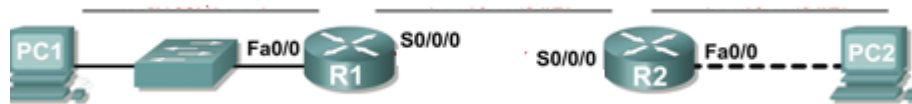


CEL 51, DCCN, Monsoon 2020

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 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?

2 subnets are needed to meet the demand for the 15 and 30 hosts on each of the networks, we need **another subnet** so that we can connect both the subnets with a route that is not belonging to either so that the link shares the same NID.

So, we need total of **3 subnets**

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

CIDR of the assigned network is **24** ,

We are free to use **2⁸ addresses**, we divide the network into **4(2²) subnets** and use **3** of the **4** assigned subnet divisions,

Hence now we have **64 (2⁶) addresses** under each subnet, which can be assigned to the networks.

That translates to the last **6** bits, and reserves the rest **26** bits as NID.

CIDR : **26**

Subnet mask : **11111111. 11111111. 11111111. 11000000**

Subnet mask : **255.255.255.192**

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

Subnet mask in slash format is **/26**

Q. How many usable hosts are there per subnet?

Usable hosts per subnet : $64 - 1 - 1 = 62$ hosts (first and last addresses are reserved for identification and broadcasting respectively)

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

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

Since the first subnet is reserved, we can assign the subnet **192.168.1.64/26** to **R1**

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

We can assign the subnet **192.168.1.128/26** to link between **R1 & R2**

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

We can assign the subnet **192.168.1.192/26** to **R3**

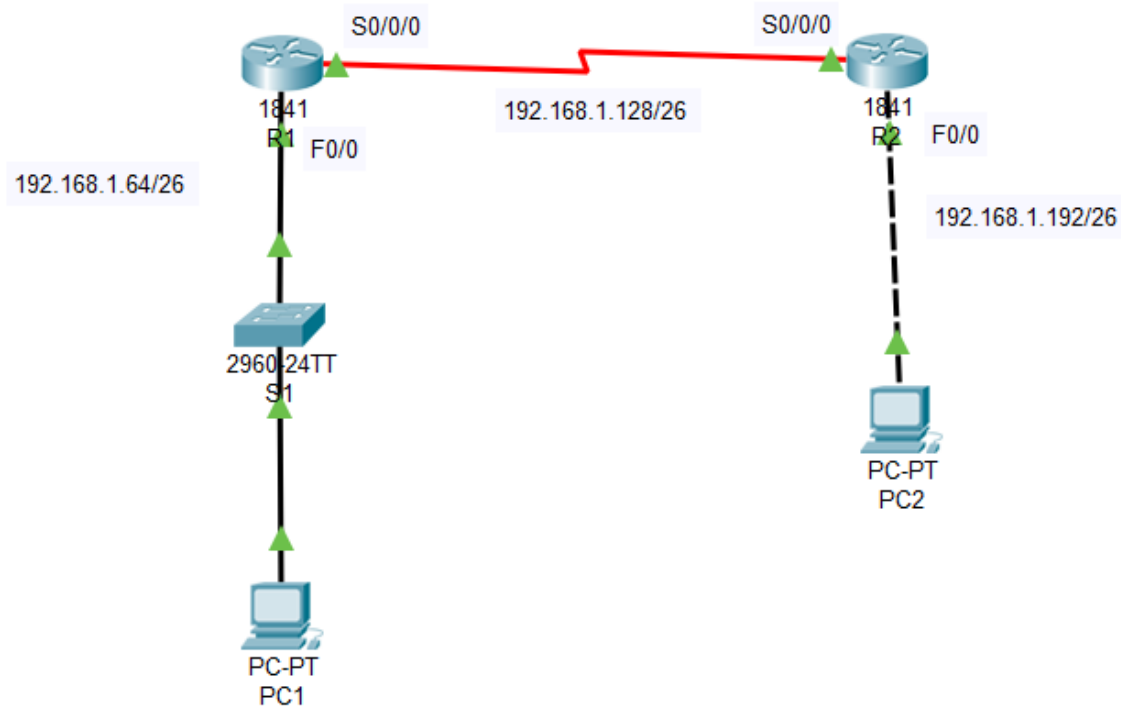
- According to the ranges above we assign the IP addresses as below:

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

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



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.

R1 config

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 0060.47DA.1301

IP Configuration

IP Address 192.168.1.65

Subnet Mask 255.255.255.192

Tx Ring Limit 10

Equivalent IOS Commands

```
% Incomplete command.  
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

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 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

R2 config

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 0006.2A09.3A01

IP Configuration

IP 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 192.168.1.190 255.255.255.192
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)#
```

☐ Top

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

Serial0/0/0

Port Status ☒ On

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)#
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

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 configuration window for PC1. The 'Desktop' tab is selected. The 'IP Configuration' section is expanded, showing the configuration for the 'FastEthernet0' interface. The 'Static' radio button is selected under 'IP Configuration'. The fields are filled with: 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 shows 'Static' selected, with empty fields for IPv6 Address, Link Local Address, IPv6 Gateway, and IPv6 DNS Server. The '802.1X' section has 'Use 802.1X Security' unchecked, and 'Authentication' set to 'MD5'. A 'Top' button is at the bottom left.

Interface	IP Configuration	IPv6 Configuration	802.1X
FastEthernet0	<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	<input type="radio"/> DHCP <input type="radio"/> Auto Config <input checked="" type="radio"/> Static IPv6 Address: Link Local Address: FE80::201:64FF:FE9D:8AC IPv6 Gateway: IPv6 DNS Server:	<input type="checkbox"/> Use 802.1X Security Authentication: MD5 Username: Password:

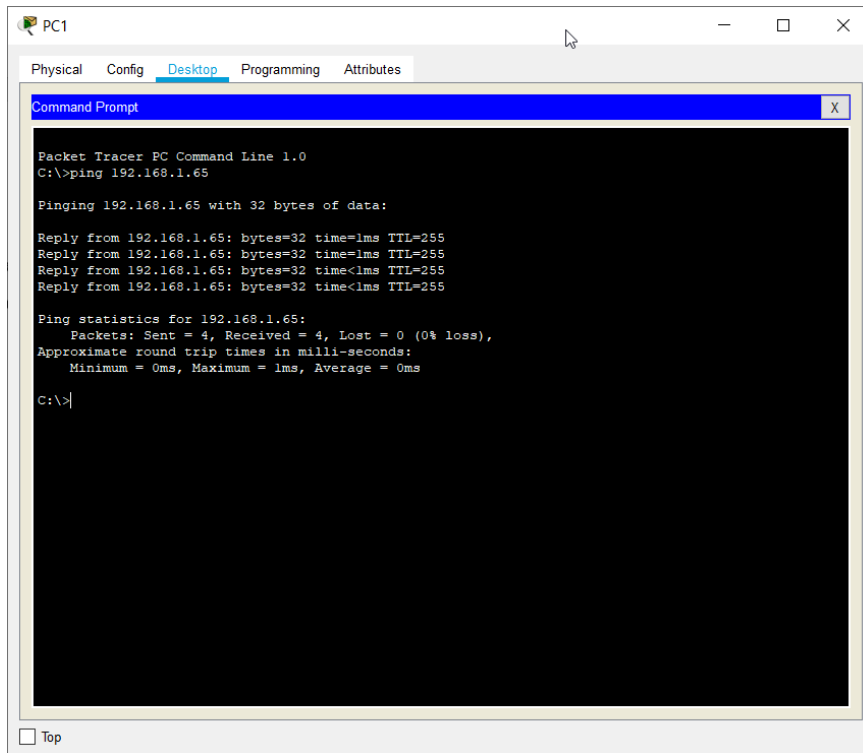
The screenshot shows the configuration window for PC2. The 'Desktop' tab is selected. The 'IP Configuration' section is expanded, showing the configuration for the 'FastEthernet0' interface. The 'Static' radio button is selected under 'IP Configuration'. The fields are filled with: IP Address: 192.168.1.254, Subnet Mask: 255.255.255.192, Default Gateway: 192.168.1.193, and DNS Server: 0.0.0.0. The 'IPv6 Configuration' section shows 'Static' selected, with empty fields for IPv6 Address, Link Local Address, IPv6 Gateway, and IPv6 DNS Server. The '802.1X' section has 'Use 802.1X Security' unchecked, and 'Authentication' set to 'MD5'. A 'Top' button is at the bottom left.

Interface	IP Configuration	IPv6 Configuration	802.1X
FastEthernet0	<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	<input type="radio"/> DHCP <input type="radio"/> Auto Config <input checked="" type="radio"/> Static IPv6 Address: Link Local Address: FE80::290:2BFF:FE93:6C59 IPv6 Gateway: IPv6 DNS Server:	<input type="checkbox"/> Use 802.1X Security Authentication: MD5 Username: Password:

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?



The screenshot shows a Packet Tracer PC window for PC1. The 'Desktop' tab is active, displaying a 'Command Prompt' window. The command prompt shows the execution of the command 'C:\>ping 192.168.1.65'. The output indicates a successful ping with 4 replies, each from 192.168.1.65, with 32 bytes of data, a time of 1ms, and a TTL of 255. The ping statistics show 4 packets sent, 4 received, 0% loss, and approximate round trip times of 0ms, 1ms, and 0ms.

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

Pinging 192.168.1.65 with 32 bytes of data:

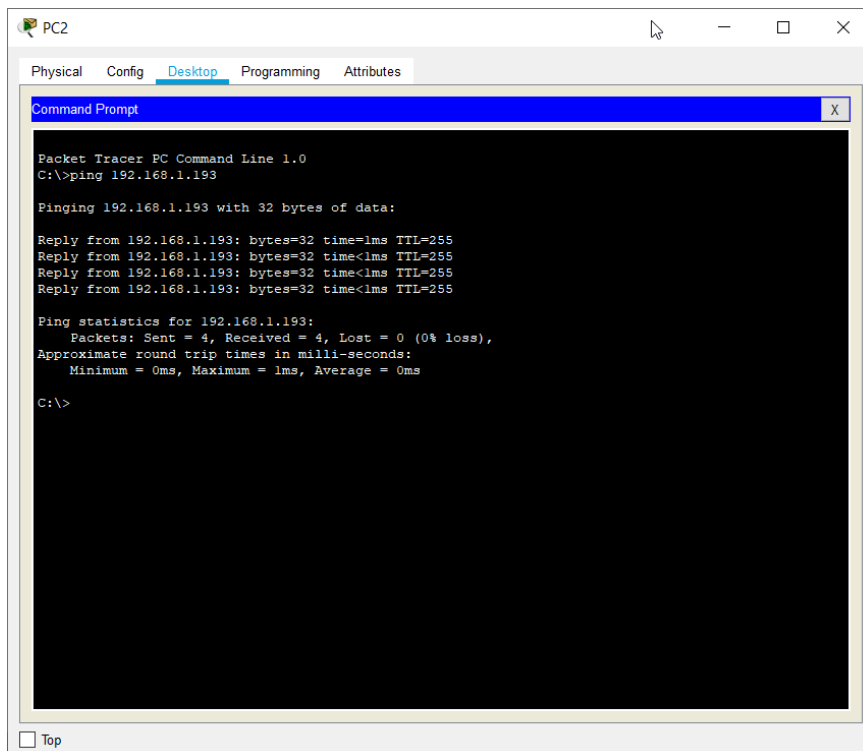
Reply from 192.168.1.65: bytes=32 time=1ms TTL=255
Reply from 192.168.1.65: bytes=32 time=1ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255
Reply from 192.168.1.65: bytes=32 time<1ms TTL=255

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 = 1ms, Average = 0ms

C:\>
```

Yes

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



The screenshot shows a Packet Tracer PC window for PC2. The 'Desktop' tab is active, displaying a 'Command Prompt' window. The command prompt shows the execution of the command 'C:\>ping 192.168.1.193'. The output indicates a successful ping with 4 replies, each from 192.168.1.193, with 32 bytes of data, a time of 1ms, and a TTL of 255. The ping statistics show 4 packets sent, 4 received, 0% loss, and approximate round trip times of 0ms, 1ms, and 0ms.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.193

Pinging 192.168.1.193 with 32 bytes of data:

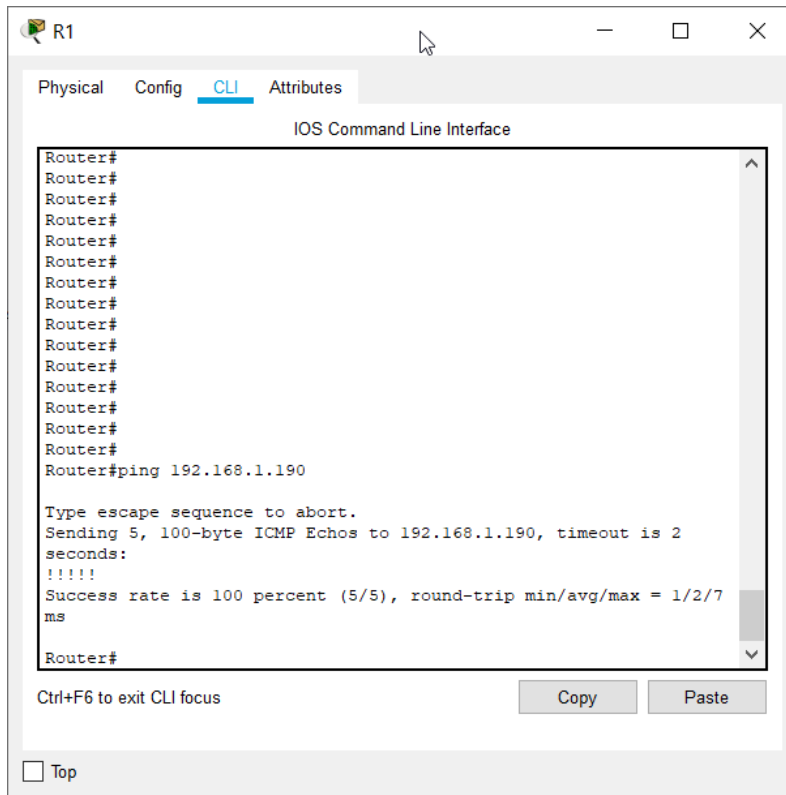
Reply from 192.168.1.193: bytes=32 time=1ms TTL=255
Reply from 192.168.1.193: bytes=32 time<1ms TTL=255
Reply from 192.168.1.193: bytes=32 time<1ms TTL=255
Reply from 192.168.1.193: bytes=32 time<1ms TTL=255

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

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



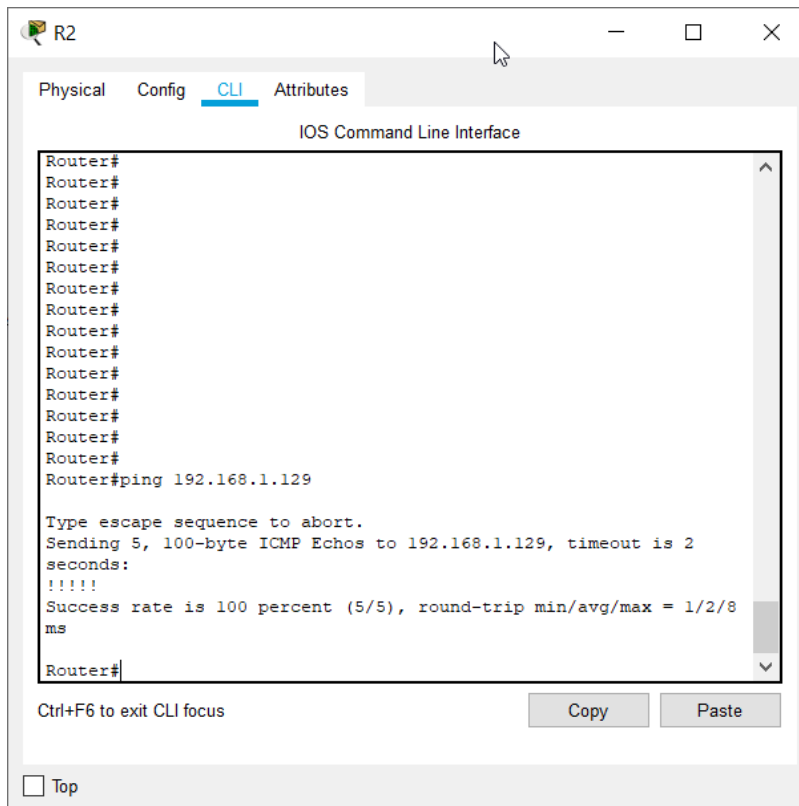
The screenshot shows the CLI of Router R1. The command 'ping 192.168.1.190' has been executed, resulting in a success rate of 100 percent (5/5) with a round-trip time of 1/2/7 ms. The interface includes tabs for Physical, Config, CLI, and Attributes, and a 'Top' button at the bottom.

```
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
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 = 1/2/7
ms
Router#
```

Yes

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



The screenshot shows the CLI of Router R2. The command 'ping 192.168.1.129' has been executed, resulting in a success rate of 100 percent (5/5) with a round-trip time of 1/2/8 ms. The interface includes tabs for Physical, Config, CLI, and Attributes, and a 'Top' button at the bottom.

```
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 = 1/2/8
ms
Router#
```

Yes

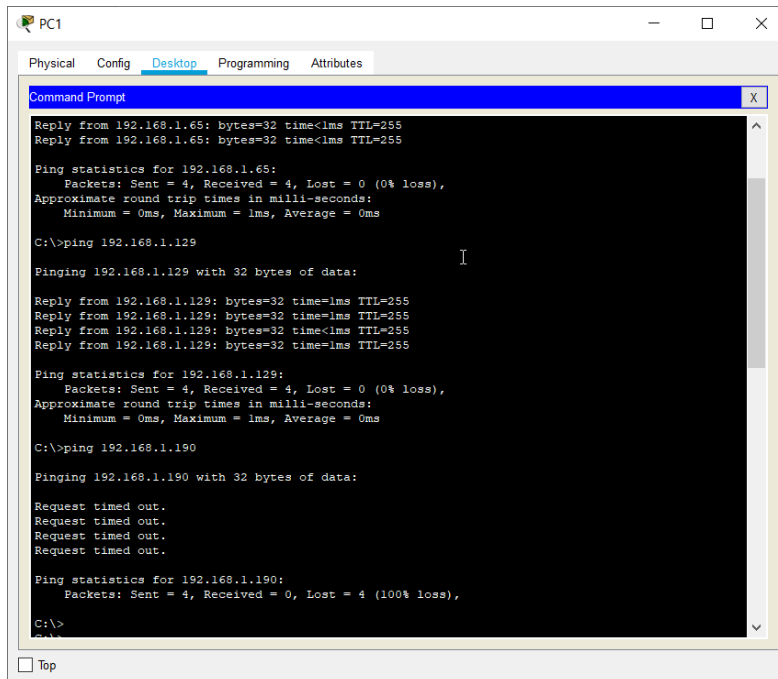
Task 5: Reflection

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

Yes,

PC1 has access to Router1, and can ping the F0/0 of R1, and S0/0/0 of the router, however, it can't ping the S0/0/0 of R2 or ping beyond it's own subnet.

Similarly PC2, can maximum ping till S0/0/0 of R2, and not beyond, i.e PC1 can't ping PC-2 and vice versa.



The screenshot shows the Command Prompt window on PC1. It displays the results of several ping commands. The first two pings are successful, reaching 192.168.1.65 and 192.168.1.129. The third ping, to 192.168.1.190, fails with 'Request timed out' and a 100% loss rate. The window has tabs for Physical, Config, Desktop, Programming, and Attributes, with Desktop selected.

```
PC1
Physical Config Desktop Programming Attributes
Command Prompt
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 = 1ms, Average = 0ms

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 = 1ms, Average = 0ms

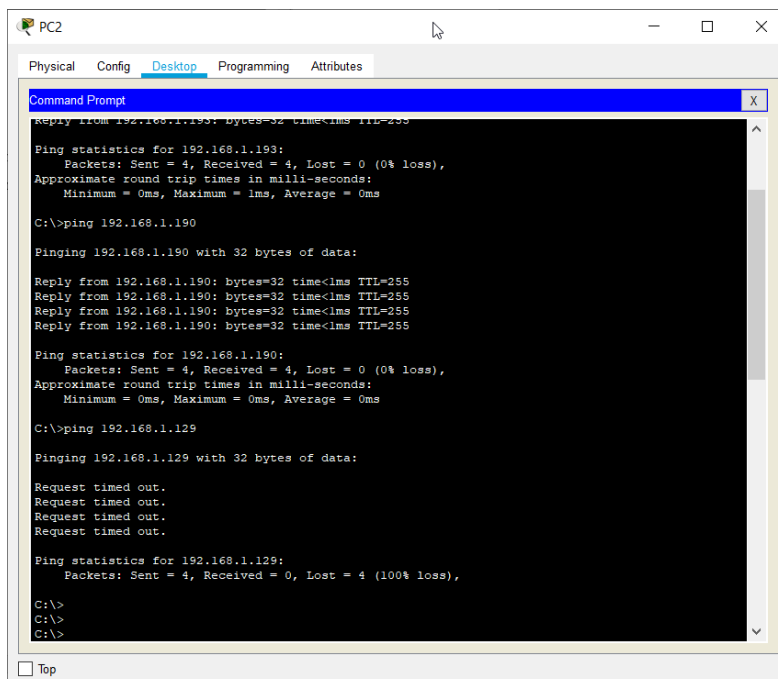
C:\>ping 192.168.1.190

Pinging 192.168.1.190 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

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

C:\>
```



The screenshot shows the Command Prompt window on PC2. It displays the results of several ping commands. The first two pings are successful, reaching 192.168.1.190 and 192.168.1.129. The third ping, to 192.168.1.190, fails with 'Request timed out' and a 100% loss rate. The window has tabs for Physical, Config, Desktop, Programming, and Attributes, with Desktop selected.

```
PC2
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 192.168.1.190: bytes=32 time<1ms TTL=255
Reply from 192.168.1.190: bytes=32 time<1ms TTL=255

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

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<1ms TTL=255
Reply from 192.168.1.190: bytes=32 time<1ms TTL=255
Reply from 192.168.1.190: bytes=32 time<1ms TTL=255
Reply from 192.168.1.190: bytes=32 time<1ms TTL=255

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

C:\>ping 192.168.1.129

Pinging 192.168.1.129 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.129:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
C:\>
C:\>
```


These are the ARP tables for the two Routers :

IP Address	Hardware Address	Interface
192.168.1.65	0060.47DA.1301	FastEthernet0/0
192.168.1.126	0001.649D.08AC	FastEthernet0/0

IP Address	Hardware Address	Interface
192.168.1.193	0006.2A09.3A01	FastEthernet0/0
192.168.1.254	0090.2B93.6C59	FastEthernet0/0

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 Proxy Router ARP table.

But, central reason is cause of different NID's and absence of a static route configuration among the two PC hosts

Conclusion :

We learnt how to choose and set up subnets, how masking works in serverless routing, and also how to debug such networks briefly.