

# VOIP Part 1

CCNP Lab 7

2018-2019

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Cisco CCNP - Hoffman and Mason - Periods 6 and 7

# VOIP Part 1 Lab 7

## **Purpose**

The purpose of this lab was to implement Voice Over IP (Internet Protocol) and set up two phones to communicate to each other using this service.

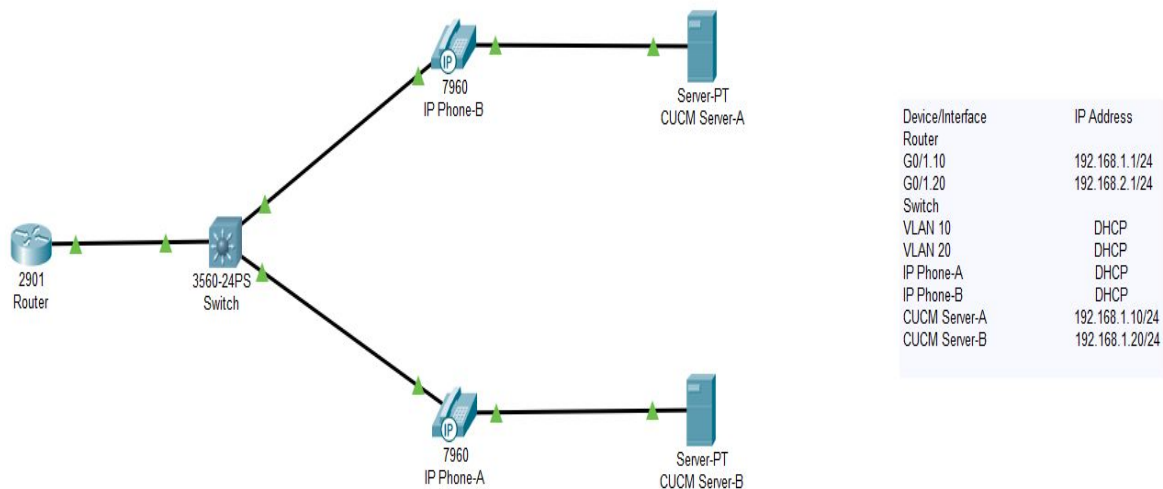
## **Background Information**

Voice Over IP, also known as VOIP, is a method of providing voice and multimedia communication over internet protocol (IP) services such as the internet. Through this, one can place free phone calls, by bypassing phone companies and their fees entirely. IP Phones, are special phones that have a RJ-45 ethernet port, rather than RJ11 port, which allows them to be directly connected to a host. The protocol used by the phones is called SCCP (Skinny Client Control Protocol). This is a proprietary protocol, originally made by Selsius Systems, but acquired later by Cisco. It allows for real time audio stream on clients, which use this protocol, giving them the capability to send audio back and forth, in real time. In this case the “clients” are the IP Phones. This protocol works in conjunction with the CUCM to achieve this real time stream of audio. The Cisco Unified Communications Manager (CUCM) is an Internet Protocol (IP) based system that allows for communication using voice, video and other data and media outlets. This software can be installed on a server to make it accessible from anywhere, allowing for secure and cost effective communication of any type, available in any network.

## Lab Summary

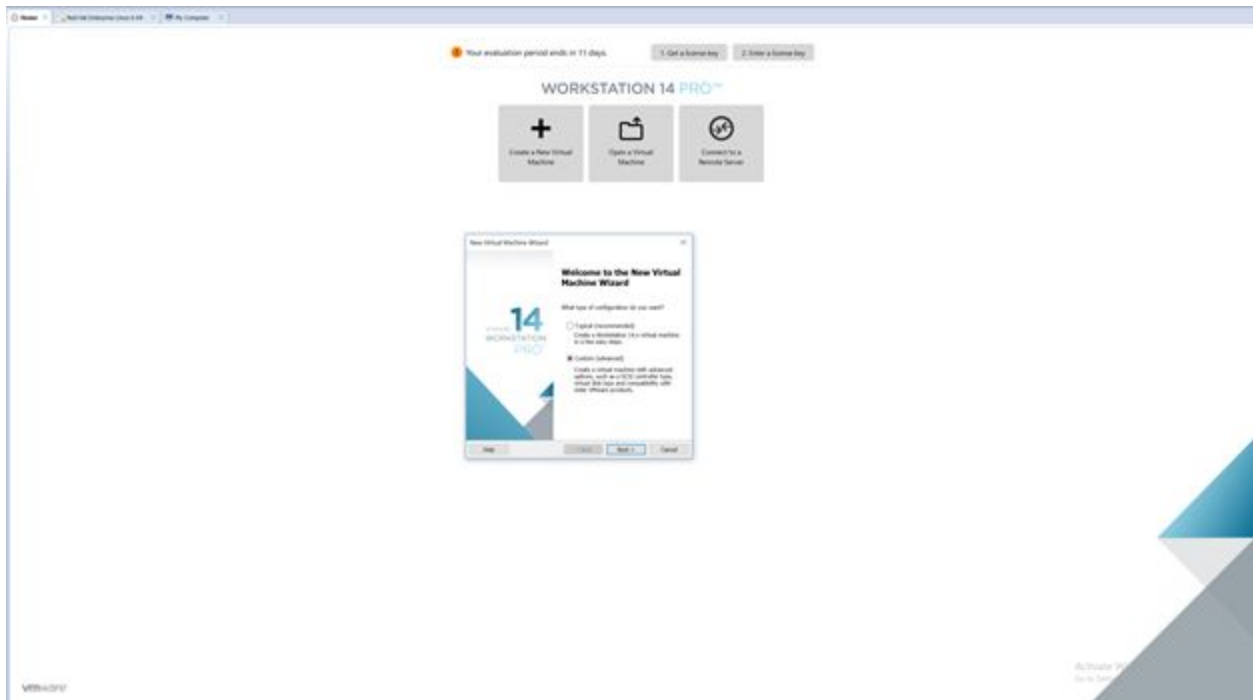
For this lab, we set up two IP Phones connected to a VM running the CUCM software. Through some CUCM setup in the browser software, we got the two phones able to communicate to each other, ringing each other. The phones can call one another and audio can be heard from one phone to another.

## Network Diagram



## Configuration Screenshots

Step 1:



Assign IP addressing schemes to the topology and run the DHCP commands on the router. Open VMWare on the computer connected to a router and create a new virtual machine. Select the custom option, which will allow for the server to be configured manually. Click next to be prompted to locate the image of the server.

New Virtual Machine Wizard

**Guest Operating System Installation**

A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?


Install from:

☐ Installer disc:

No drives available

☒ Installer disc image file (iso):

C:\Users\cisco\Desktop\VoIP files\CUCM10\_Suite\Bootz Browse...

 Could not detect which operating system is in this disc image.  
You will need to specify which operating system will be installed.

☐ I will install the operating system later.

The virtual machine will be created with a blank hard disk.

Help < Back Next > Cancel

## Step 2:

New Virtual Machine Wizard

**Select a Guest Operating System**

Which operating system will be installed on this virtual machine?

Guest operating system

☐ Microsoft Windows

☒ Linux

☐ Novell NetWare

☐ Solaris

☐ VMware ESX

☐ Other

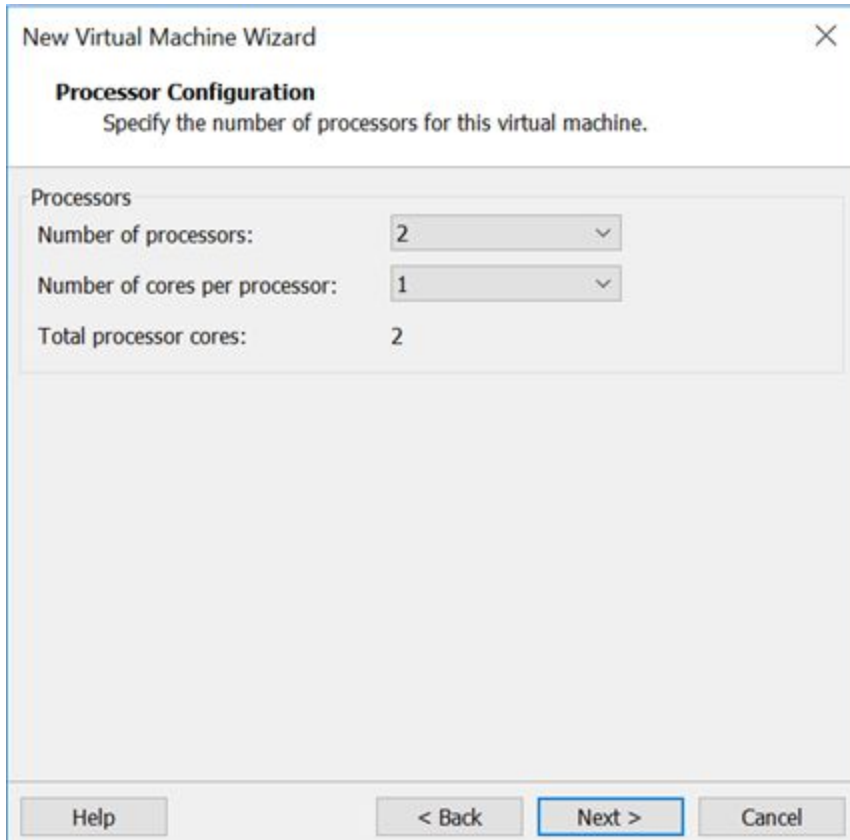
Version

Red Hat Enterprise Linux 6 64-bit

Help < Back Next > Cancel

VMWare will not be able to recognize an operating system that is compatible with the CUCM image. To bypass this choose Red Hat Enterprise Linux 64-bit from the dropdown.

Step 3:



New Virtual Machine Wizard

**Processor Configuration**  
Specify the number of processors for this virtual machine.

Processors

Number of processors: 2

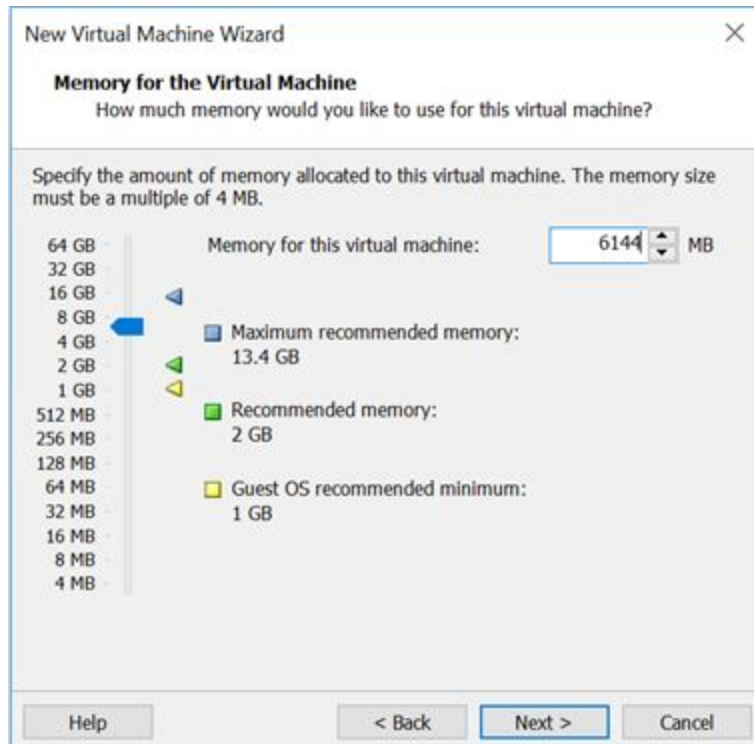
Number of cores per processor: 1

Total processor cores: 2

Help < Back Next > Cancel

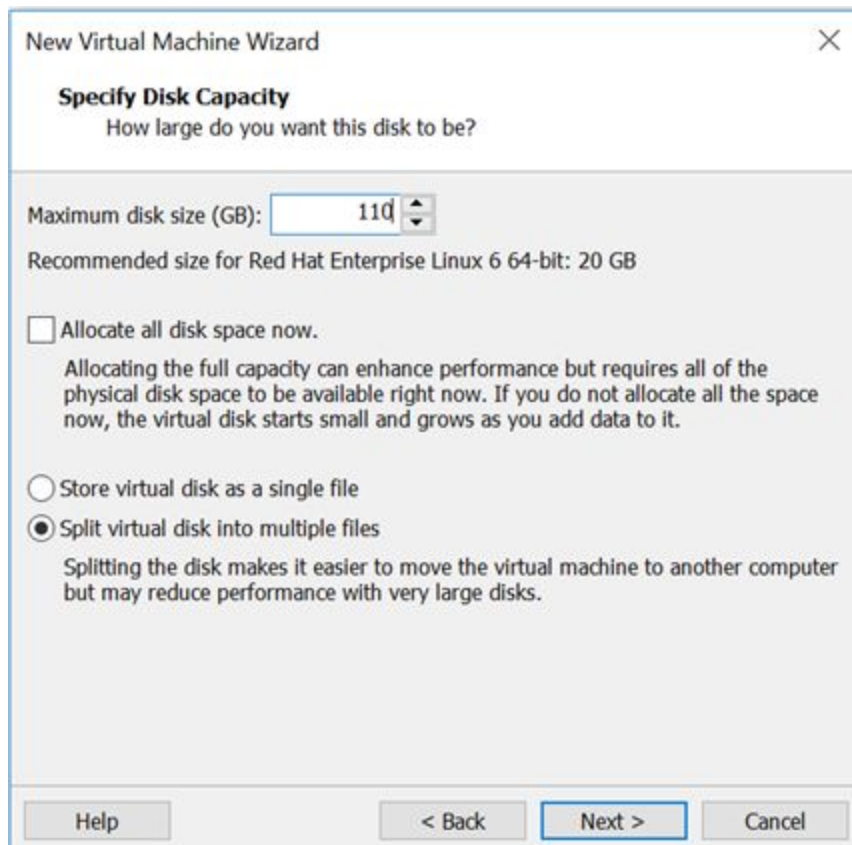
Server must be configured with 2 processors and at least one core for each processor.

Step 4:



Server must configure the server with at least 6GB of RAM so that the server runs smoothly.

Step 5:



From here , keep choosing recommended settings up until disk capacity set up is reached, the server to run smoothly requires at least 80 GB of space. After this is done, the server will automatically begin to setup on VMware.

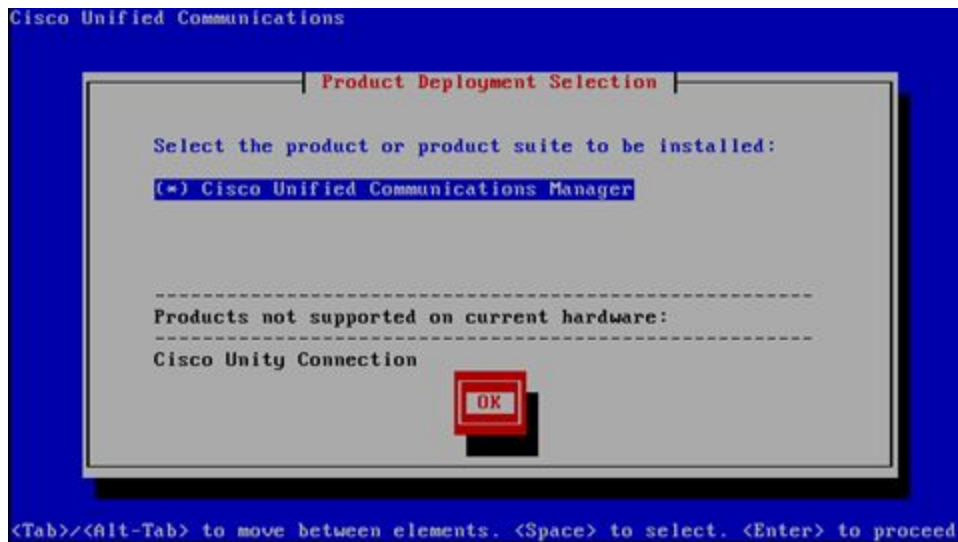
Step 6:





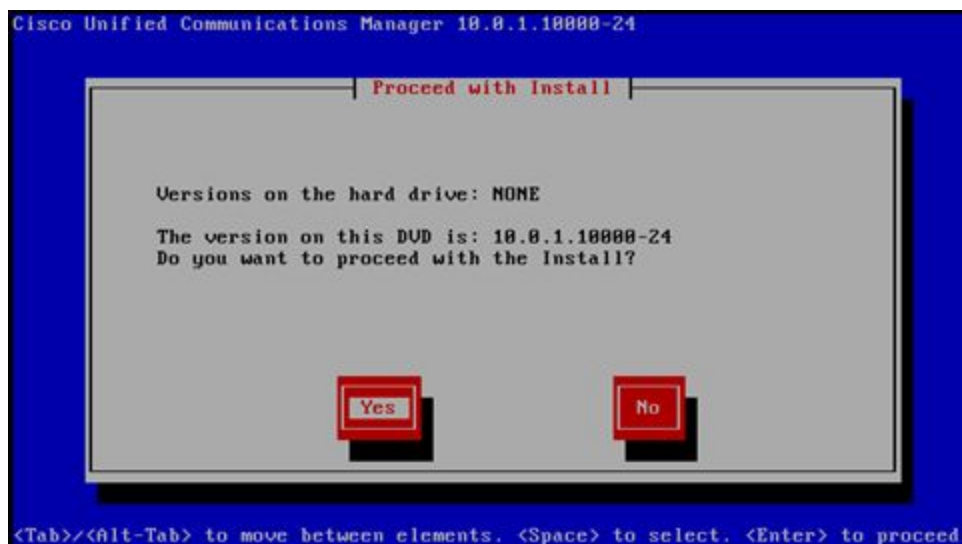
Click “OK” for testing the media. If “Skip” is chosen then the server will not find any flaws in the server and that might lead to it terminating its installation.

Step 7:



Choose the “Cisco Unified Communications Manager” product suite as that is what is used to configure the IP Phones (no other option should show up, most likely).

Step 8:



After it completes the last step, the GUI will notify the user of the version of the image. Click “Yes” to continue the installation process.

### Step 9:



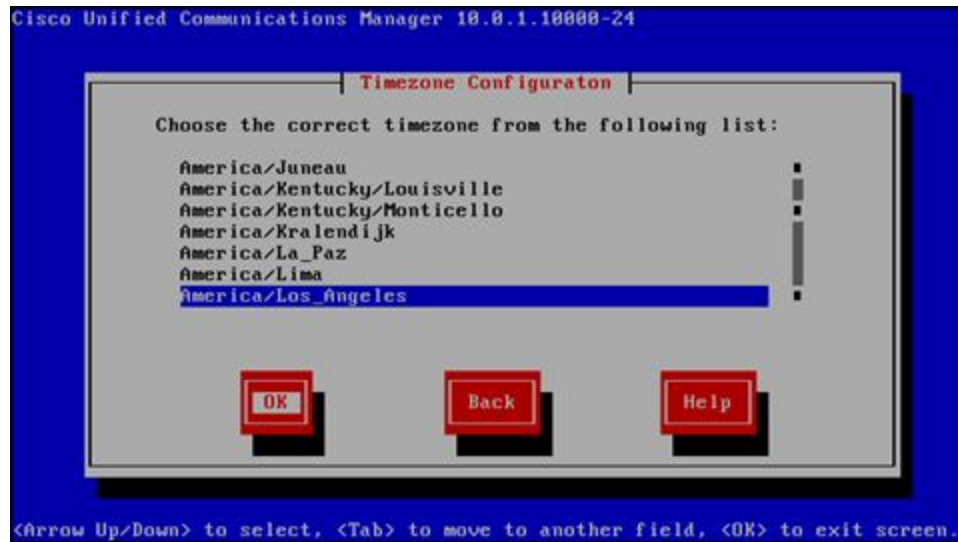
Continue with the pre-installation tasks by choosing the “Proceed” option. This will allow for configuration of the server, so it is crucial in completing this step.

### Step 10:



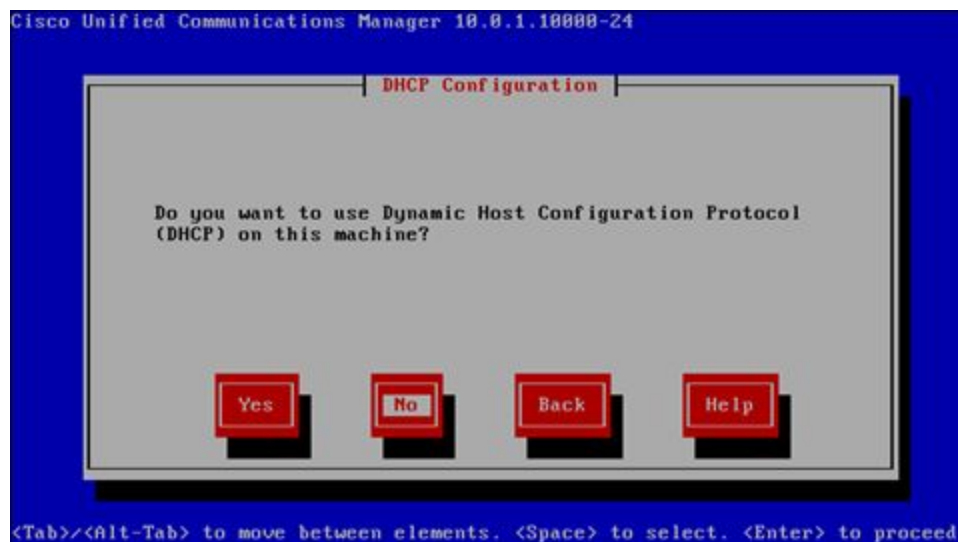
For the purposes of the lab, choose “No” to apply the upgrade patch. If connected to the internet, “Yes” can be chosen to apply the patch.

### Step 11:



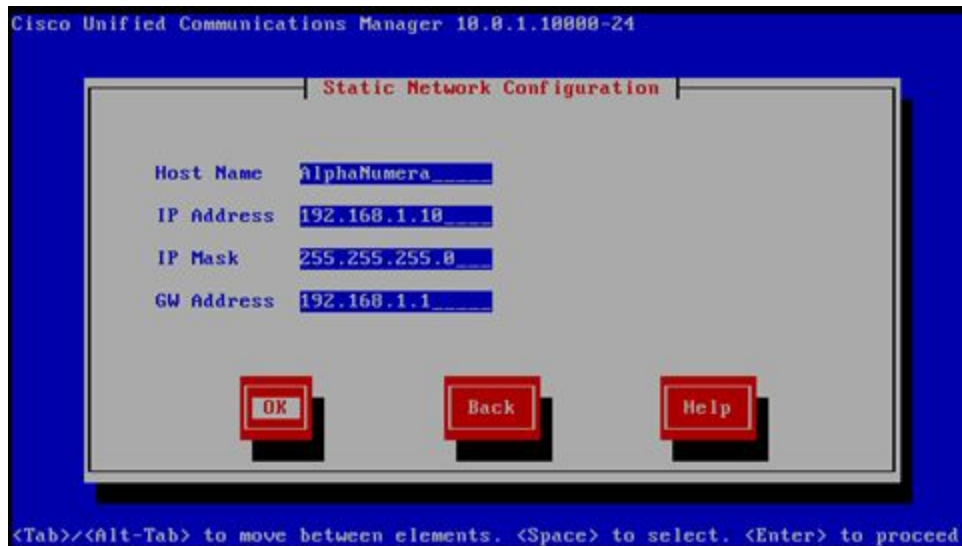
Choose the timezone and click “OK” to go on.

Step 12:



Choose “No” for configuring DHCP on the server, even though DHCP is being used on the router. It should not be used to provide addresses to the server, because the router DHCP is not going to be able to provide enough addresses to the server.

Step 13:



Follow the topology and enter the address into the server that is in alignment with the topology and provide the server a name.

Step 14:



Choose "No" for DNS as if the server can't find a DNS (which in the lab it won't) then it will terminate the install.

Step 15:

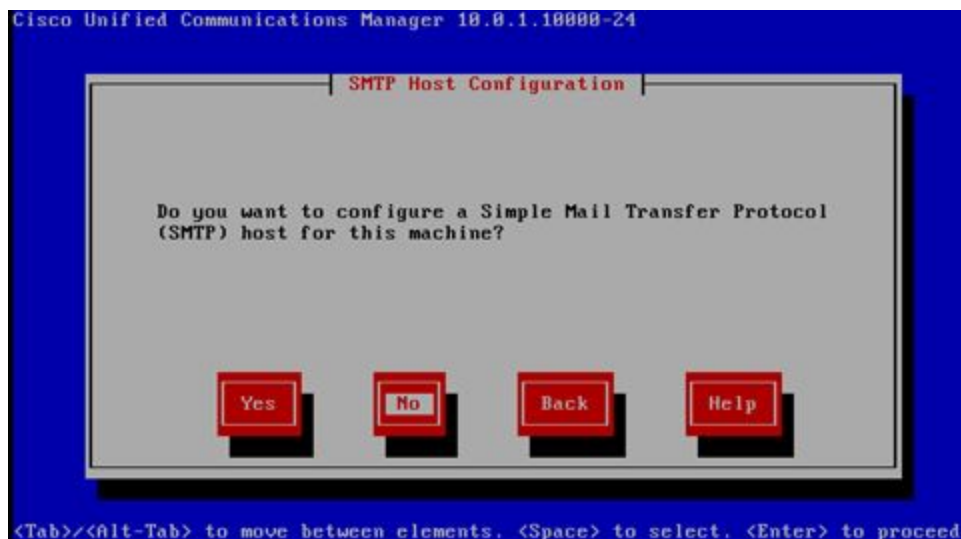
Enter a administrator ID and password into the wizard when prompted, this login will be used to login to the CUCM server in the web browser.

Step 16:



A NTP server must be created for the installation to finish. In the router the command “ntp master” must be entered in the router to create an NTP server, and the feed the IP address into the wizard.

Step 17:



Select “No” for SMTP as no mailing service is needed for this lab.

Step 18:

Create a username and password that can be used to login to the application and press “OK”. Then the server will install on VMware and notify of any errors. Once it’s done, it will prompt a login, to which the user must enter their username and password and then this screen will show.

```
The installation of Cisco Unified Communications Manager has completed successfully.

Cisco Unified Communications Manager 10.0.1.10000-24
AlphaNumera login: Tanishk
Password:
Last login: Mon Feb 25 14:00:31 on tty1
Command Line Interface is starting up, please wait ...

Welcome to the Platform Command Line Interface

VMware Installation:
  128 vCPU: Intel(R) Core(TM) i7-6700 CPU @ 3.40GHz
  Disk 1: 110GB, Partitions aligned
  6144 Mbytes RAM

admin:_
```

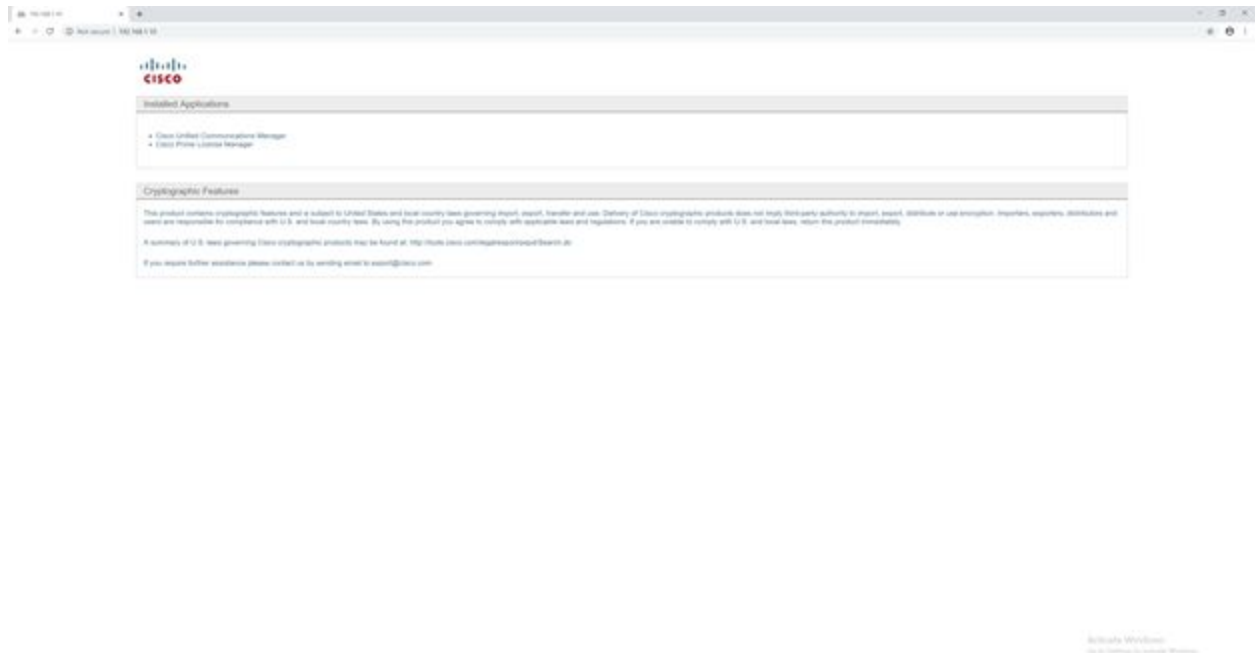
#### Step 19:

During the installation or after, “telephony-service” command must be entered in the router. This sets up the router in telephony service mode, which allows for the configuration of phone directories, and how many phones to setup. An IP address for the CUCM must be specified so the command “ip source-address [address] port [port]” must be entered. Another command is “option 150 ip [address]” under DHCP router-config mode.

#### Step 20:

The switch must be configured with 2 VLANs, getting its IP address from the router. One vlan must manage the ports connected to the IP phones and the other must be set up as a voice VLAN by entering “switchport voice vlan [vlan number]”.

#### Step 21:



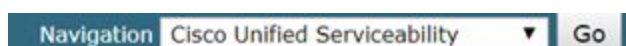
After all the setup and installation, the IP phones should be able to be pinged. Disconnect from the internet, open a browser and type the IP address of the CUCM server and this screen should appear. Then click the option “Cisco Unified Communication Manager.”

#### Step 22:



Using the credentials used in the installation progress, login to the server and configure the IP phones.

#### Step 23:



Using the dropdown shown above, select “Cisco Unified Serviceability” and press “Go”. Then activate all the services shown in the image below.

<a href="#">Back</a> <a href="#">Get to Default</a> <a href="#">Refresh</a>		
<b>Status</b> <a href="#">Refresh</a>		
<b>Select Service</b> Service: <span>Application-CM Admin Tools ▾</span> <span>(36)</span> <a href="#">Check All Services</a>		
<b>CM Services</b>		
<input type="checkbox"/>	<b>Service Name</b>	<b>Activation Status</b>
<input type="checkbox"/>	Cisco CallManager	Not Activated
<input type="checkbox"/>	Cisco Unified Mobile Voice Access Service	Not Activated
<input type="checkbox"/>	Cisco IP Video Media Streaming App	Not Activated
<input type="checkbox"/>	Cisco CTIManager	Not Activated
<input type="checkbox"/>	Cisco Extension Mobility	Not Activated
<input type="checkbox"/>	Cisco Extended Functionality	Not Activated
<input type="checkbox"/>	Cisco SMDP Monitor Service	Not Activated
<input type="checkbox"/>	Cisco Information Calling Network	Not Activated
<input type="checkbox"/>	Cisco Location Redirection Manager	Not Activated
<input type="checkbox"/>	Cisco Directory Number Area Code	Not Activated
<input type="checkbox"/>	Cisco Directory Number Area Lookup	Not Activated
<input type="checkbox"/>	Cisco Shared Number Analyzer	Not Activated
<input type="checkbox"/>	Cisco VPM	Not Activated
<b>CTI Services</b>		
<input type="checkbox"/>	<b>Service Name</b>	<b>Activation Status</b>
<input type="checkbox"/>	Cisco IP Manager Assistant	Deactivated
<input type="checkbox"/>	Cisco WebViewer Web Service	Deactivated
<input type="checkbox"/>	Self Provisioning UI	Deactivated
<b>CDM Services</b>		
<input type="checkbox"/>	<b>Service Name</b>	<b>Activation Status</b>
<input type="checkbox"/>	Cisco CDM - CDMCommand Service	Deactivated
<input type="checkbox"/>	Cisco CDM Web Service	Deactivated
<b>Database and Admin Services</b>		
<input type="checkbox"/>	<b>Service Name</b>	<b>Activation Status</b>
<input type="checkbox"/>	Cisco Bulk Provisioning Service	Deactivated
<input type="checkbox"/>	Cisco AXL Web Service	Not Activated
<input type="checkbox"/>	Cisco AXL Web Service	Deactivated
<input type="checkbox"/>	Cisco TAPI Service	Deactivated
<b>Performance and Monitoring Services</b>		
<input type="checkbox"/>	<b>Service Name</b>	<b>Activation Status</b>
<input type="checkbox"/>	Cisco Performance Reporter	Deactivated
<input type="checkbox"/>	Cisco CallManager Config Service	Deactivated
<b>Security Services</b>		
<input type="checkbox"/>	<b>Service Name</b>	<b>Activation Status</b>
<input type="checkbox"/>	Cisco TLS Provider	Deactivated
<input type="checkbox"/>	Cisco Certificate Authority Proxy Function	Deactivated
<b>Directory Services</b>		
<input type="checkbox"/>	<b>Service Name</b>	<b>Activation Status</b>
<input type="checkbox"/>	Cisco Directory	Deactivated


Using the same dropdown, select “Cisco Unified CM Administration” to register the IP Phones and assign them a number.

Navigation
 Cisco Unified CM Administration ▾
Go

Step 24:



Status

 Status: Ready

User Information

User Status

Active Local User

User ID \*

123

Password

.....

Edit Credential

Confirm Password

.....

Self-Service User ID

PIN

.....

Edit Credential

Confirm PIN

.....

Last name \*

321

Middle name

First name

Title

Directory URI

Telephone Number

Home Number

Mobile Number

Pager Number

Mail ID

Manager User ID

Department

User Locale

< None >

Associated PC

Digest Credentials

Confirm Digest Credentials

User Profile


Use System Default( \*Standard (Factory Default) Us

[View Details](#)


CUCM requires adding a user profile to register the devices. To add a user, hover over “User Management” and select “end user.” Then select “add.” Image above is an example of the screen to add a new user.

#### Step 25:

Then manually register the IP phone. Go through “device” then “phone” then “add”. Then select the model of the phone from the dropdown and select “next”.

 Next


**Status**


 Status: Ready

**Select the type of phone you would like to create**

Phone Type \*

Next

 \*- indicates required item.

 \*\*- Create a phone template using the Bulk Administration Tool to enable template-based phone creation.

Step 26:

<input checked="" type="checkbox"/> Device Is Active	
<input checked="" type="checkbox"/> Device is trusted	
MAC Address*	001DA219FB0F
Description	SEP001DA219FB0F
Device Pool*	Default <a href="#">View Details</a>
Common Device Configuration	< None > <a href="#">View Details</a>
Phone Button Template*	Standard 7940 SCCP
Softkey Template	< None >
Common Phone Profile*	Standard Common Phone Profile <a href="#">View Details</a>
Calling Search Space	< None >
AAR Calling Search Space	< None >
Media Resource Group List	< None >
User Hold MOH Audio Source	< None >
Network Hold MOH Audio Source	< None >
Location*	Hub_None
AAR Group	< None >
User Locale	< None >
Network Locale	< None >
Built In Bridge*	Default
Privacy*	Default
Device Mobility Mode*	Default <a href="#">View Current Device Mobility Settings</a>
Owner	<input type="radio"/> User <input checked="" type="radio"/> Anonymous (Public/Shared Space)
Owner User ID	
Phone Load Name	
Join Across Lines	Default
Use Trusted Relay Point*	Default
BLF Audible Alert Setting (Phone Idle)*	Default
BLF Audible Alert Setting (Phone Busy)*	Default
Always Use Prime Line*	Default
Always Use Prime Line for Voice Message*	Default
Geolocation	< None >
<input checked="" type="checkbox"/> Retry Video Call as Audio	
<input type="checkbox"/> Ignore Presentation Indicators (internal calls only)	
<input checked="" type="checkbox"/> Allow Control of Device from CTI	
<input checked="" type="checkbox"/> Logged Into Hunt Group	
<input type="checkbox"/> Remote Device	
<input type="checkbox"/> Hot line Device*****	

To register the phone, provide the MAC Address and make sure the description is correct. The “device pool” should be made default. The “Common Phone Profile” should be left “Standard {phone model} SCCP” as it is the protocol that must be used.

Step 27:

After the registration of the phone, a line must be added to it. A link next to a phone that was registered saying “Line [1] - Add a new DN”. In order to add a line and associate a number with the phone, that link must be clicked.

**Association**

Modify Button Items

- 1 [Line \[1\] - 666 \(no partition\)](#)
- 2 [Add a new SD](#)
- 3 [Line \[2\] - Add a new DN](#)
- 4 [Add a new SD](#)
- 5 [Add a new SURL](#)
- 6 [Add a new BLF SD](#)
- 7 [Add a new BLF Directed Call Park](#)
- 8 Privacy
- 9 None

Step 28:

**Directory Number Information**

Directory Number\* 3000 ☐ Urgent Priority

Route Partition < None >

Description

Alerting Name

ASCII Alerting Name

External Call Control Profile < None >

☒ Allow Control of Device from CTI

Associated Devices SEP001E4A5F0F79

**Edit Device**

**Edit Line Appearance**

Dissociate Devices

Once this screen appears, the user has to provide a Directory Number that can be anything, which will be used to call the phone.

Step 29:

Association		Phone Type	
<div>Modify Button Items</div> <div> <div>1</div> <div>Line [1] - 3000 (no partition)</div> <div>Unassigned Associated Items</div> <div>2</div> <div>Line [2] - Add a new DN</div> <div>3</div> <div>Add a new SQ</div> <div>4</div> <div>Add a new SUSL</div> <div>5</div> <div>Add a new BLF SQ</div> <div>6</div> <div>Add a new BLF Directed Call Park</div> <div>7</div> <div>Callback</div> <div>8</div> <div>Call Park</div> <div>9</div> <div>Call Pickup</div> <div>10</div> <div>Conference List</div> <div>11</div> <div>Conference</div> <div>12</div> <div>Do Not Disturb</div> <div>13</div> <div>End Call</div> <div>14</div> <div>Forward All</div> <div>15</div> <div>Group Call Pickup</div> <div>16</div> <div>Hold</div> <div>17</div> <div>Hunt Group Logout</div> <div>18</div> <div>Intercom [1] - Add a new Intercom</div> <div>19</div> <div>Malicious Call Identification</div> <div>20</div> <div>Meet Me Conference</div> <div>21</div> <div>Mobility</div> <div>22</div> <div>New Call</div> <div>23</div> <div>Other Pickup</div> <div>24</div> <div>Quality Reporting Tool</div> <div>25</div> <div>Redial</div> <div>26</div> <div>Remove Last Participant</div> <div>27</div> <div>Transfer</div> <div>28</div> <div>Video Mode</div> <div>29</div> <div>Queue Status</div> <div>30</div> <div>Privacy</div> <div>31</div> <div>None</div> </div>		<div>Product Type: Cisco 7970</div> <div>Device Protocol: SCCP</div>	
		<div>Real-time Device Status</div> <div> <div>Registration:</div> <div>Registered with Cisco Unified Communications Manager AlphaNumera</div> <div>IPv4 Address:</div> <div>192.168.1.2</div> <div>Active Load ID:</div> <div>SCCP0.9-3-1SR3-15</div> <div>Download Status:</div> <div>None</div> </div>	
		<div>Device Information</div> <div> <div> <div>Device Is Active</div> <div>Device Is Truited</div> <div>MAC Address</div> <div>Description</div> <div>Device Pool</div> <div>Common Device Configuration</div> <div>Phone Button Template</div> <div>Softkey Template</div> <div>Common Phone Profile</div> <div>Calling Search Space</div> <div>AAR Calling Search Space</div> <div>Media Resource Group List</div> <div>User Hold MOH Audio Source</div> <div>Network Hold MOH Audio Source</div> <div>Location</div> <div>AAR Group</div> <div>User Locale</div> <div>Network Locale</div> <div>Built In Bridge</div> <div>Privacy</div> <div>Device Mobility Mode</div> <div>Owner</div> <div>Owner User ID</div> <div>Phone Personalization</div> <div>Services Provisioning</div> <div>Phone Load Name</div> <div>Single Button Barge</div> <div>Join Across Lines</div> <div>Use Trusted Relay Point</div> <div>BLF Audible Alert Setting (Phone Idle)</div> <div>BLF Audible Alert Setting (Phone Busy)</div> <div>Always Use Prime Line</div> <div>Always Use Prime Line for Voice Message</div> <div>Geolocation</div> </div> <div> <div>001E4A5F0F79</div> <div>Auto 3000</div> <div>Default</div> <div>&lt; None &gt;</div> <div>Universal Device Template Button Layout</div> <div>&lt; None &gt;</div> <div>Standard Common Phone Profile</div> <div>&lt; None &gt;</div> <div>&lt; None &gt;</div> <div>&lt; None &gt;</div> <div>&lt; None &gt;</div> <div>Hub_None</div> <div>&lt; None &gt;</div> <div>&lt; None &gt;</div> <div>Default</div> <div>Default</div> <div>Default</div> <div>Anonymous (Public/Shared Space)</div> <div>Default</div> <div>Default</div> <div></div> <div>Default</div> <div>Default</div> <div>Default</div> <div>Default</div> <div>Default</div> <div>&lt; None &gt;</div> </div> <div> <div>View Details</div> <div>View Details</div> <div>View Details</div> <div>View Current Device Mobility Settings</div> </div> </div> <div> <div> <div>Retry Video Call as Audio</div> <div>Ignore Presentation Indicators (Internal calls only)</div> <div>Allow Control of Device from CTI</div> <div>Logged Into Hunt Group</div> <div>Remote Device</div> <div>Protected Device</div> <div>Hot Line Device</div> </div> </div>	

Repeat the same steps for the other phone, and you should be able to call the phones.

## On Device Configurations

### Router Configuration:

#### Router# show run

```
hostname Router
boot-start-marker
boot-end-marker
no aaa new-model
memory-size iomem 25
ip cef
ip dhcp excluded-address 192.168.1.10
ip dhcp excluded-address 192.168.2.10
ip dhcp pool voice
```

```

network 192.168.1.0 255.255.255.0
default-router 192.168.1.1
dns-server 209.165.200.254
option 150 ip 192.168.1.10
ip dhcp pool data
network 192.168.2.0 255.255.255.0
default-router 192.168.2.1
dns-server 209.165.200.254
option 150 ip 192.168.1.10
ntp master
no ipv6 cef
multilink bundle-name authenticated
voice-card 0
license udi pid CISCO2901/K9 sn FTX180180M8
license accept end user agreement
license boot module c2900 technology-package securityk9
license boot module c2900 technology-package uck9
vtp domain CCNP
vtp mode transparent
redundancy
interface Embedded-Service-Engine0/0
no ip address
shutdown
interface GigabitEthernet0/0
no ip address
shutdown
duplex auto
speed auto
interface GigabitEthernet0/1
no ip address
duplex auto
speed auto
interface GigabitEthernet0/1.10
encapsulation dot1Q 10
ip address 192.168.1.1 255.255.255.0
interface GigabitEthernet0/1.20
encapsulation dot1Q 20
ip address 192.168.2.1 255.255.255.0
interface Serial0/0/0
no ip address
shutdown
clock rate 2000000
interface Serial0/0/1
no ip address
shutdown
clock rate 2000000
ip forward-protocol nd
no ip http server
no ip http secure-server
control-plane

```

```

mgcp profile default
gatekeeper
  shutdown
telephony-service
  max-ephones 5
  max-dn 5
  ip source-address 192.168.1.10 port 2000
  max-conferences 8 gain -6
  transfer-system full-consult
line con 0
line aux 0
line 2
  no activation-character
  no exec
  transport preferred none
  transport output lat pad telnet rlogin lapb-ta mop udptn v120 ssh
  stopbits 1
line vty 0 4
  login
  transport input all
scheduler allocate 20000 1000
end

```

## Switch Configuration:

### **Switch# show run**

```

hostname Switch
boot-start-marker
boot-end-marker
no aaa new-model
system mtu routing 1500
vtp domain CCNP
vtp mode transparent
authentication mac-move permit
ip subnet-zero
spanning-tree mode pvst
spanning-tree etherchannel guard misconfig
spanning-tree extend system-id
vlan internal allocation policy ascending
vlan 2
  name InSecure
vlan 3-5,7
vlan 10
  name voice
vlan 12
vlan 20
  name data
vlan 99
vlan 100
  name Microsoft

```

```
vlan 192
  name Guest
interface FastEthernet0/1
  switchport access vlan 10
  switchport mode access
  switchport voice vlan 20
  spanning-tree portfast
interface FastEthernet0/2
  switchport trunk encapsulation dot1q
  switchport trunk allowed vlan 10,20
  switchport mode trunk
interface FastEthernet0/3
  switchport access vlan 10
  switchport mode access
  switchport voice vlan 20
  spanning-tree portfast
interface FastEthernet0/4
interface FastEthernet0/5
interface FastEthernet0/6
interface FastEthernet0/7
interface FastEthernet0/8
interface FastEthernet0/9
interface FastEthernet0/10
interface FastEthernet0/11
interface FastEthernet0/12
interface FastEthernet0/13
interface FastEthernet0/14
interface FastEthernet0/15
interface FastEthernet0/16
interface FastEthernet0/17
interface FastEthernet0/18
interface FastEthernet0/19
interface FastEthernet0/20
interface FastEthernet0/21
interface FastEthernet0/22
interface FastEthernet0/23
interface FastEthernet0/24
interface FastEthernet0/25
interface FastEthernet0/26
interface FastEthernet0/27
interface FastEthernet0/28
interface FastEthernet0/29
interface FastEthernet0/30
interface FastEthernet0/31
interface FastEthernet0/32
interface FastEthernet0/33
interface FastEthernet0/34
interface FastEthernet0/35
interface FastEthernet0/36
interface FastEthernet0/37
```



```
interface FastEthernet0/38
interface FastEthernet0/39
interface FastEthernet0/40
interface FastEthernet0/41
interface FastEthernet0/42
interface FastEthernet0/43
interface FastEthernet0/44
interface FastEthernet0/45
interface FastEthernet0/46
interface FastEthernet0/47
interface FastEthernet0/48
interface GigabitEthernet0/1
interface GigabitEthernet0/2
interface GigabitEthernet0/3
interface GigabitEthernet0/4
interface Vlan1
  no ip address
  shutdown
ip classless
ip http server
ip http secure-server
ip sla enable reaction-alerts
line con 0
line vty 5 15
end
```

## Problems

Many problems arose during the installation of CUCM. We had to restart the whole process multiple times. Finally, we found a good tutorial to refer to, which allowed us to effectively set up the VM for our purposes. If the right options aren't chosen, the whole installation process can get terminated. Another issue, was to get the phones pinging each other. After multiple hours spent debugging, we found that there were some mixed up IP addresses and after fixing those, we finally heard the rings of both phones.

## Conclusion

In conclusion, we set up two IP Phones according to a topology to use VOIP to communicate. We also set up a linux based virtual machine running CUCM to achieve this task. This service is extremely useful in providing

communication within networks, without having to use an ISP or telephone businesses.