Assignment

Network Systems Assignment

OBJECTIVE:

Design and configure a secure network in Cisco Packet Tracer consisting of two separate LANs connected through a VPN tunnel using multiple routers. Each LAN should contain five PCs connected to a switch, and routers should be configured to ensure secure communication between these two LANs and use RIP protocol for routing. Following are the network details:

LAN 1:

- Five PCs connected to a switch.
- Network address: 10.0.0.0
- Connected to Router0 (10.0.0.1)

LAN 2:

- Five PCs connected to a switch.
- Network address: 20.0.0.0
- Connected to Router0 (20.0.0.1)

Intermediate Network:

- Routers Router0, Router1, Router2, and Router3 are interconnected using these network addresses (60.0.0.0, 70.0.0.0, 80.0.0.0)
- Router0 and Router3 are the VPN endpoints.

Establish a successful VPN tunnel between Router0 and Router3. Attach all screenshots (including IP configuration, router configuration, VPN configuration, network structure, and output) along with a description in a PDF file and submit.

Network Structure
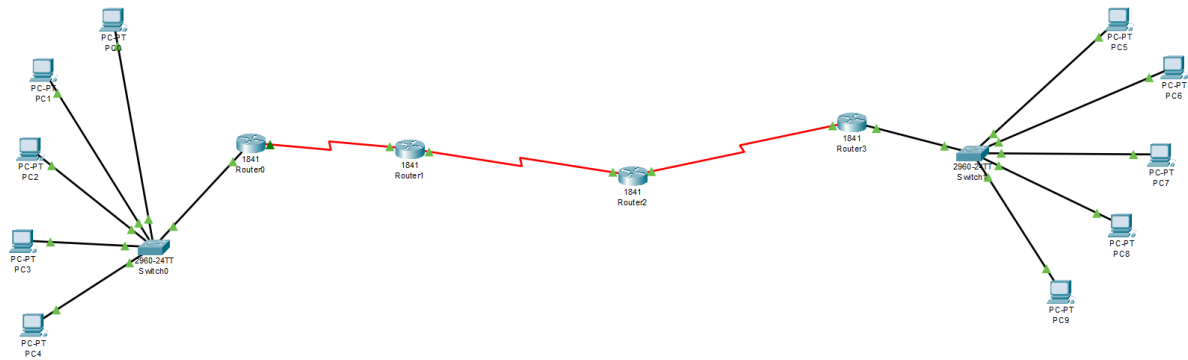
Components Used -
PC's - x10
Switch - x2 - 2960
Routers - x4 - 1841

LAN 1:
- Network Address: 10.0.0.0/8
- Router: Router0
- LAN Interface: 10.0.0.1
- Switch: Switch0
- **PCs:**
  - PC0: 10.0.0.5
  - PC1: 10.0.0.6
  - PC2: 10.0.0.7
  - PC3: 10.0.0.8
  - PC4: 10.0.0.9

LAN 2:
- Network Address: 20.0.0.0/8
- Router: Router3
- LAN Interface: 20.0.0.1
- Switch: Switch1
- **PCs:**
  - PC0: 20.0.0.5
  - PC1: 20.0.0.6
  - PC2: 20.0.0.7
  - PC3: 20.0.0.8
  - PC4: 20.0.0.9

Router connections -

- Router0 ↔ Router1 - 60.0.0.0/8 – 60.0.0.1 (R0) – 60.0.0.2 (R1)

- Router1 ↔ Router2 - 70.0.0.0/8 – 70.0.0.1 (R1) – 70.0.0.2 (R2)

- Router2 ↔ Router3 - 80.0.0.0/8 – 80.0.0.1 (R2) – 80.0.0.2 (R3)
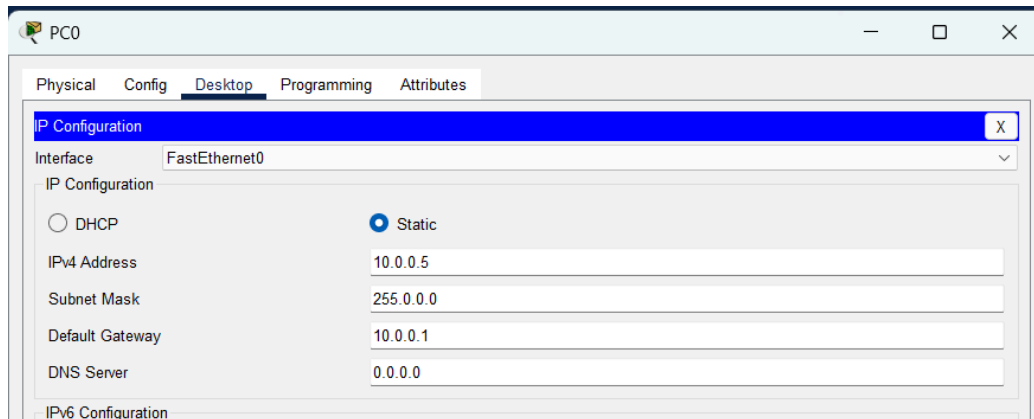
VPN Tunnel:
Endpoints:
1. Router0 (R0): VPN IP - 100.0.0.1
2. Router3 (R3): VPN IP - 100.0.0.2

Routing Protocol:
- RIP (Routing Information Protocol) is configured on all routers.
- Enables dynamic routing between LANs through intermediate routers
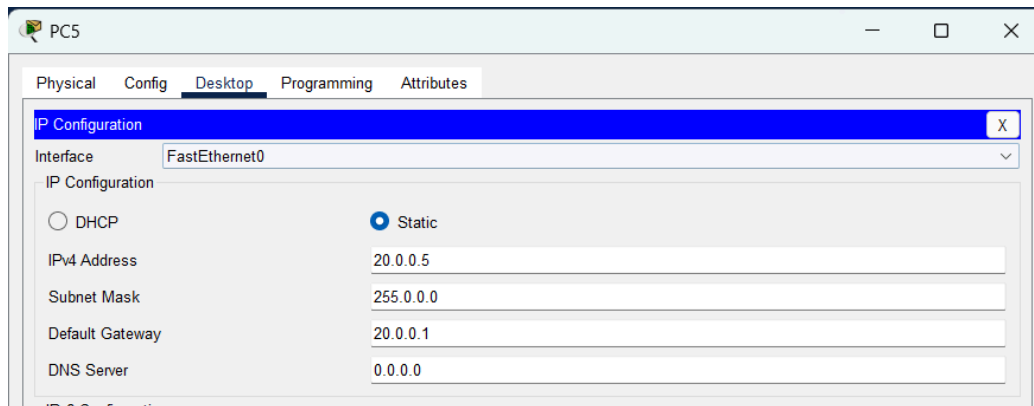
IP Configuration of PC0 - LAN 1

PC0   —   □   ✕

Physical   Config   Desktop   Programming   Attributes

IP Configuration   X

Interface   FastEthernet0   ⌄
 IP Configuration

  ○ DHCP   ● Static

  IPv4 Address   10.0.0.5

  Subnet Mask   255.0.0.0

  Default Gateway   10.0.0.1

  DNS Server   0.0.0.0

 IPv6 Configuration

IP Configuration of PC5 -LAN2

PC5   —   □   ✕

Physical   Config   Desktop   Programming   Attributes

IP Configuration   X

Interface   FastEthernet0   ⌄
 IP Configuration

  ○ DHCP   ● Static

  IPv4 Address   20.0.0.5

  Subnet Mask   255.0.0.0

  Default Gateway   20.0.0.1

  DNS Server   0.0.0.0

 IPv6 Configuration

Router Configuration -

1. **Router 0**

FastEthernet0/0			
Port Status			☑ On
Bandwidth		○ 100 Mbps ○ 10 Mbps	☑ Auto
Duplex		○ Half Duplex ◉ Full Duplex	☑ Auto
MAC Address	0001.C96C.2A01		

IP Configuration
IPv4 Address 10.0.0.1
Subnet Mask 255.0.0.0

Serial0/0/0		
Port Status		☑ On
Duplex	◉ Full Duplex	
Clock Rate	2000000	⌄

IP Configuration
IPv4 Address 60.0.0.1
Subnet Mask 255.0.0.0

Tx Ring Limit 10

2. **Router 1**

Serial0/0/0		
Port Status		☑ On
Duplex	◉ Full Duplex	
Clock Rate	2000000	⌄

IP Configuration
IPv4 Address 60.0.0.2
Subnet Mask 255.0.0.0

Tx Ring Limit 10

Serial0/0/1

Port Status	☑ On
Duplex	⊙ Full Duplex
Clock Rate	2000000 ∨

IP Configuration

IPv4 Address	70.0.0.1
Subnet Mask	255.0.0.0

Tx Ring Limit	10

3. Router 2

Serial0/0/0

Port Status	☑ On
Duplex	⊙ Full Duplex
Clock Rate	2000000 ∨

IP Configuration

IPv4 Address	70.0.0.2
Subnet Mask	255.0.0.0

Tx Ring Limit	10

Serial0/0/1

Port Status	☑ On
Duplex	⊙ Full Duplex
Clock Rate	2000000 ∨

IP Configuration

IPv4 Address	80.0.0.1
Subnet Mask	255.0.0.0

Tx Ring Limit	10

4. Router 3

FastEthernet0/0	
Port Status	☑ On
Bandwidth	○ 100 Mbps ○ 10 Mbps ☑ Auto
Duplex	○ Half Duplex ○ Full Duplex ☑ Auto
MAC Address	0030.A3B7.2101

IP Configuration

IPv4 Address	20.0.0.1
Subnet Mask	255.0.0.0

Tx Ring Limit	10

Serial0/0/0	
Port Status	☑ On
Duplex	○ Full Duplex
Clock Rate	2000000 ⌄

IP Configuration

IPv4 Address	80.0.0.2
Subnet Mask	255.0.0.0

Tx Ring Limit	10

RIP Configuration in Routers -

Pinging Before Implementation of VPN -

```
Pinging 20.0.0.5 with 32 bytes of data:

Reply from 20.0.0.5: bytes=32 time=38ms TTL=124
Reply from 20.0.0.5: bytes=32 time=96ms TTL=124
Reply from 20.0.0.5: bytes=32 time=69ms TTL=124
Reply from 20.0.0.5: bytes=32 time=82ms TTL=124

Ping statistics for 20.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 38ms, Maximum = 96ms, Average = 71ms
```

Traceroute to track path -

```
C:\>tracert 20.0.0.5

Tracing route to 20.0.0.5 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms       10.0.0.1
  2   11 ms      8 ms      4 ms       60.0.0.2
  3    1 ms      1 ms      1 ms       70.0.0.2
  4   11 ms     20 ms      1 ms       80.0.0.2
  5   10 ms      5 ms     12 ms       20.0.0.5

Trace complete.
```

The output shows that the data travels through five hops:

1. **10.0.0.1 – Router0 (LAN 1 Gateway)**
2. **60.0.0.2 – Router1**
3. **70.0.0.2 – Router2**
4. **80.0.0.2 – Router3**
5. **20.0.0.5 – Destination PC in LAN 2**

Now, implementing the VPN tunnel from Router 0 to Router 3:

A VPN tunnel is logically established from Router0 to Router3, encapsulating traffic between LAN1 and LAN2 securely over the internet-like intermediate network.

Router 0 -

```
Router#en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface tunnel 0
Router(config-if)#tunnel source Serial0/0/0
Router(config-if)#exit
Router(config)#interface tunnel 0
Router(config-if)#ip address 100.0.0.1 255.255.255.0
Router(config-if)#tunnel source Serial0/0/0
Router(config-if)#tunnel destination 80.0.0.2
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up

Router(config-if)#exit
Router(config)#
```

Commands -

- interface tunnel 0
- ip address 100.0.0.1 255.255.255.0
- tunnel source Serial0/0/0
- tunnel destination 80.0.0.2
- Exit

Router 3 -

```
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface tunnel 0

Router(config-if)#
%LINK-5-CHANGED: Interface Tunnel0, changed state to up

Router(config-if)#ip address 100.0.0.2 255.255.255.0
Router(config-if)#tunnel source Serial0/0/0
Router(config-if)#tunnel destination 60.0.0.1
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#write memory
Building configuration...
[OK]
Router#
```

Commands -

- interface tunnel 0
- ip address 100.0.0.2 255.255.255.0
- tunnel source Serial0/0/0
- tunnel destination 60.0.0.1
- exit

Checking traceroute after VPN Implementation

From PC0 to tunnel endpoint (100.0.0.2)

```
Cisco Packet Tracer PC Command Line 1.0
C:\>tracert 100.0.0.2

Tracing route to 100.0.0.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms       10.0.0.1
  2   20 ms     13 ms     17 ms       100.0.0.2

Trace complete.

C:\>
```

- It skipped Router 1 and Router 2 and directly jumped to end point (100.0.0.2) of VPN tunnel.

From PC5 to tunnel end point (100.0.0.1)

```
Cisco Packet Tracer PC Command Line 1.0
C:\>tracert 100.0.0.1

Tracing route to 100.0.0.1 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms       20.0.0.1
  2   20 ms     20 ms      3 ms       100.0.0.1

Trace complete.

C:\>
```

- It skipped Router 1 and Router 2 and directly jumped to end point (100.0.0.1) of VPN tunnel.

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