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**CLASS: TE COMPS**

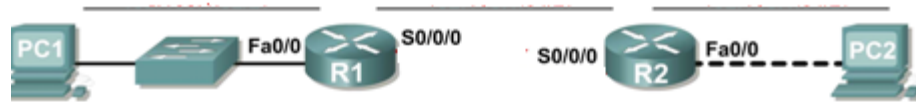
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**CEL 51, DCCN, Monsoon 2020**

## 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 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

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

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

We need 3 subnets and if we borrow 2 bits from host portion, we will get  $2^n$  subnets (n is no. of bits borrowed), i.e.  $2^2 = 4$  subnets which are enough.

Hence subnet mask will be: 11111111.11111111.11111111.11000000

255.255.255.192

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

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 /26

#### How many usable hosts are there per subnet?

$2^6 - 2 = 62$

### 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

Network ID: 192.168.1.64/26

1st usable IP: 192.168.1.65/26

Last usable IP: 192.168.1.126/26

Broadcast IP: 192.168.1.127/26

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

Subnet 2: 192.168.1.128

Network ID: 192.168.1.128/26

1st usable IP: 192.168.1.129/26

Last usable IP: 192.168.1.190/26

Broadcast IP: 192.168.1.191/26

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

Subnet 2: 192.168.1.192

Network ID: 192.168.1.192/26

1st usable IP: 192.168.1.193/26

Last used IP: 192.168.1.254/26

Broadcast IP: 192.168.1.255/26

## **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.  
**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.**

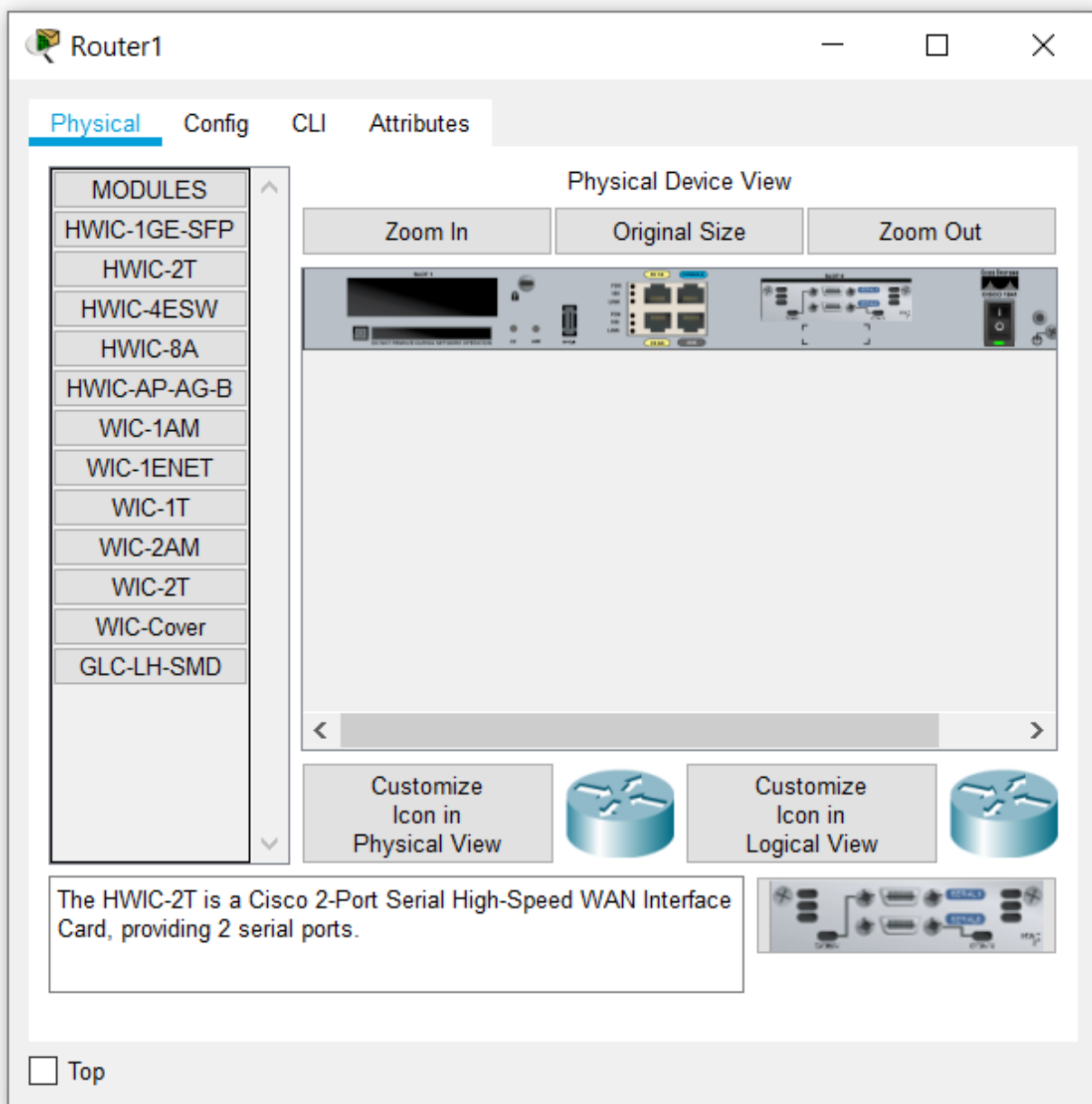
## **Task 3: Configure the Serial and FastEthernet Addresses.**

Select 2 PC's, 2 1841 Routers and a Switch and arrange them.

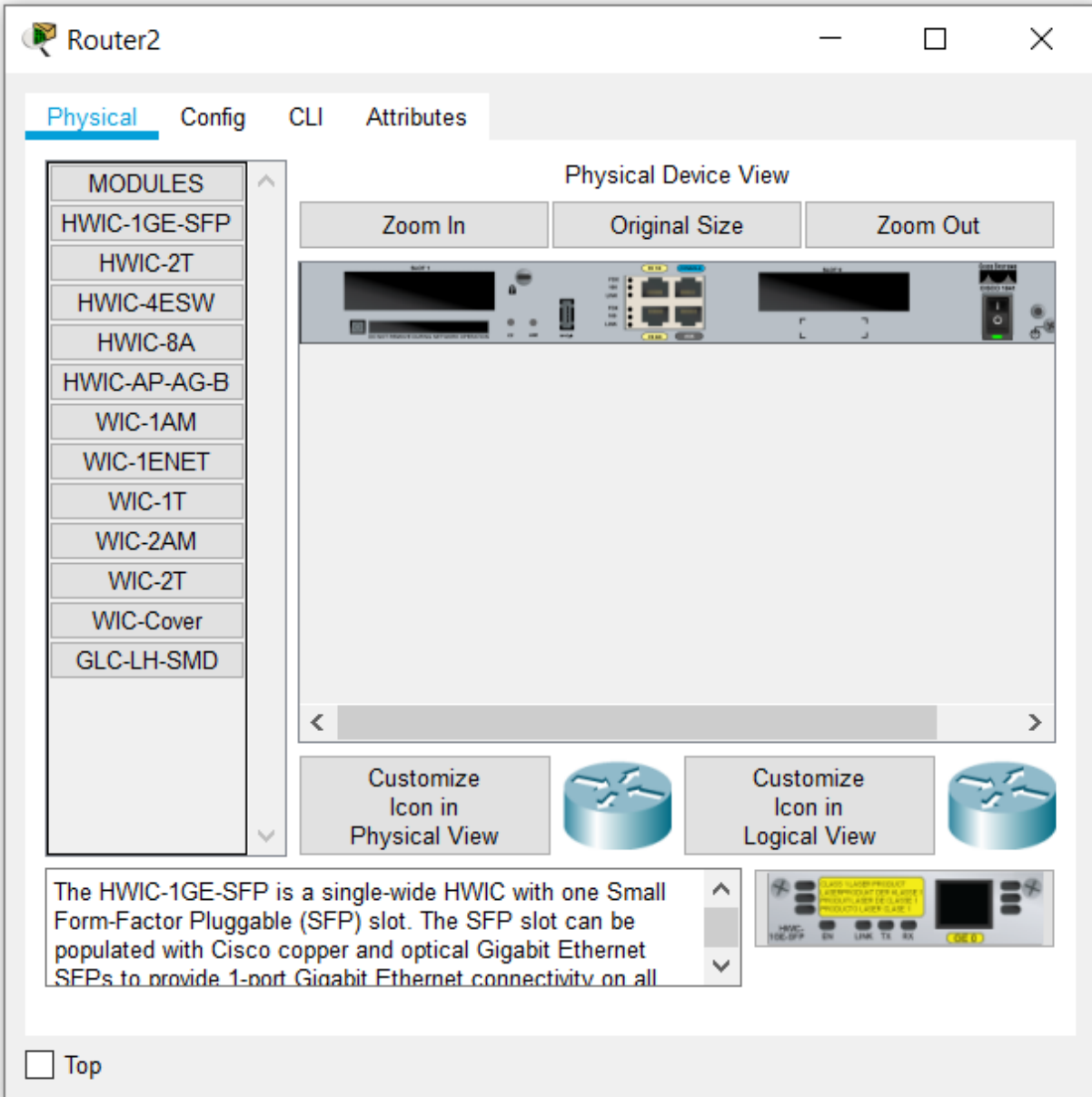


Click on Router Router1 and Physical.

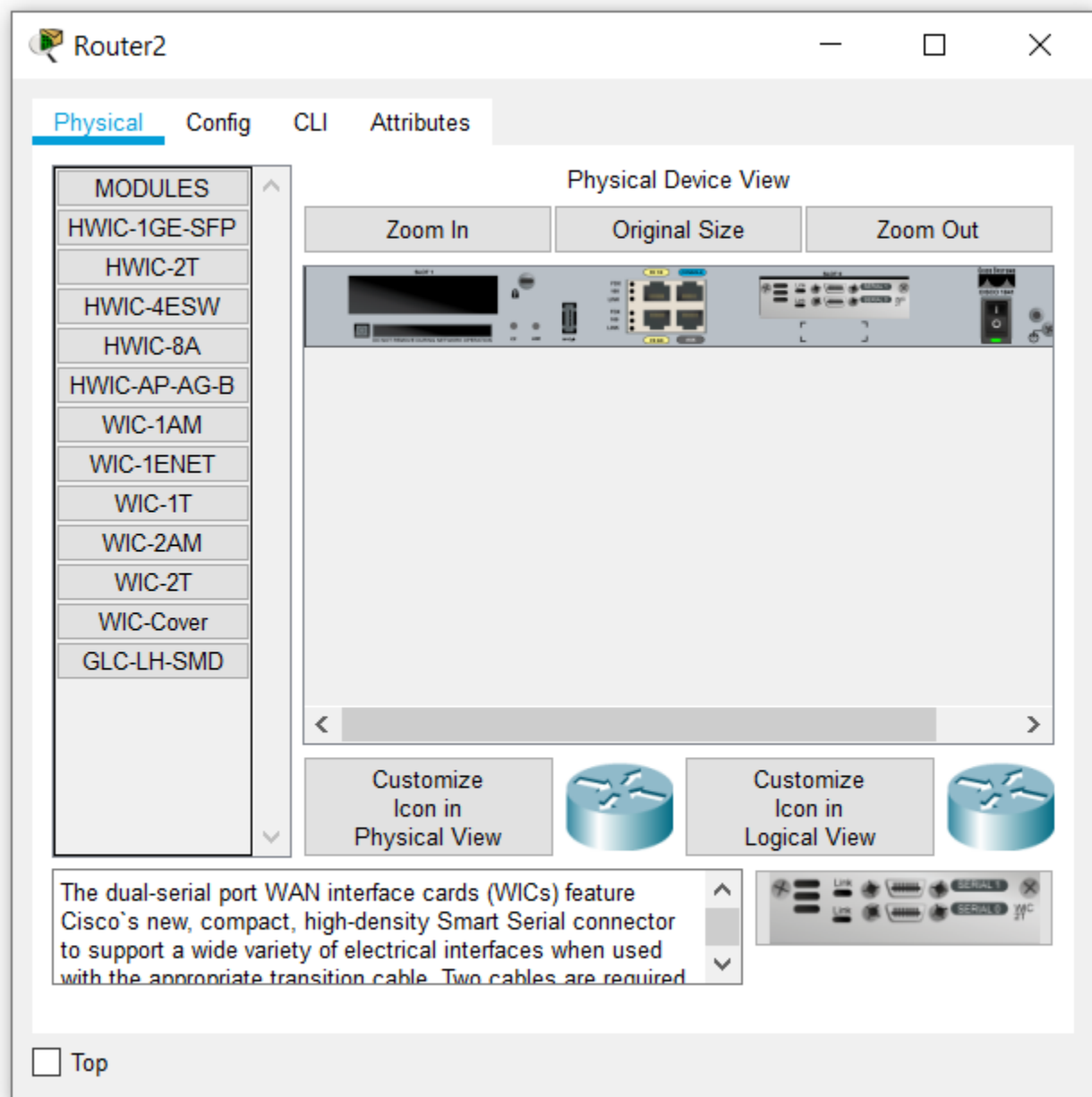
Add a WIC-2T card for serial connection.



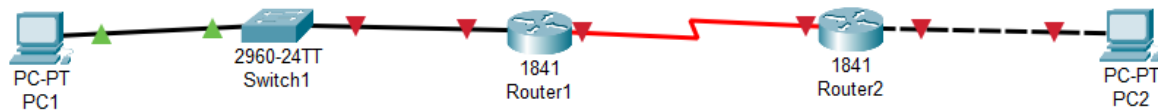
Click on Router Router2 and Physical.



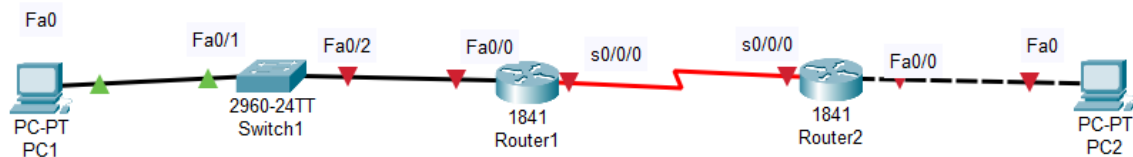
Add a WIC-2T card for serial connection.



Connect Router R1 and Router R2 with Serial DCE at Serial 0/0/0 of both Routers.



### Topology:



### 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.

Configuration for R1: Set the IP Address & Subnet mask and change the port status to on at 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
Bandwidth
Duplex
MAC Address

☒ On
☐ 100 Mbps
☐ 10 Mbps
☒ Auto
☐ Half Duplex
☒ Full Duplex
☒ Auto

0006.2AB4.8C01

IP Configuration
IP Address
Subnet Mask

192.168.1.65
255.255.255.192

Tx Ring Limit
10

Equivalent IOS Commands

```

Router(config)#interface Serial0/0/0
Router(config-if)#ip address 192.168.1.129 255.255.255.192
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)#

```

☐ Top

Set the IP Address & Subnet mask and change the port status to on at Serial0/0/0



Router1

PhysicalConfigCLIAttributes

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

IP Address

192.168.1.129

Subnet Mask

255.255.255.192

Tx Ring Limit

10

Equivalent IOS Commands

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)#

☐ Top

Save Running Configuration to NVRAM by clicking on save button in settings of R1 config.

Router1

PhysicalConfigCLIAttributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

FastEthernet0/0

FastEthernet0/1

Serial0/0/0

Serial0/0/1

Global Settings

Display NameRouter1

HostnameRouter

NVRAM

Erase

Save

Startup Config

Load...

Export...

Running Config

Export...

Merge...

Equivalent IOS Commands

%SYS-S-CONFIG\_1: Configured from console by console

Router#copy running-config startup-config

Destination filename [startup-config]?

Building configuration...

[OK]

Router#

☐ Top

Configuration for R2: Set the IP Address & Subnet mask and change the port status to on at FastEthernet0/0.

Router2

PhysicalConfigCLIAttributes

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

0001.9676.8B01

IP Configuration

IP Address

192.168.1.193

Subnet Mask

255.255.255.192

Tx Ring Limit

10

Equivalent IOS Commands

```
Router(config-if)#no shutdown
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

Set the IP Address & Subnet mask and change the port status to on at Serial0/0/0

The screenshot shows the 'Router2' configuration window with the 'Config' tab selected. The left sidebar contains a tree view with categories: GLOBAL, ROUTING, SWITCHING, and INTERFACE. Under the INTERFACE category, 'Serial0/0/0' is selected. The main configuration area for 'Serial0/0/0' shows the following settings:

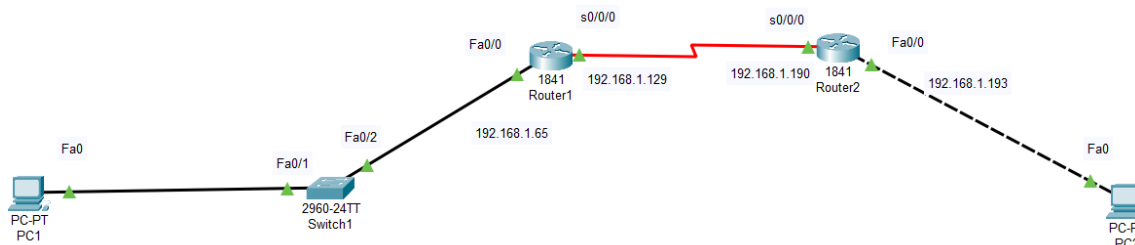
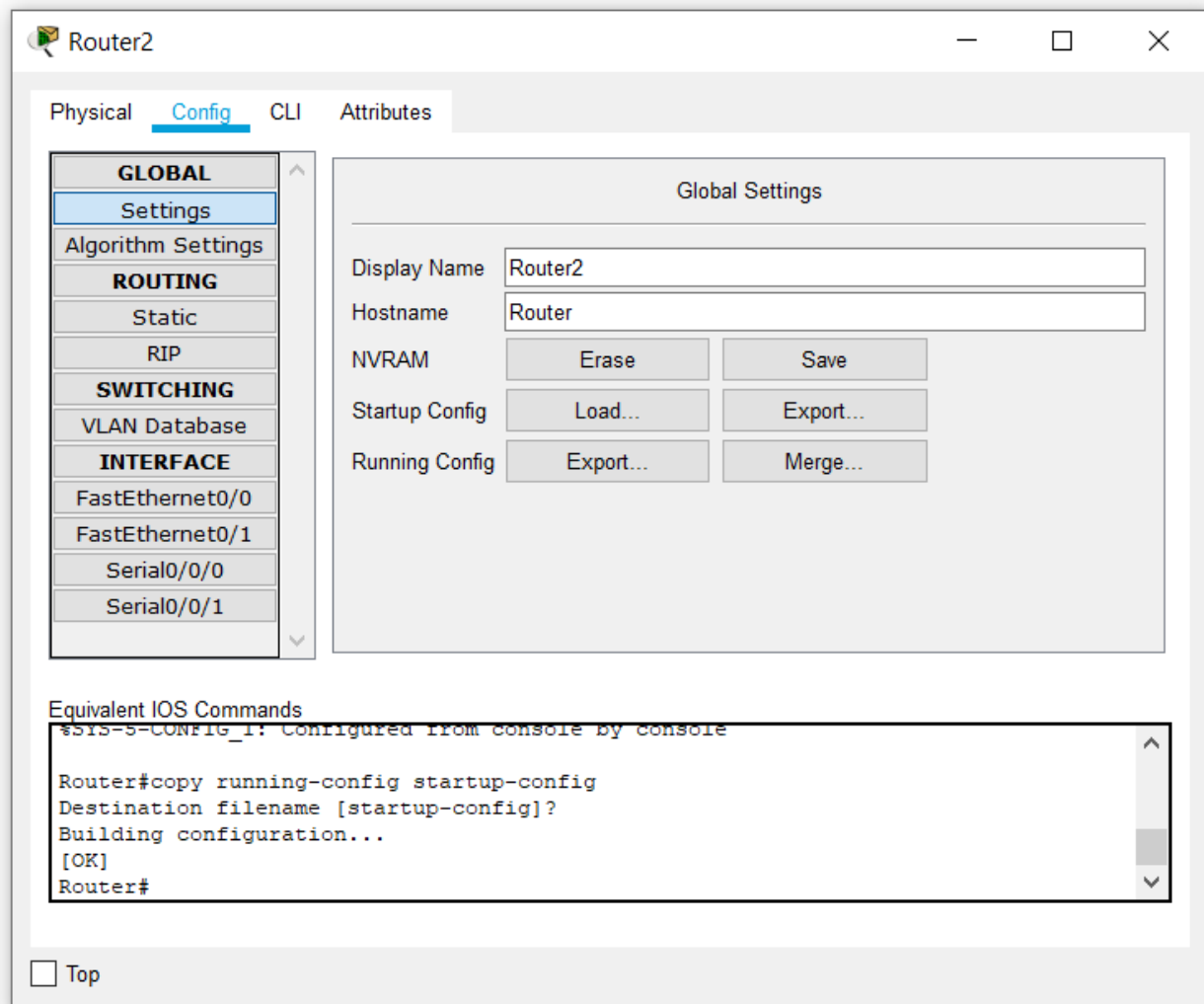
- Port Status: ☒ On
- Duplex: ☐ Full Duplex
- Clock Rate: 2000000
- IP Configuration:
  - IP Address: 192.168.1.190
  - Subnet Mask: 255.255.255.192
- Tx Ring Limit: 10

Below the configuration area, there is a section titled 'Equivalent IOS Commands' containing a list of 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)#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)#
```

At the bottom left of the window, there is a 'Top' button with a checkbox.

Save Running Configuration to NVRAM by clicking on save button in settings of R1 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 configuration:

The screenshot shows the 'PC1' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'FastEthernet0' interface. The 'Static' radio button is selected for IP configuration. The IP Address is 192.168.1.126, Subnet Mask is 255.255.255.192, Default Gateway is 192.168.1.65, and DNS Server is 0.0.0.0. The 'IPv6 Configuration' section is also expanded, showing 'Static' selected for IPv6 configuration. The IPv6 Address is empty, Link Local Address is FE80::200:CFF:FE48:E44A, IPv6 Gateway is empty, and IPv6 DNS Server is empty. The '802.1X' section is collapsed, and the 'Authentication' dropdown is set to 'MD5'. A 'Top' button is at the bottom left.

PC1

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ 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

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address /

Link Local Address FE80::200:CFF:FE48:E44A

IPv6 Gateway

IPv6 DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

☐ Top

PC2 configuration:

The image shows a configuration window for a device named 'PC2'. The window has four tabs: 'Physical', 'Config', 'Desktop' (which is selected and highlighted in blue), 'Programming', and 'Attributes'. In the 'Desktop' tab, there is a section titled 'IP Configuration' with a close button 'X' in its top right corner. Below this title, there is a dropdown menu for 'Interface' set to 'FastEthernet0'. Underneath, there are two radio buttons: 'DHCP' (unselected) and 'Static' (selected). Below these are five text input fields: 'IP Address' (192.168.1.254), 'Subnet Mask' (255.255.255.192), 'Default Gateway' (192.168.1.193), and 'DNS Server' (0.0.0.0). Below the IP Configuration section is an 'IPv6 Configuration' section. It has three radio buttons: 'DHCP' (unselected), 'Auto Config' (unselected), and 'Static' (selected). Below these are four text input fields: 'IPv6 Address' (empty), 'Link Local Address' (FE80::2D0:D3FF:FEB2:228), 'IPv6 Gateway' (empty), and 'IPv6 DNS Server' (empty). Below the IPv6 section is an '802.1X' section with a checkbox 'Use 802.1X Security' (unchecked) and a dropdown menu for 'Authentication' set to 'MD5'. At the bottom left of the window is a checkbox labeled 'Top'.

PC2

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ 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

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address /

Link Local Address FE80::2D0:D3FF:FEB2:228

IPv6 Gateway

IPv6 DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

☐ Top

## Switch1 Configuration

Switch1

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2,
changed state to up

Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface FastEthernet0/1
Switch(config-if)#exit
Switch(config)#interface vlan1
Switch(config-if)#ip address 192.168.1.2 255.255.255.224
Switch(config-if)#ip default-gateway 192.168.1.65
Switch(config)#interface vlan1
Switch(config-if)#no shutdown

Switch(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

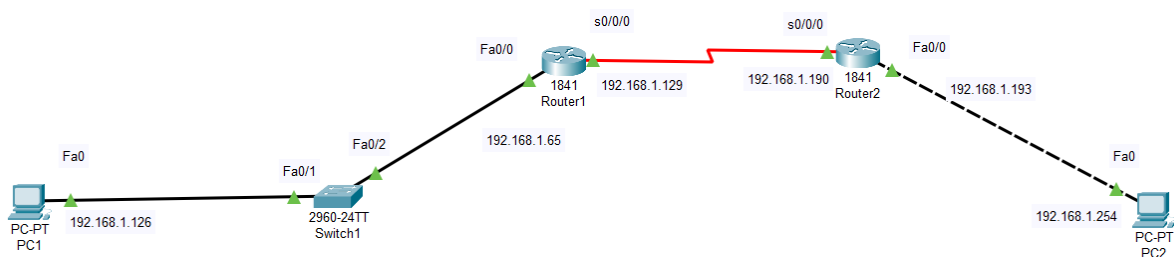
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed
state to up

Switch(config-if)#ip address 192.168.1.2 255.255.255.192
Switch(config-if)#
```

Ctrl+F6 to exit CLI focus

Copy Paste

☐ Top





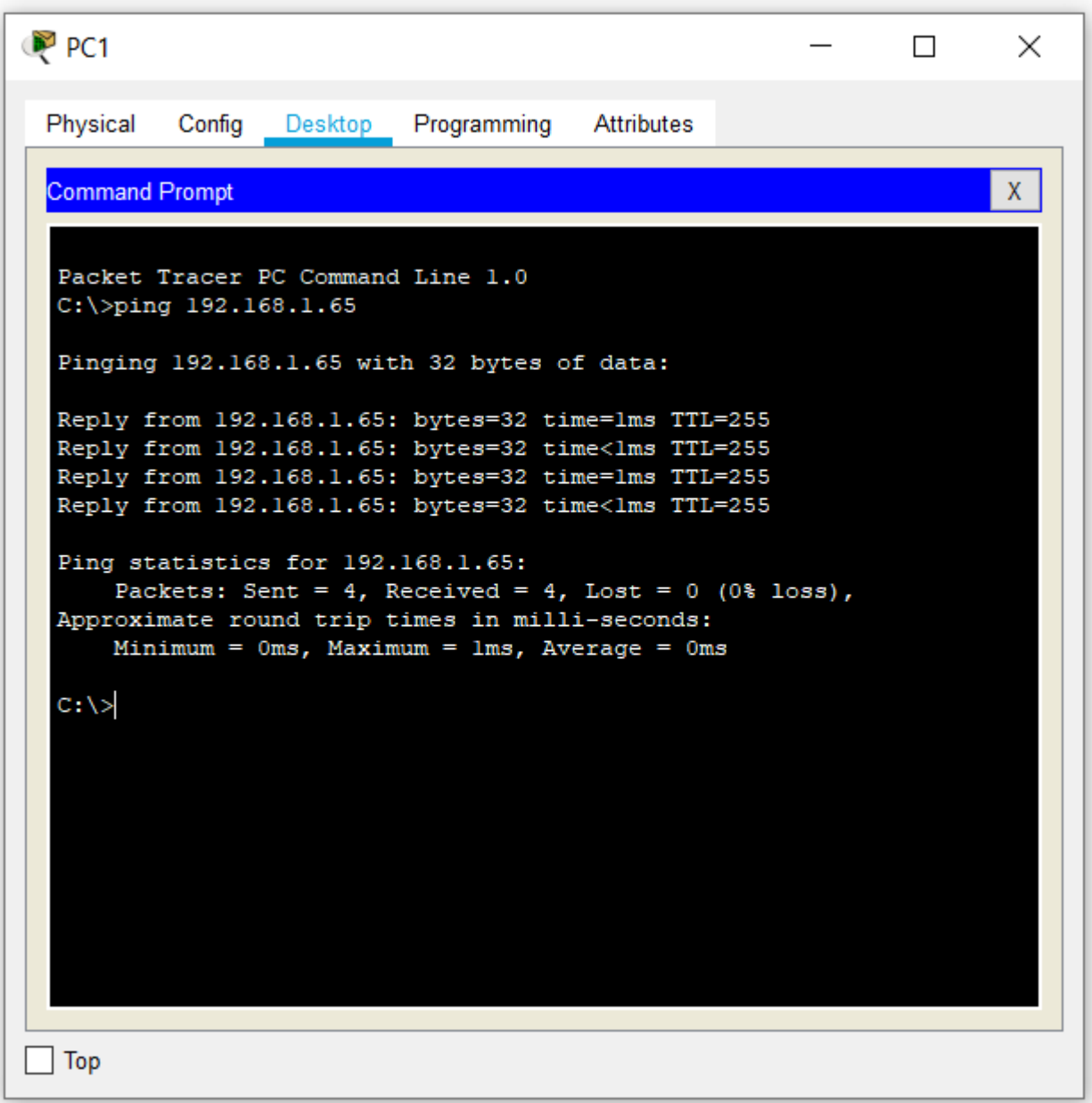
#### Task 4: Verify the Configurations.

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?

**Yes**

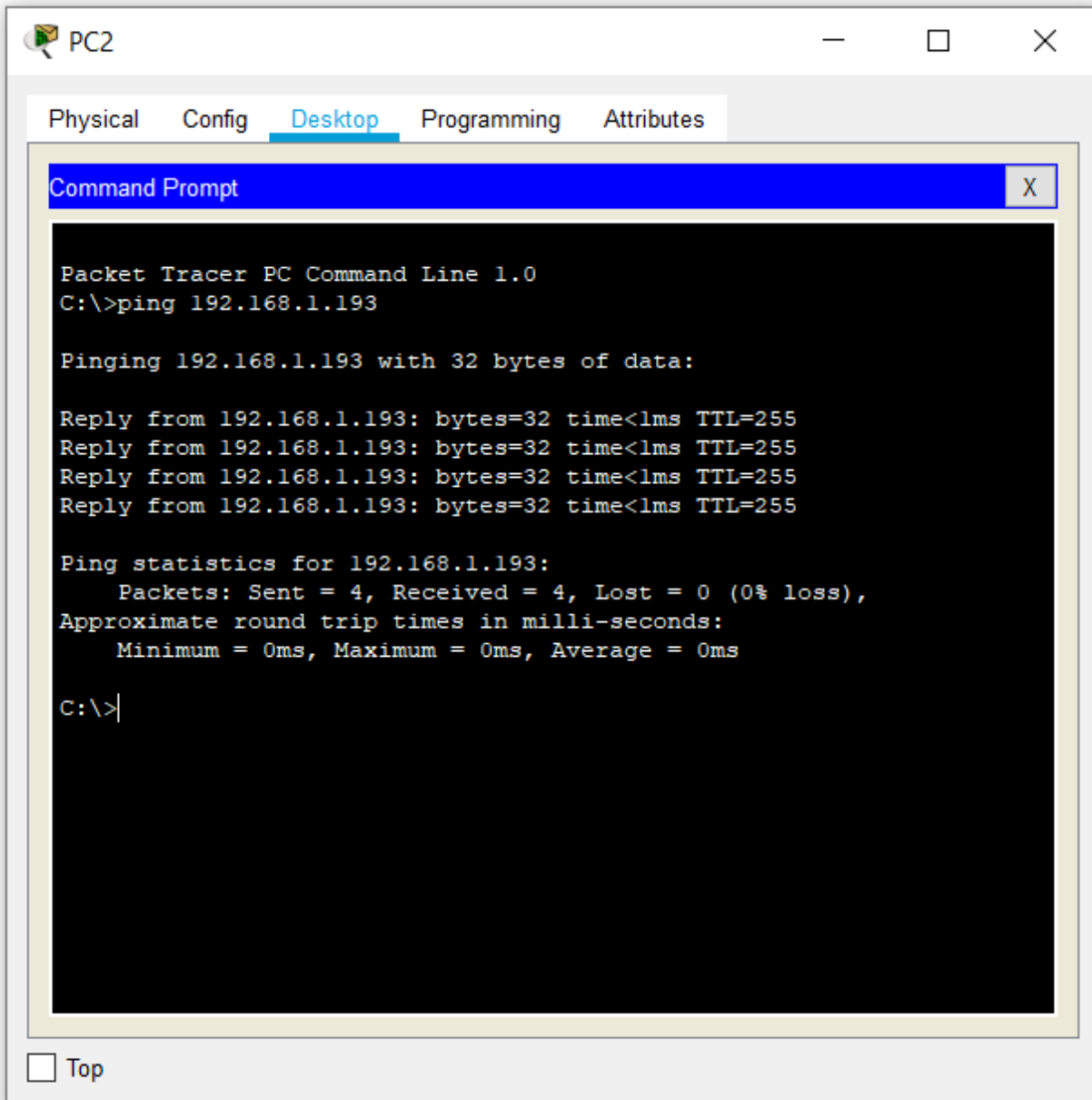
Successful ping from PC1 to default gateway i.e. Fa0/0 of R1



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

**Yes**

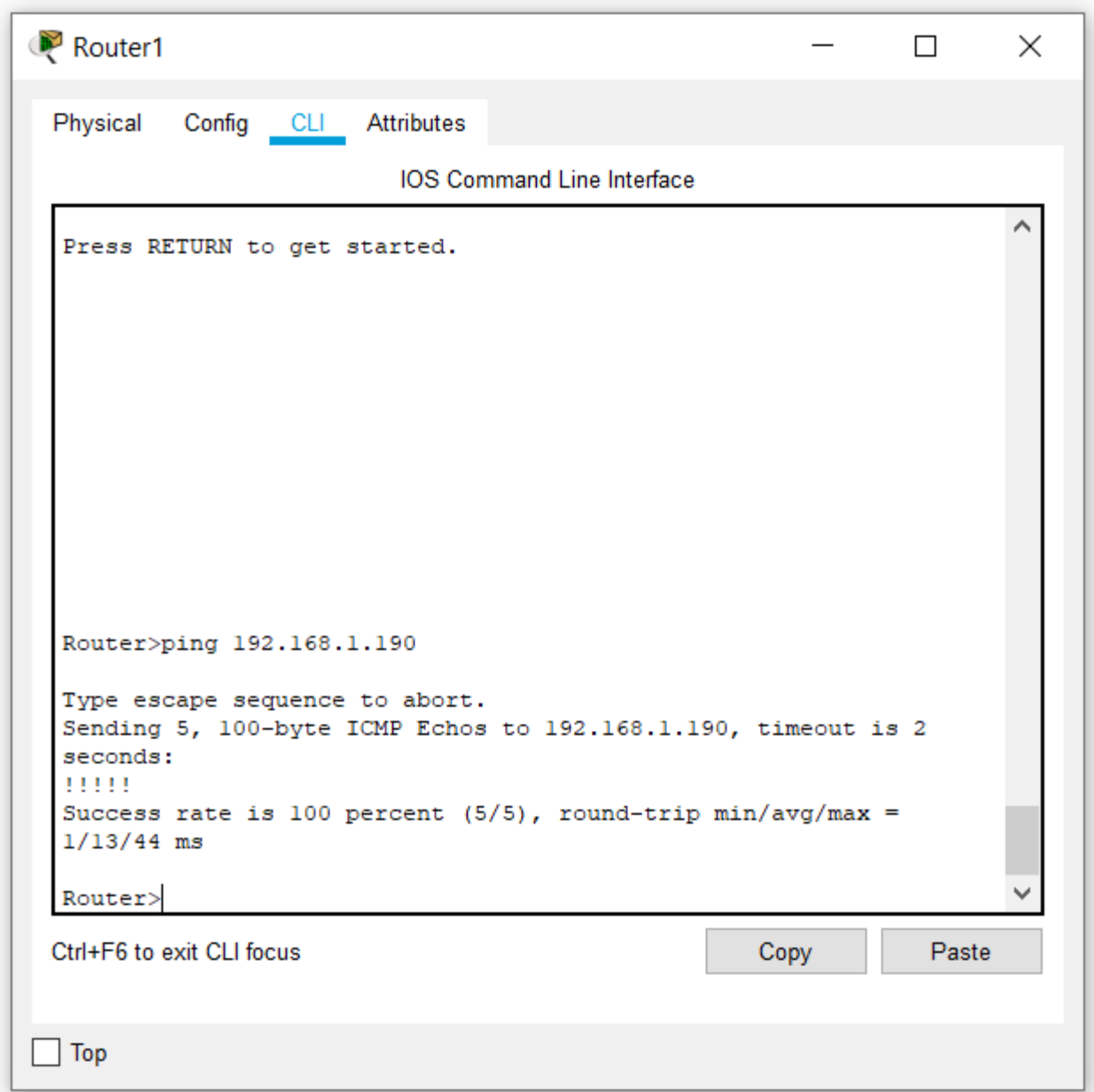
Successful ping from PC2 to default gateway i.e. Fa0/0 of R2



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

**Yes**

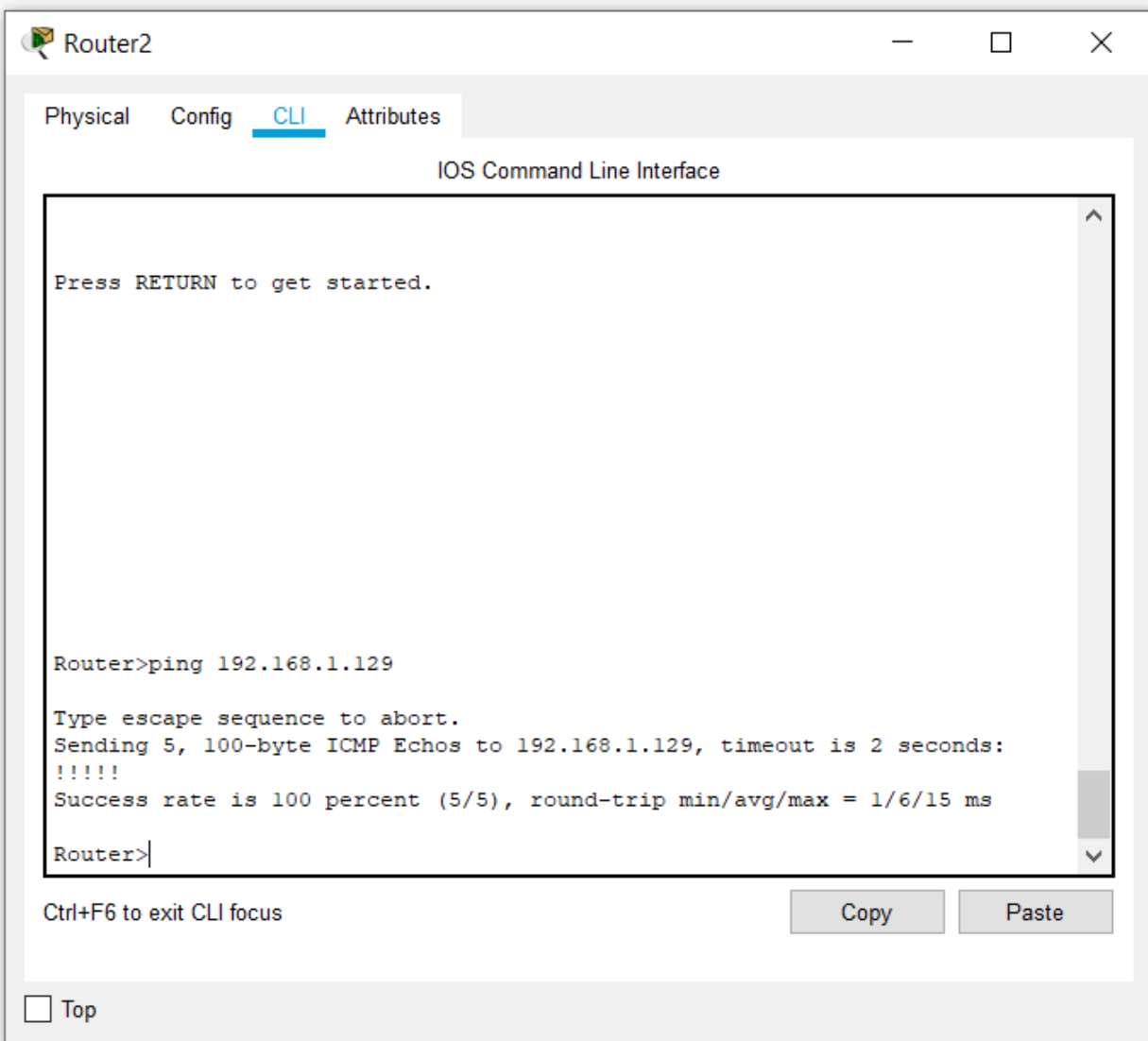
Successful ping from R1 to port S0/0/0 of Router2



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

**Yes**

Successful ping from R2 to port S0/0/0 of R1



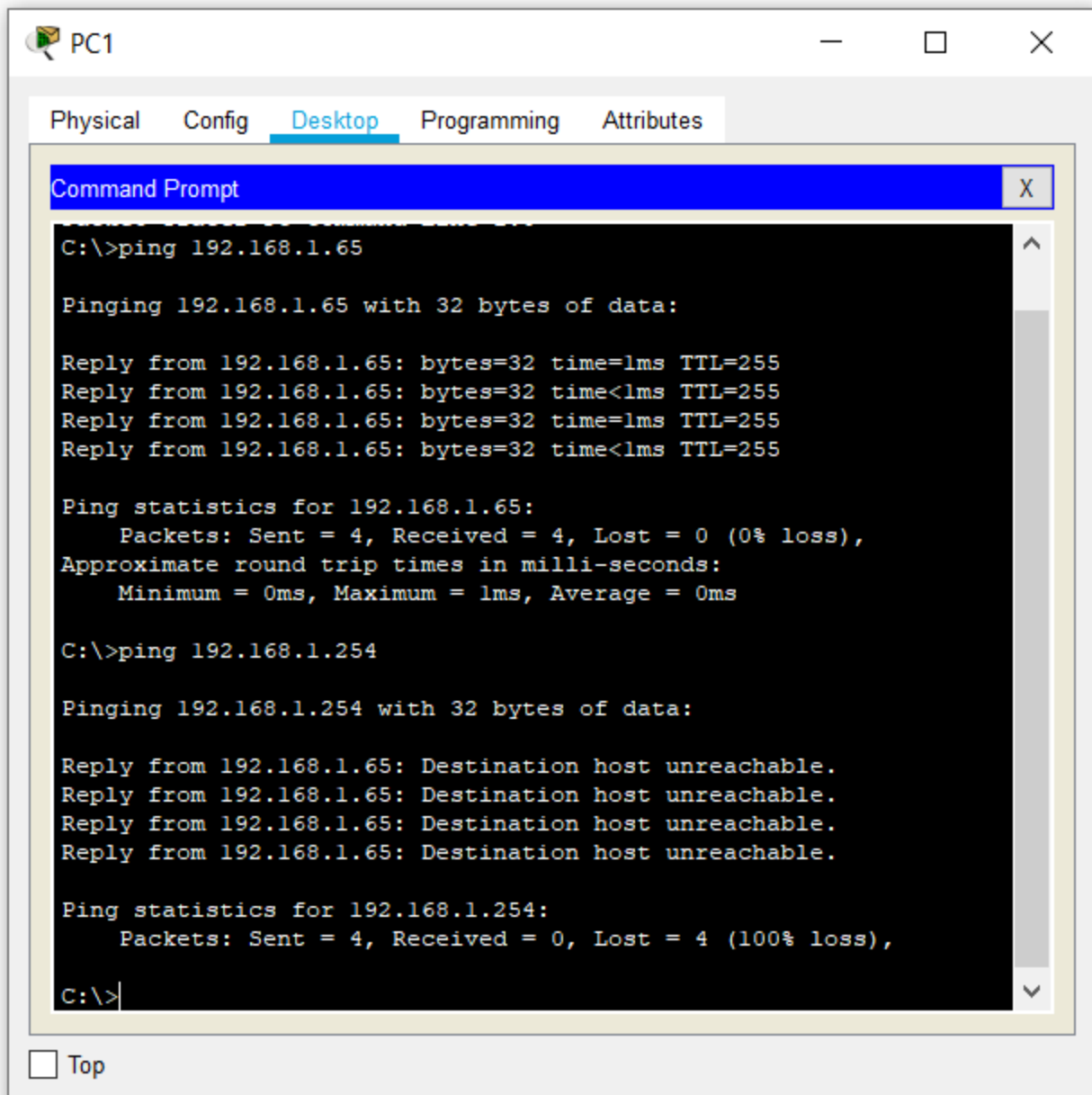
The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations.

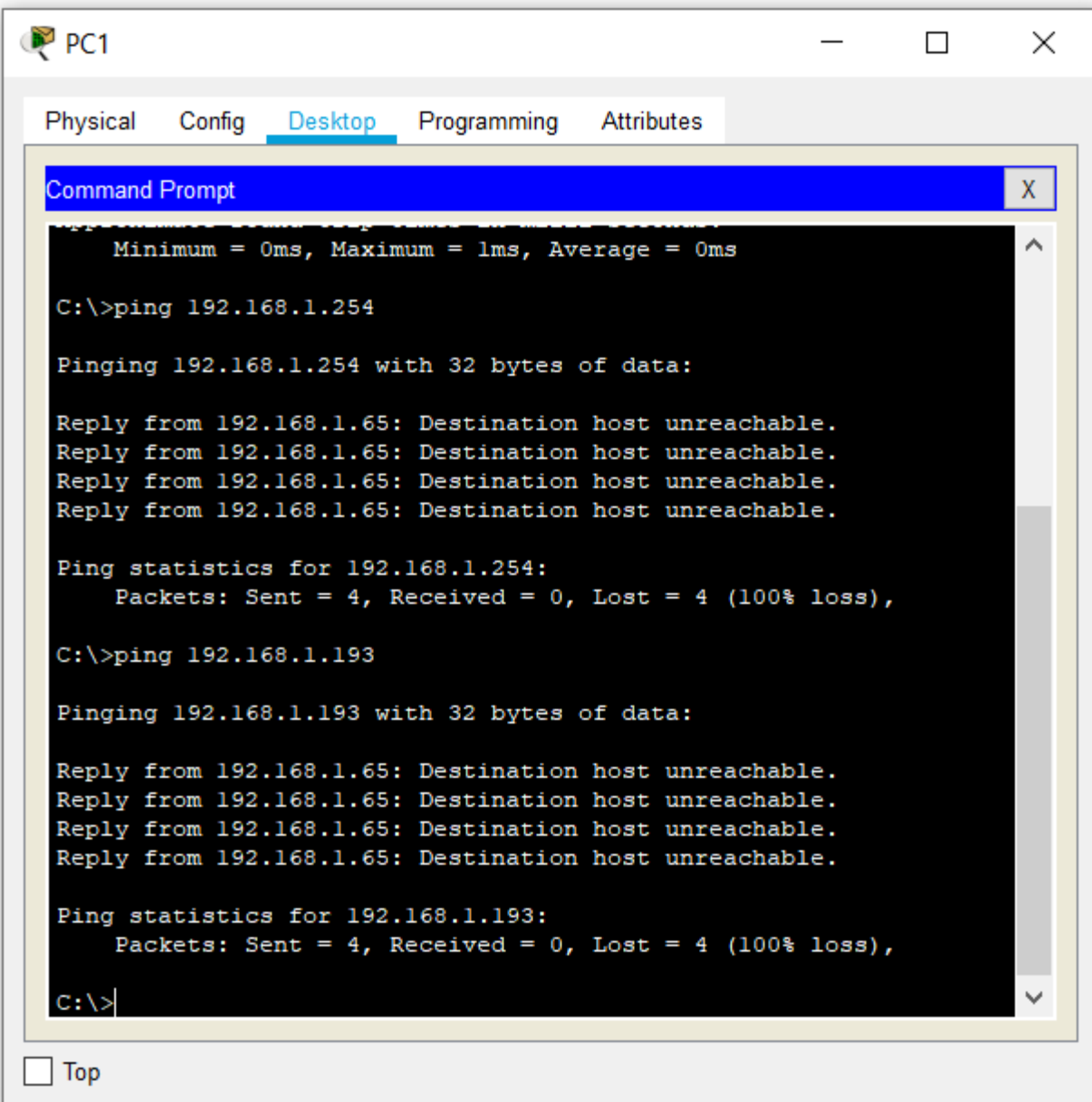
### Task 5: Reflection

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

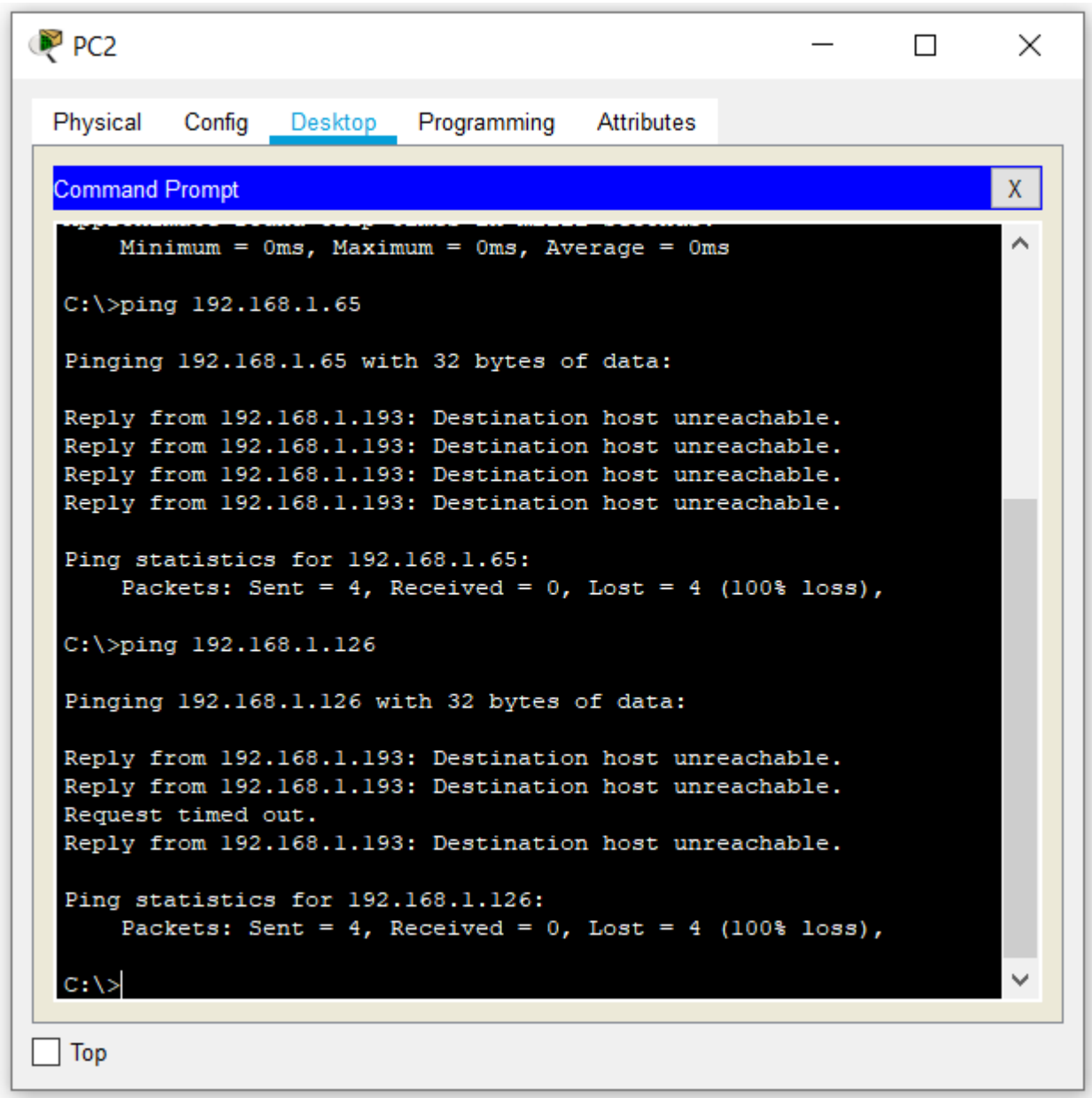
**Yes**, there are devices on the network that cannot ping each other.

- PC1 cannot ping FastEthernet port of Router2 and PC2





PC2 cannot ping FastEthernet port of Router1 and PC1



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

Router1

PhysicalConfigCLIAttributes

IOS Command Line Interface

```
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 = 1/13/44 ms

Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

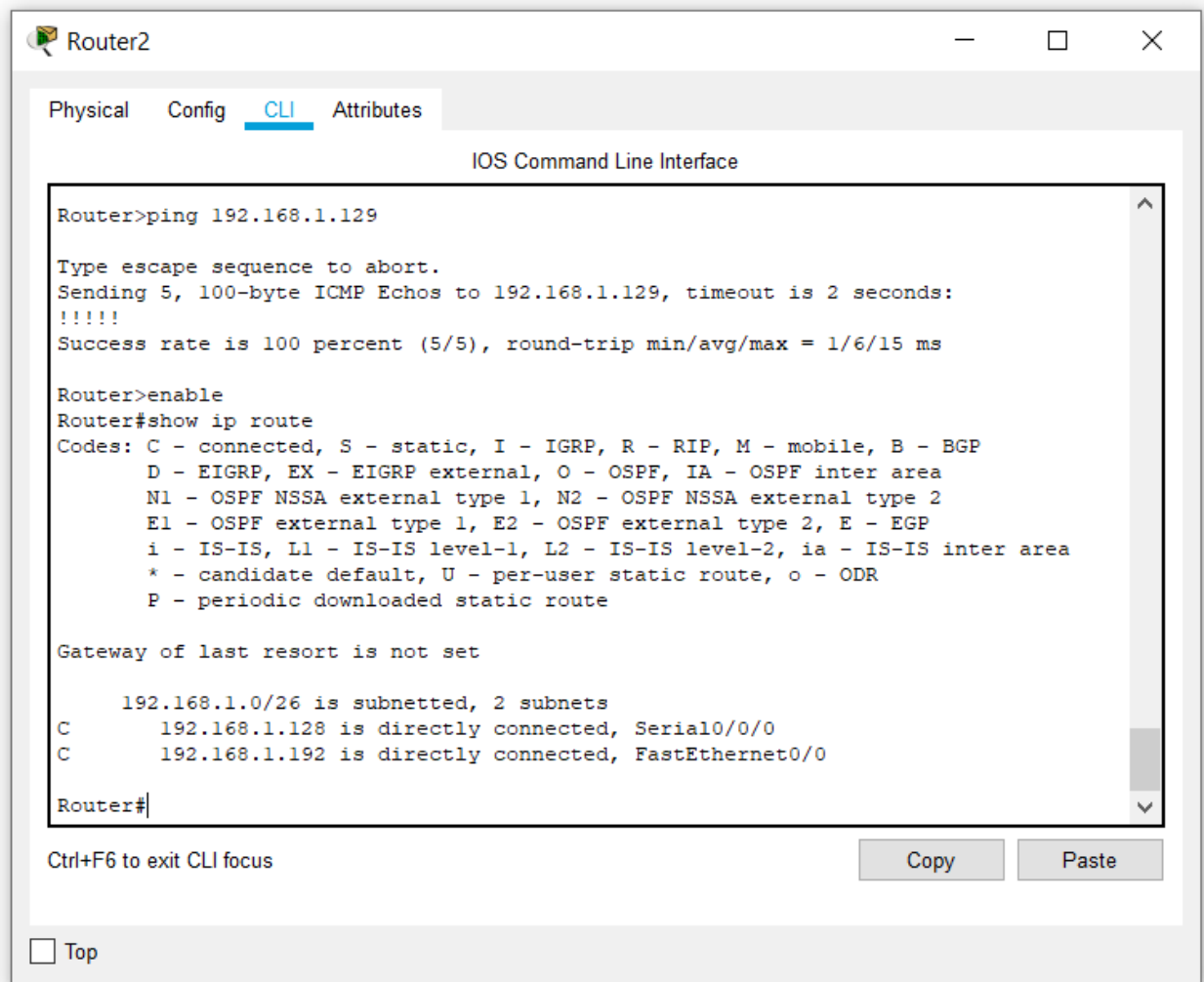
      192.168.1.0/26 is subnetted, 2 subnets
C      192.168.1.64 is directly connected, FastEthernet0/0
C      192.168.1.128 is directly connected, Serial0/0/0

Router#
```

Ctrl+F6 to exit CLI focusCopyPaste

☐ Top





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:

In this experiment I learned about subnetting a given address space and assigning subnets to various networks and router configuration.