
UNIVERSITY OF PETROLEUM & ENERGY STUDIES
School of Computer Science
Dehradun

COURSE PLAN

Programme : B. Tech – CS+CCVT

Course : **Introduction to Virtualization and Cloud Computing Lab**

Subject Code : CSVT 2101P

No. of credits : 1

Semester : III

Session : Aug. 2022 – Dec. 2022

Batch : 2021 - 2025

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COURSE PLAN

A. PREREQUISITE:

- a. Basic Knowledge of Computers
- b. Basic Knowledge of Storage and Network

B. PROGRAM OUTCOMES (POs):

B1. PROGRAM OUTCOMES (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

P11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

P12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B2. Program Specific Outcomes (PSOs)

PSO 13 Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques

PSO 14 Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.

PSO 15 Ability to understand and apply Cloud Computing architecture for scalable, secure and dynamically provisioned business-oriented environment with optimized performance tuning and data reliability.

C. OBJECTIVES OF COURSE:

The objectives of this lab course are:

1. Students should be able to understand tools and techniques for creating virtual machines and environment.
2. Student should be able to understand the concepts of Hypervisors.
3. Students should understand the architecture and installation of VMware Workstation/Virtual Box, QEMU and KVM
4. Students should be able to create a Virtual image in VMware Workstation/Virtual Box, QEMU and KVM running on Ubuntu hosts

D. COURSE OUTCOMES FOR Cloud computing and Virtualization Lab: At the end of this course student should be able to

CO1: Demonstrate Cloud Computing virtualization techniques using hypervisors and improve systems utilizations.

CO2: Analyze demonstrated guest and host systems performance.

CO3: Demonstrate server and storage virtualization on public cloud Platforms.

**E. COURSE OUTCOMES (COs), Mapping with POs and PSOs
PROGRAM \SPECIFC OUTCOMES (PSOs):**

Table: Correlation of POs and PSOs v/s COs

PO/CO	PO 1	PO2	PO 3	P O 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14	PSO 15	
CO1	1					2										3
CO2	1					2										3
CO3	1					2										3
Avg	1					2										3

Course Code	Course Title	Introduction to Cloud Computing and virtualization														
		P O 1	P O 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14	PSO 15
Cloud Computing & Virtualization	2	2	-	-	3	-	1	-	2	-	-	3	1	1	1	3

1=weakly mapped

2= moderately mapped

3=strongly mapped

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

F. COURSE OUTLINE

S.NO	Aim of the Experiment	CO's
1	Installation of VM Workstation	CO1, CO2
2	Creation of VM image of Windows XP	CO1, CO2
3	Creation of VM image of base OS	CO1, CO2
4	Installation of QEMU on Ubuntu 12.10	CO1, CO2
5	Creating & using VM using QEMU	CO1, CO2
6	KVM on Ubuntu 12.10 & managing a VM on it	CO1, CO2, CO3
7	KVM and Guest OS on Cent OS 6.3	CO1, CO2, CO3
8	Installing Guest OS in KVM using Command Line	CO1, CO2, CO3
9	Installation of VMware ESX Server	CO1, CO3
10	Creation AWS EC2 Instance	CO4
11	Connecting to AWS EC2 instance	CO4
12	Creating a Bucket and adding an object to AWS S3	CO4

G. PEDAGOGY

The concepts will be illustrated adequately with examples to make applications of theoretical concepts clear.

H. COURSE COMPLETION PLAN

Total Lab sessions	12
Total Quizzes	02
Total Assignment/Viva Voice	02

One

Session=120 minutes

I. EVALUATION & GRADING

Students will be evaluated based on the following continues evaluation system:

Sl. No.	Description	% of Weightage
1	Lab record & Continuous Assessment	40

2	Viva-Voce/Quiz	50
3	General Discipline	10

CONTINUOUS ASSESSMENT: Based on the weekly evaluation of the experiments actually performed by the students in the Laboratory and submitted on the same day or on the very next turn.

The continuous Assessment will be displayed on LMS on monthly basis i.e. on the last two or three working days of every month.

VIVA-VOCE/QUIZ: Students will be informed a week before the date of viva and will be conducted by after actually performing the experiments. Two Viva-Voce examinations will be held, one after completion of at least three experiments by each student/three turns of Laboratory Class and second after completion of at least six experiments by each student/six turns of Laboratory Class. In addition to the Viva-Voce Examination, a Quiz examination based on objective type questions will be held after completion of experiments by each student/nine turns of laboratory class. Those who do not appear in Viva-Voce and quiz examinations shall lose their marks.

GENERAL DISCIPLINE: Based on student's regularity, punctuality, sincerity and behavior in the class.

GRADING:

The overall marks obtained at the end of the semester comprising the above two mentioned shall be converted to a grade.

J. SUGGESTED READINGS:

R1: Cloud Computing: Fundamentals, Industry Approach and Trends, by Rishab Sharma, Wiley Publication

R2: "Mastering Cloud Computing, by Rajkumar Buyya

VIDEO RESOURCES:

- <https://www.youtube.com/watch?v=al1cnTjeayk>
- <https://www.youtube.com/watch?v=L1NnqCXbqMg>
- <https://www.youtube.com/watch?v=jLRmVNWOrgo>
- <https://www.unixmen.com/how-to-install-and-configure-qemu-in-ubuntu/>
- <https://www.maketecheasier.com/how-to-create-a-ubuntu-virtual-machine-with-qemu-manager/>
- <https://www.youtube.com/watch?v=gLua2nNxTlo>
- <https://www.youtube.com/watch?v=EtXZrOWGtbl>

K. DETAILED SESSION PLAN

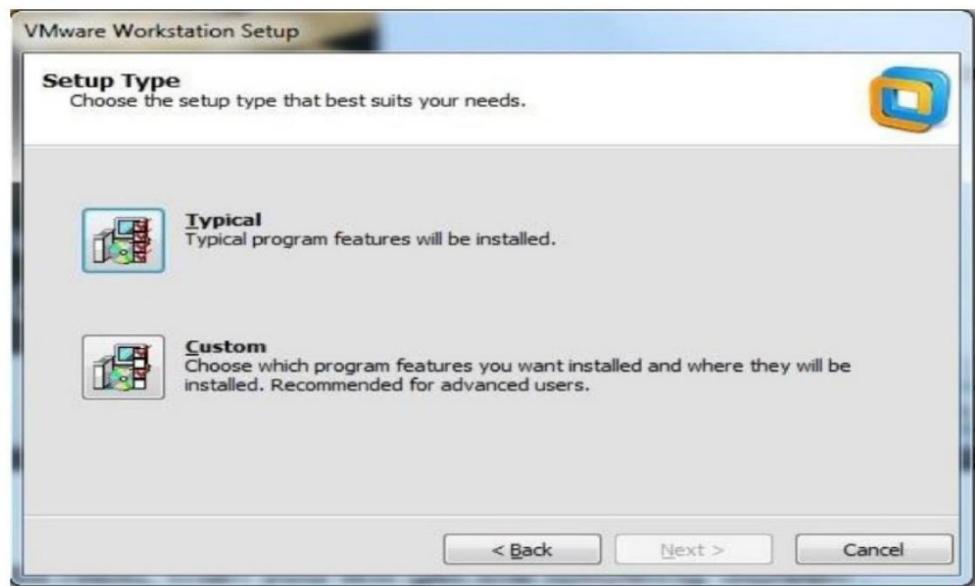
Lab-1 Installation of VMWare Workstation

Solution .

1. Download VMware-workstation-full-9.0.1-894247.exe file from the following site :
<http://freewareupdate.com/developer-tools/download-vmware-workstation>
2. Install the downloaded file VMware-workstation-full-9.0.1-894247.exe by double clicking the same.
3. You will get the following screen :

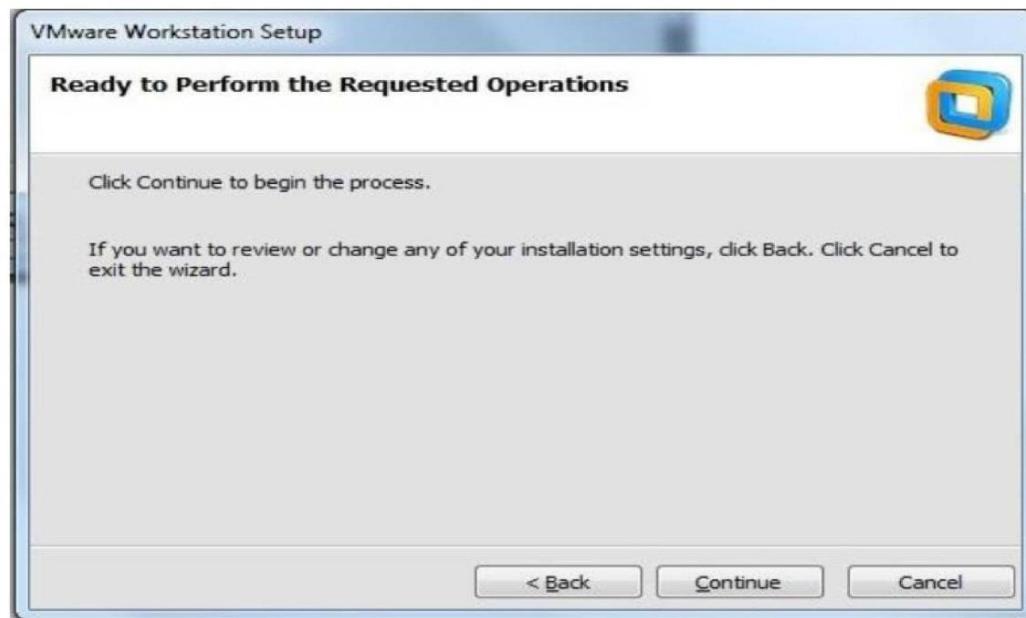


4. Press Next, than you will get the following Screen :

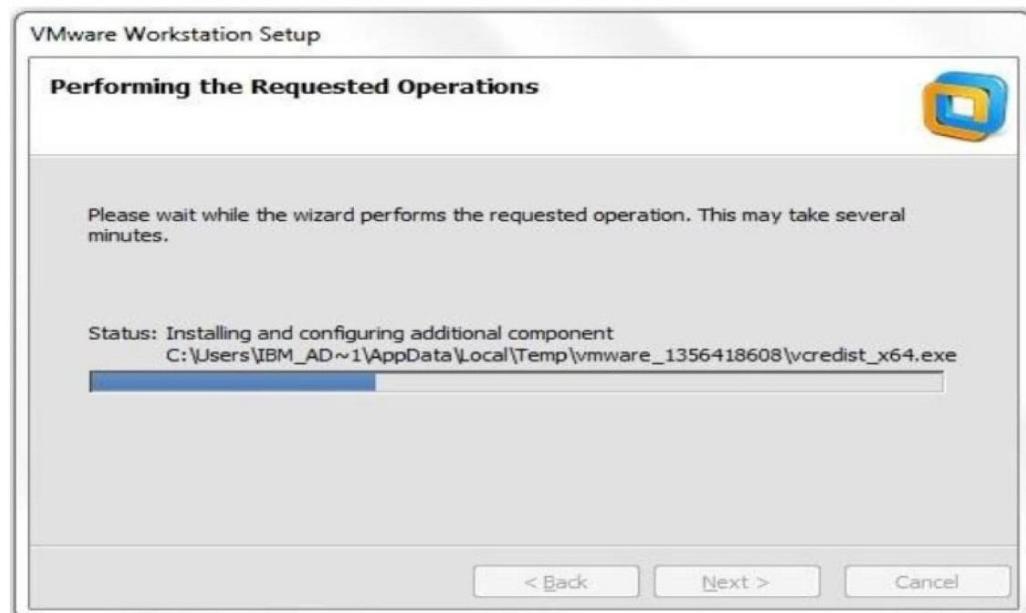


5. Click on Typical, You will be getting the following Screen

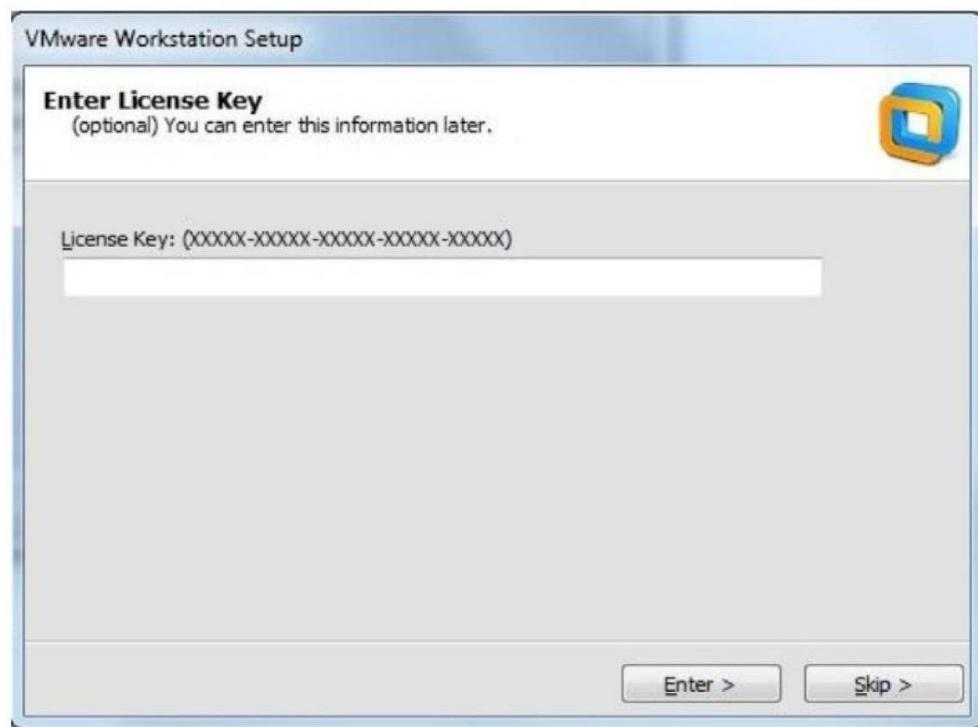




8. Press Continue, than installation process starts and you will be getting the following figure while installation and that may take few minutes to complete :



9. Next You will get the following screen, asking you to enter the License Key, if you have any you can use the same or press skip to use trail version.



10. Finally we will get the following screen, and press here the Finish button.



This completes the installation of VMware Workstation.

Lab-2 Creation of VM image of Windows XP

Creation of VM image of Windows XP

After installation of VMware Workstation, double click on vmware workstation icon created on desktop, we will get the following screen:



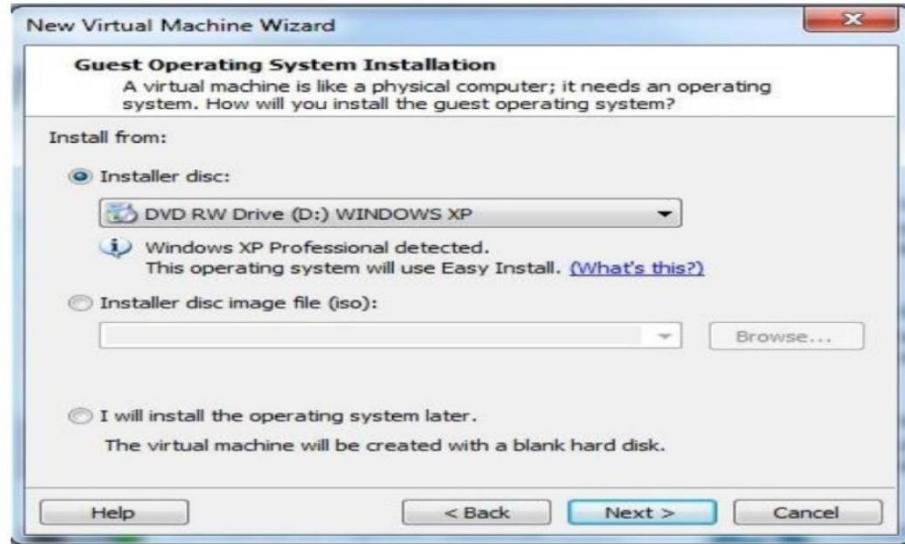
1. Select on Yes, I accept the terms in the license agreement, and proceed further by clicking on OK button. We will be getting the following screen :



2. Among many options available in the above screen click on Create a New Virtual Machine. You will be getting the following screen :



3. Before pressing Next button to continue, make sure of the availability of Windows XP CD inside the CD Tray or you will be requiring the iso image of Windows XP, once after pressing the Next button you will get the following screen



4. Press Next Button, we will get the following screen:



5. Enter the Windows Product key, Name and continue, you will get the following screen :



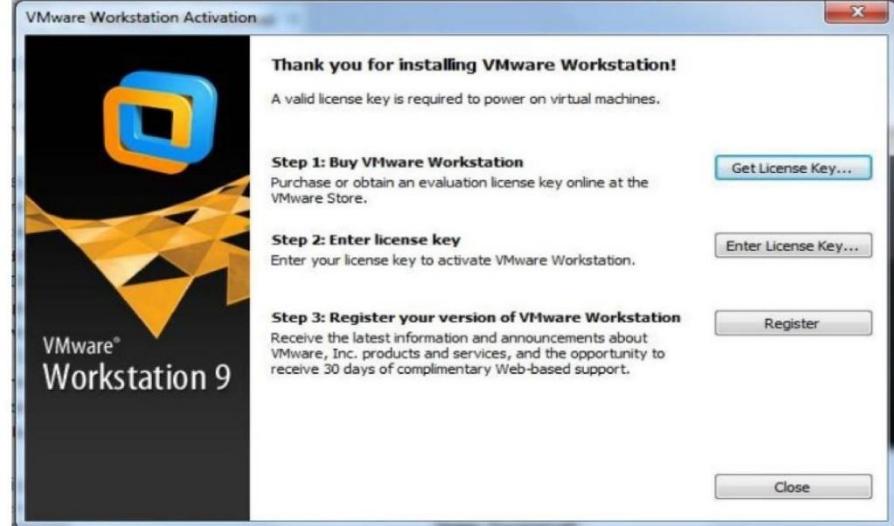
6. Press Next, we will get the following screen :



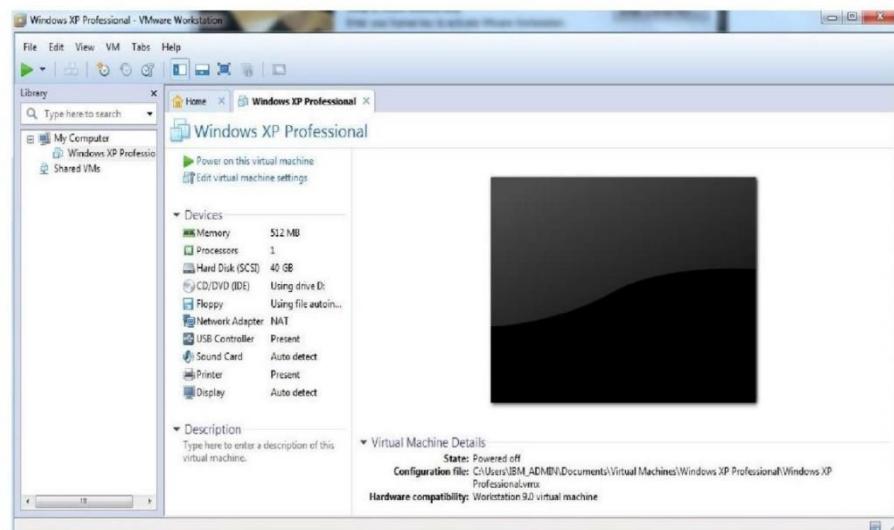
7. Press Next to continue, finally we will get the following confirmation screen :



8. Press Finish button, if you find everything is OK, than we will get the following screen :



9. Press on Close Button, we will get the following screen :





This completes the creation of Windows XP virtual machine.

Lab-3 Creation of VM image of base operating system

Creation of VM image of base operating system

1. In figure 10 you got a option Virtualize a Physical machine. Once after clicking on that, it will redirect to download the VMware vCenter Converter.

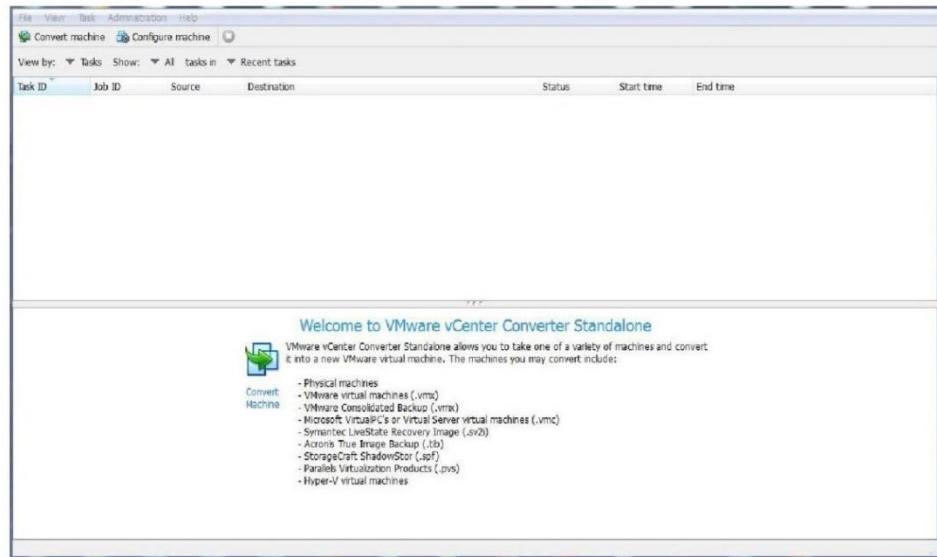
We can directly download VMware vCenter Converter Standalone 5.0.1 from the following site :

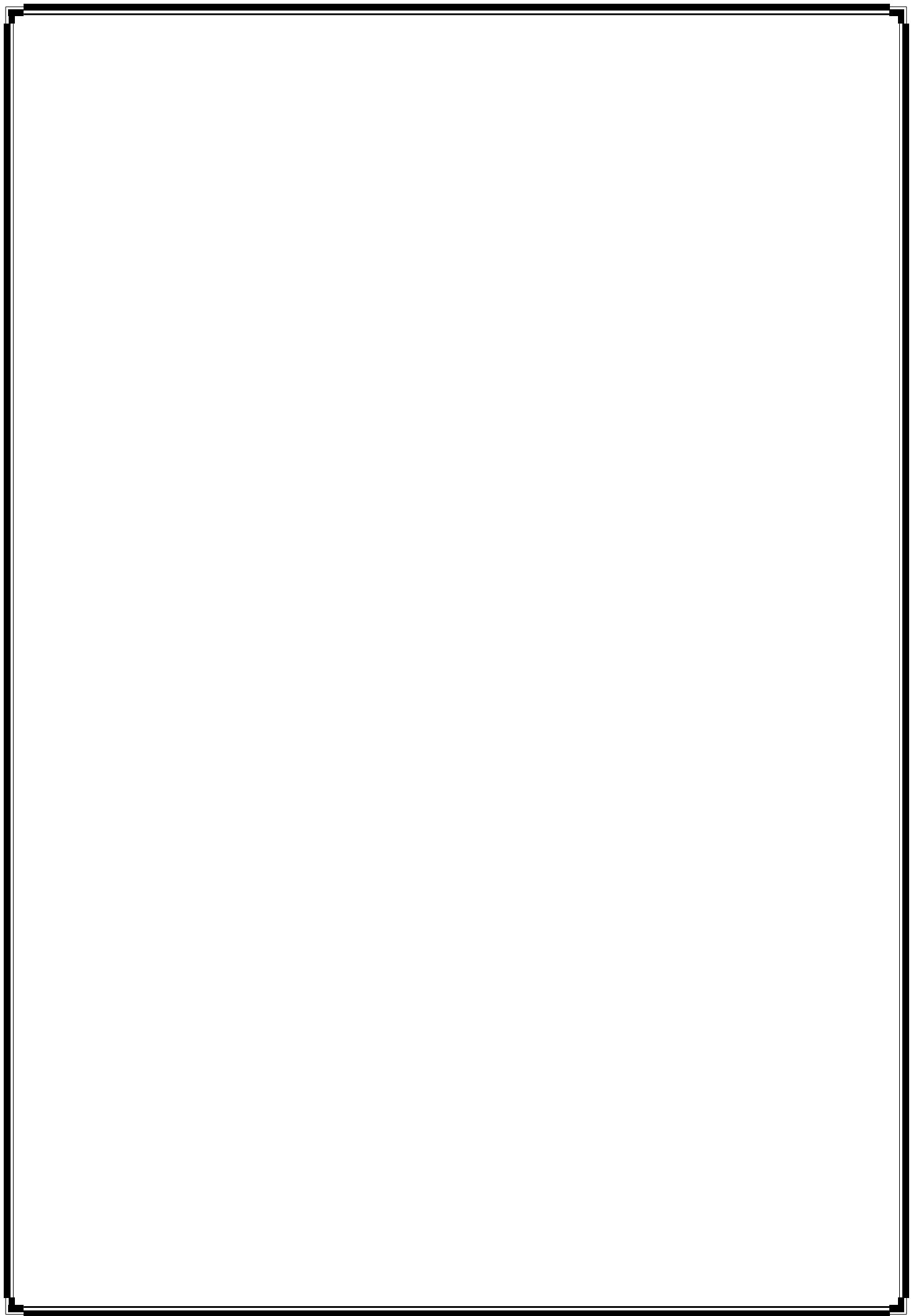
https://my.vmware.com/web/vmware/info/slug/infrastructure_operations_management/vmware_vcenter_converter_standalone/5_0

Once after downloading the VMware vCenter Converter standalone 5.0.1, install the same, in turn it creates the icon on desktop. Click the VMware vCenter Converter Standalone Client icon you will get the following screen:

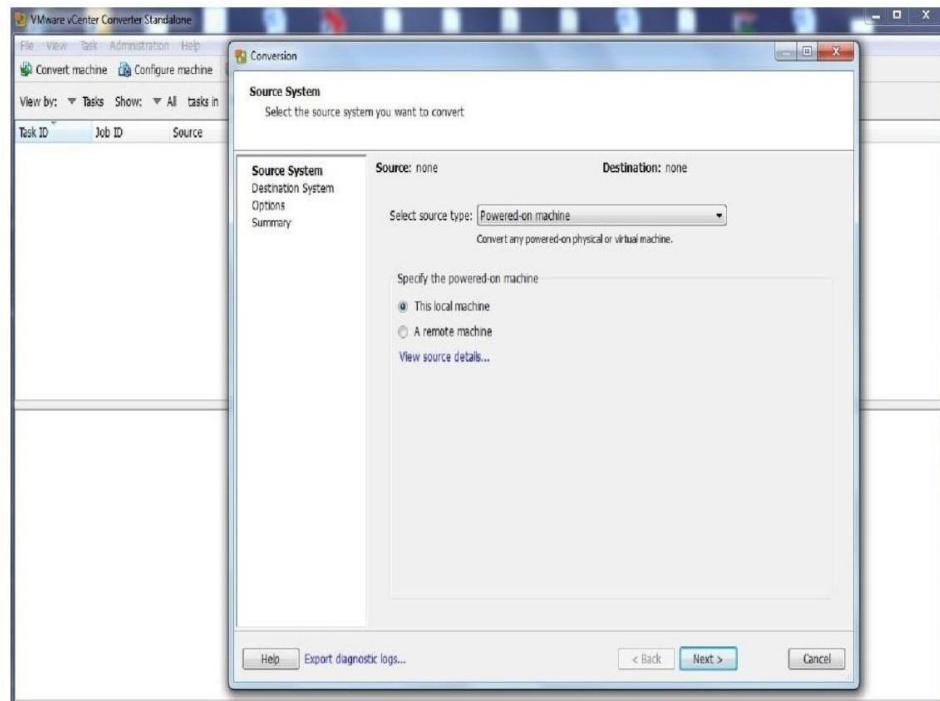


2. Select the option Connect to a local server and you will get the below screen :

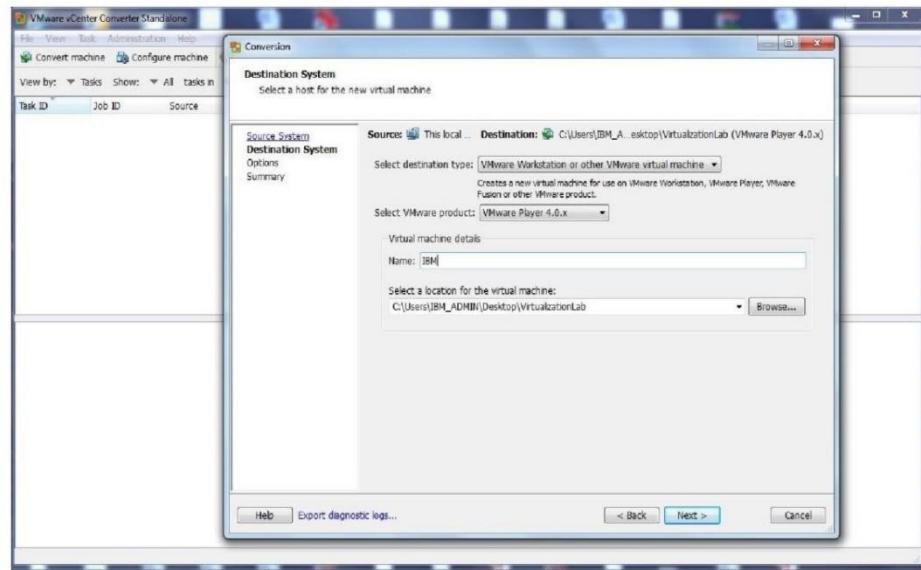




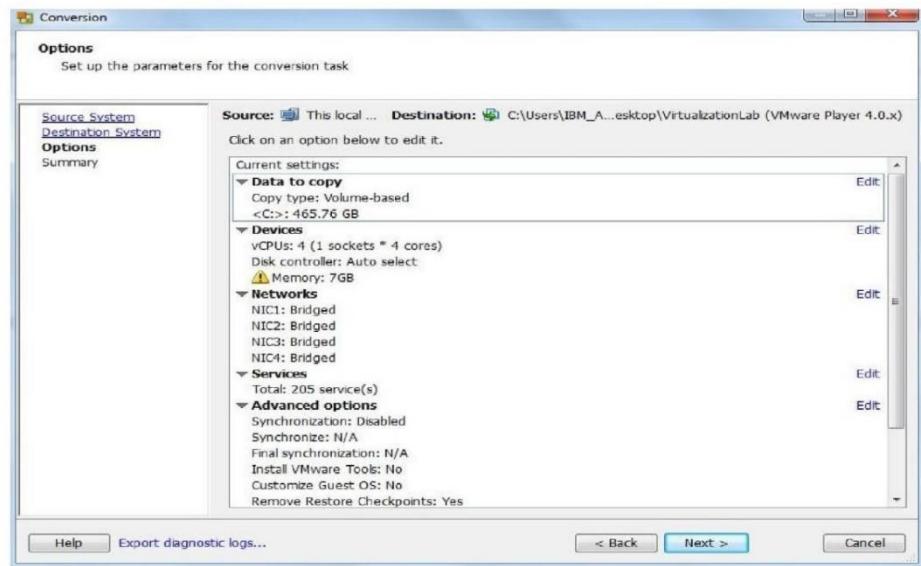
3. Click on Convert machine, we will get following screen :

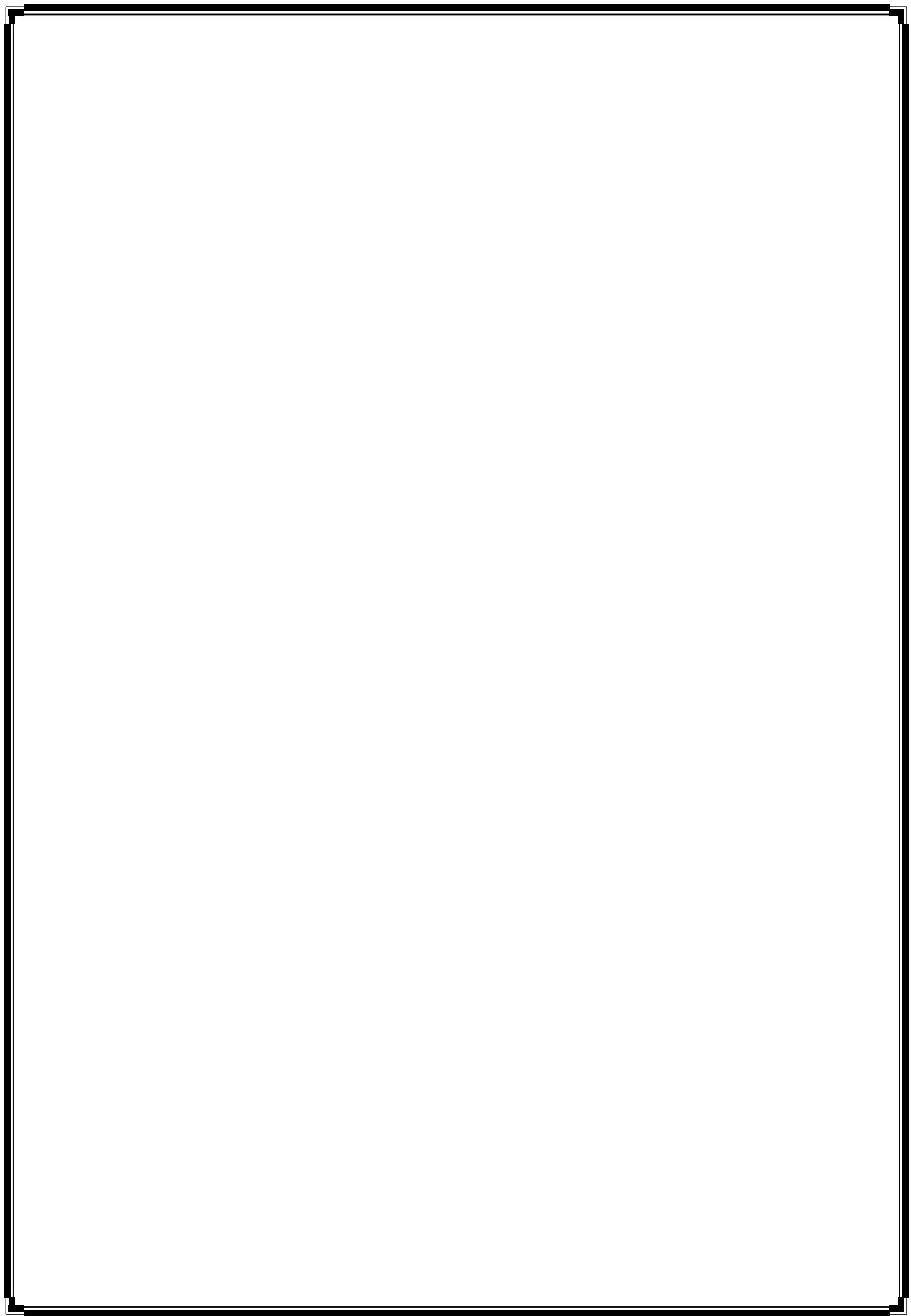


4. Select source type as Powered-on machine, Specify the powered-on machine as The Local machine, Press Next. you will get the below screen:

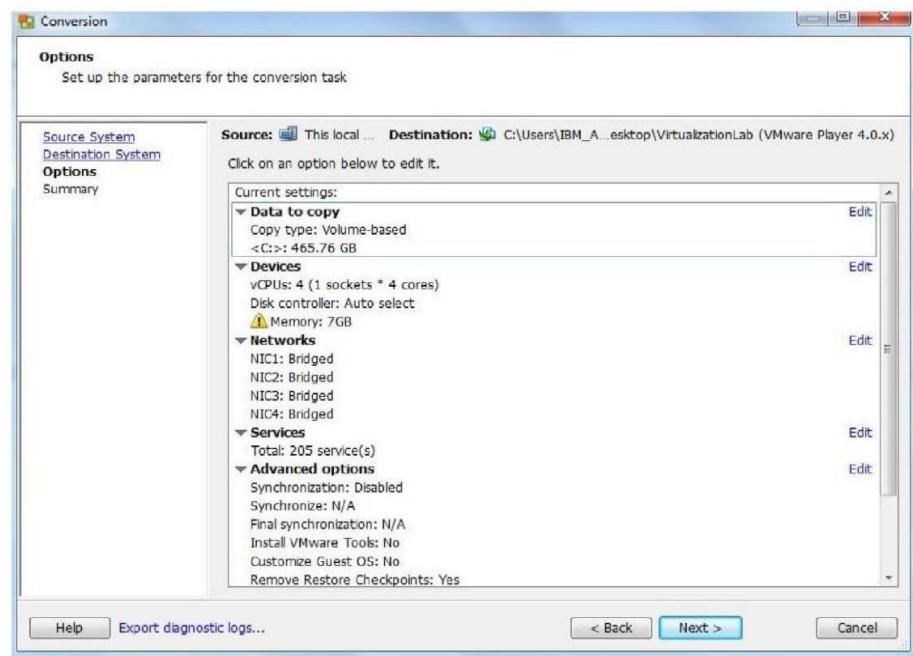


5. Click Next, after selecting destination type as VMware workstation or other VMware virtual machine, select VMware product as VMware Player 4.0.x, type user-defined virtual machine name and select the location wherein you are desiring to store Virtual machine.

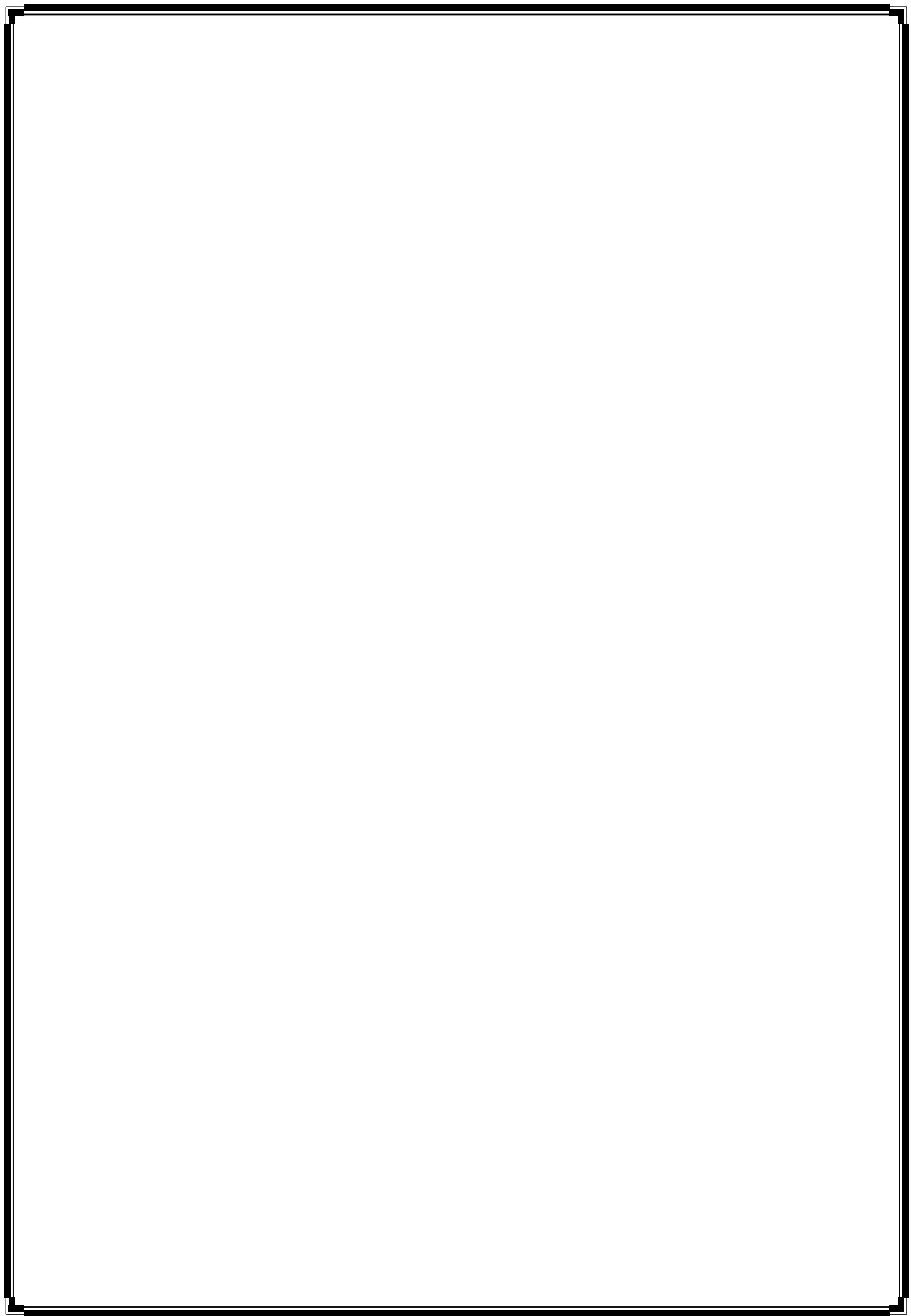




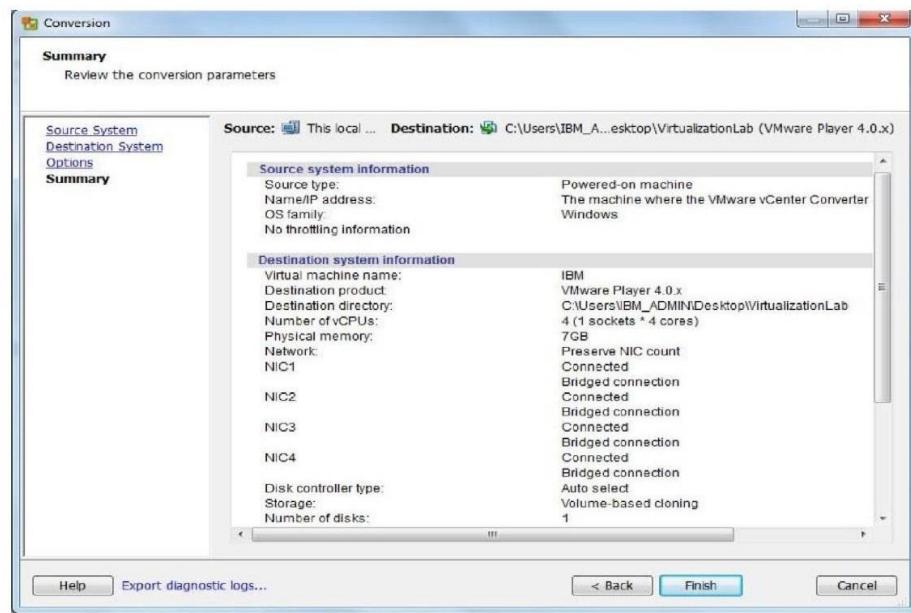
6. After pressing the Next in the above window we will get the below summary window as shown below

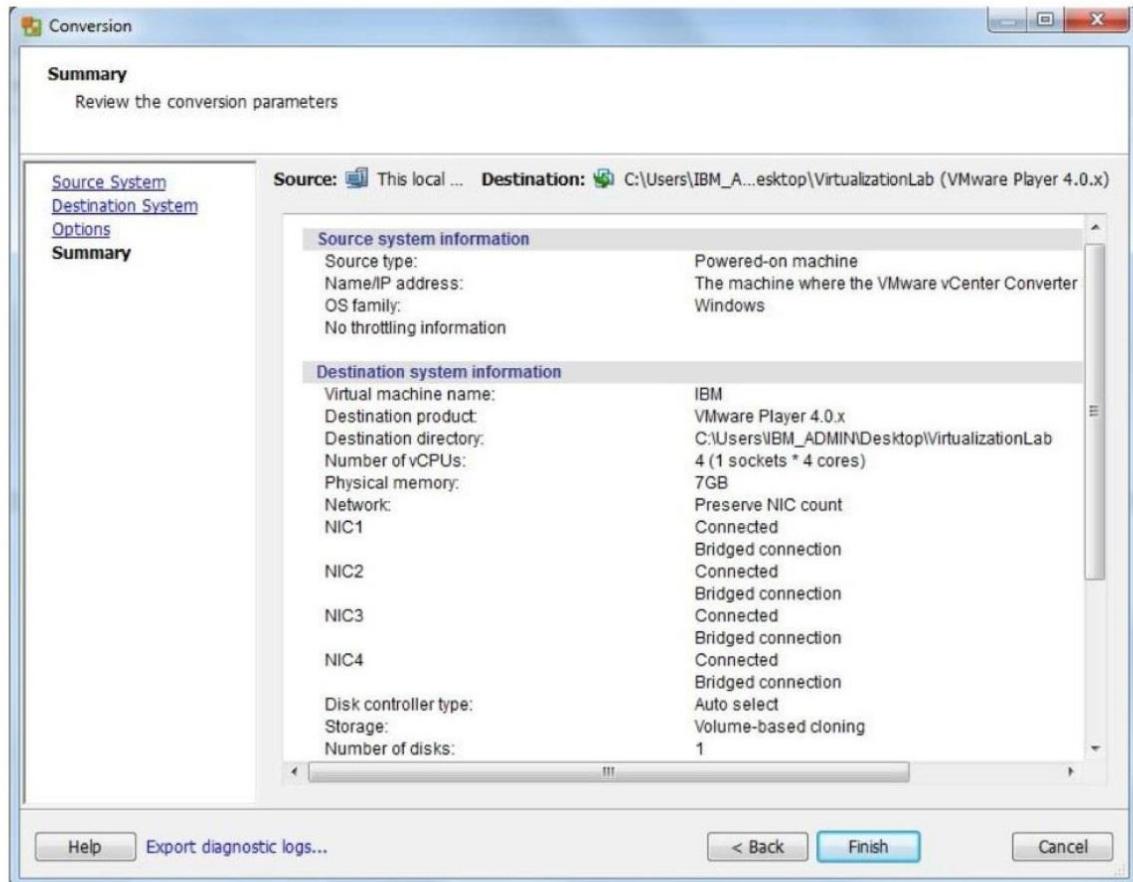


7. Finally press on Finish button, it will start to create the Local system's VM.
Thus VM image of base operating system gets created.
-



STUDIES





Virtual Machine Using QEMU

Lab-4 Installation of QEMU on Ubuntu 12.10

Installation of QEMU on Ubuntu 12.10

Type sudo apt-get install qemu-kvm
\$ sudo apt-get install qemu-kvm
[sudo] password for UserID :
Enter the password of the user who has the root privileges. This will start to download the qemu-kvm from internet.
After downloading, it will install qemu. Also make sure the gnome GUI is installed, if gnome is not installed, you can download and install the same by typing the following command
\$ sudo aptitude install gnome
After downloading and installation of gnome, we need to reboot the system, by typing the command as follows :
\$ sudo reboot

Lab-5 Creating and Using Virtual Machine Using QEMU

Creating Virtual Machine on Ubuntu 12.10 platform

Type qemu-system-x86_64 -hda winxp -cdrom cd.iso -m 192 -boot d
Here winxp is a virtual disk which is needed for the virtual machine. A virtual disk is made by creating a file of a size appropriately large to contain the full guest OS.
You can create the virtual disk by using the command qemu-img create winxp 3G, which in turn creates the winxp virtual disk with 3 GB disk space.
Here cd.iso is a iso image of guest operating system, you can use the iso image file if it was already created, if it is not created, you can create the iso image file by using the command dd if=/dev/cdrom of=cd.iso for cdrom image or dd if=/dev/dvd of=dvd.iso for dvd image.

Suppose if you have the WindowsXP CD in a CD/DVD tray and want to create the Windows XP virtual machine, you have to proceed as below :

1. Create the Windows XP iso image as cd.iso file by typing the command as follows :
\$ dd if=/dev/cdrom of=cd.iso
2. Being in the same directory, create the virtual disk of size 3GB disk space as winxp, by typing the command as follows :
\$ qemu-img create winxp 3G
3. Being in the same directory execute the following command :
\$ qemu-system-x86_64 -hda winxp -cdrom cd.iso -m 192 -boot d
4. This command instructs QEMU to use hda as the empty disk file. It uses cd.iso file as if installing from the CDROM, and sets the amount of memory to use in the virtual machine to be 192Mb. It then instructs to boot from the CDROM.
As the installer boots and goes through options, choose the defaults at each step. The installer should detect the virtual network properly and install without difficulties.
This completes the Creating Virtual Machine using QEMU on Ubuntu 12.10

Using the Virtual Machine on Ubuntu 12.10 platform

Being in the same directory, run the following command

```
$ qemu-system-x86_64 -hda winxp
```

[Note : If you have Ubuntu 32 bit version you need to use qemu-system-i386]

Lab-6 KVM on Ubuntu 12.10 and managing a VM on it.

KVM on Ubuntu 12.10

1. Make sure your hardware supports the necessary virtualization extensions for KVM. Enter the following from a terminal prompt:

```
$ kvm-ok
```

A message will be printed informing you if your CPU does or does not support hardware virtualization.

You should get the following information

INFO: Your CPU supports KVM extensions.

INFO: /dev/kvm does not exist

KVM acceleration can not be used.

2. As we will be requiring root privileges, type the command as below :

```
$ sudo su
```

3. Download and install kvm, by typing the following command :

```
# apt-get install kvm
```

4. Type the following command to install libvirt-bin

```
# apt-get install libvirt-bin
```

5. To check the KVM has successfully been installed, run the following command

```
# virsh -c qemu:///system list
```

which in turn displays as follows :

ID	Name	State
----	------	-------

If it displays an error instead, than something went wrong.

6. Type the command once again kvm-ok on a prompt, now you should get the following display

```
:  
# kvm-ok  
INFO: Your CPU supports KVM extensions  
INFO: /dev/kvm exists  
KVM acceleration can be used
```

7. Installing virt-install

```
$ sudo apt-get install virtinst
```

8. Installing virt-manager On Your Ubuntu 12.10 Desktop

We need a means of connecting to the graphical console of our guests - we can use virt-viewer or virt-manager, for this. I'm assuming that you're using an Ubuntu 12.10 desktop (it doesn't matter if it is a remote desktop or if the desktop is installed on the Ubuntu 12.10 KVM server!).

I suggest you use virt-manager instead of virt-viewer because virt-manager lets you also create and delete virtual machines and do other tasks. virt-manager can be installed as follows:

```
$ sudo apt-get install virt-manager
```

9. Install libvirt

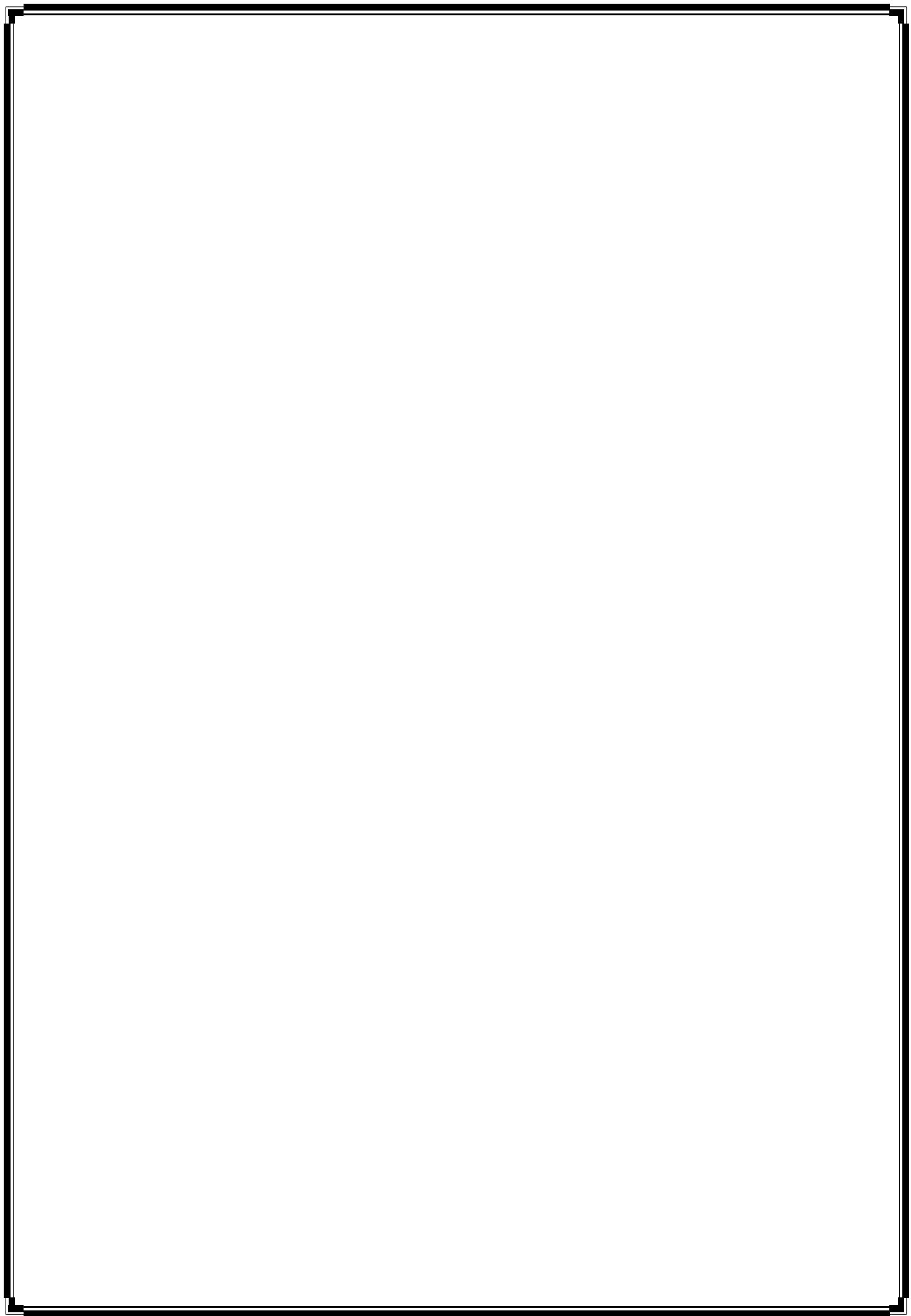
```
# apt-get install libvirt-bin  
# adduser `id -un` libvirtd  
# adduser `id -un` kvm
```

10. Install firefox

```
# apt-get install firefox  
# apt-get install ubuntu-virt-server python-vm-builder kvm-ipxe
```

11. Next we need to set up a network bridge on our server so that our virtual machines can be accessed from other hosts as if they were physical systems in the network.

```
<> # apt-get install bridge-utils  
To do this, we install the package bridge-utils...
```



```
apt-get install bridge-utils
```

... and configure a bridge. Open /etc/network/interfaces:

```
vi /etc/network/interfaces
```

Before the modification, my file looks as follows:

```
# This file describes the network interfaces available on your system  
# and how to activate them. For more information, see interfaces(5).
```

```
# The loopback network interface
```

```
auto lo
```

```
iface lo inet loopback
```

```
# The primary network interface
```

```
auto eth0
```

```
iface eth0 inet static
```

```
    address 192.168.0.100
```

```
    netmask 255.255.255.0
```

```
    network 192.168.0.0
```

```
    broadcast 192.168.0.255
```

```
    gateway 192.168.0.1
```

```
    dns-nameservers 8.8.8.8 8.8.4.4
```

I change it so that it looks like this:

```
# This file describes the network interfaces available on your system  
# and how to activate them. For more information, see interfaces(5).
```

```
# The loopback network interface
```

```
auto lo
```

```
iface lo inet loopback
```

```
# The primary network interface
```

```
auto eth0
```

```
iface eth0 inet manual
```

```
auto br0
```

```
iface br0 inet static
```

```
    address 192.168.0.100
```

```
    network 192.168.0.0
```

```
    netmask 255.255.255.0
```

```
    broadcast 192.168.0.255
```

```
    gateway 192.168.0.1
```

[REDACTED]

```
dns-nameservers 8.8.8.8 8.8.4.4
bridge_ports eth0
bridge_fd 9
bridge_hello 2
bridge_maxage 12
bridge_stp off
```

(Make sure you use the correct settings for your network!)

Restart the network...

```
/etc/init.d/networking restart
```

... and run

```
ifconfig
```

It should now show the network bridge (br0):

```
root@server1:~# ifconfig
br0    Link encap:Ethernet HWaddr 00:1e:90:f3:f0:02
        inet addr:192.168.0.100 Bcast:192.168.0.255 Mask:255.255.255.0
        inet6 addr: fe80::21e:90ff:fef3:f002/64 Scope:Link
              UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
              RX packets:29 errors:0 dropped:0 overruns:0 frame:0
              TX packets:29 errors:0 dropped:0 overruns:0 carrier:0
              collisions:0 txqueuelen:0
              RX bytes:1934 (1.9 KB) TX bytes:2844 (2.8 KB)

eth0    Link encap:Ethernet HWaddr 00:1e:90:f3:f0:02
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:44613 errors:0 dropped:0 overruns:0 frame:0
        TX packets:23445 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:63663064 (63.6 MB) TX bytes:1792940 (1.7 MB)
        Interrupt:41 Base address:0xa000

lo     Link encap:Local Loopback
        inet addr:127.0.0.1 Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
              UP LOOPBACK RUNNING MTU:16436 Metric:1
```

```
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

virbr0 Link encap:Ethernet HWaddr 2a:4a:49:13:de:8f
inet addr:192.168.122.1 Bcast:192.168.122.255 Mask:255.255.255.0
UP BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```

root@server1:~#

Before we start our first virtual machine, I recommend to reboot the system:

reboot

If you don't do this, you might get an error like open /dev/kvm: Permission denied in the virtual machine logs in the /var/log/libvirt/qemu/ directory.

Creating An Image-Based VM

We can now create our first VM - an image-based VM (if you expect lots of traffic and many read- and write operations for that VM, use an LVM-based VM instead as shown in chapter 6 - image-based VMs are heavy on hard disk IO).

I want to create my virtual machines in the directory /var/lib/libvirt/images/ (they cannot be created in the /root directory because the libvirt-qemu user doesn't have read permissions in that directory).

We will create a new directory for each VM that we want to create, e.g. /var/lib/libvirt/images/vm1, /var/lib/libvirt/images/vm2, /var/lib/libvirt/images/vm3, and so on, because each VM will have a subdirectory called ubuntu-kvm, and obviously there can be just one such directory in /var/lib/libvirt/images/vm1, for example. If you try to create a second VM in /var/lib/libvirt/images/vm1, for example, you will get an error message saying ubuntu-kvm already exists (unless you run vmbuilder with the --dest=DESTDIR argument):

```
root@server1:/var/lib/libvirt/images/vm1# vmbuilder kvm ubuntu -c vm2.cfg
2009-05-07 16:32:44,185 INFO      Cleaning up
```

```
ubuntu-kvm already exists
root@server1:/var/lib/libvirt/images/vm1#
```

We will use the vmbuilder tool to create VMs. (You can learn more about vmbuilder here.) vmbuilder uses a template to create virtual machines - this template is located in the /etc/vmbuilder/libvirt/ directory. First we create a copy:

```
mkdir -p /var/lib/libvirt/images/vm1/mytemplates/libvirt
cp /etc/vmbuilder/libvirt/* /var/lib/libvirt/images/vm1/mytemplates/libvirt/
```

Now we come to the partitioning of our VM. We create a file called vmbuilder.partition...

```
vi /var/lib/libvirt/images/vm1/vmbuilder.partition
```

... and define the desired partitions as follows:

```
root 8000
swap 4000
---
/var 20000
```

This defines a root partition (/) with a size of 8000MB, a swap partition of 4000MB, and a /var partition of 20000MB. The --- line makes that the following partition (/var in this example) is on a separate disk image (i.e., this would create two disk images, one for root and swap and one for /var). Of course, you are free to define whatever partitions you like (as long as you also define root and swap), and of course, they can be in just one disk image - this is just an example.

I want to install openssh-server in the VM. To make sure that each VM gets a unique OpenSSH key, we cannot install openssh-server when we create the VM. Therefore we create a script called boot.sh that will be executed when the VM is booted for the first time. It will install openssh-server (with a unique key) and also force the user (I will use the default username administrator for my VMs together with the default password howtoforge) to change the password when he logs in for the first time:

```
vi /var/lib/libvirt/images/vm1/boot.sh
# This script will run the first time the virtual machine boots
# It is ran as root.

# Expire the user account
passwd -e administrator
```

```
# Install openssh-server
apt-get update
apt-get install -qqy --force-yes openssh-server
```

Make sure you replace the username administrator with your default login name.

Now take a look at

```
$ vmbuilder kvm ubuntu --help
```

to learn about the available options.

To create our first VM, vm1, we go to the VM directory...

```
cd /var/lib/libvirt/images/vm1/
```

... and run vmbuilder, e.g. as follows:

```
vmbuilder kvm ubuntu --suite=precise --flavour=virtual --arch=amd64 --
mirror=http://de.archive.ubuntu.com/ubuntu -o --libvirt=qemu:///system --ip=192.168.0.101 --
gw=192.168.0.1 --part=vmbuilder.partition --templates=mytemplates --user=administrator --
name=Administrator --pass=howtoforge --addpkg=vim-nox --addpkg=unattended-upgrades --
addpkg=acpid --firstboot=/var/lib/libvirt/images/vm1/boot.sh --mem=256 --hostname=vm1 --
bridge=br0
```

Most of the options are self-explanatory. --part specifies the file with the partitioning details, relative to our working directory (that's why we had to go to our VM directory before running vmbuilder), --templates specifies the directory that holds the template file (again relative to our working directory), and --firstboot specifies the firstboot script. --libvirt=qemu:///system tells KVM to add this VM to the list of available virtual machines. --addpkg allows you to specify Ubuntu packages that you want to have installed during the VM creation (see above why you shouldn't add openssh-server to that list and use the firstboot script instead). --bridge sets up a bridged network; as we have created the bridge br0 in chapter 2, we specify that bridge here.

In the --mirror line, you can specify an official Ubuntu repository in --mirror, e.g. <http://de.archive.ubuntu.com/ubuntu>. If you leave out --mirror, then the default Ubuntu repository (<http://archive.ubuntu.com/ubuntu>) will be used.

If you specify an IP address in the --ip switch, make sure that you also specify the correct gateway IP using the --gw switch (otherwise vmbuilder will assume that it is the first valid address in the network which might not be correct). Usually the gateway IP is the same that you use in /etc/network/interfaces (see chapter 2).

The build process can take a few minutes.

Afterwards, you can find an XML configuration file for the VM in /etc/libvirt/qemu/ (=> /etc/libvirt/qemu/vm1.xml):

```
ls -l /etc/libvirt/qemu/  
root@server1:/var/lib/libvirt/images/vm1# ls -l /etc/libvirt/qemu/ total 8  
drwxr-xr-x 3 root root 4096 May 21 13:00 networks  
-rw----- 1 root root 2082 May 21 13:15 vm1.xml  
root@server1:/var/lib/libvirt/images/vm1#
```

The disk images are located in the ubuntu-kvm/ subdirectory of our VM directory:

```
ls -l /var/lib/libvirt/images/vm1/ubuntu-kvm/  
root@server1:/var/lib/libvirt/images/vm1# ls -l /var/lib/libvirt/images/vm1/ubuntu-kvm/ total 604312  
-rw-r--r-- 1 root root 324337664 May 21 13:14 tmpE4liRv.qcow2  
-rw-r--r-- 1 root root 294715392 May 21 13:15 tmpxvSVOT.qcow2  
root@server1:/var/lib/libvirt/images/vm1#
```

If you want to create a second VM (vm2), here's a short summary of the commands:

```
mkdir -p /var/lib/libvirt/images/vm2/mytemplates/libvirt  
cp /etc/vmbuilder/libvirt/* /var/lib/libvirt/images/vm2/mytemplates/libvirt/  
  
vi /var/lib/libvirt/images/vm2/vmbuilder.partition  
  
vi /var/lib/libvirt/images/vm2/boot.sh  
  
cd /var/lib/libvirt/images/vm2/  
vmbuilder kvm ubuntu --suite=precise --flavour=virtual --arch=amd64 --  
mirror=http://de.archive.ubuntu.com/ubuntu -o --libvirt=qemu:///system --ip=192.168.0.102 --  
gw=192.168.0.1 --part=vmbuilder.partition --templates=mytemplates --user=administrator --  
name=Administrator --pass=howtoforge --addpkg=vim-nox --addpkg=unattended-upgrades --  
addpkg=acpid --firstboot=/var/lib/libvirt/images/vm2/boot.sh --mem=256 --hostname=vm2 --  
bridge=br0
```

(Please note that you don't have to create a new directory for the VM (/var/lib/libvirt/images/vm2) if you pass the -d DESTDIR argument to the vmbuilder command - it allows you to create a VM in a directory where you've already created another VM. In that case you don't have to create new

vmbuilder.partition and boot.sh files and don't have to modify the template, but can simply use the existing files:

```
cd /var/lib/libvirt/images/vm1/
vmbuilder kvm ubuntu --suite=precise --flavour=virtual --arch=amd64 --
mirror=http://de.archive.ubuntu.com/ubuntu -o --libvirt=qemu:///system --ip=192.168.0.102 --
gw=192.168.0.1 --part=vmbuilder.partition --templates=mytemplates --user=administrator --
name=Administrator --pass=howtoforge --addpkg=vim-nox --addpkg=unattended-upgrades --
addpkg=acpid --firstboot=/var/lib/libvirt/images/vm1/boot.sh --mem=256 --hostname=vm2 --
bridge=br0 -d vm2-kvm )
```

Lab-7 KVM and guest operating system on CentOS 6.3

KVM and guest operating system on CentOS6.3

The KVM (Kernel Virtual Machine) is a Virtualization environment for the Linux Kernel. We will see here how to install KVM Virtualization.

Pre-requisites

You will need following System Specifications:

1. Virtualization enabled in BIOS..
2. A processor which supports Virtualization.
3. A 64-bit version of the Operating-System (CentOS 6.3).
4. 64-bit hardware architecture

First you need to enable the Virtualization in your BIOS.

Secondly check the processor compatibility for Virtualization by the help of /proc/cpuinfo file as mentioned earlier.

Finally check for the 64-bit version or 32-bit of operating system and hardware architecture by running the following command

```
# uname -a
```

The 32 bit system will show i686 and i386 after the install date and time.

The 64 bit server will show x86_64 numerous times after the install date and time.

or just type # *uname -m*

Now check for the SELinux disabled or not, you need to disable the SELinux, for disabling the SELinux, follow the below steps :

vi /etc/selinux/config

set SELINUX=disabled in the file and save. Afterwards reboot the server.

In order to effectively install KVM virtualization and configure Guest OS, you need to install multiple packages. All such packages are provided under certain package groups in RHEL 6 standard installation DVD. The groups are Virtualization, Virtualization Platform, Virtualization Clients.

Virtualization Tools

Virtualization Provides an environment for hosting virtualized guests.

Packages : qemu-kvm, qemu-kvm-tools

Virtualization Platform Provides an interface for accessing and controlling virtualized guests and containers.

Mandatory Packages: libvirt, libvirt-client

Optional Packages: fence-virtd-libvirt, fence-virtd-multicast, fence-virtd-serial, libvirt-cim, libvirt-java, libvirt-qpid, perl-Sys-Virt

Virtualization Client Clients for installing and managing virtualization instances.

Mandatory Packages: python-virtinst, virt-manager, virt-viewer

Default Packages: virt-top

Virtualization Tools Tools for offline virtual image management

Default Packages: libguestfs,

Optional Packages: libguestfs-java, libguestfs-mount, libguestfs-tools, virt-v2v

We can install all these packages by using yum as follows.

```
# yum groupinstall Virtualization  
# yum groupinstall "Virtualization Platform"  
# yum groupinstall "Virtualization Client"  
# yum groupinstall "Virtualization Tools"
```

You can verify the successful KVM installation by the following command

```
# lsmod | grep kvm  
kvm_intel 45674 0  
kvm 291811 1 kvm_intel
```

Now that you have verified successfully, you may check/start the libvirtd daemon process as follows

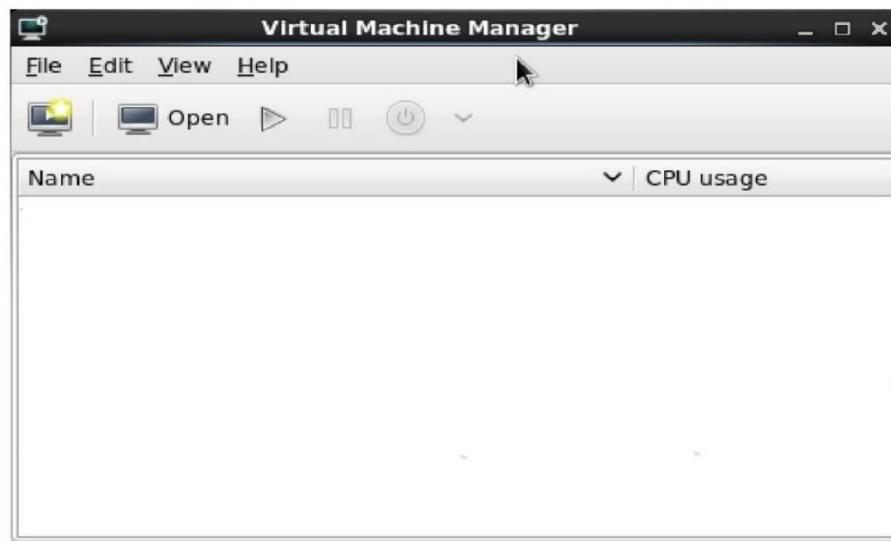
```
# service libvirtd status
```

```
libvirtd (pid 6914) is running...
```

Do not forget to run the following command if you want to run the libvirtd daemon at boot time on runlevels 3 and 5.

```
# chkconfig --level 35 libvirtd on
```

After you have installed the packages we will find a new menu option to launch the VM Manager under **Application -> System Tools -> Virtual Machine Manager**



Installing guest operating system using KVM : We need to click on the monitor icon just below the "File" menu of Virtual Machine Manager windows as a first step of VM Creation. Here will take the example of Windows XP Guest OS. We will see how to install Windows XP on KVM using VM Manager. It is assumed that we have created the iso file from the Windows XP cd before proceeding to install. If we haven't created the iso file yet then here is a quick description on how to do this.

Create iso image from Windows XP CD

Just insert the CD and type the following command at the RHEL/CentOS console

```
# dd if=/dev/cdrom of=Wxp_sp2.iso
```

After some time it will create an iso image (named "Wxp_sp2.iso") of the inserted CD/DVD in your current working directory.

Note: You can also create a Virtual Machine directly by the CDROM/DVD without creating the iso image. However in practice we usually make and keep iso's of many operating systems for ready usage and to avoid physical access to server so often.

Step 1:

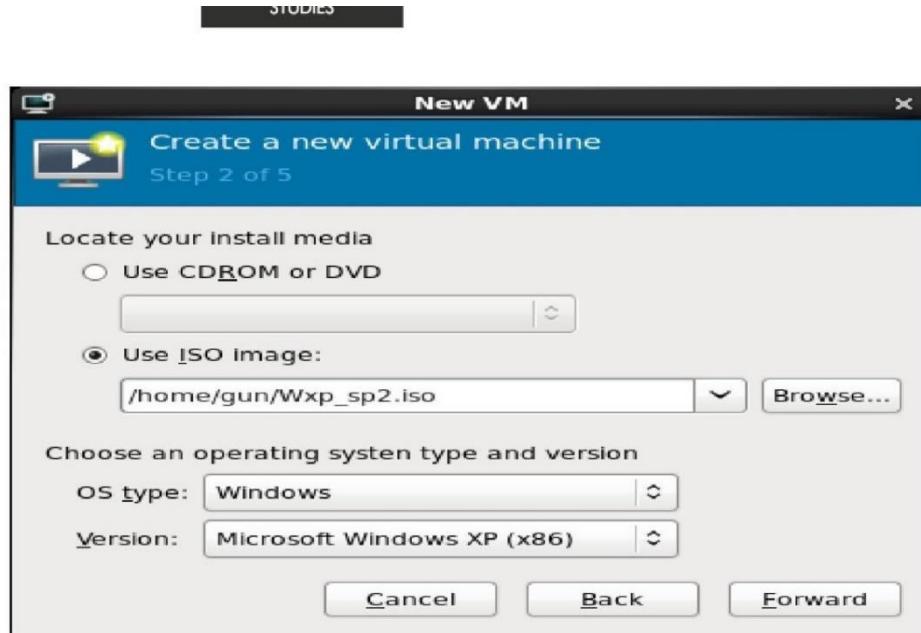
We will get a screen like below to choose the method of installation. We see clearly that the virt-manager supports both ISO and CDROM installation, it also supports complex procedures like Network Install and even PXE boot.



Choose a name of the Virtual Machine of the Virtual Machine. In our case we have chosen "Win_Xp".

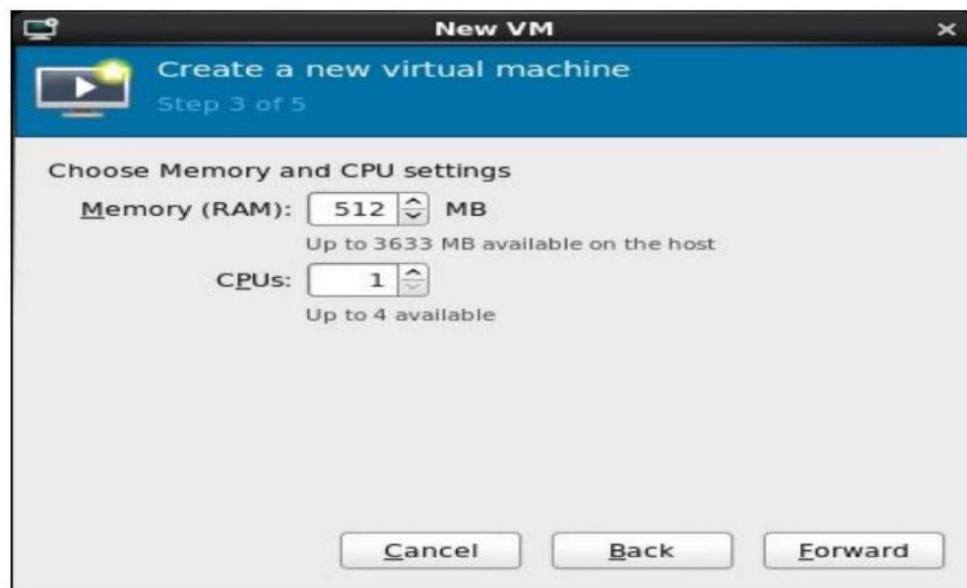
Step 2:

Now browse to the location where we have created the ISO file and point to it as shown below.



Step 3:

Now we have to assign the amount of memory and CPU which will be available to the Virtual Machine. This is the maximum RAM that the Virtual Machine will be able to use for its own purpose. A typical 512 MB memory and 1 CPU will be okay. Try to keep enough amount of memory for our base operating-system.



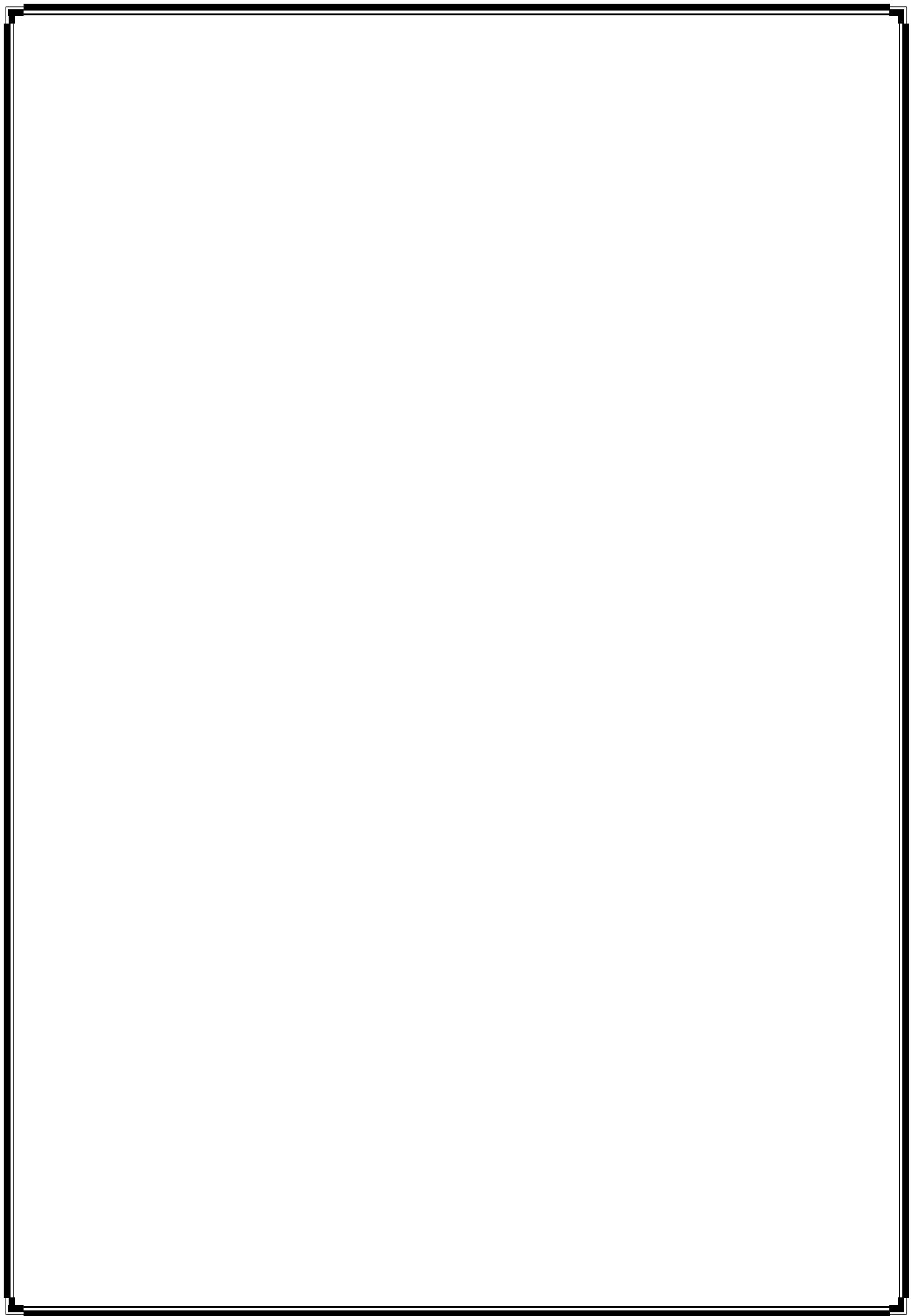
Step 4:

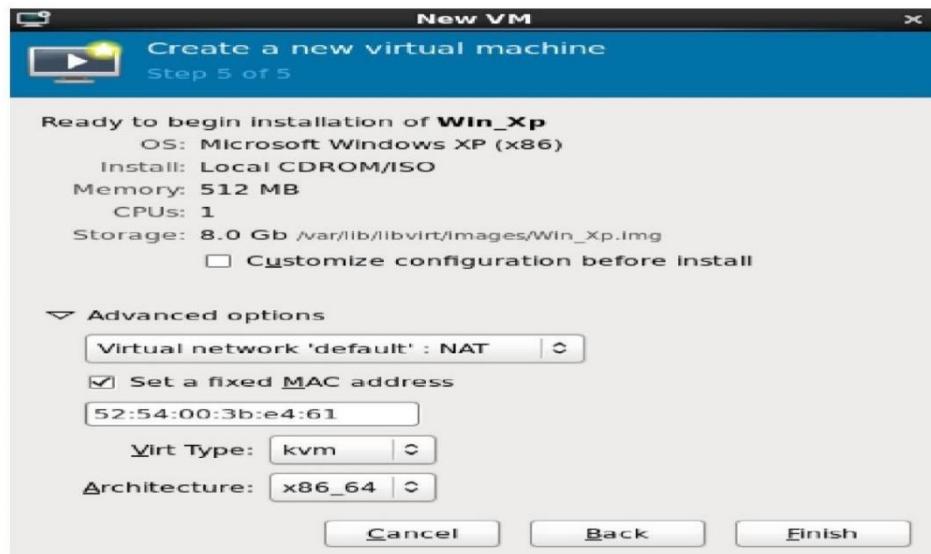
We have allocated 8 GB for Windows XP Machine. But as we can see in the image below it says “4.6 Gb available in the default location”. In this case the image cannot be kept in the default location. So we have two option either we decrease the allocated size or select a different location in our existing disk by clicking on “Select managed or other existing storage”.



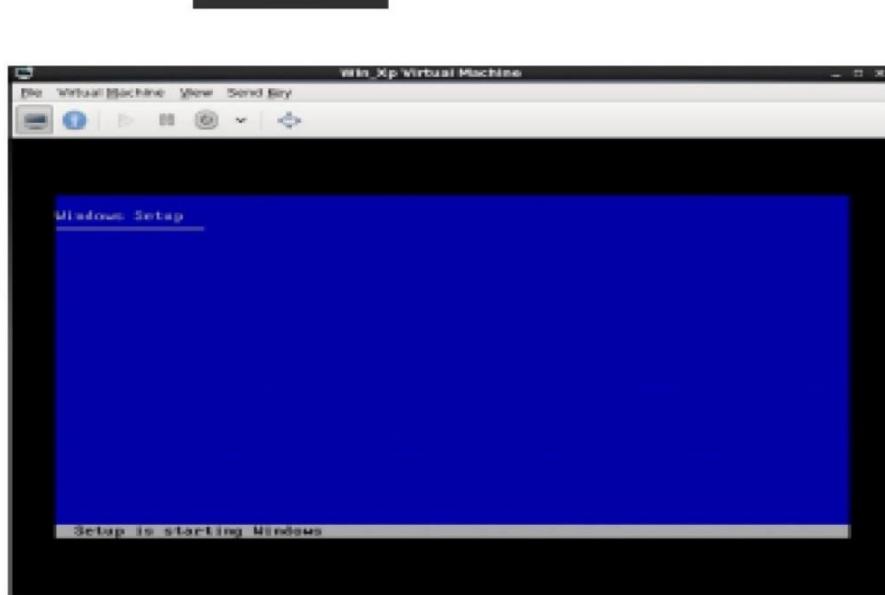
Step 5:

In the last step we will be verifying the parameters and proceed to final installation by clicking on Finish button.





Having done all these steps, we have now successfully created a Windows Machine. Remember that the above steps are similar for installing any other operating-systems like Ubuntu/Centos/Debian/Fedora/RHEL etc.
You will be now presented with the traditional Windows Setup.



Lab-8 Installing Guest OS in KVM using Command Line

Installing Guest OS in KVM using Command Line

Previously we've installed guest OS in KVM using the graphical mode, i.e. using the virt-manager. In many of the cases probably we'll not always be having the graphical mode. In such situation we have to install using the command line tool.

We'll use the *virt-install* to install guest OS in KVM using command line

virt-install supports rich set of options to install and also configure pre-installation options of a new guest OS. In the previous example we installed windows operating-system using the graphical virt-manager tool. Here we will look into installing the same Windows XP having the same configuration but now using the command line.

```
# virt-install --name cmdWinxp --ram 512 --disk path=/home/gun/cmdWinxp.img,size=5 --os-variant winxp --cdrom /home/gun/Wxp_sp2.iso
```

Starting install...

Creating storage file cmdWinxp.img | 5.0 GB 00:00

Creating domain... | 0 B 00:00

Domain installation still in progress. Waiting for installation to complete.

The above command will install a Virtual instance of the Windows XP operating system with name cmdWinxp having 512 MB available RAM. With the –disk option you can specify the destination path of the OS Image file and the size to allocate it. Since we are installing Windows XP we specified the –os-variant winxp. And finally the source of the installation ISO/CDROM. In our case it is an iso image of Windows XP located at /home/gun.

For getting *virt-install* information we can consult the man page as follows.

```
# man virt-install
```

There is one interesting option to consider and that is to install any Guest operating system, in an interactive manner with the *–prompt* option to the *virt-install* command. To illustrate this, We will install Ubuntu 11.10 Guest OS in KVM using the interactive feature of the *virt-install* command.

```
# virt-install --prompt
```

What is the name of your virtual machine? **ubuntu**

How much RAM should be allocated (in megabytes)? **512**

What would you like to use as the disk (file path)? **/home/gun/ubuntu.img**

How large would you like the disk (/home/gun/ubuntu.img) to be (in gigabytes)? **6**

What is the install CD-ROM/ISO or URL? **/home/gun/ubuntu-11.10-desktop-i386.iso**

Starting install...

Creating storage file ubuntu.img | 6.0 GB 00:00

Creating domain... | 0 B 00:00

So with the help of “*virt-install –prompt*” on command line we can install interactively any guest operating system easily.

Starting / Stopping Guest Operating Systems With virsh Command : The virsh command can be used to mange local or remote guest operating systems. This command can be used to create, pause, and shutdown domains. It can also be used to list current domains.

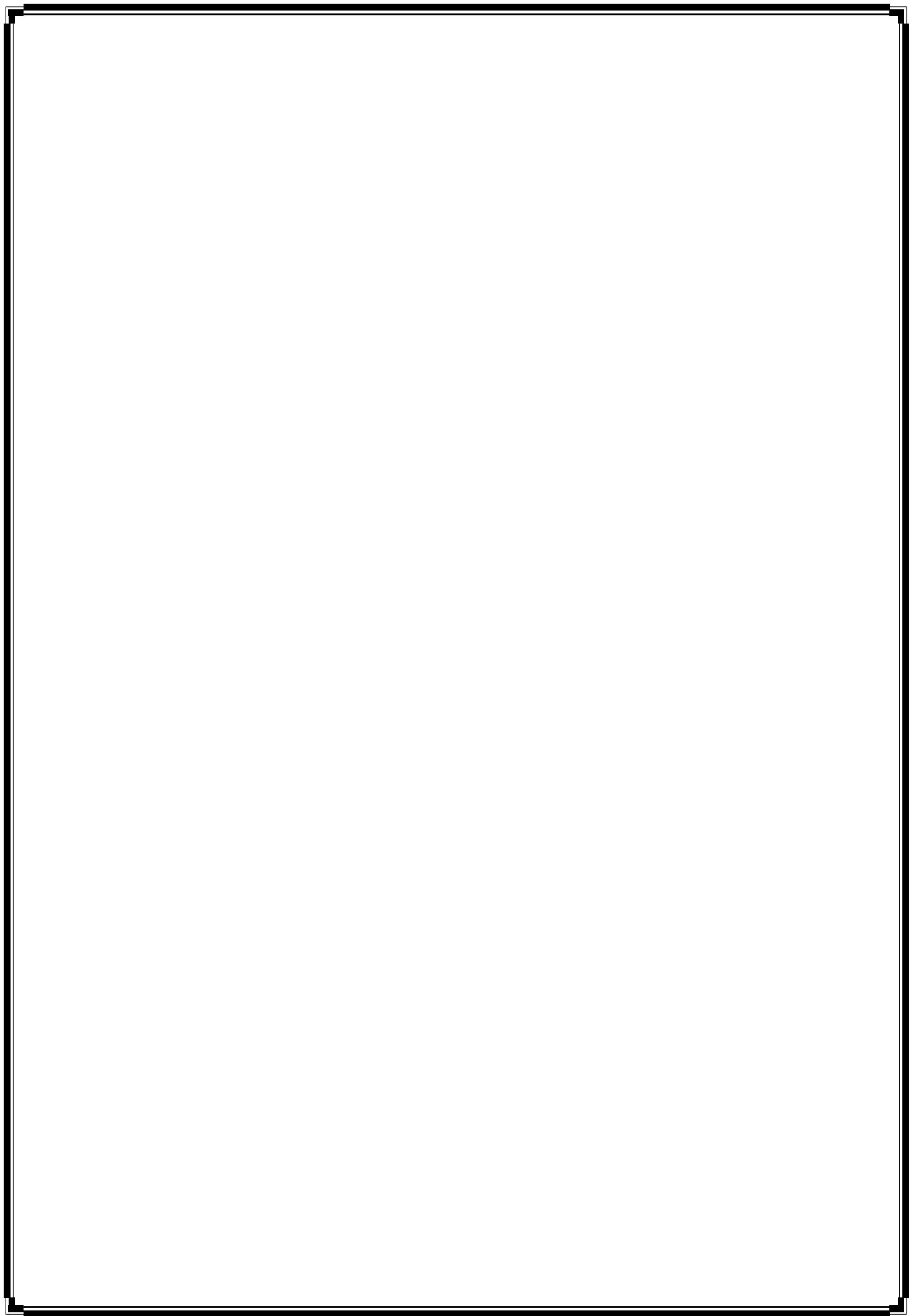
To list Running VMS

Type the following command:

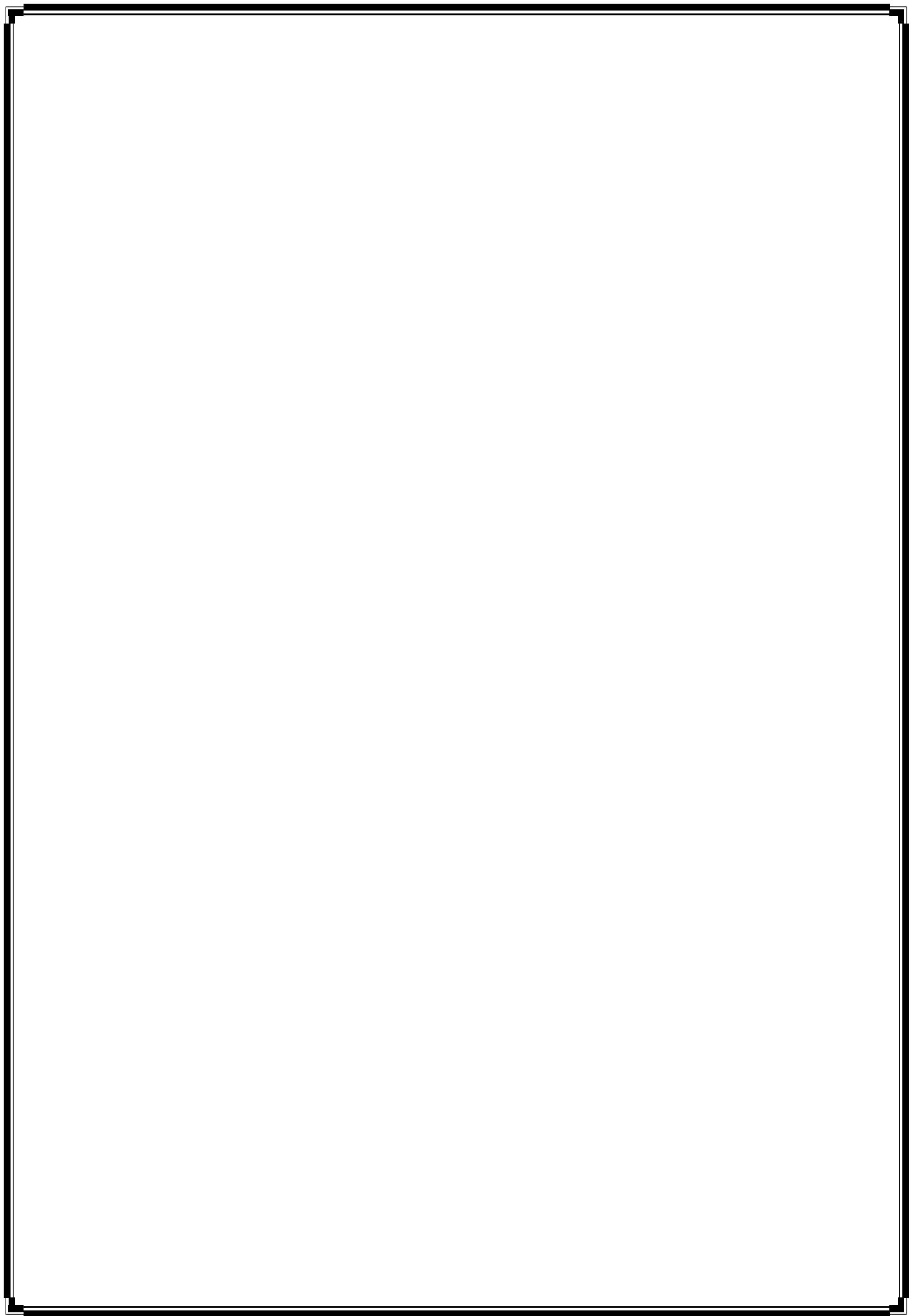
```
# virsh list
```

Sample outputs:

Id	Name	State
1	Ubuntu	running



```
-----  
1 cmdWinxp running  
2 ubuntu running  
3 Winxp running  
Shut Down A Guest  
# virsh list  
# virsh shutdown domianName  
# virsh shutdown cmdWinxp  
# virsh shutdown 1  
Rebooting A Guest  
# virsh list  
# virsh reboot domaiName  
# virsh reboot 2  
# virsh reboot ubuntu  
Forcefully Stop A Guest  
Force a guest to stop with the virsh command if it is crashed or not responding  
# virsh list  
# virsh destroy domainName  
# virsh destroy Winxp  
Get Information About Guest  
# virsh list  
# virsh dominfo dominName  
# virsh dominfo 2  
# virsh dominfo ubuntu  
Sample outputs:  
Id: 2  
Name: ubuntu  
UUID: ....  
OS Type: ....  
State: running  
CPU(s): 1  
CPU time: 24.3s  
Max memory: 524288 kB  
Used memory: 524288 kB  
Autostart: disable  
  
Get Information About Node  
# virsh nodeinfo
```



Sample Outputs:

CPU model: x86_64

CPU(s): 4

CPU frequency: 2394 MHz

CPU socket(s): 1

Core(s) per socket: 4

Thread(s) per core: 1

NUMA cell(s): 1

Memory size: 8181332 kB

Lab-9 Installation of VMware ESX Server

Installation of VMware ESX Server

Assuming that we did not receive ESX 3i embedded in our server.

To download ESX Server 3i, we need the installable 200MB ESX Server 3i ISO image(approx.). To get the same from vmware website we need to fill out all the necessary information and will be in a position to download the iso image

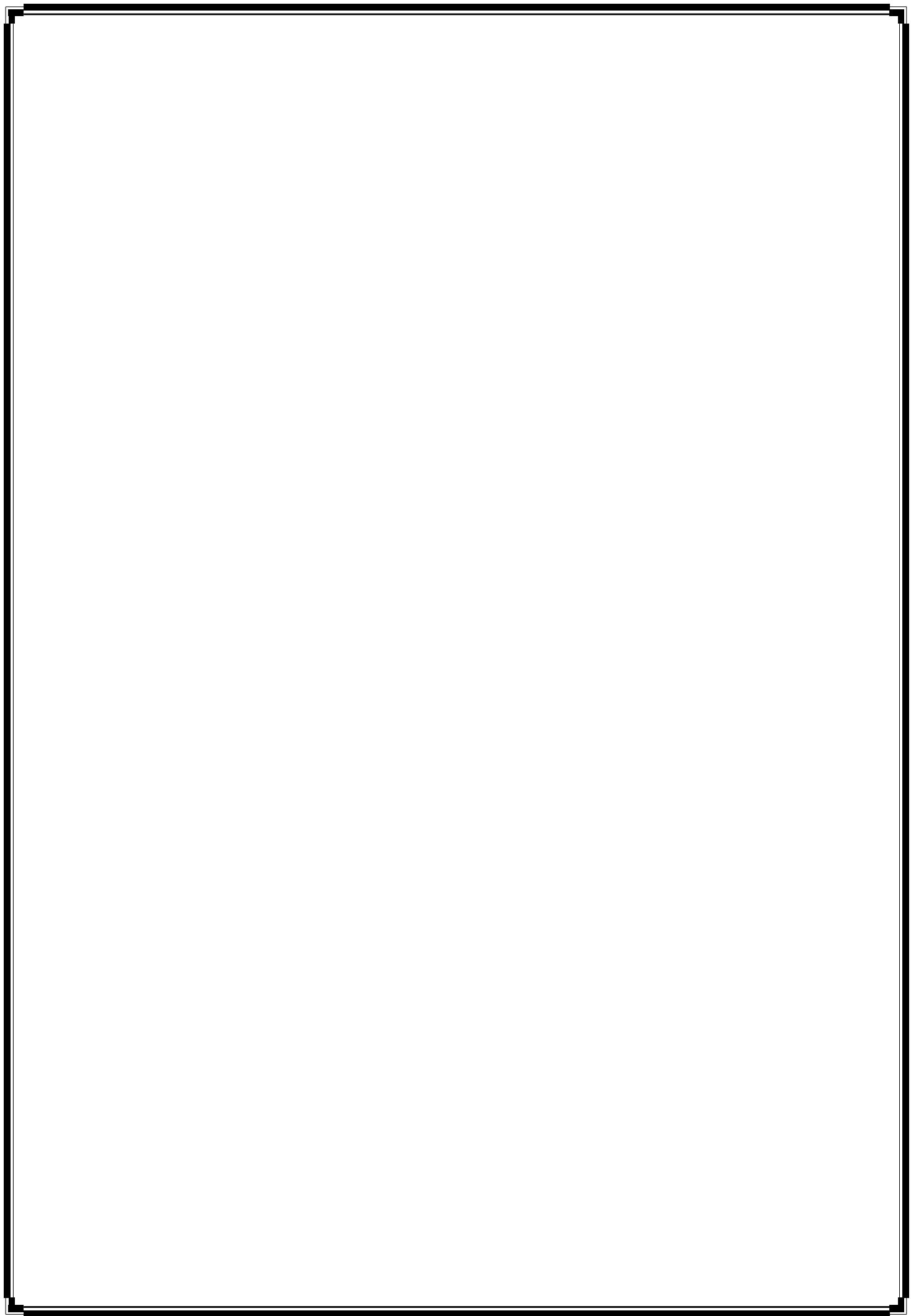
. Once we have vmware ESX 3i iso image, we can install it on any server that is supported in the VMware ESX 3i hardware compatible list.

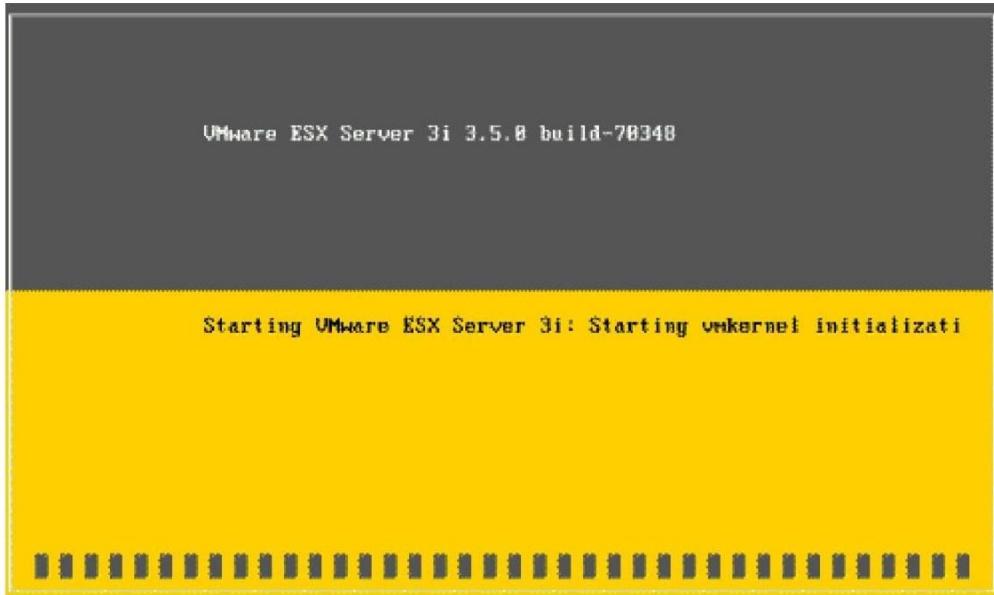
1. Burn the VMware ESX server 3i iso image file onto a bootable CD.
 2. Power on the server after inserting the burnt CD into CDDrive. (Make sure from BIOS setup that the first boot option is set on to CDDrive)
-

3. We will get the following screen :

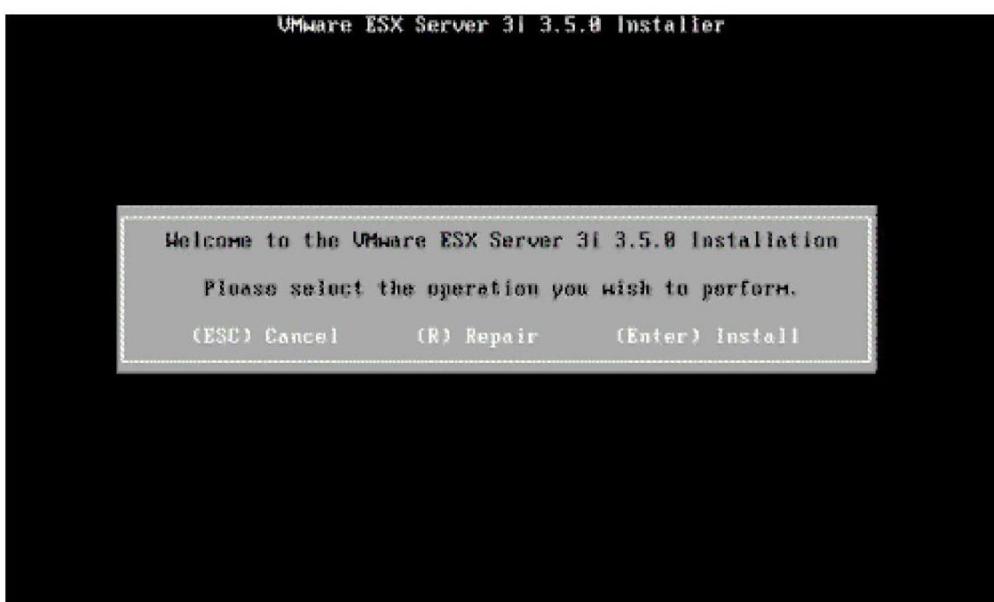


We got "black loading" screen, it switched to "yellow loading" screen after some time which is depicted as below :



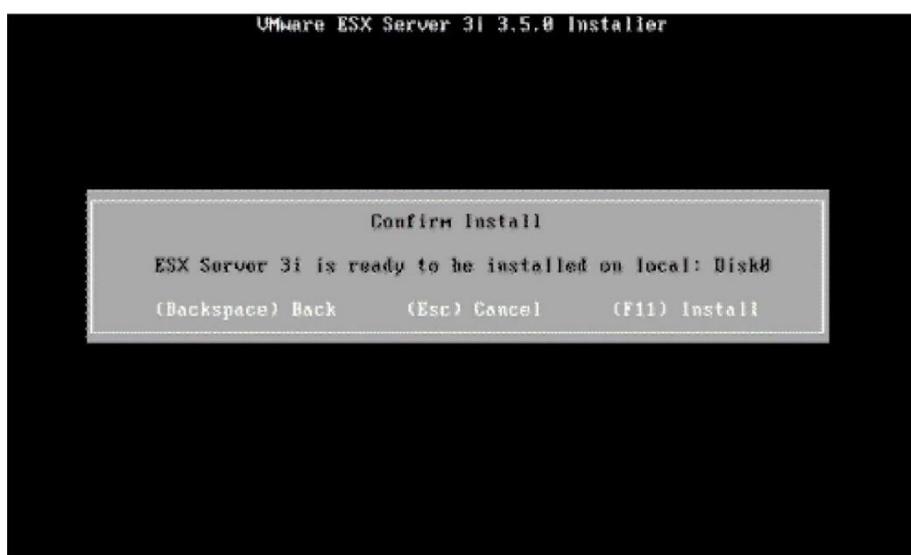


At last we got the “Welcome to VMware ESX Server 3i 3.5.0



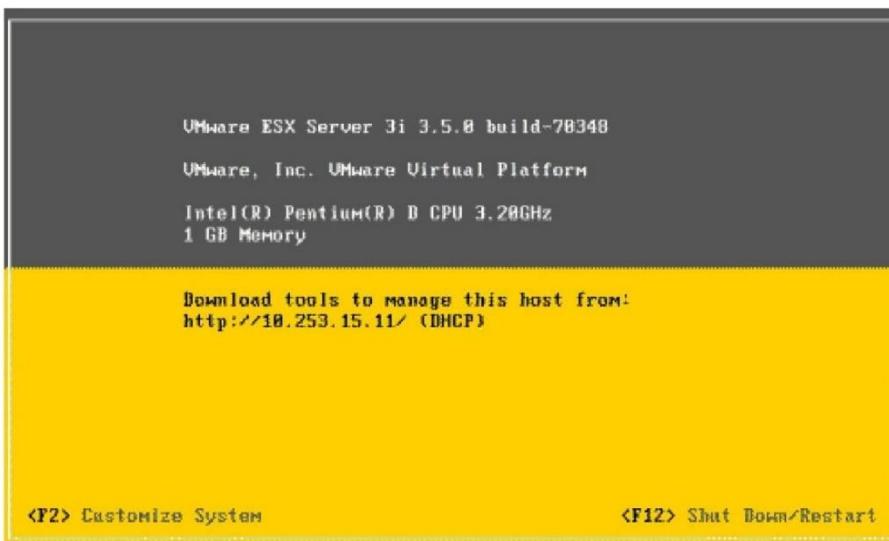
Press enter to Install and further press F11 to accept the license agreement.

Next, confirm the installation by pressing F11 after getting the following screen.



The installation will take few minutes hardly 1 or 2 minutes. Than press enter key for rebooting the system.

After rebooting we will get the following screen :



Now we have to press F2 and access the slim management interface. There, we can set the root password and configure a static IP (and other network settings) on the server.

Installing Guest Operating System in VMware ESX Server

1. Open the VMware Infrastructure Client (VI Client). Right-click on ESX Server and select New Virtual Machine or press Ctrl+N.
2. Opt to create a Typical virtual machine in order to reduce the number of queries that are needed to be answered later and click next to continue further.
3. Next, name the new Virtual Machine and than click Next.
4. Select the Datastore that the new Virtual Machine will be stored into. We can use the local storage on our ESX Server, and click Next.
5. Choose the operating system that we will be installing. In our case windows XP and click Next.
6. Choose the number of Virtual Processors. In our case, opt with the default of 1, and click Next.

7. On next screen select the amount of RAM that this new Guest VM will have. In our case, 256MB of RAM for the new Windows XP VM. click Next.
 8. Choose the number of virtual NICs and the virtual networks that the vNICs will be attached to. Opt here defaults. Click Next.
 9. Next, choose amount of disk space that will be allocated to the guest virtual disk. We can allocate the default of 8GB. Click Next.
 10. Review the settings configured for the new guest VM, If everything is as expected, click Finish.
 11. Before starting or booting the new virtual machine, we need to attach the Windows XP installation media (CDROM) to the new virtual machine. To do this, select the new guest VM, then click Edit Virtual Machine Settings(which falls under the Basic tasks and located just below Power on the virtual machine.)
 12. In virtual machine properties window, click on the Virtual CD/DVD Drive. In our case, we have the Windows XP installation media in an ISO file format and stored on the ESX server's local data store. Click on Datastore ISO file, and browse to the Windows XP ISO file. And finally, select Connect at power on, then press OK.
 13. Now that we are ready to install the operating system, Power On the new Virtual machine and move to the Console so that we can go through the installation process.
 14. Because the installation media was connected at power on, the Windows CD should boot automatically, inspects the hardware and starts to load files for Windows Setup. We need to press here F6 function key, when we see the message "press F6 to load a SCSI driver", this is because ESX will use a Buslogic SCSI driver by default and we need to direct the installer to the Buslogic driver.
 15. On the next blue screen, at bottom side, we get message S=Specify Additional Device, here press "S" to specify a SCSI driver.
 16. Proceeding further we need to download the VMware SCSI Drivers and have this file available on our system.
 17. Now, click on to Connect Floppy button on VI Client Toolbar and select the VMware SCSI Drivers FLP file that we have downloaded. Further on the Windows XP screen to "INSERT FLOPPY AND PRESS ENTER" we need to Press Enter.
-

18. Hereafter we should see normal Window XP Setup / Install screen. Press Enter to begin the setup. Now, follow the typical Windows XP installation procedure.
19. Once the file copy gets completed, Windows XP will restart. And at that point, make sure we disconnect the virtual floppy disk. After that Windows XP restarts, and we will be answering the typical Windows XP setup questions and our new Windows XP VMware ESX Server Guest will be ready for use.

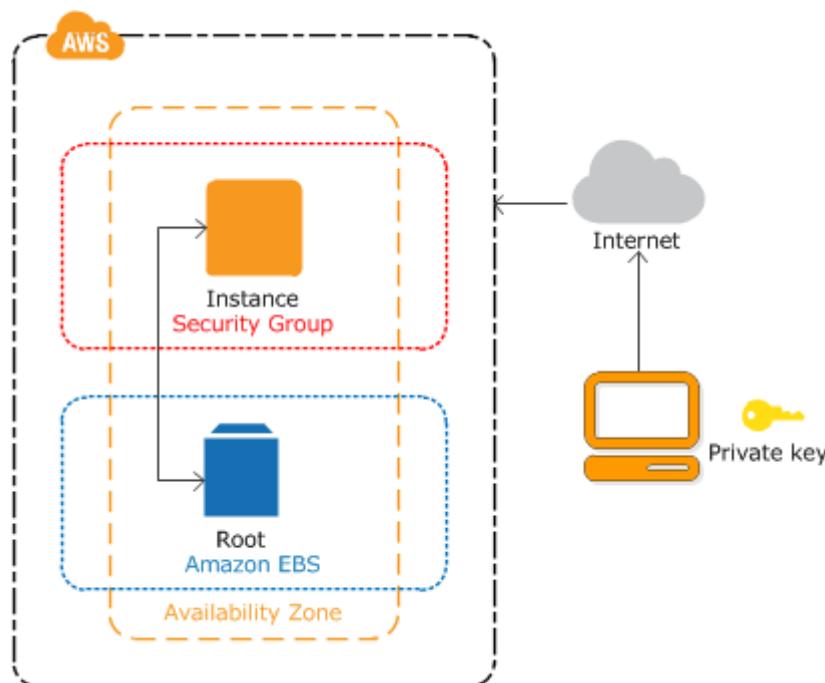
-----*****-----

Lab 9, 10: Creating AWS EC2 Instance and Connecting to it Amazon EC2 Windows Instances

An *instance* is a **virtual server in the AWS cloud**. With Amazon EC2, **you can set up and configure the operating system and applications that run on your instance**.

Overview

The instance is an Amazon EBS-backed instance (meaning that the root volume is an EBS volume). You can either specify the Availability Zone in which your instance runs, or let Amazon EC2 select an Availability Zone for you. When you launch your instance, you secure it by specifying a key pair and security group. When you connect to your instance, you must specify the private key of the key pair that you specified when launching your instance.

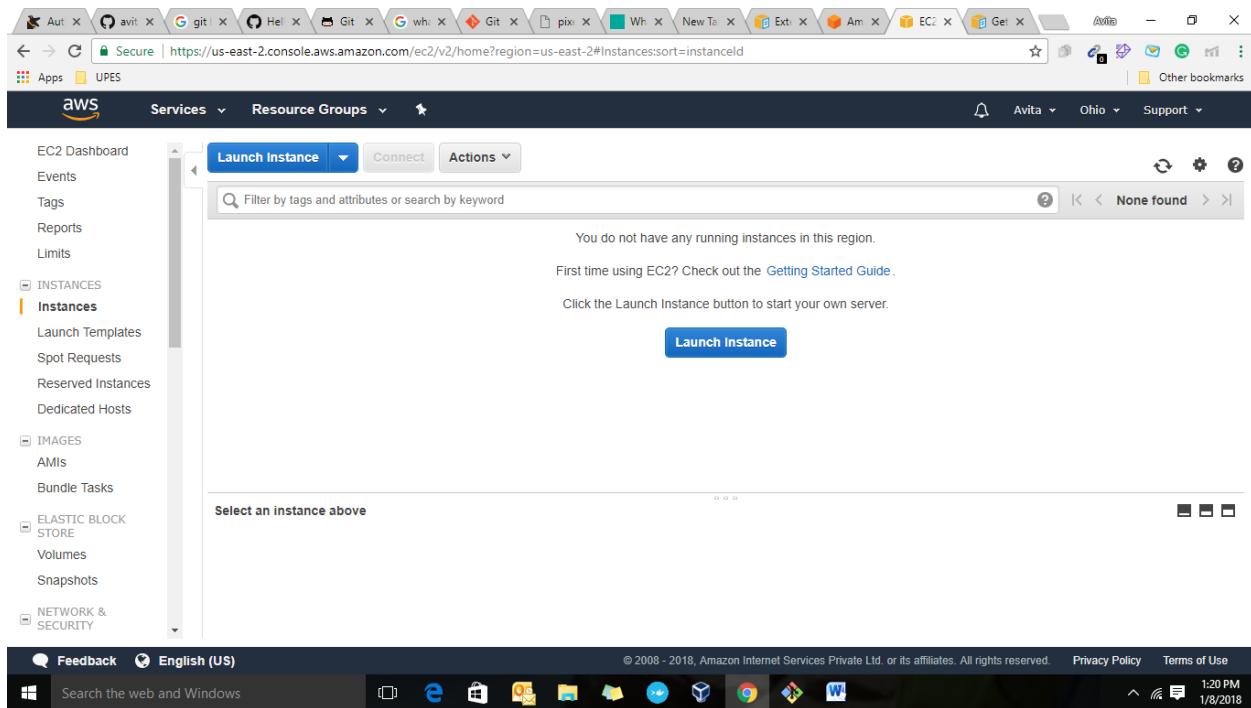


Step 1: Launch an Instance

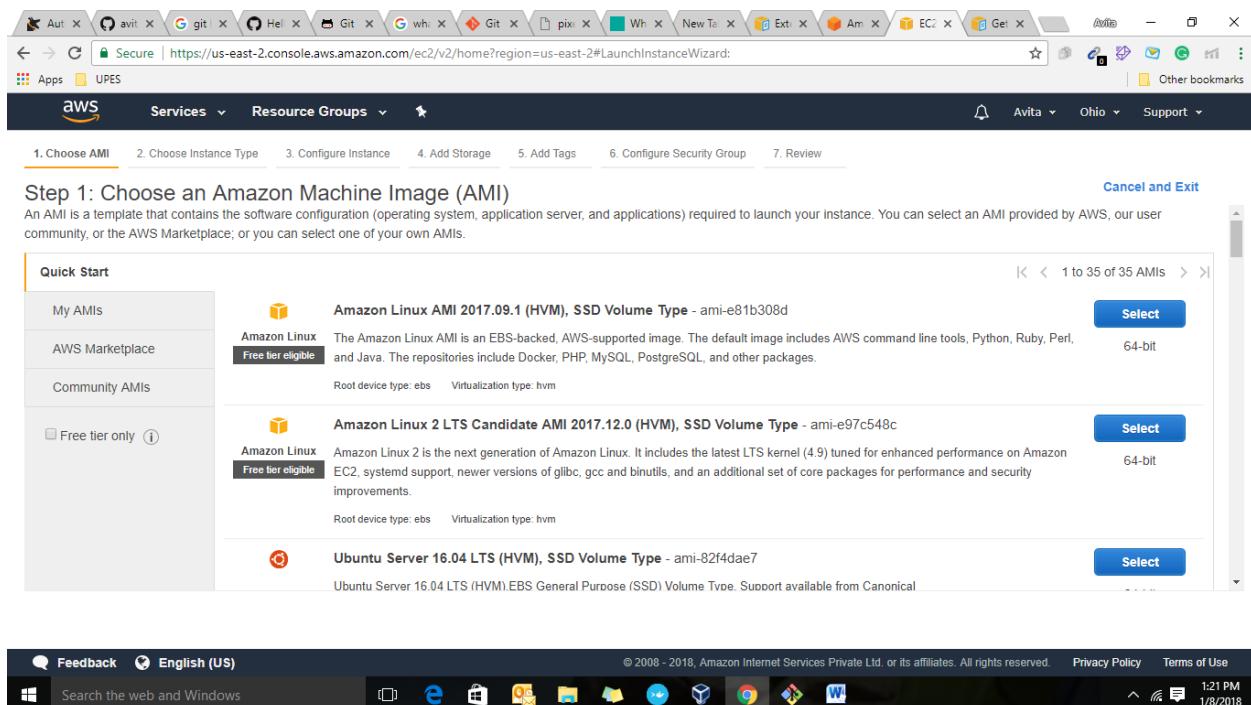
You can launch a Windows instance using the AWS Management Console as described in the following procedure. This tutorial is intended to help you launch your first instance quickly, so it doesn't cover all possible options. For more information about the advanced options, see [Launching an Instance](#).

To launch an instance

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.



2. From the console dashboard, choose **Launch Instance**.



3. The **Choose an Amazon Machine Image (AMI)** page displays a list of basic configurations, called *Amazon Machine Images (AMIs)*, that serve as templates for your

instance. Select the AMI for Windows Server 2012 R2 Base or Windows Server 2008 R2 Base. Notice that these AMIs are marked "Free tier eligible."

The screenshot shows the AWS EC2 Management Console interface. The browser tab is titled 'Authenticated EC2 Management Console Getting Started with Am...'. The main content area is titled 'Step 2: Choose an Instance Type'. It displays a table of instance types with columns for Family, Type, vCPUs, Memory (GiB), Instance Storage (GB), EBS-Optimized Available, Network Performance, and IPv6 Support. The 't2.micro' row is highlighted, showing 'Free tier eligible' in a green box. The table header indicates 'Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)'. At the bottom of the page are buttons for 'Cancel', 'Previous', 'Review and Launch' (which is blue and bolded), and 'Next: Configure Instance Details'. The Windows taskbar at the bottom includes icons for Feedback, English (US), Search, Start, File Explorer, Task View, File, Mail, Photos, Snipping Tool, Task Manager, Google Chrome, and Microsoft Edge. The date and time on the taskbar are 1/8/2018 1:22 PM.

4. On the **Choose an Instance Type** page, you can select the hardware configuration of your instance. Select the t2.micro type, which is selected by default. Notice that this instance type is eligible for the free tier.

Note

T2 instances, such as t2.micro, must be launched into a VPC. If your AWS account supports EC2-Classic and you do not have a VPC in the selected region, the launch wizard creates a VPC for you and you can continue to the next step. Otherwise, the **Review and Launch** button is disabled and you must choose **Next: Configure Instance Details** and follow the directions to select a subnet.

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

AMI Details

Microsoft Windows Server 2012 R2 Base - ami-c24e66a7
 Microsoft Windows 2012 R2 Standard edition with 64-bit architecture. [English]
 Free tier eligible
 Root Device Type: ebs Virtualization type: hvm

Instance Type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

Security Groups

Security group name: launch-wizard-1
 Description: launch-wizard-1 created 2018-01-08T13:24:25.646+05:30

Buttons: Cancel, Previous, Launch

5. Choose **Review and Launch** to let the wizard complete the other configuration settings for you.
6. On the **Review Instance Launch** page, under **Security Groups**, you'll see that the wizard created and selected a security group for you. You can use this security group, or alternatively you can select the security group that you created when getting set up using the following steps:

a. Choose **Edit security groups**.

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more](#) about Amazon EC2 security groups.

Assign a security group: Create a new security group
 Select an existing security group

Security group name:
 Description:

Type	Protocol	Port Range	Source	Description
RDP	TCP	3389	Custom	0.0.0.0/0 e.g. SSH for Admin Desktop

Add Rule

Warning
 Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.

Buttons: Cancel, Previous, Review and Launch, Add Rule

- b. On the **Configure Security Group** page, ensure that **Select an existing security group** is selected.

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more about Amazon EC2 security groups.](#)

Assign a security group: Create a new security group Select an existing security group

Security Group ID	Name	Description	Actions
sg-cfbc5ca4	default	default VPC security group	Copy to new

Select a security group above to view its inbound rules.

Feedback English (US)

Search the web and Windows

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Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more about Amazon EC2 security groups.](#)

Assign a security group: Create a new security group Select an existing security group

Security Group ID	Name	Description	Actions
sg-cfbc5ca4	default	default VPC security group	Copy to new

Inbound rules for sg-cfbc5ca4 (Selected security groups: sg-cfbc5ca4)

Type	Protocol	Port Range	Source	Description
All traffic	All	All	sg-cfbc5ca4 (default)	

[Cancel](#) [Previous](#) [Review and Launch](#)

Feedback English (US)

Search the web and Windows

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1:26 PM 1/8/2018

- c. Select your security group from the list of existing security groups, and then choose **Review and Launch**.

7. On the Review Instance Launch page, choose Launch.

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

AMI Details

Microsoft Windows Server 2012 R2 Base - ami-c24e66a7

Free tier eligible

Microsoft Windows 2012 R2 Standard edition with 64-bit architecture [English]
Root Device Type: ebs Virtualization type: hvm

Instance Type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

Security Groups

Security Group ID	Name	Description
sa-cfc5ca4	default	default VPC security group

Edit security groups

Feedback English (US)

Cancel Previous Launch

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

AMI Details

Microsoft Windows Server 2012 R2 Standard edition with 64-bit architecture [English]
Root Device Type: ebs Virtualization type: hvm

Instance Type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

Security Groups

Security Group ID	Name	Description
sa-cfc5ca4	default	default VPC security group

Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about [removing existing key pairs from a public AMI](#).

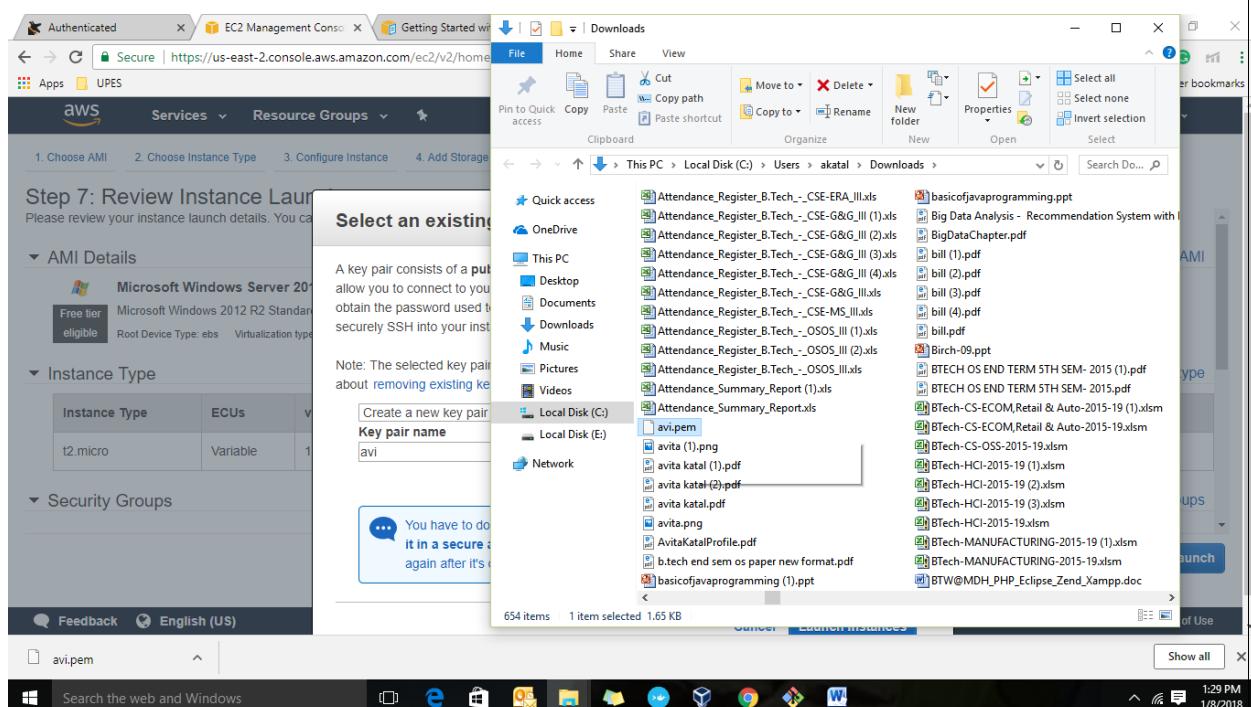
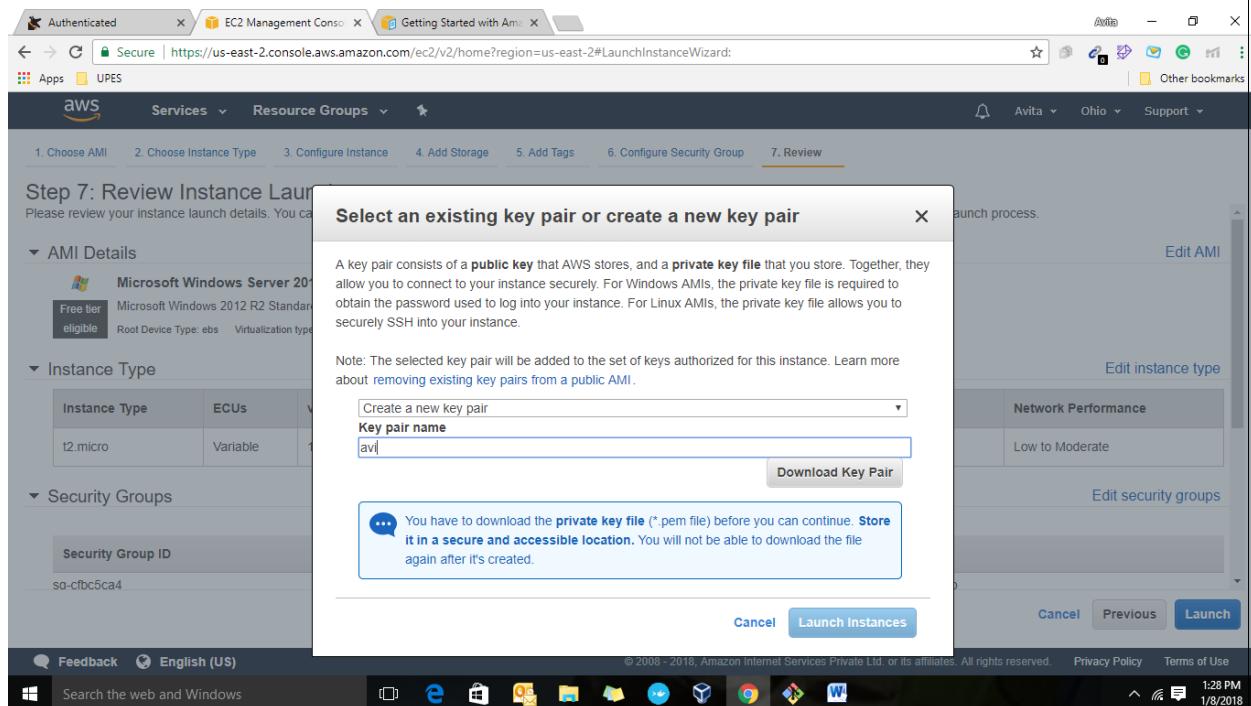
Choose an existing key pair
Select a key pair
No key pairs found

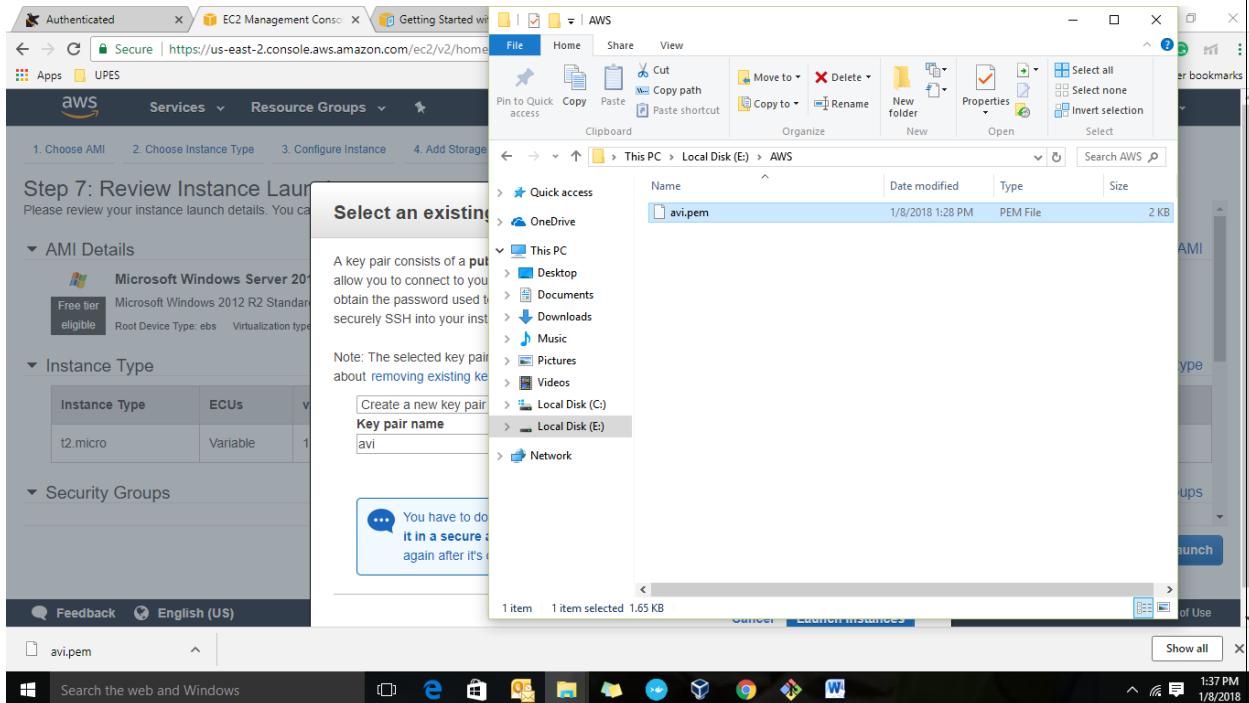
No key pairs found
You don't have any key pairs. Please create a new key pair by selecting the [Create a new key pair](#) option above to continue.

Cancel Launch Instances

- 8. When prompted for a key pair, select **Choose an existing key pair**, then select the key pair that you created when getting set up.**

Alternatively, you can create a new key pair. Select **Create a new key pair**, enter a name for the key pair, and then choose **Download Key Pair**. This is the only chance for you to save the private key file, so be sure to download it. Save the private key file in a safe place. You'll need to provide the name of your key pair when you launch an instance and the corresponding private key each time you connect to the instance.

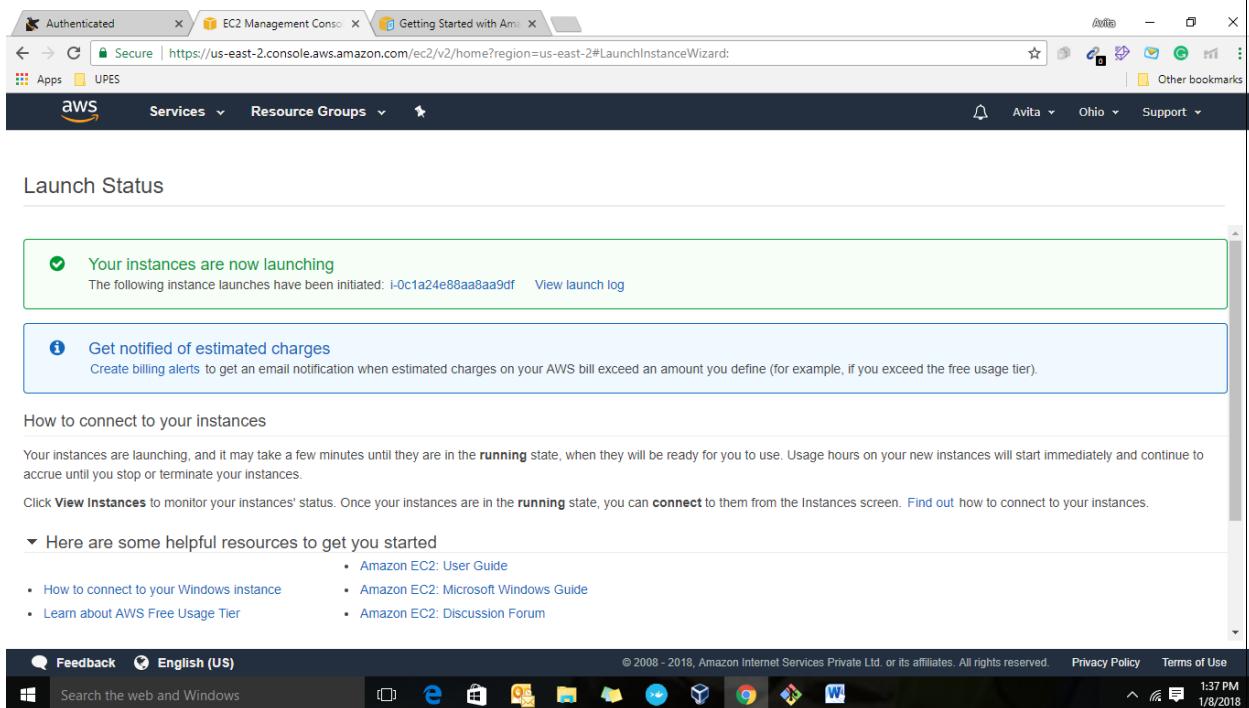




Warning

Don't select the **Proceed without a key pair** option. If you launch your instance without a key pair, then you can't connect to it.

When you are ready, select the acknowledgement check box, and then choose **Launch Instances**.



9. A confirmation page lets you know that your instance is launching. Choose **View Instances** to close the confirmation page and return to the console.

The screenshot shows two consecutive screenshots of the AWS EC2 Management Console.

Top Screenshot (Launch Status):

- The title bar shows "Authenticated" and the URL "https://us-east-2.console.aws.amazon.com/ec2/v2/home?region=us-east-2#LaunchInstanceWizard".
- The main content area is titled "Launch Status".
- Section "How to connect to your instances": Text about instances launching and reaching the "running" state. It includes a link to "View Instances".
- Section "Here are some helpful resources to get you started": A list of links including "Amazon EC2: User Guide", "How to connect to your Windows instance", "Amazon EC2: Microsoft Windows Guide", "Learn about AWS Free Usage Tier", and "Amazon EC2: Discussion Forum".
- Text "While your instances are launching you can also": Links to "Create status check alarms", "Create and attach additional EBS volumes", and "Manage security groups".
- A blue "View Instances" button at the bottom right.

Bottom Screenshot (Instances screen):

- The title bar shows "Authenticated" and the URL "https://us-east-2.console.aws.amazon.com/ec2/v2/home?region=us-east-2#Instances:sort=instanceId".
- The main content area shows the "Instances" section of the EC2 Dashboard.
- The left sidebar lists categories: EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES (highlighted), Instances, Launch Templates, Spot Requests, Reserved Instances, Dedicated Hosts, IMAGES, AMIs, Bundle Tasks, ELASTIC BLOCK STORE, Volumes, Snapshots, and NETWORK & SECURITY.
- The main pane displays a table of instances:

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)	IPv4
i-0c1a24e88aa8aa9df	i-0c1a24e88aa8aa9df	t2.micro	us-east-2b	running	Initializing	None	ec2-18-218-118-83.us-east-2.compute.amazonaws.com	18.2
- The details panel for the selected instance (i-0c1a24e88aa8aa9df) shows:

Instance: i-0c1a24e88aa8aa9df Public DNS: ec2-18-218-118-83.us-east-2.compute.amazonaws.com	
Description	Status Checks
Instance ID: i-0c1a24e88aa8aa9df	Public DNS (IPv4): ec2-18-218-118-83.us-east-2.compute.amazonaws.com
Instance state: running	IPv4 Public IP: 18.218.118.83
- The footer includes standard browser controls and the AWS navigation bar.

- On the **Instances** screen, you can view the status of the launch. It takes a short time for an instance to launch. When you launch an instance, its initial state is pending. After the instance starts, its state changes to running and it receives a public DNS name. (If the **Public DNS (IPv4)** column is hidden, choose **Show/Hide Columns** (the gear-shaped icon) in the top right corner of the page and then select **Public DNS (IPv4)**.)

The screenshot shows the AWS EC2 Management Console interface. On the left, there's a navigation sidebar with options like EC2 Dashboard, Events, Tags, Reports, Limits, Instances (selected), Launch Templates, Spot Requests, Reserved Instances, Dedicated Hosts, Images, AMIs, and Bundle Tasks. The main content area displays a table of instances. One instance is selected, showing its details in a modal window. The instance is named 'avi', has a Public DNS of 'ec2-18-218-118-83.us-east-2.compute.amazonaws.com', and is currently 'running'. The status checks column shows 'None'.

This screenshot shows the same EC2 instance 'avi' from the previous screen, but now with a status check alarm created. A modal window titled 'Create Status Check Alarm' is open, showing the 'System Status Checks' section with a green status message: 'System reachability check passed'. Below it, the 'Instance Status Checks' section also shows a green status message: 'Instance reachability check passed'. The rest of the interface remains the same, with the navigation sidebar and the main table of instances.

11. It can take a few minutes for the instance to be ready so that you can connect to it. Check that your instance has passed its status checks; you can view this information in the **Status Checks** column.

The screenshot shows the AWS EC2 Management Console interface. On the left, there's a sidebar with navigation links like EC2 Dashboard, Events, Tags, Reports, Limits, Instances, Launch Templates, Spot Requests, Reserved Instances, Dedicated Hosts, Images, AMIs, Bundle Tasks, Elastic Block Store, Volumes, Snapshots, and Network & Security. The main area displays a table of instances. One instance is selected, showing its details: Name is 'i-0c...', Public DNS is 'ec2-18-218-118-83.us-east-2.compute.amazonaws.com', Public IP is '18.218.118.83', Key Name is 'avi', Monitoring is 'disabled', and Launch Time is 'January 8, 2018 at 1:37:08 P... default'. Below the table, there are sections for System Status Checks and Instance Status Checks, both of which show green status indicators. At the bottom, there are feedback and language selection buttons ('Feedback', 'English (US)'), a search bar ('Search the web and Windows'), and a taskbar with various icons.

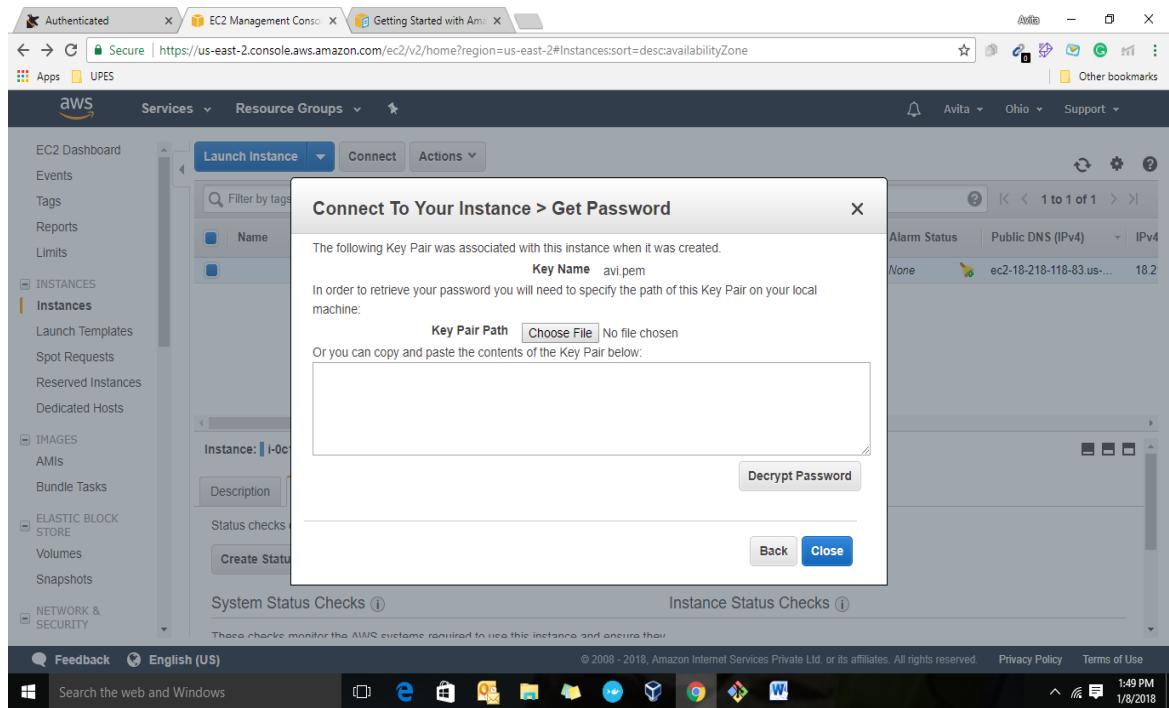
Step 2: Connect to Your Instance

To connect to your Windows instance using an RDP (Remote Desktop) client

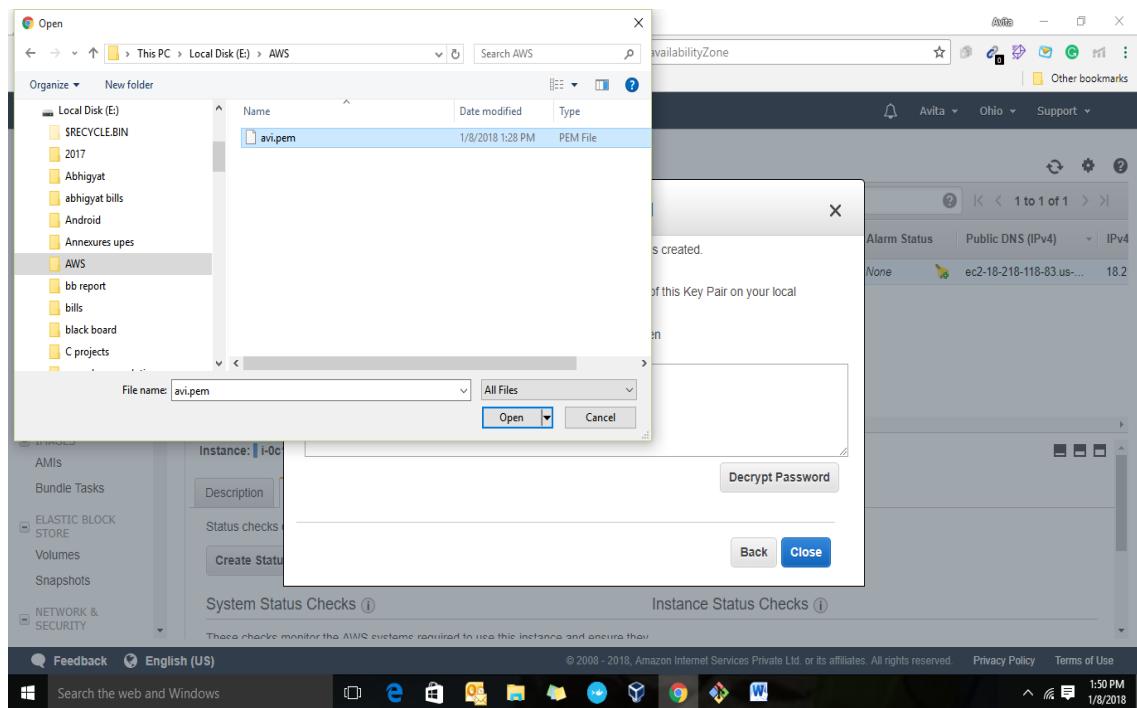
1. In the Amazon EC2 console, select the instance, and then choose **Connect**.

The screenshot shows the 'Connect To Your Instance' dialog box overlaid on the EC2 Management Console. The dialog box contains the following text:
You can connect to your Windows instance using a remote desktop client of your choice, and by downloading and running the RDP shortcut file below:
[Download Remote Desktop File](#)
When prompted, connect to your instance using the following details:
Public DNS: ec2-18-218-118-83.us-east-2.compute.amazonaws.com
User name: Administrator
Password: [Get Password](#)
If you've joined your instance to a directory, you can use your directory credentials to connect to your instance.
If you need any assistance connecting to your instance, please see our [connection documentation](#).
At the bottom right of the dialog box is a 'Close' button.

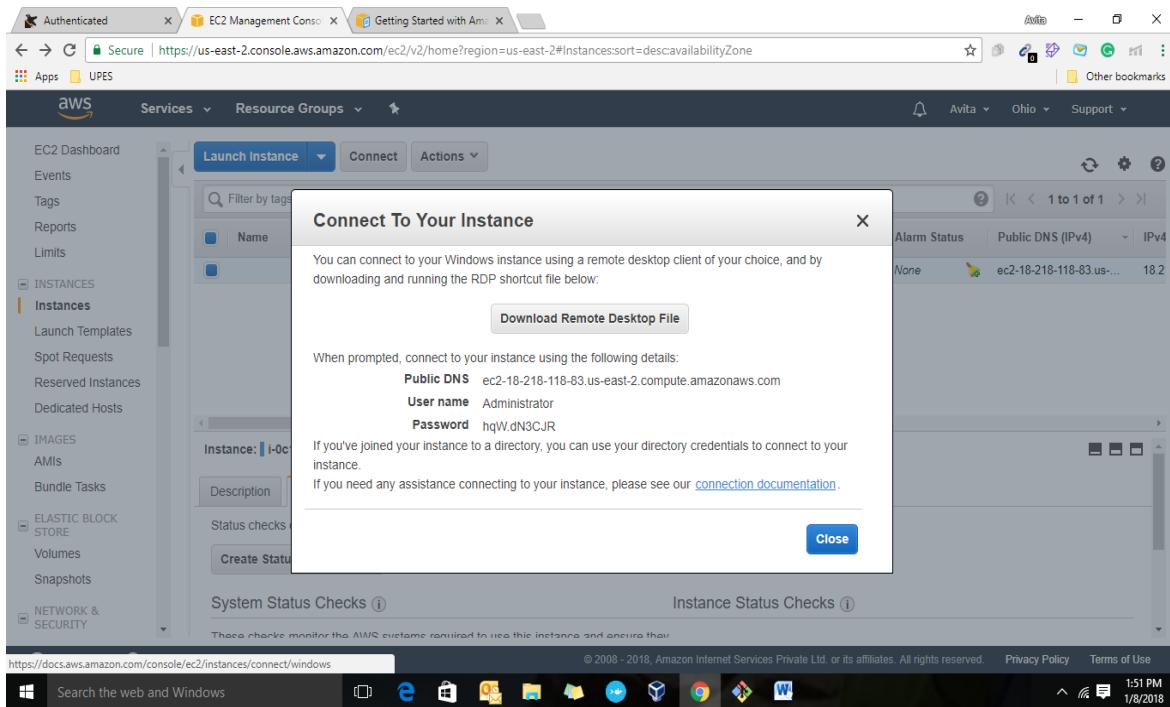
2. In the **Connect To Your Instance** dialog box, choose **Get Password** (it will take a few minutes after the instance is launched before the password is available).



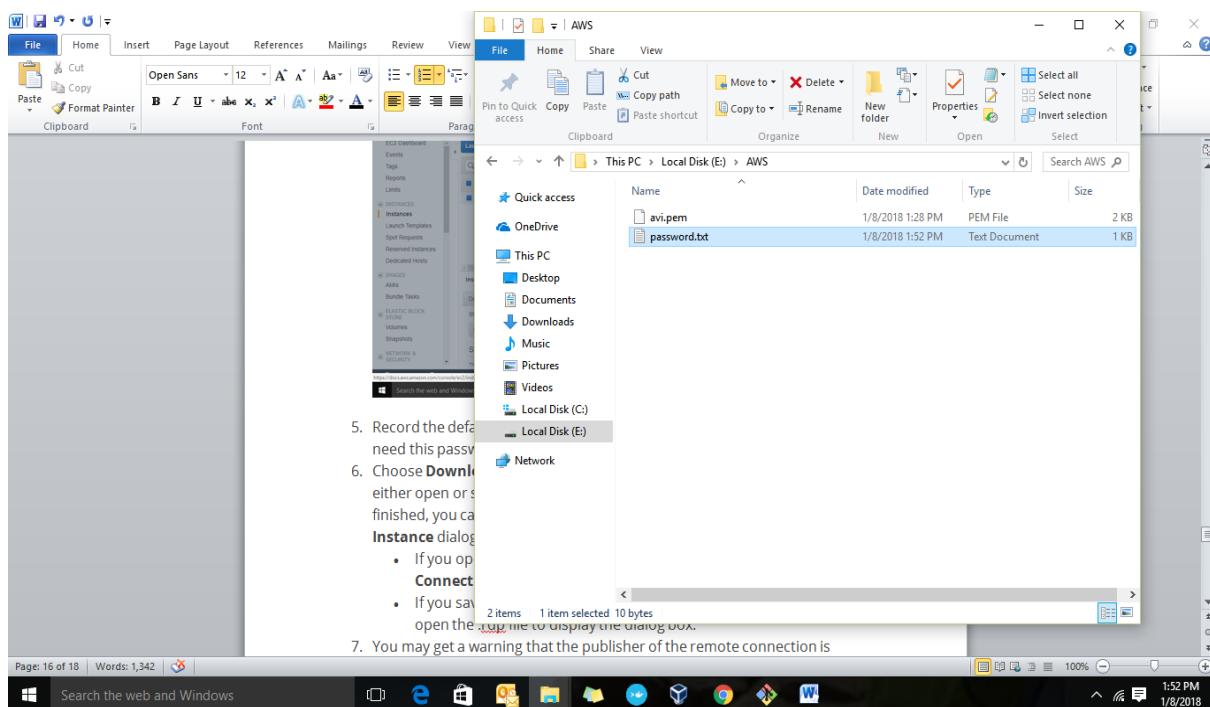
3. Choose **Browse** and navigate to the private key file you created when you launched the instance. Select the file and choose **Open** to copy the entire contents of the file into the **Contents** field.



- Choose **Decrypt Password**. The console displays the default administrator password for the instance in the **Connect To Your Instance** dialog box, replacing the link to **Get Password** shown previously with the actual password.

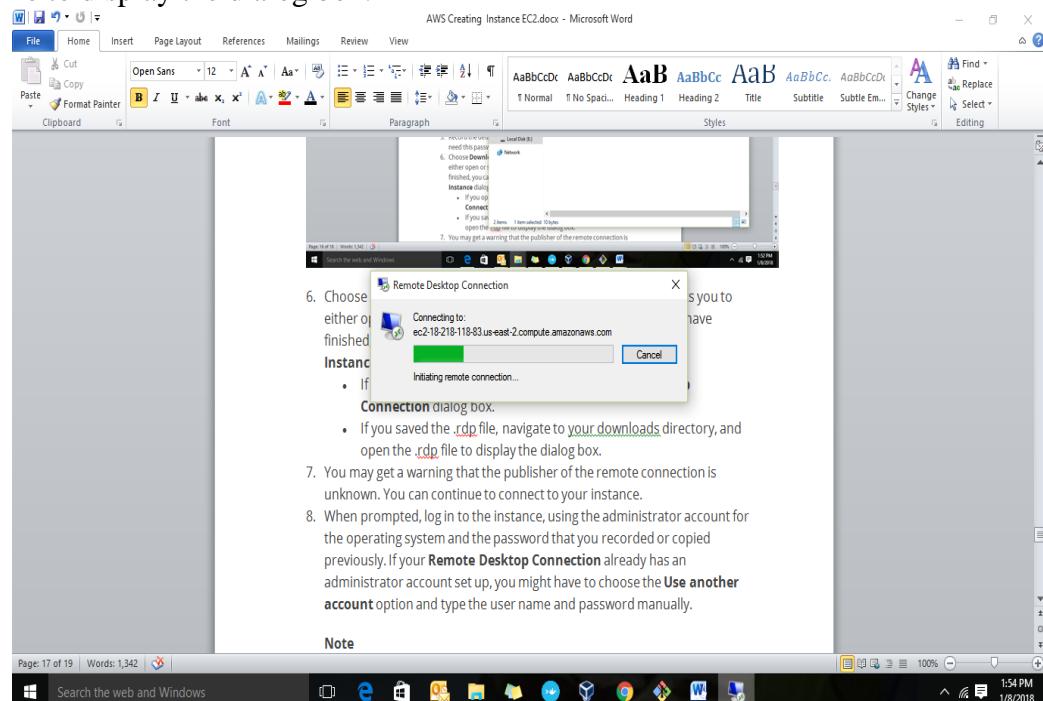


- Record the default administrator password, or copy it to the clipboard. You need this password to connect to the instance.



6. Choose **Download Remote Desktop File**. Your browser prompts you to either open or save the .rdp file. Either option is fine. When you have finished, you can choose **Close** to dismiss the **Connect To Your Instance** dialog box.

- If you opened the .rdp file, you'll see the **Remote Desktop Connection** dialog box.
- If you saved the .rdp file, navigate to your downloads directory, and open the .rdp file to display the dialog box.



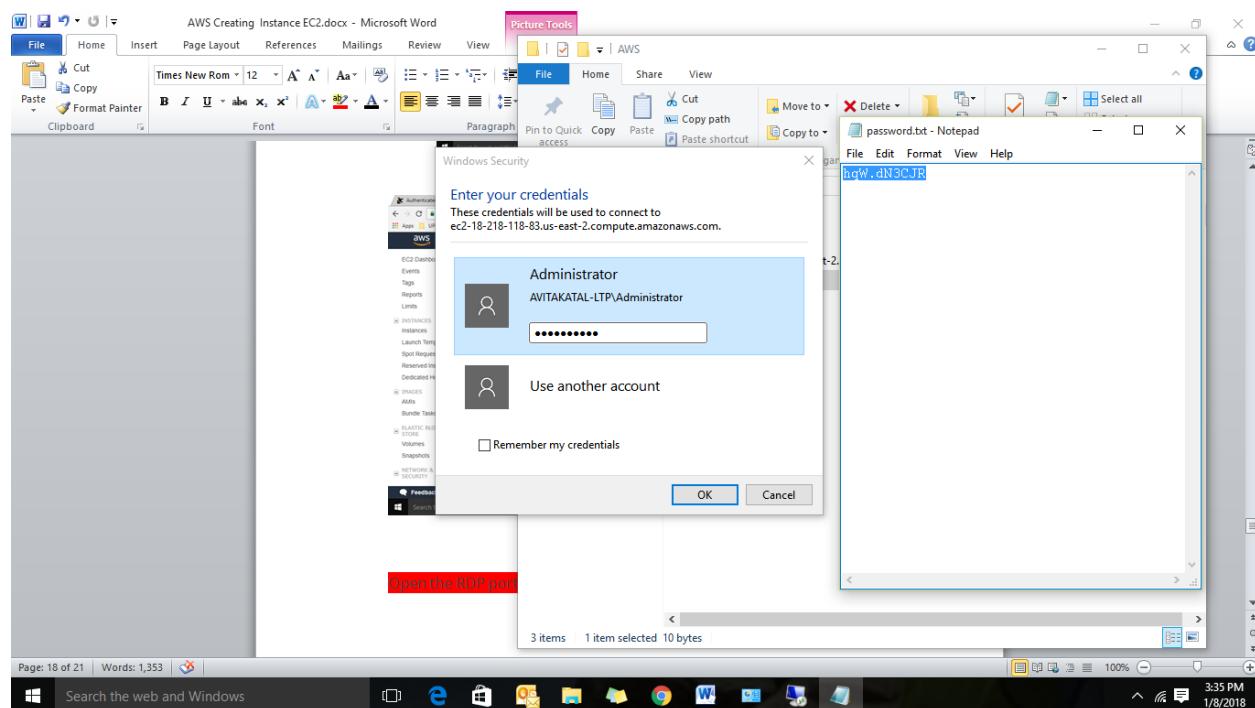
6. Choose either of the options to download the .rdp file. You are prompted to either open or save the file. When you have finished, you can choose **Close** to dismiss the **Connect To Your Instance** dialog box.
7. You may get a warning that the publisher of the remote connection is unknown. You can continue to connect to your instance.
8. When prompted, log in to the instance, using the administrator account for the operating system and the password that you recorded or copied previously. If your **Remote Desktop Connection** already has an administrator account set up, you might have to choose the **Use another account** option and type the user name and password manually.

Note

The screenshot shows the AWS EC2 Management console. On the left, the navigation menu includes "EC2 Dashboard", "Events", "Tags", "Reports", "Limits", "INSTANCES", "Launch Templates", "Spot Requests", "Reserved Instances", "Dedicated Hosts", "IMAGES", "AMIs", "Bundle Tasks", "ELASTIC BLOCK STORE", "Volumes", "Snapshots", and "NETWORK & SECURITY". The main area displays the "Create Security Group" page for a security group named "sg-cfbc5ca4". The table shows one rule: "All traffic" on "All" protocol from "sg-cfbc5ca4 (default)". Below the table, there is an "Edit" button. The bottom of the screen shows the AWS footer and the Windows taskbar.

Open the RDP port in the security group of Inbound rules

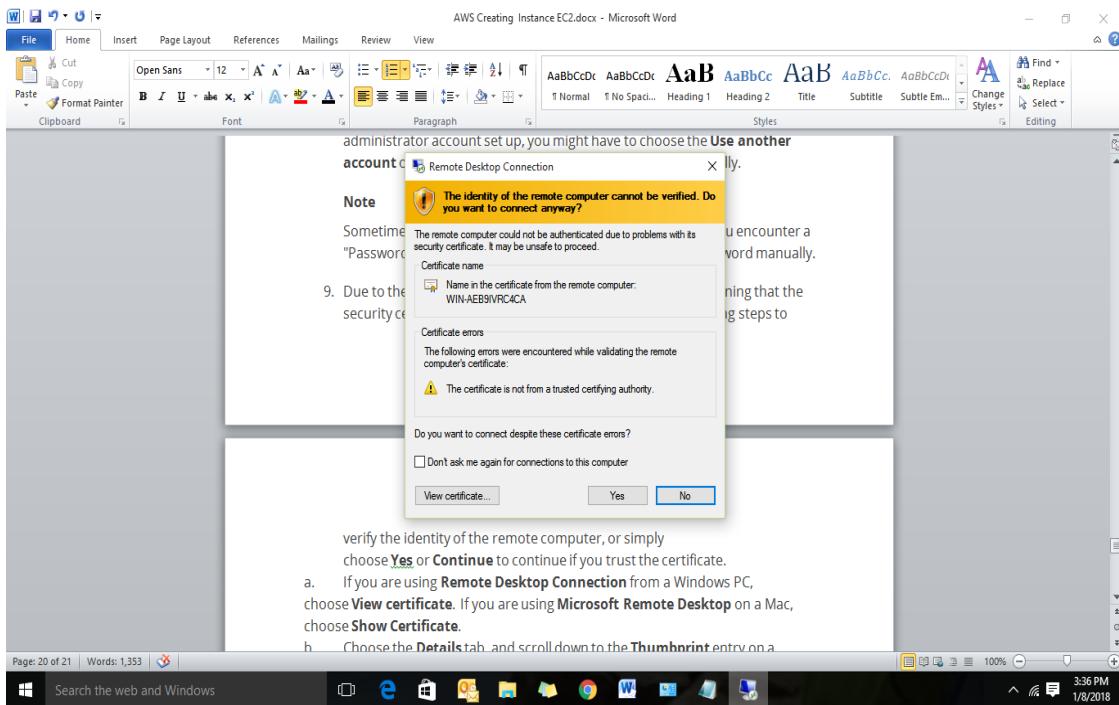
7. You may get a warning that the publisher of the remote connection is unknown. You can continue to connect to your instance.



8. When prompted, log in to the instance, using the administrator account for the operating system and the password that you recorded or copied previously. If your **Remote Desktop Connection** already has an administrator account set up, you might have to choose the **Use another account** option and type the user name and password manually.

Note

Sometimes copying and pasting content can corrupt data. If you encounter a "Password Failed" error when you log in, try typing in the password manually.



9. Due to the nature of self-signed certificates, you may get a warning that the security certificate could not be authenticated. Use the following steps to verify the identity of the remote computer, or simply choose **Yes** or **Continue** to continue if you trust the certificate.
- If you are using **Remote Desktop Connection** from a Windows PC, choose **View certificate**. If you are using **Microsoft Remote Desktop** on a Mac, choose **Show Certificate**.
 - Choose the **Details** tab, and scroll down to the **Thumbprint** entry on a Windows PC, or the **SHA1 Fingerprints** entry on a Mac. This is the unique identifier for the remote computer's security certificate.
 - In the Amazon EC2 console, select the instance, choose **Actions**, and then choose **Get System Log**.
 - In the system log output, look for an entry labeled **RDPMESSAGE-THUMBPRINT**. If this value matches the thumbprint or fingerprint of the certificate, you have verified the identity of the remote computer.
 - If you are using **Remote Desktop Connection** from a Windows PC, return to the **Certificate** dialog box and choose **OK**. If you are using **Microsoft Remote Desktop** on a Mac, return to the **Verify Certificate** and choose **Continue**.
 - [Windows] Choose **Yes** in the **Remote Desktop Connection** window to connect to your instance.
 - [Mac OS] Log in as prompted, using the default administrator account and the default administrator password that you recorded or copied previously. Note that you might need to switch spaces to see the login screen. For more information about spaces, see <http://support.apple.com/kb/PH14155>.

- If you receive an error while attempting to connect to your instance, see [Remote Desktop can't connect to the remote computer](#).



Step 3: Clean Up Your Instance

To terminate your instance

1. In the navigation pane, choose **Instances**. In the list of instances, select the instance.
2. Choose **Actions, Instance State, Terminate**.

The screenshot shows the AWS EC2 Management console. On the left, there's a sidebar with options like EC2 Dashboard, Events, Tags, Reports, Limits, Instances, Launch Templates, Spot Requests, Reserved Instances, Dedicated Hosts, Images, AMIs, Bundle Tasks, Elastic Block Store, Volumes, Snapshots, and Network & Security. The main area shows a list of instances. One instance, 'i-0c1a24e88aa8aa9df', is selected and shown in more detail. Its status is 'running'. A context menu is open over this instance, with 'Terminate' being the last option in the 'Actions' dropdown. Below the instance details, there are tabs for Description, Status Checks, Monitoring, and Tags. At the bottom, there's a Windows taskbar with various icons.

3. Choose Yes, Terminate when prompted for confirmation.

This screenshot shows a 'Terminate Instances' dialog box. It contains a warning message: 'On an EBS-backed instance, the default action is for the root EBS volume to be deleted when the instance is terminated. Storage on any local drives will be lost.' Below this, a question asks, 'Are you sure you want to terminate these instances?' followed by a list: 'i-0c1a24e88aa8aa9df (ec2-18-218-118-83.us-east-2.compute.amazonaws.com)'. At the bottom right of the dialog are 'Cancel' and 'Yes, Terminate' buttons. The background shows the same EC2 Management interface as the previous screenshot, with the instance now listed as terminated.

Amazon EC2 shuts down and terminates your instance. After your instance is terminated, it remains visible on the console for a short while, and then the entry is deleted.

NOTE IMPORTANT

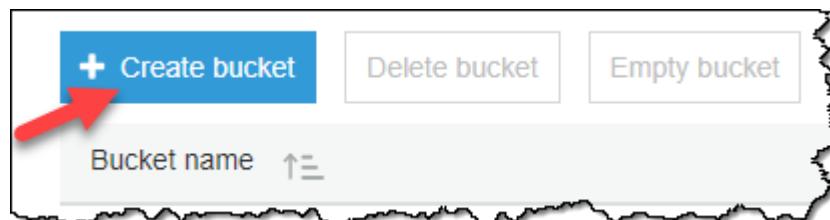
Remote connections should be allowed on your computer

1. How to use Remote Desktop
1. Share
2. Use Remote Desktop on your Windows 10 PC or on your Windows, Android, or iOS device to connect to a PC from afar.
3. First, you'll need to set up the remote PC to allow remote connections. On the remote PC, open **Settings** Gear-shaped Settings icon and select **System > About**. Note the PC name. You'll need this later. Then, under **Related settings**, select **System info**.
4. In the left pane of the **System** window, select **Advanced system settings**.
5. On the **Remote** tab of the **System Properties** dialog box, under **Remote Desktop**, select **Allow remote connections to this computer**, and then select **OK**.
6. Next, in **Settings** Gear-shaped Settings icon, select **System > Power & sleep** and check to make sure **Sleep** is set to **Never**.
7. Do one of the following:
 - **On your local Windows 10 PC:** In the search box on the taskbar, type **Remote Desktop Connection**, and then select **Remote Desktop Connection**. In Remote Desktop Connection, type the full name of the remote PC, and select **Connect**.
 - **On your Windows, Android, or iOS device:** Open the Remote Desktop app (available for free from Microsoft Store, Google Play, or the Mac App Store), and add your remote PC. Select the remote PC, and then wait for the connection to complete.

Lab 12 Creating a Bucket and adding an object to AWS S3

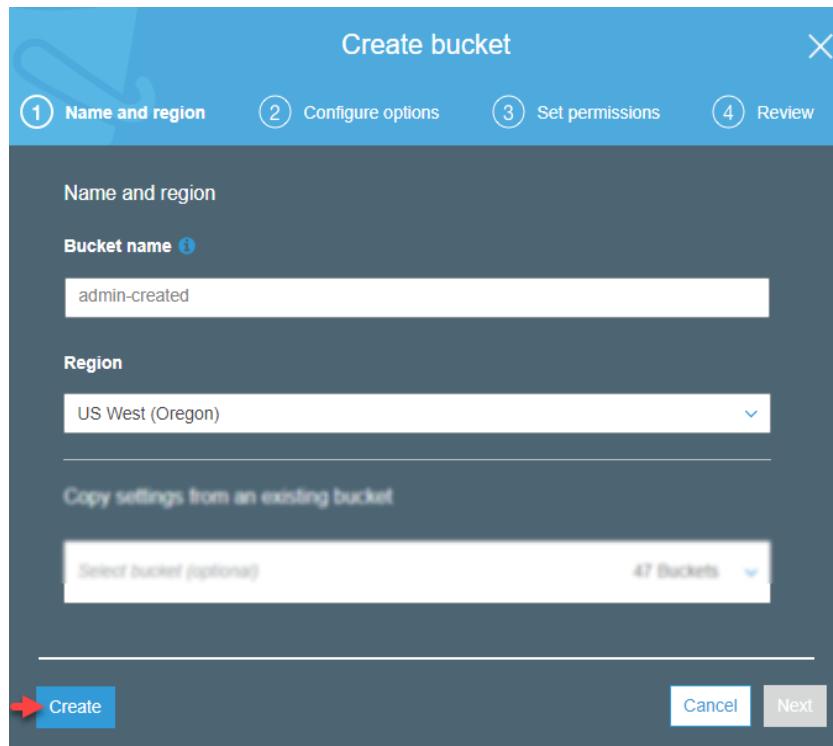
To create an S3 bucket

1. Sign in to the AWS Management Console and open the Amazon S3 console at <https://console.aws.amazon.com/s3/>.
2. Choose **Create bucket**.



3. In the **Bucket name** field, type a unique DNS-compliant name for your new bucket. (The example screen shot uses the bucket name admin-created. You cannot use this name because S3 bucket names must be unique.) Create your own bucket name using the following naming guidelines:
 - The name must be unique across all existing bucket names in Amazon S3.
 - After you create the bucket you cannot change the name, so choose wisely.
 - Choose a bucket name that reflects the objects in the bucket because the bucket name is visible in the URL that points to the objects that you're going to put in your bucket.

4. For **Region**, choose US West (Oregon) as the region where you want the bucket to reside.
5. Choose **Create**.

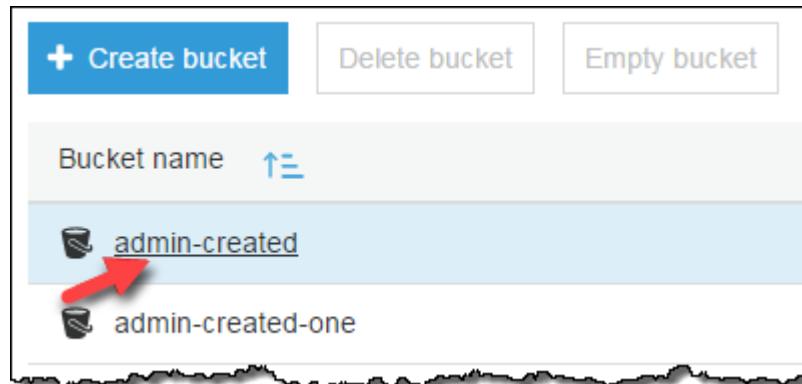


You've created a bucket in Amazon S3.

Now that you've created a bucket, you're ready to add an object to it. An object can be any kind of file: a text file, a photo, a video, and so on.

To upload an object to a bucket

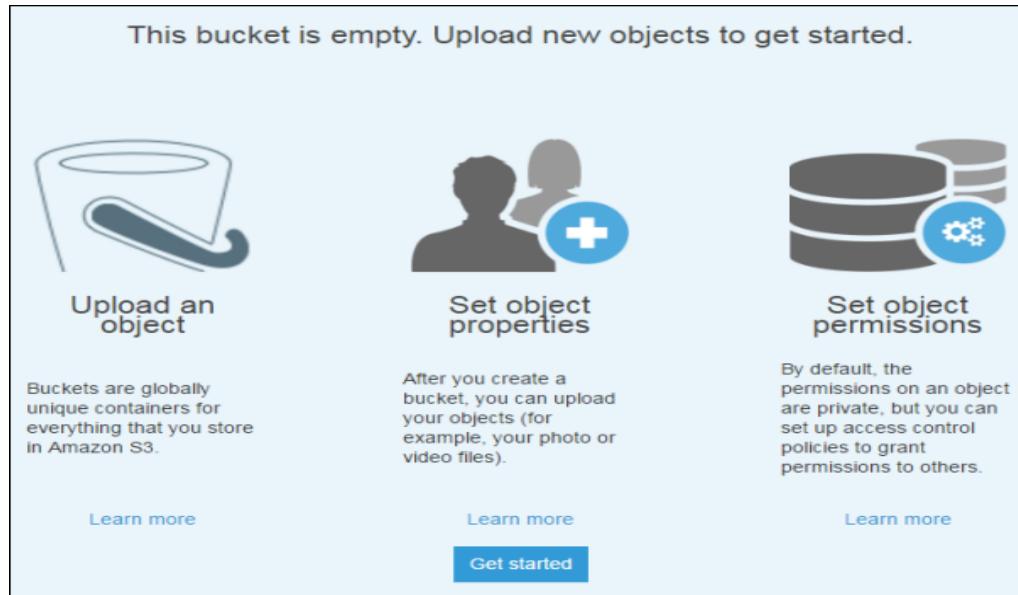
1. In the **Bucket name** list, choose the name of the bucket that you want to upload your object to.



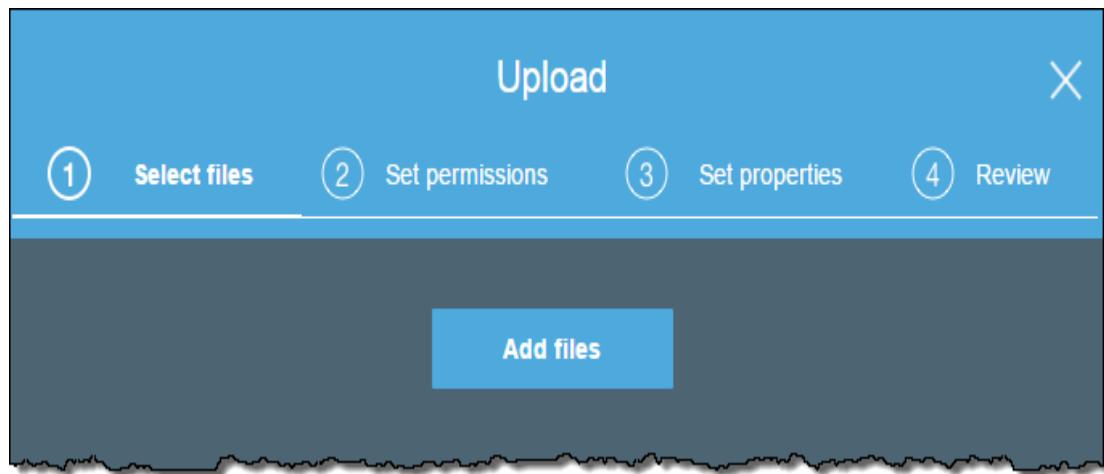
2. Choose **Upload**.



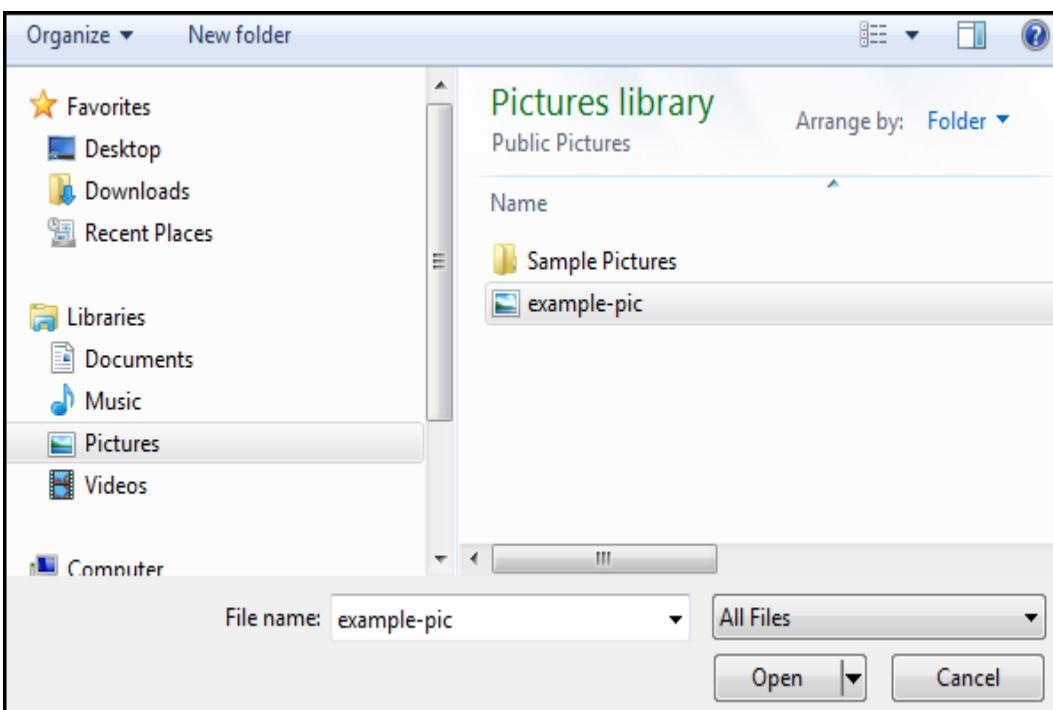
- a. Or you can choose **Get started**.



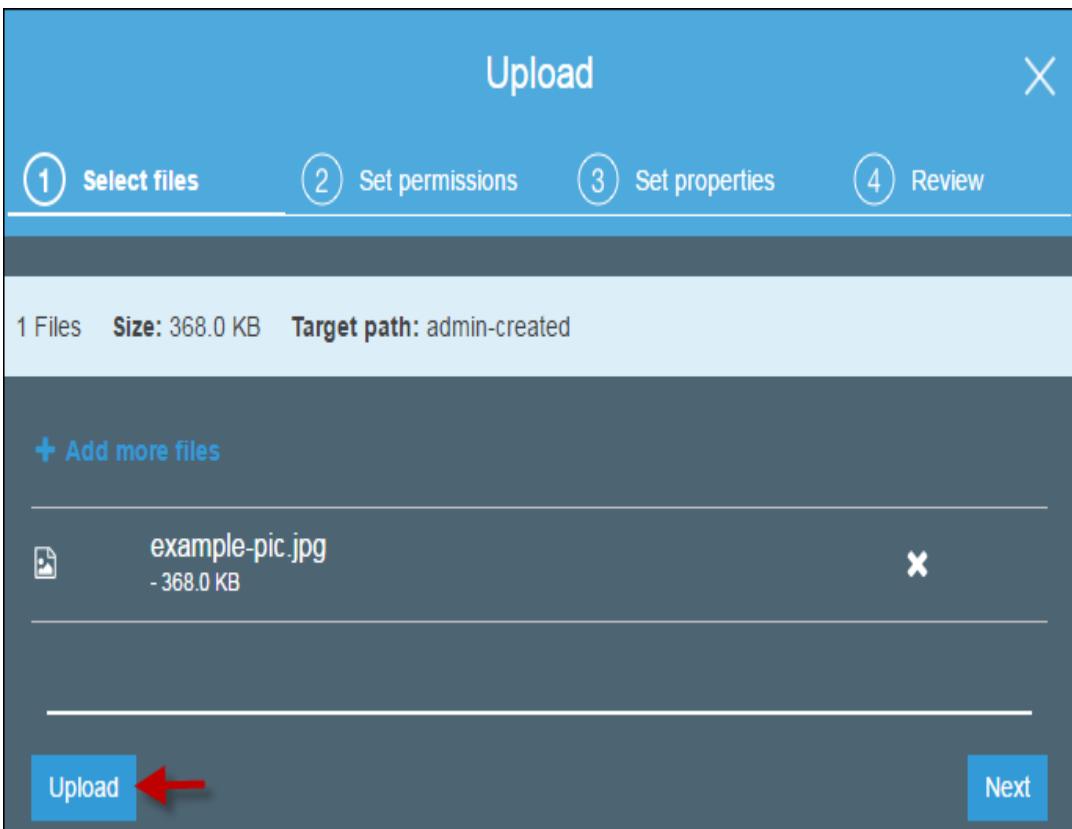
3. In the **Upload** dialog box, choose **Add files** to choose the file to upload.



4. Choose a file to upload, and then choose **Open**.

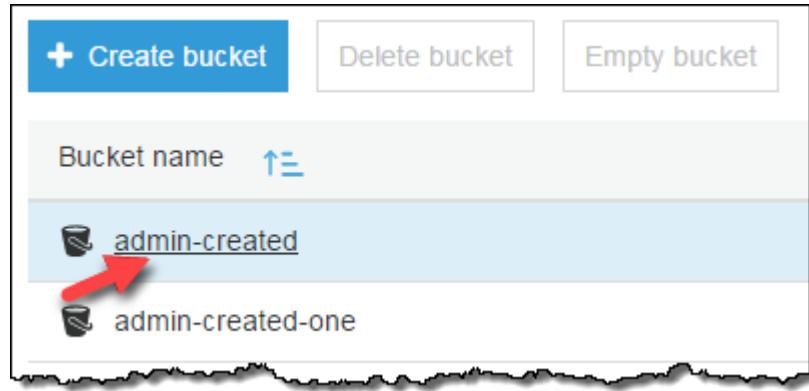


5. Choose **Upload**.

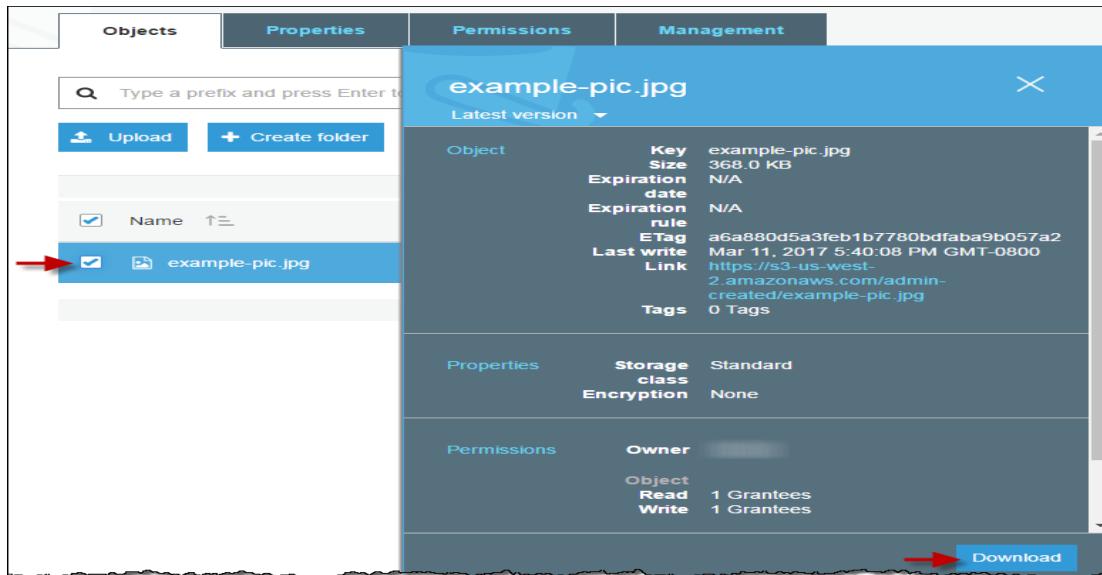


To download an object from a bucket

1. In the **Bucket name** list, choose the name of the bucket that you created.



2. In the **Name** list, select the check box next to the object that you uploaded, and then choose **Download** on the object overview panel.

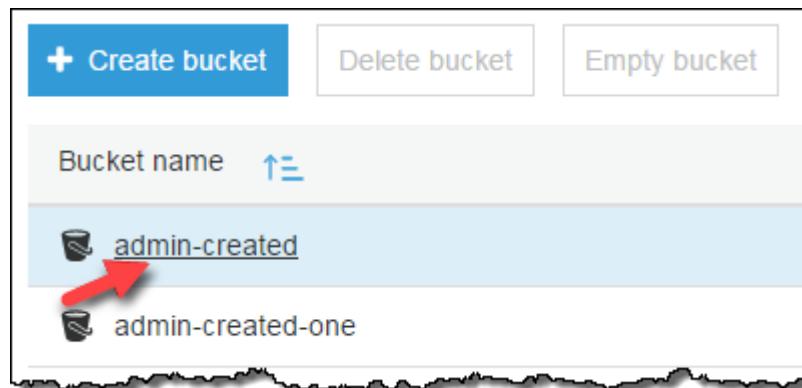


To delete an object from a bucket

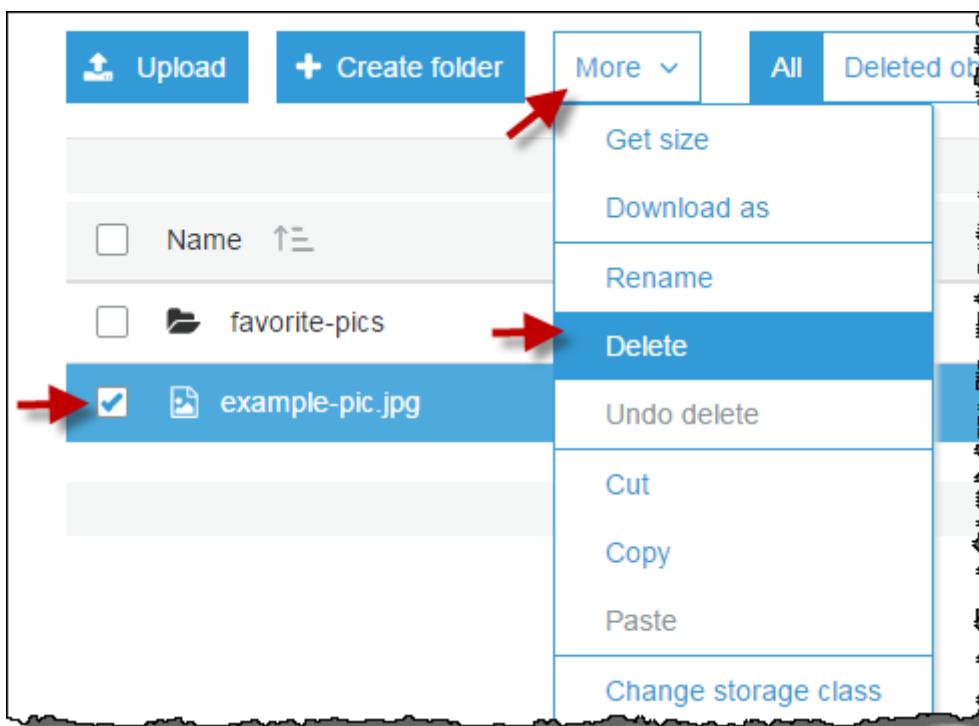
If you no longer need to store the object that you uploaded, you can delete the objects individually. Or you can empty a bucket, which deletes all the objects in the bucket without deleting the bucket.

You can also delete a bucket and all the objects contained in the bucket. However, if you want to continue to use the same bucket name, don't delete the bucket. We recommend that you empty the bucket and keep it. After a bucket is deleted, the name becomes available to reuse, but the name might not be available for you to reuse for various reasons. For example, it might take some time before the name can be reused and some other account could create a bucket with that name before you do.

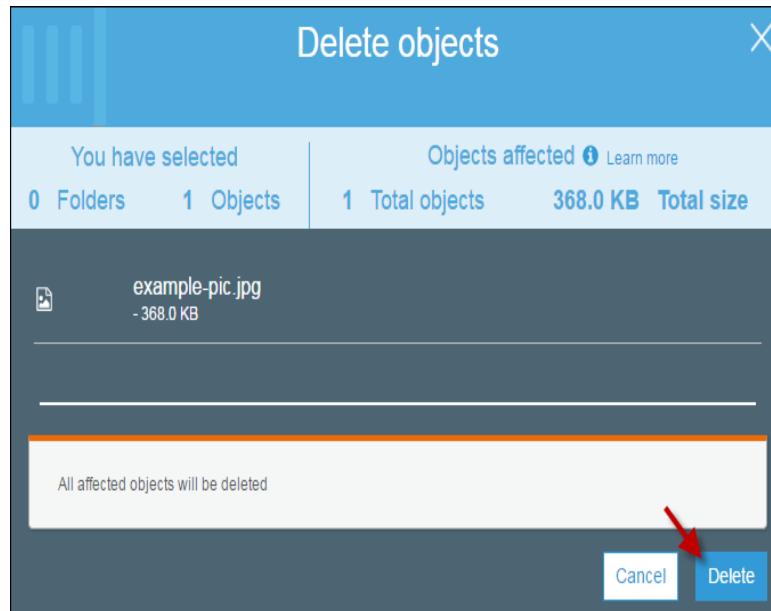
1. In the **Bucket name** list, choose the name of the bucket that you want to delete an object from.



2. In the **Name** list, select the check box next to the object that you want to delete, choose **More**, and then choose **Delete**.



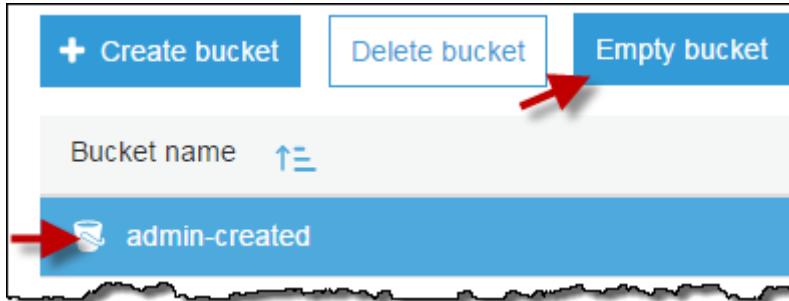
3. In the **Delete objects** dialog box, verify that the name of the object you selected for deletion is listed, and then choose **Delete**.



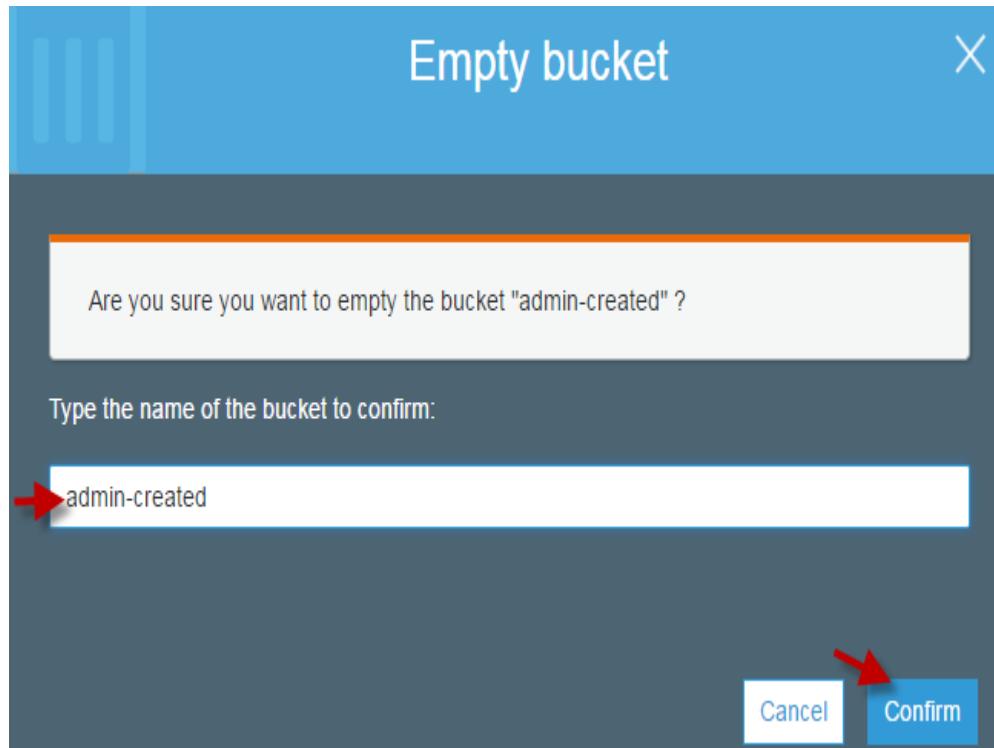
You can empty a bucket, which deletes all the objects in the bucket without deleting the bucket.

To empty a bucket

1. In the **Bucket name** list, choose the bucket icon next to the name of the bucket that you want to empty and then choose **Empty bucket**.



2. In the **Empty bucket** dialog box, type the name of the bucket for confirmation and then choose **Confirm**.



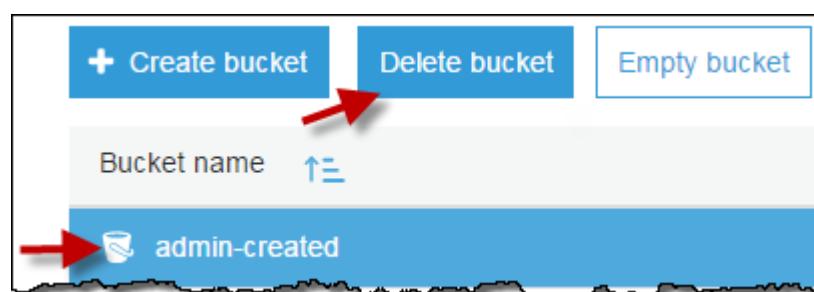
You can delete a bucket and all the objects contained in the bucket.

Important

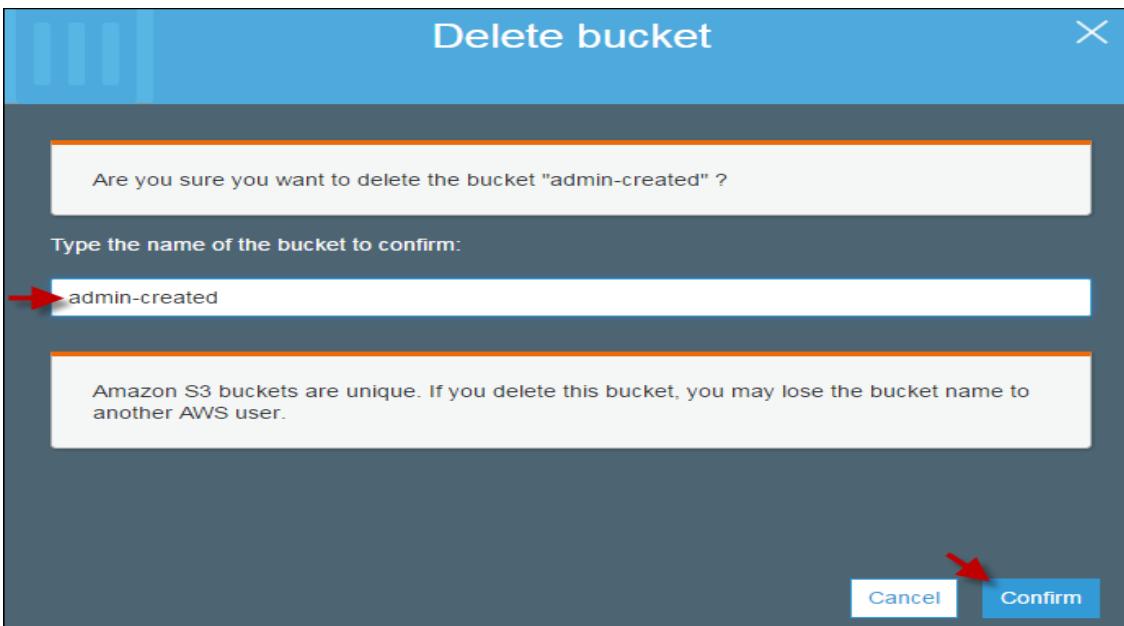
If you want to continue to use the same bucket name, don't delete the bucket. We recommend that you empty the bucket and keep it. After a bucket is deleted, the name becomes available to reuse, but the name might not be available for you to reuse for various reasons.

To delete a bucket

1. In the **Bucket name** list, choose the bucket icon next to the name of the bucket that you want to delete and then choose **Delete bucket**.



2. In the **Delete bucket** dialog box, type the name of the bucket for delete confirmation and then choose **Confirm**.



L. GUIDELINES

Cell Phones and other Electronic Communication Devices: Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination(exception online mode). Such devices MUST be turned off in the class room.

E-Mail and online learning tool: Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.

Attendance: Continuous Evaluation is followed in lab.

Passing criterion: At course completion, the student is awarded with a grade (on a 10-point scale) based on the overall marks obtained comprising the above two mentioned out of 100 marks. Students scoring less than 35 absolute marks in individual course shall be awarded a 'F' grade. Students scoring 85 marks and above as composite score shall be awarded a 'O' grade. The minimum individual course grade is 'C'. The student who is debarred due to shortage of attendance or with Grade 'F' for a lab course will need to repeat the continuous evaluation during summer vacation (June-July) after the registration by payment of the prescribed fee per subject as notified by the University. The grades are awarded based on the performance of the students and capping as per the University guidelines. All other rules and regulations such as requirement of passing, etc. will remain same.

M. COURSE OUTCOME ASSESSMENT

To assess the fulfilment of course outcomes two different approaches have been decided. Degree of fulfillment of course outcomes will be assessed in different ways through direct assessment and indirect assessment. In Direct Assessment, it is measured through quizzes, tests, assignment, Mid-term and/or End-term examinations. It is suggested that each examination is designed in such a way that it can address one or two outcomes (depending upon the course completion). Indirect assessment is done through the student survey which needs to be designed by the faculty (sample format is given below) and it shall be conducted towards the end of course completion. The evaluation of the achievement of the Course Outcomes shall be done by analyzing the inputs received through Direct and Indirect Assessments and then corrective actions suggested for further improvement.

Sample format for Indirect Assessment of Course outcomes

NAME:
ENROLLMENT NO:
SAP ID:
COURSE: Introduction to Virtualization and Cloud Computing Lab, CSVT 2101P, Aug-Dec, 2022
PROGRAM: B. Tech. CS+CCVT III Semester

Please rate the following aspects of course outcomes of Introduction to Virtualization and Cloud Computing Lab
Use the scale 1-4*

Sl. No.		1	2	3	4
1	CO1: Demonstrate Cloud Computing virtualization techniques using hypervisors and improve systems utilizations.				
2	CO2: Analyze demonstrated guest and host systems performance.				
3	CO3: Demonstrate server and storage virtualization on public cloud Platforms				

- *** 1 Below Average 3 Good
 2 Average 4 Very Good