

## Assignment 2. Voice over IP Packet Tracer Lab

Weight: 5% (5 marks)

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### Submission of report:

Upload it on-time using Blackboard link.

Late submission policy: maximum time to submit after due date: ten (10) days. No credit afterwards, but you must still submit as completing all the labs and assignments is a condition for passing the course. 10% will be deducted for each day past the due date.

### Learning objectives:

Use Packet Tracer to configure Cisco Unified Communications Manager Express (CUCME) in a basic two-site topology.

You must deliver a document requiring particular conditions. Students must demonstrate analytical skills, understand technical documentation, adapt technical instructions on specific cases, and generate technical documentation.

### Background

Cisco Unified Communications Manager Express (CUCME) is a VoIP call management software, which runs within the router IOS. In this lab, you will practice some of the basic CUCME and voice related configuration commands, which would enable IP and analog phones at two locations to communicate. You will also apply many of the configuration skills learned in your CCNA curriculum.

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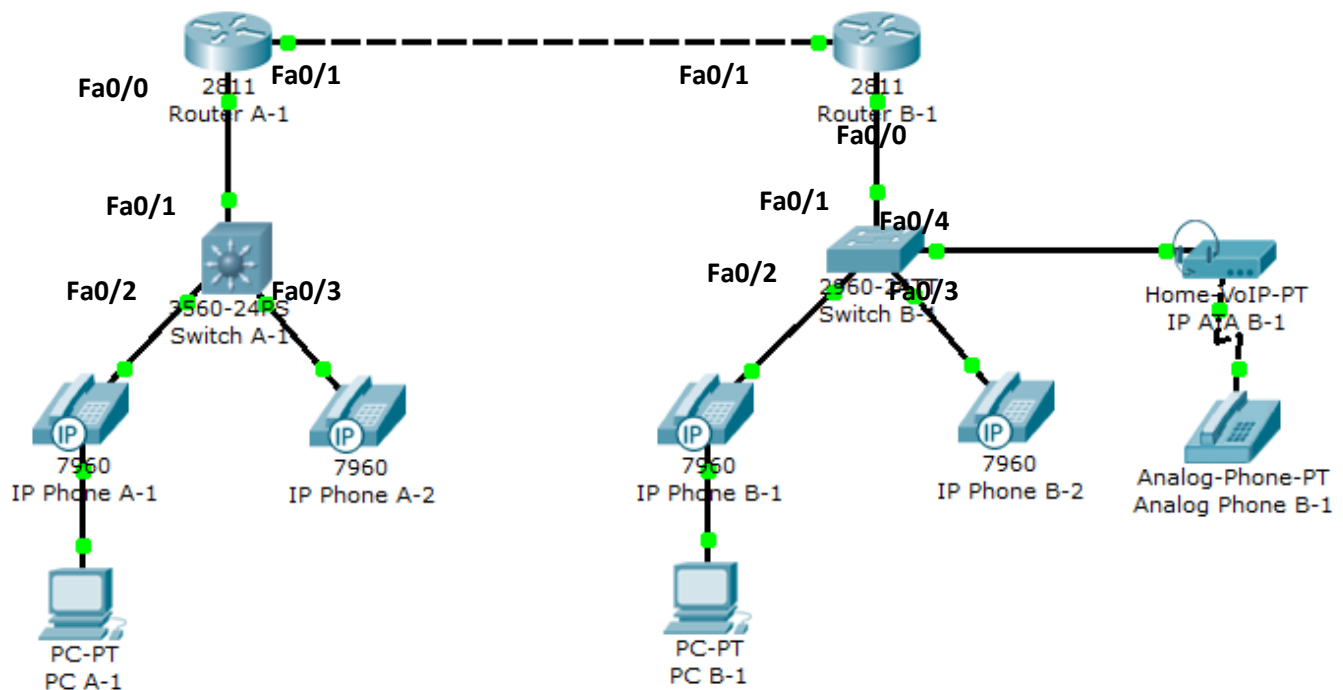
## IP Addressing Table

Device	Interface	Address
RouterA-1	FastEthernet0/0	n/a
	FastEthernet0/0.10	172.16.10.1 /24
	FastEthernet0/0.20	172.16.20.1 /24
	FastEthernet0/0.99	172.16.99.1 /24
	FastEthernet0/1	10.0.0.1/24
RouterB-1	FastEthernet0/0	n/a
	FastEthernet0/0.10	172.17.10.1 /24
	FastEthernet0/0.20	172.17.20.1 /24
	FastEthernet0/0.99	172.17.99.1 /24
	FastEthernet0/1	10.0.0.2/24
SwitchA-1	Vlan99	172.16.99.2
SwitchB-1	Vlan99	172.17.99.2

### Step 1: Build the Packet Tracer Topology. (10%)

Open a new PT file and use the *device* and *connections* tools in PT to build the topology shown below. The IP phones at site A will be receiving Power over Ethernet (PoE) from the switch but the IP phones at site B should be configured with power supplies.

### Topology



### Step 2: Perform basic device configuration. (10%)

On each router and switch:

- Set the hostname as indicated on the topology diagram

- Set the enable secret to **class**
- Disable DNS lookups
- Set a Telnet and Console password of **cisco**
- Set IP addresses as indicated in the above chart

On each switch:

- Create VLAN 10 with the name **VOICE**
- Create VLAN 20 with the name **DATA**
- Create VLAN 99 with the name **MANAGEMENT**

On each PC:

- Configure to receive IP address via DHCP

Insert configuration printouts here.

The image displays two screenshots of the Cisco Packet Tracer CLI interface for Router A-1. The top screenshot shows the initial configuration commands for Router A-1, including disabling DNS lookups, setting the enable secret to 'class', and configuring console and vty passwords. The bottom screenshot shows the configuration for the interfaces on Router A-1, including enabling the interfaces, setting encapsulation to dot1Q, and assigning IP addresses for the main interfaces and subinterfaces.

**Router A-1 CLI Configuration (Top Screenshot):**

```

Router(config)#no ip domain-lookup
Router(config)#enable secret class
Router(config)#line con 0
Router(config-line)#password cisco
Router(config-line)#logging synchronous
Router(config-line)#exec-timeout 0 0
Router(config-line)#line vty 0 4
Router(config-line)#password cisco
Router(config-line)#login
Router(config-line)#!
Router(config-line)#hostname RouterA-1
RouterA-1(config)#int f0/0

```

**Router A-1 CLI Configuration (Bottom Screenshot):**

```

RouterA-1(config-if)#
RouterA-1(config-if)#int f0/0
RouterA-1(config-if)#no shut
RouterA-1(config-if)#int f0/0.10
RouterA-1(config-subif)#encapsulation dot1Q 10
RouterA-1(config-subif)#ip addr 172.16.10.1 255.255.255.0
RouterA-1(config-subif)#int f0/0.20
RouterA-1(config-subif)#encapsulation dot1Q 20
RouterA-1(config-subif)#ip addr 172.16.20.1 255.255.255.0
RouterA-1(config-subif)#int f0/0.99
RouterA-1(config-subif)#encapsulation dot1Q 99
RouterA-1(config-subif)#ip addr 172.16.99.1 255.255.255.0
RouterA-1(config-subif)#int f0/1
RouterA-1(config-if)#ip addr 10.0.0.1 255.255.255.0
RouterA-1(config-if)#no shut

```

a0/1

Router B-1

Physical Config CLI Attributes

IOS Command Line Interface

Fatjon Dauti

```

Router(config)#no ip domain-lookup
Router(config)#enable secret class
Router(config)#line con 0
Router(config-line)#password cisco
Router(config-line)#logging synchronous
Router(config-line)#exec-timeout 0 0
Router(config-line)#line vty 0 4
Router(config-line)#password cisco
Router(config-line)#login
Router(config-line)#!
Router(config-line)#hostname RouterB-1
RouterB-1(config)#

```

A-2

IP Phone

Fa

aU/1

Router B-1

Physical Config CLI Attributes

IOS Command Line Interface

Fatjon Dauti

```

RouterB-1(config)#
RouterB-1(config)#int f0/0
RouterB-1(config-if)#no shut

RouterB-1(config-if)#int f0/0.10
RouterB-1(config-subif)#encapsulation dot1Q 10
RouterB-1(config-subif)#ip addr 172.17.10.1 255.255.255.0
RouterB-1(config-subif)#int f0/0.20
RouterB-1(config-subif)#encapsulation dot1Q 20
RouterB-1(config-subif)#ip addr 172.17.20.1 255.255.255.0
RouterB-1(config-subif)#int f0/0.99
RouterB-1(config-subif)#encapsulation dot1Q 99
RouterB-1(config-subif)#ip addr 172.17.99.1 255.255.255.0
RouterB-1(config-subif)#int f0/1
RouterB-1(config-if)#ip addr 10.0.0.2 255.255.255.0
RouterB-1(config-if)#no shut

```

ie A-2

IP Phone

Fa

Fa0

PC F

0/1

Switch A-1

Physical Config CLI Attributes

IOS Command Line Interface

Fatjon Dauti

```

Switch(config)#no ip domain-lookup
Switch(config)#enable secret class
Switch(config)#line con 0
Switch(config-line)#password cisco
Switch(config-line)#logging synchronous
Switch(config-line)#exec-timeout 0 0
Switch(config-line)#line vty 0 4
Switch(config-line)#password cisco
Switch(config-line)#login
Switch(config-line)#!
Switch(config-line)#
Switch(config-line)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Switch(config-line)#hostname SwitchA-1
SwitchA-1(config)#

```

A-2

IP Phone

Fa

Fa0

PC

Switch A-1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
SwitchA-1(config)#int vlan 99
SwitchA-1(config-if)#ip addr 172.16.99.2 255.255.255.0
SwitchA-1(config-if)#no shut
SwitchA-1(config-if)#!
SwitchA-1(config-if)#vlan 10
SwitchA-1(config-vlan)#name VOICE
SwitchA-1(config-vlan)#vlan 20
SwitchA-1(config-vlan)#name DATA
SwitchA-1(config-vlan)#vlan 99
SwitchA-1(config-vlan)#name MANAGEMENT
SwitchA-1(config-vlan)#!
%LINK-5-CHANGED: Interface Vlan99, changed state to up
```

Switch B-1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Switch(config)#no ip domain-lookup
Switch(config)#enable secret class
Switch(config)#line con 0
Switch(config-line)#password cisco
Switch(config-line)#logging synchronous
Switch(config-line)#exec-timeout 0 0
Switch(config-line)#line vty 0 4
Switch(config-line)#password cisco
Switch(config-line)#login
Switch(config-line)#!
Switch(config-line)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Switch(config-line)#hostname SwitchB-1
SwitchB-1(config)#int vlan 99
SwitchB-1(config-if)#ip addr 172.17.99.2 255.255.255.0
SwitchB-1(config-if)#no shut
SwitchB-1(config-if)#!
SwitchB-1(config-if)#vlan 10
SwitchB-1(config-vlan)#name VOICE
SwitchB-1(config-vlan)#vlan 20
SwitchB-1(config-vlan)#name DATA
SwitchB-1(config-vlan)#vlan 99
SwitchB-1(config-vlan)#name MANAGEMENT
SwitchB-1(config-vlan)#!
%LINK-5-CHANGED: Interface Vlan99, changed state to up
```

### Step 3: Configure DHCP service on the routers. (10%)

The VoIP devices and PCs in PT need to receive IP addressing information using DHCP. Each router will need to act as the DHCP server for its location. We will be separating the voice and data networks at each location so we will need two DHCP pools. The special DHCP option 150 is used to send the TFTP server's address (which in this case happens to be the same as CUCME) to the VoIP devices so they can register and receive configuration information. Even though this option is only required on the Voice VLAN we have included it on the Data VLAN in case soft-phones are ever used on the PCs.

The commands to setup the DHCP pools on RouterA-1 are given below. You will have to modify them as appropriate for RouterB-1 and apply them there as well.

```
RouterA-1(config)# ip dhcp pool VOICE
RouterA-1(dhcp-config)# network 172.16.10.0 255.255.255.0
RouterA-1(dhcp-config)# default-router 172.16.10.1
RouterA-1(dhcp-config)# option 150 ip 172.16.10.1
RouterA-1(config)# ip dhcp pool DATA
RouterA-1(dhcp-config)# network 172.16.20.0 255.255.255.0
```

```
RouterA-1(dhcp-config)# default-router 172.16.20.1
RouterA-1(dhcp-config)# option 150 ip 172.16.10.1
```

Insert configuration printouts here.

Router A-1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
RouterA-1(config)#!
RouterA-1(config)#ip dhcp excluded-address 172.16.10.1
RouterA-1(config)#ip dhcp excluded-address 172.16.20.1
RouterA-1(config)#!
RouterA-1(config)#ip dhcp pool VOICE
RouterA-1(dhcp-config)#network 172.16.10.0 255.255.255.0
RouterA-1(dhcp-config)#default-router 172.16.10.1
RouterA-1(dhcp-config)#option 150 ip 172.16.10.1
RouterA-1(dhcp-config)#ip dhcp pool DATA
RouterA-1(dhcp-config)#network 172.16.20.0 255.255.255.0
RouterA-1(dhcp-config)#default-router 172.16.20.1
RouterA-1(dhcp-config)#option 150 ip 172.16.10.1
```

Router B-1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
RouterB-1(config-if)#ip dhcp excluded-address 172.17.10.1
RouterB-1(config)#ip dhcp excluded-address 172.17.20.1
RouterB-1(config)#!
RouterB-1(config)#ip dhcp pool VOICE
RouterB-1(dhcp-config)#network 172.17.10.0 255.255.255.0
RouterB-1(dhcp-config)#default-router 172.17.10.1
RouterB-1(dhcp-config)#option 150 ip 172.17.10.1
RouterB-1(dhcp-config)#ip dhcp pool DATA
RouterB-1(dhcp-config)#network 172.17.20.0 255.255.255.0
RouterB-1(dhcp-config)#default-router 172.17.20.1
RouterB-1(dhcp-config)#option 150 ip 172.17.10.1
```

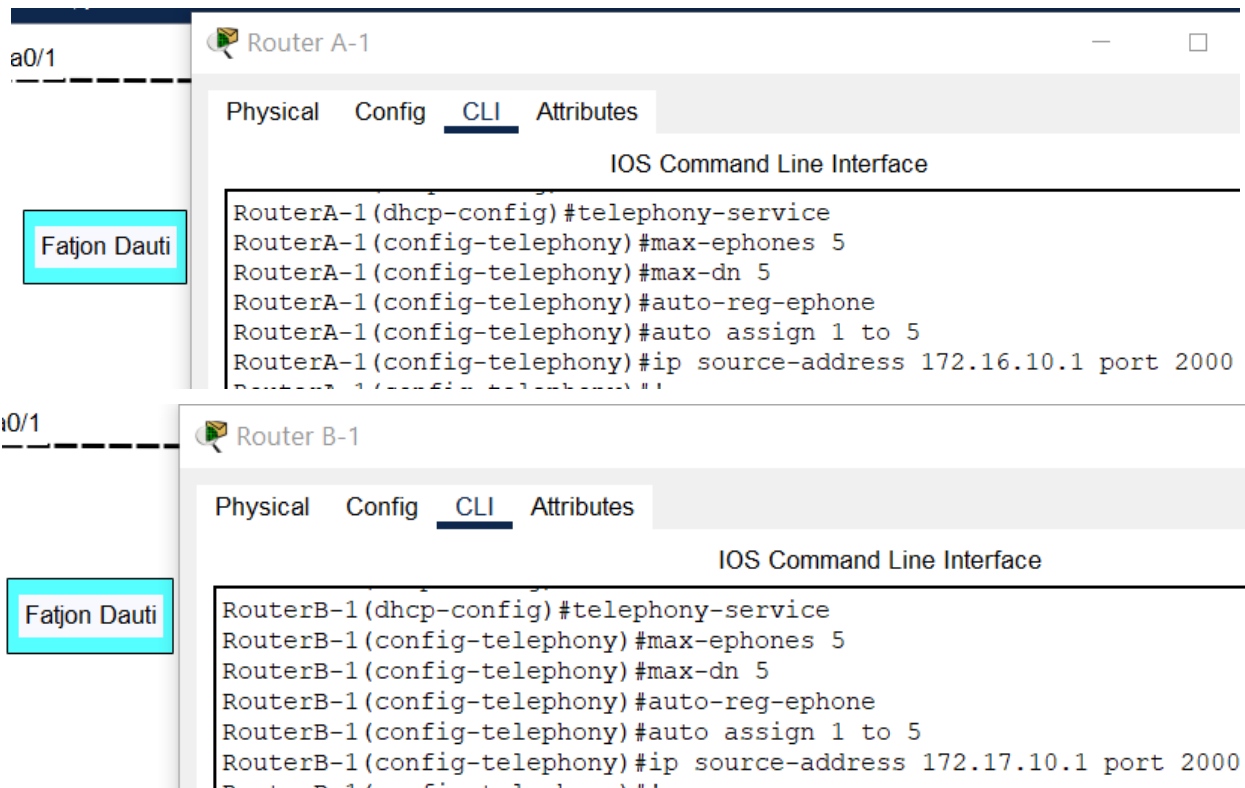
#### Step 4: Enable basic VoIP service on each router. (10%)

The DHCP option 150 instructs the VoIP devices (DHCP clients) to contact the router as the TFTP server for configuration information, which would also include the CUCME address as the call processor. We must next configure the router to provide voice services to those devices.

Enable the VoIP service and set the maximum number of VoIP devices and directory numbers to 5 on each router. We will also allow phones to auto-register and get an extension number automatically from directory numbers 1-5. Finally, the IP address and the TCP port number for SCCP traffic on the router must be selected. The example configuration commands for RouterA-1 are given below. Modify and apply to router B-1 as well.

```
RouterA-1(config)# telephony-service
RouterA-1(config-telephony)# max-ephones 5
RouterA-1(config-telephony)# max-dn 5
RouterA-1(config-telephony)# auto-reg-ephone
RouterA-1(config-telephony)# auto assign 1 to 5
RouterA-1(config-telephony)# ip source-address 172.16.10.1 port 2000
```

Insert configuration printouts here.



### Step 5: Configure the pool of directory numbers on each router. (10%)

Each site will have a unique pool of directory numbers (extensions) for its phones. With physical equipment, it is possible to have overlapping dial plans (the same extension numbers duplicated at both sites) and then use a special prefix to dial between sites, but this is not supported by PT. We will need to ensure that each phone in the topology has a unique number. The numbers at site A will all be formatted as 4xxx and at site B as 5xxx.

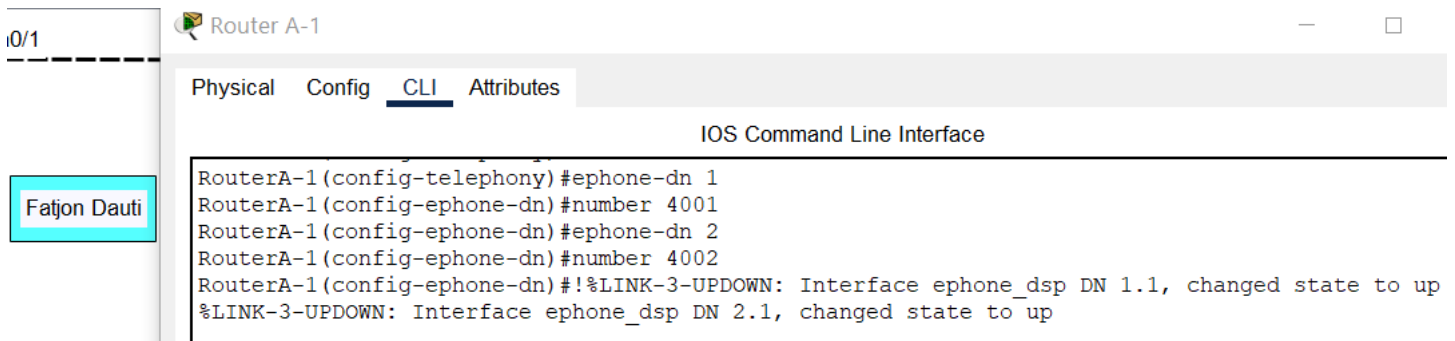
Below is the configuration for *one* of the directory numbers at site A. Create enough (correctly numbered) directory numbers at each site to support all of the VoIP devices at that site.

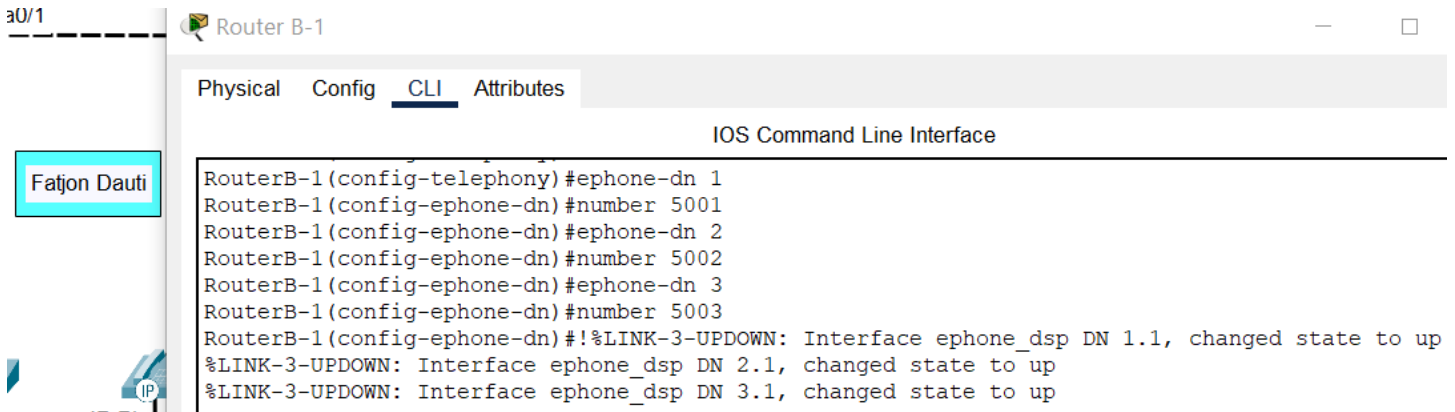
```

RouterA-1(config)# ephone-dn 1
RouterA-1(config-ephone-dn)# number 4001

```

Insert configuration printouts here.





## Step 6: Configure switch interfaces. (10%)

Trunk Ports:

Configure an 802.1Q trunk link from FastEthernet 0/1 on each switch to the router.

Access Ports:

All of the remaining ports on each switch should be configured as access ports in the **DATA** VLAN and should have PortFast enabled. The ports should all be shutdown for security reasons unless they have a device plugged into them. Enter this configuration as you normally would on the switches at both sites. Remember that there are shortcuts to configuring multiple interfaces on a switch the same way.

Because we want to have our IP phones on a different VLAN than our PCs we need to perform a special configuration on all the access switchports to turn them into 2-VLAN mini-trunks where IP phones are identified by CDP. Leave the ports in **switchport mode access** but add a special second VLAN to them for voice traffic

SwitchA-1(config-if-range)# **switchport voice vlan 10**

At site A we also need to provide power to the IP phones using PoE:

SwitchA-1(config-if-range)# **power inline auto**

Use the corresponding **show** commands to display the entire configurations you made on routers, switches, workstations and IP Phones.

Insert configuration printouts here.

This configurations are related to my first .pkt file with 2 sites

### Configuration of RouterA1

RouterA-1#!Fatjon Dauti

RouterA-1#show run

Building configuration...

Current configuration : 1662 bytes

!

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname RouterA-1

!

enable secret 5 \$1\$mERr\$9cTjUIEqNGurQiFU.ZeCi1

!



```
ip dhcp excluded-address 172.16.10.1
ip dhcp excluded-address 172.16.20.1
!
ip dhcp pool DATA
network 172.16.20.0 255.255.255.0
default-router 172.16.20.1
option 150 ip 172.16.10.1
ip dhcp pool VOICE
network 172.16.10.0 255.255.255.0
default-router 172.16.10.1
option 150 ip 172.16.10.1
!
ip cef
no ipv6 cef
!
license udi pid CISCO2811/K9 sn FTX1017ES30-
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
interface FastEthernet0/0.10
encapsulation dot1Q 10
ip address 172.16.10.1 255.255.255.0
!
interface FastEthernet0/0.20
encapsulation dot1Q 20
ip address 172.16.20.1 255.255.255.0
!
interface FastEthernet0/0.99
encapsulation dot1Q 99
ip address 172.16.99.1 255.255.255.0
!
interface FastEthernet0/1
ip address 10.0.0.1 255.255.255.0
duplex auto
speed auto
!
interface Vlan1
no ip address
shutdown
!
ip classless
!
ip flow-export version 9
!
telephony-service
max-ephones 5
max-dn 5
ip source-address 172.16.10.1 port 2000
```

```
auto assign 1 to 5
!
ephone-dn 1
number 4001
!
ephone-dn 2
number 4002
!
ephone 1
device-security-mode none
mac-address 0009.7C4C.6C0B
type 7960
button 1:1
!
ephone 2
device-security-mode none
mac-address 00E0.A333.96DE
type 7960
button 1:2
!
line con 0
exec-timeout 0 0
password 7 0822455D0A16
logging synchronous
login
!
line aux 0
!
line vty 0 4
password 7 0822455D0A16
login
!
end
```

### **Configuration of RouterB1**

```
RouterB-1#!Fatjon Dauti
RouterB-1#show run
Building configuration...
```

Current configuration : 1777 bytes

```
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname RouterB-1
!
enable secret 5 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1
!
ip dhcp excluded-address 172.17.10.1
ip dhcp excluded-address 172.17.20.1
!
ip dhcp pool VOICE
network 172.17.10.0 255.255.255.0
```

```
default-router 172.17.10.1
option 150 ip 172.17.10.1
ip dhcp pool DATA
network 172.17.20.0 255.255.255.0
default-router 172.17.20.1
option 150 ip 172.17.10.1
!
ip cef
no ipv6 cef
!
license udi pid CISCO2811/K9 sn FTX1017G68M-
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
interface FastEthernet0/0.10
encapsulation dot1Q 10
ip address 172.17.10.1 255.255.255.0
!
interface FastEthernet0/0.20
encapsulation dot1Q 20
ip address 172.17.20.1 255.255.255.0
!
interface FastEthernet0/0.99
encapsulation dot1Q 99
ip address 172.17.99.1 255.255.255.0
!
interface FastEthernet0/1
ip address 10.0.0.2 255.255.255.0
duplex auto
speed auto
!
interface Vlan1
no ip address
shutdown
!
ip classless
!
ip flow-export version 9
!
telephony-service
max-ephones 5
max-dn 5
ip source-address 172.17.10.1 port 2000
auto assign 1 to 5
!
ephone-dn 1
number 5001
!
```

```
ephone-dn 2
number 5002
!
ephone-dn 3
number 5003
!
ephone 1
device-security-mode none
mac-address 0001.6482.D71D
type 7960
button 1:1
!
ephone 2
device-security-mode none
mac-address 000A.F3C0.597A
type 7960
button 1:2
!
ephone 3
device-security-mode none
mac-address 0001.C918.4801
type ata
button 1:3
!
line con 0
exec-timeout 0 0
password 7 0822455D0A16
logging synchronous
login
!
line aux 0
!
line vty 0 4
password 7 0822455D0A16
login
!
end
```

### **Configuration of SwitchA1**

```
SwitchA-1#!Fatjon Dauti
SwitchA-1#show run
Building configuration...
Current configuration : 4204 bytes
!
version 12.2(37)SE1
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
!
hostname SwitchA-1
!
enable secret 5 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1
!
no ip domain-lookup
!
```

```
spanning-tree mode pvst
!
interface FastEthernet0/1
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface FastEthernet0/2
 switchport access vlan 20
 switchport mode access
 switchport nonegotiate
 switchport voice vlan 10
 spanning-tree portfast
!
interface FastEthernet0/3
 switchport access vlan 20
 switchport mode access
 switchport nonegotiate
 switchport voice vlan 10
 spanning-tree portfast
!
interface FastEthernet0/4
 switchport access vlan 20
 switchport mode access
 switchport nonegotiate
 spanning-tree portfast
 shutdown
!
interface FastEthernet0/5
 switchport access vlan 20
 switchport mode access
 switchport nonegotiate
 spanning-tree portfast
 shutdown
!
interface FastEthernet0/6
 switchport access vlan 20
 switchport mode access
 switchport nonegotiate
 spanning-tree portfast
 shutdown
!
interface FastEthernet0/7
 switchport access vlan 20
 switchport mode access
 switchport nonegotiate
 spanning-tree portfast
 shutdown
!
interface FastEthernet0/8
 switchport access vlan 20
 switchport mode access
 switchport nonegotiate
 spanning-tree portfast
 shutdown
!
```

```
interface FastEthernet0/9
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
!
interface FastEthernet0/10
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
!
interface FastEthernet0/11
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
!
interface FastEthernet0/12
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
!
interface FastEthernet0/13
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
!
interface FastEthernet0/14
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
!
interface FastEthernet0/15
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
!
interface FastEthernet0/16
switchport access vlan 20
switchport mode access
switchport nonegotiate
spanning-tree portfast
shutdown
```

```
!  
interface FastEthernet0/17  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast  
  shutdown  
!  
interface FastEthernet0/18  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast  
  shutdown  
!  
interface FastEthernet0/19  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast  
  shutdown  
!  
interface FastEthernet0/20  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast  
  shutdown  
!  
interface FastEthernet0/21  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast  
  shutdown  
!  
interface FastEthernet0/22  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast  
  shutdown  
!  
interface FastEthernet0/23  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast  
  shutdown  
!  
interface FastEthernet0/24  
  switchport access vlan 20  
  switchport mode access  
  switchport nonegotiate  
  spanning-tree portfast
```

```

shutdown
!
interface GigabitEthernet0/1
  switchport access vlan 20
  switchport mode access
  switchport nonegotiate
  spanning-tree portfast
  shutdown
!
interface GigabitEthernet0/2
  switchport access vlan 20
  switchport mode access
  switchport nonegotiate
  spanning-tree portfast
  shutdown
!
interface Vlan1
  no ip address
  shutdown
!
interface Vlan99
  mac-address 0060.3eb2.7b01
  ip address 172.16.99.2 255.255.255.0
!
ip classless
!
ip flow-export version 9
!
line con 0
  exec-timeout 0 0
  password 7 0822455D0A16
  logging synchronous
  login
!
line aux 0
!
line vty 0 4
  password 7 0822455D0A16
  login
!
end

```

### **Configuration of SwitchB1**

```

SwitchB-1#!Fatjon Dauti
SwitchB-1#sh run
Building configuration...
Current configuration : 2955 bytes
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname SwitchB-1
!

```



enable secret 5 \$1\$mERr\$9cTjUIEqNGurQiFU.ZeCi1

!

!

no ip domain-lookup

!

spanning-tree mode pvst

spanning-tree extend system-id

!

interface FastEthernet0/1

switchport mode trunk

!

interface FastEthernet0/2

switchport access vlan 20

switchport mode access

switchport voice vlan 10

spanning-tree portfast

!

interface FastEthernet0/3

switchport access vlan 20

switchport mode access

switchport voice vlan 10

spanning-tree portfast

!

interface FastEthernet0/4

switchport access vlan 20

switchport mode access

switchport voice vlan 10

spanning-tree portfast

!

interface FastEthernet0/5

switchport access vlan 20

switchport mode access

spanning-tree portfast

shutdown

!

interface FastEthernet0/6

switchport access vlan 20

switchport mode access

spanning-tree portfast

shutdown

!

interface FastEthernet0/7

switchport access vlan 20

switchport mode access

spanning-tree portfast

shutdown

!

interface FastEthernet0/8

switchport access vlan 20

switchport mode access

spanning-tree portfast

shutdown

!

interface FastEthernet0/9

switchport access vlan 20

switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/10  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/11  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/12  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/13  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/14  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/15  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/16  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/17  
switchport access vlan 20  
switchport mode access  
spanning-tree portfast  
shutdown

!

interface FastEthernet0/18  
switchport access vlan 20  
switchport mode access

```
spanning-tree portfast
shutdown
!
interface FastEthernet0/19
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface FastEthernet0/20
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface FastEthernet0/21
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface FastEthernet0/22
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface FastEthernet0/23
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface FastEthernet0/24
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface GigabitEthernet0/1
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface GigabitEthernet0/2
switchport access vlan 20
switchport mode access
spanning-tree portfast
shutdown
!
interface Vlan1
no ip address
shutdown
!
```

```

interface Vlan99
ip address 172.17.99.2 255.255.255.0
!
line con 0
password 7 0822455D0A16
logging synchronous
login
exec-timeout 0 0
!
line vty 0 4
password 7 0822455D0A16
login
line vty 5 15
password 7 0822455D0A16
login
!
end

```

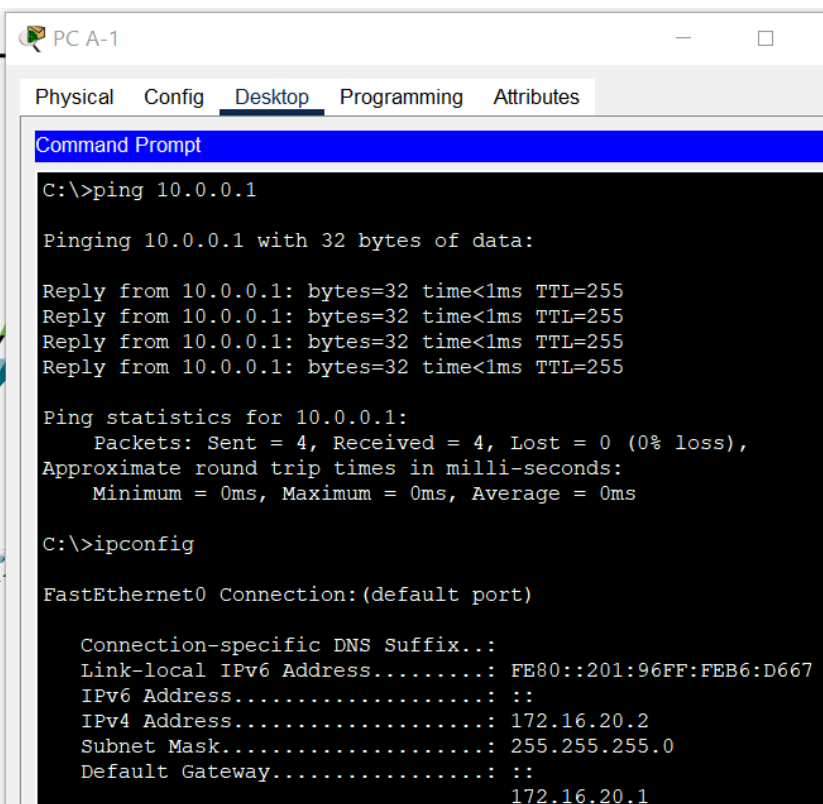
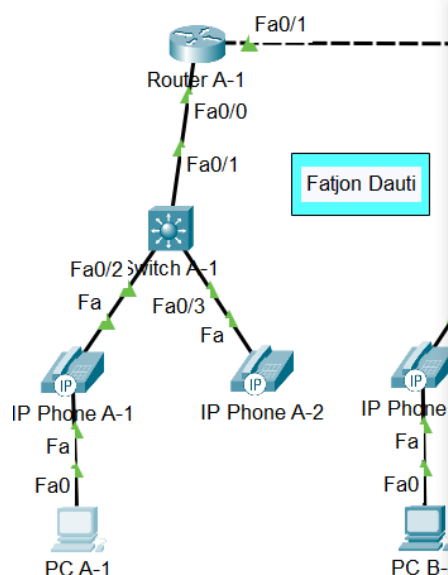
## Step 7: Test the configuration. (10%)

At this point you should have enough configuration done for communications within each site to be working so this is a good time to stop and test your work.

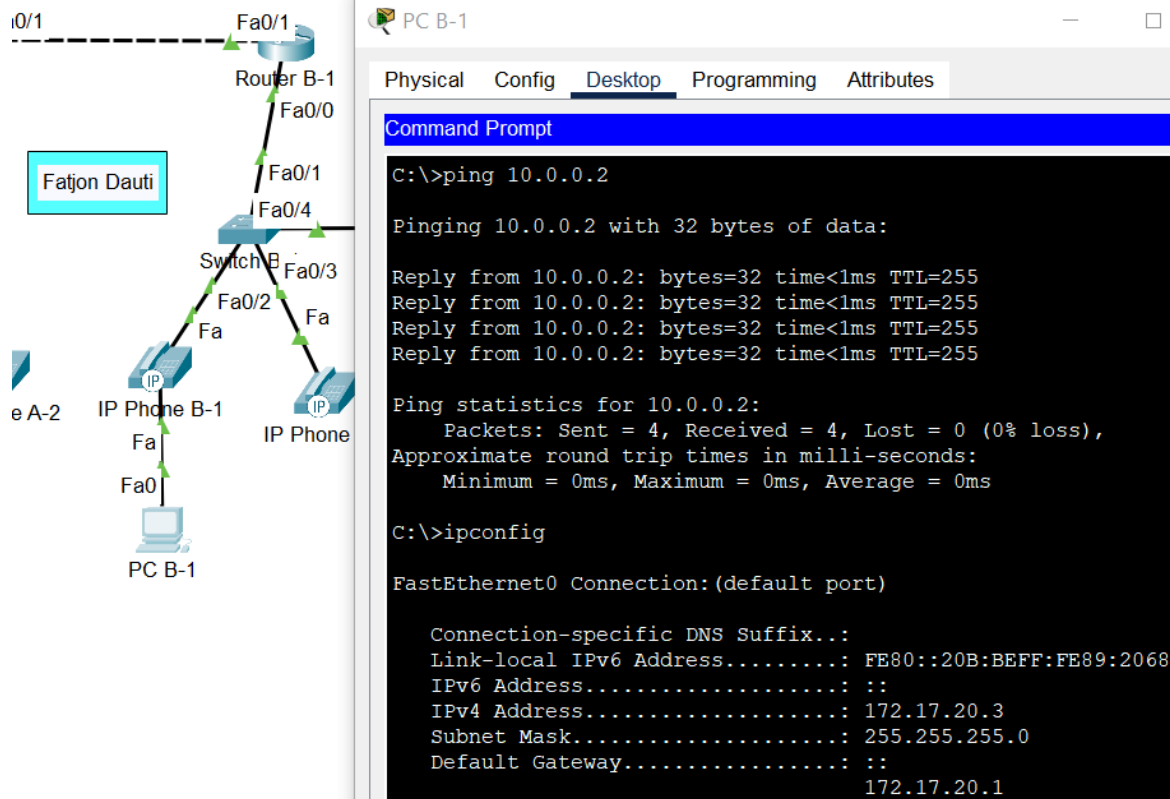
The first thing to check is to ensure all your devices have IP addresses in the appropriate subnets. Note that after you enable all the ports it will take some time for all the devices to attempt requesting a DHCP address again so if you don't see addresses right away wait a couple of minutes and check again. You can easily check the addresses of IP phones and PCs by hovering your mouse over the device in PT and check the listed IP and gateway addresses. You can further check connectivity by pinging one of the interfaces on the router at the same site from each PC.

Insert printouts of these successful ping commands here

Pinging Fa0/1 on RouterA1 from PC A1



## Pinging Fa0/1 on RouterB1 from PC B1



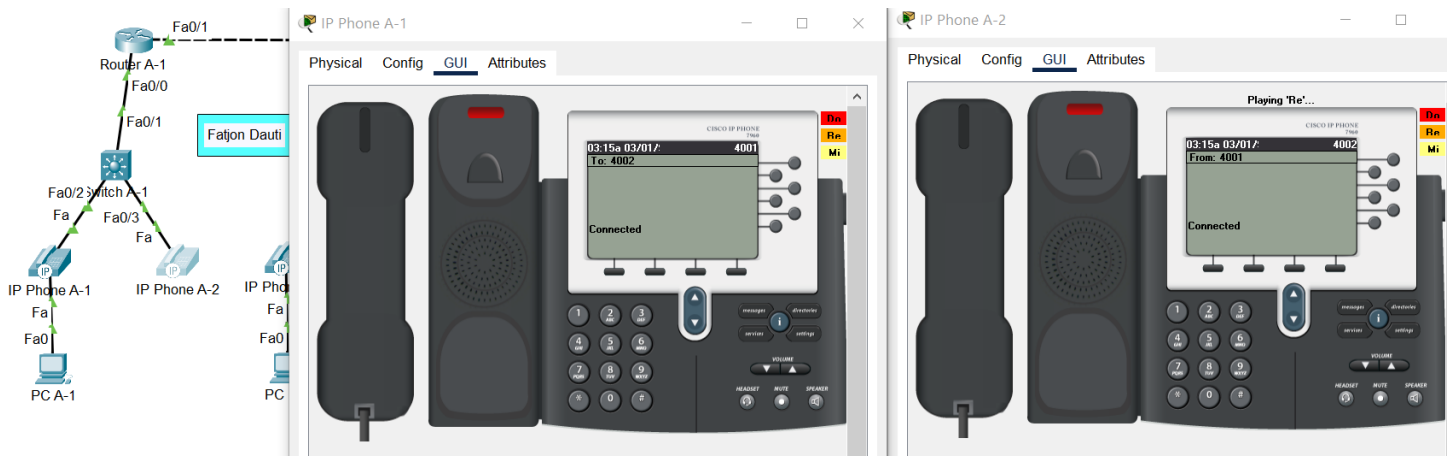
Once your IP phones have IP addresses, they should automatically contact the CUCME software running on the router, register, and get an extension number. You can verify the extension number of each IP phone by hovering your mouse over the phone and looking for a *Line Number* or by opening the phone and checking on the upper right of the display on the GUI tab. Note that the Analog Telephone Adapter (ATA) at site B does not use DHCP option 150 to find the TFTP server and from there the CUCME server. You will have to enter the correct server address on the Config tab of the ATA before the analog phone will receive an extension number.

Once all your devices have extension numbers you can try placing a call between devices at the same site. Click on one of the IP phones and switch to the GUI tab. Open up the same window for another IP phone at the same site and place it next to the first window so you can see both phones at the same time. Enter the extension number of the other phone on the dial pad of one phone and click on the receiver to place the call.

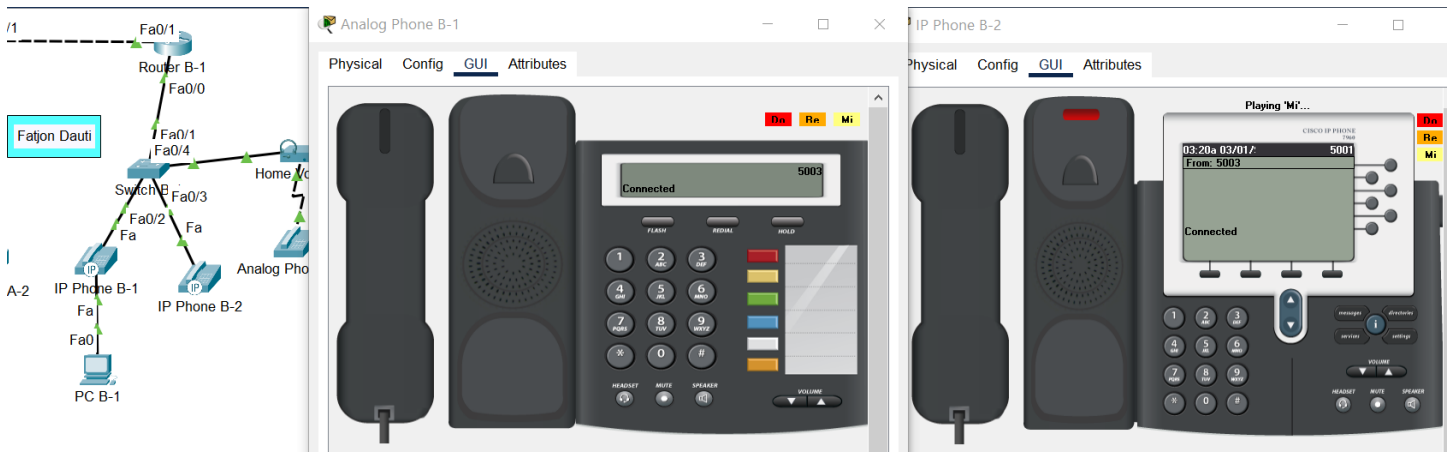
The other phone should indicate that it is ringing and the number of the extension which is calling should appear on the display. Click the receiver on this phone to answer the call. The display should now show the phones are *Connected*. If you look at the upper right corner of each phone (you may have to scroll over to the right) you should see *Do, Re, Mi* buttons. Pressing one of these buttons simulates talking into the phone. If you press one, you should see a message above the phone you are connected to like *Playing 'Do'...* for a short while after you press it. This indicates the connection between the phones is working properly.

Insert printouts of these successful calls here

Site A - Calling 4002 from 4001



### Site B - Calling 5001 from Analog phone 5003



## Step 8: Configure site-to-site calling. (10%)

To enable site-to-site dialing we must make each of the two CUCME systems aware of the other one, so that they can facilitate a connection between phones. Even though the CUCME systems manage the connection the voice traffic is not required to flow through them (though it does in this topology when a call is being made site-to-site). Therefore, the first thing we need to do is make sure that every device at each site will be able to reach all of the devices at the other site.

Add the appropriate routes to each router to enable routing between the sites. The best way to do this is with a single /16 summary route on each of the routers to manually summarize the addresses found at the other site.

Once you have the appropriate routes installed and have tested by successfully pinging from the PC at one site to the PC at the other site we need to setup VoIP call routing between sites. This link is made by what is called a **dial-peer** which identifies specific destination extensions and directs calls made to them to the other CUCME server in much the same way a routing table works for IP traffic. We must also identify what extension numbers to direct to the other server, something done with a **destination-pattern**. Examine the dial-peer configuration given for RouterA-1 below and then enter it into RouterA-1.

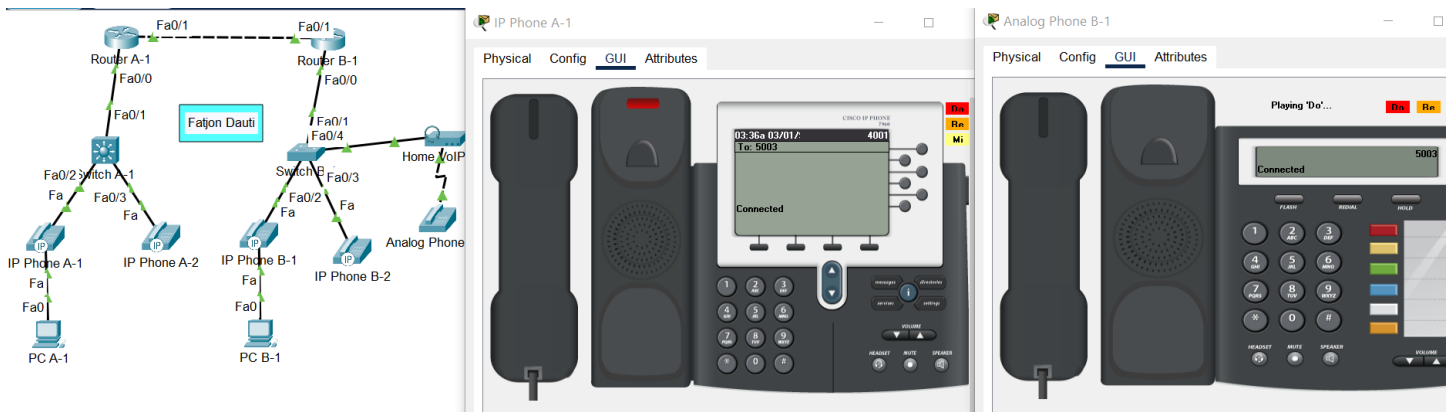
```
RouterA-1(config)# dial-peer voice 1 voip
RouterA-1(config-dial-peer)# destination-pattern 5...
RouterA-1(config-dial-peer)# session target ipv4:10.0.0.2
```

This will identify all extensions which start with a 5 followed by three other digits and direct them to the CUCME server running on RouterB-1. Make the appropriate changes to this configuration and then apply it to RouterB-1 to allow the VoIP devices at site B to call site A as well.

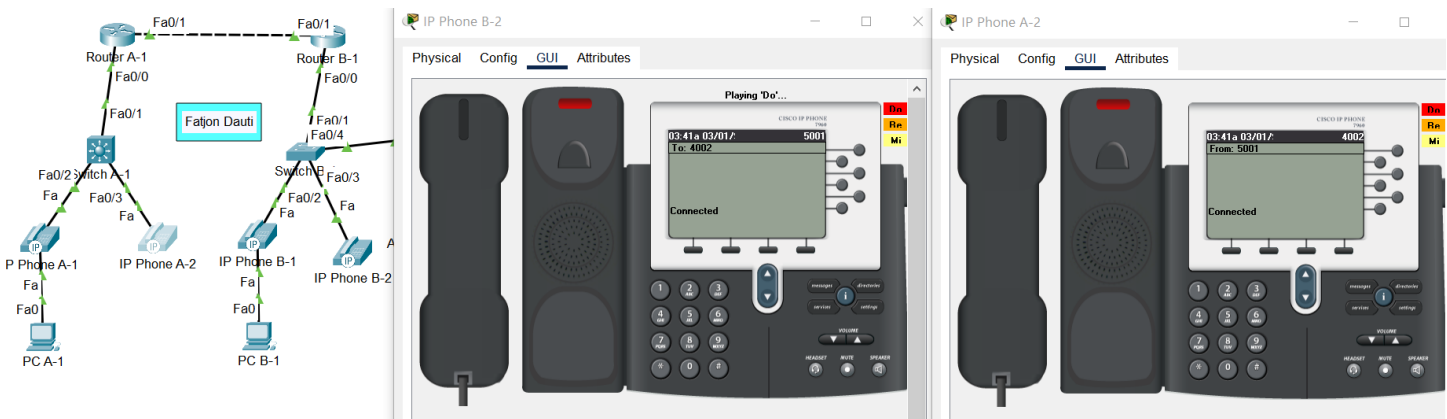
Test your configuration by calling from site A to site B and from site B to site A.

Insert printouts of these successful calls here

## Site A to B - Calling Analog Phone B1 5003 from IP Phone A1 4001



## Site B to A - Calling IP Phone A2 4002 from IP Phone B2 5001



### Additional configurations: (10%)

- Add another VoIP device (IP phone or ATA) to site A
- Setup specific devices to receive specific extensions (DNs). For example, make sure that IP Phone A-1 always receives extension 4001 and IP ATA B-1 always receives extension 5003 instead of allowing devices to auto register. *Hint:* Exploring your running configurations on the routers after you have everything working should provide some hints about how to do this.
- Add a third site and enable calling between all three sites
- Add quality of service (QoS) to the network to prioritize voice traffic over data traffic

Insert configuration printouts here.

Following configurations are related to version B .pkt file

#### Adding another IP Phone to site A

```
SwitchA-1(config)#!adding new phone to f0/4 F.Dauti
SwitchA-1(config)#int f0/4
SwitchA-1(config-if)#switchport voice vlan 10
SwitchA-1(config-if)#no shut
```

```
RouterA-1(config)#!config. IP PhoneA3 F.Dauti to CUCME
RouterA-1(config)#ephone-dn 3
RouterA-1(config-ephone-dn)#number 4003
RouterA-1(config-ephone-dn)#!%LINK-3-UPDOWN: Interface ephone_dsp DN 3.1, changed state to up
RouterA-1(config-ephone-dn)#
%IPPHONE-6-REGISTER: ephone-3 IP:172.16.10.5 Socket:2 DeviceType:Phone has registered.
```

Make sure that IP Phone A-1 always receives extension 4001 and IP ATA B-1 always receives extension 5003

I first disconnected the phones.

```
RouterA-1(config)#!config IPPhoneA1 for 4001 F.Dauti
RouterA-1(config)#no ephone 1
RouterA-1(config)#ephone 1
RouterA-1(config-ephone)#mac-address 0009.7C4C.6C0B
RouterB-1(config-ephone)#button 1:1
```

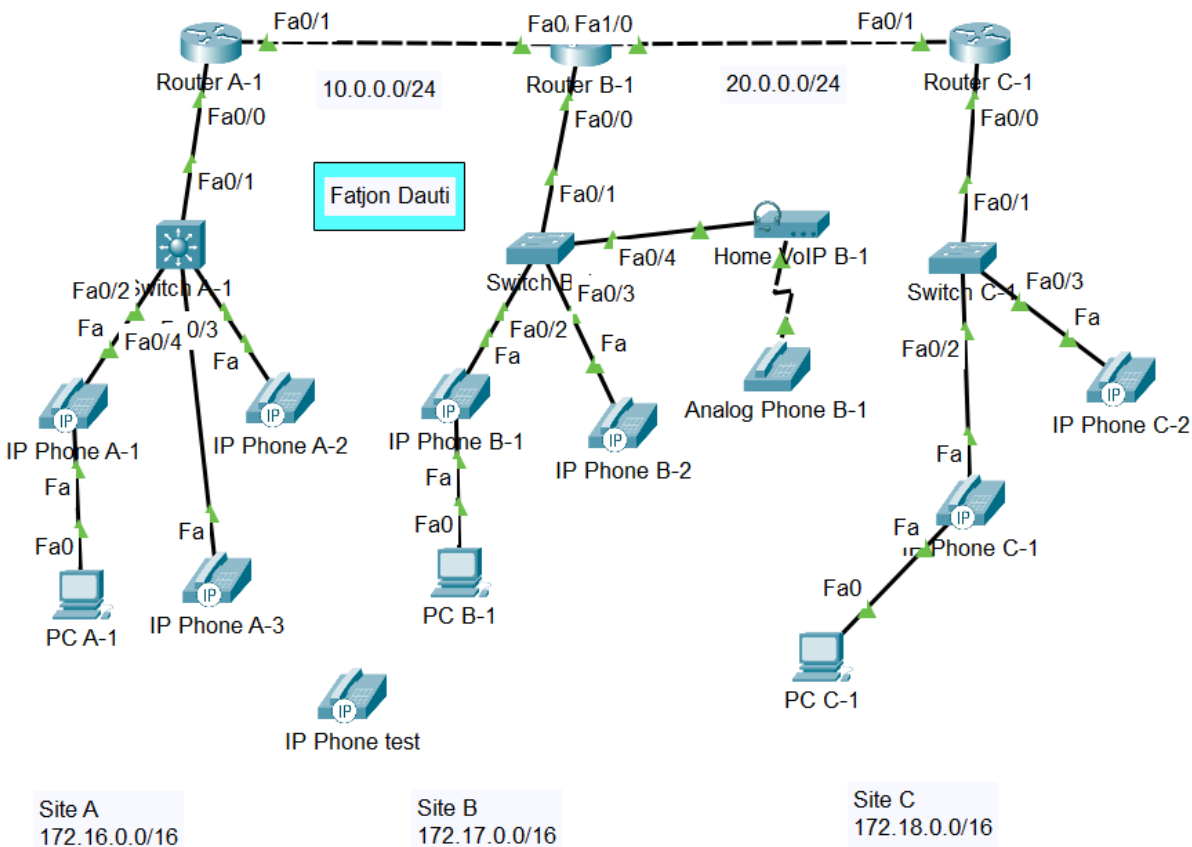
The button 1:1 command, ties the first line to the extension assigned to the first ephone-dn (which is 4001)

```
RouterB-1(config)#!config AnalogPhoneB1 for 5003 F.Dauti
RouterB-1(config)#no ephone 3
RouterB-1(config)#ephone 3
RouterB-1(config-ephone)#mac-address 0001.C918.4801
RouterB-1(config-ephone)#button 1:3
```

The mac-addr above is the one of the ATA device.

Add a third site and enable calling between all three sites

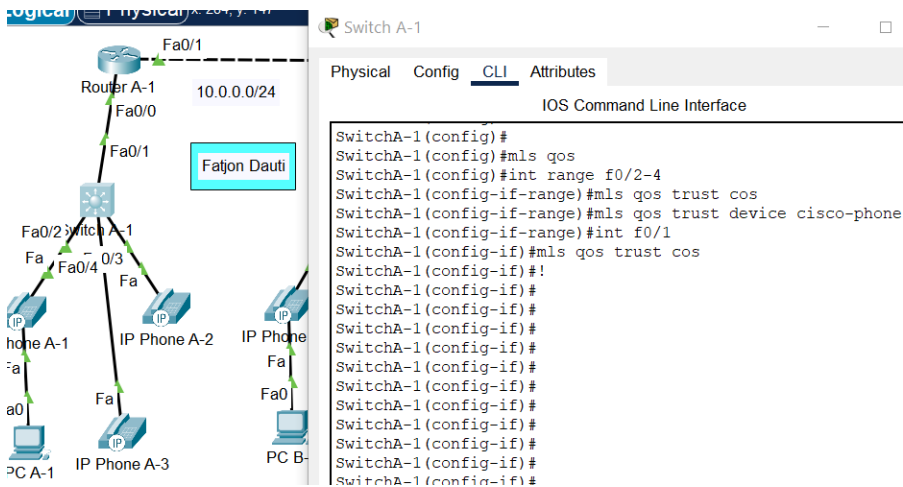
New topology with 3 sites.



p.s. I have used static routes for connecting networks



I couldn't detect any *"auto qos voip"* command on PT. As for *"mls qos"*, only the Switches on PT are supporting it. I applied the following commands to the switches on the interfaces where IP phones are connected, and also one command on the interface connecting to the corresponding router, or ATA device where used. For the *"mls qos trust device"* command, only the cisco-phone option is supported.



SwitchA-1#sh mls qos int f0/2

FastEthernet0/2

trust state: trust cos

trusted mode: trust cos

trust enabled flag: ena

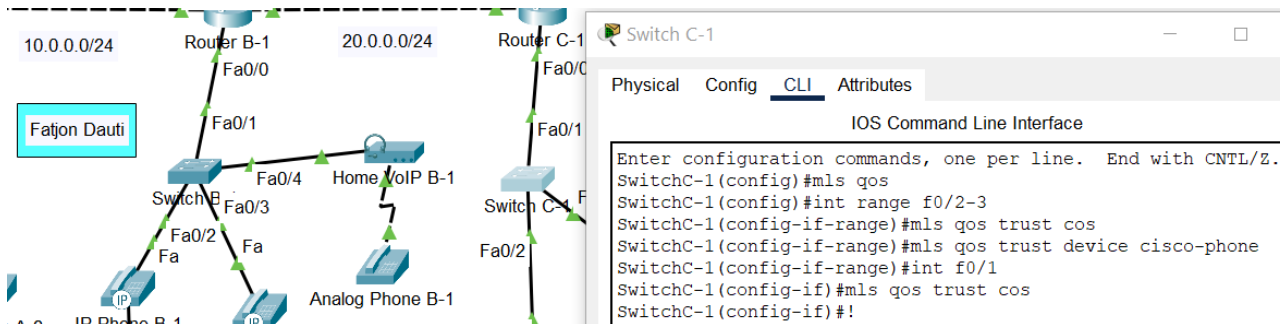
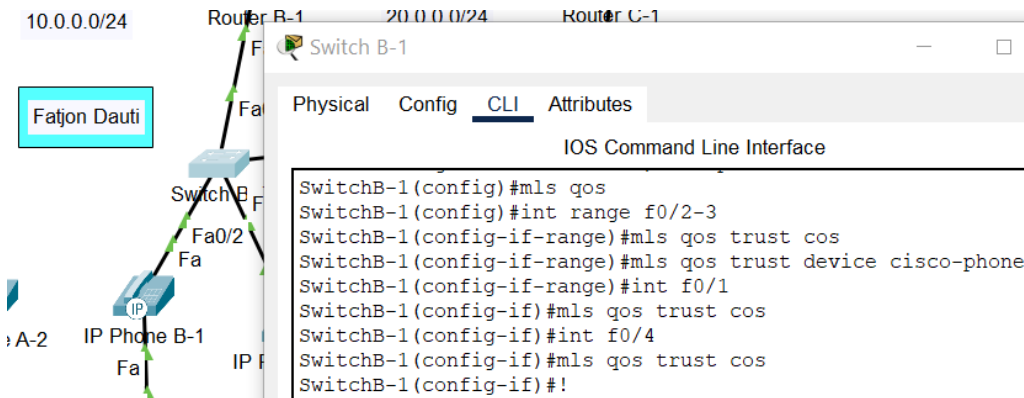
COS override: dis

default COS: 0

DSCP Mutation Map: Default DSCP Mutation Map

Trust device: cisco-phone

qos mode: port-based



Qos commands as showing on the configuration for SwitchC1 2960 above. (for the L3 SwitchA1 the qos commands will not appear in the running configuration, strange)

mls qos

!

interface FastEthernet0/1

switchport mode trunk

mls qos trust cos

!

interface FastEthernet0/2

switchport access vlan 20

switchport mode access

switchport voice vlan 10

spanning-tree portfast

mls qos trust cos

mls qos trust device cisco-phone

!

interface FastEthernet0/3

switchport access vlan 20

```
switchport mode access
switchport voice vlan 10
spanning-tree portfast
mls qos trust cos
mls qos trust device cisco-phone
!
```

Reference for QoS part:

<https://www.cisco.com/c/en/us/support/docs/switches/catalyst-3750-series-switches/91862-cat3750-qos-config.html>