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Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SWE2002 – COMPUTER NETWORKS

Fall Inter Semester 2022-23

LAB ASSESSMENT - V

Submitted by:

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BRANCH

INTEGRATED MTECH (SOFTWARE ENGINEERING)
MTECH5
SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

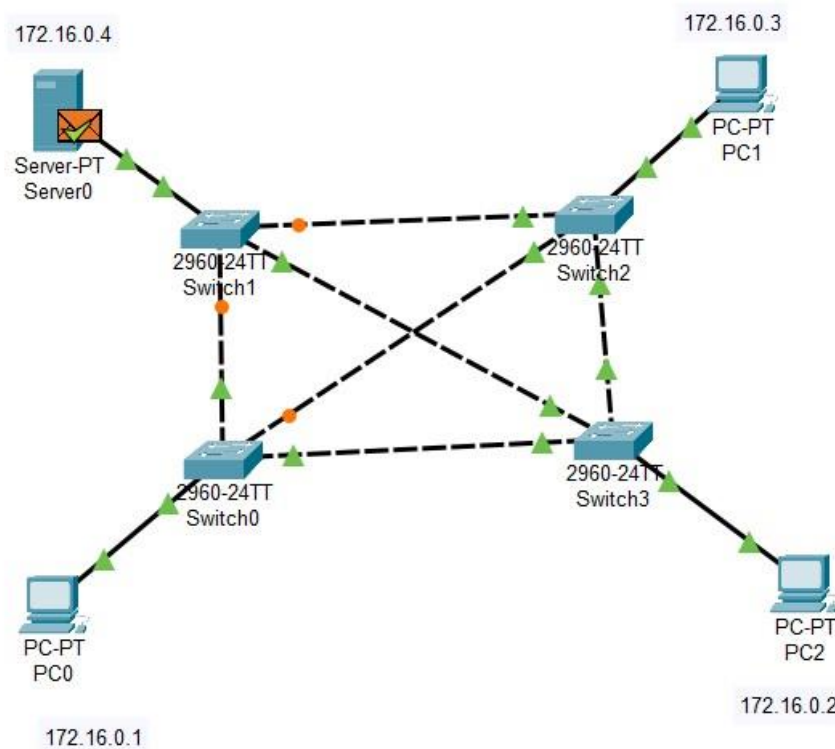
FACULTY

Prof. Sofia Nishath

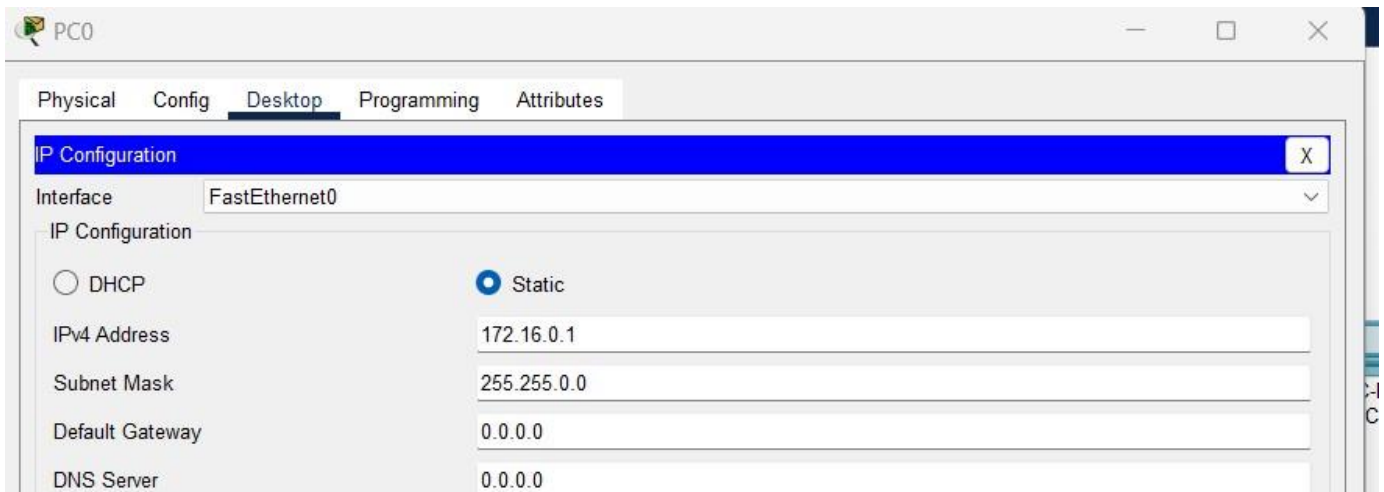
(a) Design a Client-Server LAN with Mesh Topology using Cisco Packet Tracer and check the PDU transmission between the nodes.

Step-by-Step Procedure :

1. Design a circuit in cisco packet tracer with four switches, three PCs and one server and establish a client-server LAN with Mesh Topology.
2. Mention the IP addresses of all end devices (i.e., Server and PCs) as a note as shown in below diagram.



3. Configure the IP addresses of all four end devices present in the circuit.



PC1

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 172.16.0.3

Subnet Mask 255.255.0.0

Default Gateway 0.0.0.0

DNS Server 0.0.0.0

PC2

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 172.16.0.2

Subnet Mask 255.255.0.0

Default Gateway 0.0.0.0

DNS Server 0.0.0.0

Server0

Physical Config Services Desktop Programming Attributes

IP Configuration X

IP Configuration

☐ DHCP ☒ Static

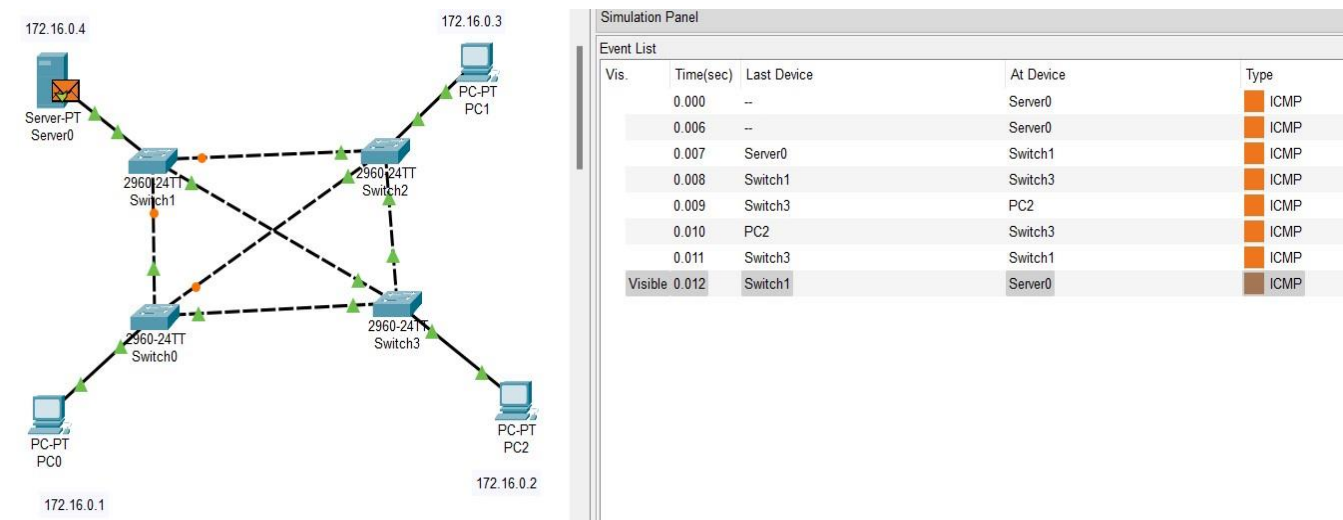
IPv4 Address 172.16.0.4

Subnet Mask 255.255.0.0

Default Gateway 0.0.0.0

DNS Server 0.0.0.0

4. Send an ICMP packet from Server 0 to PC2 and observe the simulation of it step by step in simulation panel of cisco packet tracer.



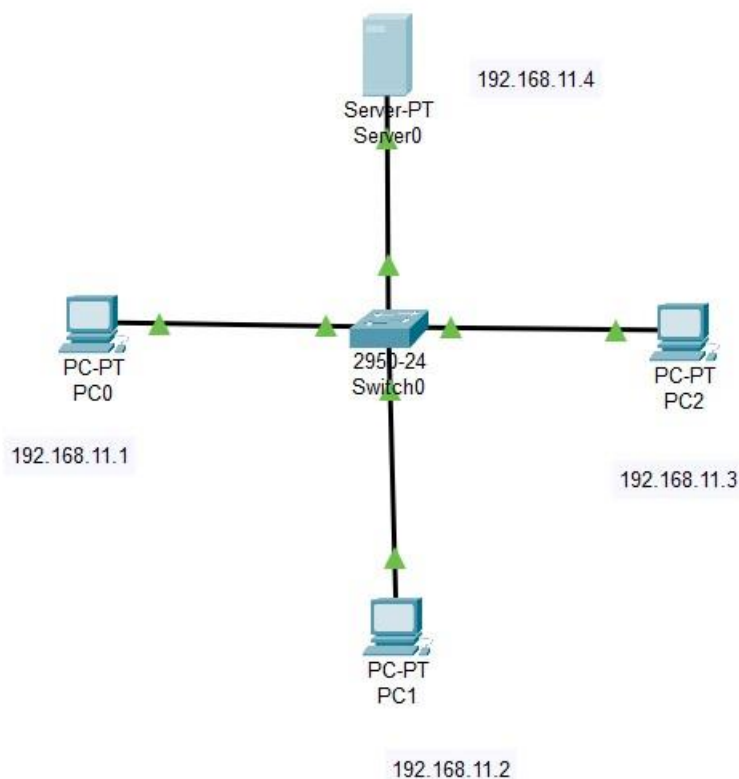
5. The simulation of ICMP packet from Server 0 to PC2 is successful , and Server 0 received acknowledgement from PC2 successfully.

Event List Realtime Simulation										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Server0	PC2	ICMP		0.000	N	0	(edit)	(delete)

(b) Configure ARP using CPT

Step-by-Step procedure :

1. Design a circuit in cisco packet tracer with one switch, three PCs and one server.
2. Mention the IP addresses of all end devices (i.e., Server and PCs) as a note as shown in below diagram.
3. Click on inspect icon >> Click on PC0 >> Select ARP Table
4. Click on inspect icon >> Click on Server0 >> Select ARP Table
5. As you can see below both the ARP Tables are initially empty.



IP Address	Hardware Address	Interface
------------	------------------	-----------

IP Address	Hardware Address	Interface
------------	------------------	-----------

6. Configure all the end devices as given below.

PC0

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.11.1

Subnet Mask 255.255.255.0

Default Gateway 0.0.0.0

DNS Server 0.0.0.0

PC1

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.11.2

Subnet Mask 255.255.255.0

Default Gateway 0.0.0.0

DNS Server 0.0.0.0

PC2

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

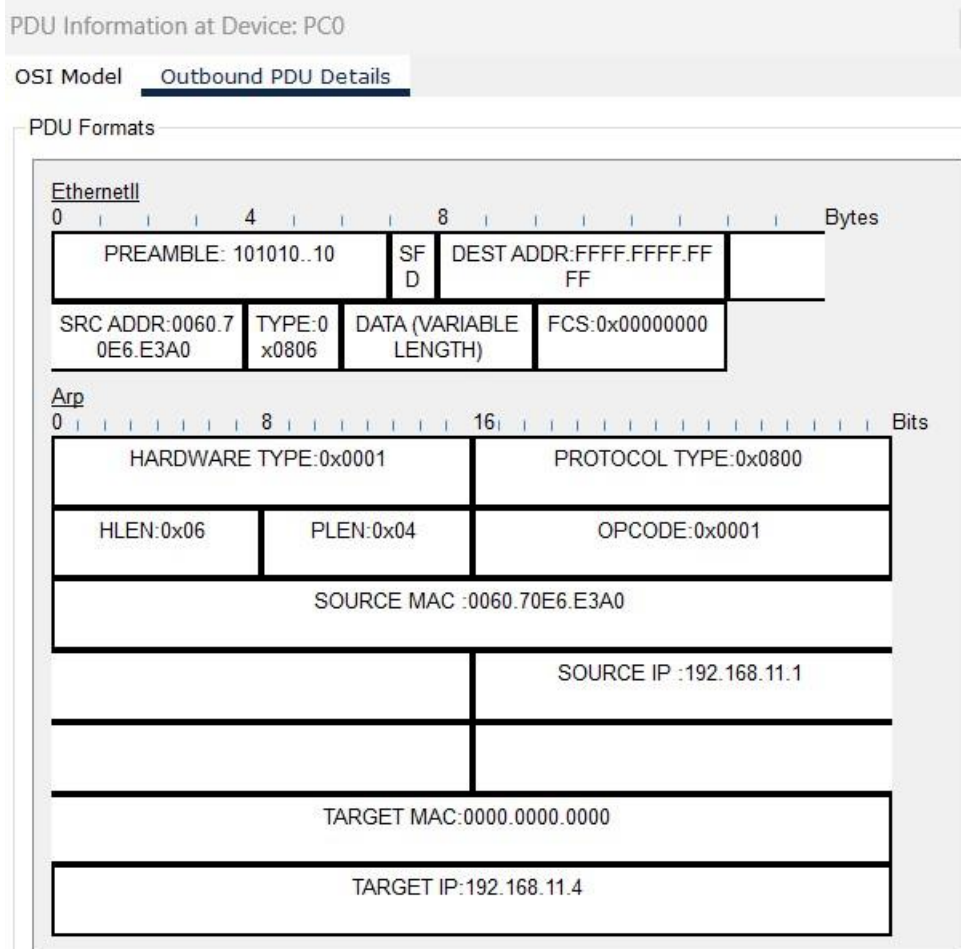
IPv4 Address 192.168.11.3

Subnet Mask 255.255.255.0

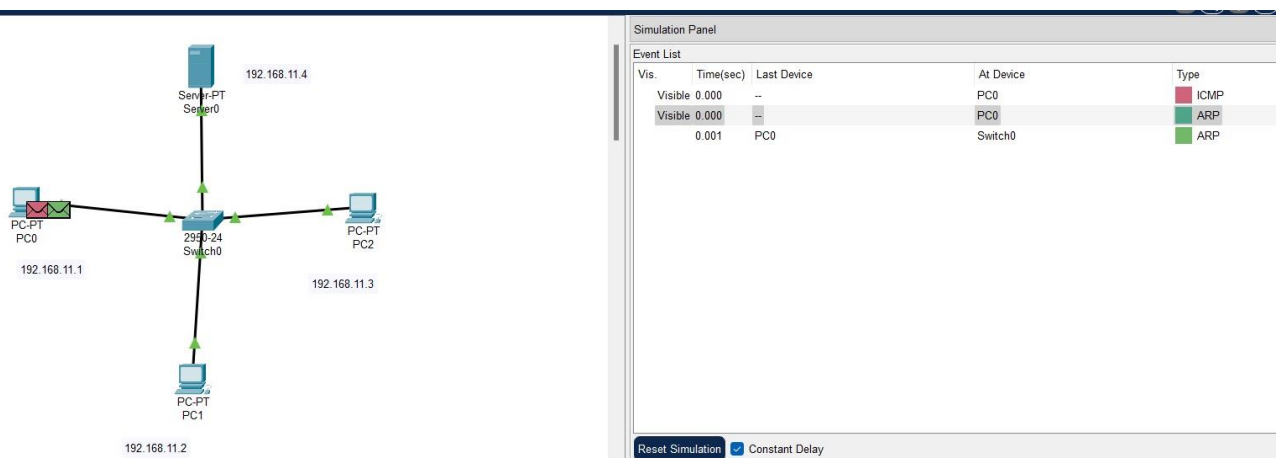
Default Gateway 0.0.0.0

DNS Server 0.0.0.0

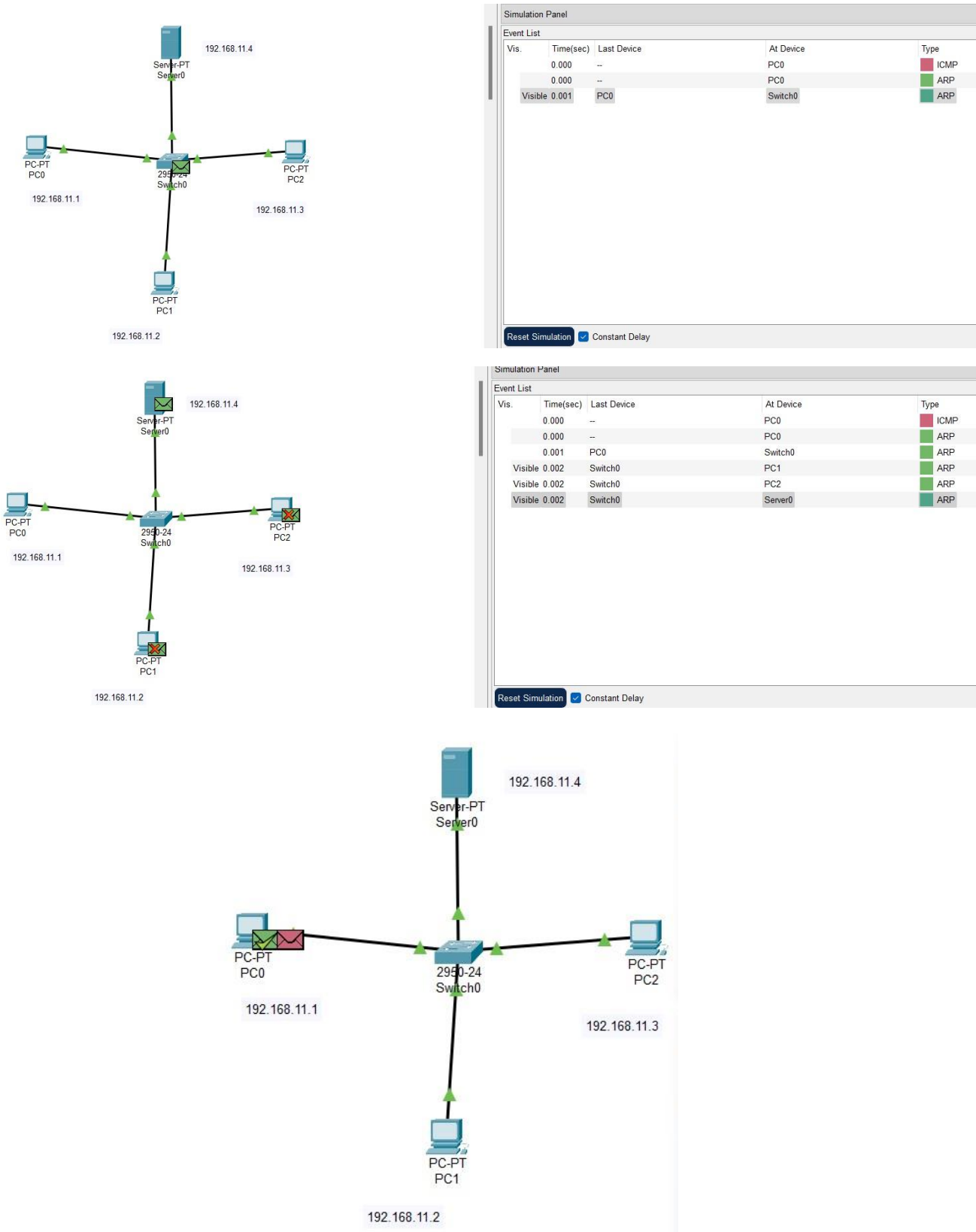
7. Click on PC0 >> PDU information >> Outbound PDU Details. You can see that we have the target IP and by configuring ARP we are going to fetch the MAC or hardware address of target i.e., Server 0.



8. Now you have an ICMP packet and an ARP packet at source i.e., PC0

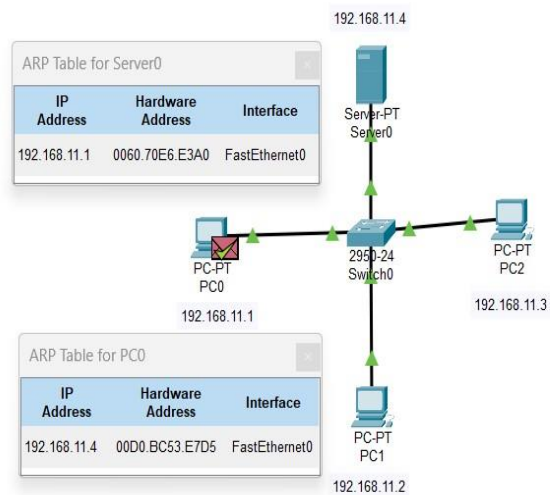


9. Now open simulation view and start simulating, ICMP packet will send ping requests to all the end devices and bring back acknowledgement to source.



10. Now simulate ARP packet, it fetches the target MAC address i.e., hardware address of Server 0.

11. As a result, we can observe the unknown MAC address of Server 0 in ARP table of Server 0 by the ARP configuration.

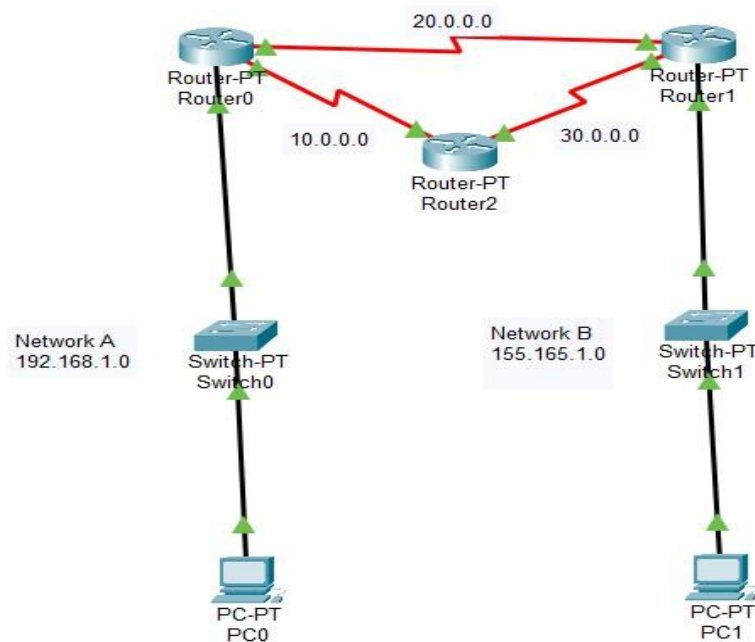


Simulation Panel				
Event List				
Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.000	--	PC0	ARP
	0.001	PC0	Switch0	ARP
	0.002	Switch0	PC1	ARP
	0.002	Switch0	PC2	ARP
	0.002	Switch0	Server0	ARP
	0.003	Server0	Switch0	ARP
	0.004	Switch0	PC0	ARP
	0.004	--	PC0	ICMP
	0.005	PC0	Switch0	ICMP
	0.006	Switch0	Server0	ICMP
	0.007	Server0	Switch0	ICMP
Visible	0.008	Switch0	PC0	ICMP

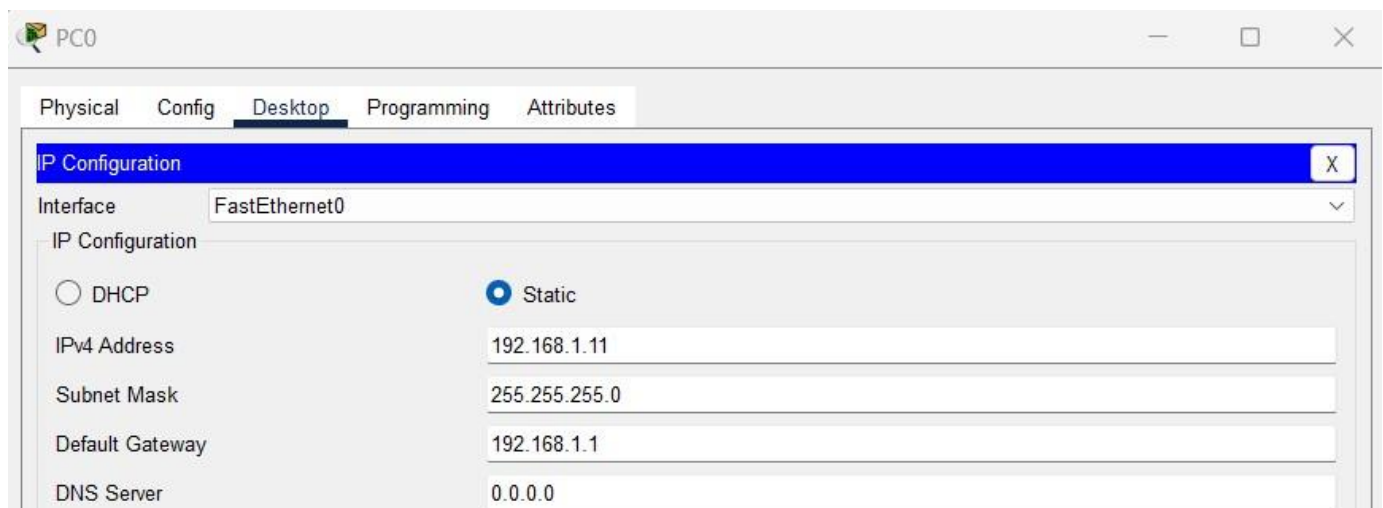
(c) Design a network with OSPF using CPT

Step-by-Step procedure :

1. Design a circuit in cisco packet tracer with two switches, two PCs and three routers to find the shortest path for a packet to travel.
2. Mention the IP addresses of all devices as a note as shown in below diagram.



3. Configure the IP addresses and default gateways of both the PCs.



PC1

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 155.165.1.11

Subnet Mask 255.255.0.0

Default Gateway 155.165.1.1

DNS Server 0.0.0.0

4. Configure the routers.

Router0

Physical **Config** CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

FastEthernet4/0

FastEthernet0/0

Port Status ☒ On

Bandwidth ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☒ Half Duplex ☐ Full Duplex ☒ Auto

MAC Address 000C.854D.BC97

IP Configuration

IPv4 Address 192.168.1.1

Subnet Mask 255.255.255.0

Tx Ring Limit 10

Router1

Physical **Config** CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

FastEthernet0/0

Port Status ☒ On

Bandwidth ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☒ Half Duplex ☐ Full Duplex ☒ Auto

MAC Address 0060.5C96.6A6B

IP Configuration

IPv4 Address 155.165.1.1

Subnet Mask 255.255.0.0

Tx Ring Limit 10

Router2

Physical **Config** CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

Serial2/0

Port Status ☒ On

Duplex ☐ Full Duplex

Clock Rate Not Set

IP Configuration

IPv4 Address 10.0.0.1

Subnet Mask 255.0.0.0

Tx Ring Limit 10

Router0

Physical **Config** CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

Serial3/0

Port Status ☒ On

Duplex ☐ Full Duplex

Clock Rate 64000

IP Configuration

IPv4 Address 20.0.0.1

Subnet Mask 255.0.0.0

Tx Ring Limit 10

Router1

Physical **Config** CLI Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

INTERFACE

FastEthernet0/0

FastEthernet1/0

Serial2/0

Serial3/0

Serial3/0

Port Status ☒ On

Duplex ☐ Full Duplex

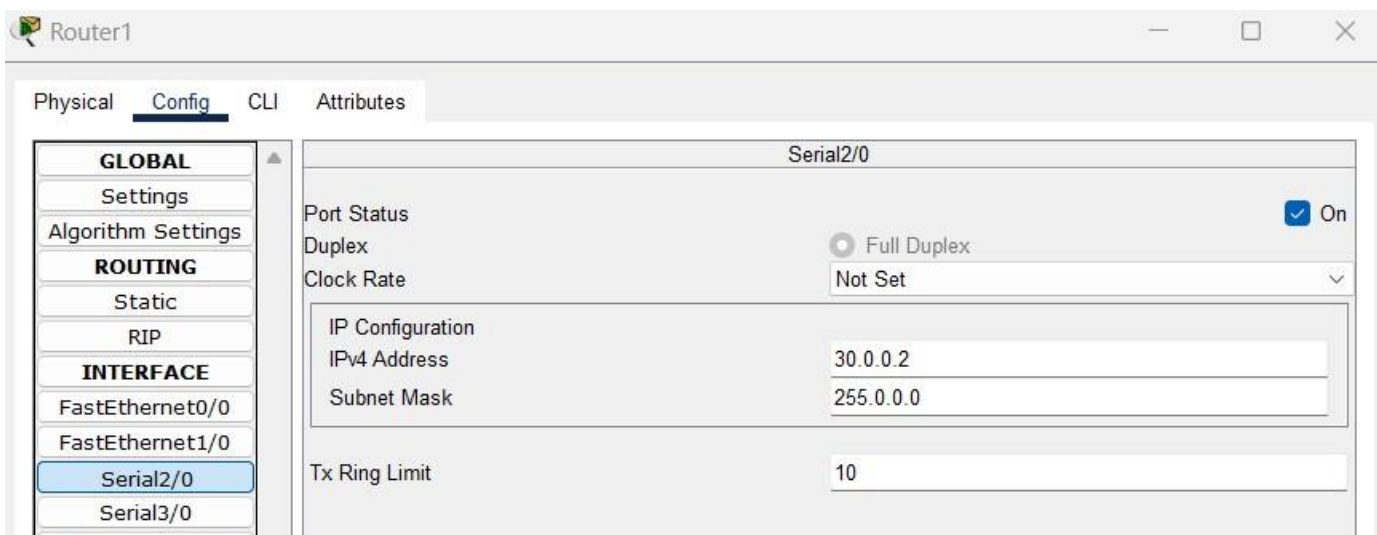
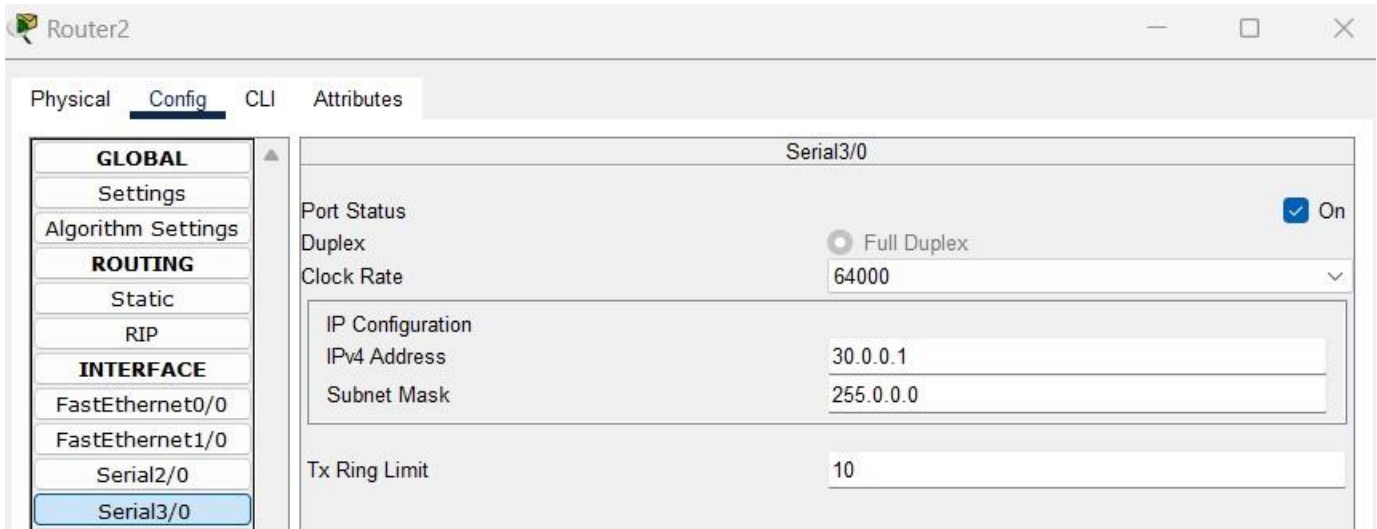
Clock Rate Not Set

IP Configuration

IPv4 Address 20.0.0.2

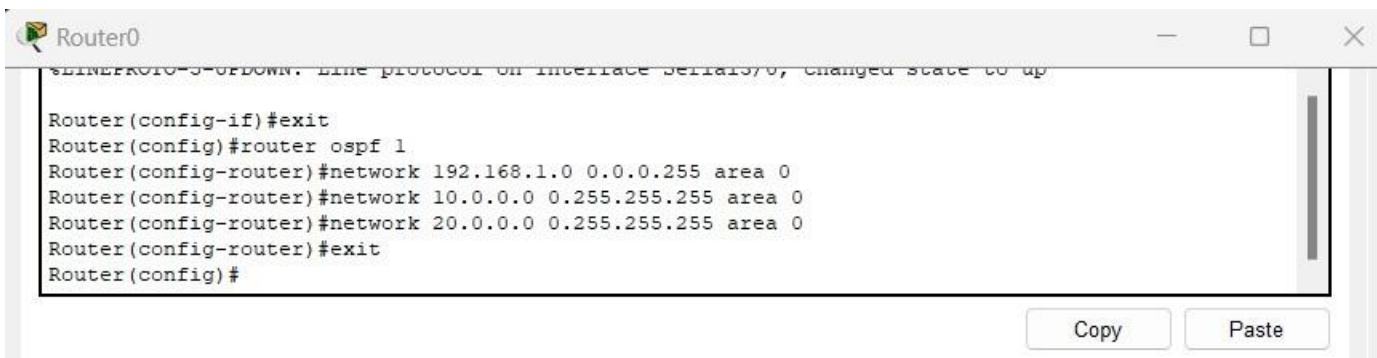
Subnet Mask 255.0.0.0

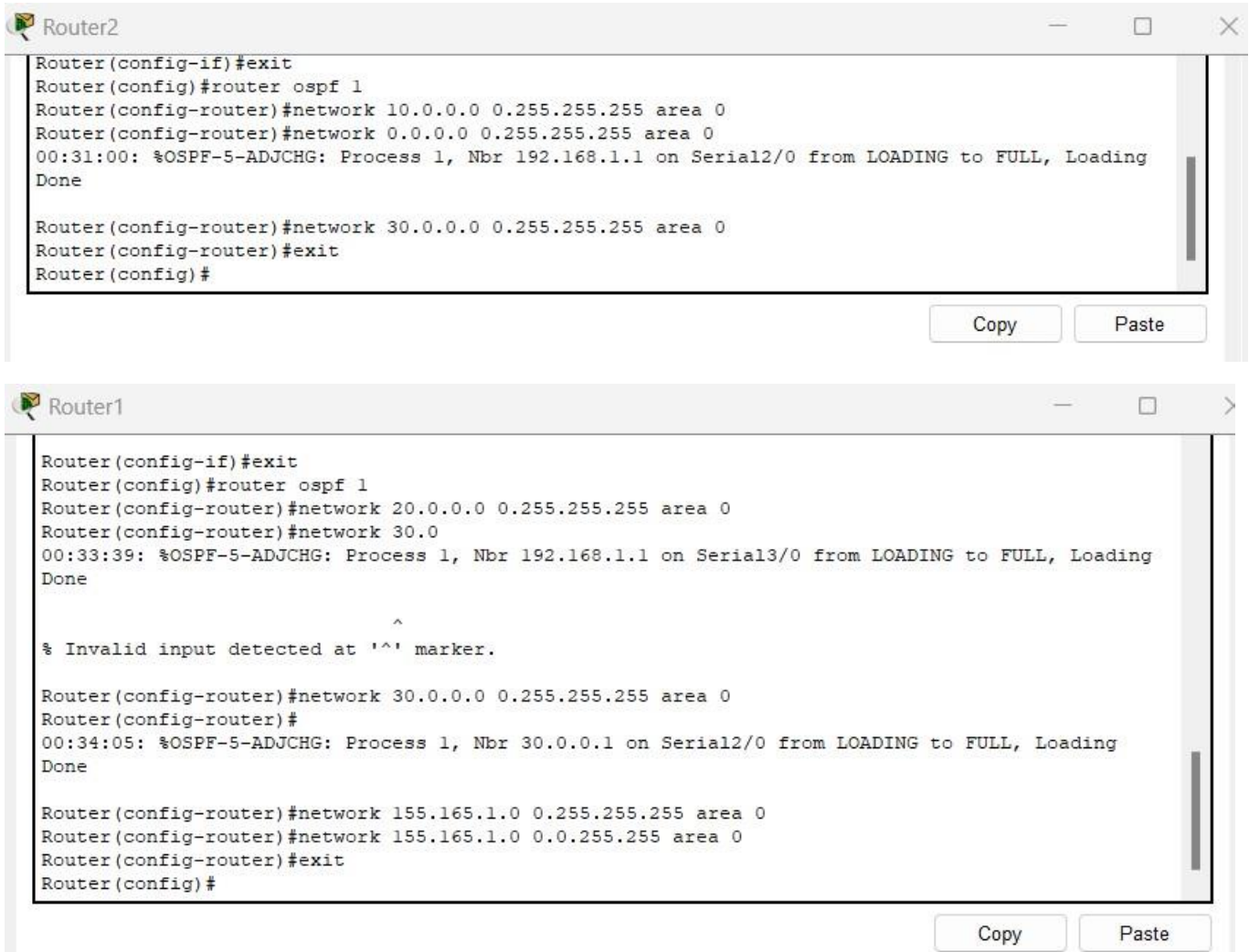
Tx Ring Limit 10



5. Open CLI of all three routers and establish OSPF.

6. Specify the networks connected to each router with syntax “network-IP address-wildcard mask-area 0”.



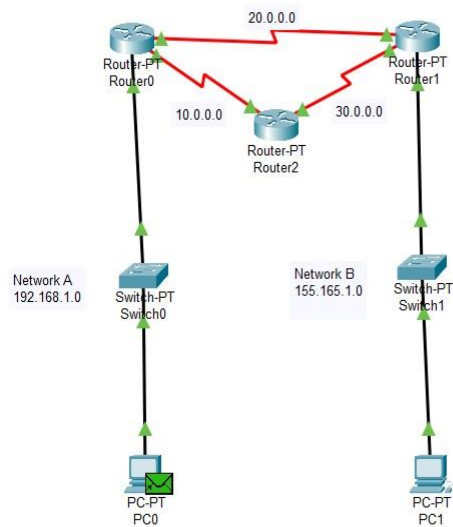


The image shows two terminal windows from a network simulation. The top window, titled 'Router2', shows the configuration of OSPF on a router. The user enters 'exit' from the interface configuration mode, then 'router ospf 1' to enter OSPF configuration mode. They then configure two networks: '10.0.0.0 0.255.255.255 area 0' and '0.0.0.0 0.255.255.255 area 0'. A system message indicates that OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial2/0 has transitioned from LOADING to FULL. After configuring the second network, the user enters 'exit' twice to return to the configuration prompt. The bottom window, titled 'Router1', shows a similar configuration process. The user enters 'exit', 'router ospf 1', and configures '20.0.0.0 0.255.255.255 area 0' and '30.0 30.0'. A system message indicates that OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial3/0 has transitioned from LOADING to FULL. The user then enters an invalid input '^', which triggers a message '% Invalid input detected at '^' marker.'. They then configure '30.0.0.0 0.255.255.255 area 0', followed by '155.165.1.0 0.255.255.255 area 0' and '155.165.1.0 0.0.255.255 area 0'. Finally, they enter 'exit' twice to return to the configuration prompt. Both windows have 'Copy' and 'Paste' buttons at the bottom right.

```
Router2
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#network 0.0.0.0 0.255.255.255 area 0
00:31:00: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial2/0 from LOADING to FULL, Loading Done
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#

Router1
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
Router(config-router)#network 30.0
00:33:39: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial3/0 from LOADING to FULL, Loading Done
^
% Invalid input detected at '^' marker.
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#
00:34:05: %OSPF-5-ADJCHG: Process 1, Nbr 30.0.0.1 on Serial2/0 from LOADING to FULL, Loading Done
Router(config-router)#network 155.165.1.0 0.255.255.255 area 0
Router(config-router)#network 155.165.1.0 0.0.255.255 area 0
Router(config-router)#exit
Router(config)#
```

7. Now send an ICMP packet from PC0 to PC1 and simulate.
8. The path of the packet is PC0 >> Router 0 >> Router 1 >> PC1 >> Router 1 >> Router 0 >> PC0
9. As a result, the above path is the shortest path as the ICMP packet didn't travelled through Router 2.



Simulation Panel				
Event List				
Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.001	PC0	Switch0	ICMP
	0.002	Switch0	Router0	ICMP
	0.003	Router0	Router1	ICMP
	0.004	Router1	Switch1	ICMP
	0.005	Switch1	PC1	ICMP
	0.006	PC1	Switch1	ICMP
	0.007	Switch1	Router1	ICMP
	0.008	Router1	Router0	ICMP
	0.009	Router0	Switch0	ICMP
Visible	0.010	Switch0	PC0	ICMP

Reset Simulation ☒ Constant Delay

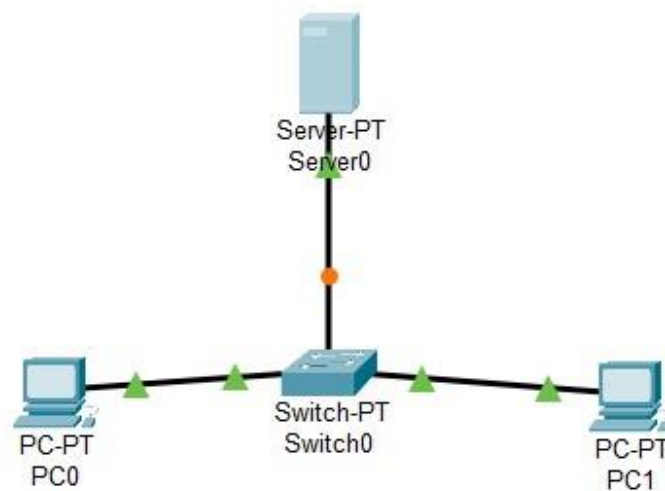
Play Controls

⏮ ⏪ ⏩ ⏭

(d) Implement a Packet Tracer script that configures a DHCP server and multiple DHCP clients. The DHCP server should provide IP addresses, subnet masks, and default gateways to the clients dynamically.

Step-by-Step procedure :

1. Design a circuit in cisco packet tracer with one switch, two PCs and one server as given below.



2. Do the below DHCP configuration for Server 0, so that server will allot the IP addresses , Default gateways and DNS Server to PC0 and PC1 dynamically.

The screenshot shows the 'Server0' window with the 'Desktop' tab selected. The 'IP Configuration' section is active, displaying the following settings:

Field	Value
IP Configuration	<input type="radio"/> DHCP <input checked="" type="radio"/> Static
IPv4 Address	10.0.0.1
Subnet Mask	255.0.0.0
Default Gateway	10.0.0.2
DNS Server	10.0.0.1

The screenshot shows the 'Server0' window with the 'Services' tab selected. The 'DHCP' service is configured as follows:

SERVICES

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

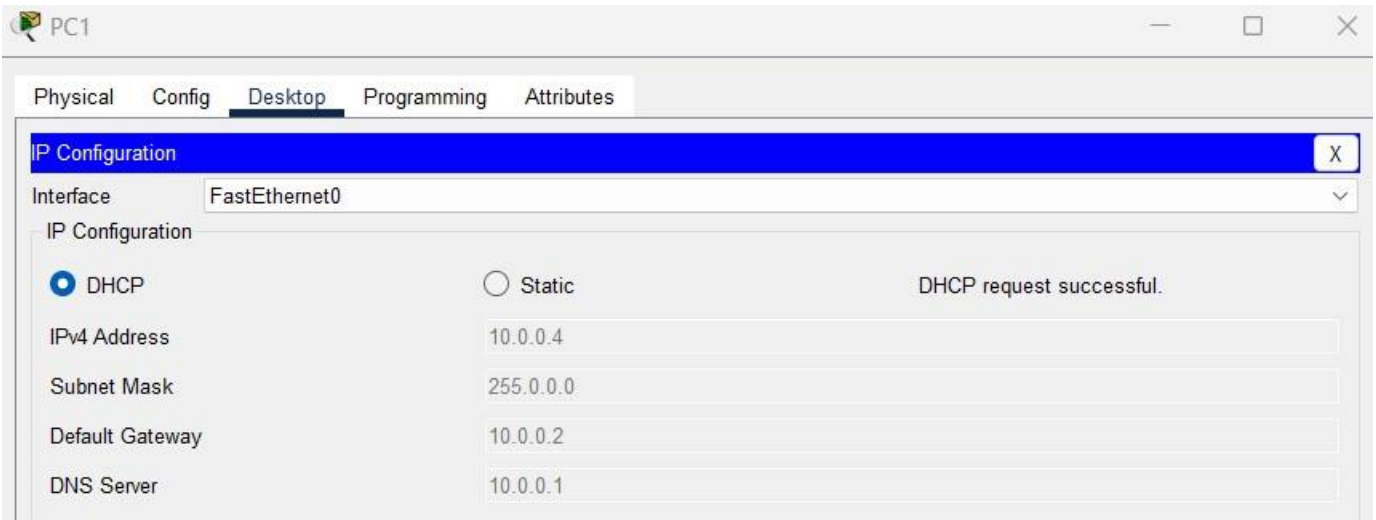
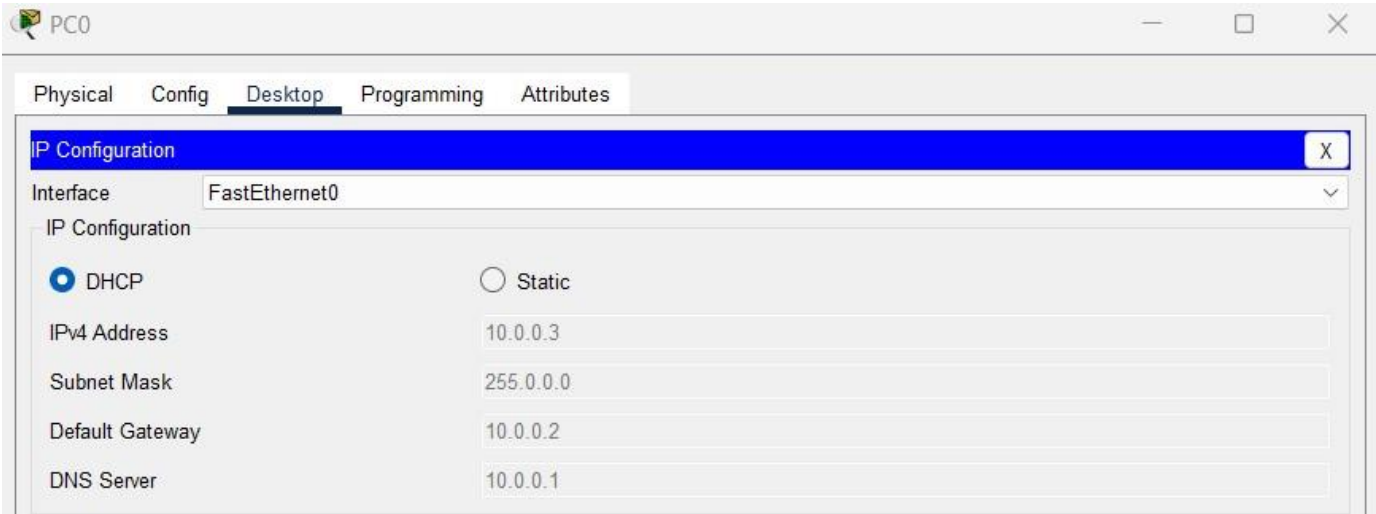
DHCP Configuration:

- Interface: FastEthernet0
- Service: ☒ On ☐ Off
- Pool Name: serverPool
- Default Gateway: 10.0.0.2
- DNS Server: 10.0.0.1
- Start IP Address: 10.0.0.3
- Subnet Mask: 255.0.0.0
- Maximum Number of Users: 512
- TFTP Server: 0.0.0.0
- WLC Address: 0.0.0.0

Buttons: Add, Save, Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool	10.0.0.2	10.0.0.1	10.0.0.3	255.0.0.0	512	0.0.0.0	0.0.0.0

3. Configure PC0 and PC1 from Static to DHCP.



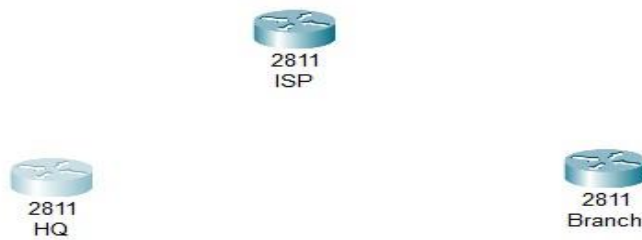
4. Send a packet from PC0 to PC1 , the transmission will be successful.

											Realtime	Simulation
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete		
	Successful	PC0	PC1	ICMP		0.000	N	0	(edit)	(delete)		

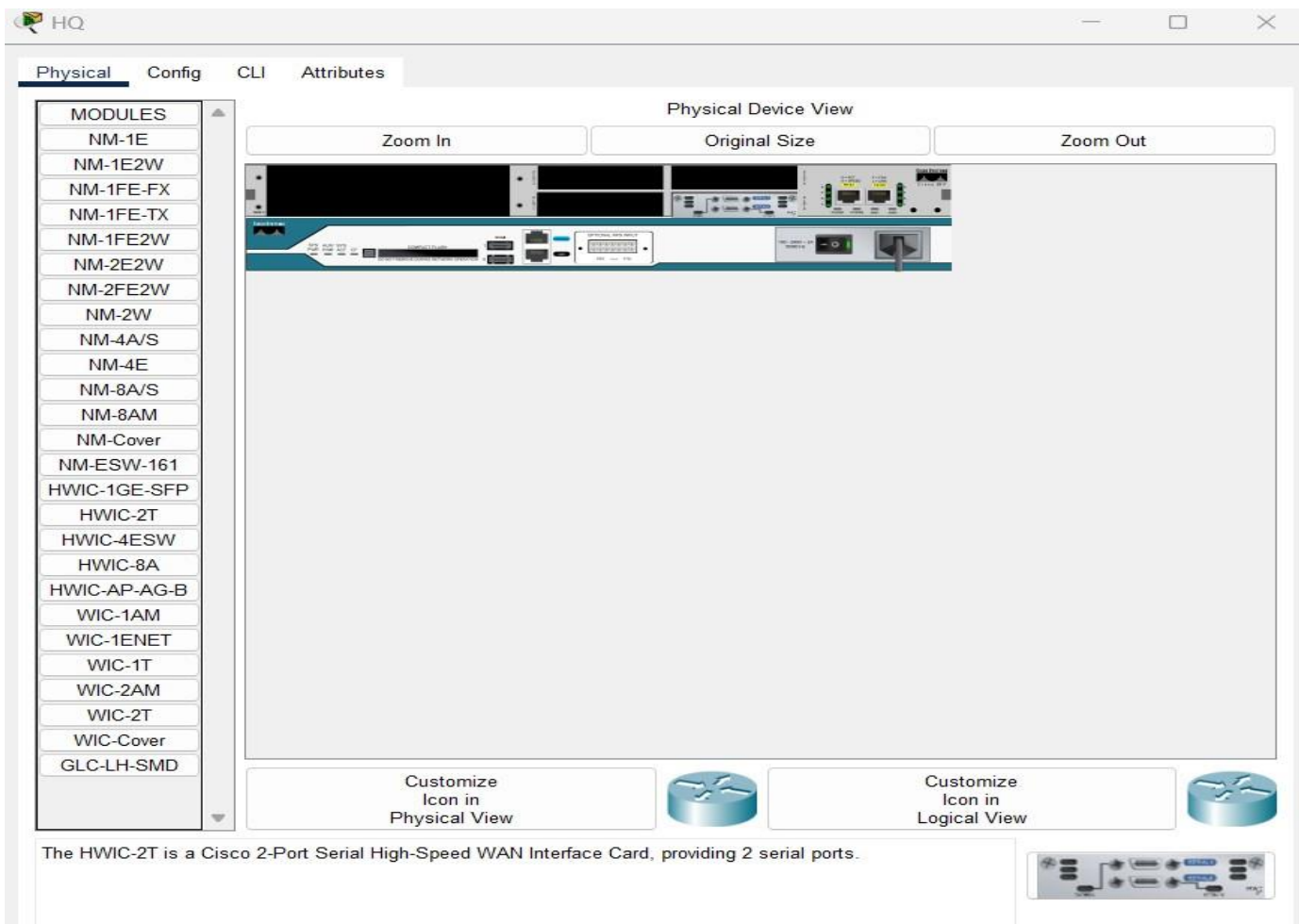
(e) Write a Packet Tracer script that simulates a network with a virtual private network (VPN) connection. Configure a VPN tunnel between two routers and verify the connectivity between the networks.

Step-by-Step procedure :

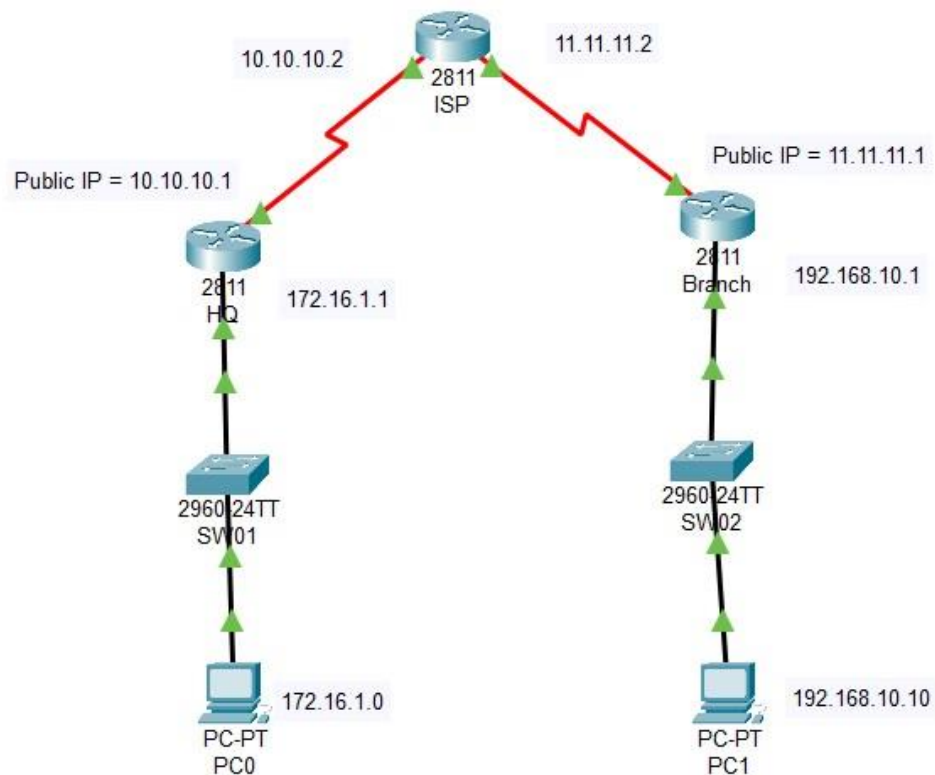
1. Take 3 routers and rename them as HQ (headquarters) , Branch and ISP. We are going to establish a VPN tunnel between HQ and Branch routers with the help of ISP.



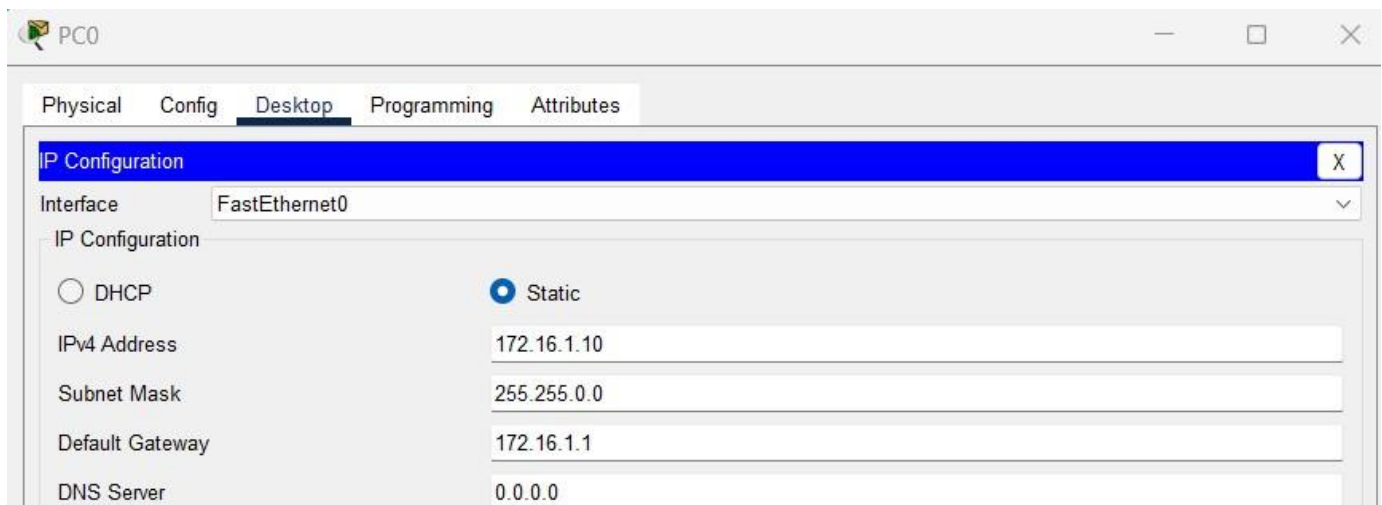
2. Configure each router HWIC-2T card and turn on the router in physical view.



3. Design a circuit and mention the IP addresses as a note as in given below diagram.



4. Configure PC0 and PC1.



PC1

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.10.10

Subnet Mask 255.255.255.0

Default Gateway 192.168.10.1

DNS Server 0.0.0.0

5. Configure all three routers in CLI.

HQ

```
HQ#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
HQ(config)#int f0/0
% Unknown command or computer name, or unable to find computer address

HQ(config)#int f0/0
HQ(config-if)#ip address 172.16.1.1 255.255.255.0
HQ(config-if)#no shutdown
HQ(config-if)#
HQ(config-if)#int s0/0/0
HQ(config-if)#ip address 10.10.10.1 255.255.255.0
HQ(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
HQ(config-if)#
```

Copy Paste

```
Branch
Would you like to enter the initial configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Branch
Branch(config)#int f0/0
Branch(config-if)#ip address 192.168.10.1 255.255.255.0
Branch(config-if)#no shutdown

Branch(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Branch(config-if)#int s0/0/0
Branch(config-if)#ip address 11.11.11.1 255.255.255.0
Branch(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
Branch(config-if)#
```

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

Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname ISP
ISP(config)#config-register t
%Invalid hex value
ISP(config)#int s0/0/0
ISP(config-if)#ip address 10.10.10.2 255.255.255.0
ISP(config-if)#no shutdown

ISP(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

ISP(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

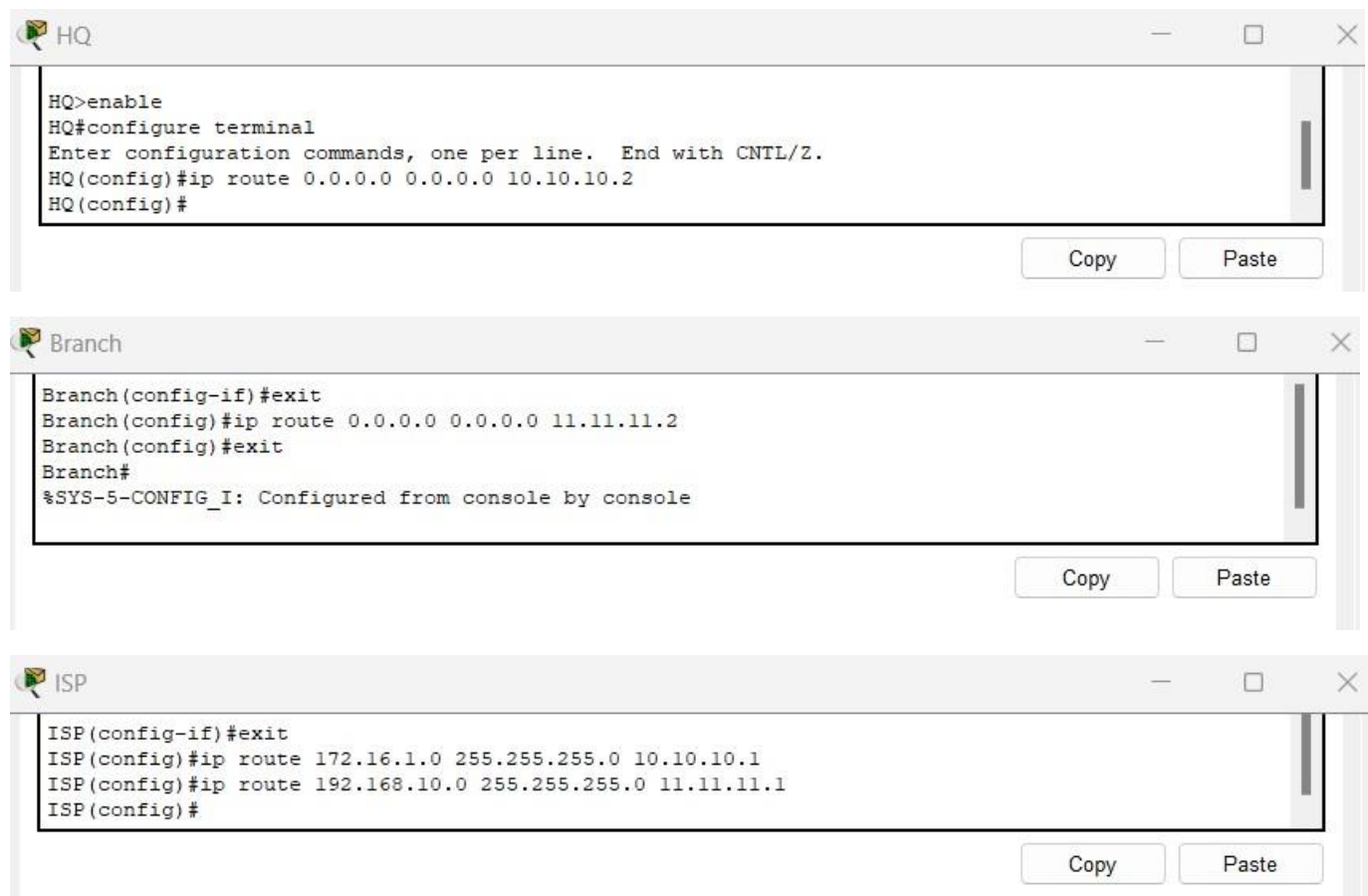
ISP(config-if)#int s0/0/1
ISP(config-if)#ip address 11.11.11.2 255.255.255.0
ISP(config-if)#no shutdown

ISP(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

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

Copy Paste
```

6. Configure default router on HQ and Branch , static router from ISP.



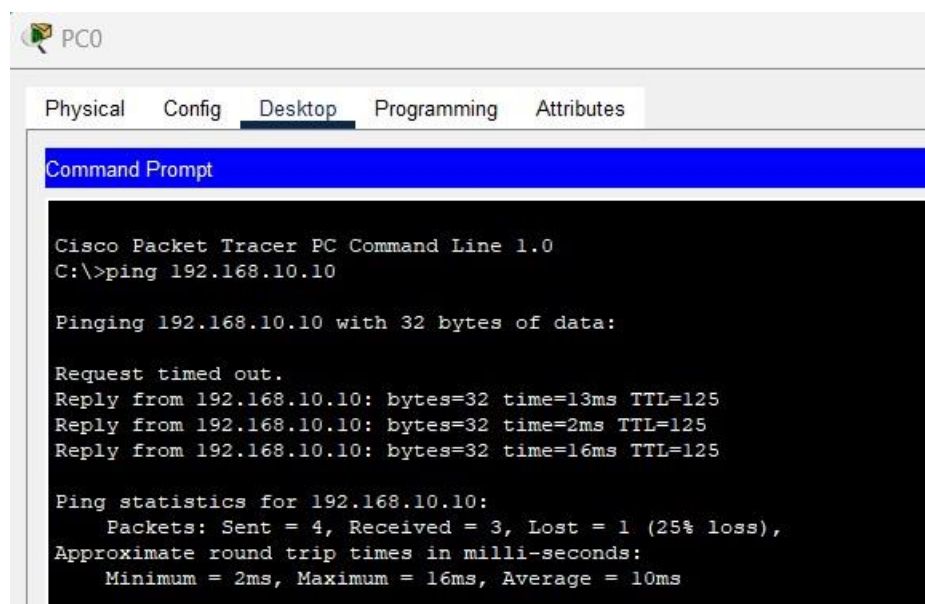
The image displays three terminal windows from a network simulation. The first window, titled 'HQ', shows the configuration of a default route: `HQ>enable`, `HQ#configure terminal`, `Enter configuration commands, one per line. End with CNTL/Z.`, `HQ(config)#ip route 0.0.0.0 0.0.0.0 10.10.10.2`, and `HQ(config)#`. The second window, titled 'Branch', shows the configuration of a default route: `Branch(config-if)#exit`, `Branch(config)#ip route 0.0.0.0 0.0.0.0 11.11.11.2`, `Branch(config)#exit`, `Branch#`, and a system message `%SYS-5-CONFIG_I: Configured from console by console`. The third window, titled 'ISP', shows the configuration of two static routes: `ISP(config-if)#exit`, `ISP(config)#ip route 172.16.1.0 255.255.255.0 10.10.10.1`, `ISP(config)#ip route 192.168.10.0 255.255.255.0 11.11.11.1`, and `ISP(config)#`. Each window has 'Copy' and 'Paste' buttons at the bottom right.

```
HQ>enable
HQ#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
HQ(config)#ip route 0.0.0.0 0.0.0.0 10.10.10.2
HQ(config)#

Branch(config-if)#exit
Branch(config)#ip route 0.0.0.0 0.0.0.0 11.11.11.2
Branch(config)#exit
Branch#
%SYS-5-CONFIG_I: Configured from console by console

ISP(config-if)#exit
ISP(config)#ip route 172.16.1.0 255.255.255.0 10.10.10.1
ISP(config)#ip route 192.168.10.0 255.255.255.0 11.11.11.1
ISP(config)#
```

7. Ping PC0 and PC1 in command prompt



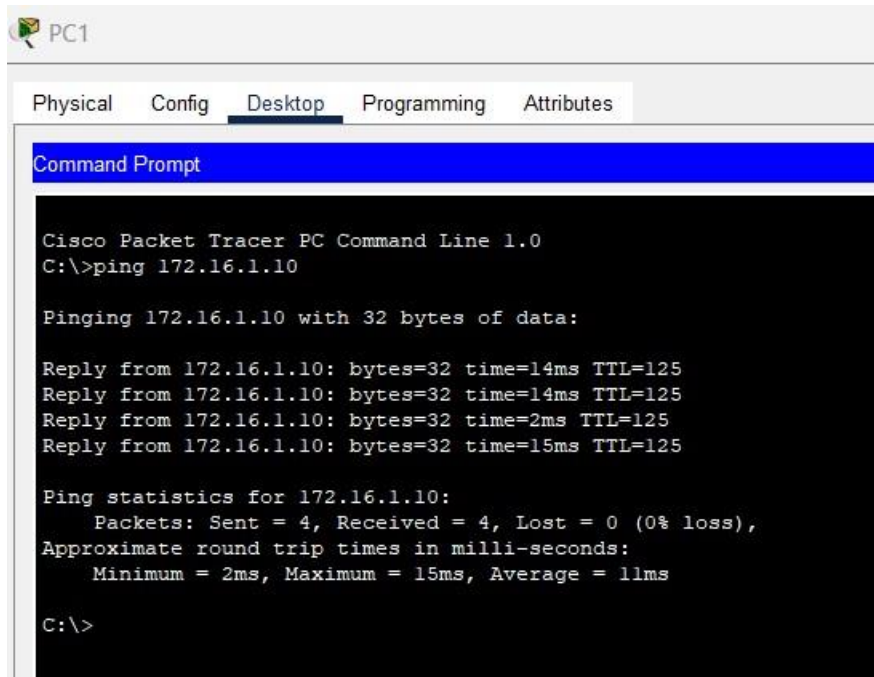
The image shows a screenshot of the 'PC0' window in a network simulation. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The command prompt shows the execution of the `ping 192.168.10.10` command. The output indicates a successful ping with 32 bytes of data, showing request times and TTL values. The ping statistics for 192.168.10.10 are also displayed, showing 4 packets sent, 3 received, and 1 lost (25% loss), with approximate round trip times in milliseconds.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Reply from 192.168.10.10: bytes=32 time=13ms TTL=125
Reply from 192.168.10.10: bytes=32 time=2ms TTL=125
Reply from 192.168.10.10: bytes=32 time=16ms TTL=125

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 16ms, Average = 10ms
```



The screenshot shows the 'PC1' window in Cisco Packet Tracer. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The command prompt shows the execution of a ping command to 172.16.1.10, resulting in four successful replies with varying round-trip times (14ms, 14ms, 2ms, 15ms) and a 0% loss rate.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 172.16.1.10

Pinging 172.16.1.10 with 32 bytes of data:

Reply from 172.16.1.10: bytes=32 time=14ms TTL=125
Reply from 172.16.1.10: bytes=32 time=14ms TTL=125
Reply from 172.16.1.10: bytes=32 time=2ms TTL=125
Reply from 172.16.1.10: bytes=32 time=15ms TTL=125

Ping statistics for 172.16.1.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 15ms, Average = 11ms

C:\>
```

8. Configure ISAKMP policy for HQ and Branch routers.
9. Define IPsec Transform set.
10. Create Access list
11. Create Crypto Map for IPsec.
12. Apply the crypto map.

HQ

Physical Config CLI Attributes

IOS Command Line Interface

```
HQ>enable
HQ#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
HQ(config)#ip route 0.0.0.0 0.0.0.0 10.10.10.2
HQ(config)#
HQ(config)#
HQ(config)#crypto isakmp policy 20
HQ(config-isakmp)#authentication pre-share
HQ(config-isakmp)#encryption 3des
HQ(config-isakmp)#hash md5
HQ(config-isakmp)#group 1
HQ(config-isakmp)#lifetime 3600
HQ(config-isakmp)#exit
HQ(config)#crypto isakmp key cisco123 address 11.11.11.1
HQ(config)#crypto ipsec transform-set myset esp-3des esp-md5-hmac
HQ(config)#access-list 100 permit ip 172.16.1.0 0.0.0.255 192.168.10.0 0.0.0.255
HQ(config)#crypto map mymap 20 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
HQ(config-crypto-map)#set peer 11.11.11.1
HQ(config-crypto-map)#set transform-set myset
HQ(config-crypto-map)#match address 100
HQ(config-crypto-map)#exit
HQ(config)#int s0/0/0
HQ(config-if)#crypto map mymap
*Jan 3 07:16:26.785: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
HQ(config-if)#
```

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Branch

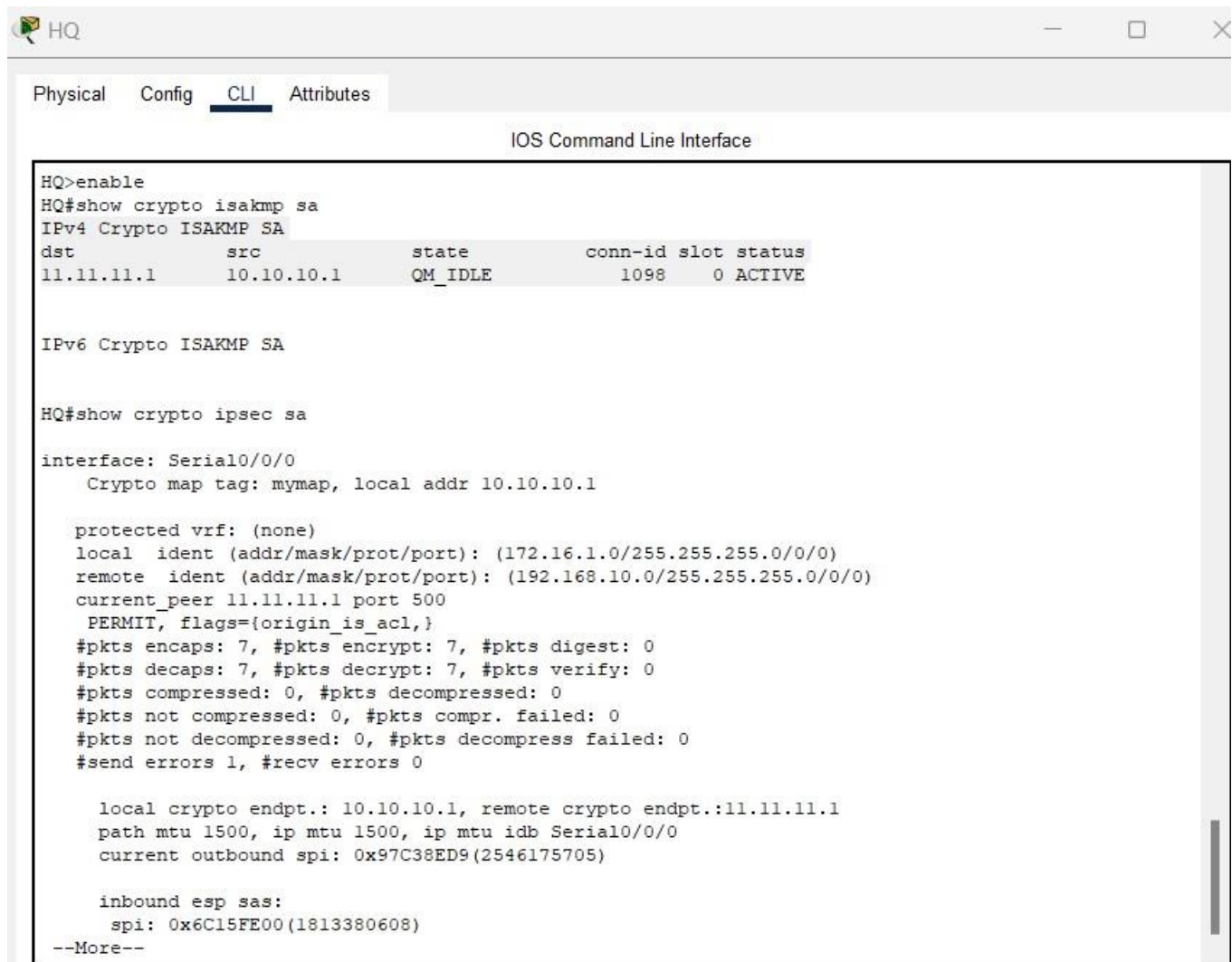
Branch#configure terminal

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

```
Branch(config)#crypto isakmp policy 20
Branch(config-isakmp)#authentication pre-share
Branch(config-isakmp)#encryption 3des
Branch(config-isakmp)#hash md5
Branch(config-isakmp)#group 1
Branch(config-isakmp)#lifetime 3600
Branch(config-isakmp)#exit
Branch(config)#crypto isakmp key cisco123 address 10.10.10.1
Branch(config)#crypto ipsec transform-set myset esp-3des esp-md5-hmac
Branch(config)#access-list 100 permit ip 192.168.10.0 0.0.0.255 172.16.1.0 0.0.0.255
Branch(config)#crypto map mymap 20 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
Branch(config-crypto-map)#set peer 10.10.10.1
Branch(config-crypto-map)#set transform-set myset
Branch(config-crypto-map)#match address 100
Branch(config-crypto-map)#exit
Branch(config)#int s0/0/0
Branch(config-if)#crypto map mymap
*Jan 3 07:16:26.785: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
Branch(config-if)#
```

Copy Paste

13. Test and Verify VPN.



The screenshot shows the HQ router's CLI interface with the following commands and output:

```
HQ>enable
HQ#show crypto isakmp sa
IPv4 Crypto ISAKMP SA
dst          src          state          conn-id slot status
11.11.11.1   10.10.10.1   QM_IDLE       1098      0  ACTIVE

IPv6 Crypto ISAKMP SA

HQ#show crypto ipsec sa
interface: Serial0/0/0
  Crypto map tag: mymap, local addr 10.10.10.1

  protected vrf: (none)
  local  ident (addr/mask/prot/port): (172.16.1.0/255.255.255.0/0/0)
  remote ident (addr/mask/prot/port): (192.168.10.0/255.255.255.0/0/0)
  current_peer 11.11.11.1 port 500
    PERMIT, flags={origin_is_acl,}
    #pkts encaps: 7, #pkts encrypt: 7, #pkts digest: 0
    #pkts decaps: 7, #pkts decrypt: 7, #pkts verify: 0
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0
    #pkts not decompressed: 0, #pkts decompress failed: 0
    #send errors 1, #recv errors 0

    local crypto endpt.: 10.10.10.1, remote crypto endpt.: 11.11.11.1
    path mtu 1500, ip mtu 1500, ip mtu idb Serial0/0/0
    current outbound spi: 0x97C38ED9(2546175705)

  inbound esp sas:
    spi: 0x6C15FE00(1813380608)
--More--
```

14. Now we can see that VPN tunnel is established between HQ and Branch routers , and the status is ACTIVE.