

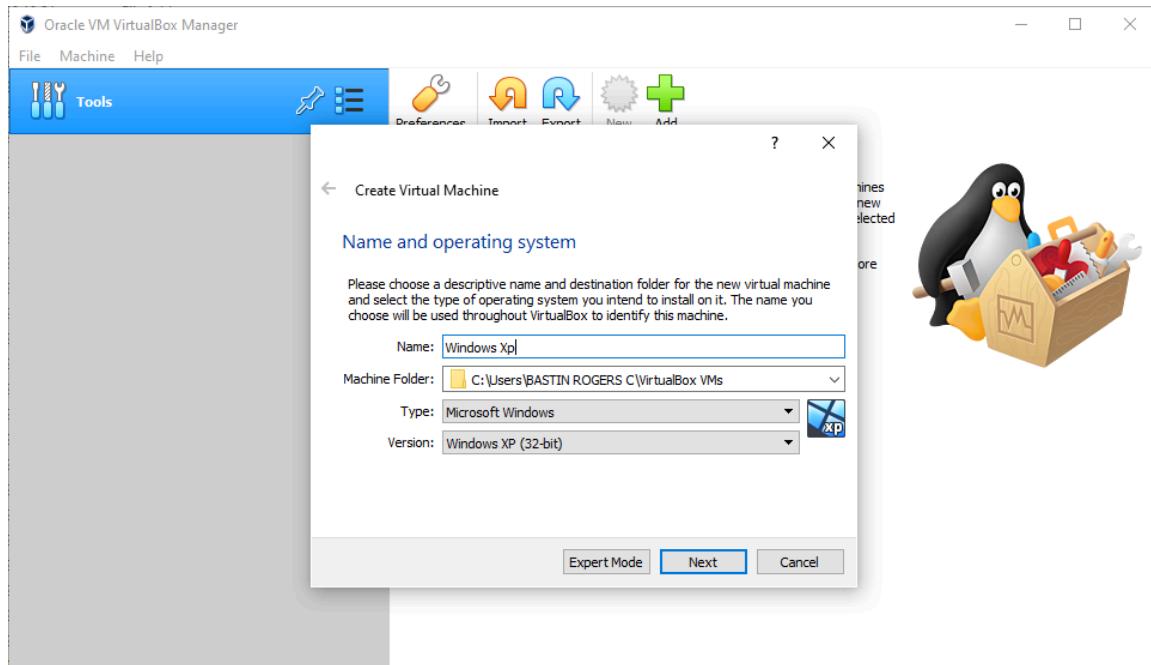
Ex.No.1**INSTALLING & CREATING A VIRTUAL MACHINE
USING VMWARE SOFTWARE****AIM:**

To Install Guest OS Windows XP using Oracle Virtual Box

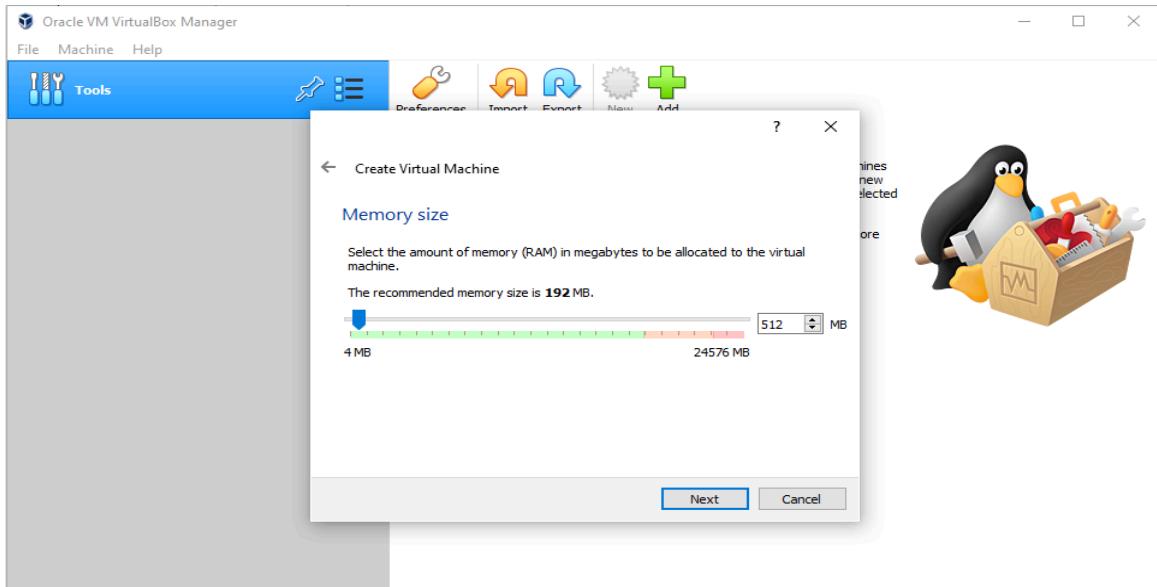
PROCEDURE:

Open the Virtual Machine Software

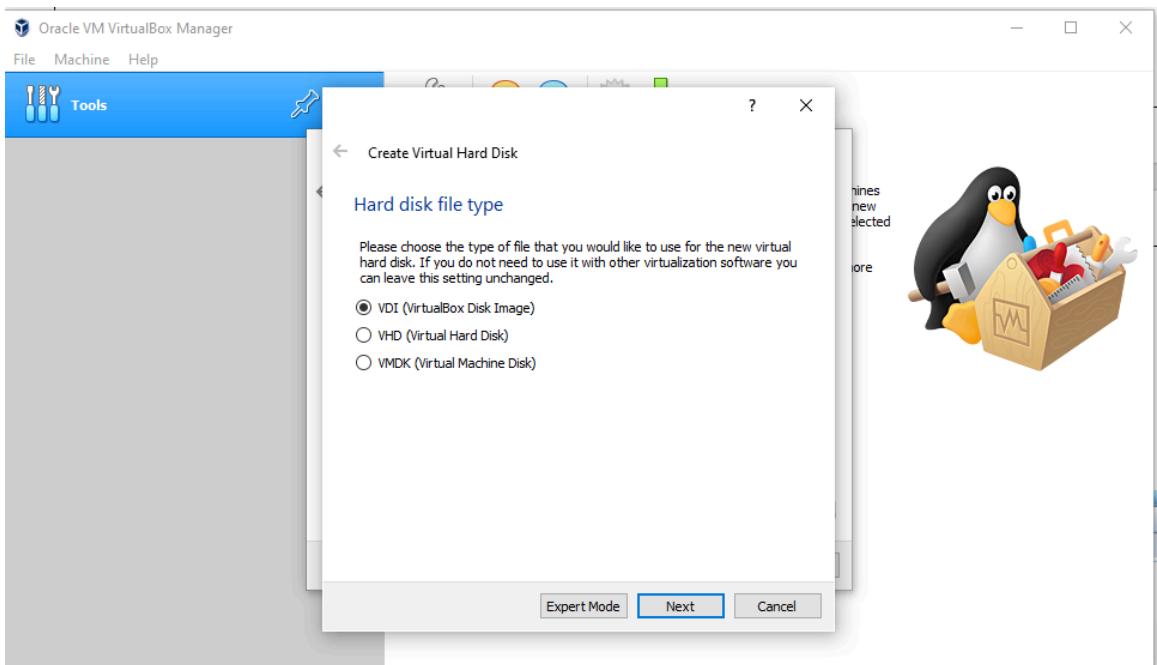
i)Click New and give the name of the Virtual Operating System you are going to install. The Virtual OS we are going to install is Windows Xp.Give the name as Windows Xp



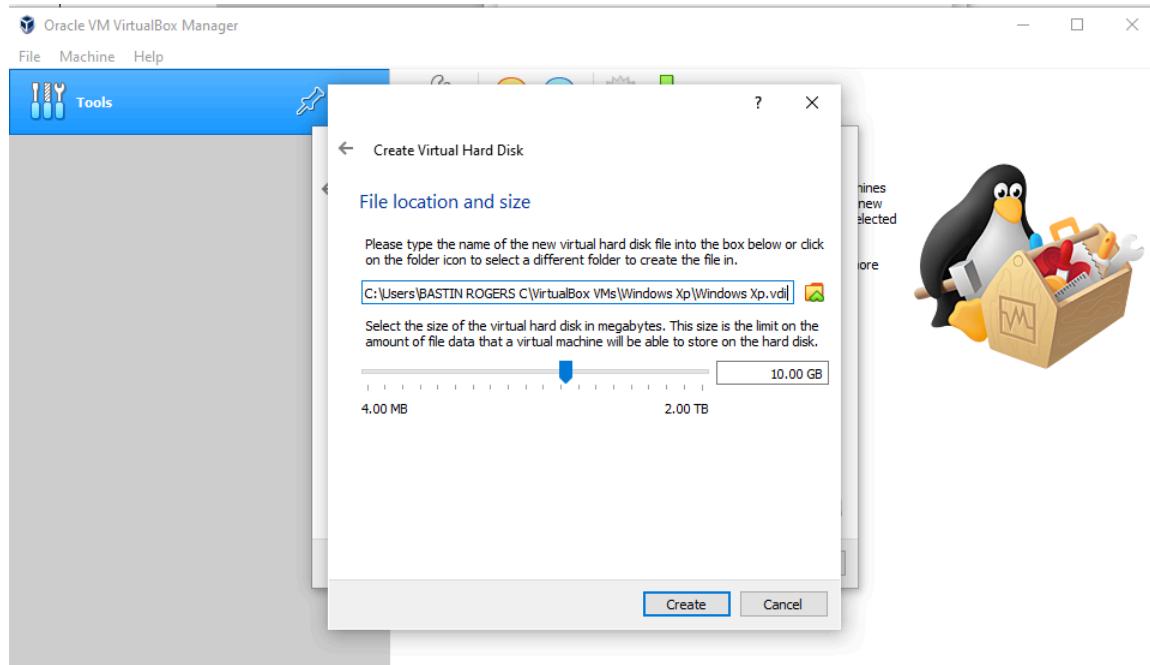
ii)Choose the Ram Capacity. Here we have allocated 512MB physical memory for Windows Xp



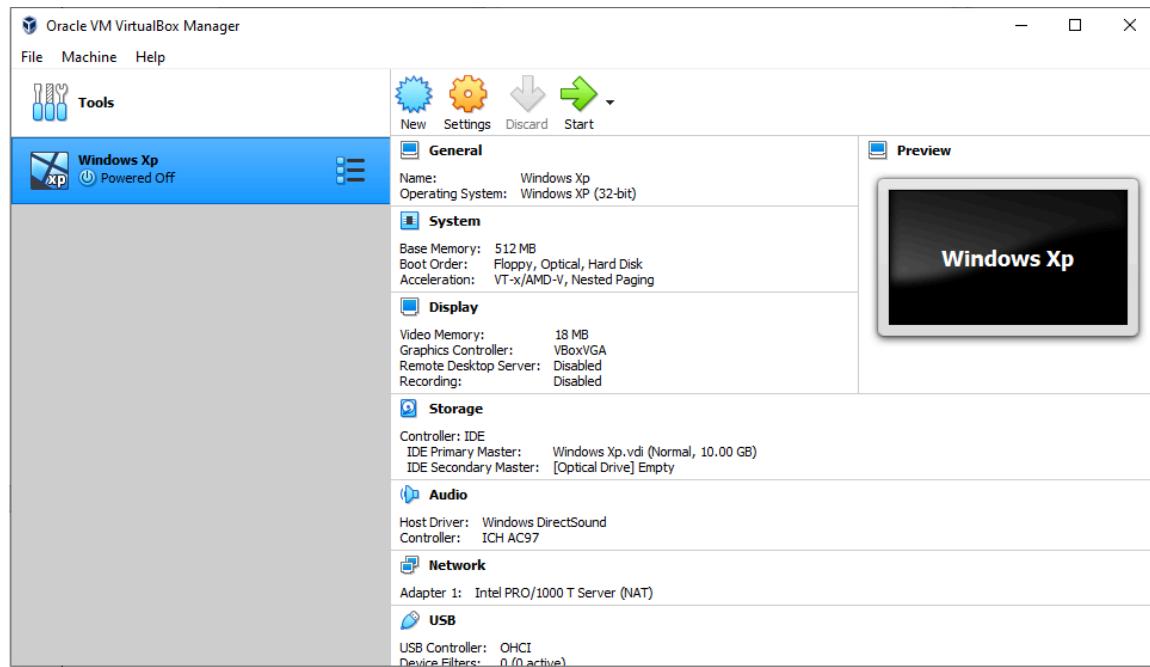
iii) Create Virtual Hard disk for the Virtual Guest OS.



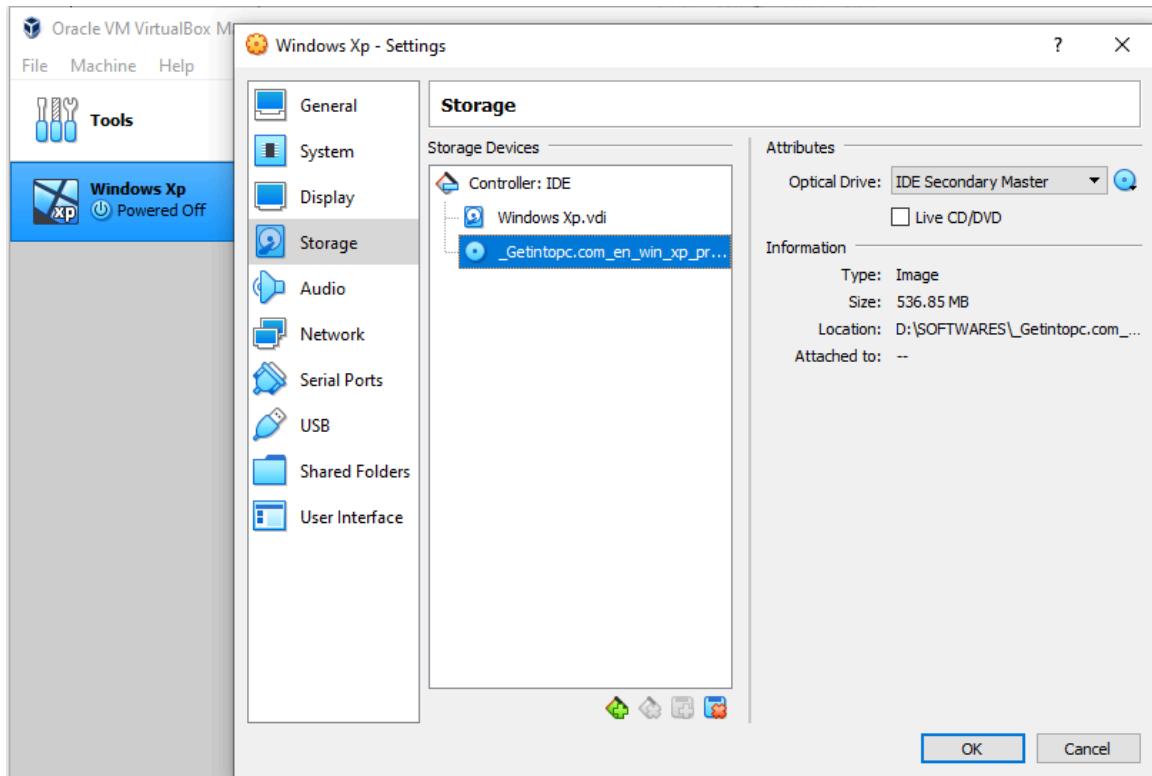
iv) Choose a Hard Disk space capacity for the Virtual OS



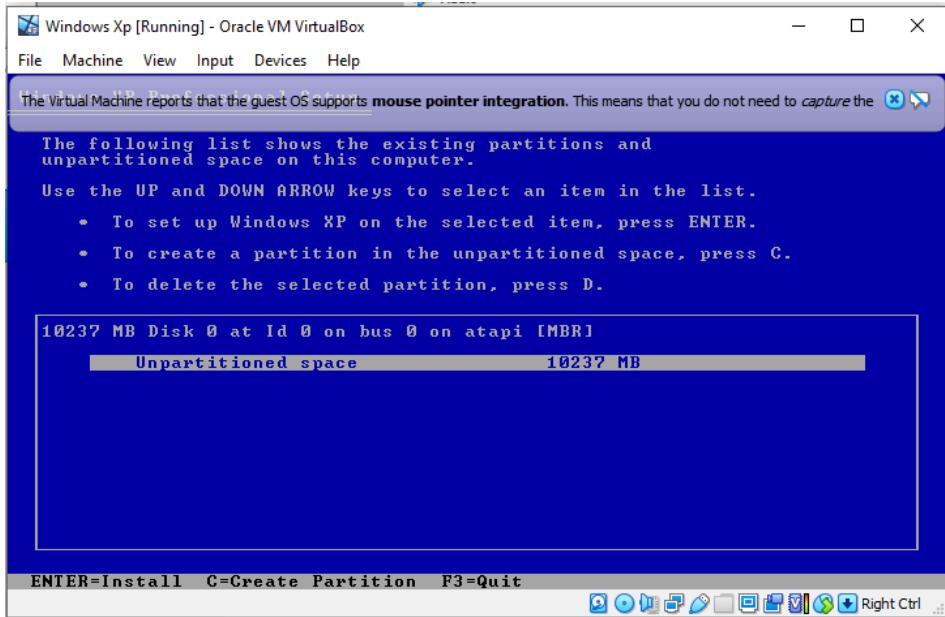
v) Click the Start Button and Select the Normal Start



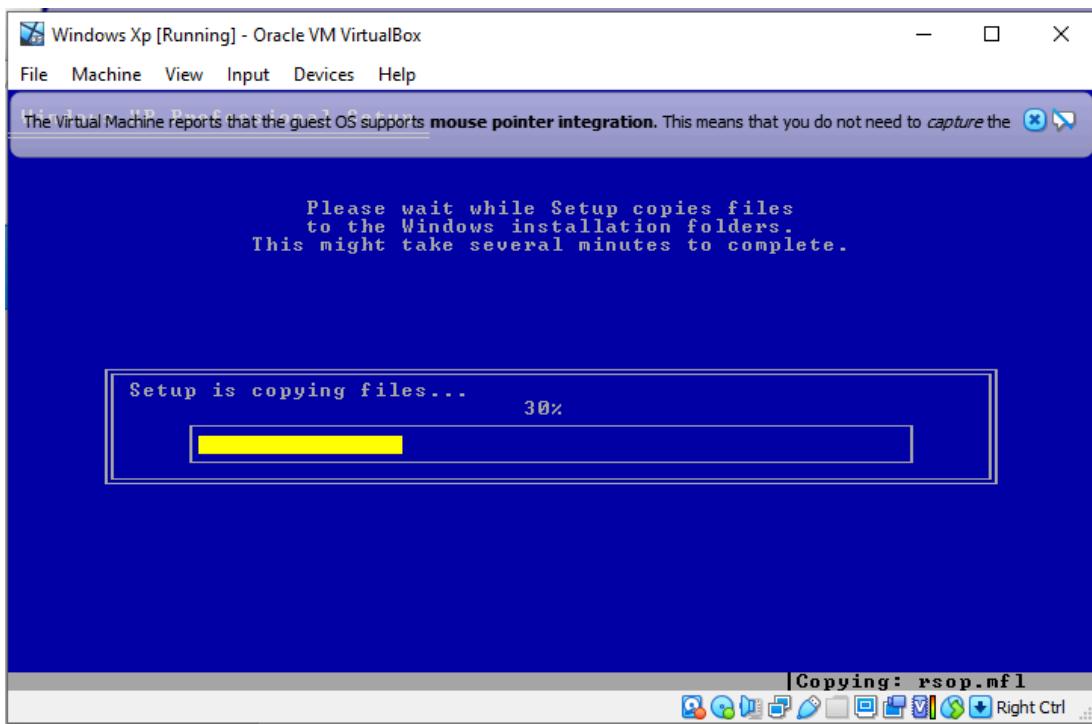
vi)Select Settings->Click Storage and add Windows xp ISO image you have downloaded



Xii) Now your Virtual OS will start to install. Click ENTER so that Virtual Hard Disk space we have created will be allocated.



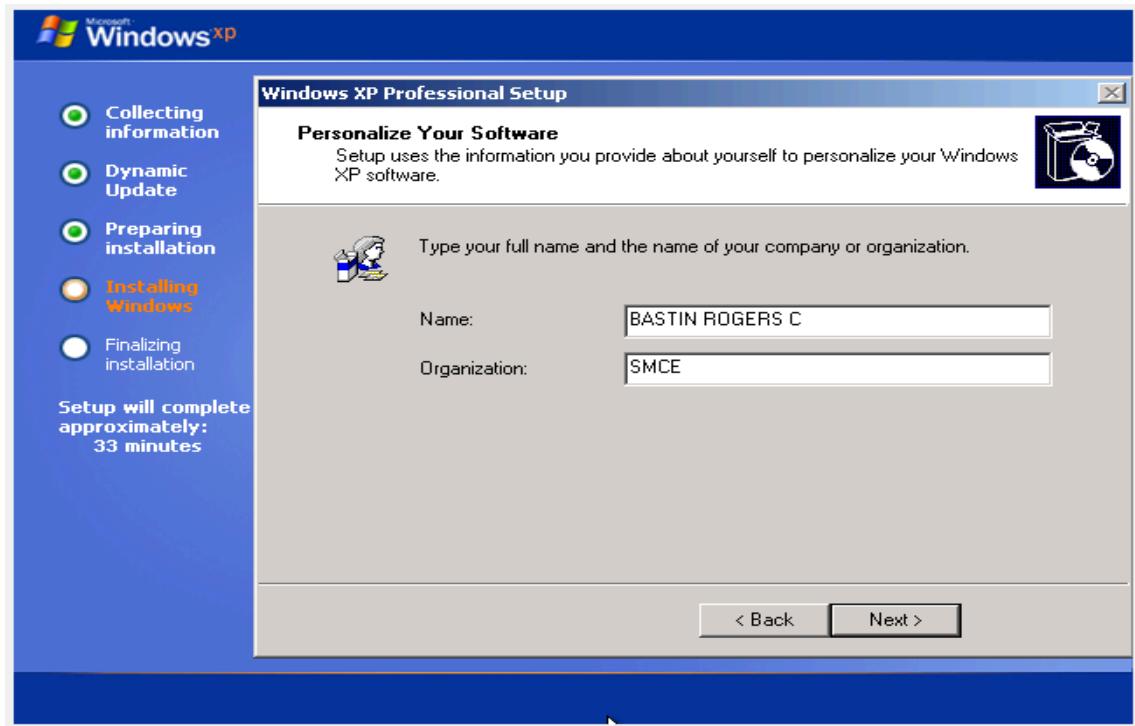
xiii) Now your Virtual OS will start to install



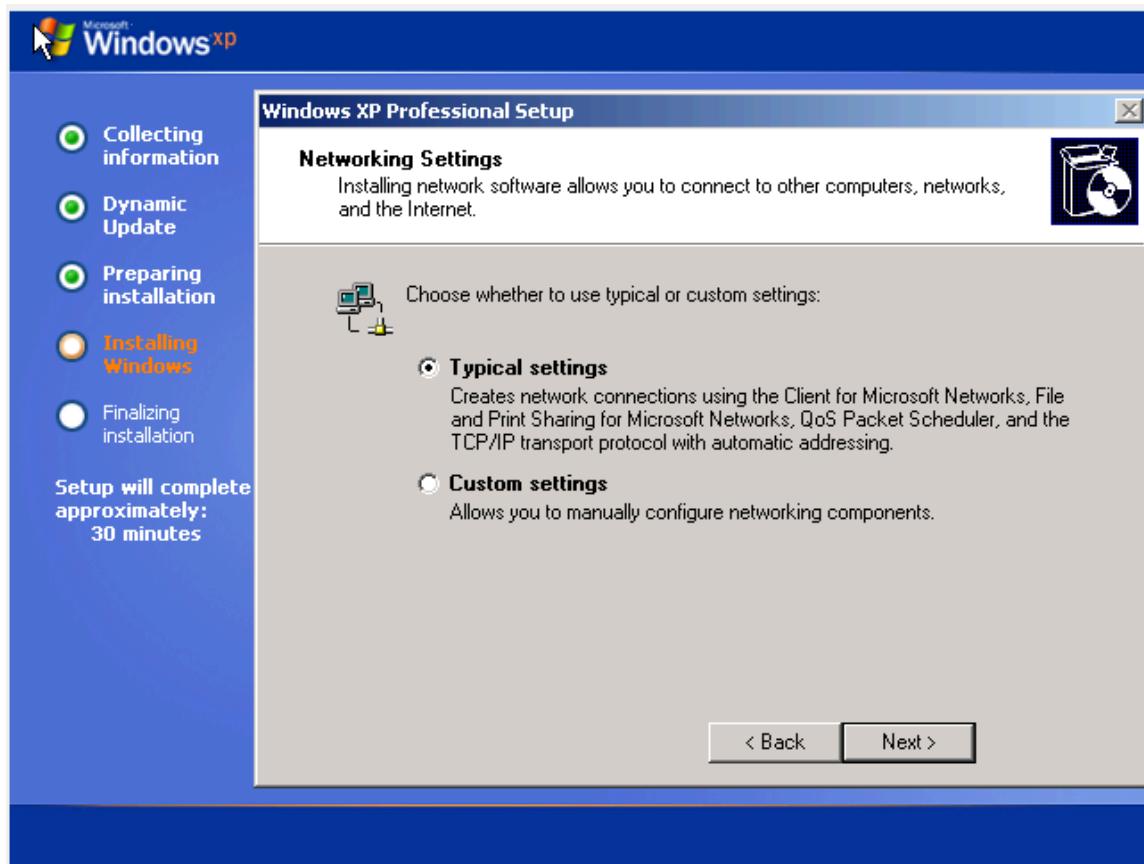
Click Next and Wait until your Windows Xp is Completely installed

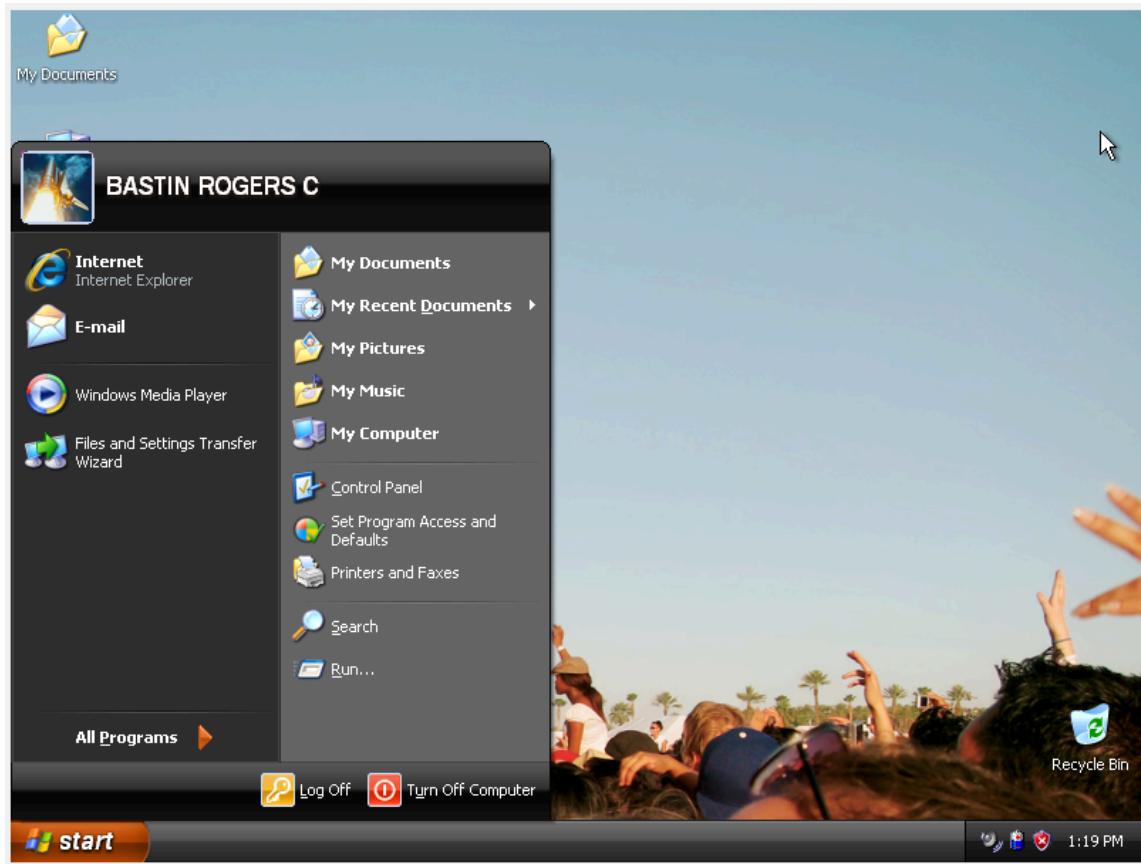


Give Your Name and the Organization Name.

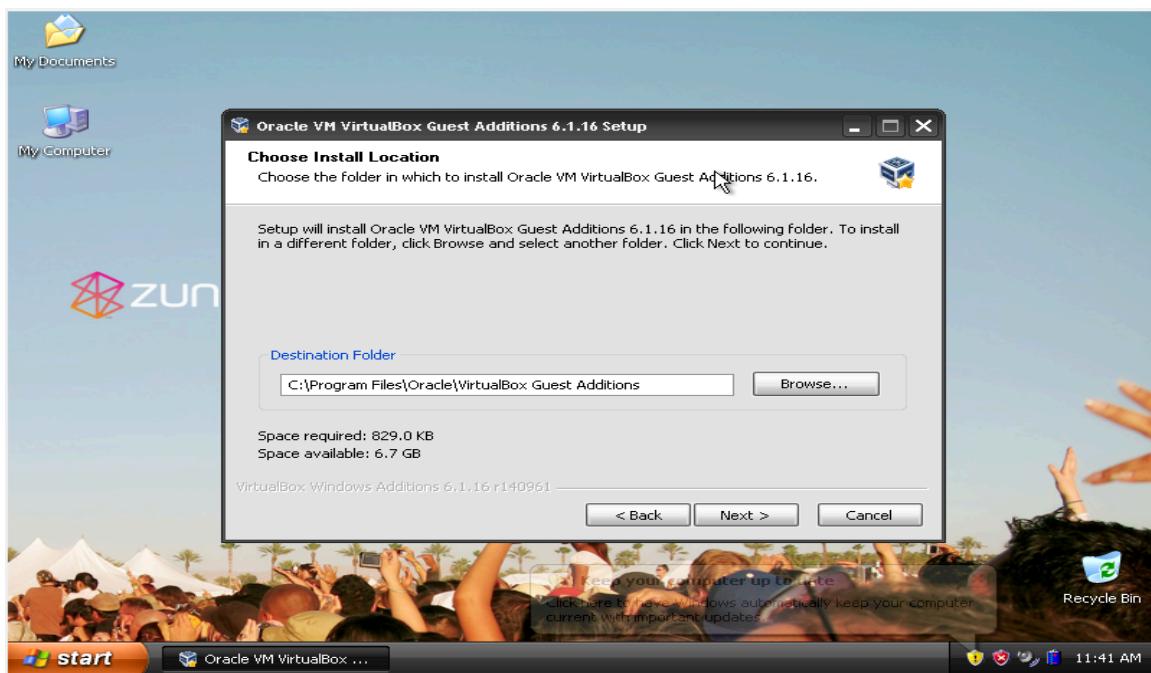


Click the Network Settings as Typical and Click next





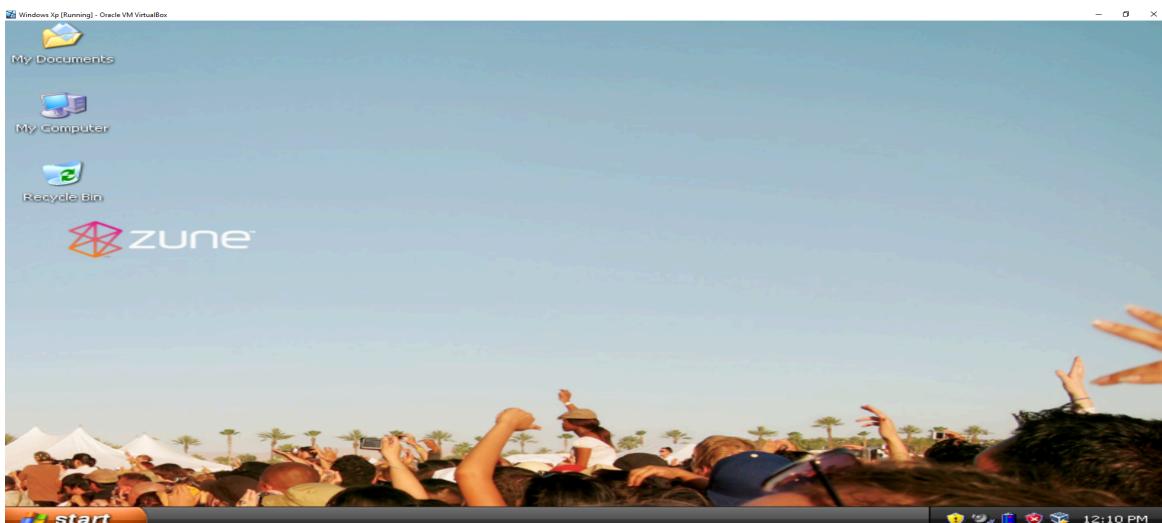
Click Devices and Install Guest Additions so that you can view your Guest OS in full screen mode



After Installing Virtual Box Guest Additions click Reboot now.



After Rebooting your system you can view your virtual OS in full screen mode



RESULT:

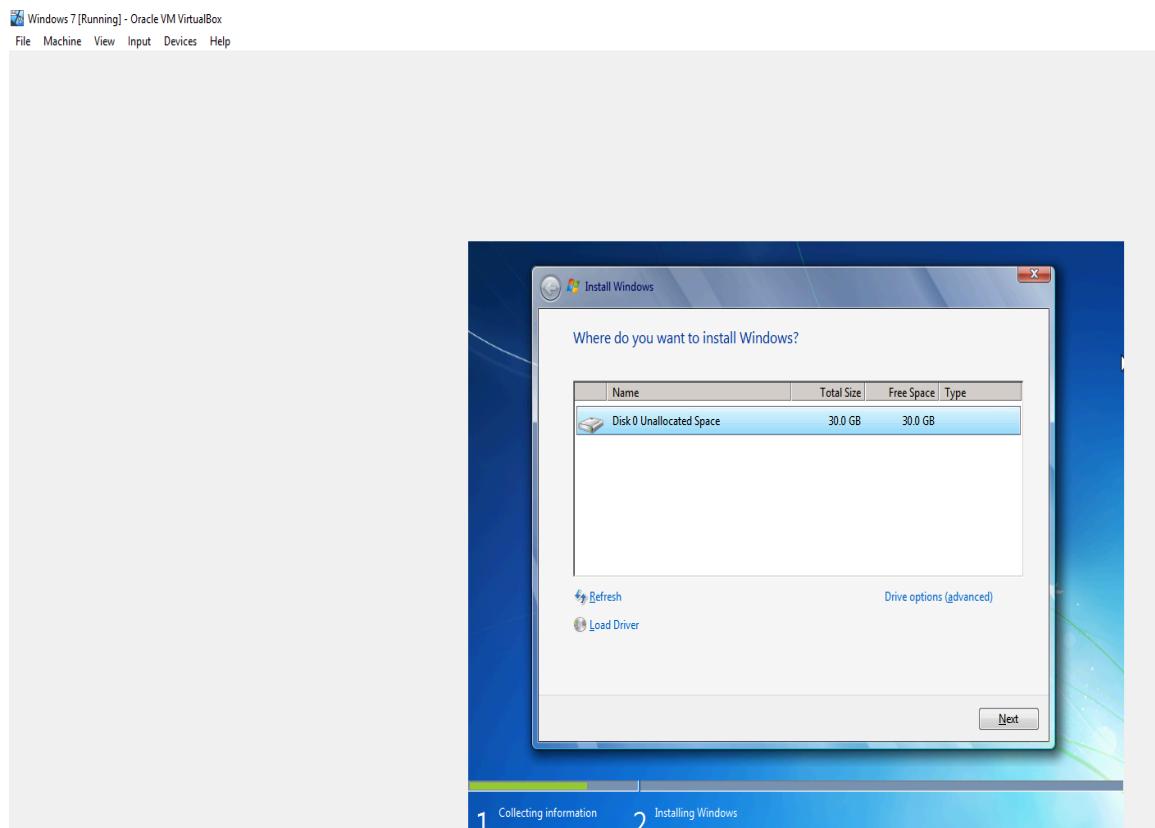
Thus the Guest OS Windows XP is created using Oracle Virtual Box
Installing Windows 7 using Oracle Virtual Box

AIM:

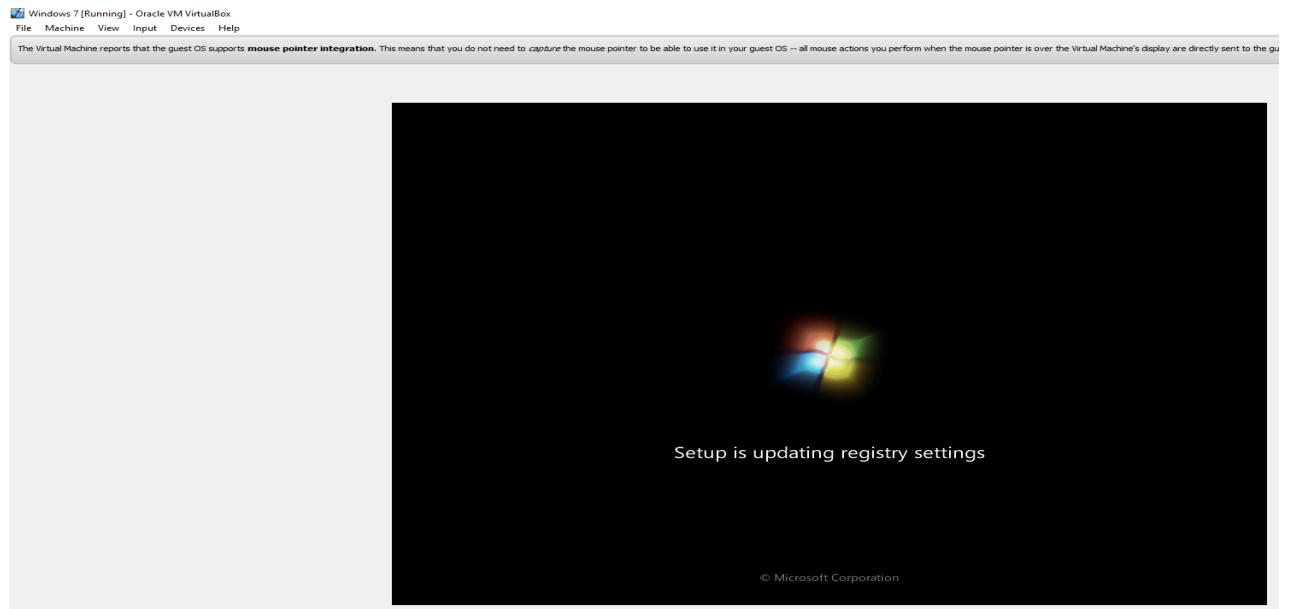
To Install an Operating System on Virtual Machine.

PROCEDURE:

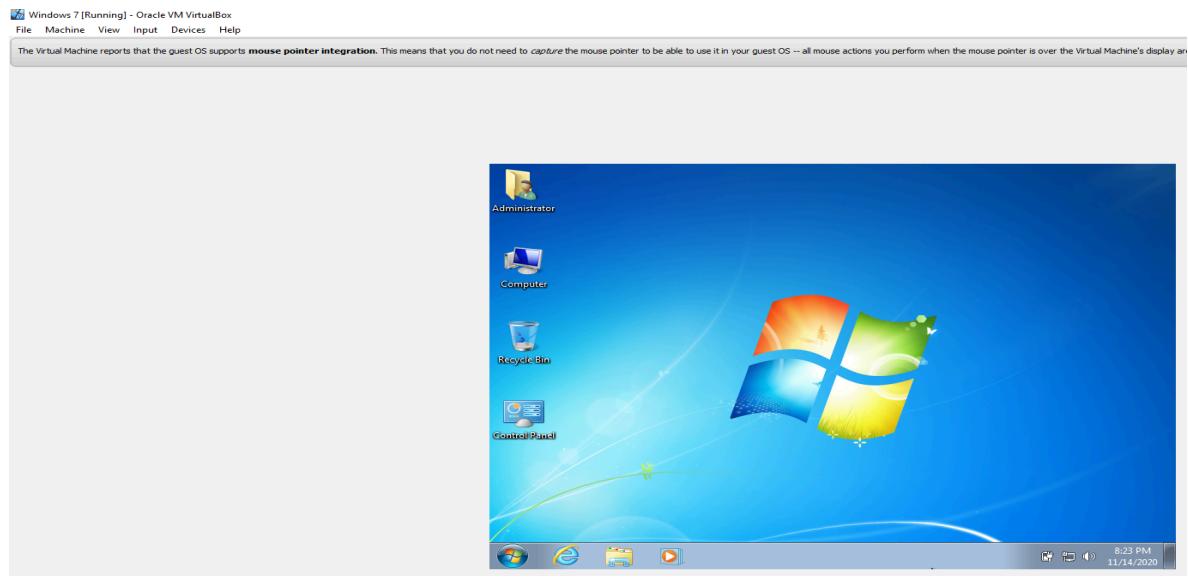
Click Next and Continue the Installation



Windows 7 will start Installing



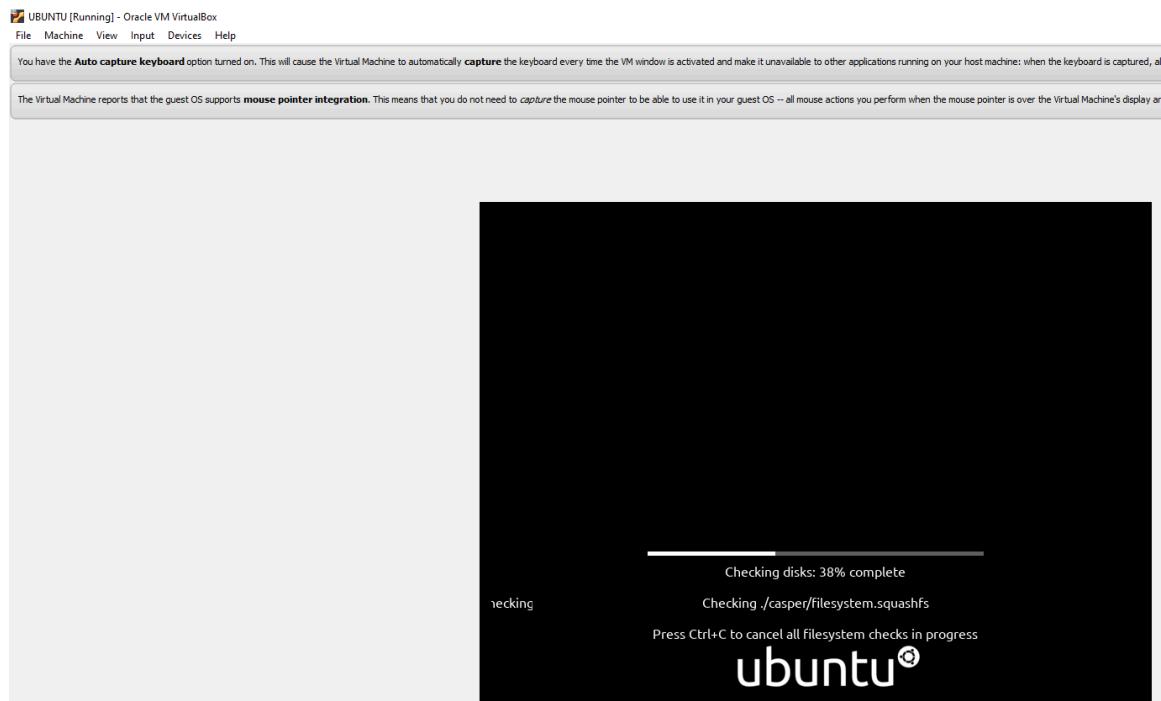
After Installing windows 7 Guest OS in Oracle Virtual Box we can run applications using this Guest OS



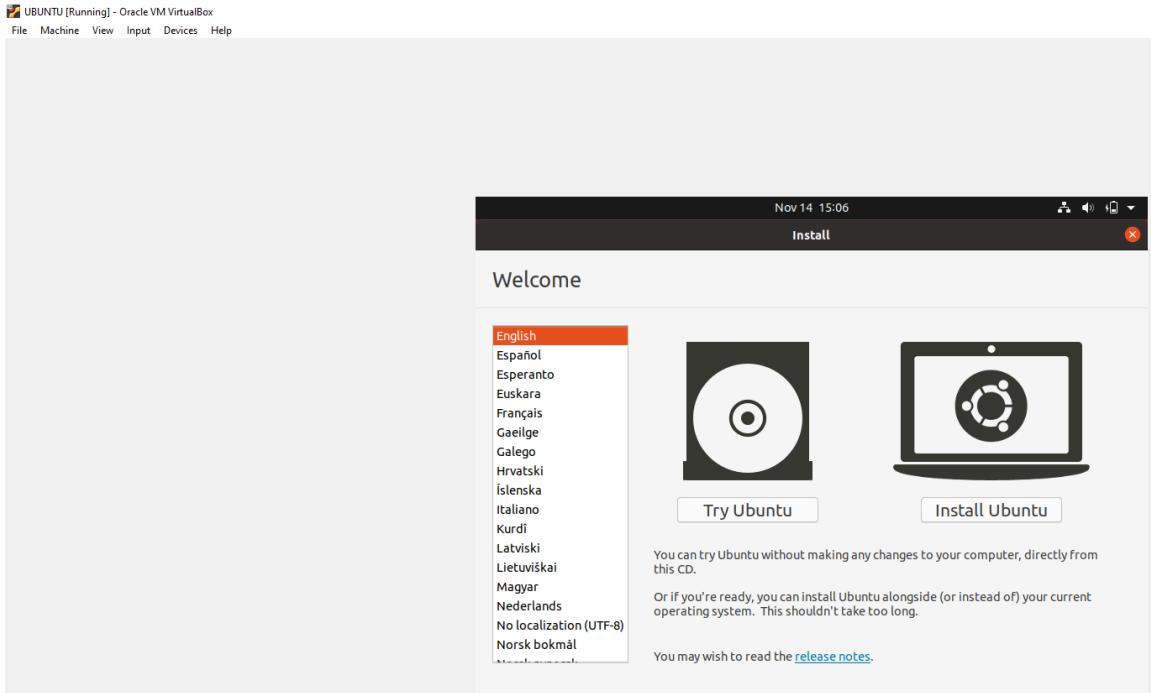
iii)Installing Ubuntu 20.04 using Oracle Virtual Box

Aim

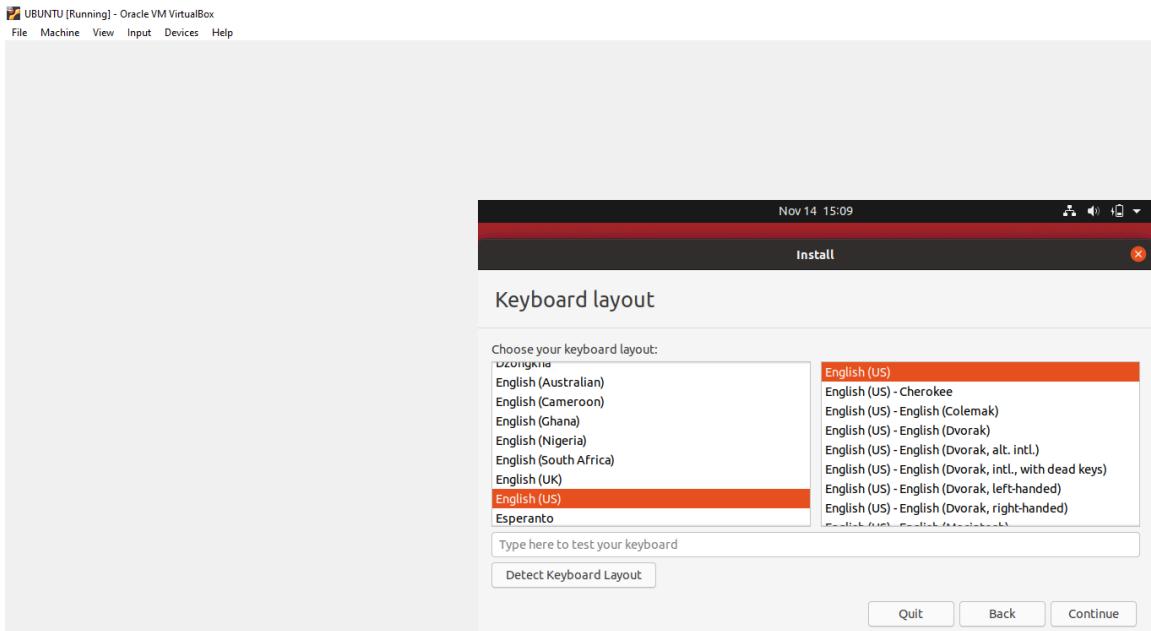
To install Guest OS Ubuntu 20.04 using Oracle Virtual Box



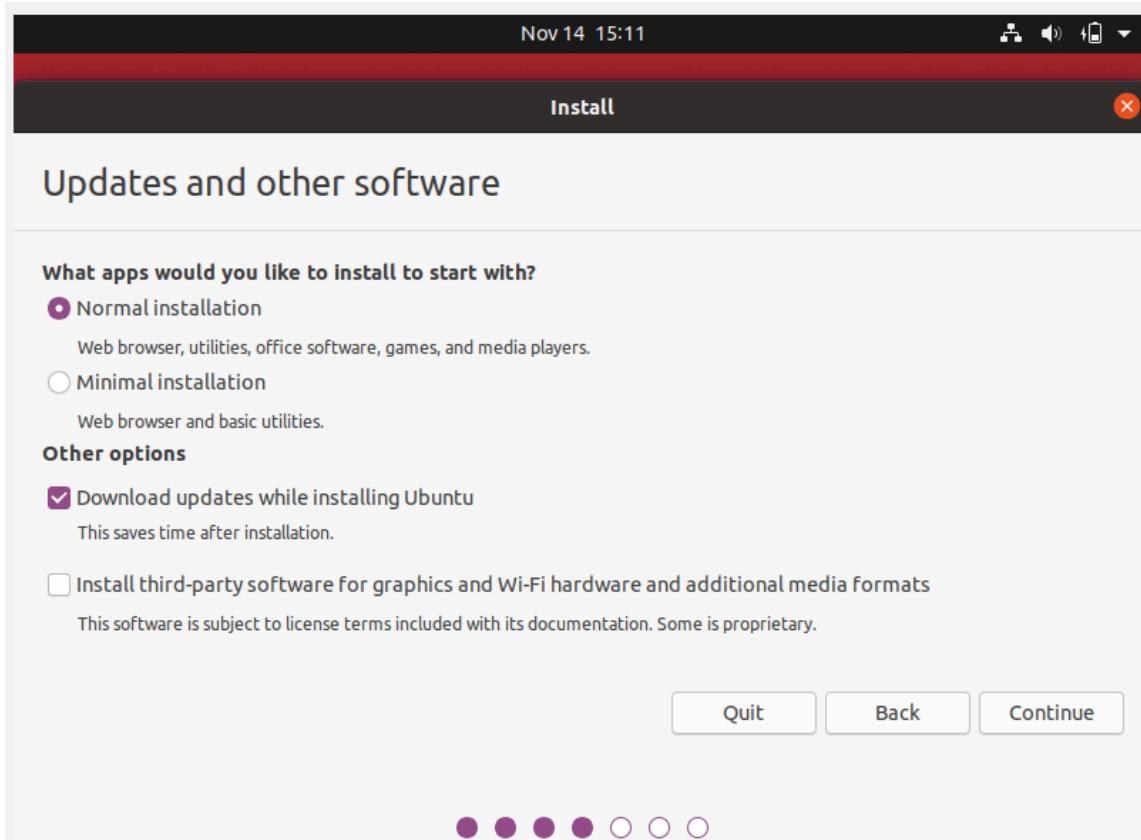
Click Install Ubuntu so that Ubuntu will start installing.



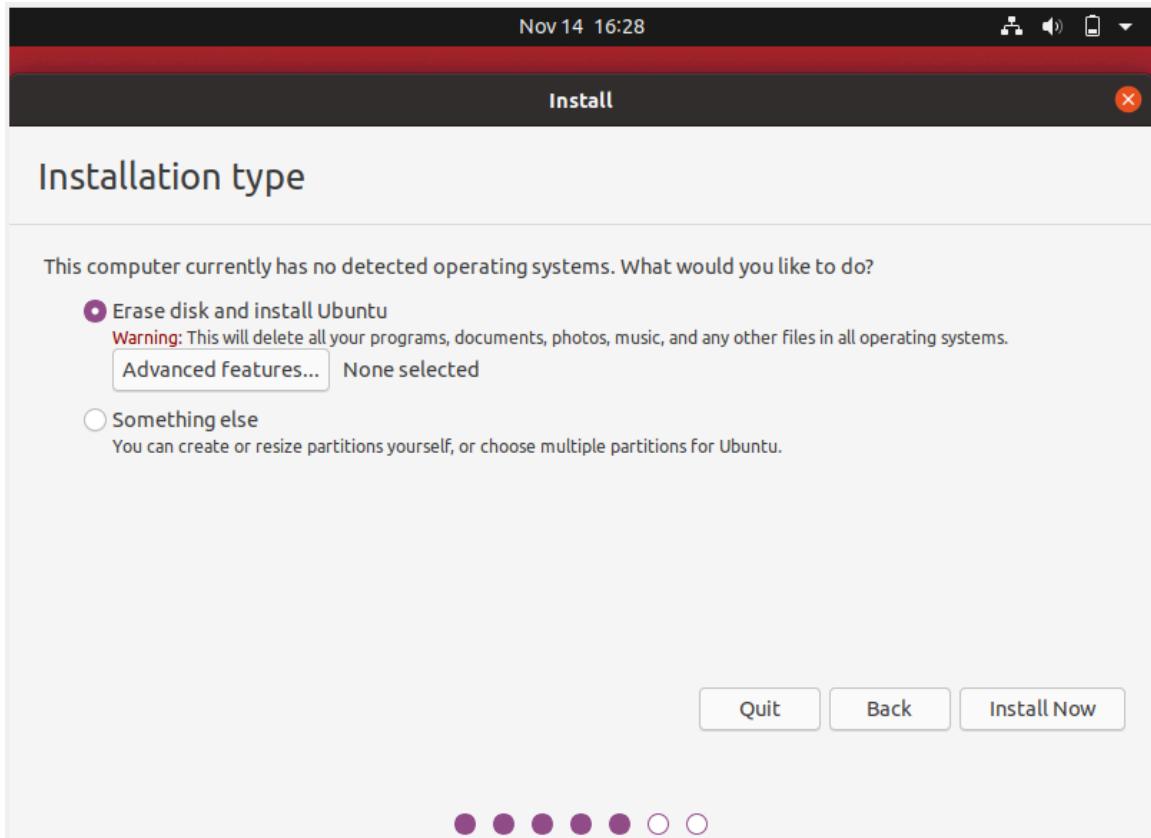
Select language English and Click Continue



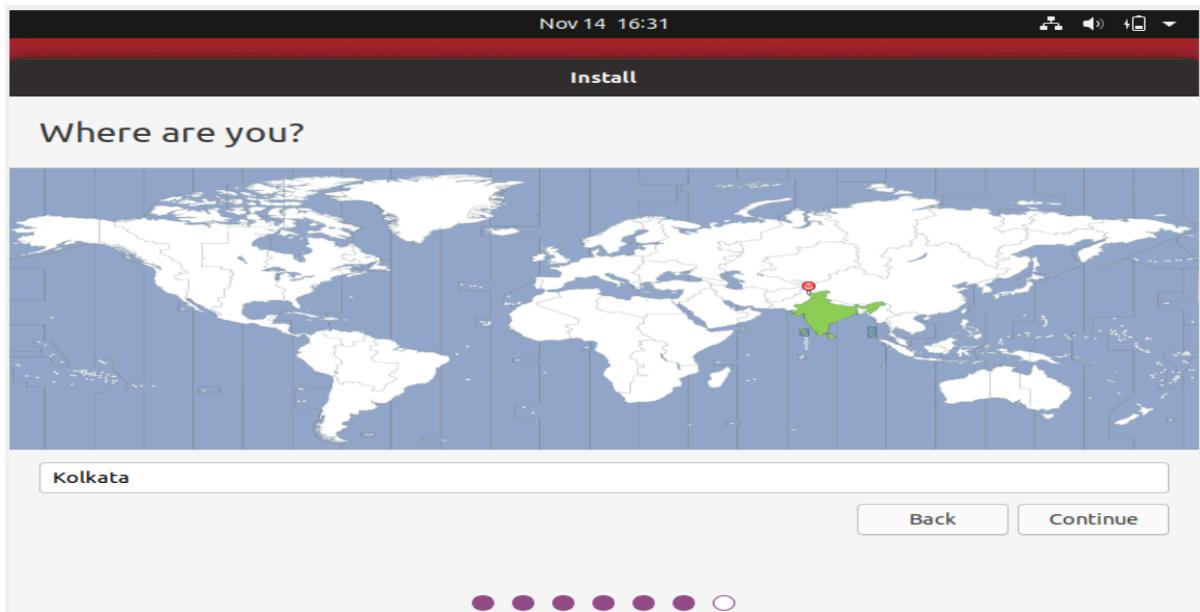
Select Normal Installation and click conti



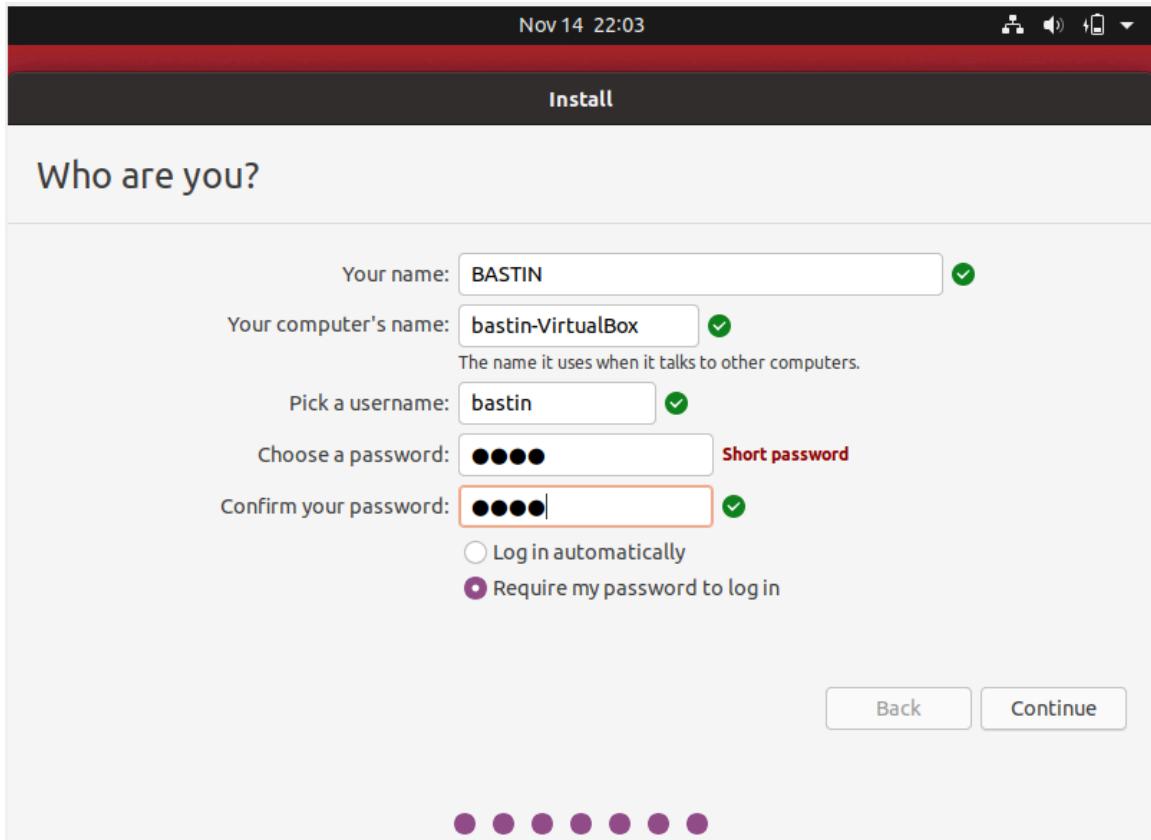
Select Erase disk and install Ubuntu and click Install Now



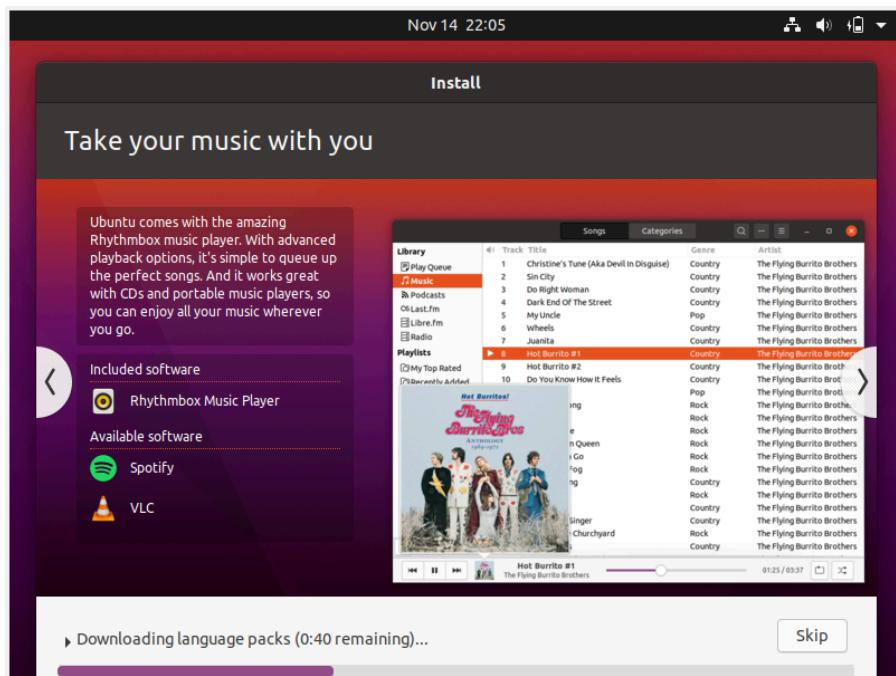
Select the Location and Click Continue



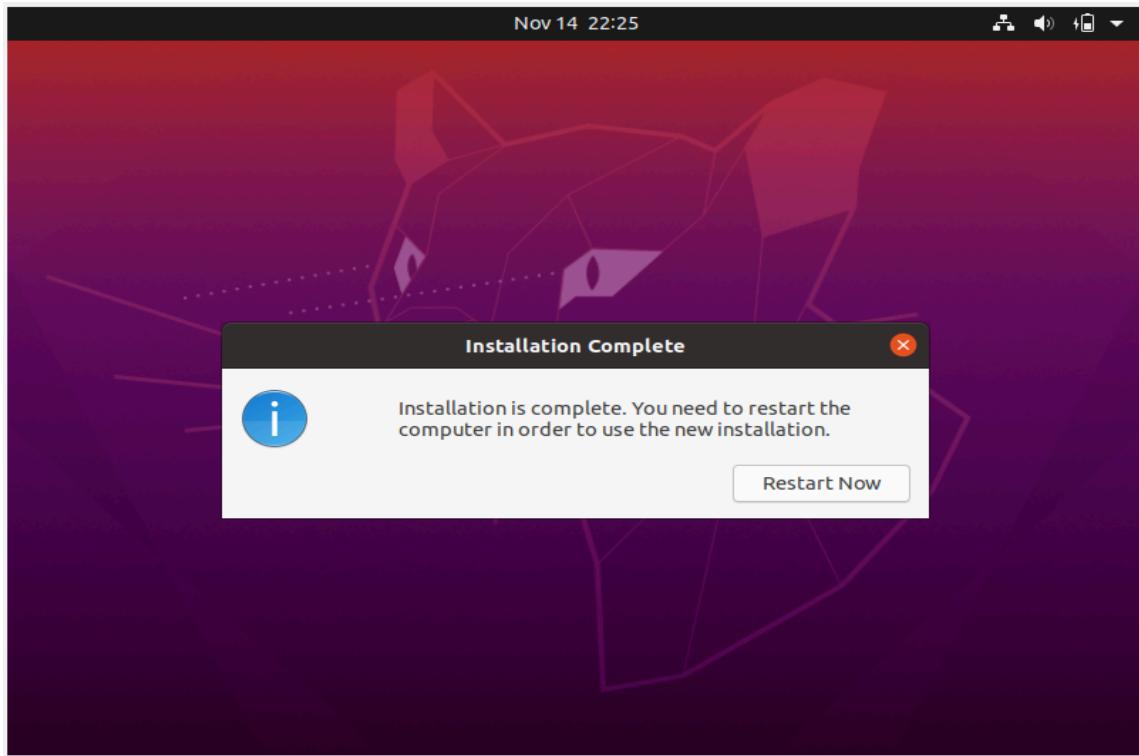
Give your Name and Password then click Continue



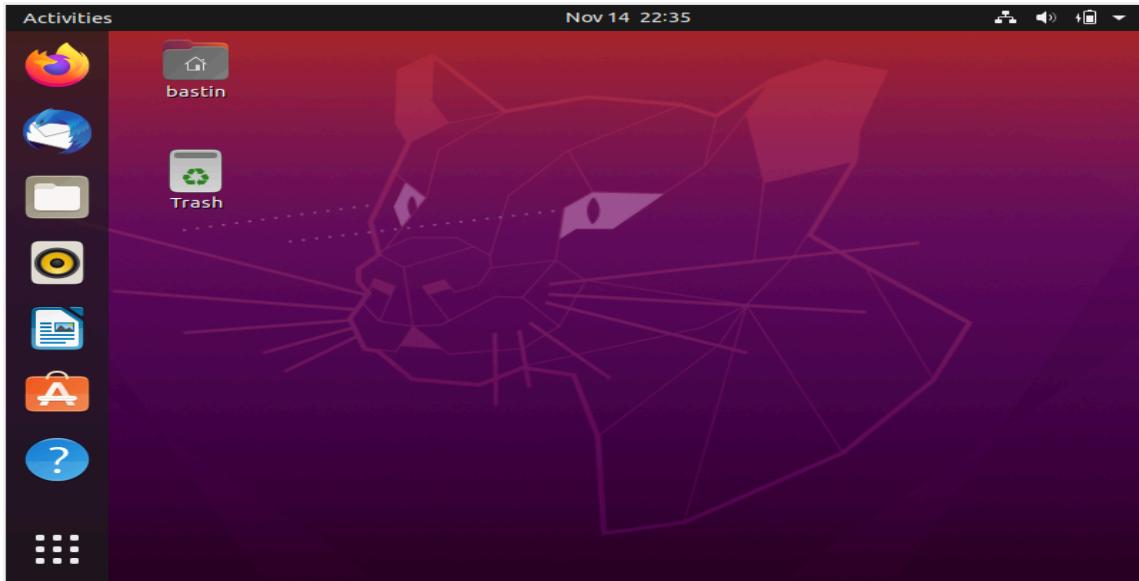
Launch Ubuntu once the installation gets completed



After installation get over click Restart Now and Launch Ubuntu Virtual OS



After Restarting you will get the ubuntu launching screen



Result

Thus, we can install different flavors of Linux and Windows using Oracle Virtual Box

Ex.No.2

Install a C compiler on Virtual Machine and execute a simple C program

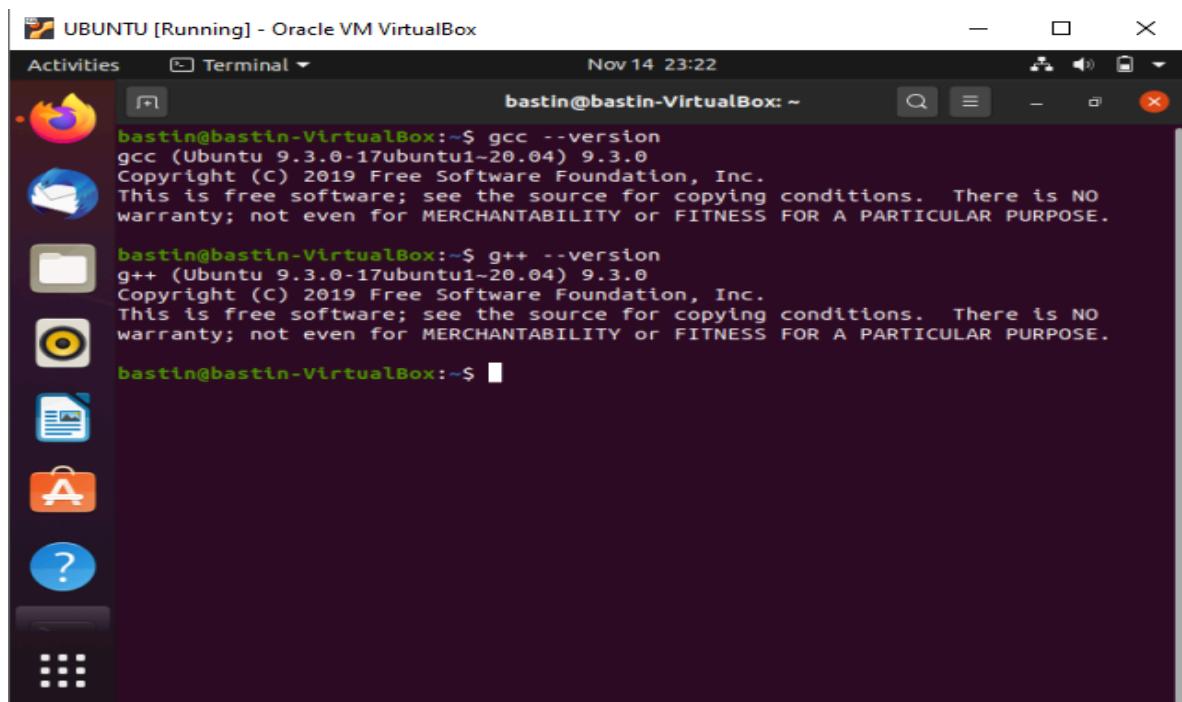
Aim :

To develop a C program using compiler in the virtual machine.

Algorithm:

1. Open terminal and type the command touch Hello.c
2. Save the file
3. Compile the program using gcc hello.c -o test
4. Run it using ./test

Checking gcc and g++ compiler after installation by typing gcc --version and g++ --version command in Terminal

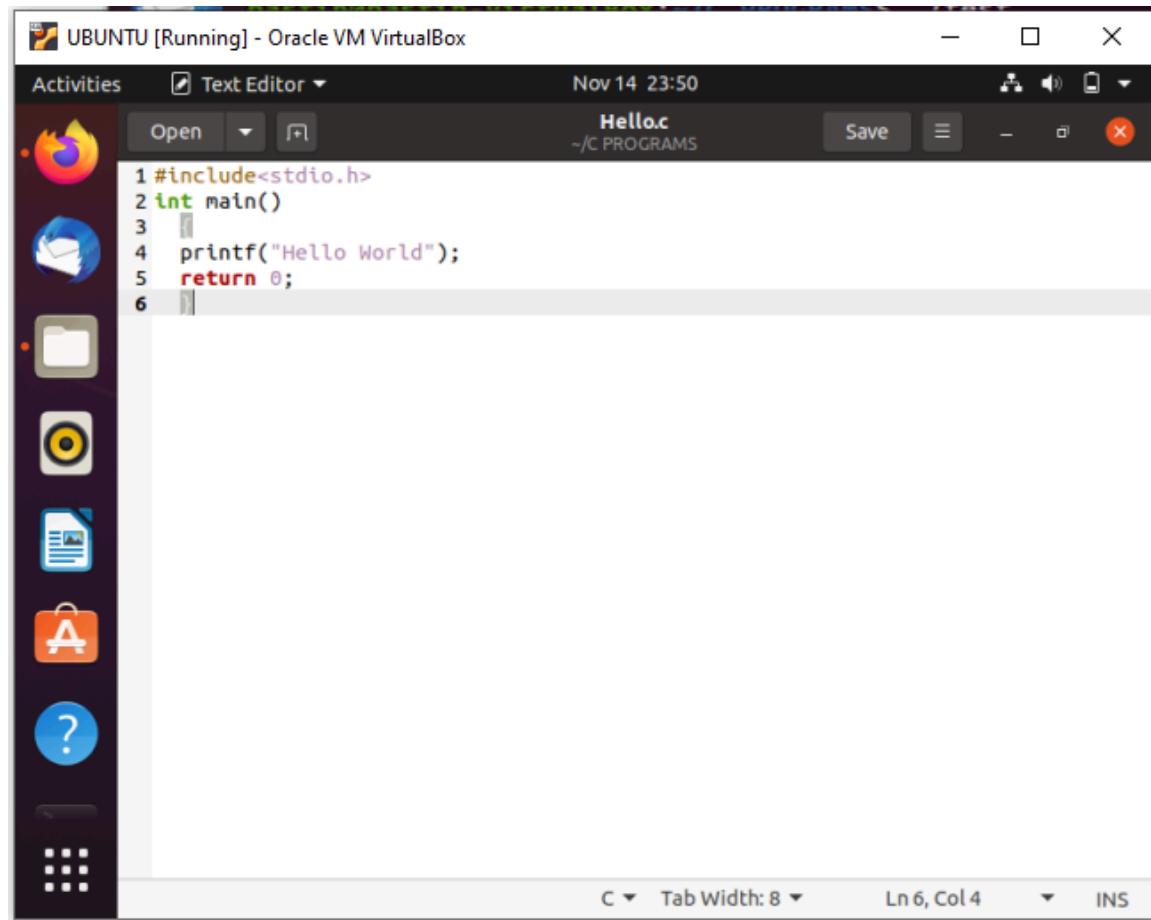


```
UBUNTU [Running] - Oracle VM VirtualBox
Activities Terminal Nov 14 23:22
bastin@bastin-VirtualBox:~$ gcc --version
gcc (Ubuntu 9.3.0-17ubuntu1-20.04) 9.3.0
Copyright (C) 2019 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

bastin@bastin-VirtualBox:~$ g++ --version
g++ (Ubuntu 9.3.0-17ubuntu1-20.04) 9.3.0
Copyright (C) 2019 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

bastin@bastin-VirtualBox:~$
```

Simple example program:

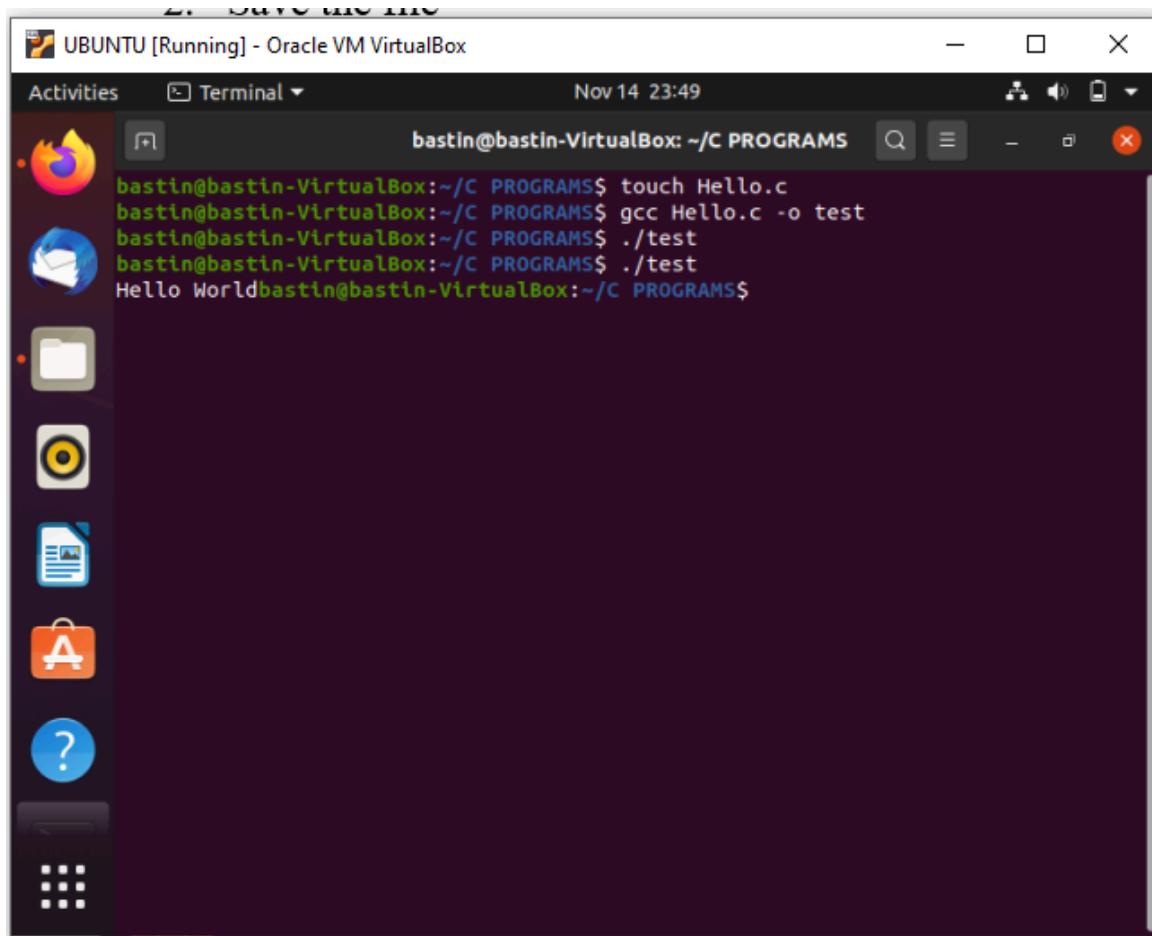


The screenshot shows a desktop environment for Ubuntu running in Oracle VM VirtualBox. The window title is "UBUNTU [Running] - Oracle VM VirtualBox". The application is a "Text Editor" showing a file named "Hello.c" located in "/C PROGRAMS". The code in the editor is:

```
1 #include<stdio.h>
2 int main()
3 {
4     printf("Hello World");
5     return 0;
6 }
```

The status bar at the bottom indicates "C" (code mode), "Tab Width: 8", "Ln 6, Col 4", and "INS" (insert mode). The left sidebar contains icons for various applications like Dash, Home, Activities, and Help.

Compiling and Running C programs



The screenshot shows a terminal window titled "UBUNTU [Running] - Oracle VM VirtualBox". The terminal session is as follows:

```
bastin@bastin-VirtualBox:~/C PROGRAMS$ touch Hello.c
bastin@bastin-VirtualBox:~/C PROGRAMS$ gcc Hello.c -o test
bastin@bastin-VirtualBox:~/C PROGRAMS$ ./test
Hello Worldbastin@bastin-VirtualBox:~/C PROGRAMS$
```

Result:

Thus, the above C program was developed using in C compiler in the virtual machine application executed successfully.

Ex.No.3

Install Google App Engine. Create hello world app and other simple web applications using python/java.

Aim

To install GAE and creating simple Hello World applications using GAE

Procedure:

This document describes the installation of the Google App Engine Software Development Kit (SDK) on a Microsoft Windows and running a simple “hello world” application.

The App Engine SDK allows you to run Google App Engine Applications on your local computer. It simulates the run--time environment of the Google App Engine infrastructure.

Pre-Requisites: Python 2.5.4

If you don't already have Python 2.5.4 installed in your computer, download and Install Python 2.5.4 from:

<http://www.python.org/download/releases/2.5.4/>

Download and Install

You can download the Google App Engine SDK by going to:

<http://code.google.com/appengine/downloads.html>

and download the appropriate install package.

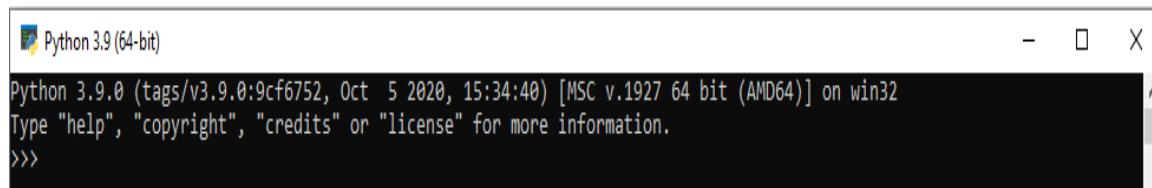
Download the Google App Engine SDK

Before downloading, please read the [Terms](#) that govern your use of the App Engine SDK.

Please note: The App Engine SDK is under **active development**, please keep this in mind as you explore its capabilities. See the [SDK Release Notes](#) for the information on the most recent changes to the App Engine SDK. If you discover any issues, please feel free to notify us via our [Issue Tracker](#).

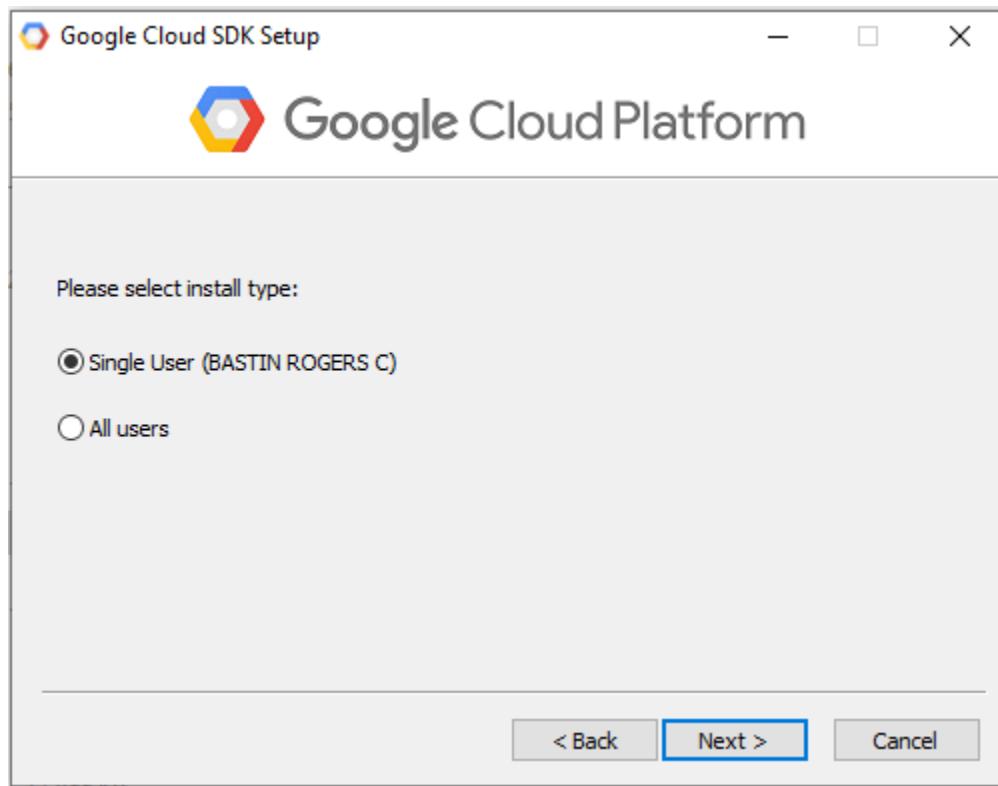
Platform	Version	Package	Size	SHA1 Checksum
Windows	1.1.5 - 10/03/08	GoogleAppEngine_1.1.5.msi	2.5 MB	e974312b4aefc0b3873ff0d93eb4c525d5e88c30
Mac OS X	1.1.5 - 10/03/08	GoogleAppEngineLauncher-1.1.5.dmg	3.6 MB	f62208ac01c1b3e39796e58100d5f1b2f052d3e7
Linux/Other Platforms	1.1.5 - 10/03/08	google_appengine_1.1.5.zip	2.6 MB	cbb9ce817bdabf1c4f181d9544864e55ee253de1

Install Python and check whether it is working correctly or not

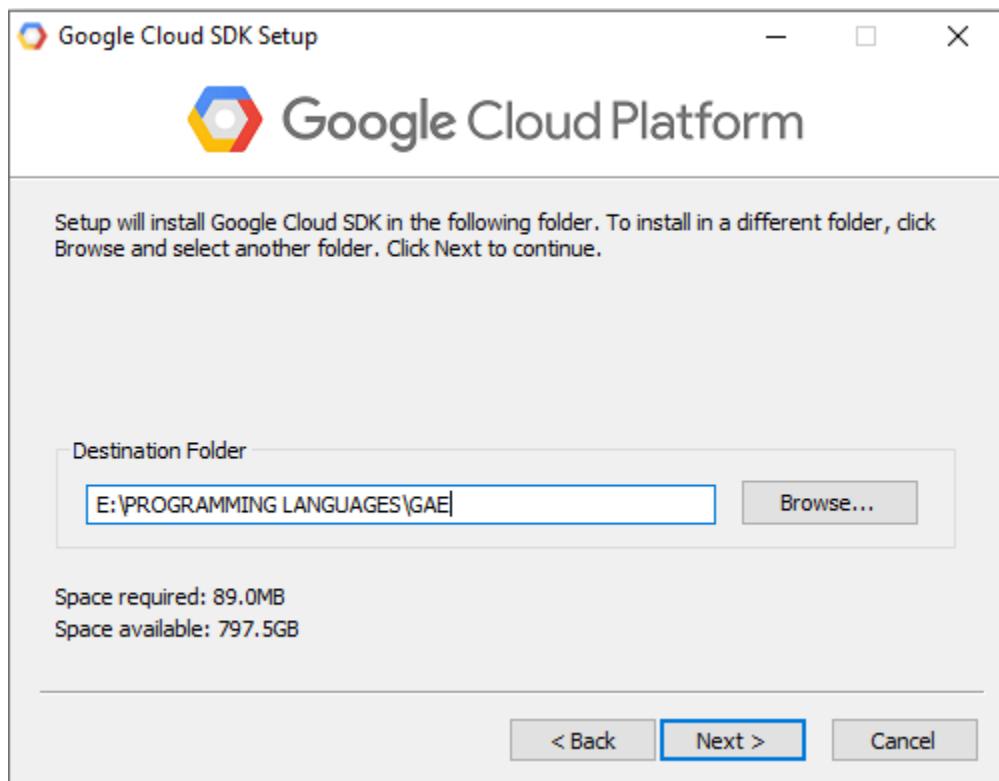


```
Python 3.9 (tags/v3.9.0:9cf6752, Oct  5 2020, 15:34:40) [MSC v.1927 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

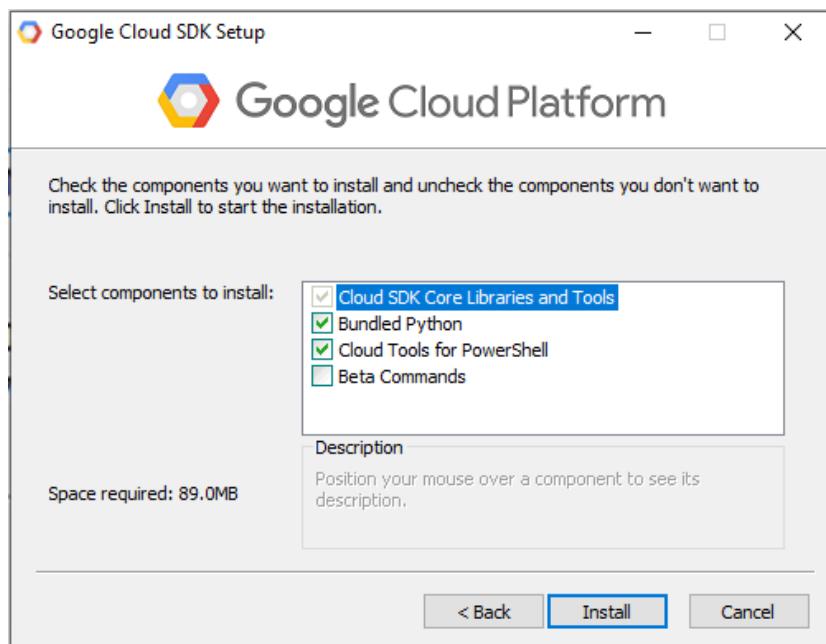
GAE installation steps:

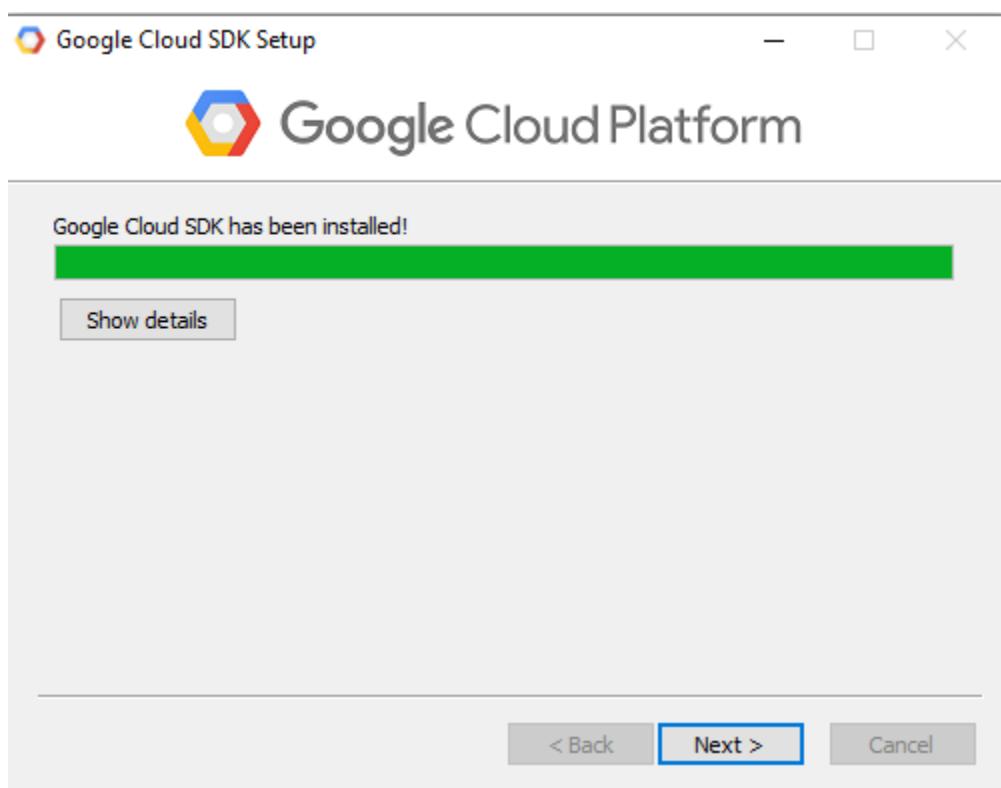
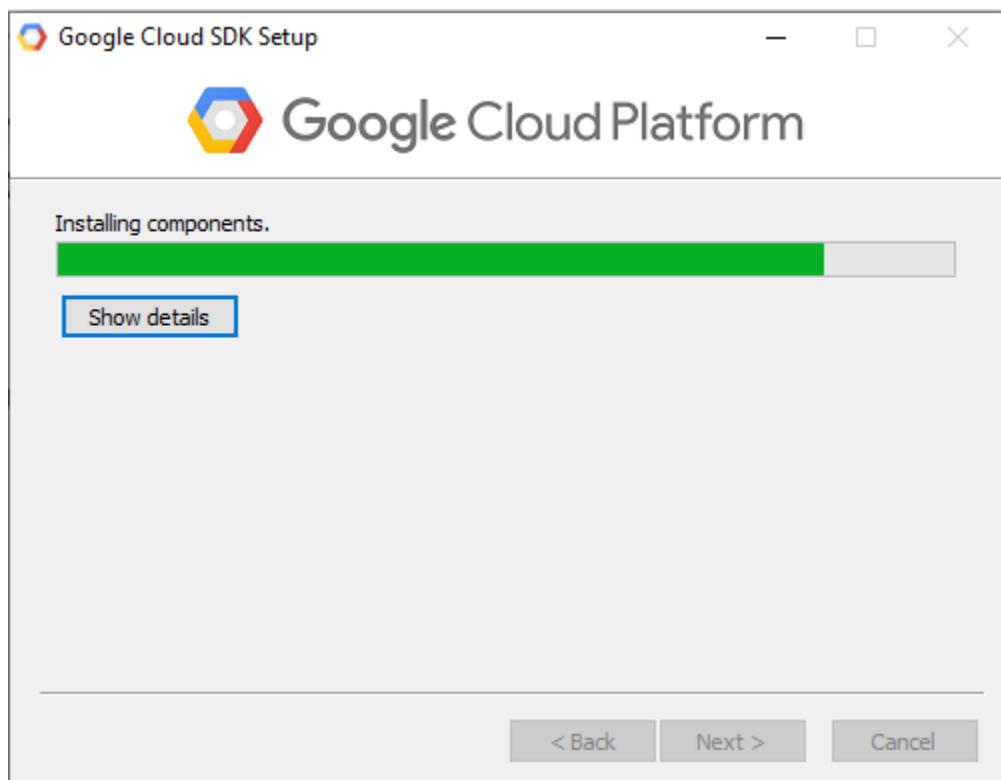


Give the destination path where you are going to install your GAE

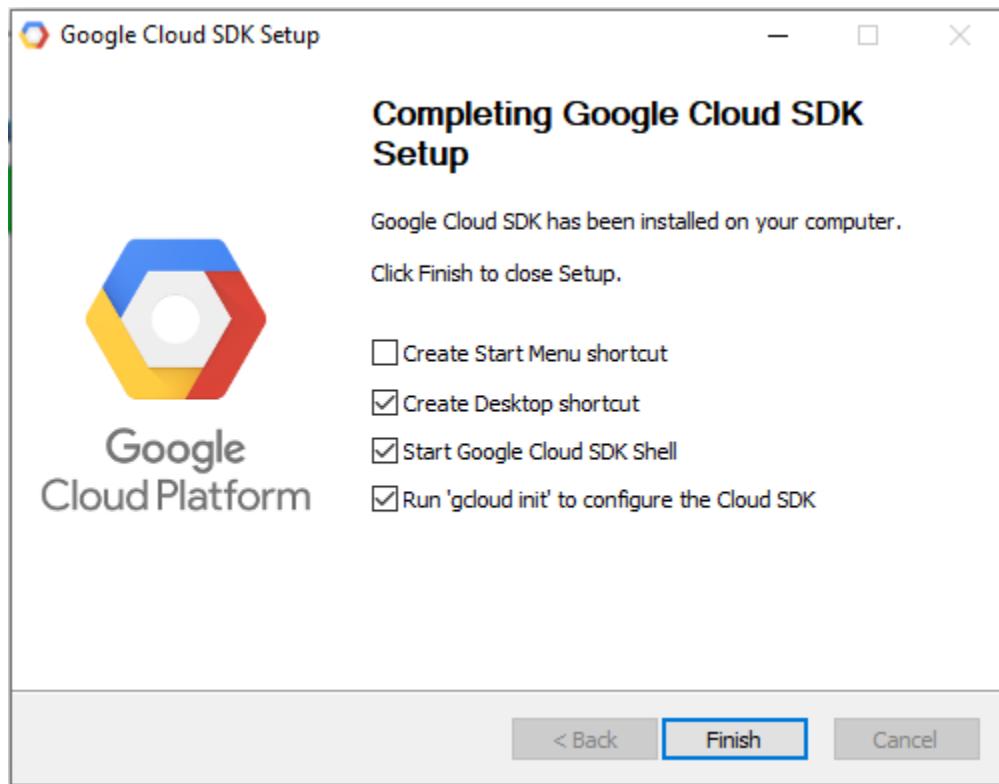


Click Install and wait till installation gets completed





After installation is over click finish



```
Welcome to the Google Cloud SDK! Run "gcloud -h" to get the list of available commands.  
--  
Welcome! This command will take you through the configuration of gcloud.  
Your current configuration has been set to: [default]  
You can skip diagnostics next time by using the following flag:  
  gcloud init --skip-diagnostics  
Network diagnostic detects and fixes local network connection issues.  
Checking network connection...done.  
Reachability Check passed.  
Network diagnostic passed (1/1 checks passed).  
You must log in to continue. Would you like to log in (Y/n)?
```

```

C:\Windows\SYSTEM32\cmd.exe - gcloud init
Welcome to the Google Cloud SDK! Run "gcloud -h" to get the list of available commands.
---
Welcome! This command will take you through the configuration of gcloud.

Your current configuration has been set to: [default]

You can skip diagnostics next time by using the following flag:
  gcloud init --skip-diagnostics

Network diagnostic detects and fixes local network connection issues.
Checking network connection...done.
Reachability Check passed.
Network diagnostic passed (1/1 checks passed).

You must log in to continue. Would you like to log in (Y/n)? Y

```

Run the python file using Google Cloud SDK Shell

```

Administrator: Google Cloud SDK Shell - google-cloud-sdk\bin\dev_appserver.py "E:\PROGRAMMING LANGUAGES\HelloWorld"
Welcome to the Google Cloud SDK! Run "gcloud -h" to get the list of available commands.
---

C:\Windows\system32>d:
D:\>e:

E:\PROGRAMMING LANGUAGES\GAE>google-cloud-sdk\bin\dev_appserver.py "E:\PROGRAMMING LANGUAGES\HelloWorld"
This action requires the installation of components: [app-engine-
python, cloud-datastore-emulator]

Your current Cloud SDK version is: 319.0.0
Installing components from version: 319.0.0

+-----+
| These components will be installed. |
| Name | Version | Size |
+-----+
| Cloud Datastore Emulator | 2.1.0 | 18.4 MiB |
| gRPC python library | 1.20.0 |
| gRPC python library | 1.20.0 | 1.5 MiB |
| gcloud app Python Extensions | 1.9.91 | 6.1 MiB |
+-----+

For the latest full release notes, please visit:
  https://cloud.google.com/sdk/release_notes

Do you want to continue (Y/n)? Y

#-----#
# Creating update staging area =#
#-----#
# Installing: Cloud Datastore Emulator =#
#-----#
# Installing: gRPC python library =#
#-----#
# Installing: gRPC python library =#
#-----#
# Installing: gcloud app Python Extensions =#
#-----#
# Creating backup and activating new installation =#
#-----#

Performing post processing steps...done.

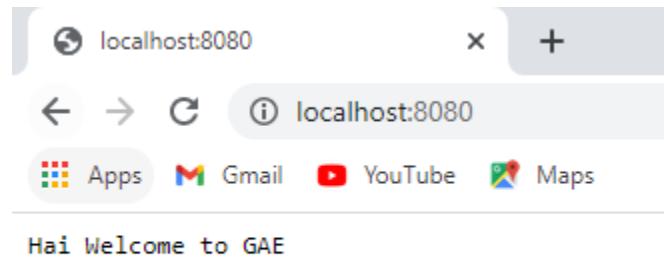
Update done!

Restarting command:
$ dev_appserver.py E:\PROGRAMMING LANGUAGES\HelloWorld

INFO    2020-11-19 11:06:30,499 devappserver2.py:289] Skipping SDK update check.
WARNING 2020-11-19 11:06:30,854 simple_search_stub.py:1198] Could not read search indexes from c:\users\bastin~1\appdata\local\temp\appengine.None\search_indexes
INFO    2020-11-19 11:06:30,858 api_server.py:282] Starting API server at: http://localhost:56792
INFO    2020-11-19 11:06:30,865 dispatcher.py:267] Starting module "default" running at: http://localhost:8080
INFO    2020-11-19 11:06:30,865 admin_server.py:150] Starting admin server at: http://localhost:8000
INFO    2020-11-19 11:06:32,987 instance.py:294] Instance PID: 12336
INFO    2020-11-19 11:07:22,210 module.py:865] default: "GET / HTTP/1.1" 200 19
INFO    2020-11-19 11:07:22,273 module.py:865] default: "GET /favicon.ico HTTP/1.1" 404 -
INFO    2020-11-19 11:07:23,334 instance.py:294] Instance PID: 14484

```

Open your browser and type localhost:8080



Result:

Thus, we can create simple web based applications using Python and Java and execute using GAE.

Ex.No.4	Use Google App Engine Launcher to launch the web
----------------	---

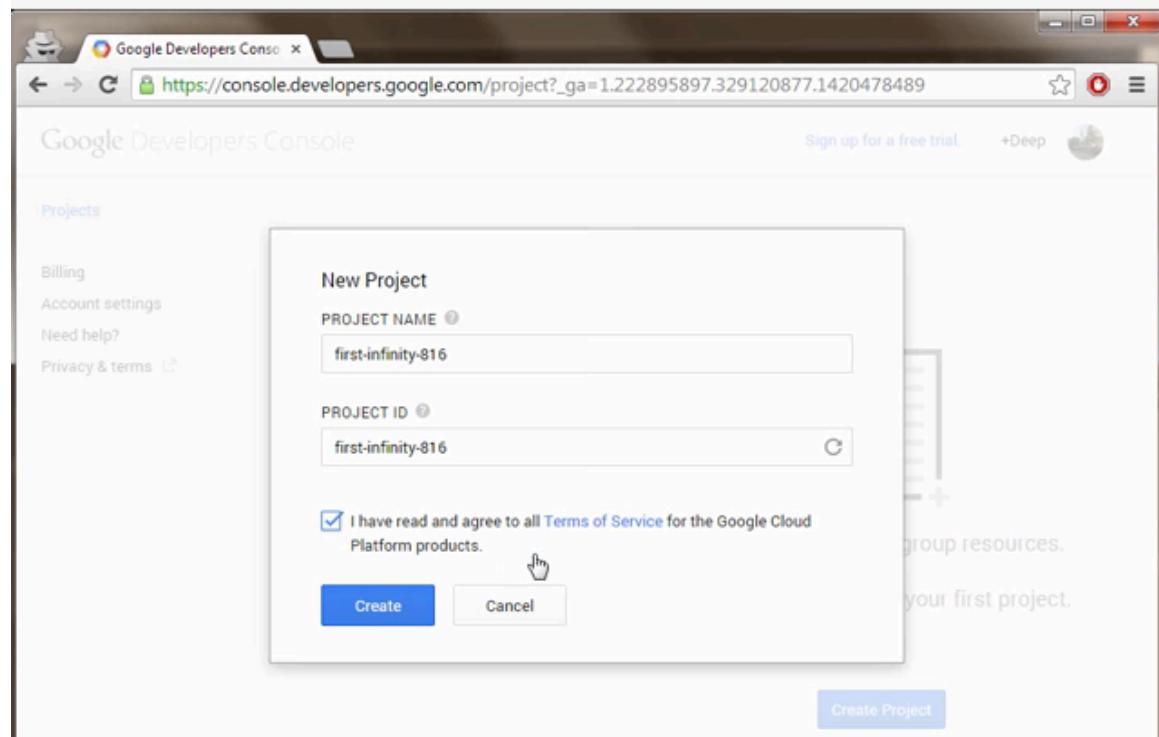
Aim:

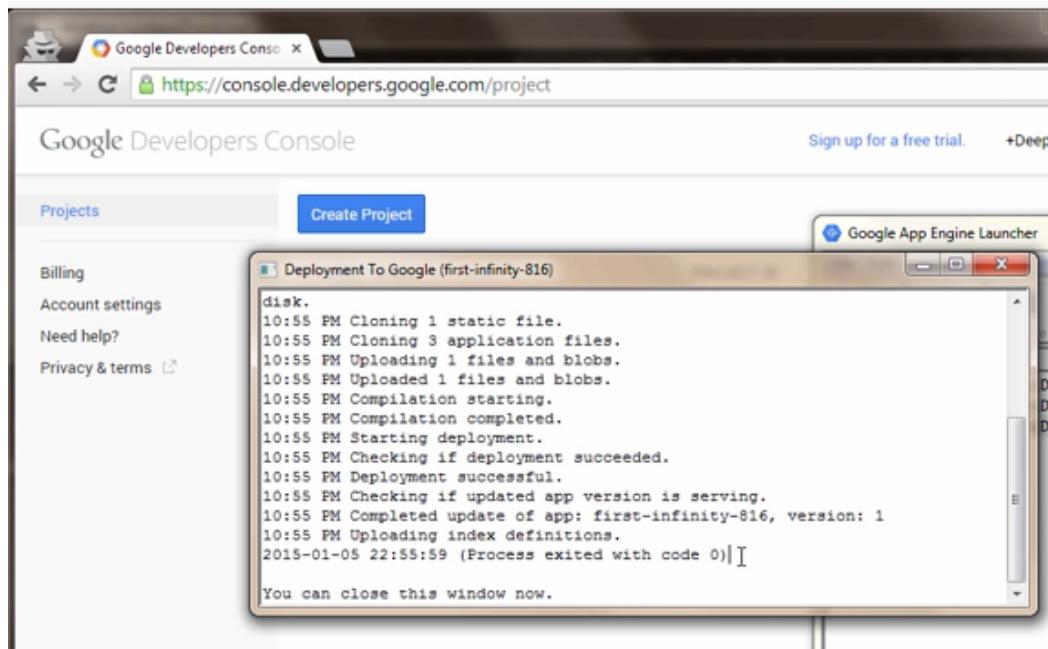
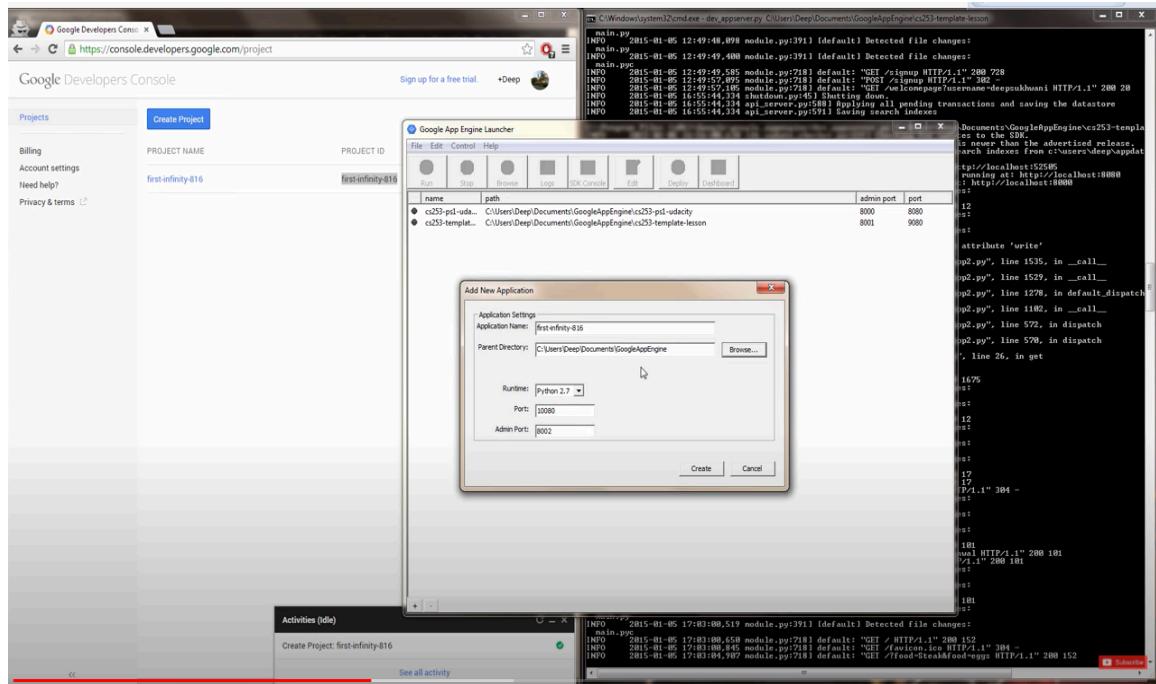
- To Make use of GAE launcher to launch web-based applications in Cloud

Procedure

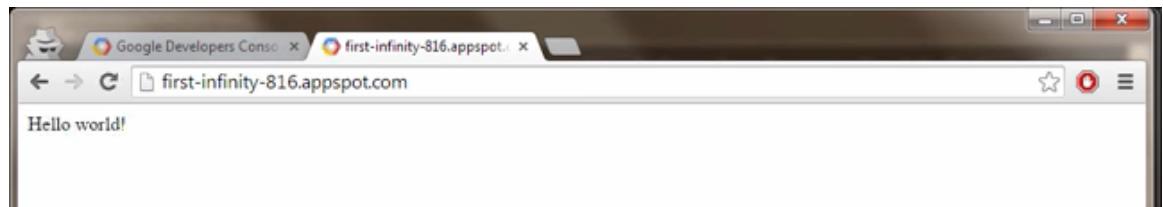
- Install GAE launcher in your system
- Go to GAE in your browser
- Go to Create New Project and give a project name and project id and click create
- Using GAE Launcher give the application name and the parent directory correctly
- Using GAE launcher deploy and run your application

Sample Screenshots





OUTPUT



Result

Thus using GAE launcher we can launch web based applications

Ex.No.5

Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Aim

- To simulate scheduling algorithm like FCFS using Cloudsim

Procedure

- Install java 1.6 or above in your system
- Install Eclipse or NetBeans IDE
- Install Cloudsim in your system

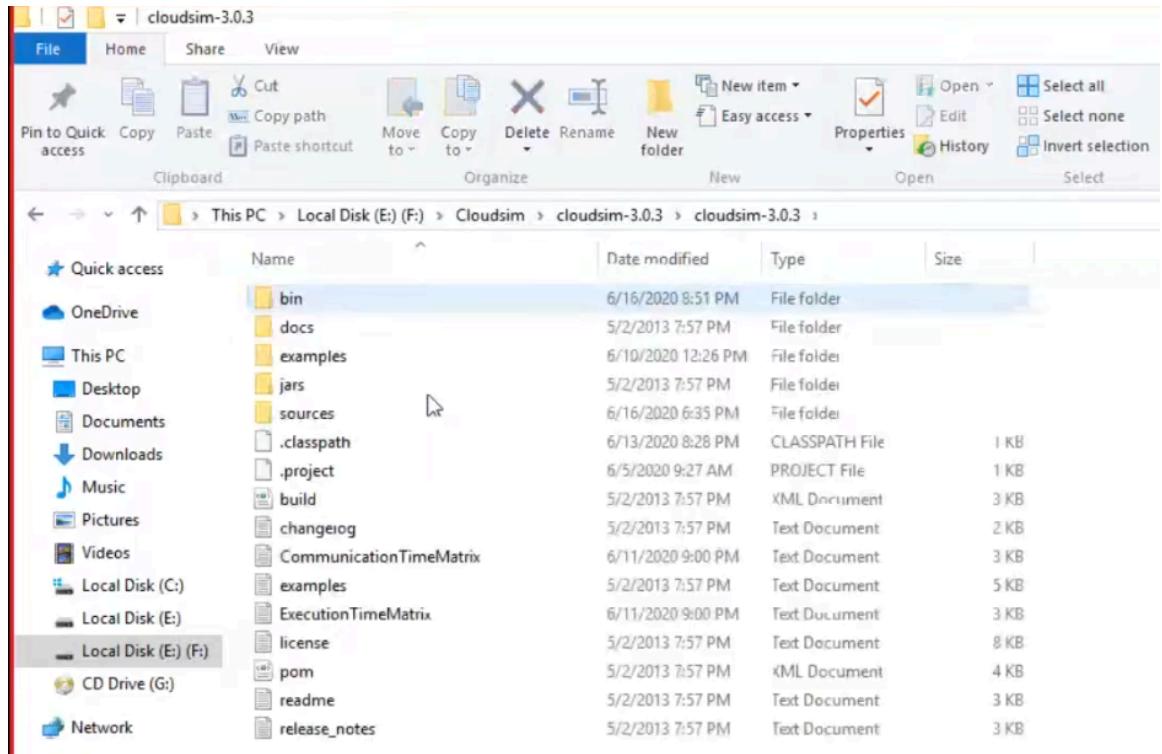
- Open Eclipse and Create new Java project
- After completing your application import all the cloudsim packages into your project folder in eclipse
- After importing all the cloudsim packages run your java program
- If your program didn't contain any error it will execute sucessfully.

Working of Cloudsim



Sample Screenshots

Download the cloudsim package. Here the package downloaded is cloudsim-3.0.3



eclipse-workspace - Csimproject/sources/FCFS/FCFS_Scheduler.java - Eclipse IDE

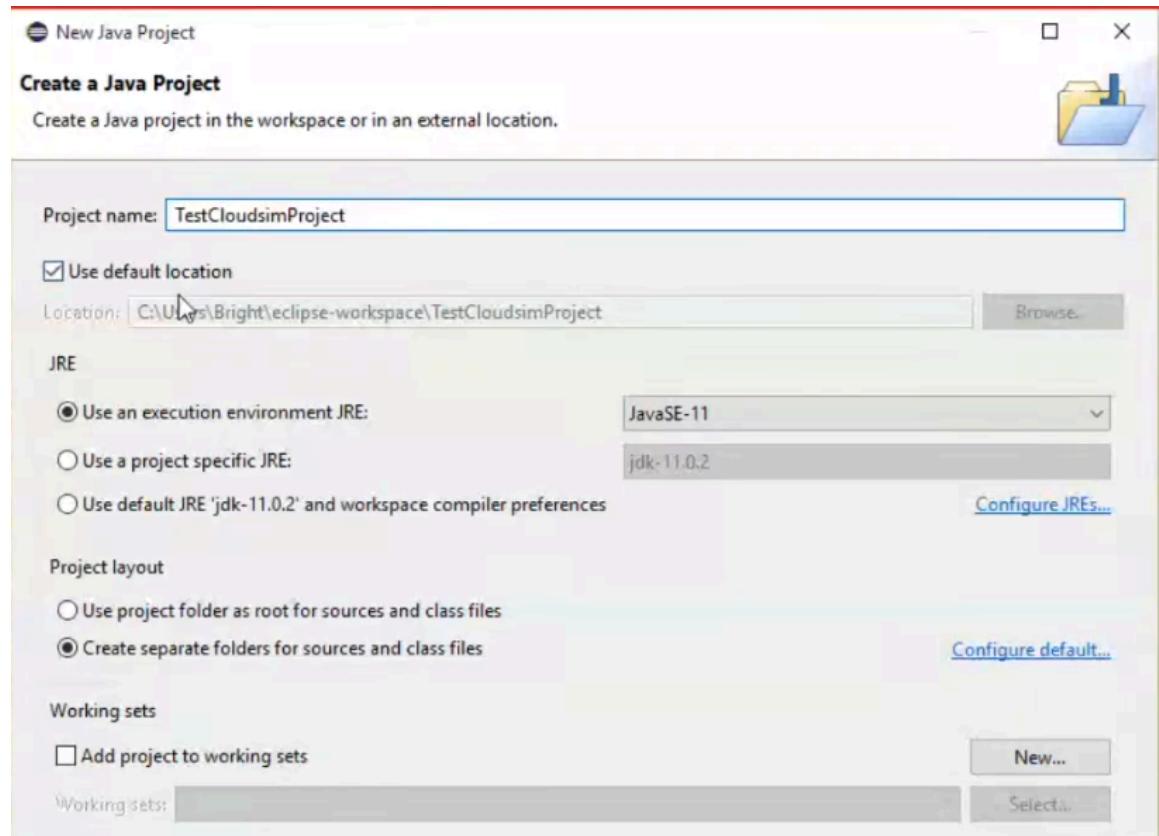
```

File Edit Source Refactor Navigate Search Project Run Window Help
Project Explorer   FCFS_Scheduler.java  FCFSDatacenterBroker.java
CloudSimTest  Csimproject (in csim)  FDPCloudsimTest (in cloudsim-3.0.3)
Servers

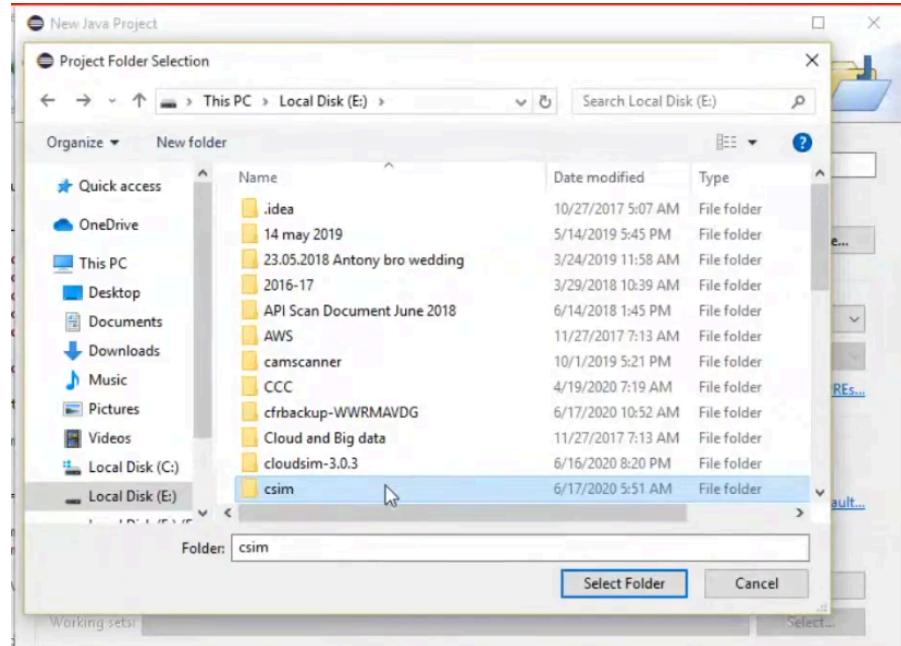
1 package FCFS;
2
3
4 import org.cloudbus.cloudsim.*;
5
6 public class FCFS_Scheduler {
7
8     private static List<Cloudlets> cloudletList;
9     private static List<Vm> vmsList;
10    private static Datacenter[] datacenter;
11    private static double[][] commMatrix;
12    private static double[][] execMatrix;
13
14    private static List<Vm> createVm(int userId, int vms) {
15        //Creates a container to store Vms. This list is passed to the broker later
16        LinkedList<Vm> list = new LinkedList<Vm>();
17
18        //Vm Parameters
19        long size = 10000; //image size (MB)
20        int ram = 512; //Vm memory (MB)
21        int mips = 250;
22        long bw = 1000;
23        int pesNumber = 1; //number of CPUs
24        String vmm = "Xen"; //Vm name
25
26        //create Vms
27        Vm[] vms = new Vm[vms];
28
29        for (int i = 0; i < vms; i++) {
30            vms[i] = new Vm(vmm, size, ram, mips, bw, pesNumber);
31        }
32
33        list.add(vms);
34
35        return list;
36    }

```

Open Eclipse and Create a java project and give a project name



Import the cloudsim package into the eclipse



```

1 package FCFS;
2
3
4@ import org.cloudbus.cloudsim.Cloudlet;
11
12 /**
13  * A Broker that schedules Tasks to the VMs
14  * as per FCFS Scheduling Policy
15  *
16  * @author Linda J
17 */
18 public class FCFSDatacenterBroker extends DatacenterBroker {
19
20@     public FCFSDatacenterBroker(String name) throws Exception {
21         super(name);
22     }
23
24     //scheduling function
25@     public void scheduleTaskstoVms() {
26
27         ArrayList<Cloudlet> clist = new ArrayList<Cloudlet>();
28
29         for (Cloudlet cloudlet : getCloudletSubmittedList()) {
30             clist.add(cloudlet);
31         }
32
33         setCloudletReceivedList(clist);
34     }
35
36@     @Override
37     protected void processCloudletReturn(SimEvent ev) {
38         Cloudlet cloudlet = (Cloudlet) ev.getData();
39         getCloudletReceivedList().add(cloudlet);
40         Log.printLine(CloudSim.clock() + ": " + getName() + ": Cloudlet " + cloudlet.getCloudletId()
41             + " returned");
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70@     public static void main(String[] args) {
71         Log.printLine("Starting FCFS Scheduler.. ");
72
73         new GenerateMatrices();
74         execMatrix = GenerateMatrices.getExecMatrix();
75         commMatrix = GenerateMatrices.getCommMatrix();
76
77         try {
78             int num_user = 1;    // number of grid users
79             Calendar calendar = Calendar.getInstance();
80             boolean trace_flag = false; // mean trace events
81
82             CloudSim.init(num_user, calendar, trace_flag);
83
84             // Second step: Create Datacenters
85             datacenter = new Datacenter[Constants.NO_OF_DATA_CENTERS];
86             for (int i = 0; i < Constants.NO_OF_DATA_CENTERS; i++) {
87                 datacenter[i] = DatacenterCreator.createDatacenter("Datacenter_" + i);
88             }
89
90             //Third step: Create Broker
91             FCFSDatacenterBroker broker = createBroker("Broker_0");
92             int brokerId = broker.getId();
93
94             //fourth step: Create VMs and Cloudlets and send them to broker
95             vmList = createVM(brokerId, Constants.NO_OF_DATA_CENTERS);
96             cloudletList = createCloudlet(brokerId, Constants.NO_OF_TASKS, 0);
97
98             broker.submitVmList(vmList);
99             broker.submitCloudletList(cloudletList);
100
101            // Fifth step: Starts the simulation
102            CloudSim.startSimulation();
103
104
105
106
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```

```

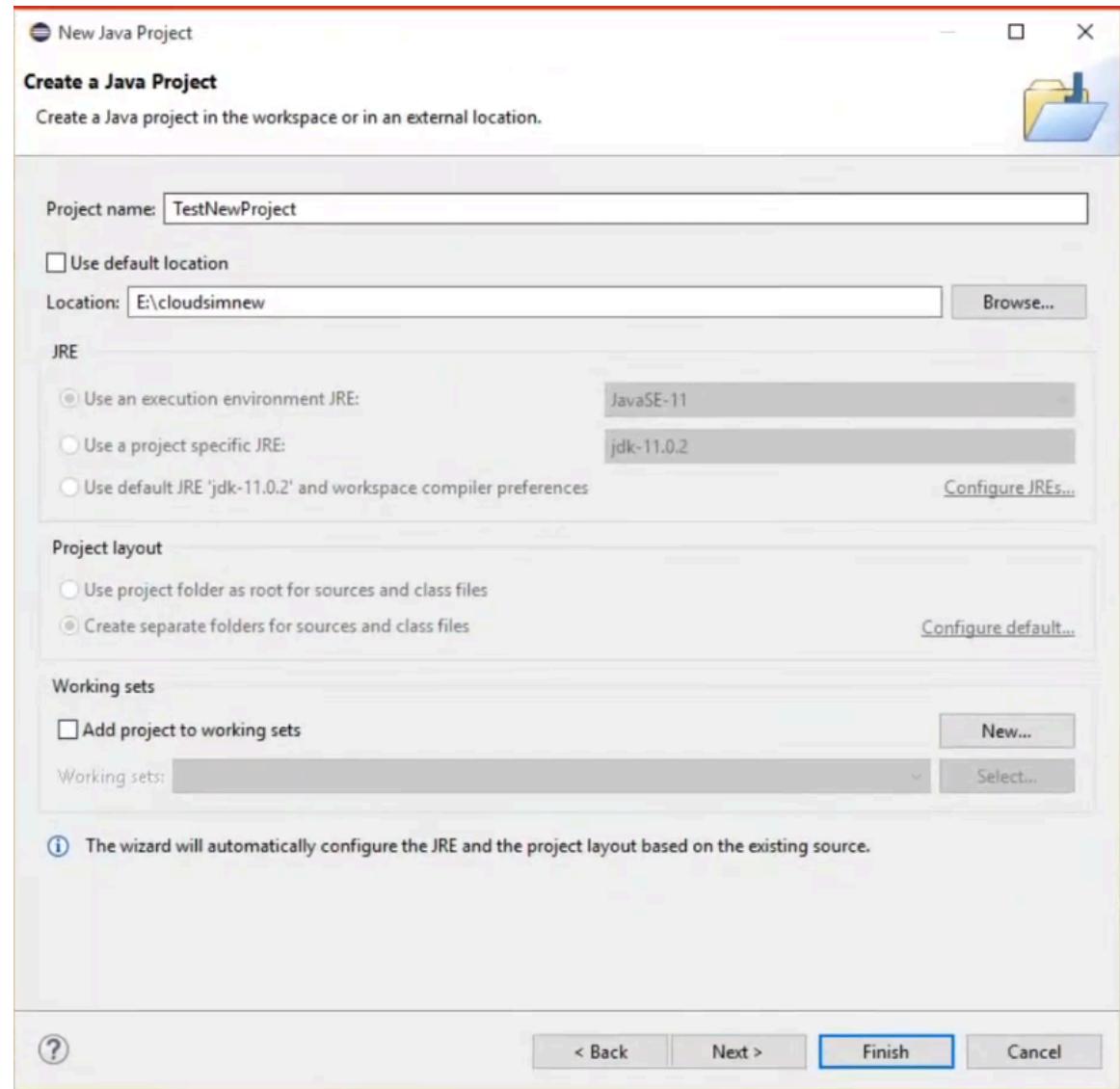
133     Log.println();
134     Log.println("===== OUTPUT =====");
135     Log.println("Cloudlet ID" + indent + "STATUS" +
136             indent + "Data center ID" +
137             indent + "VM ID" +
138             indent + indent + "Time" +
139             indent + "Start Time" +
140             indent + "Finish Time");
141
142     DecimalFormat dft = new DecimalFormat("###.##");
143     dft.setMinimumIntegerDigits(2);
144     for (int i = 0; i < size; i++) {
145         cloudlet = list.get(i);
146         Log.print(indent + dft.format(cloudlet.getCloudletId()) + indent + indent);
147
148         if (cloudlet.getCloudletStatus() == Cloudlet.SUCCESS) {
149             Log.print("SUCCESS");
150
151             Log.println(indent + indent + dft.format(cloudlet.getResourceId()) +
152                     indent + indent + indent + dft.format(cloudlet.getVmId()) +
153                     indent + indent + dft.format(cloudlet.getActualCPUTime()) +
154                     indent + indent + dft.format(cloudlet.getExecStartTime()) +
155                     indent + indent + dft.format(cloudlet.getFinishTime()));
156         }
157     }
158     //double makespan = calcMakespan(list);
159     //Log.println("Makespan using FCFS: " + makespan);
160
161 }
162
163 /* private static double calcMakespan(List<Cloudlet> list) {
164     double makespan = 0;
165     double[] dcWorkingTime = new double[Constants.NO_OF_DATA_CENTERS];

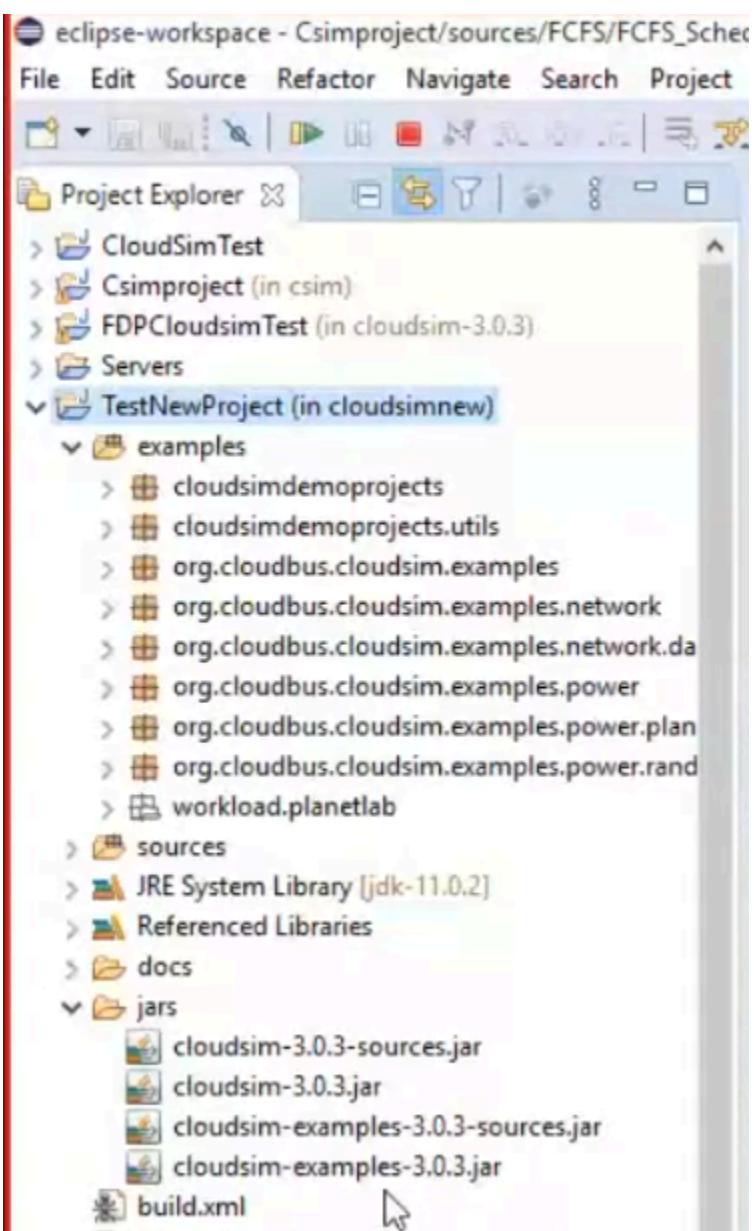
```

```

143     dft.setMinimumIntegerDigits(2);
144     for (int i = 0; i < size; i++) {
145         cloudlet = list.get(i);
146         Log.print(indent + dft.format(cloudlet.getCloudletId()) + indent + indent);
147
148         if (cloudlet.getCloudletStatus() == Cloudlet.SUCCESS) {
149             Log.print("SUCCESS");
150
151             Log.printLine(indent + indent + dft.format(cloudlet.getResourceId()) +
152                         indent + indent + indent + dft.format(cloudlet.getVmId()) +
153                         indent + indent + dft.format(cloudlet.getActualCPUTime()) +
154                         indent + indent + dft.format(cloudlet.getExecStartTime()) +
155                         indent + indent + indent + dft.format(cloudlet.getFinishTime()));
156         }
157     }
158     //double makespan = calcMakespan(list);
159     //Log.printLine("Makespan using FCFS: " + makespan);
160
161 }
162
163 /* private static double calcMakespan(List<Cloudlet> list) {
164     double makespan = 0;
165     double[] dcWorkingTime = new double[Constants.NO_OF_DATA_CENTERS];
166
167     for (int i = 0; i < Constants.NO_OF_TASKS; i++) {
168         int dcId = list.get(i).getVmId() % Constants.NO_OF_DATA_CENTERS;
169         if (dcWorkingTime[dcId] != 0) --dcWorkingTime[dcId];
170         dcWorkingTime[dcId] += execMatrix[i][dcId] + commMatrix[i][dcId];
171         makespan = Math.max(makespan, dcWorkingTime[dcId]);
172     }
173     return makespan;
174 }
175 */

```





OUTPUT

```
<terminated> FCFS_Scheduler (3) [Java Application] C:\Program Files\Java\jdk-11.0.2\bin\javaw.exe (Jun 17, 2020, 12:33:35 PM – 12:33:36 PM)
Starting FCFS Scheduler...
Reading the Matrices...
Initialising...
Starting CloudSim version 3.0
Datacenter_0 is starting...
Datacenter_1 is starting...
Datacenter_2 is starting...
Datacenter_3 is starting...
Datacenter_4 is starting...
Broker_0 is starting...
Entities started.
0.0: Broker_0: Cloud Resource List received with 5 resource(s)
0.0: Broker_0: Trying to Create VM #2 in Datacenter_0
0.0: Broker_0: Trying to Create VM #3 in Datacenter_0
0.0: Broker_0: Trying to Create VM #4 in Datacenter_0
0.0: Broker_0: Trying to Create VM #5 in Datacenter_0
0.0: Broker_0: Trying to Create VM #6 in Datacenter_0
[VmScheduler.vmCreate] Allocation of VM #6 to Host #0 failed by RAM
0.1: Broker_0: VM #2 has been created in Datacenter #2, Host #0
0.1: Broker_0: VM #3 has been created in Datacenter #2, Host #0
0.1: Broker_0: VM #4 has been created in Datacenter #2, Host #0
0.1: Broker_0: VM #5 has been created in Datacenter #2, Host #0
0.1: Broker_0: Creation of VM #6 failed in Datacenter #2
0.1: Broker_0: Trying to Create VM #6 in Datacenter_1
0.2: Broker_0: VM #6 has been created in Datacenter #3, Host #0
0.2: Broker_0: Sending cloudlet 0 to VM #2
0.2: Broker_0: Sending cloudlet 1 to VM #4
0.2: Broker_0: Sending cloudlet 2 to VM #5
0.2: Broker_0: Sending cloudlet 3 to VM #2
0.2: Broker_0: Sending cloudlet 4 to VM #2
```

```
<terminated> FCFS_Scheduler (3) [Java Application] C:\Program Files\Java\jdk-11.0.2\bin\javaw.exe (Jun 17, 2020, 12:33:35 PM – 12:33:36 PM)
02 SUCCESS 02 05 1706.26 00.2 1706.46
03 SUCCESS 02 02 3234.72 2839.99 6074.72
04 SUCCESS 02 02 2929.98 6074.72 9004.7
05 SUCCESS 02 02 913.31 9004.7 9918
06 SUCCESS 02 03 2177.9 00.2 2178.1
07 SUCCESS 02 02 3245.04 9918 13163.05
08 SUCCESS 02 03 3350.91 2178.1 5529.01
09 SUCCESS 02 02 3858.71 13163.05 17021.76
10 SUCCESS 02 05 1129.28 1706.46 2835.74
11 SUCCESS 02 05 2180.38 2835.74 5016.12
12 SUCCESS 02 02 2474.94 17021.76 19496.7
13 SUCCESS 03 06 3711.74 00.2 3711.94
14 SUCCESS 02 03 2421.93 5529.01 7950.94
15 SUCCESS 02 03 1929.52 7950.94 9880.46
16 SUCCESS 02 03 2461.84 9880.46 12342.3
17 SUCCESS 02 05 2531.69 5016.12 7547.81
18 SUCCESS 02 04 2811.84 1843.81 4655.65
19 SUCCESS 02 04 1524.05 4655.65 6179.7
20 SUCCESS 02 02 3081.24 19496.7 22577.94
21 SUCCESS 02 03 3110.16 12342.3 15452.46
22 SUCCESS 02 03 3644.78 15452.46 19097.24
23 SUCCESS 02 03 1667.96 19097.24 20765.2
24 SUCCESS 02 03 2668.17 20765.2 23433.36
25 SUCCESS 02 04 3616.35 6179.7 9796.06
26 SUCCESS 02 05 2163.46 7547.81 9711.27
27 SUCCESS 02 05 1365.07 9711.27 11876.34
28 SUCCESS 03 06 3418.82 3711.94 7130.76
29 SUCCESS 02 05 3062.3 11876.34 14138.64
FCFS.FCFS_Scheduler finished!
```

RESULT

Thus, we have simulate the FCFS scheduling algorithm using Cloudsim

Ex.No.6

Find a procedure to transfer the files from one virtual machine to another virtual

Aim:

- To transfer file between one Virtual Machine to other Virtual Machine

Procedure

- Start all the VMs
- Set administrative password for all installed OS
- Note the IP address for all the VMs
- Create file in all the Operating System and share the file by selecting properties of the file
- Check the connection by typing ping ipaddress
- Access the shared file by typing \ipaddress in the search option and by typing the administrator password

Sample Screenshots

Create a password for your Virtual OS you have installed

Create a password for your account

Type a new password:

••••

Type the new password again to confirm:

••••

If your password contains capital letters, be sure to type them the same way every time you log on.

Type a word or phrase to use as a password hint:

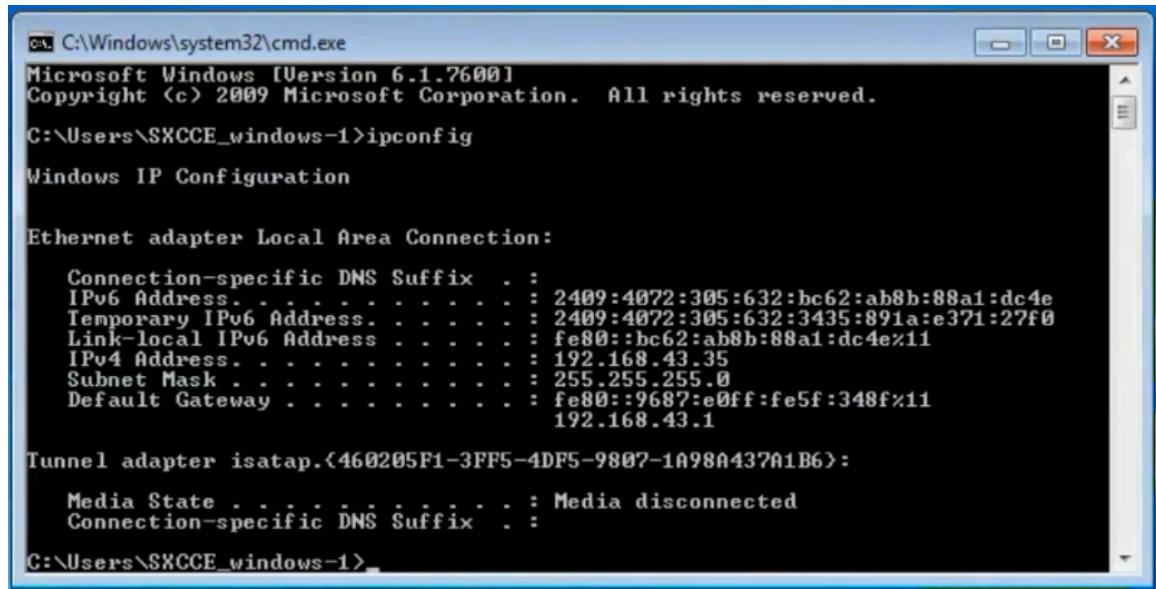
12

The password hint will be visible to everyone who uses this computer.

Create Password

Cancel

Open cmd and type ipconfig for getting your IPv4 address



```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7600]
Copyright <c> 2009 Microsoft Corporation. All rights reserved.

C:\Users\SXCCE_windows-1>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

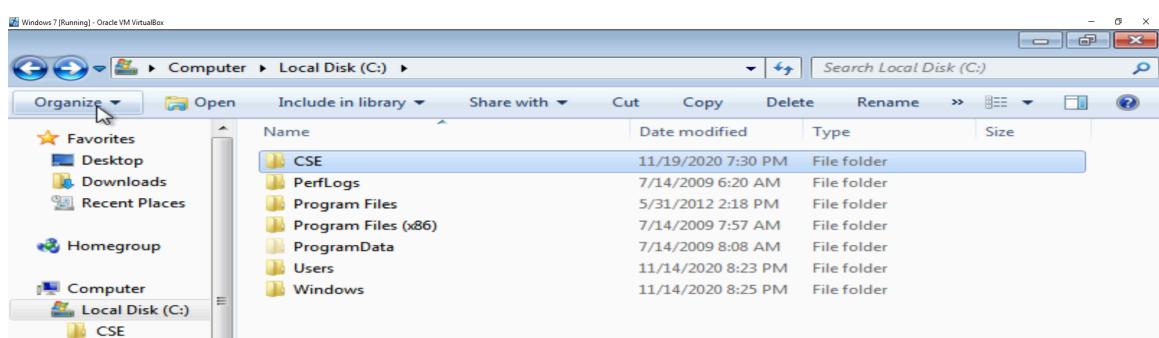
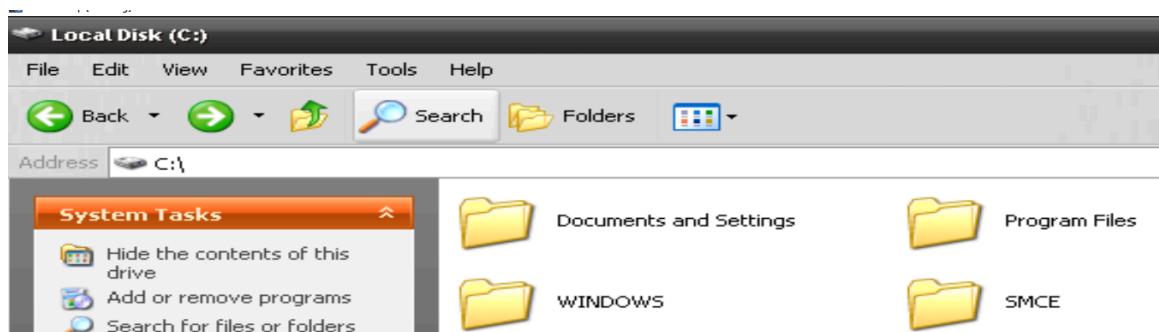
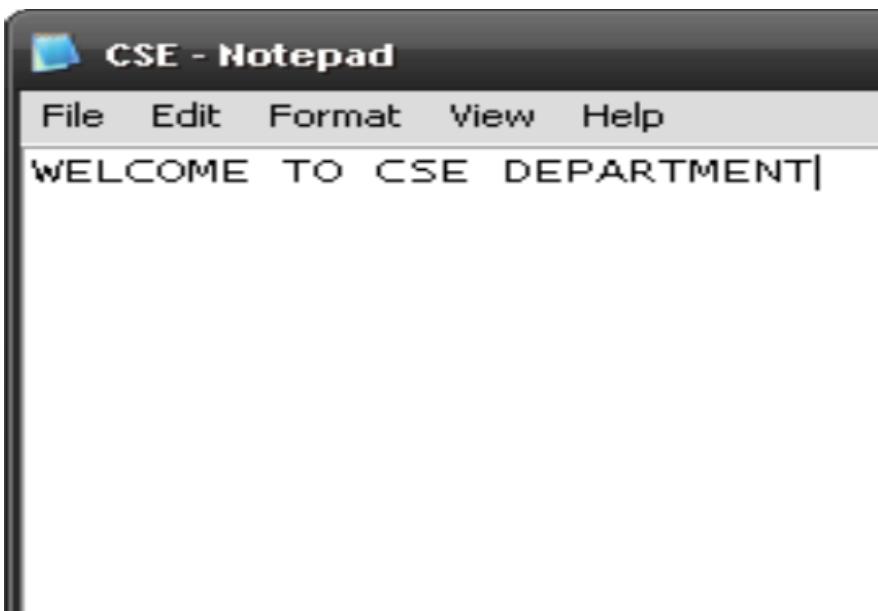
  Connection-specific DNS Suffix . :
  IPv6 Address . . . . . : 2409:4072:305:632:bc62:ab8b:88a1:dc4e
  Temporary IPv6 Address. . . . . : 2409:4072:305:632:3435:891a:e371:27f0
  Link-local IPv6 Address . . . . . : fe80::bc62:ab8b:88a1:dc4e%11
  IPv4 Address . . . . . : 192.168.43.35
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : fe80::9687:e0ff:fe5f:348f%11
                             192.168.43.1

Tunnel adapter isatap.{460205F1-3FF5-4DF5-9807-1A98A437A1B6}:

  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . . . . . :

C:\Users\SXCCE_windows-1>
```

Create a file a type contents in the file. This is the file you are going to share to other VMs



```
Command Prompt
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :

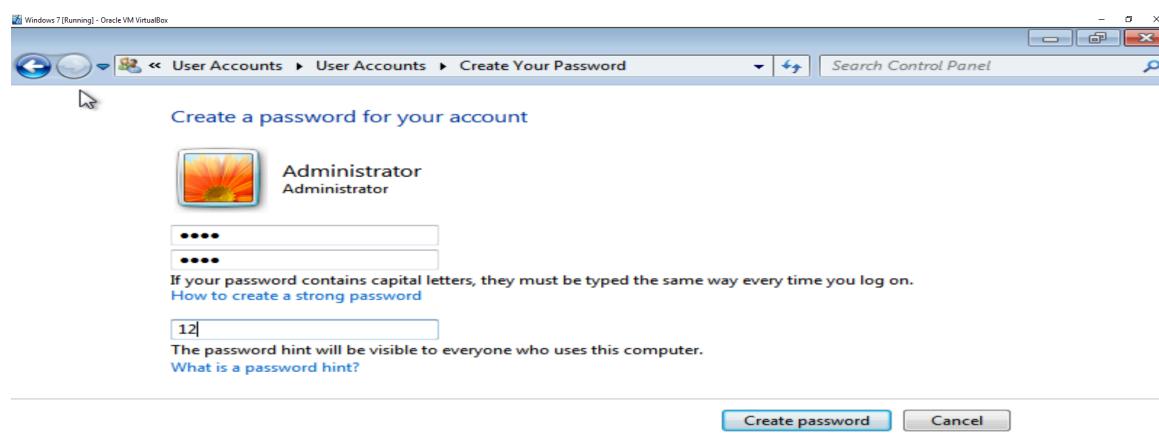
Wireless LAN adapter Local Area Connection* 1:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 10:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:
Connection-specific DNS Suffix . :
IPv6 Address . . . . . : 2409:4072:98e:fadf:6c32:353:7373:6335
Temporary IPv6 Address . . . . . : 2409:4072:98e:fadf:d119:8a0b:eb1e:f511
Link-local IPv6 Address . . . . . : fe80::6c32:353:7373:6335%5
IPv4 Address . . . . . : 192.168.1.101
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : fe80::1035:83ff:fe5a:2f14%5
                           192.168.1.1

Ethernet adapter Bluetooth Network Connection:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :

C:\Users\BASTIN ROGERS C>
```



```
Administrator: C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright <c> 2009 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>ipconfig
Windows IP Configuration

Ethernet adapter Local Area Connection:
  Connection-specific DNS Suffix . . . . . : fe80::18cf:7a64:578c:61dc%11
  Link-local IPv6 Address . . . . . : 10.0.2.15
  IPv4 Address . . . . . : 10.0.2.2
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 10.0.2.2

C:\Users\Administrator>
```

Use ping 192.168.1.101 and check whether you are getting the reply from Windows XP Virtual OS.

```
C:\ Administrator: C:\Windows\system32\cmd.exe
Windows IP Configuration

Ethernet adapter Local Area Connection:

  Connection-specific DNS Suffix  . : 
  Link-local IPv6 Address . . . . : fe80::18cf:7a64:578c:61dc%11
  IPv4 Address . . . . . : 10.0.2.15
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 10.0.2.2

C:\Users\Administrator>ping 192.168.1.101

Pinging 192.168.1.101 with 32 bytes of data:
Reply from 192.168.1.101: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.1.101:
  Packets: Sent = 4, Received = 4, Lost = 0 <0% loss>,
  Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\Administrator>
```

Use ping 10.0.2.15 and check whether you are getting the reply from windows 7 virtual OS

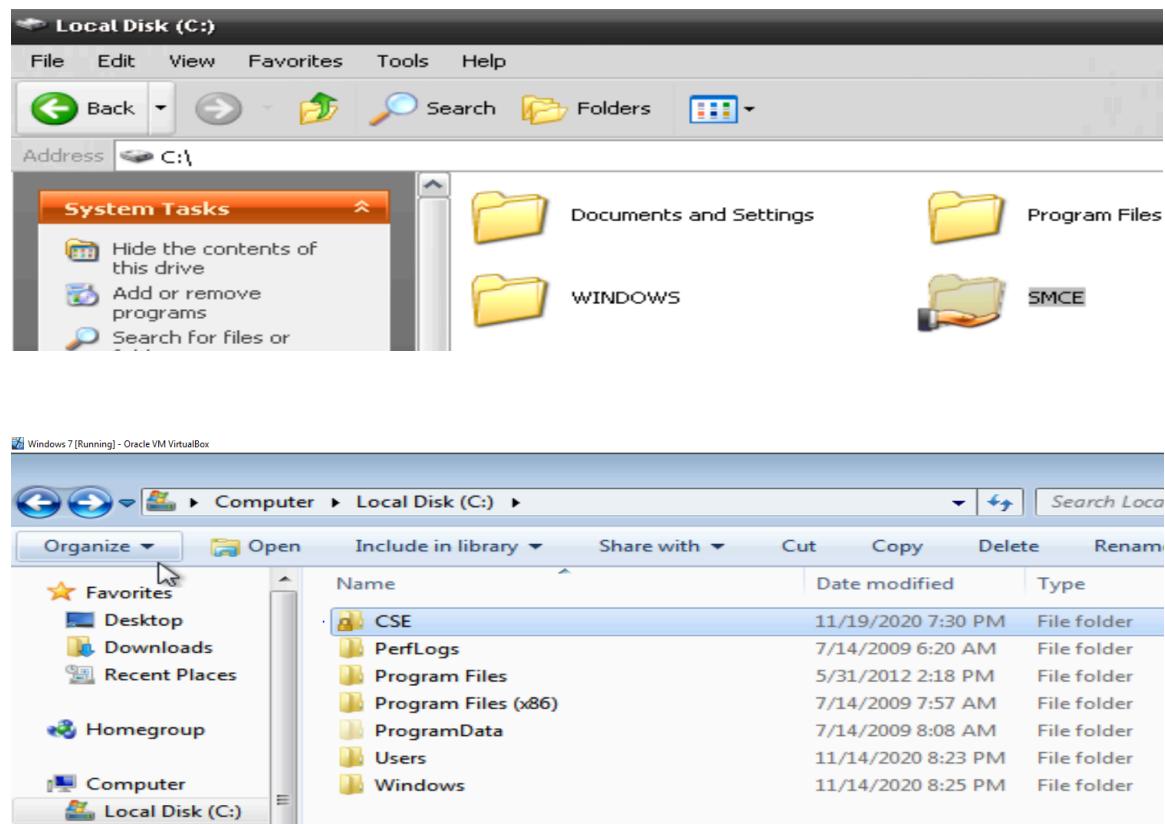
```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\BASTIN ROGERS C>ping 10.0.2.15

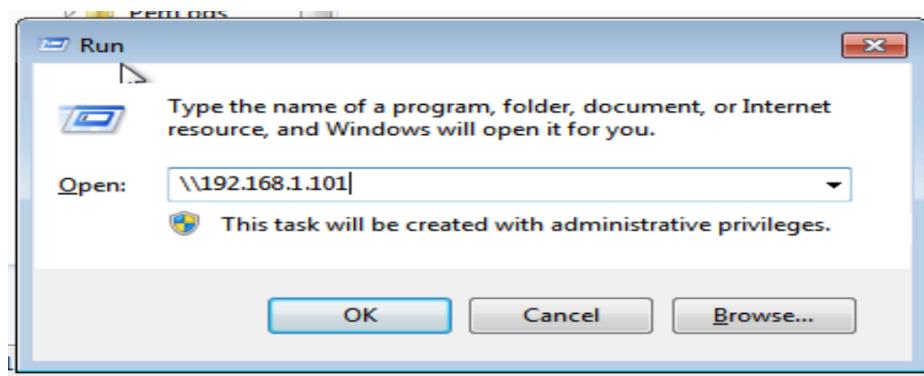
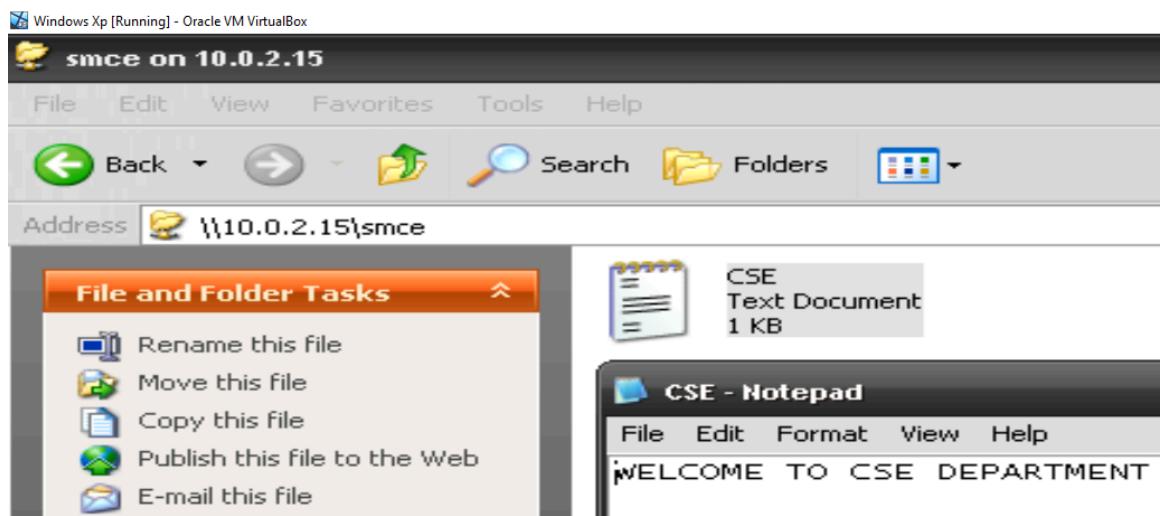
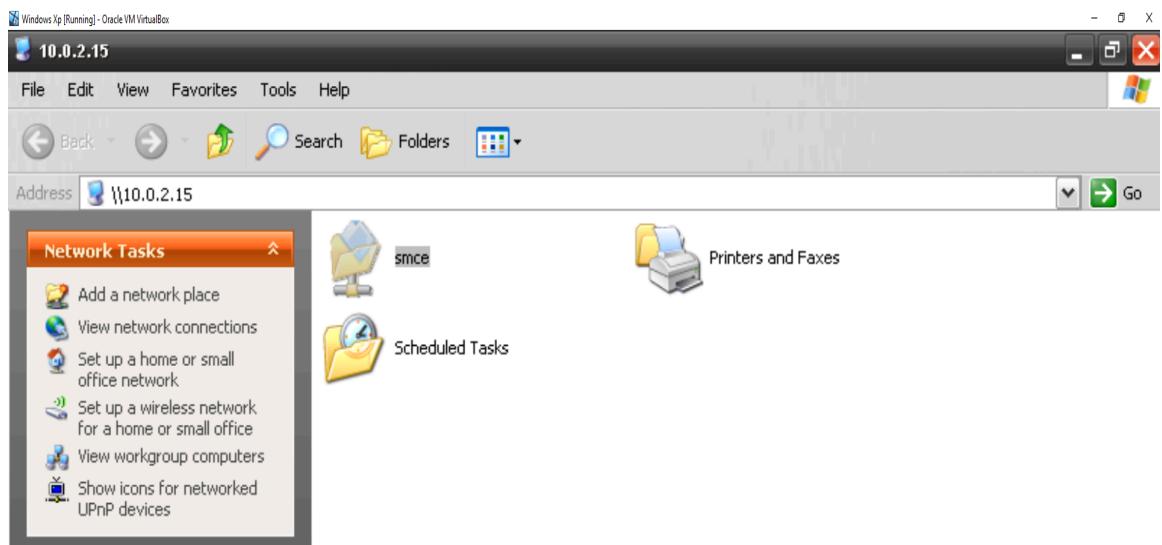
Pinging 10.0.2.15 with 32 bytes of data:
Reply from 10.0.2.15: bytes=32 time<1ms TTL=128

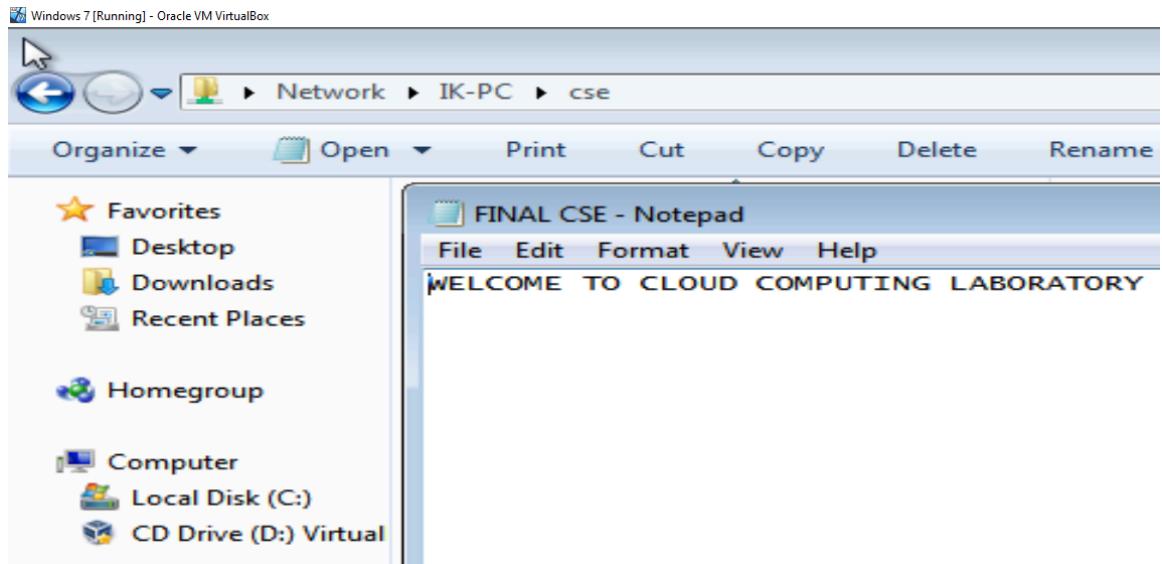
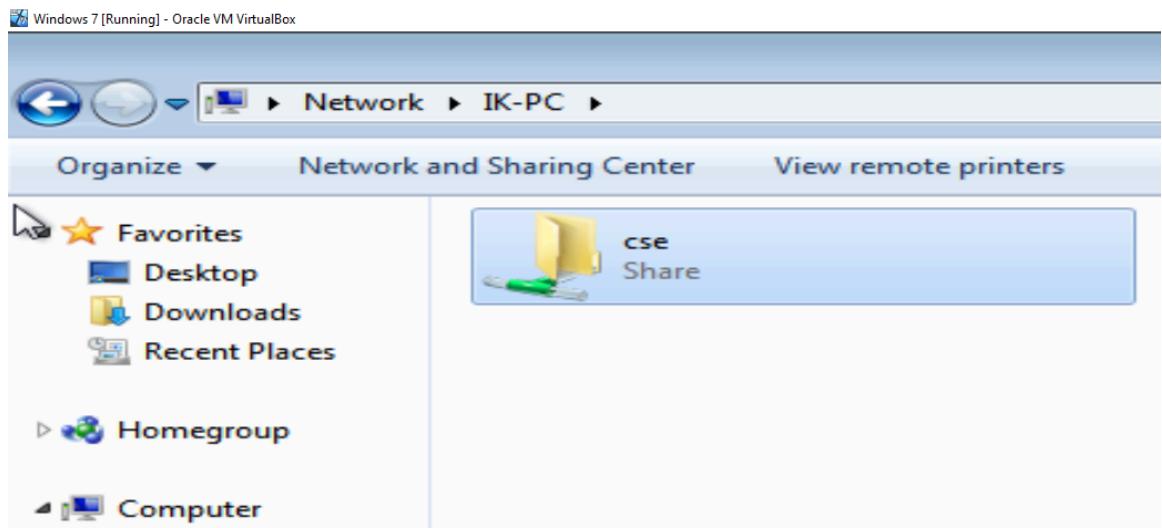
Ping statistics for 10.0.2.15:
  Packets: Sent = 4, Received = 4, Lost = 0 <0% loss>,
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Documents and Settings\BASTIN ROGERS C>
```



OUTPUT





Result

Thus, we can transfer files between different Virtual Machines of different configuration.

Install Hadoop single node cluster and run simple applications like Word Count

AIM:

To write a procedure to install a single node Hadoop cluster

PROCEDURE:

Java

Download the Java 1.8 from <https://java.com/en/download/>

Once installed confirm that you're running the correct version from command line using 'java -version'

command, output of which you can confirm in command line like this:

```
C:\WINDOWS\system32>java -version
java version "1.8.0_111"
Java(TM) SE Runtime Environment (build 1.8.0_111-b14)
Java HotSpot(TM) 64-Bit Server VM (build 25.111-b14, mixed mode)
```

WinRAR

I've downloaded and installed WinRAR 64 bit release from <http://www.rarlab.com/download.htm> that will

later allow me to decompress Linux type tar.gz packages on Windows.

Hadoop

The next step was to install a Hadoop distribution. To do so, I've decided to download the most recent

release **Hadoop 3.0.0-alpha2** (25 Jan, 2017) in a binary form, from the Apache Download

Mirror at <http://hadoop.apache.org/releases.html>

Once the **hadoop-3.0.0-alpha2.tar.gz** (250 MB) downloaded, I've extracted it by using WinRAR (installed in

the previous step) into C:\hadoop-3.0.0-alpha2 folder:

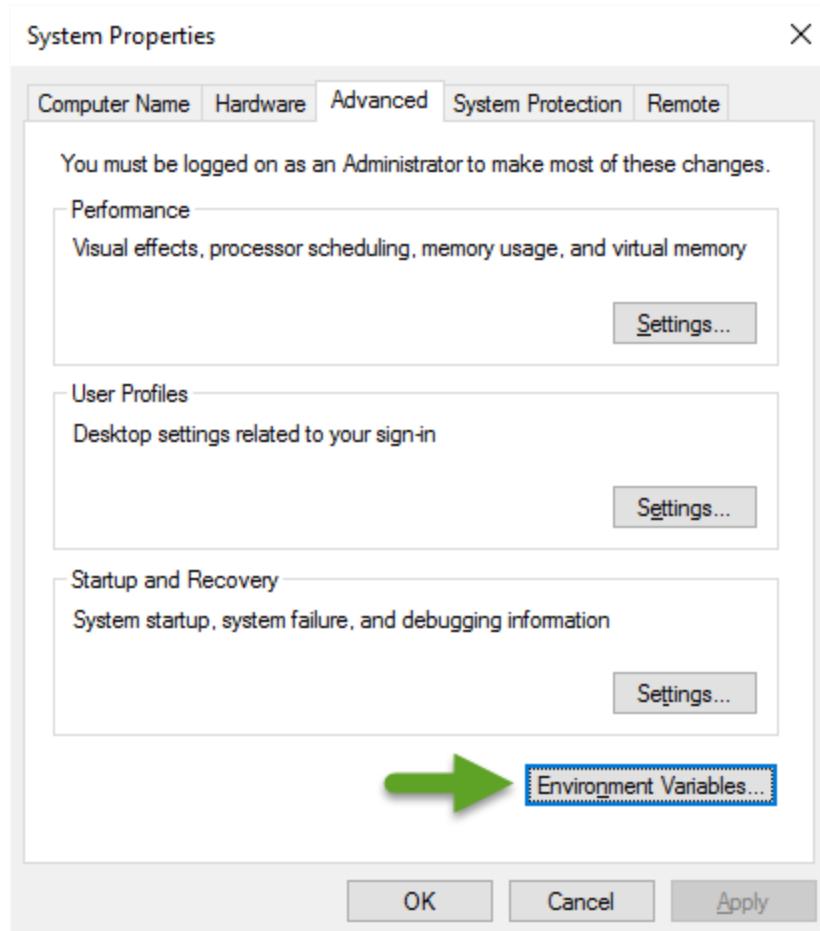
Local Disk (C:) > hadoop-3.0.0-alpha2 >

Name	Date modified	Type	Size
bin	2/01/17 5:49 AM	File folder	
etc	2/01/17 5:49 AM	File folder	
include	2/01/17 5:46 AM	File folder	
lib	2/01/17 5:46 AM	File folder	
libexec	2/01/17 5:46 AM	File folder	
sbin	2/01/17 5:46 AM	File folder	
share	2/01/17 5:48 AM	File folder	
LICENSE.txt	1/09/17 9:01 PM	Text Document	140 KB
NOTICE.txt	1/09/17 9:01 PM	Text Document	21 KB
README.txt	7/08/16 4:34 PM	Text Document	2 KB

Now that I had Hadoop downloaded, it was time to start the Hadoop cluster with a single node.

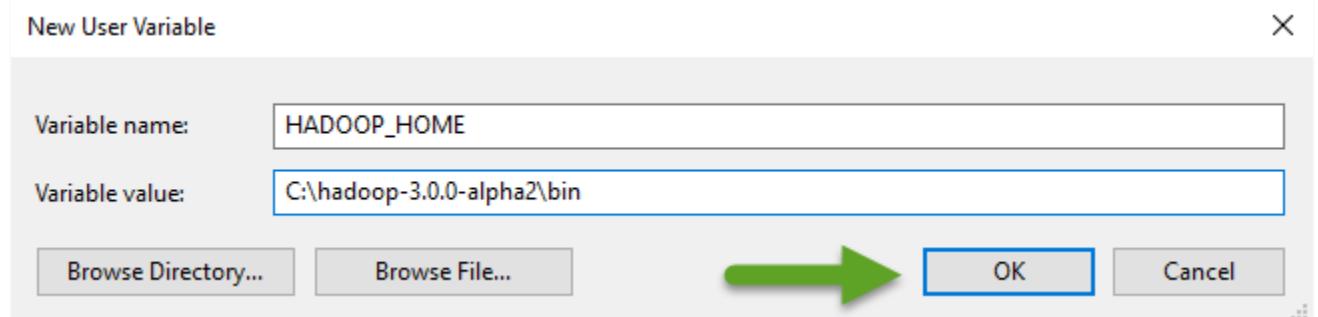
Setup Environmental Variables

In Windows 10 I've opened System Properties windows and clicked on Environment Variables button:

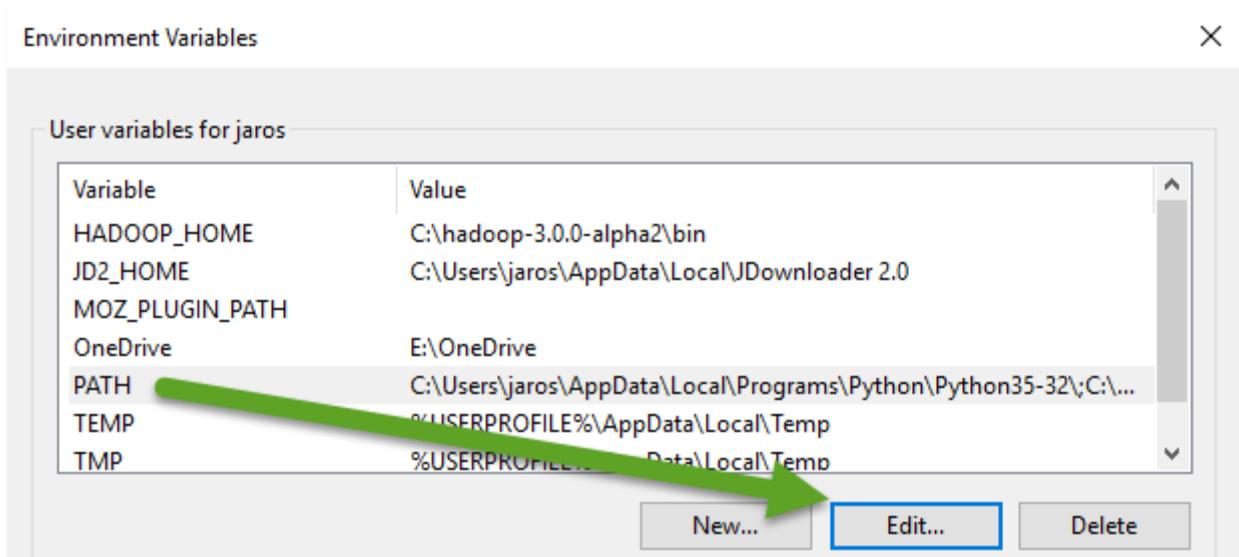


hen created a new HADOOP_HOME variable and pointed the path to C:\hadoop-3.0.0-alpha2\bin folder on my

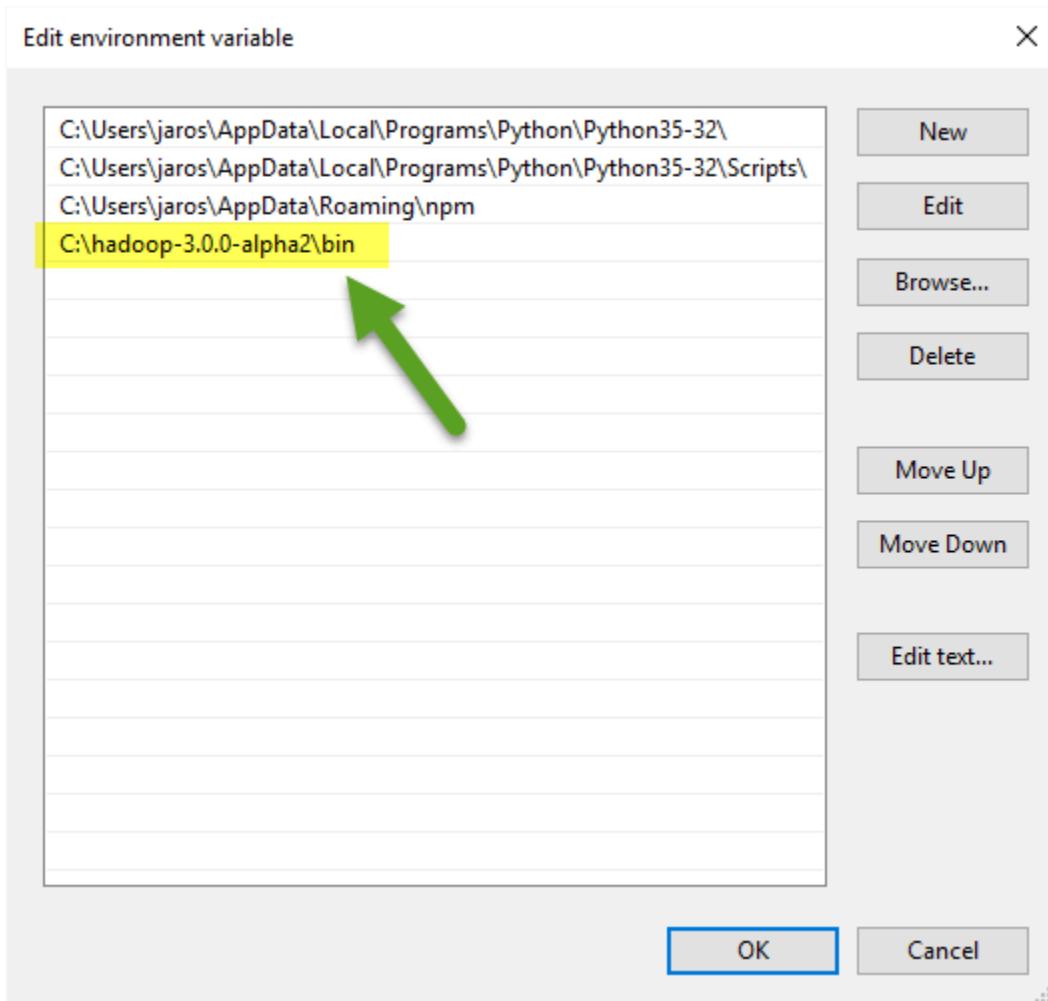
PC:



Next step was to add a Hadoop bin directory path to PATH variable. Clicked on PATH and pressed edit:

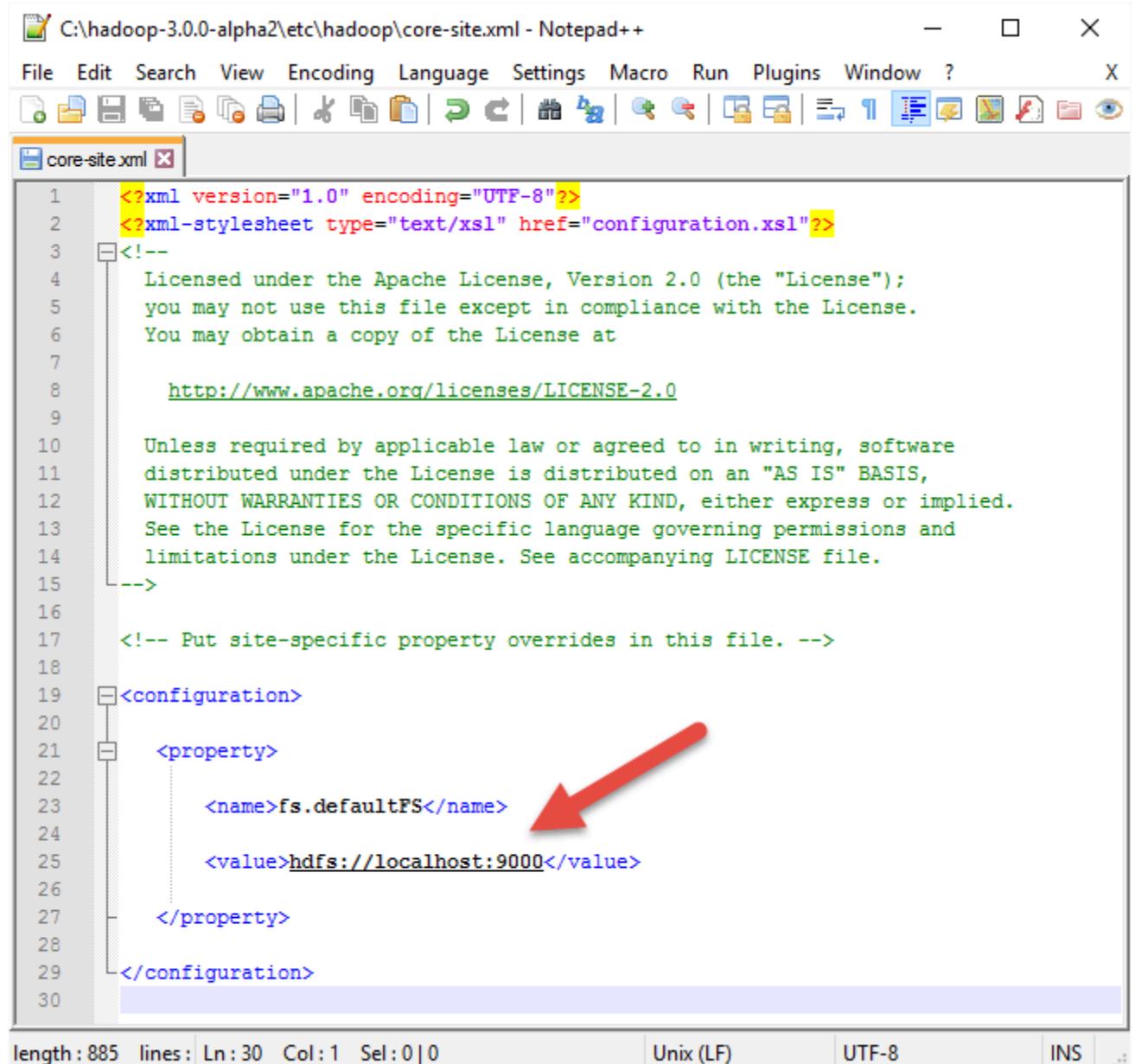


Then added a 'C:\hadoop-3.0.0-alpha2\bin' path like this and pressed OK:



Edit Hadoop Configuration

C:\hadoop-3.0.0-alpha2\etc\hadoop\core-site.xml file, just like this:



```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
3  <!--
4      Licensed under the Apache License, Version 2.0 (the "License");
5      you may not use this file except in compliance with the License.
6      You may obtain a copy of the License at
7
8          http://www.apache.org/licenses/LICENSE-2.0
9
10     Unless required by applicable law or agreed to in writing, software
11     distributed under the License is distributed on an "AS IS" BASIS,
12     WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
13     See the License for the specific language governing permissions and
14     limitations under the License. See accompanying LICENSE file.
15 -->
16
17 <!-- Put site-specific property overrides in this file. -->
18
19 <configuration>
20
21 <property>
22
23     <name>fs.defaultFS</name>
24
25     <value>hdfs://localhost:9000</value>
26
27 </property>
28
29 </configuration>
30
```

Next go to C:\hadoop-3.0.0-alpha2\etc\hadoop folder and renamed mapred-site.xml.template to mapred-site.xml.

edited the mapred-site.xml file adding the following XML Yarn configuration for Mapreduce:

```
<configuration>
```

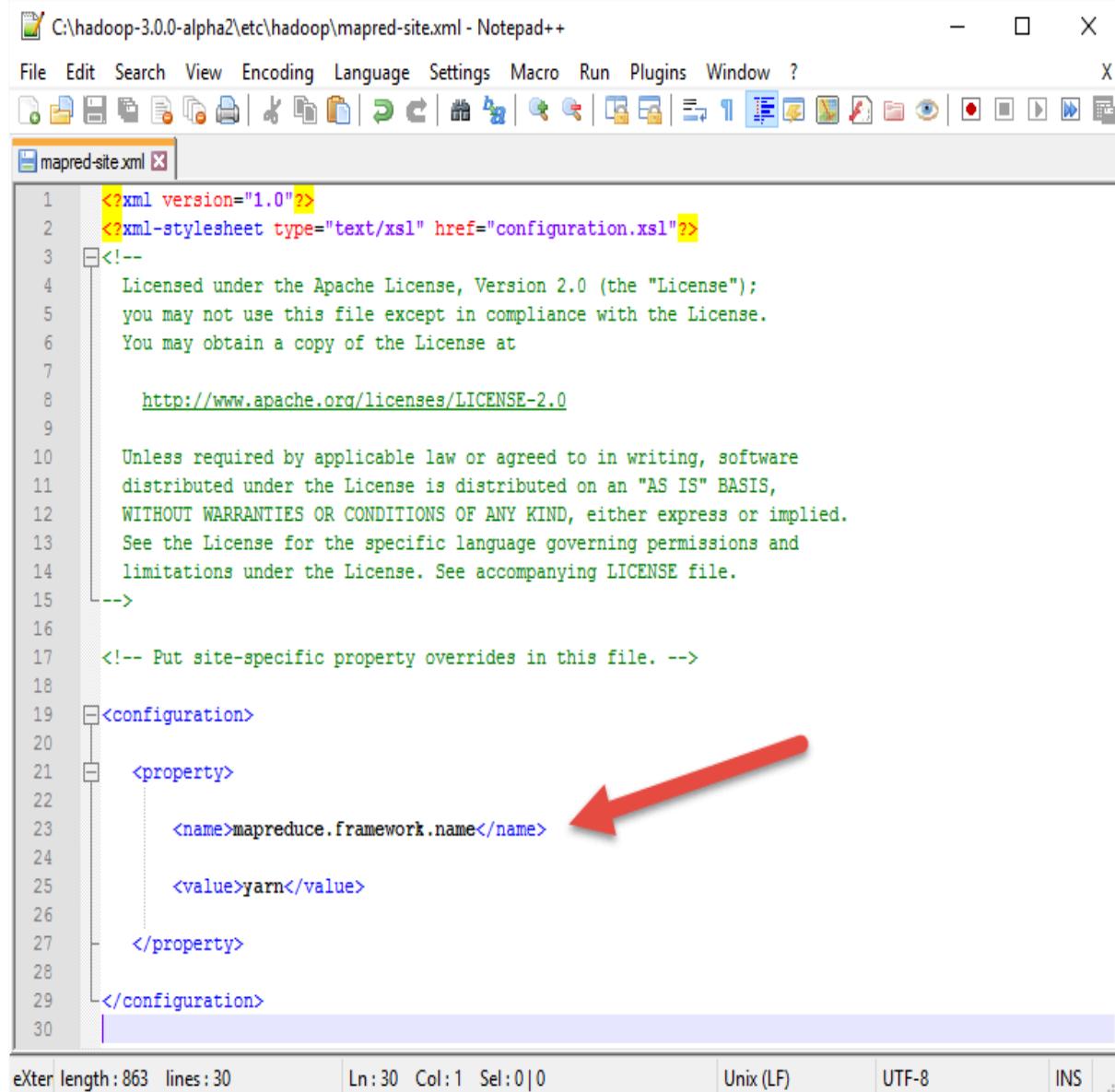
```

<property>
  <name>mapreduce.framework.name</name>
  <value>yarn</value>
</property>

```

</configuration>

This is what the file looks like when configured:



The screenshot shows the Notepad++ application window with the file 'mapred-site.xml' open. The code editor displays XML configuration for Hadoop. A red arrow points to the line containing the value 'yarn' for the 'mapreduce.framework.name' property.

```

<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at

http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
  <property>
    <name>mapreduce.framework.name</name>
    <value>yarn</value>
  </property>
</configuration>

```

The next step was to created a new ‘data’ folder in Hadoop’s home directory (C:\hadoop-3.0.0-alpha2\data).

Once done, the next step was to add a data node and name node to Hadoop, by editing c:\hadoop-3.0.0-alpha2\etc\hadoop\hdfs-site.xml file.

And added following configuration to this XML file:

configuration>

```
<property> <name>dfs.replication</name> <value>1</value> </property> <property>
<name>dfs.namenode.name.dir</name>
<value>C:/hadoop-3.0.0-alpha2/data/namenode</value> </property><property>
<name>dfs.datanode.data.dir</name>
<value>C:/hadoop-3.0.0-alpha2/data/datanode</value> </property></configuration>
```

In above step, I had to make sure that I am pointing to location of my newly created data folder and append the datanode and namenode as shown in example.

This is what hdfs-site.xml file looked like once completed:

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
3 <!--
4 Licensed under the Apache License, Version 2.0 (the "License");
5 you may not use this file except in compliance with the License.
6 You may obtain a copy of the License at
7
8 http://www.apache.org/licenses/LICENSE-2.0
9
10 Unless required by applicable law or agreed to in writing, software
11 distributed under the License is distributed on an "AS IS" BASIS,
12 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
13 See the License for the specific language governing permissions and
14 limitations under the License. See accompanying LICENSE file.
15 -->
16
17 <!-- Put site-specific property overrides in this file. -->
18
19 <configuration>
20   <property>
21     <name>dfs.replication</name>
22     <value>1</value>
23   </property>
24
25   <property>
26     <name>dfs.namenode.name.dir</name>
27     <value>C:/hadoop-3.0.0-alpha2/data/namenode</value>
28   </property>
29
30   <property>
31     <name>dfs.datanode.data.dir</name>
32     <value>C:/hadoop-3.0.0-alpha2/data/datanode</value>
33   </property>
34 </configuration>
35

```

The screenshot shows the hdfs-site.xml file in Notepad++. The file contains XML configuration for HDFS. Two specific properties are highlighted with red arrows pointing to them:

- <name>dfs.namenode.name.dir</name>
- <name>dfs.datanode.data.dir</name>

The next step was to add site specific YARN configuration properties by editing yarn-site.xml at

C:\hadoop-3.0.0-alpha2\etc\hadoop\yarn-site.xml, like this:

```

<configuration> <property>

<name>yarn.nodemanager.aux-services</name>

<value>mapreduce_shuffle</value> </property>

<property>

<name>yarn.nodemanager.aux-services.mapreduce.shuffle.class</name>

```

```

<value>org.apache.hadoop.mapred.ShuffleHandler</value>
</property>
</configuration>

```

This is what yarn-site.xml file looked like once completed:

The screenshot shows the Notepad++ application window with the file 'yarn-site.xml' open. The code is color-coded for syntax highlighting. The XML structure includes a license comment, a configuration section, and two property definitions. The properties define 'yarn.nodemanager.aux-services' as 'mapreduce_shuffle' and 'yarn.nodemanager.aux-services.mapreduce.shuffle.class' as 'org.apache.hadoop.mapred.ShuffleHandler'. The Notepad++ status bar at the bottom shows the file length as 929 and lines as 35.

```

<?xml version="1.0"?>
<!--
Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at

http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
-->

<configuration>
<property>
<name>yarn.nodemanager.aux-services</name>
<value>mapreduce_shuffle</value>
</property>
<property>
<name>yarn.nodemanager.aux-services.mapreduce.shuffle.class</name>
<value>org.apache.hadoop.mapred.ShuffleHandler</value>
</property>
</configuration>

```

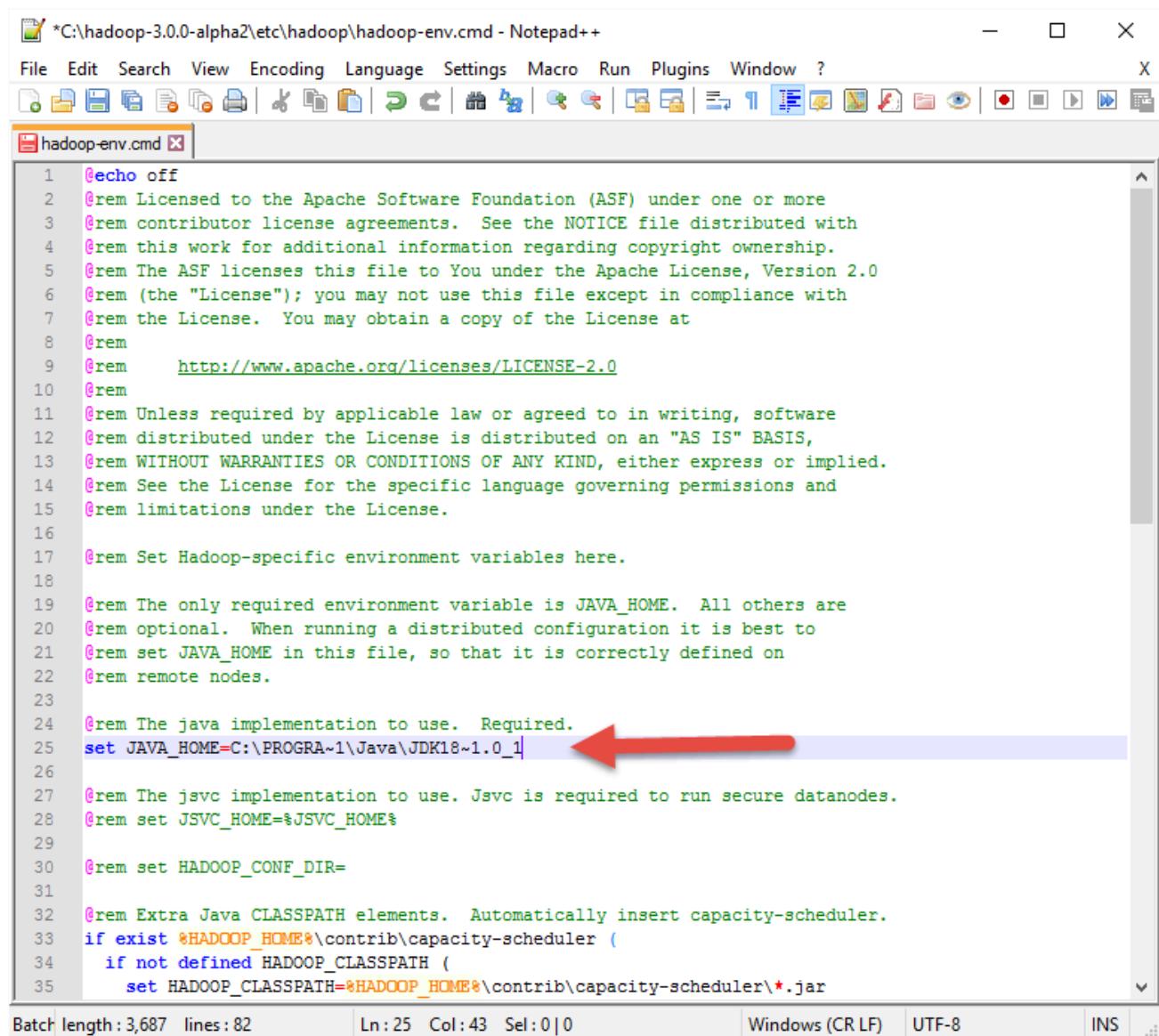
Then I continued by editing hadoop-env.cmd in C:\hadoop-3.0.0-alpha2\etc\hadoop\hadoop-env.cmd. Then changed the line for JAVA_HOME=%JAVA_HOME% and added a path to my JAVA folder: C:\PROGRA~1\Java\JDK18~1.0_1

Go to C:\Program Files\Java\jdk1.8.0_111 where my Java JDK is installed and converted a long path to

windows short name:

```
C:\Program Files\Java\jdk1.8.0_111>for %I in(.) do echo %~sI  
C:\Program Files\Java\jdk1.8.0_111>echo C:\PROGRA~1\Java\JDK18~1.0_1  
C:\PROGRA~1\Java\JDK18~1.0_1
```

Next step was to open hadoop-env.cmd and add it in there, as shown in this screenshot:

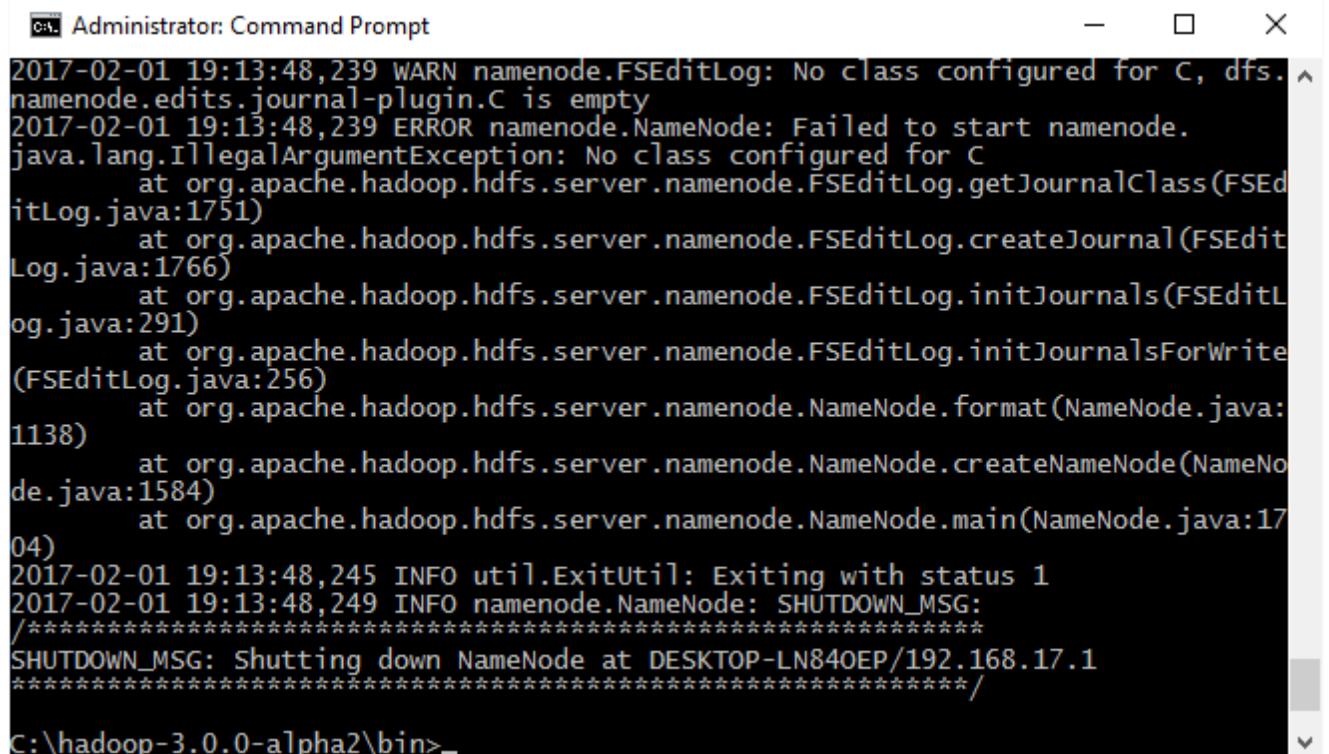


```
*C:\hadoop-3.0.0-alpha2\etc\hadoop\hadoop-env.cmd - Notepad++  
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?  
hadoop-env.cmd  
1 @echo off  
2 @rem Licensed to the Apache Software Foundation (ASF) under one or more  
3 @rem contributor license agreements. See the NOTICE file distributed with  
4 @rem this work for additional information regarding copyright ownership.  
5 @rem The ASF licenses this file to You under the Apache License, Version 2.0  
6 @rem (the "License"); you may not use this file except in compliance with  
7 @rem the License. You may obtain a copy of the License at  
8 @rem  
9 @rem     http://www.apache.org/licenses/LICENSE-2.0  
10 @rem  
11 @rem Unless required by applicable law or agreed to in writing, software  
12 @rem distributed under the License is distributed on an "AS IS" BASIS,  
13 @rem WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
14 @rem See the License for the specific language governing permissions and  
15 @rem limitations under the License.  
16  
17 @rem Set Hadoop-specific environment variables here.  
18  
19 @rem The only required environment variable is JAVA_HOME. All others are  
20 @rem optional. When running a distributed configuration it is best to  
21 @rem set JAVA_HOME in this file, so that it is correctly defined on  
22 @rem remote nodes.  
23  
24 @rem The java implementation to use. Required.  
25 set JAVA_HOME=C:\PROGRA~1\Java\JDK18~1.0_1  
26  
27 @rem The jsvc implementation to use. Jsvc is required to run secure datanodes.  
28 @rem set JSVC_HOME=%JSVC_HOME%  
29  
30 @rem set HADOOP_CONF_DIR=  
31  
32 @rem Extra Java CLASSPATH elements. Automatically insert capacity-scheduler.  
33 if exist %HADOOP_HOME%\contrib\capacity-scheduler (  
34     if not defined HADOOP_CLASSPATH (  
35         set HADOOP_CLASSPATH=%HADOOP_HOME%\contrib\capacity-scheduler\*.jar
```

Next in C:\hadoop-3.0.0-alpha2\bin using windows command prompt as admin run:

'hdfs namenode -format' command.

Output looked like this:



The screenshot shows an 'Administrator: Command Prompt' window. The output of the command 'hdfs namenode -format' is displayed, showing several warning and error messages related to the NameNode's configuration and startup. The errors indicate that no journal class was configured, leading to a failed start. The process ends with the NameNode shutting down at DESKTOP-LN840EP/192.168.17.1.

```
Administrator: Command Prompt
2017-02-01 19:13:48,239 WARN namenode.FSEditLog: No class configured for C, dfs.namenode.edits.journal-plugin.C is empty
2017-02-01 19:13:48,239 ERROR namenode.NameNode: Failed to start namenode.
java.lang.IllegalArgumentException: No class configured for C
    at org.apache.hadoop.hdfs.server.namenode.FSEditLog.getJournalClass(FSEditLog.java:1751)
    at org.apache.hadoop.hdfs.server.namenode.FSEditLog.createJournal(FSEditLog.java:1766)
    at org.apache.hadoop.hdfs.server.namenode.FSEditLog.initJournals(FSEditLog.java:291)
    at org.apache.hadoop.hdfs.server.namenode.FSEditLog.initJournalsForWrite(FSEditLog.java:256)
    at org.apache.hadoop.hdfs.server.namenode.NameNode.format(NameNode.java:1138)
    at org.apache.hadoop.hdfs.server.namenode.NameNode.createNameNode(NameNode.java:1584)
    at org.apache.hadoop.hdfs.server.namenode.NameNode.main(NameNode.java:1704)
2017-02-01 19:13:48,245 INFO util.ExitUtil: Exiting with status 1
2017-02-01 19:13:48,249 INFO namenode.NameNode: SHUTDOWN_MSG:
/*****
SHUTDOWN_MSG: Shutting down NameNode at DESKTOP-LN840EP/192.168.17.1
*****/
C:\hadoop-3.0.0-alpha2\bin>
```

Then I've finally started Hadoop. I've opened command prompt as admin in C:\hadoop-3.0.0-alpha2\sbin and

ran

start-dfs.cmd and also **start-yarn.cmd**, like this:

```
C:\hadoop-3.0.0-alpha2\sbin>start-dfs.cmd
C:\hadoop-3.0.0-alpha2\sbin>start-yarn.cmd
starting yarn daemons
```

Open Hadoop GUI

Once all above steps were completed, I've opened browser and navigated to: <http://localhost:8088/cluster>

The screenshot shows the Hadoop Web UI at localhost:8088/cluster. The main title is "All Applications". On the left, there's a sidebar with a "Cluster" section containing links for About, Nodes, Node Labels, Applications (with status: NEW, SAVING, SUBMITTED, ACCEPTED, RUNNING, FINISHED, FAILED, KILLED), and Tools.

Cluster Metrics:

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	Memory Total	Memory Reserved	Vcores Used	Vcores Total	Vcores Reserved
0	0	0	0	0	0 B	0 B	0 B	0	0	0

Cluster Nodes Metrics:

Active Nodes	Decommissioning Nodes	Decommissioned Nodes	Lost Nodes	Unhealthy Nodes	Rebooted Nodes	Shutdown Nodes
0	0	0	0	0	0	0

Scheduler Metrics:

Scheduler Type	Scheduling Resource Type	Minimum Allocation	Maximum Allocation	Maximum Cluster Application Priority
Capacity Scheduler	[MEMORY]	<memory:1024, vCores:1>	<memory:8192, vCores:4>	0

Table Headers:

ID	User	Name	Application Type	Queue	Application Priority	StartTime	FinishTime	State	FinalStatus	Running Containers	Allocated CPU Vcores	Allocated Memory MB	% of Queue	% of Cluster	Progress	Tracking UI	Blacklisted Nodes
----	------	------	------------------	-------	----------------------	-----------	------------	-------	-------------	--------------------	----------------------	---------------------	------------	--------------	----------	-------------	-------------------

No data available in table

Showing 0 to 0 of 0 entries First Previous Next Last

WORD COUNT PROGRAM:

Mapper Reducer Program using JAVA

```

import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.Reducer;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
public class WordCount {
    public static class TokenizerMapper extends Mapper<Object, Text, Text, IntWritable> {
        private final static IntWritable one = new IntWritable(1);
        private Text word = new Text();
        public void map(Object key, Text value, Context context

```

```

) throws IOException, InterruptedException {
StringTokenizer itr = new StringTokenizer(value.toString());
while (itr.hasMoreTokens()) {
word.set(itr.nextToken());
context.write(word, one);
}
}

public static class IntSumReducer
    extends Reducer<Text, IntWritable, Text, IntWritable> {
private IntWritable result = new IntWritable();

public void reduce(Text key, Iterable<IntWritable> values,
                  Context context
) throws IOException, InterruptedException {
int sum = 0;
for (IntWritable val : values) {
    sum += val.get();
}
result.set(sum);
context.write(key, result);
}

public static void main(String[] args) throws Exception {
    Configuration conf = new Configuration();
    Job job = Job.getInstance(conf, "word count");
job.setJarByClass(WordCount.class);
job.setMapperClass(TokenizerMapper.class);
job.setCombinerClass(IntSumReducer.class);
job.setReducerClass(IntSumReducer.class);
job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);
FileInputFormat.addInputPath(job, new Path(args[0]));
FileOutputFormat.setOutputPath(job, new Path(args[1]));
System.exit(job.waitForCompletion(true) ? 0 : 1);
}
}

```

```

WordCount
package com.jarosciak.jozef;
import java.io.IOException;
import java.util.*;

import org.apache.hadoop.fs.Path;
import org.apache.hadoop.conf.*;
import org.apache.hadoop.io.*;
import org.apache.hadoop.mapreduce.*;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.input.TextInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.mapreduce.lib.output.TextOutputFormat;

public class WordCount {

    public static class Map extends Mapper<LongWritable, Text, Text, IntWritable> {
        private final static IntWritable one = new IntWritable(1);
        private Text word = new Text();

        public void map(LongWritable key, Text value, Context context) throws IOException, InterruptedException {
            String line = value.toString();
            StringTokenizer tokenizer = new StringTokenizer(line);
            while (tokenizer.hasMoreTokens()) {
                word.set(tokenizer.nextToken());
                context.write(word, one);
            }
        }
    }

    public static class Reduce extends Reducer<Text, IntWritable, Text, IntWritable> {

        public void reduce(Text key, Iterable<IntWritable> values, Context context)
                throws IOException, InterruptedException {
            int sum = 0;
            for (IntWritable val : values) {
                sum += val.get();
            }
            context.write(key, new IntWritable(sum));
        }
    }
}

```

Then go to <https://www.randomlists.com/random-words> to create couple of random words:

1. untidy	2. strengthen	3. blot	4. expect
5. command	6. unkempt	7. right	8. succinct
9. reach	10. moor	11. seed	12. approval
13. van	14. defeated	15. lake	16. jobless
17. hollow	18. reply	19. awesome	20. bubble
21. kindly	22. inform	23. descriptive	24. wood
25. taste	26. trip	27. request	28. irritating
29. thumb	30. identify	31. action	32. sheet
33. jumpy	34. gabby	35. sore	36. complete
37. achiever	38. license	39. abusive	40. unique
41. pull	42. lackadaisical	43. squash	44. elite
45. tart	46. cross	47. flock	48. changeable
49. decorate	50. border	51. confess	52. smash
53. watch	54. understood	55. pour	56. stir
57. tender	58. moor	59. measure	60. black
61. preach	62. noisy	63. dark	64. glistening
65. colour	66. rule	67. peck	68. trite
69. bleach	70. marble	71. scold	72. suggest
73. wasteful	74. pot	75. angry	76. basket
77. stop	78. broad	79. rebel	80. shoes
81. radiate	82. neat	83. admit	84. bounce
85. object	86. well-to-do	87. friction	88. fold
89. bashful	90. mark	91. cloth	92. male
93. orange	94. air	95. cough	96. mug
97. release	98. flap	99. blood	100. quarrelsome

Then save words to words.txt,

Running Wordlist against Hadoop's MapReduce

Once I ran my code, it executed and started processing the words.txt file that was prior to execution copied to

input folder (which I created earlier together with the output folder for the outcome files).

Following was the result of Hadoop's processing job:

```

17/02/01 20:13:39 INFO mapreduce.Job: Running job: job_1486004321196_0006
17/02/01 20:13:49 INFO mapreduce.Job: Job job_1486004321196_0006 running in uber mode : false
17/02/01 20:13:49 INFO mapreduce.Job: map 0% reduce 0%
17/02/01 20:13:56 INFO mapreduce.Job: map 100% reduce 0%
17/02/01 20:14:04 INFO mapreduce.Job: map 100% reduce 100%
17/02/01 20:14:04 INFO mapreduce.Job: Job job_1486004321196_0006 completed successfully
17/02/01 20:14:04 INFO mapreduce.Job: Counters: 49
    File System Counters
        FILE: Number of bytes read=1248
        FILE: Number of bytes written=235851
        FILE: Number of read operations=0
        FILE: Number of large read operations=0
        FILE: Number of write operations=0
        HDFS: Number of bytes read=847
        HDFS: Number of bytes written=858
        HDFS: Number of read operations=6
        HDFS: Number of large read operations=0
        HDFS: Number of write operations=2
    Job Counters
        Launched map tasks=1
        Launched reduce tasks=1
        Data-local map tasks=1
        Total time spent by all maps in occupied slots (ms)=4862
        Total time spent by all reduces in occupied slots (ms)=5706
        Total time spent by all map tasks (ms)=4862
        Total time spent by all reduce tasks (ms)=5706
        Total vcore-seconds taken by all map tasks=4862
        Total vcore-seconds taken by all reduce tasks=5706
        Total megabyte-seconds taken by all map tasks=4978688
        Total megabyte-seconds taken by all reduce tasks=5842944
    Map-Reduce Framework
        Map input records=1
        Map output records=101
        Map output bytes=1115
        Map output materialized bytes=1248
        Input split bytes=136
        Combine input records=101
        Combine output records=96
        Reduce input groups=96
        Reduce shuffle bytes=1248
        Reduce input records=96
        Reduce output records=96
        Spilled Records=192
        Shuffled Maps =1
        Failed Shuffles=0
        Merged Map outputs=1
        GC time elapsed (ms)=123
        CPU time spent (ms)=1330
        Physical memory (bytes) snapshot=343425024
        Virtual memory (bytes) snapshot=3007807488
        Total committed heap usage (bytes)=226365440
    Shuffle Errors
        BAD_ID=0
        CONNECTION=0
        IO_ERROR=0
        WRONG_LENGTH=0
        WRONG_MAP=0
        WRONG_REDUCE=0
    File Input Format Counters
        Bytes Read=711
    File Output Format Counters
        Bytes Written=858

```

We can see the job progress in the browser as well:



MapReduce Job job_1486004321196_0006

Logged in as: dr.who

Application

Job

Overview

Counters

Configuration

Map tasks

Reduce tasks

Tools

Job Overview

Job Name: word count

User Name: dr.who

Queue: root

State: SUCCEEDED

Uberized: false

Submitted: Wed Feb 01 20:13:39 PST 2017

Started: Wed Feb 01 20:13:47 PST 2017

Finished: Wed Feb 01 20:14:02 PST 2017

Elapsed: 15sec

Diagnostics:

Average Map Time 4sec

Average Shuffle Time 4sec

Average Merge Time 0sec

Average Reduce Time 0sec

ApplicationMaster			
Attempt Number	Start Time	Node	Logs
1	Wed Feb 01 20:13:41 PST 2017		logs
Task Type		Total	Complete
Map	1	1	
Reduce	1	1	
Attempt Type		Failed	Killed
Maps	0	0	1
Reduces	0	0	1

OUTPUT:

1. abusive 1
2. achiever 1
3. action 1
4. admit 1
5. air 1
6. angry 1
7. approval 1
8. awesome 1
9. bashful 1
10. basket 1
11. black 1
12. bleach 1
13. blood 1
14. blot 1
15. border 1
16. bounce 1
17. broad 1
18. bubble 1
19. changeable 1
20. cloth 1
21. colour 1

- 22. command 1
- 23. confess 1
- 24. cough 1
- 25. cross 1
- 26. dark 1
- 27. decorate 1
- 28. defeated 1
- 29. descriptive 1
- 30. elite 1
- 31. expect 1
- 32. flap 1
- 33. flock 1
- 34. fold 1
- 35. friction 1
- 36. gabby 1
- 37. hollow 1
- 38. identify 1
- 39. inform 1
- 40. irritating 1
- 41. **jarosciak 5**
- 42. jobless 1
- 43. jumpy 1
- 44. kindly 1
- 45. lackadaisical 1
- 46. lake 1
- 47. license 1
- 48. male 1
- 49. marble 1
- 50. mark 1
- 51. measure 1
- 52. moor 2
- 53. mug 1
- 54. neat 1
- 55. noisy 1
- 56. object 1
- 57. orange 1
- 58. peck 1
- 59. pot 1
- 60. pour 1
- 61. preach 1

62. pull 1
63. quarrelsome 1
64. radiate 1
65. reach 1
66. rebel 1
67. release 1
68. reply 1
69. request 1
70. right 1
71. scold 1
72. seed 1
73. sheet 1
74. shoes 1
75. smash 1
76. sore 1
77. squash 1
78. stir 1
79. stop 1
80. strengthen 1
81. succinct 1
82. suggest 1
83. tart 1
84. taste 1
85. thumb 1
86. trip 1
87. trite 1
88. understood 1
89. unique 1
90. unkempt 1
91. untidy 1
92. van 1
93. wasteful 1
94. watch 1
95. well-to-do 1
96. wood 1

RESULT:

Thus a procedure to install single node Hadoop cluster was successfully executed

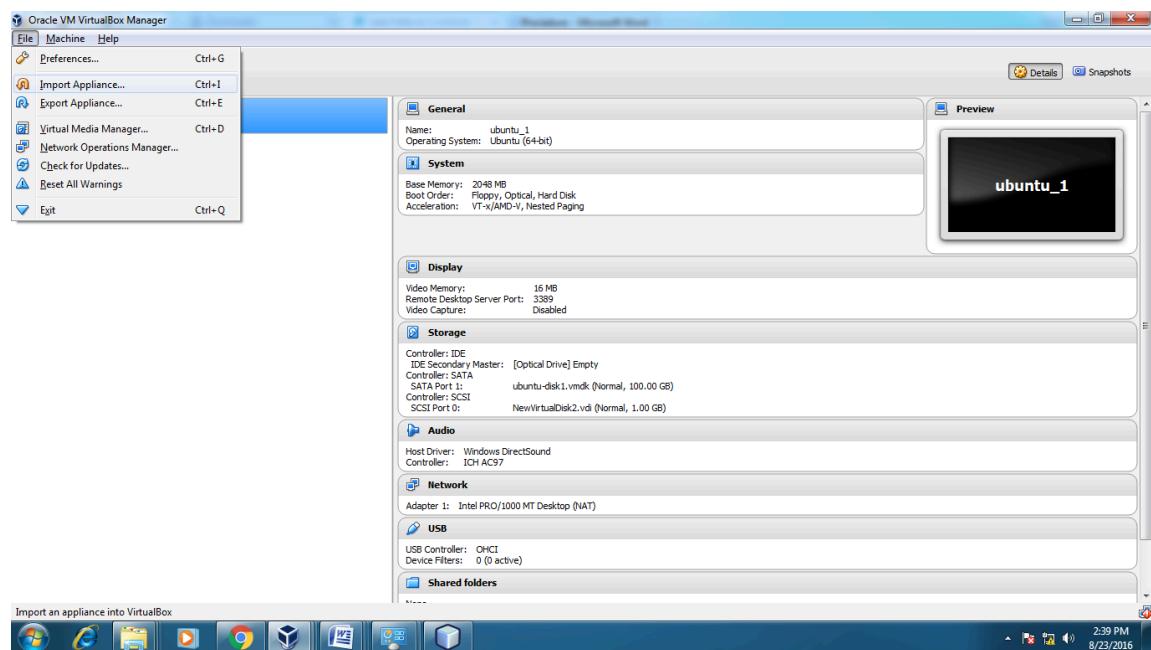
CONTENT BEYOND SYLLABUS

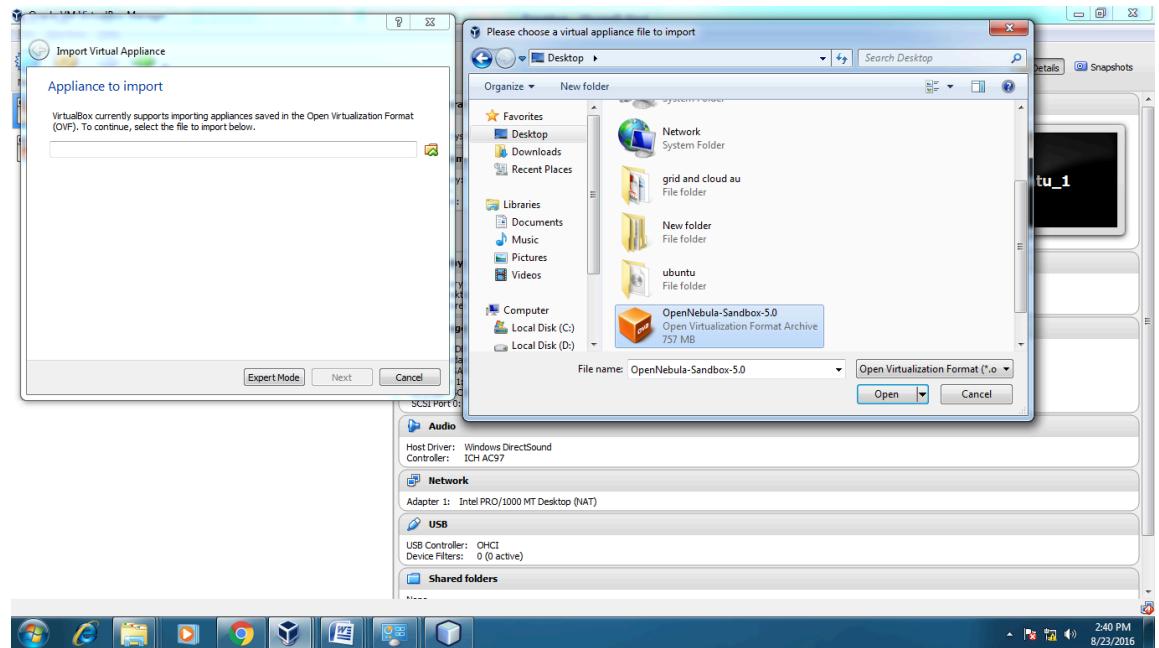
Ex.No.9**To create Virtual Machines of different Configuration using Opennebula Sandbox****Aim:**

To create Virtual machines using Opennebula and checking how many VM's can be created and configured.

Procedure**Install Open nebula sandbox:**

1. Open Virtual box
2. File Import Appliance
3. Browse OpenNebula-Sandbox-5.0.ova file
4. Then go to setting, select USB and choose USB 1.1
5. Then Start the Open Nebula
6. Login using username: root, password:opennebula





Host:one-sandbox

The screenshot shows the OpenNebula Sunstone web interface. The URL is "localhost:9869". The left sidebar navigation includes:

- Dashboard
- Instances
- VMs
- Services
- Virtual Routers
- Templates
- Storage
- Network
- Infrastructure
- Clusters
- Hosts
- Zones
- System
- Settings

The main content area is titled "Host one-sandbox". It shows a table of VMs:

ID	Owner	Group	Name	Status	Host	IPs
7	oneadmin	oneadmin	vm8	RUNNING	one-sandbox	172.16.100.207
6	oneadmin	oneadmin	vm8	RUNNING	one-sandbox	172.16.100.206

At the bottom of the sidebar, there is a "Support" section with a "Not connected" message and a "Sign in" button.

Result

Thus multiple Virtual machines are created and configured using opennebula.

Ex.No.10

To Migrate Virtual Machines from one Host to another Host using Opennebula Sandbox

Aim:

To migrate virtual machines from one host to another by using opennebula

Procedure:

1. Open Browser, type localhost:9869
2. Login using username: oneadmin, password: opennebula
3. Then follow the steps to migrate VMs
 - a. Click on infrastructure
 - b. Select clusters and enter the cluster name
 - c. Then select host tab, and select all host
 - d. Then select Vnets tab, and select all vnet
 - e. Then select datastores tab, and select all datastores
 - f. And then choose host under infrastructure tab
 - g. Click on + symbol to add new host, name the host then click on create.
4. on instances, select VMs to migrate then follow the stpes
 - a. Click on 8th icon ,the drop down list display
 - b. Select migrate on that ,the popup window display
 - c. On that select the target host to migrate then click on migrate.

Before Migration

The screenshot shows the OpenNebula Sunstone web interface at localhost:9869. The title bar indicates the user is 'oneadmin'. The main area displays a table of hosts, with the 'Hosts' tab selected. The table has columns for ID, Owner, Group, Name, Status, Host, and IPs. There are 6 entries shown:

ID	Owner	Group	Name	Status	Host	IPs
5	oneadmin	oneadmin	vm2	FAILURE	naveenkumar	172.16.100.205
4	oneadmin	oneadmin	vm2	FAILURE	naveenkumar	172.16.100.204
3	oneadmin	oneadmin	vm1	FAILURE	naveenkumar	172.16.100.203
2	oneadmin	oneadmin	naveen	FAILURE	naveenkumar	172.16.100.202
1	oneadmin	oneadmin	naveen	FAILURE	naveenkumar	172.16.100.201
0	oneadmin	oneadmin	ttylinux-0	FAILURE	naveenkumar	172.16.100.200

Below the table, a message says 'Showing 1 to 6 of 6 entries'. The left sidebar contains navigation links for Dashboard, Instances (VMs, Services, Virtual Routers), Templates, Storage, Network, Infrastructure (Clusters, Hosts, Zones), System, Settings, Support (Not connected), and Upgrade Available. The bottom navigation bar includes icons for various applications and the text 'OpenNebula 5.0.0'.

K.Ramakrishnan Group Of Downloads OpenNebula Sunstone: Cl New Tab

localhost:9869

Host 0 one-sandbox

oneadmin OpenNebula

Dashboard Instances VMs Services Virtual Routers Templates Storage Network Infrastructure Clusters Hosts Zones System Settings Support Not connected Sign in Upgrade Available 0

OpenNebula 5.0.0

Info Graphs VMs Wlids Zombies

Search

ID Owner Group Name Status Host IPs

ID	Owner	Group	Name	Status	Host	IPs
7	oneadmin	oneadmin	vm8	RUNNING	one-sandbox	172.16.100.207
6	oneadmin	oneadmin	vm8	RUNNING	one-sandbox	172.16.100.206

Showing 1 to 2 of 2 entries Previous 1 Next

2:34 PM 8/23/2016

After Migration

Migrate Virtual Machine

VM 6 vm8 is currently running on Host one-sandbox
VM 7 vm8 is currently running on Host one-sandbox

Select a Host

Please select a Host from the list

ID	Name	Cluster	RVMs	Allocated CPU	Allocated MEM	Status
2	raa	default	0	0/0	OKB/-	RETRY
1	naveenkumar	rama	6	62/0	44MB/-	ERROR
0	one-sandbox	rama	2	20/100 (20%)	4MB/741MB (1%)	ON

Showing 1 to 3 of 3 entries

Advanced Options

Migrate

Result:

Thus the VM is migrated from one host to another

VIVA QUESTIONS

1.What are the advantages of using cloud computing?

The advantages of using cloud computing are

- a) Data backup and storage of data
- b) Powerful server capabilities
- c) SaaS (Software as a service)
- d) Information technology sandboxing capabilities
- e) Increase in productivity
- f) Cost effective & Time saving

2) Mention platforms which are used for large scale cloud computing?

The platforms that are used for large scale cloud computing are

- a) Apache Hadoop
- b) MapReduce

3) Explain different models for deployment in cloud computing?

The different deployment models in cloud computing are

- a) Private Cloud
- b) Public Cloud
- c) Community Cloud
- d) Hybrid Cloud

4) What is the difference in cloud computing and computing for mobiles?

Mobile computing uses the same concept as cloud computing. Cloud computing becomes active with the data

with the help of internet rather than individual device. It provides users with the data which they have to

retrieve on demand. In mobile, the applications runs on the remote server and gives user the access for storage and manage.

5) How user can gain from utility computing?

Utility computing allows the user to pay only for what they are using. It is a plug-in managed by an organization which decides what type of services has to be deployed from the cloud.

Most organizations prefer hybrid strategy.

6) For a transport in cloud how you can secure your data?

To secure your data while transporting them from one place to another, check that there is no leak

with the encryption key implemented with the data you are sending.

7) What are the security aspects provided with cloud?

- a) Identity management: It authorizes the application services

- b) Access control: permission has to be provided to the users so that they can control the access of another user who is entering into the cloud environment.
- c) Authentication and Authorization: Allows only the authorized and authenticated user only to access the data and applications

8) List out different layers which define cloud architecture?

The different layers used by cloud architecture are

- a) CLC or Cloud Controller
- b) Walrus
- c) Cluster Controller
- d) SC or Storage Controller
- e) NC or Node Controller

9) What are system integrators in Cloud Computing?

In Cloud Computing, systems integrator provides the strategy of the complicated process used to design a cloud platform. Integrator allows to create more accurate hybrid and private cloud network, as integrators have all the knowledge about the data center creation.

10) What is “EUCALYPTUS” stands for?

“EUCALYPTUS” stands for Elastic Utility Computing Architecture For Linking Your Programs To Useful Systems”

11) Explain what is the use of “EUCALYPTUS” in cloud computing?

“Eucalyptus” is an open source software infrastructure in cloud computing, which is used to implement clusters in cloud computing platform. It is used to build public, hybrid and private clouds. It has the ability to produce your own data center into a private cloud and allows you to use its functionality to many other organizations.

12) What is the requirement of virtualization platform in implementing cloud?

The requirement of virtualization platform in implementing cloud is to

- a) Manage the service level policies
- b) Cloud Operating System
- c) Virtualization platforms helps to keep the backend level and user level concepts different from each other

13) Before going for cloud computing platform what are the essential things to be taken in concern by users?

- a) Compliance
- b) Loss of data
- c) Data storage
- d) Business continuity
- e) Uptime
- f) Data integrity in cloud computing

14) Mention some open source cloud computing platform databases?

The open source cloud computing platform databases are

- a) MongoDB
- b) CouchDB
- c) LucidDB

15) What are the security laws which are implemented to secure data in a cloud ?

The security laws which are implemented to secure data in cloud are

- a) Processing: Control the data that is being processed correctly and completely in an application
- b) File: It manages and control the data being manipulated in any of the file
- c) Output reconciliation: It controls the data which has to be reconciled from input to output
- d) Input Validation: Control the input data
- e) Security and Backup: It provides security and backup it also controls the security breaches logs

16) Mention the name of some large cloud providers and databases?

- a) Google bigtable
- b) Amazon simpleDB
- c) Cloud based SQL

17) Explain the difference between cloud and traditional datacenters?

- a) The cost of the traditional data center is higher due to heating and hardware/software issues
- b) Cloud gets scaled when the demand increases. Majority of the expenses are spent on the maintenance of the data centers, while that is not the case with cloud computing

18) Explain what are the different modes of software as a service (SaaS)?

- a) Simple multi-tenancy : In this each user has independent resources and are different from other users, it is an efficient mode.
- b) Fine grain multi-tenancy: In this type, the resources can be shared by many but the functionality remains the same.

19) What is the use of API's in cloud services?

API's (Application Programming Interface) is very useful in cloud platforms

- a) It eliminates the need to write the fully fledged programs
- b) It provides the instructions to make communication between one or more applications
- c) It allows easy creation of applications and link the cloud services with other systems

20) What are the different data centers deployed for cloud computing?

Cloud computing consists of different datacenters like

- a) Containerized Datacenters
- b) Low Density Datacenters

21) In cloud computing what are the different layers?

The different layers of cloud computing are:

- a) SaaS: Software as a Service (SaaS), it provides users access directly to the cloud application without installing anything on the system.
- b) IaaS: Infrastructure as a service, it provides the infrastructure in terms of hardware like memory, processor speed etc.
- c) PaaS: Platform as a service, it provides cloud application platform for the developers

22) How important is the platform as a service?

Platform as a service or PAAS is an important layer in cloud computing. It provides application platform for providers. It is responsible for providing complete virtualization of the infrastructure layer and makes it work like a single server.

23) What is a cloud service?

Cloud service is used to build cloud applications using the server in a network through internet. It provides the facility of using the cloud application without installing it on the computer. It also reduces the maintenance and support of the application which are developed using cloud service.

24) List down the three basic clouds in cloud computing?

- a) Professional cloud
- b) Personal cloud
- c) Performance cloud

25) As a infrastructure as a service what are the resources that are provided by it?

IAAS (Infrastructure As A Service) provides virtual and physical resources that are used to build a cloud. It deals with the complexities of deploying and maintaining of the services provided by this layer. Here the infrastructure is the servers, storage and other hardware systems.

26) What are the business benefits involved in cloud architecture?

The benefits involved in cloud architecture is

- a) Zero infrastructure investment
- b) Just in time infrastructure
- c) More efficient resource utilization

27) What are the characteristics of cloud architecture that separates it from traditional one?

The characteristics that makes cloud architecture above traditional architecture is

- a) According to the demand cloud architecture provides the hardware requirement
- b) Cloud architecture is capable of scaling the resource on demand
- c) Cloud architecture is capable of managing and handling dynamic workloads without failure

28) Mention what is the difference between elasticity and scalability in cloud computing?

Scalability is a characteristics of cloud computing through which increasing workload can be handled by increasing in proportion the amount of resource capacity. Whereas, elasticity, is being one of the characteristics that highlights the concept of commissioning and decommissioning of a large amount of resource capacity.

29) Mention the services that are provided by Window Azure Operating System?

Window Azure provides three core services which are given as

- a) Compute
- b) Storage
- c) Management

30) In cloud architecture what are the different components that are required?

- a) Cloud Ingress
- b) Processor Speed
- c) Cloud storage services
- d) Cloud provided services
- e) Intra-cloud communications

31) In cloud architecture what are the different phases involved?

- a) Launch Phase
- b) Monitor Phase

- c) Shutdown Phase
- d) Cleanup Phase

32) List down the basic characteristics of cloud computing?

- a) Elasticity and Scalability
- b) Self-service provisioning and automatic de-provisioning
- c) Standardized interfaces
- d) Billing self service based usage model

33) In cloud architecture what are the building blocks?

- a) Reference architecture
- b) Technical architecture
- c) Deployment operation architecture

34) Mention in what ways cloud architecture provide automation and performance transparency?

To provide the performance transparency and automation there are many tools used by cloud architecture. It

allows to manage the cloud architecture and monitor reports. It also allows them to share the application using

the cloud architecture. Automation is the key component of cloud architecture which helps to improve the degree of quality.

35) In cloud computing explain the role of performance cloud?

Performance cloud is useful in transferring maximum amount of data instantly. It is used by the professionals

who work on high performance computing research.

36) Explain hybrid and community cloud?

Hybrid cloud: It consists of multiple service providers. It is a combination of public and private cloud features.

It is used by the company when they require both private and public clouds both.

Community Cloud: This model is quite expensive and is used when the organizations having common goals

and requirements, and are ready to share the benefits of the cloud service.

37) In cloud what are the optimizing strategies?

To overcome the maintenance cost and to optimize the resources ,there is a concept of three data center in

cloud which provides recovery and back-up in case of disaster or system failure and keeps all the data safe and intact.

38) What is Amazon SQS?

To communicate between different connectors Amazon SQS message is used, between various components of AMAZON, it acts as a communicator.

39) How buffer is used to Amazon web services?

In order to make system more efficient against the burst of traffic or load, buffer is used. It synchronizes different component . The component always receives and processes the request in an unbalanced way. The balance between different components are managed by buffer, and makes them work at the same speed to provide faster services.

40) Mention what is Hypervisor in cloud computing and their types?

Hypervisor is a Virtual Machine Monitor which manages resources for virtual machines. There are mainly two types of hypervisors

Type 1: The guest Vm runs directly over the host hardware, eg Xen, VmWare ESXI

Type 2: The guest Vm runs over hardware through a host OS, eg Kvm, oracle virtualbox

41. Compare Cloud and On-premise Computing?

Criteria	Cloud	On-premise
Initial cost	Low	High
Maintenance & Support	Hassle-free	Needs attention
Upgrade	Automatic	Manual
Scalability	Excellent	Good
Pay as you go	Yes	No

42. What is a Cloud?

A cloud is a collaboration of networks, hardware, services, storage, and interfaces that helps in delivering computing as a service. It has three users:

1. End users
2. Business management users
3. Cloud service provider

43. What is Cloud Computing?

It is advance stage technology implemented so that the cloud provides the services globally as per the user requirements. It provides a method to access several servers worldwide. Become Cloud Computing Certified in 20 hrs.

44. Mention the Layers of PaaS Architecture.

Cloud Controller

- Automatically creates Virtual machines and controllers.
- Deploys Applications
- Connects to services
- Automatically scales Ups and Downs.

Storage Services

- Object
- NoSQL
- Relational
- Block Storage

Applications store in storage services

- Simple to scale applications
- Easier recovery from failure

45. What are the components of Windows Azure?

Windows Azure platform services

- The Cloud
- SQL Azure
- App Fabric: Allows fabric cloud

46. Which agent is equivalent of Nova Compute?

Azure Agent

47. Mention the Reliability and Availability of Cloud Computing.

Use of fault domains:

- Two virtual machines are in single fault domain if a single hardware can bring down both the
- virtual machines.
- Azure automatically distributes instances of a role across fault domains.

Use of Upgrade Domains:

- When new version of software is rolled out, then only one up gradation of domain is done at a time.
- Ensures that some instance of the service is always available.

- Availability of the applications in the multiple instances

Storage and Network Availability:

- Copies of data are stored in different domains.
- Mechanism to guard against DoS and DDoS attacks.

48. Give the best example for open source Cloud Computing.

OpenStack

49. Explain the Common storage of PaaS Architecture.

Cloud Controller:

- Automatically creates the virtual machines and containers.
- Deploys applications
- Connects to services
- Automatically scales ups and downs

Storage Services:

- Object
- NoSQL
- Relational
- Block Storage

Applications store state in storage services:

- Simple to scale applications
- Easier recovery from failure.

50. Mention the different datacenters deployment of cloud computing.

Cloud computing consists of different datacenters such as :

- **Containerized datacenters** – Containerized datacenters are the packages that contain consistent
- set of servers, network components and storage delivered to large warehouse kind of facilities. Here
- each deployment is relatively unique.
- **Low-density datacenters** – Containerized datacentres promote heavy density which in turn causes
- much heat and significant engineering troubles. Low density datacentres are the solution to this