

CLOUD COMPUTING

Lab 01

Compare the features and requirements of VirtualBox and install VMware Workstation for running various flavors of Linux and Windows OS on Windows 8, 10, and 11.

This experiment is to be performed in LAB 1.

PROCEDURE TO INSTALL

Step 1- Download Link

Link for downloading the software is <https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html>. Download the software for windows. Good thing is that there is no signup process. Click and download begins. Software is around 541 MB.

Step 2- Download the installer file

It should probably be in the download folder by default, if you have not changed the settings in your browser. File name should be something like VMware-workstation-full-15.5.1-15018445.exe. This file name can change depending on the version of the software currently available for download. But for now, till the next version is available, they will all be VMware Workstation 15 Pro.

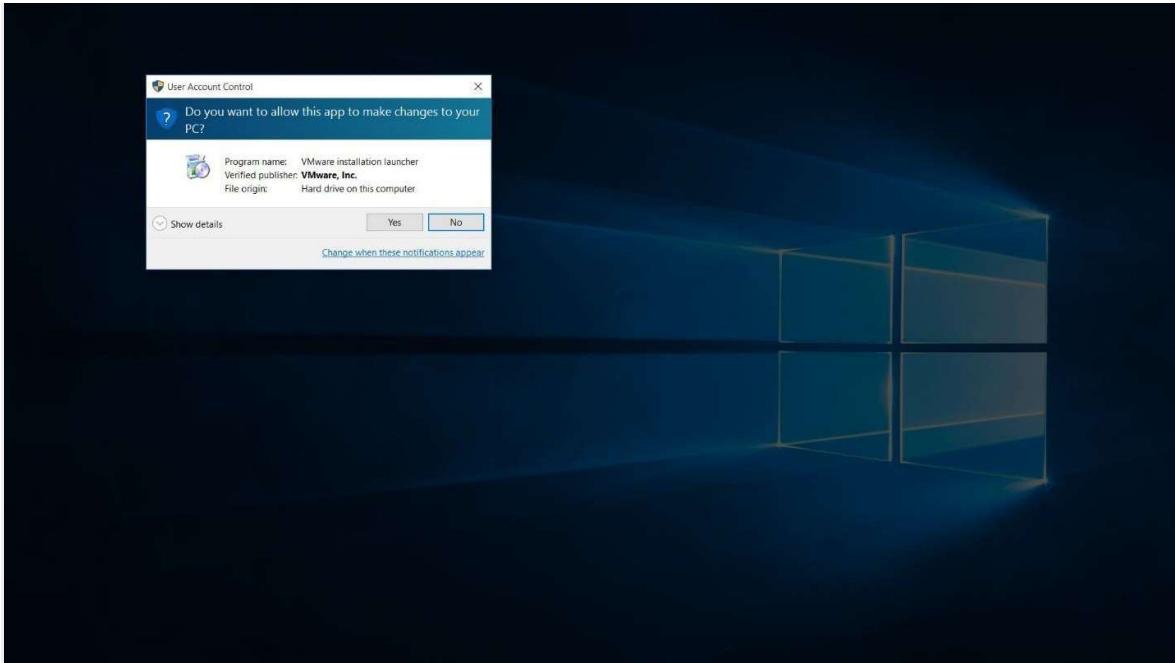
Step 3- Locate the downloaded installer file

For demonstration purpose, I have placed the downloaded installer on my desktop. Find the installer on your system and double click to launch the application.

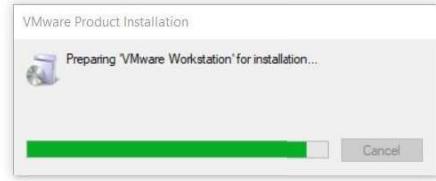
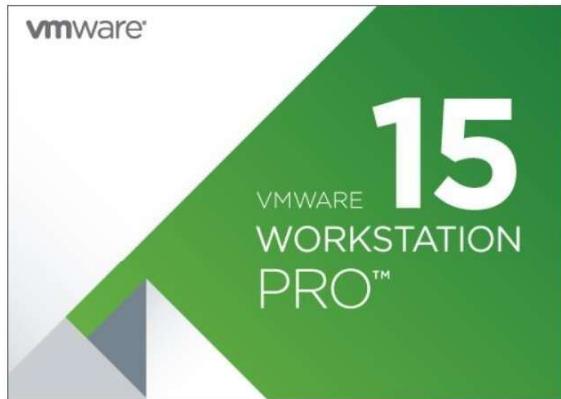


Step 4- User Access Control (UAC) Warning

Now you should see User Access Control (UAC) dialog box. Click yes to continue.



Initial Splash screen will appear. Wait for the process to complete.



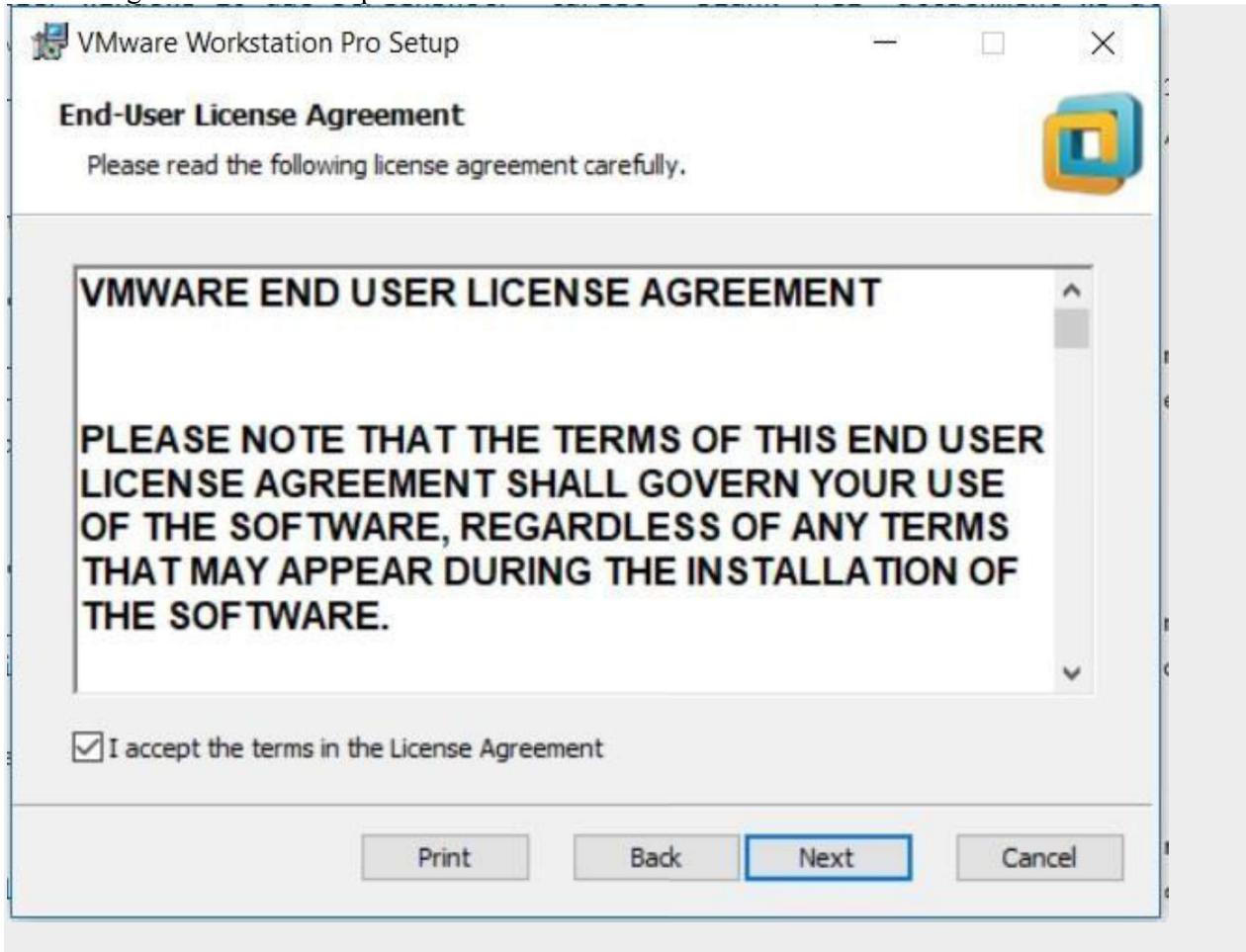
Step 5- VMware Workstation Setup wizard

Now you will see VMware Workstation setup wizard dialog box. Click next to continue.



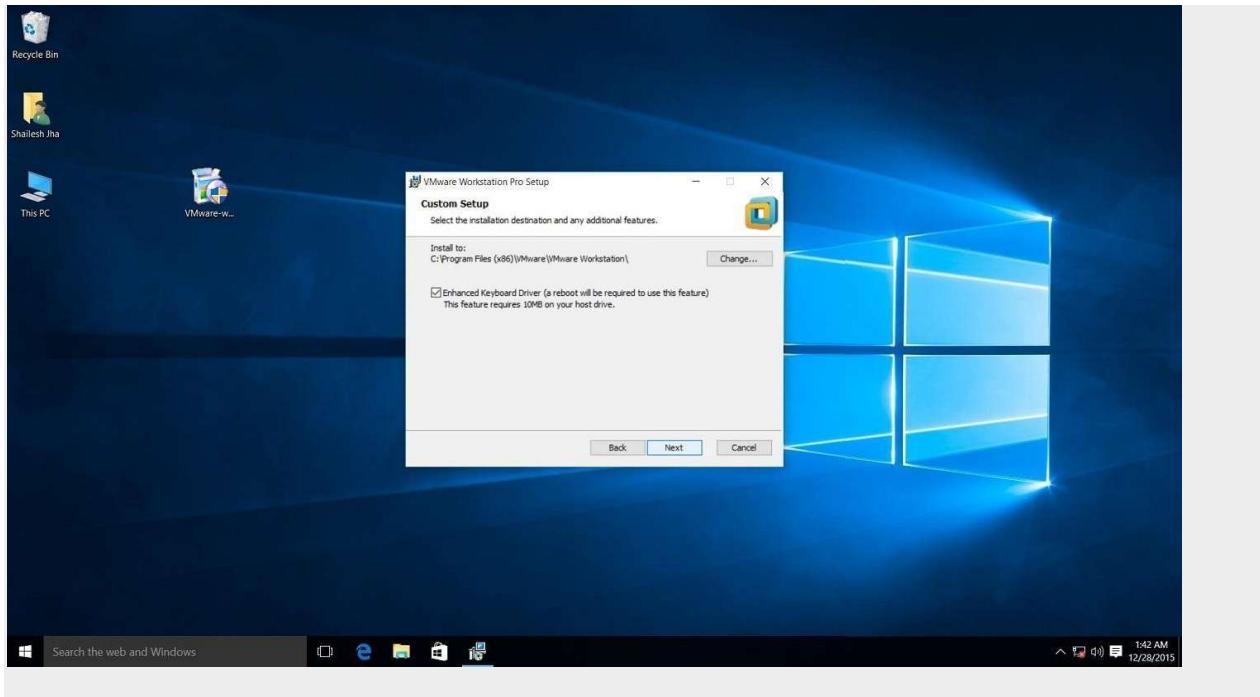
Step 6- End User Licence Agreement

This time you should see End User Licence Agreement dialog box. Check “I accept the terms in the Licence Agreement” box and press next to continue.



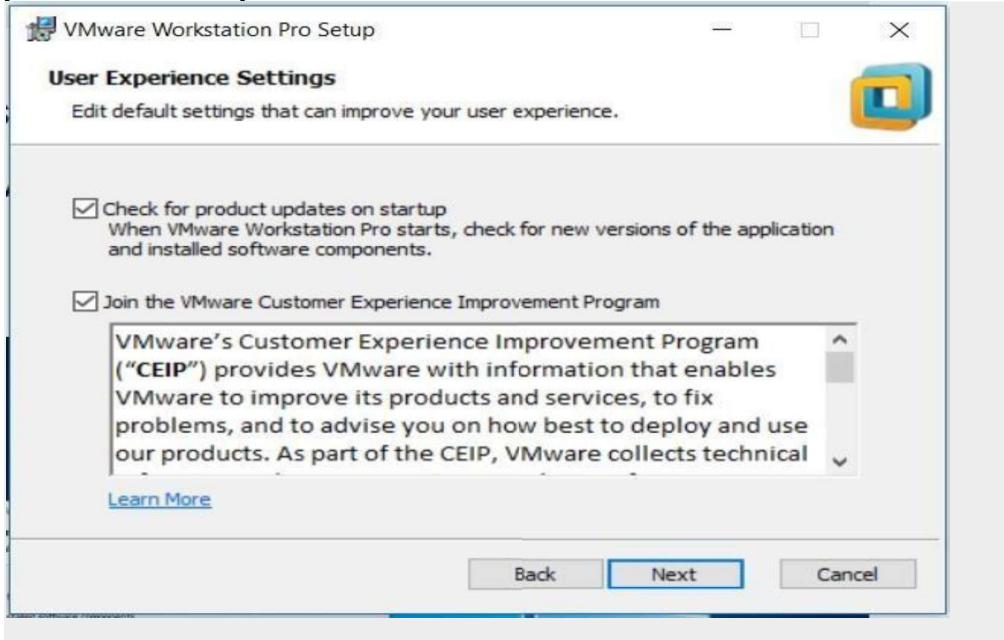
Step 7- Custom Setup options

Select the folder in which you would like to install the application. There is no harm in leaving the defaults as it is. Also select Enhanced Keyboard Driver check box.



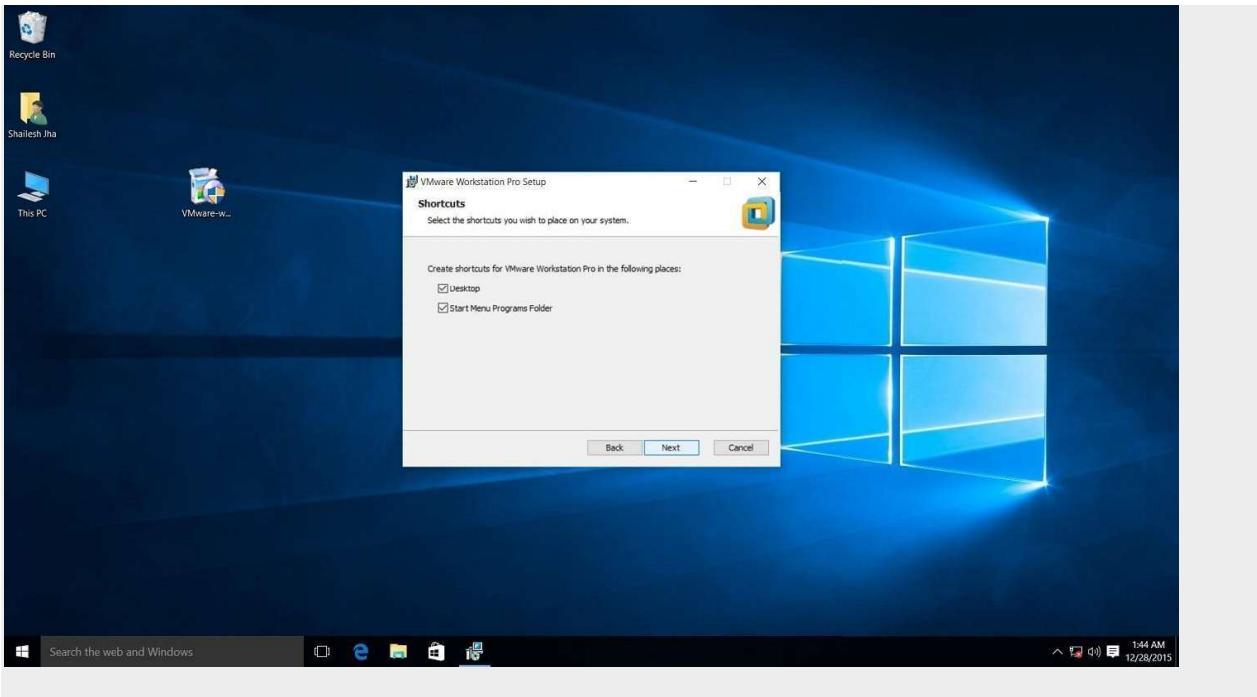
Step 8- User Experience Settings

Next you are asked to select “Check for Updates” and “Help improve VMware Workstation Pro”. Do as you wish. I normally leave it to defaults that is unchecked.



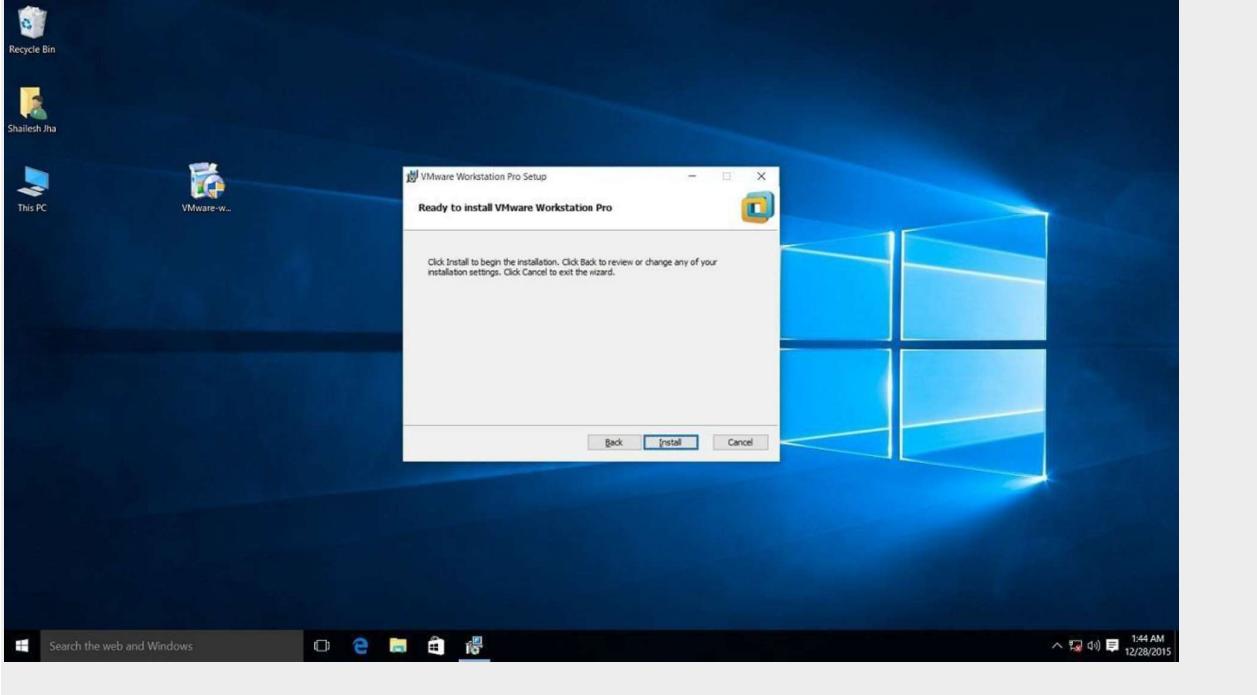
Step 9- Application Shortcuts preference

Next step is to select the place you want the shortcut icons to be placed on your system to launch the application. Please select both the options, desktop and start menu and click next.

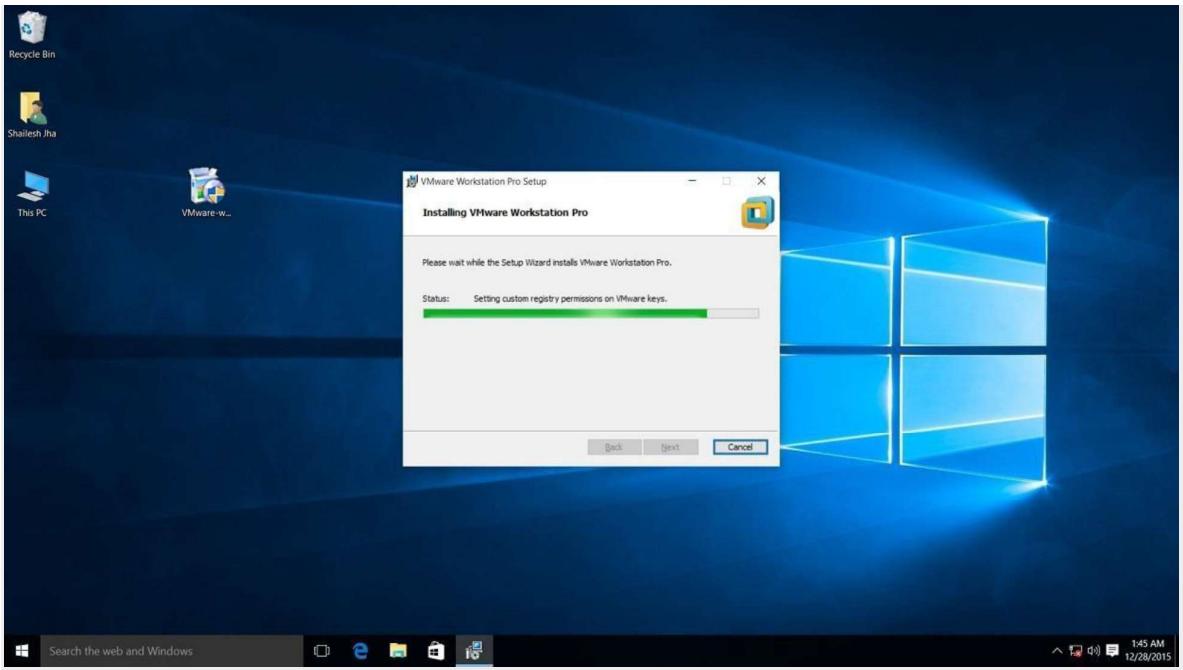


Step 10- Installation begins

Now you see the begin installation dialog box. Click install to start the installation process.



Below screenshot shows Installation in progress. Wait for this to complete.



At the end you will see installation complete dialog box. Click finish and you are done with the installation process. You may be asked to restart your computer. Click on Yes to restart.



Step 11- Launch VMware Workstation

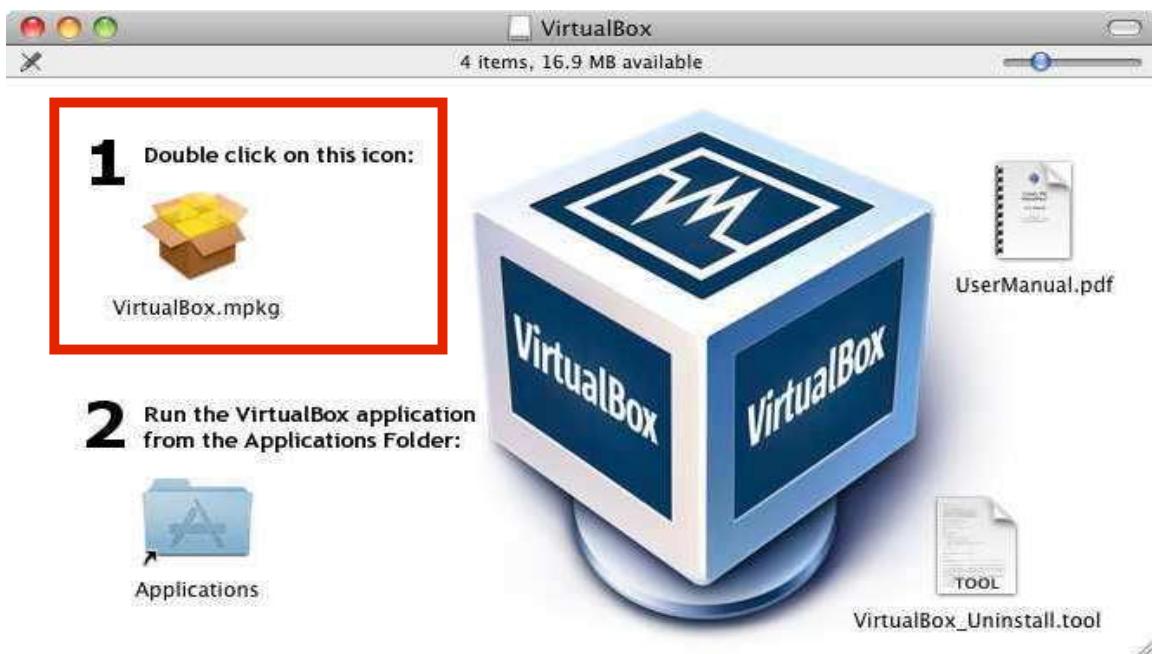
After the installation completes, you should see VMware Workstation icon on the desktop. Double click on it to launch

Before you start..

- Please note that this is NOT a required part of the course and is not a homework.
- This manual is written for someone who has never programmed / never used Linux before.
- If you have background knowledge, you can ignore this.
- If you have any questions, please email Yoonji Shin ys2476@columbia.edu
-
- Don't be scared, programming is fun! Enjoy :)

Install VirtualBox

1. Visit <http://www.virtualbox.org/wiki/downloads>
2. Download VirtualBox platform packages for your OS
3. Open the Installation Package by double clicking **MAC**



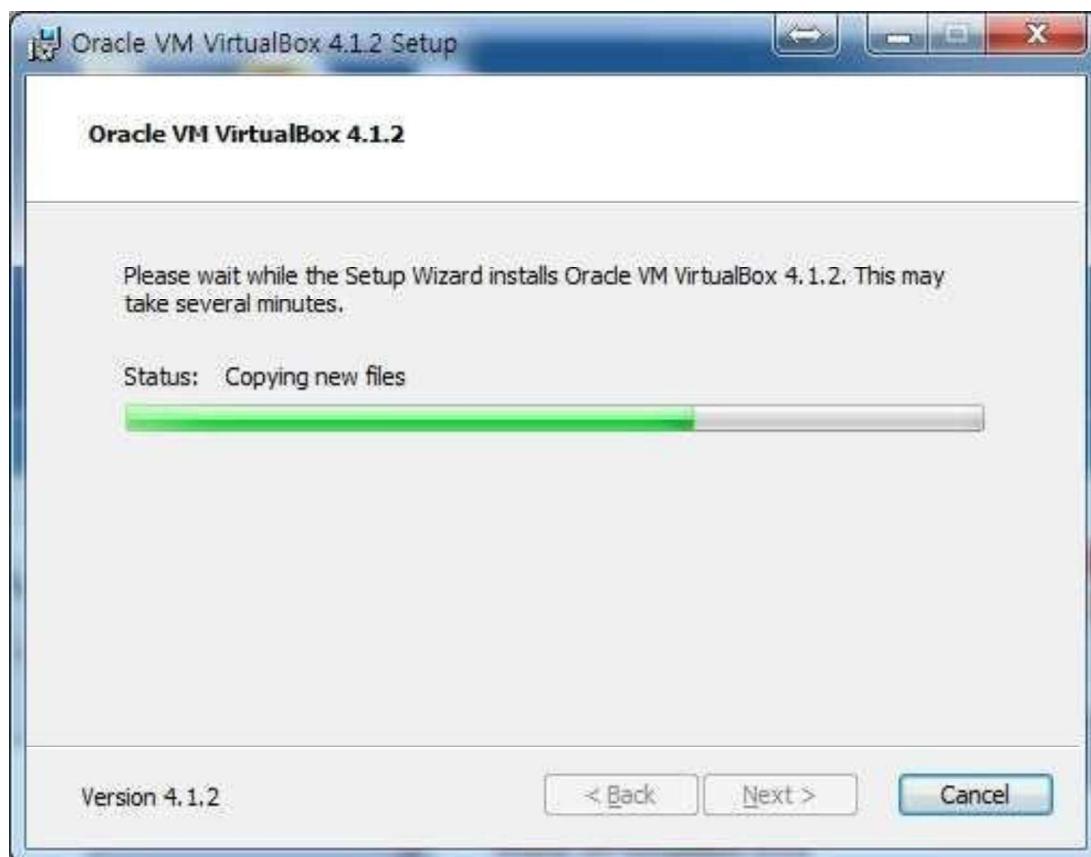
Install VirtualBox

1. Click continue and finish installing VirtualBox

MAC

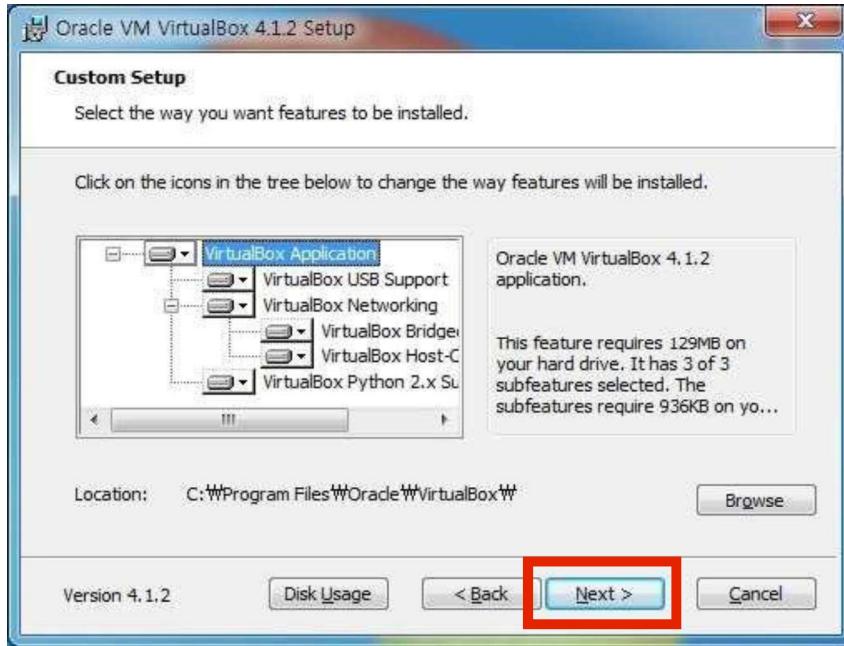


PC



2. When finished installation, close the window.

Download Linux



- Visit the page <http://www.ubuntu.com/download/ubuntu/download>

2. Choose the Latest version of Ubuntu and 32-bit and click "Start Download"

Install Linux using Virtual Box

4. Run VirtualBox by double-clicking the icon

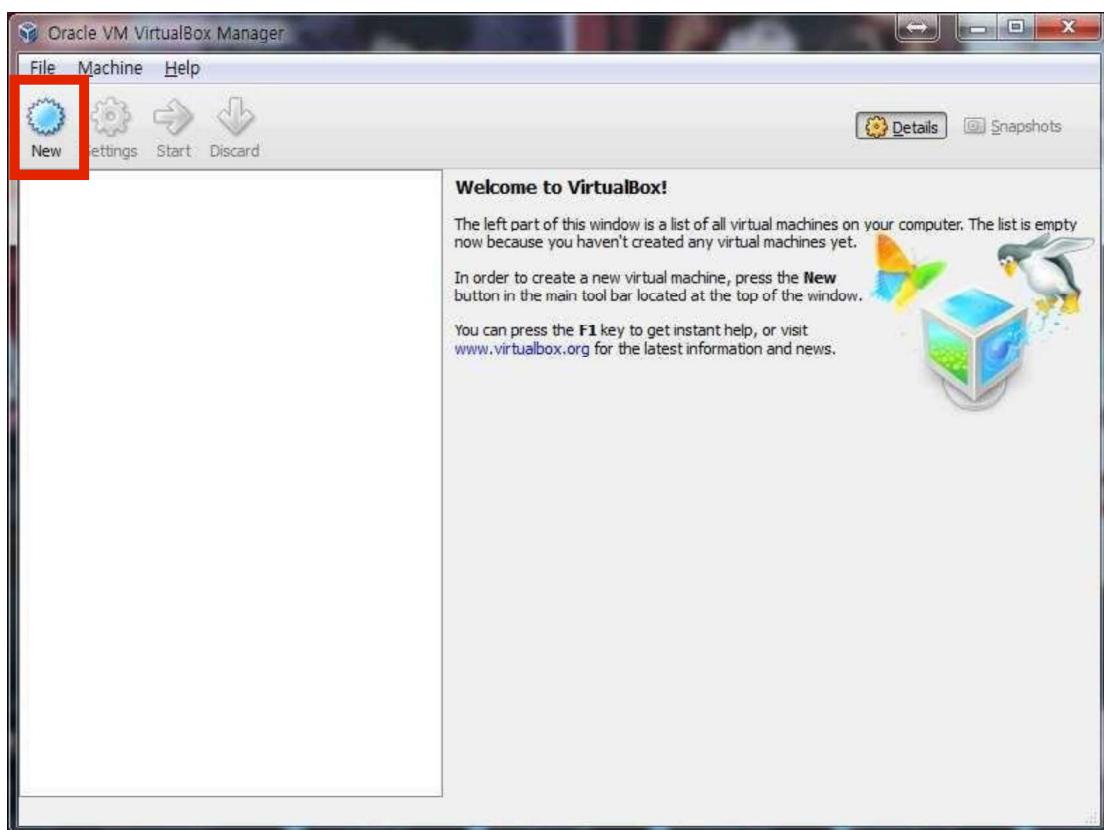
A screenshot of the Ubuntu download page. At the top, there are tabs for "Download", "Windows Installer", "Alternative downloads", "CDs", "Upgrade", and "下载 Ubuntu". The main section is titled "1 Download Ubuntu". It says "Click the big orange button to download the latest version of Ubuntu. You will need to create a CD or USB stick to install Ubuntu." Below this is a "Download options" section with two dropdown menus: "Ubuntu 11.04 - Latest version" and "32-bit (recommended)". To the right, a large orange button says "Download started" with "Ubuntu 11.04 32-bit" underneath. An arrow points from the word "CLI" to this button. At the bottom, there are sections for "Additional options", "If you're running Windows", and "Other ways to get Ubuntu".

5. Click "New" button on the top left corner

MAC



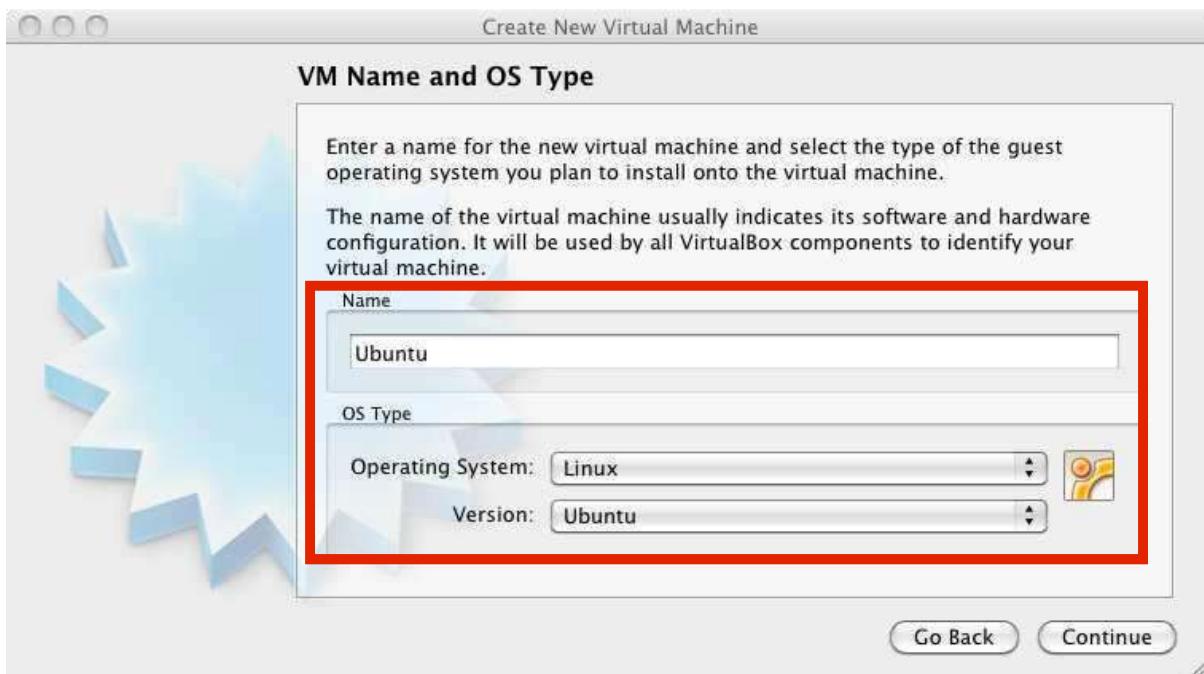
PC



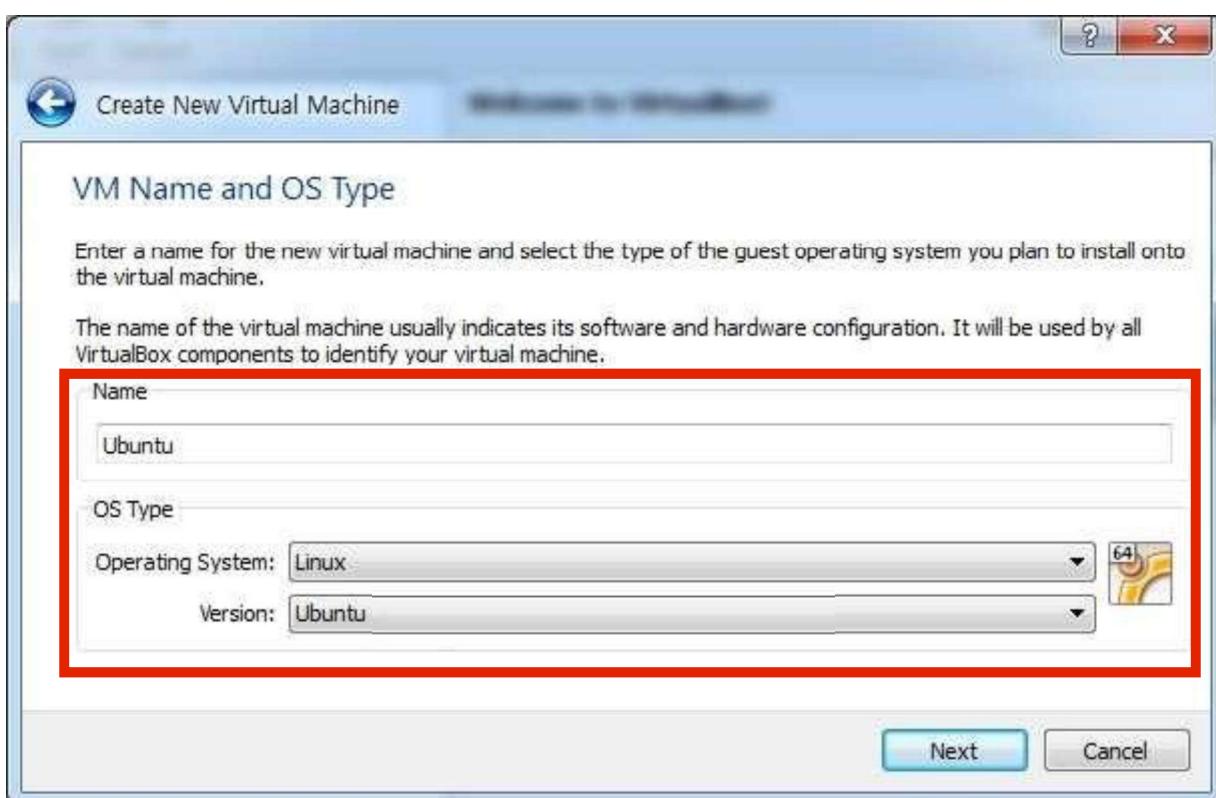
Install Linux using Virtual Box

1. Click Continue on the pop-up window
2. Type VM name, select Linux for the OS and choose Ubuntu for the version.

MAC

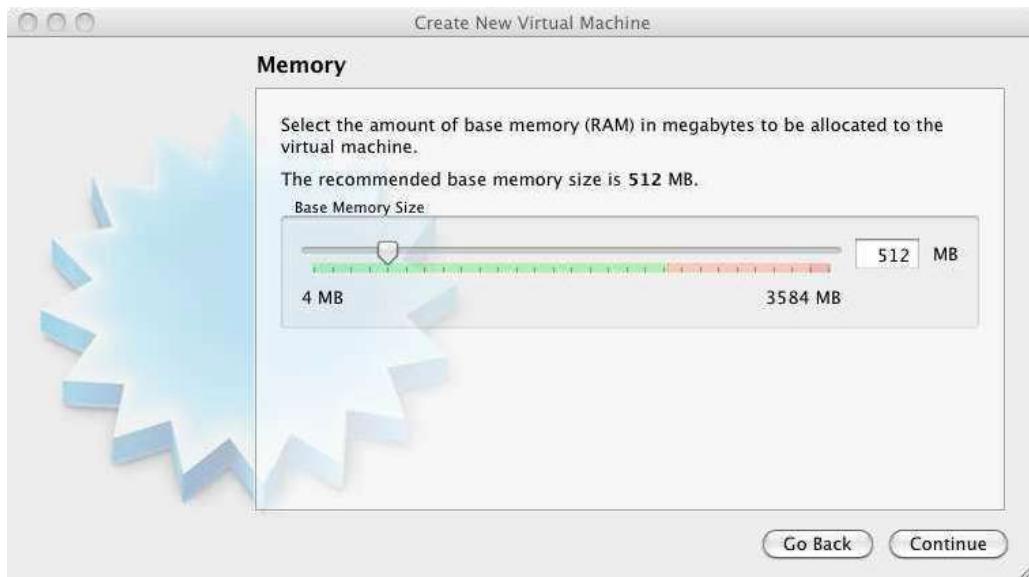


PC

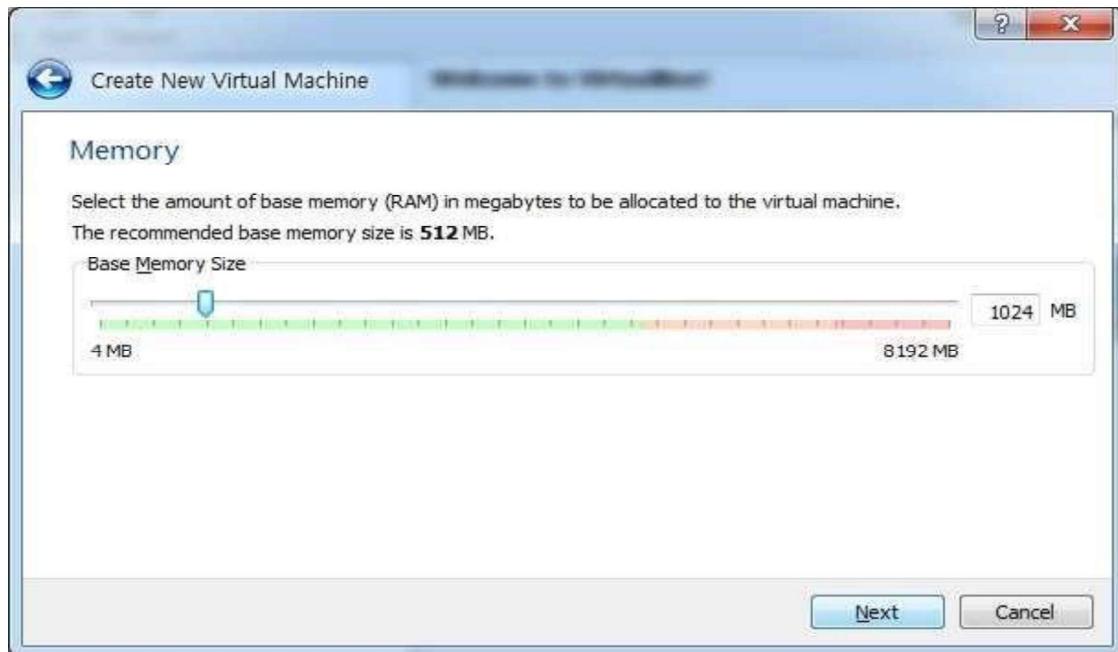


2. Click Continue or Next

MAC



PC



Install Linux using Virtual Box

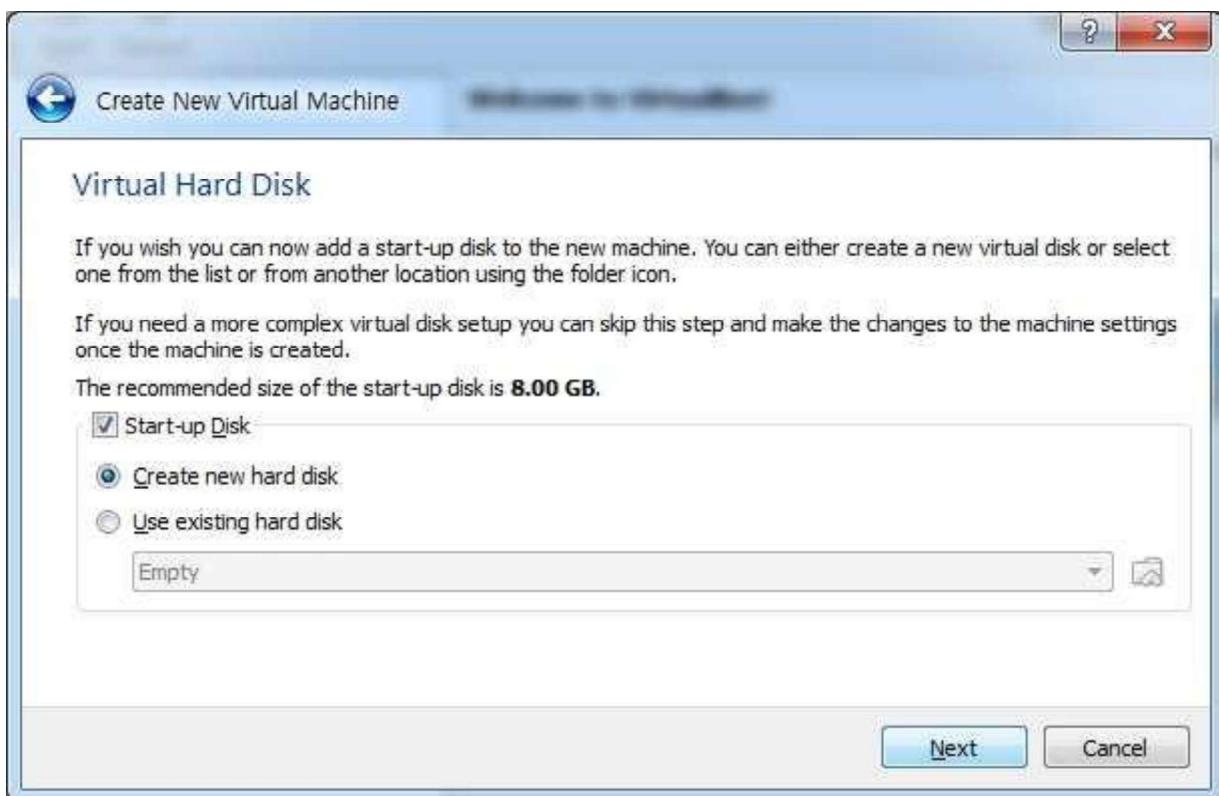
3. Choose create a new virtual hard disk

4. Click Continue or Next

MAC



PC



Install Linux using Virtual Box

Choose **VDI** (VirtualBox Disk Image)

5. Click Continue or Next

MAC



PC



Install Linux using Virtual Box

6. Choose Dynamically Allocated click continue.

This way, the size of your Virtual Hard Disk will grow as you use.

MAC



PC

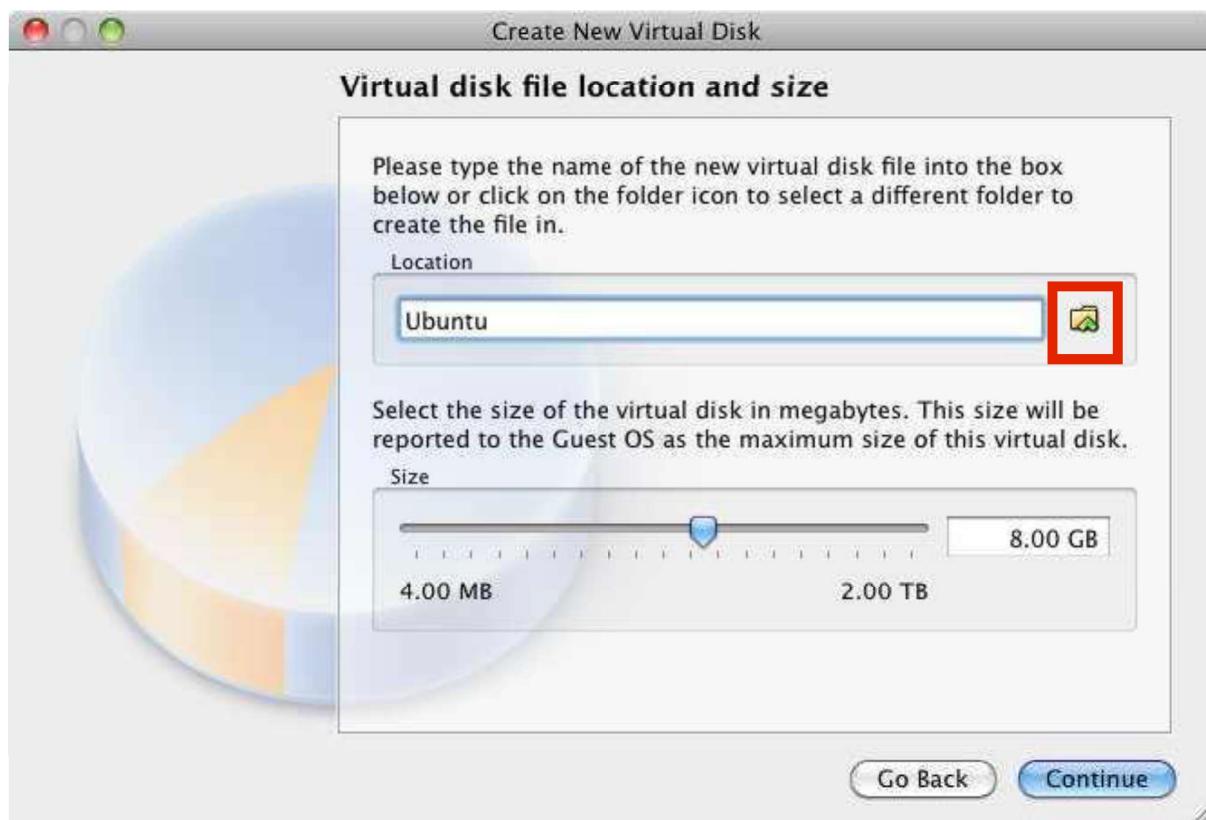


Install Linux using Virtual Box

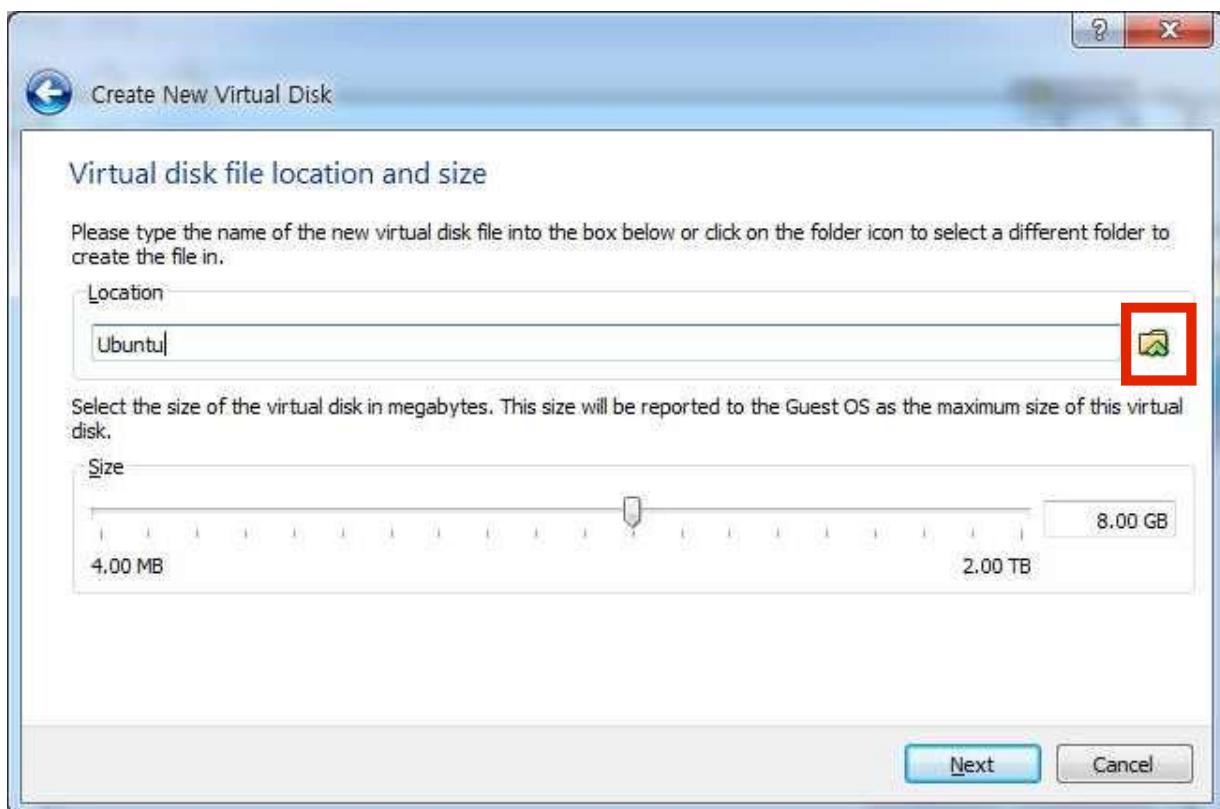


7. Click the folder icon and choose the ubuntu iso file you downloaded.
8. Select the size of the Virtual Disk (I recommend choosing 8 GB) and click continue

MAC



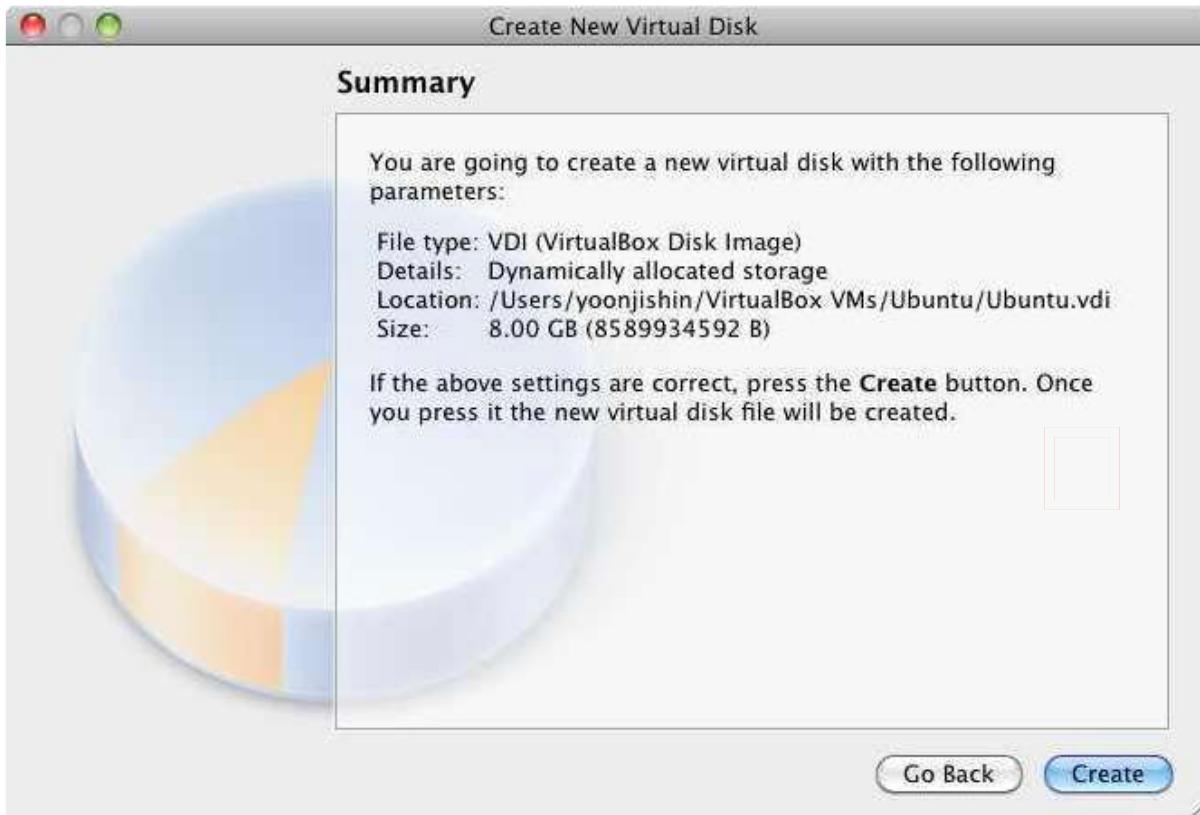
PC



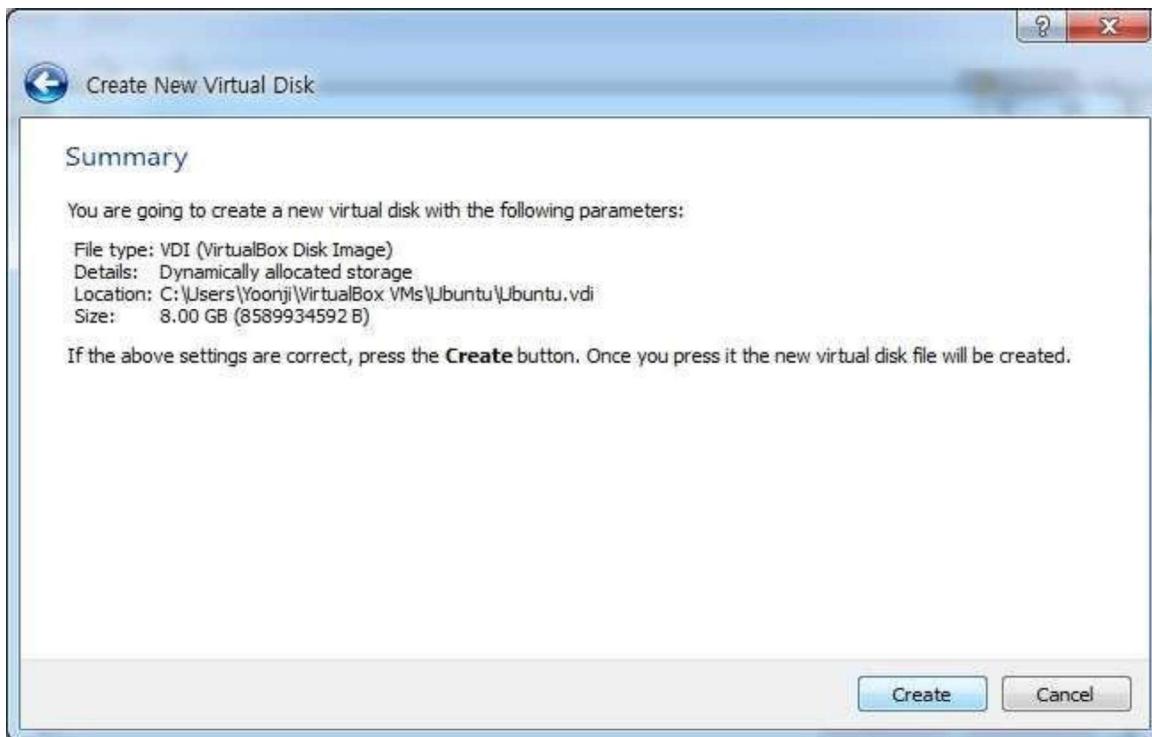
9.

Click Create

MAC



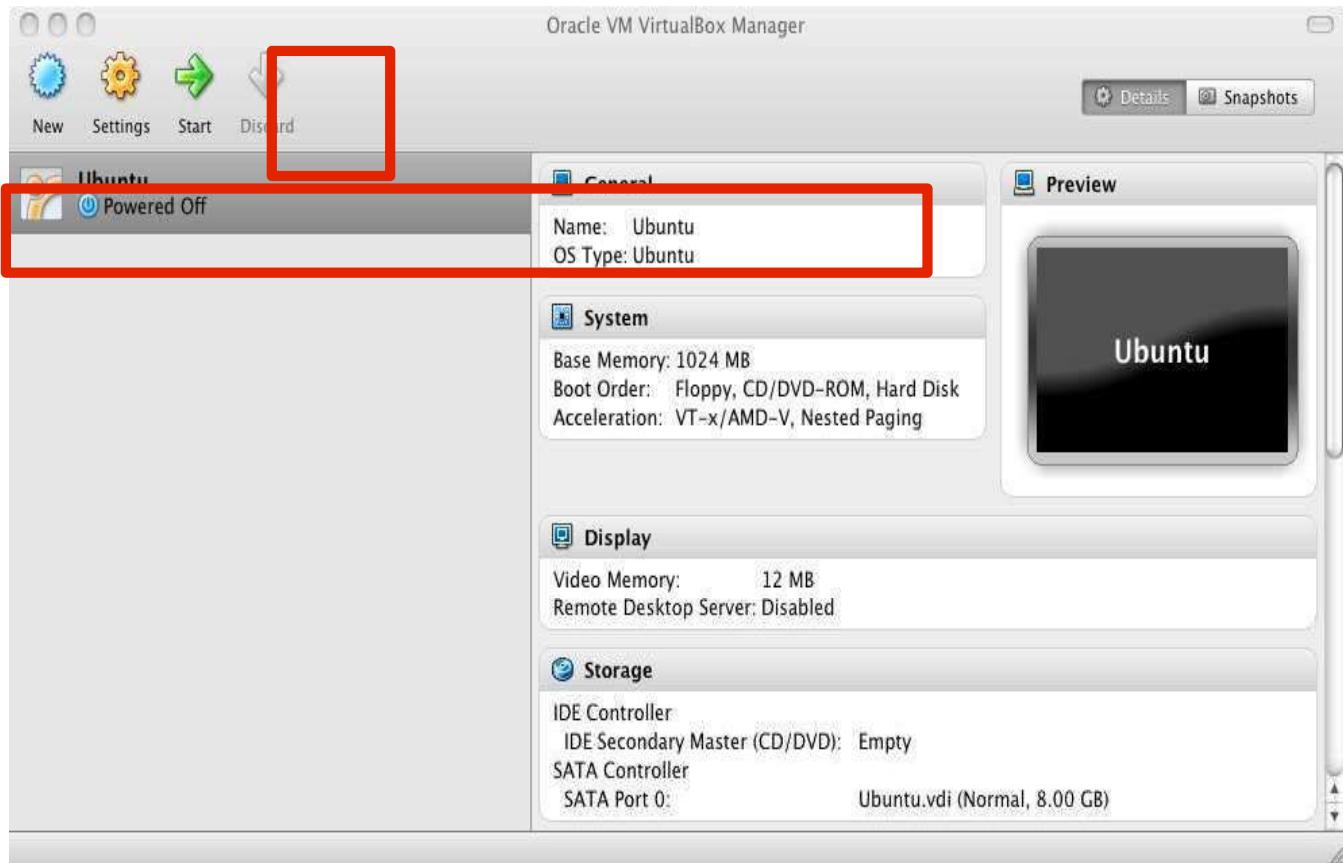
PC



Running Linux

1. Choose Ubuntu from left column and click Start

MAC & PC



Running Linux

1. Click continue on pop-up window

MAC



PC



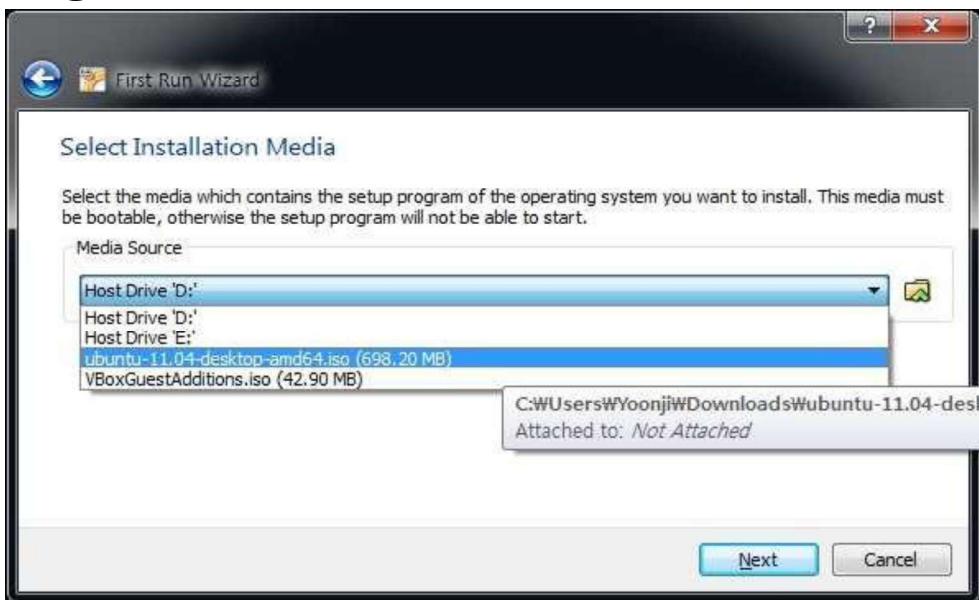
Running Linux

1. Click the folder icon and choose the ubuntu iso you downloaded and click continue and start

MAC

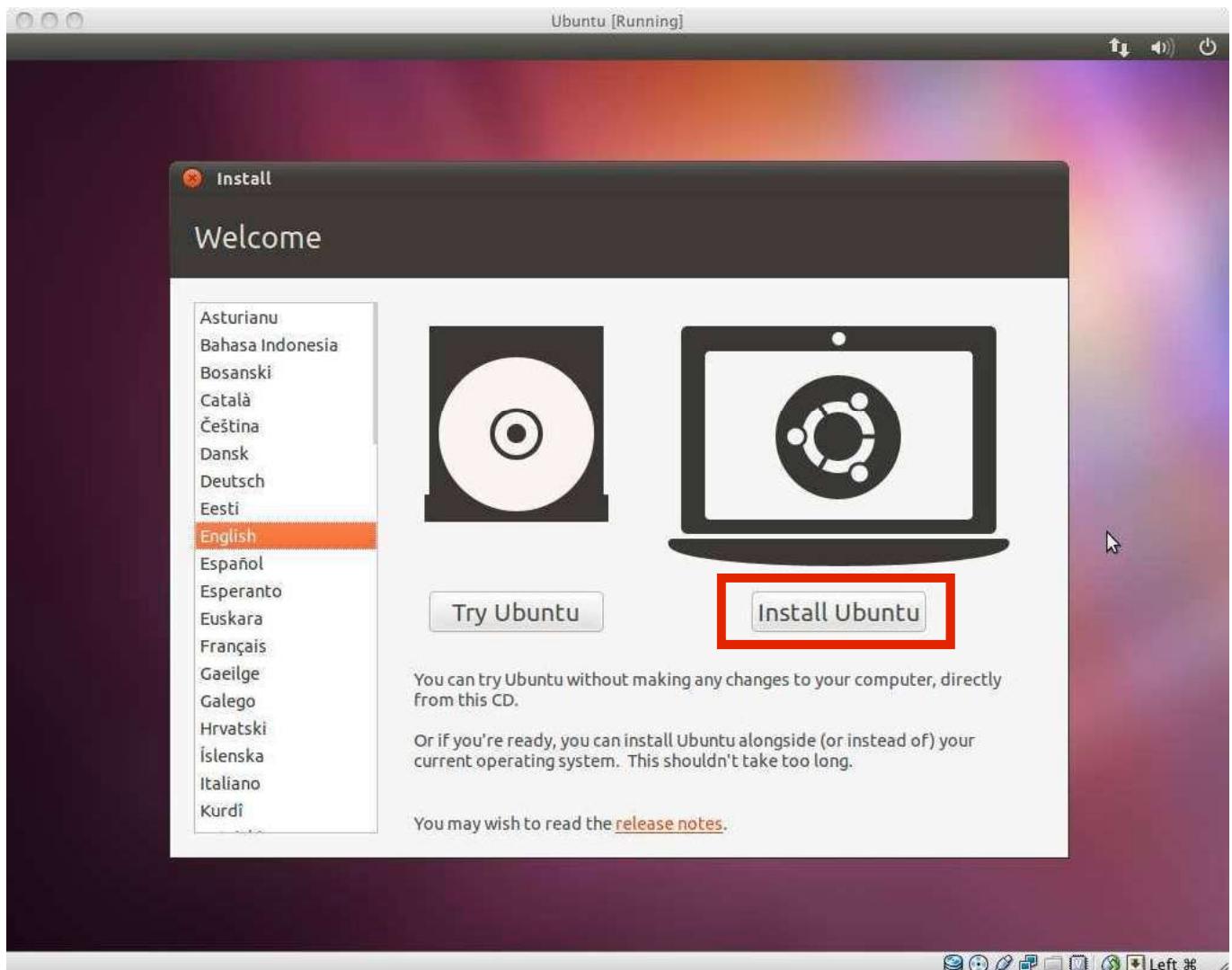


PC

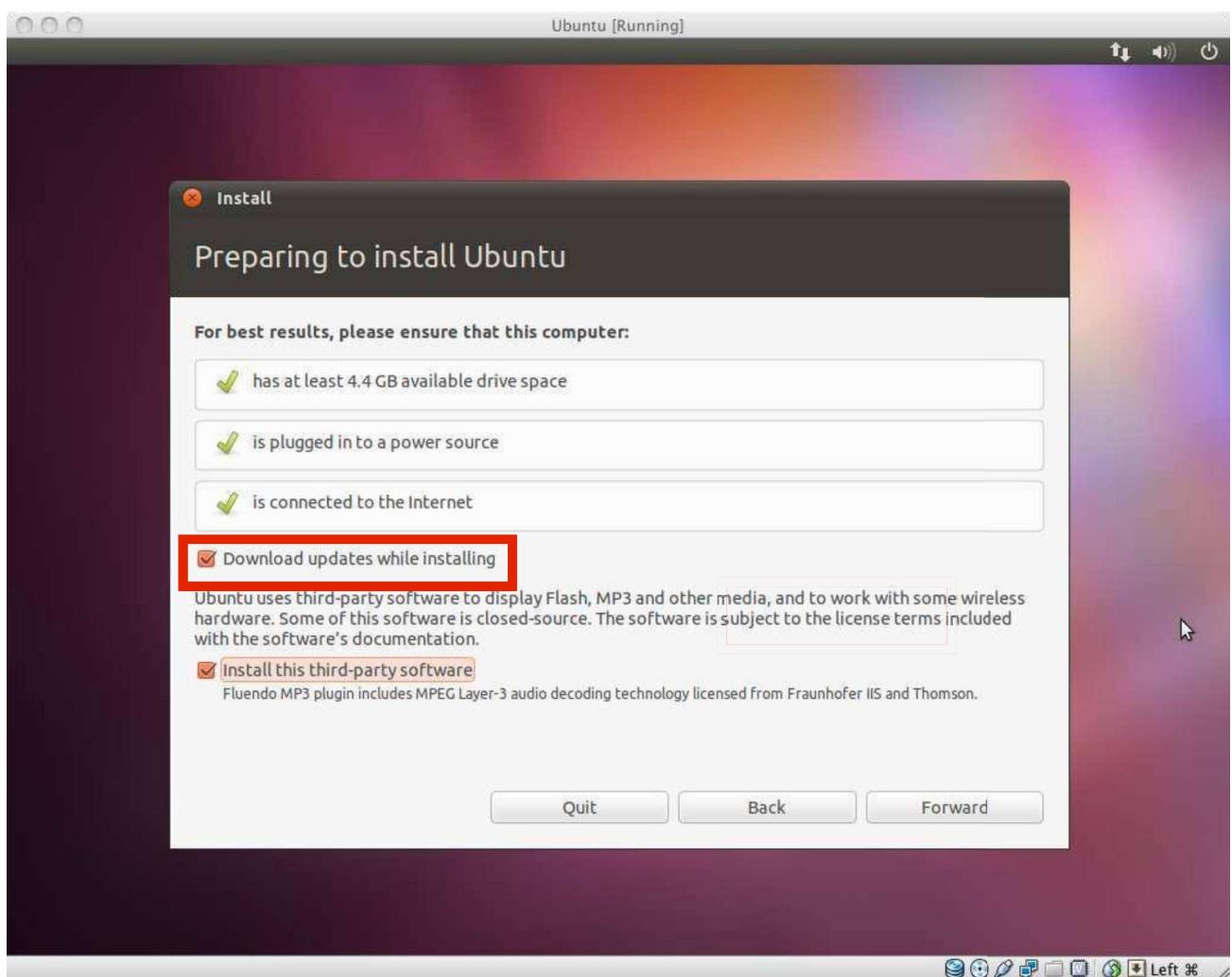


Running Linux

1. Click Install Ubuntu

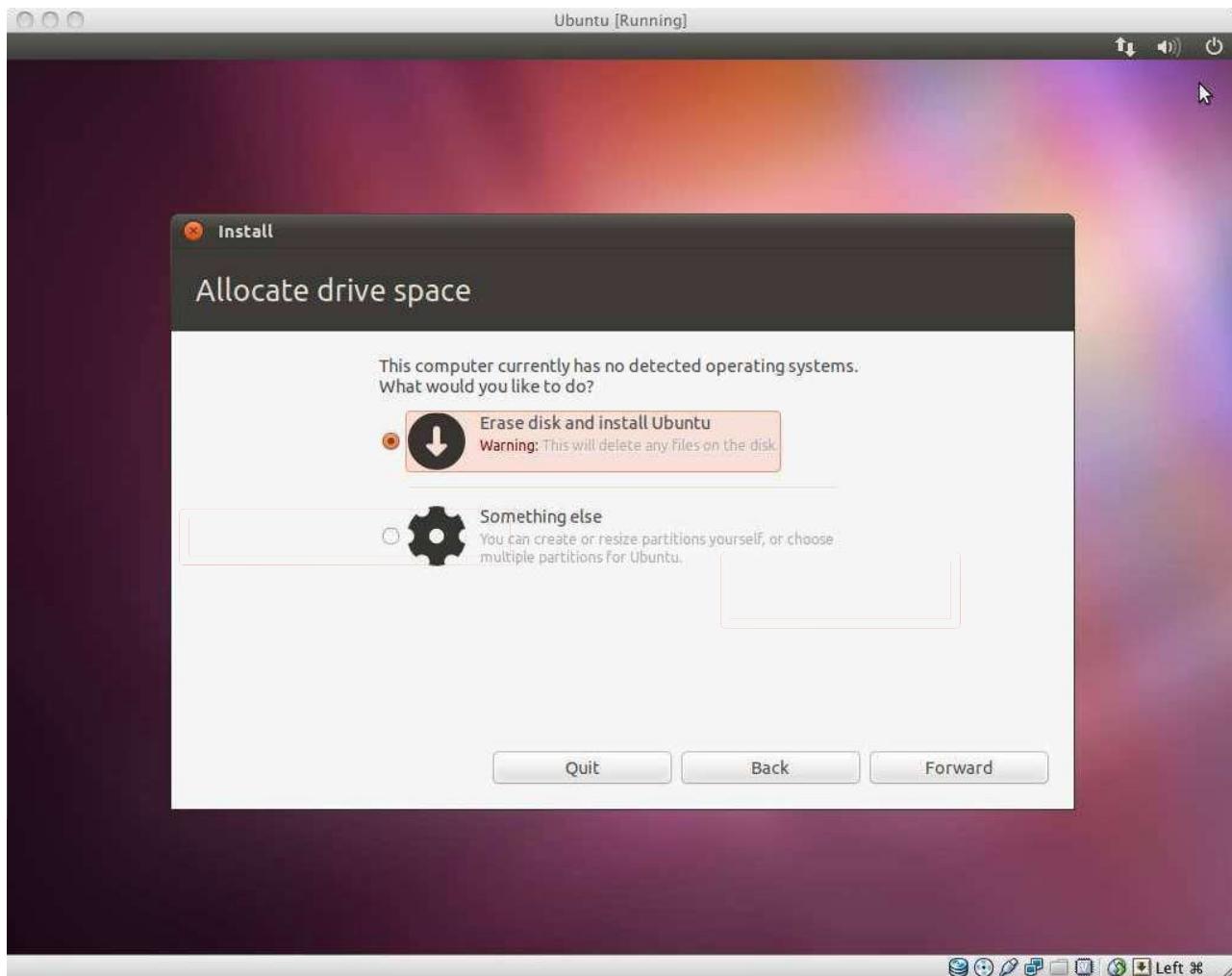


2. Check Download updates and click Forward



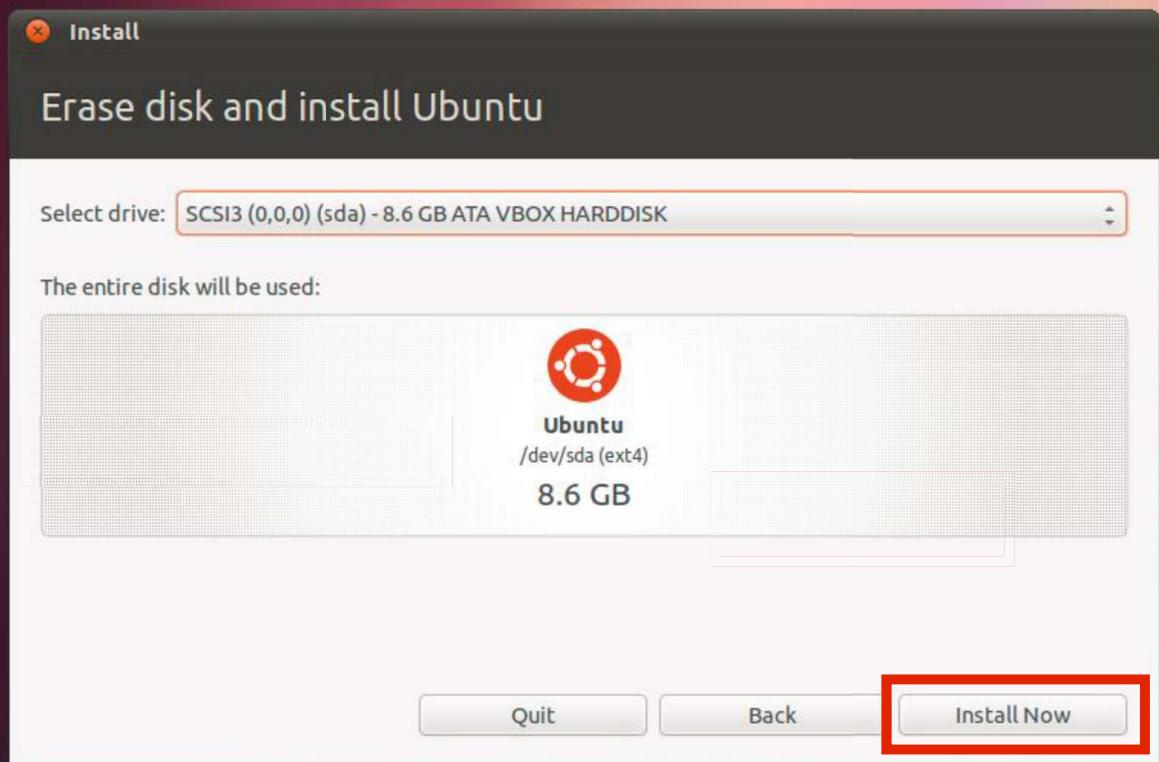
Running Linux

3. Choose Erase disk and install Ubuntu and click Forward (Don't worry, it won't wipe your computer)



Running Linux

1. Click Install Now and wait. Maybe grab a snack.



2. When finished, click Restart and press Enter.

Lab 02

Analyze the configurations of VMware Workstation, find procedure to run the virtual machine of different configuration.

Configuring General Option Settings for a Virtual Machine (vmware workstation Pro17)

General option settings include the virtual machine name, the guest operating system type and version, and the location of the directory where virtual machine files are stored.

To configure general option settings for a selected virtual machine, select VM > Settings, click the Options tab, and select General.

Changing a Virtual Machine Name

Changing the name of the virtual machine does not change the name of this directory, nor does it rename the virtual machine files on the host. Workstation Pro uses the original name of the virtual machine to create the directory where virtual machine files are stored.

To specify a new name for a selected virtual machine, select VM > Settings, click the Options tab, and select General.

Changing the Guest Operating System

You can change the guest operating system or operating system version for a virtual machine. You might want to change the guest operating system for a virtual machine when you upgrade the guest operating system or if you specified the wrong operating system version when you created the virtual machine.

To select a new guest operating system or operating system version for a selected virtual machine, select VM > Settings, click the Options tab, and select General.

When you change the operating system type, the virtual machine configuration file is changed but the guest operating system is not changed. To change the guest operating system, you must obtain the operating system software and upgrade the guest operating system.

The virtual machine must be powered off when you change these settings.

Changing the Virtual Machine Working Directory

You can change the working directory for a virtual machine. The working directory is where Workstation Pro stores suspended state (.vmss), snapshot (.vmsn), and virtual machine paging (.vmem) files. By default, the working directory is where the virtual machine files are stored.

Note: You cannot change the working directory for a remote virtual machine.

To specify a new working directory for a selected virtual machine, select VM > Settings, click the Options tab, and select General.

You might want to change the working directory in the following situations.

- To organize all of your snapshots in a separate directory, you can create a directory in another location. If you plan to take many snapshots and use a large amount of disk space, place the working directory on a disk with a lot of space.
- To run a virtual machine that is stored on a network share or iPod, which might slow performance, you can change the working directory to your local hard disk. Then you can take a snapshot, power on the virtual machine, use it, and discard the snapshot when you are finished. The virtual machine then reverts to its original state.

- To create a paging file on a fast disk with a lot of disk space but leave the virtual disk and configuration file on a different disk, you can change the working directory so that it is located on the fast disk.

Changing the working directory does not change the directory where Workstation Pro stores the virtual machine configuration (.vmx) file and log files.

The virtual machine must be powered off when you change this setting.

Configuring Power Settings for a Virtual Machine

You can configure power options and power control settings for a virtual machine.

To change power options and settings for a selected virtual machine, select VM > Settings, click the Options tab, and select Power.

Power options control how a virtual machine behaves after it is powered off, closed, or suspended.

To configure power options for a selected virtual machine, select VM > Settings, click the Options tab, and select Power.

Note: You cannot configure power options for a remote virtual machine.

Power Options

Option	Description
Enter full screen mode after powering on	The virtual machine window enters full screen mode after it is powered on.
Close after powering off or suspending	The virtual machine tab closes after it is powered off or suspended.
Report battery information to guest	Battery information is reported to the guest operating system. If you run the virtual machine on a laptop in full screen mode, this option enables you to determine when the battery is running low. This option is available only for Workstation 6.x and later virtual machines.

Configuring Power Controls for a Virtual Machine

Power control settings affect the behavior of the stop, suspend, start, and reset buttons for a virtual machine. The behavior that you select appears in a tooltip when you mouse over the associated button. Power control settings also determine which power options appear in the context menu when you right-click the virtual machine in the library.

You can configure a soft or hard setting for each power control. A soft setting sends a request to the guest operating system, which it can ignore or, in the case of a deadlocked guest, it might not be able to handle. A guest operating system cannot ignore a hard power control. Hard power control settings are configured by default.

To change power controls for a selected virtual machine, select VM > Settings, click the Options tab, and select Power.

Power Controls

Control	Description
Stop	<p>Power Off</p> <p>(Hard option) Workstation Pro powers off the virtual machine abruptly with no consideration for work in progress.</p> <p>Shut Down Guest</p> <p>(Soft option) Workstation Pro sends a shut-down signal to the guest operating system. An operating system that recognizes the signal shuts down gracefully. Not all guest operating systems respond to a shut-down signal from Workstation Pro. If the guest operating system does not respond to the signal, shut down from the guest operating system as you would a physical machine.</p>
Suspend	<p>Suspend</p> <p>(Hard option) Workstation Pro suspends the virtual machine and leaves it connected to the network.</p> <p>Suspend Guest</p> <p>(Soft option) Workstation Pro suspends the virtual machine and disconnects it from the network. VMware Tools runs a script in the guest operating system. On Windows guests, if the virtual machine is configured to use DHCP, the script releases the IP address of the virtual machine. On Linux, FreeBSD, and Solaris guests, the script stops networking for the virtual machine.</p>

Start

Power On

(Hard option) Workstation Pro starts the virtual machine.

Start Up Guest

(Soft option) Workstation Pro starts the virtual machine and VMware Tools runs a script in the guest operating system. On Windows guests, if the virtual machine is configured to use DHCP, the script renews the IP address of the virtual machine. On a Linux, FreeBSD, or Solaris guest, the script starts networking for the virtual machine.

Note:

You cannot configure this setting for a remote virtual machine.

Reset

Reset

(Hard option) Workstation Pro resets the virtual machine abruptly with no consideration for work in progress.

Restart Guest

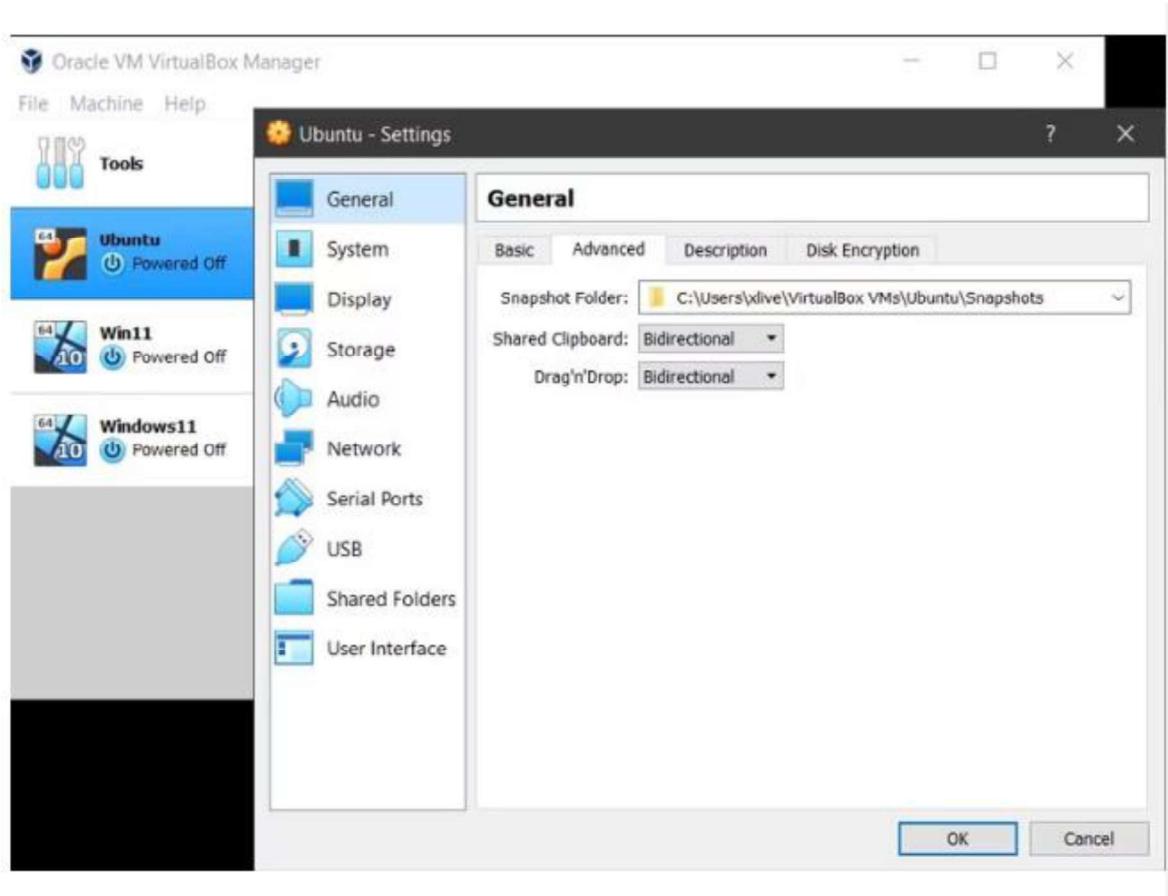
(Soft option) Workstation Pro shuts down and restarts the guest operating system gracefully. VMware Tools runs scripts before the virtual machine shuts down and when the virtual machine starts up.

Lab 3

Evaluate different methods to sharing Data to and from Virtual Machine and Basic Commands of Ubuntu

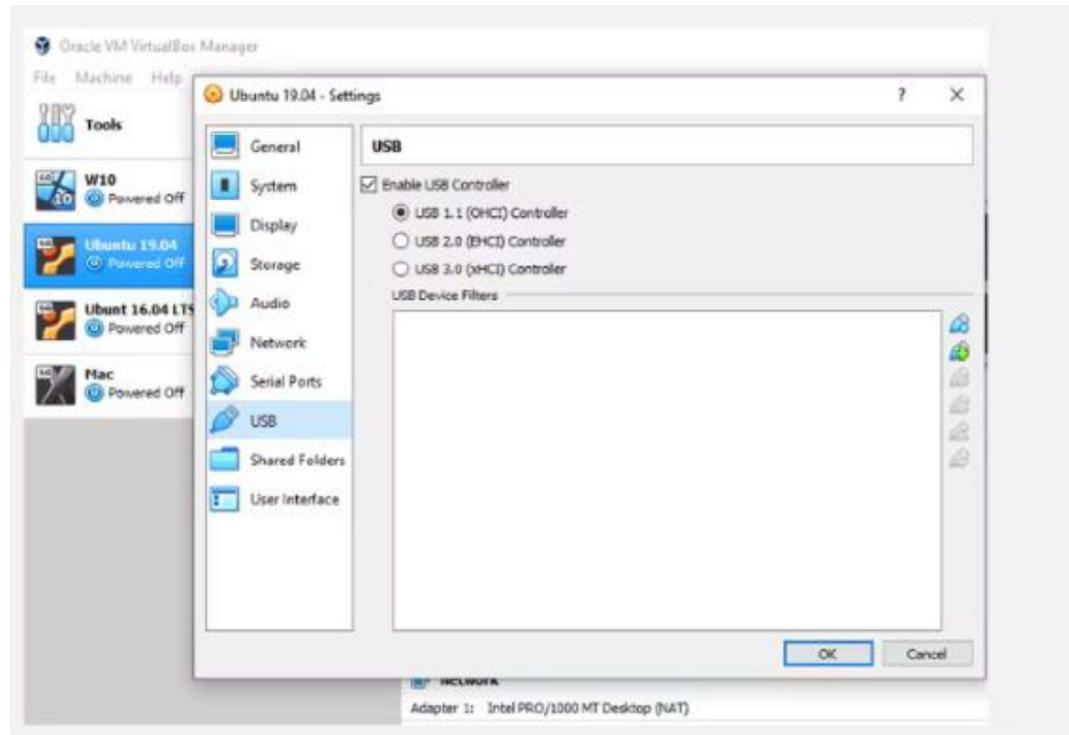
1. Drag & Drop and Shared Clipboard

The simplest option to transfer files between your host PC and a virtual machine is to set up a shared clipboard and/or drag and drop. This will allow you to use a common clipboard, meaning you will be free to copy/paste text/images and files between the virtual machine and your host PC.



2. Copy Files from VM to the Local Machine on a USB Stick

Using a USB stick to transfer data between two physical machines is a time-honored tradition. Although not ideal, a USB stick can transfer files between the host PC and virtual machine. Let's look at how you can use a USB drive to share data between a virtual machine and your host PC.



Open Host Controller Interface (OHCI)

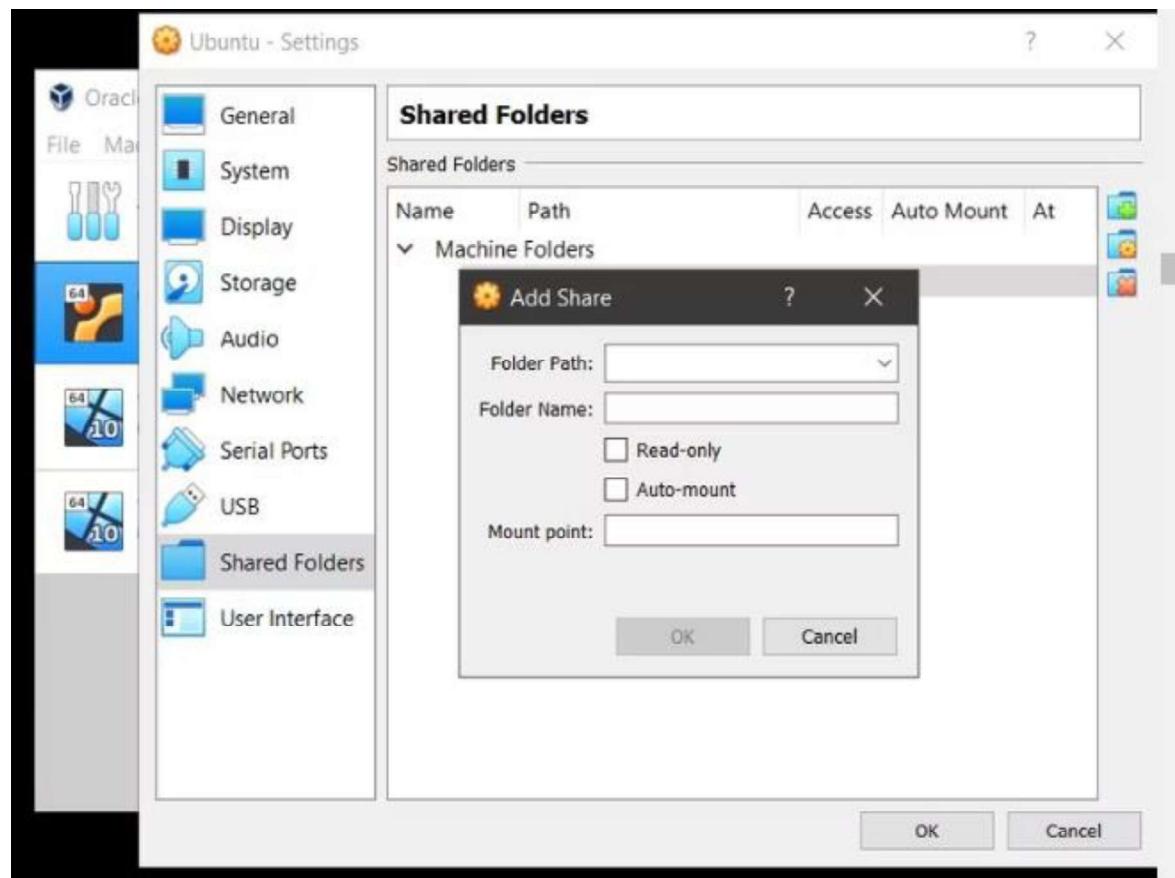
Enhanced Host Controller Interface (EHCI)

eXtensible Host Controller Interface (xHCI)

3. Create a Shared Folder to Transfer Files from Host to VM (Add a Shared Folder)

Your third option for copying files from host to guest PC is to set up a network share. This means designating a portion of your PC's hard disk drive as accessible over the local network. With this setup, the VM can then connect to the network and access the drive.

Although physically all on the same computer, this adds higher capacity to your virtual machine data sharing.



You can share files between virtual machines and your Mac by using shared folders.

Procedure

1. Select **Window > Virtual Machine Library**.
2. Select a virtual machine in the **Virtual Machine Library** window and click **Settings**.
3. Under Systems Settings in the **Settings** window, click **Sharing**.
4. Select the **Enable Shared Folders** check box.

On Windows and macOS virtual machines, a **VMware Shared Folders** shortcut is created on the guest operating system.

5. Click the add (+) button at the bottom of the display box.
6. In the Finder sheet, find the location of the folder to share, select it, and click **Add**.
7. In the Permissions field, set the virtual machine permission on the contents of the Mac's shared folder.

Option	Description
Read & Write	Enables the virtual machine to change the contents of the shared folder on your Mac.
Read Only	Prevents the virtual machine from changing the contents of the shared folder on your Mac.

Enable Shared Folders or Mirrored Folders for a Virtual Machine

Before you can identify which folders to share or mirror, you must configure your virtual machine to share folders.

Procedure

1. Select **Window > Virtual Machine Library**.
2. Select a virtual machine in the **Virtual Machine Library** window and click **Settings**.
3. Under Systems Settings in the **Settings** window, click **Sharing**.
4. Select the **Enable Shared Folders** check box.

This action enables shared folders. It also enables mirrored folders for supported Windows guest operating systems. On Windows and macOS virtual machines, a VMware Shared Folders shortcut is created on the guest operating system. Click on the shortcut to view the shared folders.

Remove a Shared Folder

You can remove a folder from the list of shared folders to stop sharing it.

Procedure

1. Select **Window > Virtual Machine Library**.
2. Select a virtual machine in the **Virtual Machine Library** window and click **Settings**.
3. Under Systems Settings in the **Settings** window, click **Sharing**.
4. In the display box at the top of the Sharing panel, select the folder to remove.
5. Click the remove (-) button at the bottom of the display box.

Student Task:

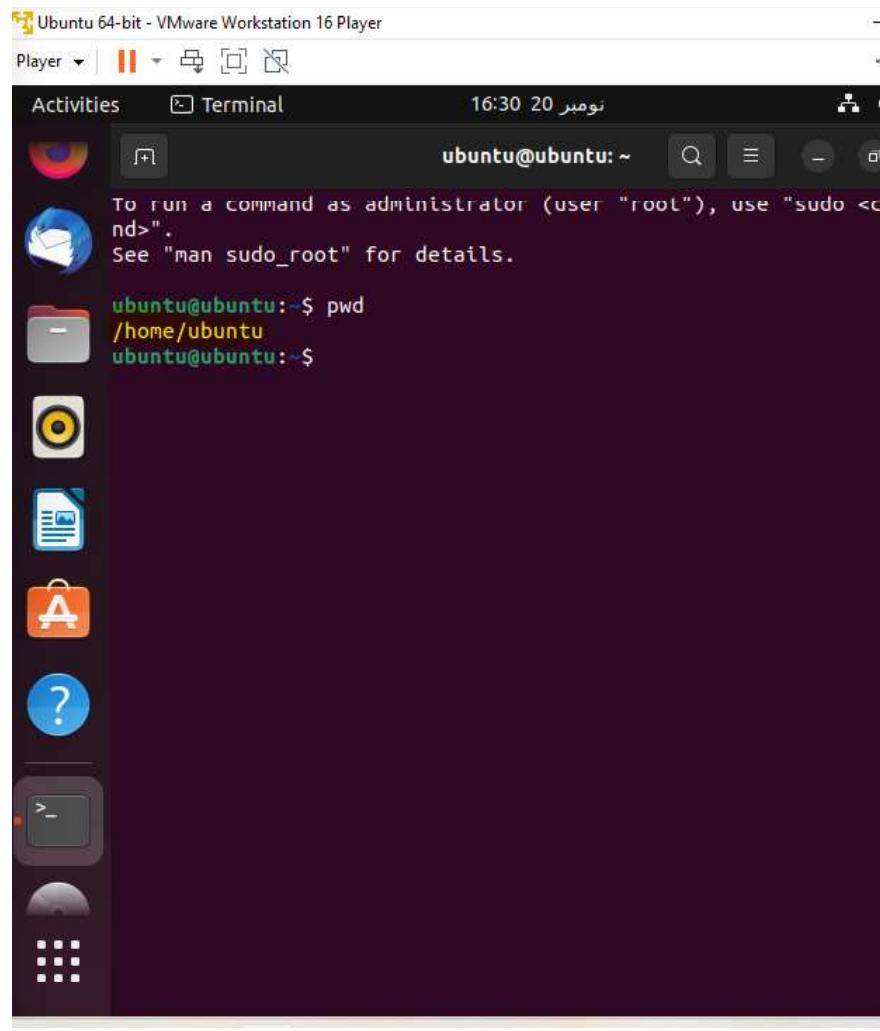
First change the working directory of virtual machine then shred folder to transfer data from host to Virtual Machine. The name of the shared directory must be “YourNameSharedDir”

What are the basic commands of Ubuntu

This section contains some basic commands of Ubuntu, so let us start and discuss them one by one. Firstly, you must open the terminal in Ubuntu; press “**ctrl+alt+t**” from your keyboard to open the terminal.

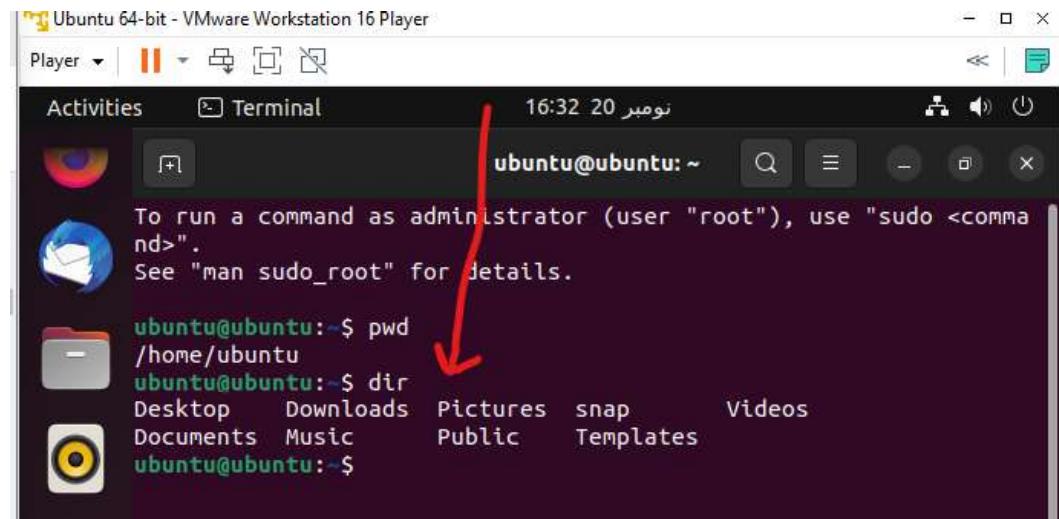
Command 1: pwd

This command refers to the present working directory in which you are operating; in simpler words, in which your terminal is open. To check PWD, execute the pwd keyword in your terminal and hit enter; the command of PWD is written below along with the result of that command.



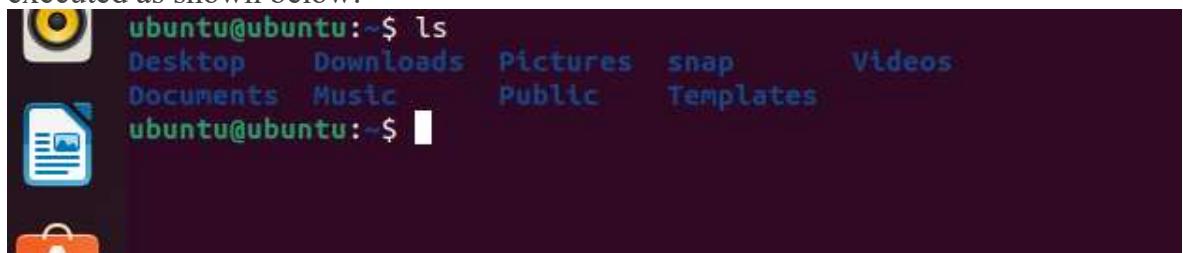
Command 2: dir

The dir command is used to print (on the terminal) all the available directories in the present working directory:



Command 3: ls

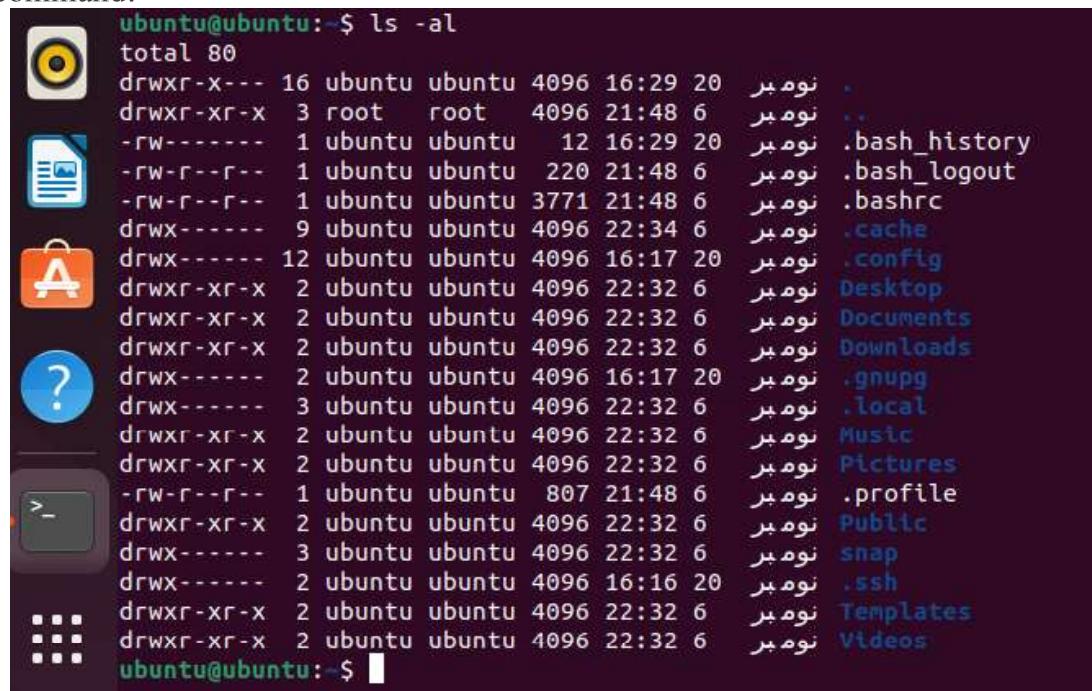
This command is used to list down all the directories and files inside the present working directory (or you can give the path of a specific directory); the ls command can be executed as shown below:



```
ubuntu@ubuntu:~$ ls
Desktop   Downloads  Pictures  snap      Videos
Documents  Music    Public    Templates
ubuntu@ubuntu:~$
```

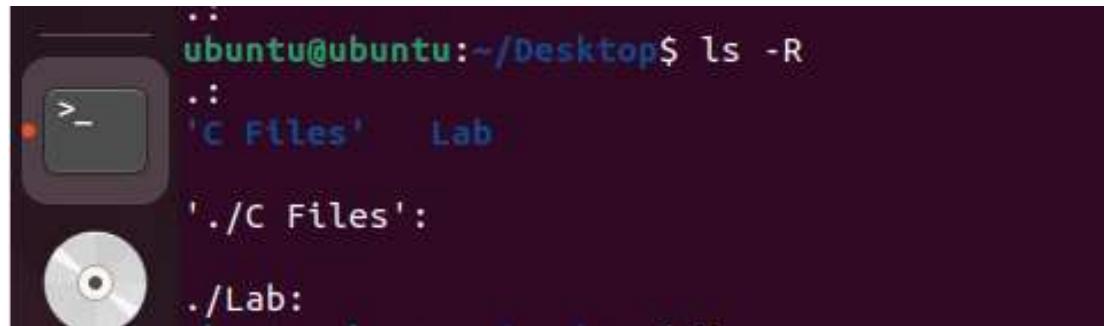
The ls command supports various flags, and each flag has some specific role in printing the directories or files of the current working directory.

To print the detailed information of the files/directories; the “-al” flag is used with the “ls” command:



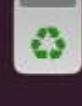
```
ubuntu@ubuntu:~$ ls -al
total 80
drwxr-x--- 16 ubuntu ubuntu 4096 16:29 20   نومبر .
drwxr-xr-x  3 root   root   4096 21:48 6   نومبر ..
-rw-------  1 ubuntu ubuntu   12 16:29 20   نومبر .bash_history
-rw-r--r--  1 ubuntu ubuntu  220 21:48 6   نومبر .bash_logout
-rw-r--r--  1 ubuntu ubuntu 3771 21:48 6   نومبر .bashrc
drwx----- 9 ubuntu ubuntu 4096 22:34 6   نومبر .cache
drwx----- 12 ubuntu ubuntu 4096 16:17 20  نومبر .config
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Desktop
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Documents
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Downloads
drwxr-xr-x  2 ubuntu ubuntu 4096 16:17 20  نومبر .gnupg
drwx----- 3 ubuntu ubuntu 4096 22:32 6   نومبر .local
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Music
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Pictures
-rw-r--r--  1 ubuntu ubuntu  807 21:48 6   نومبر .profile
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Public
drwx----- 3 ubuntu ubuntu 4096 22:32 6   نومبر snap
drwx----- 2 ubuntu ubuntu 4096 16:16 20  نومبر .ssh
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Templates
drwxr-xr-x  2 ubuntu ubuntu 4096 22:32 6   نومبر Videos
ubuntu@ubuntu:~$
```

The “-R” flag will print subdirectories of a directory as well:



```
.. .
ubuntu@ubuntu:~/Desktop$ ls -R
.:
'C Files'  Lab
'./C Files':
./Lab:
```

Moreover, to get the hidden files, “-a” flag is used:



```
ubuntu@ubuntu:~$ ls -a
.
..
.bashrc  Documents  Music    snap
.cache   Downloads  Pictures  .ssh
.bash_history .config  .gnupg   .profile  Templates
.bash_logout  Desktop  .local   Public    Videos
ubuntu@ubuntu:~$
```

Command 4: cd

One of the most used commands of Ubuntu; you can change the directories in the terminal using the “cd” command. For instance, the following command will change the pwd to desktop.



```
ubuntu@ubuntu:~$ ls -a
.
..
.bashrc  Documents  Music    snap
.cache   Downloads  Pictures  .ssh
.bash_history .config  .gnupg   .profile  Templates
.bash_logout  Desktop  .local   Public    Videos
ubuntu@ubuntu:~$ cd Desktop
ubuntu@ubuntu:~/Desktop$
```

There are multiple uses of this command: one can change the present directory to root directory or home directory using this command. When you open a fresh terminal, you are in the home directory.

To change directory to root. For instance, we are in the Desktop directory and want to switch to the root directory:



```
ubuntu@ubuntu:~$ cd Desktop
ubuntu@ubuntu:~/Desktop$ cd /
ubuntu@ubuntu:/$
```

To change the present directory to the home directory:



```
ubuntu@ubuntu:~$ cd
ubuntu@ubuntu:~$ cd Desktop
ubuntu@ubuntu:~/Desktop$ cd /
ubuntu@ubuntu:/$ cd<
ubuntu@ubuntu:~$
```

Command 5: touch

This Ubuntu command can be used to create a new file as well one can use it to change the timestamp of any file; the command given below will create a new text file in pwd:

```
ubuntu@ubuntu:~$ cd Desktop
ubuntu@ubuntu:~/Desktop$ cd Lab
ubuntu@ubuntu:~/Desktop/Lab$ touch file1.txt
ubuntu@ubuntu:~/Desktop/Lab$ ls
file1.txt ←
ubuntu@ubuntu:~/Desktop/Lab$
```

If we execute a touch command to create a file, but the file is already created, then it would change the timestamp of that file to the current time; for instance, the command given below will change the timestamp of the file1.txt. you can check that the timestamp has been changed to the current time:

```
ubuntu@ubuntu:~/Desktop$ cd Lab
ubuntu@ubuntu:~/Desktop/Lab$ touch file1.txt
ubuntu@ubuntu:~/Desktop/Lab$ ls
file1.txt
ubuntu@ubuntu:~/Desktop/Lab$ touch file1.txt ←
ubuntu@ubuntu:~/Desktop/Lab$ stat file1.txt
  File: file1.txt
  Size: 0          Blocks: 0          IO Block: 4096   regul
ar empty file
Device: 803h/2051d      Inode: 1048986      Links: 1
Access: (0664/-rw-rw-r--)  Uid: ( 1000/  ubuntu)  Gid: ( 1000/
ubuntu)
Access: 2022-11-20 16:53:50.300721363 +0500
Modify: 2022-11-20 16:53:50.300721363 +0500
Change: 2022-11-20 16:53:50.300721363 +0500
 Birth: 2022-11-20 16:50:50.711629729 +0500
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 6: cat

This command is used to show the content of any file: For instance, the following command will display the content inside “file1.txt”:

```
ubuntu@ubuntu:~/Desktop/Lab$ cat file1.txt
heloo
my name is Andy

ubuntu@ubuntu:~/Desktop/Lab$
```

Or you can use this command to save the content of multiples files to one file:

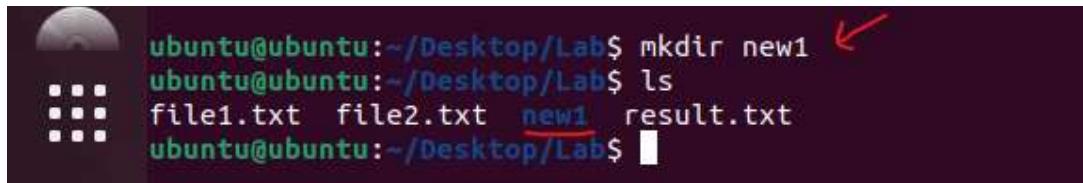
```
ubuntu@ubuntu:~/Desktop/Lab$ cat file1.txt file2.txt >result.txt
ubuntu@ubuntu:~/Desktop/Lab$ cat result.txt
heloo
my name is Andy
hy
my name harry.
```

To add text in a file, write the command **cat >> file1.txt** and press Ctrl+C to save text in file.

To overwrite text in a file, write the command `cat > file1.txt` and press Ctrl+C to save text in file.

Command 7: mkdir

The above-mentioned command will make a directory in your pwd; for example, the following command will make the directory “new” in pwd.

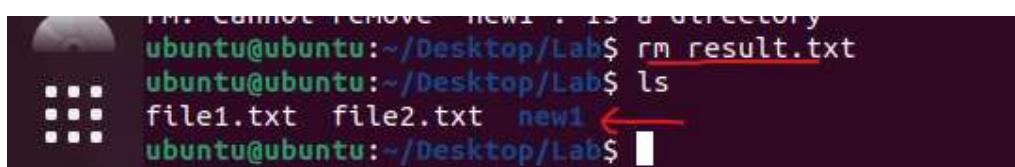


```
ubuntu@ubuntu:~/Desktop/Lab$ mkdir new1
ubuntu@ubuntu:~/Desktop/Lab$ ls
file1.txt file2.txt new1 result.txt
ubuntu@ubuntu:~/Desktop/Lab$
```

A screenshot of a terminal window on an Ubuntu system. The prompt shows the user is in their home directory under the Desktop/Lab folder. The user runs the command 'mkdir new1'. After pressing Enter, they run 'ls' to list the contents of the directory. The output shows 'file1.txt', 'file2.txt', 'new1', and 'result.txt'. A red arrow points to the 'new1' directory in the list.

Command 8: rm

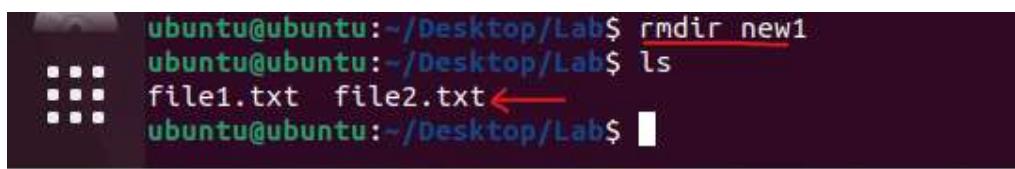
This remove command is used to remove the specific file from a directory; For instance, below mentioned command would remove the “test.txt” file from the pwd:



```
ubuntu@ubuntu:~/Desktop/Lab$ rm result.txt
ubuntu@ubuntu:~/Desktop/Lab$ ls
file1.txt file2.txt new1
ubuntu@ubuntu:~/Desktop/Lab$
```

A screenshot of a terminal window on an Ubuntu system. The user runs 'rm result.txt' to delete the 'result.txt' file. After pressing Enter, they run 'ls' to list the contents of the directory. The output shows 'file1.txt', 'file2.txt', and 'new1'. A red arrow points to the 'new1' directory in the list.

Or you can remove the empty directory, as the command given below will remove the “new1” directory



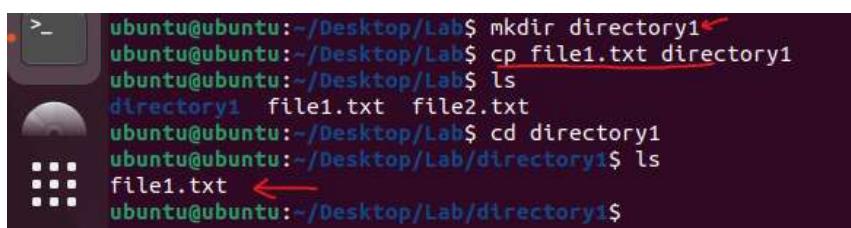
```
ubuntu@ubuntu:~/Desktop/Lab$ rmdir new1
ubuntu@ubuntu:~/Desktop/Lab$ ls
file1.txt file2.txt
ubuntu@ubuntu:~/Desktop/Lab$
```

A screenshot of a terminal window on an Ubuntu system. The user runs 'rmdir new1' to delete the empty 'new1' directory. After pressing Enter, they run 'ls' to list the contents of the directory. The output shows 'file1.txt' and 'file2.txt'. A red arrow points to the 'file2.txt' file in the list.

Command 9: cp

The cp command will help you to copy any file or folder to any directory;

To copy a file to directory1:



```
ubuntu@ubuntu:~/Desktop/Lab$ mkdir directory1
ubuntu@ubuntu:~/Desktop/Lab$ cp file1.txt directory1
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1 file1.txt file2.txt
ubuntu@ubuntu:~/Desktop/Lab$ cd directory1
ubuntu@ubuntu:~/Desktop/Lab/directory1$ ls
file1.txt
ubuntu@ubuntu:~/Desktop/Lab/directory1$
```

A screenshot of a terminal window on an Ubuntu system. The user runs 'mkdir directory1' to create a new directory named 'directory1'. After pressing Enter, they run 'cp file1.txt directory1' to copy 'file1.txt' into the new directory. They then run 'ls' to list the contents of 'directory1', which shows 'file1.txt' and 'file2.txt'. Finally, they change to the 'directory1' directory using 'cd directory1' and run 'ls' again, which shows only 'file1.txt'. A red arrow points to 'file1.txt' in the 'directory1' list.

Command 10: mv

You can use this command to move files around the computer, and you can also rename files or directories inside a specific directory: the command given below will move the “file2.txt” to “directory1”:

```
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1  file1.txt  file2.txt
ubuntu@ubuntu:~/Desktop/Lab$ mv file2.txt directory1
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1  file1.txt
ubuntu@ubuntu:~/Desktop/Lab$ cd directory1
ubuntu@ubuntu:~/Desktop/Lab/directory1$ ls
file1.txt  file2.txt
ubuntu@ubuntu:~/Desktop/Lab/directory1$
```

Moreover, the command given below will move the “new1” directory to “Lab”:

```
ubuntu@ubuntu:~/Desktop$ mkdir new1
ubuntu@ubuntu:~/Desktop$ ls
'C Files'  Lab  new1
ubuntu@ubuntu:~/Desktop$ mv new1 Lab
ubuntu@ubuntu:~/Desktop$ ls
'C Files'  Lab
ubuntu@ubuntu:~/Desktop$ cd Lab
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1  file1.txt  new1
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 11: head

This command helps you to get the first ten lines of a text file; for instance, the following command will help to get the first ten lines of the “file1.txt” file:

```
ubuntu@ubuntu:~/Desktop$ cd Lab
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1  file1.txt  new1
ubuntu@ubuntu:~/Desktop/Lab$ head file1.txt
heloo
my name is Andy ←
ubuntu@ubuntu:~/Desktop/Lab$
```

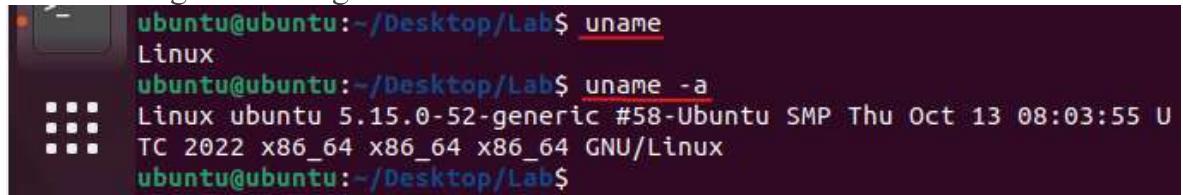
Command 12: tail

The tail command is used to get the last ten lines of the text file; the command below will print the ten lines from the bottom of “file1.txt”:

```
ubuntu@ubuntu:~/Desktop/Lab$ tail file1.txt
heloo
my name is Andy
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 13: uname

You can use the command to get the release number, version of Linux, and much more. The “-a” flag is used to get detailed information.



```
ubuntu@ubuntu:~/Desktop/Lab$ uname
Linux
ubuntu@ubuntu:~/Desktop/Lab$ uname -a
Linux ubuntu 5.15.0-52-generic #58-Ubuntu SMP Thu Oct 13 08:03:55 U
TC 2022 x86_64 x86_64 x86_64 GNU/Linux
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 14: wget

You can use the wget command to download the content from the internet; for instance, the following command will download VirtualBox.

```
$ wget https://download.virtualbox.org/virtualbox/6.1.26/VirtualBox-
6.1.26-145957-Win.exe
```

Command 15: apt-get or -apt

This is one of the most important and most used commands of Ubuntu that works with Ubuntu Advanced Packaging Tool (APT); you can use this “-apt-get” or “-apt” to install or remove packages, or you can perform other maintenance tasks. The “apt” requires sudo privileges to successfully execute the command.

The syntax stated below will help you to install the required package:

```
$ sudo apt install [packagename]
```

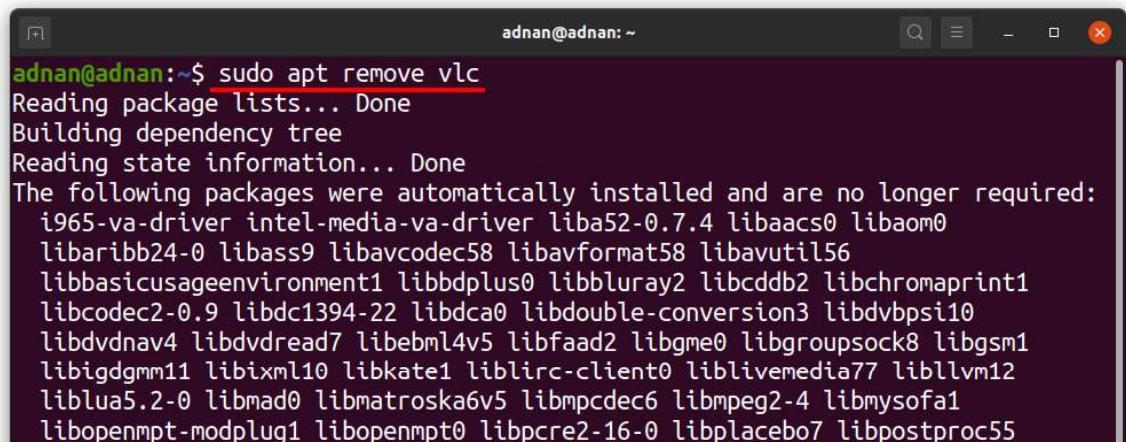
For install to install vlc media player package use:

```
$ sudo apt install vlc
```

Or you can remove the package by executing the command given below:

```
$ sudo apt remove [packagename]
```

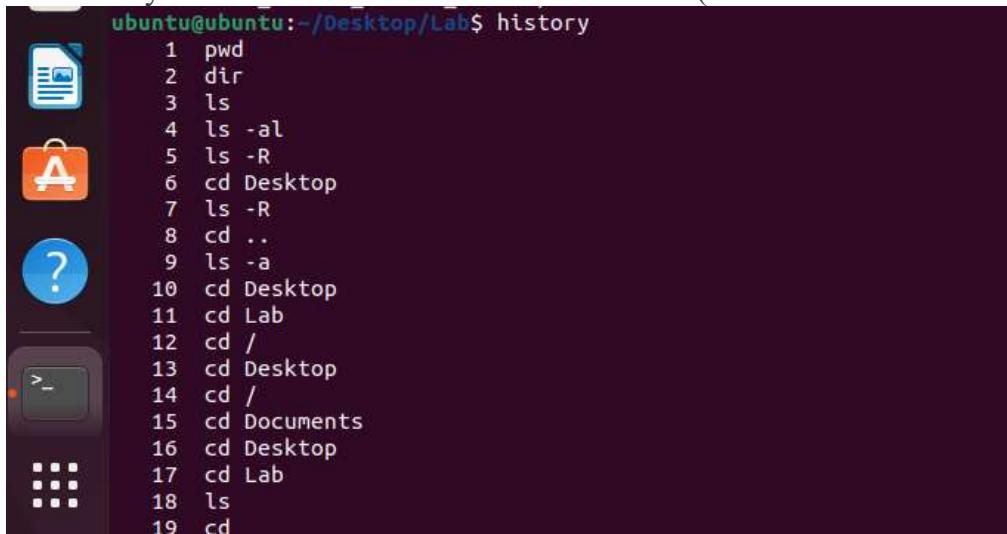
And to delete vlc media player package:



```
adnan@adnan:~$ sudo apt remove vlc
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  i965-va-driver intel-media-va-driver libaacs0 libao0
  libaribb24-0 libass9 libavcodec58 libavformat58 libavutil56
  libbasicusageenvironment1 libbdplus0 libbluray2 libcddb2 libchromaprint1
  libcodec2-0.9 libdc1394-22 libdca0 libdouble-conversion3 libdvbpsi10
  libdvdnav4 libdvdread7 libebml4v5 libfaad2 libgme0 libgroupsock8 libgsf1
  libigdgmm11 libixml10 libkate1 liblirc-client0 liblivemedia77 libllvm12
  liblu5.2-0 libmad0 libmatroska6v5 libmpcdec6 libmpeg2-4 libmysofa1
  libopenmpt-modplug1 libopenmpt0 libpcre2-16-0 libplacebo7 libpostproc55
```

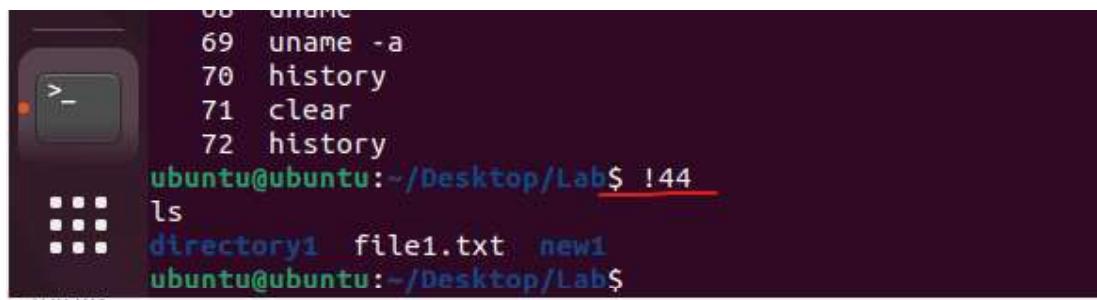
Command 16: history

The history command shows the list of commands (with numeric numbers) executed:



```
ubuntu@ubuntu:~/Desktop/Lab$ history
 1  pwd
 2  dir
 3  ls
 4  ls -al
 5  ls -R
 6  cd Desktop
 7  ls -R
 8  cd ..
 9  ls -a
10  cd Desktop
11  cd Lab
12  cd /
13  cd Desktop
14  cd /
15  cd Documents
16  cd Desktop
17  cd Lab
18  ls
19  cd
```

And you can execute any of the listed commands. For instance, if you want to execute the 2nd command (which is apt update command), then you have to write “!44” to get the result of that command:

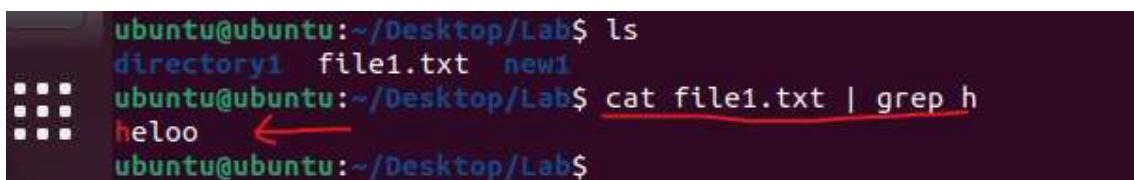


```
68  uname
69  uname -a
70  history
71  clear
72  history
ubuntu@ubuntu:~/Desktop/Lab$ !44
ls
directory1  file1.txt  new1
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 17: grep

With the help of grep, you can search for a pattern in which a specific word lies; for instance, the command given below will print all the lines that contain “20” from “file1.txt”:

```
$ cat file1.txt | grep 20
```

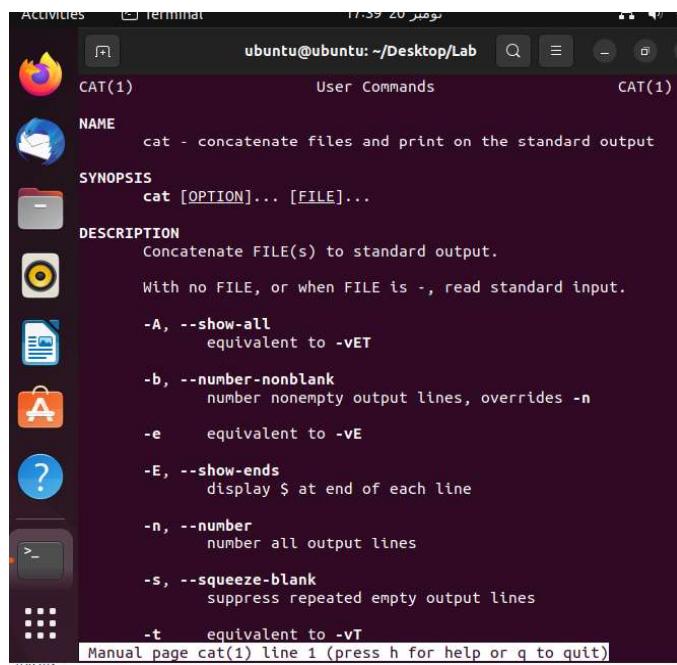


```
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1  file1.txt  new1
ubuntu@ubuntu:~/Desktop/Lab$ cat file1.txt | grep h
heoo ←
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 18: man

The man command will help you to get the complete user manual of any specific command; for instance, the following command will list down the detailed usage of the “cat” command:

```
$ man cat
```



A screenshot of a Linux desktop environment. In the top bar, there are icons for a browser, a terminal, and system status. The terminal window is open to the man page for the 'cat' command. The title bar says 'ubuntu@ubuntu: ~/Desktop/Lab'. The man page content includes sections for NAME, SYNOPSIS, DESCRIPTION, and various options like -A, -b, -e, -E, -n, -s, and -t. At the bottom of the man page, it says 'Manual page cat(1) line 1 (press h for help or q to quit)'.

Command 19: ps

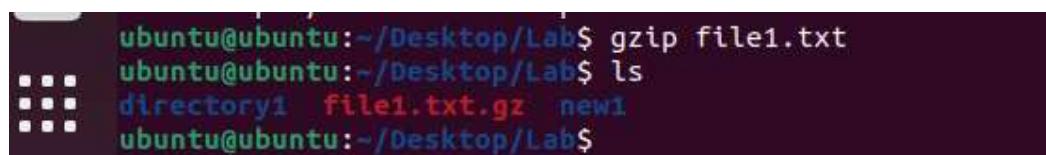
Using the **-ps** command, you will be able to get the list of processes.

```
$ ps
```

Command 20: zip or unzip

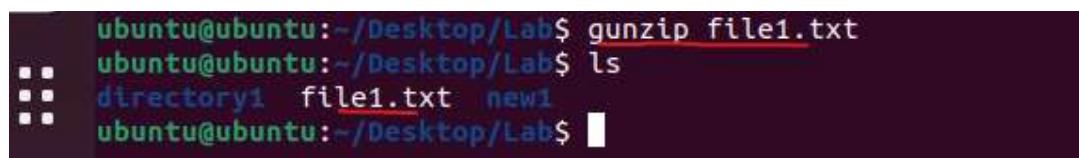
To convert your files to zip archive; you can get help by using the “**gzip**” command; moreover, a zipped file can be unzipped using the “**gunzip**” command:

```
$ gzip file1.txt
```



```
ubuntu@ubuntu:~/Desktop/Lab$ gzip file1.txt
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1  file1.txt.gz  new1
ubuntu@ubuntu:~/Desktop/Lab$
```

You can unzip the “file1.txt” as shown below:



```
ubuntu@ubuntu:~/Desktop/Lab$ gunzip file1.txt
ubuntu@ubuntu:~/Desktop/Lab$ ls
directory1  file1.txt  new1
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 21: hostname

This command will print your hostname on the terminal:

```
ubuntu@ubuntu:~/Desktop/Lab$ hostname
ubuntu
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 22: ping

You can use the ping command to check the connectivity to your server; for example, the command below will ping to YouTube and also prints the response time:

```
ubuntu@ubuntu:~/Desktop/Lab$ ping youtube.com
PING youtube.com (142.250.201.142) 56(84) bytes of data.
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=1 ttl=128 time=55.6 ms
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=2 ttl=128 time=46.1 ms
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=3 ttl=128 time=46.9 ms
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=4 ttl=128 time=46.1 ms
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=5 ttl=128 time=45.9 ms
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=6 ttl=128 time=47.2 ms
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=7 ttl=128 time=46.7 ms
64 bytes from mct01s21-in-f14.1e100.net (142.250.201.142): icmp_seq=8 ttl=128 time=45.3 ms
```

Command 23: w

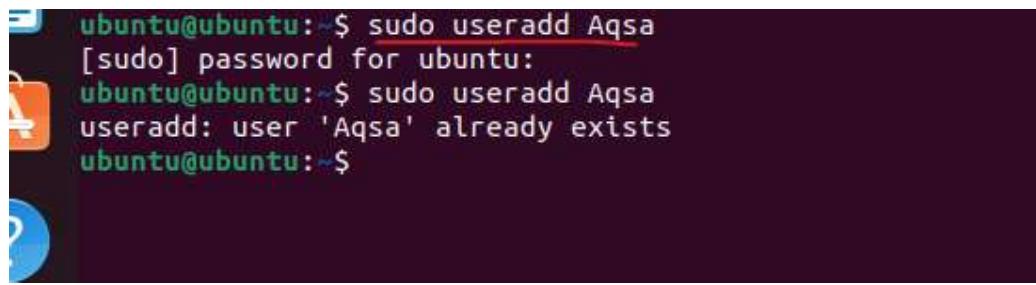
This command will display the user details that are currently logged into the system:

```
Activities Terminal 17:53 20 نوامبر
ubuntu@ubuntu:~/Desktop/Lab$ w
17:53:47 up 1:39, 1 user,  load average: 0.01, 0.08, 0.14
USER   TTY   FROM      LOGIN@   IDLE   JCPU   PCPU WH
AT     ubuntu  tty2    tty2      16:15   1:39m  0.23s  0.12s /
usr/li
ubuntu@ubuntu:~/Desktop/Lab$
```

Command 24: useradd

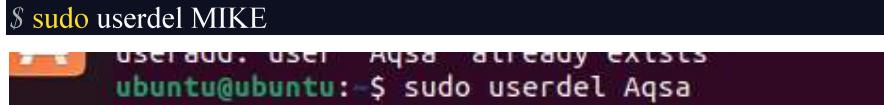
Ubuntu supports multiuser access; if you want to add another user to your system, execute the following command to do so:

```
$ sudo useradd MIKE
```



```
ubuntu@ubuntu:~$ sudo useradd Aqsa
[sudo] password for ubuntu:
ubuntu@ubuntu:~$ sudo useradd Aqsa
useradd: user 'Aqsa' already exists
ubuntu@ubuntu:~$
```

Or you can delete the user also;



```
$ sudo userdel MIKE
userdel: user 'MIKE' already exists
ubuntu@ubuntu:~$ sudo userdel Aqsa
```

Command 25: passwd

With the help of the passwd command, you can change the password of your Ubuntu user:



```
$ passwd newuser
```

Lab 4

Compare and Installation of GCC with different supported versions and Install a C compiler in the virtual machine and execute a sample program

Ubuntu is a widely used **Linux-based** operating system for running Linux-based programs. We need the GCC compiler to compile a C program and run it on Ubuntu operating system. GCC Compiler is a component of the build-essential package that we must install from the Ubuntu repository.

We can install the build-essential package by using the following command in the Ubuntu terminal:

1. `$ sudo apt update`
2. `$ sudo apt install build-essential`

After installing the build-essential package, we have to write our C program in an **Integrated Development Environment** (IDE) like Visual Studio Code, or a simple Text editor and then compile and run our C program on the terminal. We can use the following commands to compile and run our C Program.

1. Use the following command to compile the sample.c C program file in the same directory where the sample.c is present:

```
$ gcc sample.c -o sample
```

This command generates an executable file sample that we can run directly on the terminal using the below command.

2. To run the sample file, execute the following command in the same directory as where the sample executable file is present:

```
$ ./sample
```

Steps to Run a C Program in Ubuntu

Follow the given steps to run a C program on the Ubuntu operating system:

1. First, make sure that the **GCC** compiler is installed on your Ubuntu operating system, we can check the **GCC** compiler installation status using the following command :

```
$ gcc --version
```