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Chapter 1

Introduction

Voice over Internet Protocol (VoIP), also called IP telephony, is a method and group of technologies for voice calls for the delivery of voice communication sessions over Internet Protocol(IP) networks, such as the internet. Voice over Internet Protocol (VoIP), is a technology that allows making voice calls over a broadband Internet connection instead of an analog (regular) phone line. Some VoIP services allow to call people using the same service, but others may allow to call anyone. They can have a telephone number – including local, long-distance, mobile, and international numbers or not. Some VoIP services only work over a computer or a special VoIP phone while other services allow to use a traditional phone connected to a VoIP adapter.Although its name suggests that it only enables voice calls, modern VoIP services are far more capable and can offer video calls, file transfer, group calls, and much more. It's also referred to as internet telephony.

1.1 How Does VoIP Work?

VoIP calls can be made using computers, smartphones, tablets, special VoIP phones, traditional phones connected to an adapter, and other internet-connected devices.

Analog voice is converted into a digital signal by VoIP services that travel over the Internet. Voice audio is converted into packets of data that then travel through the Internet. These packets of sound data travel almost instantly through public and private Internet networks to route from the origination to the destination. It first reaches your VoIP service provider, who then routes it to the receiver, where it's converted back to a voice signal. The receiver can be anyone: a user of the same VoIP service, a mobile phone, or someone with a landline, as long as the VoIP supports calling them. Depending on the service, they may not be required on the same service as you or have a VoIP phone. If the regular phone number is called, the signal is converted to a regular telephone signal i.e. an analog signal before it reaches the destination. VoIP can allow you to make a call directly from a computer having a special VoIP phone or a traditional phone connected to a special adapter. Wireless hot spots in locations such as airports, hospitals, cafes, etc allow you to connect to the Internet and can enable you to use VoIP service wirelessly. Any landline or mobile phone that is connected to the Internet can place and receive VoIP calls. VoIP calls can also be conducted on computers through the computer microphone and speakers or headsets.

1.2 What Do You Need for VoIP Calling?

There are three main requirements for making a VoIP call: an internet connection, a VoIP service, and the necessary hardware.

1.3 Equipment Required in VoIP

- An Internet connection must be very high to use VoIP services.
- Internet access can be via cable modem or LAN and other high-speed services.
- Users need compatible devices, such as computers, adapters, or special VoIP phones.
- Some VoIP services only work through a specific computer or VoIP phone.
- Computer-based tests require inexpensive software and microphones.

Chapter 2

Network configuration

To configure the below network topology using packet tracer, we used 2 pcs, 2 phones, one switch and 1router. Then we connect the router to the switch on one side and on the other side of the switch we connect the two phones then we connect each pc on each phones. And we take an assumptions of the Ip address and interface and we label the device in the network inluding the line number of each phones.

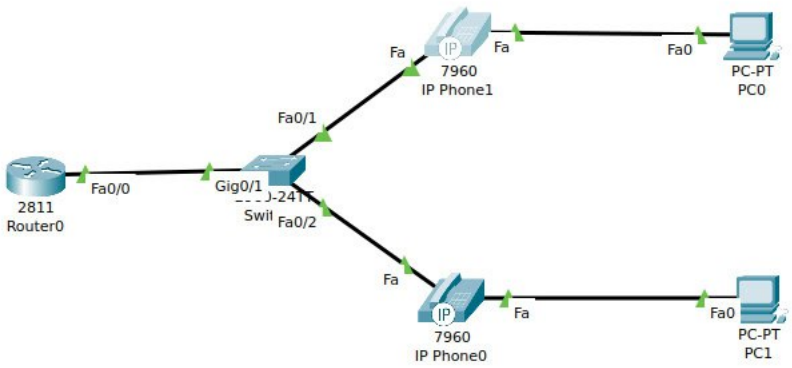


Figure 2.1: Network configuration for VoIP

Chapter 3

IP Address Assumptions

Assumptions

Component/Interface	IP Address	Default Router	Line Number
Router	192.168.11.1		
FastEthernet0/0.10			
Router	192.168.12.1		
FastEthernet0/0.50			
Vlan 10 (DATA vlan)	192.168.11.0/24	192.168.11.1	
Vlan 50 (VOICE vlan)	192.168.12.0/24	192.168.12.1	
IP PHONE 1	DHCP		0912
IP PHONE @	DHCP		0923

Table 3.1: Network Configuration Table

Table 3.2: Configured VLANs

VLAN	Name	Status	Ports
1	default	active	Fa0/3, Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/12, Fa0/13, Fa0/14, Fa0/15, Fa0/16, Fa0/17, Fa0/18, Fa0/19, Fa0/20, Fa0/21, Fa0/22, Fa0/23, Fa0/24, Gig0/2
10	DATA	active	Fa0/1, Fa0/2
50	VOICE	active	Fa0/1, Fa0/2
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

Chapter 4

syntax configuration

Chapter 4: Syntax Configuration

Configuration Syntax

After correctly constructing the network topology and powering up the networking devices, the following configurations were performed to implement the VoIP service.

Configuration 1: Configuring VLANs on the Switch

The two VLANs, namely the voice and the data VLANs, must be configured on the switch in order to have the VoIP service.

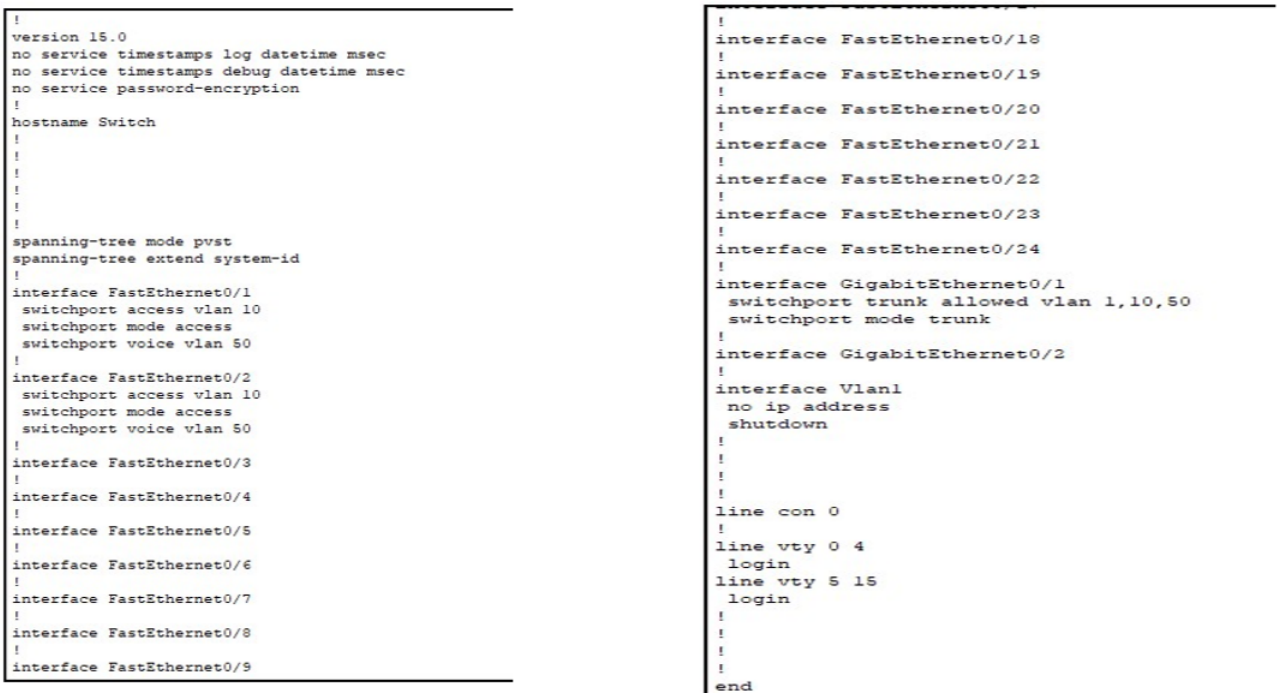
Task 1: Configuring VLANs

```
Switch > enable
Switch# configure terminal
Switch (config)# vlan 10
Switch (config-vlan)# name DATA
Switch (config)# vlan 50
Switch (config-vlan)# name VOICE
Switch (config-vlan)# exit
Switch (config)#
```

Task 2: Assigning interfaces to the created VLANs

The gig 0/1 interface should be a trunk.

```
Switch (config)# interface range fa0/0 - 3
Switch (config-if-range)# switchport mode access
Switch (config-if-range)# switchport access vlan 10
Switch (config-if-range)# switchport access vlan 50
Switch (config-if-range)# exit
Switch (config)# interface gig0/1
Switch (config-if)# switchport mode trunk
Switch (config-if)# switchport trunk allowed vlan 1,10,50
Switch (config-if)# end
Switch (config)# do write
Switch (config)# do show start
```



```
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Switch
!
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
 switchport voice vlan 50
!
interface FastEthernet0/2
 switchport access vlan 10
 switchport mode access
 switchport voice vlan 50
!
interface FastEthernet0/3
!
interface FastEthernet0/4
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8
!
interface FastEthernet0/9
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface GigabitEthernet0/1
 switchport trunk allowed vlan 1,10,50
 switchport mode trunk
!
interface GigabitEthernet0/2
!
interface Vlan1
 no ip address
 shutdown
!
!
!
!
line con 0
!
line vty 0 4
 login
line vty 5 15
 login
!
!
!
!
end
```

Figure 4.1: configuring Vlans on the switch

Configuration 2: Router Configuration

Task 1: Setting DHCP Pool to Automatically Address the IP Phones and the PCs

```
Router > enable
Router # config term
Router (config)# service dhcp
Router (config)# ip dhcp pool DATA
Router (dhcp-config)# network 192.168.11.0 255.255.255.0
Router (dhcp-config)# default-router 192.168.11.1
Router (dhcp-config)# exit
Router (config)# ip dhcp pool VOICE
Router (dhcp-config)# network 192.168.12.0 255.255.255.0
Router (dhcp-config)# default-router 192.168.12.1
Router (dhcp-config)# option 150 ip 192.168.12.1
Router (dhcp-config)# exit
Router (config)# interface fa0/0.10
Router (config-subif)# encapsulation Dot1q.10
Router (config-subif)# ip address 192.168.11.1 255.255.255.0
Router (config-subif)# exit
Router (config)# interface fa0/0.50
Router (config-subif)# encapsulation Dot1q.50
Router (config-subif)# ip address 192.168.12.1 255.255.255.0
Router (config-subif)# exit
Router (config)# do write
```

Task 2: Configuring Telephony Service on the Router

```
Router (config)# telephony-service
Router (config-telephony)# max-dn 2
Router (config-telephony)# max-ephones 2
Router (config-telephony)# ip source-address 192.168.12.1
Router (config-telephony)# auto assign 1 to 2
Router (config-telephony)# exit
Router (config)# ephone-dn 1
Router (config-ephone-dn)# number 0912
Router (config-ephone-dn)# exit
Router (config)# ephone-dn 2
Router (config-ephone-dn)# number 0923
Router (config-ephone-dn)# exit
Router (config)# do write
```

Chapter 5

Configuration Test

5.0.1 Check that VLANs are set up for voice traffic

By configuring the switch we can check that VLANs are set up for voice traffic.

By writing the following command we can check the VLANS setup.

Switch >en

Switch#show vlan brief

This command will result the following output, which inturn shows the Vlans status and ports.

```
Switch>en
Switch#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                Fa0/23, Fa0/24, Gig0/2
10   DATA                             active    Fa0/1, Fa0/2
50   VOICE                            active    Fa0/1, Fa0/2
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
Switch#
```

Figure 5.1: Check VLANS status and Port

5.0.2 Check Interfaces status

By writing the following configuration we can check for interface statues.

Switch#show interfaces status

```
Switch#show interfaces status
Port      Name               Status       Vlan       Duplex  Speed Type
Fa0/1                        connected    10         auto    auto  10/100BaseTX
Fa0/2                        connected    10         auto    auto  10/100BaseTX
Fa0/3                        notconnect   1          auto    auto  10/100BaseTX
Fa0/4                        notconnect   1          auto    auto  10/100BaseTX
Fa0/5                        notconnect   1          auto    auto  10/100BaseTX
Fa0/6                        notconnect   1          auto    auto  10/100BaseTX
Fa0/7                        notconnect   1          auto    auto  10/100BaseTX
Fa0/8                        notconnect   1          auto    auto  10/100BaseTX
Fa0/9                        notconnect   1          auto    auto  10/100BaseTX
Fa0/10                       notconnect   1          auto    auto  10/100BaseTX
Fa0/11                       notconnect   1          auto    auto  10/100BaseTX
Fa0/12                       notconnect   1          auto    auto  10/100BaseTX
Fa0/13                       notconnect   1          auto    auto  10/100BaseTX
Fa0/14                       notconnect   1          auto    auto  10/100BaseTX
Fa0/15                       notconnect   1          auto    auto  10/100BaseTX
Fa0/16                       notconnect   1          auto    auto  10/100BaseTX
Fa0/17                       notconnect   1          auto    auto  10/100BaseTX
Fa0/18                       notconnect   1          auto    auto  10/100BaseTX
Fa0/19                       notconnect   1          auto    auto  10/100BaseTX
Fa0/20                       notconnect   1          auto    auto  10/100BaseTX
Fa0/21                       notconnect   1          auto    auto  10/100BaseTX
 --More-- |
```

Figure 5.2: Check interface status

The above command shows the status of each interface and its VLAN assignment. Ensure the interfaces Fa0/1 to Fa0/2 are assigned to Vlan 10.

5.0.3 Check Trunk Ports

To figure out the trunk ports by writing the command Switch#show interfaces trunk

```
Switch#
Switch#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Gig0/1      on           802.1q         trunking      1

Port        Vlans allowed on trunk
Gig0/1      1,10,50

Port        Vlans allowed and active in management domain
Gig0/1      1,10,50

Port        Vlans in spanning tree forwarding state and not pruned
Gig0/1      1,10,50

Switch#
```

Figure 5.3: Check trunk ports

Chapter 6

Result and Discussion

6.0.1 First let's figure out the IP and the Line number of each phone.

Phone 0

Has Ip:192.168.12.1
Line-Number: 0923
Phone 1
Has Ip: 192.168.12.1
Line-Number: 0912

The figure in the next page shows the information about the two phones. This information include the specific device name we assign it the device model, ports,Link, IP address and Mac Address in each device. And additionally also the line number of each device which is the most important to create connection accross the network.

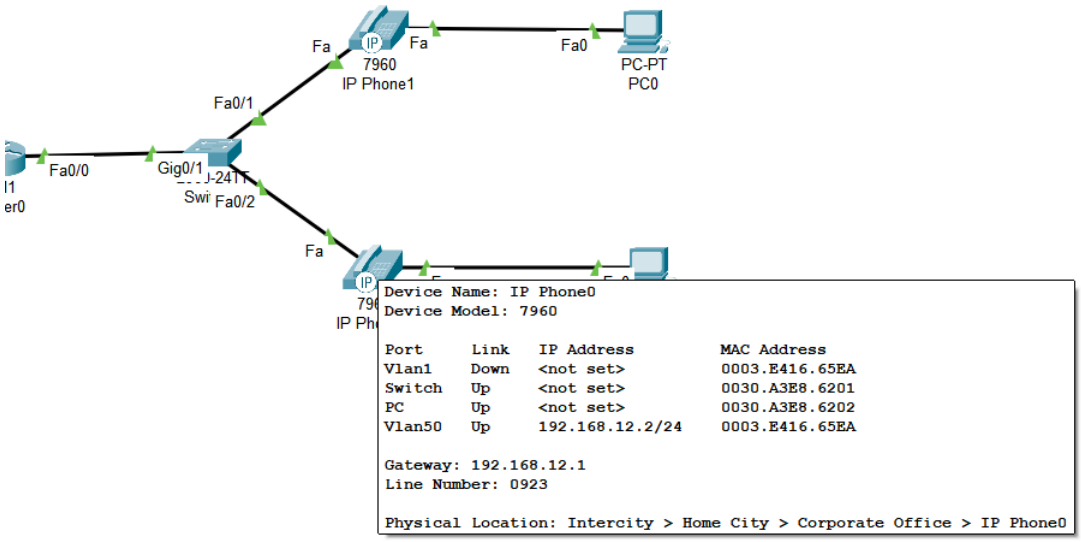


Figure 6.1: The IP and line-number of Phone 0

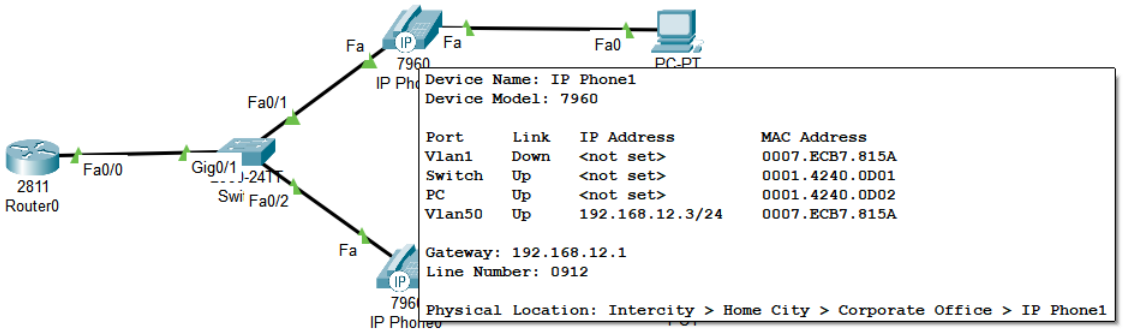


Figure 6.2: The IP and line-number of Phone 1

6.0.2 Then after we know the line number of each device, we dial using the line number of the other device.

1.we insert the line number of phone 0 on phone 1

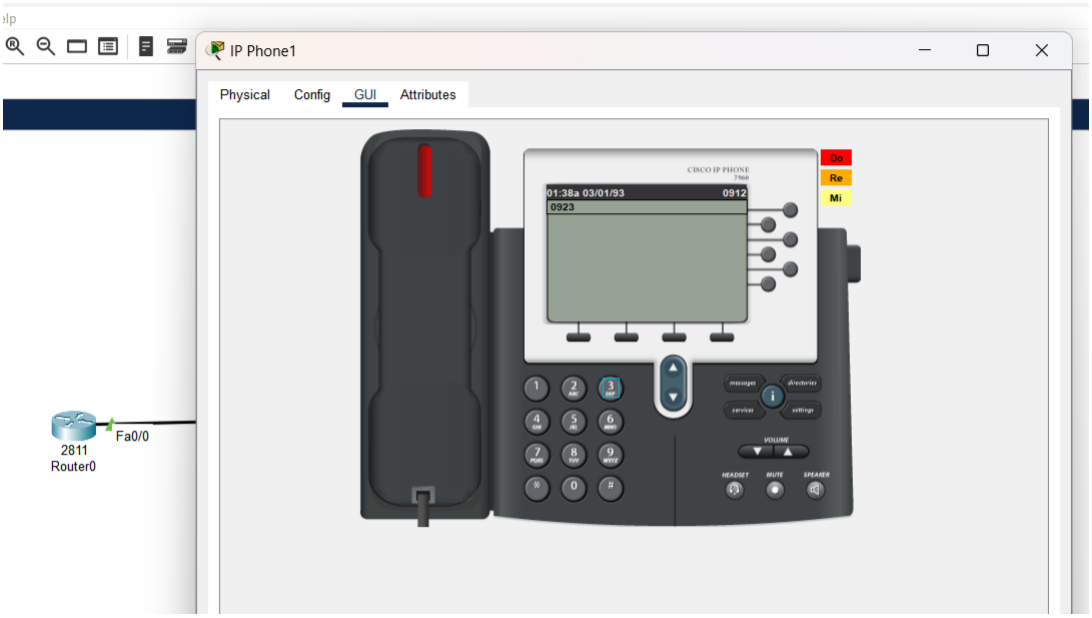


Figure 6.3: Inserting the line number of phone 0

2.Then dial to phone 0

Figure 6.4: Dialing to phone 0

3.Some person on phone 0 receives the dial with sound and display on its screen

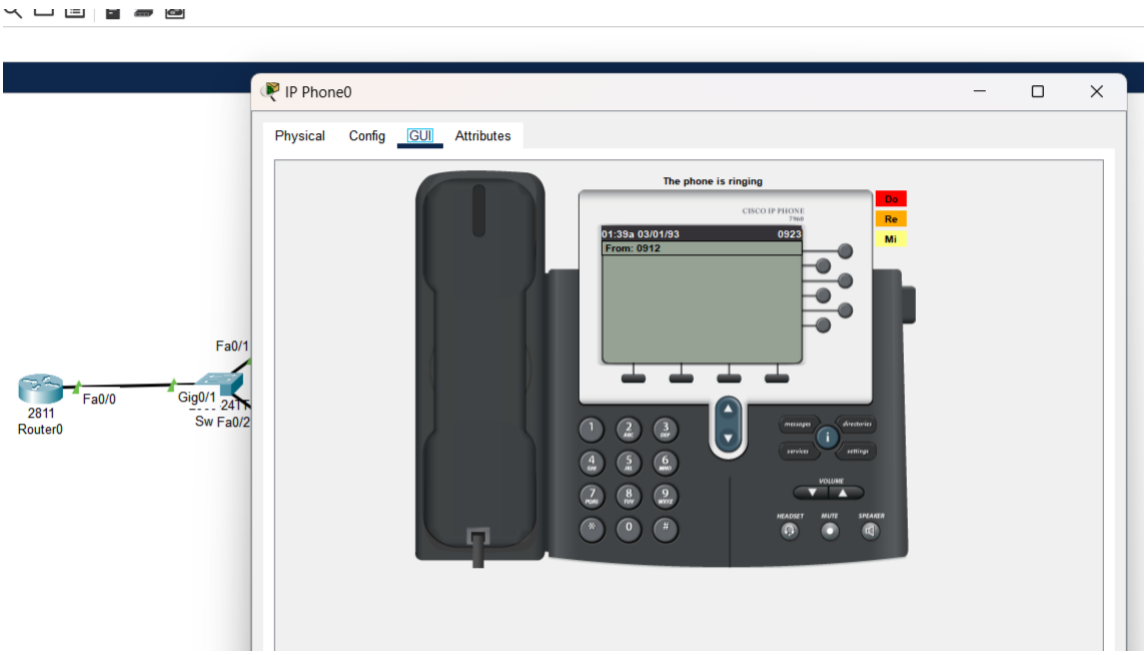


Figure 6.5: phone 0 IS Ringing

4.The the person on phone 0 receive the call

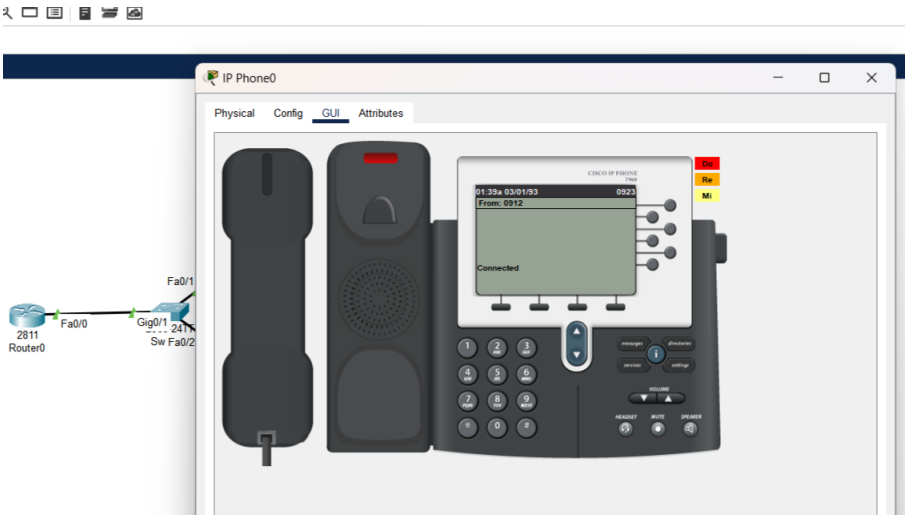


Figure 6.6: phone 0 IS Ringing

After all we can see that the two device where connected successfully using VoIP protocol.

References

1. Cisco Catalyst Switches Configuration Examples and TechNotes
   https://www.cisco.com/c/en/us/support/switches/catalyst-4500-series-switches/products-configuration-examples-list.html

2. Cisco IOS Quality of Service Solutions Configuration Guide
   https://www.cisco.com/c/en/us/td/docs/ios/qos/configuration/guide/12_2sr/qos_12_2sr_book/cls_bsd_policing.html