**REPUBLIQUE DU CAMEROON**

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**FACULTE D'INGENIERIE ET DE TECHNOLOGIE**

**REPUBLIC OF CAMEROON**

**Peace-Work-Fatherland**

**MINISTER OF HIGHER EDUCATION**

**FACULTY OF ENGINEERING AND TECHNOLOGY**

***************************UNIVERSITY OF BUEA*************************

**DEPARTMENT OF COMPUTER ENGINEERING**

# CEF 458: ENTERPRISE IP TELEPHONY

## LAB #1 REPORT

## Design an IP Telephony system for a Small Enterprise

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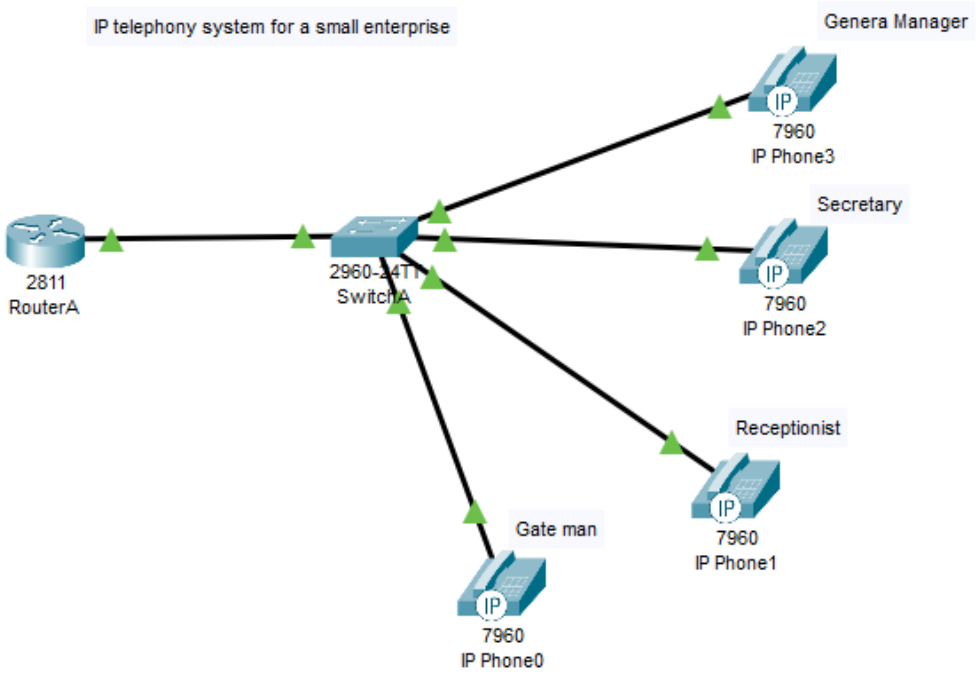
## LAB #1:

## AIM: Design an IP Telephony system for a Small Enterprise

## Overview:

IP telephony (Internet Protocol telephony) is a general term for technologies, products and services that use the Internet Protocol's packet-switched connections to support voice calling, voicemail, video calling, video conferencing, faxing and instant messaging (IM).

## Topology:



**Procedure:**

**The experimental setup is as shown above**

**Step 1: Configuring devices:**

- configure interface FastEthernet 0/0 of router A as the default gateway
- configure DHCP server on Router A (2811) to automatically attribute IP addresses to ephones. Consider 192.168.10.1 as the default route
- configure the router's ip default gateway as the default TFTP server ip address from where the ip phones will download their default configuration parameters.

```
Router>enable
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface f0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown

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

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

**The DHCP server is needed to provide an IP address and the TFTP server location for each IP phone**

```
Router(config-if)#exit
Router(config)#ip dhcp pool VOICE
Router(dhcp-config)#network 192.168.10.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.10.1
Router(dhcp-config)#option 150 ip 192.168.10.1
Router(dhcp-config)#exit
Router(config)#
```

a. **#Ip dhcp pool VOICE:** Creates a DHCP pool named VOICE
b. **#network 192.168.10.0 255.255.255.0:** Creates a DHCP network
c. **#default**-router 192.168.10.1: creates a default router ip address
d. **#option 150 ip 192.**168.10.1: It is mandatory for voip configuration.

**Step 2: Configure the Call Manager Express telephony service (VoIP server) on RouterA**

- enter the telephony mode.
- configure the maximum number of directory numbers Network address: 192.168.10.1 Subnet mask: 255.255.255.0 2
- configure the maximum number of ephones in the system
- Automatically assign dn tags 4 to 6 and 1 to 5 to the dn lines

```
Router(config)#telephony-service
Router(config-telephony)#max-dn
% Incomplete command.
Router(config-telephony)#max-dn 5
Router(config-telephony)#max-ephones 5
Router(config-telephony)#ip source-address 192.168.10.1 port 2000
Router(config-telephony)#auto assign 4 to 6
Router(config-telephony)#auto assign 1 to 5
Router(config-telephony)#exit
Router(config)#
```

a. **#telephony-service:** Configuring the router for telephony
b. **#max-dn 5**: Defining the maximum number of directory numbers
c. **#max-ephones**: Defining the number of phones
d. **#ip source-address 192.169.10.1 port 2000**: defining the Ip address source and the port
e. **#auto assign 1 to 5 and 4 to 6:** automatically assigning ext. numbers to buttons

**Step 3: Configure a voice vlan on SwitchA:**

- To enable the QoS, we should separate the voice traffic from all the other traffics on the network. For this purpose, we configure the voice vlan on the switch and assign the telephone ports to that specific vlan.

```
Switch>enable
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface range fa0/1-5
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport voice vlan 1
Switch(config-if-range)#
```

## Step 4: Configure the phone directory for IP Phones 1 and 2

- Assign phone numbers 54001 and 54002 respectively to ephone line 1 (phone line for ephone 1) and ephone line 2 () to phone lines created.

```
Router(config)#ephone-dn 1
Router(config-ephone-dn)#%LINK-3-UPDOWN: Interface ephone_dsp DN 1.1, changed state to up

Router(config-ephone-dn)#number 54001
Router(config-ephone-dn)#ephone-dn 2
Router(config-ephone-dn)#%LINK-3-UPDOWN: Interface ephone_dsp DN 2.1, changed state to up

Router(config-ephone-dn)#number 54002
Router(config-ephone-dn)#
```

### Configuring phone numbers for the other ephones

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ephone-dn 3
Router(config-ephone-dn)#%LINK-3-UPDOWN: Interface ephone_dsp DN 3.1, changed state to up

Router(config-ephone-dn)#number 54003
Router(config-ephone-dn)#
%IPPHONE-6-REGISTER: ephone-3 IP:192.168.10.4 Socket:2 DeviceType:Phone has registered.

Router(config-ephone-dn)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
Router#
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ephone-dn 4
Router(config-ephone-dn)#%LINK-3-UPDOWN: Interface ephone_dsp DN 4.1, changed state to up

Router(config-ephone-dn)#number 54004
Router(config-ephone-dn)#
%IPPHONE-6-REGISTER: ephone-4 IP:192.168.10.5 Socket:2 DeviceType:Phone has registered.
```

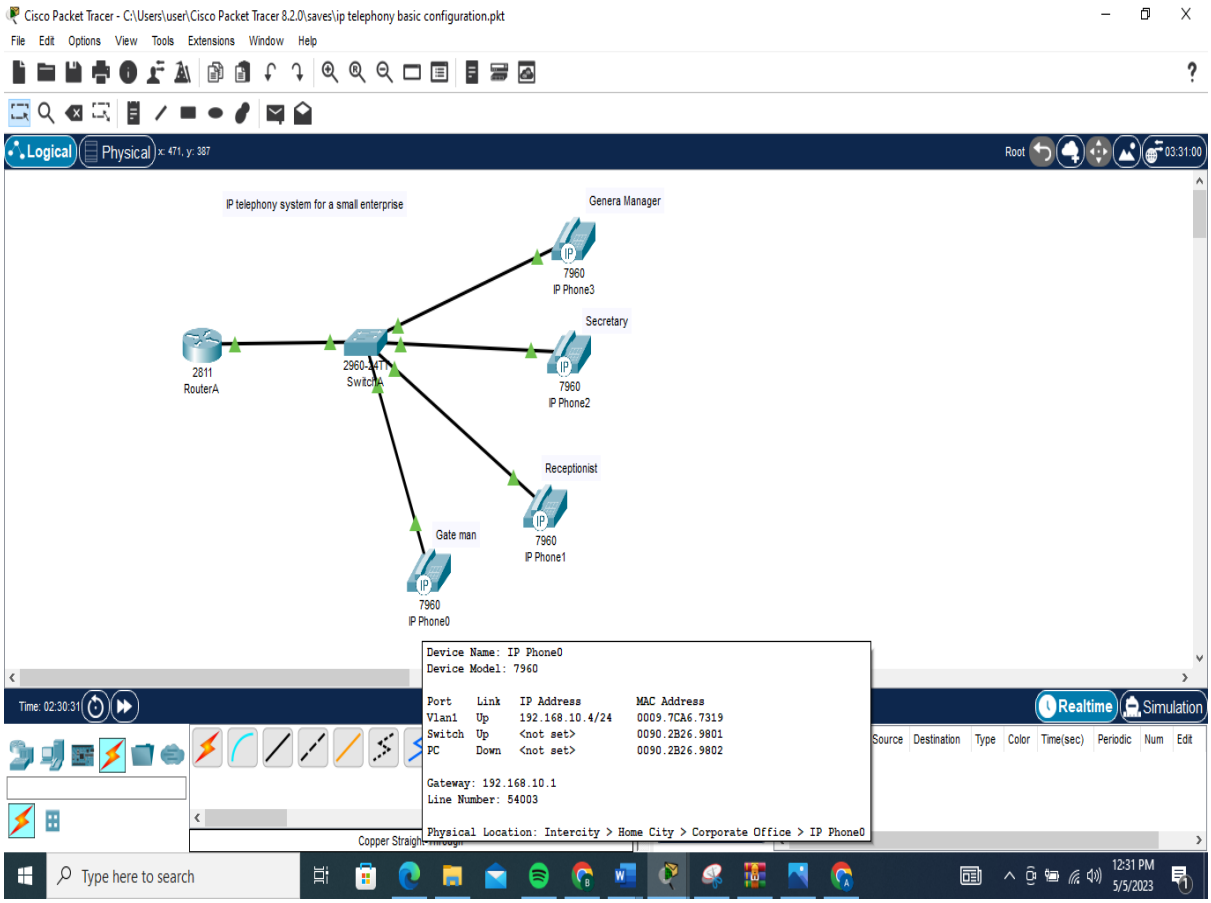
a. **#ephone-dn 1**: Defining the first directory entry
b. **#number 54001**: Assigning a phone number to this directory
c. **#ephone-dn 2:** Defining the first directory entry
d. **#number 54002**: Assigning a phone number to this directory

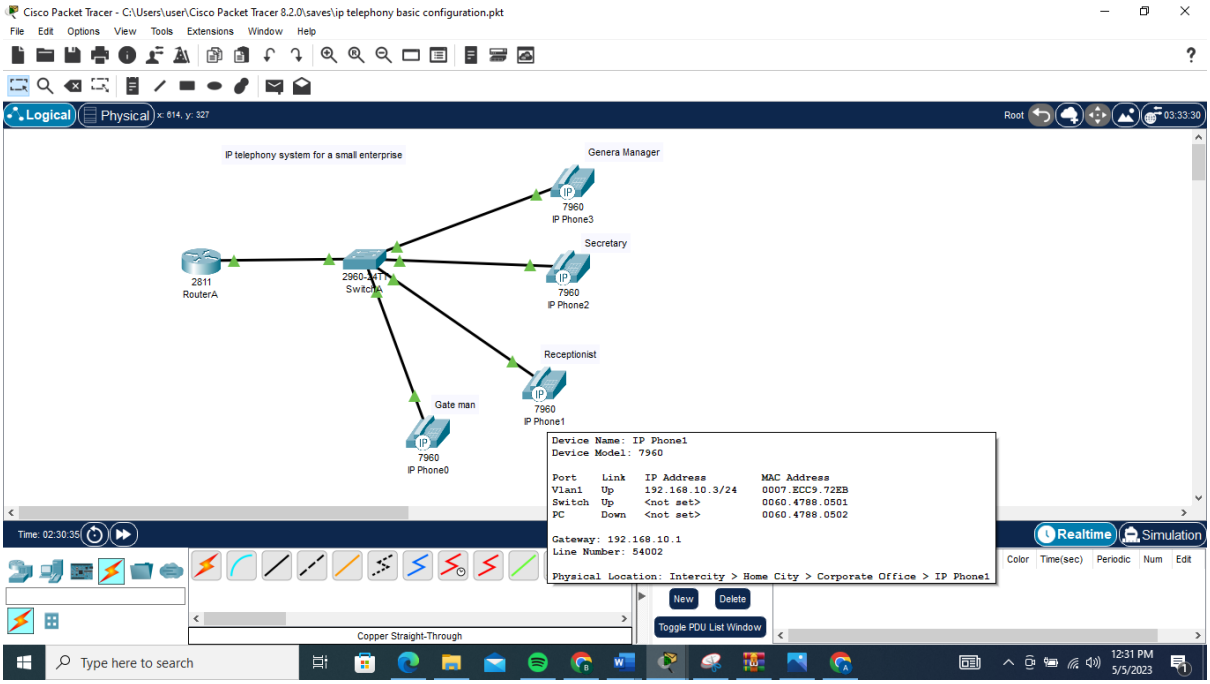
## Step 5: Verify the configuration

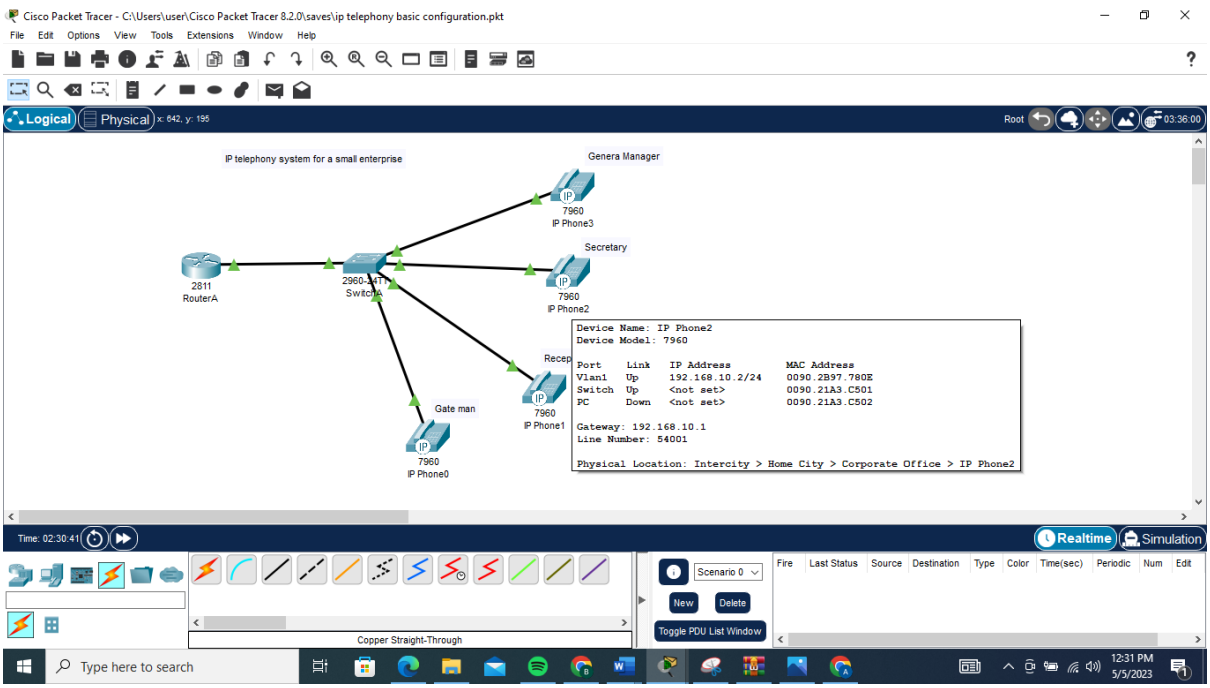
- Verify that the IP addresses have automatically been attributed to IP phones
- Verify that the phone numbers have been attributed.
- From ephone 1, deal ephone 2's phone number
- Establish the communication between ephone 1 and ephone 2

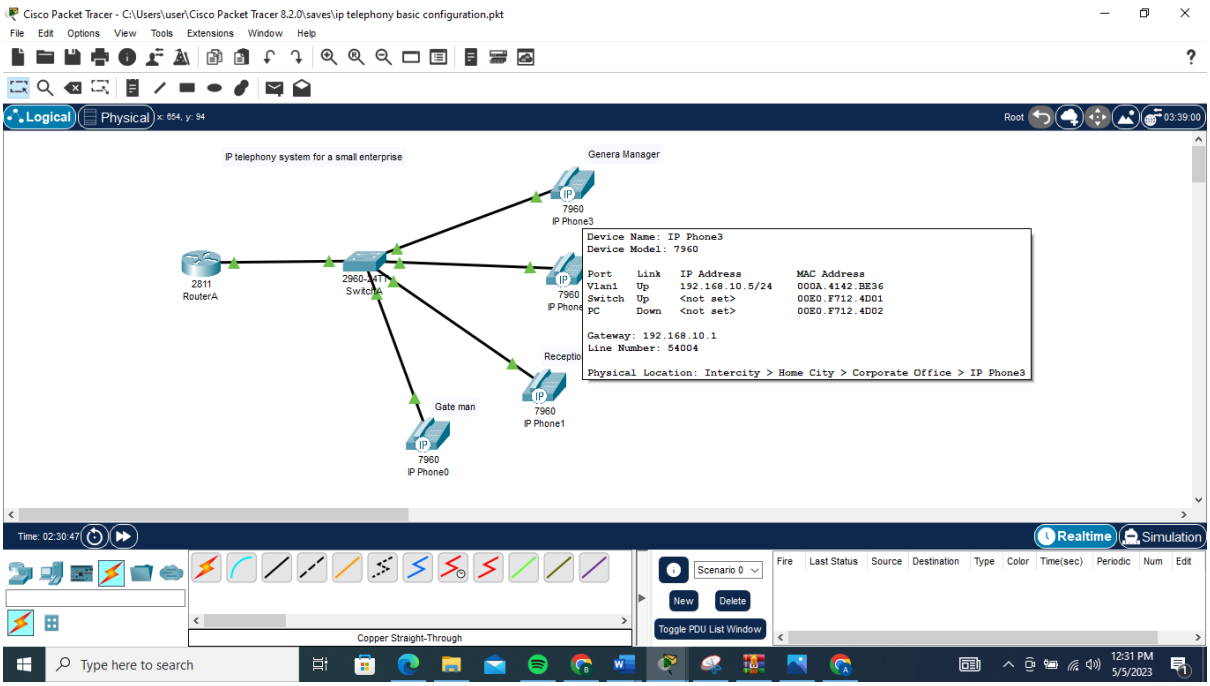
**Observations:**

The screenshots below shows that the IP address, default gateway and the line number has been successfully attributed




Cisco Packet Tracer - C:\Users\user\Cisco Packet Tracer 8.2.0\saves\ip telephony basic configuration.pkt
File Edit Options View Tools Extensions Window Help
Logical Physical x: 614, y: 327
Root 03:33:30
IP telephony system for a small enterprise
Genera Manager
7960
IP Phone3
Secretary
2811
RouterA
2960-24TT
SwitchA
7960
IP Phone2
Receptionist
7960
IP Phone1
Gate man
7960
IP Phone0
Device Name: IP Phone1
Device Model: 7960
Port Link IP Address MAC Address
Vlan1 Up 192.168.10.3/24 0007.ECC9.72EB
Switch Up <not set> 0060.4788.0501
PC Down <not set> 0060.4788.0502
Gateway: 192.168.10.1
Line Number: 54002
Physical Location: Intercity > Home City > Corporate Office > IP Phone1
Time: 02:30:35
Realtime
Simulation
Color Time(sec) Periodic Num Edit
New
Delete
Toggle PDU List Window
Copper Straight-Through
Type here to search
12:31 PM
5/5/2023


Cisco Packet Tracer - C:\Users\user\Cisco Packet Tracer 8.2.0\saves\ip telephony basic configuration.pkt
File Edit Options View Tools Extensions Window Help
Logical Physical x: 642, y: 195
Root 03:36:00
IP telephony system for a small enterprise
Genera Manager
7960
IP Phone3
Secretary
2811
RouterA
2960-24TT
SwitchA
7960
IP Phone2
Recep
7960
IP Phone1
Gate man
7960
IP Phone0
Device Name: IP Phone2
Device Model: 7960
Port Link IP Address MAC Address
Vlan1 Up 192.168.10.2/24 0090.2B97.780E
Switch Up <not set> 0090.21A3.C501
PC Down <not set> 0090.21A3.C502
Gateway: 192.168.10.1
Line Number: 54001
Physical Location: Intercity > Home City > Corporate Office > IP Phone2
Time: 02:30:41
Realtime
Simulation
Scenario 0
Fire Last Status Source Destination Type Color Time(sec) Periodic Num Edit
New
Delete
Toggle PDU List Window
Copper Straight-Through
Type here to search
12:31 PM
5/5/2023




**This screenshot shows that ephones have been successfully registered.**

```
%LINK-3-UPDOWN: Interface ephone_dsp DN 1.1, changed state to up
%LINK-3-UPDOWN: Interface ephone_dsp DN 2.1, changed state to up

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

%IPPHONE-6-REGISTER: ephone-2 IP:192.168.10.3 Socket:2 DeviceType:Phone has registered.

%IPPHONE-6-REGISTER: ephone-1 IP:192.168.10.2 Socket:2 DeviceType:Phone has registered.
```

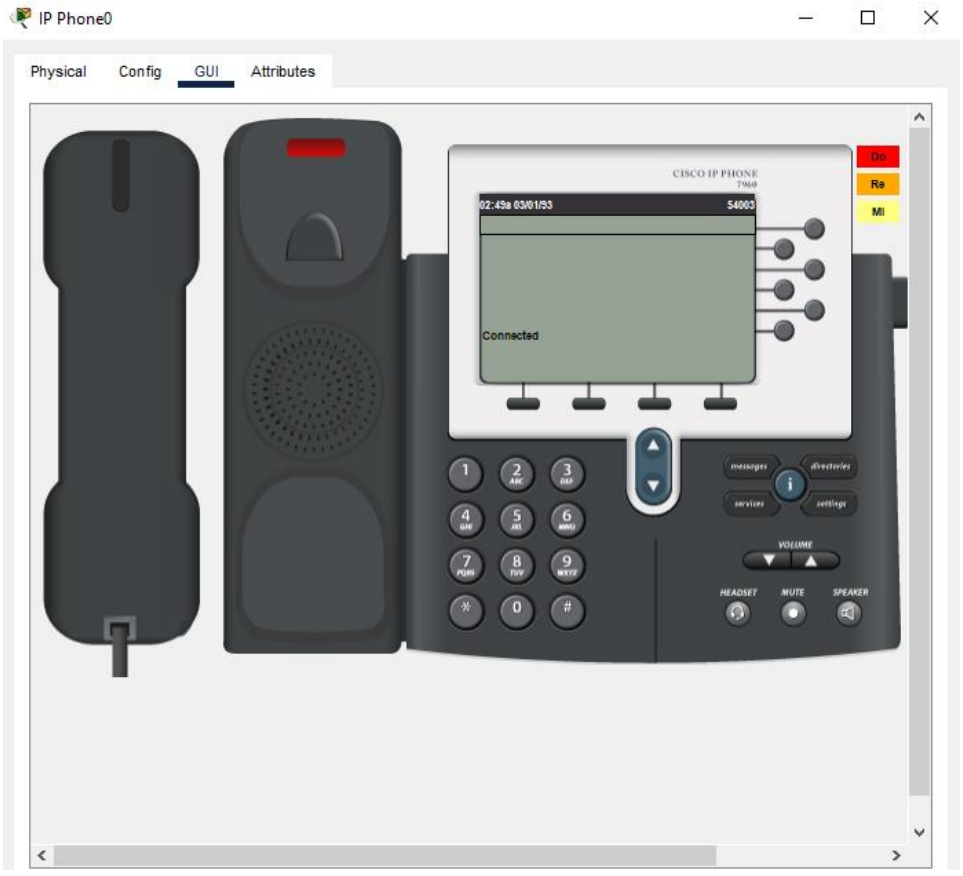
```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ephone-dn 3
Router(config-ephone-dn)#%LINK-3-UPDOWN: Interface ephone_dsp DN 3.1, changed state to up

Router(config-ephone-dn)#number 54003
Router(config-ephone-dn)#
%IPPHONE-6-REGISTER: ephone-3 IP:192.168.10.4 Socket:2 DeviceType:Phone has registered.

Router(config-ephone-dn)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
Router#
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ephone-dn 4
Router(config-ephone-dn)#%LINK-3-UPDOWN: Interface ephone_dsp DN 4.1, changed state to up

Router(config-ephone-dn)#number 54004
Router(config-ephone-dn)#
%IPPHONE-6-REGISTER: ephone-4 IP:192.168.10.5 Socket:2 DeviceType:Phone has registered.
```

## IP phone2 with phone number 54001


## IP phone1 with phone number 54002

## IP phone3 with phone number 54003


## IP phone0 with phone number 54003



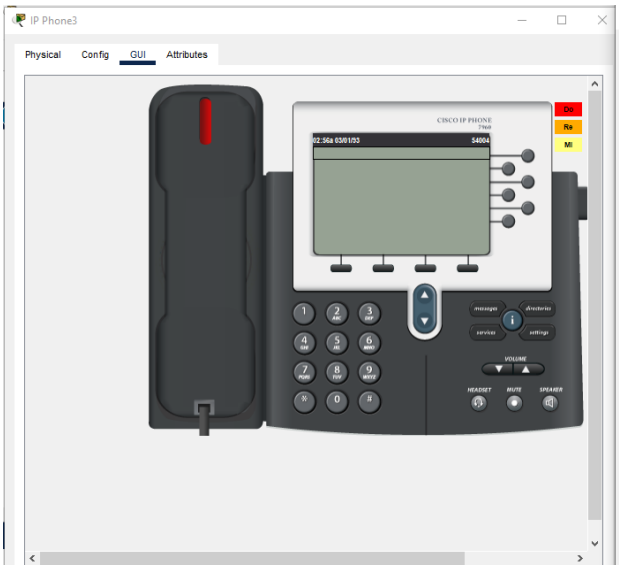
## Calling IP phone2 with IP phone1

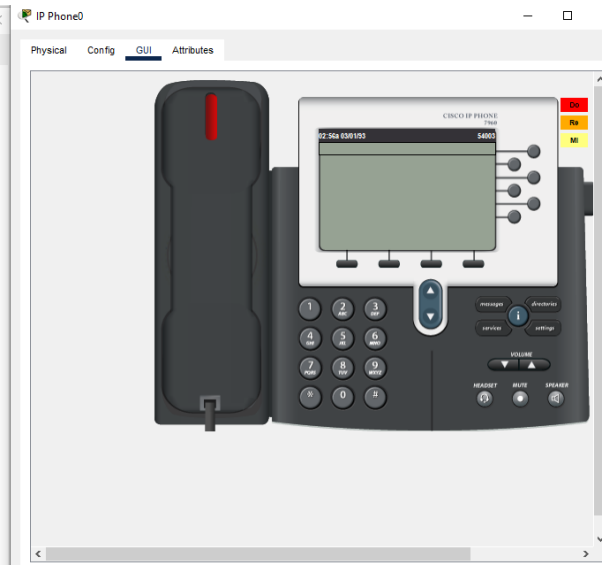


## Connection established

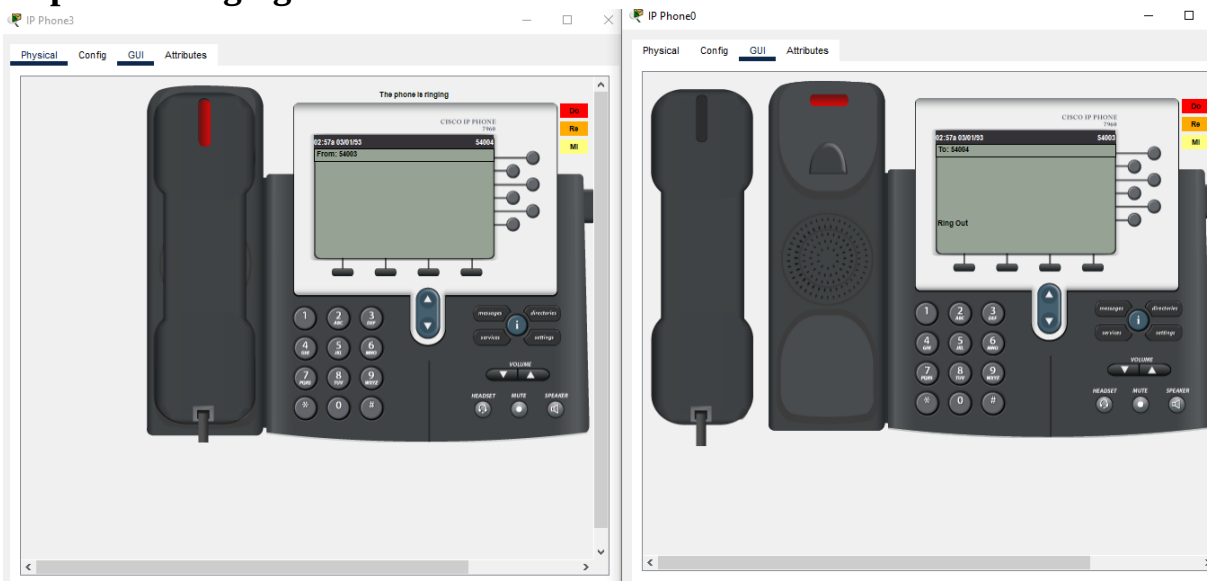


## Calling IP phone3 with IP phone0

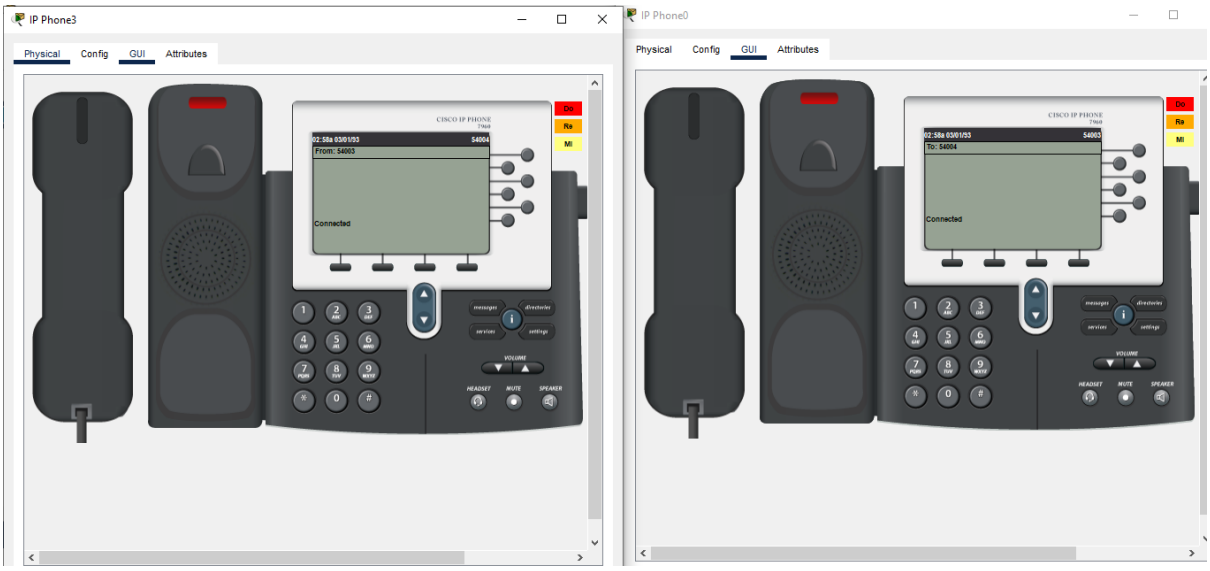


## IP phone3 ringing




## Connection established between the IP phones




## CONCLUSION:

The IP telephony network for the small enterprise was successfully created with 4 IP phones configured and given phone numbers, the 4 IP phones were able to obtain IP addresses dynamically.

The IP phones were able to call each other and a connection was established.