

DOKUZ EYLUL UNIVERSITY
ENGINEERING FACULTY
DEPARTMENT OF COMPUTER ENGINEERING

METROPOLITAN AREA NETWORK
SIMULATION PROJECT

by

Çağrı Anıl ERBEY 2014510028

Kemalcan ŞİMŞEK 2013510093

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CHAPTER ONE

INTRODUCTION

1.1. Project Definition and Problem Formulation

A metropolitan area network (MAN) is a network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN). The term is applied to the interconnection of networks in a city into a single larger network. It is also used to mean the interconnection of several local area networks by bridging them with backbone lines. The latter usage is also sometimes referred to as a campus network.

1.2. The Purpose and Motivation of the Project

MAN allows sending and receiving of local emails in a cheaper and more quicker manner. Due to its use of fiber optics, users can transfer databases and files quickly, as the speed of the network has the capacity of reaching 1000Mbps. This is why telephone companies across the world utilize the structure of MAN and use fiber optics to transfer data in an unprecedented speed. MAN has the feature of allowing network administrators to manage the entire network centrally leading to much more effective and efficient network management. Speaking of effective network management, it is always highly recommended to essential network training beforehand. A MAN is also considered a more secure network in comparison to a WAN[2].

1.3. Term Definitions

Network: This general term refers to all the components involved in getting computers and other types of hardware to talk to each other.

Server: Also called "file server" and "network server" this term refers to the "nerve center" of your network. It typically needs to be much more high-powered than a regular desktop workstation. The server is home to hardware that is networked (allows more than one person to use it simultaneously). All of your data will typically be stored on this machine.

Workstation: This refers to each person's computer. Your front and back office staff computers and the machines in the examination room will be workstations on the network.

Wireless: This refers to a type of network that broadcasts an access signal to the workstations. This allows for transporting laptops and tablet PCs from room to room while maintaining a network connection continuously. A wireless network also presents some additional security requirements.

Ethernet: This is the backbone of our network. It consists of the cabling and is typically able to transfer data at a rate of 100mb/s. What is not shown here are the hubs and switches that are used to connect computers and other devices together.

Router: This is your network's "air traffic controller." It routes all the data on your network to where it is supposed to go. It also assigns unique network addresses to all the computers (IP addresses). Routers can also hide the computer and devices that connect to it from the outside world. To people on the Internet, your entire network looks like one computer (one IP address). This adds another layer of protection to the computers on your network. A router may contain a VPN server and/or a firewall. Read more about hubs, switches and routers.

Architecture: Network architecture is the design of a computer network. It can also be defined as the physical and logical design of the software, hardware, protocols, and media of the transmission of data.

Switch: Switch is a high-speed device that receives incoming data packets and redirects them to their destination.

Server: Servers manage access to a centralized resource or service in a network.

Packet: Packet is a formatted unit of data carried by a packet-switched network.

Channel: Channel refers either to a physical transmission medium such as a wire or to a logical connection over a multiplexed medium such as a radio channel.

Protocol: Protocols define rules of communication between network devices.

DNS : DNS stands for domain name system. It is an application layer protocol used to provide a human-friendly naming mechanism for internet resources. It is what ties a domain name to an IP address and allows you to access sites by name in your browser.

IP : The IP protocol is one of the fundamental protocols that allow the internet to work. IP addresses are unique on each network and they allow machines to address each other across a network. It is implemented on the internet layer in the IP/TCP model[3].

CHAPTER TWO

METHOD AND SIMULATION

2.1. Simulation and Modelling Concepts

The network requirements, physical and logical needs were calculated. The alternate approach, known as bottom-up, is more commonly employed, but is far from optimal. They have a tendency to begin the design process at this level, leaving applications and services as an afterthought to be considered later. In most cases, taking a bottom-up approach tends to require a less thorough initial analysis, and is easier to implement as a quick fix.

The main approach to the modelling is building workstations (some facilities include the wireless workstation users and to provide a successful connection wireless router were used and their configurations were adjusted) as needed for facilities and connections between each of them. Furthermore, we could call it this method as divide and conquer. It makes the process much easier than the thought.

After building workstations, the IP's are assigned for each workstation. In deeply, first campus is located on network. Network devices connections between workstations and network devices are analysed. In addition to analyse process, facilities have more than one network devices and they must be connected logically and physically to workstations. Network devices were configured.

In order to connect workstations to the each other to provide essential connection, the physical cable is chosen as automatically by the packet tracer simulation software. In this case, workstations are connected with straight copper cable to the switches.

A facilities which are located in the same campuses are connected each other with a main switch over a fast ethernet port. Router has been used for two different networks which are commonly used same network channel rules/bases. The other significant responsibility of the router is managing the packages; if one of the workstation wants to send something (message/mail or etc.) to another workstation at different network, router ensure the package goes to the other network with the help of static routing.(In packet tracer simulation, router has a option for redirecting the incoming network requests named as static routing configuration).

Finally, to achieve the main requested services; such as sending/receiving mail, browsing the web, sending/receiving files, VoIP Services (sending voice data over an IP between dedicated users/workstations) and lastly database management the servers are essential and needful. Servers are located in second campus, third facility. Servers were configured and connected to the main switch of server farm. This server farm switch is connected to the other switch of second facility.

To sum up, we did not want to mention the structure deeply. All network connections are ended and connected successfully to ensure the achievable accomplished network connection between two distinct campuses.

2.2. Simulation Environment

The simulations done in the project Cisco Packet Tracer was used. Packet Tracer offers a unique combination of realistic simulation and visualization experiences, complex assessment and activity authoring capabilities and opportunities for multi-user collaboration. Cisco Packet Tracer makes learning and teaching significantly easier by supporting multi-user collaboration and by providing a realistic simulation environment for exploration and experimentation.

2.3. Network Design Requirements

Server/client architecture was used as the architecture of the network. Seven switches, four access points, four routers and seven servers used for the design. MAIL, DNS, HTTP 3, HTTP 2, HTTP 1, FTP 1, FTP 2 and DHCP protocols were used for the communication between devices. LANs contained in the MAN use the star topology so in general our topology can be considered to be a hybrid topology. Logical and physical topology of the network is presented below with the configurations for the servers.

2.4. Requirement Analysis

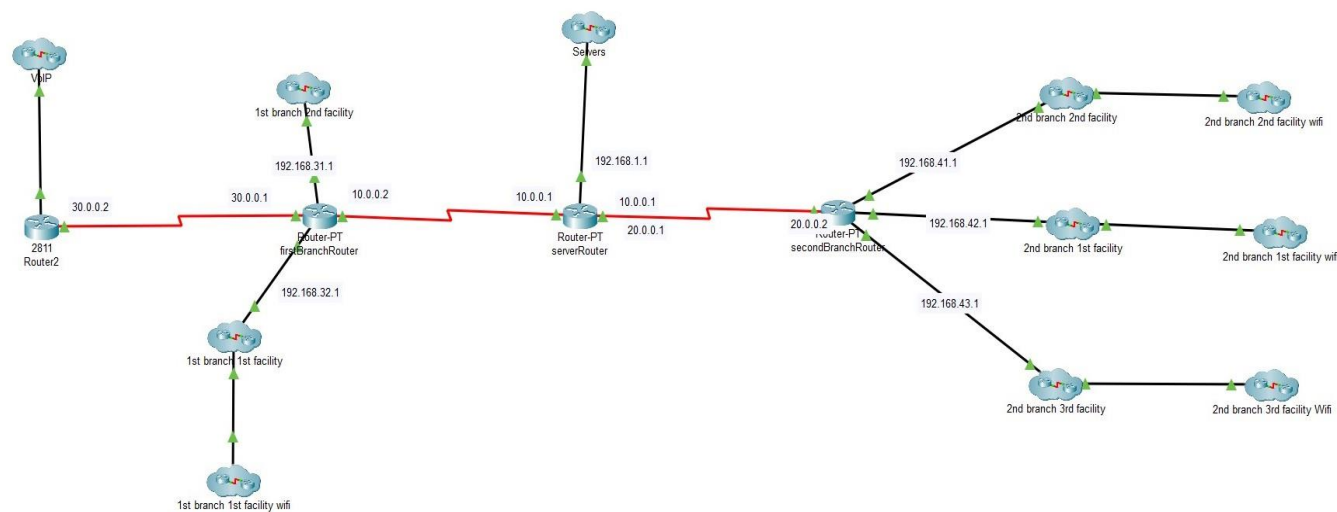
All workstations in all facilities of the first branch and in the first, second and third facilities of the second branch have access to web servers located in the third facility of the first branch.

The mail server was authorized to send mail to all workstations in the first and second facilities of the first branch, to receive mail from workstations in the third facility of the first branch, and to use mail applications to the workstations in the first and third facilities of the second branch. FTP servers were authorized to send files to workstations in the first and second facilities of the first branch, second facility of second branch, and access to the FTP server to workstations in the first facility.

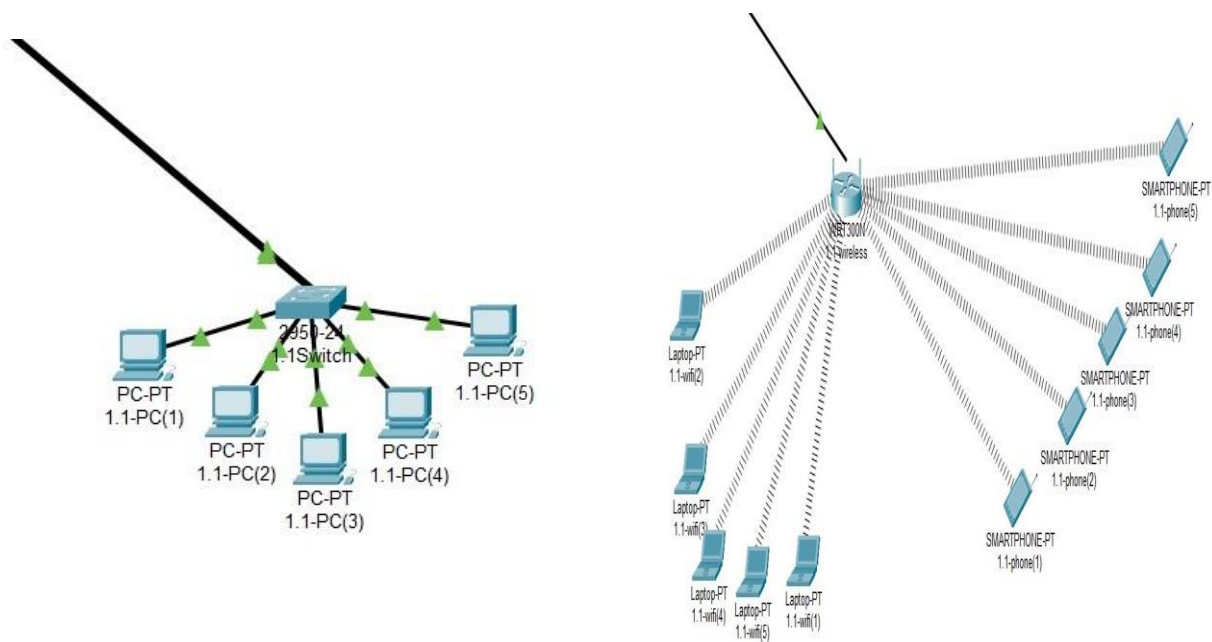
Workstations at the second facility of the first branch were given the authority to use the workstations at the second facility of the second campus were allowed to organize files and applications.

In addition, the access point was used for the wireless network feature of the workstations in the first facility of the second branch, and only 10 computers from the workstations in the second facility of the first branch were used in that facility for the VoIP protocol router2811 because other routers are not suitable for sending voice.

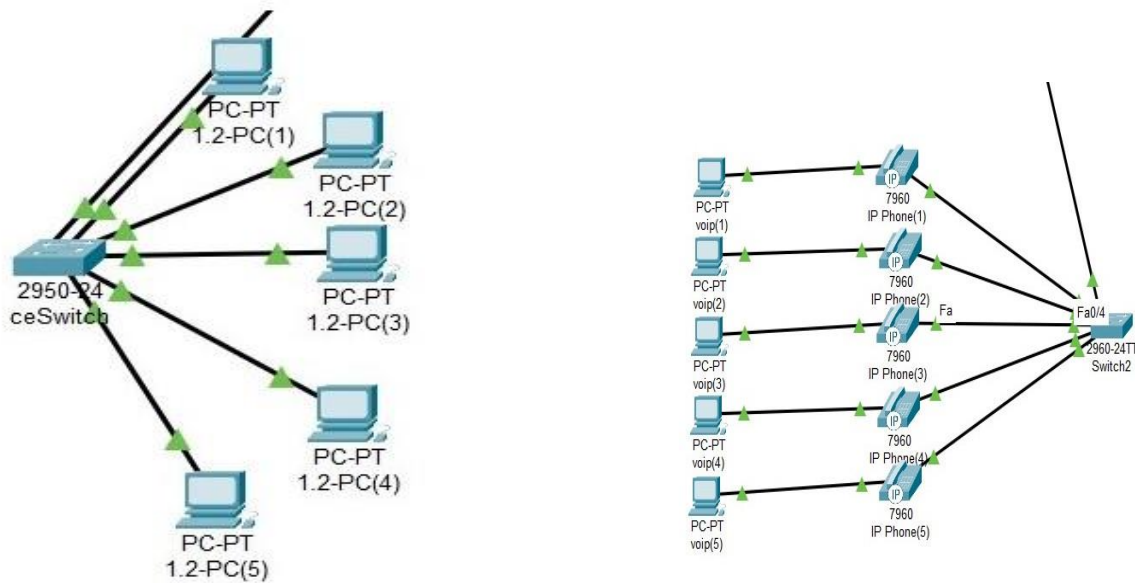
2.5. Definitions of the System/Model



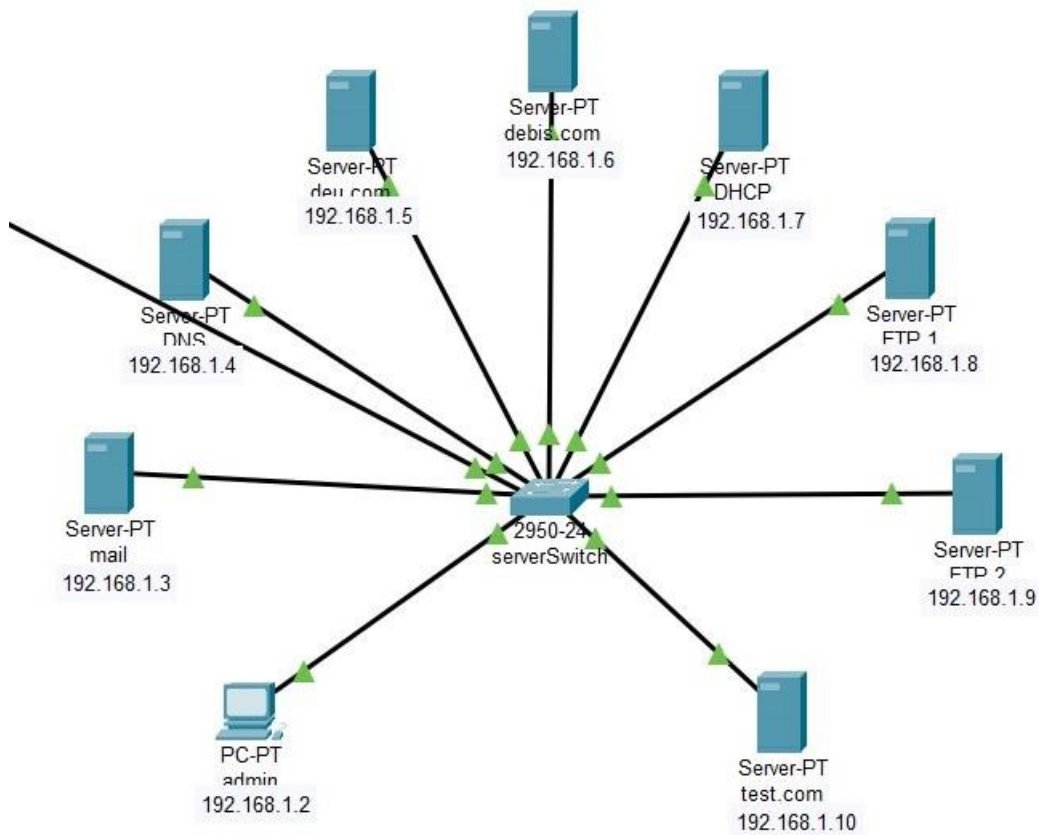
General Shape of The System



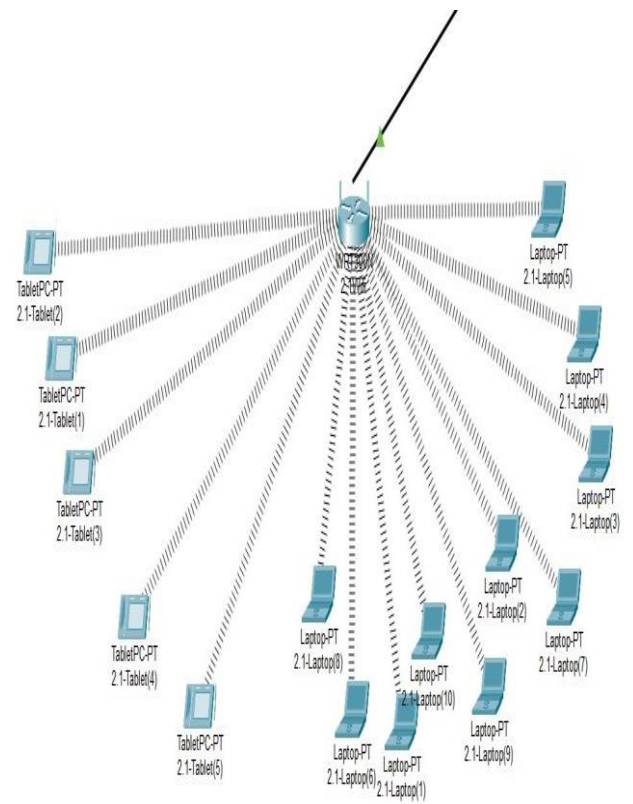
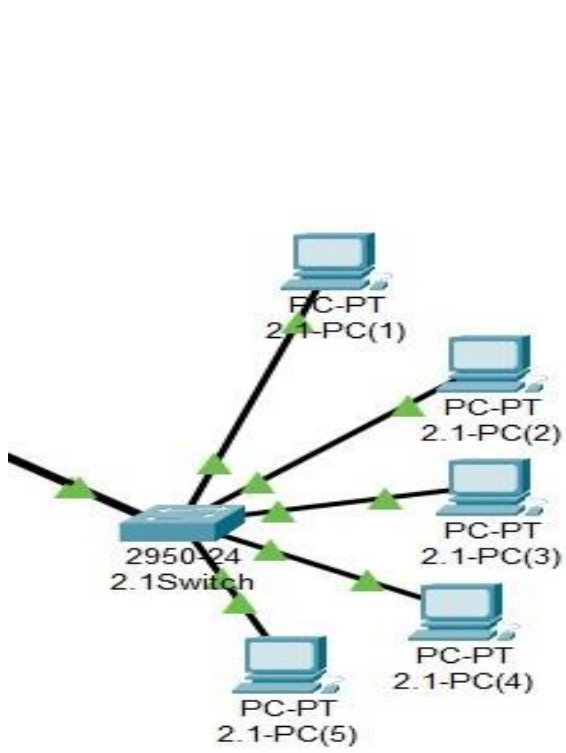
First Branch First Facility



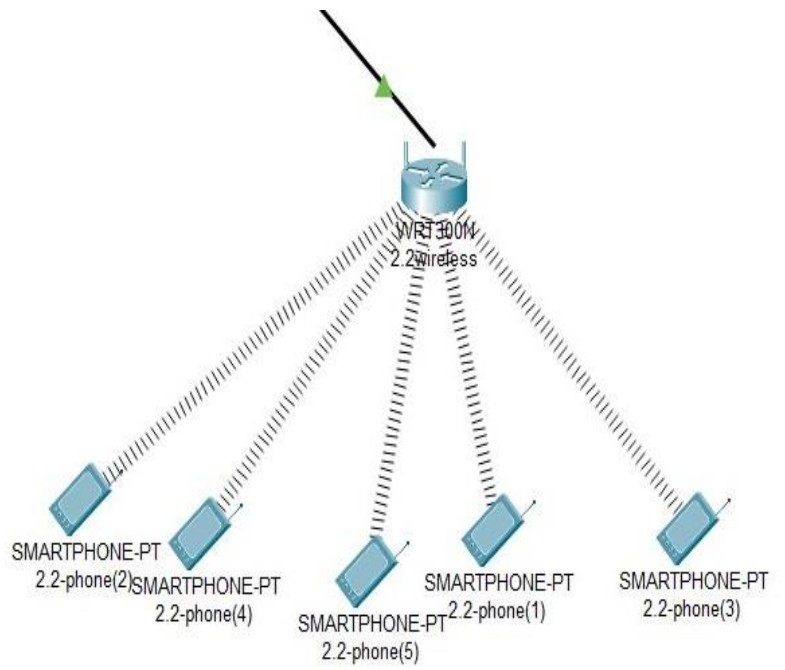
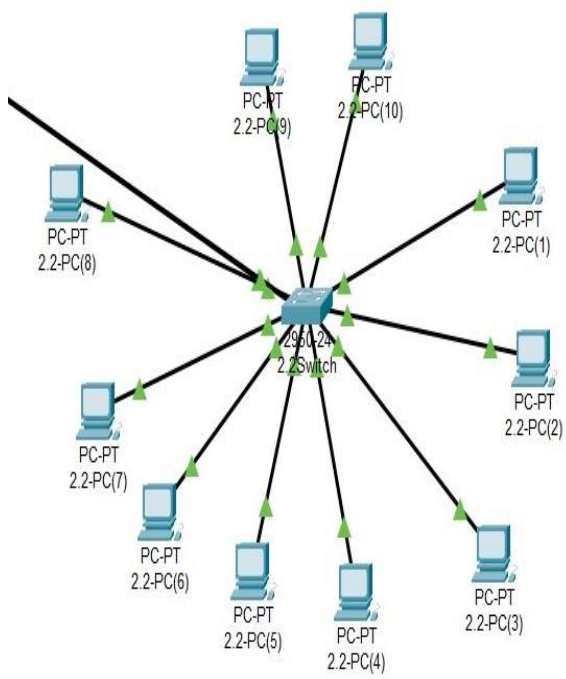
First Branch Second Facility



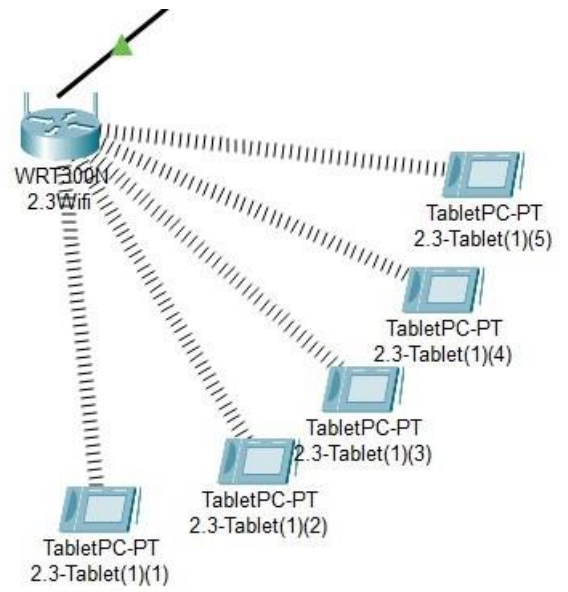
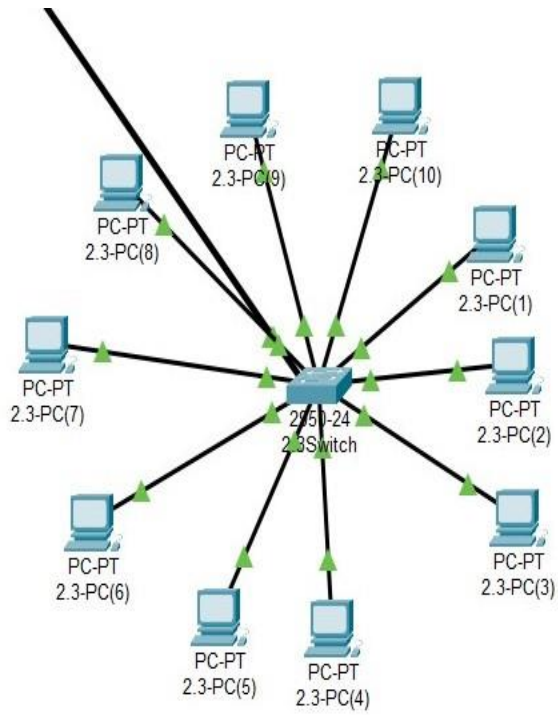
First Branch Third Facility



Second Branch First Facility

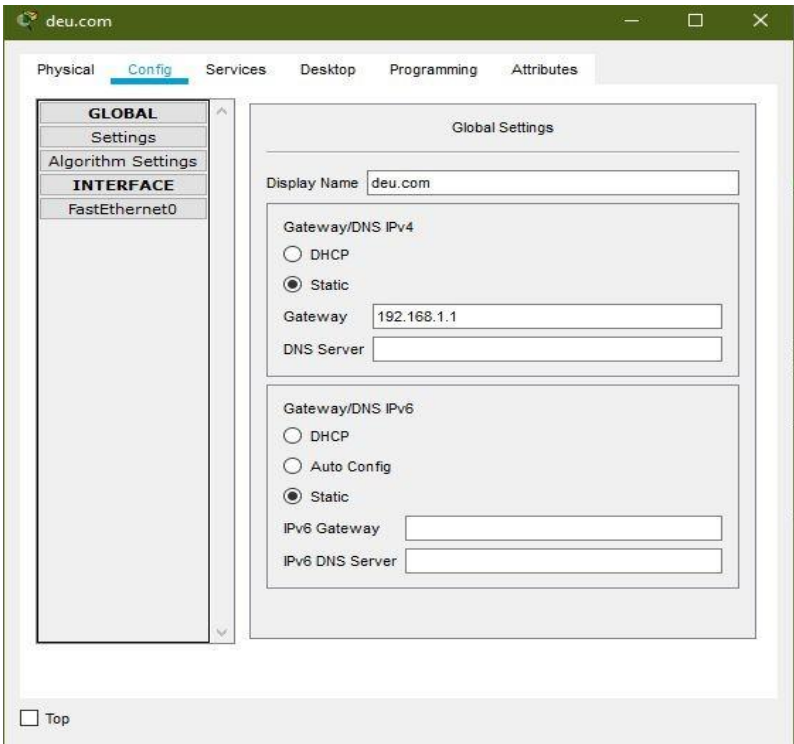


Second Branch Second Facility

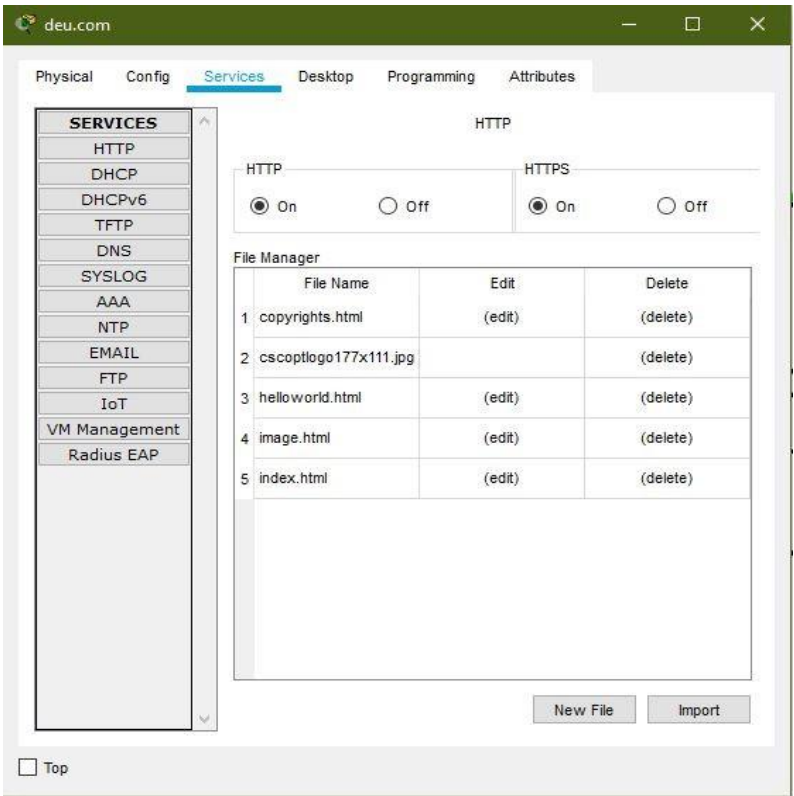


Second Branch Third Facility

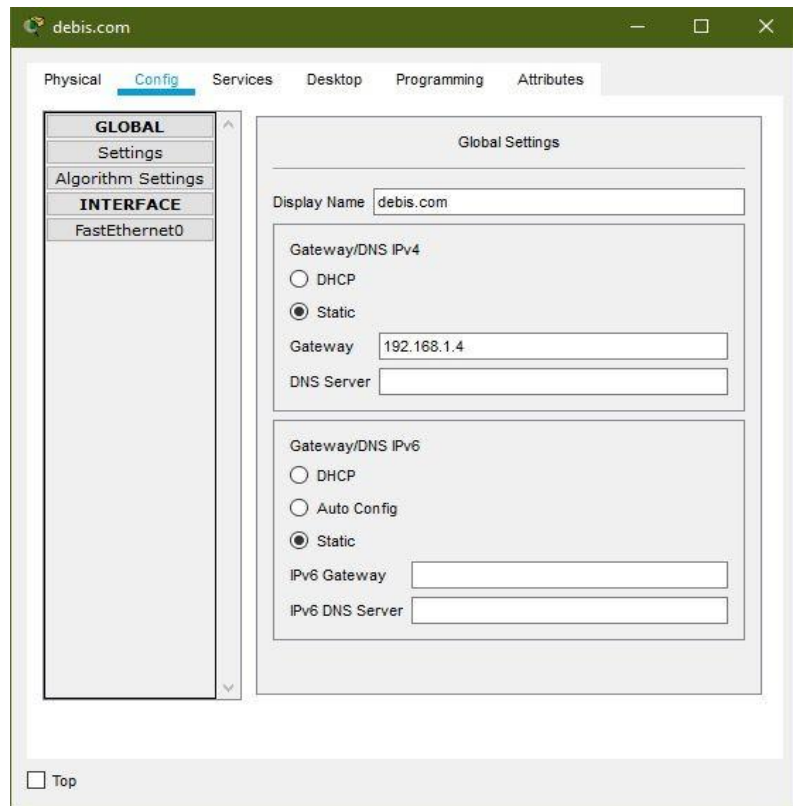
2.6. Simulation Elements



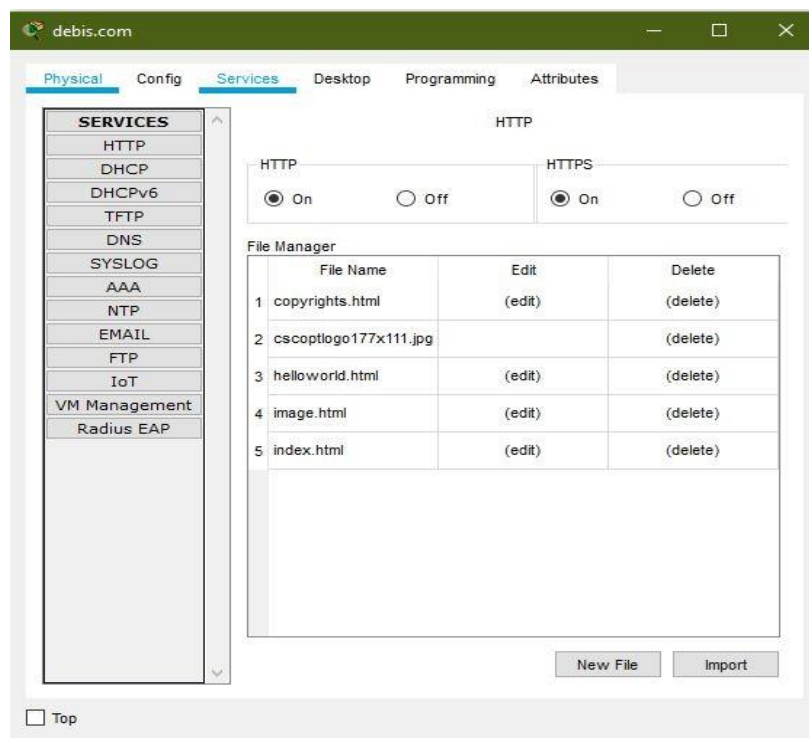
HTTP1 Server Config



HTTP1 Server Services



HTTP2 Server Config



HTTP2 Server Services

test.com

Physical **Config** Services Desktop Programming Attributes

GLOBAL
 Settings
 Algorithm Settings
INTERFACE
 FastEthernet0

Global Settings

Display Name

Gateway/DNS IPv4

☐ DHCP

☒ Static

Default Gateway

DNS Server

Gateway/DNS IPv6

☐ Automatic

☒ Static

Default Gateway

DNS Server

☐ Top

HTTP3 Server Config

test.com

Physical Config **Services** Desktop Programming Attributes

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

HTTP

HTTP ☒ On ☐ Off

HTTPS ☒ On ☐ Off

File Manager

	File Name	Edit	Delete
1	copyrights.html	(edit)	(delete)
2	cscoptlogo177x111.jpg		(delete)
3	helloworld.html	(edit)	(delete)
4	image.html	(edit)	(delete)
5	index.html	(edit)	(delete)

☐ Top

New File Import

HTTP3 Server Services

FTP 1

Physical **Config** Services Desktop Programming Attributes

GLOBAL
 Settings
 Algorithm Settings
INTERFACE
 FastEthernet0

Global Settings

Display Name

Gateway/DNS IPv4

☐ DHCP

☒ Static

Gateway

DNS Server

Gateway/DNS IPv6

☐ DHCP

☐ Auto Config

☒ Static

IPv6 Gateway

IPv6 DNS Server

☐ Top

FTP1 Server Config

FTP 1

Physical Config **Services** Desktop Programming Attributes

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

HTTP

HTTP ☐ On ☒ Off

HTTPS ☐ On ☒ Off

File Manager

	File Name	Edit	Delete
1	copyrights.html	(edit)	(delete)
2	cscoptlogo177x111.jpg		(delete)
3	helloworld.html	(edit)	(delete)
4	image.html	(edit)	(delete)
5	index.html	(edit)	(delete)

☐ Top

FTP1 Server Service

The screenshot shows the 'FTP 2' configuration window with the 'Config' tab selected. The left sidebar shows a tree view with 'GLOBAL' expanded, containing 'Settings', 'Algorithm Settings', and 'INTERFACE'. The 'INTERFACE' section is further expanded to show 'FastEthernet0'. The main area displays 'Global Settings' for 'FTP 2'. It includes fields for 'Display Name' (FTP 2), 'Gateway/DNS IPv4' (Static, 192.168.1.1), 'DNS Server', 'Gateway/DNS IPv6' (Static), 'IPv6 Gateway', and 'IPv6 DNS Server'. A 'Top' button is at the bottom left.

Physical **Config** Services Desktop Programming Attributes

GLOBAL

- Settings
- Algorithm Settings
- INTERFACE**
- FastEthernet0

Global Settings

Display Name:

Gateway/DNS IPv4

☐ DHCP

☒ Static

Gateway:

DNS Server:

Gateway/DNS IPv6

☐ DHCP

☐ Auto Config

☒ Static

IPv6 Gateway:

IPv6 DNS Server:

☐ Top

FTP2 Server Config

The screenshot shows the 'FTP 2' configuration window with the 'Services' tab selected. The left sidebar shows a tree view with 'SERVICES' expanded, containing various services like HTTP, DHCP, DNS, etc. The main area displays the 'HTTP' service configuration. It includes tabs for 'HTTP' and 'HTTPS', both with 'On' and 'Off' radio buttons. Below is a 'File Manager' table with columns for 'File Name', 'Edit', and 'Delete'. The table lists five files: 'copyrights.html', 'cscoptlogo177x111.jpg', 'helloworld.html', 'image.html', and 'index.html'. 'New File' and 'Import' buttons are at the bottom right. A 'Top' button is at the bottom left.

Physical Config **Services** Desktop Programming Attributes

SERVICES

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

HTTP

HTTP: ☐ On ☒ Off

HTTPS: ☐ On ☒ Off

File Manager

	File Name	Edit	Delete
1	copyrights.html	(edit)	(delete)
2	cscoptlogo177x111.jpg		(delete)
3	helloworld.html	(edit)	(delete)
4	image.html	(edit)	(delete)
5	index.html	(edit)	(delete)

☐ Top

New File Import

FTP2 Server Service

The screenshot shows the DHCP configuration window with the 'Config' tab selected. The left sidebar lists 'GLOBAL' (Settings, Algorithm Settings) and 'INTERFACE' (FastEthernet0). The main area is titled 'Global Settings' and contains the following fields:

- Display Name:** DHCP
- Gateway/DNS IPv4:**
 - ☐ DHCP
 - ☒ Static
 - Gateway:** 192.168.1.1
 - DNS Server:** (empty)
- Gateway/DNS IPv6:**
 - ☐ DHCP
 - ☐ Auto Config
 - ☒ Static
 - IPv6 Gateway:** (empty)
 - IPv6 DNS Server:** (empty)

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

DHCP Server Config

The screenshot shows the DHCP configuration window with the 'Services' tab selected. The left sidebar lists 'SERVICES' (HTTP, DHCP, DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, IoT, VM Management, Radius EAP). The main area is titled 'HTTP' and contains the following fields:

- HTTP:** ☐ On, ☒ Off
- HTTPS:** ☐ On, ☒ Off
- File Manager:**

	File Name	Edit	Delete
1	copyrights.html	(edit)	(delete)
2	cscoptlogo177x111.jpg		(delete)
3	helloworld.html	(edit)	(delete)
4	image.html	(edit)	(delete)
5	index.html	(edit)	(delete)

At the bottom right, there are 'New File' and 'Import' buttons. At the bottom left, there is a 'Top' button.

DHCP Server Service

The screenshot shows the 'DNS' configuration window with the 'Config' tab selected. The left sidebar has a tree view with 'GLOBAL' expanded, showing 'Settings' and 'Algorithm Settings'. Under 'INTERFACE', 'FastEthernet0' is selected. The main area is titled 'Global Settings' and contains the following fields:

- Display Name:** DNS
- Gateway/DNS IPv4:**
 - ☐ DHCP
 - ☒ Static
 - Gateway:** 192.168.1.1
 - DNS Server:** (empty field)
- Gateway/DNS IPv6:**
 - ☐ DHCP
 - ☐ Auto Config
 - ☒ Static
 - IPv6 Gateway:** (empty field)
 - IPv6 DNS Server:** (empty field)

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

DNS Server Config

The screenshot shows the 'DNS' configuration window with the 'Services' tab selected. The left sidebar has a tree view with 'SERVICES' expanded, showing a list of services: HTTP, DHCP, DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, IoT, VM Management, and Radius EAP. The main area is titled 'HTTP' and contains the following elements:

- HTTP/HTTPS Status:**
 - HTTP:** ☐ On, ☒ Off
 - HTTPS:** ☐ On, ☒ Off
- File Manager:** A table listing files with 'Edit' and 'Delete' actions.
- Buttons:** 'New File' and 'Import' buttons at the bottom right.

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

	File Name	Edit	Delete
1	copyrights.html	(edit)	(delete)
2	cscoptlogo177x111.jpg		(delete)
3	helloworld.html	(edit)	(delete)
4	image.html	(edit)	(delete)
5	index.html	(edit)	(delete)

DNS Server Service

The screenshot shows the 'mail' configuration window with the 'Config' tab selected. The left sidebar shows a tree view with 'GLOBAL' expanded, containing 'Settings' and 'Algorithm Settings'. Under 'INTERFACE', 'FastEthernet0' is selected. The main area displays 'Global Settings' for the 'mail' interface. It includes fields for 'Display Name' (mail), 'Gateway/DNS IPv4' (Static, 192.168.1.1), 'DNS Server', 'Gateway/DNS IPv6' (Static), 'IPv6 Gateway', and 'IPv6 DNS Server'. A 'Top' button is at the bottom left.

Global Settings

Display Name: mail

Gateway/DNS IPv4

☐ DHCP

☒ Static

Gateway: 192.168.1.1

DNS Server:

Gateway/DNS IPv6

☐ DHCP

☐ Auto Config

☒ Static

IPv6 Gateway:

IPv6 DNS Server:

☐ Top

MAIL Server Config

The screenshot shows the 'mail' configuration window with the 'Services' tab selected. The left sidebar shows a tree view with 'SERVICES' expanded, containing various services like HTTP, DHCP, DNS, etc. The main area displays the 'HTTP' service configuration. It includes toggle switches for 'HTTP' (Off) and 'HTTPS' (Off). Below is a 'File Manager' table with 5 rows of files. At the bottom right are 'New File' and 'Import' buttons. A 'Top' button is at the bottom left.

SERVICES

HTTP

HTTP: ☐ On ☒ Off

HTTPS: ☐ On ☒ Off

File Manager

	File Name	Edit	Delete
1	copyrights.html	(edit)	(delete)
2	cscoptlogo177x111.jpg		(delete)
3	helloworld.html	(edit)	(delete)
4	image.html	(edit)	(delete)
5	index.html	(edit)	(delete)

New File Import

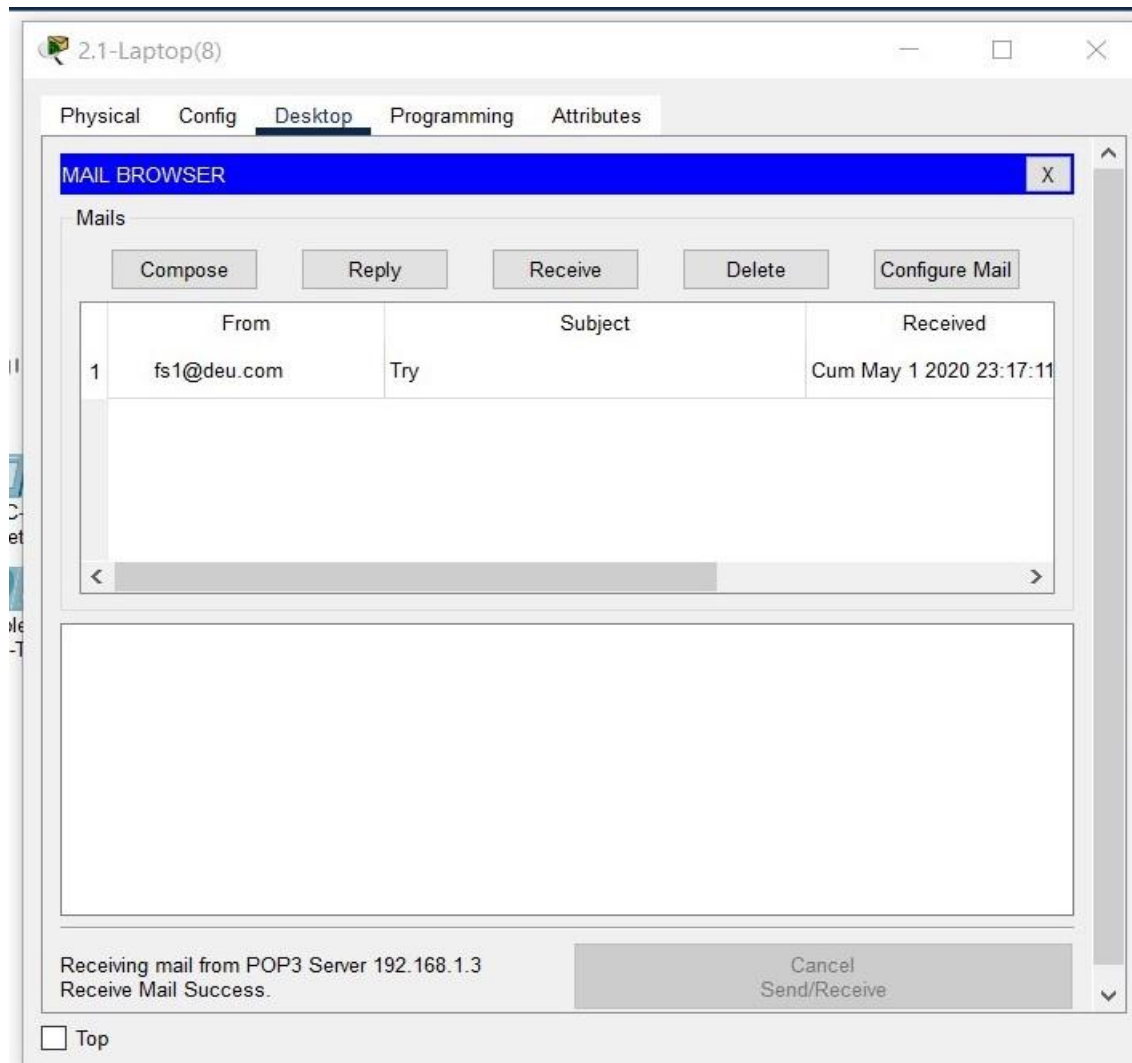
☐ Top

MAIL Server Service

CHAPTER THREE

TRAFFIC ANALYSIS & SIMULATION RESULTS

Scenario 1 : A wireless user from first facility of second branch wants to read emails and browse Web



2.1-Laptop(2)

Physical

Config

Desktop

Programming

Attributes

Web Browser

<

>

URL

http://test.com

Go

Stop

Cisco Packet Tracer

Welcome to Cisco Packet Tracer. Opening doors to new opportunities. Mind Wide Open.

Quick Links:

[A small page](#)
[Copyrights](#)
[Image page](#)
[Image](#)

☐ Top

PROTOCOL ID:0										VE RSI0 N:0										MESSAGE TYPE:0																	
P		M		POR ^						P		M		P		M																					
				TR0																																	
										ROOT PATH COST:0																											
BRIDGE ID:32769 / 0001.43E3.65A9																																					
										PORT ID:32773														MESSAGE AGE:0													
										MAX AGE:20														HELLO TIME:2													
										FORWARD DELAY:15																											

Scenario 2 : A computer engineer from second facility of second branch developed a web application and wants to send her code files to FTP server in the third facility of first branch.

Physical Config Desktop Programming Attributes

Command Prompt X

```
Listing /ftp directory from 192.168.1.9:
0 : asa842-k8.bin 5571584
1 : asa923-k8.bin 30468096
2 : ayrilik.txt 72
3 : c1841-advipservicesk9-mz.124-15.T1.bin 33591768
4 : c1841-ipbase-mz.123-14.T7.bin 13832032
5 : c1841-ipbasek9-mz.124-12.bin 16599160
6 : c1900-universalk9-mz.SPA.155-3.M4a.bin 33591768
7 : c2600-advipservicesk9-mz.124-15.T1.bin 33591768
8 : c2600-i-mz.122-28.bin 5571584
9 : c2600-ipbasek9-mz.124-8.bin 13169700
10 : c2800nm-advipservicesk9-mz.124-15.T1.bin 50938004
11 : c2800nm-advipservicesk9-mz.151-4.M4.bin 33591768
12 : c2800nm-ipbase-mz.123-14.T7.bin 5571584
13 : c2800nm-ipbasek9-mz.124-8.bin 15522644
14 : c2900-universalk9-mz.SPA.155-3.M4a.bin 33591768
15 : c2950-i6q412-mz.121-22.EA4.bin 3058048
16 : c2950-i6q412-mz.121-22.EA8.bin 3117390
17 : c2960-lanbase-mz.122-25.FX.bin 4414921
18 : c2960-lanbase-mz.122-25.SEE1.bin 4670455
19 : c2960-lanbasek9-mz.150-2.SE4.bin 4670455
20 : c3560-advipservicesk9-mz.122-37.SE1.bin 8662192
21 : c3560-advipservicesk9-mz.122-46.SE.bin 10713279
22 : c800-universalk9-mz.SPA.152-4.M4.bin 33591768
23 : c800-universalk9-mz.SPA.154-3.M6a.bin 83029236
24 : cat3k_caa-universalk9.16.03.02.SPA.bin 505532849
25 : cgr1000-universalk9-mz.SPA.154-2.CG 159487552
26 : cgr1000-universalk9-mz.SPA.156-3.CG 184530138
27 : ir800-universalk9-bundle.SPA.156-3.M.bin 160968869
28 : ir800-universalk9-mz.SPA.155-3.M 61750062
29 : ir800-universalk9-mz.SPA.156-3.M 63753767
30 : ir800_yocto-1.7.2.tar 2877440
31 : ir800_yocto-1.7.2_python-2.7.3.tar 6912000
32 : pt1000-i-mz.122-28.bin 5571584
33 : pt3000-i6q412-mz.121-22.EA4.bin 3117390
34 : webSite.txt 21
ftp>
```

Top

Physical Config Desktop Programming Attributes

Command Prompt

```
1/1/1970 3:0 PM 21 website.txt
1/1/1970 3:0 PM 4 websitesi.txt
51 bytes 3 File(s)
C:\>ftp 192.168.1.9
Trying to connect...192.168.1.9
Connected to 192.168.1.9
220- Welcome to PT Ftp server
Username:admin
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>put webSite.txt

Writing file webSite.txt to 192.168.1.9:
File transfer in progress...

[Transfer complete - 21 bytes]

21 bytes copied in 0.021 secs (1000 bytes/sec)
ftp>dir

Listing /ftp directory from 192.168.1.9:
0 : asa842-k8.bin 5571584
1 : asa923-k8.bin 30468096
2 : ayriilik.txt 72
3 : cl841-advipservicesk9-mz.124-15.T1.bin 33591768
4 : cl841-ipbase-mz.123-14.T7.bin 13832032
5 : cl841-ipbasek9-mz.124-12.bin 16599160
6 : cl900-universalk9-mz.SPA.155-3.M4a.bin 33591768
7 : c2600-advipservicesk9-mz.124-15.T1.bin 33591768
8 : c2600-i-mz.122-28.bin 5571584
9 : c2600-ipbasek9-mz.124-8.bin 13169700
10 : c2800nm-advipservicesk9-mz.124-15.T1.bin 50938004
11 : c2800nm-advipservicesk9-mz.151-4.M4.bin 33591768
12 : c2800nm-ipbase-mz.123-14.T7.bin 5571584
13 : c2800nm-ipbasek9-mz.124-8.bin 15522644
14 : c2800-universalk9-mz.SPA.155-3.M4a.bin 33591768
```

Top

voip(1)

Physical Config Desktop Programming Attributes

Command Prompt

```
19 : c2960-lanbasek9-mz.150-2.SE4.bin 4670455
20 : c3560-advipservicesk9-mz.122-37.SE1.bin 8662192
21 : c3560-advipservicesk9-mz.122-46.SE.bin 10713279
22 : c800-universalk9-mz.SPA.152-4.M4.bin 33591768
23 : c800-universalk9-mz.SPA.154-3.M6a.bin 83029236
24 : cat3k_caa-universalk9.16.03.02.SPA.bin 505532849
25 : cgr1000-universalk9-mz.SPA.154-2.CG 159487552
26 : cgr1000-universalk9-mz.SPA.156-3.CG 184530138
27 : ir800-universalk9-bundle.SPA.156-3.M.bin 160968869
28 : ir800-universalk9-mz.SPA.155-3.M 61750062
29 : ir800-universalk9-mz.SPA.156-3.M 63753767
30 : ir800_yocto-1.7.2.tar 2877440
31 : ir800_yocto-1.7.2_python-2.7.3.tar 6912000
32 : pt1000-i-mz.122-28.bin 5571584
33 : pt3000-i6q412-mz.121-22.EA4.bin 3117390
34 : webSite.txt 21
ftp>get webSite.txt

Reading file webSite.txt from 192.168.1.9:
File transfer in progress...

[Transfer complete - 21 bytes]

21 bytes copied in 0.008 secs (2625 bytes/sec)
ftp>quit

221- Service closing control connection.
C:\>dir

Volume in drive C has no label.
Volume Serial Number is 5E12-4AF3
Directory of C:\

1/1/1970 3:0 PM 26 sampleFile.txt
1/1/1970 3:0 PM 21 webSite.txt
47 bytes 2 File(s)

C:\>
```

Top

voip(1)

Physical Config Desktop Programming Attributes

Command Prompt

```

7 : c2600-advipservicesk9-mz.124-15.T1.bin          33591768
8 : c2600-i-mz.122-28.bin                            5571584
9 : c2600-ipbasek9-mz.124-8.bin                      13169700
10 : c2800nm-advipservicesk9-mz.124-15.T1.bin        50938004
11 : c2800nm-advipservicesk9-mz.151-4.M4.bin         33591768
12 : c2800nm-ipbase-mz.123-14.T7.bin                 5571584
13 : c2800nm-ipbasek9-mz.124-8.bin                   15522644
14 : c2900-universalk9-mz.SPA.155-3.M4a.bin          33591768
15 : c2950-i6q412-mz.121-22.EA4.bin                  3058048
16 : c2950-i6q412-mz.121-22.EA8.bin                 3117390
17 : c2960-lanbase-mz.122-25.FX.bin                  4414921
18 : c2960-lanbase-mz.122-25.SEE1.bin                4670455
19 : c2960-lanbasek9-mz.150-2.SE4.bin                 4670455
20 : c3560-advipservicesk9-mz.122-37.SE1.bin         8662192
21 : c3560-advipservicesk9-mz.122-46.SE.bin          10713279
22 : c800-universalk9-mz.SPA.152-4.M4.bin             33591768
23 : c800-universalk9-mz.SPA.154-3.M6a.bin            83029236
24 : cat3k_caa-universalk9.16.03.02.SPA.bin           505532849
25 : cgr1000-universalk9-mz.SPA.154-2.CG              159487552
26 : cgr1000-universalk9-mz.SPA.156-3.CG              184530138
27 : ir800-universalk9-bundle.SPA.156-3.M.bin         160968869
28 : ir800-universalk9-mz.SPA.155-3.M                 61750062
29 : ir800-universalk9-mz.SPA.156-3.M                 63753767
30 : ir800_yocto-1.7.2.tar                           2877440
31 : ir800_yocto-1.7.2_python-2.7.3.tar              6912000
32 : pt1000-i-mz.122-28.bin                           5571584
33 : pt3000-i6q412-mz.121-22.EA4.bin                 3117390
34 : webSite.txt                                       21

ftp>get webSite.txt

Reading file webSite.txt from 192.168.1.9:
File transfer in progress...

[Transfer complete - 21 bytes]

21 bytes copied in 0.008 secs (2625 bytes/sec)
ftp>

```

Top

voip(1)

Physical Config Desktop Programming Attributes

Command Prompt

```

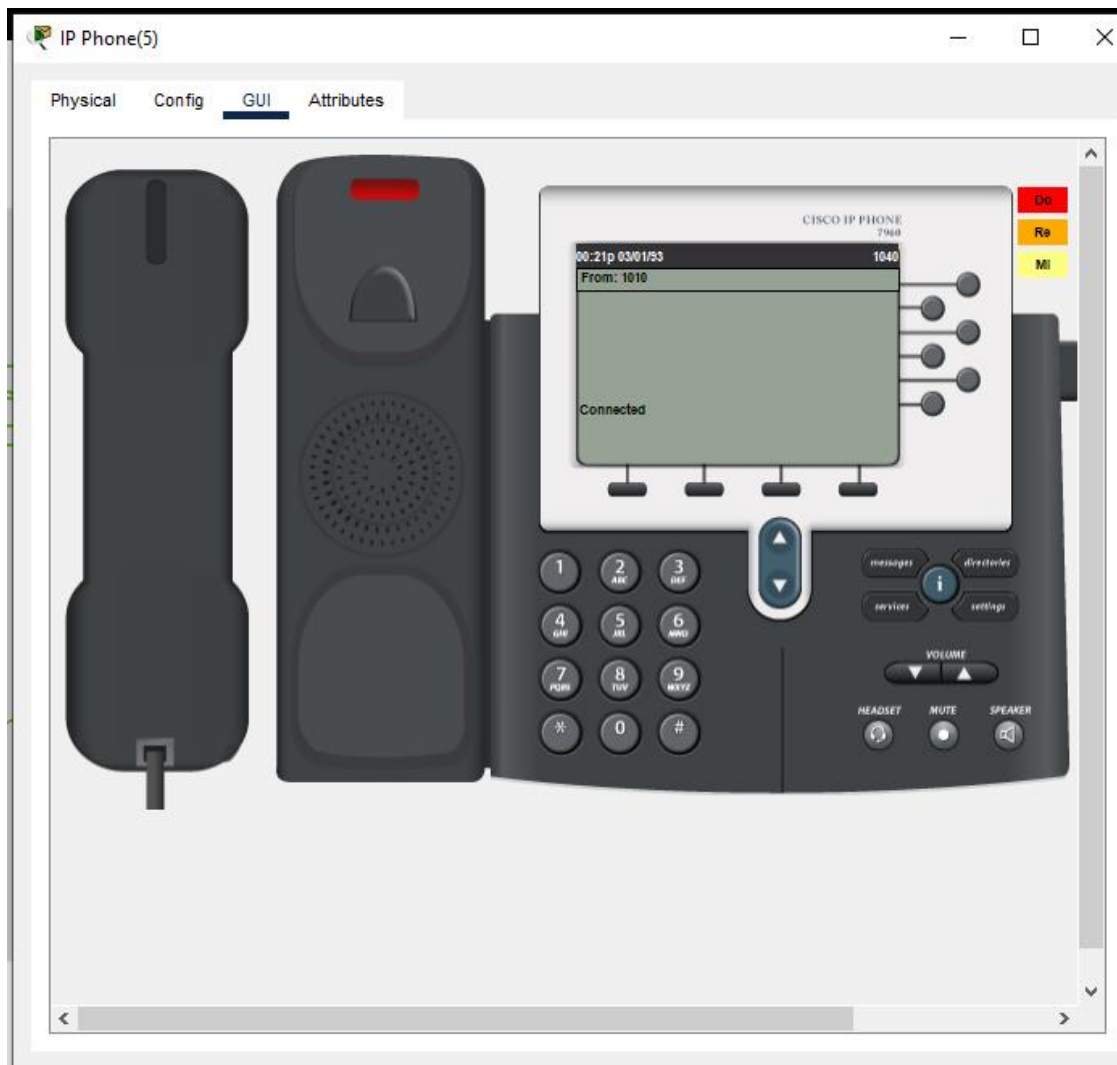
Packet Tracer PC Command Line 1.0
C:\>ftp 192.168.1.9
Trying to connect...192.168.1.9
Connected to 192.168.1.9
220- Welcome to PT Ftp server
Username:admin
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>dir

Listing /ftp directory from 192.168.1.9:
0 : asa842-k8.bin          5571584
1 : asa923-k8.bin          30468096
2 : ayrilik.txt            72
3 : cl841-advipservicesk9-mz.124-15.T1.bin        33591768
4 : cl841-ipbase-mz.123-14.T7.bin                  13832032
5 : cl841-ipbasek9-mz.124-12.bin                   16599160
6 : cl900-universalk9-mz.SPA.155-3.M4a.bin          33591768
7 : c2600-advipservicesk9-mz.124-15.T1.bin          33591768
8 : c2600-i-mz.122-28.bin                            5571584
9 : c2600-ipbasek9-mz.124-8.bin                     13169700
10 : c2800nm-advipservicesk9-mz.124-15.T1.bin       50938004
11 : c2800nm-advipservicesk9-mz.151-4.M4.bin        33591768
12 : c2800nm-ipbase-mz.123-14.T7.bin                 5571584
13 : c2800nm-ipbasek9-mz.124-8.bin                   15522644
14 : c2900-universalk9-mz.SPA.155-3.M4a.bin          33591768
15 : c2950-i6q412-mz.121-22.EA4.bin                  3058048
16 : c2950-i6q412-mz.121-22.EA8.bin                 3117390
17 : c2960-lanbase-mz.122-25.FX.bin                  4414921
18 : c2960-lanbase-mz.122-25.SEE1.bin                4670455
19 : c2960-lanbasek9-mz.150-2.SE4.bin                 4670455
20 : c3560-advipservicesk9-mz.122-37.SE1.bin         8662192
21 : c3560-advipservicesk9-mz.122-46.SE.bin          10713279
22 : c800-universalk9-mz.SPA.152-4.M4.bin             33591768

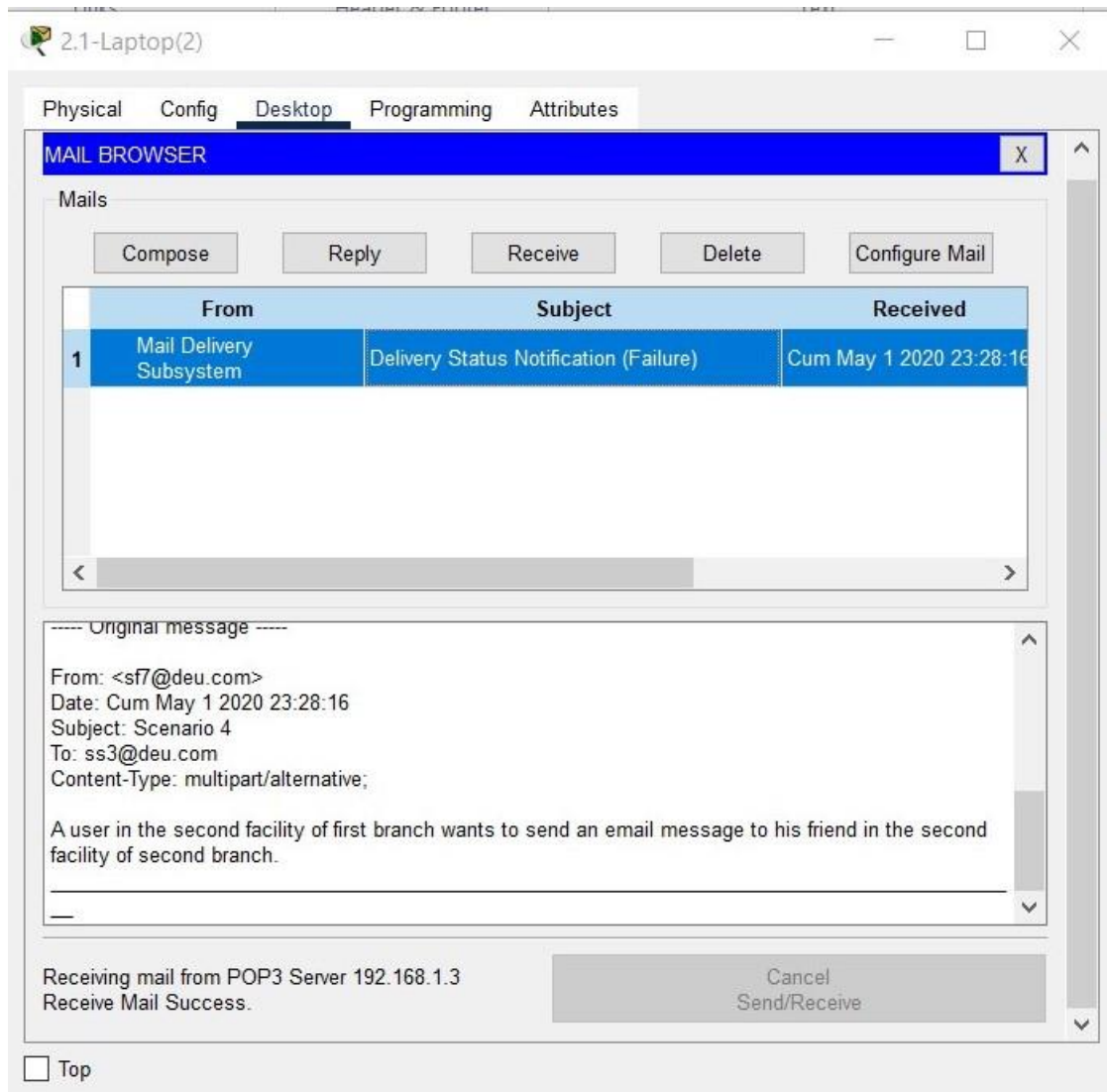
```

Top

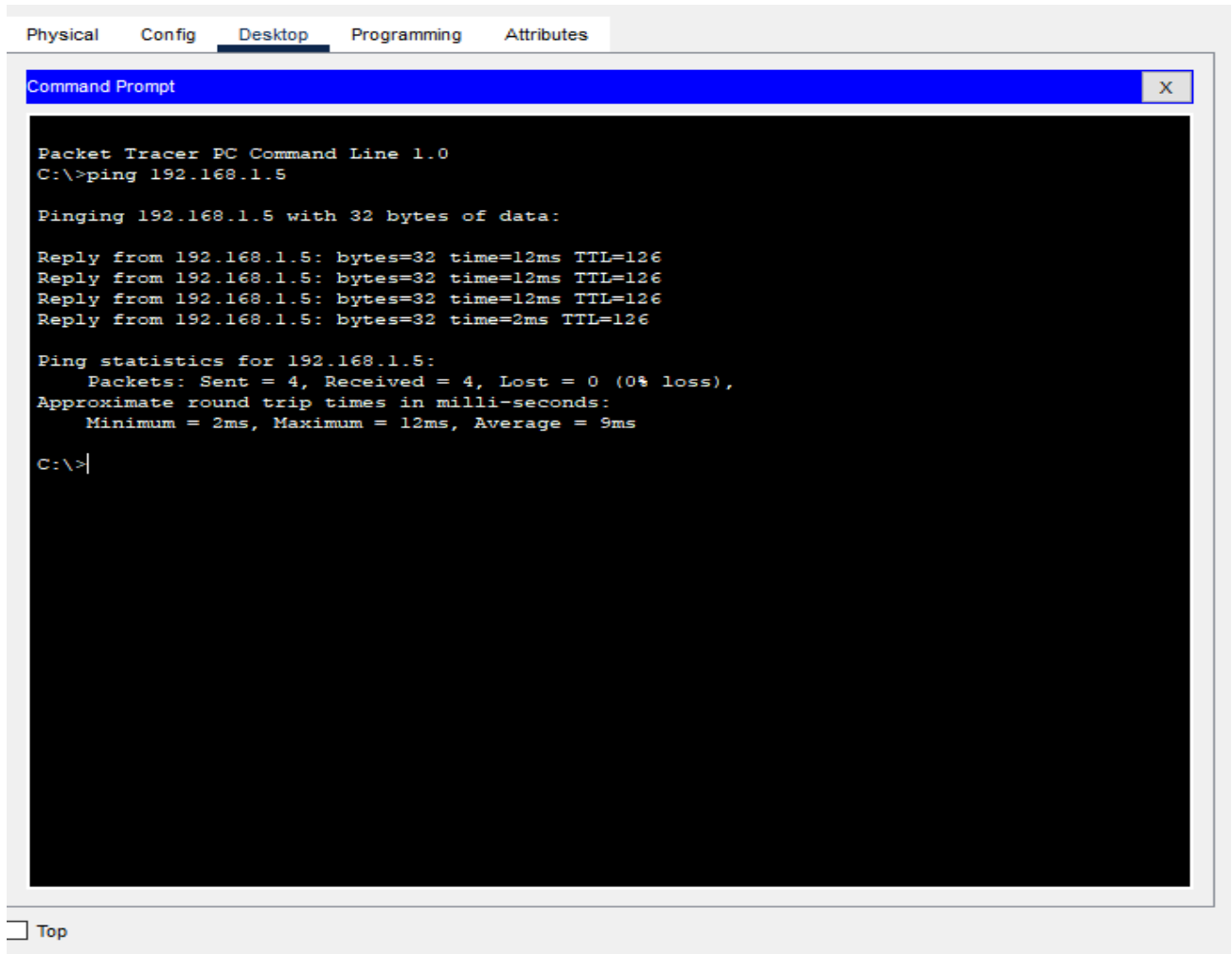
Scenario 3 : Two users from second facility of first branch want to talk via VoIP.



Scenario 4 : A user in the second facility of first branch wants to send an email message to his friend in the second facility of second branch.



Scenario 5 : A user from first facility of second branch pings Web server of second facility of first branch.



The screenshot shows a Packet Tracer Desktop window with tabs for Physical, Config, Desktop, Programming, and Attributes. The Desktop tab is active, displaying a Command Prompt window titled "Command Prompt". The Command Prompt shows the output of a ping command to 192.168.1.5. The output indicates that the ping was successful with 0% loss and provides round trip time statistics.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.5

Pinging 192.168.1.5 with 32 bytes of data:

Reply from 192.168.1.5: bytes=32 time=12ms TTL=126
Reply from 192.168.1.5: bytes=32 time=12ms TTL=126
Reply from 192.168.1.5: bytes=32 time=12ms TTL=126
Reply from 192.168.1.5: bytes=32 time=2ms TTL=126

Ping statistics for 192.168.1.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 12ms, Average = 9ms

C:\>|
```

Top

Scenario 6 : A laptop user from first facility of first branch office wants to send email to her friend in the first facility of second branch office.

1.1-wifi(2)

Physical

Config

Desktop

Programming

Attributes

Compass Mail

X

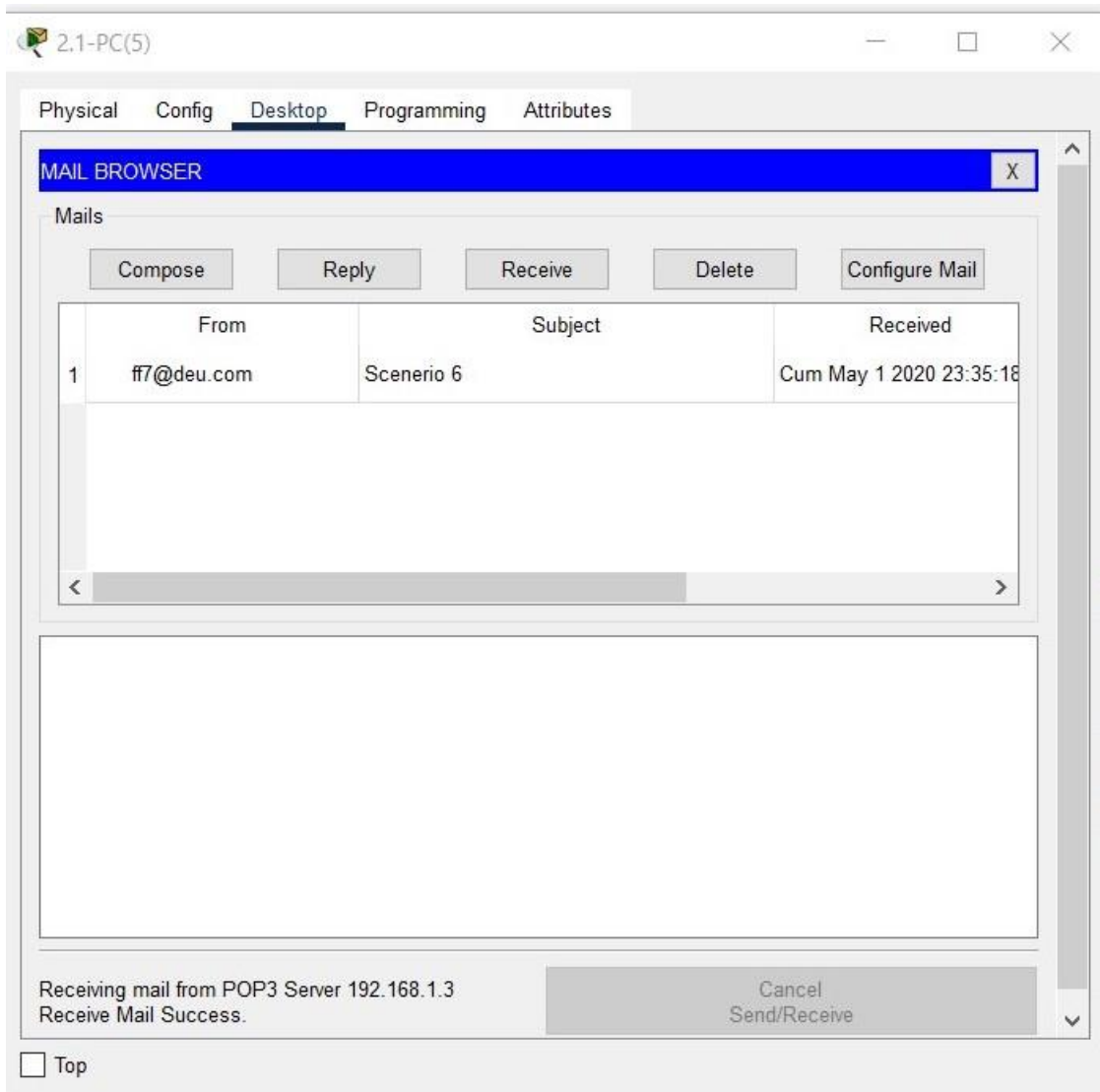
Send

To: sf5@deu.com

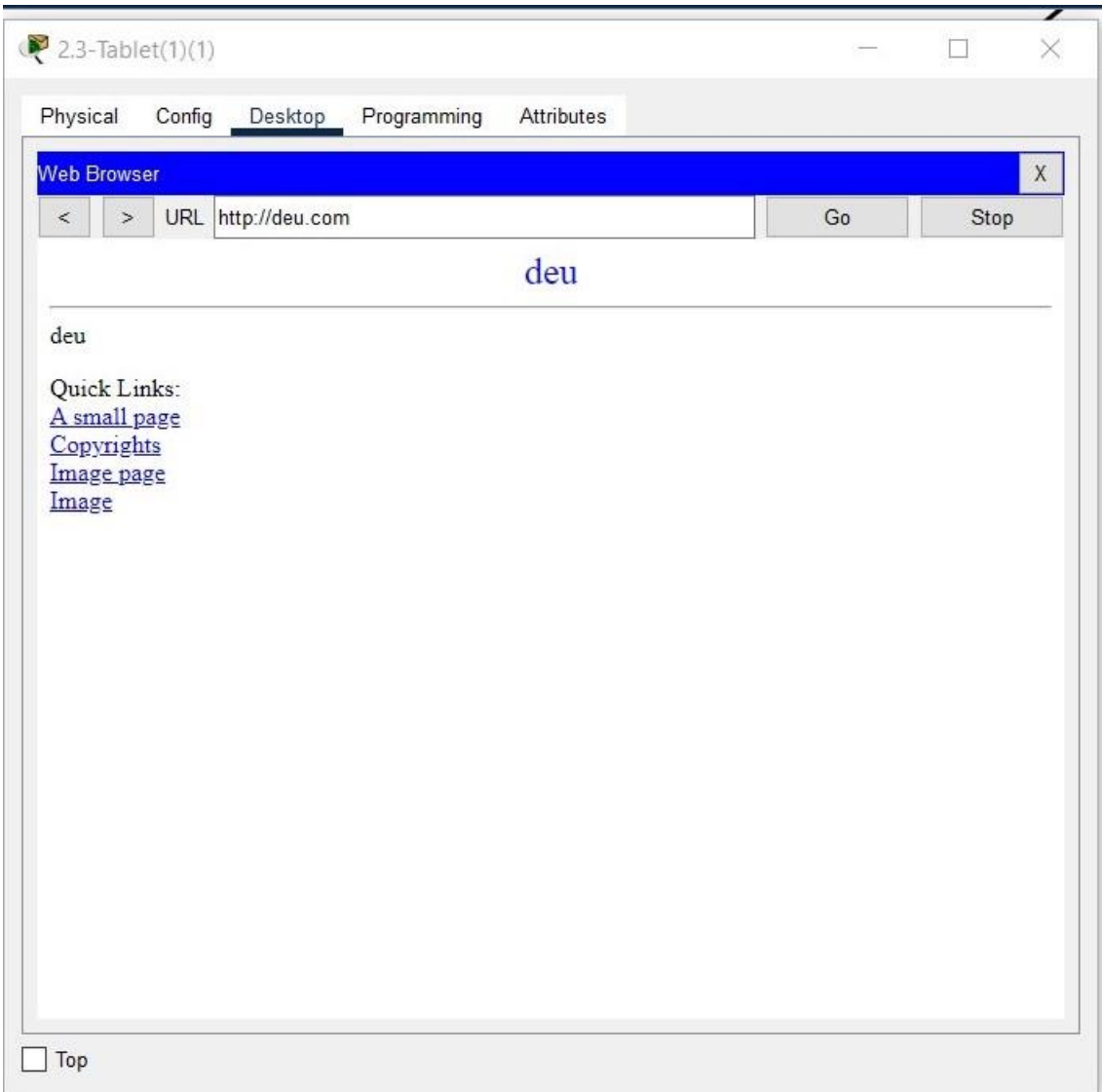
Subject: Scenerio 6

A laptop user from first facility of first branch office wants to send email to her friend in the first facility of second branch office.

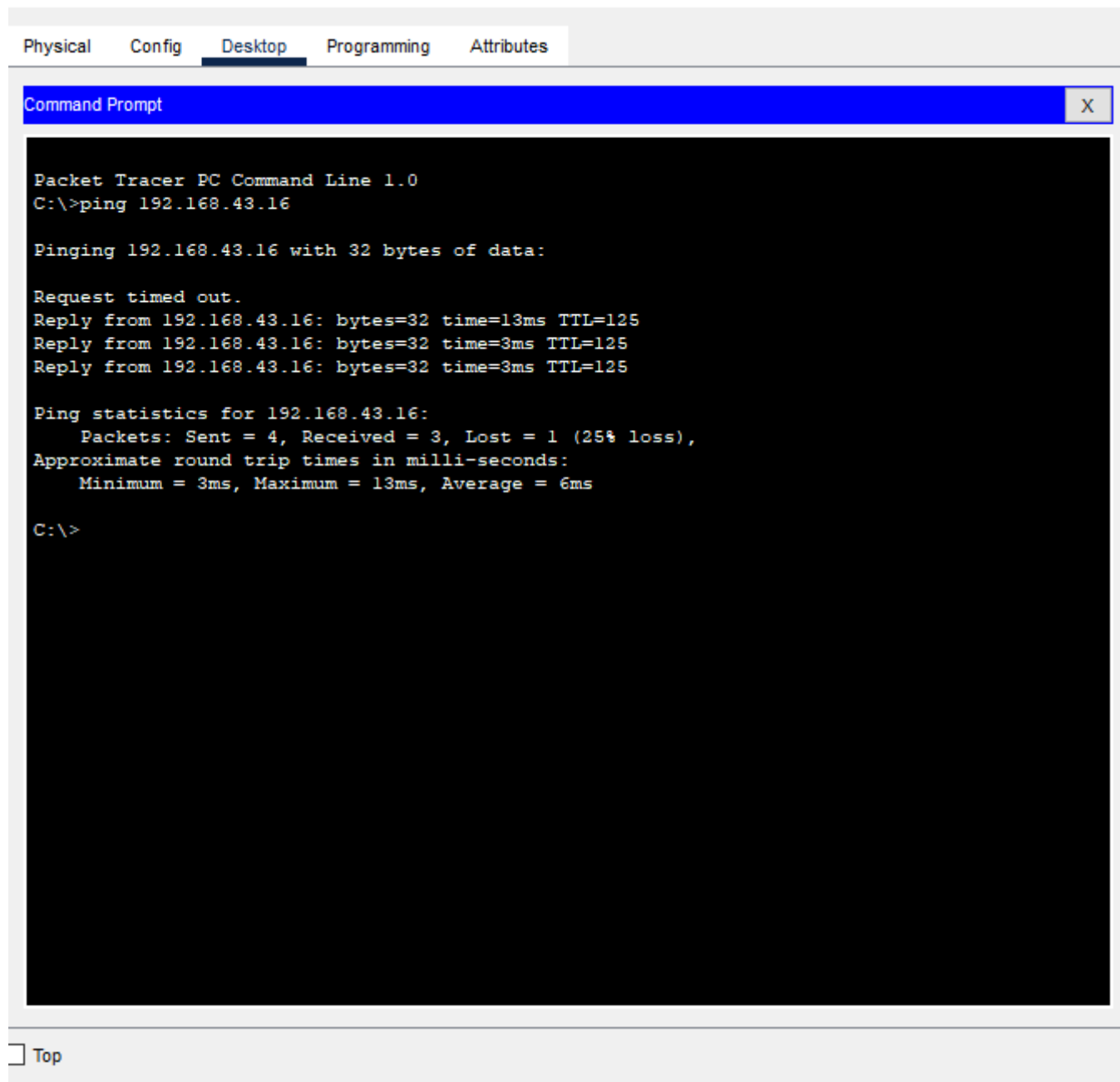
☐ Top



Scenario 8 : A tablet user from third facility of second branch wants to read emails and browse Web.



Scenario 9: Pinging the pc that is in the second facility of first branch from a tablet which is in the third facility of second branch.



The screenshot shows a Packet Tracer interface with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the output of a ping command. The text in the window is as follows:

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.43.16

Pinging 192.168.43.16 with 32 bytes of data:

Request timed out.
Reply from 192.168.43.16: bytes=32 time=13ms TTL=125
Reply from 192.168.43.16: bytes=32 time=3ms TTL=125
Reply from 192.168.43.16: bytes=32 time=3ms TTL=125

Ping statistics for 192.168.43.16:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 13ms, Average = 6ms

C:\>
```

At the bottom left of the Packet Tracer window, there is a 'Top' button.

Scenario 10 : Connecting the 3rd device to the 2nd device's VoIP call



CHAPTER FOUR

CONCLUSION

Analysis and tests on simulation show that topology and architecture selection is done correctly according to requirements. Using the metropolitan area network instead of the wide area network provided the desired security and speed. The network was successful in providing the desired services using the protocols specified in the report. As a result, networks created between the two campuses of the university and within the campuses themselves were successful. The project team has gained insights into the network design and the challenges it brings.

CHAPTER FIVE

REFERENCES

- [1] https://en.wikipedia.org/wiki/Metropolitan_area_network
- [2] <https://www.ibm.com/cloud/learn/networking-a-complete-guide>
- [3] <https://www.digitalocean.com/community/tutorials/an-introduction-to-networking-terminology-interfaces-and-protocols>