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Packet Tracer – Subnet an IPv4 Network

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
CustomerRouter	G0/0	192.168.0.1	255.255.255.192	N/A
	G0/1	192.168.0.65	255.255.255.192	
	S0/1/0	209.165.201.2	255.255.255.252	
LAN-A Switch	VLAN1	192.168.0.2	255.255.255.192	192.168.0.1
LAN-B Switch	VLAN1	192.168.0.66	255.255.255.192	192.168.0.65
PC-A	NIC	192.168.0.62	255.255.255.192	192.168.0.1
PC-B	NIC	192.168.0.126	255.255.255.192	192.168.0.65
ISPRouter	G0/0	209.165.200.225	255.255.255.224	N/A
	S0/1/0	209.165.201.1	255.255.255.252	
ISPSwitch	VLAN1	209.165.200.226	255.255.255.224	209.165.200.225
ISP Workstation	NIC	209.165.200.235	255.255.255.224	209.165.200.225
ISP Server	NIC	209.165.200.240	255.255.255.224	209.165.200.225

Objectives

Part 1: Design an IPv4 Network Subnetting Scheme

Part 2: Configure the Devices

Part 3: Test and Troubleshoot the Network

Background / Scenario

In this activity, you will subnet the Customer network into multiple subnets. The subnet scheme should be based on the number of host computers required in each subnet, as well as other network considerations, like future network host expansion.

After you have created a subnetting scheme and completed the table by filling in the missing host and interface IP addresses, you will configure the host PCs, switches and router interfaces.

After the network devices and host PCs have been configured, you will use the **ping** command to test for network connectivity.

Instructions

Part 1: Subnet the Assigned Network

Step 1: Create a subnetting scheme that meets the required number of subnets and required number of host addresses.

In this scenario, you are a network technician assigned to install a new network for a customer. You must create multiple subnets out of the 192.168.0.0/24 network address space to meet the following requirements:

- a. The first subnet is the LAN-A network. You need a minimum of 50 host IP addresses.
- b. The second subnet is the LAN-B network. You need a minimum of 40 host IP addresses.
- c. You also need at least two additional unused subnets for future network expansion.

Note: Variable length subnet masks will not be used. All of the device subnet masks should be the same length.

- d. Answer the following questions to help create a subnetting scheme that meets the stated network requirements:

How many host addresses are needed in the largest required subnet?

50 host addresses are needed in the largest required subnet.

What is the minimum number of subnets required?

The minimum number of subnets required is 4.

The network that you are tasked to subnet is 192.168.0.0/24. What is the /24 subnet mask in binary?

The /24 subnet mask is 255.255.255.0 and it is 11111111.11111111.11111111.00000000 when converted to binary.

- e. The subnet mask is made up of two portions, the network portion, and the host portion. This is represented in the binary by the ones and the zeros in the subnet mask.

In the network mask, what do the ones represent?

In the network mask, the ones represent the network part of the address.

In the network mask, what do the zeros represent?

In the network mask, the zeros represent the host's part of the address.

- f. To subnet a network, bits from the host portion of the original network mask are changed into subnet bits. The number of subnet bits defines the number of subnets.

Given each of the possible subnet masks depicted in the following binary format, how many subnets and how many hosts are created in each example?

Hint: Remember that the number of host bits (to the power of 2) defines the number of hosts per subnet (minus 2), and the number of subnet bits (to the power of two) defines the number of subnets. The subnet

bits (shown in bold) are the bits that have been borrowed beyond the original network mask of /24. The /24 is the prefix notation and corresponds to a dotted decimal mask of 255.255.255.0.

- 1) (/25) 11111111.11111111.11111111.**1**0000000

Dotted decimal subnet mask equivalent:

The dotted decimal subnet mask equivalent is 255.255.255.128.

Number of subnets?

2 subnets

Number of hosts?

126 hosts

- 2) (/26) 11111111.11111111.11111111.**11**000000

Dotted decimal subnet mask equivalent:

The dotted decimal subnet mask equivalent is 255.255.255.192.

Number of subnets?

4 subnets

Number of hosts?

62 hosts

- 3) (/27) 11111111.11111111.11111111.**111**00000

Dotted decimal subnet mask equivalent:

The dotted decimal subnet mask equivalent is 255.255.255.224.

Number of subnets?

8 subnets

Number of hosts?

30 hosts

- 4) (/28) 11111111.11111111.11111111.**1111**0000

Dotted decimal subnet mask equivalent:

The dotted decimal subnet mask equivalent is 255.255.255.240.

Number of subnets?

16 subnets

Number of hosts?

14 hosts

- 5) (/29) 11111111.11111111.11111111.11111000

Dotted decimal subnet mask equivalent:

The dotted decimal subnet mask equivalent is 255.255.255.248.

Number of subnets?

32 subnets

Number of hosts?

6 hosts

- 6) (/30) 11111111.11111111.11111111.11111100

Dotted decimal subnet mask equivalent:

The dotted decimal subnet mask equivalent is 255.255.255.252.

Number of subnets?

64 subnets

Number of hosts?

2 hosts

Considering your answers above, which subnet masks meet the required number of minimum host addresses?

Subnet masks /25 & /26 meet the required number of minimum host addresses.

Considering your answers above, which subnet masks meets the minimum number of subnets required?

Subnet masks /27, /28, /29, & /30 meet the required number of minimum subnets.

Considering your answers above, which subnet mask meets both the required minimum number of hosts and the minimum number of subnets required?

Subnet masks /26 is the only subnet mask that meets both the required number of minimum host addresses and the minimum number of subnets.

When you have determined which subnet mask meets all of the stated network requirements, derive each of the subnets. List the subnets from first to last in the table. Remember that the first subnet is 192.168.0.0 with the chosen subnet mask.

Subnet Address	Prefix	Subnet Mask
192.168.0.0	/26	255.255.255.192
192.168.0.64	/26	255.255.255.192
192.168.0.128	/26	255.255.255.192
192.168.0.192	/26	255.255.255.192

Step 2: Fill in the missing IP addresses in the Addressing Table

Assign IP addresses based on the following criteria: Use the ISP Network settings as an example.


- a. Assign the first subnet to LAN-A.
 - 1) Use the first host address for the CustomerRouter interface connected to LAN-A switch.
 - 2) Use the second host address for the LAN-A switch. Make sure to assign a default gateway address for the switch.
 - 3) Use the last host address for PC-A. Make sure to assign a default gateway address for the PC.
- b. Assign the second subnet to LAN-B.
 - 1) Use the first host address for the CustomerRouter interface connected to LAN-B switch.
 - 2) Use the second host address for the LAN-B switch. Make sure to assign a default gateway address for the switch.
 - 3) Use the last host address for PC-B. Make sure to assign a default gateway address for the PC.

Part 2: Configure the Devices

Configure basic settings on the PCs, switches, and router. Refer to the Addressing Table for device names and address information.

Step 1: Configure CustomerRouter.

- a. Set the enable secret password on CustomerRouter to **Class123**



```
CustomerRouter
Physical Config CLI Attributes
IOS Command Line Interface

%LINK-3-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
%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
%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
%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
%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
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to down

Router>enable
Router#show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0        unassigned      YES unset   administratively down down
GigabitEthernet0/1        unassigned      YES unset   administratively down down
Serial0/1/0               209.165.201.2   YES manual   up          up
Serial0/1/1               unassigned      YES unset   administratively down down
Vlan1                     unassigned      YES unset   administratively down down

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret Class123
```

- b. Set the console login password to **Cisco123**.



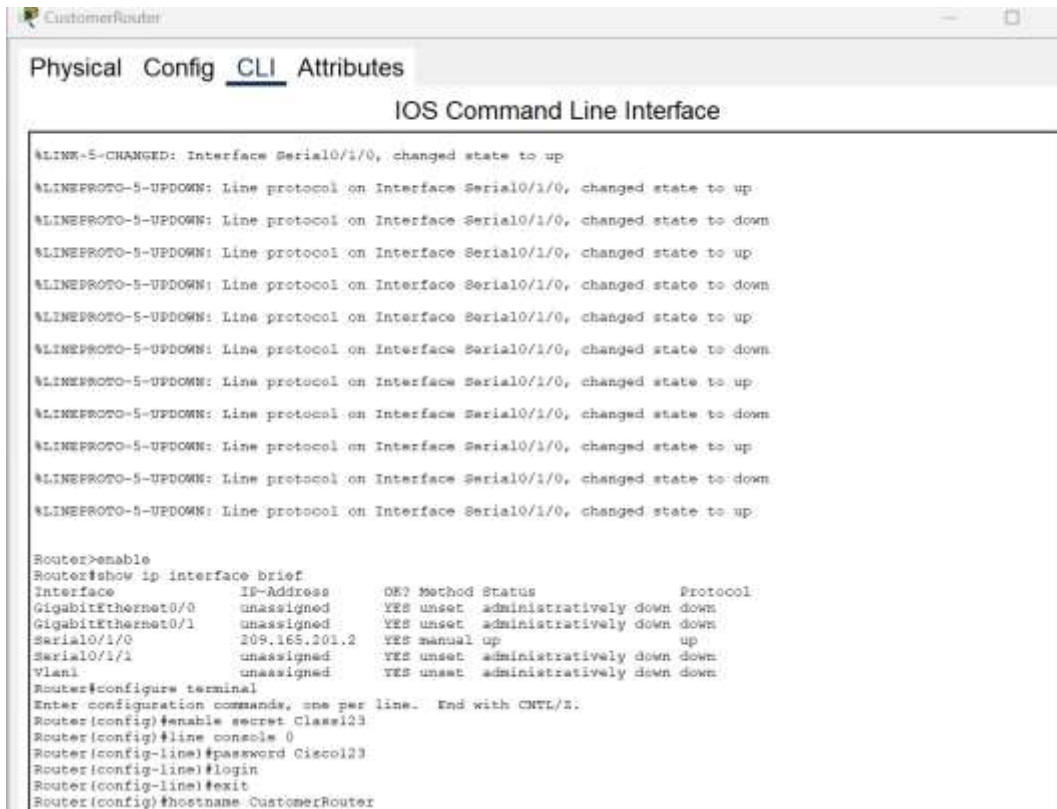
```
CustomerRouter
Physical Config CLI Attributes
IOS Command Line Interface

%LINK-3-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
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%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
%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
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%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to down

Router>enable
Router#show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0        unassigned      YES unset   administratively down down
GigabitEthernet0/1        unassigned      YES unset   administratively down down
Serial0/1/0               209.165.201.2   YES manual   up          up
Serial0/1/1               unassigned      YES unset   administratively down down
Vlan1                     unassigned      YES unset   administratively down down

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret Class123
Router(config)#line console 0
Router(config-line)#password Cisco123
Router(config-line)#login
Router(config-line)#exit
```

- c. Configure **CustomerRouter** as the hostname for the router.



```
CustomerRouter
Physical Config CLI Attributes

IOS Command Line Interface

%LINE-5-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
%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
%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
%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
%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
%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>enable
Router#show ip interface brief
Interface      IP-Address      OE? Method Status      Protocol
GigabitEthernet0/0    unassigned      YES unset    administratively down down
GigabitEthernet0/1    unassigned      YES unset    administratively down down
Serial0/1/0         209.165.201.2   YES manual   up          up
Serial0/1/1         unassigned      YES unset    administratively down down
Vlan1             unassigned      YES unset    administratively down down

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret Class123
Router(config)#line console 0
Router(config-line)#password Cisco123
Router(config-line)#login
Router(config-line)#exit
Router(config)#hostname CustomerRouter
```

- d. Configure the G0/0 and G0/1 interfaces with IP addresses and subnet masks, and then enable them.

CustomerRouter

Physical Config CLI Attributes

IOS Command Line Interface

```

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
%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
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%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>enable
Router#show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0        unassigned      YES unset    administratively down down
GigabitEthernet0/1        unassigned      YES unset    administratively down down
Serial0/1/0               209.165.201.2   YES manual   up          up
Serial0/1/1               unassigned      YES unset    administratively down down
Vlan1                     unassigned      YES unset    administratively down down
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret Class123
Router(config)#line console 0
Router(config-line)#password Cisco123
Router(config-line)#login
Router(config-line)#exit
Router(config)#hostname CustomerRouter
CustomerRouter(config)#interface g
CustomerRouter(config)#interface gigabitEthernet 0/0
CustomerRouter(config-if)#ip address 192.168.0.1 255.255.255.192
CustomerRouter(config-if)#no shutdown

CustomerRouter(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
CustomerRouter(config-if)#
  
```

Copy Paste

☐ Top

The screenshot shows the 'Custom Router' window in Cisco Packet Tracer, with the 'CLI' tab selected. The window title is 'CustomerRouter'. The CLI interface shows the following commands and output:

```
Router>enable
Router#show ip interface brief
Interface      IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0 unassigned      YES unset   administratively down down
GigabitEthernet0/1 unassigned      YES unset   administratively down down
Serial0/1/0     209.165.201.2   YES manual up          up
Serial0/1/1     unassigned      YES unset   administratively down down
Vlan1           unassigned      YES unset   administratively down down
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret Class123
Router(config)#line console 0
Router(config-line)#password Cisc0123
Router(config-line)#login
Router(config-line)#exit
Router(config)#hostname CustomerRouter
CustomerRouter(config)#interface g
CustomerRouter(config)#interface gigabitEthernet 0/0
CustomerRouter(config-if)#ip address 192.168.0.1 255.255.255.192
CustomerRouter(config-if)#no shutdown

CustomerRouter(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

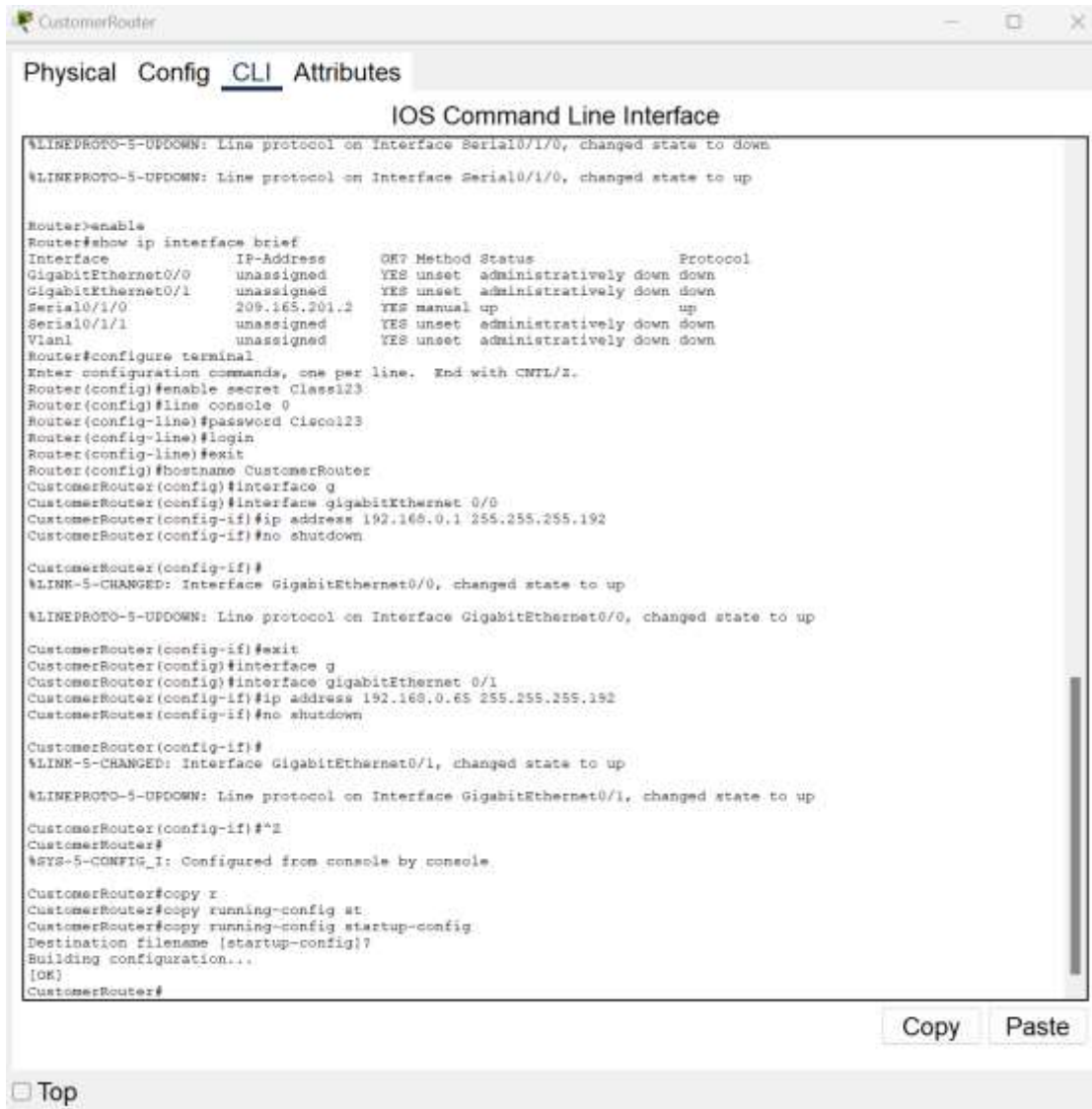
CustomerRouter(config-if)#exit
CustomerRouter(config)#interface g
CustomerRouter(config)#interface gigabitEthernet 0/1
CustomerRouter(config-if)#ip address 192.168.0.65 255.255.255.192
CustomerRouter(config-if)#no shutdown

CustomerRouter(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

CustomerRouter(config-if)#
```

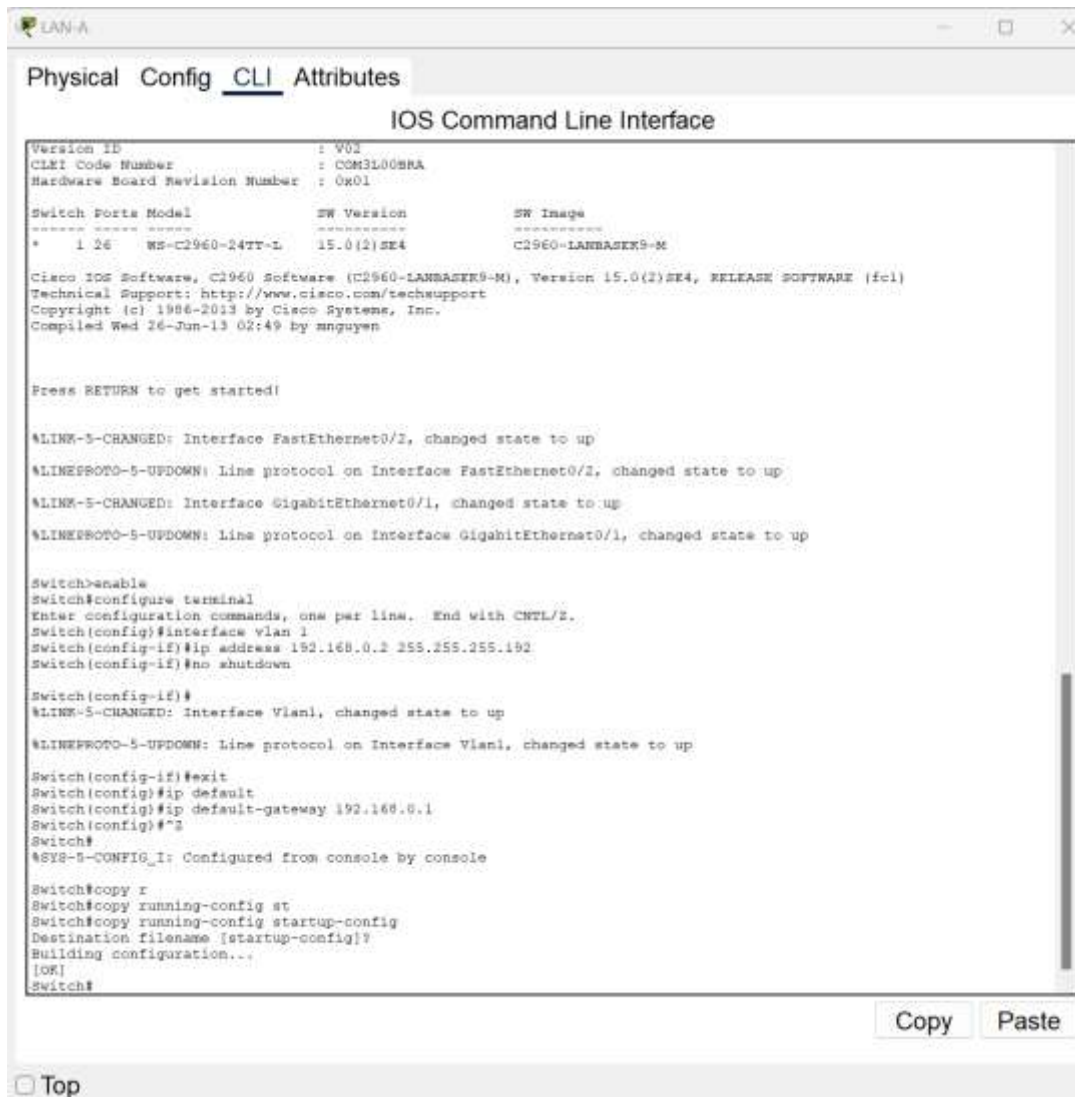
At the bottom of the CLI window, there are 'Copy' and 'Paste' buttons. Below the CLI window, there is a 'Top' button.

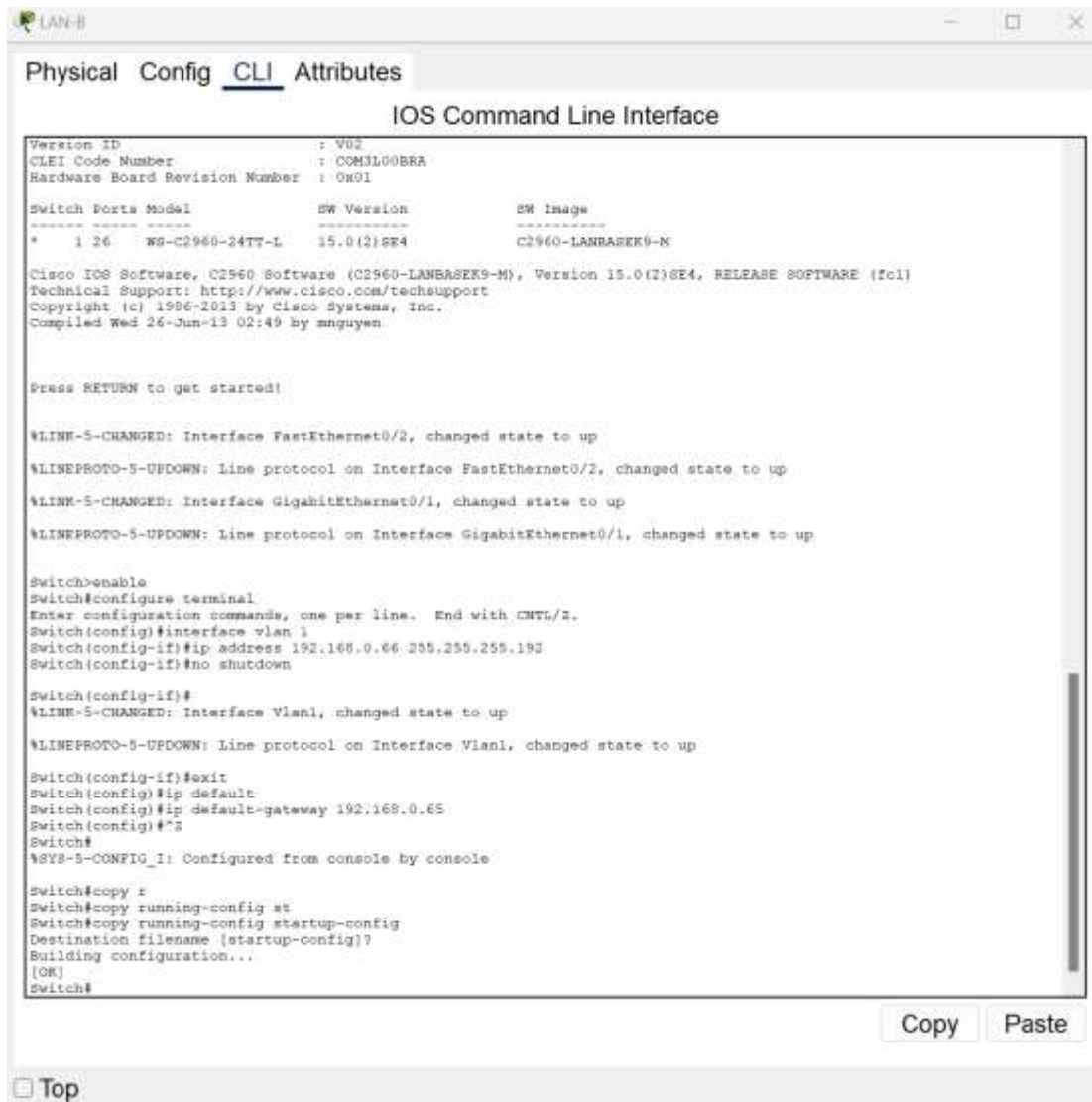
- e. Save the running configuration to the startup configuration file.



Step 2: Configure the two customer LAN switches.

Configure the IP addresses on interface VLAN 1 on the two customer LAN switches. Make sure to configure the correct default gateway on each switch.





Step 3: Configure the PC interfaces.

Configure the IP address, subnet mask, and default gateway settings on **PC-A** and **PC-B**.

PC-A

Physical Config Desktop Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.0.62

Subnet Mask 255.255.255.192

Default Gateway 192.168.0.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::2E0:B0FF:FE58:A7A9

Default Gateway

DNS Server

802.1X

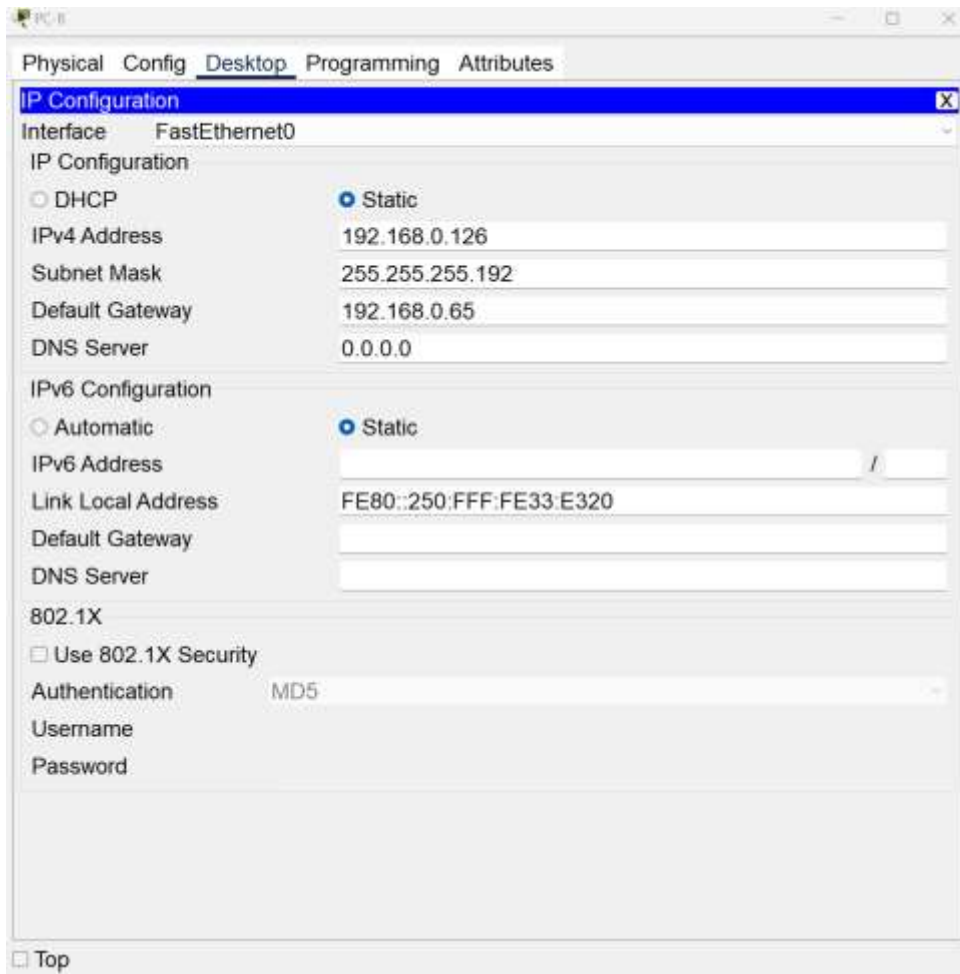
☐ Use 802.1X Security

Authentication MD5

Username

Password

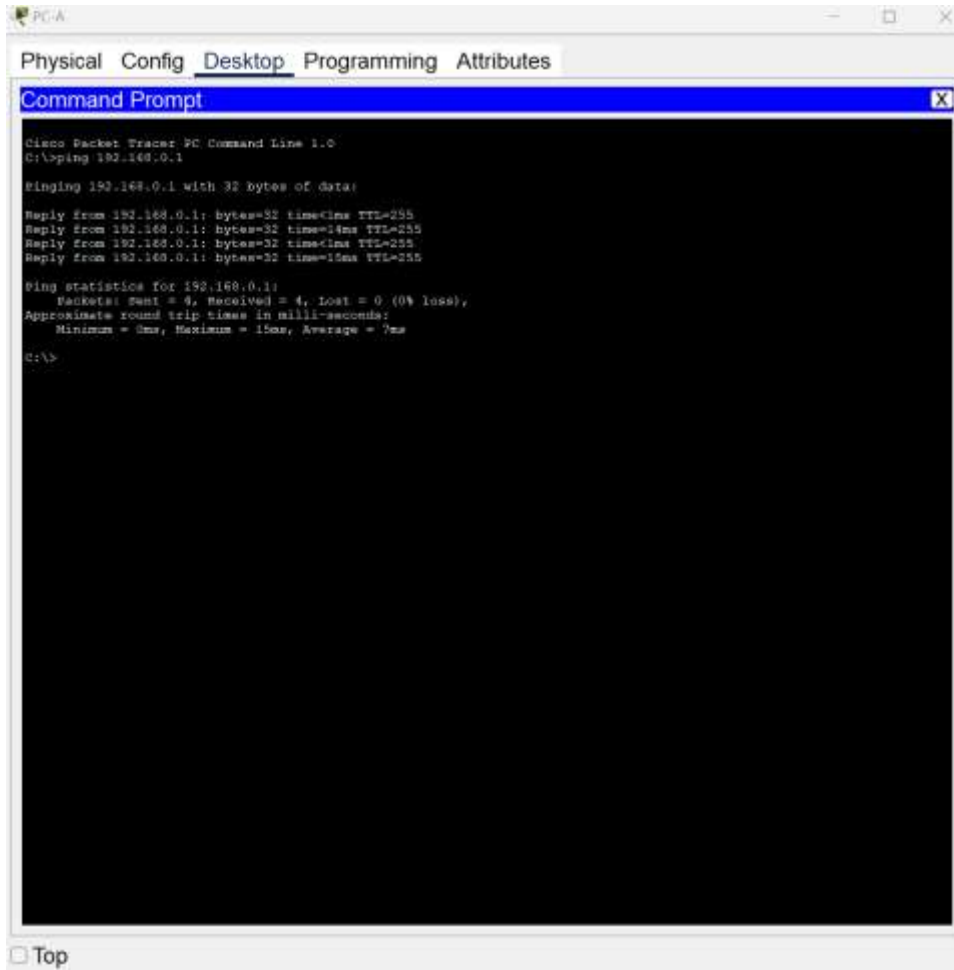
Top



Part 3: Test and Troubleshoot the Network

In Part 3, you will use the **ping** command to test network connectivity.

- a. Determine if PC-A can communicate with its default gateway. Do you get a reply?



```
PC-A
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.1

Pinging 192.168.0.1 with 32 bytes of data:

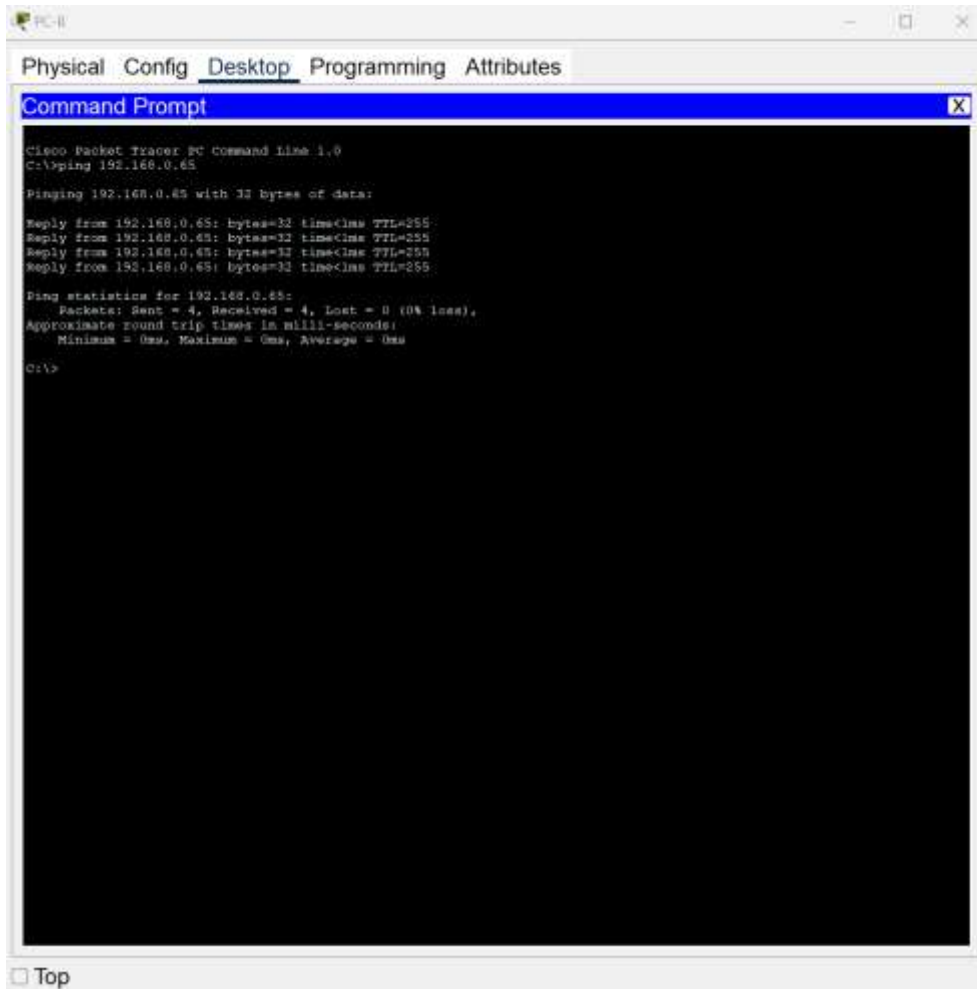
Reply from 192.168.0.1: bytes=32 time=14ms TTL=255
Reply from 192.168.0.1: bytes=32 time=14ms TTL=255
Reply from 192.168.0.1: bytes=32 time=15ms TTL=255
Reply from 192.168.0.1: bytes=32 time=15ms TTL=255

Ping statistics for 192.168.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 14ms, Maximum = 15ms, Average = 7ms

C:\>
```

Yes, I was able to receive a response.

- b. Determine if PC-B can communicate with its default gateway. Do you get a reply?



The screenshot shows a Packet Tracer PC window with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the following text:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.65

Pinging 192.168.0.65 with 32 bytes of data:

Reply from 192.168.0.65: bytes=32 time=0ms TTL=255
Reply from 192.168.0.65: bytes=32 time=0ms TTL=255
Reply from 192.168.0.65: bytes=32 time=0ms TTL=255
Reply from 192.168.0.65: bytes=32 time=0ms TTL=255

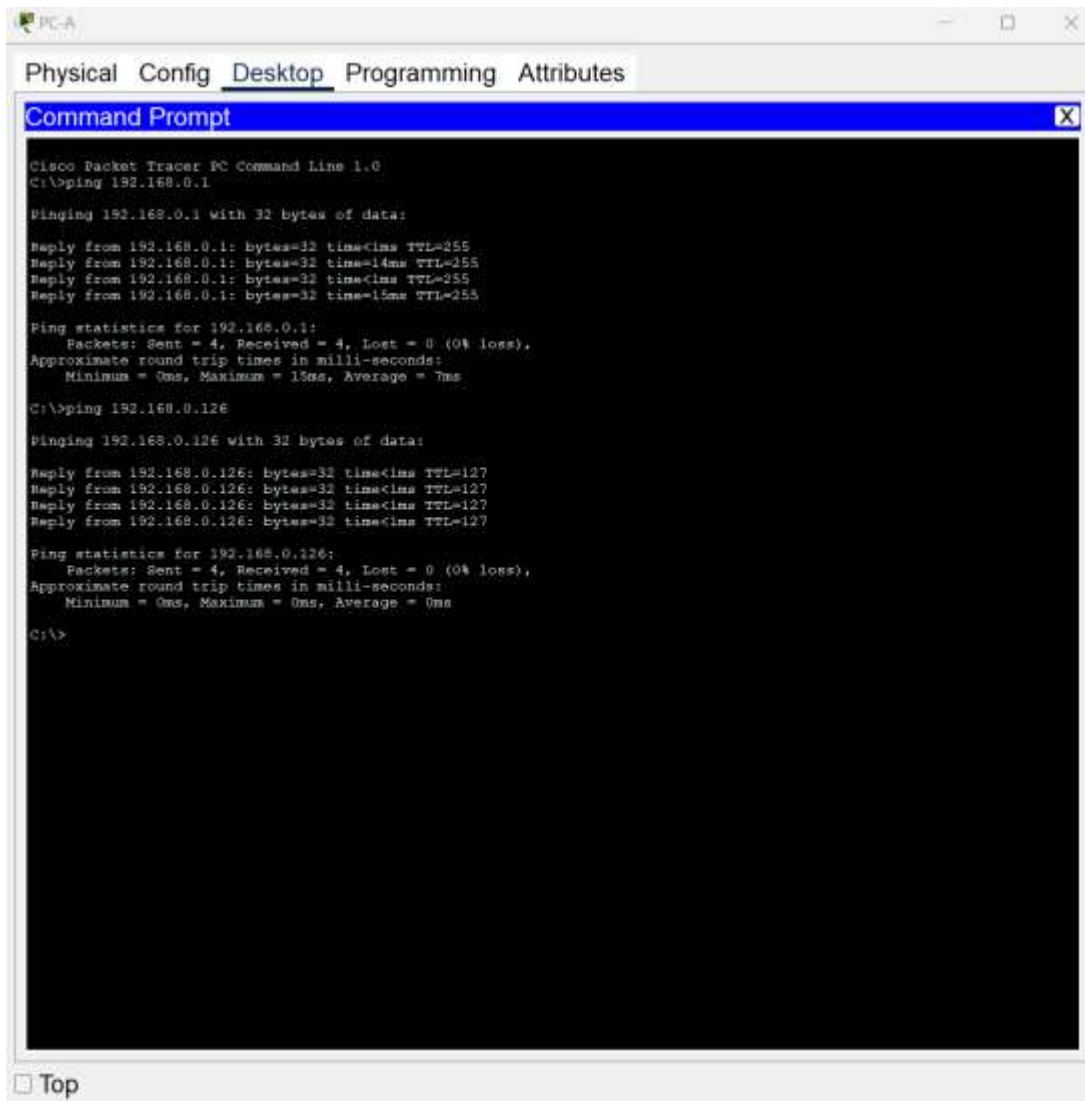
Ping statistics for 192.168.0.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

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

Yes, I was able to receive a response.

- c. Determine if PC-A can communicate with PC-B. Do you get a reply?



The screenshot shows a Cisco Packet Tracer PC Command Prompt window for PC-A. The window has tabs for Physical, Config, Desktop, Programming, and Attributes, with 'Desktop' selected. The Command Prompt displays the following text:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.1

Pinging 192.168.0.1 with 32 bytes of data:

Reply from 192.168.0.1: bytes=32 time<1ms TTL=255
Reply from 192.168.0.1: bytes=32 time=14ms TTL=255
Reply from 192.168.0.1: bytes=32 time<1ms TTL=255
Reply from 192.168.0.1: bytes=32 time=15ms TTL=255

Ping statistics for 192.168.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 15ms, Average = 7ms

C:\>ping 192.168.0.126

Pinging 192.168.0.126 with 32 bytes of data:

Reply from 192.168.0.126: bytes=32 time<1ms TTL=127
Reply from 192.168.0.126: bytes=32 time<1ms TTL=127
Reply from 192.168.0.126: bytes=32 time<1ms TTL=127
Reply from 192.168.0.126: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.0.126:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

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

Yes, I was able to receive a response.

If you answered “no” to any of the preceding questions, then you should go back and check your IP address and subnet mask configurations, and ensure that the default gateways have been correctly configured on PC-A and PC-B.