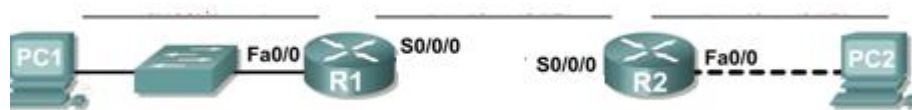


## CEL 51, DCCN, Monsoon 2020

### 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	192.168.1.33	255.255.255.224	N/A
	S0/0/0	192.168.1.65	255.255.255.224	N/A
R2	Fa0/0	192.168.1.97	255.255.255.224	N/A
	S0/0/0	192.168.1.94	255.255.255.224	N/A
PC1	NIC	192.168.1.62	255.255.255.224	192.168.1.33
PC2	NIC	192.168.1.126	255.255.255.224	192.168.1.97

#### 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

**Ans) 3 subnets will be needed as three networks are formed**

- 1. Network connected to R1**
- 2. Network connected to R2**
- 3. Link between R1 and R2**

What is the subnet mask for this network in dotted decimal format? 255.255.255.224

**Ans) 192.168.1.0/24 is a Class C network because the first octet 192 falls in the class C network range**

**Class C network has a default subnet mask of 11111111.11111111.11111111.0**

**The first three octets are dedicated to network and they never change**

**The remaining 1s in the subnet mask has to be our subnet bits**

**3 bits are required for subnets so there will be 3 1s in the final octet**

**So, the binary form of the subnet mask is 11111111.11111111.11111111.11100000**

**Converting to dotted-decimal form,**

**The subnet mask is 255.255.255.224**

What is the subnet mask for the network in slash format? /27

**Ans) It is the total number of ones in the binary form of the subnet mask**

**So, the subnet mask in slash format is /27**

How many usable hosts are there per subnet? 30

**Ans) Using the hosts formula,**

**$h = \text{number of zeroes in the binary form of subnet mask} = 5$**

**Usable hosts =  $2^h - 2 = 2^5 - 2 = 30$  hosts**

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

1. Assign subnet 1 to the network attached to R1.
2. Assign subnet 2 to the link between R1 and R2.
3. Assign subnet 3 to the network attached to R2.

### 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.  
192.168.1.33
2. Assign the last valid host address in subnet 1 to PC1.  
192.168.1.62
3. Assign the first valid host address in subnet 2 to the WAN interface on R1.  
192.168.1.65
4. Assign the last valid host address in subnet 2 to the WAN interface on R2.  
192.168.1.94
5. Assign the first valid host address in subnet 3 to the LAN interface of R2.  
192.168.1.97
6. Assign the last valid host address in subnet 3 to PC2.  
192.168.1.126

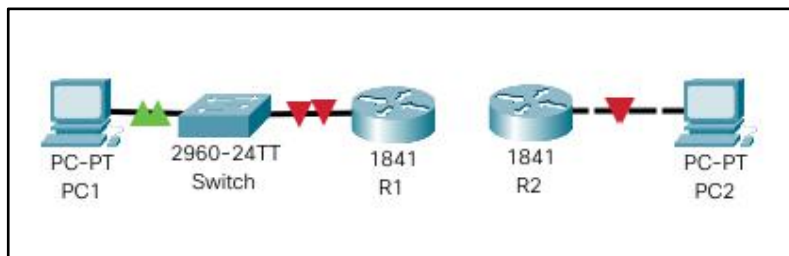
#### Step 2: Document the addresses to be used in the table provided under the Topology Diagram.

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

#### Step 1: Configure the router interfaces.

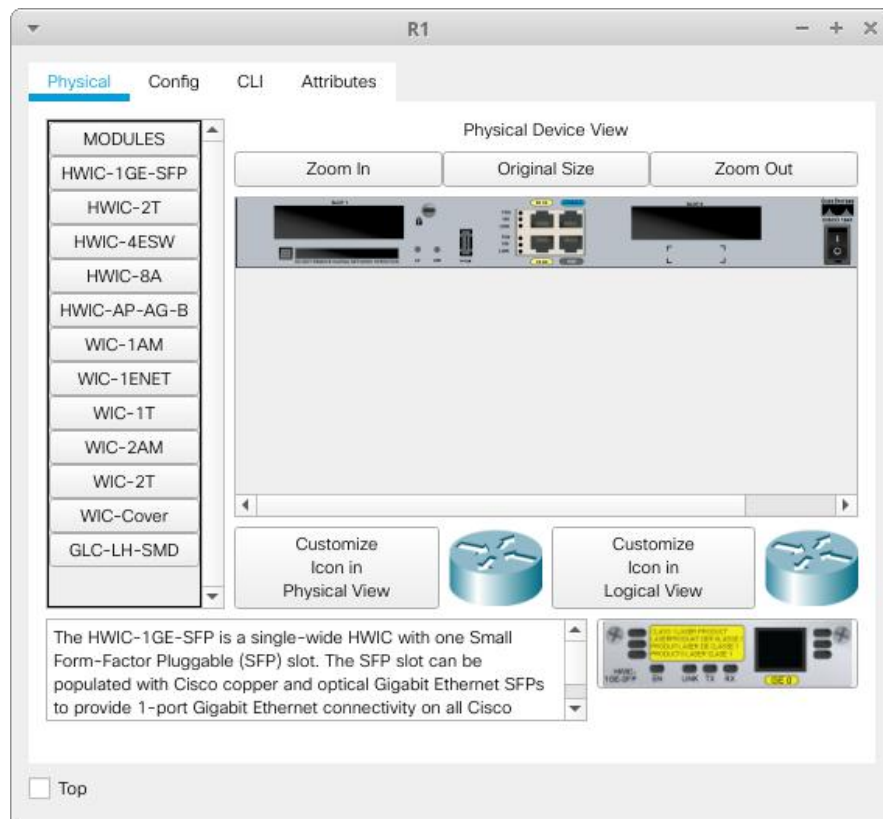
Configure the interfaces on the R1 and R2 routers with the IP addresses from your network design. Please note, to complete the activity in Packet Tracer you will be using the Config Tab. When you have finished, be sure to save the running configuration to the NVRAM of the router.

Network devices

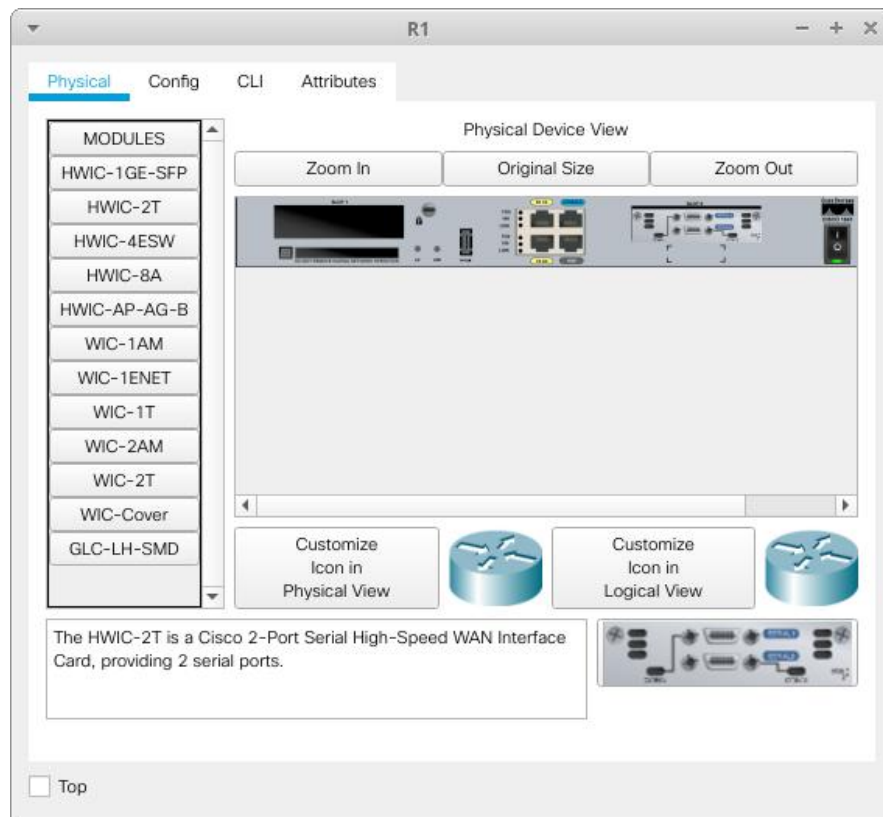


## Adding Serial Ports to Routers

- a. Turn Router off in Physical Tab

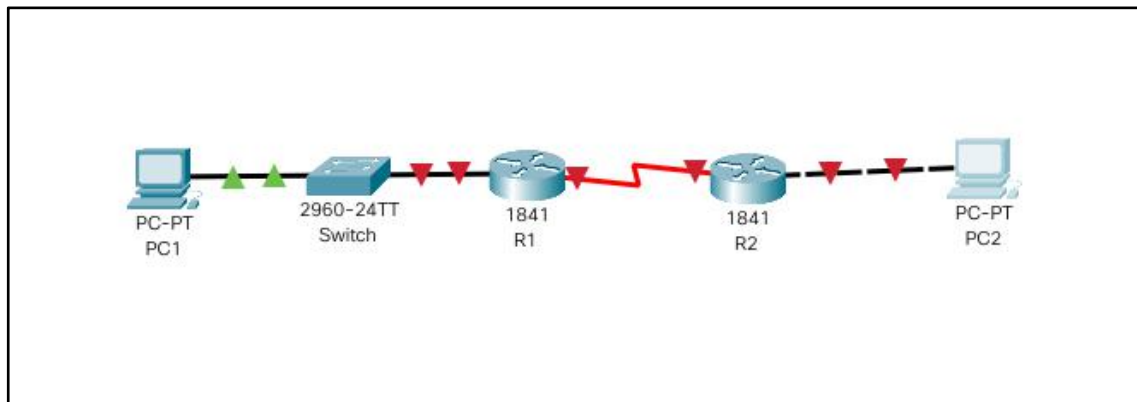


- b. Click on HWIC-2T tab and drag Cisco HWIC-2T 2-Port Serial WAN Interface Card to router then turn router on



Similarly, 2 serial ports are added to R2

Now, we can connect R1 and R2 using DTE



## Router Configuration

Interface Fa0/0 of R1

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

FastEthernet0/0

Port Status ☒ On

Bandwidth ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☒ Half Duplex ☐ Full Duplex ☒ Auto

MAC Address 0001.978A.2101

IP Configuration

IPv4 Address 192.168.1.33

Subnet Mask 255.255.255.224

Tx Ring Limit 10

Equivalent IOS Commands

Router(config-if)#

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

☐ Top

Interface S0/0/0 of R1

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 1200

IP Configuration

IPv4 Address 192.168.1.65

Subnet Mask 255.255.255.224

Tx Ring Limit 10

Equivalent IOS Commands

```
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#
```

☐ Top

Interface Fa0/0 of R2

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 0002.4A41.1E01

IP Configuration

IPv4 Address 192.168.1.97

Subnet Mask 255.255.255.224

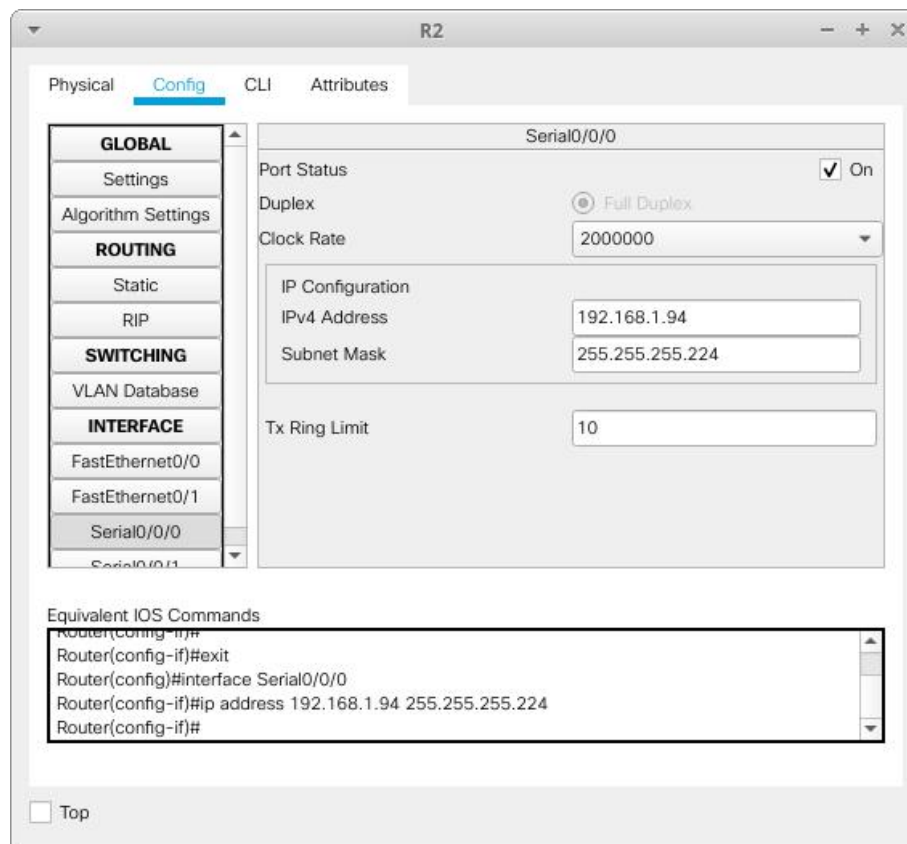
Tx Ring Limit 10

Equivalent IOS Commands

```
Router(config)#interface Serial0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#
```

☐ Top

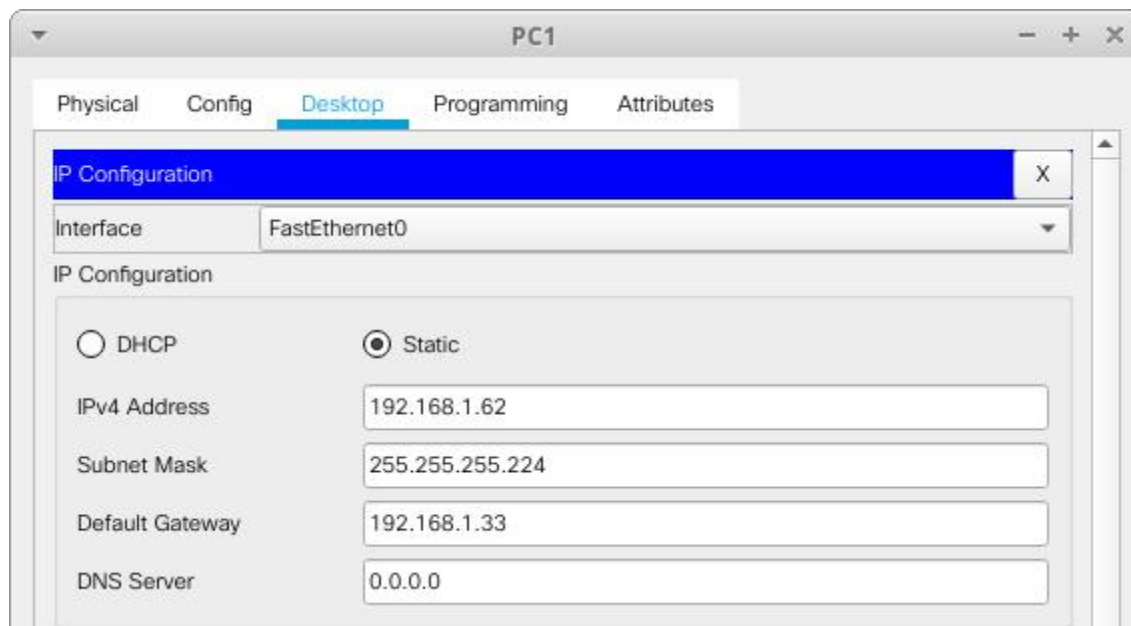
Interface S0/0/0 of R2



## 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.

Interface Fa0/0 of PC1





## Interface Fa0/0 of PC2

PC2

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.126

Subnet Mask 255.255.255.224

Default Gateway 192.168.1.97

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

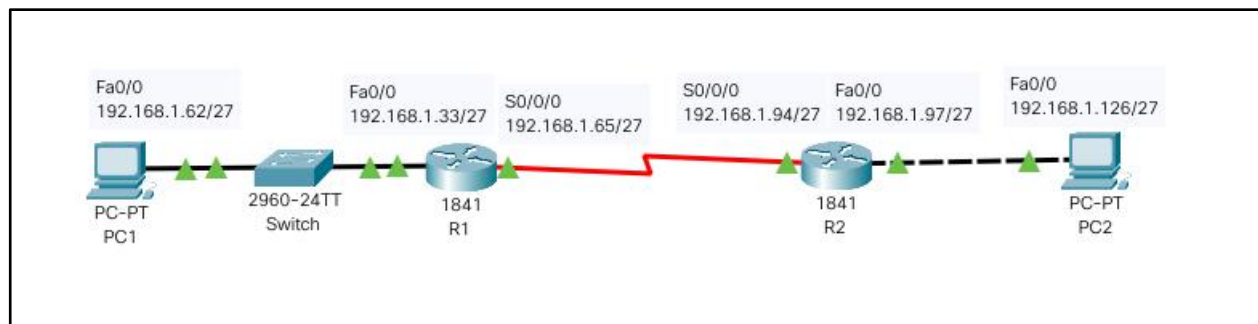
Link Local Address FE80::202:16FF:FE7A:89CC

Default Gateway

DNS Server

☐ Top

## Final Network

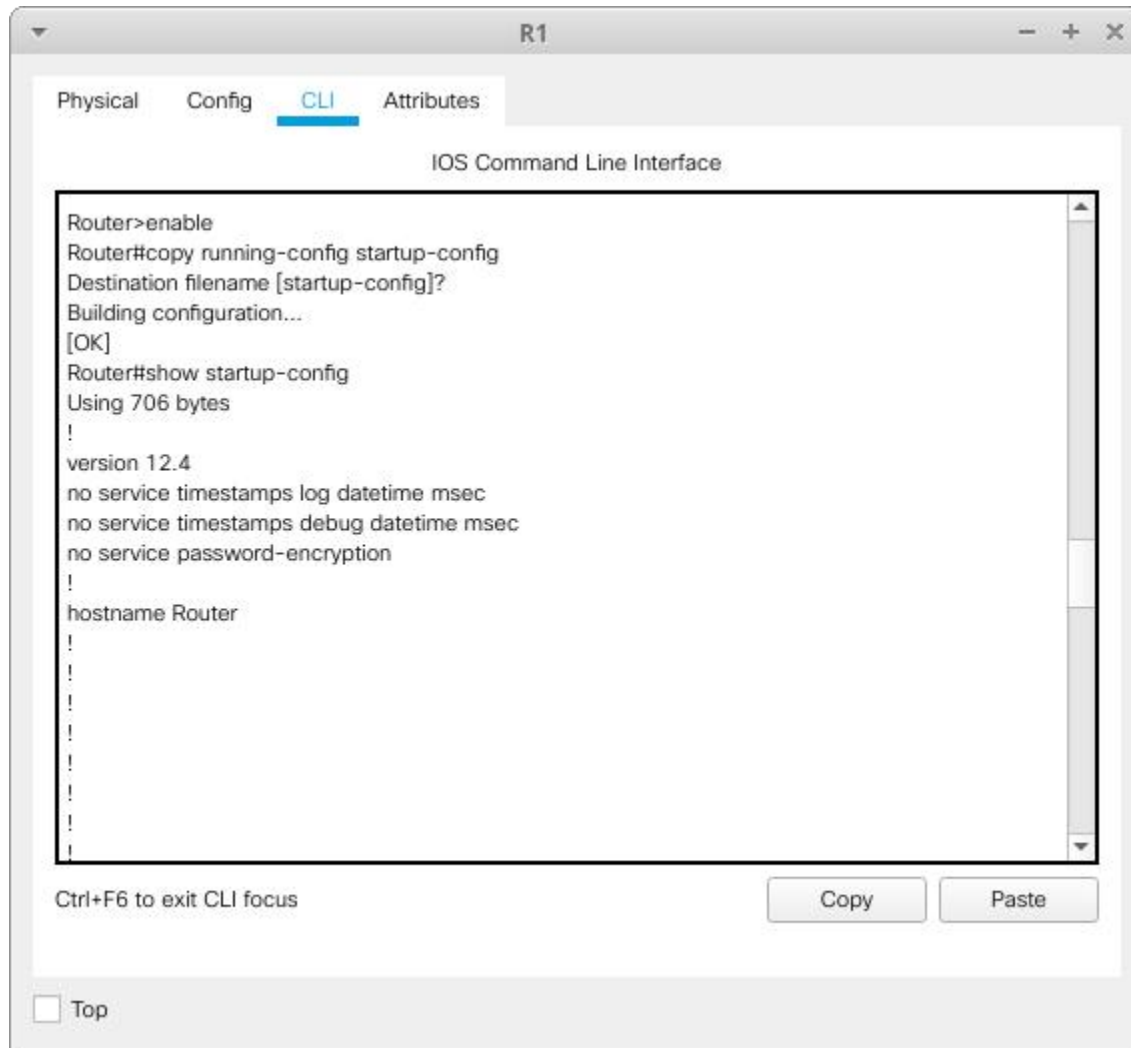


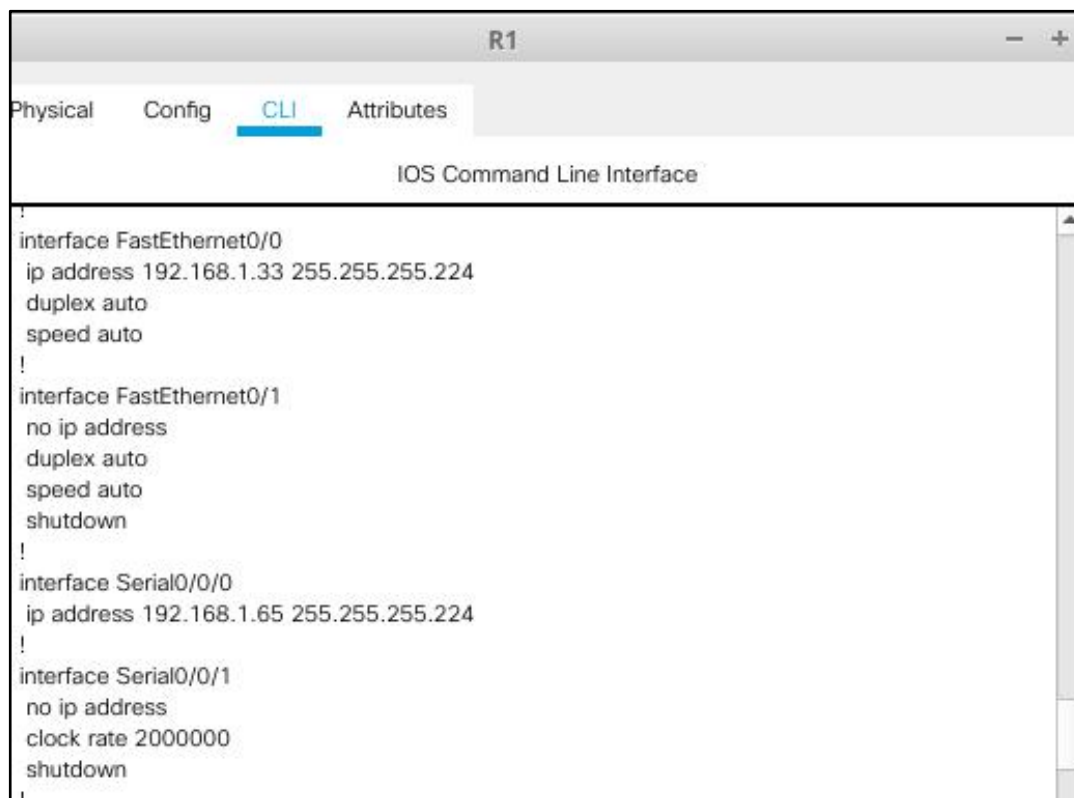
Save the running configuration to the NVRAM of the router

Initially, the routers have no startup-config

```
Router>enable
Router#show startup-config
startup-config is not present
```

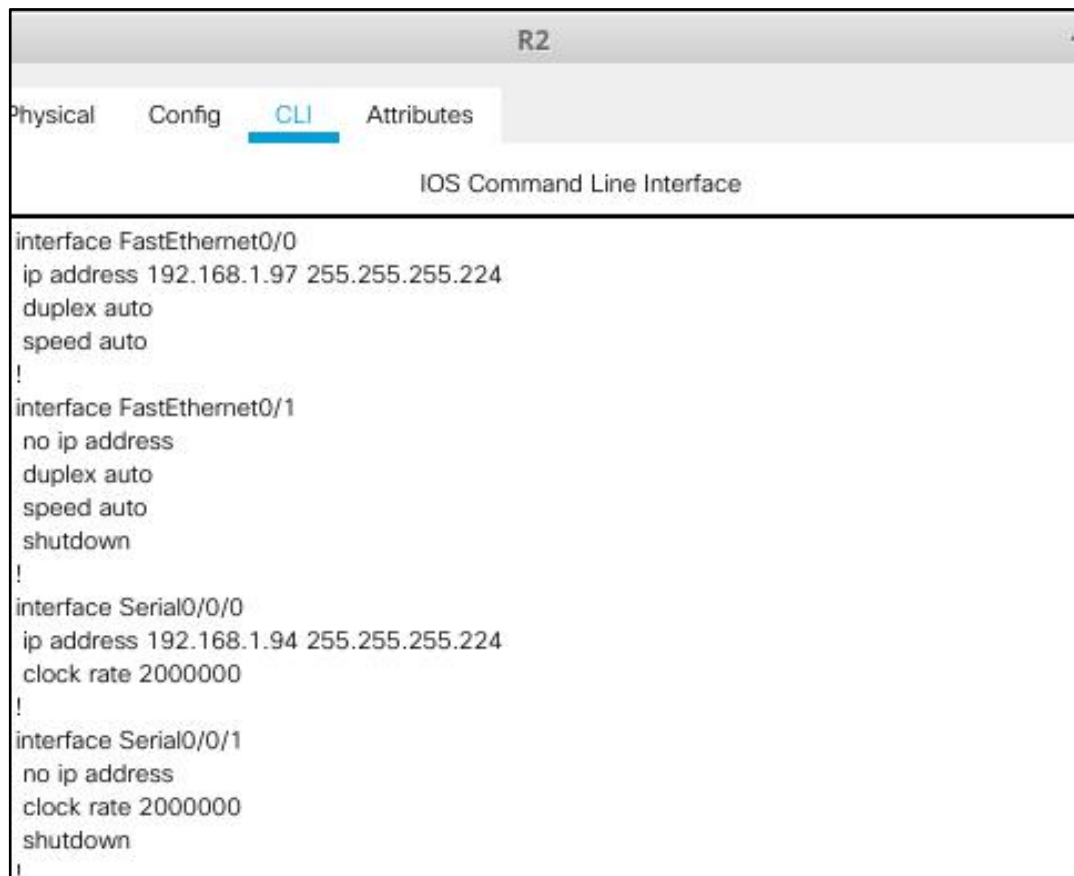
Saving running-config as startup-config



A screenshot of a network device's CLI interface for R1. The window has a title bar with 'R1' and standard window controls. Below the title bar are four tabs: 'Physical', 'Config', 'CLI' (which is selected and highlighted with a blue underline), and 'Attributes'. Under the 'CLI' tab, the text 'IOS Command Line Interface' is displayed. The main area of the window contains a configuration script for four interfaces, separated by exclamation marks. The configuration for FastEthernet0/0 includes an IP address of 192.168.1.33, duplex auto, and speed auto. FastEthernet0/1 has no IP address, duplex auto, speed auto, and is in shutdown state. Serial0/0/0 has an IP address of 192.168.1.65, duplex auto, speed auto, and is in shutdown state. Serial0/0/1 has no IP address, a clock rate of 2000000, and is in shutdown state.

```
!
interface FastEthernet0/0
ip address 192.168.1.33 255.255.255.224
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
ip address 192.168.1.65 255.255.255.224
!
interface Serial0/0/1
no ip address
clock rate 2000000
shutdown
!
```

The startup-config shows the running-config details as expected

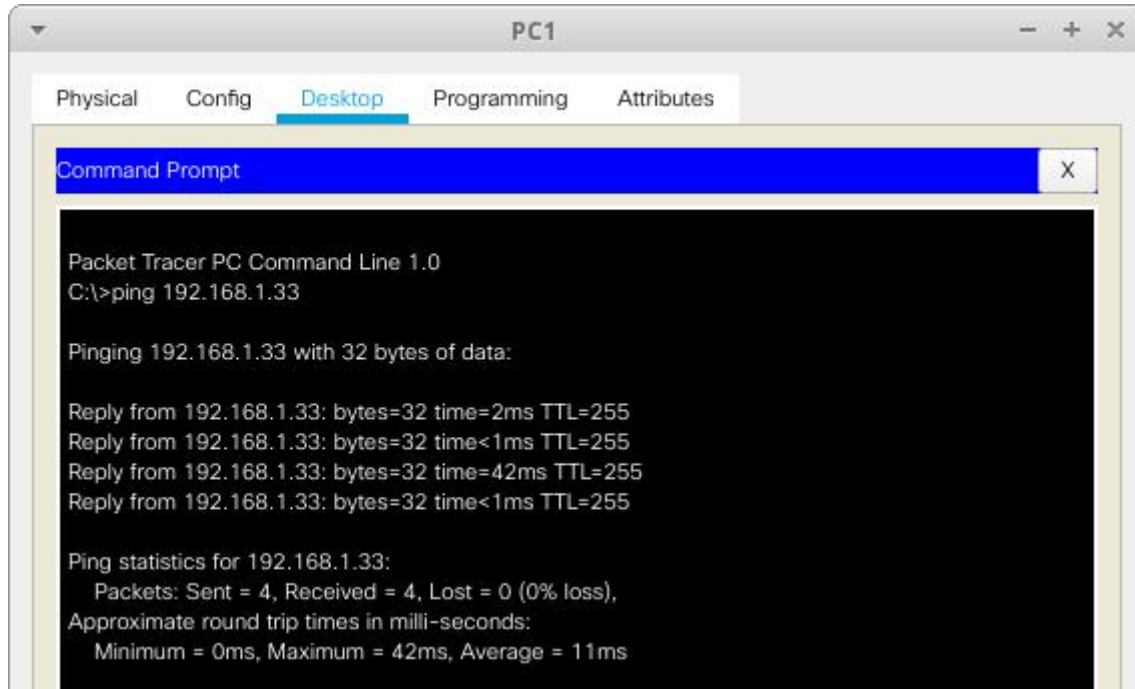
A screenshot of a network device's CLI interface for R2. The window has a title bar with 'R2' and standard window controls. Below the title bar are four tabs: 'Physical', 'Config', 'CLI' (which is selected and highlighted with a blue underline), and 'Attributes'. Under the 'CLI' tab, the text 'IOS Command Line Interface' is displayed. The main area of the window contains a configuration script for four interfaces, separated by exclamation marks. The configuration for FastEthernet0/0 includes an IP address of 192.168.1.97, duplex auto, and speed auto. FastEthernet0/1 has no IP address, duplex auto, speed auto, and is in shutdown state. Serial0/0/0 has an IP address of 192.168.1.94, duplex auto, speed auto, and is in shutdown state. Serial0/0/1 has no IP address, a clock rate of 2000000, and is in shutdown state.

```
!
interface FastEthernet0/0
ip address 192.168.1.97 255.255.255.224
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
ip address 192.168.1.94 255.255.255.224
clock rate 2000000
!
interface Serial0/0/1
no ip address
clock rate 2000000
shutdown
!
```

#### 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



The screenshot shows the 'PC1' window with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the output of a ping command to 192.168.1.33. The output shows four successful replies with varying round-trip times (2ms, <1ms, 42ms, <1ms) and a TTL of 255. The ping statistics indicate 4 packets sent, 4 received, and 0% loss, with an average round-trip time of 11ms.

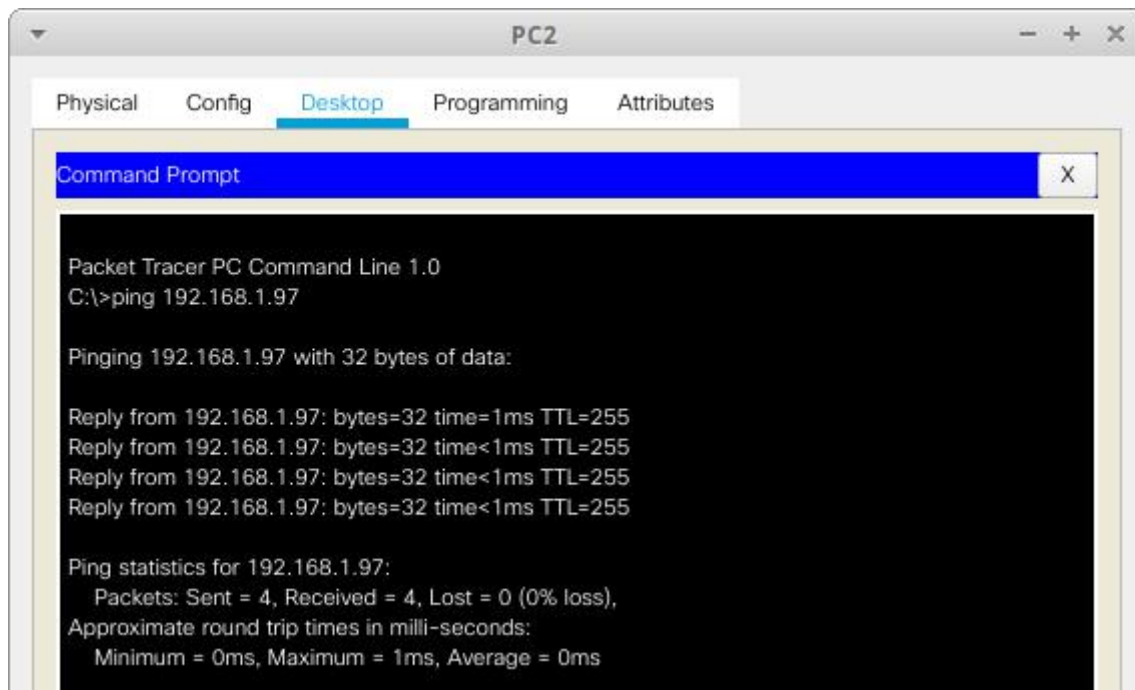
```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.33

Pinging 192.168.1.33 with 32 bytes of data:

Reply from 192.168.1.33: bytes=32 time=2ms TTL=255
Reply from 192.168.1.33: bytes=32 time<1ms TTL=255
Reply from 192.168.1.33: bytes=32 time=42ms TTL=255
Reply from 192.168.1.33: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.1.33:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 42ms, Average = 11ms
```

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



The screenshot shows the 'PC2' window with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the output of a ping command to 192.168.1.97. The output shows four successful replies with round-trip times of 1ms or less and a TTL of 255. The ping statistics indicate 4 packets sent, 4 received, and 0% loss, with an average round-trip time of 0ms.

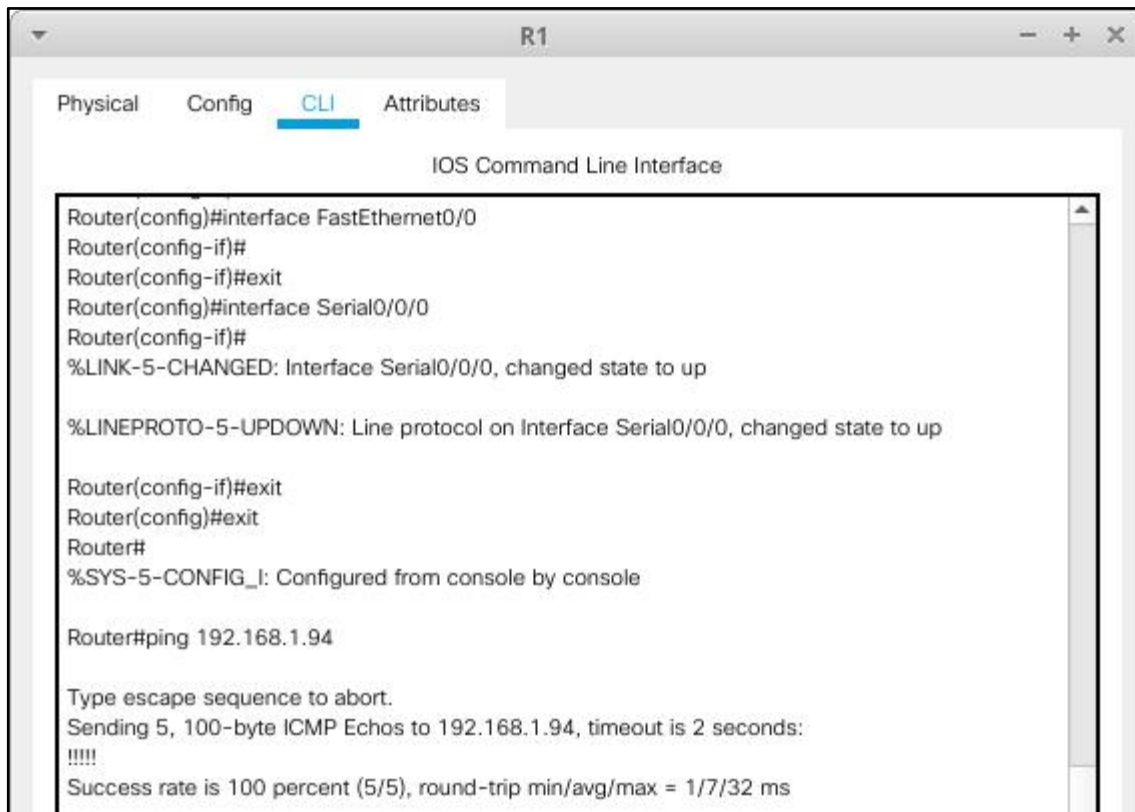
```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.97

Pinging 192.168.1.97 with 32 bytes of data:

Reply from 192.168.1.97: bytes=32 time=1ms TTL=255
Reply from 192.168.1.97: bytes=32 time<1ms TTL=255
Reply from 192.168.1.97: bytes=32 time<1ms TTL=255
Reply from 192.168.1.97: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.1.97:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

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



The screenshot shows the CLI of Router R1. The 'CLI' tab is selected. The command history shows the configuration of FastEthernet0/0 and Serial0/0/0. The Serial0/0/0 interface is now up. A ping command is executed from the Router prompt, sending 5 ICMP echos to 192.168.1.94. The results show a 100% success rate with a round-trip time of 1/7/32 ms.

```
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

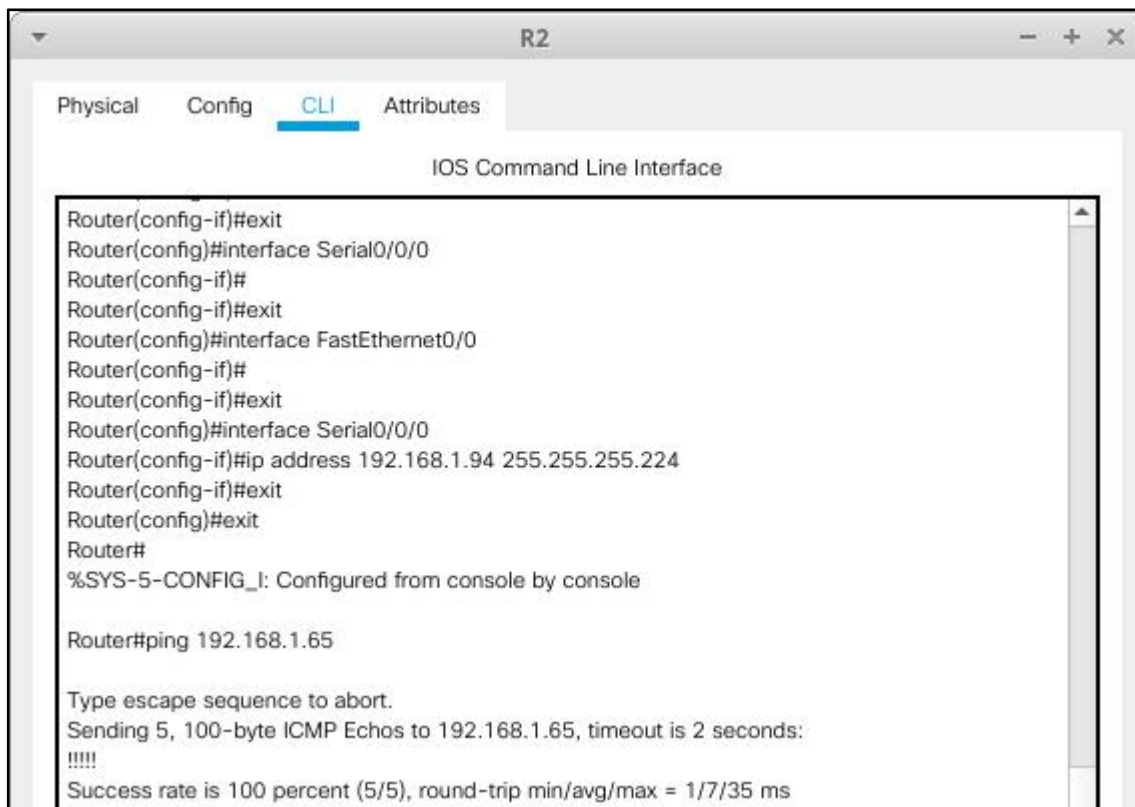
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#ping 192.168.1.94

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.94, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/32 ms
```

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



The screenshot shows the CLI of Router R2. The 'CLI' tab is selected. The command history shows the configuration of Serial0/0/0 and FastEthernet0/0. The Serial0/0/0 interface is configured with IP address 192.168.1.94. A ping command is executed from the Router prompt, sending 5 ICMP echos to 192.168.1.65. The results show a 100% success rate with a round-trip time of 1/7/35 ms.

```
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.94 255.255.255.224
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#ping 192.168.1.65

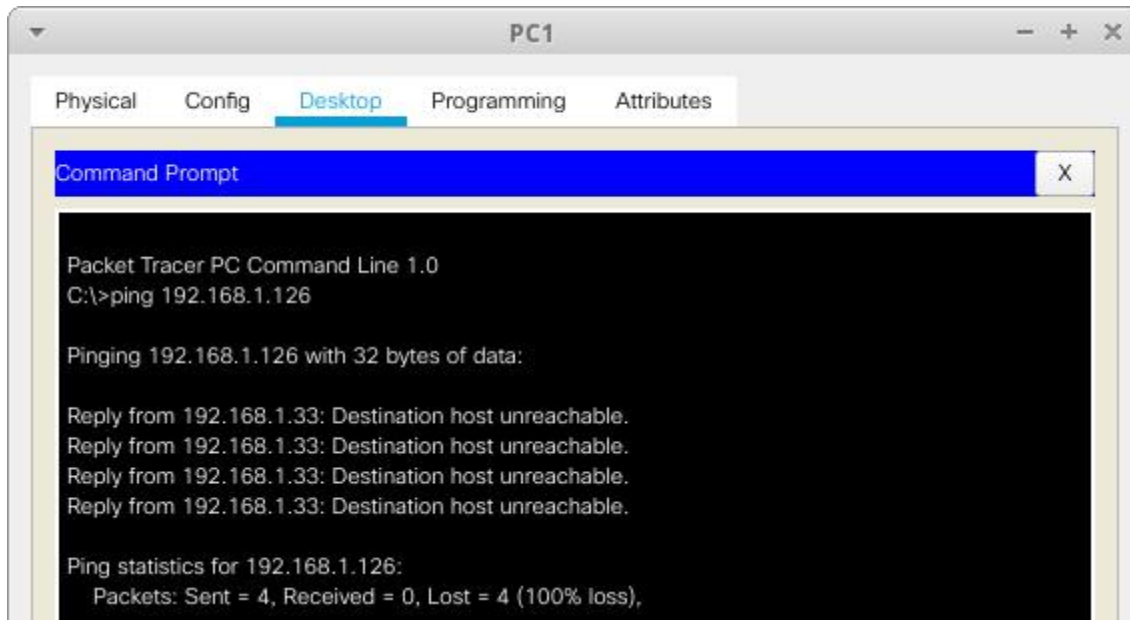
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.65, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/35 ms
```

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?

Yes, devices that are not a part of the same network cannot ping each other. For example, PC1 and PC2 cannot ping each other



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

Switch is missing