Experiment 14

Aim: Subnet an IPv4 Network (Packet Tracer 11.5.5)

Theory: In this activity, we design an IPv4 subnetting scheme to allocate IP addresses based on network needs, ensuring enough subnets and hosts while allowing for future expansion. Subnetting divides a network into smaller segments, improving performance and security. Devices are configured with appropriate IP addresses, subnet masks, and default gateways. Finally, connectivity is tested using the ping command to verify proper communication between devices. This practical approach reinforces core networking concepts, emphasizing IP addressing, subnetting, and troubleshooting for successful network configuration.

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?

What is the minimum number of subnets required?

The network that you are tasked to subnet is 192.168.0.0/24. What is the /24 subnet mask in 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, what do the zeros represent?

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:

Number of subnets? Number of hosts?

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

   Dotted decimal subnet mask equivalent:

   Number of subnets? Number of hosts?

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

   Dotted decimal subnet mask equivalent:

   Number of subnets? Number of hosts?

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

   Dotted decimal subnet mask equivalent:

   Number of subnets? Number of hosts?

5) (/29) 11111111.11111111.11111111.**11111**000

   Dotted decimal subnet mask equivalent:

   Number of subnets? Number of hosts?

6) (/30) 11111111.11111111.11111111.**111111**00

   Dotted decimal subnet mask equivalent:

   Number of subnets? Number of hosts?

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

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

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

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.

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**

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

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

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

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**.

Part 3: Test and Troubleshoot the Network

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

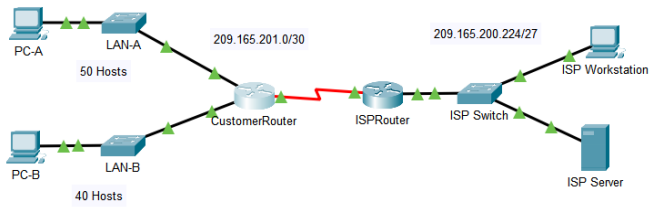
a. Determine if PC-A can communicate with its default gateway. Do you get a reply?

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

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

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.

Commands/Results:



LAN-A

Physical Config CLI Attributes

IOS Command Line Interface

```
Press RETURN to get started!


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

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

%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up


Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface vlan 1
Switch(config-if)#ip address 192.168.0.2 255.255.255.192
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)#exit
Switch(config)#ip default-gateway 192.168.0.1
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Switch#
```

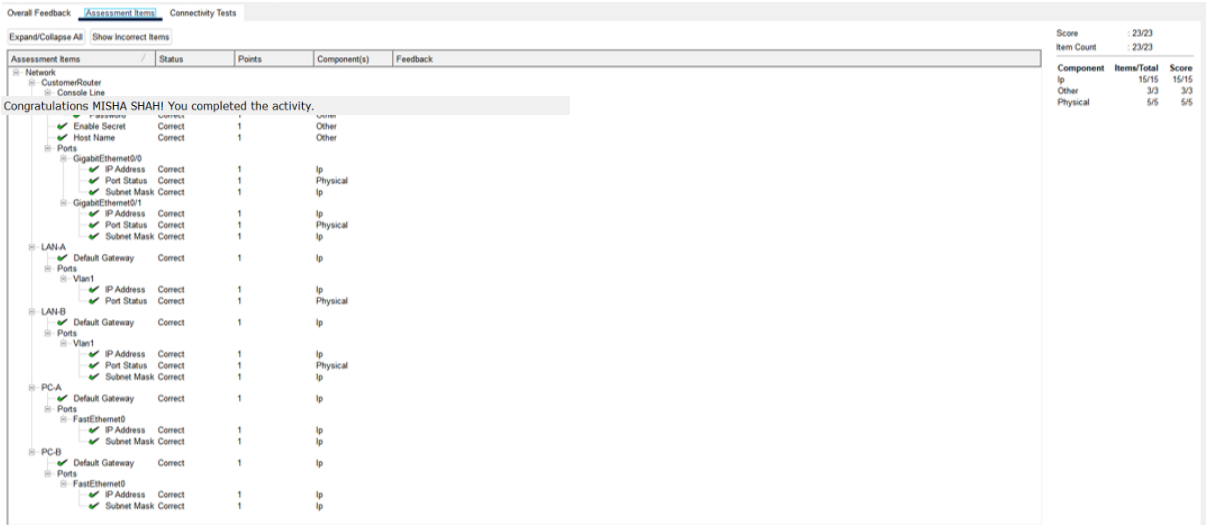
LAN-B

Physical Config CLI Attributes

IOS Command Line Interface

```
Compiled Wed 26-Jun-13 02:49 by mnguyen


Press RETURN to get started!

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

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

%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up


Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface vlan 1
Switch(config-if)#ip address 192.168.0.66 255.255.255.192
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)#exit
Switch(config)#ip default-gateway 192.168.0.65
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Switch#
```

```
CustomerRouter(config)#interface gigabitEthernet
% Incomplete command.
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)#int g0/1
CustomerRouter(config-if)#ip address 192.168.0.65 255.255.255.192
CustomerRouter(config-if)#exit
CustomerRouter(config)#enable secret Class123
CustomerRouter(config)#console 0
                       ^
% Invalid input detected at '^' marker.

CustomerRouter(config)#line console 0
CustomerRouter(config-line)#password Class123
CustomerRouter(config-line)#login
CustomerRouter(config-line)#exit
CustomerRouter(config)#hostname CustomerRouter
CustomerRouter(config)#exit
CustomerRouter#
%SYS-5-CONFIG_I: Configured from console by console

CustomerRouter#enable
CustomerRouter#configutre termianl
                       ^
% Invalid input detected at '^' marker.

CustomerRouter#configure termianl
                          ^
% Invalid input detected at '^' marker.

CustomerRouter#enable secret Class123
                     ^
% Invalid input detected at '^' marker.

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


Overall Feedback
Assessment Items
Connectivity Tests
Expand/Collapse All
Show Incorrect Items
Assessment Items
Status
Points
Component(s)
Feedback
Network
CustomerRouter
Console Line
Congratulations MISHA SHAH! You completed the activity.
Enable Secret Correct 1 Other
Host Name Correct 1 Other
Ports
GigabitEthernet0/0
IP Address Correct 1 Ip
Port Status Correct 1 Physical
Subnet Mask Correct 1 Ip
GigabitEthernet0/1
IP Address Correct 1 Ip
Port Status Correct 1 Physical
Subnet Mask Correct 1 Ip
LAN-A
Default Gateway Correct 1 Ip
Ports
Vlan1
IP Address Correct 1 Ip
Port Status Correct 1 Physical
LAN-B
Default Gateway Correct 1 Ip
Ports
Vlan1
IP Address Correct 1 Ip
Port Status Correct 1 Physical
Subnet Mask Correct 1 Ip
PC-A
Default Gateway Correct 1 Ip
Ports
FastEthernet0
IP Address Correct 1 Ip
Subnet Mask Correct 1 Ip
PC-B
Default Gateway Correct 1 Ip
Ports
FastEthernet0
IP Address Correct 1 Ip
Subnet Mask Correct 1 Ip
Score : 23/23
Item Count : 23/23
Component Items/Total Score
Ip 15/15 15/15
Other 3/3 3/3
Physical 5/5 5/5

Experiment 15

Aim: Verify IPv4 and IPv6 Addressing (Packet Tracer 13.2.6)

Theory: Dual-stack networks support both IPv4 and IPv6, enabling devices to communicate using either protocol. In this activity, we verify IP configurations using ipconfig and ipv6config to document addressing for both protocols. We test connectivity between devices by pinging IPv4 and IPv6 addresses, ensuring proper network setup. Additionally, tracert helps trace the route between devices, revealing intermediary hops and network interfaces. This hands-on activity demonstrates the coexistence of IPv4 and IPv6 and highlights the importance of verifying connectivity and route paths in a dual-stack environment.

Instructions:

Step 1: Use ipconfig to verify IPv4 addressing.

a. Click **PC1** and open the **Command Prompt.**

b. Enter the **ipconfig /all** command to collect the IPv4 information. Fill-in the **Addressing Table** with the IPv4 address, subnet mask, and default gateway.

c. Click **PC2** and open the **Command Prompt.**

d. Enter the **ipconfig /all** command to collect the IPv4 information. Fill-in the **Addressing Table** with the IPv4 address, subnet mask, and default gateway.

Step 2: Use ipv6config to verify IPv6 addressing.

a. On **PC1**, enter the **ipv6config /all** command to collect the IPv6 information. Fill-in the **Addressing Table** with the IPv6 address, subnet prefix, and default gateway.

b. On **PC2**, enter the **ipv6config /all** command to collect the IPv6 information. Fill-in the **Addressing Table** with the IPv6 address, subnet prefix, and default gateway.

Part 2: Test Connectivity Using Ping

Step 1: Use ping to verify IPv4 connectivity.

a. From **PC1**, ping the IPv4 address for **PC2**.

Was the result successful?

b. From **PC2**, ping the IPv4 address for **PC1**.

Was the result successful?

Step 2: Use ping to verify IPv6 connectivity.

a. From **PC1**, ping the IPv6 address for **PC2**.

Was the result successful?

From **PC2**, ping the IPv6 address of **PC1**.

Was the result successful?

Part 3: Discover the Path by Tracing the Route

Step 1: Use tracert to discover the IPv4 path.

a. From **PC1**, trace the route to **PC2**.

PC> **tracert 10.10.1.20**

What addresses were encountered along the path?

With which interfaces are the four addresses associated

b. From **PC2**, trace the route to **PC1**.

What addresses were encountered along the path?

With which interfaces are the four addresses associated?

Step 2: Use tracert to discover the IPv6 path.

a. From **PC1**, trace the route to the IPv6 address for **PC2**.

PC> **tracert 2001:db8:1:4::a**

What addresses were encountered along the path?

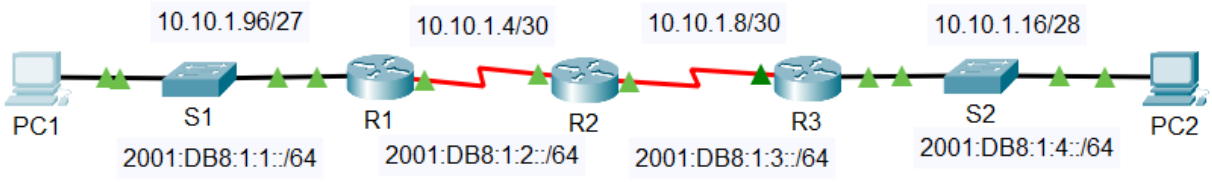
With which interfaces are the four addresses associated?

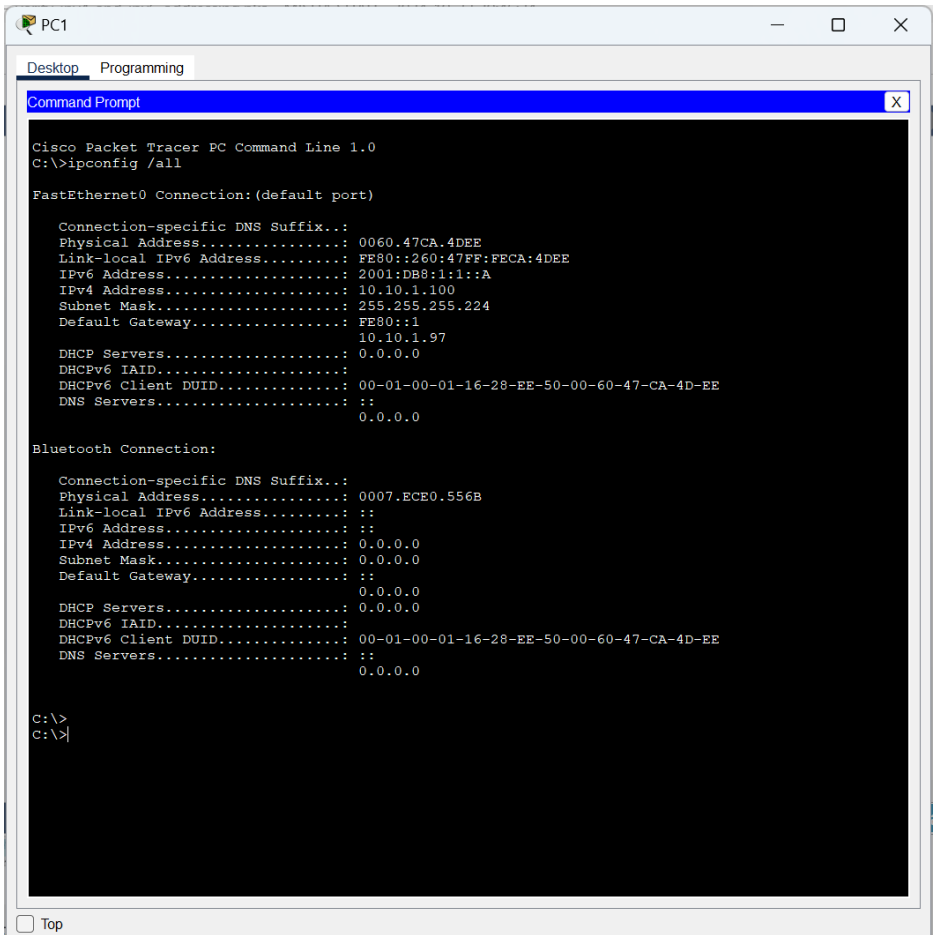
b. From **PC2**, trace the route to the IPv6 address for **PC1**.

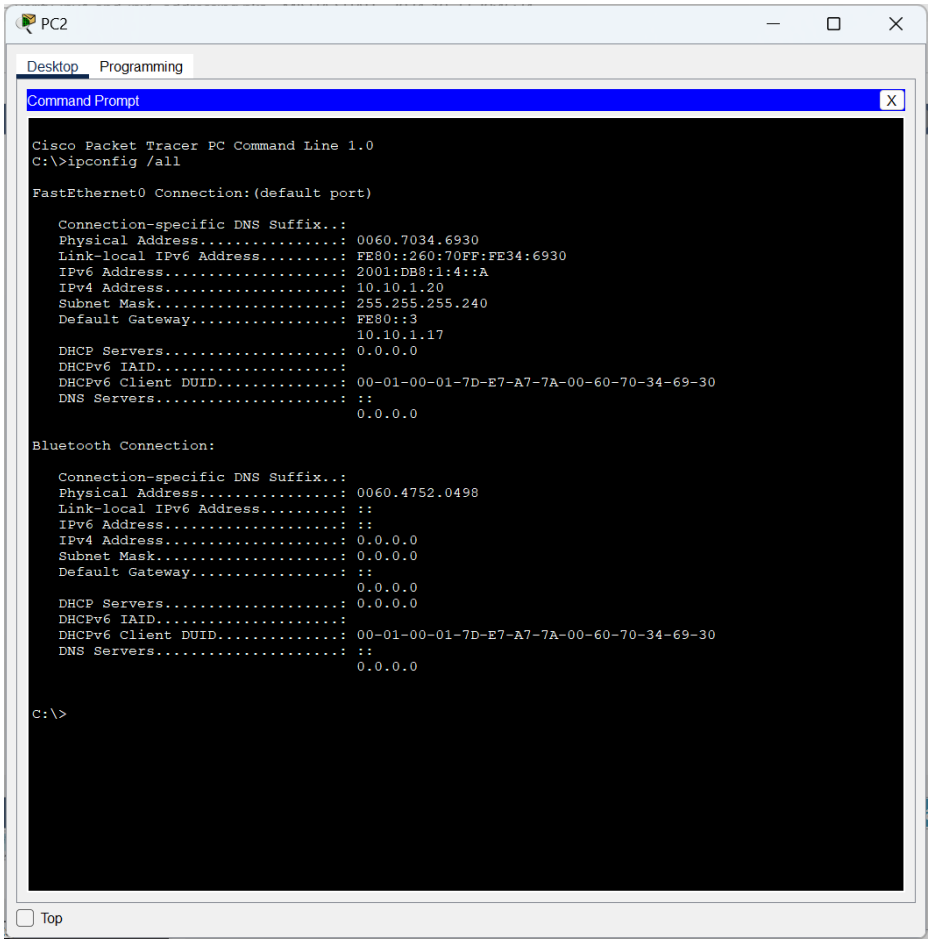
What addresses were encountered along the path?

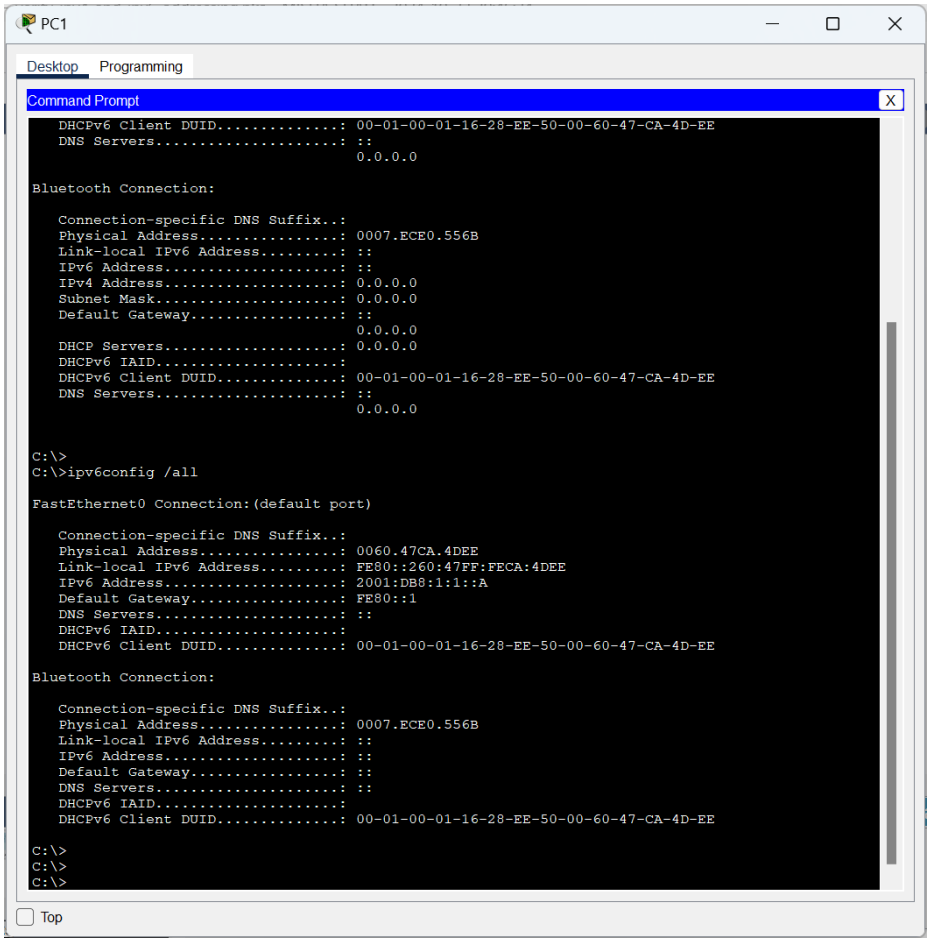
With which interfaces are the four addresses associated?

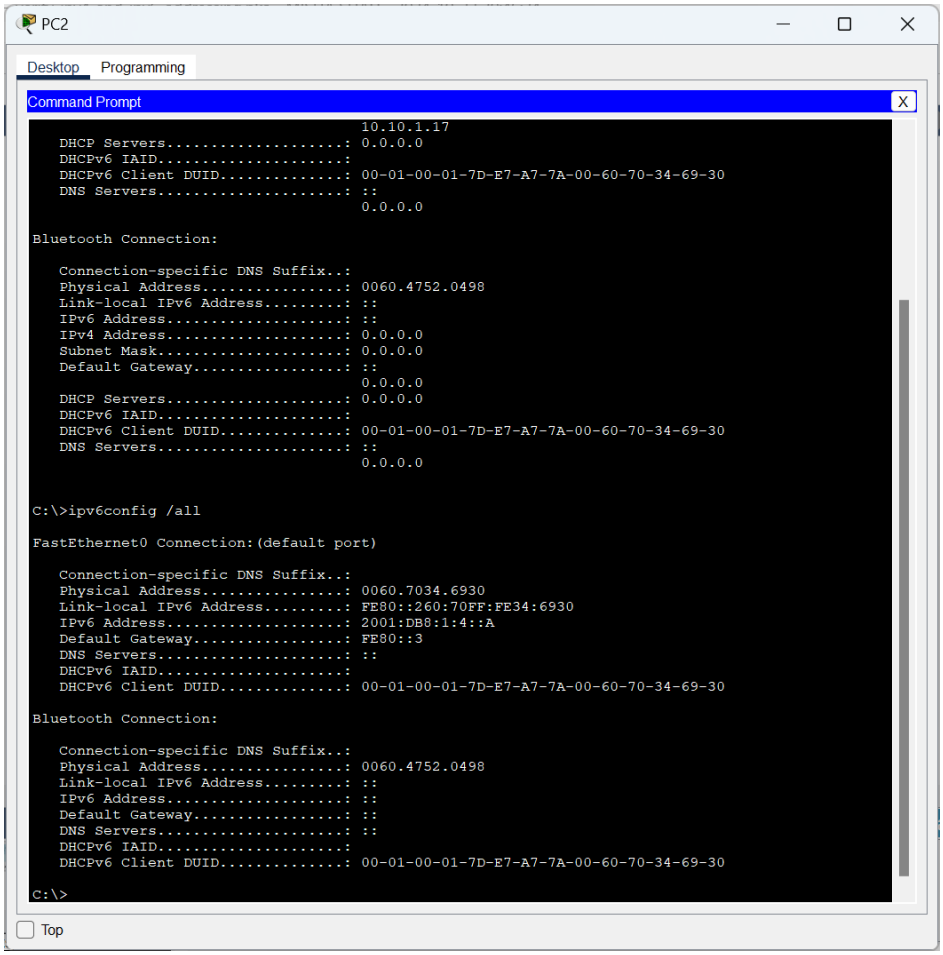
Commands/Results:

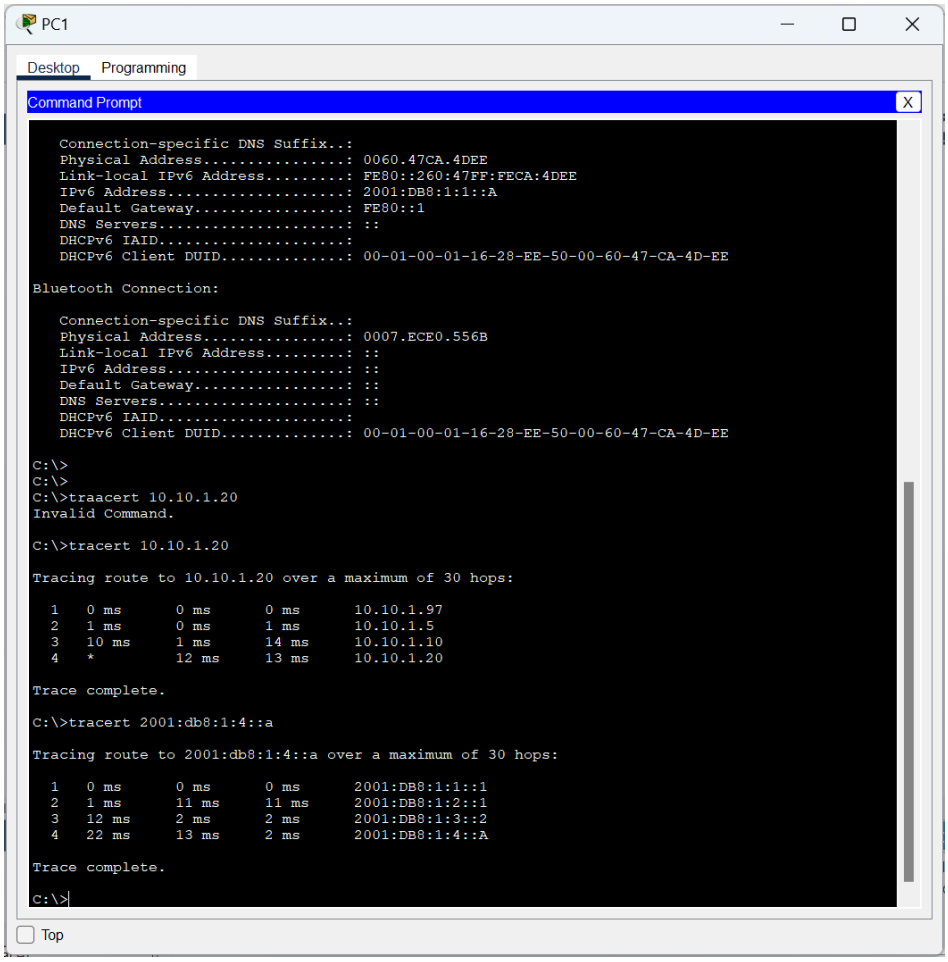


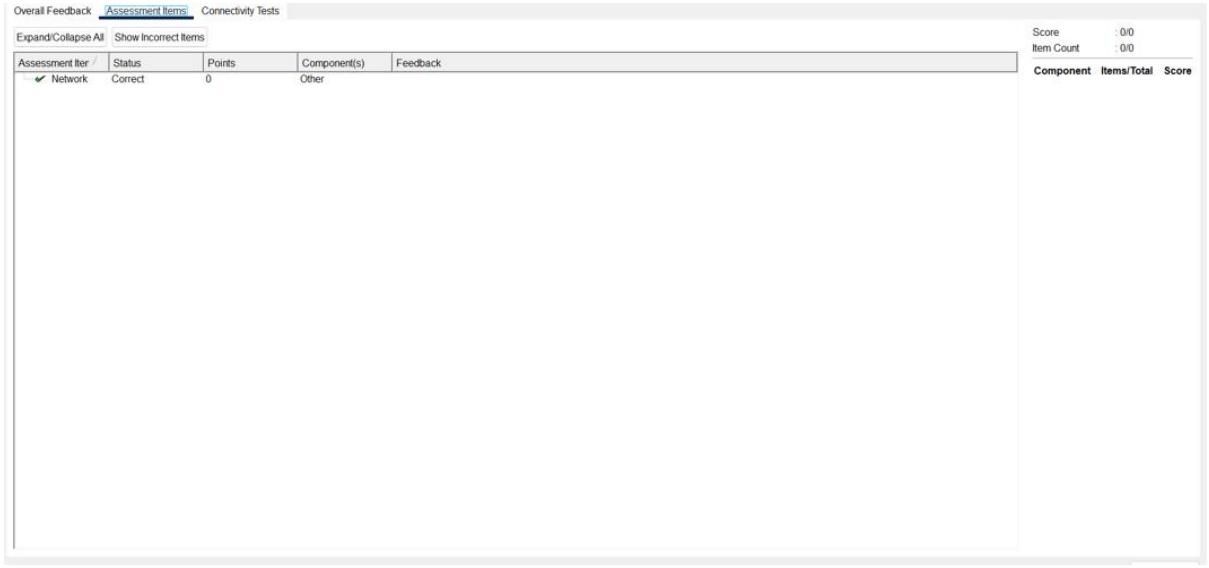



PC2
Desktop
Programming
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig /all
FastEthernet0 Connection:(default port)
Connection-specific DNS Suffix..:
Physical Address.....: 0060.7034.6930
Link-local IPv6 Address.....: FE80::260:70FF:FE34:6930
IPv6 Address.....: 2001:DB8:1:4::A
IPv4 Address.....: 10.10.1.20
Subnet Mask.....: 255.255.255.240
Default Gateway.....: FE80::3
10.10.1.17
DHCP Servers.....: 0.0.0.0
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-7D-E7-A7-7A-00-60-70-34-69-30
DNS Servers.....: ::
0.0.0.0
Bluetooth Connection:
Connection-specific DNS Suffix..:
Physical Address.....: 0060.4752.0498
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
IPv4 Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway.....: ::
0.0.0.0
DHCP Servers.....: 0.0.0.0
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-7D-E7-A7-7A-00-60-70-34-69-30
DNS Servers.....: ::
0.0.0.0
C:\>
Top


PC1
Desktop
Programming
Command Prompt
X
DHCPv6 Client DUID.....: 00-01-00-01-16-28-EE-50-00-60-47-CA-4D-EE
DNS Servers.....: ::
0.0.0.0
Bluetooth Connection:
Connection-specific DNS Suffix..:
Physical Address.....: 0007.ECE0.556B
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
IPv4 Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway.....: ::
0.0.0.0
DHCP Servers.....: 0.0.0.0
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-16-28-EE-50-00-60-47-CA-4D-EE
DNS Servers.....: ::
0.0.0.0
C:\>
C:\>ipv6config /all
FastEthernet0 Connection:(default port)
Connection-specific DNS Suffix..:
Physical Address.....: 0060.47CA.4DEE
Link-local IPv6 Address.....: FE80::260:47FF:FECA:4DEE
IPv6 Address.....: 2001:DB8:1:1::A
Default Gateway.....: FE80::1
DNS Servers.....: ::
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-16-28-EE-50-00-60-47-CA-4D-EE
Bluetooth Connection:
Connection-specific DNS Suffix..:
Physical Address.....: 0007.ECE0.556B
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
Default Gateway.....: ::
DNS Servers.....: ::
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-16-28-EE-50-00-60-47-CA-4D-EE
C:\>
C:\>
C:\>
Top


PC2
Desktop
Programming
Command Prompt
X
10.10.1.17
DHCP Servers.....: 0.0.0.0
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-7D-E7-A7-7A-00-60-70-34-69-30
DNS Servers.....: ::
0.0.0.0
Bluetooth Connection:
Connection-specific DNS Suffix..:
Physical Address.....: 0060.4752.0498
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
IPv4 Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway.....: ::
0.0.0.0
DHCP Servers.....: 0.0.0.0
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-7D-E7-A7-7A-00-60-70-34-69-30
DNS Servers.....: ::
0.0.0.0
C:\>ipv6config /all
FastEthernet0 Connection:(default port)
Connection-specific DNS Suffix..:
Physical Address.....: 0060.7034.6930
Link-local IPv6 Address.....: FE80::260:70FF:FE34:6930
IPv6 Address.....: 2001:DB8:1:4::A
Default Gateway.....: FE80::3
DNS Servers.....: ::
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-7D-E7-A7-7A-00-60-70-34-69-30
Bluetooth Connection:
Connection-specific DNS Suffix..:
Physical Address.....: 0060.4752.0498
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
Default Gateway.....: ::
DNS Servers.....: ::
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-7D-E7-A7-7A-00-60-70-34-69-30
C:\>
Top


PC1
Desktop
Programming
Command Prompt
X
Connection-specific DNS Suffix..:
Physical Address.....: 0060.47CA.4DEE
Link-local IPv6 Address.....: FE80::260:47FF:FECA:4DEE
IPv6 Address.....: 2001:DB8:1:1::A
Default Gateway.....: FE80::1
DNS Servers.....: ::
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-16-28-EE-50-00-60-47-CA-4D-EE
Bluetooth Connection:
Connection-specific DNS Suffix..:
Physical Address.....: 0007.ECE0.556B
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
Default Gateway.....: ::
DNS Servers.....: ::
DHCPv6 IAID.....:
DHCPv6 Client DUID.....: 00-01-00-01-16-28-EE-50-00-60-47-CA-4D-EE
C:\>
C:\>
C:\>traacert 10.10.1.20
Invalid Command.
C:\>tracert 10.10.1.20
Tracing route to 10.10.1.20 over a maximum of 30 hops:
1 0 ms 0 ms 0 ms 10.10.1.97
2 1 ms 0 ms 1 ms 10.10.1.5
3 10 ms 1 ms 14 ms 10.10.1.10
4 * 12 ms 13 ms 10.10.1.20
Trace complete.
C:\>tracert 2001:db8:1:4::a
Tracing route to 2001:db8:1:4::a over a maximum of 30 hops:
1 0 ms 0 ms 0 ms 2001:DB8:1:1::1
2 1 ms 11 ms 11 ms 2001:DB8:1:2::1
3 12 ms 2 ms 2 ms 2001:DB8:1:3::2
4 22 ms 13 ms 2 ms 2001:DB8:1:4::A
Trace complete.
C:\>
Top


Overall Feedback
Assessment Items
Connectivity Tests
Expand/Collapse All
Show Incorrect Items
Assessment Iter
Status
Points
Component(s)
Feedback
Network
Correct
0
Other
Score : 0/0
Item Count : 0/0
Component
Items/Total
Score