

Project on Corporate Office Network

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Chapter 1

Introduction

1.1 Introduction

This report presents a detailed networking project implemented using Cisco Packet Tracer. The project demonstrates the integration of several networking technologies and protocols, including DHCP, sub-interfaces with encapsulation, switch trunk, OSPF, VLANs, email services, HTTP web servers, and DNS servers. The aim is to design, configure, and test a reliable and scalable network that adheres to the outlined specifications.

1.2 Objectives

The main objective of this project is to set up a functional and efficient network using Cisco Packet Tracer. Key goals include:

- Configuring DHCP to dynamically assign IP addresses.
- Implementing sub-interfaces with encapsulation to support multiple VLANs.
- Setting up switch trunking to enable VLAN traffic across multiple switches.
- Configuring OSPF for dynamic routing.
- Setting up and testing email and HTTP web servers.
- DNS server resolves hostnames to IP addresses, facilitating communication between devices.

1.3 Expected Outcome

The expected outcomes of this project are:

- A fully operational network with dynamic IP allocation via DHCP.
- Successful communication between devices across VLANs using trunk ports.
- Efficient data packet routing using OSPF.
- Segmented network traffic to improve security and manageability using VLANs.
- Functional Email, HTTP web servers, and a DNS server accessible within the network.

Chapter 2

Methodology and Tools

2.1 Methodology

The methodology employed in this project involves the following steps:

- **Network design:** Designing the network topology, including the placement of devices, VLANs, and sub-interfaces.
- **Device configuration:** Configuring Cisco devices, including routers, switches, and servers, using Cisco Packet Tracer.
- **Protocol implementation:** Implementing DHCP, OSPF, and other protocols to enable network communication.
- **Testing and verification:** Testing the network to ensure that it meets the expected outcome.

2.1 Tools

The following tools were used in this project:

- **Cisco Packet Tracer:** A Network simulation software used to design, configure, and test the network infrastructure.
- **Cisco devices:** Routers, switches, and servers were used to build the network infrastructure.

Chapter 3

Design and Implementation

3.1 Use Case/ Block Diagram of the System

The network design consists of the following components:

- Four routers (R,R2,R3,R4) with six sub-interfaces (**VLAN 20<A,C,E>** and **VLAN 40<B,D,F>**).
- Five **switches** (S0,S1,S3,S4 and S5), here three **switches**(S0,S1,S3) has trunking enabled and rest of the **switches** are in default mode.
- One **DHCP** server.
- One **Email** server.
- One **HTTP** web server.
- One **DNS** server.
- Multiple clients (PCs and laptops).

The block diagram of the system is shown below:

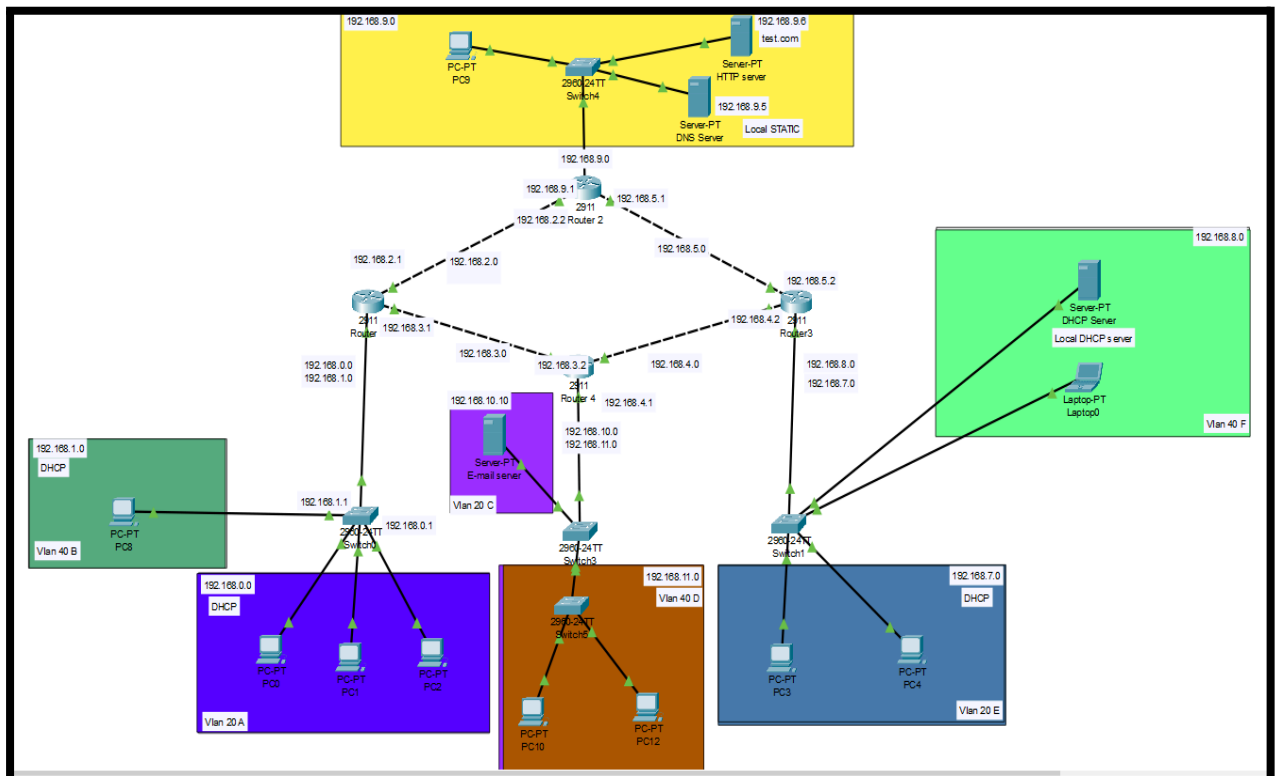


Fig: 01

3.2 Implementation

NETWORK ADDRESS TABLE:

| NETWORK ADDRESS | SUBNET MASK | ROUTER(IP) | SWITCH | VLAN (name)/DHCP |
|-----------------|------------------|----------------------------------|--------|------------------------|
| 192.168.0.0 | 255.255.255.0/24 | R1(192.168.0.1) | SW0 | VLAN20 A |
| 192.168.1.0 | 255.255.255.0/24 | R1(192.168.1.1) | SW0 | VLAN 40 B |
| 192.168.2.0 | 255.255.255.0/24 | R1(192.168.2.1), R2(192.168.2.2) | | |
| 192.168.3.0 | 255.255.255.0/24 | R1(192.168.3.1), R4(192.168.3.2) | | |
| 192.168.4.0 | 255.255.255.0/24 | R3(192.168.4.2), R4(192.168.4.1) | | |
| 192.168.5.0 | 255.255.255.0/24 | R2(192.168.5.1), R3(192.168.5.2) | | |
| 192.168.7.0 | 255.255.255.0/24 | R3(192.168.7.1) | SW1 | VLAN20 E (DHCP) |
| 192.168.8.0 | 255.255.255.0/24 | R3(192.168.8.1) | SW1 | VLAN 40 F (DHCP) |
| 192.168.9.0 | 255.255.255.0/24 | R2(192.168.9.1) | SW4 | LAN STATIC ADDRESS |
| 192.168.10.0 | 255.255.255.0/24 | R4(192.168.10.1) | SW3 | VLAN 20 C (LAN STATIC) |
| 192.168.11.0 | 255.255.255.0/24 | R4(192.168.11.1) | SW3 | VLAN 40 D (DHCP) |

Following this, the configuration files for each device are provided below:

Router 1,

```
enable
configure terminal
int gig0/0
no ip address
no shutdown
exit
int gig0/0.20
encapsulation dot1Q 20
ip address 192.168.0.1 255.255.255.0
exit
int gig0/0.40
encapsulation dot1Q 40
ip address 192.168.1.1 255.255.255.0
exit
int gig0/1
ip address 192.168.2.1 255.255.255.0
no shutdown
exit
int gig0/2
ip address 192.168.3.1 255.255.255.0
no shutdown
exit
ip dhcp pool vlan20A
network 192.168.0.0 255.255.255.0
default-router 192.168.0.1
dns-server 192.168.8.2
exit
ip dhcp pool vlan40B
network 192.168.1.0 255.255.255.0
default-router 192.168.1.1
dns-server 192.168.8.2
exit
ip dhcp excluded-address 192.168.0.1
ip dhcp excluded-address 192.168.1.1
router ospf 1
network 192.168.0.0 0.0.0.255 area 1
network 192.168.1.0 0.0.0.255 area 1
network 192.168.2.0 0.0.0.255 area 1
network 192.168.3.0 0.0.0.255 area 1
end
```

Switch 0,

```
enable
configure terminal
vlan 20
name Anik20A
exit
vlan 40
name Anik40B
exit
int range fa0/1-2
switchport mode access
switchport access vlan 20
exit
int fa0/3
switchport mode access
switchport access vlan 40
exit
int gig0/1
switchport mode trunk
end
```

Router 2,

```
enable
configure terminal
int gig0/0
ip address 192.168.2.2 255.255.255.0
no shutdown
exit
int gig0/1
ip address 192.168.5.1 255.255.255.0
no shutdown
exit
int gig0/2
ip address 192.168.9.1 255.255.255.0
no shutdown
exit
router ospf 2
network 192.168.2.0 0.0.0.255 area 1
network 192.168.5.0 0.0.0.255 area 1
network 192.168.9.0 0.0.0.255 area 1
end
```

Router Switch1,

```
enable
configure terminal
int gig0/1
ip address 192.168.4.2 255.255.255.0
no shutdown
exit
int gig0/0
ip address 192.168.5.2 255.255.255.0
no shutdown
exit
int gig0/2
no ip address
no shutdown
exit
int gig0/2.10
encapsulation dot1Q 10
ip address 192.168.7.1 255.255.255.0
ip helper-address 192.168.8.2
exit
int gig0/2.20
encapsulation dot1Q 20
ip address 192.168.8.1 255.255.255.0
ip helper-address 192.168.8.2
exit
router ospf 3
network 192.168.4.0 0.0.0.255 area 1
network 192.168.5.0 0.0.0.255 area 1
network 192.168.7.0 0.0.0.255 area 1
network 192.168.8.0 0.0.0.255 area 1
end
```

3

```
enable
configure terminal
vlan 20
name Anik20E
exit
vlan 40
name Anikserver40F
exit
int range fa0/1-2
switchport mode access
switchport access vlan 20
exit
int range fa0/3-4
switchport mode access
switchport access vlan 40
exit
int gig0/1
switchport mode trunk
end
```

Router 4

```
enable
configure terminal
int gig0/0
ip address 192.168.3.2 255.255.255.0
no shutdown
exit
int gig0/1
ip address 192.168.4.1 255.255.255.0
no shutdown
exit
int gig0/2.10
encapsulation dot1Q 10
ip address 192.168.10.1 255.255.255.0
exit
int gig0/2.20
encapsulation dot1Q 20
ip address 192.168.11.1 255.255.255.0
ip helper-address 192.168.8.2
exit
router ospf 4
network 192.168.3.0 0.0.0.255 area 1
network 192.168.4.0 0.0.0.255 area 1
network 192.168.10.0 0.0.0.255 area 1
network 192.168.11.0 0.0.0.255 area 1
end
```

Switch 3

```
enable
confi
vlan
name
exit
vlan
name
exit
int r
switc
switc
exit
int f
switc
switc
exit
int g
switc
end
```

Switch 4 Default

Switch 5 Default

E-mail Server Configuration:

Email domain: email.com

The screenshot shows the 'E-mail server' configuration window. The 'Services' tab is active, and 'EMAIL' is selected in the left-hand menu. The main area is titled 'EMAIL' and contains the following settings:

- SMTP Service:** ☒ ON ☐ OFF
- POP3 Service:** ☒ ON ☐ OFF
- Domain Name:** email.com (with a 'Set' button)
- User Setup:** A section with 'User' and 'Password' input fields. Below them is a list of users: anik, fiza, fardin, rakib, a, b, c. To the right of the list are buttons for '+', '-', 'Change', and 'Password'.

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

Here, we manually set a static local IP address for incoming and outgoing email server.
That will be used in every client connected to this network for email service.

The screenshot shows the 'E-mail server' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing 'Static' as the selected option. The fields are filled with the following values:

| Field | Value |
|-----------------|---------------|
| IPv4 Address | 192.168.10.10 |
| Subnet Mask | 255.255.255.0 |
| Default Gateway | 192.168.10.1 |
| DNS Server | 192.168.10.1 |

The 'IPv6 Configuration' section is also expanded, showing 'Static' as the selected option. The fields are filled with the following values:

| Field | Value |
|--------------------|--------------------------|
| IPv6 Address | |
| Link Local Address | FE80::203:E4FF:FEB0:9DCA |
| Default Gateway | |
| DNS Server | |

The '802.1X' section is expanded, showing 'Use 802.1X Security' as unchecked. The 'Authentication' dropdown is set to 'MD5'. The 'Username' field is empty. A 'Top' button is located at the bottom left.

Client setup Page for email,

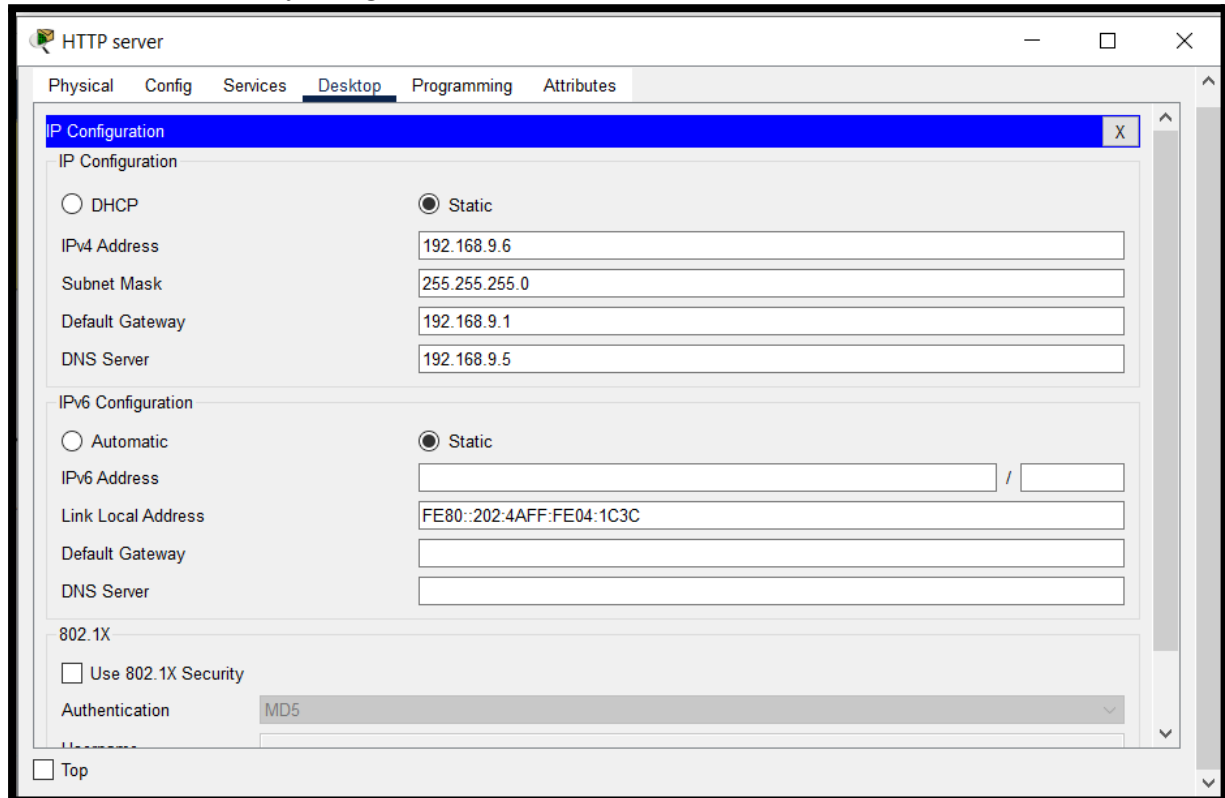
The screenshot shows the 'PC8' configuration window with the 'Desktop' tab selected. The 'Configure Mail' section is expanded, showing the following fields:

| Section | Field | Value |
|--------------------|----------------------|-----------------|
| User Information | Your Name: | rakib |
| | Email Address | rakib@email.com |
| Server Information | Incoming Mail Server | 192.168.10.10 |
| | Outgoing Mail Server | 192.168.10.10 |
| Logon Information | User Name: | rakib |
| | Password: | •••• |

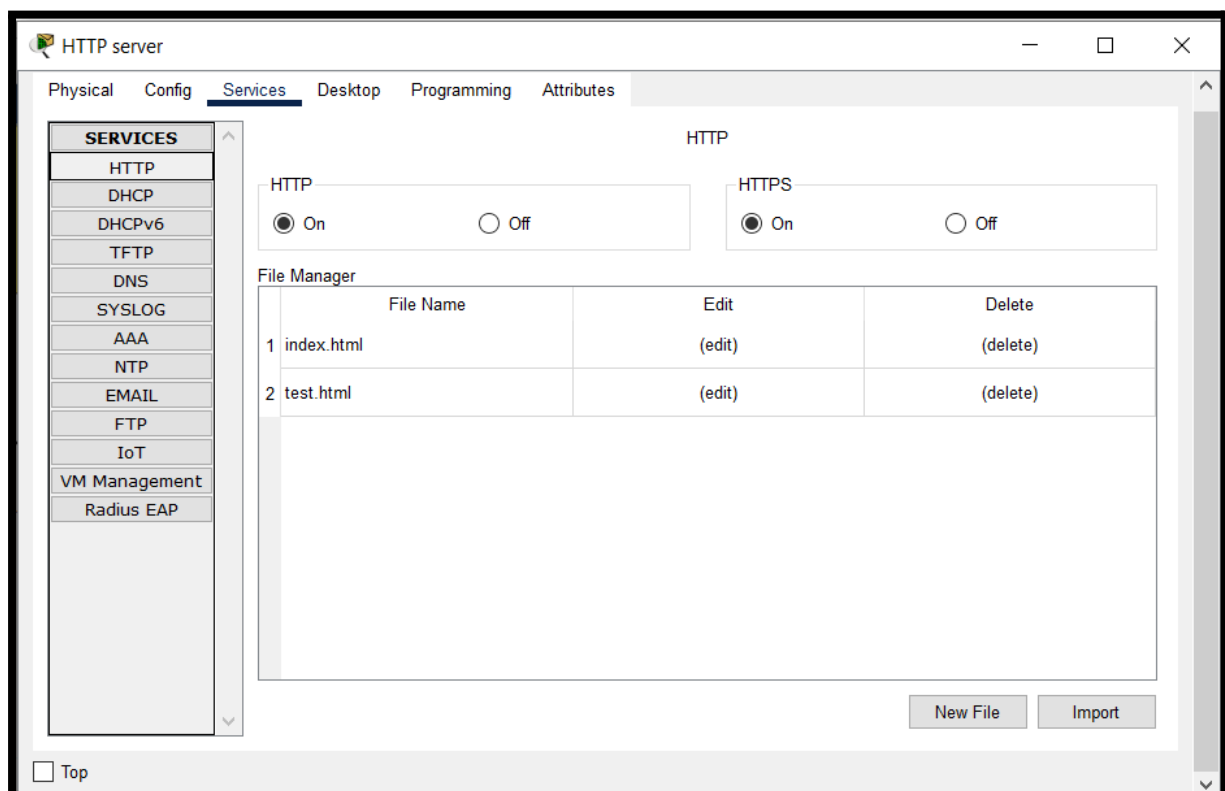
At the bottom, there are four buttons: 'Save', 'Remove', 'Clear', and 'Reset'.

Webserver Configuration:

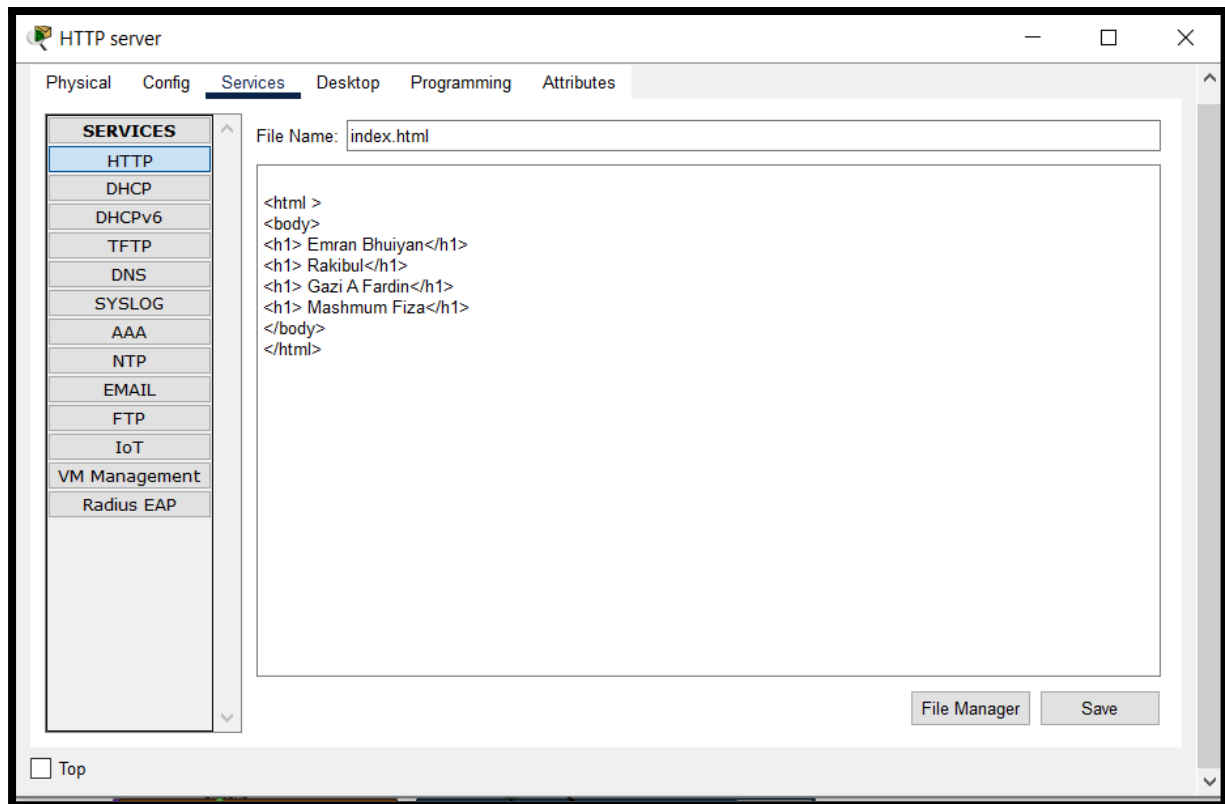
1st of all we manually assign a static local IP address for our web server.



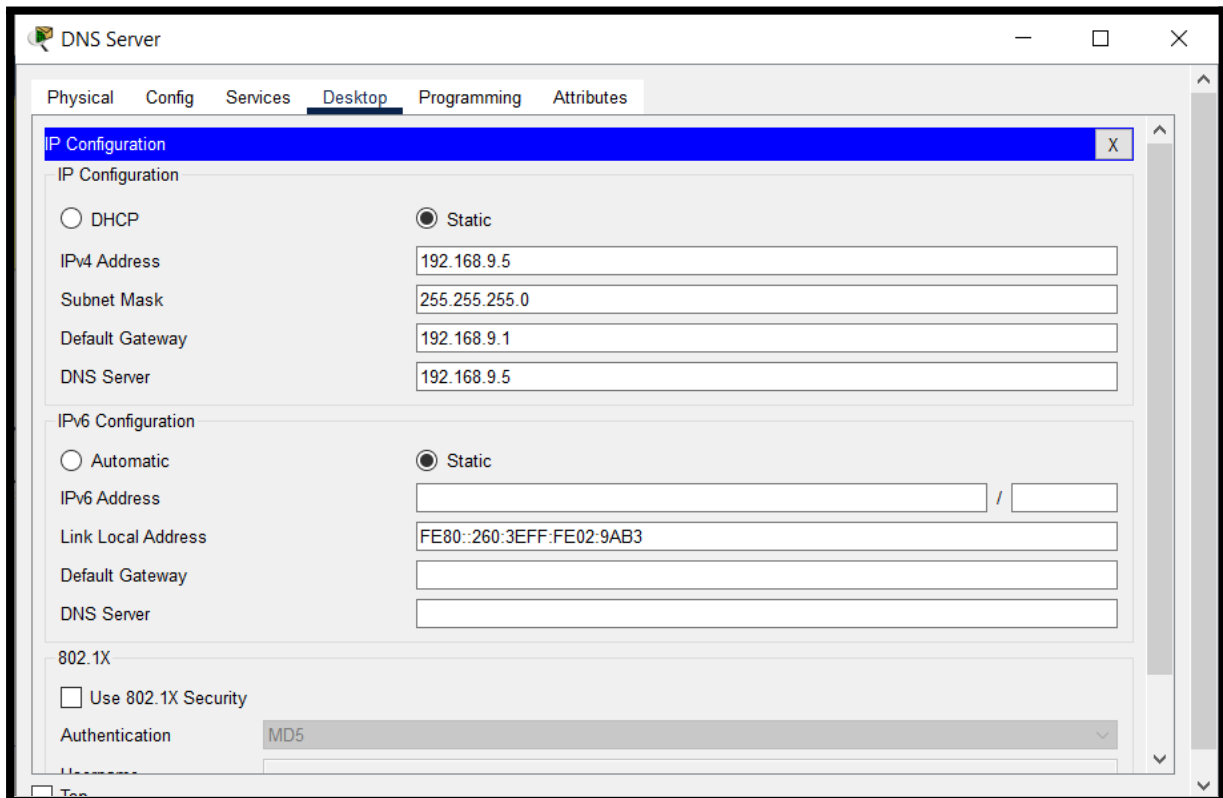
Then, we enable http services in our server,



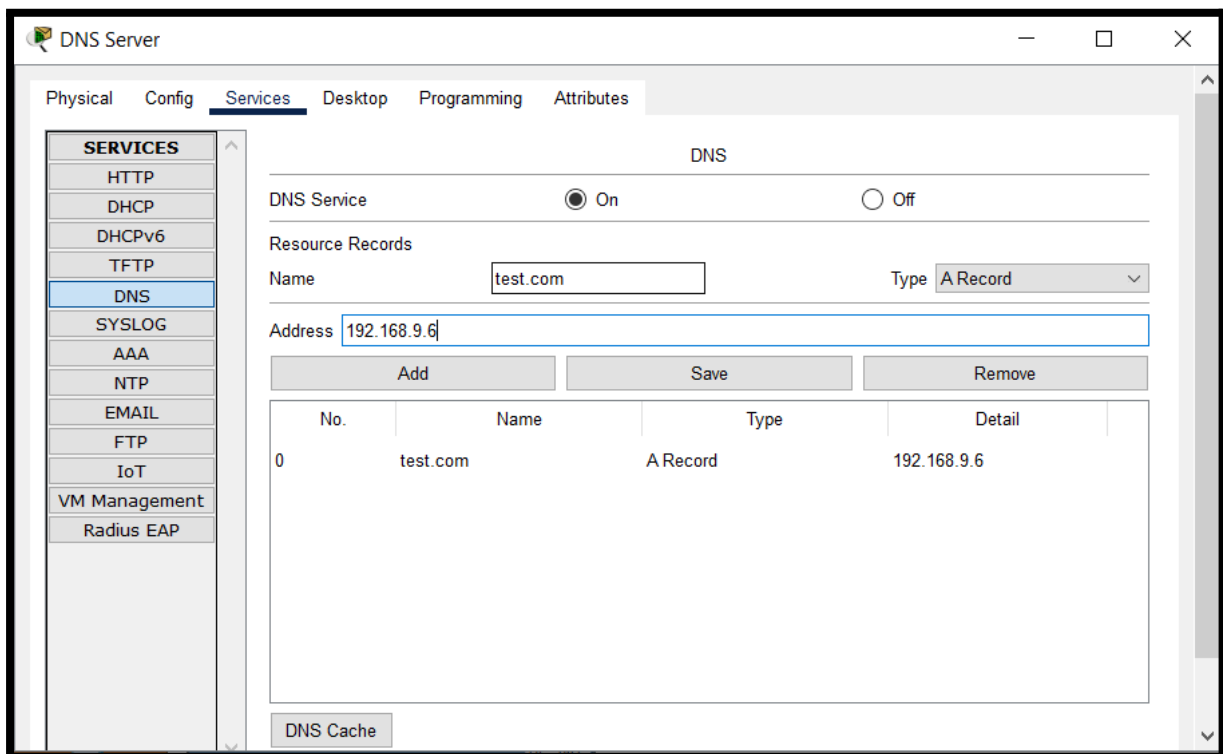
Lastly, we provide our html files for website into the server.



After completing this step, we setup our DNS server for domain name and entire network. So that, client can access or visit this website smoothly. Our DNS server IP address should be static.



Now, we have to add domain name into DNS server and our website is now ready for entire network to visit smoothly.



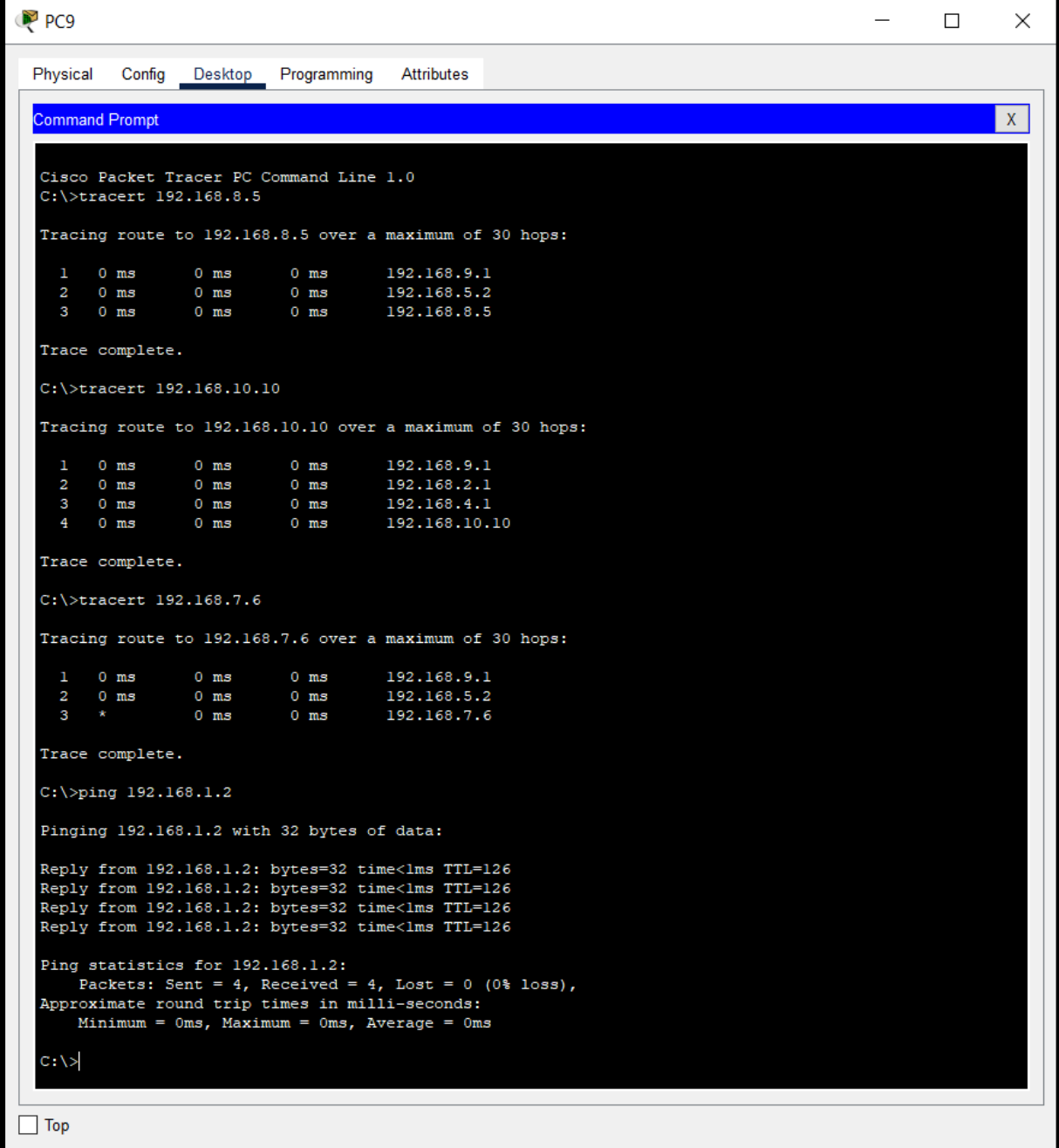
Chapter 4

Result and Conclusion

4.1 Result

The network infrastructure was successfully implemented, and the following screen shots demonstrate the expected outcome:

Our entire network system is working properly with an excellent speed of connectivity. Tested some clients with tracert and ping,



The screenshot shows a Cisco Packet Tracer PC Command Line window for PC9. The window has tabs for Physical, Config, Desktop, Programming, and Attributes. The Desktop tab is active, showing a Command Prompt window. The Command Prompt displays the results of several network tests:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>tracert 192.168.8.5

Tracing route to 192.168.8.5 over a maximum of 30 hops:

  1  0 ms    0 ms    0 ms    192.168.9.1
  2  0 ms    0 ms    0 ms    192.168.5.2
  3  0 ms    0 ms    0 ms    192.168.8.5

Trace complete.

C:\>tracert 192.168.10.10

Tracing route to 192.168.10.10 over a maximum of 30 hops:

  1  0 ms    0 ms    0 ms    192.168.9.1
  2  0 ms    0 ms    0 ms    192.168.2.1
  3  0 ms    0 ms    0 ms    192.168.4.1
  4  0 ms    0 ms    0 ms    192.168.10.10

Trace complete.

C:\>tracert 192.168.7.6

Tracing route to 192.168.7.6 over a maximum of 30 hops:

  1  0 ms    0 ms    0 ms    192.168.9.1
  2  0 ms    0 ms    0 ms    192.168.5.2
  3  *        0 ms    0 ms    192.168.7.6

Trace complete.

C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

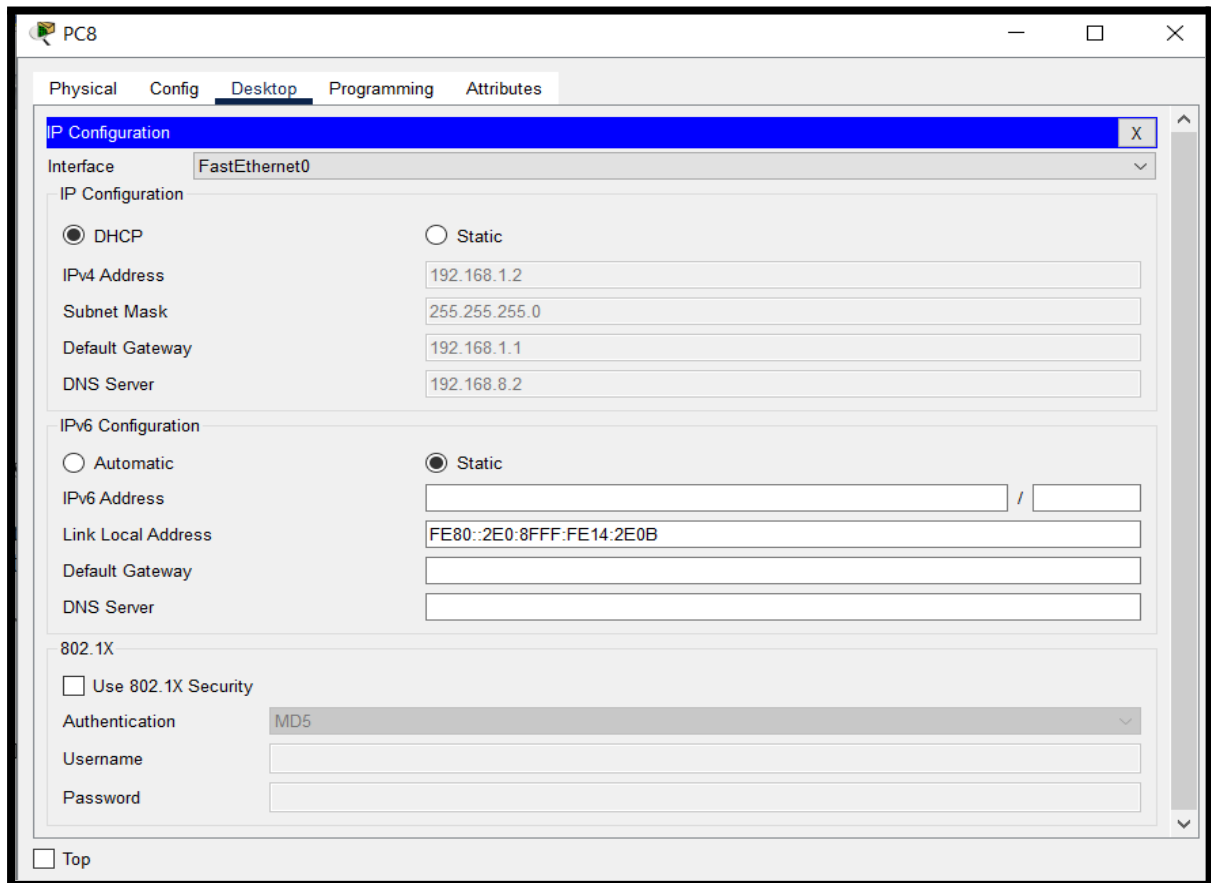
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126
Reply from 192.168.1.2: bytes=32 time<1ms TTL=126

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 = 0ms, Average = 0ms

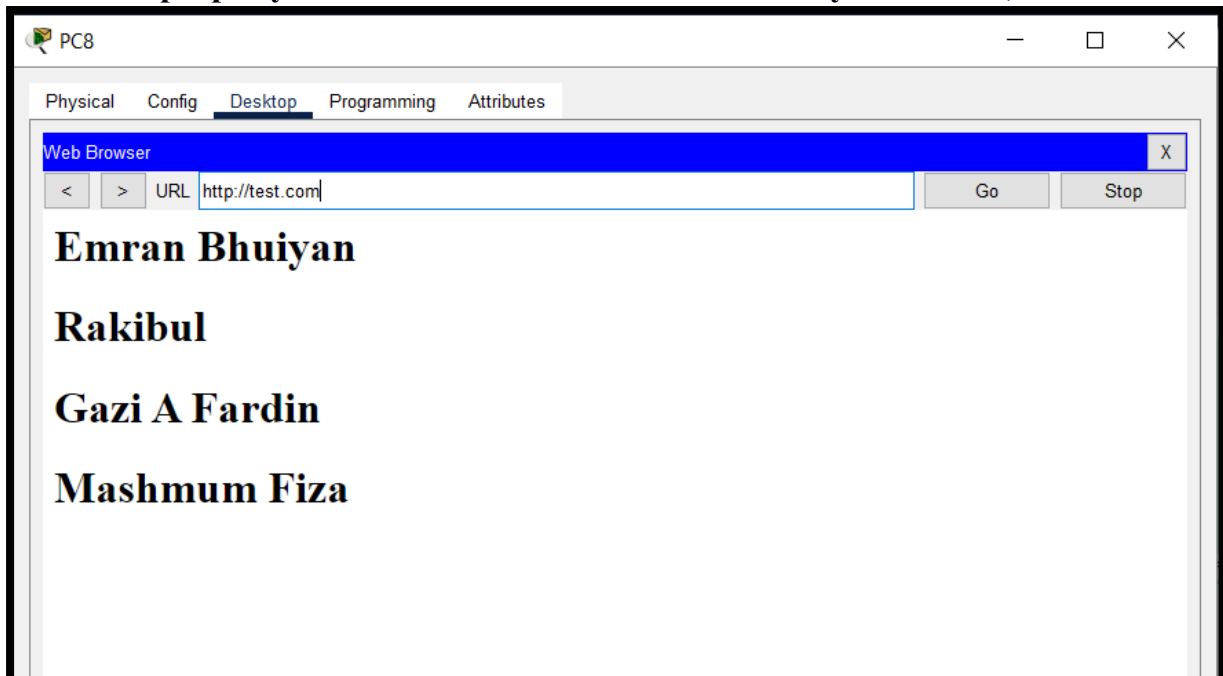
C:\>
```

At the bottom of the window, there is a checkbox labeled "Top" which is currently unchecked.

DHCP Services working properly,



Website is properly accessed from all devices without any DNS issue,



Email system is properly working for all client,

HTTP web server, and DNS server. The successful implementation of this network infrastructure ensures secure and efficient communication between devices, meeting the expected outcome of the project.