Ganpat University | Institute of Computer Technology
॥ विद्यया समाजोत्कर्षः ॥

NETWORK SECURITY

PROJECT - 2024

PROJECT TITLE

SIMULATION OF THE ENTERPRISE COMPUTER NETWORK USING CISCO PACKET TRACER

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COURSE : 2CSE603 NETWORK SECURITY

DATE OF SUBMISSION : 31/03/2023

Aim

To Design and Test network using Packet Tracer. The task is to create a simulation of the enterprise computer network using Cisco Packet Tracer.

The network, will have at least the following equipment's:

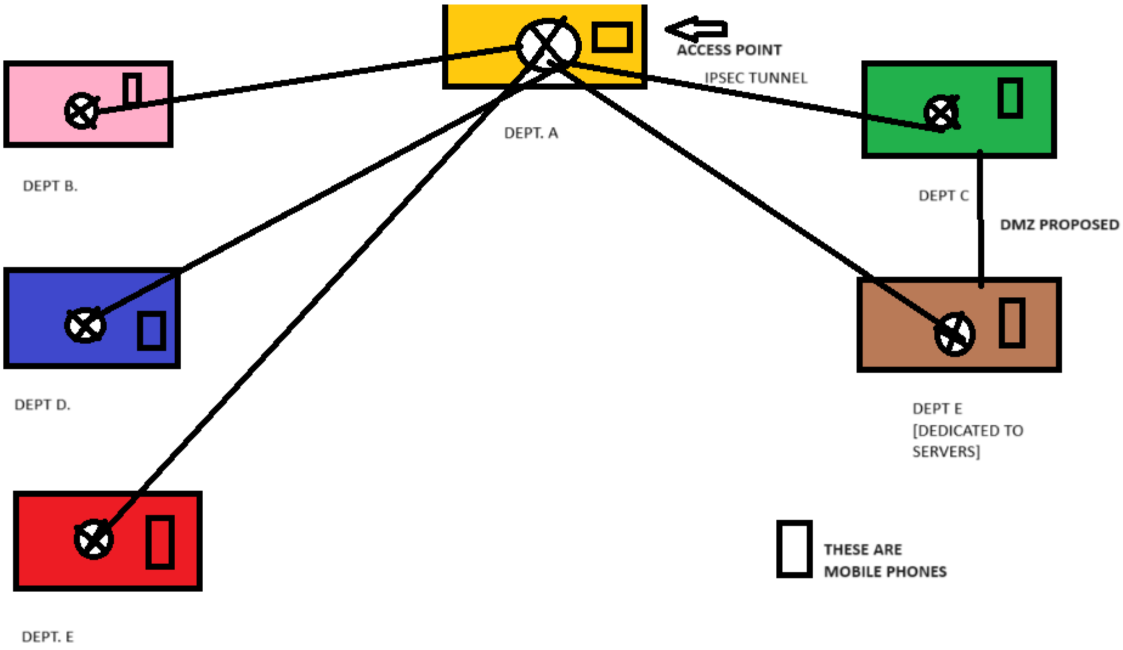
- Work stations,
- Switches,
- Routers,
- Servers,
- Wireless Access points
- Mobile devices,
- Laptops,
- Routers,
- Firewall

Your Job will be:

1) Design the complete networks, using the Cisco Packet Tracer.
2) Configure all the network component, correctly so any Work Station or Computers server can ping any other equipment, (All the equipment must be included in test cases).
3) Create a DMZ zone.
4) Add a webserver, website and DNS server to the network, and configure them correctly, (the web site and DNS tests must be included in test cases).
5) Add at least three firewall in proper location (choose the best location), and then configure the firewall (s).
6) Configure the firewall, so it allows input to webserver, and DNS server an 8080 or 80 port only, from outside the network, and protect all other part and allow accessing from any work station to outside using only the 8080 or 80
ports.
7) Create an IPsec tunnel between two departments and ensure that the users of both the parties are able to connect to each other.

1. Block Diagram of whole Network / Solution to Problem

We have designed proper Block Diagram of the whole Network before implementing it in Cisco Packet Tracer.
Upon studying the complexity & requirements of the Project, we have designed the whole network according to the perspective of a big university. We have created a total of 6 departments including one special for to host & configure Servers.



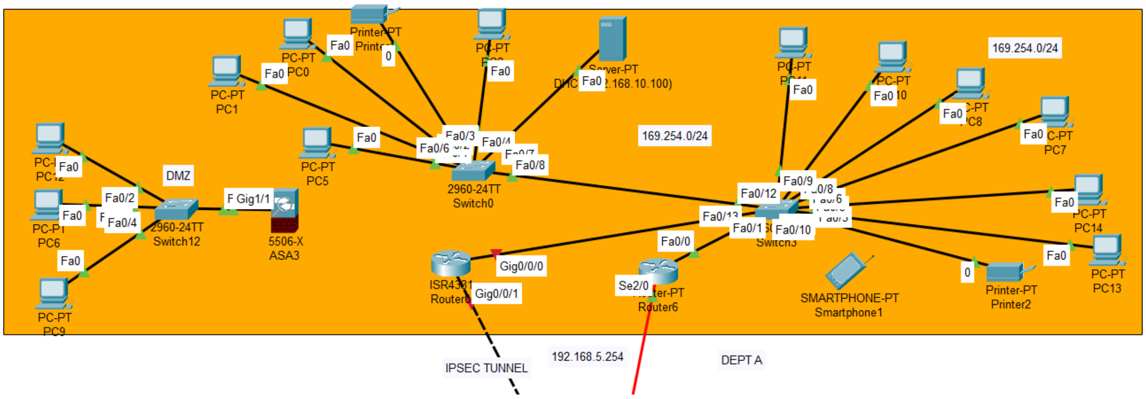
Note : (i)This is an indicative diagram of the Network. Final Network diagram might have slight variations as per the availability and utilization of space.

***(ii) Please Assume that routers are connected to switches and switches are connected to multiple end-points and servers, as it is quite not possible to display each and every component in Block Diagram*.**

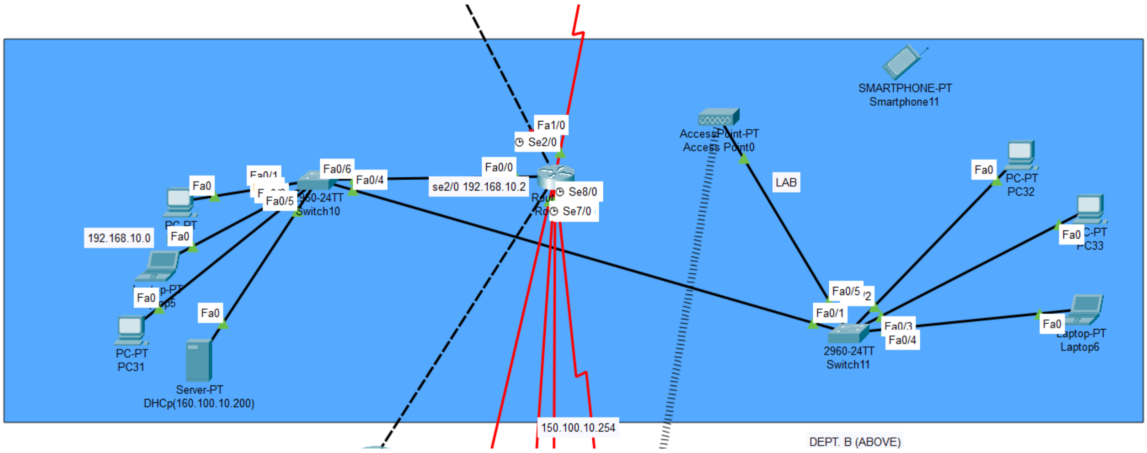
2. List and number of devices configured in the Network.

Device	**Qty. (Number)**
Work Stations	30+
Switches	12
Routers	8
Servers (Total)	13
Access Points	1
Mobiles	5
Laptops	7
Firewalls	3
Printers	5

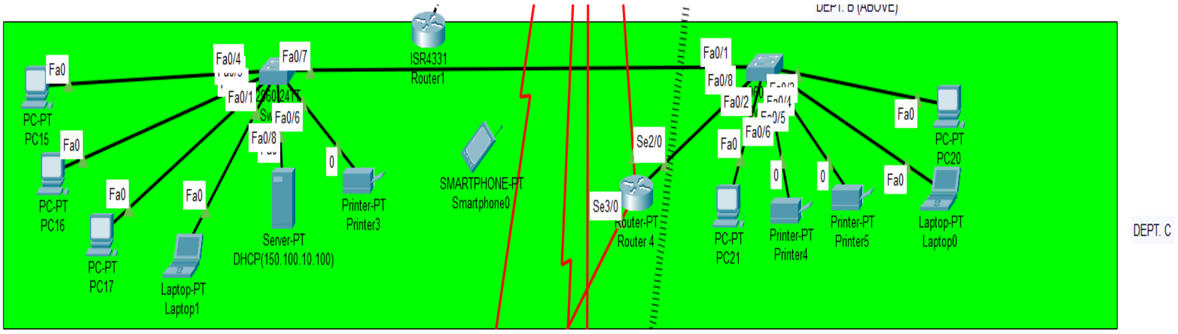
3. Screenshots of Network



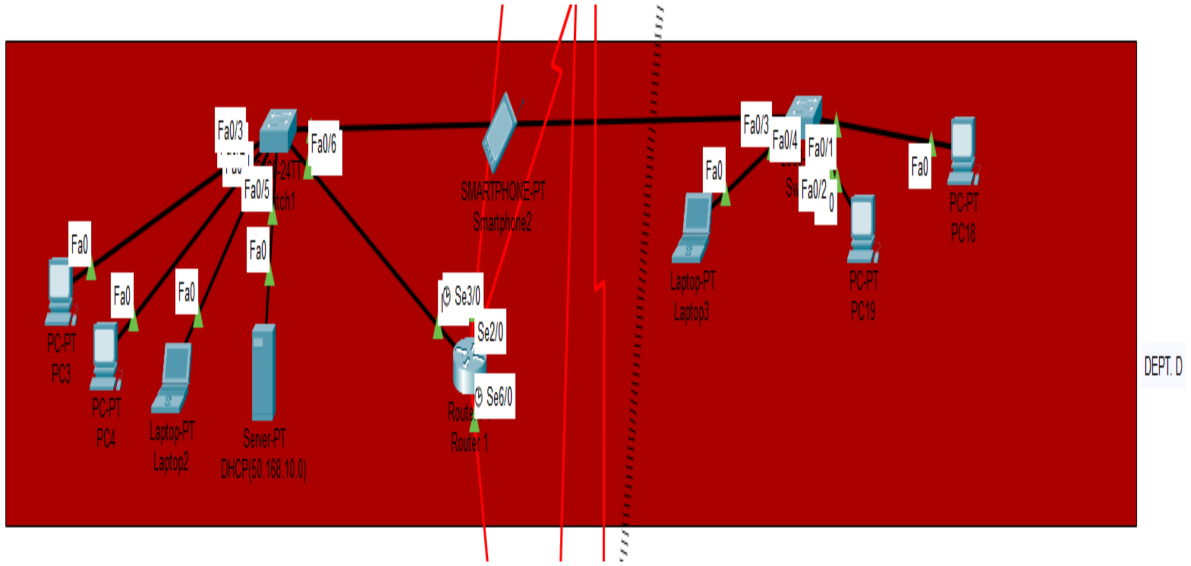
Dept. A



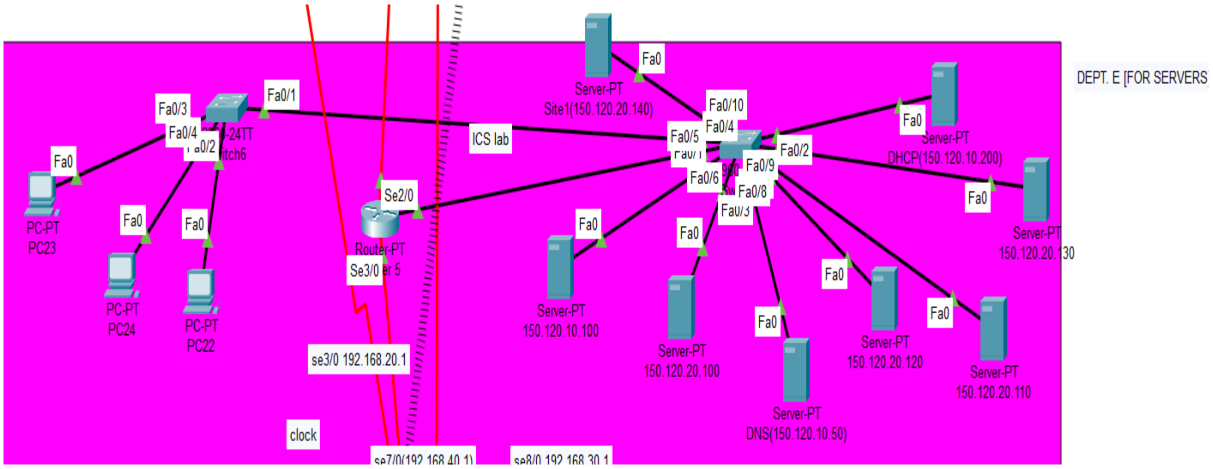
Dept. B



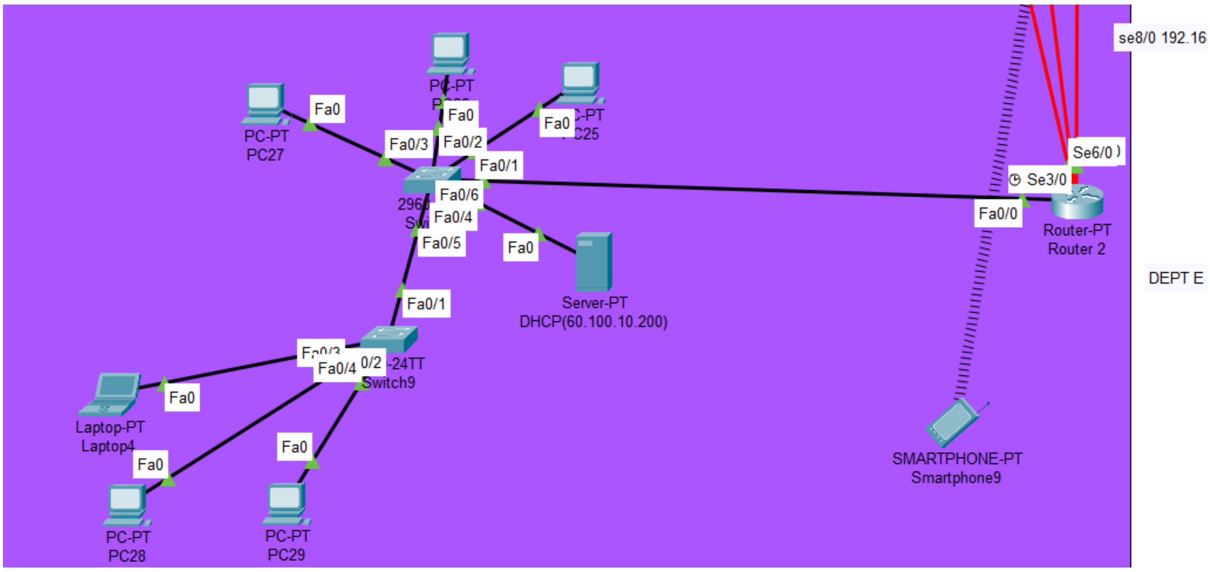
Dept. C


Fa0/3
Fa0/6
Fa0/5
Fa0
PC-PT
PC3
PC-PT
PC4
Laptop-PT
Laptop2
Server-PT
DHCP(50.168.10.0)
SMARTPHONE-PT
Smartphone2
Se3/0
Se2/0
Se6/0
Router1
Fa0/3
Fa0/4
Fa0/1
Fa0/2
Laptop-PT
Laptop3
PC-PT
PC19
PC-PT
PC18
DEPT. D

Dept. D


DEPT. E [FOR SERVERS
Fa0/3
Fa0/4
Fa0/1
Fa0/2
Fa0
PC-PT
PC23
PC-PT
PC24
PC-PT
PC22
Se2/0
Router-PT
Se3/0
se3/0 192.168.20.1
clock
se7/0(192.168.40.1)
se8/0 192.168.30.1
ICS lab
Server-PT
Site1(150.120.20.140)
Fa0/10
Fa0/4
Fa0/5
Fa0/2
Fa0/6
Fa0/9
Fa0/8
Fa0/3
Server-PT
DHCP(150.120.10.200)
Server-PT
150.120.20.130
Server-PT
150.120.10.100
Server-PT
150.120.20.100
Server-PT
DNS(150.120.10.50)
Server-PT
150.120.20.120
Server-PT
150.120.20.110

Dept. E


se8/0 192.16
PC-PT
Fa0
PC-PT
PC27
Fa0/3
Fa0/2
Fa0
PC25
Fa0/1
Se6/0
Se3/0
Fa0/6
Fa0/4
Fa0/5
Fa0
Fa0/0
Router-PT
Router 2
DEPT E
Server-PT
DHCP(60.100.10.200)
Fa0/1
Fa0/3
Fa0/4
-24TT
Switch9
Fa0
Laptop-PT
Laptop4
Fa0
Fa0
PC-PT
PC28
PC-PT
PC29
SMARTPHONE-PT
Smartphone9

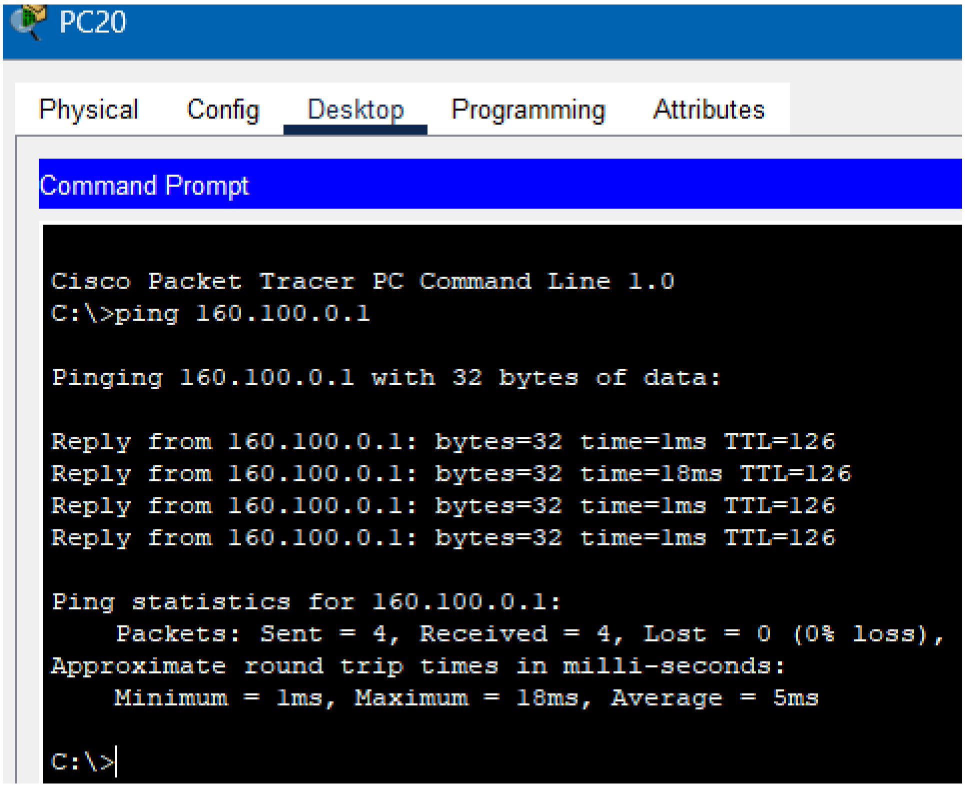
Dept. F

4. Implementation of Various Services / Protocols etc.

4.1 Ping from one device to another device.

Here, we will ping from any random device to other device

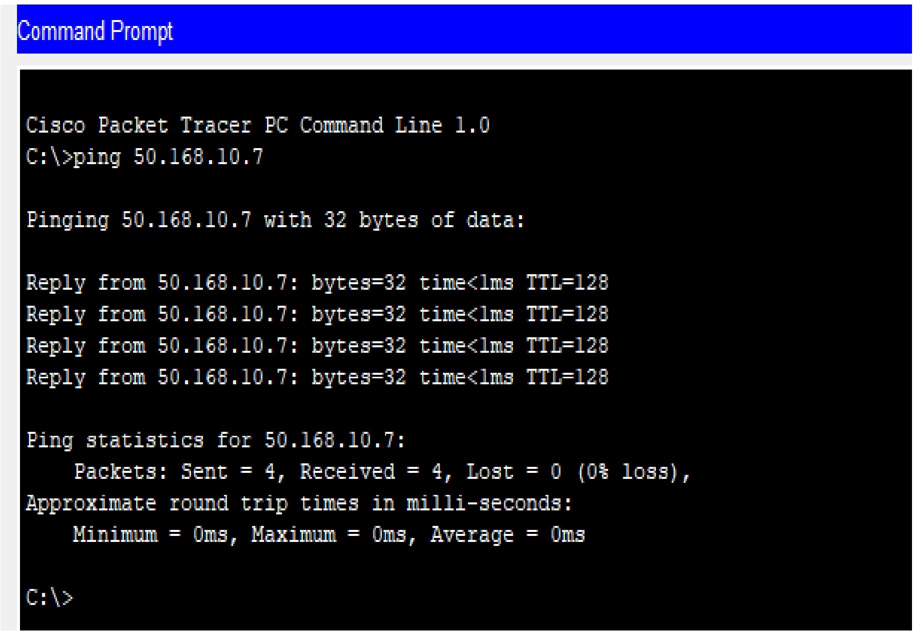
Test Case 1



```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 160.100.0.1

Pinging 160.100.0.1 with 32 bytes of data:

Reply from 160.100.0.1: bytes=32 time=1ms TTL=126
Reply from 160.100.0.1: bytes=32 time=18ms TTL=126
Reply from 160.100.0.1: bytes=32 time=1ms TTL=126
Reply from 160.100.0.1: bytes=32 time=1ms TTL=126

Ping statistics for 160.100.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 18ms, Average = 5ms

C:\>
```

Pinged from PC 20 of Dept C to PC 33 of Dept. B. (Between different departments)

Test Case 2

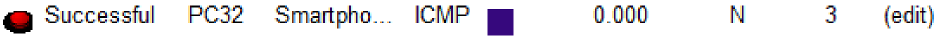


Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 50.168.10.7

Pinging 50.168.10.7 with 32 bytes of data:

Reply from 50.168.10.7: bytes=32 time<1ms TTL=128
Reply from 50.168.10.7: bytes=32 time<1ms TTL=128
Reply from 50.168.10.7: bytes=32 time<1ms TTL=128
Reply from 50.168.10.7: bytes=32 time<1ms TTL=128

Ping statistics for 50.168.10.7:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Pinged from PC 4 of Dept D to PC 19 of Dept. D.
(Internally within the same Dept's.)

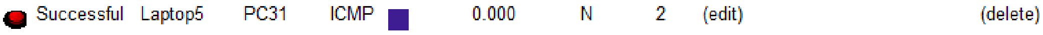
Test Case 3



●	Successful	PC32	Smartpho...	ICMP	■	0.000	N	3	(edit)

Here we pinged PC to mobile (Dept B to Dept. F)

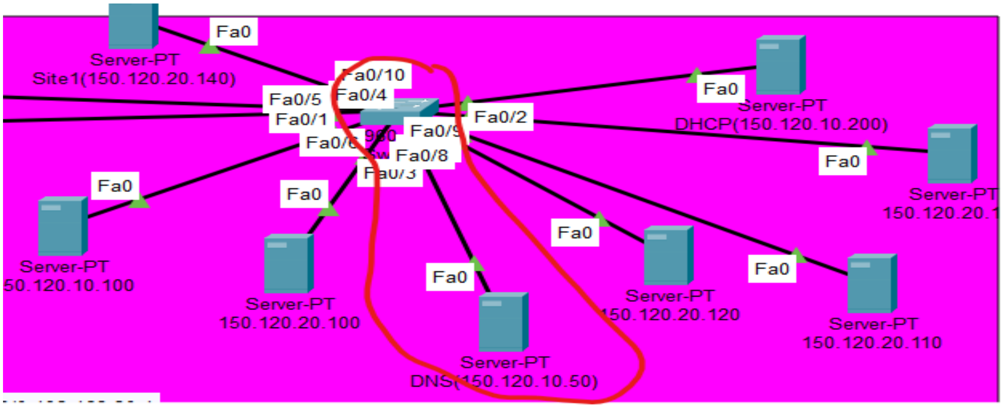
Test Case 4

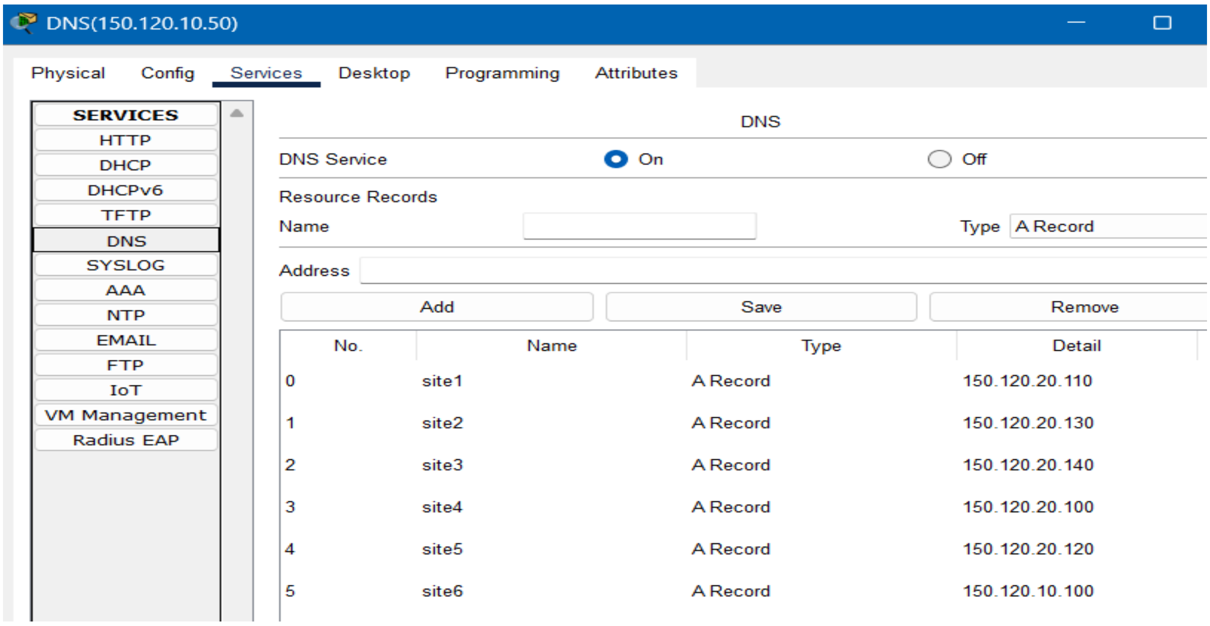


●	Successful	Laptop5	PC31	ICMP	■	0.000	N	2	(edit)	(delete)

Here we pinged from Laptop to PC
Hence we performed Test Cases for all equipments .

4.2 Configuring webserver , website and a dns.





DNS

DNS Service ● On ○ Off

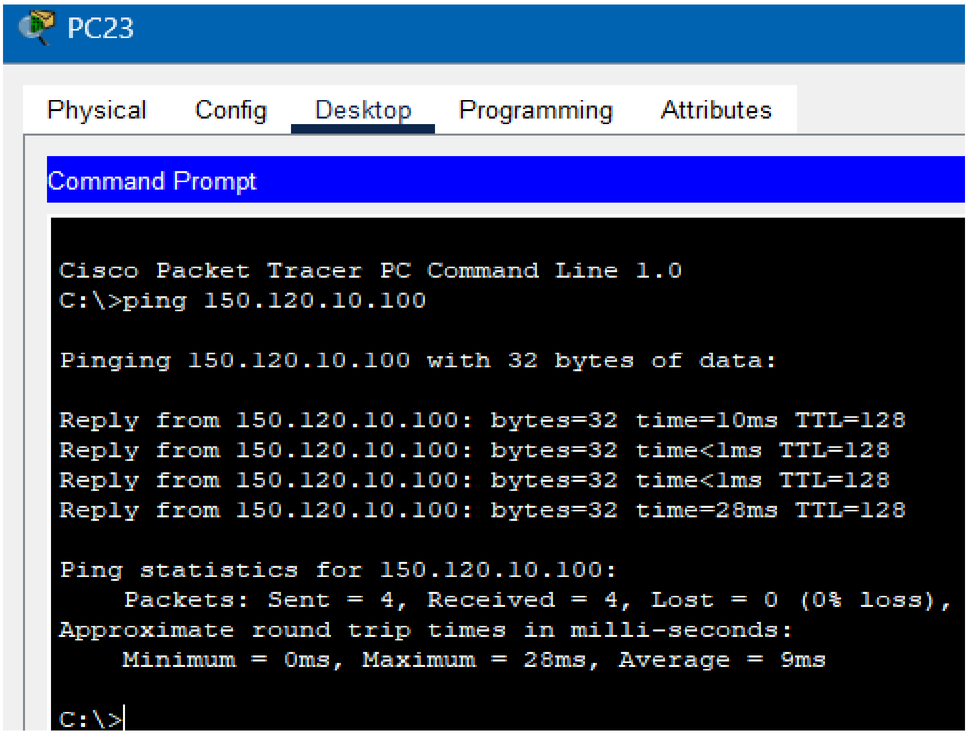
Resource Records

Name Type A Record

Address

No.	Name	Type	Detail
0	site1	A Record	150.120.20.110
1	site2	A Record	150.120.20.130
2	site3	A Record	150.120.20.140
3	site4	A Record	150.120.20.100
4	site5	A Record	150.120.20.120
5	site6	A Record	150.120.10.100

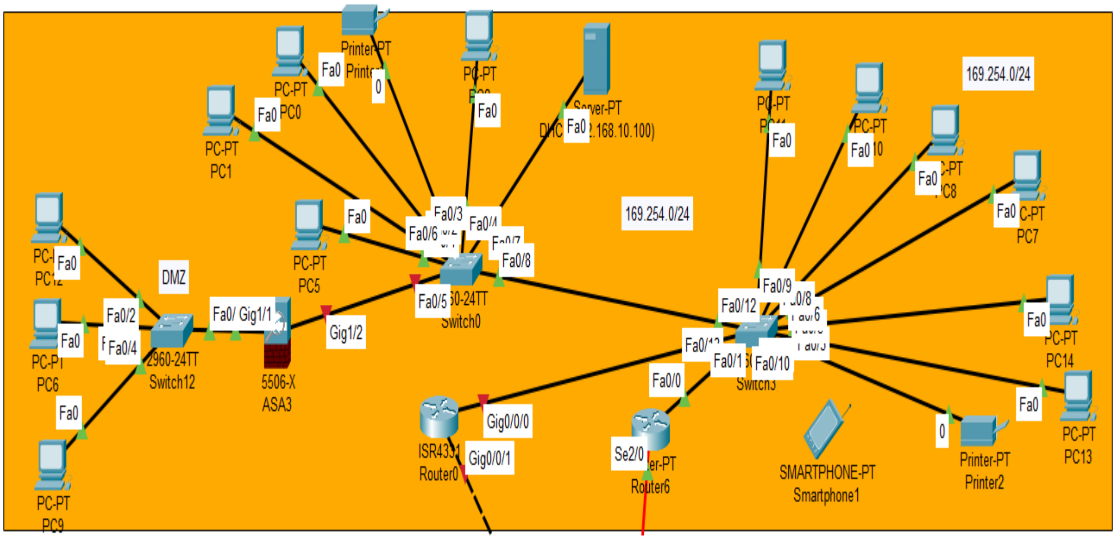
We have configured 6 sites with the DNS.



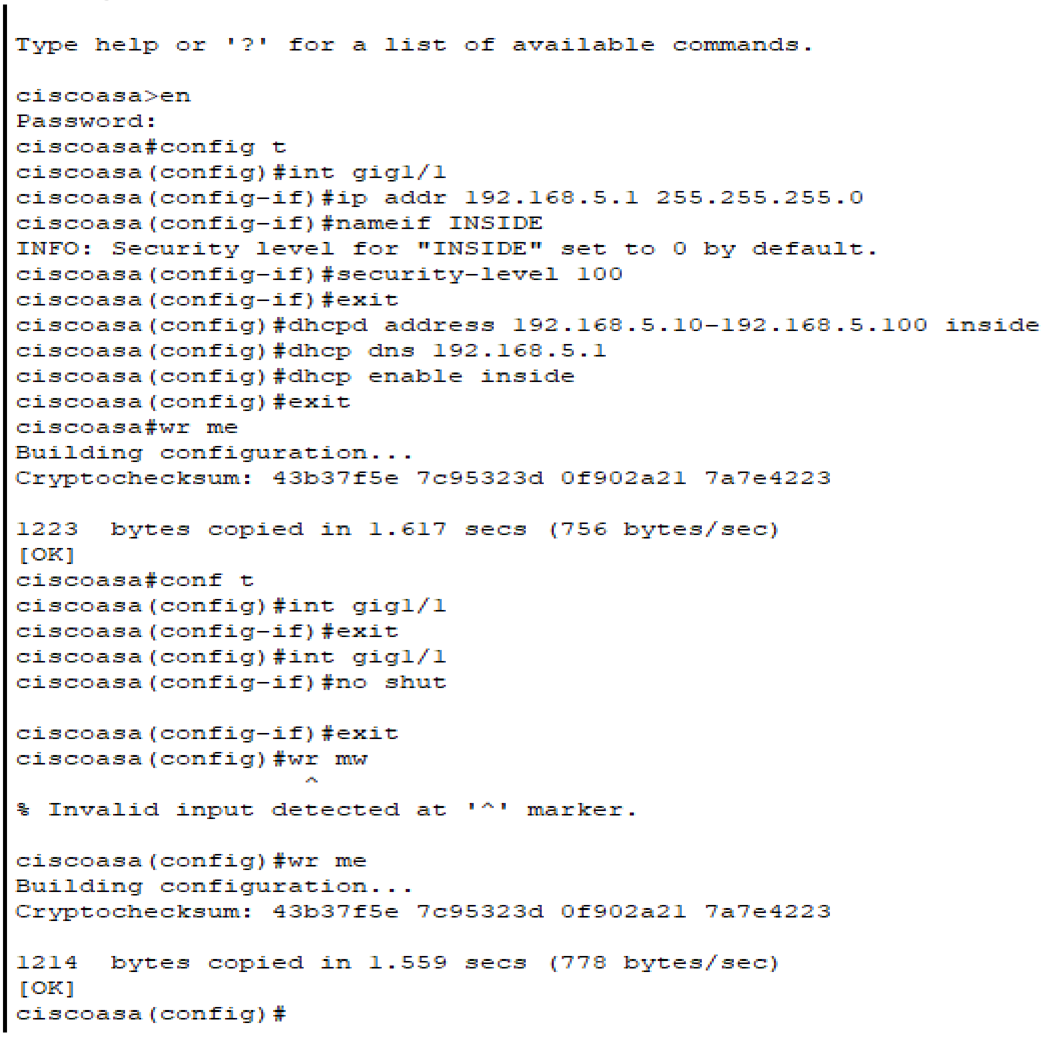
```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 150.120.10.100

Pinging 150.120.10.100 with 32 bytes of data:

Reply from 150.120.10.100: bytes=32 time=10ms TTL=128
Reply from 150.120.10.100: bytes=32 time<1ms TTL=128
Reply from 150.120.10.100: bytes=32 time<1ms TTL=128
Reply from 150.120.10.100: bytes=32 time=28ms TTL=128

Ping statistics for 150.120.10.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 28ms, Average = 9ms

C:\>
```

We can see that site 6 is responding (with IP : 150.120.10.100)

4.3 Create a DMZ zone



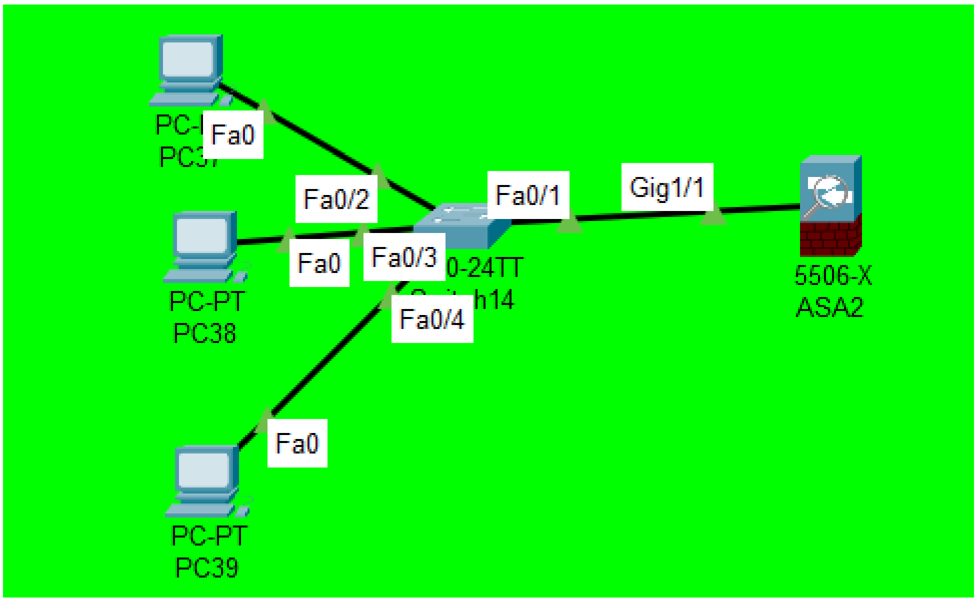
Configuration of ASA appliance



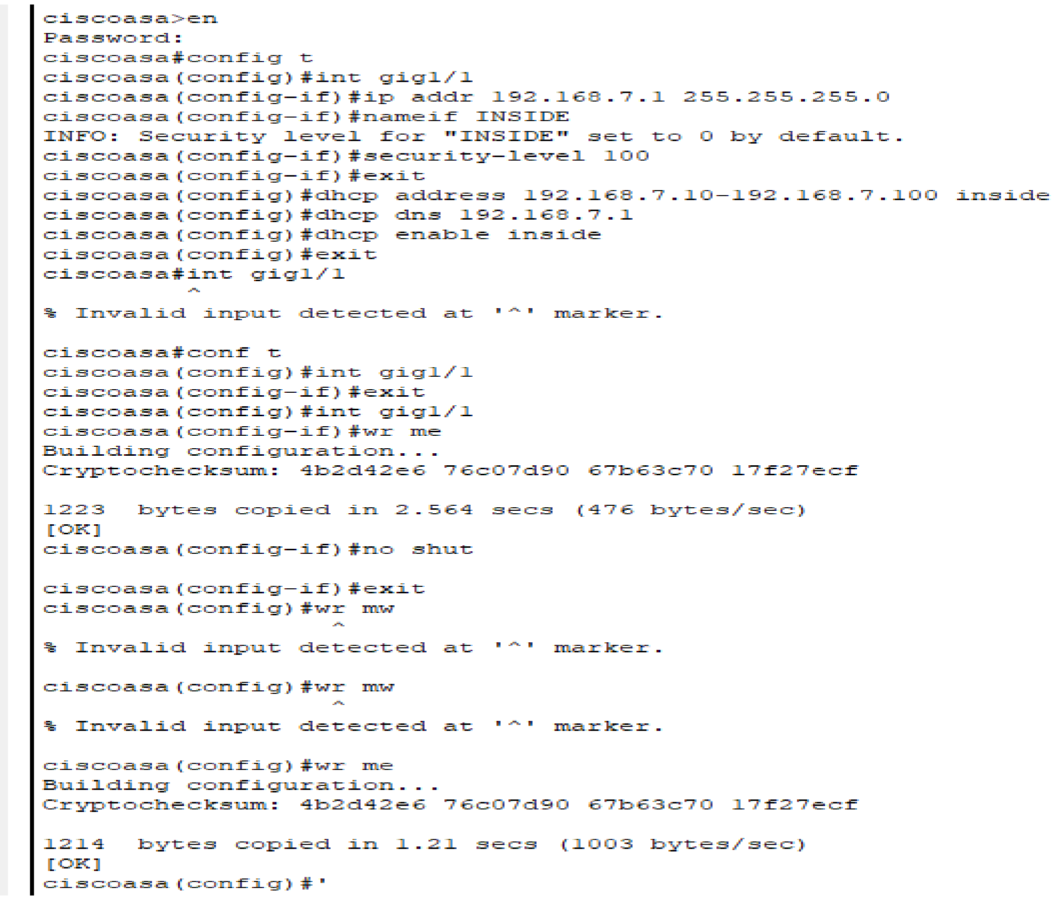
```
Type help or '?' for a list of available commands.

ciscoasa>en
Password:
ciscoasa#config t
ciscoasa(config)#int gig1/1
ciscoasa(config-if)#ip addr 192.168.5.1 255.255.255.0
ciscoasa(config-if)#nameif INSIDE
INFO: Security level for "INSIDE" set to 0 by default.
ciscoasa(config-if)#security-level 100
ciscoasa(config-if)#exit
ciscoasa(config)#dhcpd address 192.168.5.10-192.168.5.100 inside
ciscoasa(config)#dhcp dns 192.168.5.1
ciscoasa(config)#dhcp enable inside
ciscoasa(config)#exit
ciscoasa#wr me
Building configuration...
Cryptochecksum: 43b37f5e 7c95323d 0f902a21 7a7e4223

1223  bytes copied in 1.617 secs (756 bytes/sec)
[OK]
ciscoasa#conf t
ciscoasa(config)#int gig1/1
ciscoasa(config-if)#exit
ciscoasa(config)#int gig1/1
ciscoasa(config-if)#no shut

ciscoasa(config-if)#exit
ciscoasa(config)#wr mw
                         ^
% Invalid input detected at '^' marker.

ciscoasa(config)#wr me
Building configuration...
Cryptochecksum: 43b37f5e 7c95323d 0f902a21 7a7e4223

1214  bytes copied in 1.559 secs (778 bytes/sec)
[OK]
ciscoasa(config)#
```

4.4 Configure three firewalls with the best location and configure them

We’ve configured firewall with DHCP in all PC’s

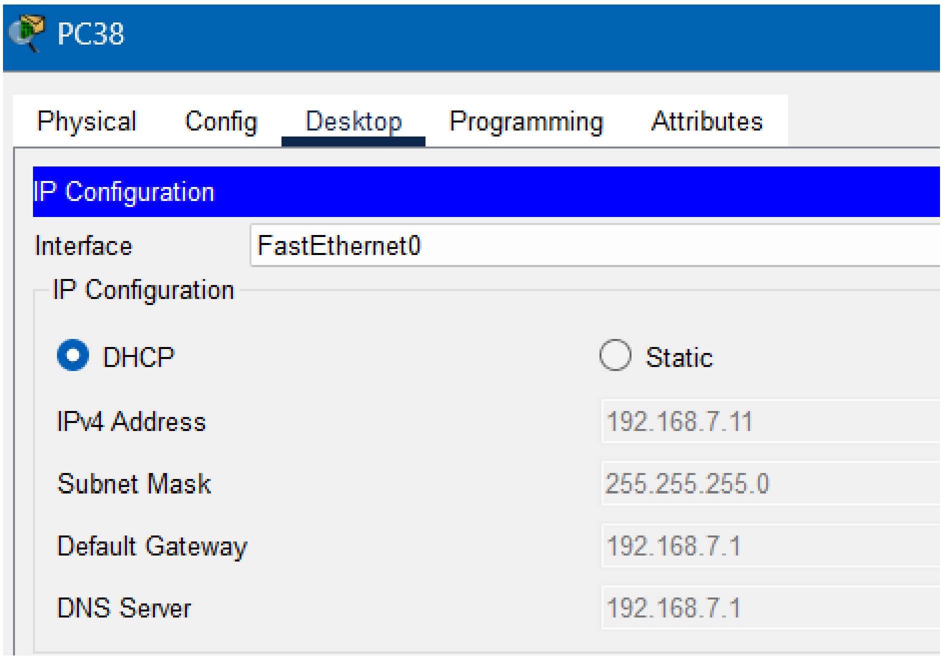


Firewall 1 (Placed beside a whole Dept.)



```
ciscoasa>en
Password:
ciscoasa#config t
ciscoasa(config)#int gig1/1
ciscoasa(config-if)#ip addr 192.168.7.1 255.255.255.0
ciscoasa(config-if)#nameif INSIDE
INFO: Security level for "INSIDE" set to 0 by default.
ciscoasa(config-if)#security-level 100
ciscoasa(config-if)#exit
ciscoasa(config)#dhcp address 192.168.7.10-192.168.7.100 inside
ciscoasa(config)#dhcp dns 192.168.7.1
ciscoasa(config)#dhcp enable inside
ciscoasa(config)#exit
ciscoasa#int gig1/1
          ^
% Invalid input detected at '^' marker.

ciscoasa#conf t
ciscoasa(config)#int gig1/1
ciscoasa(config-if)#exit
ciscoasa(config)#int gig1/1
ciscoasa(config-if)#wr me
Building configuration...
Cryptochecksum: 4b2d42e6 76c07d90 67b63c70 17f27ecf

1223  bytes copied in 2.564 secs (476 bytes/sec)
[OK]
ciscoasa(config-if)#no shut

ciscoasa(config-if)#exit
ciscoasa(config)#wr mw
                    ^
% Invalid input detected at '^' marker.

ciscoasa(config)#wr mw
                    ^
% Invalid input detected at '^' marker.

ciscoasa(config)#wr me
Building configuration...
Cryptochecksum: 4b2d42e6 76c07d90 67b63c70 17f27ecf

1214  bytes copied in 1.21 secs (1003 bytes/sec)
[OK]
ciscoasa(config)#'
```

This is the Firewall Configuration.



Interface: FastEthernet0

IP Configuration

● DHCP ○ Static

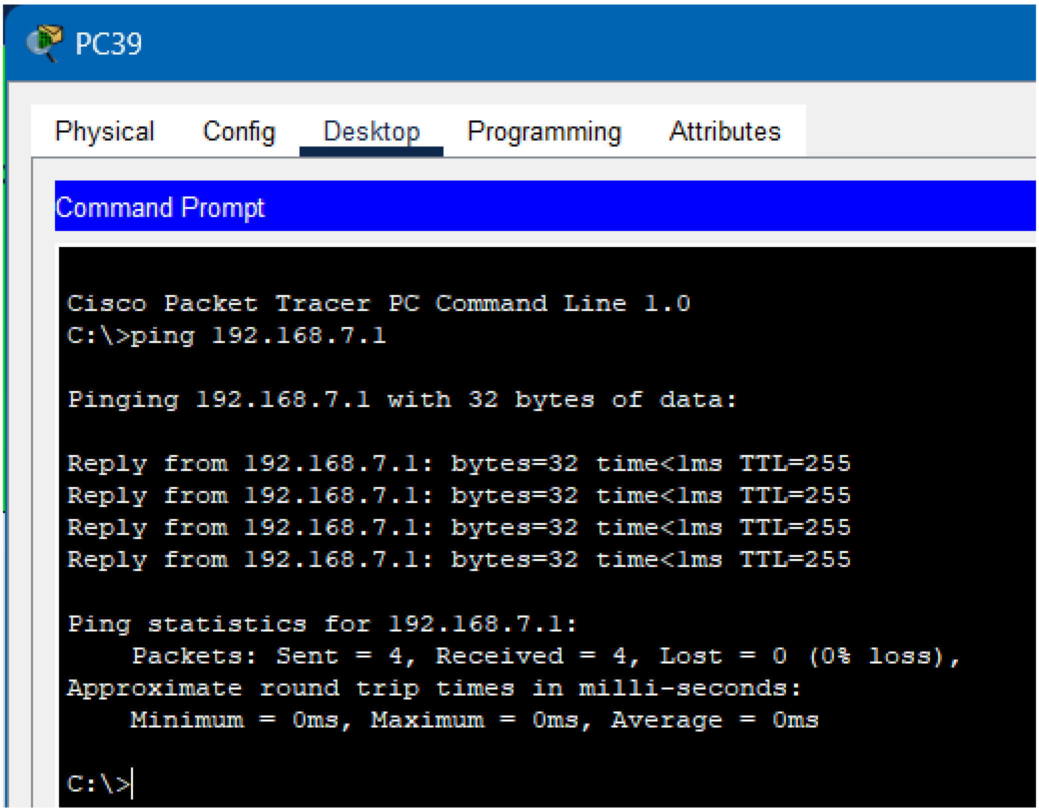
IPv4 Address: 192.168.7.11

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.7.1

DNS Server: 192.168.7.1

We can see that IP Address are being generated by DHCP.

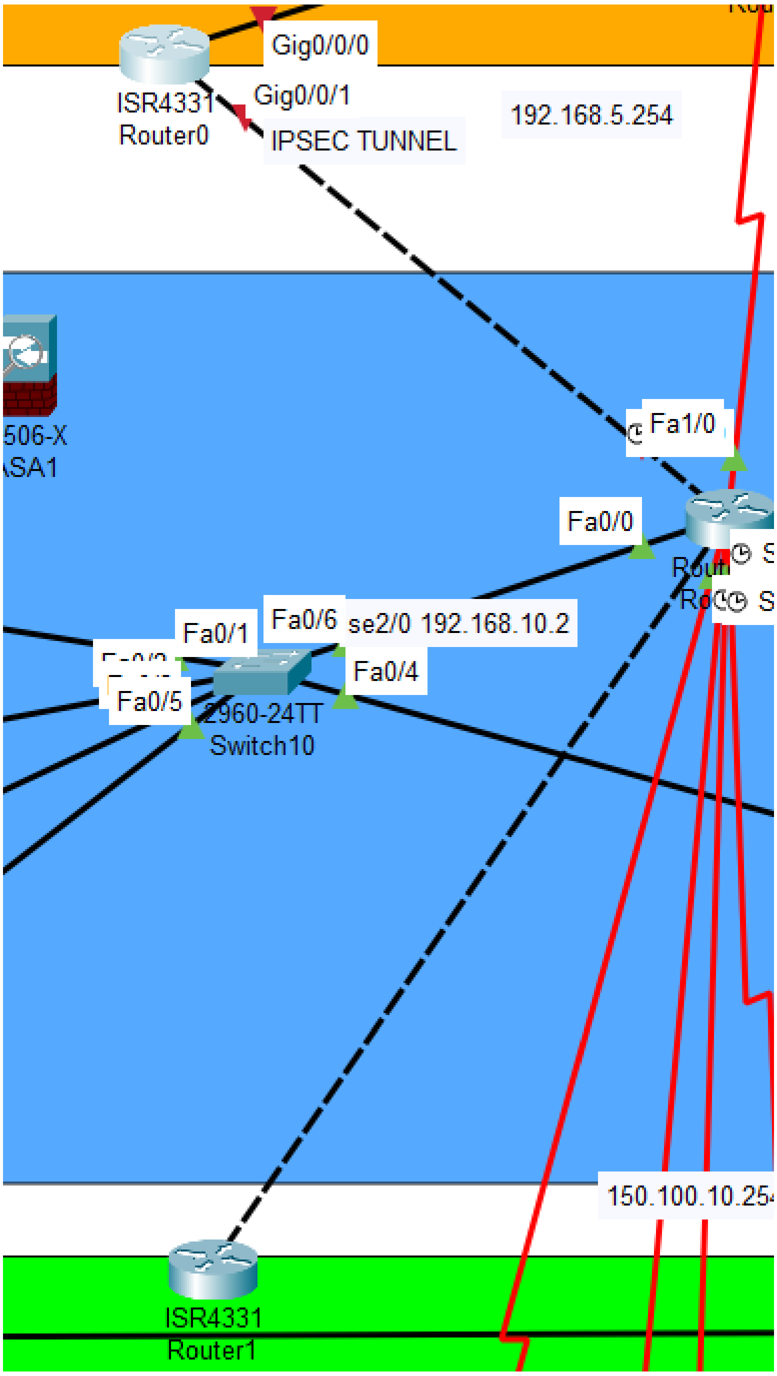


```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.7.1

Pinging 192.168.7.1 with 32 bytes of data:

Reply from 192.168.7.1: bytes=32 time<1ms TTL=255
Reply from 192.168.7.1: bytes=32 time<1ms TTL=255
Reply from 192.168.7.1: bytes=32 time<1ms TTL=255
Reply from 192.168.7.1: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.7.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Host IP ping successful from any PC.

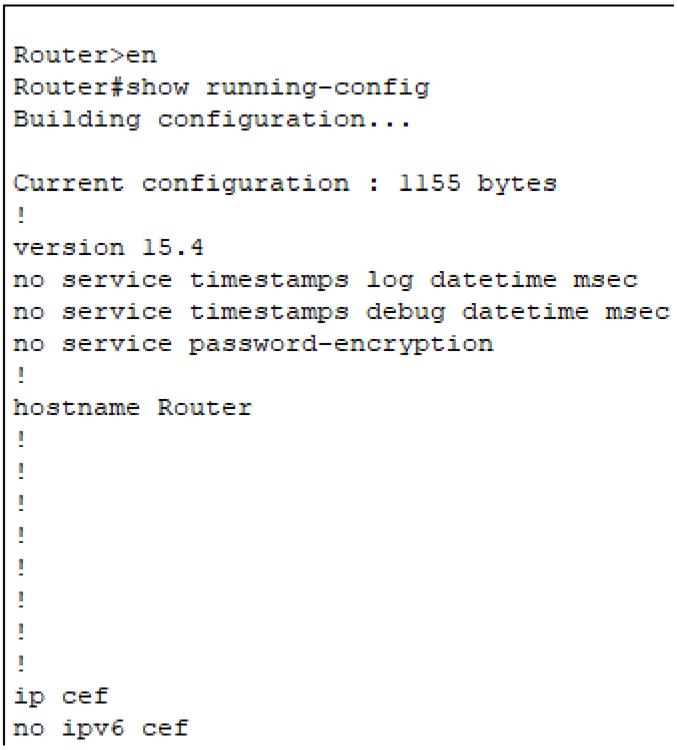
Similarly, we configure the rest 2 Firewalls.

4.5 Configuring the IpSec Tunnel

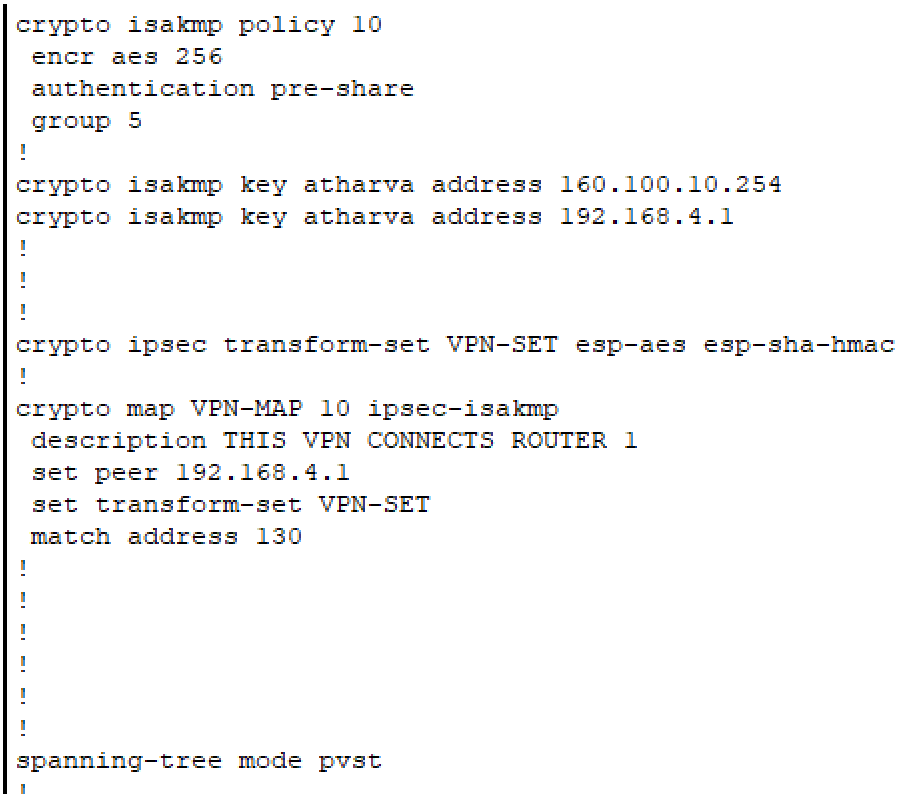


We have implemented the tunnel from Router 0 to Router 1.

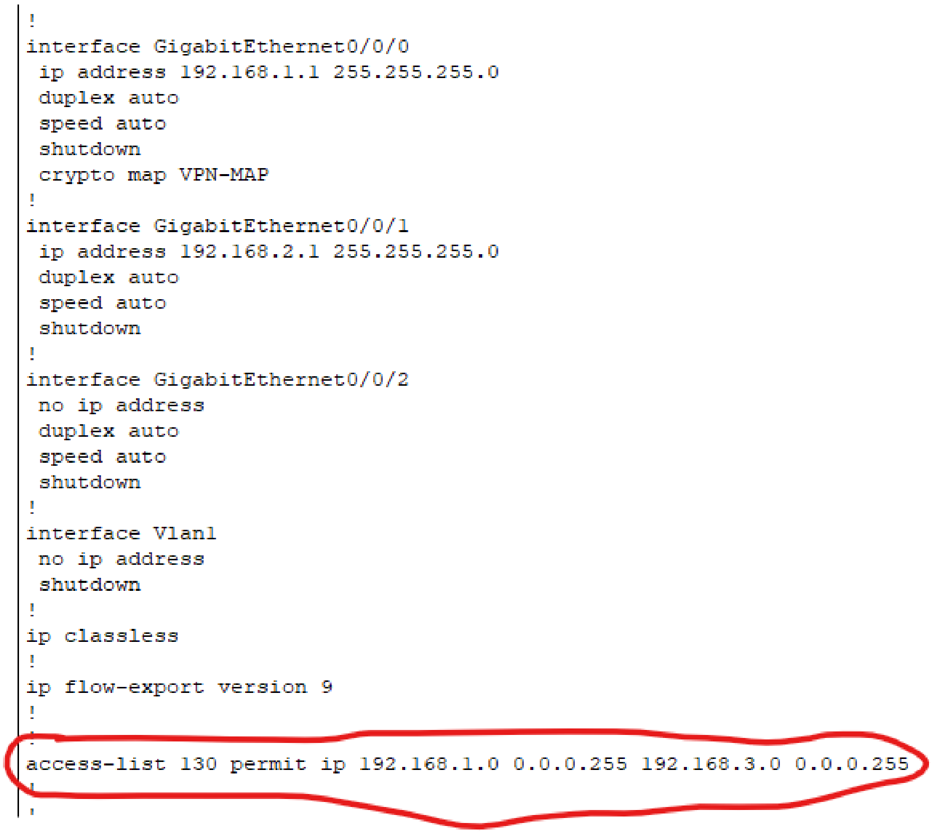
Configurations of router 0



```
Router>en
Router#show running-config
Building configuration...

Current configuration : 1155 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
```



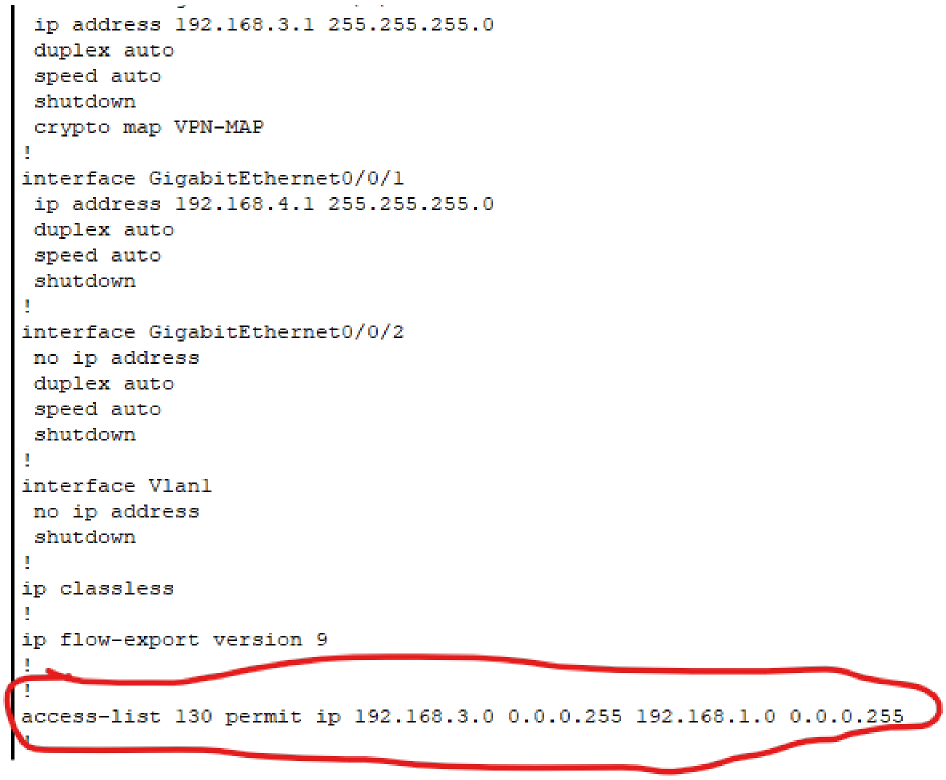
```
crypto isakmp policy 10
 encr aes 256
 authentication pre-share
 group 5
!
crypto isakmp key atharva address 160.100.10.254
crypto isakmp key atharva address 192.168.4.1
!
!
!
crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
!
crypto map VPN-MAP 10 ipsec-isakmp
 description THIS VPN CONNECTS ROUTER 1
 set peer 192.168.4.1
 set transform-set VPN-SET
 match address 130
!
!
!
!
!
!
spanning-tree mode pvst
!
```



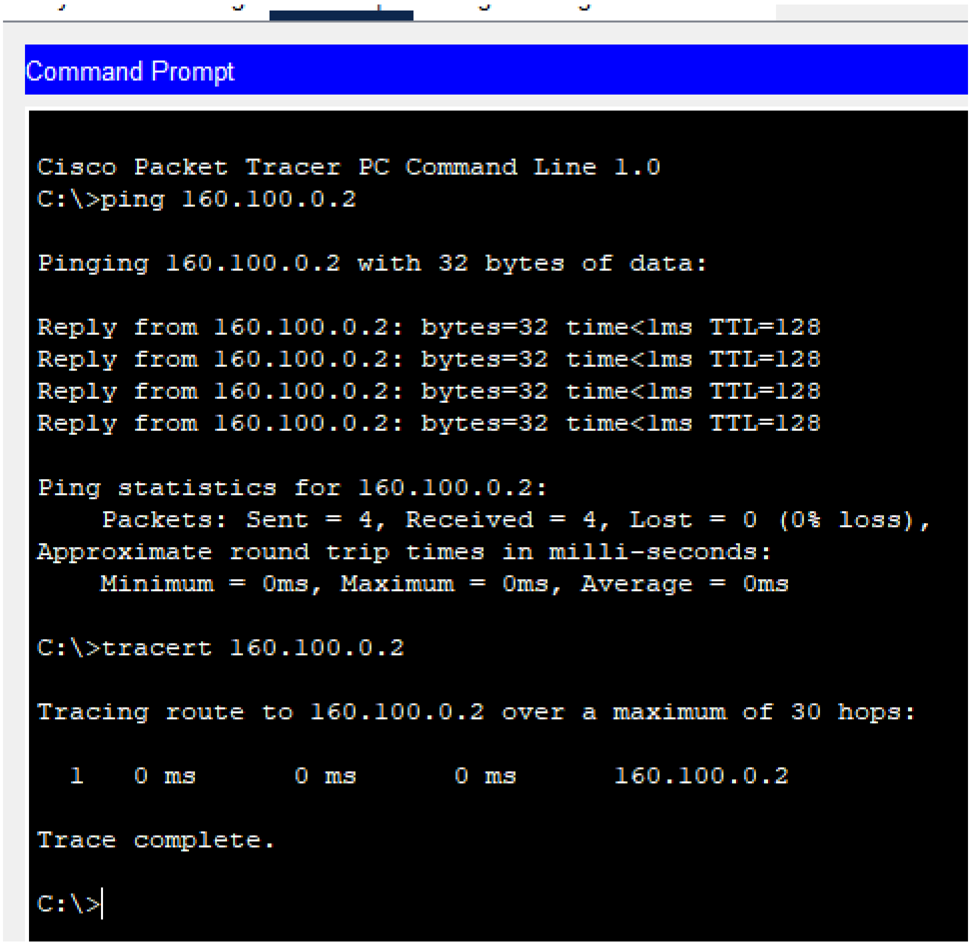
```
!
interface GigabitEthernet0/0/0
 ip address 192.168.1.1 255.255.255.0
 duplex auto
 speed auto
 shutdown
 crypto map VPN-MAP
!
interface GigabitEthernet0/0/1
 ip address 192.168.2.1 255.255.255.0
 duplex auto
 speed auto
 shutdown
!
interface GigabitEthernet0/0/2
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
!
ip flow-export version 9
!
!
access-list 130 permit ip 192.168.1.0 0.0.0.255 192.168.3.0 0.0.0.255
!
!
```

Similarly, we do the same configurations on router 1.

ACL for Router 1



```
 ip address 192.168.3.1 255.255.255.0
 duplex auto
 speed auto
 shutdown
 crypto map VPN-MAP
!
interface GigabitEthernet0/0/1
 ip address 192.168.4.1 255.255.255.0
 duplex auto
 speed auto
 shutdown
!
interface GigabitEthernet0/0/2
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
!
ip flow-export version 9
!
!
access-list 130 permit ip 192.168.3.0 0.0.0.255 192.168.1.0 0.0.0.255
!
```

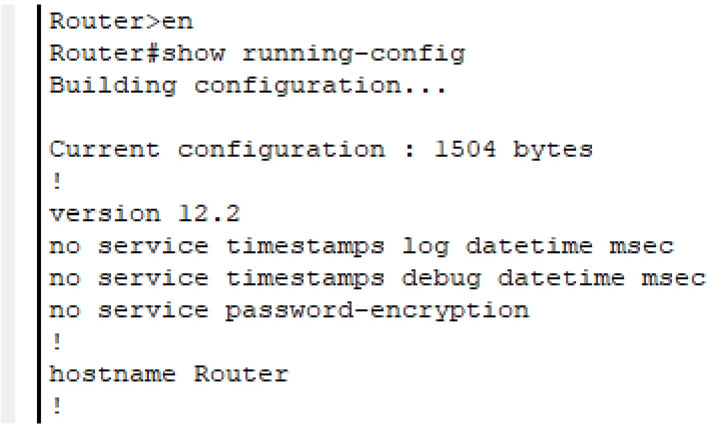


Command Prompt

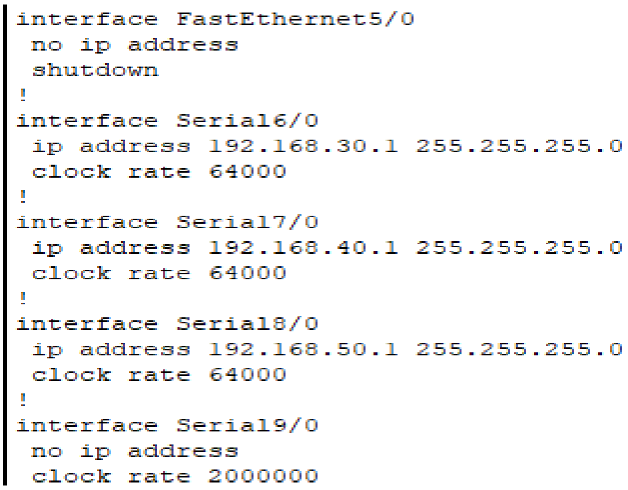
```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 160.100.0.2

Pinging 160.100.0.2 with 32 bytes of data:

Reply from 160.100.0.2: bytes=32 time<1ms TTL=128
Reply from 160.100.0.2: bytes=32 time<1ms TTL=128
Reply from 160.100.0.2: bytes=32 time<1ms TTL=128
Reply from 160.100.0.2: bytes=32 time<1ms TTL=128

Ping statistics for 160.100.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>tracert 160.100.0.2

Tracing route to 160.100.0.2 over a maximum of 30 hops:

  1   0 ms      0 ms      0 ms      160.100.0.2

Trace complete.

C:\>
```

4.6 Implementation of OSPF

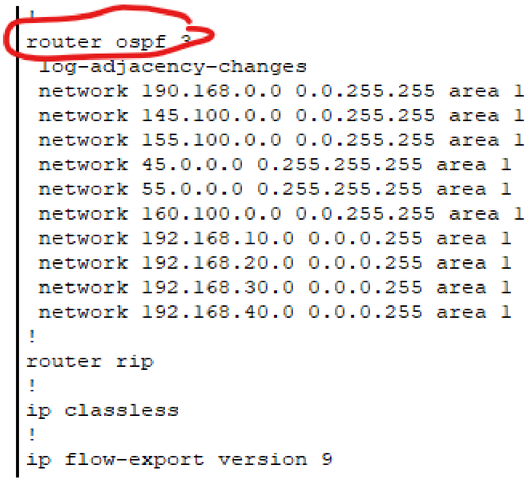
We have implemented OSPF in router 4



```
Router>en
Router#show running-config
Building configuration...

Current configuration : 1504 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
```



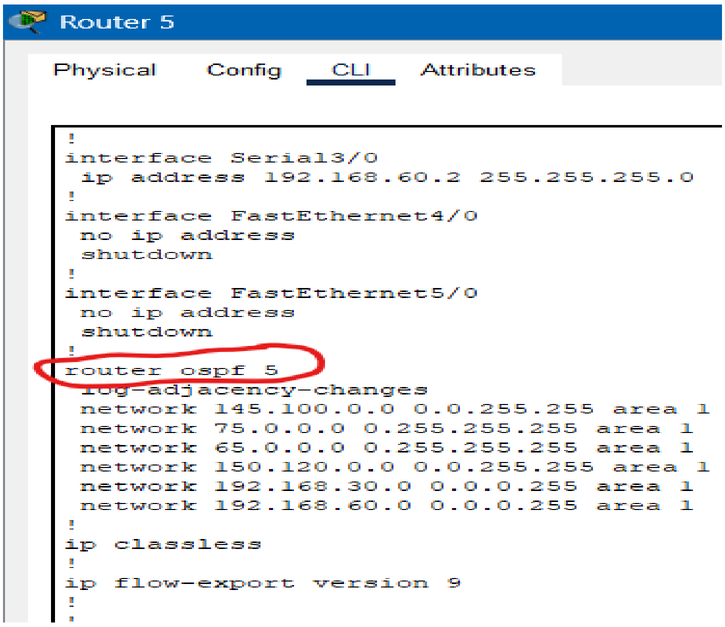
```
interface FastEthernet5/0
 no ip address
 shutdown
!
interface Serial6/0
 ip address 192.168.30.1 255.255.255.0
 clock rate 64000
!
interface Serial7/0
 ip address 192.168.40.1 255.255.255.0
 clock rate 64000
!
interface Serial8/0
 ip address 192.168.50.1 255.255.255.0
 clock rate 64000
!
interface Serial9/0
 no ip address
 clock rate 2000000
```



```
!
router ospf 3
 log-adjacency-changes
 network 190.168.0.0 0.0.255.255 area 1
 network 145.100.0.0 0.0.255.255 area 1
 network 155.100.0.0 0.0.255.255 area 1
 network 45.0.0.0 0.255.255.255 area 1
 network 55.0.0.0 0.255.255.255 area 1
 network 160.100.0.0 0.0.255.255 area 1
 network 192.168.10.0 0.0.0.255 area 1
 network 192.168.20.0 0.0.0.255 area 1
 network 192.168.30.0 0.0.0.255 area 1
 network 192.168.40.0 0.0.0.255 area 1
!
router rip
!
ip classless
!
ip flow-export version 9
```

Similarly, we have implemented OSPF in Routers 2,4 and 5.

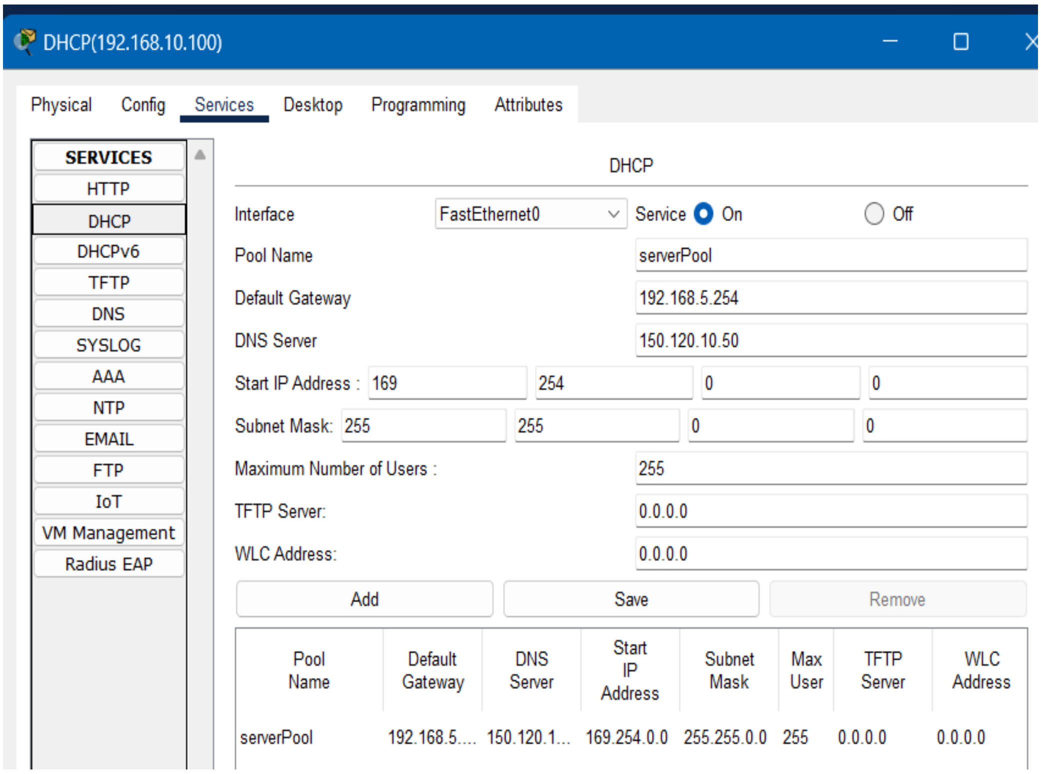
Configuration for Router 5



```
!
interface Serial3/0
 ip address 192.168.60.2 255.255.255.0
!
interface FastEthernet4/0
 no ip address
 shutdown
!
interface FastEthernet5/0
 no ip address
 shutdown
!
router ospf 5
 log-adjacency-changes
 network 145.100.0.0 0.0.255.255 area 1
 network 75.0.0.0 0.255.255.255 area 1
 network 65.0.0.0 0.255.255.255 area 1
 network 150.120.0.0 0.0.255.255 area 1
 network 192.168.30.0 0.0.0.255 area 1
 network 192.168.60.0 0.0.0.255 area 1
!
ip classless
!
ip flow-export version 9
!
!
```

4.7 Implementation of DHCP in all PC / End points.

4.8



DHCP

Interface FastEthernet0 Service ● On ○ Off

Pool Name serverPool

Default Gateway 192.168.5.254

DNS Server 150.120.10.50

Start IP Address : 169 254 0 0

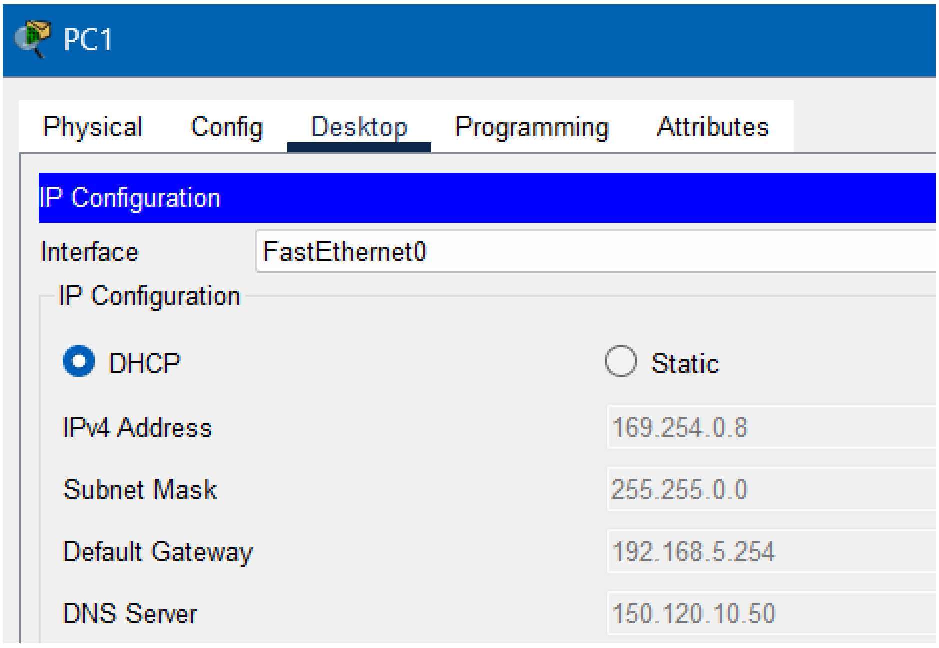
Subnet Mask: 255 255 0 0

Maximum Number of Users : 255

TFTP Server: 0.0.0.0

WLC Address: 0.0.0.0

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool	192.168.5....	150.120.1...	169.254.0.0	255.255.0.0	255	0.0.0.0	0.0.0.0



IP Configuration

Interface FastEthernet0

IP Configuration

● DHCP ○ Static

IPv4 Address 169.254.0.8

Subnet Mask 255.255.0.0

Default Gateway 192.168.5.254

DNS Server 150.120.10.50

In a similar fashion, DHCP is applied to all Departments.

5. CONCLUSION

As per the requirements of the project we have successfully implemented the following :-

- ✓ **All cases of Network Pings from one device to another. (This includes all end devices).**
- ✓ **Creation of DMZ Zone.**
- ✓ **Implemented three firewalls with proper location.**
- ✓ **Added a DNS server , 6 websites and web-server.**
- ✓ **Created a VPN IPSEC Tunnel between routers from Dept. A to Dept. B.**
- ✓ **Implemented OSPF (Open Shortest Path First) in three routers.**
- ✓ **Implemented DHCP in all end points in all Departments.**

Along with this report, a file of Packet Tracer is also being submitted.

6. PORTFOLIO

Upon successful creation of Network in Packet Tracer and showing the Network to the client (Supposing a University), **we will hire a Hardware Network Engineer and approve the Network from him and optimize it further.** After that, the University will be efficiently built from our designed network.

For post support after Sale, we will be setting up a dedicated Engineering team for client which will look after all the technical difficulties and which can the assist the client any time.

7. REFERENCES

References have taken from the following sources :

1) Teaching by respective faculty in Theory lectures and labs.
2) Some help from Practical content.
3) You Tube Lectures for Complex Concepts.
4) ppT’s uploaded by Respective subject faculty
5) Kind guidance from subject faculty.
6) Peers and College Friends.

THE END