

Computer Networks Project



Project Topic

Campus Network Design, Implementation & Simulation

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1. Abstract

In recent years, computer networks have evolved beyond being just a collection of networked gadgets. Networking is the process of connecting computers, printers, routers, and other devices over a channel in order to share information/resources. It is a highly useful instrument in the day-to-day functioning of the company. Data communication and networking research has resulted in new technologies whose objective is to communicate data such as text, audio, video, and so on. Recently, no decent business can function successfully and efficiently without a solid computer network or the internet. In this project, I have provided a computer network strategy, design, and simulation for universities in developing countries. All possible blocks for one university can be seen in prototype of this project. The aim of project is to design a network with high-quality security by giving user and privilege mode password to routers. All devices are configured by putting IP addresses whereas servers in academic block are DNS, DHCP and WEB servers. Additionally, wireless devices are also used in some blocks of campus by giving WEP key. I have designed a special telephone room using DHCP pool in campus. I used EIGRP and RIP protocols to make connect all devices in campus. My aim is to received more than 80% of data supplied successfully.

2. Campus Design

I have designed a campus which is shown in Figure 1. This campus has following blocks/sections:

- Reception
- Staff
- Sports Golf
- Cafeteria
- Library
- MBA Department (Non-Technical Department)
- BTECH Departments
- Vice Chancellor Room
- Office
 - Academic Section
 - Account Section
- Hostel
 - Boys Hostel
 - Girls Hostel
- Telephone Room

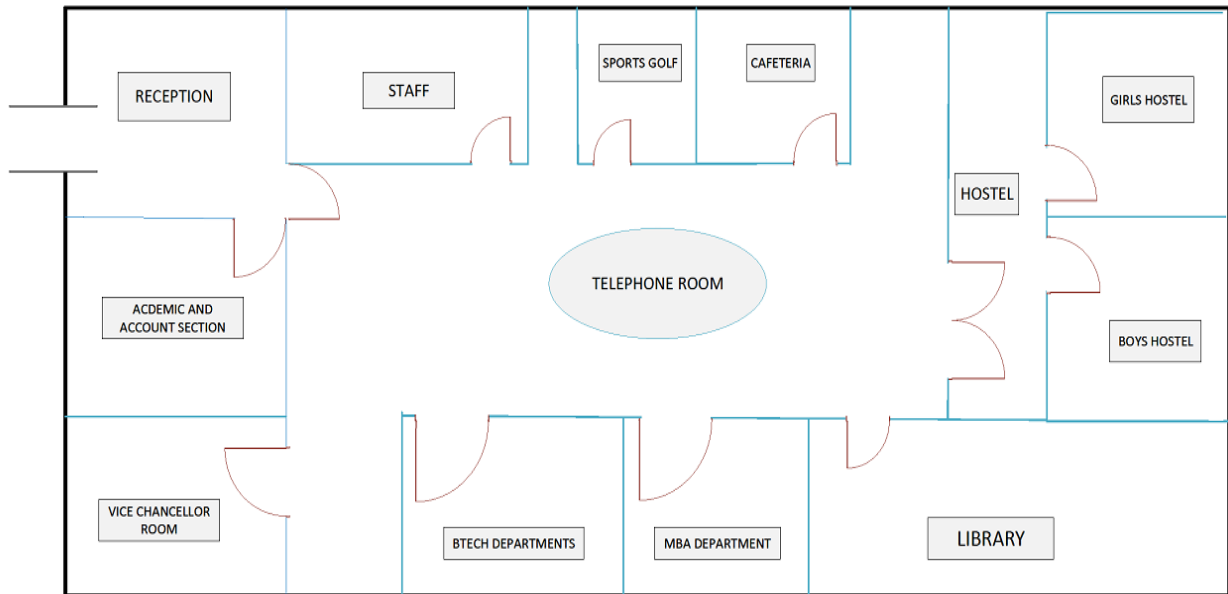


Figure 1. Block Diagram

3. Project Implementation and Results

3.1 Campus Blocks Implementation

In first step I have made all departments separately and give IP addresses to each device or host which is shown in network diagram below:

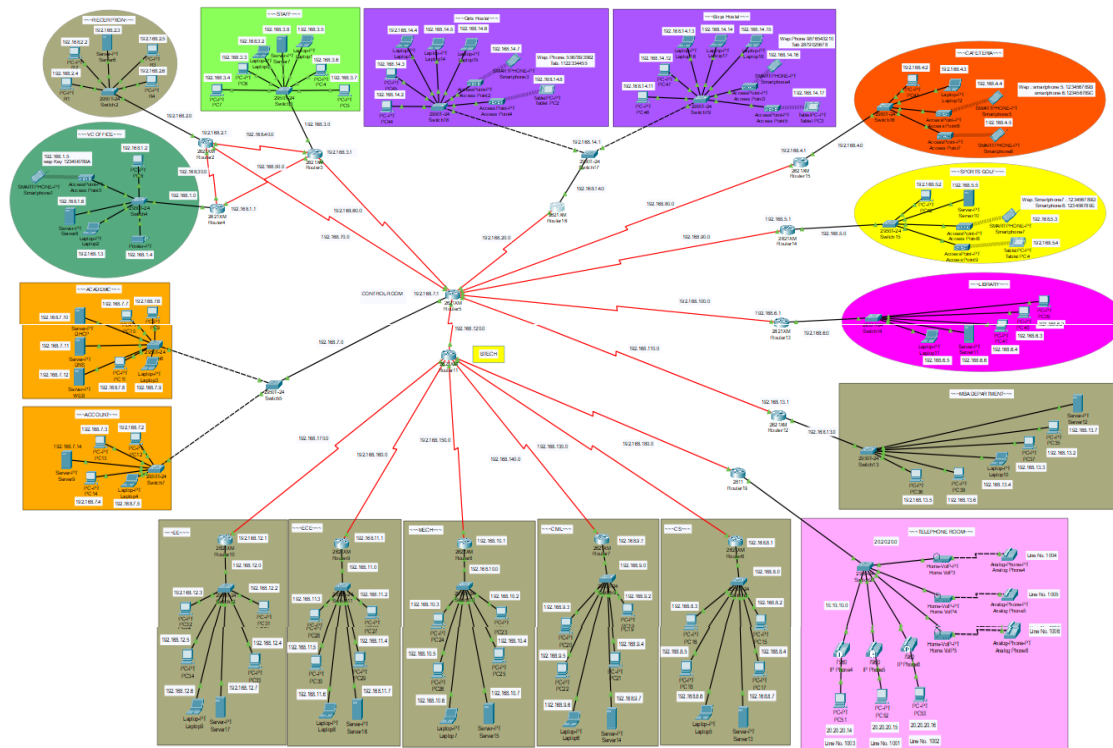
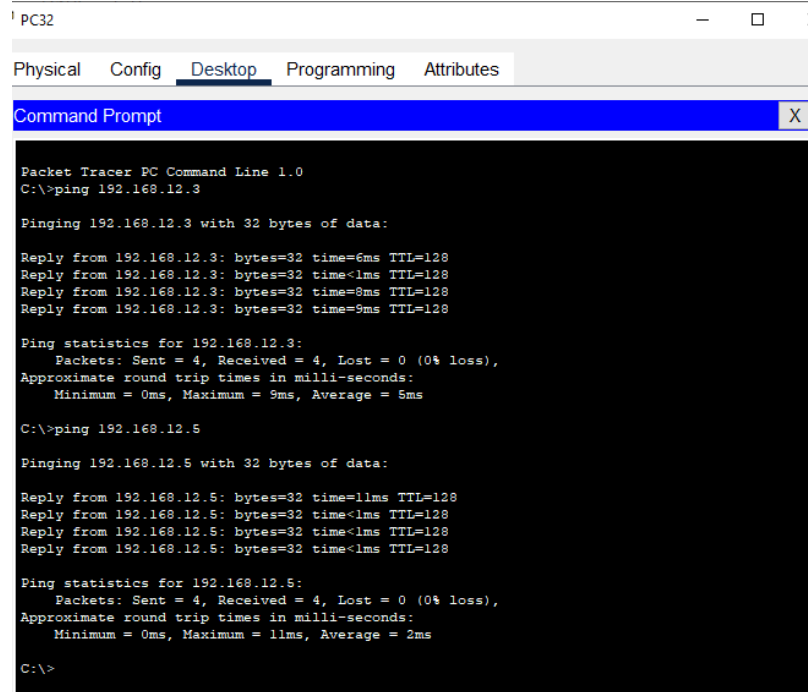


Figure 2. Designed Topology

After this the **communication inside each block is successful** as shown below:



```
PC32
Physical Config Desktop Programming Attributes
Command Prompt X

Packet Tracer PC Command Line 1.0
C:\>ping 192.168.12.3

Pinging 192.168.12.3 with 32 bytes of data:

Reply from 192.168.12.3: bytes=32 time=6ms TTL=128
Reply from 192.168.12.3: bytes=32 time<1ms TTL=128
Reply from 192.168.12.3: bytes=32 time=8ms TTL=128
Reply from 192.168.12.3: bytes=32 time=9ms TTL=128

Ping statistics for 192.168.12.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 9ms, Average = 5ms

C:\>ping 192.168.12.5

Pinging 192.168.12.5 with 32 bytes of data:

Reply from 192.168.12.5: bytes=32 time=11ms TTL=128
Reply from 192.168.12.5: bytes=32 time<1ms TTL=128
Reply from 192.168.12.5: bytes=32 time<1ms TTL=128
Reply from 192.168.12.5: bytes=32 time<1ms TTL=128

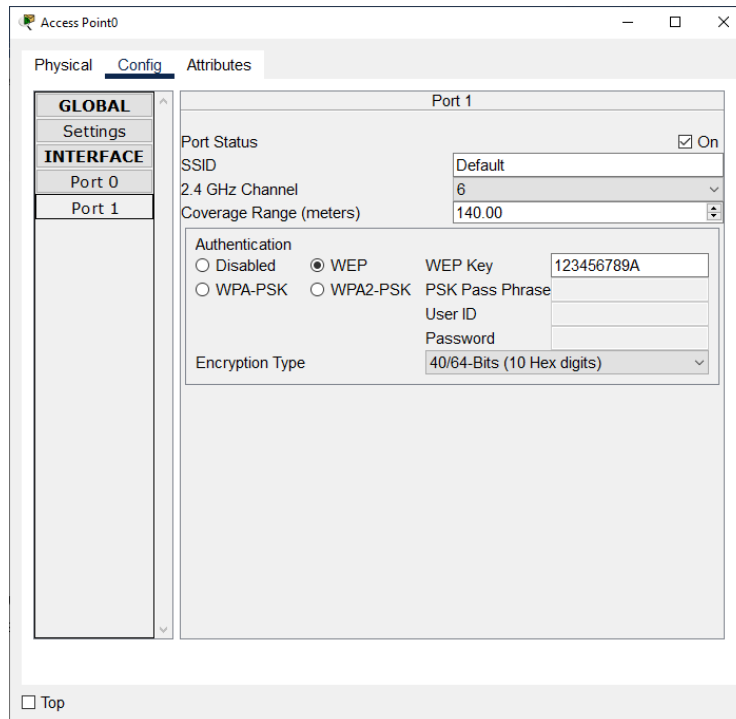
Ping statistics for 192.168.12.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 2ms

C:\>
```

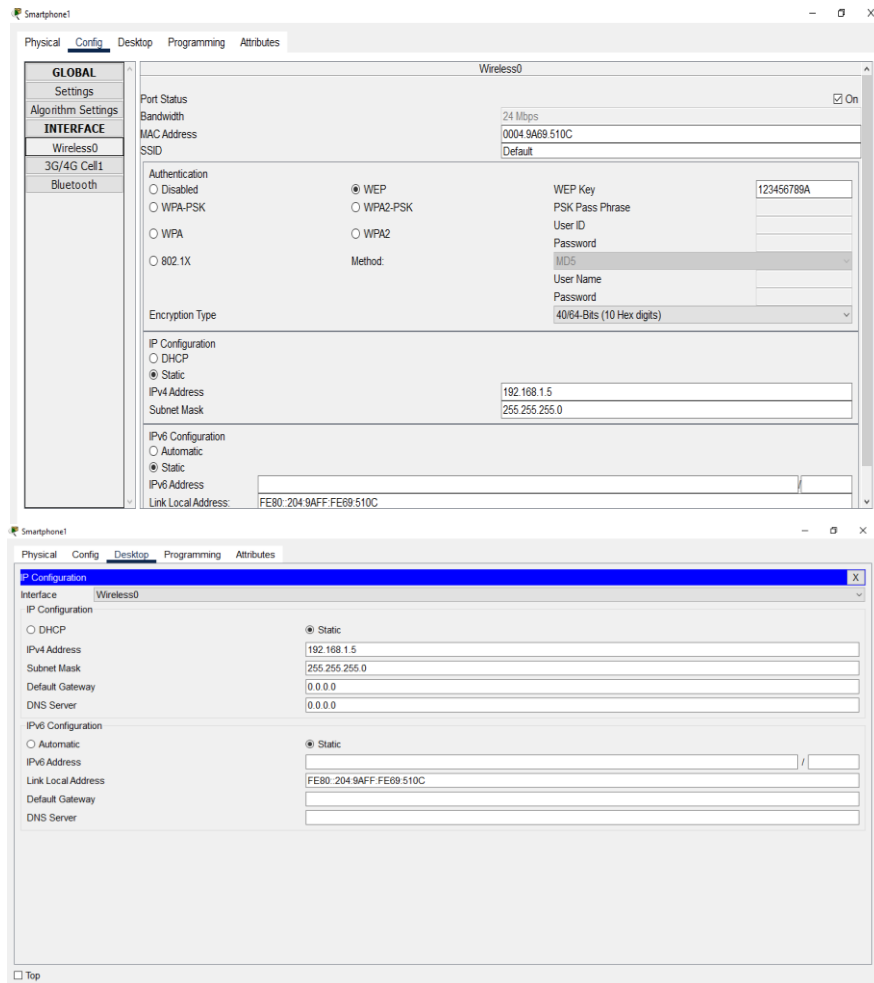
3.2 Wireless Devices Configuration

I have used wireless devices in this network by using Access Point-PT, Smartphones and tablets. To wirelessly communicate I have set WEP keys in both Access Point-PT and wireless device then set IP address for wireless device as shown below:

Access Point configuration is:



Smartphone configuration is:



Smartphone1

Physical Config Desktop Programming Attributes

GLOBAL

Settings

Algorithm Settings

INTERFACE

Wireless0

3G/4G Cell1

Bluetooth

Wireless0

Port Status ☒ On

Bandwidth 24 Mbps

MAC Address 0004 9A69 510C

SSID Default

Authentication

☐ Disabled ☒ WEP ☐ WPA2-PSK ☐ WPA ☐ 802.1X

WEP Key 123456789A

PSK Pass Phrase

User ID

Password

Method MD5

User Name

Password

Encryption Type 40/64-Bits (10 Hex digits)

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.5

Subnet Mask 255.255.255.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address

Link Local Address FE80::204:9AFF:FE69:510C

Smartphone1

Physical Config Desktop Programming Attributes

IP Configuration

Interface Wireless0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.5

Subnet Mask 255.255.255.0

Default Gateway 0.0.0.0

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address

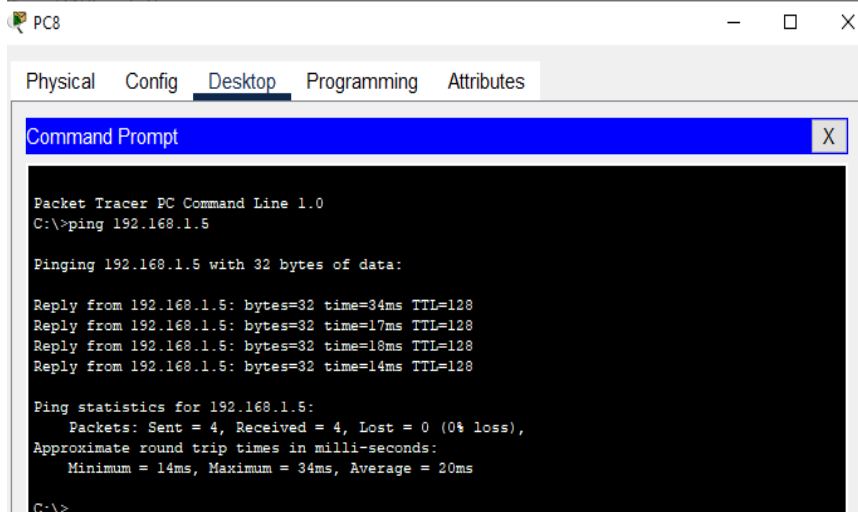
Link Local Address FE80::204:9AFF:FE69:510C

Default Gateway

DNS Server

Top

As a result, now **ping with wireless device is successful** as shown below:



PC8

Physical Config Desktop Programming Attributes

Command Prompt

```
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=34ms TTL=128
Reply from 192.168.1.5: bytes=32 time=17ms TTL=128
Reply from 192.168.1.5: bytes=32 time=18ms TTL=128
Reply from 192.168.1.5: bytes=32 time=14ms TTL=128

Ping statistics for 192.168.1.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 14ms, Maximum = 34ms, Average = 20ms

C:\>
```

3.3 Servers for Academic Section Settings

I have used three servers DHCP, DNS and Web in academic block. Their configurations are given below:

DHCP Server configuration is:

The DHCP configuration interface consists of three main sections:

- Global Settings:** Displays the 'Display Name' as 'DHCP'. Under 'Gateway/DNS IPv4', 'Static' is selected with a Default Gateway of 192.168.7.1 and a DNS Server of 192.168.7.11. Under 'Gateway/DNS IPv6', 'Static' is also selected, with fields for Default Gateway and DNS Server.
- Services:** The 'DHCP' service is selected. The 'Interface' is 'FastEthernet0' and the 'Service' is 'On'. A 'serverPool' is defined with a Default Gateway of 192.168.7.1, a DNS Server of 192.168.7.11, and a Subnet Mask of 255.255.255.0. The 'Start IP Address' is 192.168.7.1 and the 'Maximum Number of Users' is 255.
- Desktop:** This section provides detailed IP configuration. For IPv4, 'Static' is selected with an IP Address of 192.168.7.10, Subnet Mask of 255.255.255.0, Default Gateway of 192.168.7.1, and DNS Server of 192.168.7.11. For IPv6, 'Static' is selected with an IP Address of FE80::201:96FF:FE09:6829, Link Local Address, and Default Gateway.

DNS Server configuration is:

The DNS configuration interface consists of two main sections:

- Global Settings:** Displays the 'Display Name' as 'DNS'. Under 'Gateway/DNS IPv4', 'Static' is selected with a Default Gateway of 192.168.7.1 and a DNS Server of 192.168.7.11. Under 'Gateway/DNS IPv6', 'Static' is also selected, with fields for Default Gateway and DNS Server.
- Services:** The 'DNS' service is selected. The 'DNS Service' is 'On'. Under 'Resource Records', an 'ARecord' is added with the Name 'www.academic.com' and Address '192.168.7.12'.

DNS Configuration Window:

- Physical** | **Config** | Services | Desktop | Programming | Attributes
- IP Configuration**
 - ☐ DHCP ☒ Static
 - IPv4 Address: 192.168.7.11
 - Subnet Mask: 255.255.255.0
 - Default Gateway: 192.168.7.1
 - DNS Server: 192.168.7.11
- IPv6 Configuration**
 - ☐ Automatic ☒ Static
 - IPv6 Address: FE80::290:2BFF:FE9D:C0B5
 - Link Local Address: FE80::290:2BFF:FE9D:C0B5
 - Default Gateway:
 - DNS Server:
- 802.1X**
 - ☐ Use 802.1X Security
 - Authentication: MD5
 - Username:
 - Password:

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WEB Server Configuration is:

WEB Configuration Windows:

Left Window (Config Tab):

- GLOBAL** | Settings | Algorithm Settings | **INTERFACE** | FastEthernet0
- Port Status: ☒ On
- Bandwidth: 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: Half Duplex ☐ Full Duplex ☒ Auto
- MAC Address: 00D0.97E6.D028
- IP Configuration**
 - ☐ DHCP ☒ Static
 - IPv4 Address: 192.168.7.12
 - Subnet Mask: 255.255.255.0
- IPv6 Configuration**
 - ☐ Automatic ☒ Static
 - IPv6 Address:
 - Link Local Address: FE80::2D0:97FF:FEE6:D028

☐ Top

Right Window (Services Tab):

- SERVICES**
 - HTTP: ☒ On ☐ Off
 - DHCP: ☐ On ☐ Off
 - DHCPv6: ☐ On ☐ Off
 - TFTP: ☐ On ☐ Off
 - DNS: ☐ On ☐ Off
 - SYSLOG: ☐ On ☐ Off
 - AAA: ☐ On ☐ Off
 - NTP: ☐ On ☐ Off
 - EMAIL: ☐ On ☐ Off
 - FTP: ☐ On ☐ Off
 - IoT: ☐ On ☐ Off
 - VM Management: ☐ On ☐ Off
 - Radius EAP: ☐ On ☐ Off
- File Manager**

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

☐ Top

Bottom Window (Desktop Tab):

- Physical** | **Config** | Services | **Desktop** | Programming | Attributes
- IP Configuration**
 - ☐ DHCP ☒ Static
 - IPv4 Address: 192.168.7.12
 - Subnet Mask: 255.255.255.0
 - Default Gateway: 192.168.7.1
 - DNS Server: 192.168.7.11
- IPv6 Configuration**
 - ☐ Automatic ☒ Static
 - IPv6 Address:
 - Link Local Address: FE80::2D0:97FF:FEE6:D028
 - Default Gateway:
 - DNS Server:
- 802.1X**
 - ☐ Use 802.1X Security
 - Authentication: MD5
 - Username:
 - Password:

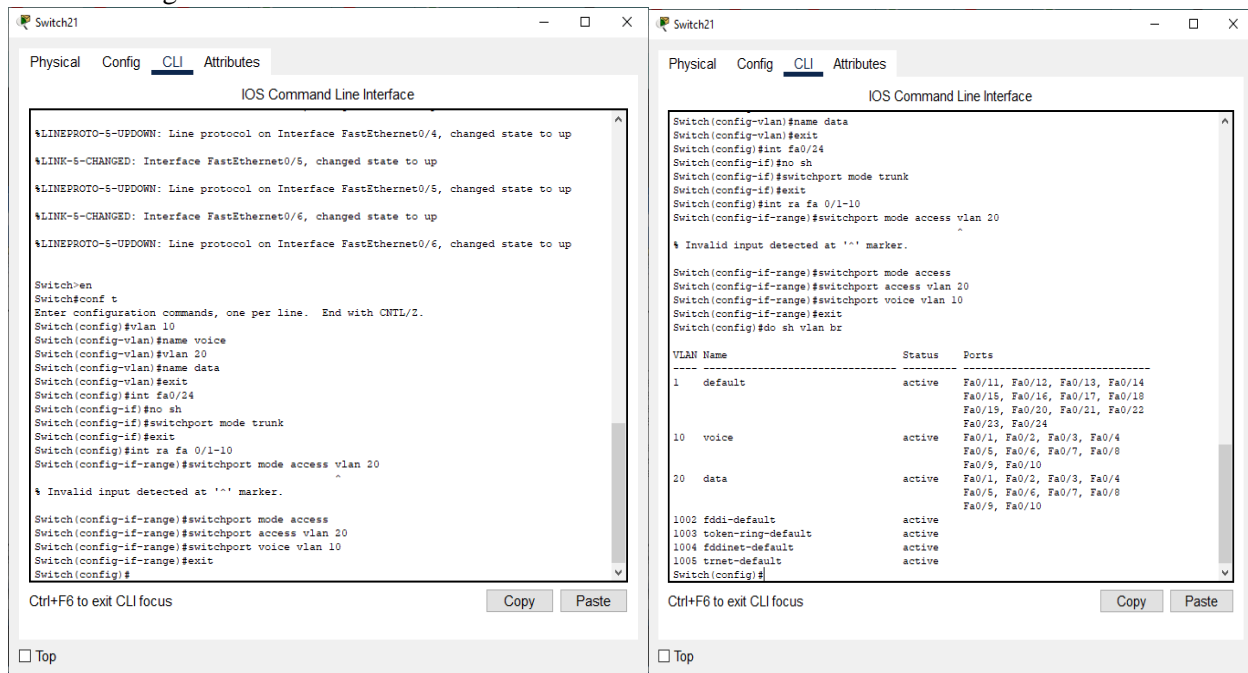
☐ Top

Their results are shown in simulation.

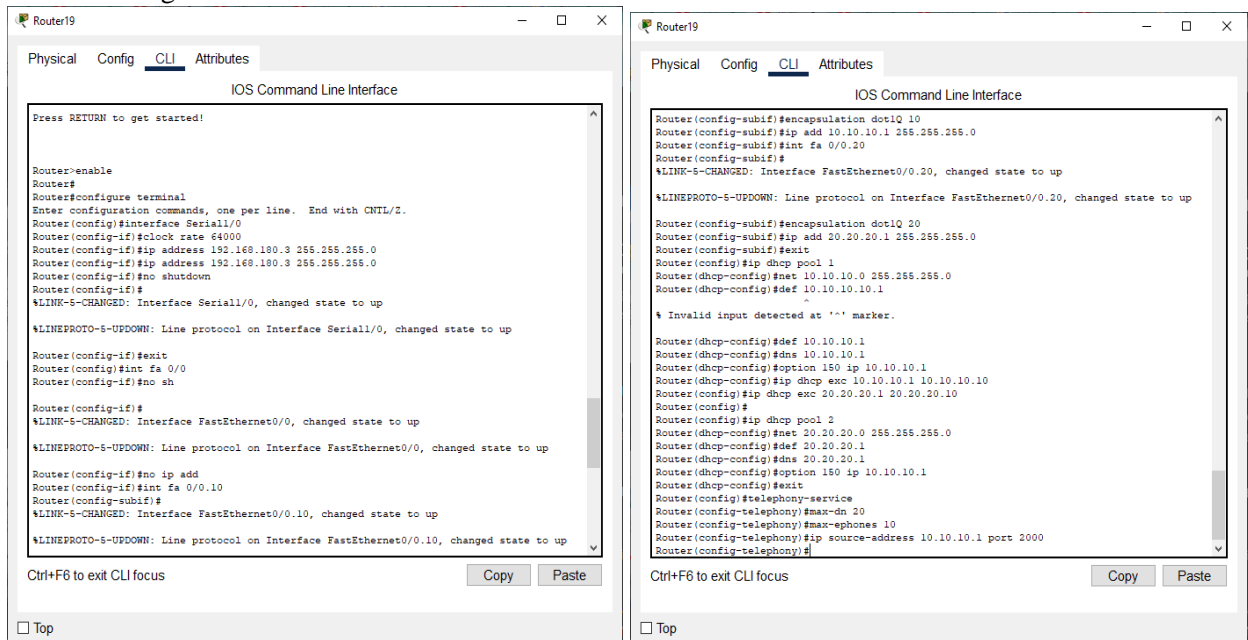
3.4 Home-VOIP and IP Phone Settings

I have made a telephone room in this campus in which I have used three Home-VOIPs and three IP Phones.

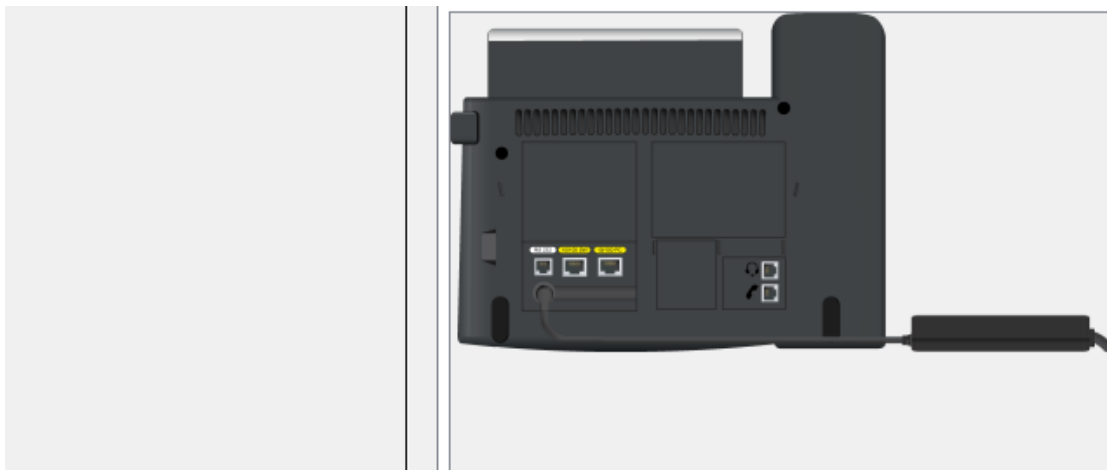
Switch Configuration is:



Router Configuration is:



Set adapter of IP-Phone:



Set server address for Home VOIP

Home VolP3

Physical **Config** Attributes

GLOBAL
Settings

Global Settings

Display Name Home VolP3

Server Address 10.10.10.1

Set line numbers to all phones after seeing their MAC addresses

Router19

Physical Config **CLI** Attributes

IOS Command Line Interface

```
%SYS-5-CONFIG_I: Configured from console by console

Router#sh ephone

ephone-1 Mac:000C.CF2A.0AA4 TCP socket:[1] activeLine:1 UNREGISTERED
mediaActive:0 offhook:1 ringing:0 reset:0 reset_sent:0 paging 0 debug:0 caps:8
IP:0.0.0.0 0 keepalive 43 max_line 2
button 1: dn CH1 DOWN

ephone-2 Mac:0060.3EA0.83E6 TCP socket:[1] activeLine:1 UNREGISTERED
mediaActive:0 offhook:1 ringing:0 reset:0 reset_sent:0 paging 0 debug:0 caps:8
IP:0.0.0.0 0 keepalive 43 max_line 2
button 1: dn CH1 DOWN

ephone-3 Mac:00D0.5848.3382 TCP socket:[1] activeLine:1 UNREGISTERED
mediaActive:0 offhook:1 ringing:0 reset:0 reset_sent:0 paging 0 debug:0 caps:8
IP:0.0.0.0 0 keepalive 43 max_line 2
button 1: dn CH1 DOWN

ephone-4 Mac:0030.F257.B701 TCP socket:[1] activeLine:1 UNREGISTERED
mediaActive:0 offhook:1 ringing:0 reset:0 reset_sent:0 paging 0 debug:0 caps:8
IP:0.0.0.0 0 keepalive 43 max_line 2
button 1: dn CH1 DOWN

ephone-5 Mac:0001.C9E4.9B01 TCP socket:[1] activeLine:1 UNREGISTERED
mediaActive:0 offhook:1 ringing:0 reset:0 reset_sent:0 paging 0 debug:0 caps:8
IP:0.0.0.0 0 keepalive 43 max_line 2
button 1: dn CH1 DOWN

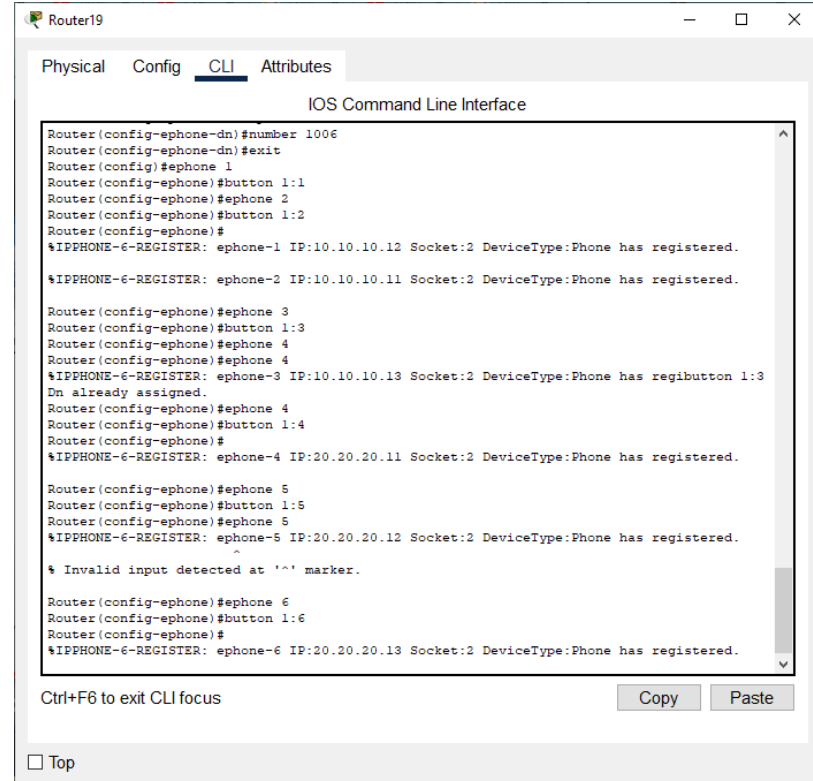
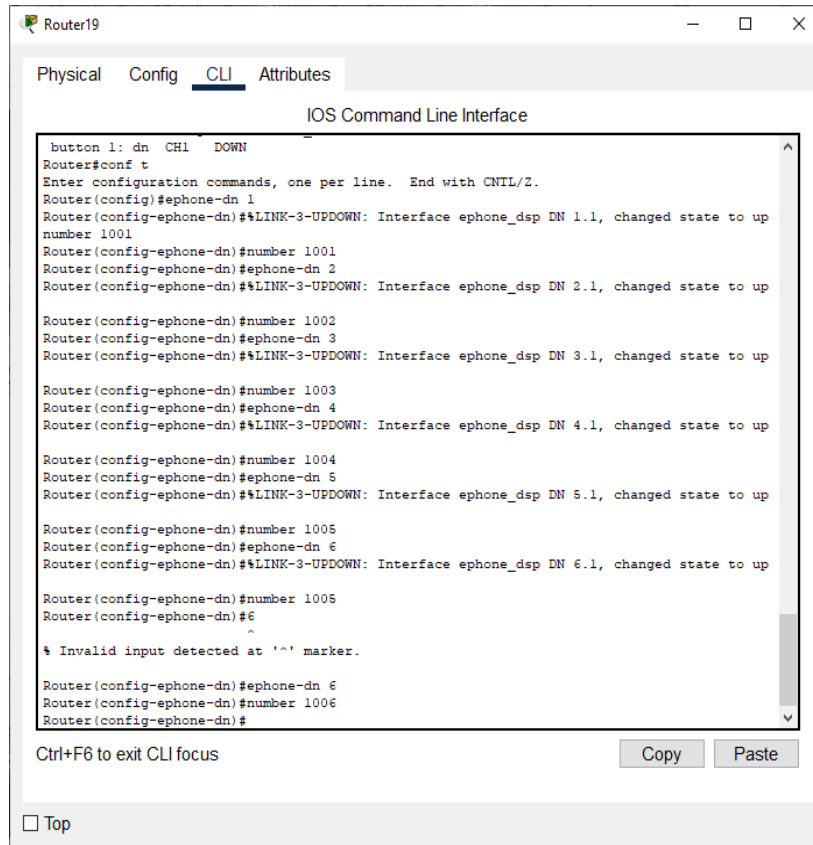
ephone-6 Mac:00D0.FF6C.4D01 TCP socket:[1] activeLine:1 UNREGISTERED
mediaActive:0 offhook:1 ringing:0 reset:0 reset_sent:0 paging 0 debug:0 caps:8
IP:0.0.0.0 0 keepalive 43 max_line 2
button 1: dn CH1 DOWN

Router#
```

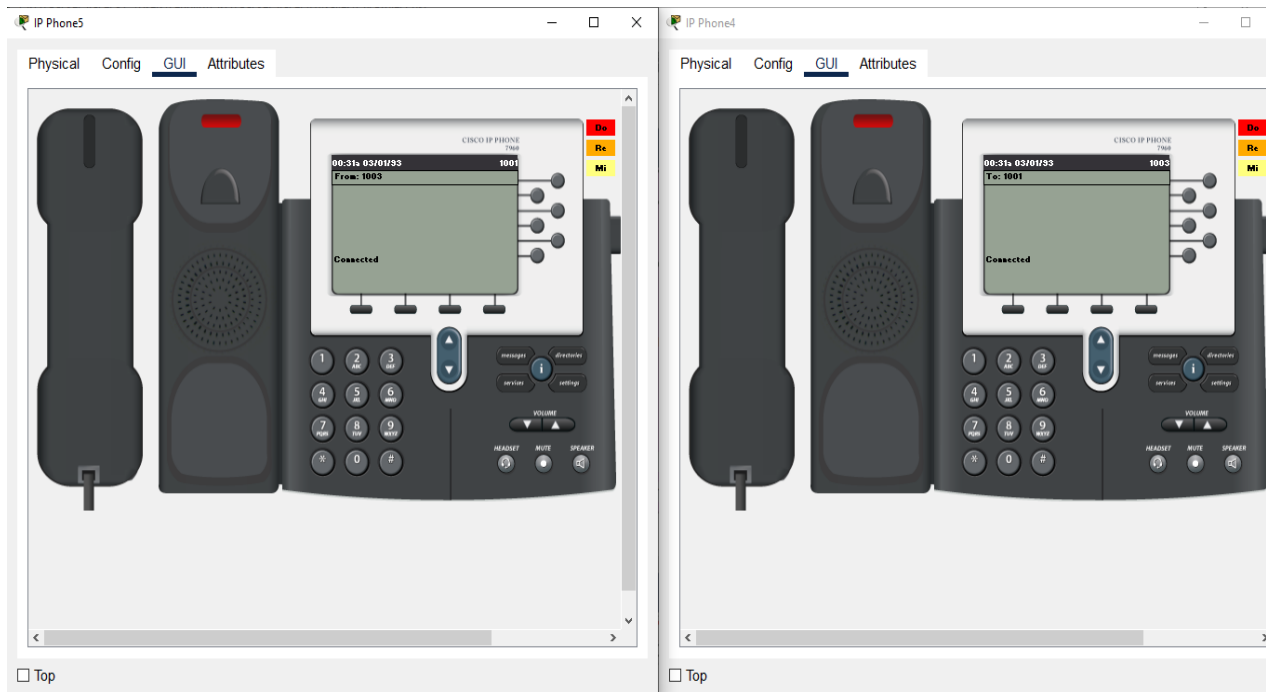
Ctrl+F6 to exit CLI focus

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Connection is successful. Results are shown below:



3.5 Enhanced Interior Gateway Routing Protocol (EIGRP) Implementation

Implement EIGRP on all routers in network

For one router it is shown below:

```
Router2
Physical Config CLI Attributes
IOS Command Line Interface
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

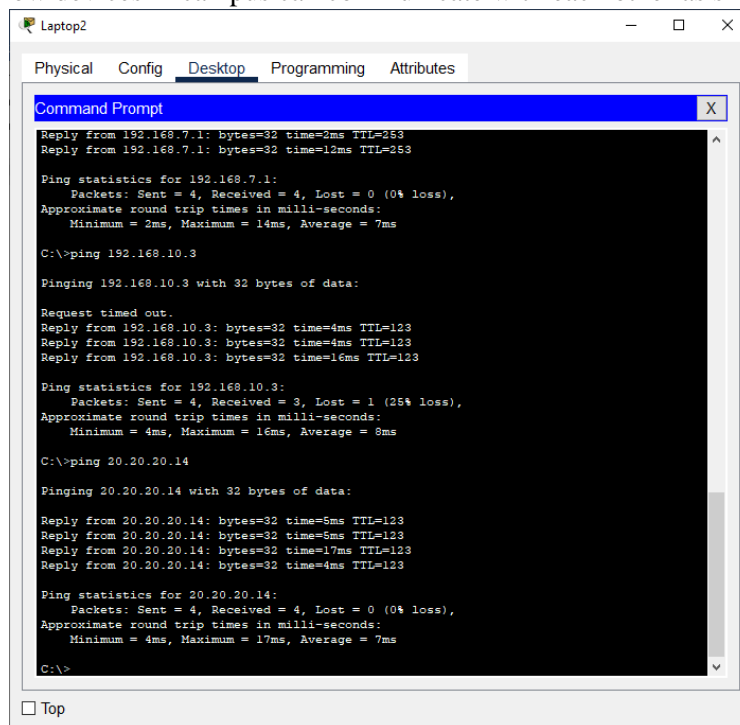
Gateway of last resort is not set

C 192.168.2.0/24 is directly connected, FastEthernet0/0
C 192.168.30.0/24 is directly connected, Serial0/0
C 192.168.40.0/24 is directly connected, Serial0/1
C 192.168.70.0/24 is directly connected, Serial0/2

Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router eigrp ?
<1-65535> Autonomous system number
Router(config)#router eigrp 100
Router(config-router)#network 192.168.2.0
Router(config-router)#network 192.168.30.0
Router(config-router)#network 192.168.40.0
Router(config-router)#network 192.168.70.0
Router(config-router)#no auto summary
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

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

After implementing now devices in campus can communicate with each other as shown below:



```
Command Prompt
Reply from 192.168.7.1: bytes=32 time=2ms TTL=253
Reply from 192.168.7.1: bytes=32 time=12ms TTL=253

Ping statistics for 192.168.7.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 14ms, Average = 7ms

C:\>ping 192.168.10.3

Pinging 192.168.10.3 with 32 bytes of data:

Request timed out.
Reply from 192.168.10.3: bytes=32 time=4ms TTL=123
Reply from 192.168.10.3: bytes=32 time=4ms TTL=123
Reply from 192.168.10.3: bytes=32 time=16ms TTL=123

Ping statistics for 192.168.10.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 16ms, Average = 8ms

C:\>ping 20.20.20.14

Pinging 20.20.20.14 with 32 bytes of data:

Reply from 20.20.20.14: bytes=32 time=5ms TTL=123
Reply from 20.20.20.14: bytes=32 time=5ms TTL=123
Reply from 20.20.20.14: bytes=32 time=17ms TTL=123
Reply from 20.20.20.14: bytes=32 time=4ms TTL=123

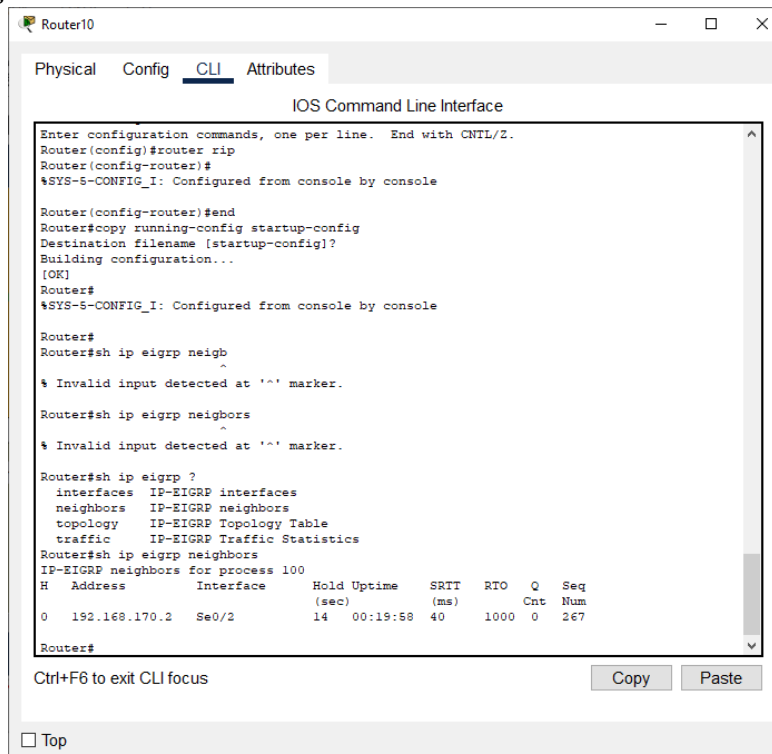
Ping statistics for 20.20.20.14:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 17ms, Average = 7ms

C:\>
```

3.6 Enhanced Interior Gateway Routing Protocol (EIGRP) Tables

Three tables of EIGRP are shown below:

i. ip eigrp neighbors



```
Router10
Physical Config CLI Attributes
IOS Command Line Interface
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#
%SYS-5-CONFIG_I: Configured from console by console

Router(config-router)#end
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
Router#sh ip eigrp neighb
^
% Invalid input detected at '^' marker.

Router#sh ip eigrp neighbors
^
% Invalid input detected at '^' marker.

Router#sh ip eigrp ?
interfaces  IP-EIGRP interfaces
neighbors   IP-EIGRP neighbors
topology    IP-EIGRP Topology Table
traffic     IP-EIGRP Traffic Statistics
Router#sh ip eigrp neighbors
IP-EIGRP neighbors for process 100
H   Address      Interface    Hold Uptime   SRTT  RTO  Q  Seq
(sec)              (ms)          Cnt  Num
0   192.168.170.2  Se0/2        14   00:19:58    40   1000 0   267
Router#
```

ii. ip eigrp topology

Router10

Physical Config **CLI** Attributes

IOS Command Line Interface

```
interfaces IP-EIGRP interfaces
neighbors IP-EIGRP neighbors
topology IP-EIGRP Topology Table
traffic IP-EIGRP Traffic Statistics
Router#sh ip eigrp neighbors
IP-EIGRP neighbors for process 100
H Address Interface Hold Uptime SRTT RTO Q Seq
(sec) (ms) Cnt Num
0 192.168.170.2 Se0/2 14 00:19:58 40 1000 0 267

Router#sh ip eigrp topology
IP-EIGRP Topology Table for AS 100/ID(192.168.170.3)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - Reply status

P 10.10.10.0/24, 1 successors, FD is 21026560
   via 192.168.170.2 (21026560/20514560), Serial0/2
P 20.20.20.0/24, 1 successors, FD is 21026560
   via 192.168.170.2 (21026560/20514560), Serial0/2
P 192.168.1.0/24, 1 successors, FD is 3708416
   via 192.168.170.2 (3708416/3196416), Serial0/2
P 192.168.2.0/24, 1 successors, FD is 3196416
   via 192.168.170.2 (3196416/2684416), Serial0/2
P 192.168.3.0/24, 1 successors, FD is 3196416
   via 192.168.170.2 (3196416/2684416), Serial0/2
P 192.168.4.0/24, 1 successors, FD is 3196416
   via 192.168.170.2 (3196416/2684416), Serial0/2
P 192.168.5.0/24, 1 successors, FD is 21538560
   via 192.168.170.2 (21538560/21026560), Serial0/2
P 192.168.6.0/24, 1 successors, FD is 21538560
   via 192.168.170.2 (21538560/21026560), Serial0/2
P 192.168.7.0/24, 1 successors, FD is 2684416
--More--
```

Ctrl+F6 to exit CLI focus

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iii. show ip route eigrp

Router10

Physical Config **CLI** Attributes

IOS Command Line Interface

```
P 192.168.180.0/24, 1 successors, FD is 21024000
   via 192.168.170.2 (21024000/20512000), Serial0/2
Router#
Router#sh ip route eigrp
10.0.0.0/24 is subnetted, 1 subnets
D    10.10.10.0 [90/21026560] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
20.0.0.0/24 is subnetted, 1 subnets
D    20.20.20.0 [90/21026560] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.1.0/24 [90/3708416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.2.0/24 [90/3196416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.3.0/24 [90/3196416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.4.0/24 [90/3196416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.5.0/24 [90/21538560] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.6.0/24 [90/21538560] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.7.0/24 [90/2684416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.8.0/24 [90/2684416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.9.0/24 [90/2684416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.10.0/24 [90/2684416] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.11.0/24 [90/21026560] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
D    192.168.13.0/24 [90/21538560] via 192.168.170.2, 4294967273:4294967257:4294967292,
Serial0/2
```

Ctrl+F6 to exit CLI focus

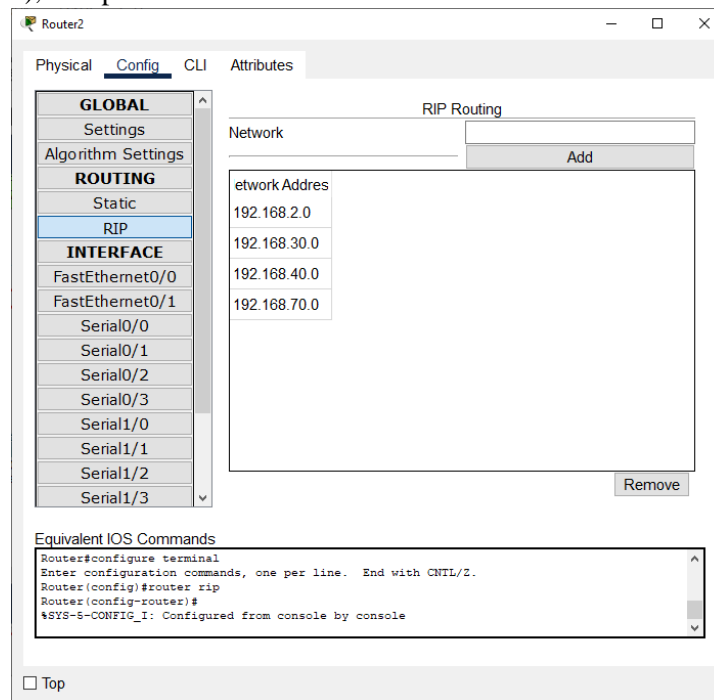
Copy Paste

☐ Top

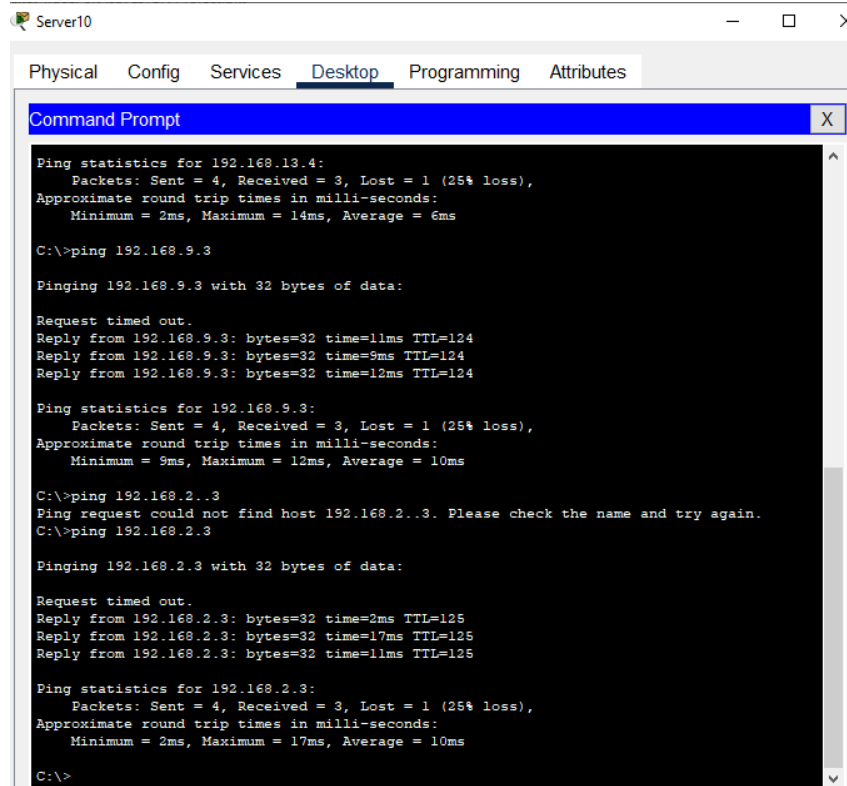
3.7 Routing Information Protocol (RIP) Implementation

In next step I Implemented RIP protocol on all routers in network.

For Router 2(Reception), RIP protocol is shown:



Results are shown below:



3.8 Security

At the end set privilege passwords for all blocks in campus and set user and privileged mode password for control room to secure it more.

For all routers CLI commands are:

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable password staff123
Router(config)#enable secret staff123s
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

For control room's router CLI commands are:

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#line console 0
Router(config-line)#password controll123
Router(config-line)#login
Router(config-line)#exit
Router(config)#line vty 0 15
Router(config-line)#password controll123
Router(config-line)#login
Router(config-line)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Router#exit

User Access Verification

Password:

```
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret controlpriv123
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Router#exit

For all routers and switches passwords are assigned. Now when CLI mode of switch or router is accessible only for authorized people who know password as shown below:

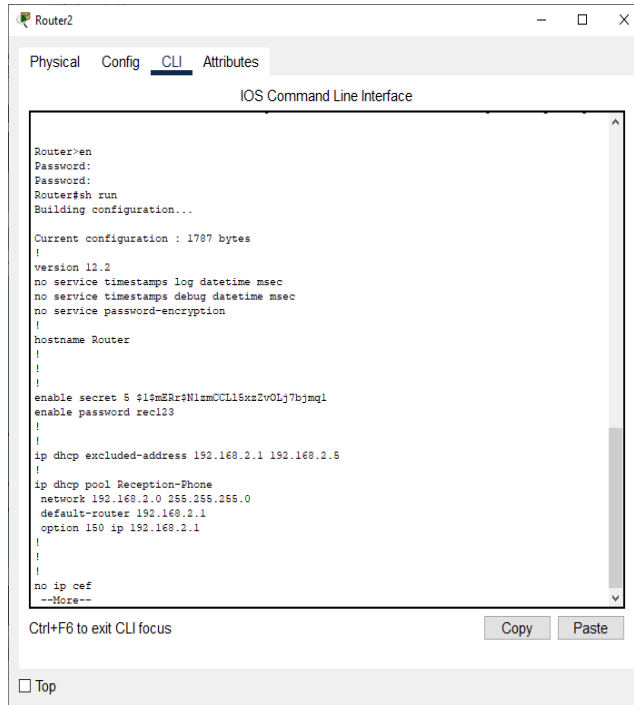
User Access Verification

Password:

```
Router>en
Password:
Password:
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
```


4. Simulations

4.1 Router Configuration



Router2

Physical Config **CLI** Attributes

IOS Command Line Interface

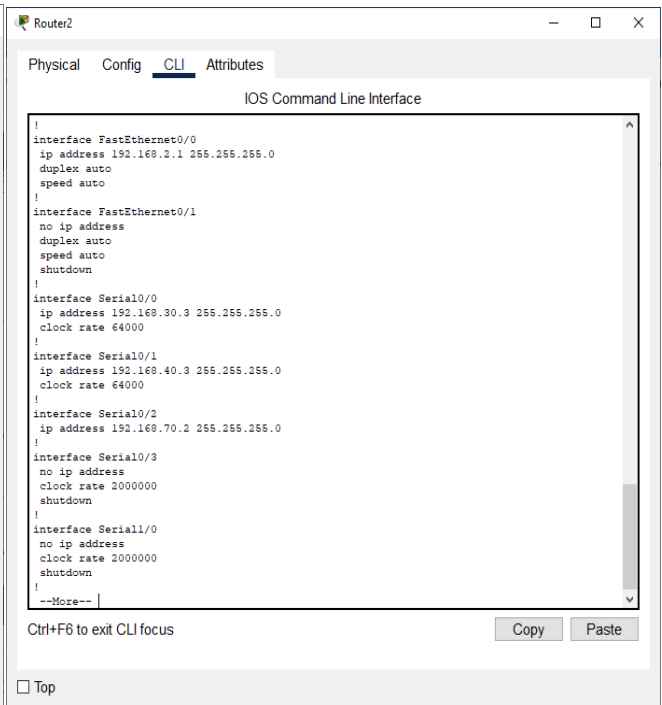
```
Router>en
Password:
Password:
Router#sh run
Building configuration...

Current configuration : 1787 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
enable secret 5 $1$mERsN1zmCCL15xz2vOlj7bjmq1
enable password rec123
!
!
ip dhcp excluded-address 192.168.2.1 192.168.2.5
!
ip dhcp pool Reception-Phone
network 192.168.2.0 255.255.255.0
default-router 192.168.2.1
option 150 ip 192.168.2.1
!
!
no ip cef
--More--
```

Ctrl+F6 to exit CLI focus

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Router2

Physical Config **CLI** Attributes

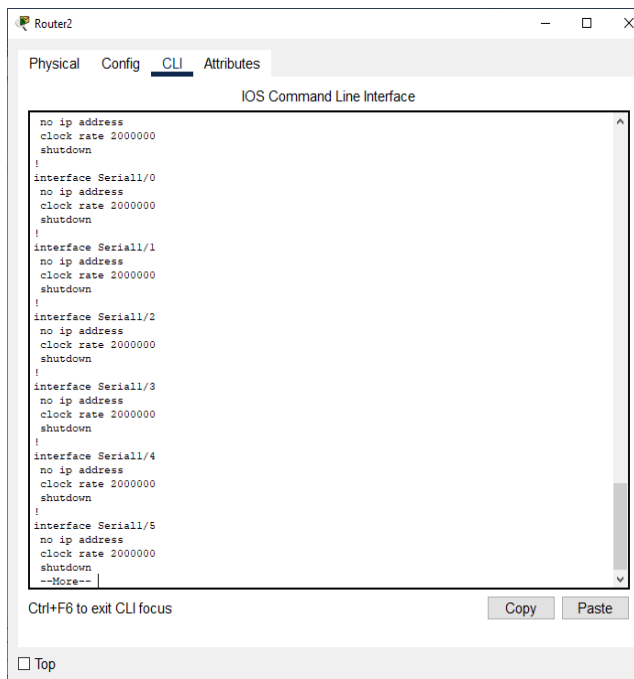
IOS Command Line Interface

```
!
interface FastEthernet0/0
ip address 192.168.2.1 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0
ip address 192.168.30.3 255.255.255.0
clock rate 64000
!
interface Serial0/1
ip address 192.168.40.3 255.255.255.0
clock rate 64000
!
interface Serial0/2
ip address 192.168.70.2 255.255.255.0
!
interface Serial0/3
no ip address
clock rate 2000000
shutdown
!
interface Serial1/0
no ip address
clock rate 2000000
shutdown
!
--More--
```

Ctrl+F6 to exit CLI focus

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Router2

Physical Config **CLI** Attributes

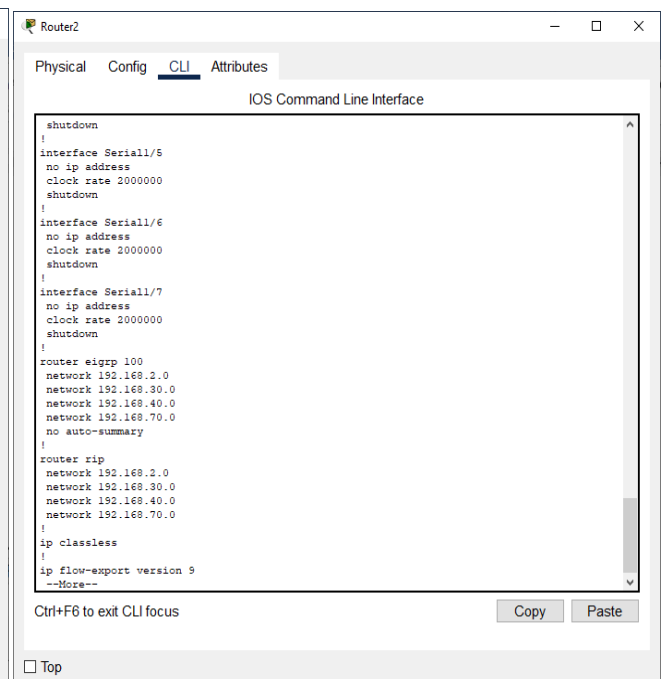
IOS Command Line Interface

```
no ip address
clock rate 2000000
shutdown
!
interface Serial1/0
no ip address
clock rate 2000000
shutdown
!
interface Serial1/1
no ip address
clock rate 2000000
shutdown
!
interface Serial1/2
no ip address
clock rate 2000000
shutdown
!
interface Serial1/3
no ip address
clock rate 2000000
shutdown
!
interface Serial1/4
no ip address
clock rate 2000000
shutdown
!
interface Serial1/5
no ip address
clock rate 2000000
shutdown
!
--More--
```

Ctrl+F6 to exit CLI focus

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Router2

Physical Config **CLI** Attributes

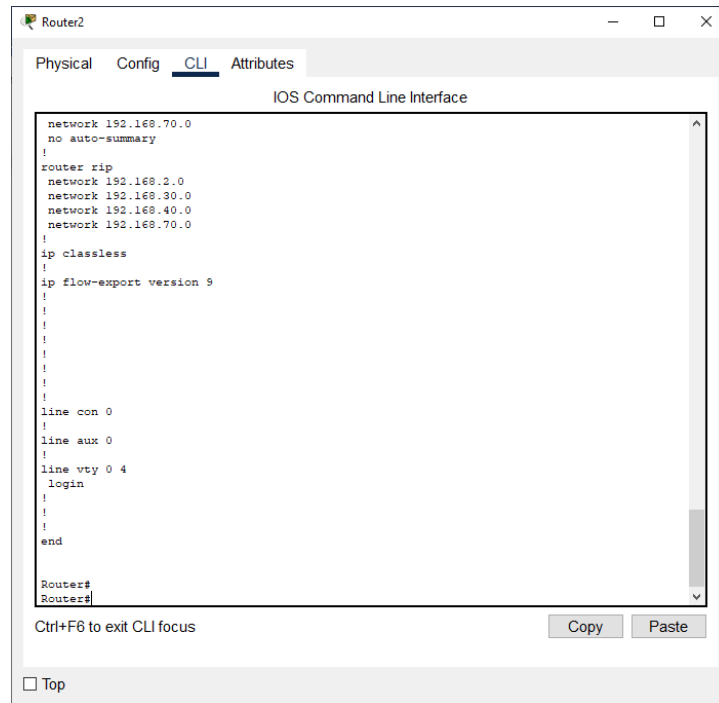
IOS Command Line Interface

```
shutdown
!
interface Serial1/6
no ip address
clock rate 2000000
shutdown
!
interface Serial1/7
no ip address
clock rate 2000000
shutdown
!
router eigrp 100
network 192.168.2.0
network 192.168.30.0
network 192.168.40.0
network 192.168.70.0
no auto-summary
!
router rip
network 192.168.2.0
network 192.168.30.0
network 192.168.40.0
network 192.168.70.0
!
ip classless
!
ip flow-export version 9
!
--More--
```

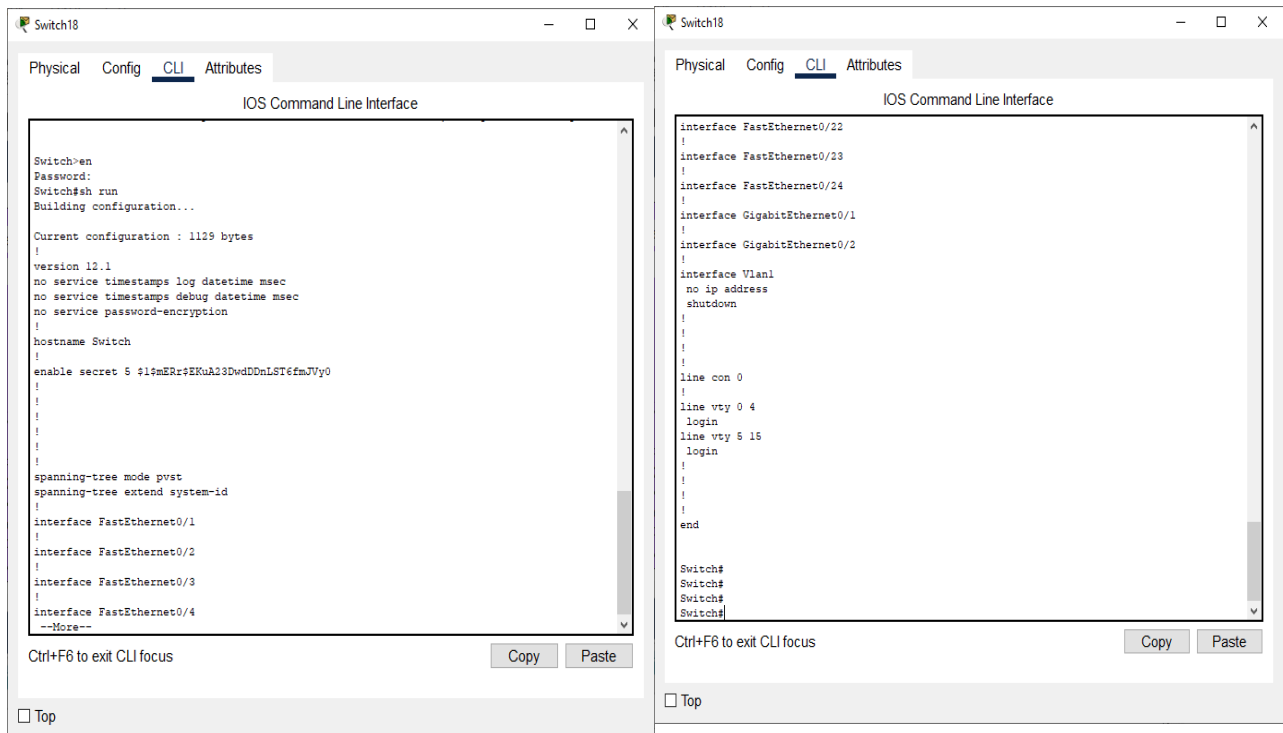
Ctrl+F6 to exit CLI focus

Copy Paste

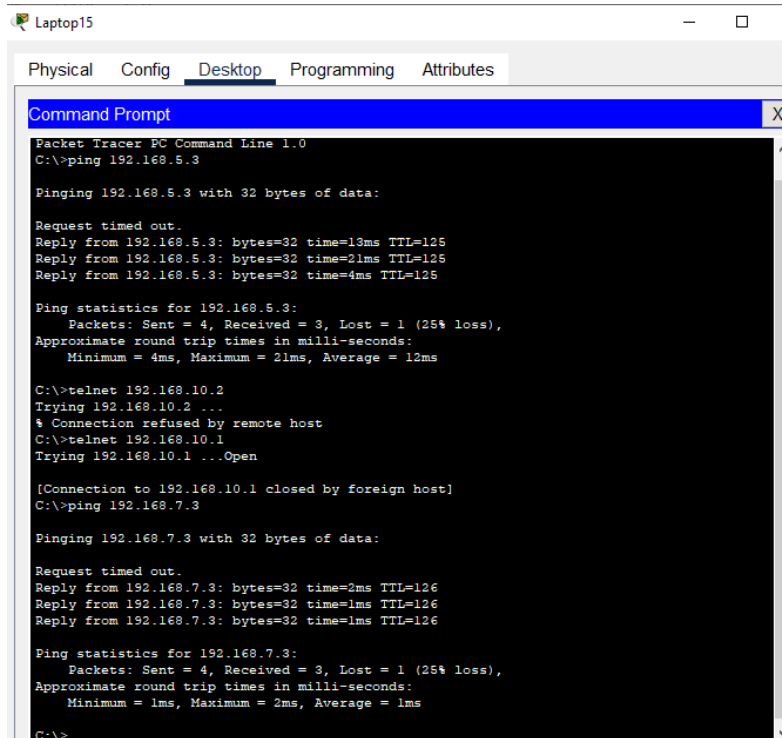
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4.2 Switch Configuration



4.3 Communication Between Hosts Simulation



```
Laptop15
Physical Config Desktop Programming Attributes
Command Prompt
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.5.3

Pinging 192.168.5.3 with 32 bytes of data:

Request timed out.
Reply from 192.168.5.3: bytes=32 time=13ms TTL=125
Reply from 192.168.5.3: bytes=32 time=21ms TTL=125
Reply from 192.168.5.3: bytes=32 time=4ms TTL=125

Ping statistics for 192.168.5.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 21ms, Average = 12ms

C:\>telnet 192.168.10.2
Trying 192.168.10.2 ...
% Connection refused by remote host
C:\>telnet 192.168.10.1
Trying 192.168.10.1 ...Open

[Connection to 192.168.10.1 closed by foreign host]
C:\>ping 192.168.7.3

Pinging 192.168.7.3 with 32 bytes of data:

Request timed out.
Reply from 192.168.7.3: bytes=32 time=2ms TTL=126
Reply from 192.168.7.3: bytes=32 time=1ms TTL=126
Reply from 192.168.7.3: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.7.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\>
```

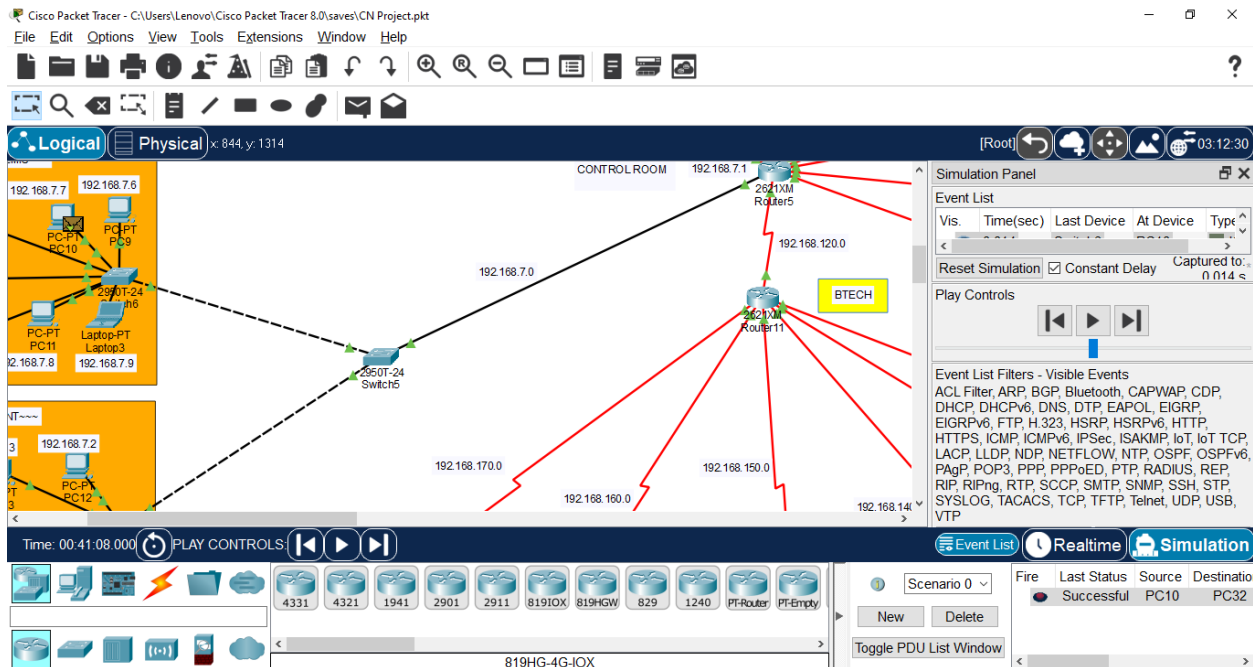
4.4 Analog Phone Simulation



4.5 Web Server Simulation



4.6 Network Simulation



5. Conclusions

This project has proven that a standard network system can be designed with less cost and more secure. This network design is composed of many blocks. There is a special Telephone Room in campus where VOIP phones and IP Phones are installed. I have used the cheapest devices in designing the network. This network is using EIGRP and RIP protocols. We used some important servers such as DNS and DHCP which help the network to perform their functions in a smooth way. On the simulated network, more than 85% of data supplied was successfully received, with just around 15% of lost as claimed in abstract. Lastly, this network design is not limited to only developing countries but developed countries that are trying to cut cost in any of their network design projects can also adopt the methods used in this project.

References

[1] AlSarhan, Rafid Salih Sarhan, "Computer Network Design for Universities in Developing Countries" (2016). Information Technology, Capstone Research Project Reports. 2. Available at: <http://scholar.valpo.edu/itcrpr/2>

[2] Huichao Ma,Guoliang Lv,Chunyu Wu, "Campus Network Planning and Design", Journal of Computer Hardware Engineering(2018), School of Computer and Information, Hefei University of Technology, Anhui, China