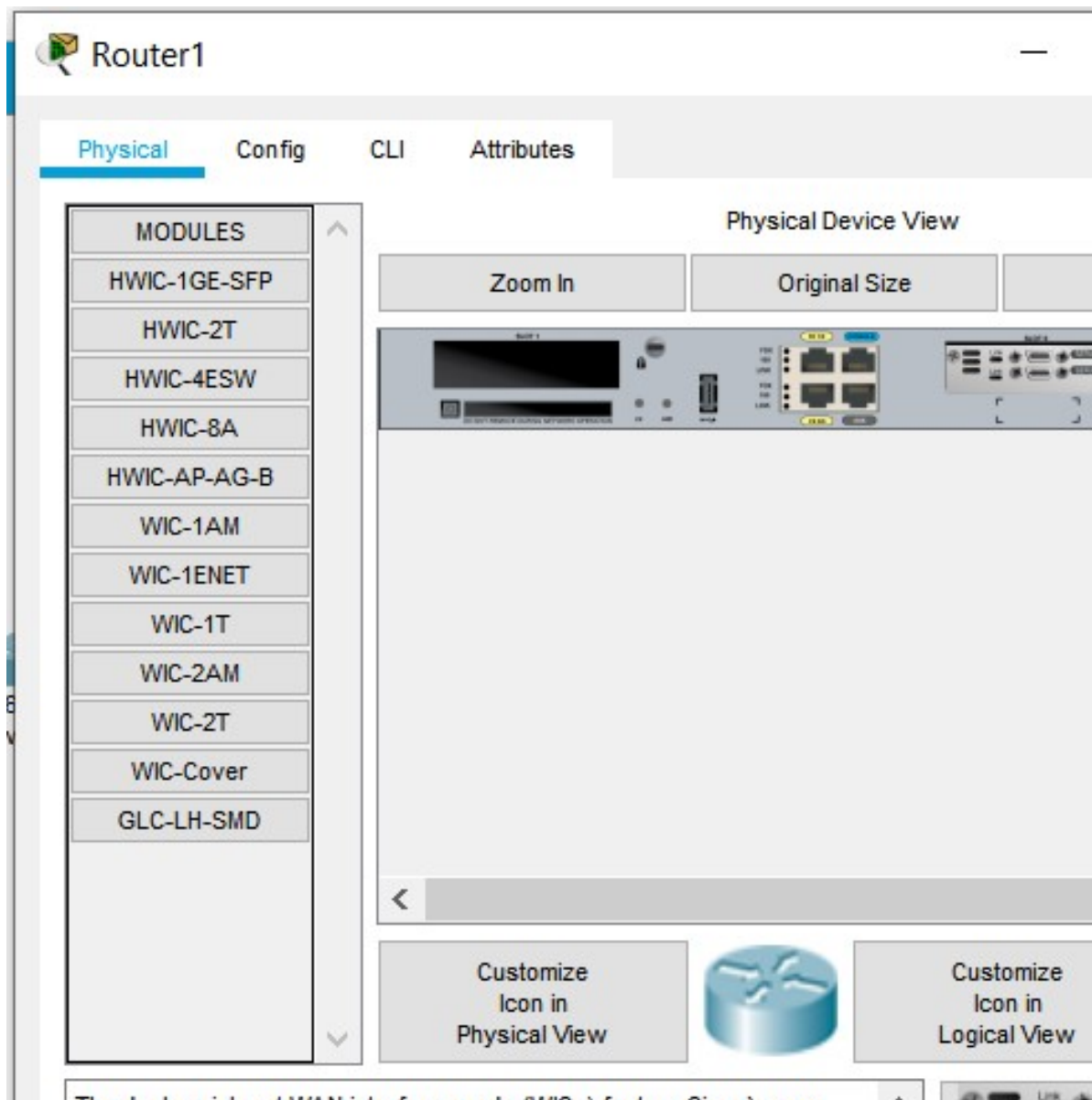
Customize Icon in Physical View



Customize Icon in Logical View

The HWIC 4GE SFP is a single wide HWIC with two Small Form Factor





## WIC-2T :

The dual-serial port WAN interface cards (WICs) for the Cisco 2600 and 1700 series 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).

Why do we use DCE?

Data Communications Equipment, or DCE, is any device that supports data transmission over a serial telecommunications link. Typically, data communications equipment (DCE) refers to modems, Channel Service Unit/Data Service Units (CSU/DSUs), multiplexers, and similar devices. The purpose of a DCE is to provide termination for the telecommunications link and an interface for connecting data terminal equipment (DTE) to the link. And since we are connecting two routers we will use a DCE connector.

### 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.

```
Router#copy running-config startup-config
Destination filename [startup-config]? star
Building configuration...
[OK]
```

Router 0 : (R1)

Router0

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

Bandwidth ☒ 100 Mbps ☐ 1

Duplex ☐ Half Duplex ☒ Full

MAC Address 0001.6485.680

IP Configuration

IP Address 192.168.1.65

Subnet Mask 255.255.255.192

Tx Ring Limit 10

Equivalent IOS Commands

```
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
```

Physical **Config** CLI Attributes


GLOBAL	Serial0/0/0
Settings	Port Status
Algorithm Settings	Duplex <input checked="" type="radio"/> Full Duplex
<b>ROUTING</b>	Clock Rate <input type="text" value="2000000"/>
Static	IP Configuration
RIP	IP Address <input type="text" value="192.168.1.129"/>
<b>SWITCHING</b>	Subnet Mask <input type="text" value="255.255.255.192"/>
VLAN Database	
<b>INTERFACE</b>	Tx Ring Limit <input type="text" value="10"/>
FastEthernet0/0	
FastEthernet0/1	
<b>Serial0/0/0</b>	
Serial0/0/1	

#### Equivalent IOS Commands

```
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 1 : (R2)

 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

Bandwidth

Duplex

MAC Address

IP Configuration

IP Address

Subnet Mask

Tx Ring Limit

100 Mbps

10

Half Duplex

Full D

00D0.5838.2401

192.168.1.193

255.255.255.192

10

Equivalent IOS Commands

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



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

Duplex

☐ Full Duplex

Clock Rate

1200

IP Configuration

IP Address

192.168.1.190

Subnet Mask

255.255.255.192

Tx Ring Limit

10

Equivalent IOS Commands

```
Router(config-if)#ip address 192.168.1.190 255.255.255.192
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
```

## 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.

PC 0: (PC1)

The screenshot shows the configuration window for PC0. The 'Desktop' tab is selected, and the 'FastEthernet0' interface is chosen. The 'IP Configuration' section has 'Static' selected, with fields for IP Address (192.168.1.126), Subnet Mask (255.255.255.192), Default Gateway (192.168.1.65), and DNS Server (0.0.0.0). The 'IPv6 Configuration' section has 'Static' selected, with fields for IPv6 Address, Link Local Address (FE80::2E0:B0FF:FE47:767), IPv6 Gateway, and IPv6 DNS Server. The '802.1X' section is partially visible at the bottom.

IP Configuration	
Interface	FastEthernet0
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IP 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		
<input type="radio"/> DHCP	<input type="radio"/> Auto Config	<input checked="" type="radio"/> Static
IPv6 Address		
Link Local Address	FE80::2E0:B0FF:FE47:767	
IPv6 Gateway		
IPv6 DNS Server		

802.1X

☐ Use 802.1X Security

PC 1: (PC2)

The screenshot shows the configuration interface for PC1. The 'Desktop' tab is selected. Under 'IP Configuration', the 'FastEthernet0' interface is chosen. The 'Static' radio button is selected for IP configuration. The IP Address is 192.168.1.254, Subnet Mask is 255.255.255.192, Default Gateway is 192.168.1.193, and DNS Server is 0.0.0.0. Under 'IPv6 Configuration', the 'Static' radio button is also selected. The IPv6 Address field is empty, Link Local Address is FE80::203:E4FF:FE55:ADD0, and both IPv6 Gateway and IPv6 DNS Server fields are empty. The '802.1X' section is partially visible at the bottom.

IP Configuration		
Interface	FastEthernet0	
<b>IP Configuration</b>		
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static	
IP Address	192.168.1.254	
Subnet Mask	255.255.255.192	
Default Gateway	192.168.1.193	
DNS Server	0.0.0.0	
<b>IPv6 Configuration</b>		
<input type="radio"/> DHCP	<input type="radio"/> Auto Config	<input checked="" type="radio"/> Static
IPv6 Address		
Link Local Address	FE80::203:E4FF:FE55:ADD0	
IPv6 Gateway		
IPv6 DNS Server		
<b>802.1X</b>		
<input type="checkbox"/> Use 802.1X Security		

Switch :

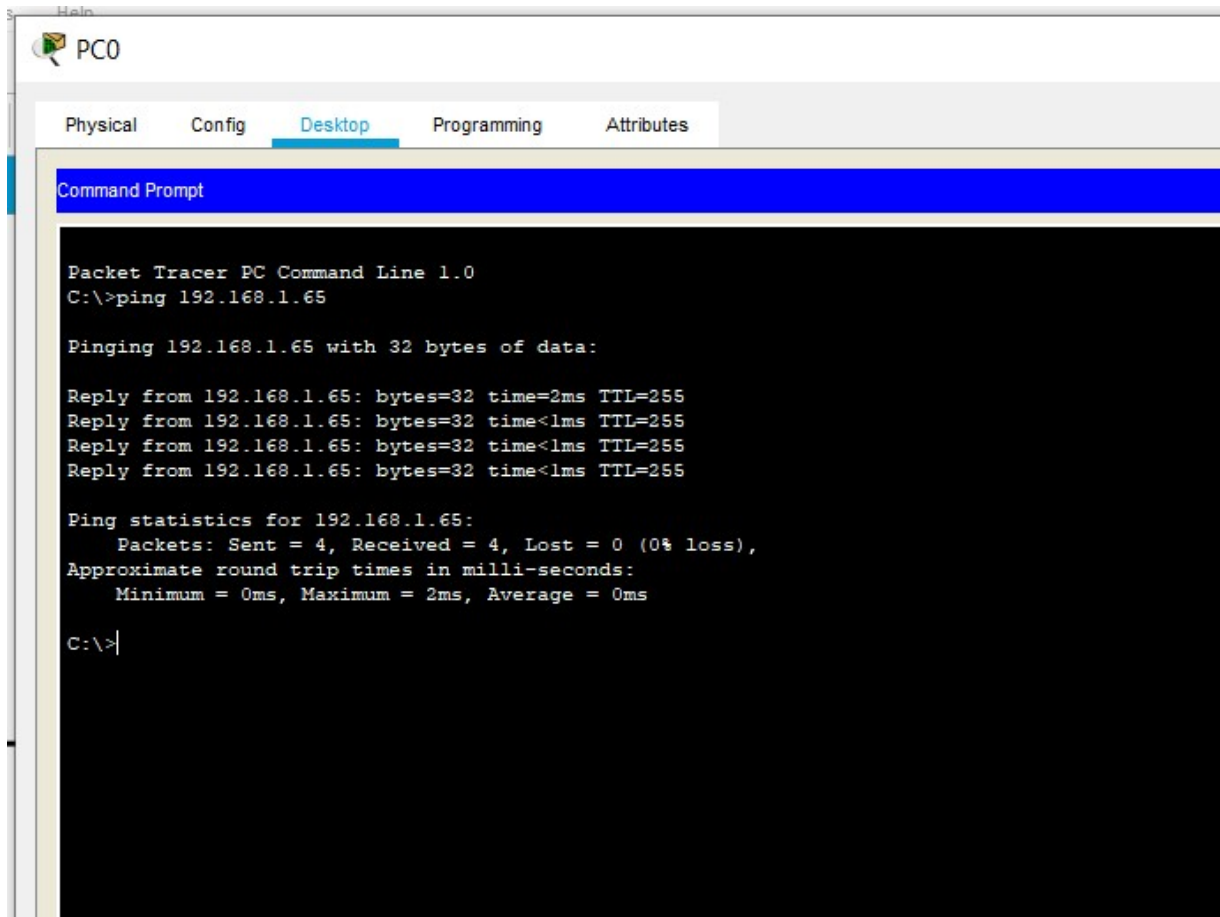
```
Switch(config)#ip default-gateway 192.168.1.65
Switch(config)#
```

#### 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



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

Pinging 192.168.1.65 with 32 bytes of data:

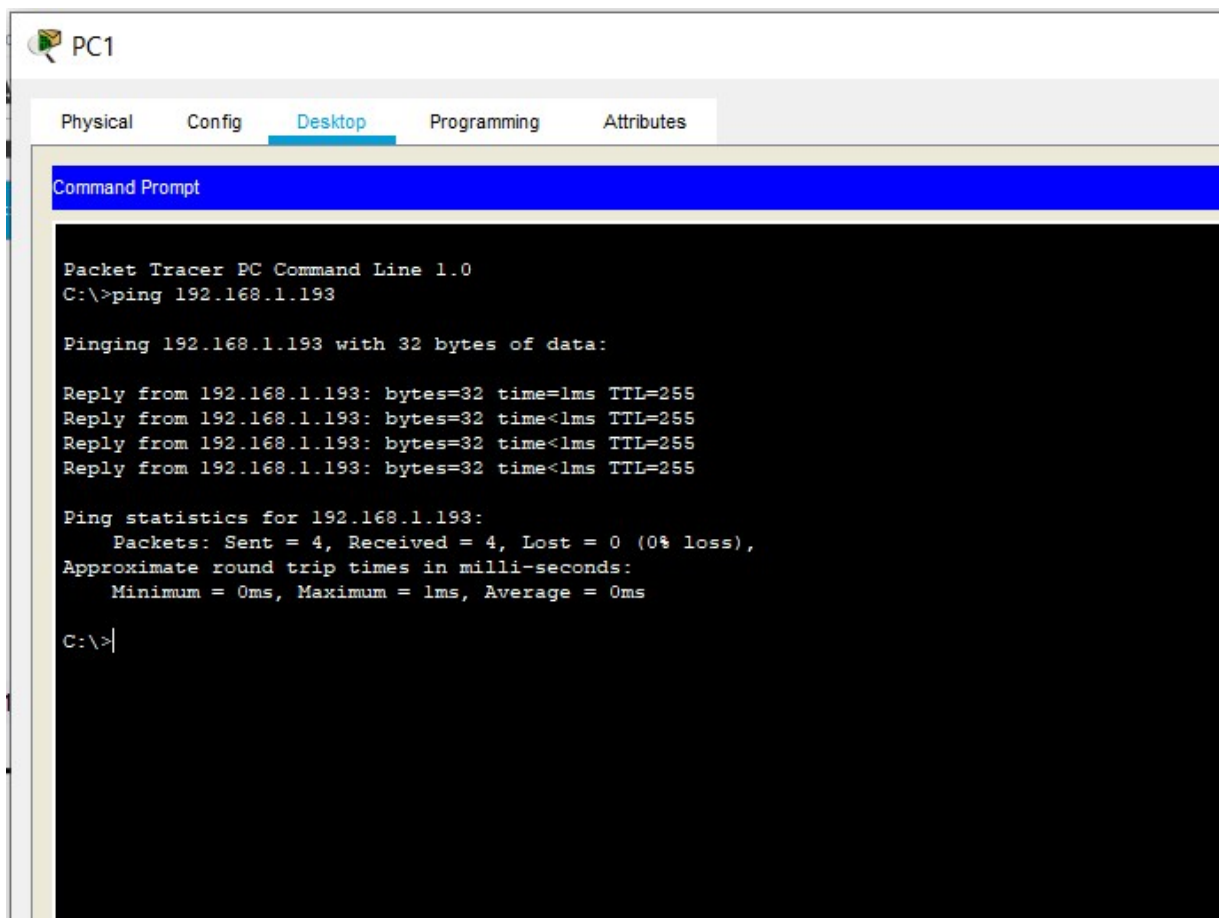
Reply from 192.168.1.65: bytes=32 time=2ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255

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 = 2ms, Average = 0ms

C:\>
```

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

Yes



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

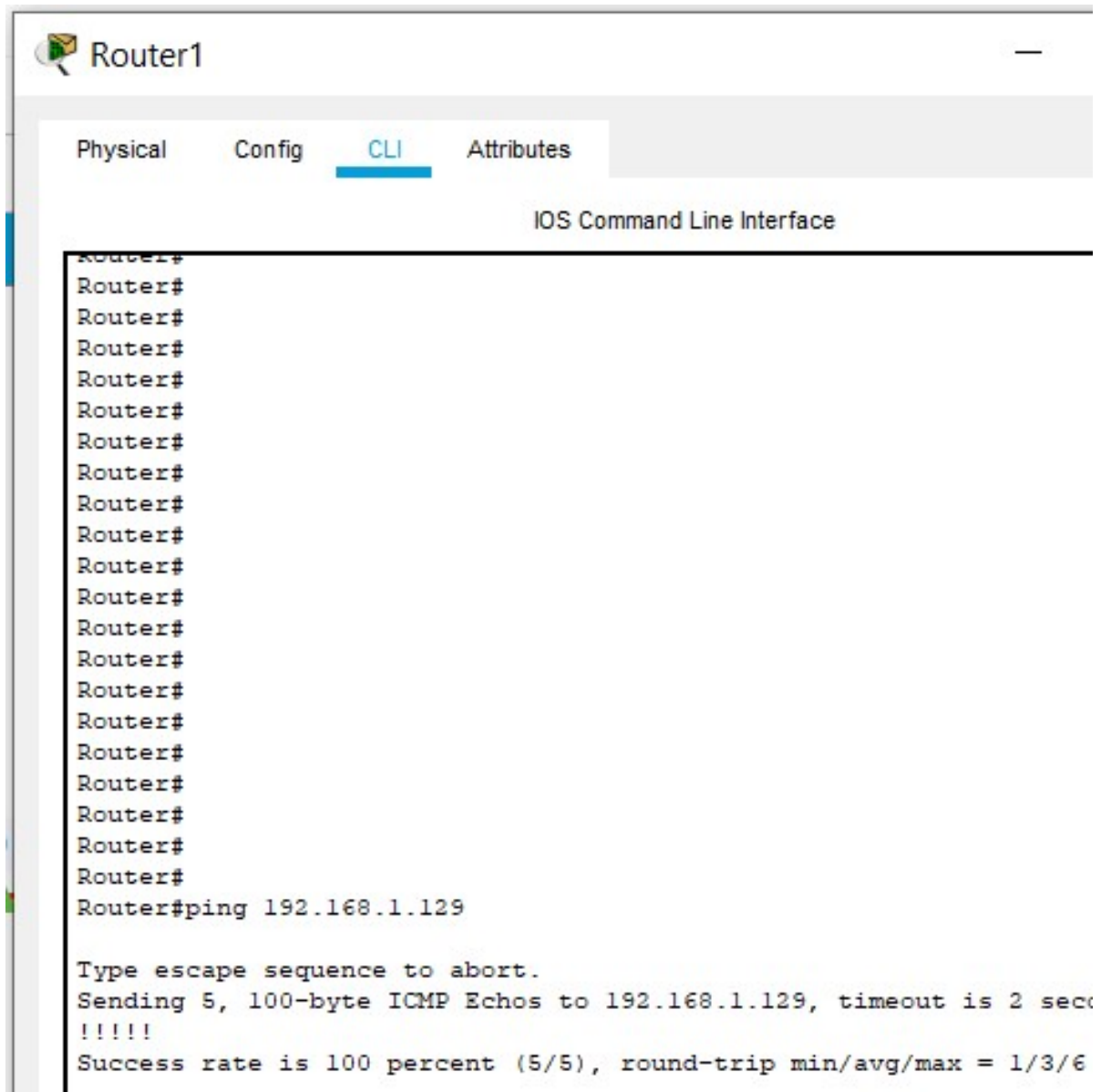
C:\>|
```

Yes

[illegible]

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

Yes



The screenshot shows the CLI interface of Router1. The tabs at the top are Physical, Config, CLI (selected), and Attributes. The title bar says "Router1". The main area is titled "IOS Command Line Interface". The command history shows multiple "Router#" prompts. The last command entered is "Router#ping 192.168.1.129". The output of the command is displayed below the prompt: "Type escape sequence to abort.", "Sending 5, 100-byte ICMP Echos to 192.168.1.129, timeout is 2 seconds", "!!!!", and "Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/6".

```
Router1
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
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 = 1/3/6
```

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?

The devices on the two different LANs cannot be pinged. Therefore PC1 cannot ping PC2 and vice versa.

Pinging PC2 from PC1

```
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:
```

Pinging PC1 from PC2

```
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
```

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

This is because the Routers connecting the two LANs only have the IP addresses of the devices they have been configured to. Thus if we want the devices on the different LANs to be able to ping each other we need to configure the IP addresses of the devices on the Router ARP table either dynamically or statically.

Routing Table for Router0				
Type	Network	Port	Next Hop IP	Metric
C	192.168.1.64/26	FastEthernet0/0	---	0/0
C	192.168.1.128/26	Serial0/0/0	---	0/0

Routing Table for Router1				
Type	Network	Port	Next Hop IP	Metric
C	192.168.1.128/26	Serial0/0/0	---	0/0
C	192.168.1.192/26	FastEthernet0/0	---	0/0

Conclusion :

1. I was able to set up subnets based on the host requirements.
2. I understood how to setup the serial port.