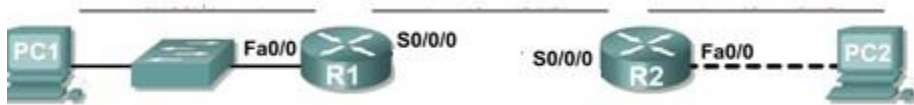


## Lab 6: Subnet and Router Configuration

---

### Topology Diagram



### Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0			N/A
	S0/0/0			N/A
R2	Fa0/0			N/A
	S0/0/0			N/A
PC1	NIC			
PC2	NIC			

### 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. Q.** How many subnets are needed for this network?

**Ans:** 3 subnets will be needed for this network:

1. For the network connected to R1
2. For the network between the routers R1 and R2
3. For the network connected to R2

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

**Ans:** 192.168.1.0/24 is a class C type of network for which the default subnet mask is 255.255.255.0 which in binary is = 11111111.11111111.11111111.0. Hence the first 3 octets are reserved for the network id and the last octet for the subnet and host. Since the no. of subnets needed are 3, hence a maximum of 2 bits in the last octet will be required for the subnet ID. Therefore, the subnet mask of the network in binary format is 11111111.11111111.11111111.11000000 which in the decimal format is **255.255.255.192**

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

**Ans:** Binary form of the subnet mask as written above is 11111111.11111111.11111111.11000000. The slash format indicates the no. of 1s in the binary format of the subnet mask. So in this case, the slash format is **/26**

**Q.** How many usable hosts are there per subnet?

**Ans:** The no. of usable hosts in a subnet is given by the formula  $2^B - 2$ , where B is the no. of 0s in the binary format of the subnet mask. In this case, B = 6, and hence  $2^6 - 2 = 62$ . Therefore, there are **62** useable hosts.

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

Out of 8 subnets, only 2 are required. And for each subnet, out of the 64 possible IDs only 62 are useable ( as the other 2 IDs are reserved for the Network ID and Broadcast ID ). Hence assigning the subnets as follows:

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.

Ans: R1 - Fa0/0 = 192.168.1.1

2. Assign the last valid host address in subnet 1 to PC1.

Ans: PC1 - 192.168.1.62

3. Assign the first valid host address in subnet 2 to the WAN interface on R1.

Ans: R1 - S0/0/0 = 192.168.1.65

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

Ans: R2 - S0/0/0 = 192.168.1.126

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

Ans: R2 - Fa0/0 = 192.168.1.129

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

Ans: PC2 - 192.168.1.190

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

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0	192.168.1.1	255.255.255.192	N/A
	S0/0/0	192.168.1.65	255.255.255.192	N/A
R2	Fa0/0	192.168.1.129	255.255.255.192	N/A
	S0/0/0	192.168.1.126	255.255.255.192	N/A
PC1	NIC	192.168.1.62	255.255.255.192	192.168.1.1
PC2	NIC	192.168.1.190	255.255.255.192	192.168.1.129

**Task 3: Configure the Serial and Fast Ethernet 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.

Router1

Physical
Config
CLI
Attributes

GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
FastEthernet0/0
FastEthernet0/1
Serial0/1/0
Serial0/1/1

FastEthernet0/0

FastEthernet0/0

Port Status
☒ On

Bandwidth
☒ 100 Mbps
☐ 10 Mbps
☒ Auto

Duplex
☐ Half Duplex
☒ Full Duplex
☒ Auto

MAC Address
00E0.F7AB.2C01

IP Configuration
IPv4 Address
192.168.1.1
Subnet Mask
255.255.255.192

Tx Ring Limit
10

Router1

Physical
Config
CLI
Attributes

GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
FastEthernet0/0
FastEthernet0/1
Serial0/1/0
Serial0/1/1

Serial0/1/0

Serial0/1/0

Port Status
☒ On

Duplex
☒ Full Duplex

Clock Rate
1200

IP Configuration
IPv4 Address
192.168.1.65
Subnet Mask
255.255.255.192

Tx Ring Limit
10

Router1

Physical
 Config
 CLI
 Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

FastEthernet0/0

FastEthernet0/1

Serial0/1/0

Serial0/1/1

Global Settings

Display Name Router1

Hostname Router

NVRAM

Erase

Save

Startup Config

Load...

Export...

Running Config

Export...

Merge...

Equivalent IOS Commands

```

Router(config-if)#end
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#
%SYS-5-CONFIG I: Configured from console by console
          
```

☐ Top

Router2

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

Serial0/1/0

Serial0/1/1

FastEthernet0/0

Port Status ☒ On

Bandwidth

☒ 100 Mbps
☐ 10 Mbps
☒ Auto

Duplex

☐ Half Duplex
☒ Full Duplex
☒ Auto

MAC Address 0050.0F00.8401

IP Configuration

IPv4 Address 192.168.1.129

Subnet Mask 255.255.255.192

Tx Ring Limit 10

Router2

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  
Serial0/1/0  
Serial0/1/1

### Serial0/0/0

Port Status ☒ On  
Duplex ☐ Full Duplex  
Clock Rate 2000000  

IP Configuration  
IPv4 Address 192.168.1.126  
Subnet Mask 255.255.255.192

Tx Ring Limit 10

Router2

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  
Serial0/1/0  
Serial0/1/1

### Global Settings

Display Name Router2  
Hostname Router  
NVRAM Erase Save  
Startup Config Load... Export...  
Running Config Export... Merge...

Equivalent IOS Commands

```

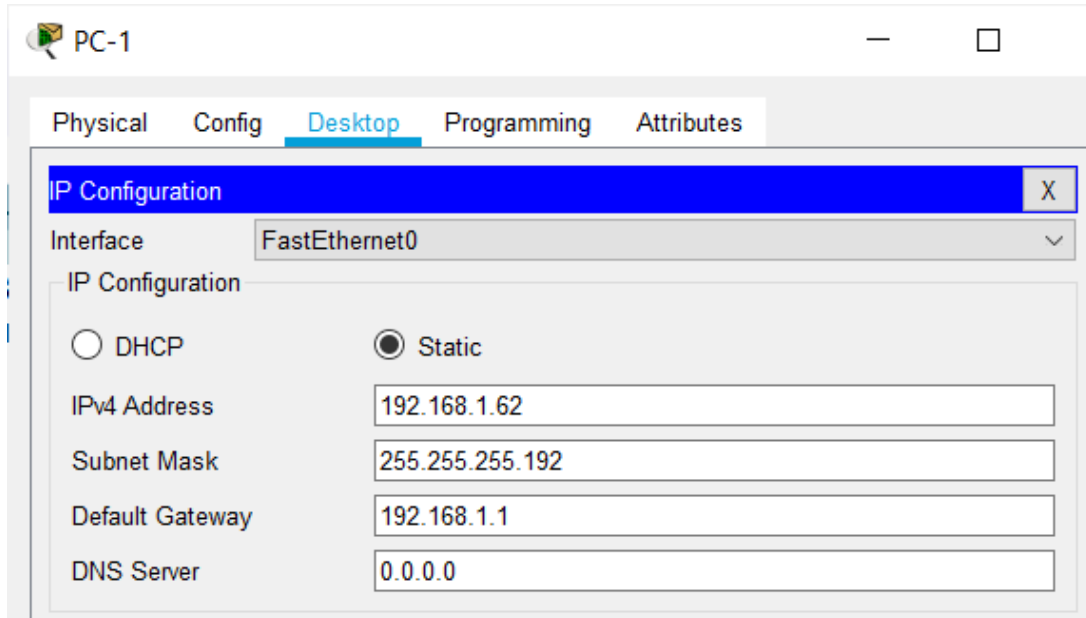
Router(config-if)#end
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#

```

☐ Top

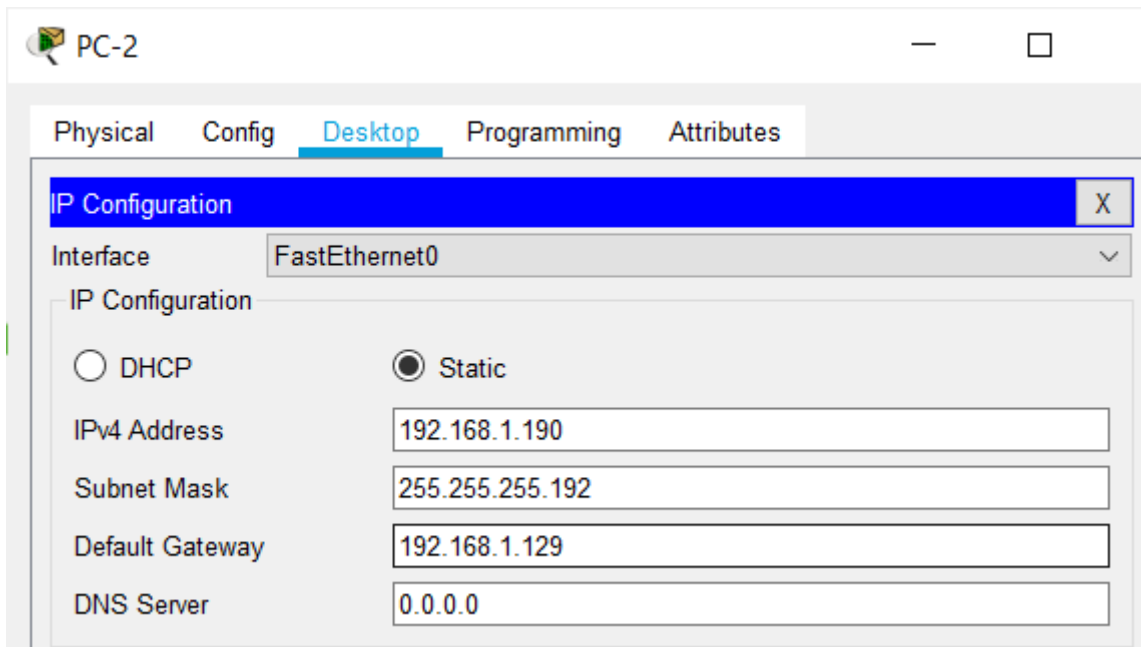
## Step 2: Configure the PC interfaces.

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



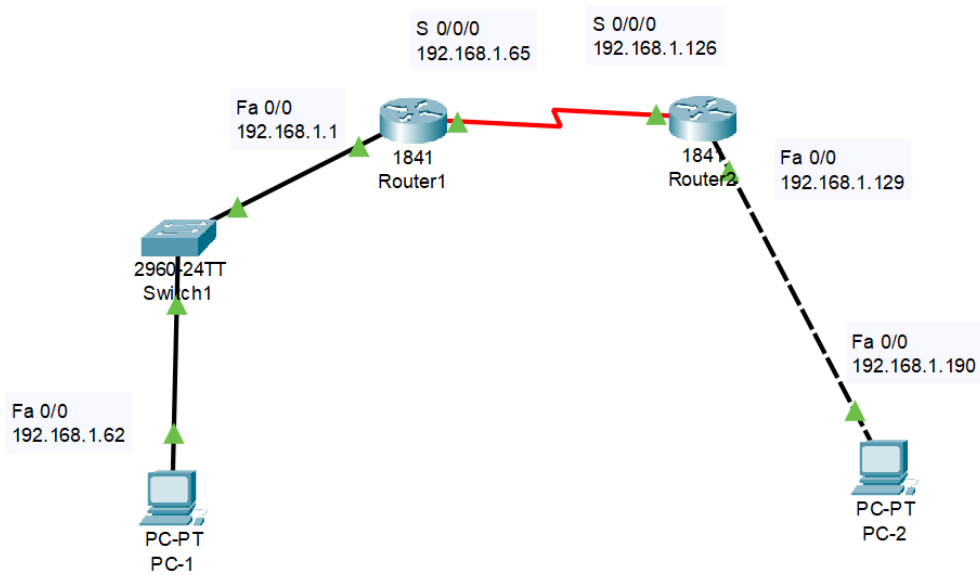
The screenshot shows the 'PC-1' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is active, showing the 'FastEthernet0' interface configured with static IP settings.

Interface	Value
IPv4 Address	192.168.1.62
Subnet Mask	255.255.255.192
Default Gateway	192.168.1.1
DNS Server	0.0.0.0



The screenshot shows the 'PC-2' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is active, showing the 'FastEthernet0' interface configured with static IP settings.

Interface	Value
IPv4 Address	192.168.1.190
Subnet Mask	255.255.255.192
Default Gateway	192.168.1.129
DNS Server	0.0.0.0



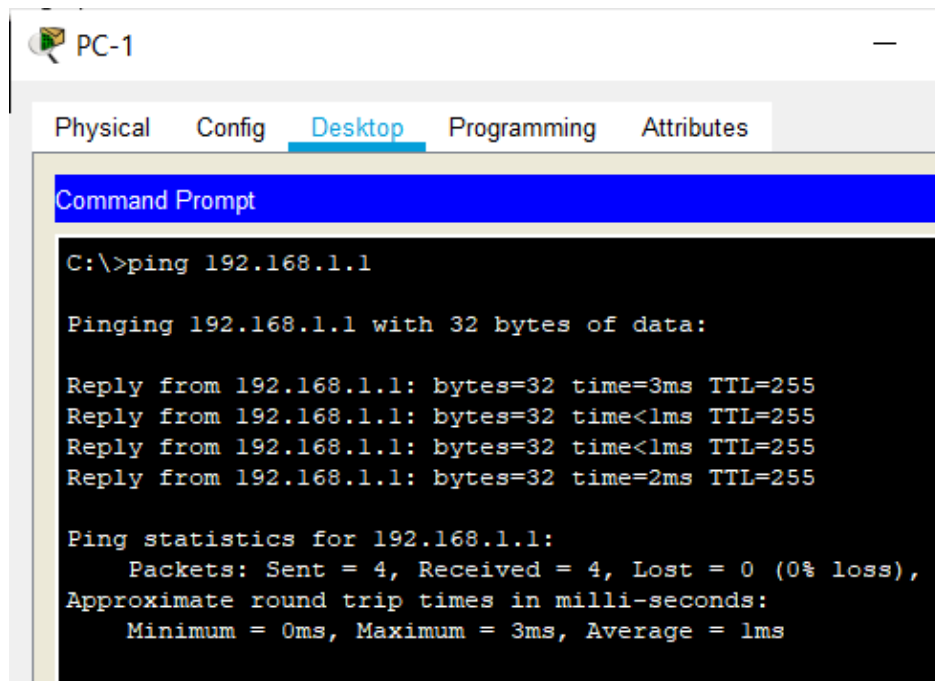
#### Task 4: Verify the Configurations.

Answer the following questions to verify that the network is operating as expected.



**Q.** From the host attached to R1, is it possible to ping the default gateway?

**Ans:** Yes



The screenshot shows a Packet Tracer PC configuration window for PC-1. The 'Desktop' tab is selected, displaying a Command Prompt. The user has entered the command 'ping 192.168.1.1'. The output shows four successful replies from 192.168.1.1 with varying times (3ms, <1ms, <1ms, 2ms) and a TTL of 255. The ping statistics indicate 4 packets sent, 4 received, and 0% loss, with an average round trip time of 1ms.

```
PC-1
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 192.168.1.1

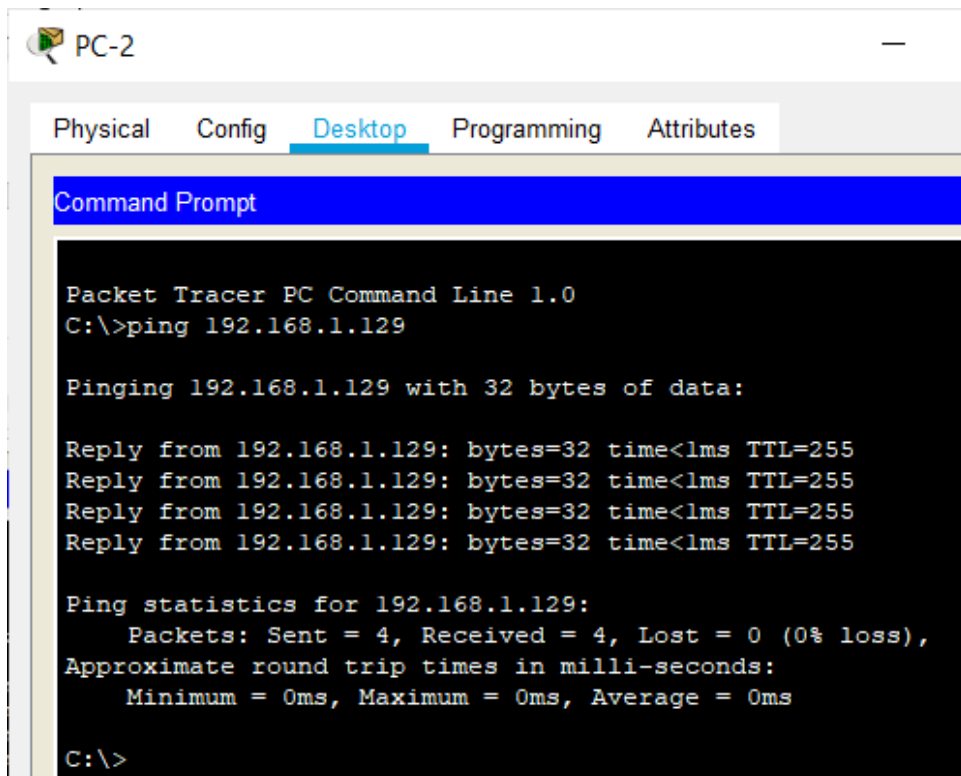
Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=3ms TTL=255
Reply from 192.168.1.1: bytes=32 time<1ms TTL=255
Reply from 192.168.1.1: bytes=32 time<1ms TTL=255
Reply from 192.168.1.1: bytes=32 time=2ms TTL=255

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 1ms
```

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

**Ans:** Yes



The screenshot shows a Packet Tracer PC configuration window for PC-2. The 'Desktop' tab is selected, displaying a Command Prompt. The user has entered the command 'ping 192.168.1.129'. The output shows four successful replies from 192.168.1.129 with a time of <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 0ms.

```
PC-2
Physical Config Desktop Programming Attributes
Command Prompt

Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.129

Pinging 192.168.1.129 with 32 bytes of data:

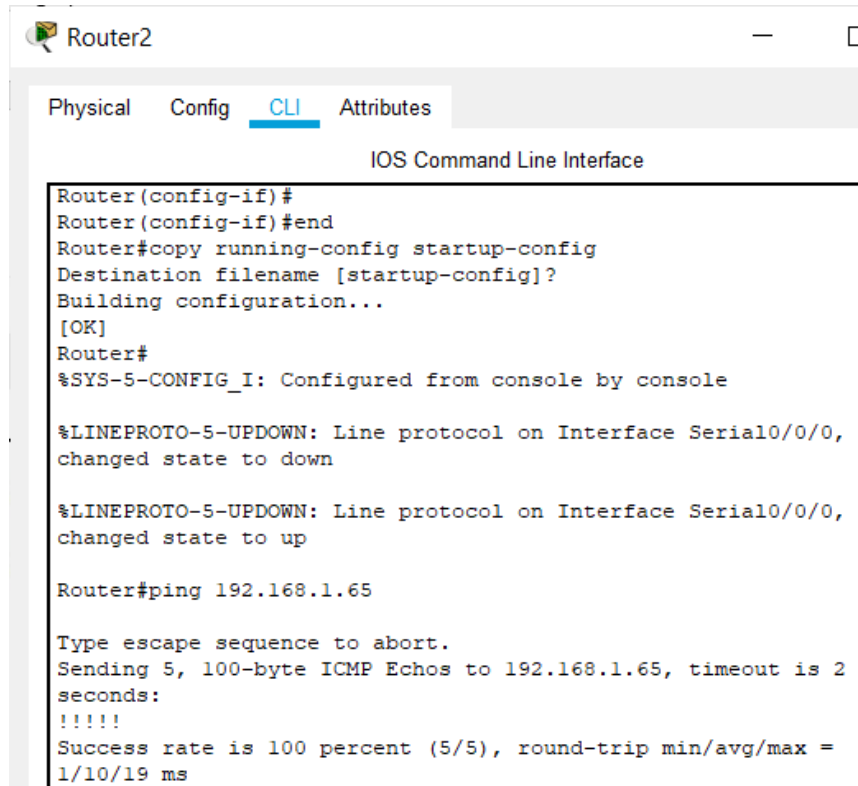
Reply from 192.168.1.129: bytes=32 time<1ms TTL=255
Reply from 192.168.1.129: bytes=32 time<1ms TTL=255
Reply from 192.168.1.129: bytes=32 time<1ms TTL=255
Reply from 192.168.1.129: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.1.129:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

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

**Ans:** Yes



```
Router2
Physical Config CLI Attributes
IOS Command Line Interface
Router(config-if)#
Router(config-if)#end
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#
%SYS-5-CONFIG_I: Configured from console by console

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

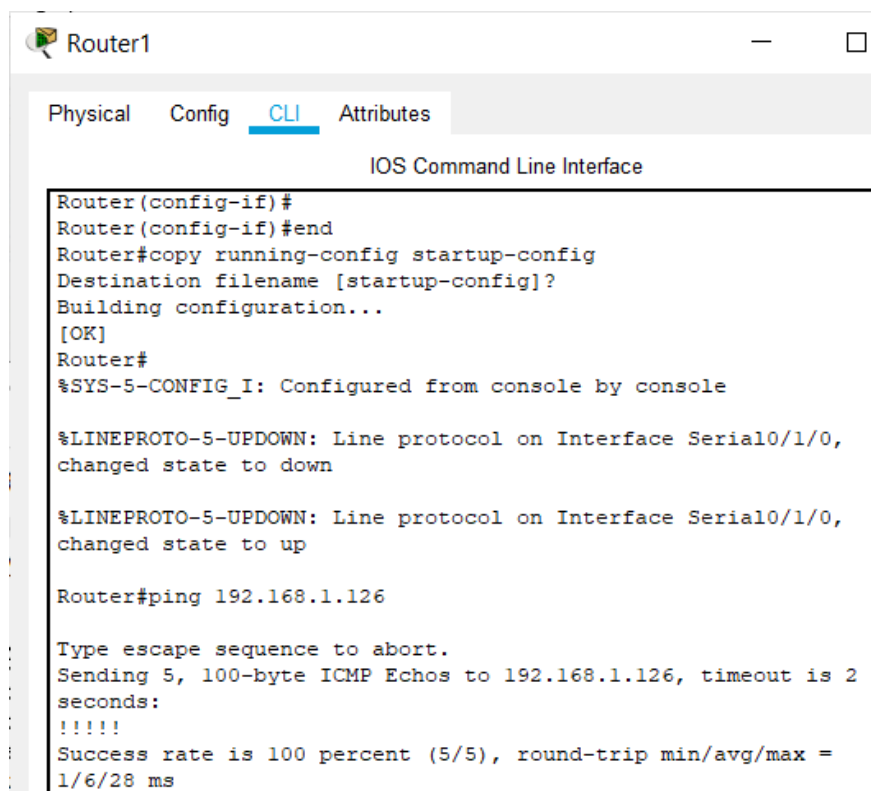
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0,
changed state to up

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 =
1/10/19 ms
```

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

**Ans:**



```
Router1
Physical Config CLI Attributes
IOS Command Line Interface
Router(config-if)#
Router(config-if)#end
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#
%SYS-5-CONFIG_I: Configured from console by console

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0,
changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0,
changed state to up

Router#ping 192.168.1.126

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.126, timeout is 2
seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
1/6/28 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

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

**Ans:** Yes. PC-1 and PC-2 cannot ping each other.

```
C:\>ping 192.168.1.190

Pinging 192.168.1.190 with 32 bytes of data:

Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.

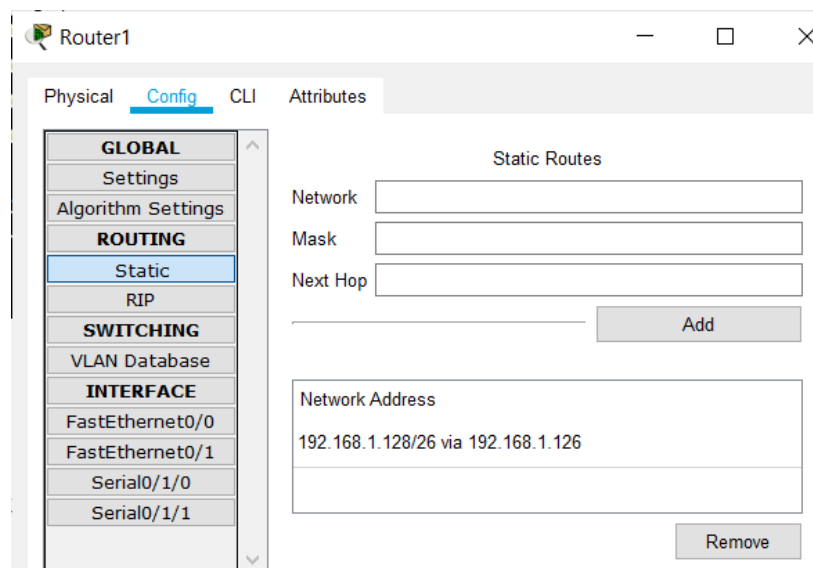
Ping statistics for 192.168.1.190:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

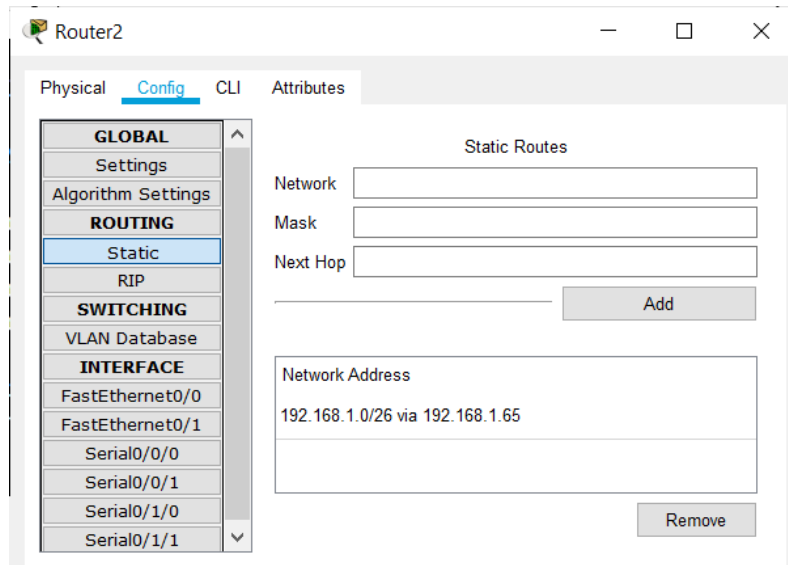
Command Prompt of PC-1

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

**Ans:** We have to make the following static routing configurations to enable successful pig operations.



```
Router(config)#ip route 192.168.1.128 255.255.255.192
192.168.1.126
Router(config)#
```



```
Router(config)#ip route 192.168.1.0 255.255.255.192 192.168.1.65
Router(config)#
```

```
C:\>ping 192.168.1.62

Pinging 192.168.1.62 with 32 bytes of data:

Reply from 192.168.1.62: bytes=32 time=3ms TTL=126
Reply from 192.168.1.62: bytes=32 time=1ms TTL=126
Reply from 192.168.1.62: bytes=32 time=1ms TTL=126
Reply from 192.168.1.62: bytes=32 time=3ms TTL=126

Ping statistics for 192.168.1.62:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 2ms

C:\>
```

```
C:\>ping 192.168.1.190

Pinging 192.168.1.190 with 32 bytes of data:

Reply from 192.168.1.190: bytes=32 time=20ms TTL=126
Reply from 192.168.1.190: bytes=32 time=2ms TTL=126
Reply from 192.168.1.190: bytes=32 time=1ms TTL=126
Reply from 192.168.1.190: bytes=32 time=2ms TTL=126

Ping statistics for 192.168.1.190:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 20ms, Average = 6ms

C:\>
```