GRACE COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi & Affiliated to ANNA University, Chennai)

MULLAKKADU, THOOTHUKUDI - 628 005

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

BE- Computer Science & Engineering

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CS8711- Cloud Computing Laboratory

IV Year/VII Semester

Lab Manual

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EX.NO.1:	INSTALL VIRTUALBOX WITH LINUX OS ON TOP OF WINDOWS

AIM:

To install Virtualbox with Ubuntu OS on top of windows host operating systems.

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PROCEDURE:

Steps to install VirtualBox:

1. Download VirtualBox installer for windows.
2. The installer can be downloaded from the link

   https://www.virtualbox.org/wiki/Downloads

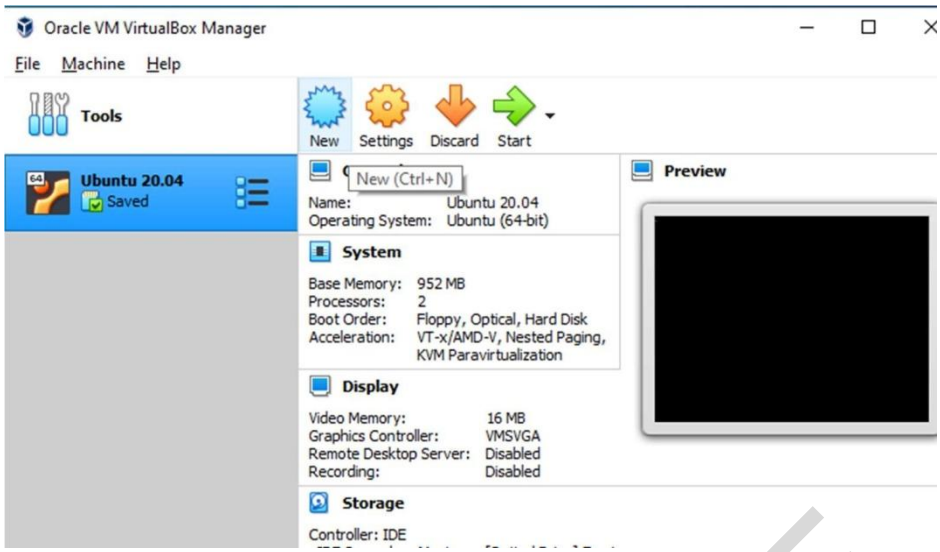
3. Click “Windows host” to download the binary version for windows host.
4. The installer file downloaded will have the file name format like VirtualBox-VersionNumber-BuildNumber-Win.exe.

   Example: VirtualBox-6.1.12-139181-Win.exe.
5. Double click on the installer to launch the setup Wizard. Click on Next to continue.

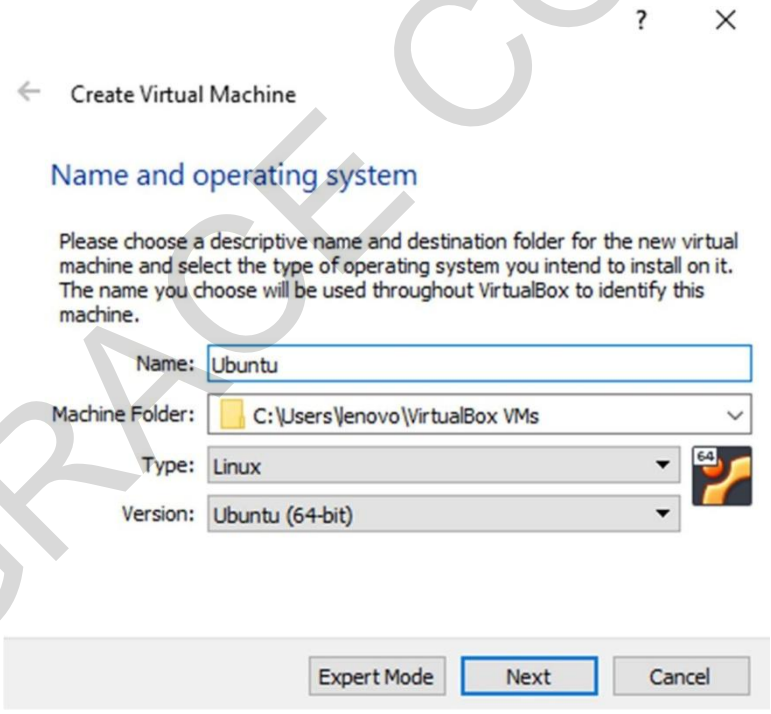
6. Custom setup dialog box will be opened. Accept the default settings and click next.
7. Select the way you want the features to be installed. You can accept the default and click next.
8. A dialog box opens with Network Interfaces warning. Click Yes to proceed.
9. Click install to begin the installation process.
10. When prompted with a message to install (Trust) Oracle Universal Serial Bus, click Install to continue.
11. After the installation completes, click finish to exit the setup wizard.
12. Launch the Oracle VM VirtualBox.

Steps to create a virtual machine [Ubuntu] in VirtualBox:

1. Open the Oracle VM VirtualBox.
2. Click New icon or ‘Ctrl + N’ to create a new virtual machine.



3. Enter a name for the new virtual machine. Choose the Type and Version. Note that VirtualBox automatically changes 'Type' to Linux and 'Version' to 'Ubuntu (64 bit)' if the name is given as ‘Ubuntu’. Click Next.



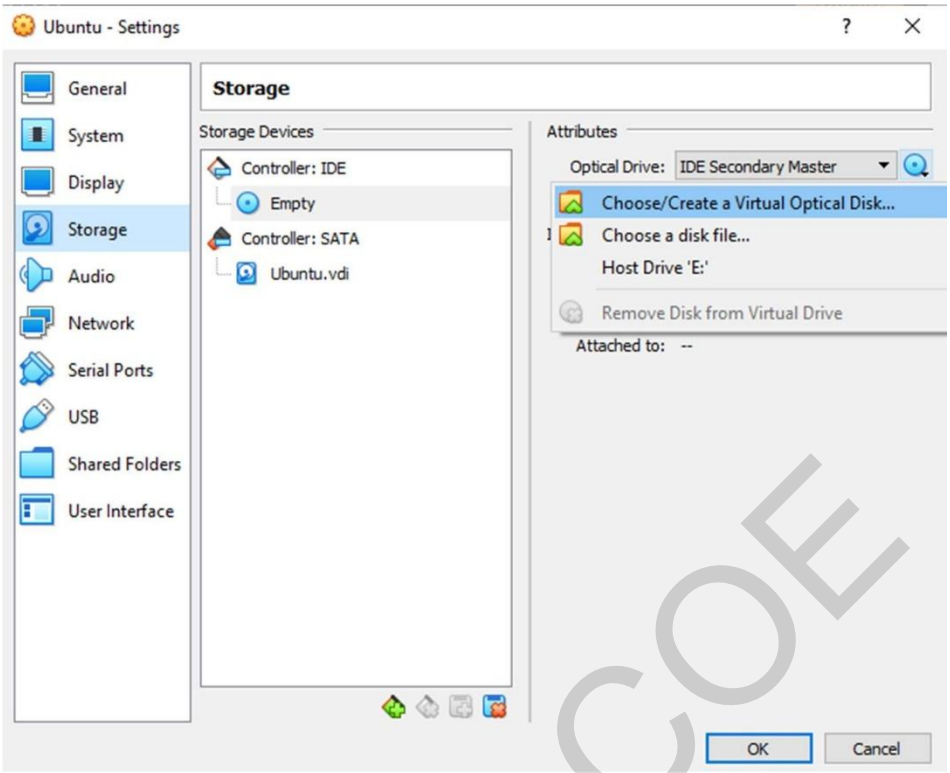
4. Select the amount of RAM to use. The ideal amount of RAM will automatically be selected. Do not increase the RAM into the red section of the slider; keep the slider in the green section.
5. Accept the default 'Create a virtual hard drive now' and click 'Create' button.
6. Choose the hard disk file type as VDI (VirtualBox Disk Image). Click Next.

7. Click Next to accept the default option ‘Dynamically allocated’ for storage on physical hard drive.
8. Select the size of the virtual hard disk and click create.
9. The newly created virtual machine will be displayed in the dashboard.
10. Download the ISO file [Ubuntu disk image file]. Latest version of Ubuntu iso file can be downloaded from the link https://ubuntu.com/download/desktop. Click Download button.

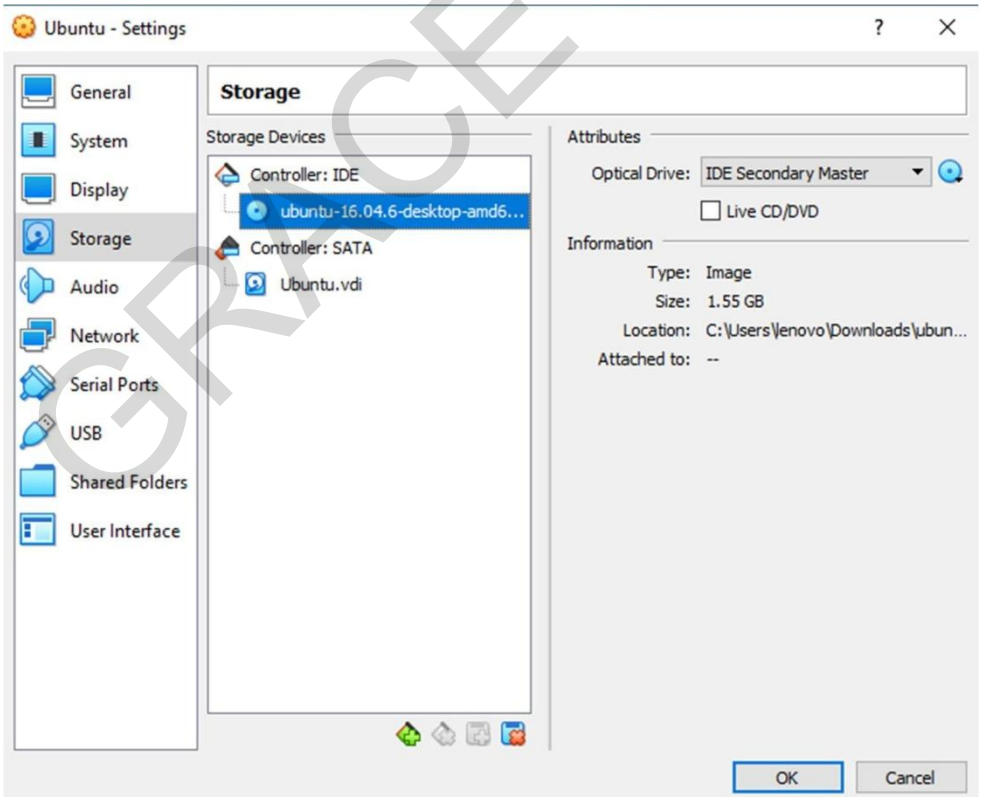
11. For previous versions, goto http://releases.ubuntu.com. Choose the preferred version of Ubuntu and download the iso file.

12. To setup the Ubuntu disk image file (iso file) goto settings.
13. Click Storage. Under ‘Storage Devices’ section click ‘Empty’.

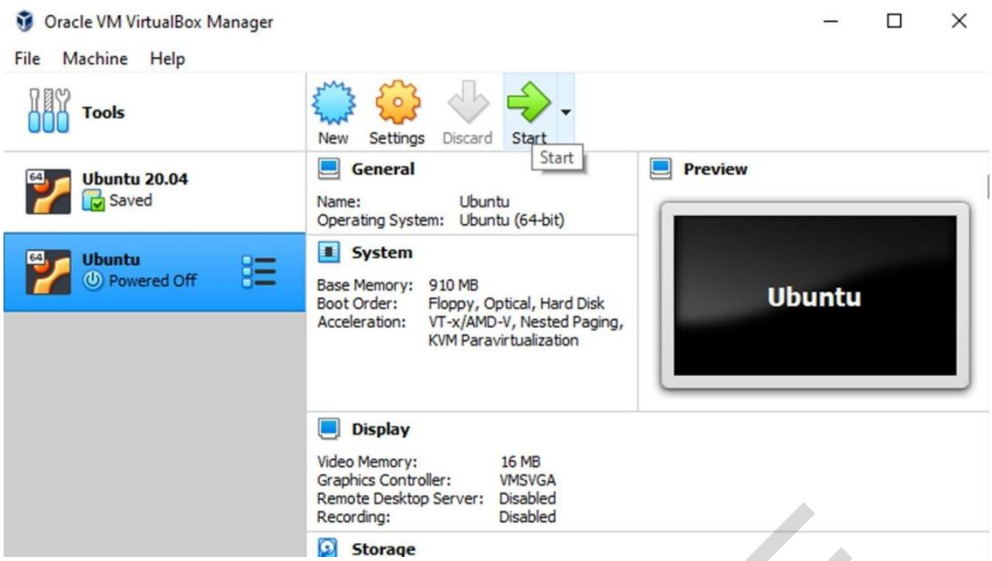
14. In Attributes section, click the disk image and then "Choose Virtual Optical Disk File".



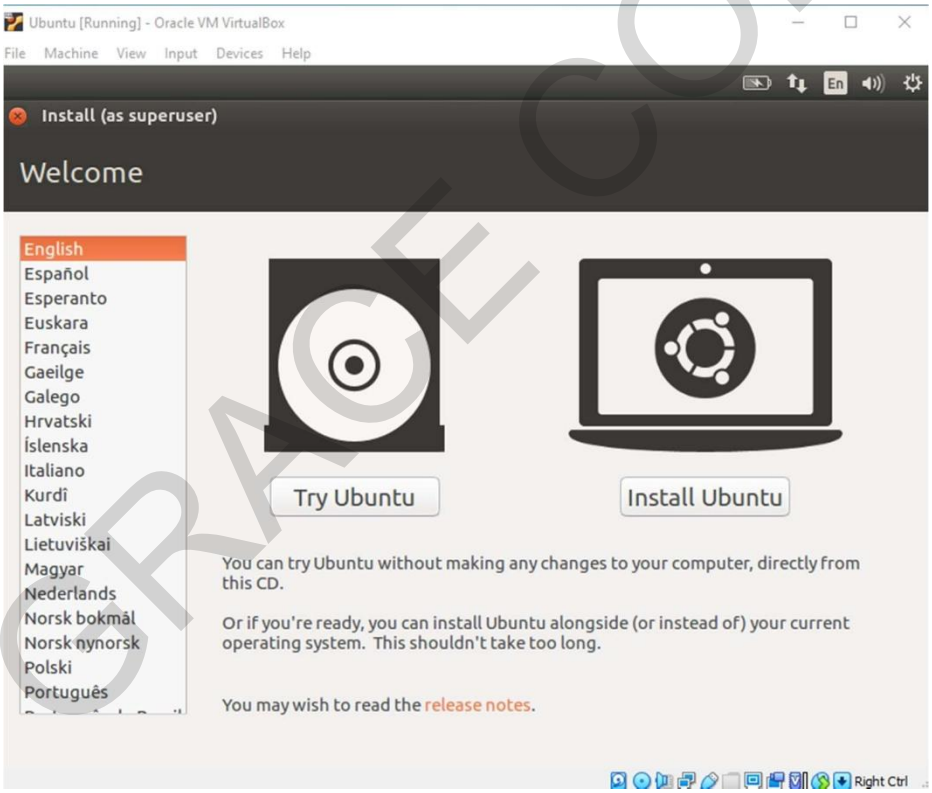
15. Browse and select the downloaded iso file. Click ok.



16. Select the newly created virtual machine in the dashboard and click start button.



17. In the welcome screen, click ‘Install Ubuntu’ button.



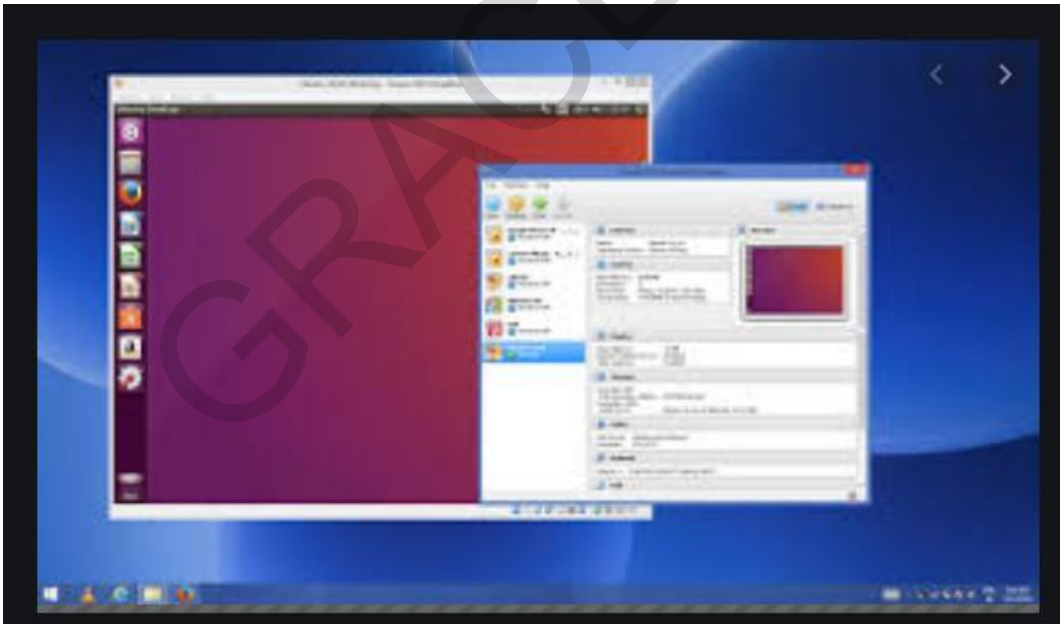
18. Click 'Continue' button.
19. Make sure 'Erase disk and install Ubuntu' option is selected and click 'Install Now' button.
20. Choose the default and click continue.
21. Setup up your profile by creating username and password.
22. After installation is complete, click 'Restart Now' button and follow the instructions.
23. The Ubuntu OS is ready to use. Login with the username and password.

OUTPUT 1:

Virtualbox on top of windows.

OUTPUT 2:

Installation of Virtual box with **Linux OS (Guest OS/VM)**on top of windows Host.



RESULT:

The Virtualbox installation is completed and the Virtual machine is created on top of windows host operating system.

EX.NO:2	INSTALL A C COMPILER IN THE VIRTUAL MACHINE

AIM:

To install a C compiler in the virtual machine and execute a sample program.

PROCEDURE:

1. Launch the virtual box and open the virtual machine (Ubuntu).
2. Run the following command in the virtual machine terminal.

   $ sudo apt update

   $ sudo apt install gcc

   It will install all the necessary packages for gcc complier.
3. Type the C program in the text editor and save the file with with .c extension.

   //demo.c

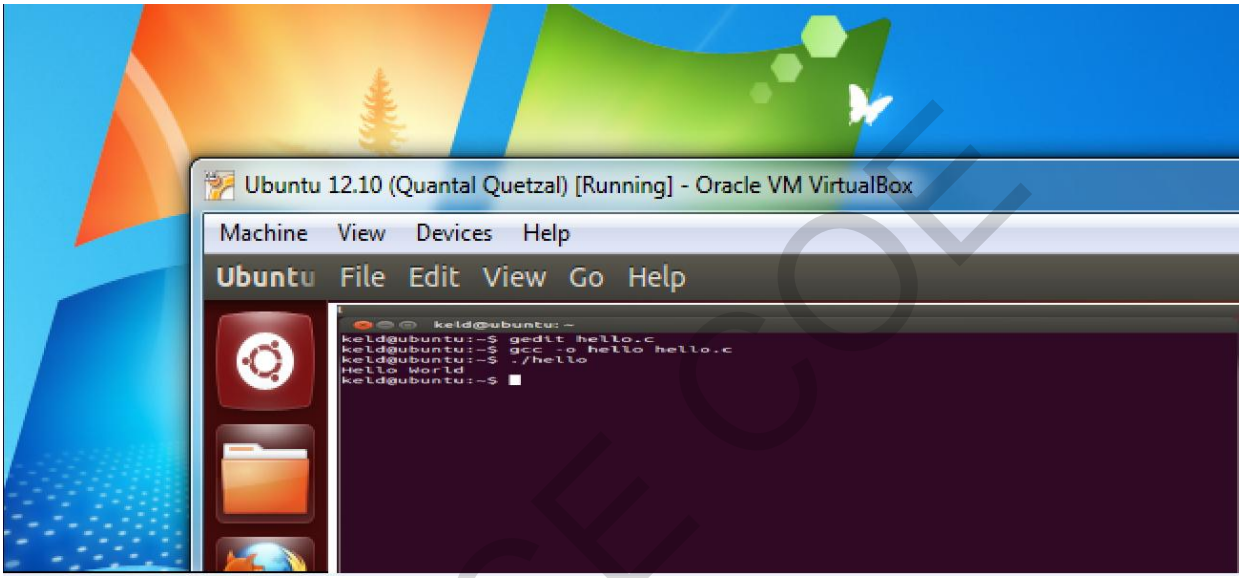
```
#include<stdio.h> int
main()
{
printf("Hello World"); return
0;
}
```

4. Compile and Run the C Program

```
cc demo.c
./a.out
```

OUTPUT:

Installation of a C compiler in the virtual machine and executing a sample program



RESULT:

Thus a C compiler is installed on a Ubuntu Virtual Machine on top of Windows Host and executed a C program on a virtual machine.

EX.NO :3	INSTALL GOOGLE APP ENGINE AND CREATE A WEB APPLICATIONS USING JAVA

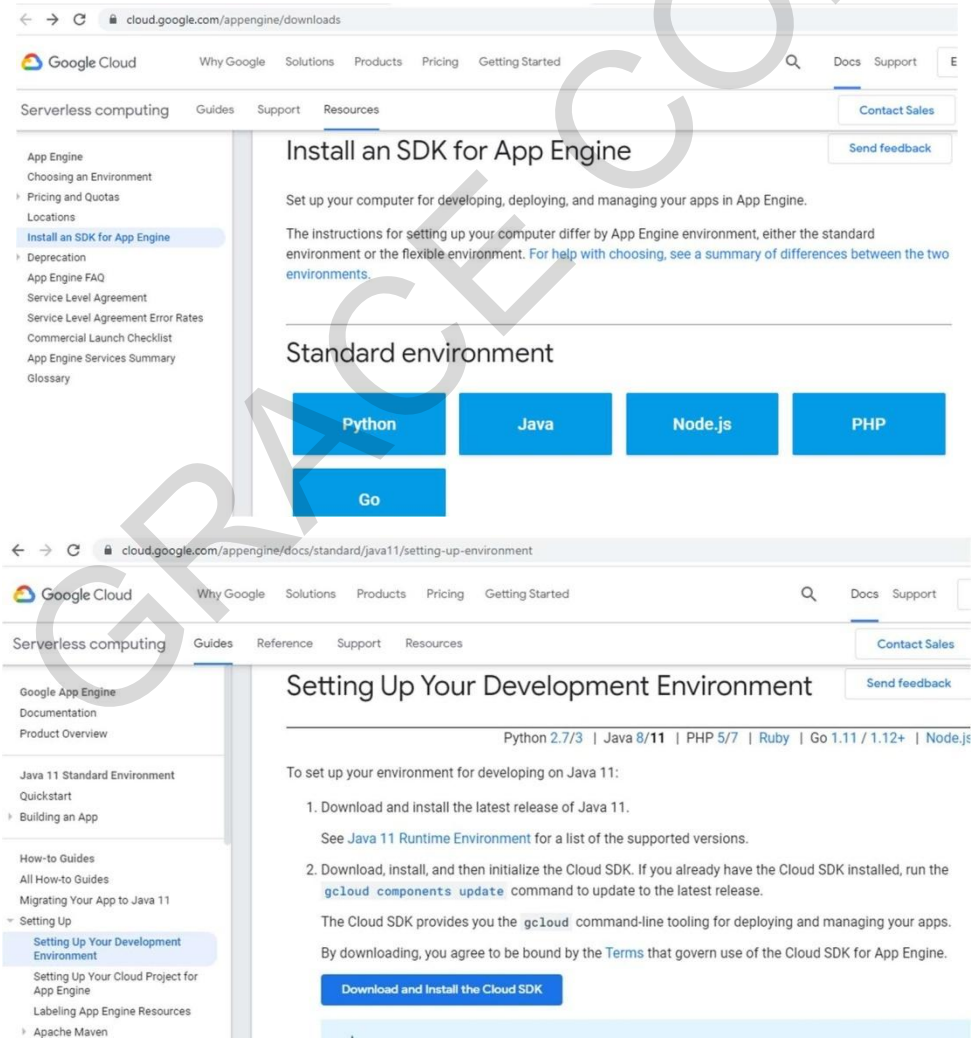
AIM:

To install Google App Engine and to create *hello world* app and other simple web applications using java.

PROCEDURE:

Google App Engine SDK Installation:

1. Download the Google Cloud SDK installer using thelink https://cloud.google.com/appengine/downloads.
2. Select the standard environment asJava.



3. Click ‘Download and Install the Cloud SDK’. Launch the installer and follow the prompts.
4. After installation has completed, the installer presents severaloptions:

   Make sure that the following are selected:

   - Start Google Cloud SDKShell
   - Run"gcloudinit"

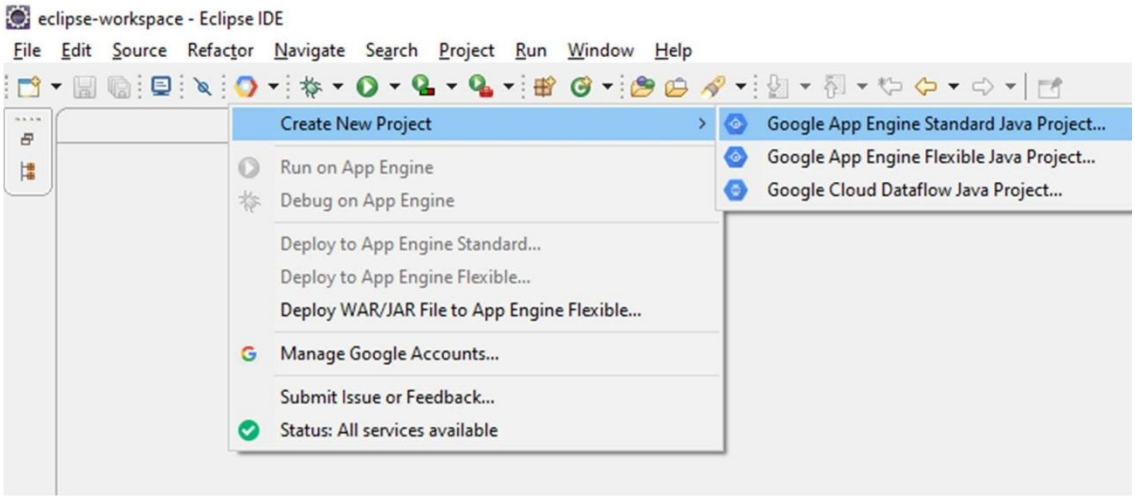
   Theinstallerthenstartsaterminalwindowandrunsthe**gcloudinit**command.

5. Run the following command in your terminal to install the gcloud component that includes the App Engine extension for Java11:

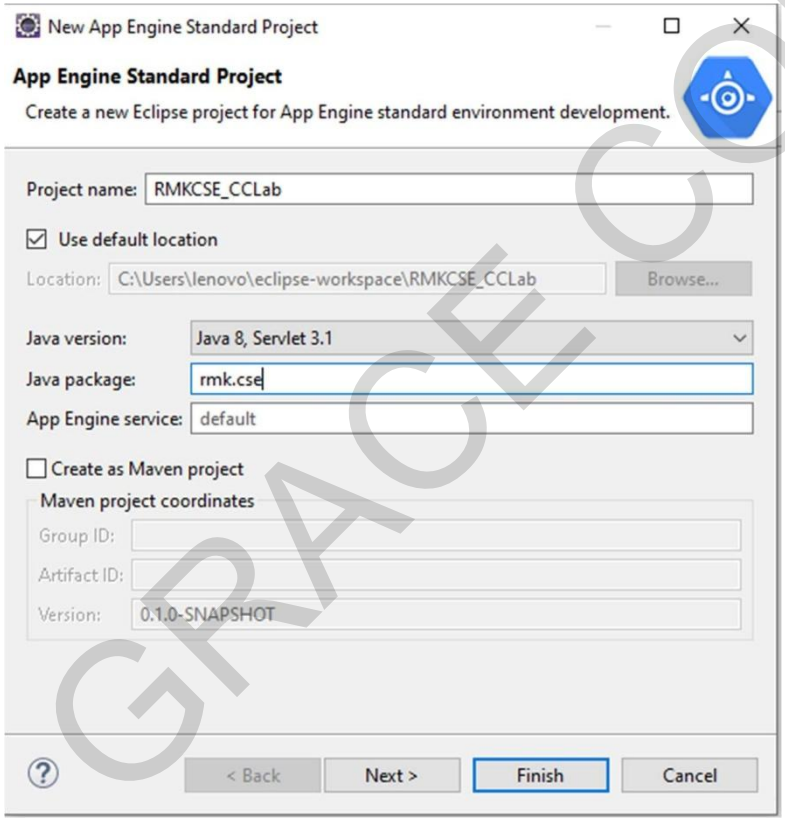
```
gcloudcomponentsinstallapp-engine-java
```

Creating a new App Engine standard project in Eclipse:

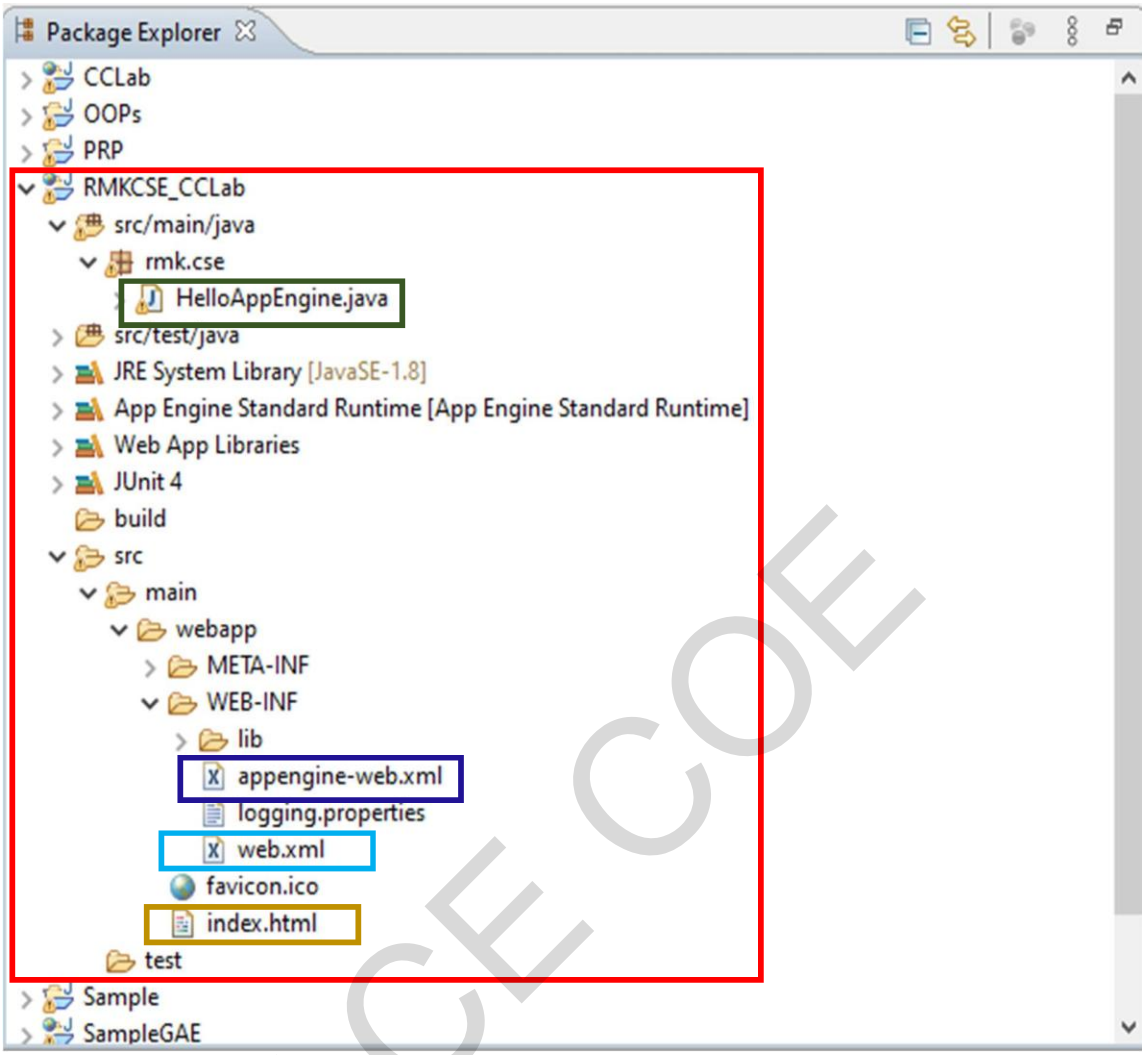
6. Eclipse with the cloud tools is used to create App Engine standardproject.
7. To install the Cloud Tools in Eclipse, select Help > Eclipse Marketplace... and search for ‘Google Cloud Tools for Eclipse’ and clickinstall.
8. After installation restart eclipse whenprompted.
9. Click the **Google Cloud Platform** toolbarbutton.
10. Select **Create New Project** >**Google App Engine Standard JavaProject**.



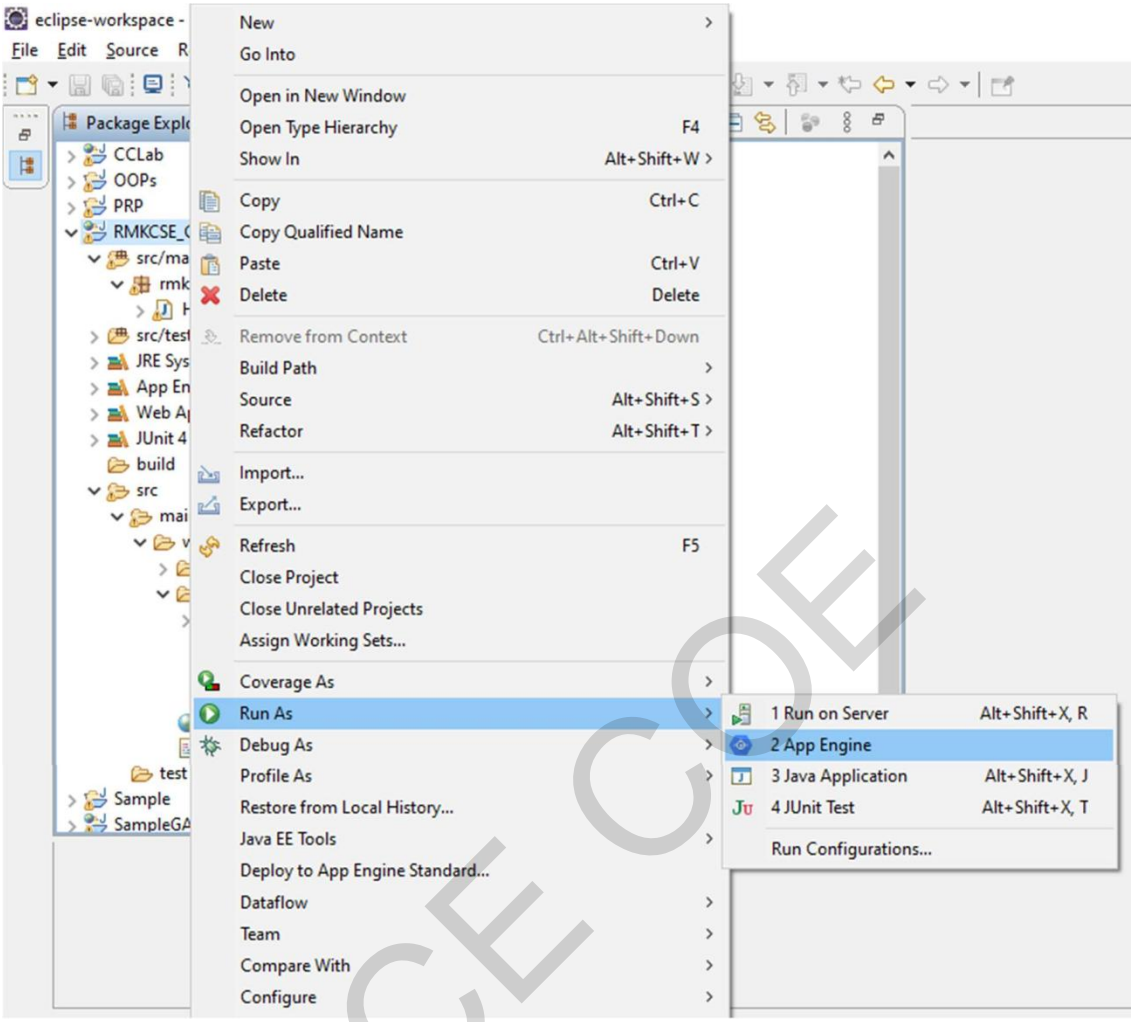
11. Enter the project name and packagename.



12. Click Next. Select the libraries required for theproject.
13. ClickFinish.
14. The wizard generates a native Eclipse project, with a simple servlet, that you can run and deploy from theIDE.



15. App Engine Java applications use the Java Servlet API to interact with the web server. Modify the defaultHelloAppEngine.java file with your application code.
16. **appengine-web.xml**is a Google App Engine specific configurationfile.
17. **web.xml**is a standard web application configurationfile.
18. Right click the project in the Package Explorer, select Run As > AppEngine.



19. Eclipse opens its internal web browser to your application. You can also open an external browser and navigate to http://localhost:8080. Either way, you'll see a static HTML page with a link to theservlet.

```
Aug 15, 2020 11:24:11 AM com.google.appengine.tools.development.AbstractModule startup
INFO: Module instance default is running at http://localhost:8080/
Aug 15, 2020 11:24:11 AM com.google.appengine.tools.development.AbstractModule startup
INFO: The admin console is running at http://localhost:8080/_ah/admin
Aug 15, 2020 4:54:11 PM com.google.appengine.tools.development.DevAppServerImpl doStart
INFO: Dev App Server is now running
```

```
//HelloAppEngine.java

package  rmk.cse;

import  java.io.IOException;

import  javax.servlet.annotation.WebServlet; import  javax.servlet.http.HttpServlet;  import
javax.servlet.http.HttpServletRequest;
import  javax.servlet.http.HttpServletResponse;

@WebServlet(
name  =  "HelloAppEngine", urlPatterns  =  {"/hello"}
)
public  classHelloAppEngine  extends  HttpServlet  {

@Override
public  voiddoGet(HttpServletRequest  request,  HttpServletResponse  response)
throws  IOException  {

response.setContentType("text/plain"); response.setCharacterEncoding("UTF-8");

response.getWriter().print("Hello  App  Engine!\r\n");

}

}

//appengine-web.xml

<?xml  version="1.0"  encoding="utf-8"?>
<appengine-web-app  xmlns="http://appengine.google.com/ns/1.0">

<threadsafe>true</threadsafe>
<sessions-enabled>false</sessions-enabled>
<runtime>java8</runtime>

<system-properties>
<property  name="java.util.logging.config.file"  value="WEB- INF/logging.properties"/>
</system-properties>


</appengine-web-app>

//web.xml

<?xml  version="1.0"  encoding="utf-8"?>
<web-app  xmlns="http://xmlns.jcp.org/xml/ns/javaee"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/javaee
http://xmlns.jcp.org/xml/ns/javaee/web-app_3_1.xsd"
version="3.1">
<welcome-file-list>
<welcome-file>index.html</welcome-file>

<welcome-file>index.jsp</welcome-file>
```

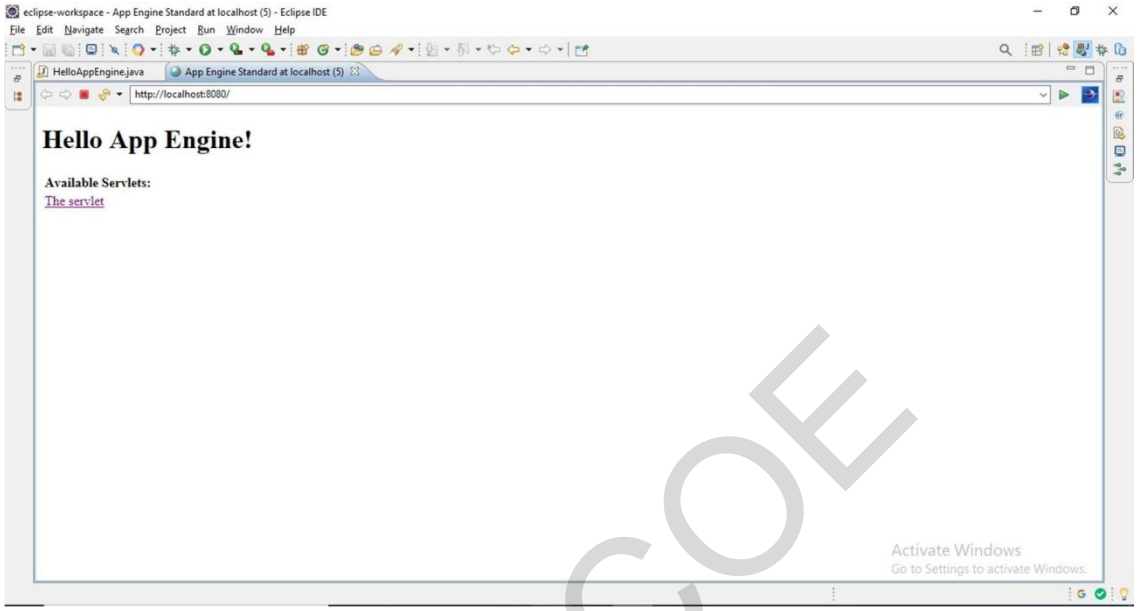
```
</welcome-file-list>

</web-app>
```

//index.html

```
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/xhtml" lang="en">
<head>
<meta http-equiv="content-type" content="application/xhtml+xml; charset=UTF-8"
/>
<title>Hello App Engine</title>
</head>

<body>
<h1>Hello App Engine!</h1>

<table>
<tr>
<td colspan="2" style="font-weight:bold;">Available Servlets:</td>
</tr>
<tr>
<td><a href='/hello'>The servlet</a></td>
</tr>
</table>
</body>

</html>
```

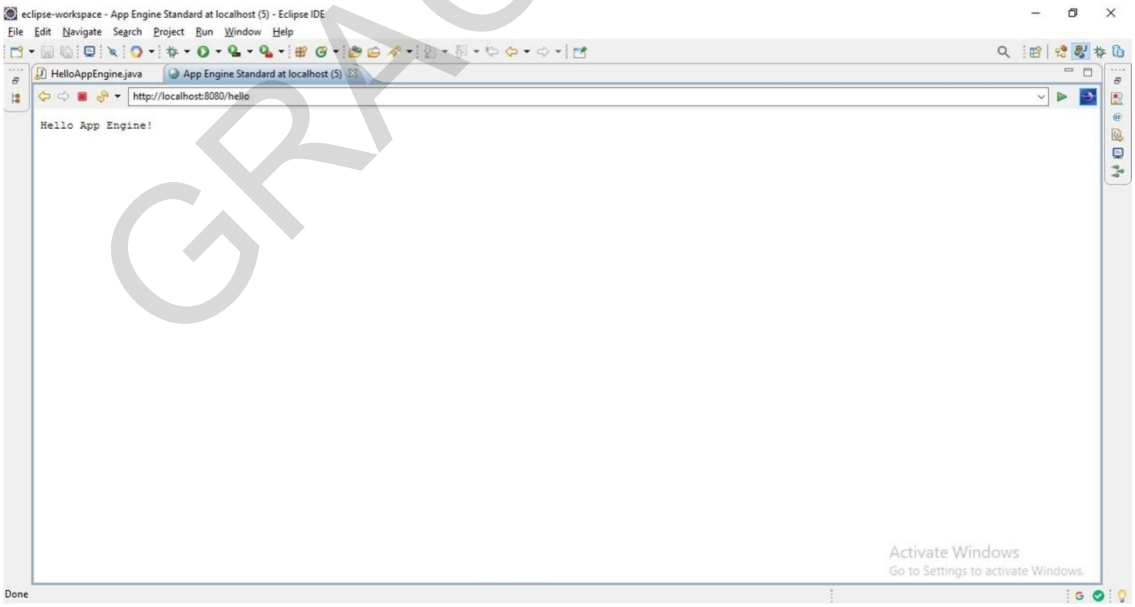
OUTPUT 1:

INSTALLATION OF A GOOGLE APP ENGINE



OUTPUT 2:

CREATION OF A WEB APPLICATIONS ON GAE



Result:

The Google App Engine is installed and *hello world* app is created in java environment.

Ex.No.4	GOOGLE APP ENGINE PYTHON HELLO WORLD EXAMPLE USING ECLIPSE

AIM:

To launch a web application using **Google App Engine** (GAE).

TOOLS USED :

In this exercise, we are going to create a GAE based Python **web project (hello world)using** Eclipse.

1. Python 2.7
2. Eclipse 3.7 + PyDev plugin
3. Google App Engine SDK for Python 1.6.4

PROCEDURE:

P.S Assume Python 2.7 and Eclipse 3.7 are installed.

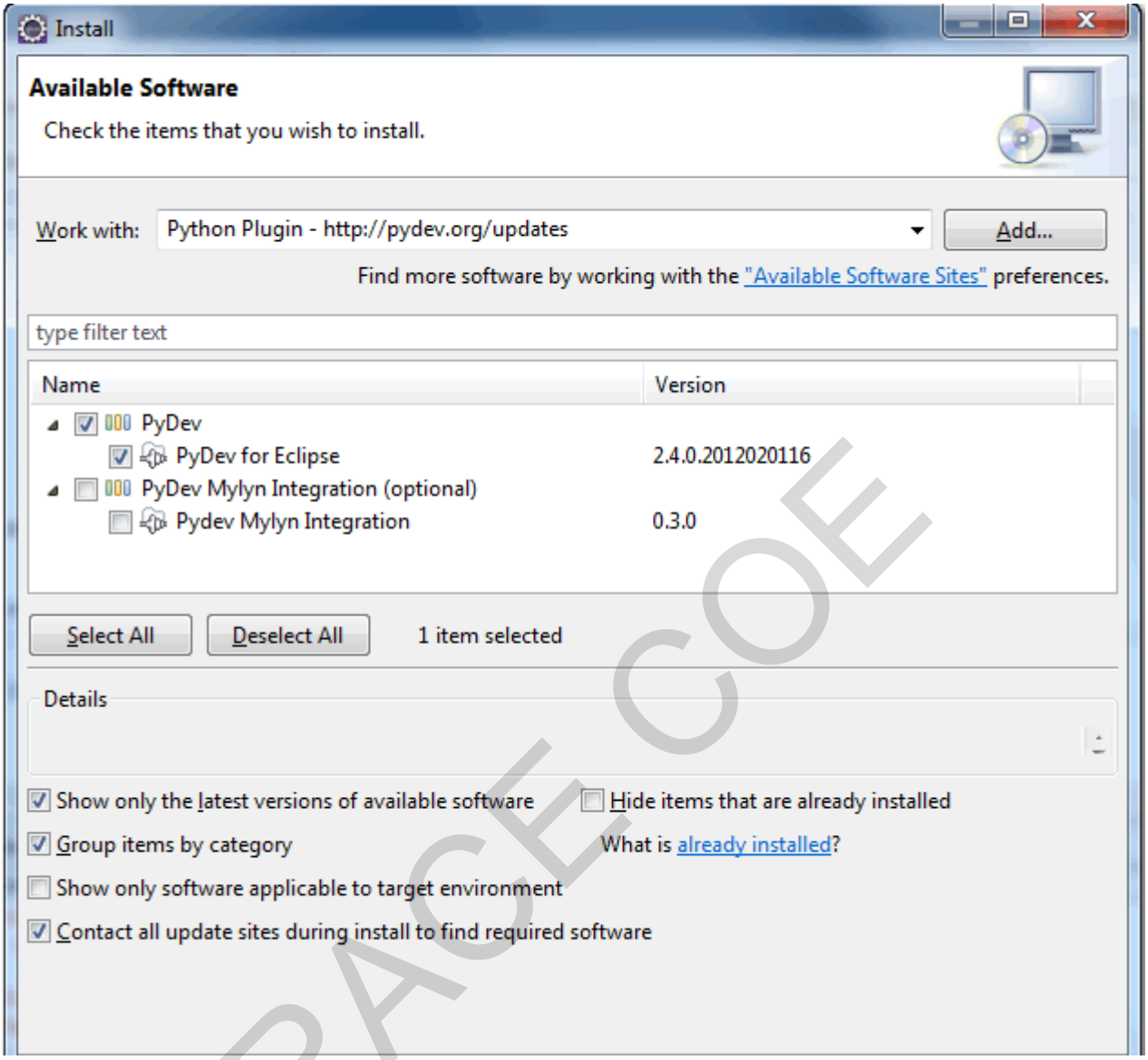
Step:1. Install PyDev plugin for Eclipse

Use following URL to install PyDev as Eclipse plugin.

http://pydev.org/updates

Figure 1 – In Eclipse , menu, "Help –> Install New Software.." and put above URL. Select "**PyDev for**

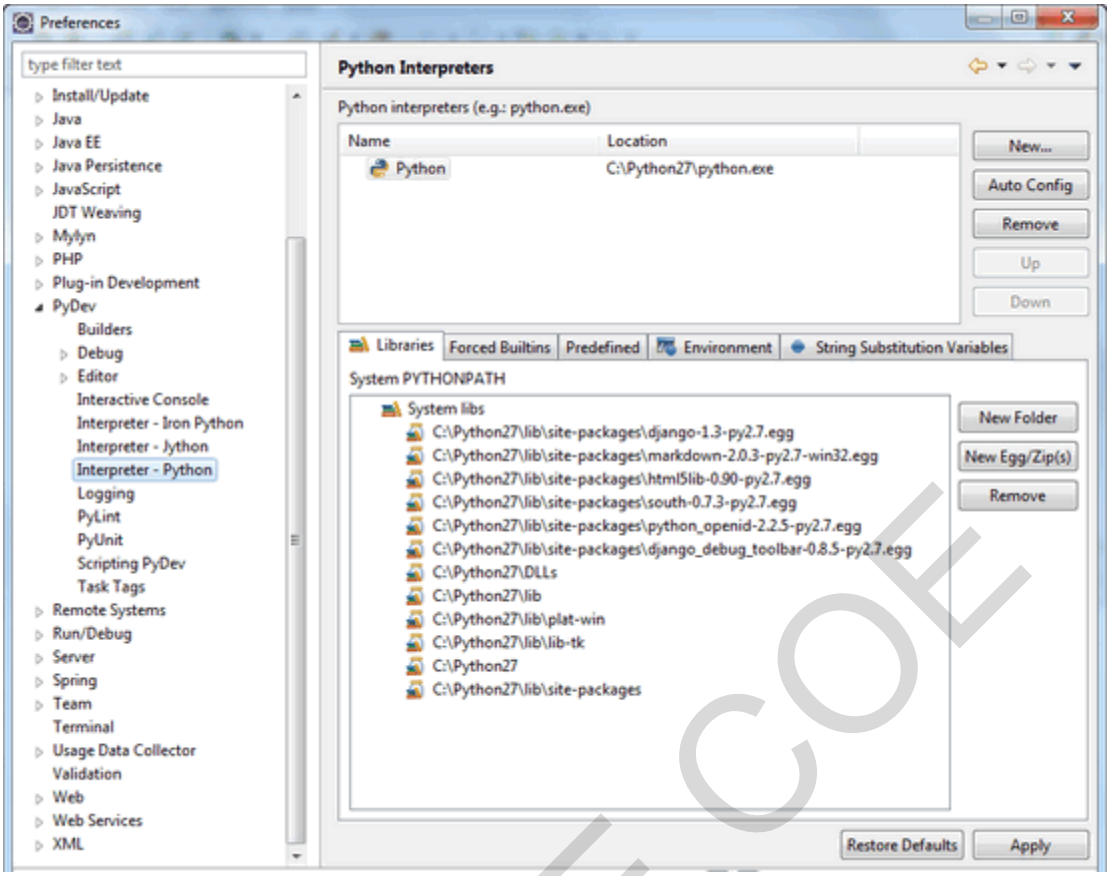
Eclipse" option, follow steps, and restart Eclipse once completed.



Step 2. Verify PyDev

After Eclipse is restarted, make sure **PyDev's interpreter** is pointed to your "`python.exe`".

Figure 2 – Eclipse -> Windows –> Preferences, make sure "**Interpreter – Python**" is configured properly.



Step:3. Google App Engine SDK Python

Download and install Google App Engine SDK for Python.

Step:4. Python Hello World in Eclipse

Following steps to show you how to create a GAE project via Pydev plugin.

Figure 4.1 – Eclipse menu, File -> New -> Other… , PyDev folder, choose "**PyDev Google App Engine**

Project".

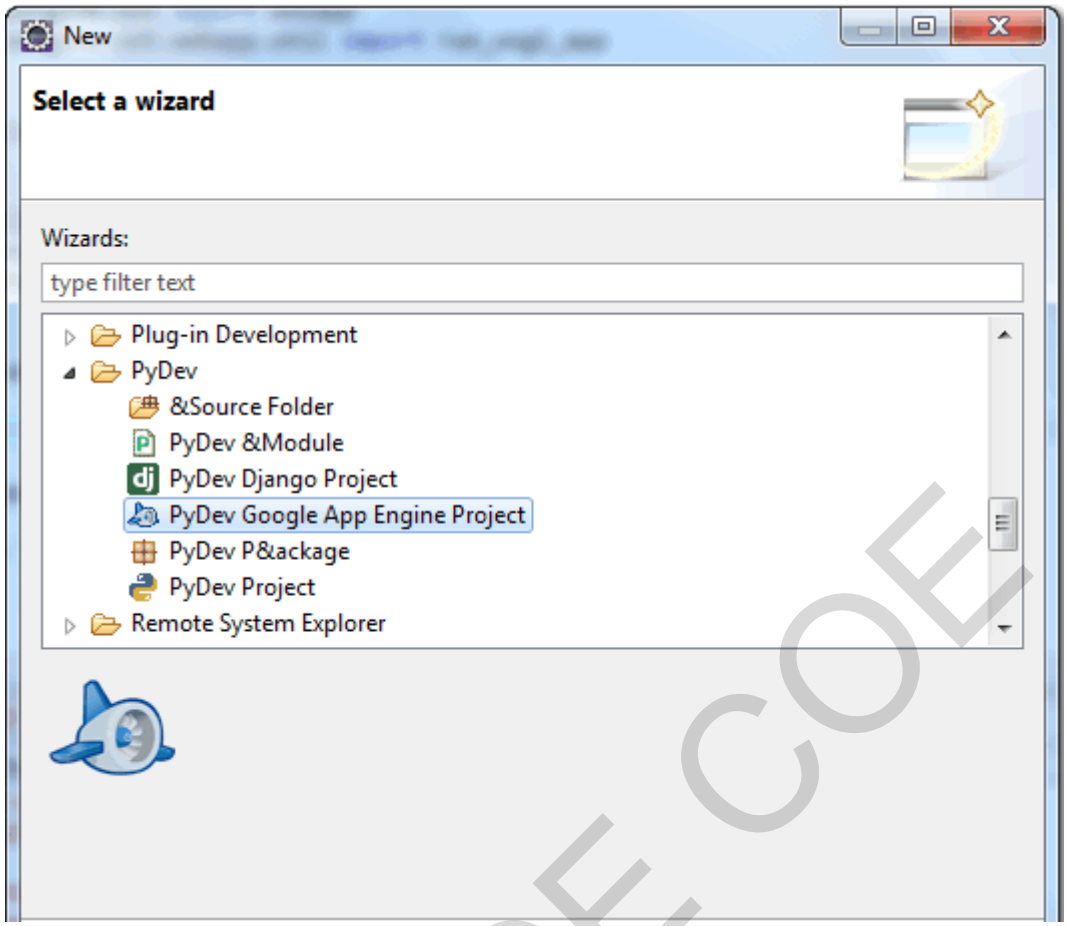


Figure 4.2 – Type project name, if the interpreter is not configure yet (in step 2), you can do it now. And select

this option – **"Create 'src' folder and add it to PYTHONPATH**".

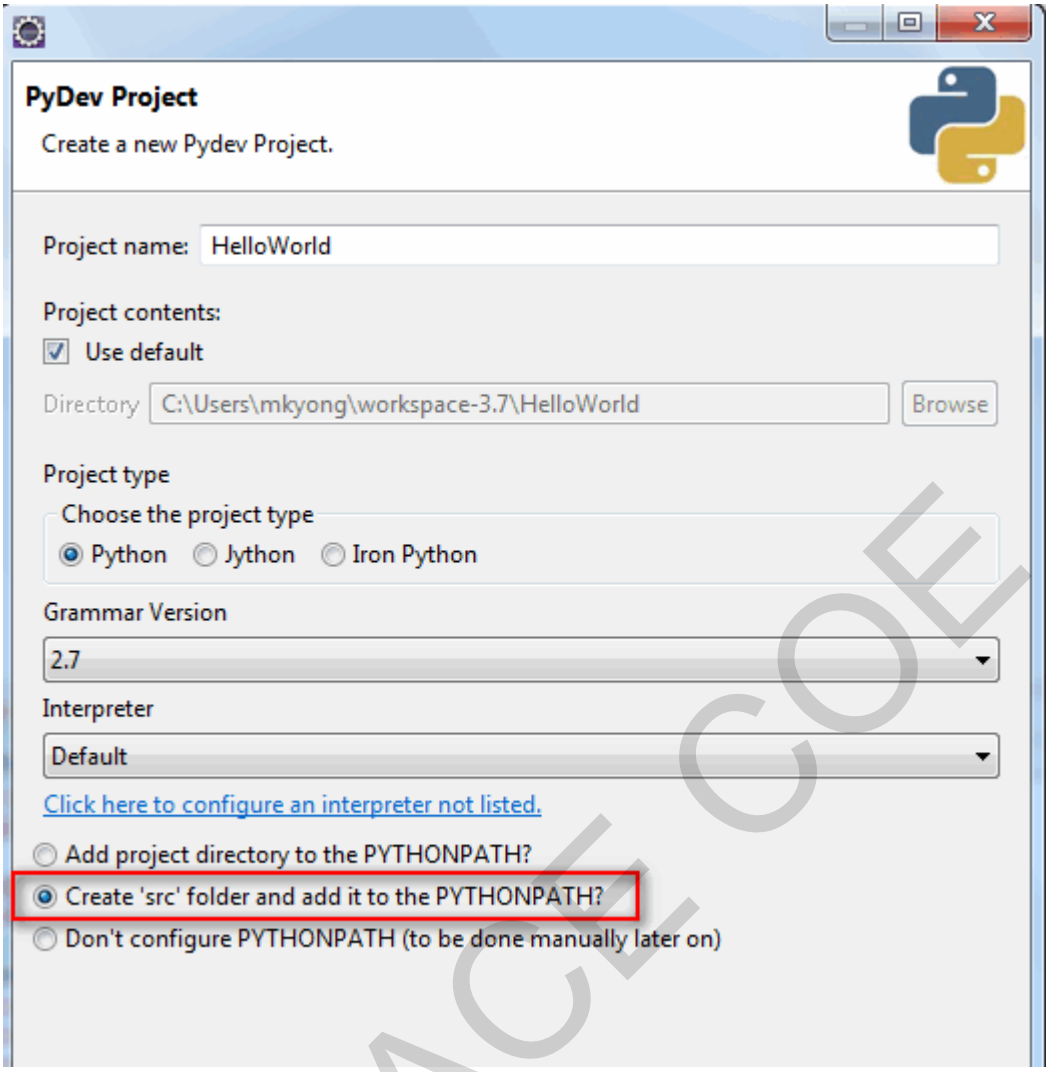


Figure 4.3 – Click "Browse" button and point it to the Google App Engine installed directory (in step 3).

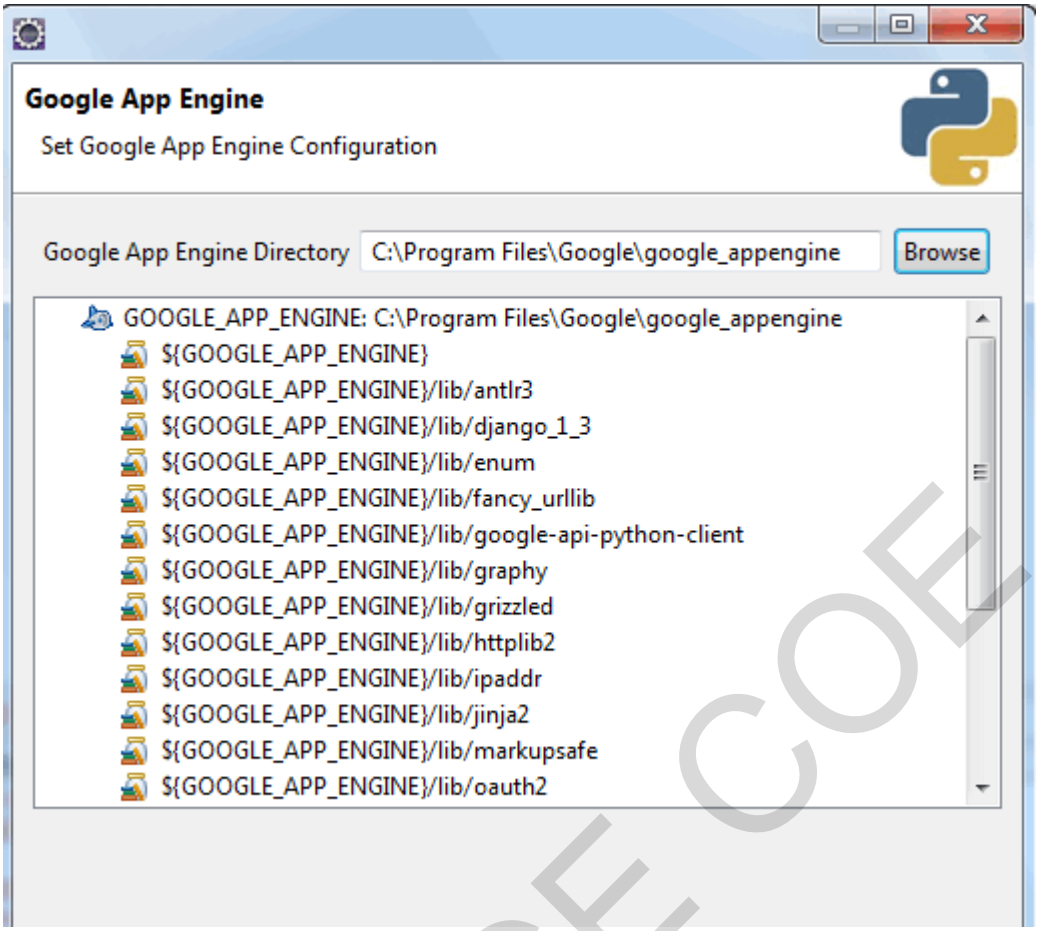


Figure 4.4 – Name your application id in GAE, type anything, you can change it later. And choose "**Hello**

Webapp World" template to generate the sample files.

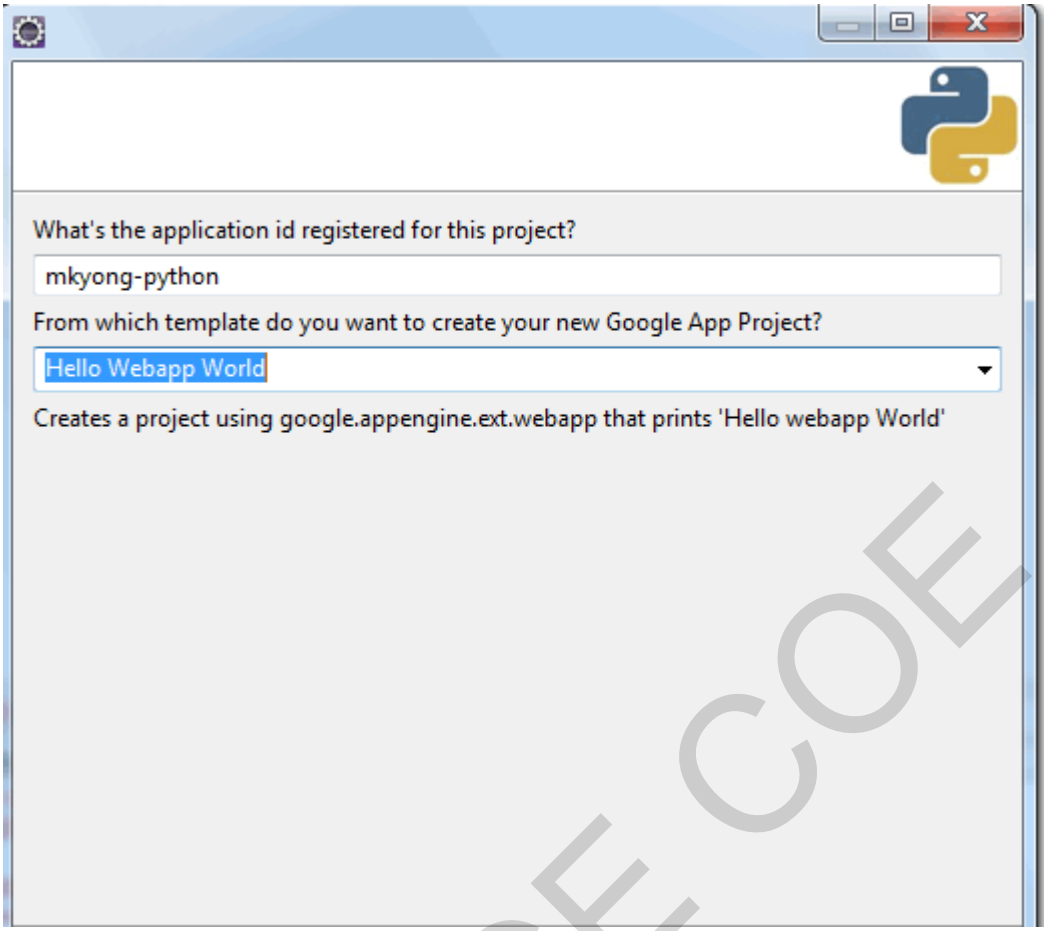
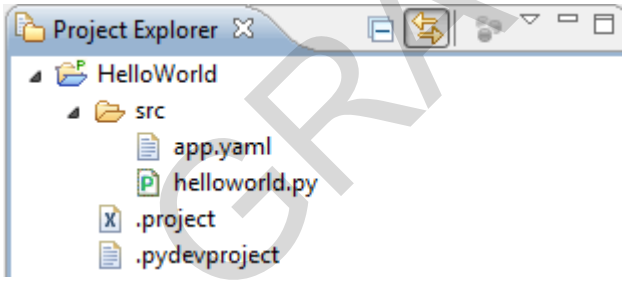


Figure 4.5 – Done, 4 files are generated, Both "`.pydevproject`" and "`.project`" are Eclipse project files, ignore it.



Review the generated Python's files :

File : helloworld.py – Just output a hello world.

```
from google.appengine.ext import webapp
from google.appengine.ext.webapp.util import run_wsgi_app

class MainPage(webapp.RequestHandler):

    def get(self):
```

```
        self.response.headers['Content-Type'] = 'text/plain'
        self.response.out.write('Hello, webapp World!')

application = webapp.WSGIApplication([('/', MainPage)], debug=True)

def main():
   run_wsgi_app(application)

if __name__ == "__main__":
   main()
```
Copy

File : app.yaml – GAE need this file to run and deploy your Python project, it's quite self-explanatory, for

detail syntax and configuration, visit yaml and app.yaml reference.

```
application: mkyong-python
version: 1
runtime: python
api_version: 1

handlers:
- url: /.*
  script: helloworld.py
```
Copy

Step:5. Run it locally

To run it locally, right click on the `helloworld.py`, choose "Run As" –> "Run Configuration", create a new

"**PyDev Google App Run**".

Figure 5.1 – In Main tab -> Main module, manually type the directory path of "**dev_appserver.py**".

"Browse" button is not able to help you, type manually.

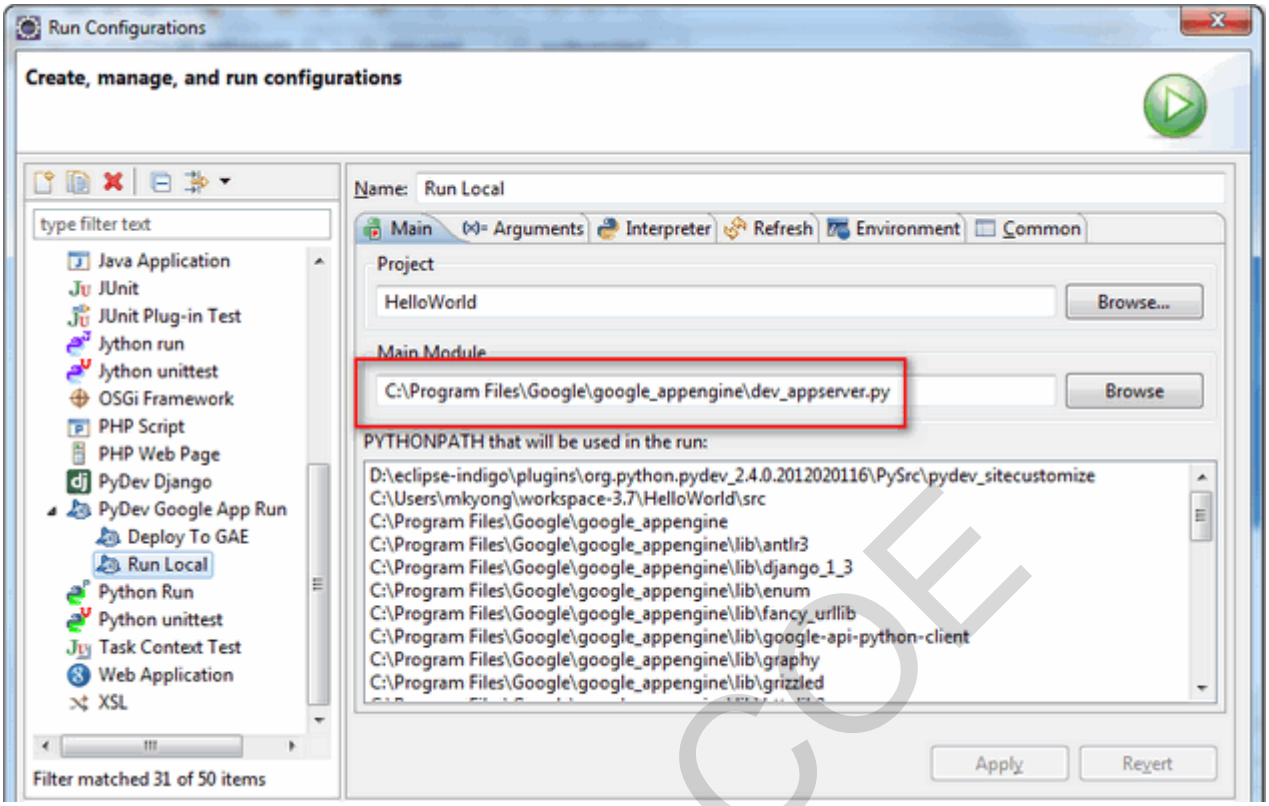


Figure 5.2 – In Arguments tab -> Program arguments, put "**${project_loc}/src**".

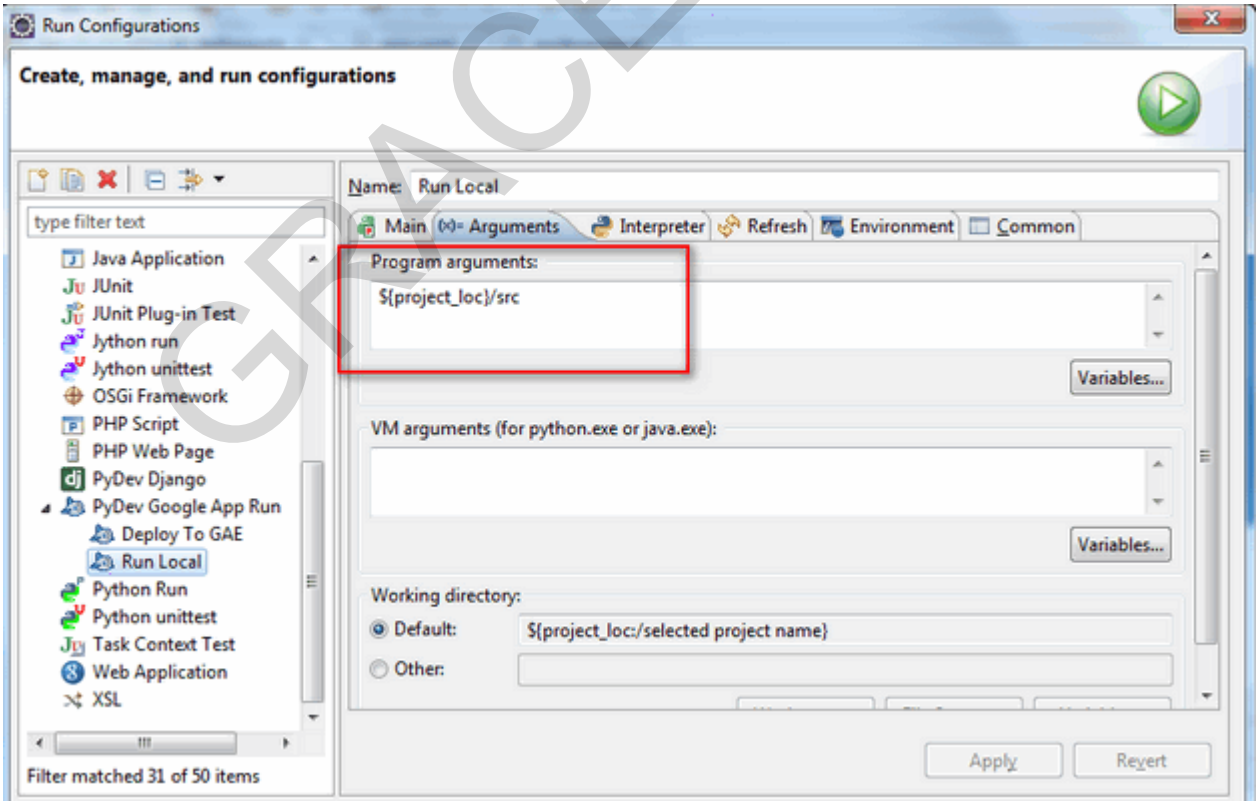


Figure 5.3 – Run it. By default, it will deploy to *http://localhost:8080*.

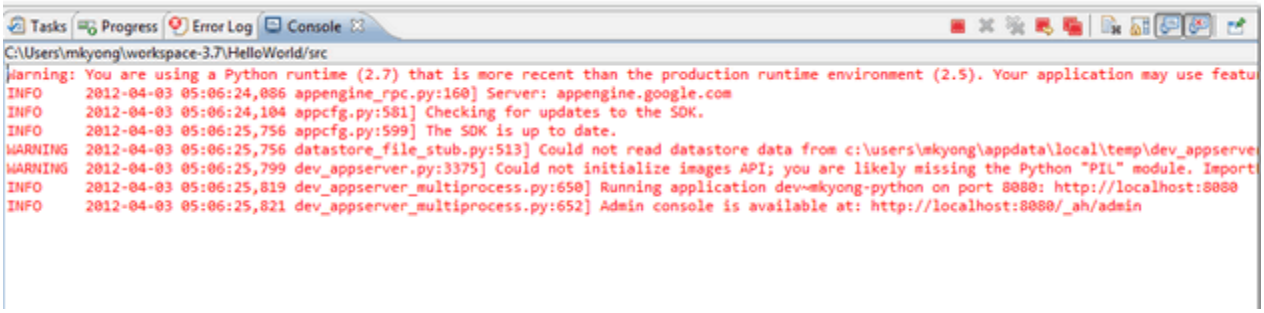
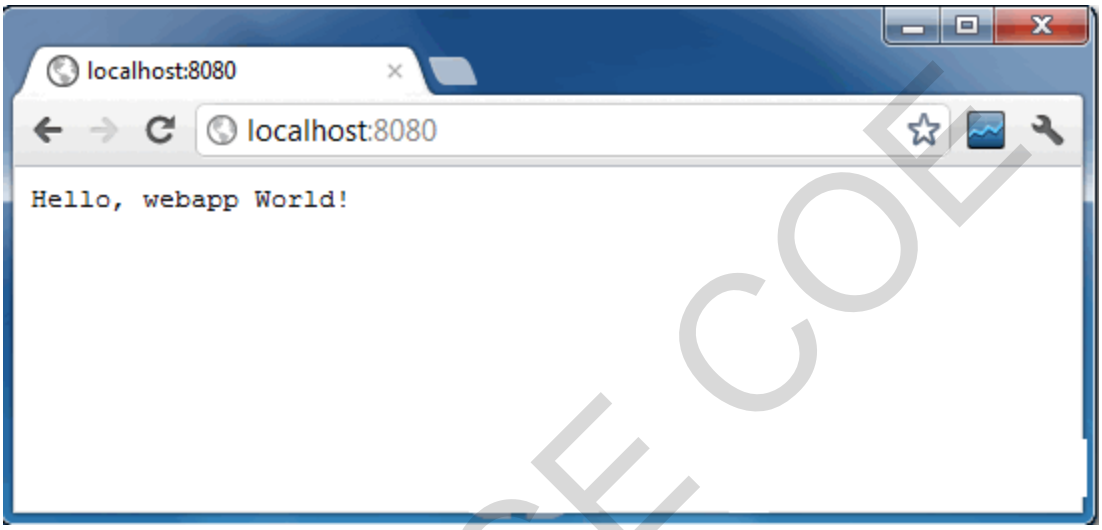


Figure 5.4 – Done.



5. Deploy to Google App Engine

Register an account on https://appengine.google.com/, and create an application ID for your web

application. Review "`app.yaml`" again, this web app will be deployed to GAE with application ID

"**mkyong-python**".

File : app.yaml

```
application: mkyong-python
version: 1
runtime: python
api_version: 1

handlers:
- url: /.*
  script: helloworld.py
```

Copy

To deploy to GAE, see following steps :

Figure 5.1 – Create another new "PyDev Google App Run", In Main tab -> Main module, manually type

the directory path of "**appcfg.py**".

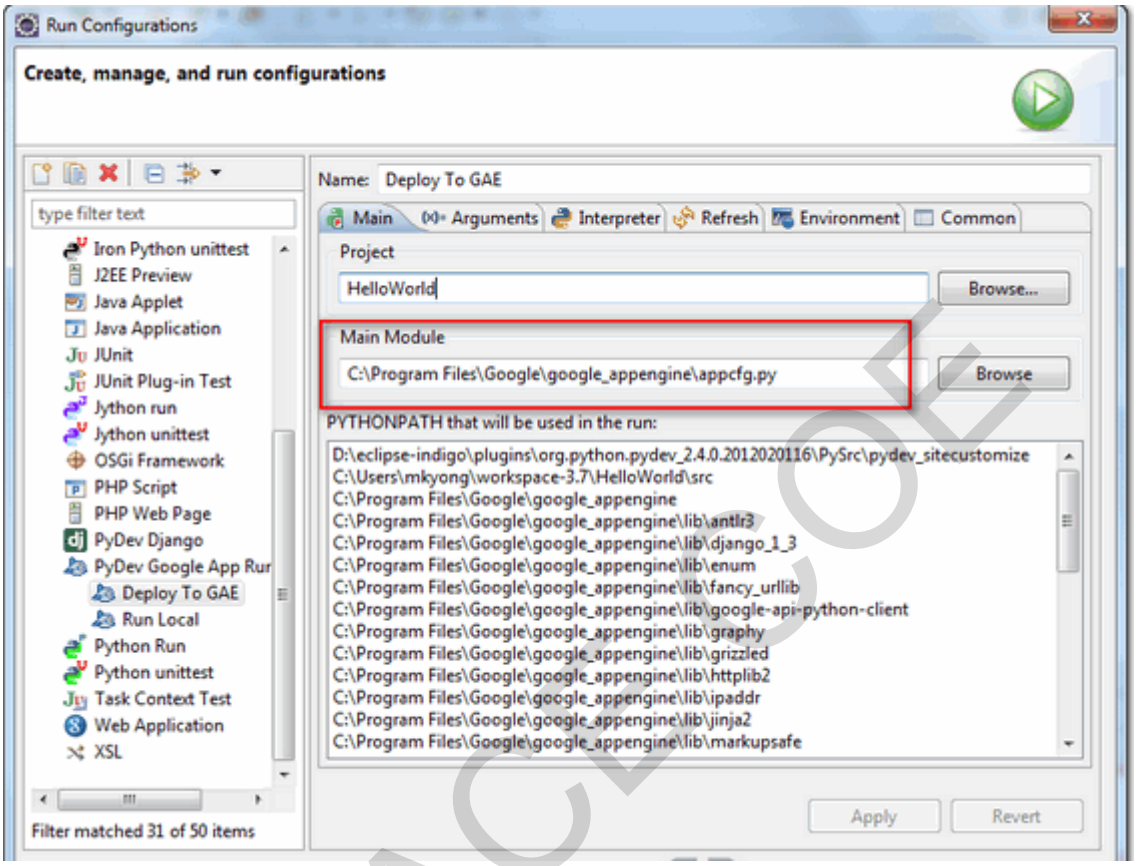


Figure 5.2 – In Arguments tab -> Program arguments, put "**update ${project_loc}/src**".

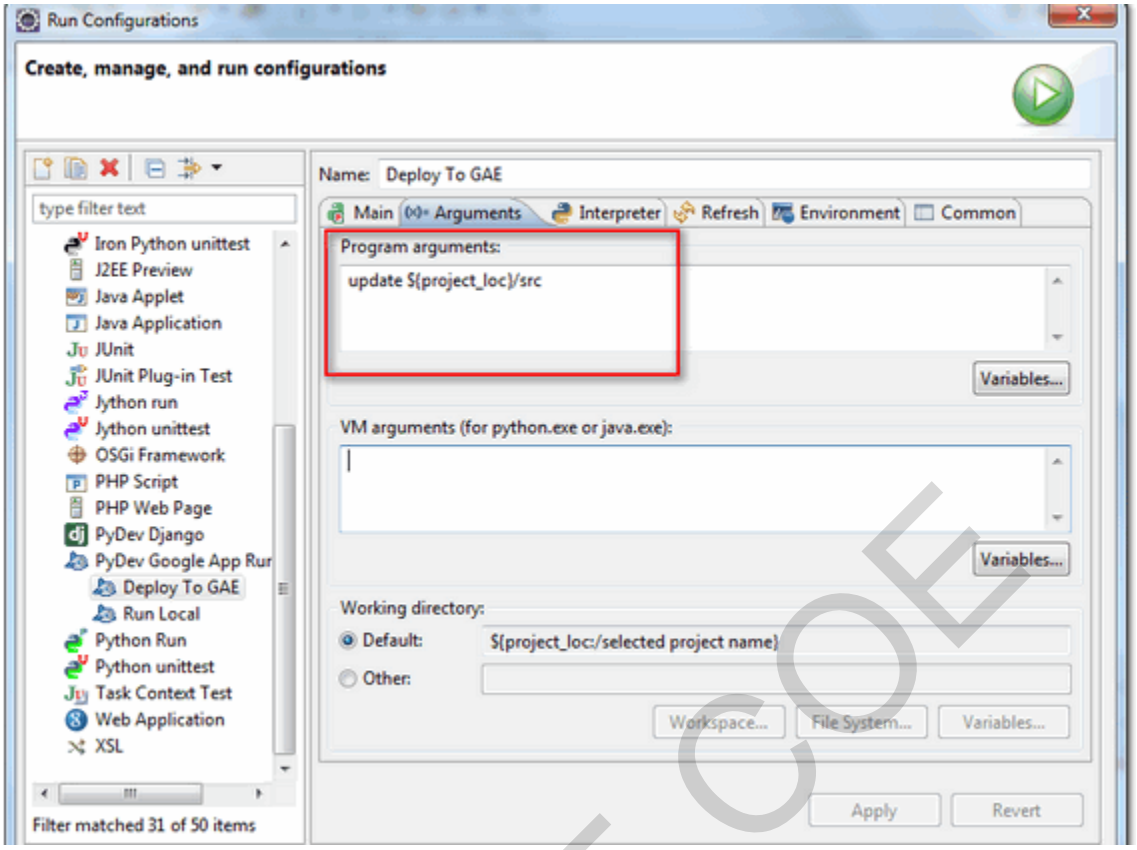


Figure 5.3 – During deploying process, you need to type your GAE email and password for authentication.

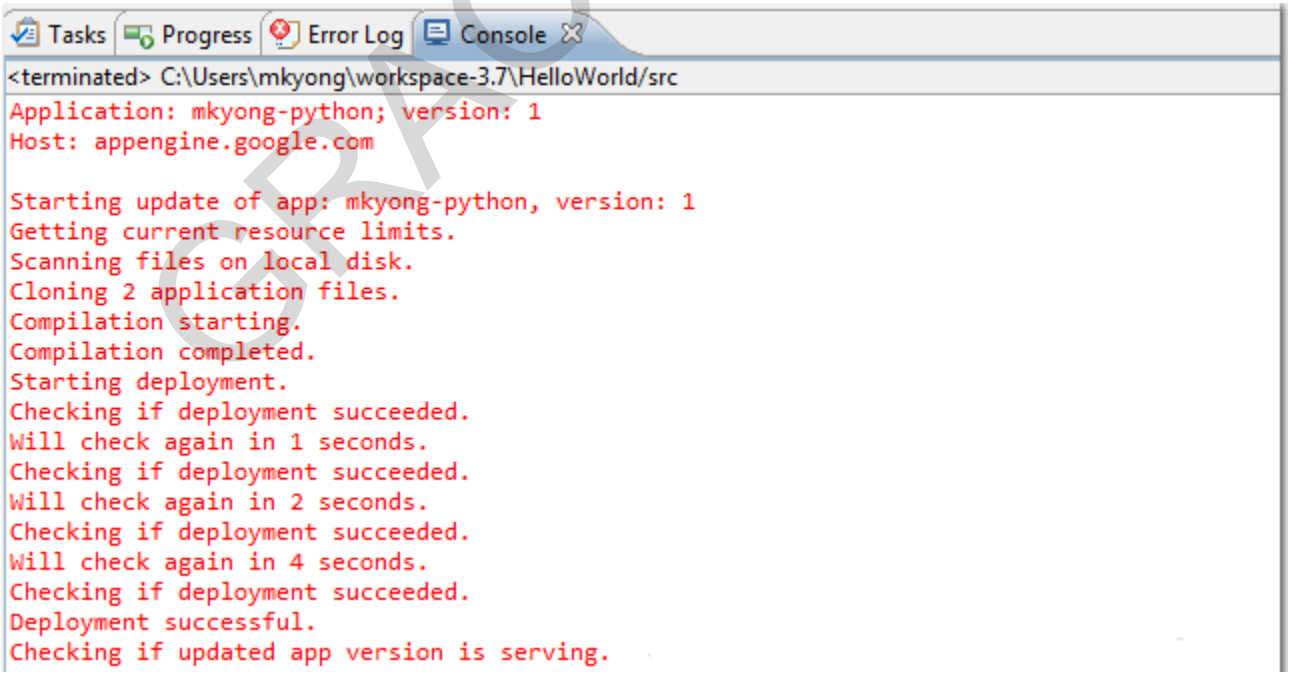
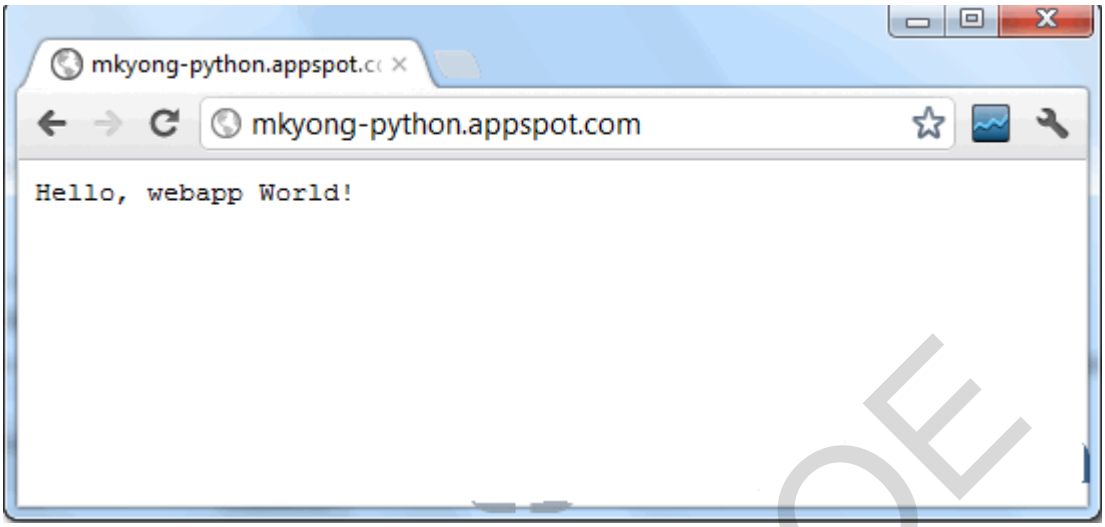


Figure 5.4 – If success, the web app will be deployed to – http://mkyong-python.appspot.com/.

OUTPUT:



RESULT:

Thus a hello world web application has been launched using GAE.

EX.NO:5	SIMULATE A CLOUD SCENARIO USING CLOUDSIM AN RUN A SCHEDULING ALGORITHM

Aim:

To Simulate a cloud scenario using CloudSim and run a scheduling algorithm

Procedure:

What is Cloudsim?

CloudSim is a simulation toolkit that supports the modeling and simulation of the core functionality of cloud, like job/task queue, processing of events, creation of cloud entities(datacenter, datacenter brokers, etc), communication between different entities, implementation of broker policies, etc. This toolkit allows to:

- Test application services in a repeatable and controllable environment.
- Tune the system bottlenecks before deploying apps in an actual cloud.
- Experiment with different workload mix and resource performance scenarios on simulated infrastructure for developing and testing adaptive application provisioning techniques

Core features of CloudSim are:

- The Support of modeling and simulation of large scale computing environment as federated cloud data centers, virtualized server hosts, with customizable policies for provisioning host resources to virtual machines and energy-aware computational resources
- It is a self-contained platform for modeling cloud's service brokers, provisioning, and allocation policies.
- It supports the simulation of network connections among simulated system elements.
- Support for simulation of federated cloud environment, that inter-networks resources from both private and public domains.
- Availability of a virtualization engine that aids in the creation and management of multiple independent and co-hosted virtual services on a data center node.
- Flexibility to switch between space shared and time shared allocation of processing cores to virtualized services.

How to use CloudSim in Eclipse:

CloudSim is written in Java. The knowledge you need to use CloudSim is basic Java programming and some basics about cloud computing. Knowledge of programming IDEs such as Eclipse or NetBeans is also helpful. It is a library and, hence, CloudSim does not have to be installed. Normally, you can unpack the downloaded package in any directory, add it to the Java classpath and it is ready to be used. Please verify whether Java is available on your system.

To use CloudSim in Eclipse:

1. Download CloudSim installable files
from https://code.google.com/p/cloudsim/downloads/list and unzip
2. Open Eclipse
3. Create a new Java Project: File -> New

4. Import an unpacked CloudSim project into the new Java Project
5. The first step is to initialise the CloudSim package by initialising the CloudSim library, as follows:
CloudSim.init(num_user, calendar, trace_flag)
6. Data centres are the resource providers in CloudSim; hence, creation of data centres is a second step. To create Datacenter, you need the DatacenterCharacteristics object that stores the properties of a data centre such as architecture, OS, list of machines, allocation policy that covers the time or spaceshared, the time zone and its price:
Datacenter datacenter9883 = new Datacenter(name, characteristics, new VmAllocationPolicySimple(hostList), stor
7. The third step is to create a broker:
DatacenterBroker broker = createBroker();
8. The fourth step is to create one virtual machine unique ID of the VM, userId ID of the VM's owner, mips, number Of Pes amount of CPUs, amount of RAM, amount of bandwidth, amount of storage, virtual machine monitor, and cloudletScheduler policy for cloudlets:
Vm vm = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared())
9. Submit the VM list to the broker:
broker.submitVmList(vmlist)
10. Create a cloudlet with length, file size, output size, and utilisation model:
Cloudlet cloudlet = new Cloudlet(id, length, pesNumber, fileSize, outputSize, utilizationModel, utilizationModel,
11. Submit the cloudlet list to the broker:
broker.submitCloudletList(cloudletList)
12. Start the simulation:
CloudSim.startSimulation()
Sample Output from the Existing Example:

```
Starting CloudSimExample1...
Initialising...
Starting CloudSim version 3.0
Datacenter_0 is starting...
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>null
Broker is starting...
Entities started.
0.0: Broker: Cloud Resource List received with 1 resource(s)
0.0: Broker: Trying to Create VM #0 in Datacenter_0
0.1: Broker: VM #0 has been created in Datacenter #2, Host #0
0.1: Broker: Sending cloudlet 0 to VM #0
400.1: Broker: Cloudlet 0 received
400.1: Broker: All Cloudlets executed. Finishing...
400.1: Broker: Destroying VM #0
Broker is shutting down...
Simulation: No more future events
CloudInformationService: Notify all CloudSim entities for shutting down.
Datacenter_0 is shutting down...
Broker is shutting down...
Simulation completed.
Simulation completed.
```

OUTPUT:

Cloudlet ID STATUS Data center ID VM ID Time Start Time Finish Time
0 SUCCESS 2 0 400 0.1 400.1
*****Datacenter: Datacenter_0*****
User id Debt
3 35.6

CloudSimExample1 finished!

RESULT:

Thus a hello world web application has been launched using GAE.

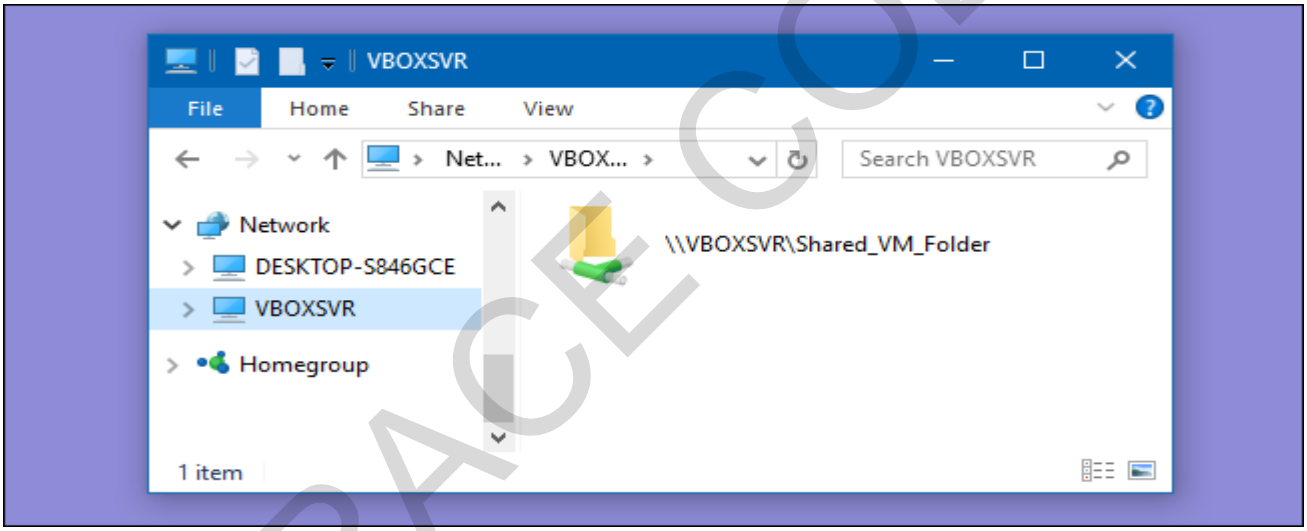
EX.NO:6	COPY FILES FROM ONE VIRTUAL MACHINE TO ANOTHER

AIM:

To write a procedure to copy files from one virtual machine to another

PROCEDURE:

1.Create one shared folder in virtual box



VirtualBox

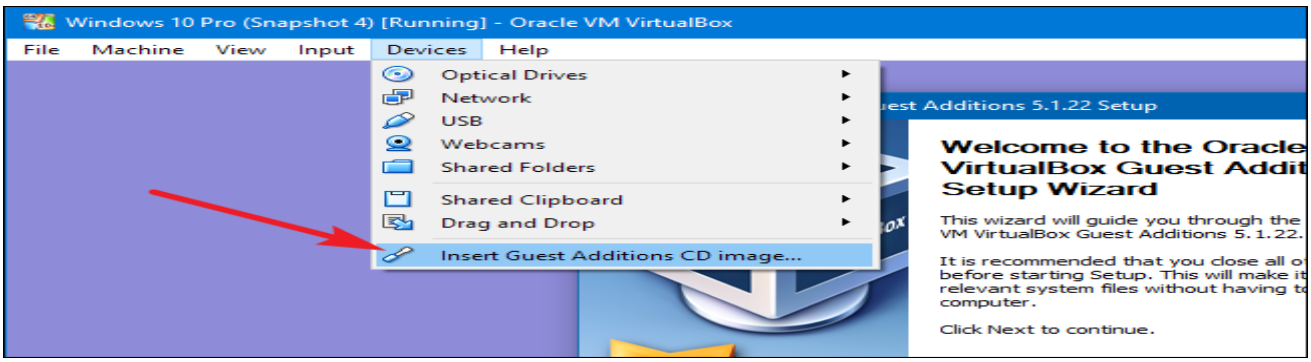
VirtualBox's Shared Folders feature works with both Windows and Linux guest operating systems. To use

the feature, you first need to install VirtualBox's Guest Additions in the guest virtual machine.

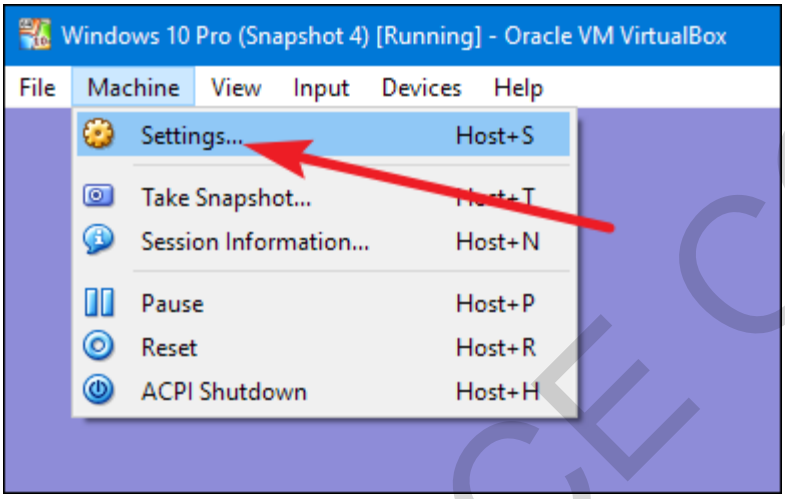
With the virtual machine running, click the "Devices" menu and choose the "Insert Guest Additions CD

image" option. This inserts a virtual CD that you can use within the guest operating system to install the

Guest Additions.



After the Guest Additions are installed, open the "Machine" menu and click the "Settings" option.



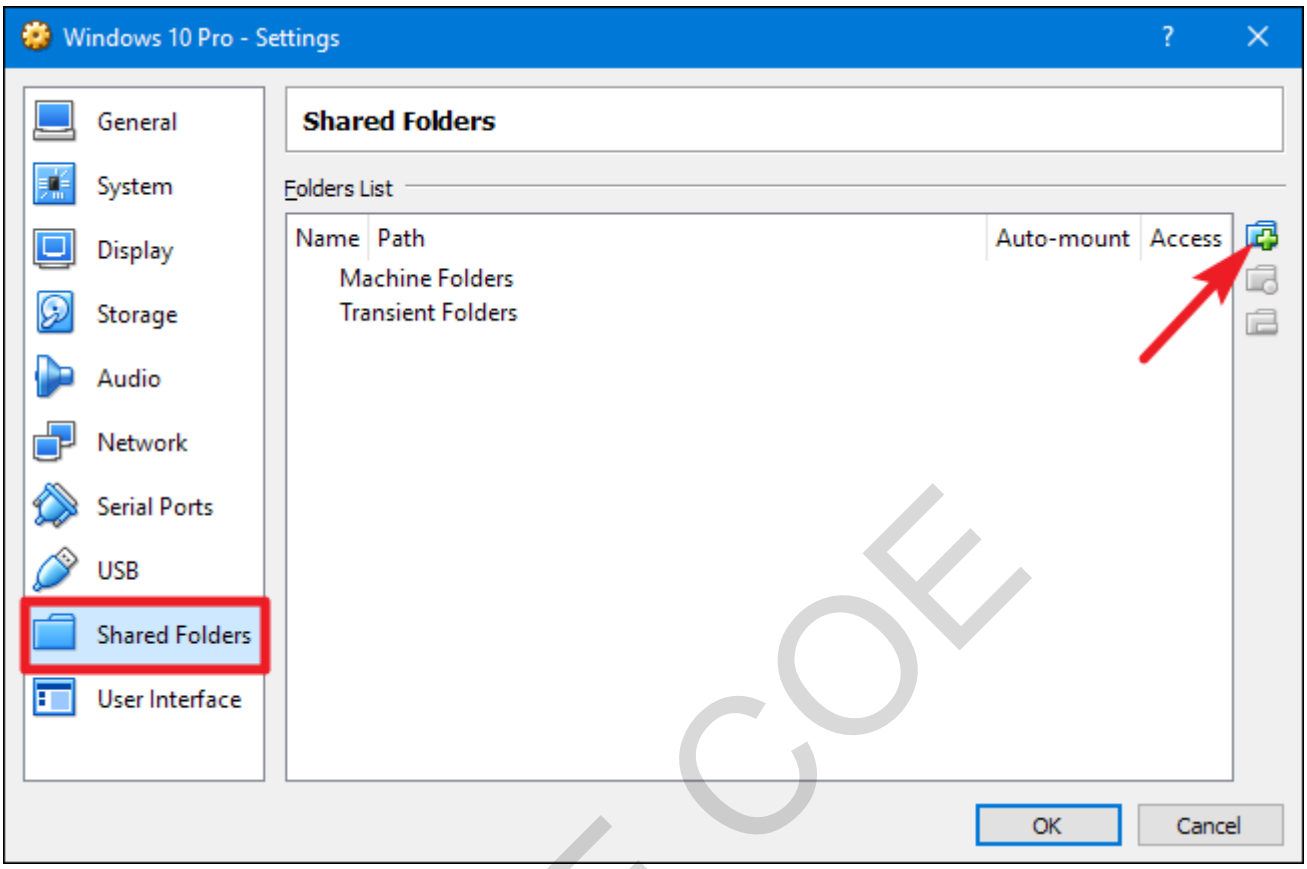
In the "Settings" window, switch to the "Shared Folders" tab. Here you can see any shared folders you've

set up. There are two types of shared folders. Machine Folders are permanent folders that are shared until

you remove them. Transient Folders are temporary and are automatically removed when you restart or shut down

the virtual machine.

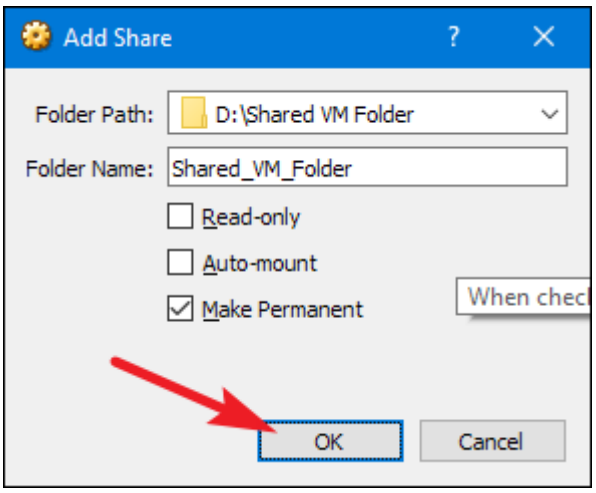
Click the "Add" button (the folder with a plus on it) to create a new shared folder.



In the “Add Share” window, you can specify the following:

- **Folder Path:** This is the location of the shared folder on your host operating system (your real PC).
- **Folder Name:** This is how the shared folder will appear inside the guest operating system.
- **Read-only:** By default, the virtual machine has full read-write access to the shared folder. Enable the
- “Read-only” checkbox if you want the virtual machine only to be able to read files from the shared
- folder, but not modify them.
- **Auto-mount:** This option makes the guest operating system attempt to automatically mount the folder
- when it boots.
- **Make Permanent:** This option makes the shared folder a Machine Folder. If you don’t select this
- option, it becomes a transient folder that is removed with the virtual machine restarts.

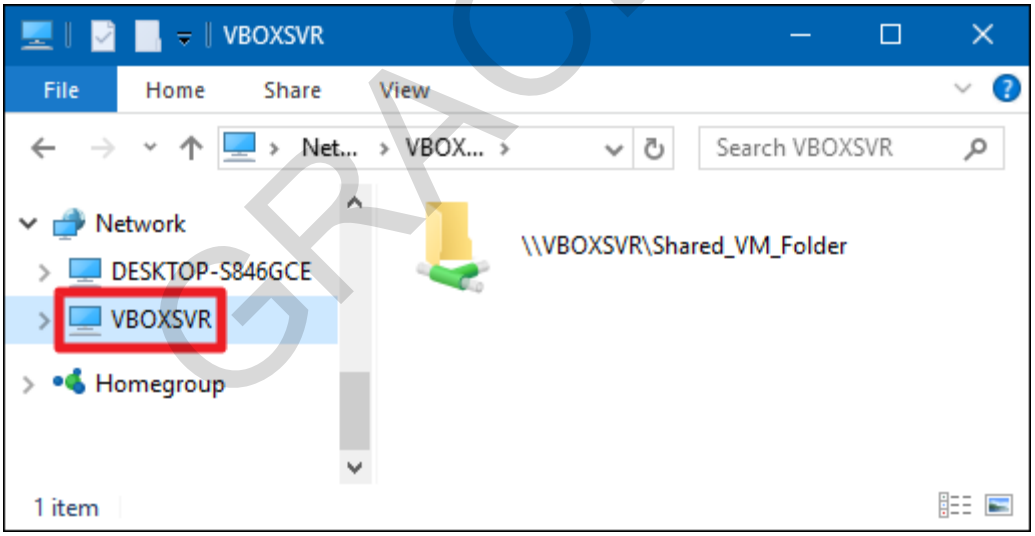
Make all your choices and then hit the “OK” button.



You should now see the shared folders appear as network file shares. If you're using a Windows guest operating system, open File Explorer, select "Network", and then look under the "VBOXSRV" computer.

OUTPUT:

"VBOXSRV" contains shared files.



RESULT:

Thus a procedure to copy files from one virtual ,machine to another virtual machine was executed successfully.

Ex.No.7	CREATE, DEPLOY AND LAUNCH VIRTUAL MACHINES IN OPENSTACK

AIM:

To Write a procedure to create ,deploy and launch a virtul machine s in open stack.

REQUIREMENTS

1. Install OpenStack in RHEL and CentOS 7
2. Configure OpenStack Networking Service

PROCEDURE:

Step 1: Allocate Floating IP to OpenStack

1. Before you deploy an **OpenStack** image, first you need to assure that all pieces are in place and we'll
2. start by allocating floating IP.

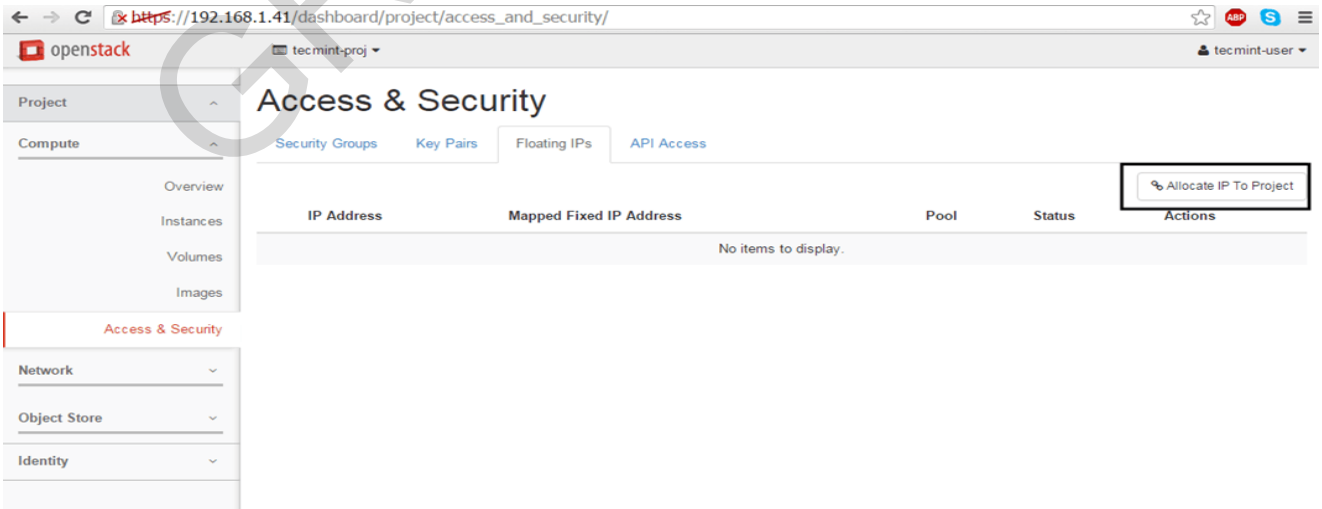
Floating IP allows external access from outside networks or internet to an Openstack virtual machine. In

order to create floating IPs for your project, login with your **user** credentials and go to **Project** ->

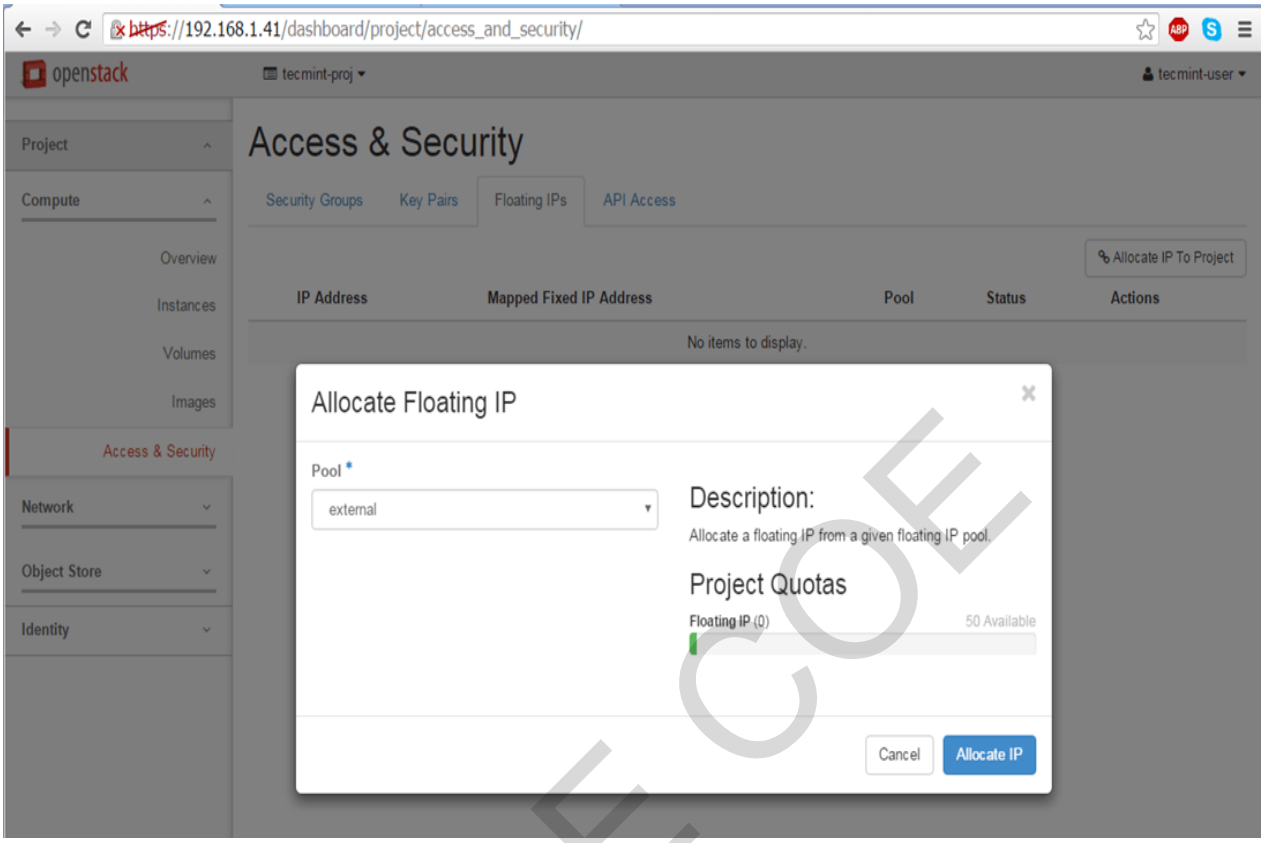
Compute -> **Access & Security** -> **Floating IPs** tab and click on **Allocate IP** to The Project.

Choose external **Pool** and hit on **Allocate IP** button and the IP address should appear in dashboard. It's a good

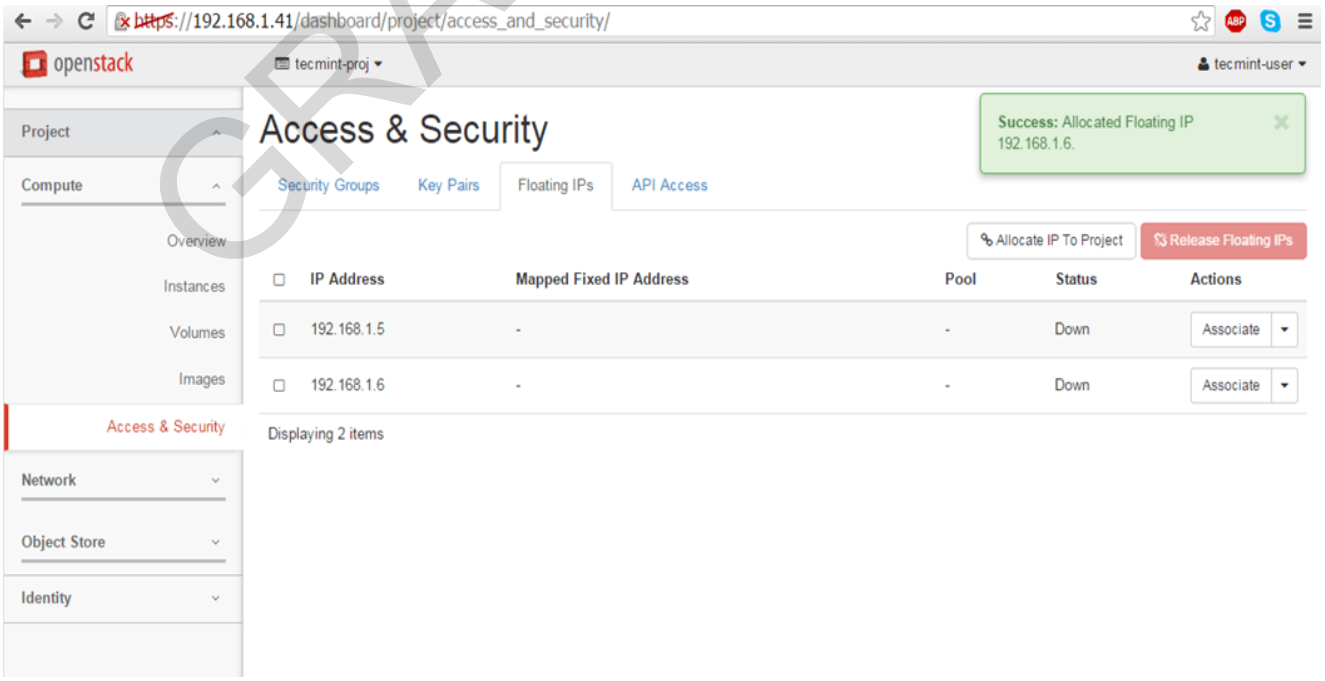
idea to allocate a Floating IP for each instance you run.



Allocate Floating IP to Project in OpenStack



Allocate Floating IP to External Pool



Confirmation of Adding Floating IP

Step 2: Create an OpenStack Image

3. OpenStack images are just virtual machines already created by third-parties. You can create your own
4. customized images on your machine by installing an Linux OS in a virtual machine using a
5. virtualization tool, such as KVM, VirtualBox, VMware or Hyper-V.

Once you have installed the OS, just convert the file to raw and upload it to your OpenStack cloud infrastructure.

To deploy official images provided by major Linux distributions use the following links to download the

latest packaged images:

1. **CentOS 7** – http://cloud.centos.org/centos/7/images/
2. **CentOS 6** – http://cloud.centos.org/centos/6/images/
3. **Fedora 23** – https://download.fedoraproject.org/pub/fedora/linux/releases/23/Cloud/
4. **Ubuntu** – http://cloud-images.ubuntu.com/
5. **Debian** – http://cdimage.debian.org/cdimage/openstack/current/
6. **Windows Server 2012 R2** – https://cloudbase.it/windows-cloud-images/#download

Official images additionally contain the **cloud-init** package which is responsible with SSH key pair and user

data injection.

On this guide we'll deploy a test image, for demonstration purposes, based on a lightweight Cirros cloud

image which can be obtained by visiting the following link http://download.cirros-cloud.net/0.3.4/.

The image file can be used directly from the HTTP link or downloaded locally on your machine and

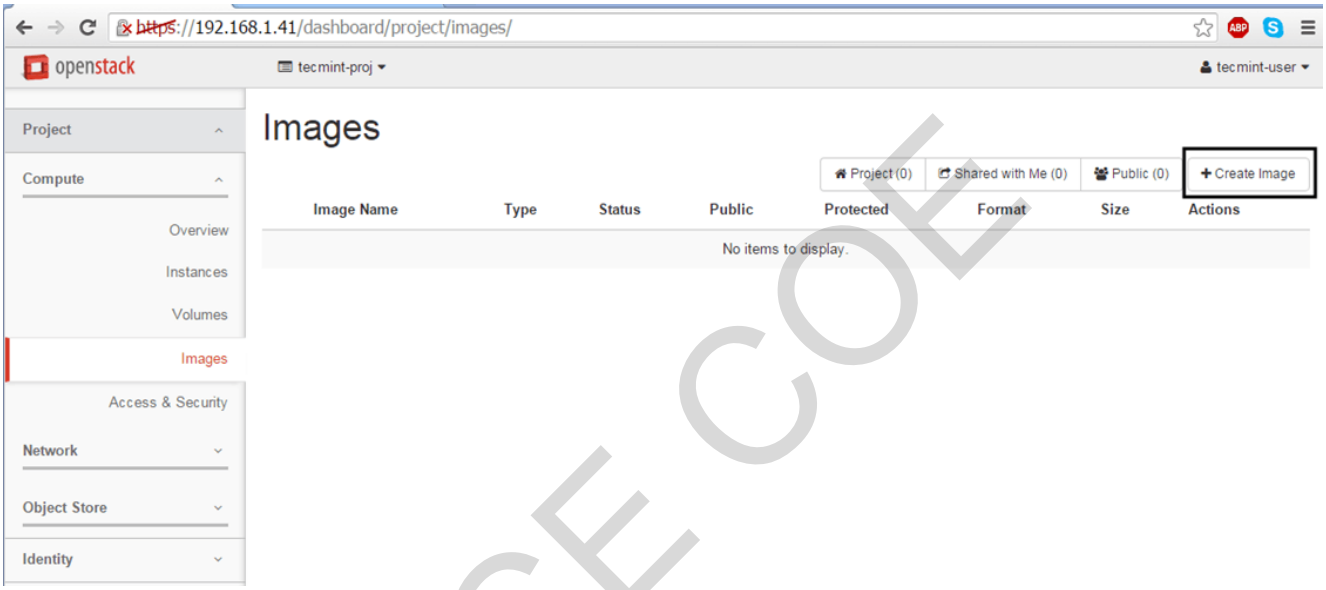
uploaded to OpenStack cloud.

To create an image, go **OpenStack** web panel and navigate to **Project** -> **Compute** -> **Images** and hit on

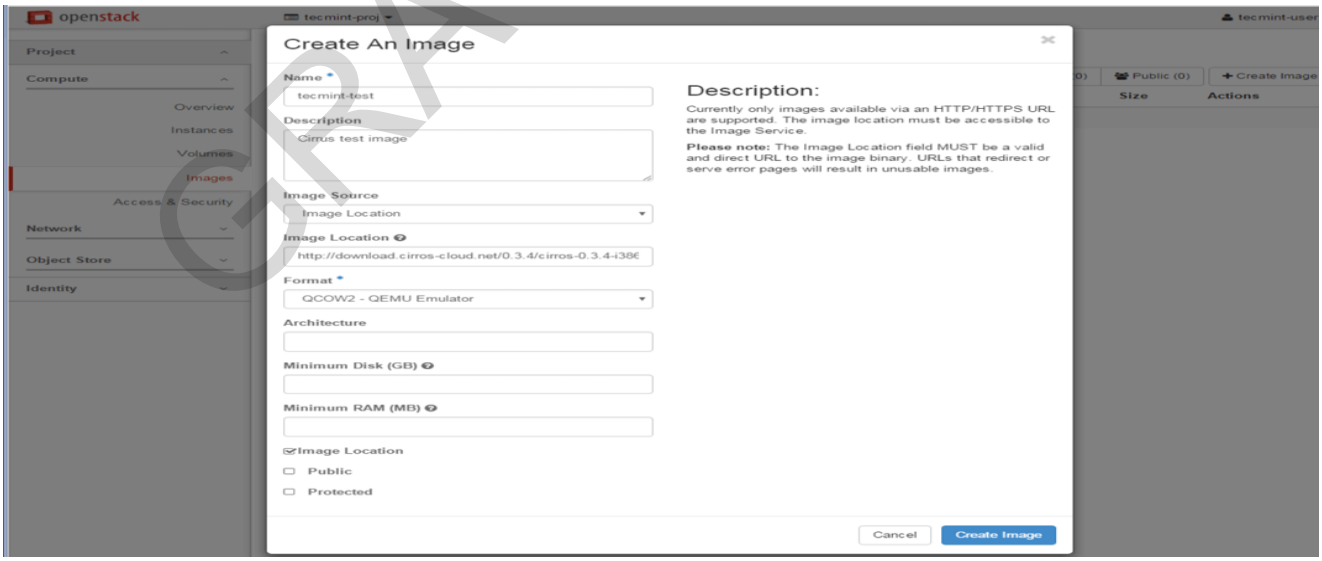
Create Image button. On the image prompt use the following settings and hit on **Create Image** when done.

Name: **tecmint-test**
Description: **Cirros test image**

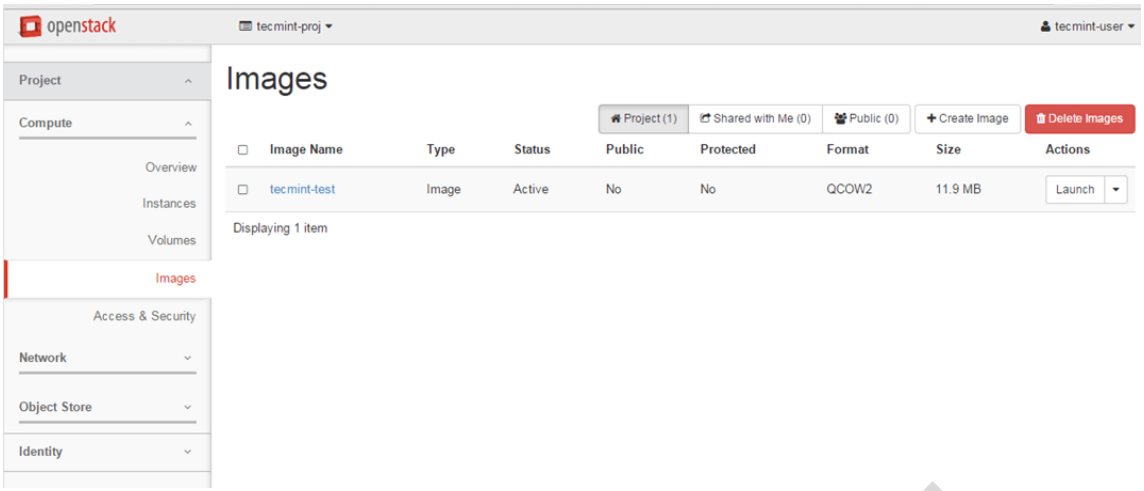
Image Source: **Image Location** #Use Image File if you've downloaded the file locally on your hard disk
Image Location: **http://download.cirros-cloud.net/0.3.4/cirros-0.3.4-i386-disk.img**
Format: **QCOWW2 – QEMU Emulator**
Architecture: **leave blank**
Minimum Disk: leave blank
Minimum RAM: **leave blank**
Image Location: **checked**
Public: **unchecked**
Protected: **unchecked**



Create Images in OpenStack



Add OpenStack Image Details

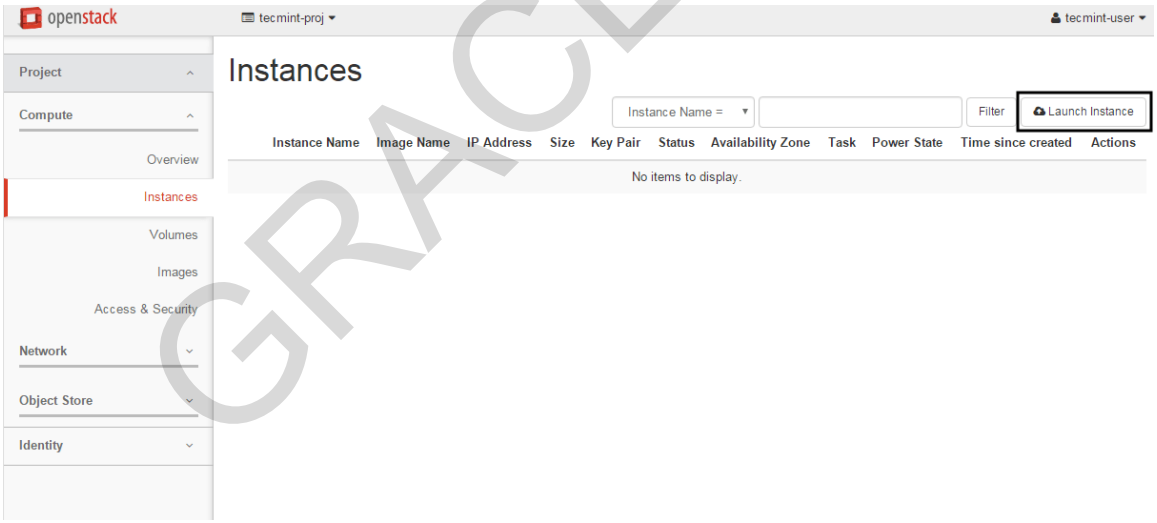


OpenStack Images

Step 3: Launch an Image Instance in OpenStack

3. Once you've created an image you're good to go. Now you can run the virtual machine based on the
4. image created earlier in your cloud environment.

Move to **Project** -> **Instances** and hit on **Launch Instance** button and a new window will appear.

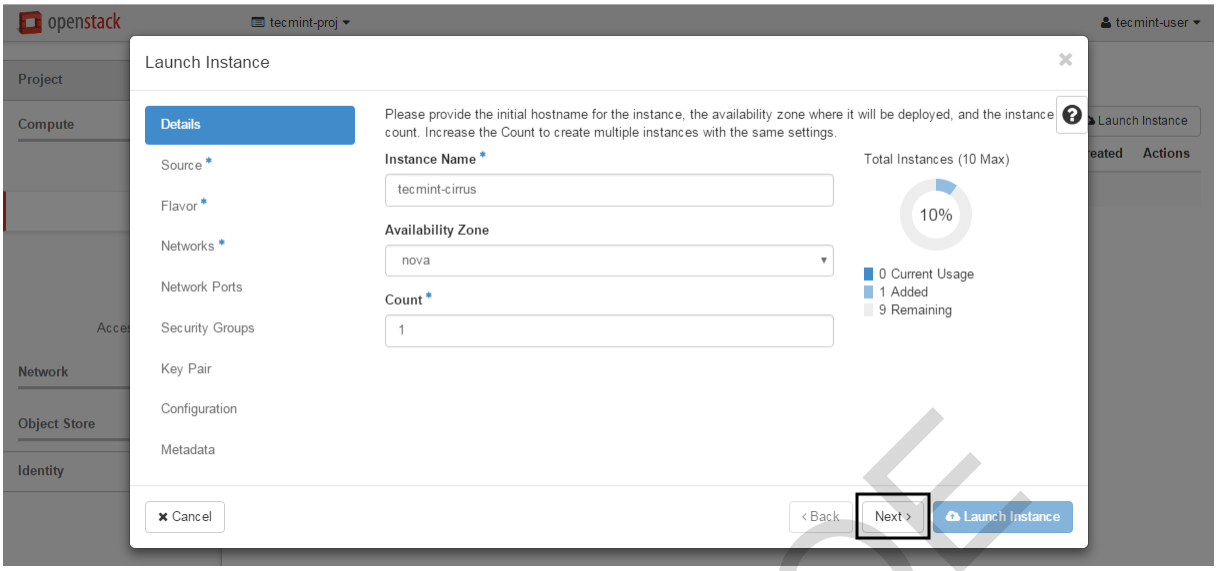


Launch Image Instance in Openstack

5. On the first screen add a name for your instance, leave the **Availability Zone** to nova, use one instance count
6. and hit on **Next** button to continue.

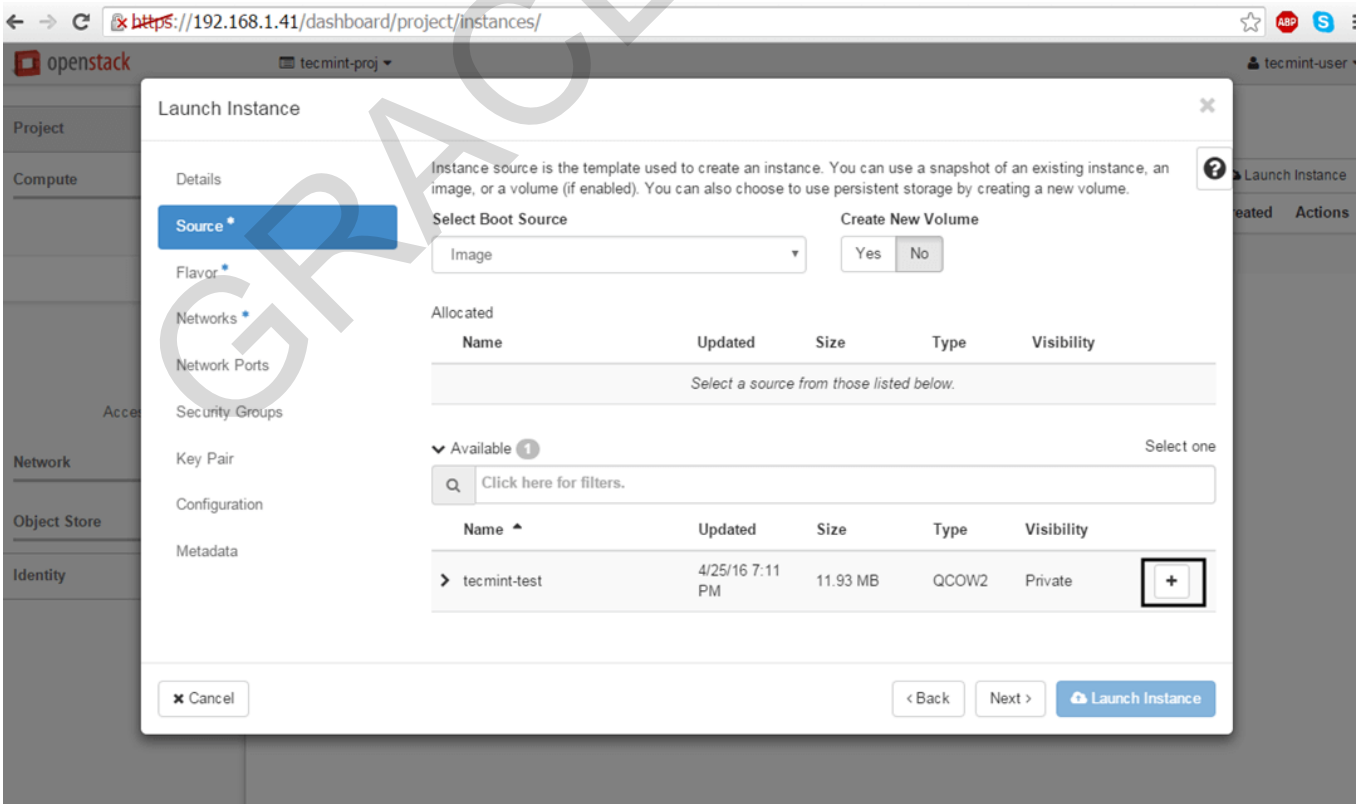
Choose a descriptive **Instance Name** for your instance because this name will be used to form the virtual

machine hostname.

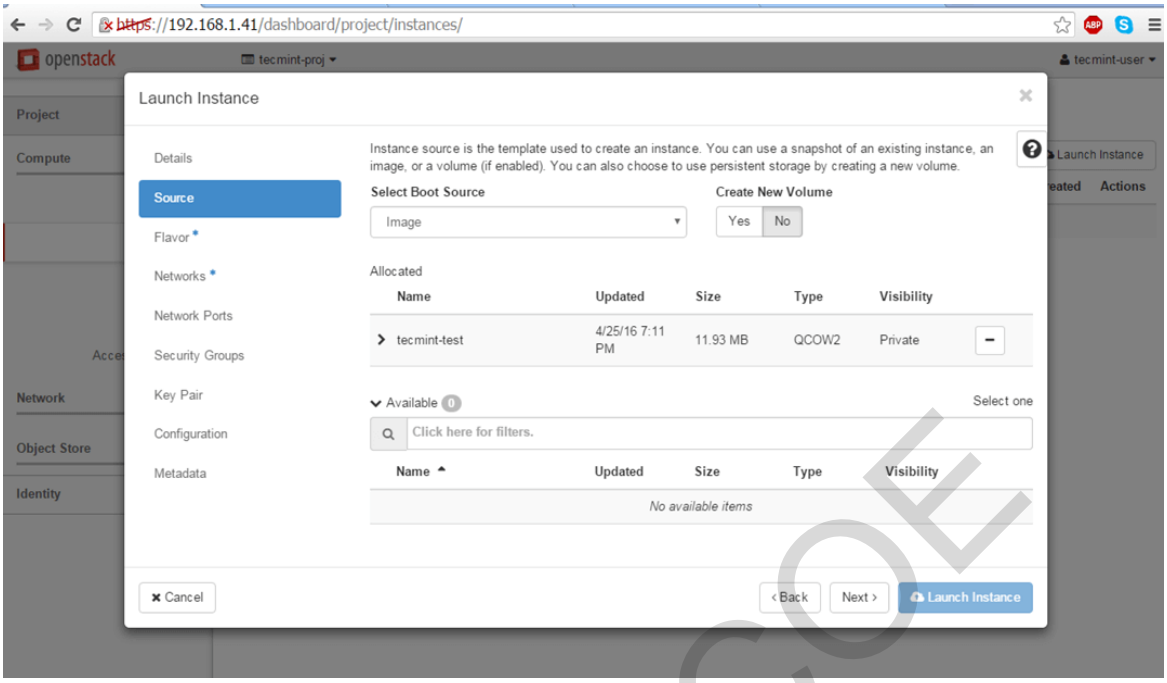


Add Hostname to OpenStack Instance

6. Next, select Image as a **Boot Source**, add the **Cirros** test image created earlier by hitting the + button
7. and hit
8. **Next** to proceed further.

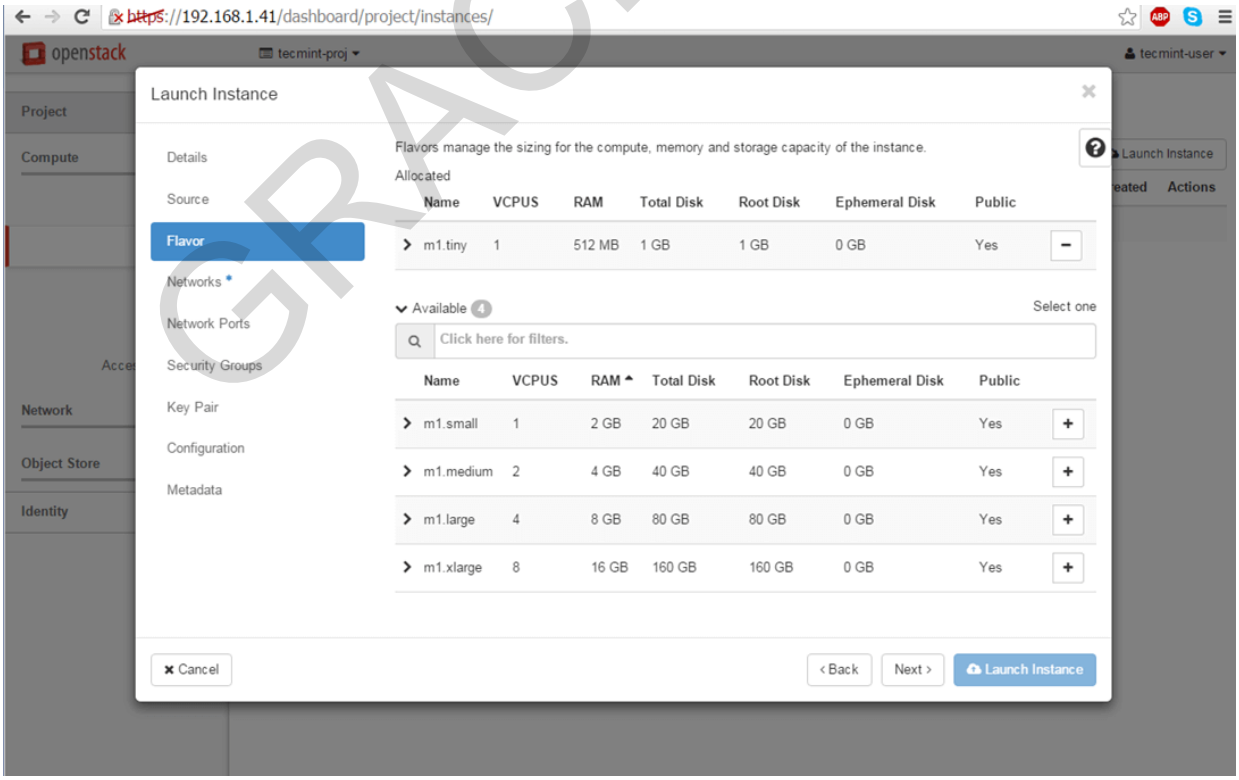


Select OpenStack Instance Boot Source



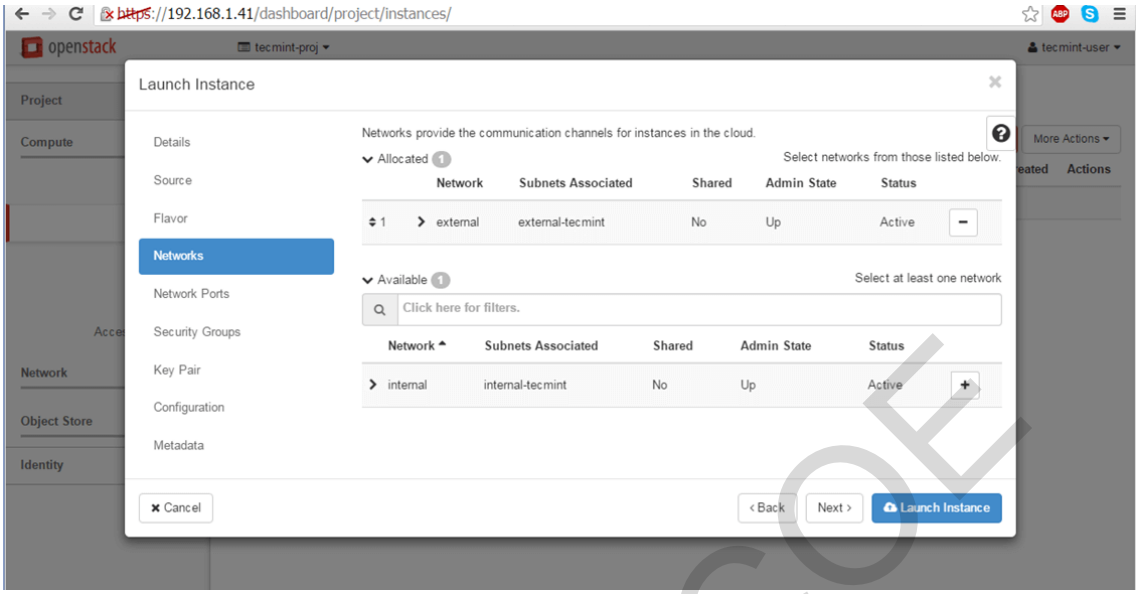
Add Cirros Text Image

7. Allocate the virtual machine resources by adding a flavor best suited for your needs and click on **Next** to move on.



Add Resources to OpenStack Instance

7. Finally, add one of the OpenStack available networks to your instance using the + button and hit on
8. **Launch Instance** to start the virtual machine.

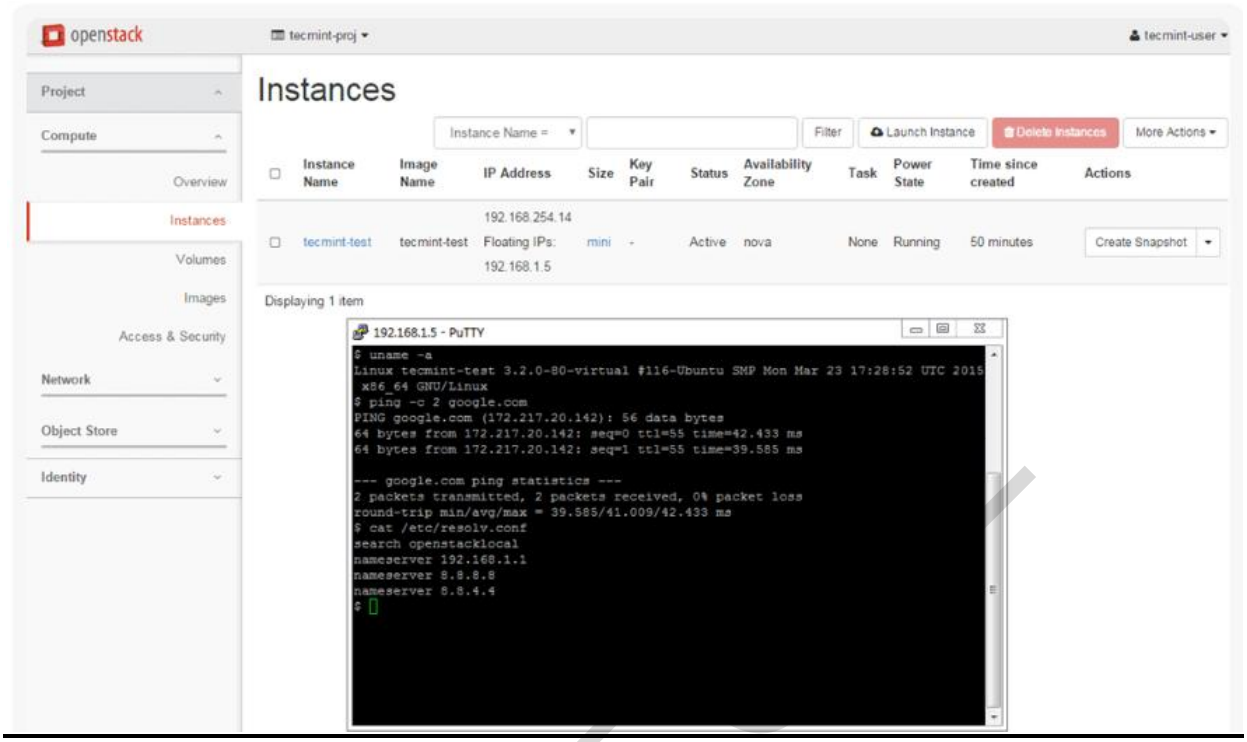


Add Network to OpenStack Instance

9. Once the instance has been started, hit on the right arrow from **Create Snapshot** menu button and
10. choose **Associate Floating IP**.

Select one of the floating IP created earlier and hit on **Associate** button in order to make the instance reachable from your internal LAN.

OUTPUT:



RESULT:

Thus the procedure to deploy virtual machined in open stack was successfully executed.

Ex.No.8	INSTALL HADOOP SINGLE NODE CLUSTER

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

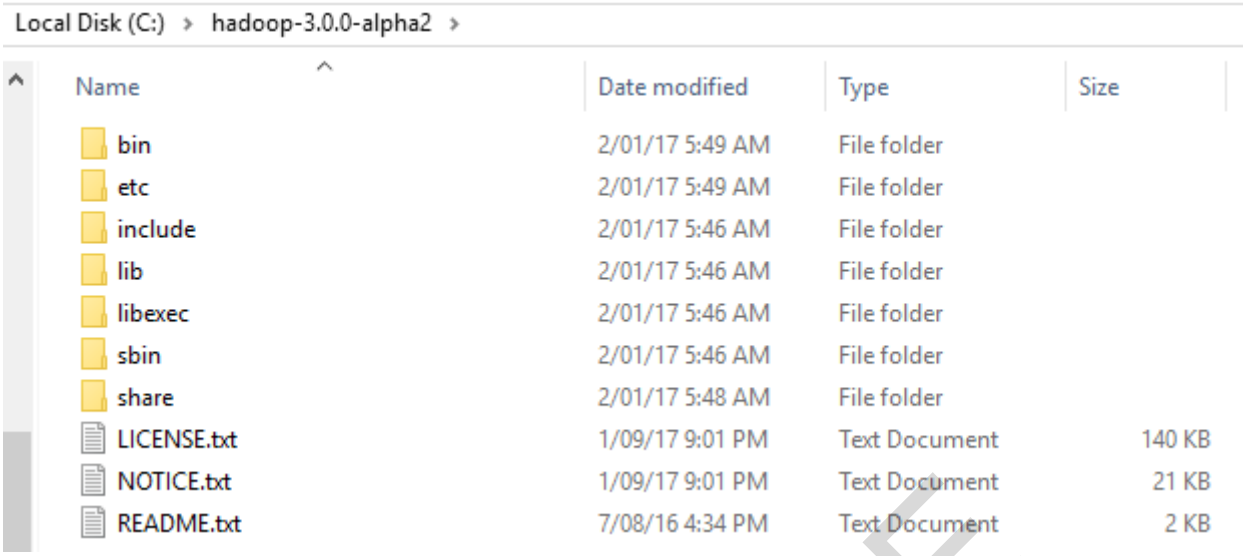
The next step was to install a Hadoop distribution. To do so, I've decided to download the most recent

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

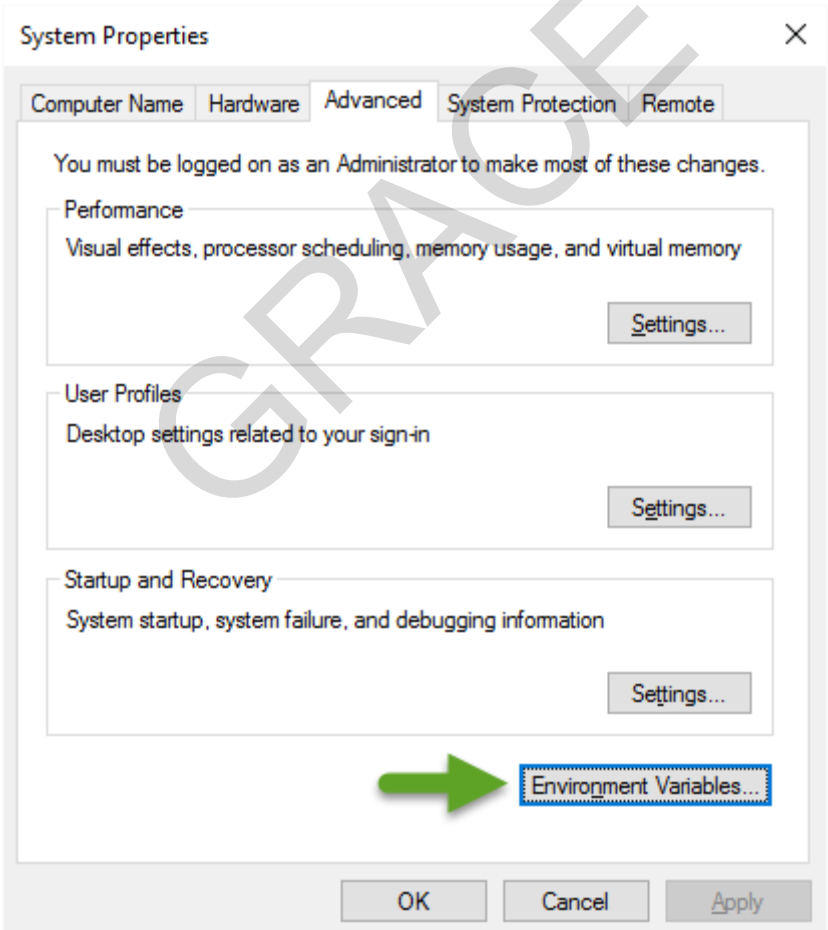
the previous step) into C:\hadoop-3.0.0-alpha2 folder:



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

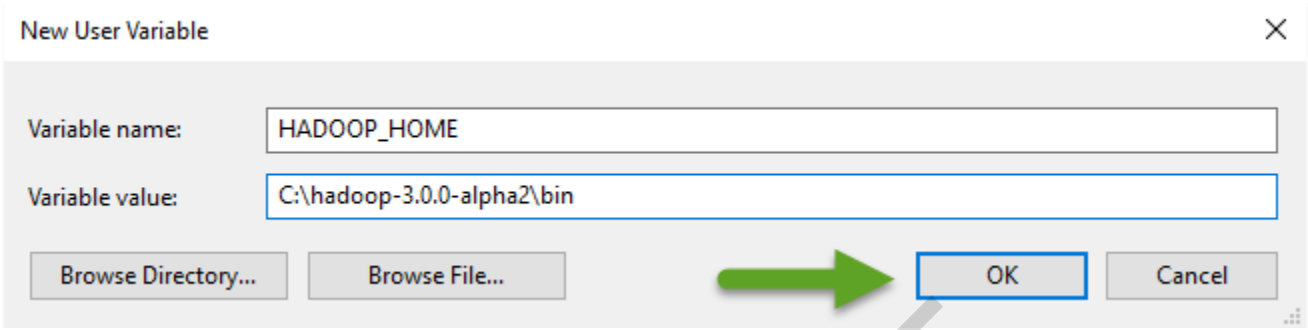
Setup Environmental Variables

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

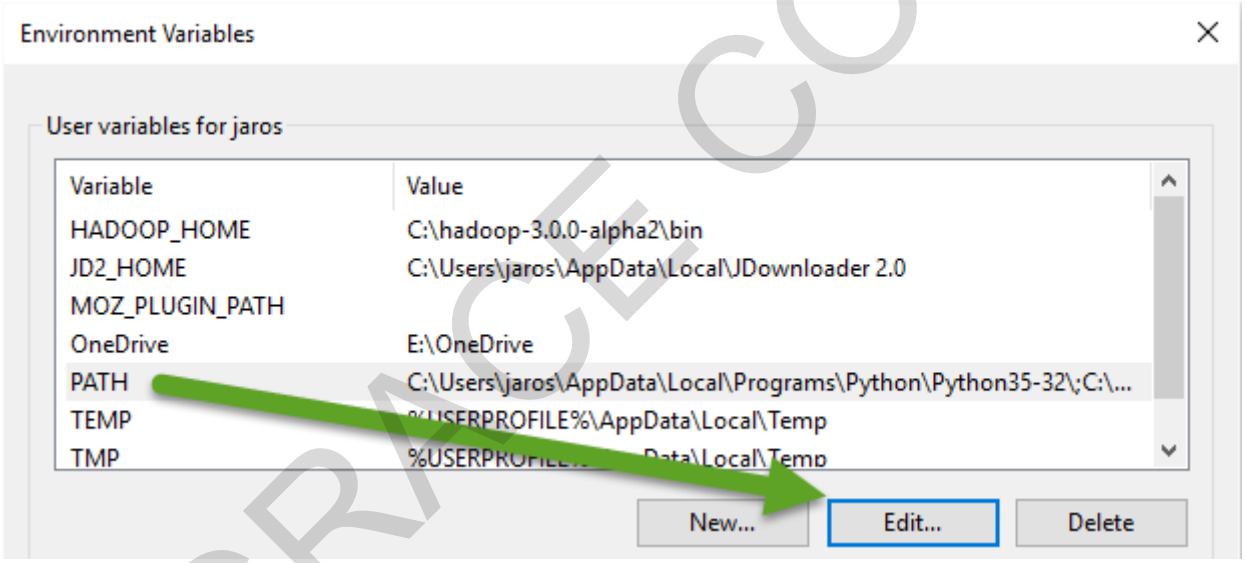


hen created a new HADOOP_HOME variable and pointed the path to C:\hadoop-3.0.0-alpha2\bin folder on my

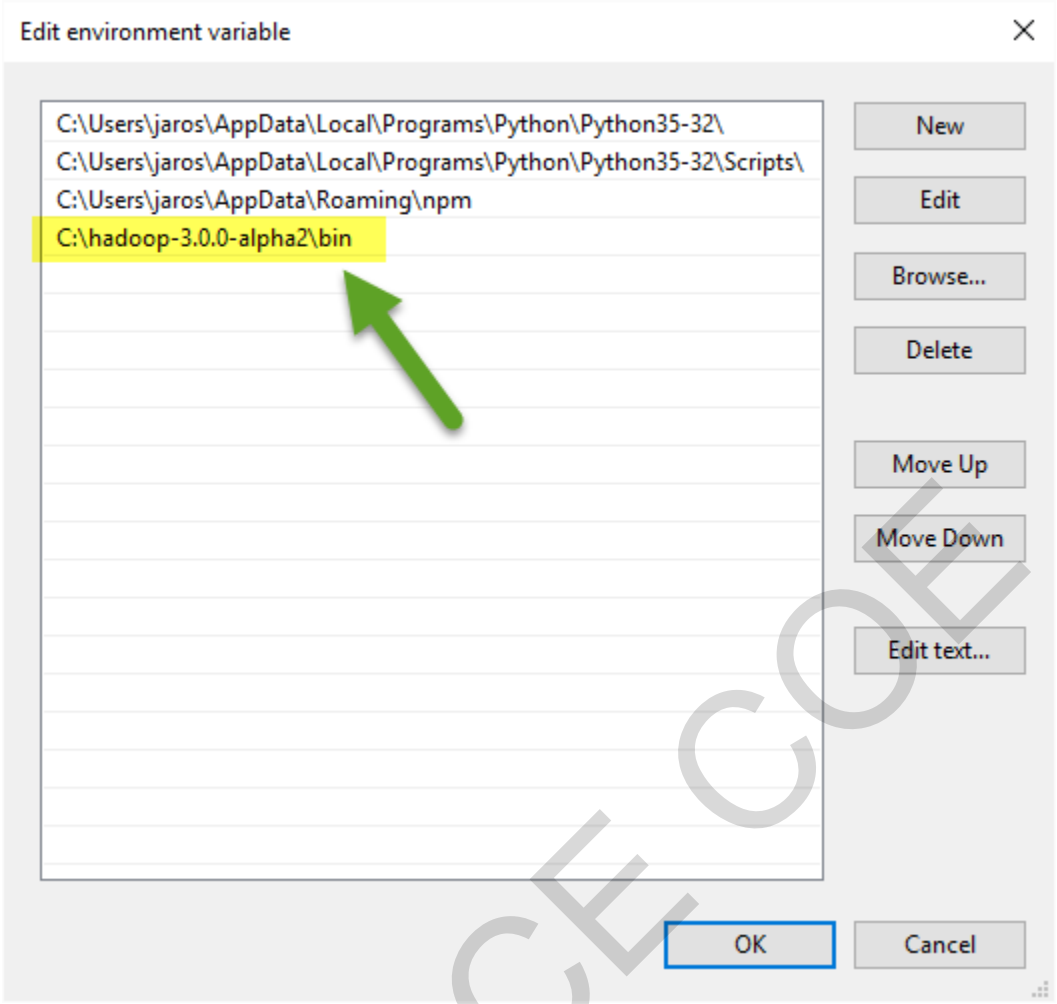
PC:



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

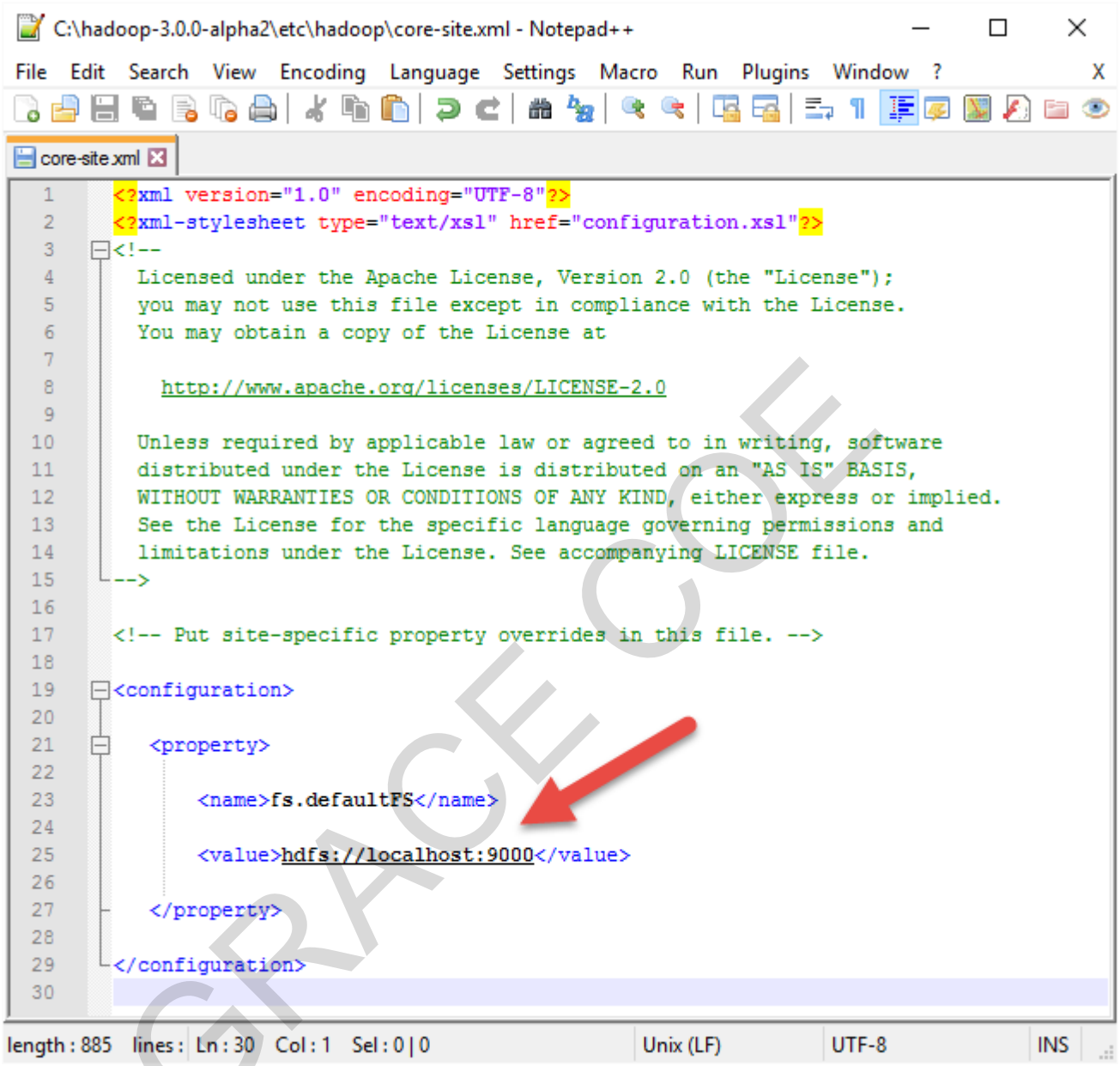


Then added a 'C:\hadoop-3.0.0-alpha2\bin' path like this and pressed OK:



Edit Hadoop Configuration

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



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>

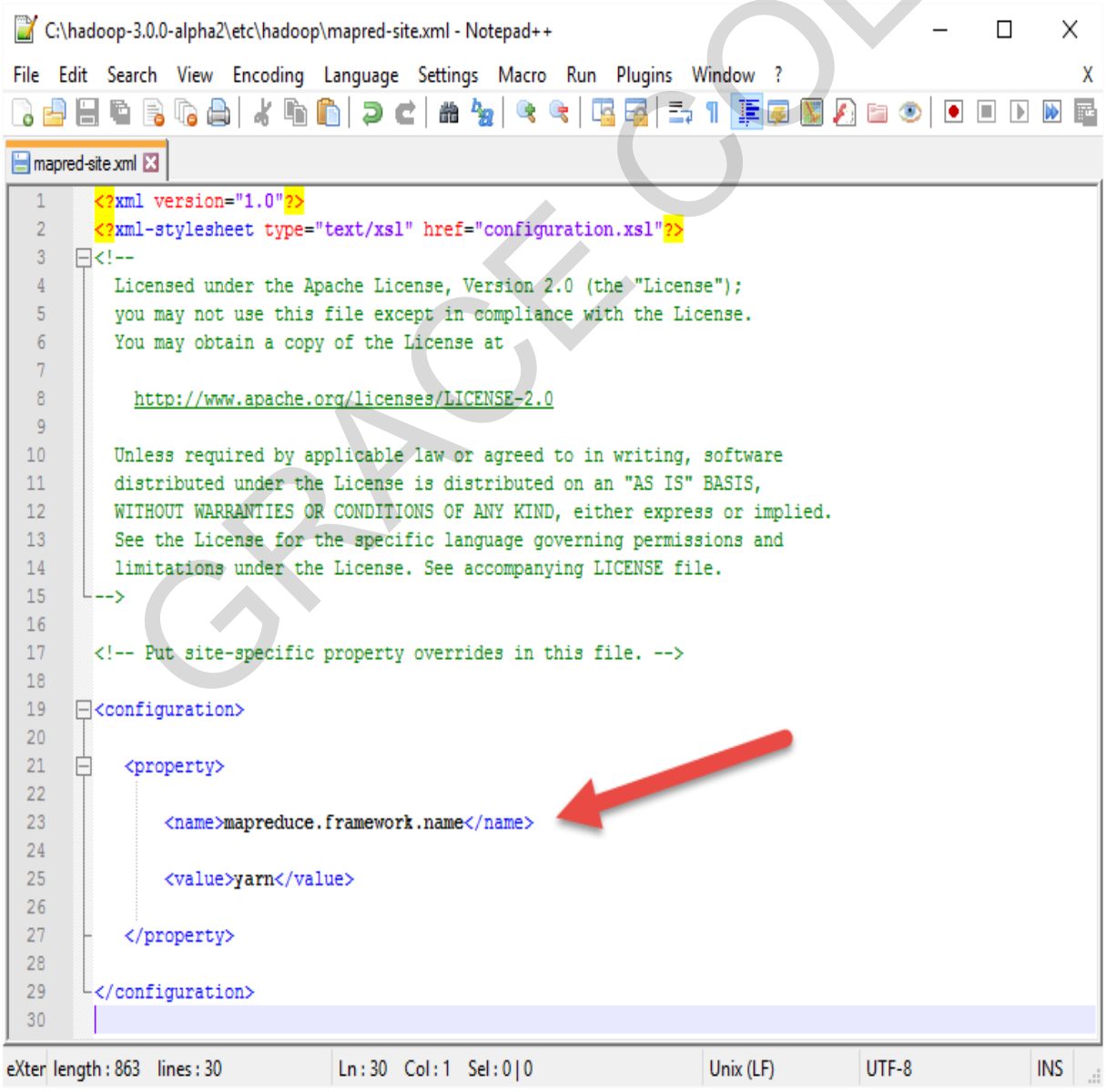
<name>mapreduce.framework.name</name>

<value>yarn</value>

</property>

</configuration>

This is what the file looks like when configured:



The 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.

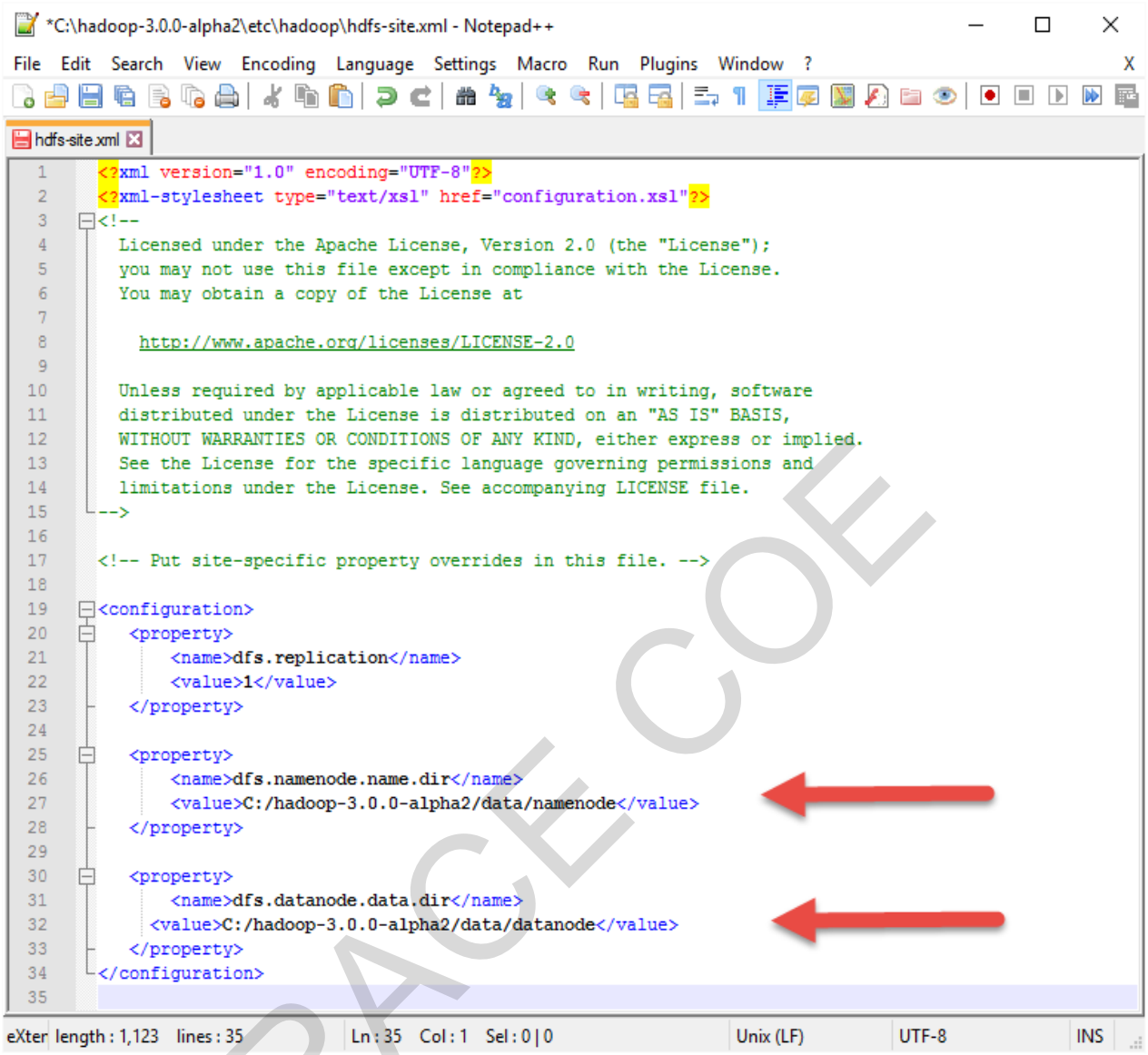
And added following configuration to this XML file:

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:



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>

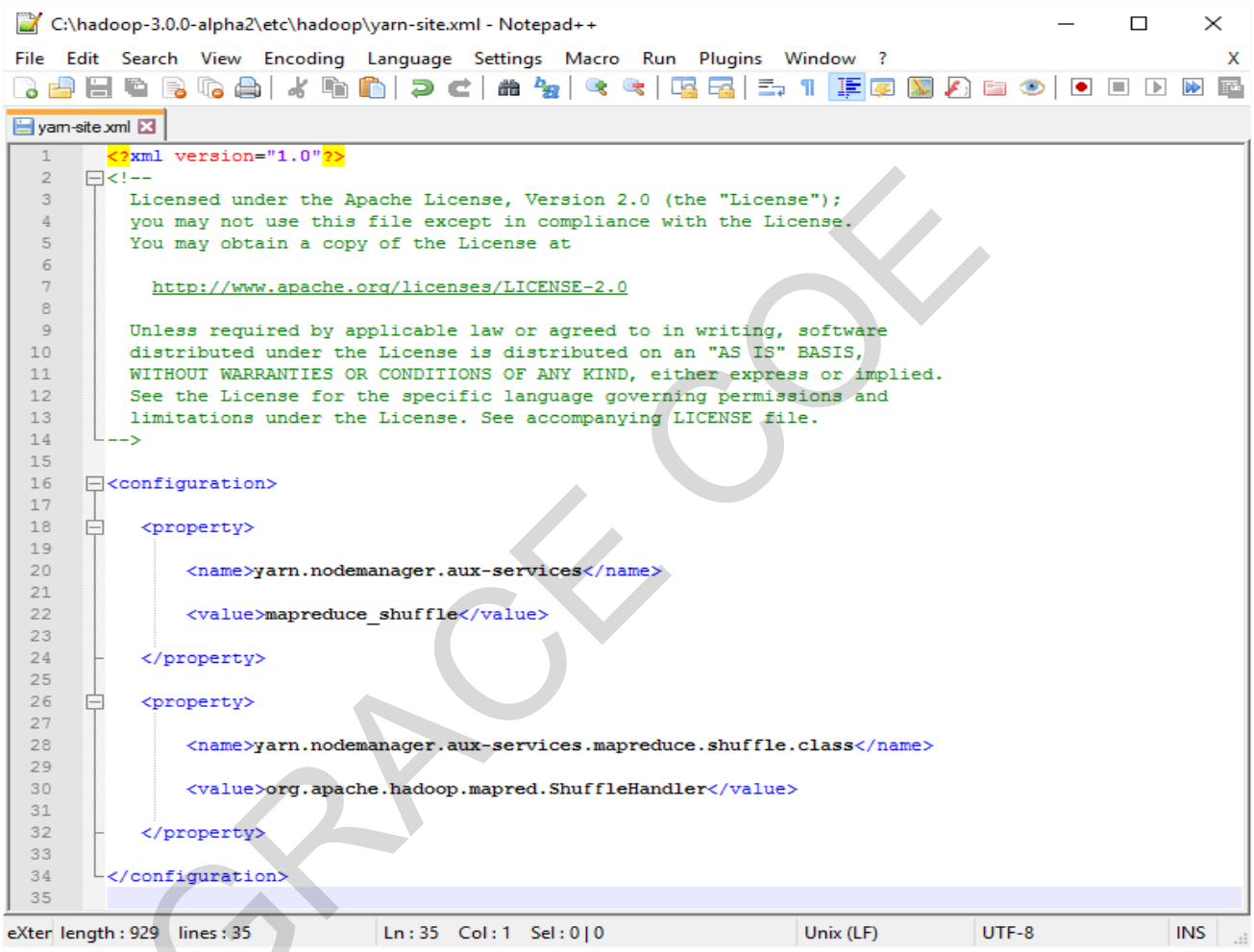
<name>yarn.nodemanager.aux-services.mapreduce.shuffle.class</name>

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

</property>

</configuration>

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



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

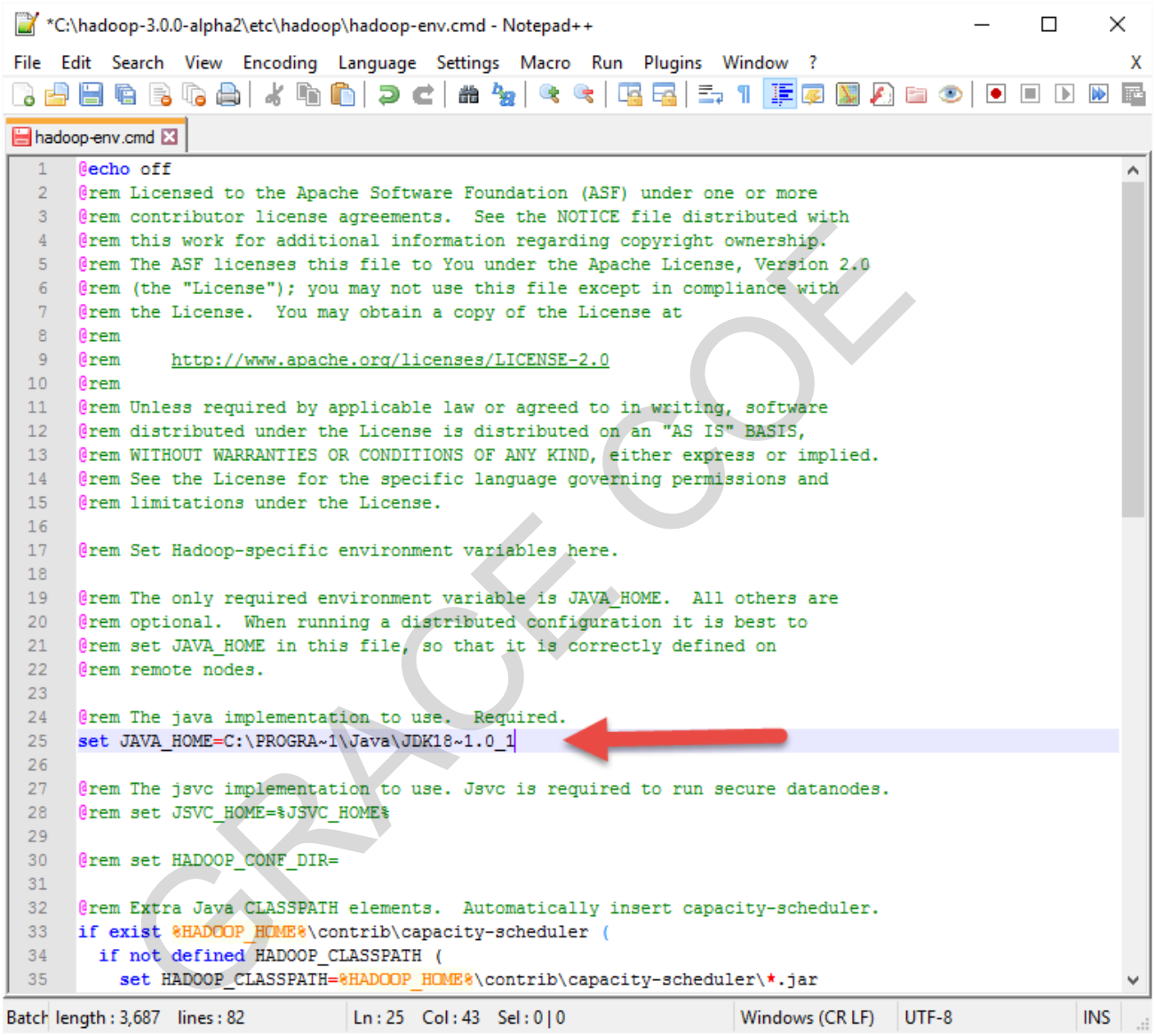
folder: C:\PROGRA~1\Java\JDK18~1.0_1

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
```

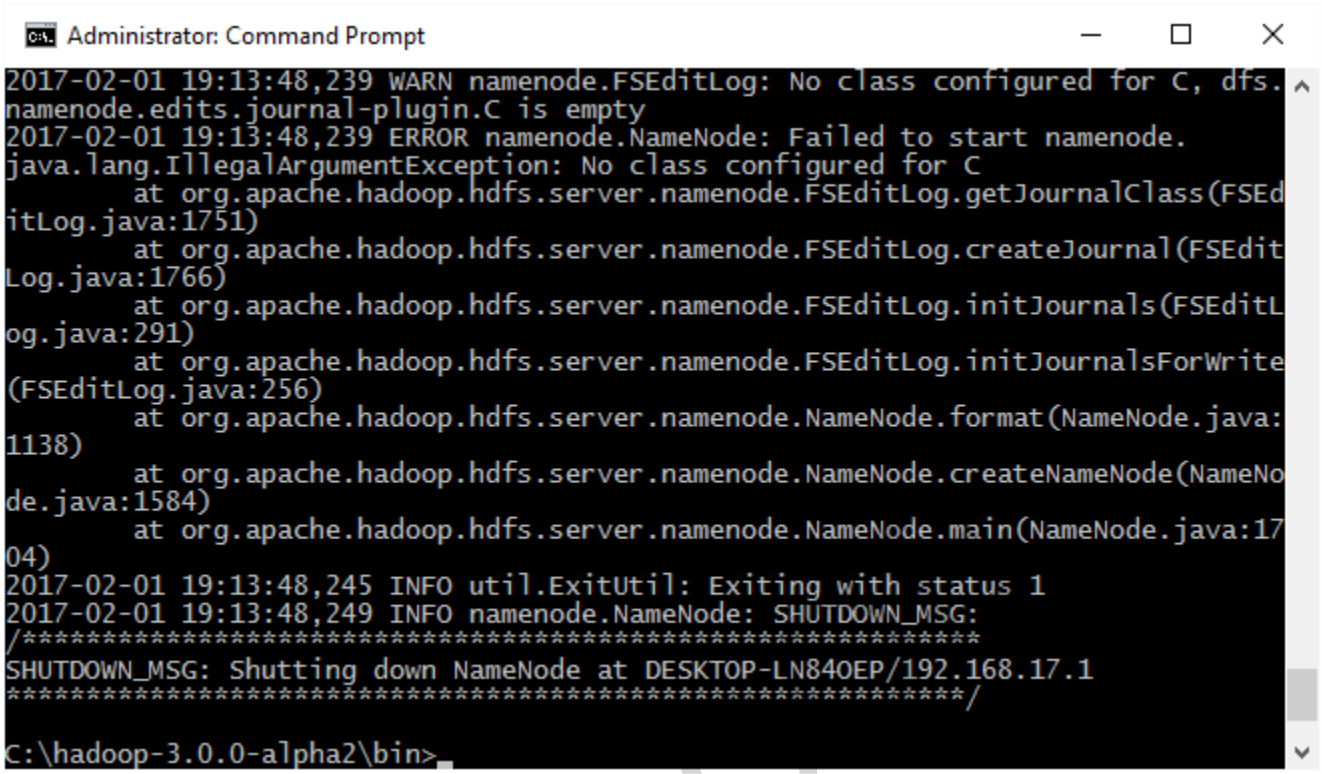
Next step was to open hadoop-env.cmd and add it in there, as shown in this screenshot:



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

'hdfs namenode -format' command.

Output looked like this:



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

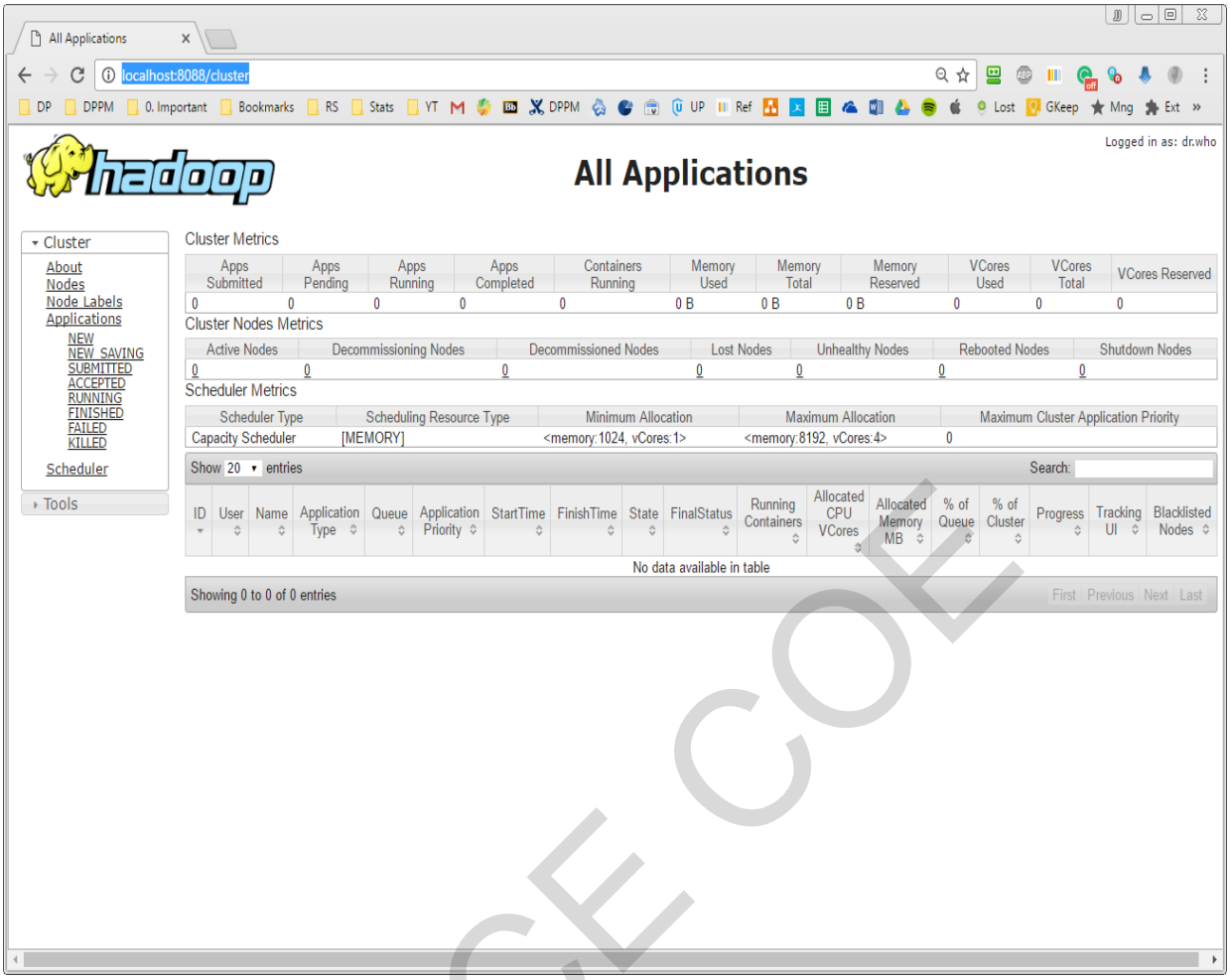
ran

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



WORD COUNT PROGRAM:

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, Interr
            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:

Then save words to words.txt,

Running Wordlist against Hadoop's MapReduce

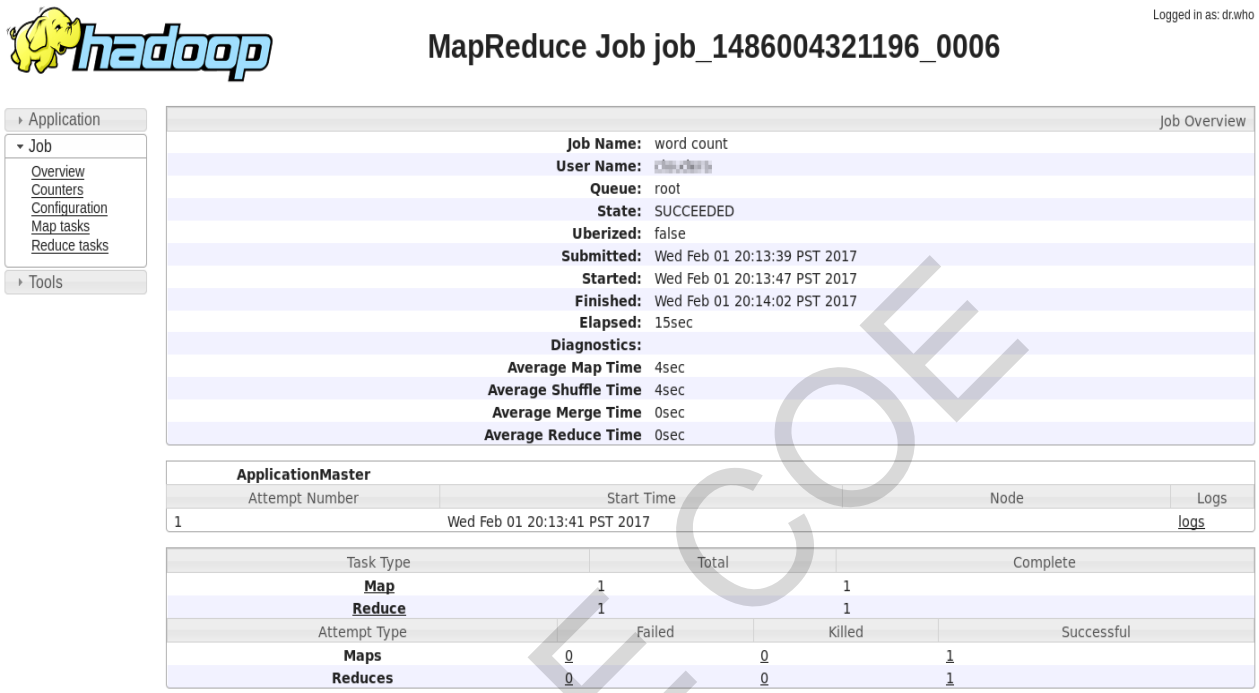
Once I ran my code, it executed and started processing the words.txt file that was prior to execution copied to

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:



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.