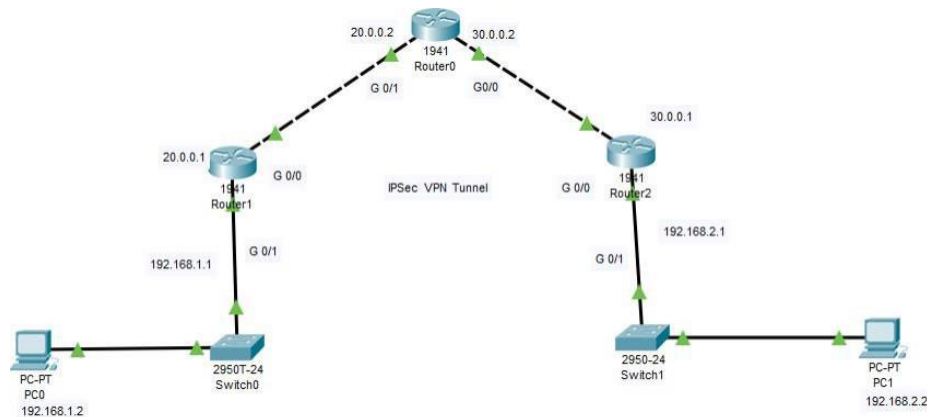


Practical No.6

Aim : To Configure IPSec on network devices to provide secure communication and protect against unauthorized access and attacks.



Configuring PC0:

The screenshot shows the configuration window for PC0, specifically the 'Desktop' tab. The 'IP Configuration' section is active, showing the configuration for the 'FastEthernet0' interface. The 'Static' radio button is selected under 'IP Configuration'. The fields are filled with the following values:

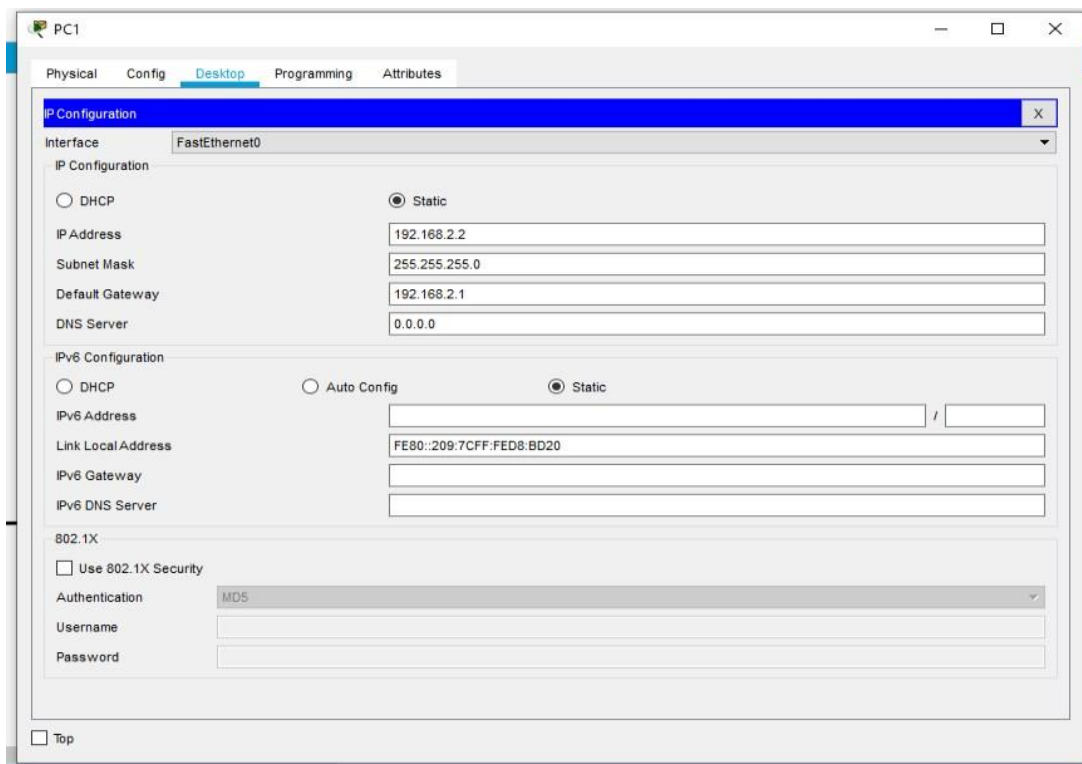
- IP Address: 192.168.1.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.1.1
- DNS Server: 0.0.0.0

The 'IPv6 Configuration' section shows the 'Static' radio button selected. The fields are filled with the following values:

- IPv6 Address: (empty)
- Link Local Address: FE80::290:CFF:FE86:EB39
- IPv6 Gateway: (empty)
- IPv6 DNS Server: (empty)

The '802.1X' section shows the 'Use 802.1X Security' checkbox unchecked. The 'Authentication' dropdown is set to 'MD5'. The 'Username' and 'Password' fields are empty.

INS Configuring PC1:



The PC1 Configuration window shows the 'Desktop' tab. The 'IP Configuration' section is active, showing 'FastEthernet0' as the interface. The 'Static' radio button is selected for IP Configuration. The IP Address is 192.168.2.2, Subnet Mask is 255.255.255.0, Default Gateway is 192.168.2.1, and DNS Server is 0.0.0.0. The 'IPv6 Configuration' section shows 'Static' selected, with an empty IPv6 Address field, Link Local Address FE80::209:7CFF:FED8:BD20, and empty IPv6 Gateway and DNS Server fields. The '802.1X' section has 'Use 802.1X Security' unchecked, Authentication set to 'MD5', and empty Username and Password fields.

PC1

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IP Address: 192.168.2.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.2.1

DNS Server: 0.0.0.0

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address: /

Link Local Address: FE80::209:7CFF:FED8:BD20

IPv6 Gateway:

IPv6 DNS Server:

802.1X

☐ Use 802.1X Security

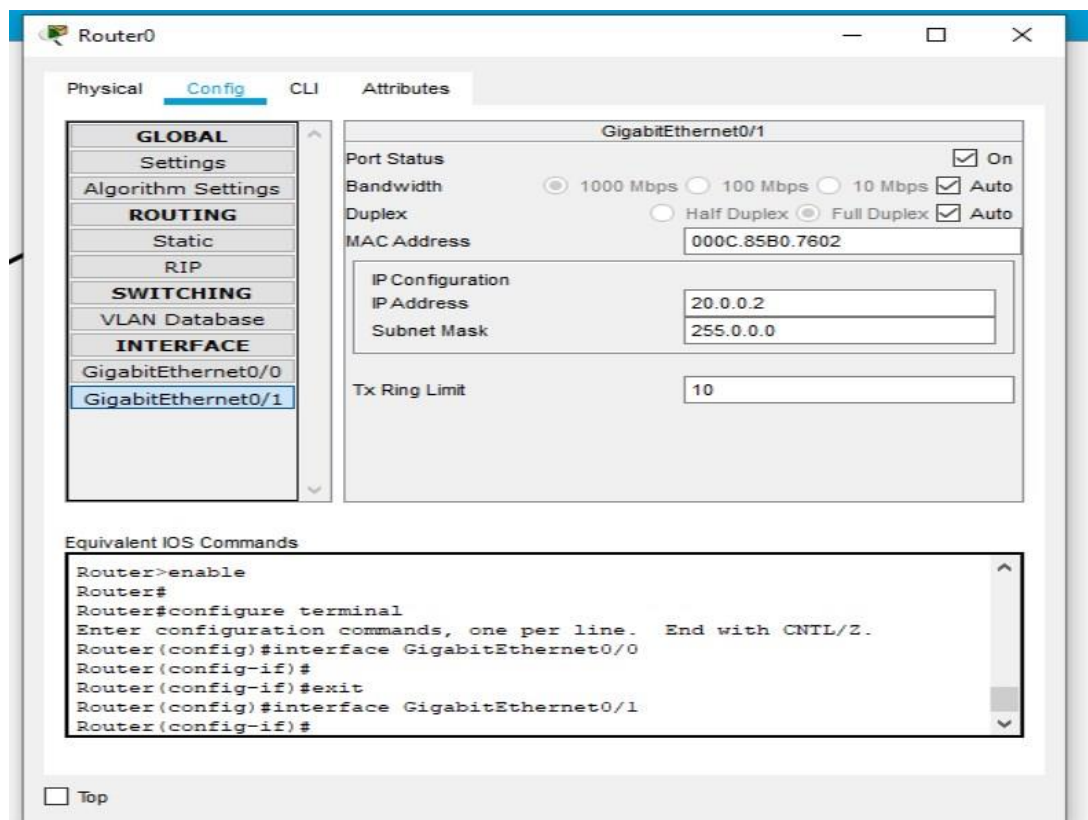
Authentication: MD5

Username:

Password:

☐ Top

Configuring Router 0: Interface GigabitEthernet0/1:



The Router0 Configuration window shows the 'Config' tab. The 'GigabitEthernet0/1' interface is selected in the 'INTERFACE' section of the left sidebar. The 'GigabitEthernet0/1' configuration panel shows 'Port Status' checked 'On', 'Bandwidth' set to '1000 Mbps', 'Duplex' set to 'Full Duplex', 'MAC Address' 000C.85B0.7602, 'IP Configuration' with 'IP Address' 20.0.0.2 and 'Subnet Mask' 255.0.0.0, and 'Tx Ring Limit' 10. The 'Equivalent IOS Commands' section shows the configuration commands for the interface.

Router0

Physical **Config** CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0

GigabitEthernet0/1

GigabitEthernet0/1

Port Status: ☒ On

Bandwidth: ☒ 1000 Mbps ☐ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address: 000C.85B0.7602

IP Configuration

IP Address: 20.0.0.2

Subnet Mask: 255.0.0.0

Tx Ring Limit: 10

Equivalent IOS Commands

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
```

☐ Top

Interface GigabitEthernet0/0:

The screenshot shows the configuration window for Router0. The 'Config' tab is active, and the 'INTERFACE' section is expanded, showing 'GigabitEthernet0/0' selected. The configuration details for this interface are as follows:

GigabitEthernet0/0	
Port Status	<input checked="" type="checkbox"/> On
Bandwidth	<input checked="" type="radio"/> 1000 Mbps <input type="radio"/> 100 Mbps <input type="radio"/> 10 Mbps <input checked="" type="checkbox"/> Auto
Duplex	<input type="radio"/> Half Duplex <input checked="" type="radio"/> Full Duplex <input checked="" type="checkbox"/> Auto
MAC Address	000C.85B0.7601
IP Configuration	
IP Address	30.0.0.2
Subnet Mask	255.0.0.0
Tx Ring Limit	10

Equivalent IOS Commands:

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
```

☐ Top

Configuring Router1: Interface GigabitEthernet0/0:

The screenshot shows the configuration window for Router1. The 'Config' tab is active, and the 'INTERFACE' section is expanded, showing 'GigabitEthernet0/0' selected. The configuration details for this interface are as follows:

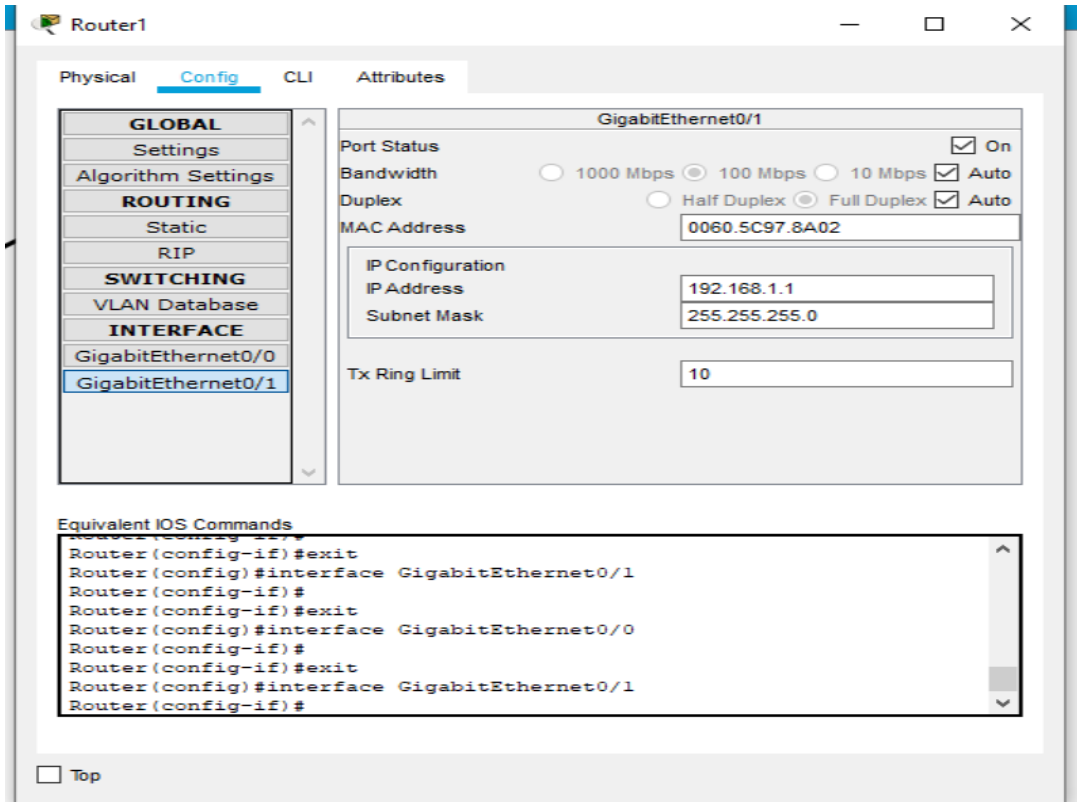
GigabitEthernet0/0	
Port Status	<input checked="" type="checkbox"/> On
Bandwidth	<input checked="" type="radio"/> 1000 Mbps <input type="radio"/> 100 Mbps <input type="radio"/> 10 Mbps <input checked="" type="checkbox"/> Auto
Duplex	<input type="radio"/> Half Duplex <input checked="" type="radio"/> Full Duplex <input checked="" type="checkbox"/> Auto
MAC Address	0060.5C97.8A01
IP Configuration	
IP Address	20.0.0.1
Subnet Mask	255.0.0.0
Tx Ring Limit	10

Equivalent IOS Commands:

```
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
```

☐ Top

. INS Interface Gigabit Ethernet 0/1:



The screenshot shows the configuration window for Router1, specifically for the GigabitEthernet0/1 interface. The window has tabs for Physical, Config, CLI, and Attributes. The Config tab is active, showing a tree view on the left with categories: GLOBAL (Settings, Algorithm Settings), ROUTING (Static, RIP), SWITCHING (VLAN Database), and INTERFACE (GigabitEthernet0/0, GigabitEthernet0/1). The GigabitEthernet0/1 interface is selected. The main configuration area shows the following settings:

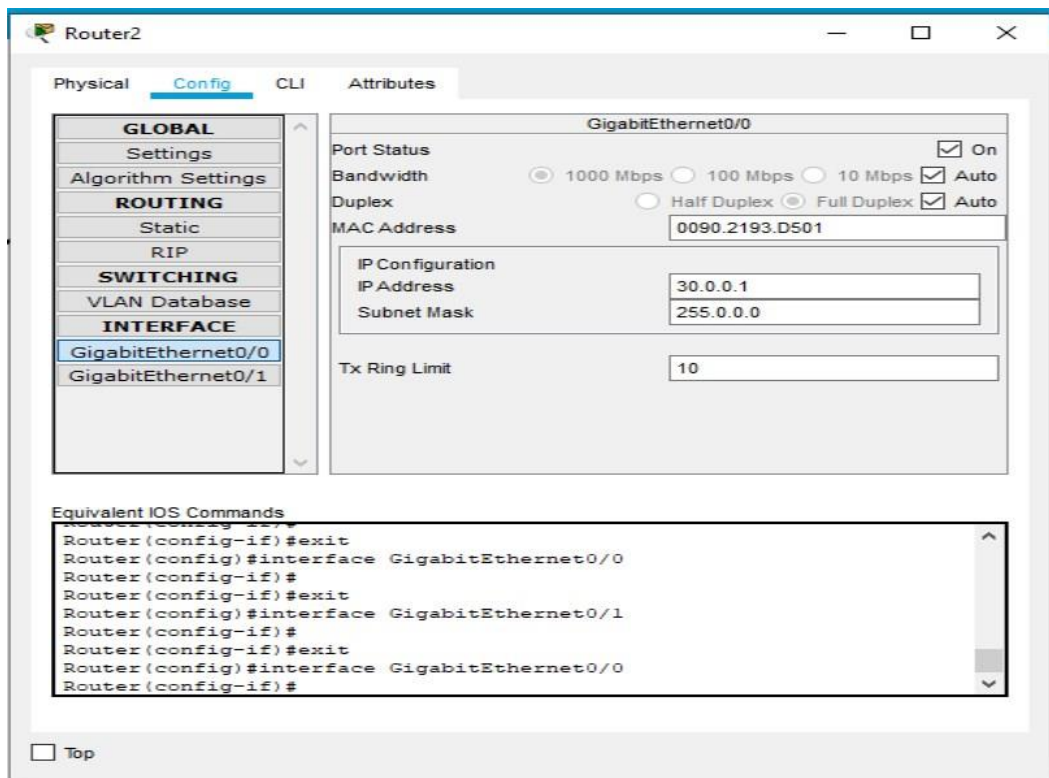
- Port Status: ☒ On
- Bandwidth: ☐ 1000 Mbps ☒ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 0060.5C97.8A02
- IP Configuration:
 - IP Address: 192.168.1.1
 - Subnet Mask: 255.255.255.0
- Tx Ring Limit: 10

Below the configuration area, there is a section for Equivalent IOS Commands:

```
Router(config)#  
Router(config-if)#exit  
Router(config)#interface GigabitEthernet0/1  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#interface GigabitEthernet0/0  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#interface GigabitEthernet0/1  
Router(config-if)#
```

At the bottom left, there is a checkbox labeled "Top".

Configuring Router2: Interface GigabitEthernet0/0:



The screenshot shows the configuration window for Router2, specifically for the GigabitEthernet0/0 interface. The window has tabs for Physical, Config, CLI, and Attributes. The Config tab is active, showing a tree view on the left with categories: GLOBAL (Settings, Algorithm Settings), ROUTING (Static, RIP), SWITCHING (VLAN Database), and INTERFACE (GigabitEthernet0/0, GigabitEthernet0/1). The GigabitEthernet0/0 interface is selected. The main configuration area shows the following settings:

- Port Status: ☒ On
- Bandwidth: ☒ 1000 Mbps ☐ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 0090.2193.D501
- IP Configuration:
 - IP Address: 30.0.0.1
 - Subnet Mask: 255.0.0.0
- Tx Ring Limit: 10

Below the configuration area, there is a section for Equivalent IOS Commands:

```
Router(config)#  
Router(config-if)#exit  
Router(config)#interface GigabitEthernet0/0  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#interface GigabitEthernet0/1  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#interface GigabitEthernet0/0  
Router(config-if)#
```

At the bottom left, there is a checkbox labeled "Top".

Interface GigabitEthernet0/1:

The screenshot shows the configuration window for Router2, specifically the 'Config' tab for the 'GigabitEthernet0/1' interface. The left sidebar shows a tree view with 'GigabitEthernet0/1' selected under the 'INTERFACE' section. The main configuration area shows the following settings:

- Port Status:** ☒ On
- Bandwidth:** ☐ 1000 Mbps ☒ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex:** ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address:** 0090.2193.D502
- IP Configuration:**
 - IP Address:** 192.168.2.1
 - Subnet Mask:** 255.255.255.0
- Tx Ring Limit:** 10

Below the configuration area, the 'Equivalent IOS Commands' section shows the following commands:

```

Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
  
```

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

Checking and Enabling the Security features in Router R1 and R2:

Enter the following command in the CLI mode of Router1

```
Router(config)#ip route 0.0.0.0 0.0.0.0 20.0.0.2
```

```
Router(config)#hostname R1
```

```
R1(config)#exit
```

```
R1#show version
```

```

Device# PID SN
-----
*0 CISC01941/K9 FTX1524N826-

Technology Package License Information for Module:'c1900'

-----
Technology Technology-package Technology-package
Current Type Next reboot
-----
ipbase ipbasek9 Permanent ipbasek9
security None None None
data None None None

Configuration register is 0x2102
  
```

```
R1#copy run startup-config
```

```
R1#reload R1>enable R1#show version
```

```
Technology Package License Information for Module:'c1900'
```

Technology	Technology-package Current	Type	Technology-package Next reboot
ipbase	ipbasek9	Permanent	ipbasek9
security	securityk9	Evaluation	securityk9
data	disable	None	None

```
Configuration register is 0x2102
```

(The security package is enabled)

Enter the following command in the CLI mode of Router2

```
Router(config)#ip route 0.0.0.0 0.0.0.0 30.0.0.2
```

```
Router(config)#hostname R2
```

```
R2(config)#exit
```

```
R2#show version
```

```
Device# PID SN
-----
*0 CISC01941/K9 FTX1524N826-
```

```
Technology Package License Information for Module:'c1900'
```

Technology	Technology-package Current	Type	Technology-package Next reboot
ipbase	ipbasek9	Permanent	ipbasek9
security	None	None	None
data	None	None	None

```
Configuration register is 0x2102
```

(We see that the security feature is not enabled, hence we need to enable the security package R2#)

```
R2#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
R2(config)#
```

```
R2(config)#license boot module c1900 technology-package securityk9
```

```
R2(config)#exit
```

```
R2#
```

```
R2#copy run startup-config
```

```
R2#reload
```

```
R2>enable
```

```
R2#show version
```

```
Technology Package License Information for Module:'c1900'
```

Technology	Technology-package Current	Technology-package Type	Technology-package Next reboot
security	securityk9	Evaluation	securityk9
data	disable	None	None

```
Configuration register is 0x2102
```

(The security package is enabled)

Enter the following command in the CLI mode of Router0

```
Router>enable
```

```
Router#configure terminal
```

```
Router(config)#hostname R0
```

```
R0(config)#
```

Defining the Hostname for all Routers and Configuring the Routers R1 and R2 for IPSec VPN tunnel

```
R1#configure terminal
```

```
R1(config)#access-list 100 permit ip 192.168.1.0 0.0.0.255 192.168.2.0 0.0.0.255
```

```
R1(config)#crypto isakmp policy 10
```

```
R1(config-isakmp)#encryption aes 256
```

```
R1(config-isakmp)#authentication pre-share R1(config-isakmp)#group 5
```

```
R1(config-isakmp)#exit
```

```
R1(config)#crypto isakmp key viva address 30.0.0.1
```

```
R1(config)#crypto ipsec transform-set R1->R2 esp-aes 256 esp-sha-hmac
```

```
R1(config)#
```

```
R2#
```

```
R2#configure terminal
```

```
R2(config)#access-list 100 permit ip 192.168.2.0 0.0.0.255 192.168.1.0 0.0.0.255
```

```
R2(config)#crypto isakmp policy 10
```

```
R2(config-isakmp)#encryption aes 256
```

```
R2(config-isakmp)#authentication pre-share
```

```
R2(config-isakmp)#group 5
```

```
R2(config-isakmp)#exit
```

R2(config)#crypto isakmp key viva address 20.0.0.1

R2(config)#crypto ipsec transform-set R2->R1 esp-aes 256 esp-sha-hmac R2(config)#

R1>enable

R1#configure terminal

R1(config)#crypto map IPSEC-MAP 10 ipsec- isakmp

R1(config-crypto-map)#set peer 30.0.0.1 R1(config-crypto-map)#set pfs group5

R1(config-crypto-map)#set security-association lifetime seconds 86400

R1(config-crypto-map)#set transform-set R1->R2

R1(config-crypto-map)#match address 100

R1(config-crypto-map)#exit

R1(config)#interface g0/0

R1(config-if)#crypto map IPSEC-MAP

R2>enable

R2#configure terminal

R2(config)#crypto map IPSEC-MAP 10 ipsec- isakmp

R2(config-crypto-map)#set peer 20.0.0.1

R2(config-crypto-map)#set pfs group5

R2(config-crypto-map)#set security-association lifetime seconds 86400

R2(config-crypto-map)#set transform-set R2->R1

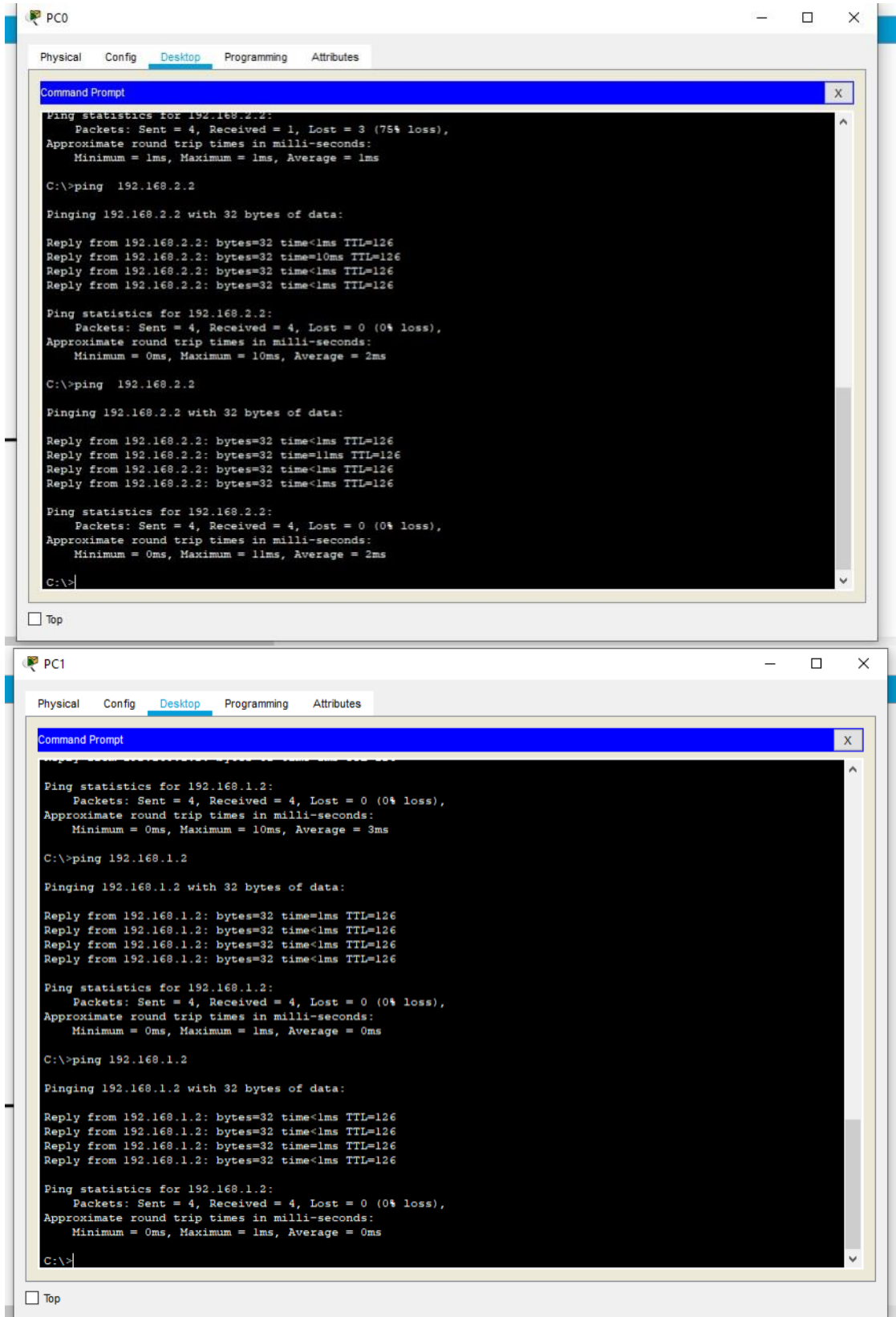
R2(config-crypto-map)#match address 100

R2(config-crypto-map)#exit R2(config)#interface g0/0

R2(config-if)#crypto map IPSEC-MAP

Output:

Pinging PC2(192.168.2.2) from PC1 and then PC1(192.168.1.2) from PC2



The image displays two screenshots of a network simulation interface, showing the results of ping commands executed from two different PCs (PC0 and PC1).

PC0 Screenshot:

- The window title is "PC0".
- The "Desktop" tab is selected.
- The "Command Prompt" window shows the following output:

```
Ping statistics for 192.168.2.2:
  Packets: Sent = 4, Received = 1, Lost = 3 (75% loss),
Approximate round trip times in milli-seconds:
  Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=10ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.2.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 10ms, Average = 2ms

C:\>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=11ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.2.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 11ms, Average = 2ms

C:\>
```

PC1 Screenshot:

- The window title is "PC1".
- The "Desktop" tab is selected.
- The "Command Prompt" window shows the following output:

```
Ping statistics for 192.168.1.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 10ms, Average = 3ms

C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time=1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```