

**EX NO: 1                    INSTALL VIRTUALBOX/VMWARE WORKSTATION WITH  
DIFFERENT FLAVOURS OF LINUX OR WINDOWS OS****DATE:****AIM:**

To Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.

**PROCEDURE:**

Before downloading and installing VMware Workstation:

Ensure that you are using a supported guest operating system (Windows /Linux)

**Downloading VMware Workstation and ISO file**

To download VMware Workstation:

Navigate to the VMware Workstation Download Center.

STEP 1. Based on your requirements, click Go to Downloads for VMware Workstation for Linux.

STEP 2. Click Download Now.

STEP 3. Review the End User License Agreement and click Yes.

STEP 4. Click Download Now.

STEP 5: Go to the official website of ubuntu and choose the releases (ubuntu 16.04) .iso file

**Alternate way to download the VMware player**

STEP 1 . Download the VMware package file from the ubuntu official website (file with .bundle extension)

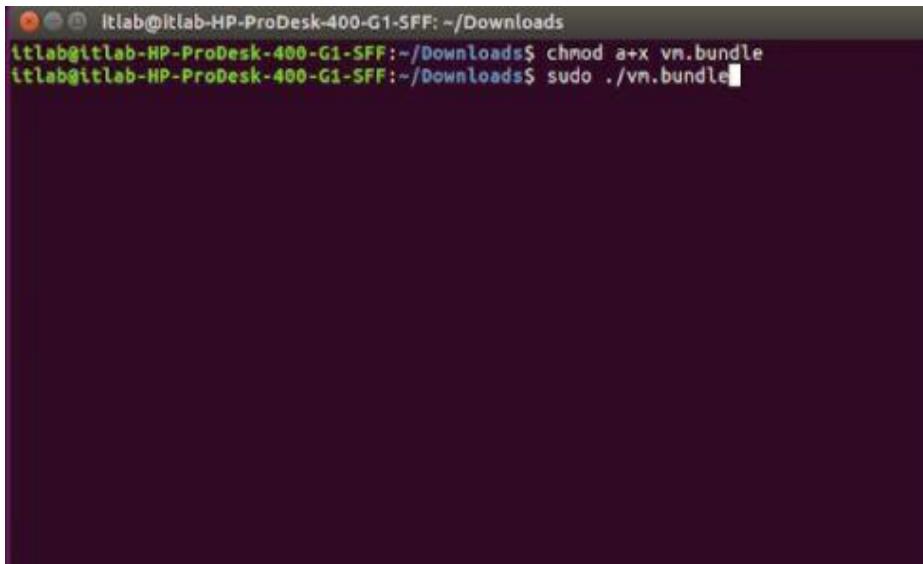
STEP 2 . Once after the download is complete, open the terminal and move to the “Downloads” folder using cd command

cd Downloads

STEP 3 . change permission of the file to make it executable

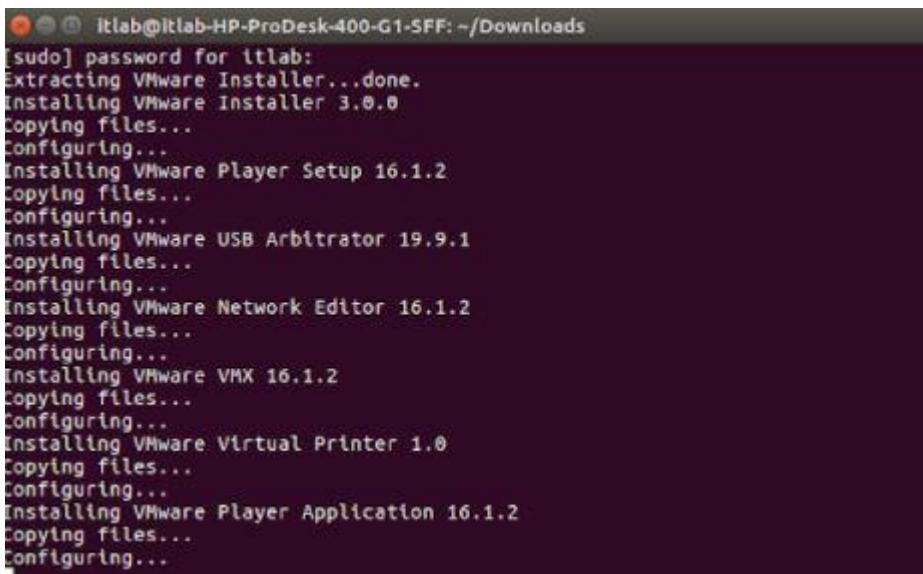
Chmod a+x vm.bundle

STEP 4. Start the file. If it fails, use root privileges to install VMWare, but that is not always required



```
itlab@itlab-HP-ProDesk-400-G1-SFF:~/Downloads$ chmod a+x vm.bundle
itlab@itlab-HP-ProDesk-400-G1-SFF:~/Downloads$ sudo ./vm.bundle
```

STEP 5. Wait until the bundle is extracted . Upon the completion of the process, “Installation successful message is displayed”

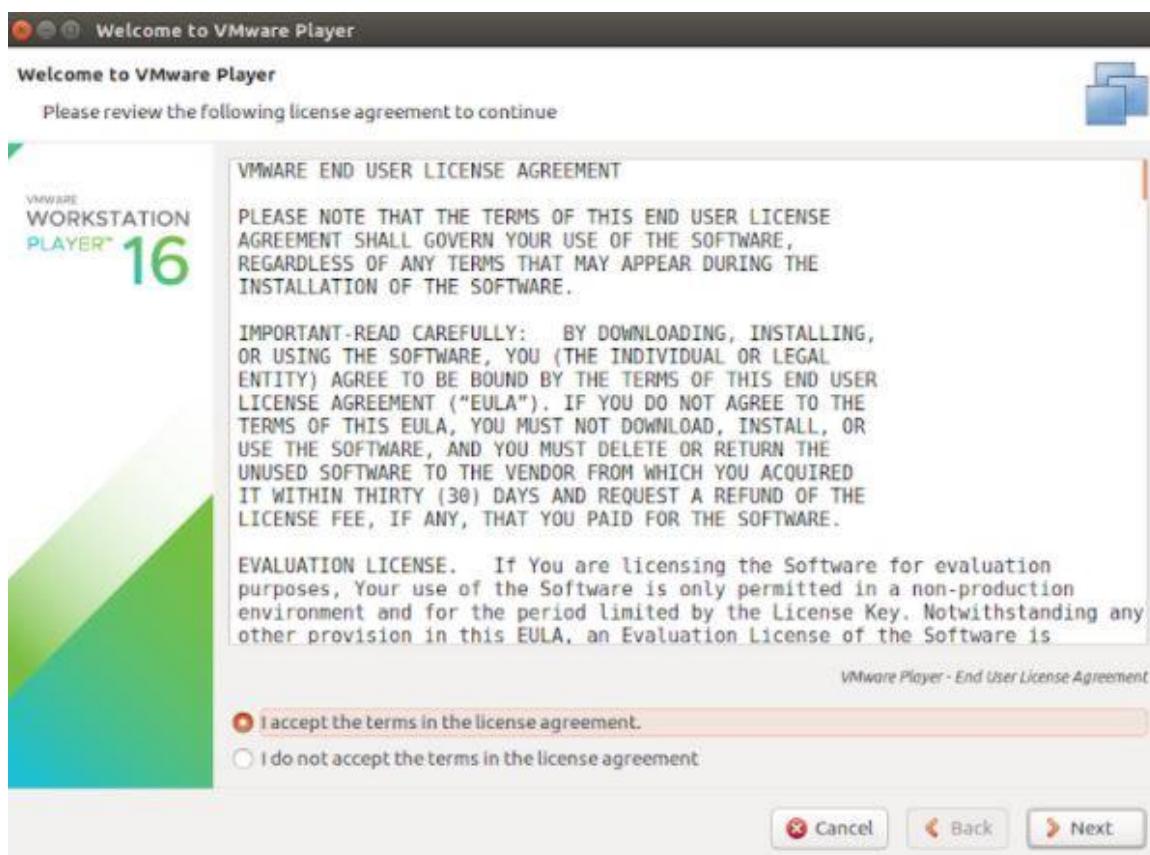


```
[sudo] password for itlab:
Extracting VMware Installer...done.
Installing VMware Installer 3.0.0
Copying files...
Configuring...
Installing VMware Player Setup 16.1.2
Copying files...
Configuring...
Installing VMware USB Arbitrator 19.9.1
Copying files...
Configuring...
Installing VMware Network Editor 16.1.2
Copying files...
Configuring...
Installing VMware VMX 16.1.2
Copying files...
Configuring...
Installing VMware Virtual Printer 1.0
Copying files...
Configuring...
Installing VMware Player Application 16.1.2
Copying files...
Configuring...
```

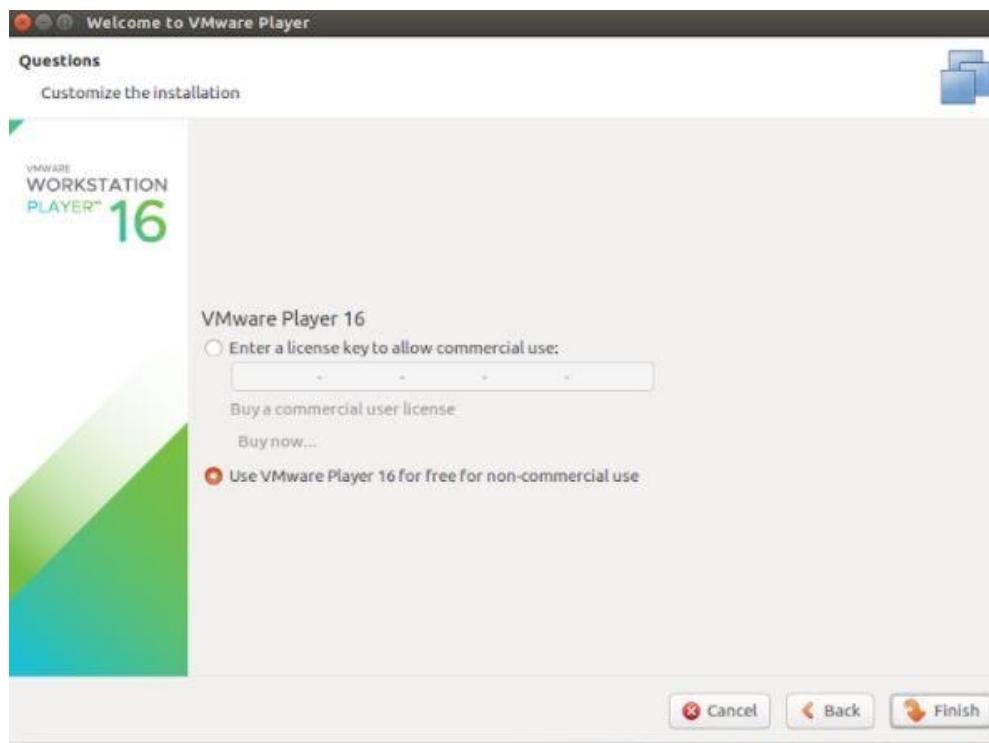
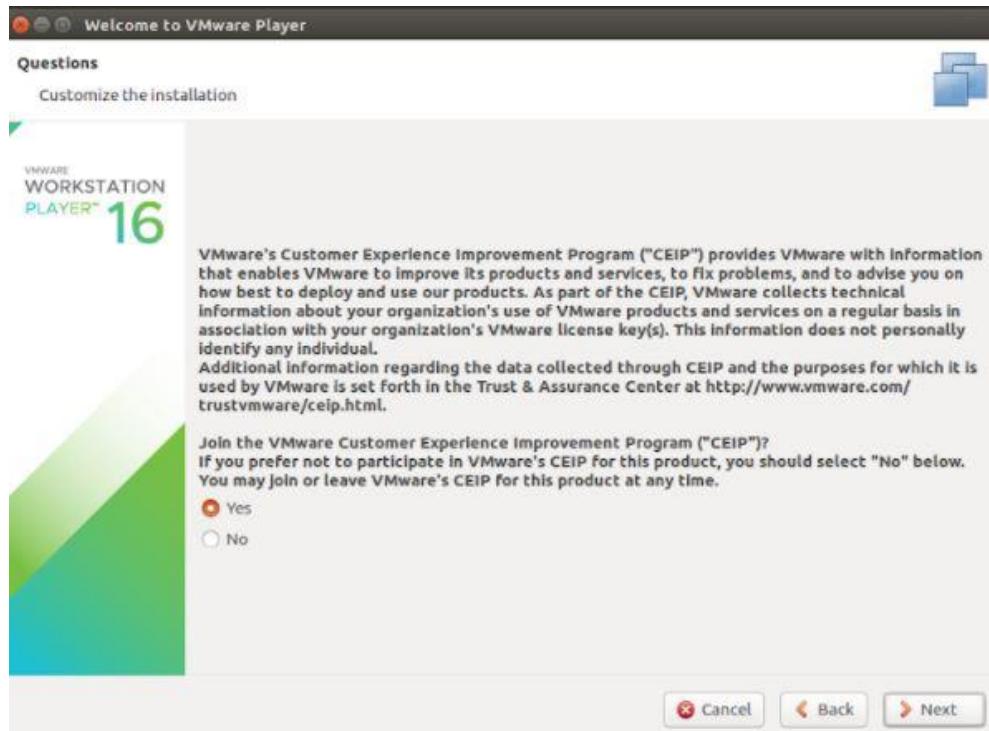
```
itlab@itlab-HP-ProDesk-400-G1-SFF: ~/Downloads
Configuring...
Installing VMware USB Arbitrator 19.9.1
Copying files...
Configuring...
Installing VMware Network Editor 16.1.2
Copying files...
Configuring...
Installing VMware VMX 16.1.2
Copying files...
Configuring...
Installing VMware Virtual Printer 1.0
Copying files...
Configuring...
Installing VMware Player Application 16.1.2
Copying files...
Configuring...
Installing VMware OVF Tool component for Linux 4.4.1
Copying files...
Configuring...
Installing VMware Player 16.1.2
Copying files...
Configuring...
Installation was successful.
itlab@itlab-HP-ProDesk-400-G1-SFF:~/Downloads$
```

## Steps to create a new VM

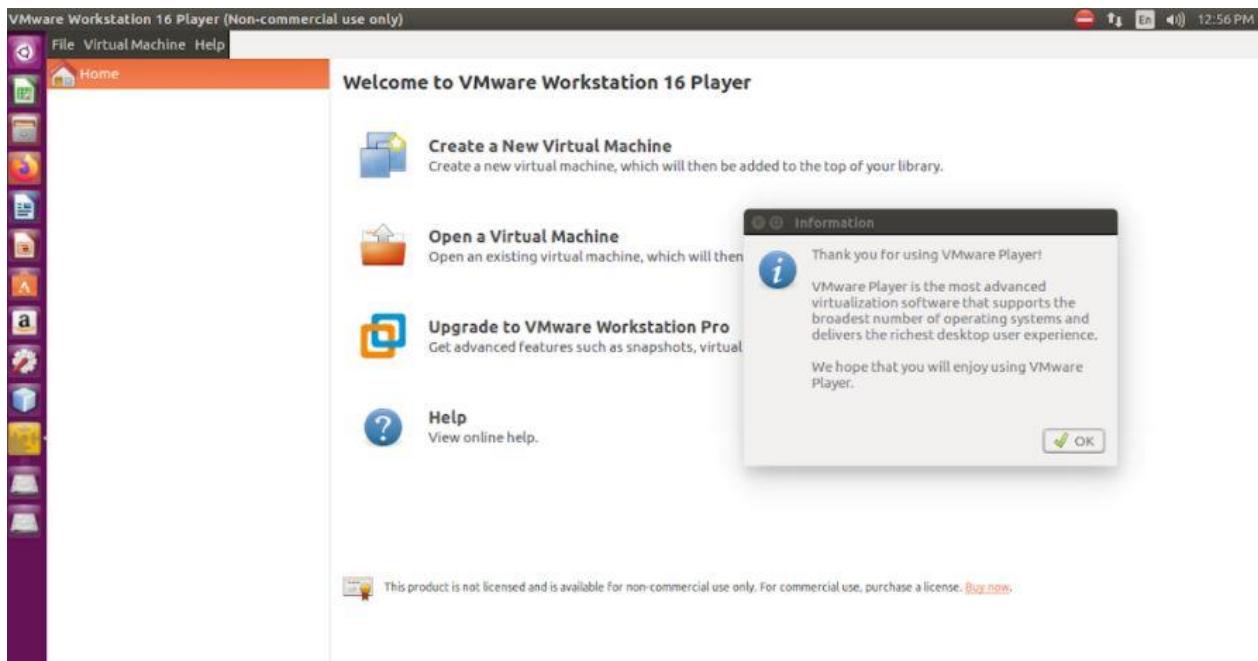
STEP 1: Open the VMware player and accept the terms and conditions



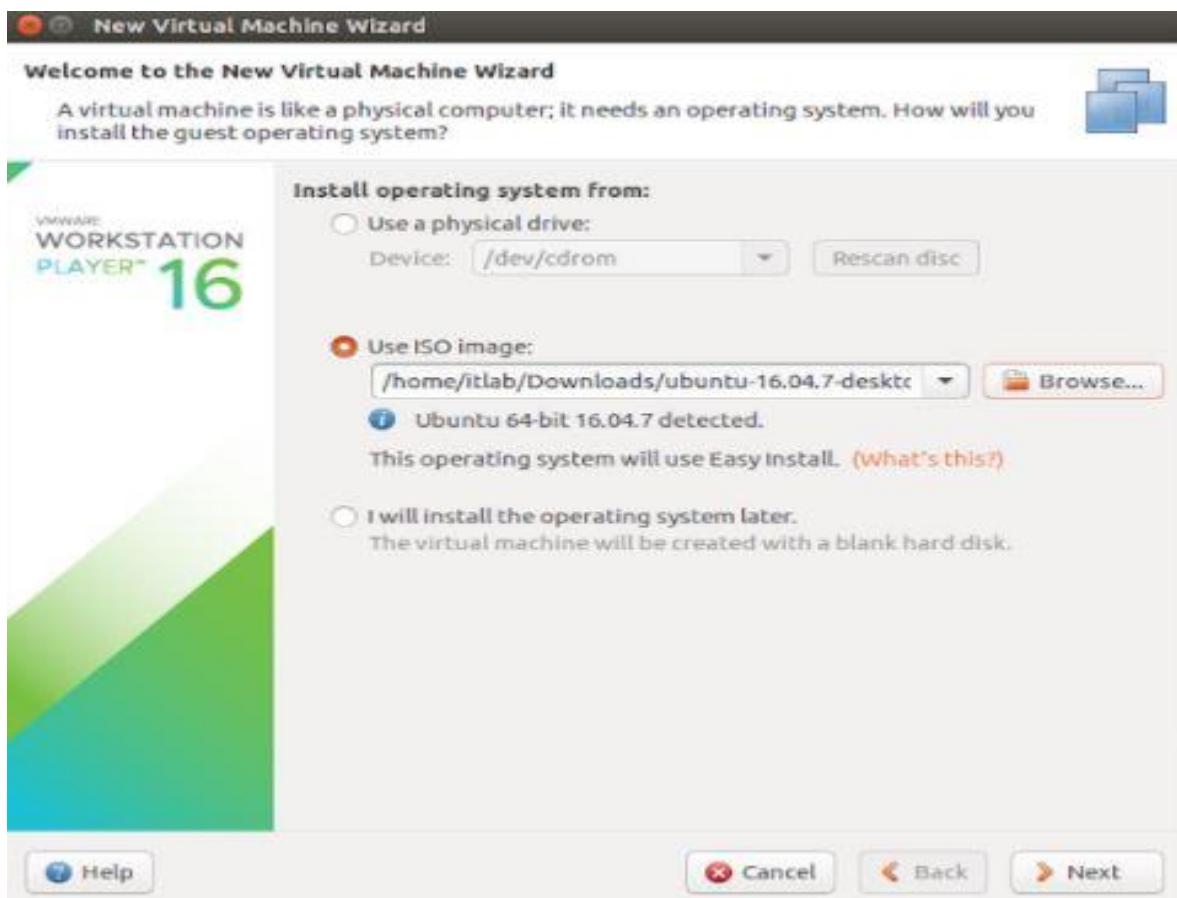
STEP 2: Click next to proceed further



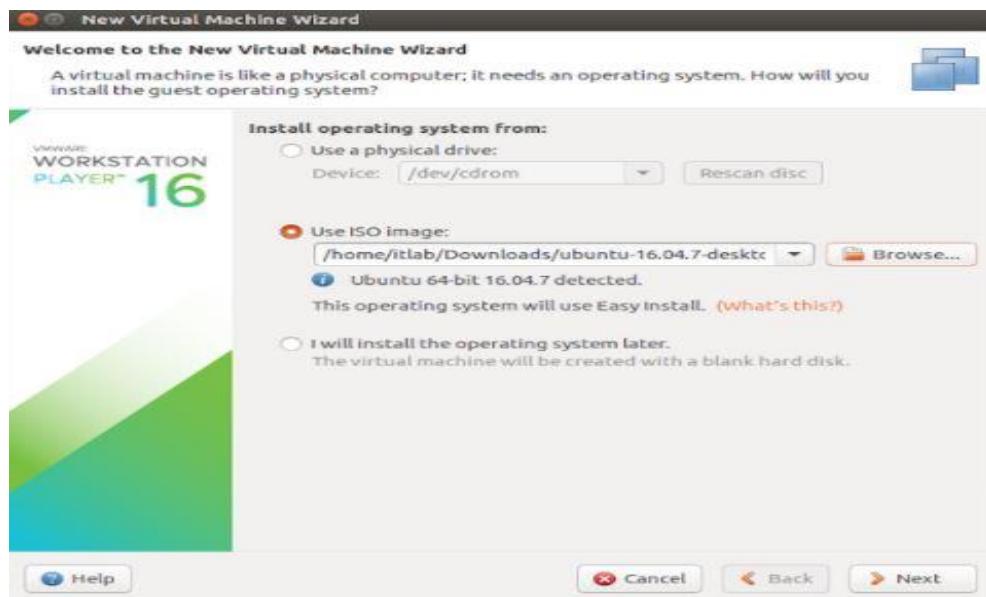
STEP 3: The configuration steps are complete. And now, a new ubuntu Virtual machine can be created.



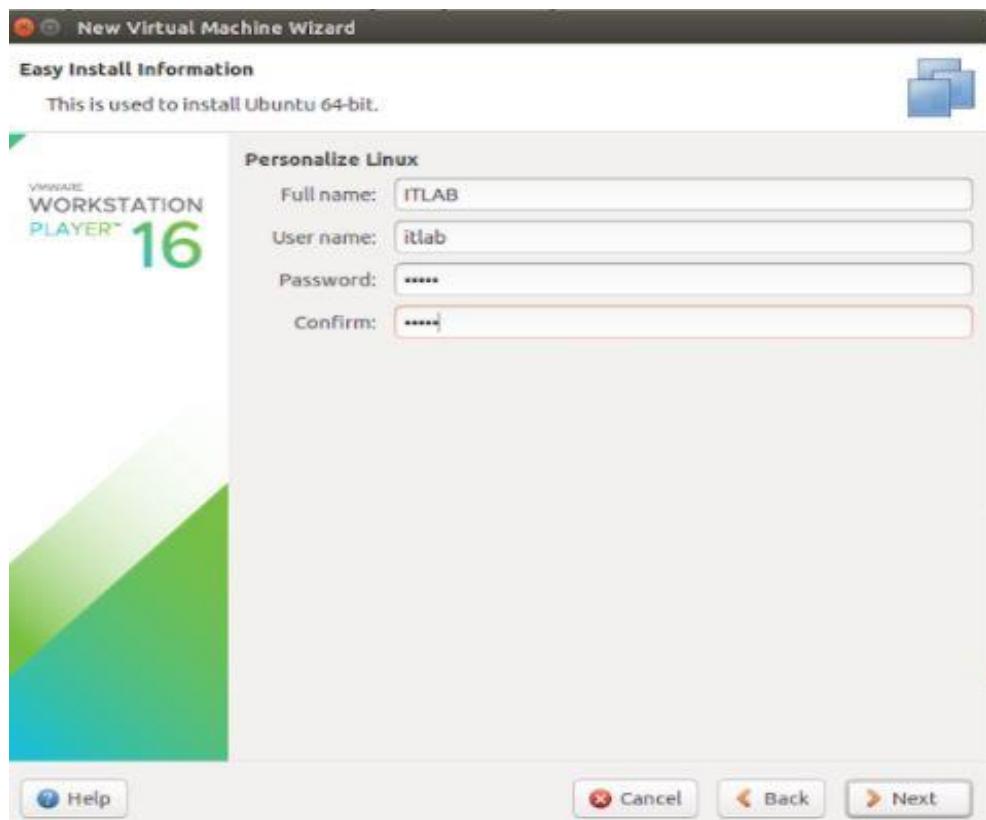
STEP 4: Click on “Create new virtual machine” and the below dialog box appears



STEP 5: Choose the “use ISO image” option and fetch the location of the downloaded ubuntu iso file.



STEP 6: Configure the VM by providing a username and password

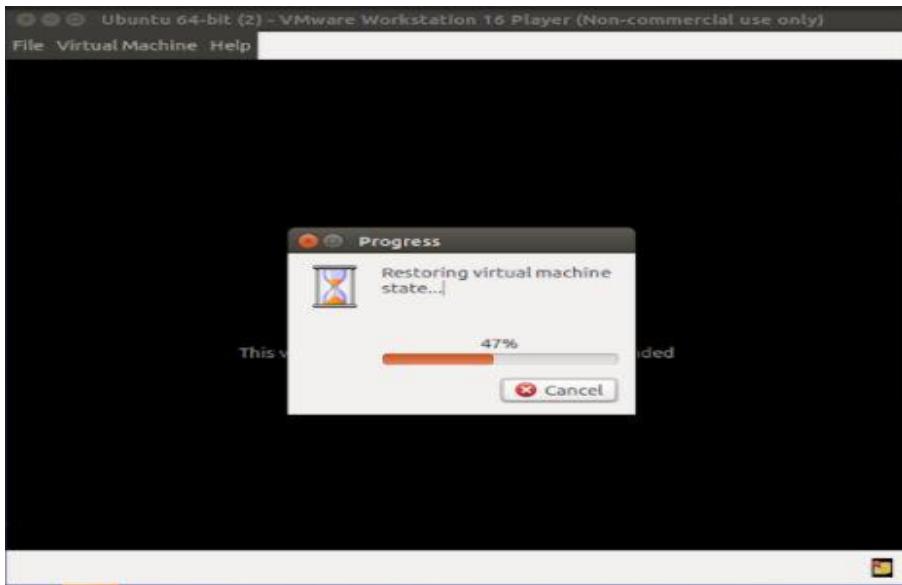




STEP 7: The below dialog box shows the complete configuration of the virtual machine to be created.

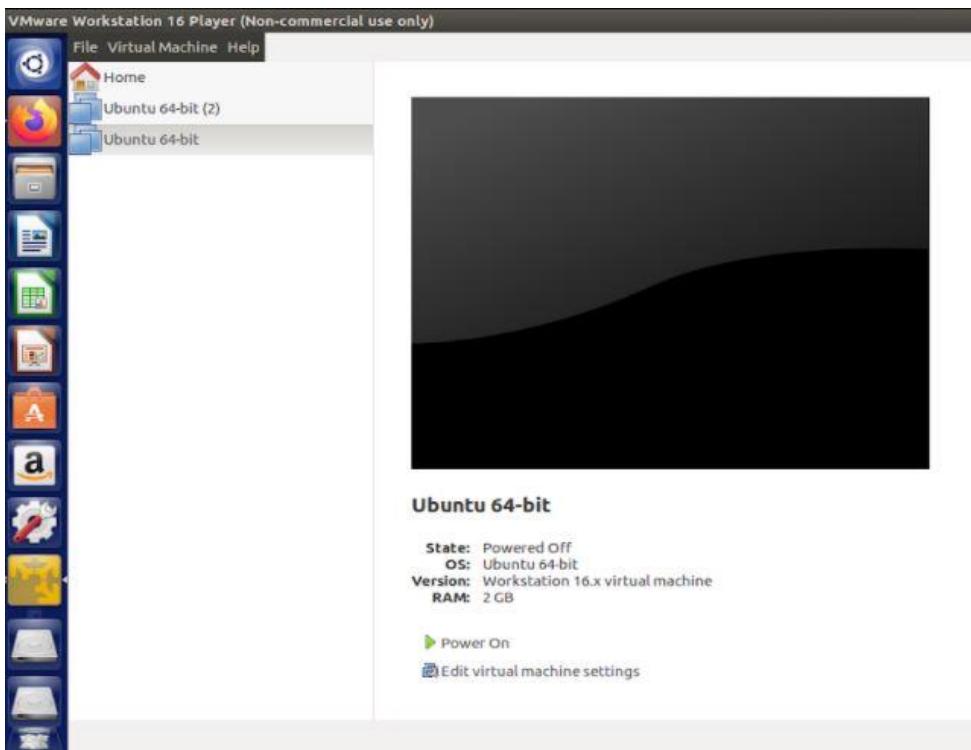


STEP 8: Click finish to complete the installation procedure and the Virtual machine opens.

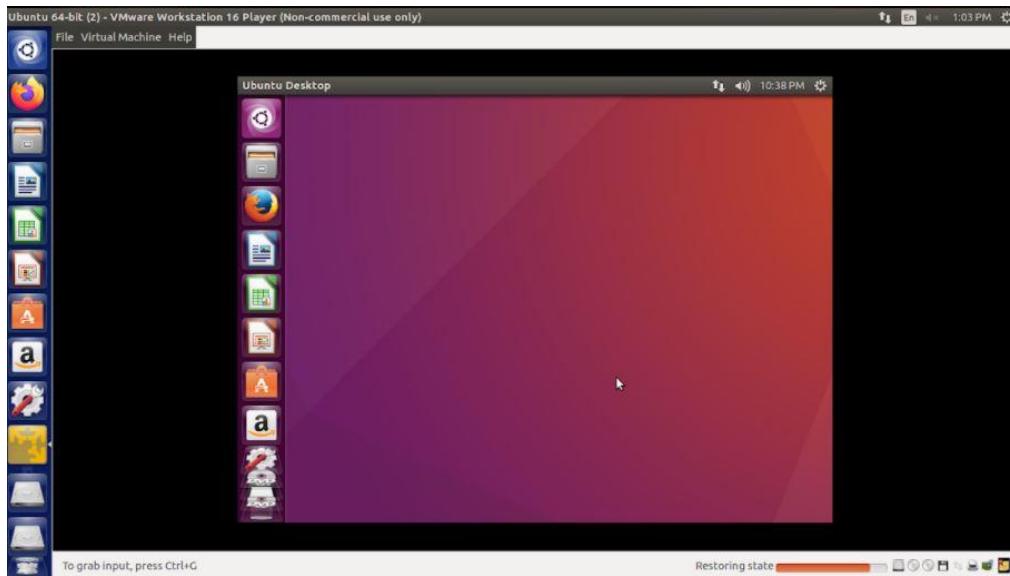


Configure the settings of the VM by providing language preferences and region details.

STEP 9: From the VMware workstation, you can launch the VM by choosing the required VM and select power on



STEP 10: The virtual machine boots and shows up



**RESULT:**

## EX NO 2,3 INSTALL A C/GCC COMPILER IN THE VIRTUAL MACHINE AND EXECUTE A SAMPLE PROGRAM

**DATE:**

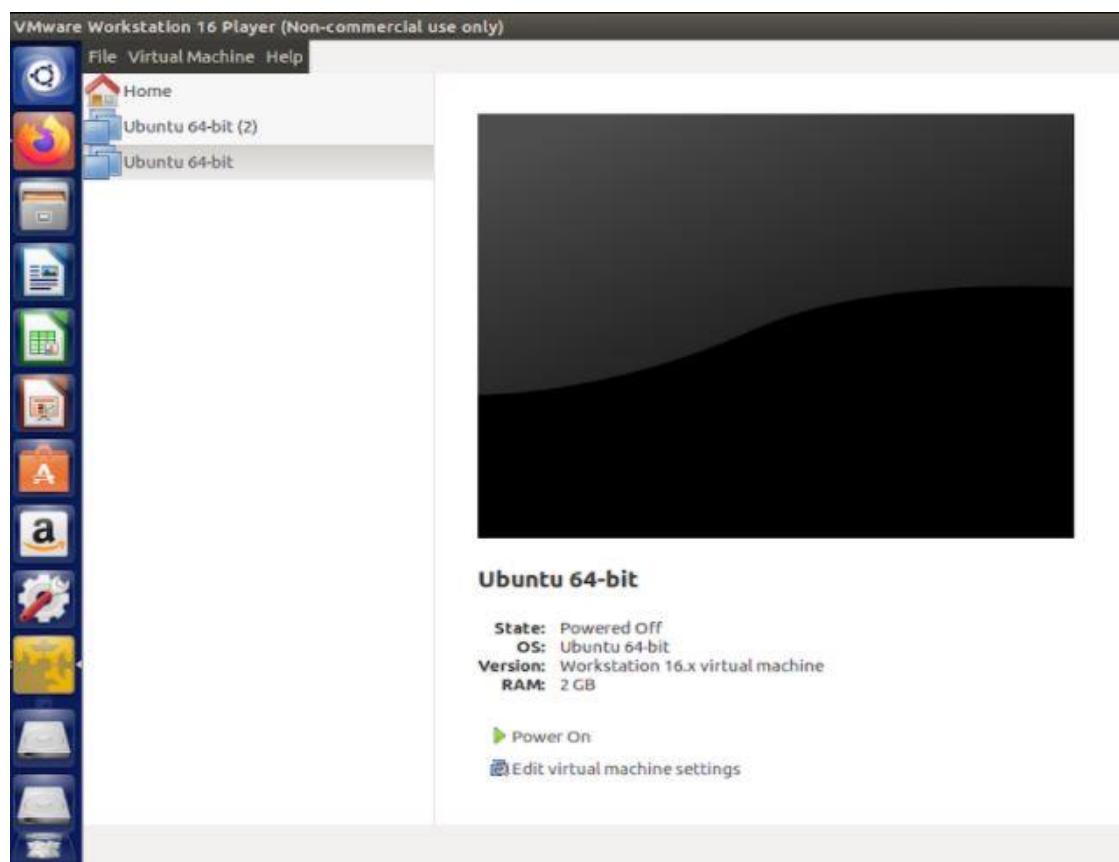
**AIM**

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

**PROCEDURE**

STEP 1: Install the VMware player and host the Virtual Machine(Ubuntu 16.04)

STEP 2: Open the VMware workstation and power on the virtual machine

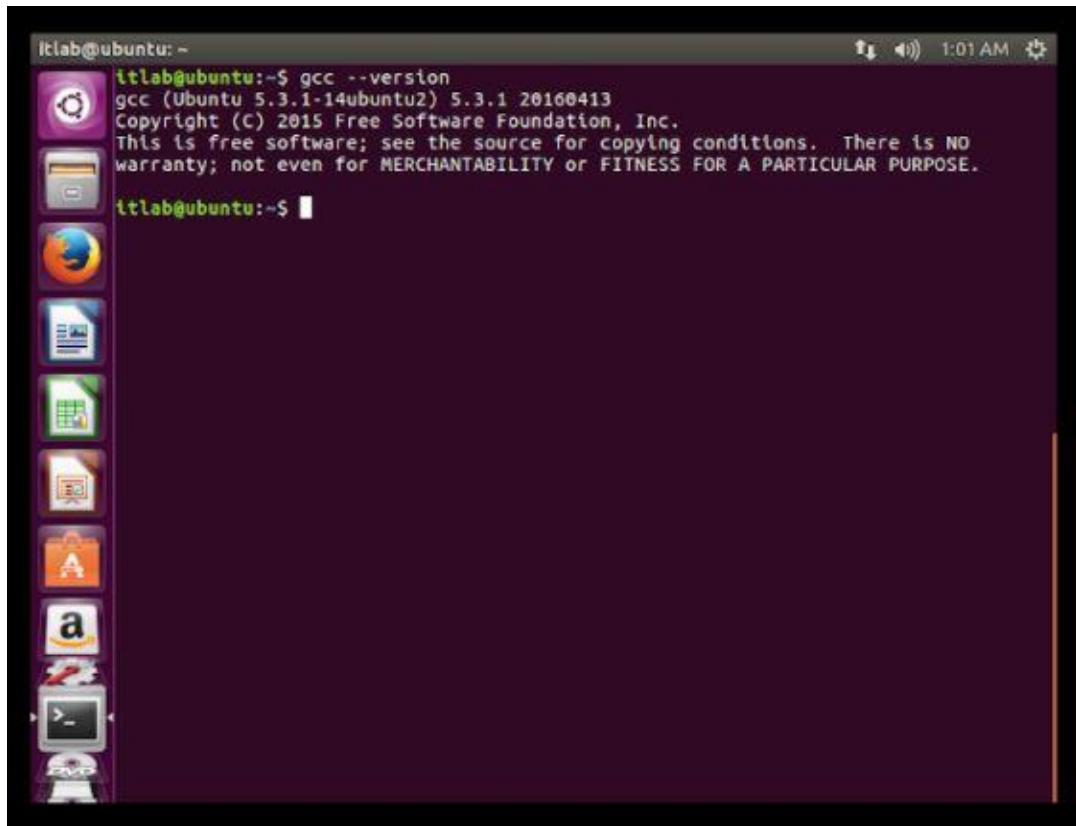




STEP 3: Right click and choose open terminal



STEP 4: Type in `gcc -version` to check if gcc compiler is installed by default



STEP 5: Else install gcc using the commands

```
// $ sudo add-apt-repository ppa:ubuntu-toolchain-r/test
$ sudo apt-get update
$ sudo apt-get install gcc-6 gcc-6-base
```

STEP 7: Create a sample file named helloworld.c

Helloworld.c

```
#include<stdio.h>
```

```
Void main()
```

```
{
```

```
Printf("Hello world \n");
```

```
}
```

STEP 8: Compile and execute the file

```
itlab@ubuntu:~$ gcc helloworld.c
itlab@ubuntu:~$ ./a.out
Hello world
itlab@ubuntu:~$ █
```

**RESULT:**

## EX NO:4 CONTROL SYSTEMS COMMAND TO CLONE, COMMIT, PUSH, FETCH, PULL, CHECKOUT, RESET, AND DELETE

### DATE

### AIM:

Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories.

### PROCEDURE:

Git is a version control system (software) and GitHub is a source code hosting service. Git is a version control system for tracking changes in computer files and coordinating work on those files among multiple people.

#### Setting Up Git

You need to setup Git on your local machine, as follows:

1. Download & Install: For Ubuntu, issue command "sudo apt-get install git".

```
ttlab@ttlab-HP-ProDesk-400-G1-SFF:~$ sudo apt-get install git
[sudo] password for ttlab:
Reading package lists... Done
Building dependency tree
Building state information... Done
The following packages were automatically installed and are no longer required:
  linux-headers-4.4.0-170 linux-headers-4.4.0-170-generic
  linux-headers-4.4.0-171 linux-headers-4.4.0-171-generic
  linux-headers-4.4.0-173 linux-headers-4.4.0-173-generic
  linux-headers-4.4.0-21 linux-headers-4.4.0-21-generic
  linux-image-4.4.0-170-generic linux-image-4.4.0-171-generic
  linux-image-4.4.0-173-generic linux-image-4.4.0-21-generic
  linux-image-extra-4.4.0-21-generic linux-modules-4.4.0-170-generic
  linux-modules-4.4.0-171-generic linux-modules-4.4.0-173-generic
  linux-modules-extra-4.4.0-170-generic linux-modules-extra-4.4.0-171-generic
  linux-modules-extra-4.4.0-173-generic
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  git-man liberror-perl
Suggested packages:
  git-daemon-run git-daemon-sysvinit git-doc git-el git-email git-gui gitk
  gitweb git-arch git-cvs git-mediawiki git-svn
The following NEW packages will be installed:
  git-man liberror-perl
0 upgraded, 3 newly installed, 0 to remove and 292 not upgraded.
Need to get 3,939 kB of archives.
After this operation, 25.6 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://in.archive.ubuntu.com/ubuntu xenial/main amd64 liberror-perl all 0.17-1.2 [19.6 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu xenial-updates/main amd64 git-man all 1:2.7.4-0ubuntu1.10 [10.2 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu xenial-updates/main amd64 git amd64 1:2.7.4-0ubuntu1.10 [3,820 kB]
Fetched 3,939 kB in 2s (1,368 kB/s)
Selecting previously unselected package liberror-perl.
(Reading database ... 337483 files and directories currently installed.)
Preparing to unpack .../liberror-perl_0.17-1.2_all.deb ...
Unpacking liberror-perl (0.17-1.2) ...
Selecting previously unselected package git-man.
Preparing to unpack .../git-man_1%ea2.7.4-0ubuntu1.10_all.deb ...
Unpacking git-man (1:2.7.4-0ubuntu1.10) ...
Selecting previously unselected package git.
Preparing to unpack .../git_1%ea2.7.4-0ubuntu1.10_amd64.deb ...
Unpacking git (1:2.7.4-0ubuntu1.10) ...
Processing triggers for man-db (2.7.5-1) ...
```

2. For Mac/Ubuntu, use the "Terminal".
  3. Customize Git: Issue "git config" command (For Ubuntu/Mac, launch a "Terminal")
  4. Set up your username and email (to be used in labeling your commits)
- ```
$ git config --global user.name "your-name"
$ git config --global user.email "your-email@youremail.com"
```
5. The settings are kept in "/etc/gitconfig" (of the GIT installed directory) and "./.gitconfig" (of the user's home directory).
  6. You can issue "git config --list" to list the settings

```
$ git config --list user.email =xxxxxx@xxxxxx.com user.name=xxxxxx
```

## GIT COMMANDS

- 1) To get help on Git commands:

```
$ git help --command or $ git <command> --help
```

```
Admin@DESKTOP-R2TRD7L MINGW64 /e/OneDrive/Desktop
$ git help
usage: git [--version] [--help] [-C <path>] [-c <name>=<value>]
           [--exec-path[=<path>]] [--html-path] [--man-path] [--info-path]
           [-p | --paginate | -P | --no-pager] [--no-replace-objects] [--bare]
           [--git-dir=<path>] [--work-tree=<path>] [--namespace=<name>]
           <command> [<args>]

These are common Git commands used in various situations:

start a working area (see also: git help tutorial)
  clone      Clone a repository into a new directory
  init       Create an empty Git repository or reinitialize an existing
one

work on the current change (see also: git help everyday)
  add        Add file contents to the index
  mv         Move or rename a file, a directory, or a symlink
  restore    Restore working tree files
  rm         Remove files from the working tree and from the index
  sparse-checkout Initialize and modify the sparse-checkout

examine the history and state (see also: git help revisions)
  bisect    Use binary search to find the commit that introduced a bug
  diff      Show changes between commits, commit and working tree, etc
  grep      Print lines matching a pattern
  log       Show commit logs
  show      Show various types of objects
  status    Show the working tree status
```

- 2) Create a new directory and initialize a git repository

```
$mkdir new_directory
$cd new_directory
$git init
```

```
itlab@itlab-HP-ProDesk-400-G1-SFF:~$ mkdir helloworld
itlab@itlab-HP-ProDesk-400-G1-SFF:~$ cd helloworld
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git init
Initialized empty Git repository in /home/itlab/helloworld/.git/
```

- 3) Staging File Changes for Tracking

Issue a "git status" command to show the status of the files

```
$ git status
```

git log – used to display the records of the commits in a git repository

```
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git status
On branch master

Initial commit

nothing to commit (create/copy files and use "git add" to track)
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git log
fatal: your current branch 'master' does not have any commits yet
```

- 4) Create a new file named helloworld in the working directory and track the changes

```
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git status
On branch master

Initial commit

Untracked files:
  (use "git add <file>..." to include in what will be committed)

    .helloworld

nothing added to commit but untracked files present (use "git add" to track)
```

- 5) To stage a new file for tracking, use "git add ..." command.

Add any file present in the working directory

```
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ ls
helloworld index.html
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git add index.html
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git add .
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git status
On branch master

Initial commit

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)

    .helloworld
    index.html
```

- 6) Committing File Changes (git commit)

The "git commit" command commits all the file changes in the staging area.

Use a -m option to provide a message for the commit

```
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git commit -m "new commit"
[master (root-commit) 91d15a6] new commit
 2 files changed, 12 insertions(+)
 create mode 100644 helloworld
 create mode 100644 index.html
```

- 7) Check the status of your commit

```
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git log
commit 91d15a69a7e5dice4a6c9d959892768ed06fd8b4
Author: [REDACTED] <[REDACTED].com>
Date:  Tue Sep 14 11:32:44 2021 +0530

  new commit
```

- 8) git branch can be used to create a new branch

```
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git branch hema
itlab@itlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git branch --list
  hema
* master
```

- 9) "git checkout" can be used to checkout a branch, a commit, or files. The syntaxes are:

```
$ git checkout <branch-name>
$ git checkout <commit-name>
$ git checkout <commit-name> file_name
```

```
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git checkout hema
A    doc2.html
D    helloworld
Switched to branch 'hema'
```

- 10) Create a new file and commit changes in the new branch

```
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git add .
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git commit -m "latest commit"
[ hema b4d4222] latest commit
 3 files changed, 7 insertions(+), 7 deletions(-)
 create mode 100644 doc2.html
 delete mode 100644 helloworld
```

```
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git log
commit b4d422260e4a10200daf8b41eb955685e7150d5b
Author: [REDACTED] <[REDACTED]@gmail.com>
Date:   Tue Sep 14 11:36:40 2021 +0530
```

```
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git log --oneline
b4d4222 latest commit
91d15a6 new commit
```

- 11) Switch back to the master branch and merge

```
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git checkout master
Switched to branch 'master'
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git status
On branch master
nothing to commit, working directory clean
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git merge hema
Updating 91d15a6..b4d4222
Fast-forward
 doc2.html | 6 ++++++
 helloworld | 6 +-----
 index.html | 2 ++
 3 files changed, 7 insertions(+), 7 deletions(-)
 create mode 100644 doc2.html
 delete mode 100644 helloworld
```

- 12) Delete the branch

\$git branch -d new\_branch

```
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git branch -d hema
Deleted branch hema (was b4d4222).
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git branch --list
* master
```

- 13) Clone a repository locally by specifying the url

```
itlabgitlab-HP-ProDesk-400-G1-SFF:~/helloworld$ git clone https://github.com/97k/spam-ham-web-app.git
Cloning into 'spam-ham-web-app'...
remote: Enumerating objects: 2860, done.
remote: Total 2860 (delta 0), reused 0 (delta 0), pack-reused 2860
Receiving objects: 100% (2860/2860), 69.97 MiB | 1.69 MiB/s, done.
Resolving deltas: 100% (139/139), done.
```

- 14) Push to an existing repository

```
$ git remote add origin git@github.com:username/new_repo  
$ git push -u origin master
```

#### 15) git reset and "git reset --hard"

```
$ git reset
```

// Unstage the changes of from staging area, // not affecting the working tree.

```
$ git reset
```

// Reset the staging area

// Remove all changes (of all files) from staging area, // not affecting the working tree.

```
$ git reset --hard
```

// Reset the staging area and working tree to match the

// recent commit (i.e., discard all changes since the // last commit).

```
$ git reset
```

// Move the HEAD of current branch to the given commit,

// not affecting the working tree.

```
$ git reset --hard
```

// Reset both staging area and working tree to the given

// commit, i.e., discard all changes after that commit.

#### 16) Pull command

As a short hand, "git pull" combines "git fetch" and "git merge" into one command, for convenience

```
$ git pull
```

// Fetch the remote's copy of the current branch and merge it

// into the local repo immediately, i.e., update the working tree

// Same as

```
$ git fetch <remote-name> <current-branch-name>
```

```
$ git merge <remote-name> <current-branch-name>
```

```
$ git pull --rebase <remote-name>
```

// linearize local changes after the remote branch.

#### 17) Pushing to Remote Repo

The "git push " is the counterpart of "git fetch", which exports commits from local repo to remote repo.

```
$ git push
```

```
// Push the specific branch of the local repo  
  
$ git push --all  
// Push all branches of the local repo  
  
$ git push --tag  
// Push all tags  
// "git push" does not push tags  
  
$ git push -u  
// Save the remote-name and branch-name as the  
// reference (or current) remote-name and branch-name.  
// Subsequent "git push" without argument will use these references.
```

**RESULT:**

**EX NO: 5, 6 INSTALL GOOGLE APP ENGINE , CREATE HELLO WORLD APP AND LAUNCH SIMPLE WEB APPLICATIONS****DATE:****AIM:**

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

**THEORY:**

App Engine allows developers to focus on doing what they do best, writing code. The App Engine standard environment is based on container instances running on Google's infrastructure. Containers are preconfigured with one of several available runtimes (Java 7, Java 8, Python 2.7, Go and PHP). Each runtime also includes libraries that support [App Engine Standard APIs](#). For many applications, the standard environment runtimes and libraries might be all you need.

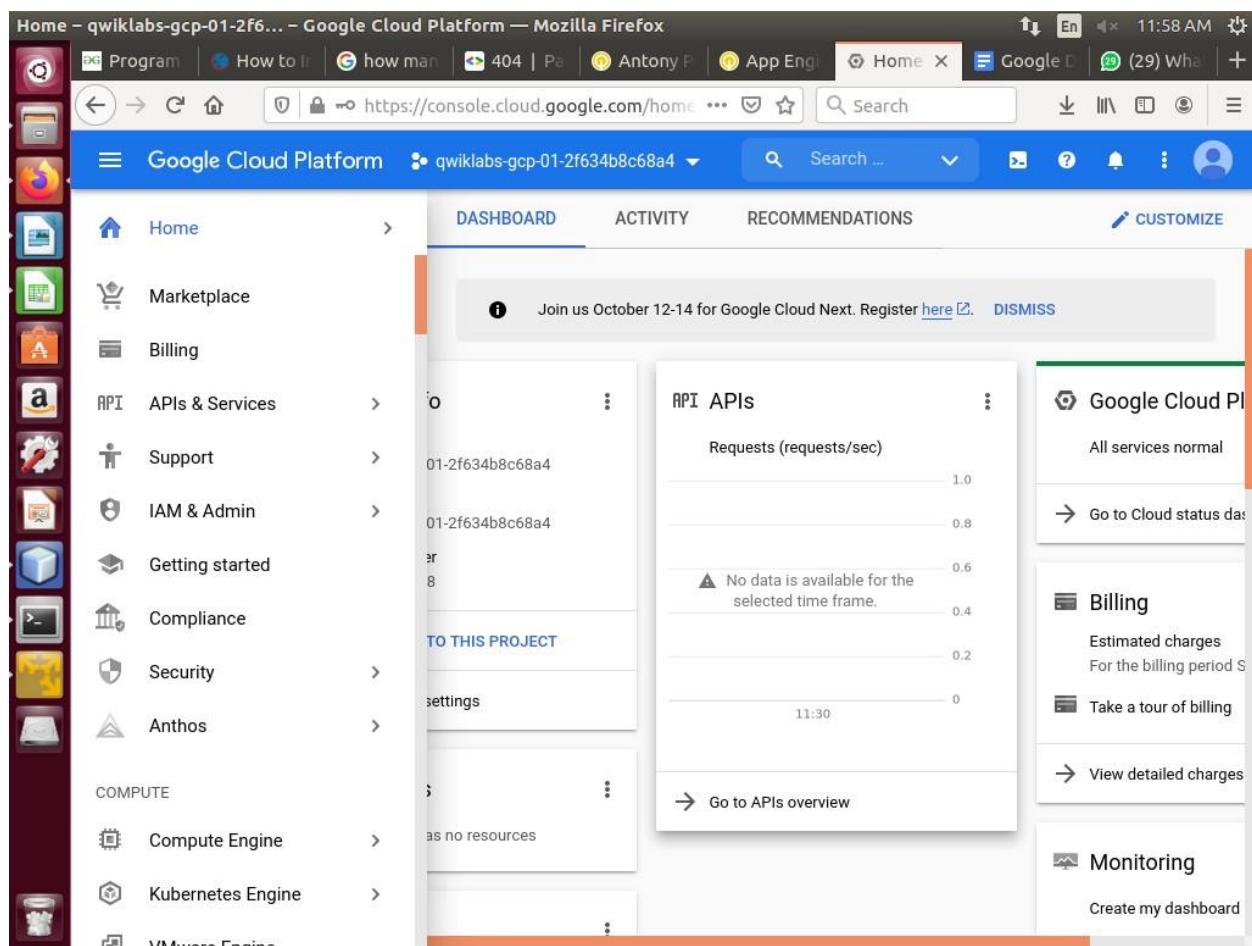
The App Engine standard environment makes it easy to build and deploy an application that runs reliably even under heavy load and with large amounts of data. It includes the following features:

- Persistent storage with queries, sorting, and transactions.
- Automatic scaling and load balancing.
- Asynchronous task queues for performing work outside the scope of a request.
- Scheduled tasks for triggering events at specified times or regular intervals.
- Integration with other [Google cloud services and APIs](#).

Applications run in a secure, sandboxed environment, allowing App Engine standard environment to distribute requests across multiple servers, and scaling servers to meet traffic demands. Your application runs within its own secure, reliable environment that is independent of the hardware, operating system, or physical location of the server.

**ALGORITHM:**

Step 1: Login to the google cloud portal and go to the console.

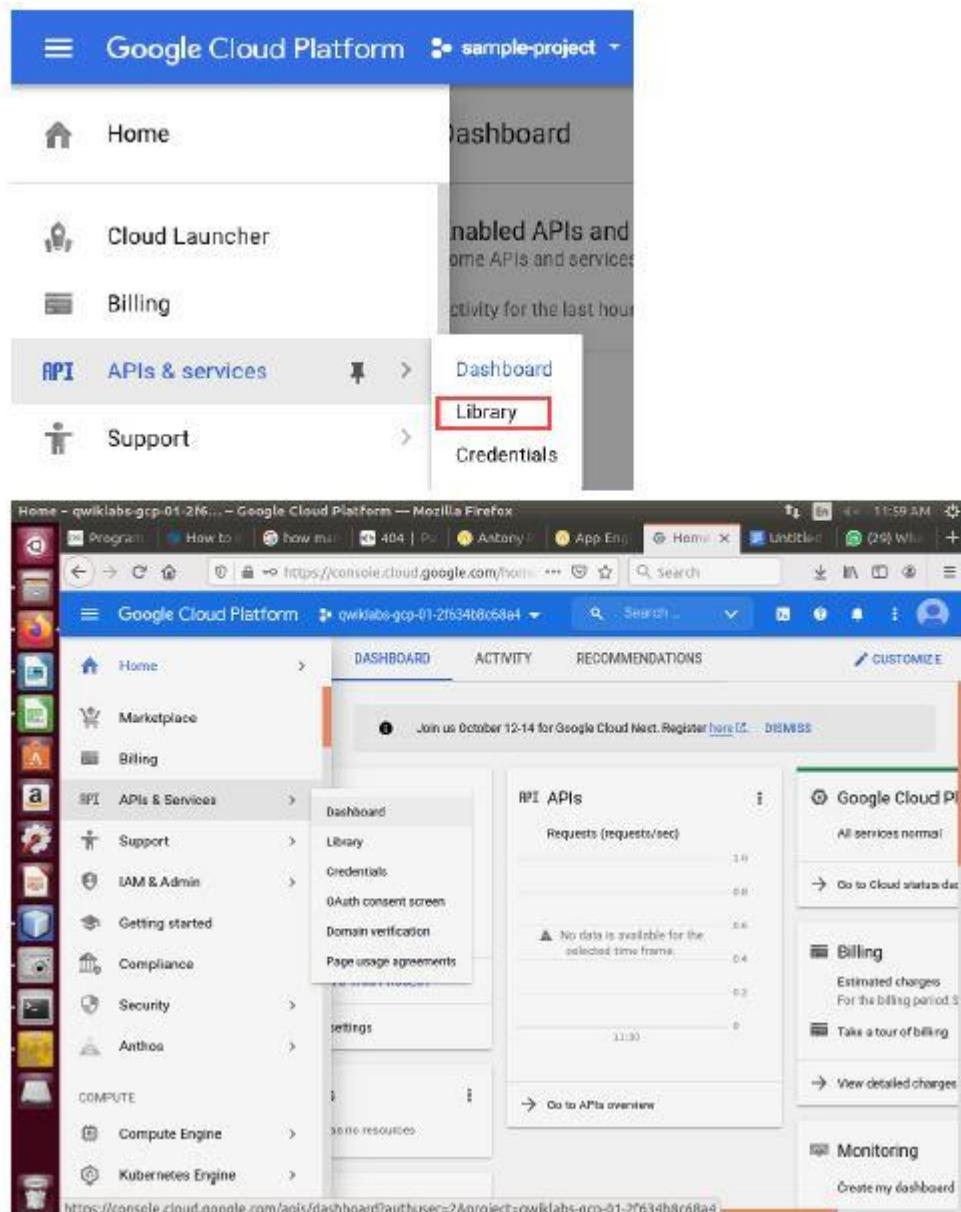


Step 2:

**Enable Google App Engine Admin API**

The App Engine Admin API enables developers to provision and manage their App Engine Applications.

In the left menu click **APIs & Services > Library**.



### Step 3:

Type "App Engine Admin API" in search box and Click **App Engine Admin API**.

Click **Enable**. If there is no prompt to enable the API, then it is already enabled and no action is needed.

The screenshot shows a web browser window with the URL <https://console.cloud.google.com/apis/library>. The page title is "Google Cloud Platform" and the sub-page title is "API Library". A search bar at the top contains the query "app engine admin api". Below the search bar, a single result is shown: "app engine admin api". To the left of the search results, there is a sidebar titled "Filter by" with sections for "VISIBILITY" (Public 354, Private 3) and "CATEGORY" (Advertising 14, Analytics 5, Big data 17, Blog & CMS 1). On the right side of the search results, there is a "Maps" section with two items: "Maps SDK for Android" and "Maps SDK for iOS". A "VIEW ALL (17)" link is located above the "Maps" section.



## App Engine Admin API

Google

Provisions and manages developers' App Engine applications.

**ENABLE**

[TRY THIS API](#)

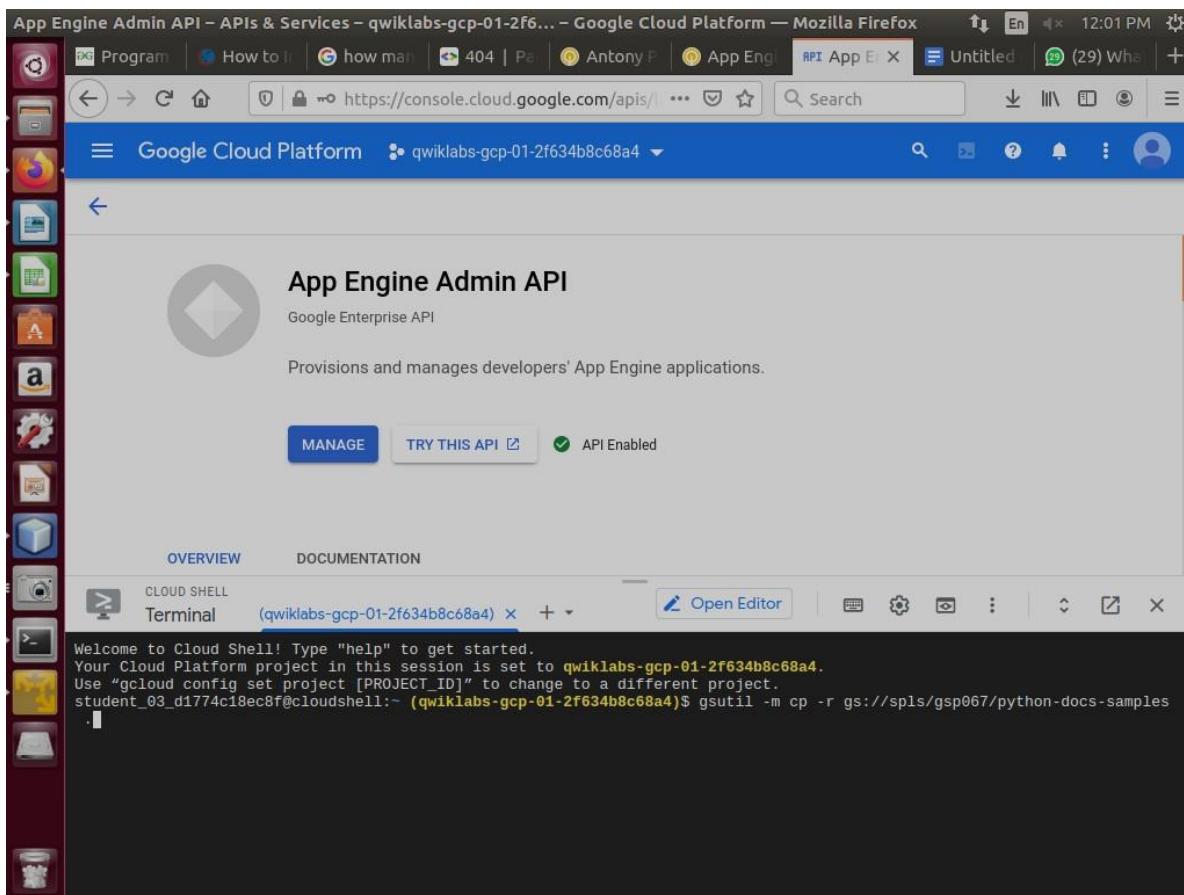
The screenshot shows the Google Cloud Platform interface. On the left, there's a sidebar with various icons. The main area displays the "App Engine Admin API" page under "Google Enterprise API". It shows a "MANAGE" button, a "TRY THIS API" button, and a status indicator "API Enabled". Below this, there are tabs for "OVERVIEW" and "DOCUMENTATION". A "CLOUD SHELL" tab is active, showing a terminal window with the following text:

```
Welcome to Cloud Shell! Type "help" to get started.  
Your Cloud Platform project in this session is set to qwiklabs-gcp-01-2f634b8c68a4.  
Use "gcloud config set project [PROJECT_ID]" to change to a different project.  
student_03_d1774c18ec8f@cloudshell:~ (qwiklabs-gcp-01-2f634b8c68a4)$ gsutil -m cp -r gs://splis/gsp067/python-docs-samples .
```

Below the terminal, there's another "OVERVIEW" section with a "Tutorial and documentation" link.

Step 4:  
Activate the cloud shell

The screenshot shows the Google Cloud Platform dashboard. At the top, there's a search bar and a user profile icon. Below the search bar, there are navigation links for "Home" and "Marketplace". In the top right corner, there's a blue square icon with a white square inside, which is highlighted with a red box. This icon represents the Cloud Shell feature.



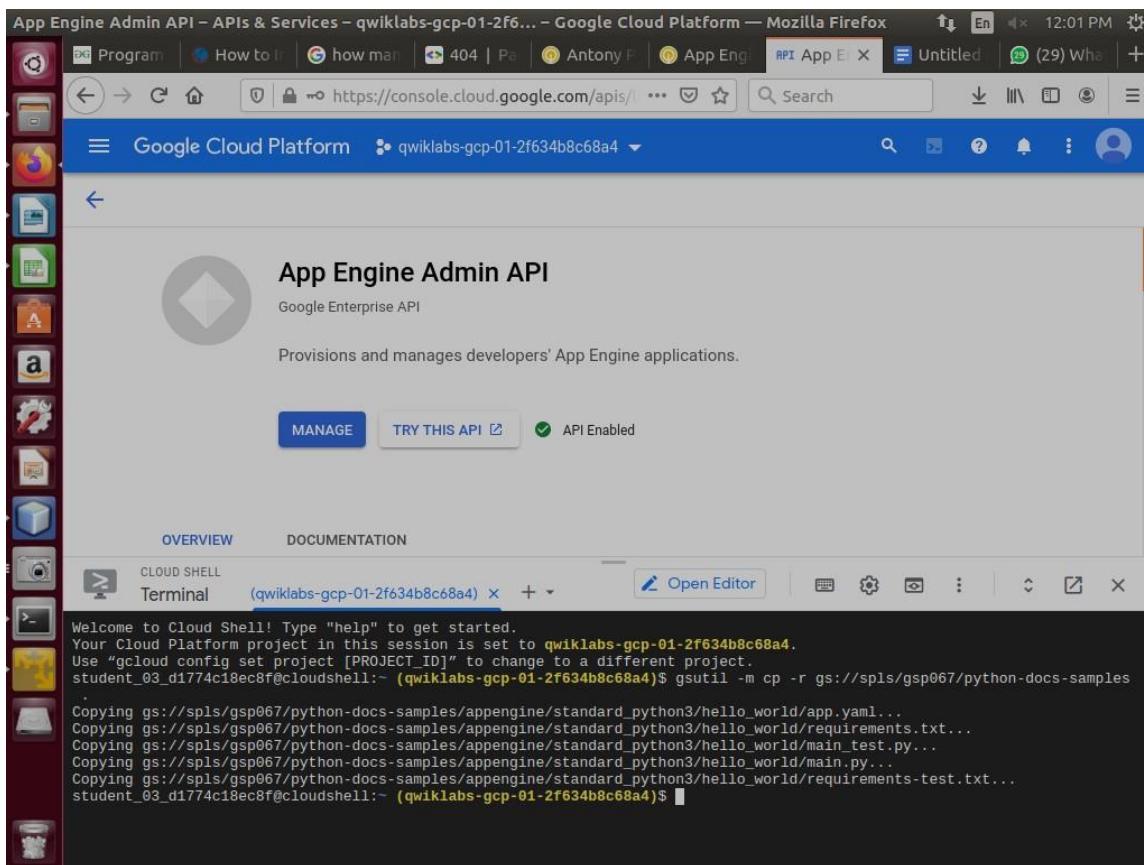
## Step 5:

### Download the Hello World app

There is a simple Hello World app for Python you can use to quickly get a feel for deploying an app to Google Cloud. Follow these steps to download Hello World to your Google Cloud instance.

5.1 Enter the following command to copy the Hello World sample app repository to your Google Cloud instance:

```
gsutil -m cp -r gs://spl/gsp067/python-docs-samples .
```



## 5.2 Go to the directory that contains the sample code:

```
cd python-docs-samples/appengine/standard_python3/hello_world
```

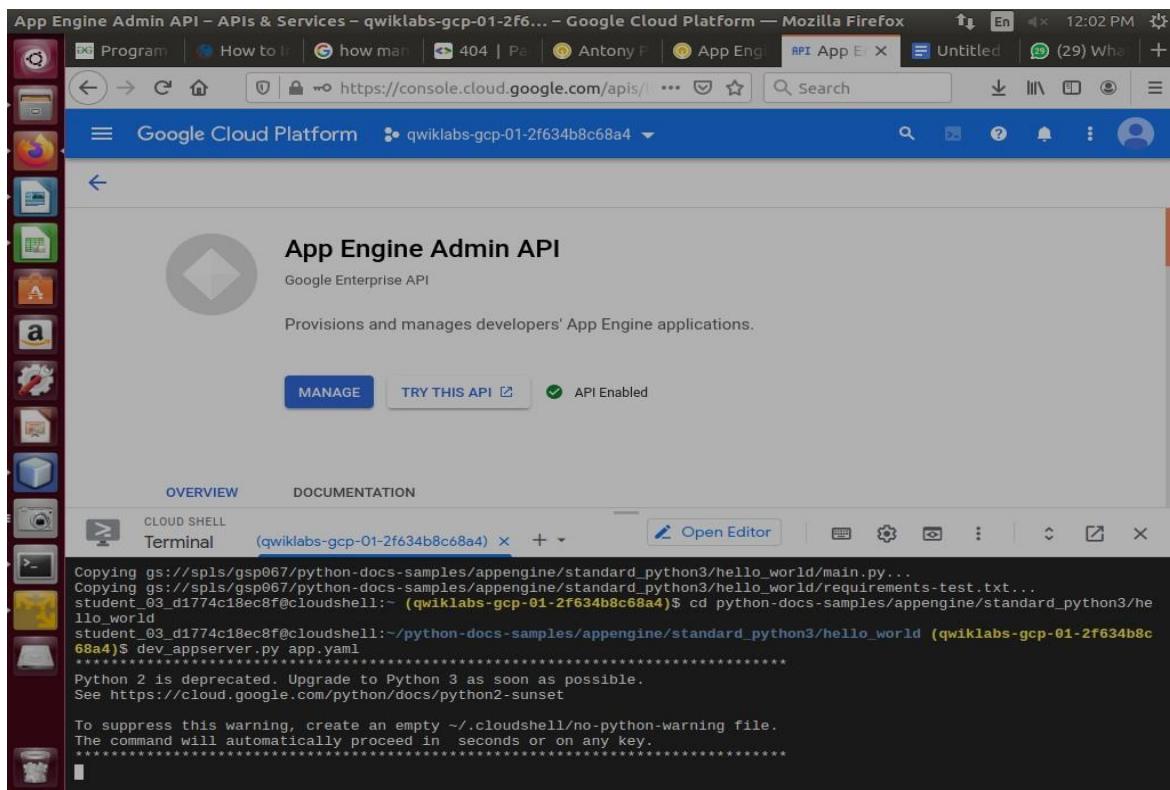
Step 6:

### Test the application

Test the application using the Google Cloud development server (`dev_appserver.py`), which is included with the preinstalled App Engine SDK.

6.1 From within your helloworld directory where the app's [app.yaml](#) configuration file is located, start the Google Cloud development server with the following command:

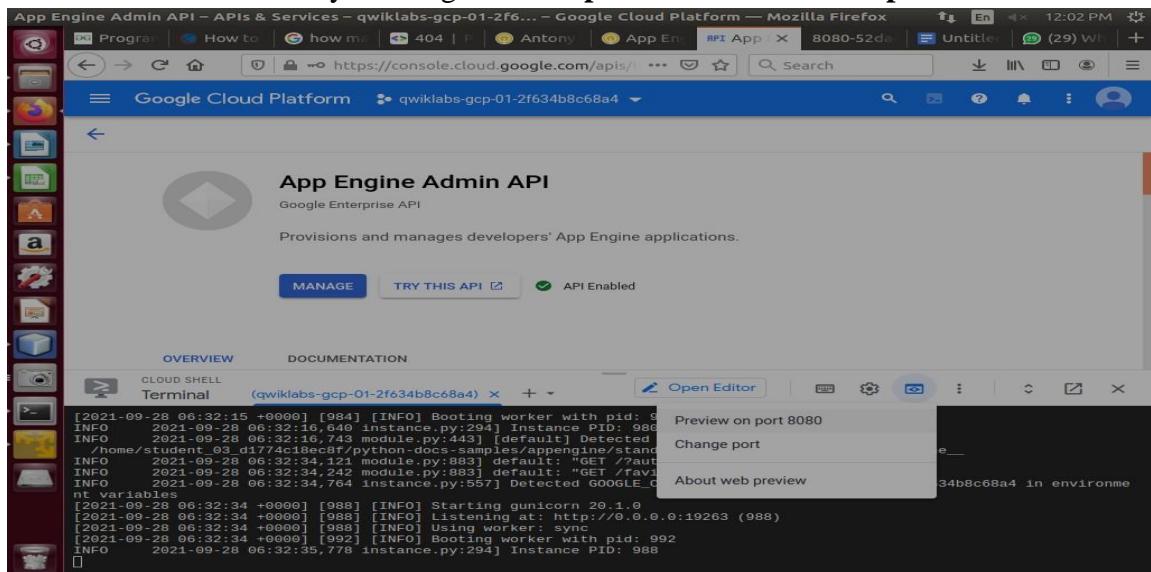
### dev\_appserver.py app.yaml



The screenshot shows a Mozilla Firefox browser window with the URL <https://console.cloud.google.com/apis/>. The page title is "App Engine Admin API - APIs & Services - qwiklabs-gcp-01-2f6... - Google Cloud Platform — Mozilla Firefox". On the left, there's a sidebar with various icons. The main content area is titled "App Engine Admin API" and "Google Enterprise API". It says "Provisions and manages developers' App Engine applications." Below this are "MANAGE" and "TRY THIS API" buttons, and a status indicator "API Enabled". Under "OVERVIEW", there's a "CLOUD SHELL" section with a "Terminal" tab open. The terminal window shows the command:

```
Copying gs://splz/gsp067/python-docs-samples/appengine/standard_python3/hello_world/main.py...
Copying gs://splz/gsp067/python-docs-samples/appengine/standard_python3/hello_world/requirements-test.txt...
student_03_d1774c18ec8f@cloudshell:~ (qwiklabs-gcp-01-2f634b8c68a4)$ cd python-docs-samples/appengine/standard_python3/he...
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c...
68a4)$ dev_appserver.py app.yaml
*****
Python 2 is deprecated. Upgrade to Python 3 as soon as possible.
See https://cloud.google.com/python/docs/python2-sunset
To suppress this warning, create an empty ~/.cloudshell/no-python-warning file.
The command will automatically proceed in  seconds or on any key.
*****
```

### 6.1 View the results by clicking the Web preview > Preview on port 8080.

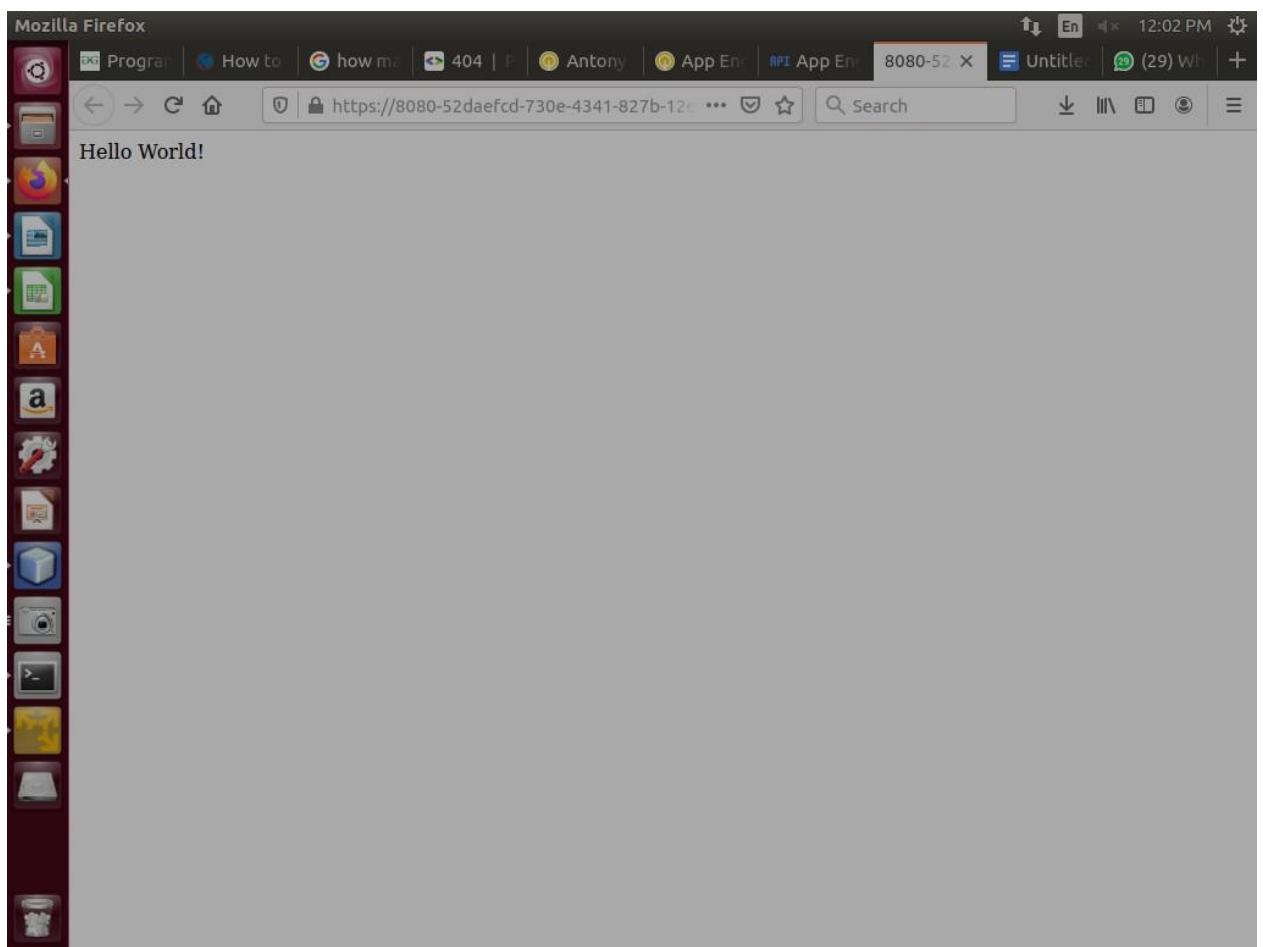


This screenshot is similar to the previous one, showing the "App Engine Admin API" page in Mozilla Firefox. The terminal output shows the application booting up:

```
[2021-09-28 06:32:15 +0000] [984] [INFO] Booting worker with pid: 892
INFO 2021-09-28 06:32:16.740 instance.py:294] Instance PID: 982
INFO 2021-09-28 06:32:16.743 module.py:443] [default] Detected ...
INFO 2021-09-28 06:32:34.123 module.py:883] default: "GET /au...
INFO 2021-09-28 06:32:34.242 module.py:883] default: "GET /rav...
INFO 2021-09-28 06:32:34.764 instance.py:557] Detected GOOGLE_O...
nt variables
[2021-09-28 06:32:34 +0000] [988] [INFO] Starting gunicorn 20.1.0
[2021-09-28 06:32:34 +0000] [988] [INFO] Listening at: http://0.0.0.0:19263 (988)
[2021-09-28 06:32:34 +0000] [988] [INFO] Using worker: sync
[2021-09-28 06:32:34 +0000] [992] [INFO] Booting worker with pid: 982
INFO 2021-09-28 06:32:35.778 instance.py:294] Instance PID: 988
```

A "Preview on port 8080" button is highlighted with a red box. The right side of the screen shows a preview window with the text "34b8c68a4 in environment variables".

You'll see this in a new browser window:



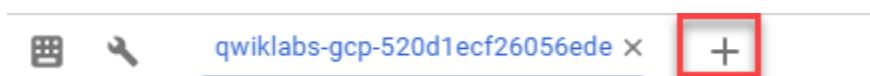
Step 7:

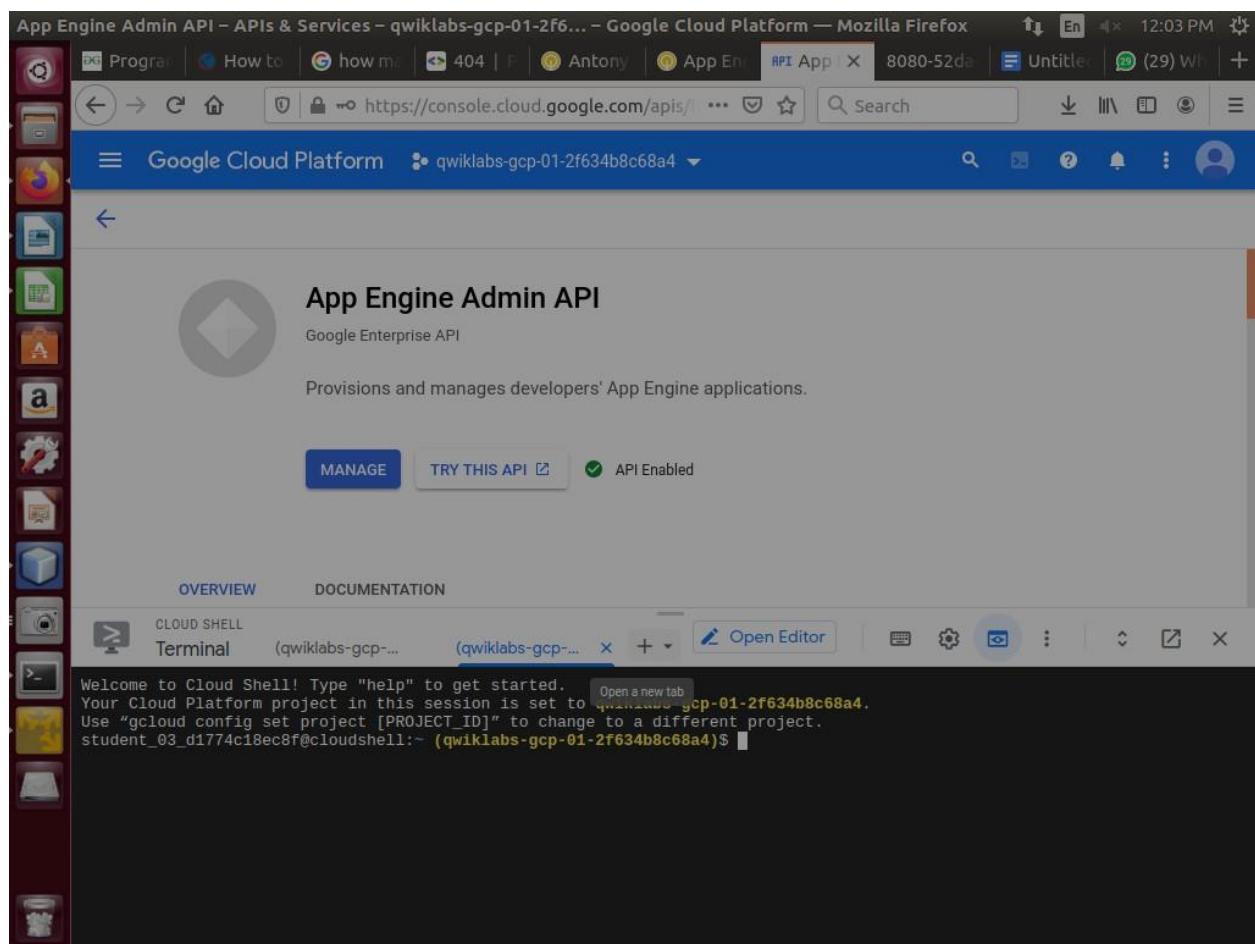
### To render other web applications and to make changes in the existing ones

You can leave the development server running while you develop your application. The development server watches for changes in your source files and reloads them if necessary.

Let's try it. Leave the development server running. We'll open another command line window, then edit main.py to change "Hello World!" to "Hello, SJCE FOSS World!".

7.1 Click the (+) next to your Cloud Shell tab to open a new command line session.



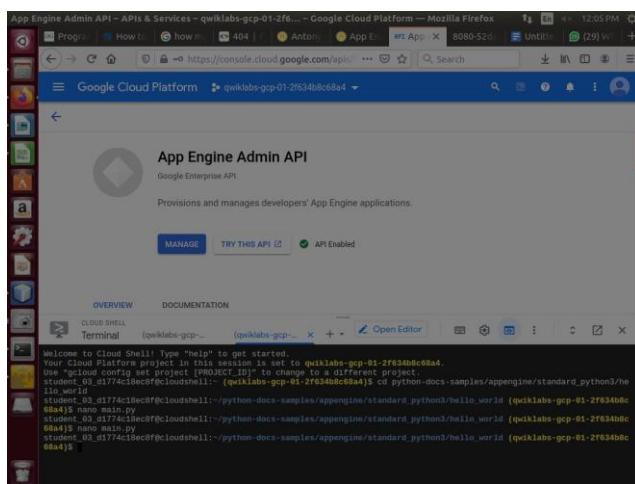


7.2 Enter this command to go to the directory that contains the sample code.

*cd python-docs-samples/appengine/standard\_python3/hello\_world*

7.3 Enter the following to open main.py in nano to edit the content.

*nano main.py*

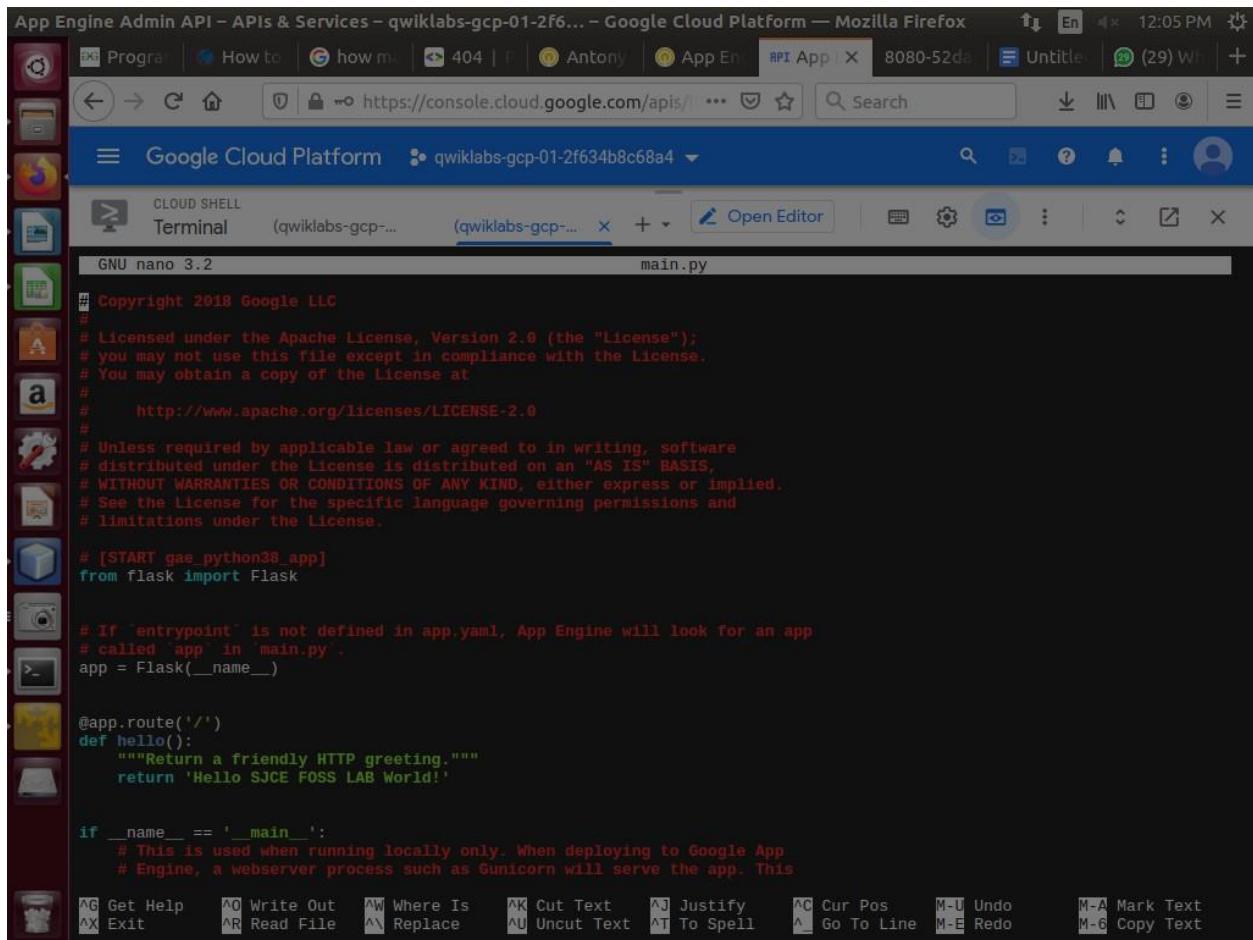


7.4 Change "Hello World!" to "Hello, SJCE FOSS LAB World!". Exit and save the file.

A screenshot of a Mozilla Firefox browser window. The address bar shows 'https://console.cloud.google.com/apis/'. The main content area displays the 'App Engine Admin API' page for a project named 'qwiklabs-gcp-01-2f634b8c68a4'. Below the API documentation, there is a terminal window titled 'CLOUD SHELL' showing a terminal session. The user is in a nano editor with a file named 'main.py'. The code in the file is:

```
# Copyright 2018 Google LLC
#
# 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
```

The terminal prompt shows the user has typed 'nano main.py' and is currently editing the file.



The screenshot shows a terminal window titled "Terminal" within the Google Cloud Platform interface. The file being edited is "main.py". The code in the file is as follows:

```

# Copyright 2018 Google LLC
#
# 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.

# [START gae_python38_app]
from flask import Flask

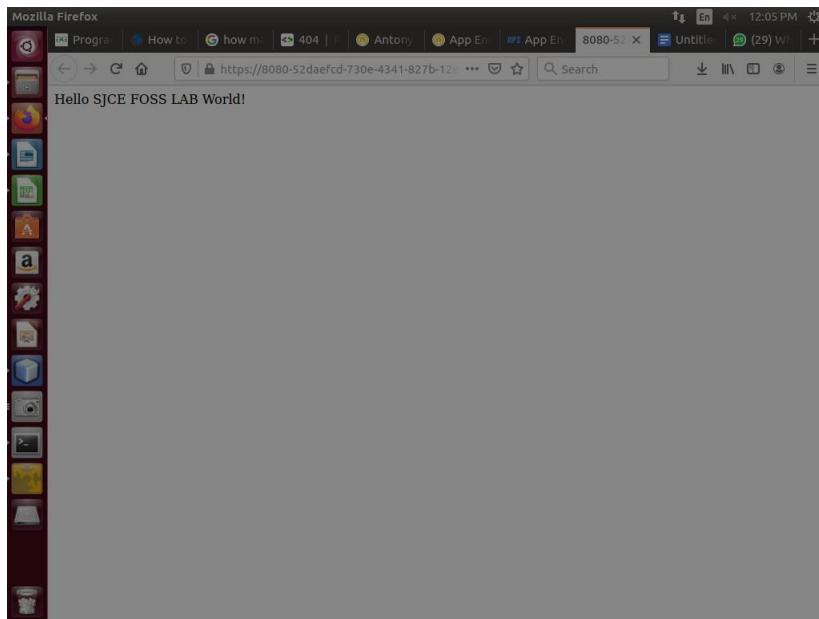
# If `entrypoint` is not defined in app.yaml, App Engine will look for an app
# called `app` in `main.py`.
app = Flask(__name__)

@app.route('/')
def hello():
    """Return a friendly HTTP greeting."""
    return 'Hello SJCE FOSS LAB World!'

if __name__ == '__main__':
    # This is used when running locally only. When deploying to Google App
    # Engine, a webserver process such as Gunicorn will serve the app. This

```

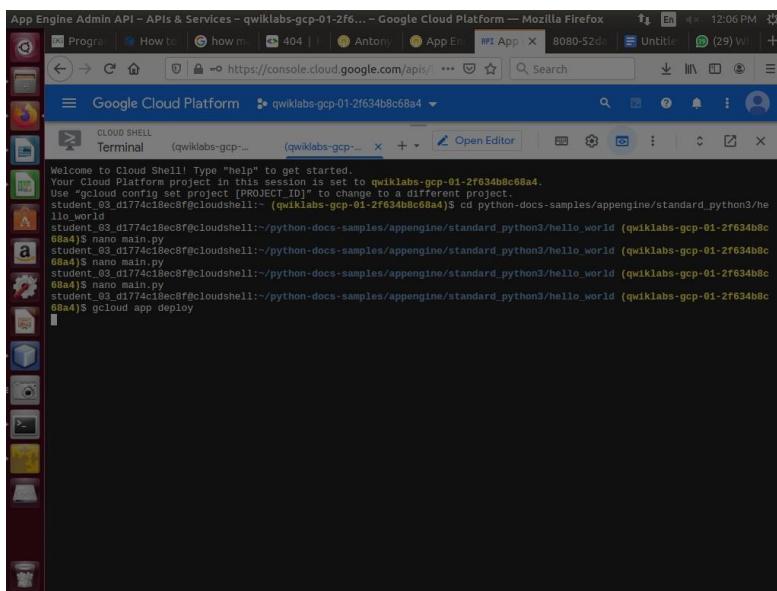
7.5 Reload the Hello World! Browser or click the **Web Preview > Preview on port 8080** to see the results.



Step 8:

## Deploy your app

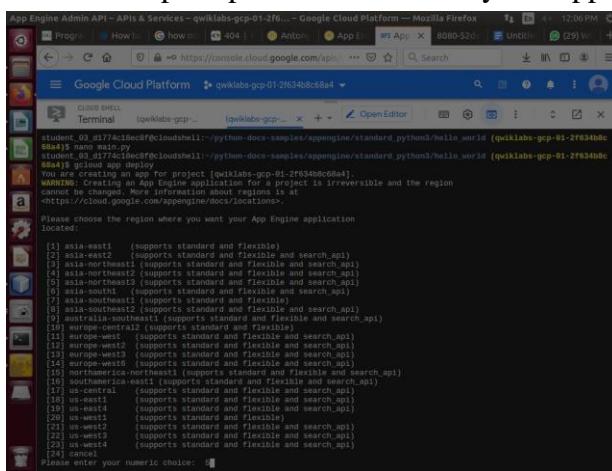
To deploy your app to App Engine, run the following command from within the root directory of your application where the app.yaml file is located:



```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to qwiklabs-gcp-01-2f634b8c68a4.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
student_03_d1774c18ec8f@cloudshell:~$ cd python-docs-samples/appengine/standard_python3/hello_world
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c68a4)$ nano main.py
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c68a4)$ nano main.py
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c68a4)$ gcloud app deploy
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c68a4)$
```

### *gcloud app deploy*

You will be prompted to enter where your App engine will be located.

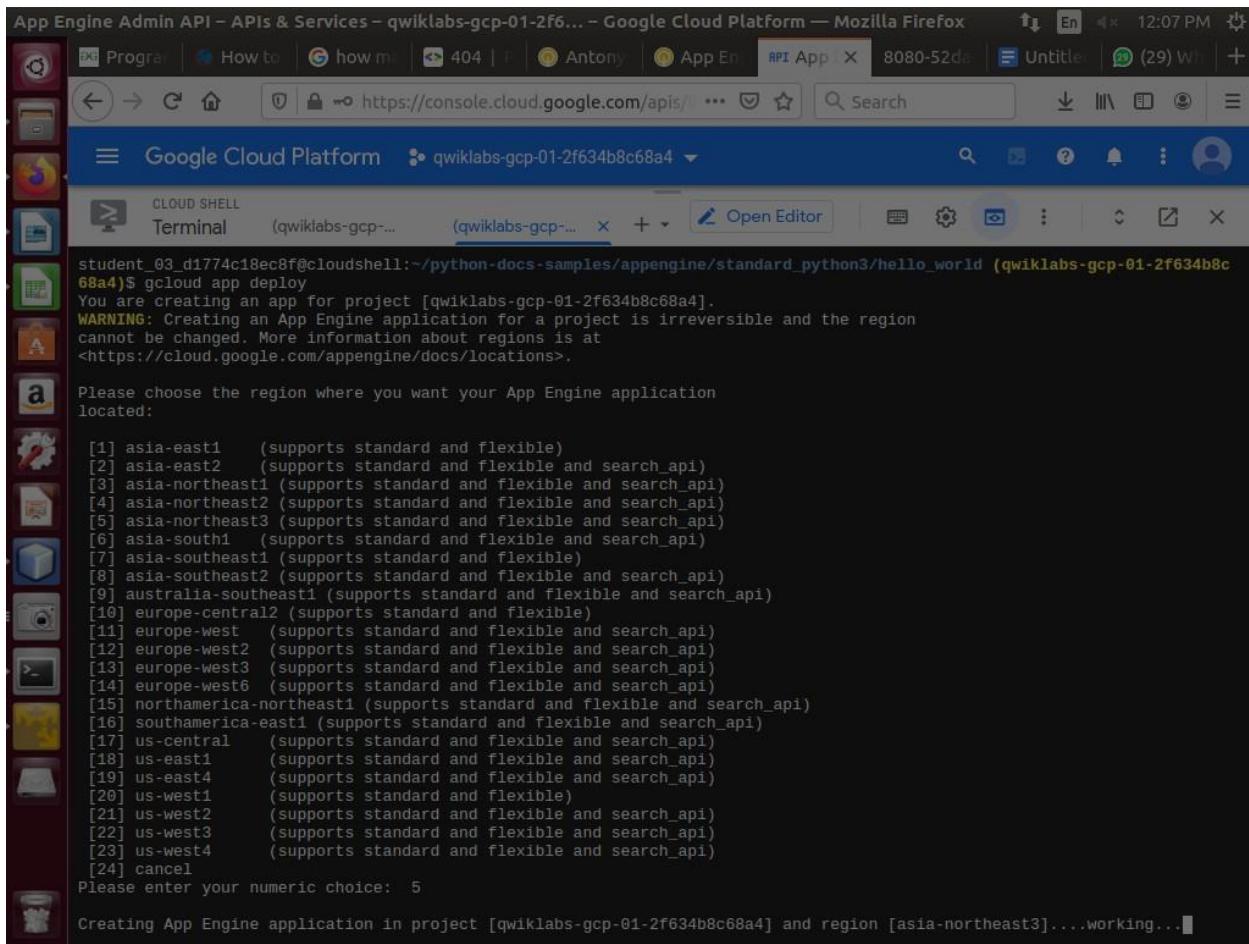


```
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c68a4)$ gcloud app deploy
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c68a4)$
You are creating an app for project [qwiklabs-gcp-01-2f634b8c68a4].
WARNING: Creating an App Engine application for a project is irreversible and the region
        you choose will be used at all times thereafter.
        Please see https://cloud.google.com/appengine/docs/locations.

Please choose the region where you want your App Engine application
located:
[1] asia-east1 (supports standard and flexible)
[2] asia-east2 (supports standard and flexible and search_api)
[3] asia-north1 (supports standard and flexible and search_api)
[4] asia-north2 (supports standard and flexible and search_api)
[5] asia-northwest3 (supports standard and flexible and search_api)
[6] asia-south1 (supports standard and flexible)
[7] asia-southwest1 (supports standard and flexible)
[8] asia-southwest2 (supports standard and flexible and search_api)
[9] europe-central2 (supports standard and flexible and search_api)
[10] europe-central3 (supports standard and flexible and search_api)
[11] europe-west (supports standard and flexible and search_api)
[12] europe-west2 (supports standard and flexible and search_api)
[13] europe-west3 (supports standard and flexible and search_api)
[14] europe-west4 (supports standard and flexible and search_api)
[15] southamerica-east1 (supports standard and flexible and search_api)
[16] us-central1 (supports standard and flexible and search_api)
[17] us-east1 (supports standard and flexible and search_api)
[18] us-east2 (supports standard and flexible and search_api)
[19] us-east4 (supports standard and flexible and search_api)
[20] us-west1 (supports standard and flexible and search_api)
[21] us-west2 (supports standard and flexible and search_api)
[22] us-west3 (supports standard and flexible and search_api)
[23] us-west4 (supports standard and flexible and search_api)
[24] cancel1
```

Please enter your numeric choice:

Enter **Y** when prompted to confirm the details and begin the deployment of service.



```
App Engine Admin API - APIs & Services - qwiklabs-gcp-01-2f6... - Google Cloud Platform — Mozilla Firefox
Program How to how m 404 | P Antony App En API App 8080-52d8 Untitled (29 W) 12:07 PM
https://console.cloud.google.com/apis/ ... Search
Google Cloud Platform qwiklabs-gcp-01-2f634b8c68a4
CLOUD SHELL Terminal (qwiklabs-gcp-... x + Open Editor
student_03_d1774c18ec8f@cloudshell:~/python-docs-samples/appengine/standard_python3/hello_world (qwiklabs-gcp-01-2f634b8c68a4)$ gcloud app deploy
You are creating an app for project [qwiklabs-gcp-01-2f634b8c68a4].
WARNING: Creating an App Engine application for a project is irreversible and the region
cannot be changed. More information about regions is at
<https://cloud.google.com/appengine/docs/locations>.

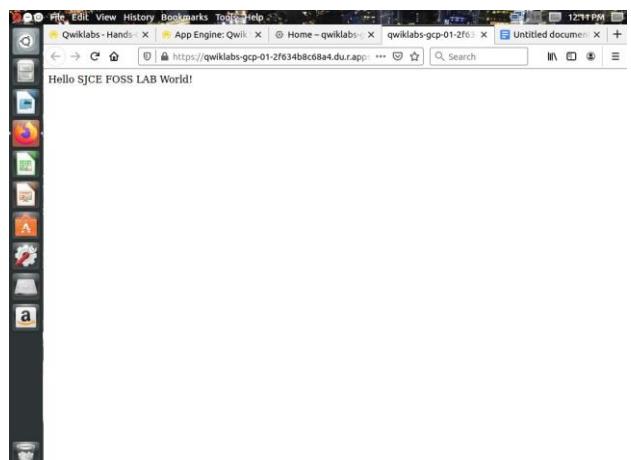
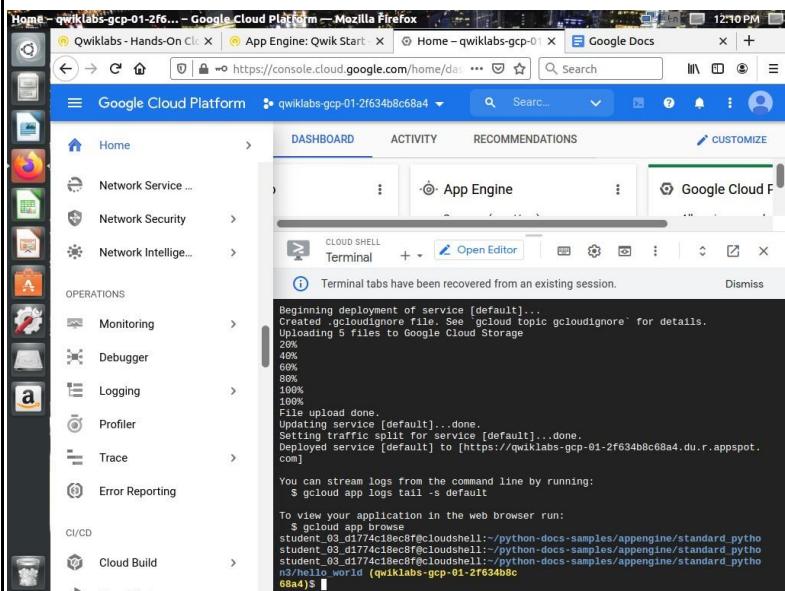
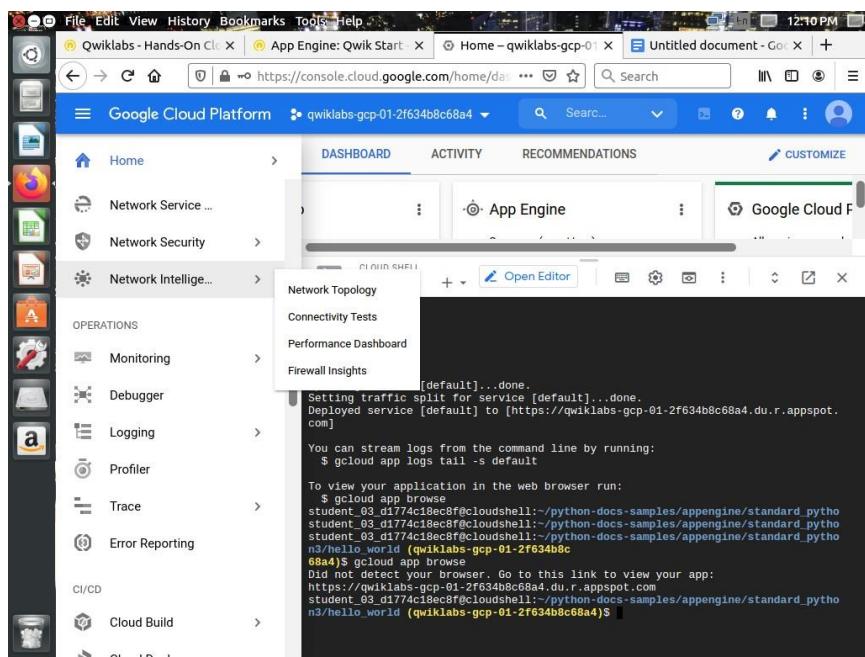
Please choose the region where you want your App Engine application
located:

[1] asia-east1 (supports standard and flexible)
[2] asia-east2 (supports standard and flexible and search_api)
[3] asia-northeast1 (supports standard and flexible and search_api)
[4] asia-northeast2 (supports standard and flexible and search_api)
[5] asia-northeast3 (supports standard and flexible and search_api)
[6] asia-south1 (supports standard and flexible and search_api)
[7] asia-southeast1 (supports standard and flexible)
[8] asia-southeast2 (supports standard and flexible and search_api)
[9] australia-southeast1 (supports standard and flexible and search_api)
[10] europe-central2 (supports standard and flexible)
[11] europe-west (supports standard and flexible and search_api)
[12] europe-west2 (supports standard and flexible and search_api)
[13] europe-west3 (supports standard and flexible and search_api)
[14] europe-west6 (supports standard and flexible and search_api)
[15] northamerica-northeast1 (supports standard and flexible and search_api)
[16] southamerica-east1 (supports standard and flexible and search_api)
[17] us-central (supports standard and flexible and search_api)
[18] us-east1 (supports standard and flexible and search_api)
[19] us-east4 (supports standard and flexible and search_api)
[20] us-west1 (supports standard and flexible)
[21] us-west2 (supports standard and flexible and search_api)
[22] us-west3 (supports standard and flexible and search_api)
[23] us-west4 (supports standard and flexible and search_api)
[24] cancel
Please enter your numeric choice: 5
Creating App Engine application in project [qwiklabs-gcp-01-2f634b8c68a4] and region [asia-northeast3]....working...
```

### Step 9: View your application

Execute the command

*gcloud app browse*



## RESULT:

## EX NO 7 SIMULATE A CLOUD SCENARIO USING CLOUDSIM AND RUN A SCHEDULING ALGORITHM

**DATE:**

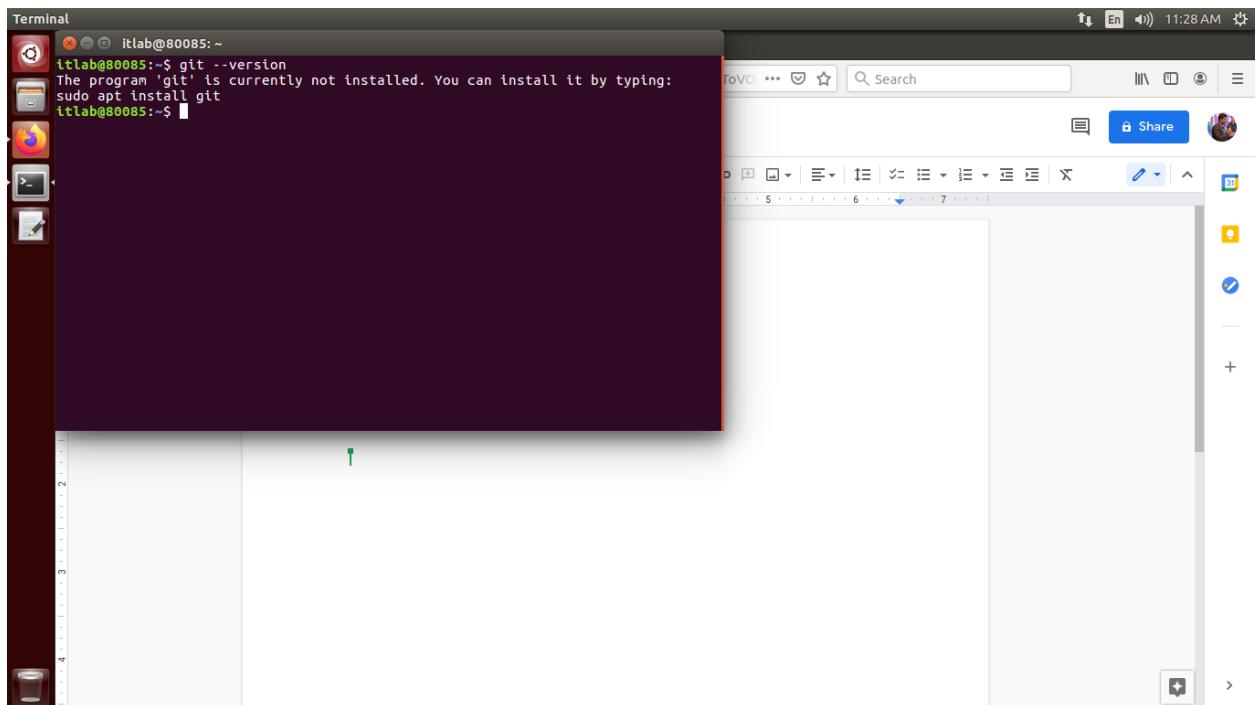
**AIM:**

To simulate a cloud scenario using cloudsim and run a scheduling algorithm.

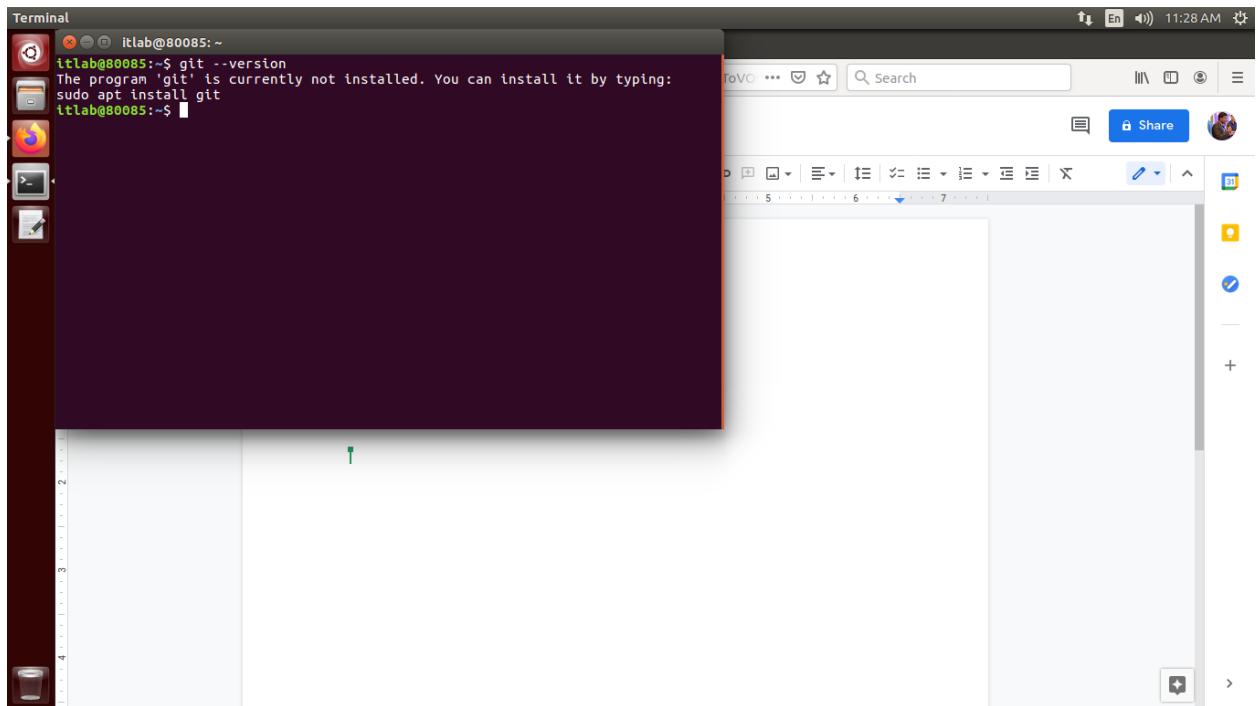
### PROCEDURE

1. Check for git installation

**git --version**

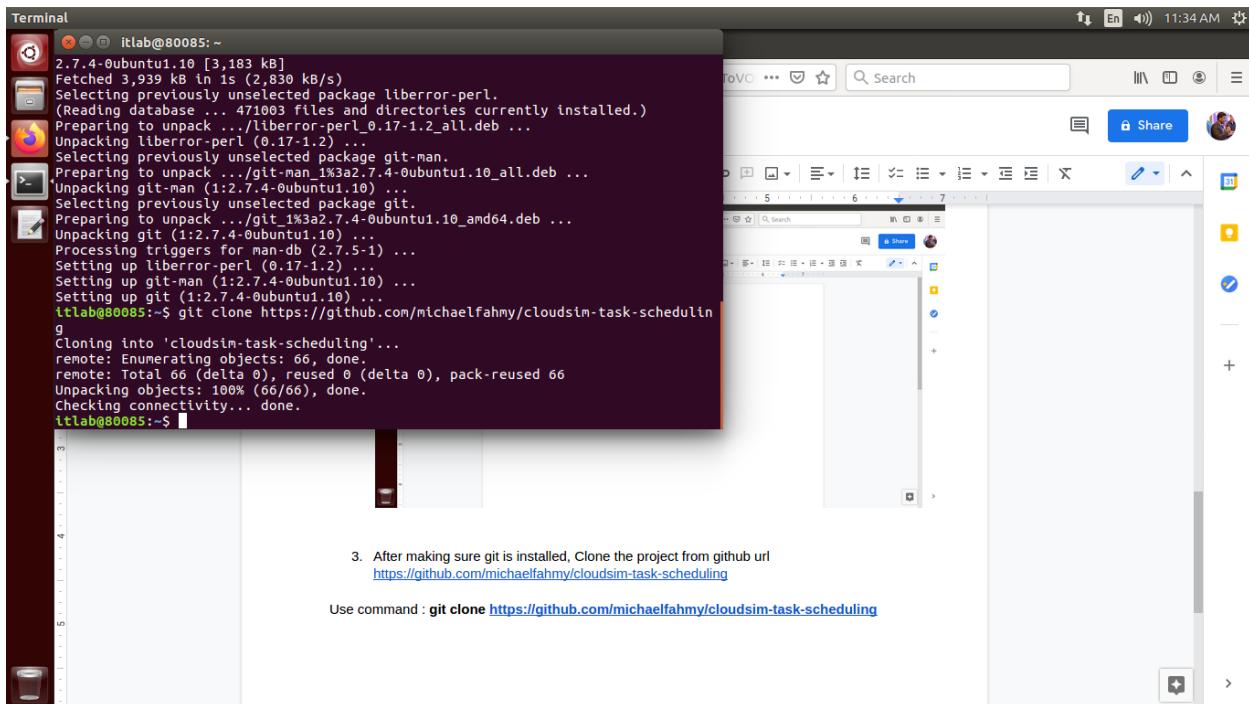


2. If git is not installed,  
Use **sudo apt-get install git**

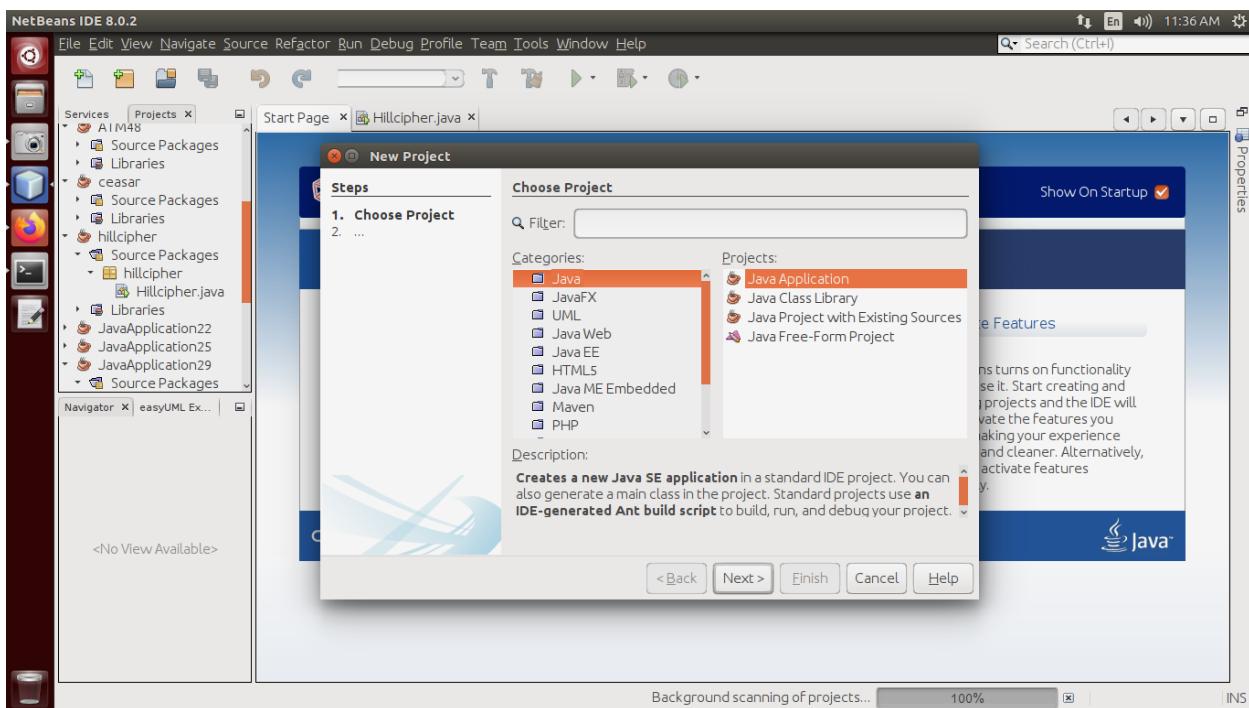


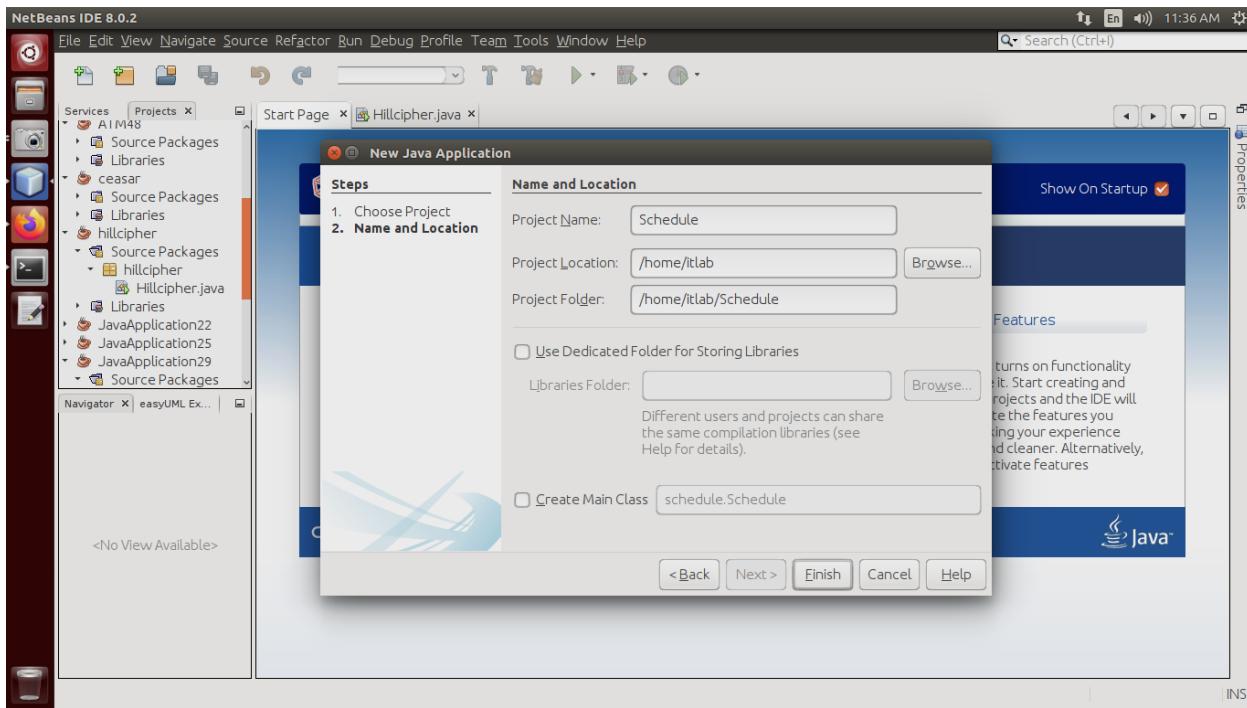
3. After making sure git is installed, Clone the project from github url  
<https://github.com/michaelfahmy/cloudsim-task-scheduling>

Use command : **git clone <https://github.com/michaelfahmy/cloudsim-task-scheduling>**

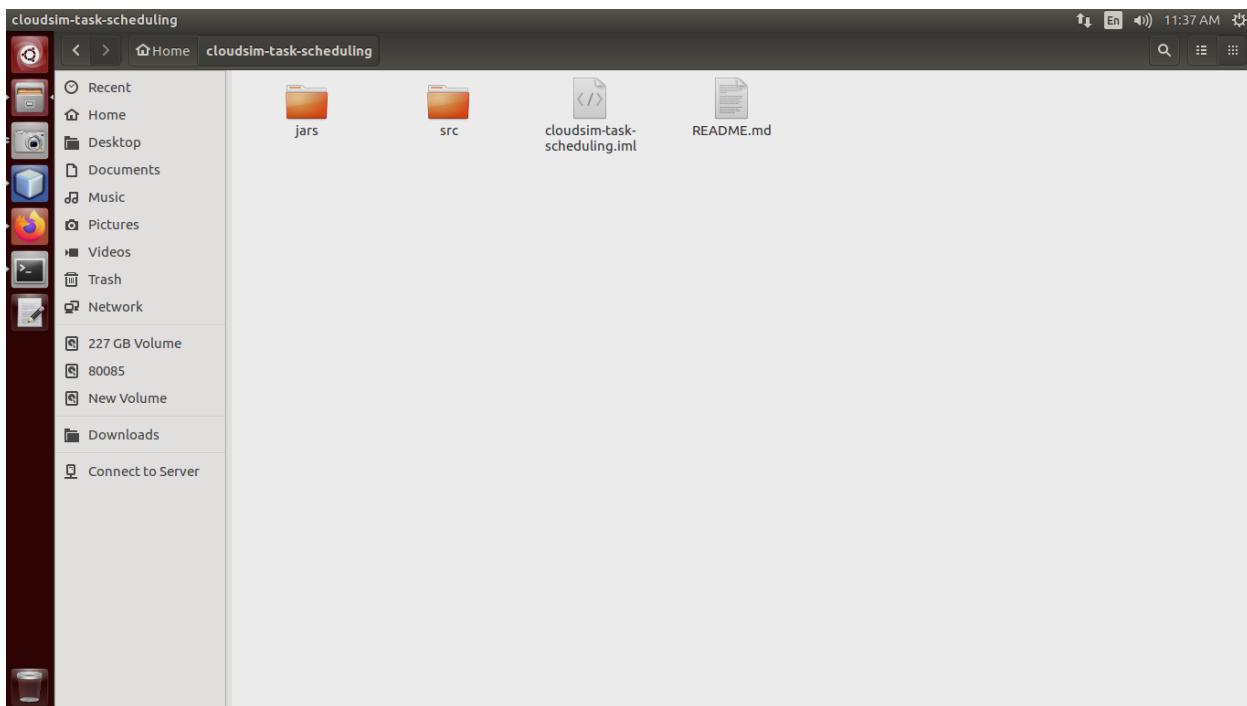


#### 4. Open netbeans 8.x and create a new java project from files

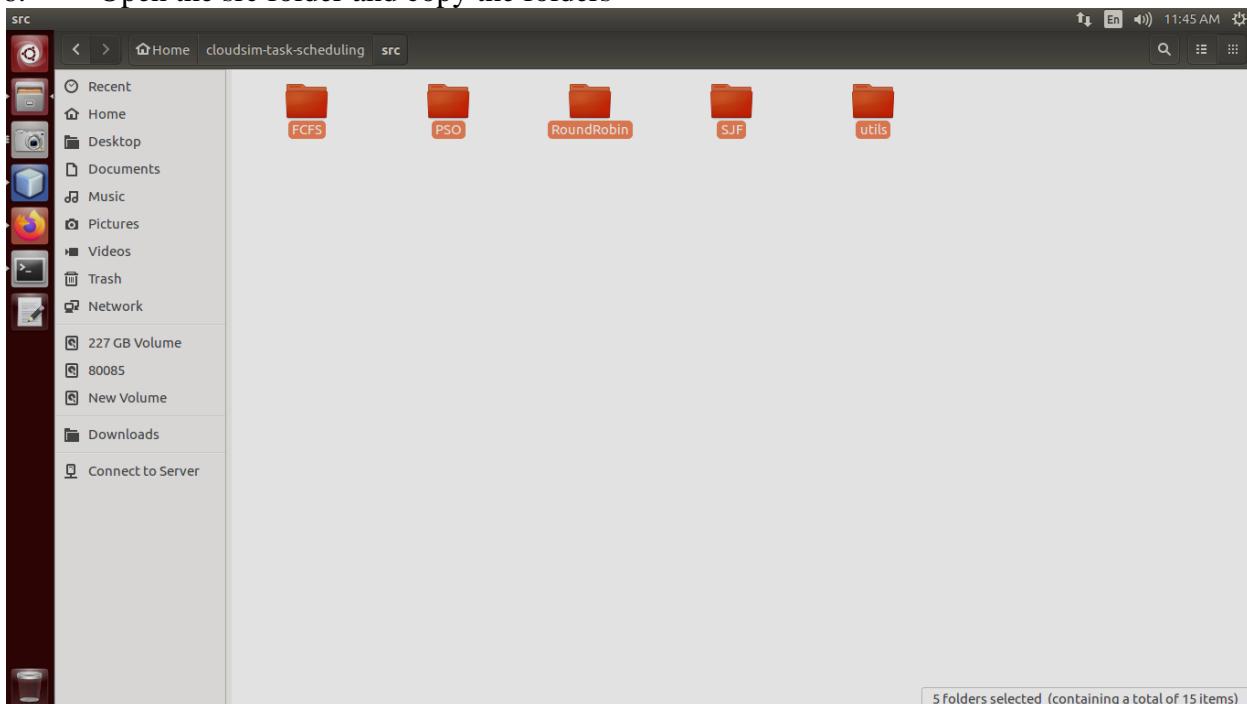




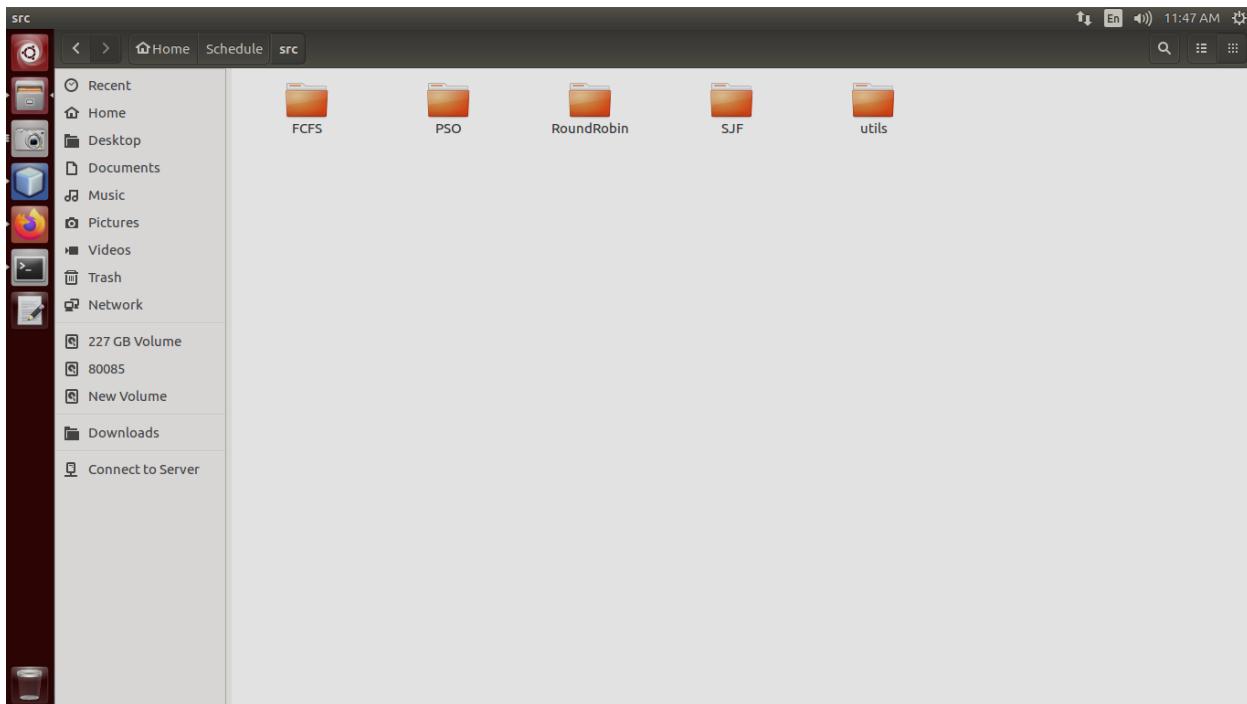
5. Now find the cloned project folder which generally in linux will be in /home/itlab



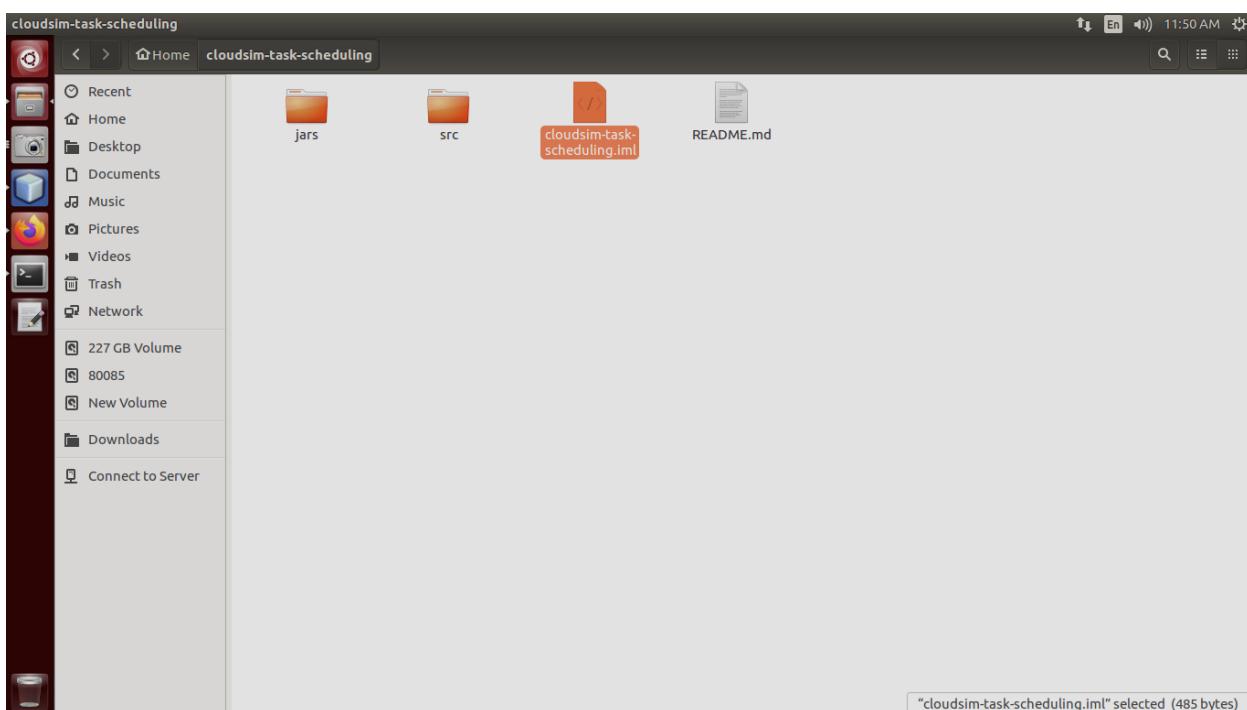
6. Open the src folder and copy the folders

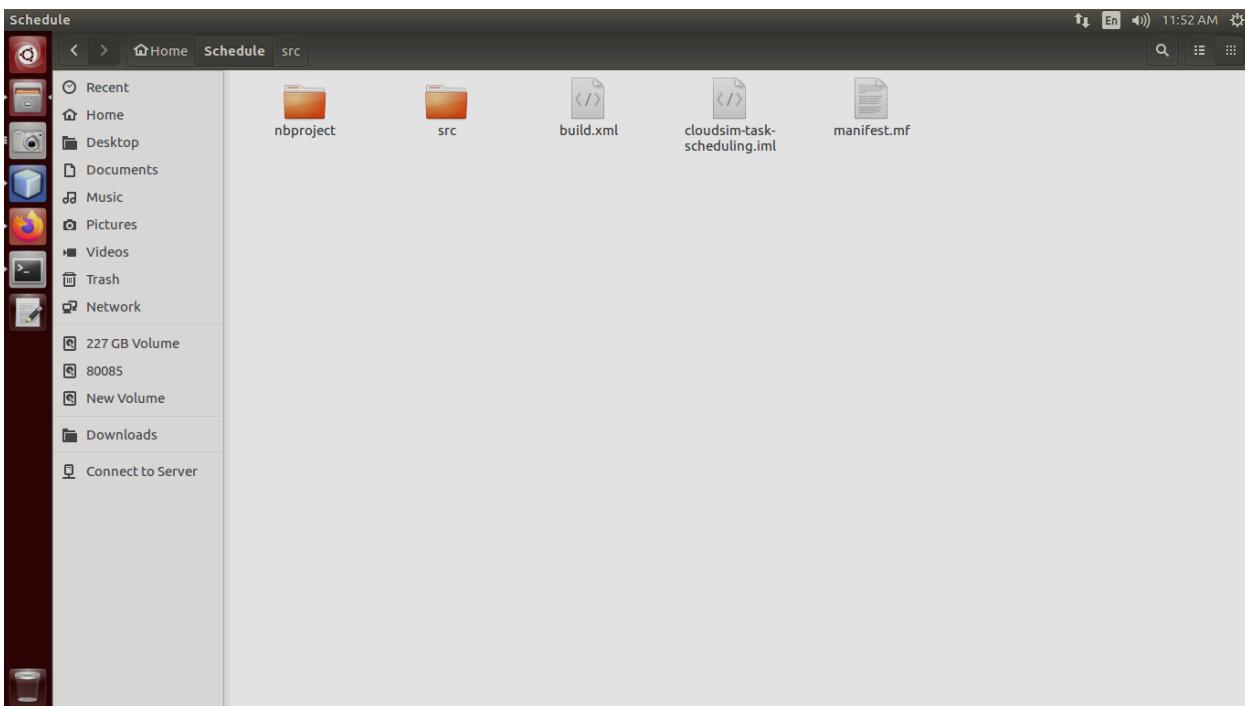


7. Paste the folders in the src folder of the newly created netbeans project

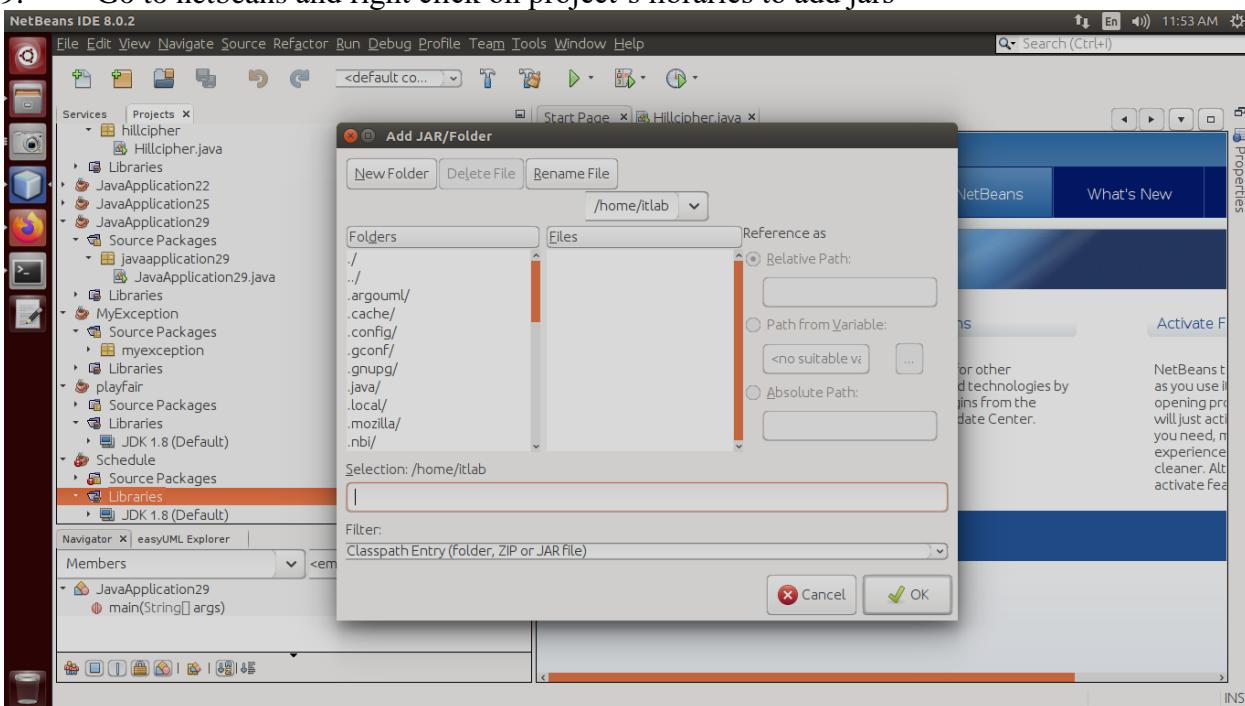


8. Also copy the cloudsim-task-scheduling.iml to the netbeans project

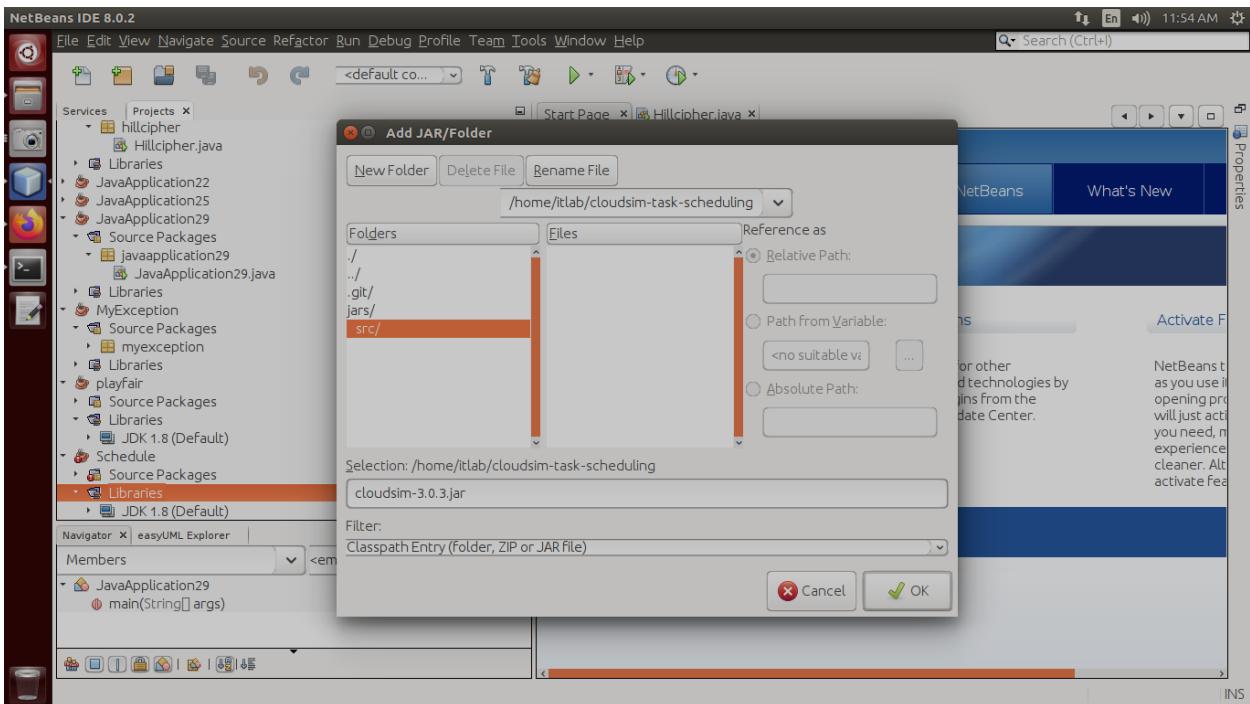




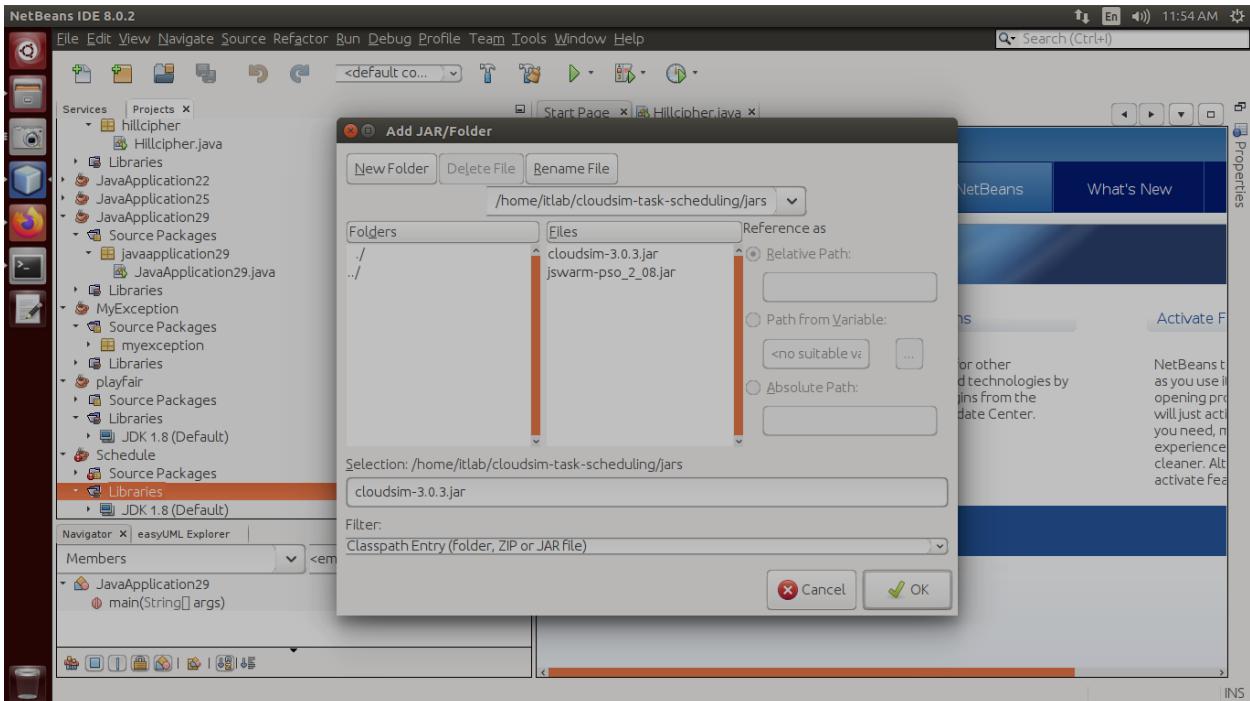
9. Go to netbeans and right click on project's libraries to add jars



Select the folder where you cloned the git project and go to jars



And double click

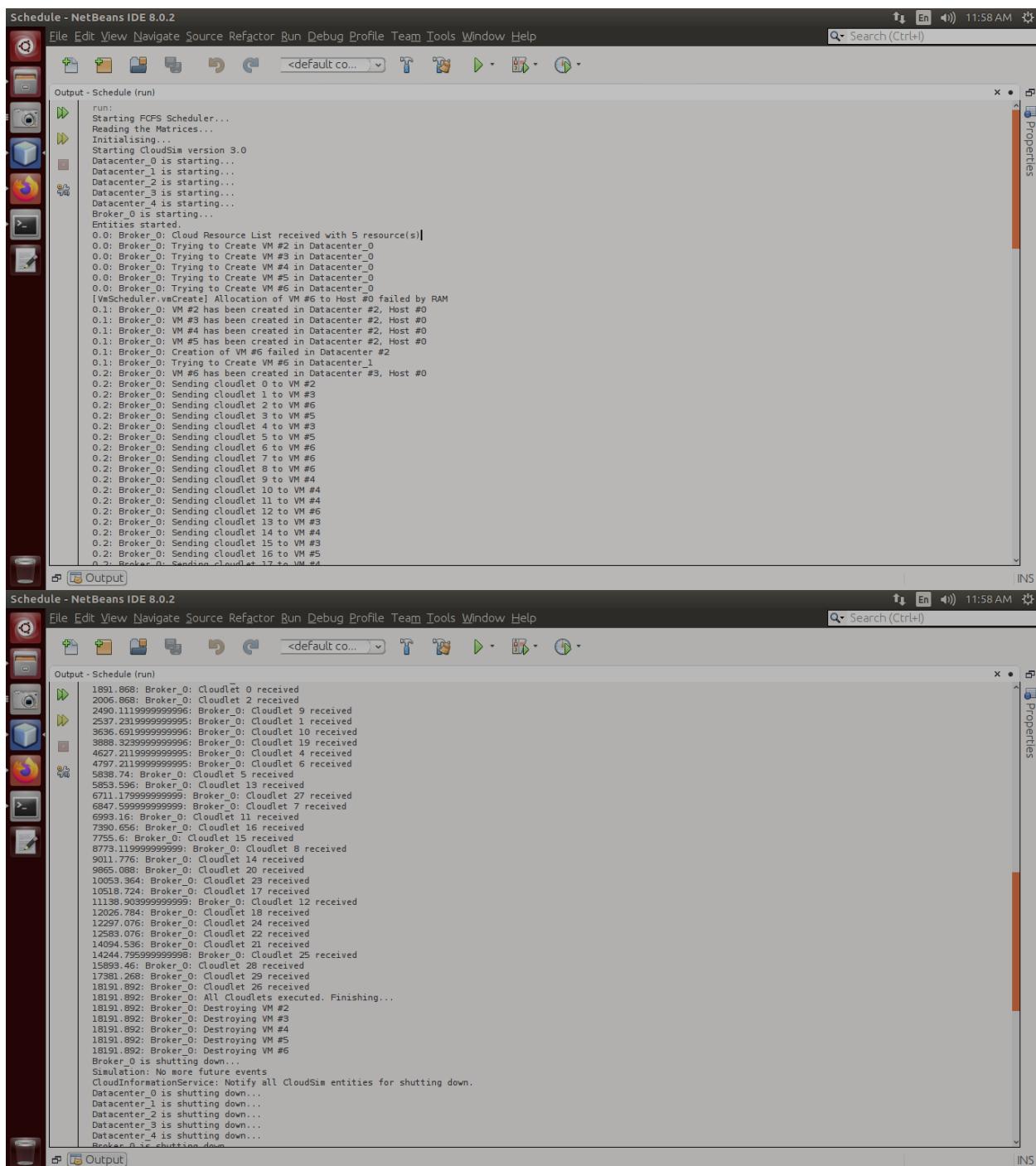


Select the jar file - cloudsim-3.0.3.jar and click Ok

Similarly add jswarm-psos\_2\_08.jar

10 . To run any scheduling , expand the folder and right click on the file ending on \_scheduler and run file

For FCFS, run FCFS\_Scheduler.java



```

Schedule - NetBeans IDE 8.0.2
File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help
Output - Schedule (run)
run:
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 #6 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: 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 #3
0.2: Broker_0: Sending cloudlet 2 to VM #6
0.2: Broker_0: Sending cloudlet 3 to VM #5
0.2: Broker_0: Sending cloudlet 4 to VM #3
0.2: Broker_0: Sending cloudlet 5 to VM #5
0.2: Broker_0: Sending cloudlet 7 to VM #6
0.2: Broker_0: Sending cloudlet 8 to VM #6
0.2: Broker_0: Sending cloudlet 9 to VM #4
0.2: Broker_0: Sending cloudlet 10 to VM #4
0.2: Broker_0: Sending cloudlet 11 to VM #4
0.2: Broker_0: Sending cloudlet 12 to VM #6
0.2: Broker_0: Sending cloudlet 13 to VM #3
0.2: Broker_0: Sending cloudlet 14 to VM #4
0.2: Broker_0: Sending cloudlet 15 to VM #3
0.2: Broker_0: Sending cloudlet 16 to VM #5
0.2: Broker_0: Sending cloudlet 17 to VM #4
INS

Schedule - NetBeans IDE 8.0.2
File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help
Output - Schedule (run)
1891.868: Broker_0: Cloudlet 0 received
2006.868: Broker_0: Cloudlet 2 received
2490.1119999999996: Broker_0: Cloudlet 9 received
2537.2319999999995: Broker_0: Cloudlet 1 received
3636.6919999999996: Broker_0: Cloudlet 10 received
3888.3239999999996: Broker_0: Cloudlet 19 received
4627.2119999999995: Broker_0: Cloudlet 4 received
4797.2419999999995: Broker_0: Cloudlet 6 received
5893.596: Broker_0: Cloudlet 5 received
6711.179999999999: Broker_0: Cloudlet 27 received
6847.599999999999: Broker_0: Cloudlet 7 received
6993.16: Broker_0: Cloudlet 11 received
7390.656: Broker_0: Cloudlet 16 received
7755.6: Broker_0: Cloudlet 15 received
8773.119999999999: Broker_0: Cloudlet 8 received
9011.776: Broker_0: Cloudlet 14 received
9865.688: Broker_0: Cloudlet 20 received
10053.364: Broker_0: Cloudlet 23 received
10301.104: Broker_0: Cloudlet 13 received
11158.903999999999: Broker_0: Cloudlet 12 received
12026.784: Broker_0: Cloudlet 18 received
12297.076: Broker_0: Cloudlet 24 received
12583.076: Broker_0: Cloudlet 22 received
14094.536: Broker_0: Cloudlet 21 received
14244.795999999998: Broker_0: Cloudlet 25 received
15893.46: Broker_0: Cloudlet 28 received
17381.268: Broker_0: Cloudlet 29 received
18191.892: Broker_0: Cloudlet 26 received
18191.892: Broker_0: All cloudlets executed. Finishing...
18191.892: Broker_0: Shutting down...
18191.892: Broker_0: Destroying VM #2
18191.892: Broker_0: Destroying VM #3
18191.892: Broker_0: Destroying VM #4
18191.892: Broker_0: Destroying VM #5
18191.892: Broker_0: Destroying VM #6
Broker_0 is shutting down...
Simulation: No more future events
CloudInformationService: Notify all CloudSim entities for shutting down.
Datacenter_0 is shutting down...
Datacenter_1 is shutting down...
Datacenter_2 is shutting down...
Datacenter_3 is shutting down...
Datacenter_4 is shutting down...
Broker_0 is shutting down...
INS

```

Schedule - NetBeans IDE 8.0.2

File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help

Output - Schedule (run)

```
Datacenter_1 is shutting down...
Datacenter_2 is shutting down...
Datacenter_3 is shutting down...
Datacenter_4 is shutting down...
Broker_0 is shutting down...
Simulation completed.

Simulation completed.
```

===== OUTPUT =====

| Cloudlet ID | Status  | Data center ID | VM ID | Time    | Start Time | Finish Time |
|-------------|---------|----------------|-------|---------|------------|-------------|
| 00          | SUCCESS | 02             | 02    | 1891.67 | 00.2       | 1891.87     |
| 01          | SUCCESS | 02             | 03    | 2537.03 | 00.2       | 2537.23     |
| 02          | SUCCESS | 03             | 06    | 2006.67 | 00.2       | 2006.87     |
| 03          | SUCCESS | 02             | 05    | 1702.66 | 00.2       | 1702.86     |
| 04          | SUCCESS | 02             | 03    | 2069.98 | 2537.23    | 4627.21     |
| 05          | SUCCESS | 02             | 05    | 4135.98 | 1702.86    | 5800.74     |
| 06          | SUCCESS | 03             | 05    | 2790.34 | 2006.87    | 4797.21     |
| 07          | SUCCESS | 03             | 06    | 2050.39 | 4797.21    | 6847.6      |
| 08          | SUCCESS | 03             | 06    | 1925.52 | 6847.6     | 8773.12     |
| 09          | SUCCESS | 02             | 04    | 2489.91 | 00.2       | 2490.11     |
| 10          | SUCCESS | 02             | 04    | 1146.58 | 2490.11    | 3636.69     |
| 11          | SUCCESS | 02             | 04    | 3356.47 | 3636.69    | 6993.16     |
| 12          | SUCCESS | 03             | 06    | 2365.78 | 8773.12    | 11138.9     |
| 13          | SUCCESS | 02             | 03    | 1226.38 | 4627.21    | 5853.6      |
| 14          | SUCCESS | 02             | 04    | 2018.62 | 6993.16    | 9011.78     |
| 15          | SUCCESS | 02             | 03    | 1902.01 | 5853.6     | 7755.6      |
| 16          | SUCCESS | 02             | 05    | 1531.92 | 5853.6     | 7290.66     |
| 17          | SUCCESS | 02             | 04    | 1506.95 | 9011.78    | 10518.72    |
| 18          | SUCCESS | 02             | 04    | 1508.06 | 10518.72   | 12026.78    |
| 19          | SUCCESS | 02             | 02    | 1996.46 | 1891.87    | 3888.32     |
| 20          | SUCCESS | 02             | 03    | 2109.49 | 7755.6     | 9865.09     |
| 21          | SUCCESS | 02             | 04    | 2067.75 | 12026.78   | 14094.54    |
| 22          | SUCCESS | 02             | 03    | 2717.99 | 9865.09    | 12583.08    |
| 23          | SUCCESS | 02             | 05    | 2562.71 | 7390.66    | 10053.36    |
| 24          | SUCCESS | 02             | 05    | 2243.71 | 10053.36   | 12297.08    |
| 25          | SUCCESS | 03             | 06    | 3105.89 | 11138.9    | 14244.8     |
| 26          | SUCCESS | 02             | 04    | 4097.36 | 14094.54   | 18191.89    |
| 27          | SUCCESS | 02             | 02    | 2822.88 | 8888.32    | 6771.18     |
| 28          | SUCCESS | 02             | 03    | 3510.38 | 12583.08   | 15893.46    |
| 29          | SUCCESS | 02             | 03    | 1487.81 | 15893.46   | 17381.27    |

Makespan using FCFS: 4724.949185867268  
FCFS\_FCFS\_Scheduler finished!  
BUILD SUCCESSFUL (total time: 0 seconds)

For PSO run PSO\_Scheduler.java

Schedule - NetBeans IDE 8.0.2

File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help

Output - Schedule (run)

```
run:
Starting PSO Scheduler...
Reading the Matrices...
Globl best at iteration (0): 7630.060068
Globl best at iteration (10): 6793.420024
Globl best at iteration (20): 5703.442002
Globl best at iteration (30): 6014.304742
Globl best at iteration (40): 5761.584259
Globl best at iteration (50): 5761.584259
Globl best at iteration (60): 5748.730665
Globl best at iteration (70): 5748.347002
Globl best at iteration (80): 5748.347002
Globl best at iteration (90): 5748.347002
Globl best at iteration (100): 5748.347002
Globl best at iteration (110): 5748.347002
Globl best at iteration (120): 5739.491267
Globl best at iteration (130): 5703.742746
Globl best at iteration (140): 5703.742746
Globl best at iteration (150): 5703.742746
Globl best at iteration (160): 5703.742746
Globl best at iteration (170): 5703.742746
Globl best at iteration (180): 5703.742746
Globl best at iteration (190): 5703.742746
Globl best at iteration (200): 5703.742746
Globl best at iteration (210): 5703.742746
Globl best at iteration (220): 5703.742746
Globl best at iteration (230): 5703.742746
Globl best at iteration (240): 5703.742746
Globl best at iteration (250): 5703.742746
Globl best at iteration (260): 5703.742746
Globl best at iteration (270): 5703.742746
Globl best at iteration (280): 5703.742746
Globl best at iteration (290): 5703.742746
Globl best at iteration (300): 5703.742746
Globl best at iteration (310): 5703.742746
Globl best at iteration (320): 5703.742746
Globl best at iteration (330): 5703.742746
Globl best at iteration (340): 5703.742746
Globl best at iteration (350): 5703.742746
```

Schedule - NetBeans IDE 8.0.2

File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help

<default co...>

Services Projects Libraries

Output - Schedule (run)

```

The best fitness value: 5703.742745688138
Best makespan: 2951.9216931575775
The best solution is:
There are 3 tasks associated to Data Center 0 and they are 3 6 7 8 9 13 19 25
There are 7 tasks associated to Data Center 1 and they are 4 5 11 12 15 16 18
There are 6 tasks associated to Data Center 2 and they are 1 2 14 22 24 27
There are 3 tasks associated to Data Center 3 and they are 0 20 28
There are 6 tasks associated to Data Center 4 and they are 10 17 21 23 26 28

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_1
0.0: Broker_0: Trying to Create VM #4 in Datacenter_2
0.0: Broker_0: Trying to Create VM #5 in Datacenter_3
0.0: Broker_0: Trying to Create VM #6 in Datacenter_4
0.1: Broker_0: VM #2 has been created in Datacenter_0, Host #0
0.1: Broker_0: VM #3 has been created in Datacenter_1, 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_3, Host #0
0.1: Broker_0: VM #6 has been created in Datacenter_4, Host #0
0.1: Broker_0: Sending cloudlet 0 to VM #2
0.1: Broker_0: Sending cloudlet 1 to VM #3
0.1: Broker_0: Sending cloudlet 2 to VM #3
0.1: Broker_0: Sending cloudlet 3 to VM #4
0.1: Broker_0: Sending cloudlet 4 to VM #5
0.1: Broker_0: Sending cloudlet 5 to VM #5
0.1: Broker_0: Sending cloudlet 6 to VM #4
0.1: Broker_0: Sending cloudlet 7 to VM #4
0.1: Broker_0: Sending cloudlet 8 to VM #4
0.1: Broker_0: Sending cloudlet 9 to VM #4
0.1: Broker_0: Sending cloudlet 10 to VM #4

```

INS

Schedule - NetBeans IDE 8.0.2

File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help

<default co...>

Services Projects Libraries

Output - Schedule (run)

| Cloudlet ID | STATUS  | Data center ID | VM ID | Time    | Start Time | Finish Time |
|-------------|---------|----------------|-------|---------|------------|-------------|
| 00          | SUCCESS | 02             | 02    | 1588.21 | 00.1       | 1588.31     |
| 03          | SUCCESS | 04             | 04    | 1592.87 | 00.1       | 1592.97     |
| 01          | SUCCESS | 03             | 03    | 1810.77 | 00.1       | 1810.87     |
| 10          | SUCCESS | 06             | 06    | 1883.04 | 00.1       | 1883.14     |
| 04          | SUCCESS | 05             | 05    | 2089.98 | 00.1       | 2090.08     |
| 20          | SUCCESS | 02             | 02    | 1181.26 |            | 1588.51     |
| 29          | SUCCESS | 02             | 02    | 277.64  | 1589.57    | 2769.57     |
| 06          | SUCCESS | 04             | 04    | 1486.5  | 1592.97    | 9091.57     |
| 05          | SUCCESS | 05             | 05    | 1182.44 | 2090.08    | 3272.52     |
| 02          | SUCCESS | 03             | 03    | 1957.47 | 1810.87    | 3768.34     |
| 11          | SUCCESS | 05             | 05    | 1179.32 | 3272.52    | 4451.84     |
| 07          | SUCCESS | 04             | 04    | 1377.3  | 3081.57    | 4458.87     |
| 17          | SUCCESS | 06             | 06    | 2761.63 | 1883.14    | 4644.77     |
| 21          | SUCCESS | 06             | 06    | 491.07  | 4644.77    | 5135.84     |
| 14          | SUCCESS | 03             | 03    | 2018.62 | 3768.34    | 5786.96     |
| 12          | SUCCESS | 05             | 05    | 2060.52 | 4451.84    | 6512.36     |
| 08          | SUCCESS | 04             | 04    | 2064.02 | 4458.87    | 6522.89     |
| 23          | SUCCESS | 06             | 06    | 1540.05 | 5135.84    | 7075.9      |
| 09          | SUCCESS | 04             | 04    | 671.84  | 6522.89    | 7134.74     |
| 22          | SUCCESS | 03             | 03    | 1904.56 | 5786.96    | 7691.52     |
| 15          | SUCCESS | 05             | 05    | 1902.06 | 6512.36    | 8414.36     |
| 13          | SUCCESS | 04             | 04    | 1876.22 | 7134.74    | 9070.96     |
| 26          | SUCCESS | 06             | 06    | 2755.14 | 7075.9     | 9831.04     |
| 24          | SUCCESS | 03             | 03    | 2164.52 | 7691.52    | 9856.04     |
| 16          | SUCCESS | 05             | 05    | 1520.3  | 8414.36    | 9934.66     |
| 28          | SUCCESS | 06             | 06    | 797.78  | 9831.04    | 10628.82    |
| 19          | SUCCESS | 04             | 04    | 1996.46 | 9070.96    | 11067.41    |
| 27          | SUCCESS | 03             | 03    | 1614.44 | 9856.04    | 11470.48    |
| 18          | SUCCESS | 05             | 05    | 1582.13 | 9934.66    | 11516.79    |
| 25          | SUCCESS | 04             | 04    | 768.56  | 11067.41   | 11835.77    |

Best fitness value: 5703.742745688138  
Best makespan: 2951.9216931575775  
PSO\_PSO Scheduler finished!  
BUILD SUCCESSFUL (total time: 0 seconds)

INS

## RESULT

**EX NO: 8****FIND A PROCEDURE TO LAUNCH VIRTUAL MACHINE USING OPENSTACK****DATE:****AIM:**

To study and find a procedure to work with openstack

**PROCEDURE:**

OpenStack was introduced by Rackspace and NASA in July 2010. OpenStack is an Infrastructure as a Service known as Cloud Operating System, that take resources such as Compute, Storage, Network and Virtualization Technologies and control those resources at a data center level . The project is building an open source community - to share resources and technologies with the goal of creating a massively scalable and secure cloud infrastructure. The software is open source and limited to just open source APIs such as Amazon. It is modular architecture , Designed to easily scale out Based on (growing) set of core services ,The major components are 1. Keystone 2. Nova 3. Glance 4. Swift 5. Quantum 6. Cinder

**Compute (Nova):** Compute is a controller that is used to manage resources in virtualized environments. It handles several virtual machines and other instances that perform computing tasks.

**Object Storage (Swift):** To store and retrieve arbitrary data in the cloud, object storage is used. In Swift, it is possible to store the files, objects, backups, images, videos, virtual machines, and other unstructured data. Developers may use a special identifier for referring the file and objects in place of the path, which directly points to a file and allows the OpenStack to manage where to store the files.

**Block Storage (Cinder):** This works in the traditional way of attaching and detaching an external hard drive to the OS for its local use. Cinder manages to add, remove, create new disk space in the server. This component provides the virtual storage for the virtual machines in the system.

**Networking (Neutron):** This component is used for networking in OpenStack. Neutron manages all the network-related queries, such as IP address management, routers, subnets, firewalls, VPNs, etc. It confirms that all the other components are well connected with the OpenStack.

**Dashboard (Horizon):** This is the first component that the user sees in the OpenStack. Horizon is the web UI (user interface) component used to access the other back-end services. Through individual API (Application programming interface), developers can access the OpenStack's components, but through the dashboard, system administrators can look at what is going on in the cloud and manage it as per their need.

**Identity Service (Keystone):** It is the central repository of all the users and their permissions for the OpenStack services they use. This component is used to manage identity services like authorization, authentication, AWS Styles (Amazon Web Services) logins, token-based systems, and checking the other credentials (username & password).

**Image Service (Glance):** The glance component is used to provide the image services to OpenStack. Here, image service means the images or virtual copies of hard disks. When we plan to deploy a new virtual machine instance, then glance allows us to use these images as templates. Glance allows virtual box (VDI), VMware (VMDK, OVF), Raw, Hyper-V (VHD) and KVM (qcow2) virtual images.

**Telemetry (Ceilometer):** It is used to meter the usage and report it to OpenStack's individual users. So basically, Telemetry provides billing services to OpenStack's individual users.

**Orchestration (Heat):** It allows the developers to store the cloud application's necessities as a file so that all-important resources are available in handy. This component organizes many complex applications of the cloud through the templates, via both the local OpenStack REST API and Query API.

**Shared File System (Manila):** It offers storage of the file to a virtual machine. This component gives an infrastructure for managing and provisioning file shares.

**Elastic Map-reduce (Sahara):** The Sahara component offers a simple method to the users to preplanned Hadoop clusters by referring to the multiple options such as the Hadoop version, cluster topology and hardware details of nodes and some more.

## WORKING OF OPENSTACK

Basically, OpenStack is a series of commands which is called scripts. And these scripts are packed into packages, which are called projects that rely on tasks that create cloud environments. OpenStack relies on two other forms of software in order to construct certain environments:

- Virtualization means a layer of virtual resources basically abstracted from the hardware.
- A base OS that executes commands basically provided by OpenStack Scripts.

So, we can say all three technologies, i.e., virtualization, base operating system, and OpenStack must work together. As we know, the Horizon is an interface for the appliance environment. Anything that the user wants to do should use the Horizon (Dashboard). The Dashboard is a simple graphical user interface with multiple modules, where each module performs specific tasks.

All the actions in OpenStack work by the service API call. So, if you are performing any task, it means you are calling a service API. Each API call is first validated by Keystone. So, you will have to login yourself as a registered user with your login username and password before you enter the OpenStack dashboard.

Once you successfully log in to the OpenStack dashboard, you will get many options to create new instances, volumes, Cinder, and configure the network.

Instances are nothing but a virtual machine or environment. To generate a new VM, use the 'instances' option from the OpenStack dashboard. In these instances, you can configure your cloud. Instances can be RedHat, OpenSUSE, Ubuntu, etc. The formation of an instance is also an API call. You can configure network information in the instances. You can connect these instances to the cinder instance or volume to add more services.

After the successful creation of an instance, you can configure it, you can access it through CLI, and whatever data you want to add, you can do it. Even you can set up an instance to manage and store the snapshots for future reference or backup purposes.

## BENEFITS OF OPENSTACK

There are a lot of benefits of OpenStack in the cloud computing platform. Let's see one by one :

### 1. Open Source

As we know, using the open-source environment, we can create a truly defined data center. OpenStack is the largest open-source platform. It offers the networking, computing, and storage subsystems in a single platform. Some vendors (such as RedHat) have developed and continue to support their own OpenStack distributions.

The two main advantages of the open-source OpenStack project is :

- OpenStack can be modified according to your rising demand - As per your requirement, you can add the extra features in OpenStack.
- It can be used without any limitations - Since OpenStack is a freely available project, so there are no limitations or restrictions to use it. You can use it as per your requirement. There are no limits for what purpose you use it, where you use it, or how long you use it.

### 2. Scalability

Scalability is the major key component of cloud computing. OpenStack offers better scalability for businesses. Through this feature, it allows enterprises to spin up and spin down servers on-demand.

### 3. Security

One of the significant features of OpenStack is security, and this is the key reason why OpenStack is so popular in the cloud computing world.

- With OpenStack, your data is always secure - When company owners want to move their IT infrastructure to the cloud, they always fear data loss. But there is no need to think about data loss with OpenStack. It offers the best security feature.
- OpenStack provides security professionals who are responsive to OpenStack's strong security.

#### 4. Automation

Automation is one of the main keys selling points of OpenStack when compared to another option. The ease with which you can automate tasks makes OpenStack efficient. OpenStack comes with a lot of inbuilt tools that make cloud management much faster and easier. OpenStack provides its own API or Application Program Interface that helps other applications to have full control over the cloud. This function makes it easier to build your own apps that can communicate with OpenStack to perform tasks such as firing up VMs.

#### **Development Support**

Since OpenStack's source code is freely accessible, experts from all over the world can improve the platform. If a new feature is being designed, it can be built easily and professionally by a development team. OpenStack is like Linux in that have many distributions with different features but share the same component.

Support from companies - For development, OpenStack gets support from IT founders, including Intel, IBM, AT&T, Cisco, Red Hat, Dell, Ubuntu, and so on. So, by leaps and bounds, it's changing, which is a massive benefit for you.

Support from the developers' community - Many developers are working on the enhancement of OpenStack. They are continuously working hard to make the OpenStack better.

#### 5. Easy to Access and Manage

We can easily access and manage OpenStack, which is the biggest benefit for you. OpenStack is easy to access and manage because of the following features :

Command Line Tools - We can access the OpenStack using command-line tools.

Dashboard - OpenStack offers users and administrators to access and manage various aspects of OpenStack using GUI (graphical user interface) based dashboard component. It is available as a web UI.

APIs - There are a lot of APIs (Application Program Interface), which is used to manage OpenStack.

#### 6. Services

OpenStack provides many services required for several different tasks for your public, private, and hybrid cloud.

List of services - OpenStack offers a list of services or components such as the Nova, Cinder, Glance, Keystone, Neutron, Ceilometer, Sahara, Manila, Searchlight, Heat, Ironic, Swift, Trove, Horizon, etc.

Each component is used for different tasks. Such as Nova provides computing services, Neutron provides networking services, Horizon provides a dashboard interface, etc.

## 7. Strong Community

OpenStack has many experts, developers, and users who love to come together to work on the product of OpenStack and enhance the feature of OpenStack.

## 8. Compatibility

Public cloud systems like AWS (Amazon Web Services) are compatible with OpenStack.

## Installation of OpenStack

In order to install the DevStack in a system, first, you have to create a Linux VM on your computer (such as using VirtualBox or VMware) or remotely in the cloud (such as using AWS).

The VM must have at least 4GB of memory, and the proper internet connection is also important. Here, we are going to use one version of the ubuntu, i.e., 18.04.

Follow the following steps to install the OpenStack in your ubuntu virtual machine :

### **Step 1: Update Ubuntu System**

Open the terminal and run the following command to ensure that the system is up to date :

```
$ sudo apt update  
$ sudo apt -y upgrade  
$ sudo apt -y dist-upgrade
```

Reboot the system after running the above command. To reboot the system, run the following command :

```
$ sudo reboot
```

### **Step 2: Create Stack User**

It is important that the devstack must run as a regular user (non-root user) with the sudo enabled.

To keep this note in mind, let's create a new user with the name "stack" and assign the sudo permissions or privileges. To create a stack user, run the following command in your terminal:

```
$ sudo useradd -s /bin/bash -d /opt/stack -m stack
```

to assign the sudo privileges to the stack user, run the following command :

```
$ echo "stack ALL=(ALL) NOPASSWD: ALL" | sudo tee /etc/sudoers.d/stack
```

You can switch to the 'stack' user by running the following command:

```
$ sudo su - stack
```

### **Step 3: Install the Git**

In Most of the ubuntu systems, git comes by default. But if git is missing on your system, then install it by running the following command:

```
$ sudo apt install git -y
```

### **Step 4: Download OpenStack**

Once you install the git, use the git command to download the DevStack from Github.

```
$ git clone https://git.openstack.org/openstack-dev/devstack
```

### **Step 5: Create a DevStack Configuration File**

First of all, go to the devstack directory by running the following command :

```
$ cd devstack
```

Now, create a local.conf file in which you have to enter the four passwords and the host IP address :

Copy the following line of content in the file :

```
[[local|localrc]]  
# Password for KeyStone, Database, RabbitMQ and Service  
ADMIN_PASSWORD=StrongAdminSecret  
DATABASE_PASSWORD=$ADMIN_PASSWORD
```

```
RABBIT_PASSWORD=$ADMIN_PASSWORD
SERVICE_PASSWORD=$ADMIN_PASSWORD
# Host IP - To get your Server or VM IP, run the 'ip addr' or 'ifconfig' command
HOST_IP=192.168.56.103
```

Press the ESC, then wq to save and then exit from the local.conf file.

Here, ADMIN\_PASSWORD is the password that we will use to log into the OpenStack login page. The default username for an OpenStack is 'admin'.

And HOST\_IP is the IP address of your system. To get your Server or VM IP, run the 'ifconfig' or 'ip addr' command.

### **Step 6 : Install OpenStack with DevStack**

To install and run the openstack, execute the following command :

```
$ ./stack.sh
```

The installation will take about 10-20 minutes, mostly depends on your internet speed.

At the very end of the installation, you will get the host's IP address, URL for managing it and the username and password to handle the administrative task.

### **Step 7: Accessing OpenStack on a browser**

Copy the horizon URL given in the installation output and paste it into your browser :

```
http://<IP Address>/dashboard
```

To login to OpenStack with the default username - admin or demo and configured password - secret.

Once you login into the OpenStack, you will be redirected to the Dashboard of OpenStack. This dashboard screen is called the Openstack management web console.

### **RESULT:**

**EX NO: 9****MOVING FILES BETWEEN VIRTUAL MACHINES****AIM:**

To move the files between virtual machine(between a VM and host machine)

**PROCEDURE**

You can move files between virtual machines in several ways:

You can copy files using network utilities as you would between physical computers on your network. To do this between two virtual machine:

Both virtual machines must be configured to allow access to your network. Any of the networking methods (host-only, bridged and NAT) are appropriate.

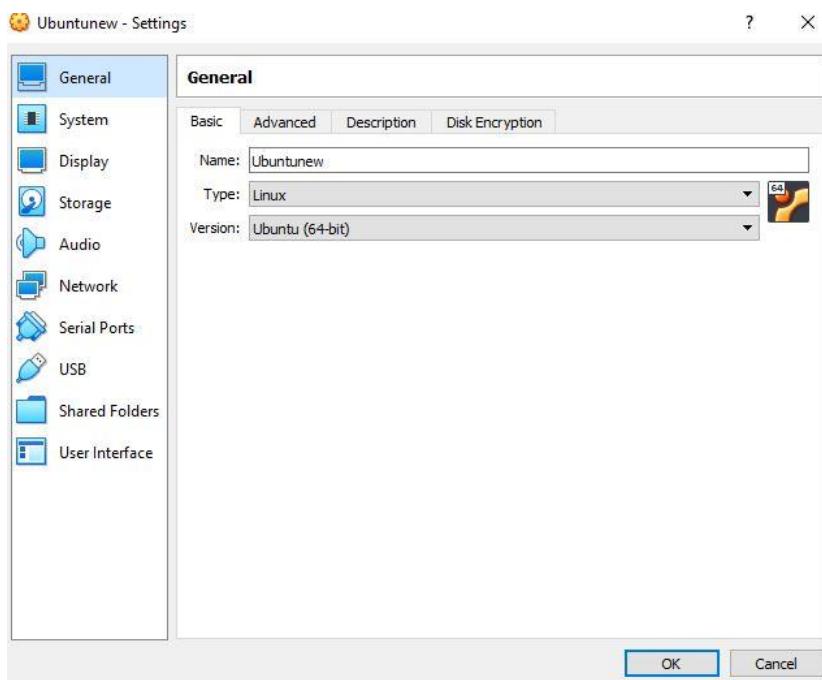
With host-only networking, you copy files from the virtual machines to the host and vice-versa, since host-only networking only allows the virtual machines see your host computer.

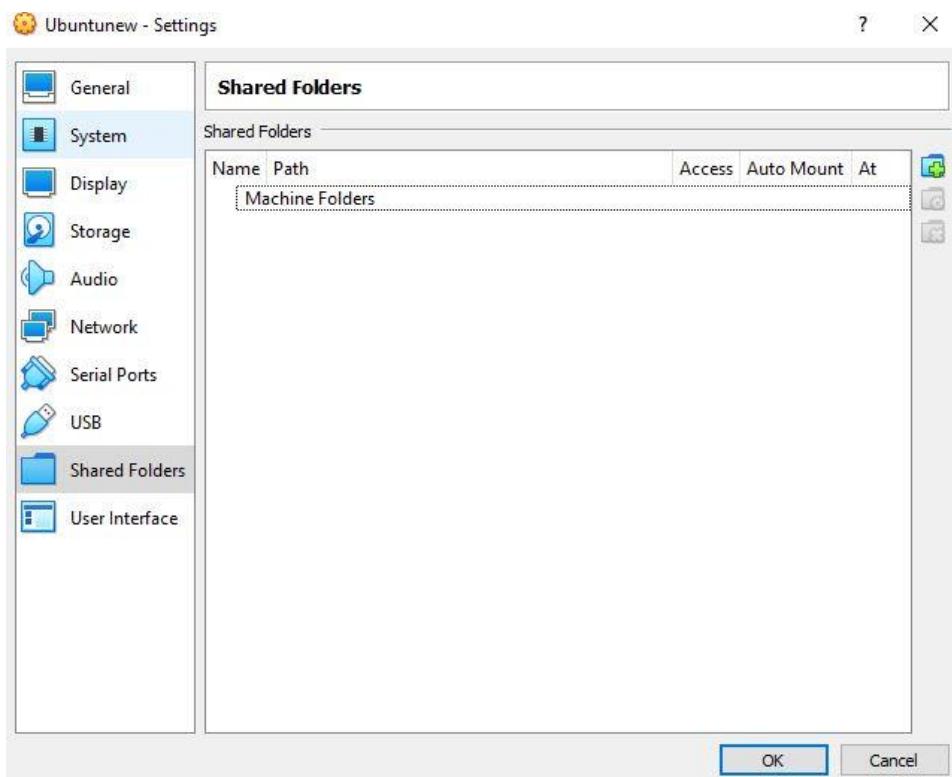
With bridged networking or NAT enabled, you can copy files across your network between the virtual machines.

You can create a shared drive, either a virtual disk or a raw partition, and mount the drive in each of the virtual machines

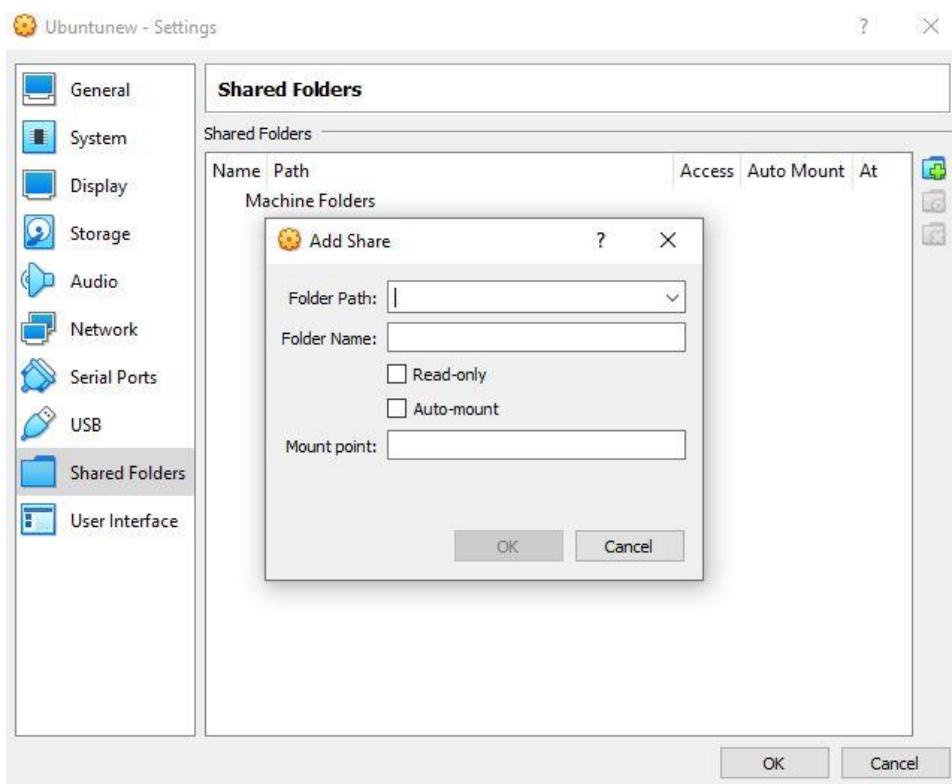
**METHOD:**

**STEP 1 :** From VirtualBox menu click Devices and choose Shared Folders

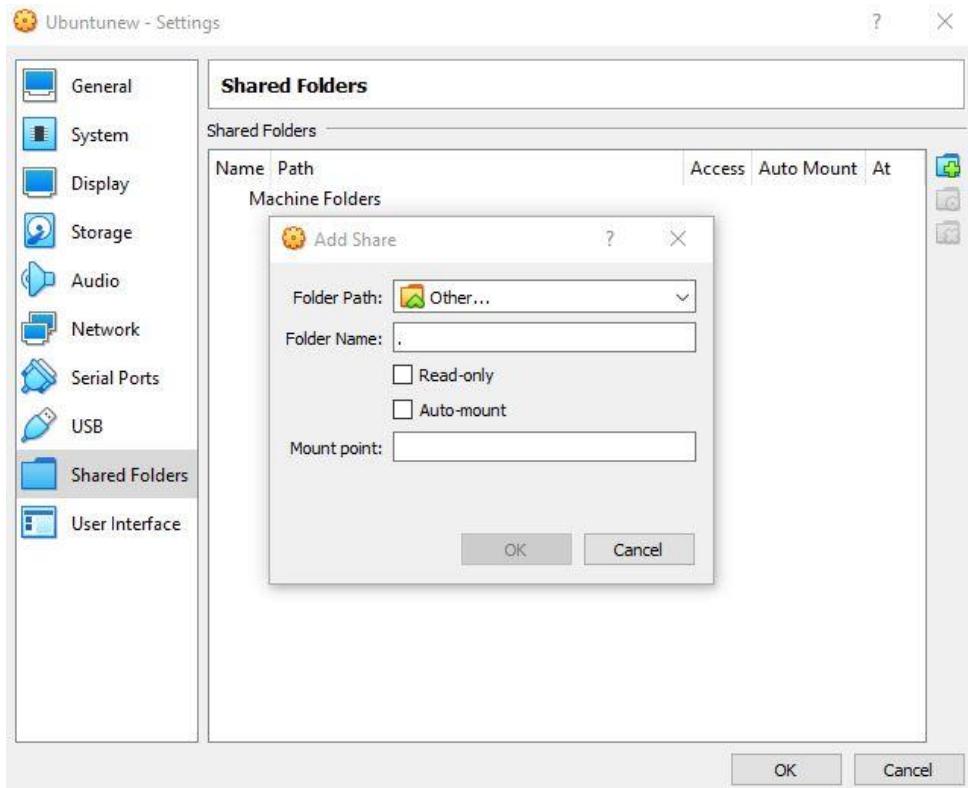




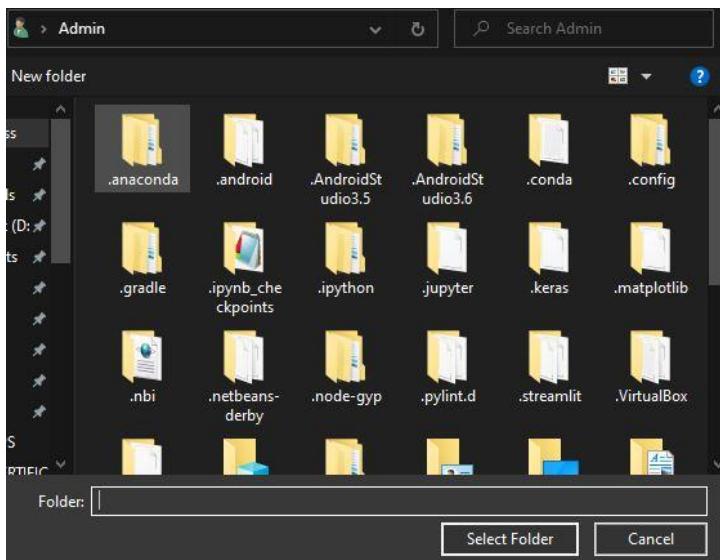
**STEP 2.** Click the Add new shared folder icon



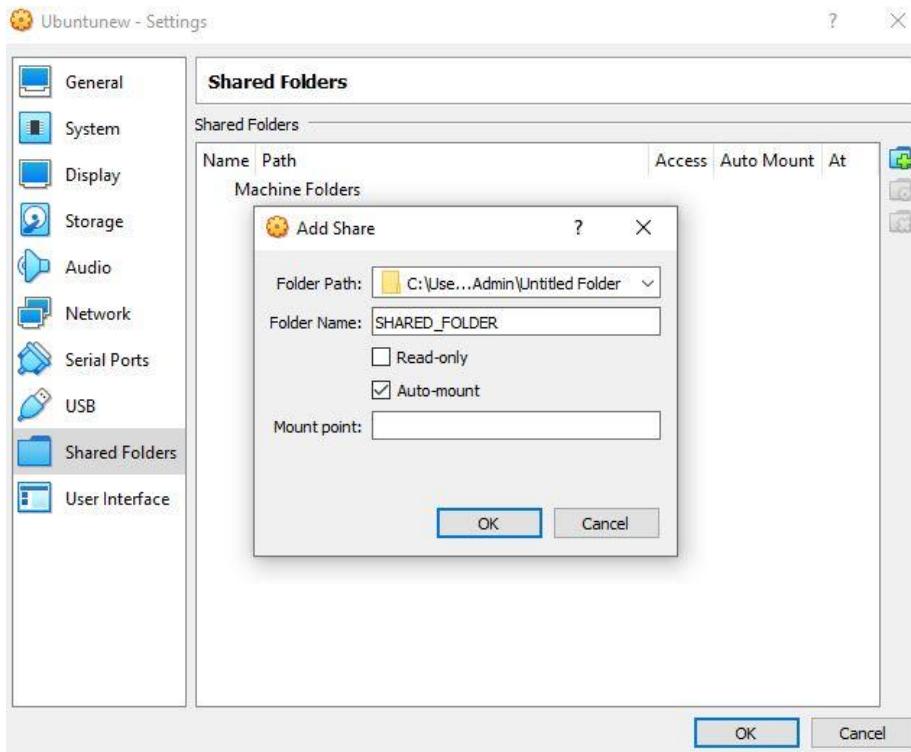
**STEP 3:** Click the drop-down arrow and select Other.



**STEP 4:** Locate and highlight (from the Host OS) the folder that you want to share between the VirtualBox Guest machine and the Host and click Select Folder. \*



**STEP 5:** Now, in the 'Add Share' options, type a name (if you want) at the 'Folder Name' box, click the Auto Mount checkbox and click OK twice to close the Shared Folder Settings.



**STEP 6:** To access the shared folder from the Guest OS, open Windows Explorer and under the 'Network locations' you should see a new network drive that corresponds to the shared folder on the Host OS.

## RESULT:

## EX NO: 10 INSTALLATION OF HADOOP SINGLE NODE CLUSTER AND RUN WORDCOUNT PROGRAM

**DATE:**

**AIM:**

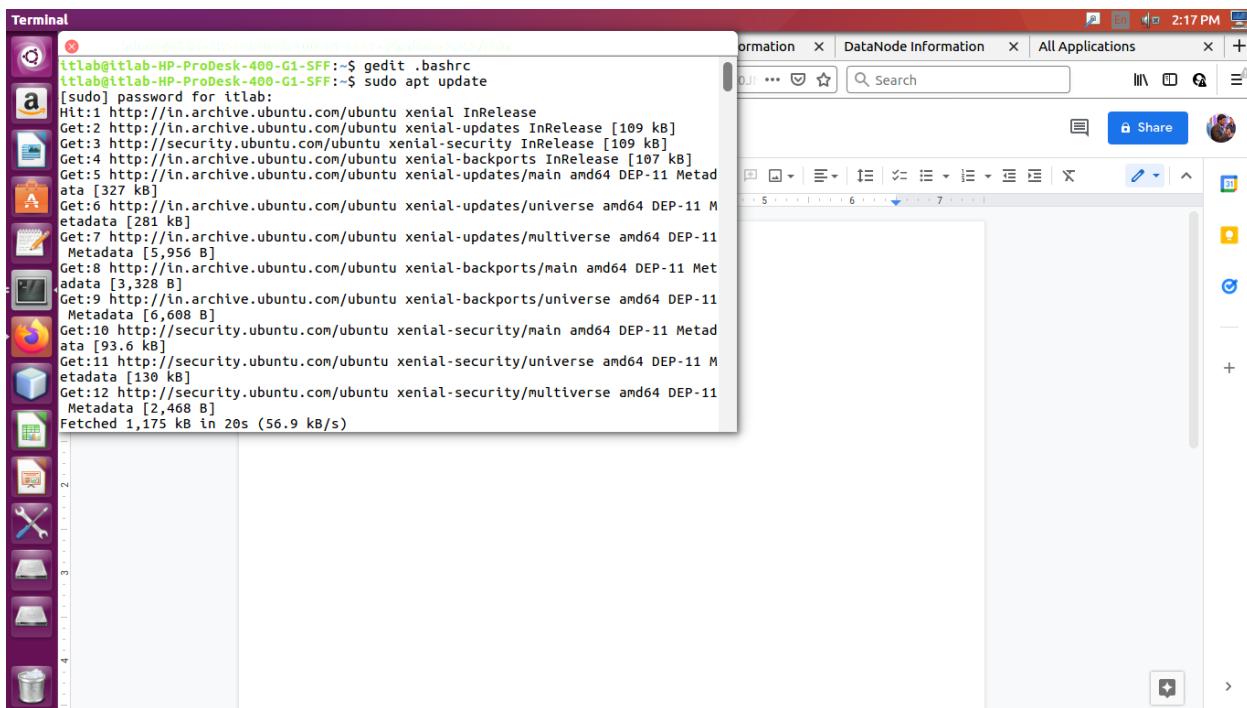
To Install Hadoop single node cluster and run simple programs like wordcount

**PROCEDURE:**

### Install OpenJDK on Ubuntu

1. The Hadoop framework is written in Java, and its services require a compatible Java Runtime Environment (JRE) and Java Development Kit (JDK). Use the following command to update your system before initiating a new installation:

**sudo apt update**



2. Check if java installation exists

**java -version; javac -version**

```
onap@onap-VirtualBox:~$ java -version;javac -version
openjdk version "1.8.0_252"
OpenJDK Runtime Environment (build 1.8.0_252-8u252-b09-1~18.04-b09)
OpenJDK 64-Bit Server VM (build 25.252-b09, mixed mode)
javac 1.8.0_252
```

- If the installation does not exist, install java jdk using the following command

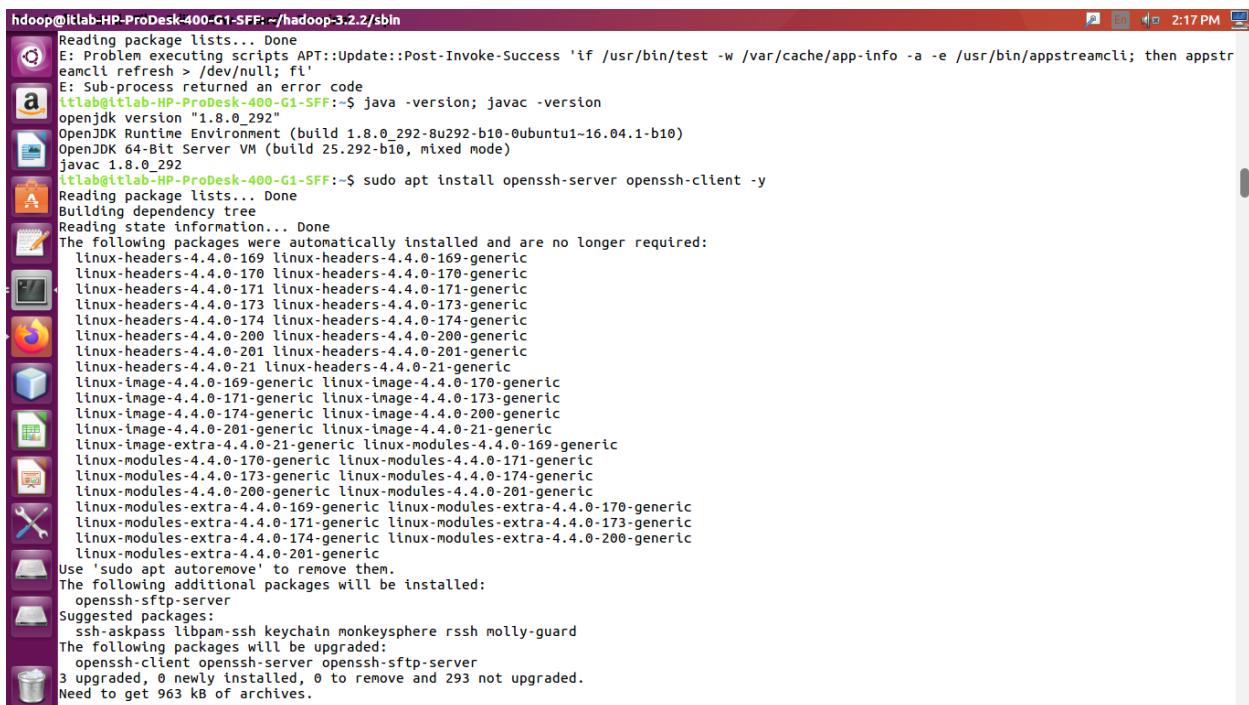
**sudo apt install openjdk-8-jdk -y**

### Set Up a Non-Root User for Hadoop Environment

It is advisable to create a non-root user, specifically for the Hadoop environment.

- Install the OpenSSH server and client using the following command:

**sudo apt install openssh-server openssh-client -y**



```
hadoop@ltlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin
Reading package lists... Done
E: Problem executing scripts APT::Update::Post-Invoke-Success 'if /usr/bin/test -w /var/cache/app-info -a -e /usr/bin/appstreamcli; then appstreamcli refresh > /dev/null; fi'
E: Sub-process returned an error code
ltlab@ltlab-HP-ProDesk-400-G1-SFF:~$ java -version; javac -version
openjdk version "1.8.0_292"
OpenJDK Runtime Environment (build 1.8.0_292-8u292-b10-0ubuntu1-16.04.1-b10)
OpenJDK 64-Bit Server VM (build 25.292-b10, mixed mode)
java 1.8.0_292
ltlab@ltlab-HP-ProDesk-400-G1-SFF:~$ sudo apt install openssh-server openssh-client -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  linux-headers-4.4.0-169 linux-headers-4.4.0-169-generic
  linux-headers-4.4.0-170 linux-headers-4.4.0-170-generic
  linux-headers-4.4.0-171 linux-headers-4.4.0-171-generic
  linux-headers-4.4.0-173 linux-headers-4.4.0-173-generic
  linux-headers-4.4.0-174 linux-headers-4.4.0-174-generic
  linux-headers-4.4.0-200 linux-headers-4.4.0-200-generic
  linux-headers-4.4.0-201 linux-headers-4.4.0-201-generic
  linux-headers-4.4.0-21 linux-headers-4.4.0-21-generic
  linux-image-4.4.0-169 generic linux-image-4.4.0-170-generic
  linux-image-4.4.0-171 generic linux-image-4.4.0-173-generic
  linux-image-4.4.0-174 generic linux-image-4.4.0-200-generic
  linux-image-4.4.0-201 generic linux-image-4.4.0-21-generic
  linux-image-4.4.0-21 generic linux-modules-4.4.0-169-generic
  linux-modules-4.4.0-170 generic linux-modules-4.4.0-171-generic
  linux-modules-4.4.0-173 generic linux-modules-4.4.0-174-generic
  linux-modules-4.4.0-200 generic linux-modules-4.4.0-201-generic
  linux-modules-extra-4.4.0-169 generic linux-modules-extra-4.4.0-170-generic
  linux-modules-extra-4.4.0-171 generic linux-modules-extra-4.4.0-173-generic
  linux-modules-extra-4.4.0-201 generic
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  openssh-sftp-server
Suggested packages:
  ssh-askpass libpam-ssh keychain monkeysphere rssh molly-guard
The following packages will be upgraded:
  openssh-client openssh-server openssh-sftp-server
3 upgraded, 0 newly installed, 0 to remove and 293 not upgraded.
Need to get 963 kB of archives.
```

5. Utilize the **adduser** command to create a new Hadoop user :**sudo adduser hdoop**

You will be asked to enter a new password and other details like name and contact



```

hdoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$ Preparing to unpack .../openssh-sftp-server_1%3a7.2p2-4ubuntu2.10_amd64.deb ...
Unpacking openssh-sftp-server (1:7.2p2-4ubuntu2.10) over (1:7.2p2-4ubuntu2.8) ...
Preparing to unpack .../openssh-server_1%3a7.2p2-4ubuntu2.10_amd64.deb ...
Unpacking openssh-server (1:7.2p2-4ubuntu2.10) over (1:7.2p2-4ubuntu2.8) ...
Preparing to unpack .../openssh-client_1%3a7.2p2-4ubuntu2.10_amd64.deb ...
Unpacking openssh-client (1:7.2p2-4ubuntu2.10) over (1:7.2p2-4ubuntu2.8) ...
Processing triggers for man-db (2.7.5-1) ...
Processing triggers for systemd (229-4ubuntu21.27) ...
Processing triggers for ureadahead (0.100.0-19) ...
ureadahead will be reprofiled on next reboot
Processing triggers for ufw (0.35-0ubuntu2) ...
Setting up openssh-client (1:7.2p2-4ubuntu2.10) ...
Setting up openssh-sftp-server (1:7.2p2-4ubuntu2.10) ...
Setting up openssh-server (1:7.2p2-4ubuntu2.10) ...
itlab@itlab-HP-ProDesk-400-G1-SFF:~$ sudo adduser hdoop
Adding user 'hdoop' ...
Adding new group 'hdoop' (1004) ...
Adding new user 'hdoop' (1001) with group 'hdoop' ...
Creating home directory '/home/hdoop' ...
Copying files from '/etc/skel' ...
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for hdoop
Enter the new value, or press ENTER for the default
  Full Name []: hdoop
  Room Number []: 1
  Work Phone []: 1
  Home Phone []: 1
  Other []: 1
Is the information correct? [Y/n] Y
itlab@itlab-HP-ProDesk-400-G1-SFF:~$ su hdoop
Password:
hdoop@itlab-HP-ProDesk-400-G1-SFF:~/home/itlab$ cd ../..
hdoop@itlab-HP-ProDesk-400-G1-SFF:~/cd ..
hdoop@itlab-HP-ProDesk-400-G1-SFF:~/$ su hdoop
Password:
hdoop@itlab-HP-ProDesk-400-G1-SFF:~/cd home
hdoop@itlab-HP-ProDesk-400-G1-SFF:~/home$ cd itlab
hdoop@itlab-HP-ProDesk-400-G1-SFF:~/home/itlab$ ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa
Generating public/private rsa key pair.
Created directory '/home/hdoop/.ssh'.
Your identification has been saved in /home/hdoop/.ssh/id_rsa.

```

6. Switch to the newly created user and enter the corresponding password:

**su - hdoop**

7. The user now needs to be able to SSH to the localhost without being prompted for a password.

Generate an SSH key pair\_and define the location it is to be stored in:

**ssh-keygen -t rsa -P "" -f ~/.ssh/id\_rsa**

8. Use the **cat** command to store the public key as **authorized\_keys** in the **ssh** directory:

**cat ~/.ssh/id\_rsa.pub >> ~/.ssh/authorized\_keys**

9. Set the permissions for your user with the **chmod** command:

**chmod 0600 ~/.ssh/authorized\_keys**

10. The new user is now able to SSH without needing to enter a password every time. Verify everything is set up correctly by using the **hadoop** user to SSH to localhost:

**ssh localhost**

```
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin
hadoop@itlab-HP-ProDesk-400-G1-SFF:$ su hadoop
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ cd home
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/home$ cd itlab
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/home/itlab$ ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa
Generating public/private rsa key pair.
Created directory '/home/hadoop/.ssh'.
Your identification has been saved in /home/hadoop/.ssh/id_rsa.
Your public key has been saved in /home/hadoop/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:GocSNOVqn9aiBLVclyswnE1IyAmZfyWxgIQNMB1/nng hadoop@itlab-HP-ProDesk-400-G1-SFF
The key's randomart image is:
+---[RSA 2048]---+
+++=+=o0
*oBoo*
..E+=*..
o.=o0.
o.= S
. o . o
.
+---[SHA256]---+
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/home/itlab$ cat ~/.ssh/id_rsa.pub >> ~/.ssh/authorized_keys
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/home/itlab$ chmod 0600 ~/.ssh/authorized_keys
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/home/itlab$ ssh localhost
The authenticity of host 'localhost (127.0.0.1)' can't be established.
ECDSA key fingerprint is SHA256:ZFRbeoxLyBdhAPMLSYSBWA5DD3afQ8CTYY4cBZIKo.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'localhost' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 16.04 LTS (GNU/Linux 4.4.0-210-generic x86_64)

 * Documentation: https://help.ubuntu.com/
304 packages can be updated.
2 updates are security updates.

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.
```

## Download and Install Hadoop on Ubuntu

11. Visit the [official Apache Hadoop project page](#), and select the version of Hadoop you want to implement.

**Download**

Hadoop is released as source code tarballs with corresponding binary tarballs for convenience. The downloads are distributed via mirror sites and should be checked for tampering using GPG or SHA-512.

| Version | Release date | Source download             | Binary download                                                   | Release notes                |
|---------|--------------|-----------------------------|-------------------------------------------------------------------|------------------------------|
| 3.3.1   | 2021 Jun 15  | source (checksum signature) | binary (checksum signature)<br>binary-arch64 (checksum signature) | <a href="#">Announcement</a> |
| 3.2.2   | 2021 Jan 9   | source (checksum signature) | binary (checksum signature)                                       | <a href="#">Announcement</a> |
| 2.10.1  | 2020 Sep 21  | source (checksum signature) | binary (checksum signature)                                       | <a href="#">Announcement</a> |

**To verify Hadoop releases using GPG:**

1. Download the release hadoop-X.Y.Z-src.tar.gz from a [mirror site](#).
2. Download the signature file hadoop-X.Y.Z-src.tar.gz.asc from [Apache](#).
3. Download the [Hadoop KEYS](#) file.
4. gpg --import KEYS
5. gpg --verify hadoop-X.Y.Z-src.tar.gz.asc

**To perform a quick check using SHA-512:**

1. Download the release hadoop-X.Y.Z-src.tar.gz from a [mirror site](#).
2. Download the checksum hadoop-X.Y.Z-src.tar.gz.sha512 or hadoop-X.Y.Z-src.tar.gz.mds from [Apache](#).
3. shasum -a 512 hadoop-X.Y.Z-src.tar.gz

All previous releases of Hadoop are available from the [Apache release archive](#) site.

The steps outlined in this tutorial use the Binary download for **Hadoop Version 3.2.2**.

Select your preferred option, and you are presented with a mirror link that allows you to download the **Hadoop tar package**.

The screenshot shows a web browser window with multiple tabs open. The active tab is titled "Apache Download Mirrors" and shows the Apache Software Foundation website. The page content includes:

- Community-Led Development "THE APACHE WAY"**
- HTTP**: <https://dlcdn.apache.org/hadoop/common/hadoop-3.2.2/hadoop-3.2.2.tar.gz>
- BACKUP SITES**: <https://downloads.apache.org/hadoop/common/hadoop-3.2.2/hadoop-3.2.2.tar.gz>
- VERIFY THE INTEGRITY OF THE FILES**: Instructions for verifying file integrity using PGP signatures or hashes.

12. Use the provided mirror link and download the Hadoop package with the **wget** command:

```
 wget https://downloads.apache.org/hadoop/common/hadoop-3.2.1/hadoop-3.2.2.tar.gz
```

13. Once the download is complete, extract the files to initiate the Hadoop installation:

```
 tar xzf hadoop-3.2.2.tar.gz
```

The Hadoop binary files are now located within the *hadoop-3.2.2* directory.

```

hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ wget https://downloads.apache.org/hadoop/common/hadoop-3.2.1/hadoop-3.2.1.tar.gz
--2021-10-18 13:51:27-- https://downloads.apache.org/hadoop/common/hadoop-3.2.1/hadoop-3.2.1.tar.gz
Resolving downloads.apache.org (downloads.apache.org)... 135.181.214.104, 88.99.95.219, 2a01:4f9:3a:2c57::2, ...
Connecting to downloads.apache.org (downloads.apache.org)|135.181.214.104|:443... connected.
HTTP request sent, awaiting response... 404 Not Found
2021-10-18 13:51:33 ERROR 404: Not Found.

hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ wget https://downloads.apache.org/hadoop/common/hadoop-3.2.2/hadoop-3.2.2.tar.gz
--2021-10-18 13:51:54-- https://downloads.apache.org/hadoop/common/hadoop-3.2.2/hadoop-3.2.2.tar.gz
Resolving downloads.apache.org (downloads.apache.org)... 135.181.214.104, 88.99.95.219, 2a01:4f9:3a:2c57::2, ...
Connecting to downloads.apache.org (downloads.apache.org)|135.181.214.104|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 395448622 (377M) [application/x-gzip]
Saving to: 'hadoop-3.2.2.tar.gz'

hadoop-3.2.2.tar.gz 100%[=====] 377.13M 4.18MB/s   in 3m 7s

2021-10-18 13:55:01 (2.02 MB/s) - 'hadoop-3.2.2.tar.gz' saved [395448622/395448622]

hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ tar xzf hadoop-3.2.2.tar.gz
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ sudo nano .bashrc
[sudo] password for hadoop:
hadoop is not in the sudoers file. This incident will be reported.
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ nano .bashrc
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ gedit .bashrc
Failed to connect to Mir: Failed to connect to server socket: No such file or directory
Unable to intt server: Could not connect: Connection refused

(gedit:7221): Gtk-WARNING **: cannot open display:
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ nano .bashrc \
> `c
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ nano .bashrc
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ source ~/.bashrc
-hash: export: 'HADOOP_OPTS-Djava.library.path=/home/hadoop/hadoop-3.2.2/lib/nativ': not a valid identifier
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ source ~/ .bashrc
-hash: source: '/home/hadoop/' is a directory
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ source .bashrc
-hash: export: 'HADOOP_OPTS-Djava.library.path=/home/hadoop/hadoop-3.2.2/lib/nativ': not a valid identifier

```

## Single Node Hadoop Deployment (Pseudo-Distributed Mode)

Hadoop excels when deployed in a **fully distributed mode** on a large cluster of networked servers. However, if you are new to Hadoop and want to explore basic commands or test applications, you can configure Hadoop on a single node.

This setup, also called **pseudo-distributed mode**, allows each Hadoop daemon to run as a single Java process. A Hadoop environment is configured by editing a set of configuration files:

- bashrc
- hadoop-env.sh
- core-site.xml
- hdfs-site.xml
- mapred-site.xml
- yarn-site.xml

### 14. Configure Hadoop Environment Variables (bashrc)

Edit the `.bashrc` shell configuration file using a text editor of your choice (we will be using nano):

**nano .bashrc**

Define the Hadoop environment variables by adding the following content to the end of the file and type **ctrl+o** and click ‘enter’ key and then **ctrl+x**:

### #Hadoop Related Options

```

export HADOOP_HOME=/home/hadoop/hadoop-3.2.2
export HADOOP_INSTALL=$HADOOP_HOME
export HADOOP_MAPRED_HOME=$HADOOP_HOME
export HADOOP_COMMON_HOME=$HADOOP_HOME
export HADOOP_HDFS_HOME=$HADOOP_HOME
export YARN_HOME=$HADOOP_HOME
export HADOOP_COMMON_LIB_NATIVE_DIR=$HADOOP_HOME/lib/native
export PATH=$PATH:$HADOOP_HOME/sbin:$HADOOP_HOME/bin
export HADOOP_OPTS="-Djava.library.path=$HADOOP_HOME/lib/nativ"

```

It is vital to apply the changes to the current running environment by using the following command:

```
source ~/.bashrc
```

```

hadoop@itlab-HP-ProDesk-400-G1-SFF: ~/hadoop-3.2.2/sbin
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ wget https://downloads.apache.org/hadoop/common/hadoop-3.2.1/hadoop-3.2.1.tar.gz
--2021-10-18 13:51:27-- https://downloads.apache.org/hadoop/common/hadoop-3.2.1/hadoop-3.2.1.tar.gz
Resolving downloads.apache.org (downloads.apache.org)... 135.181.214.104, 88.99.95.219, 2a01:4f9:3a:2c57::2, ...
Connecting to downloads.apache.org (downloads.apache.org)|135.181.214.104|:443... connected.
HTTP request sent, awaiting response... 404 Not Found
2021-10-18 13:51:33 ERROR 404: Not Found.

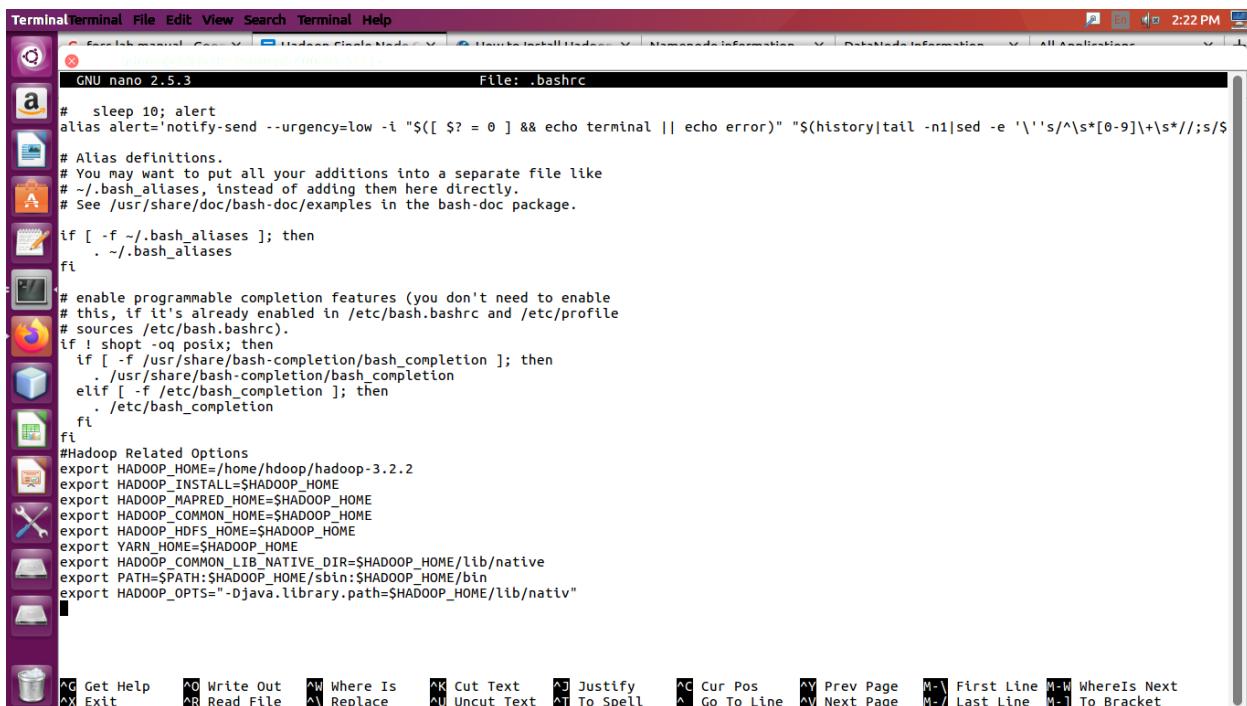
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ wget https://downloads.apache.org/hadoop/common/hadoop-3.2.2/hadoop-3.2.2.tar.gz
--2021-10-18 13:51:54-- https://downloads.apache.org/hadoop/common/hadoop-3.2.2/hadoop-3.2.2.tar.gz
Resolving downloads.apache.org (downloads.apache.org)... 135.181.214.104, 88.99.95.219, 2a01:4f9:3a:2c57::2, ...
Connecting to downloads.apache.org (downloads.apache.org)|135.181.214.104|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 395448622 (377M) [application/x-gzip]
Saving to: 'hadoop-3.2.2.tar.gz'

hadoop-3.2.2.tar.gz 100%[=====] 377.13M  4.18MB/s   in 3m 7s
2021-10-18 13:55:01 (2.02 MB/s) - 'hadoop-3.2.2.tar.gz' saved [395448622/395448622]

hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ tar xzf hadoop-3.2.2.tar.gz
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ sudo nano .bashrc
[sudo] password for hadoop:
hadoop is not in the sudoers file. This incident will be reported.
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ nano .bashrc
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ gedit .bashrc
Failed to Connect to Miri: Failed to connect to server socket: No such file or directory
Unable to init server: Could not connect: Connection refused

(gedit:7221): Gtk-WARNING **: cannot open display:
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ nano .bashrc \
> ^C
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ nano .bashrc
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ source ~/.bashrc
-bash: export: `HADOOP_OPTS-Djava.library.path=/home/hadoop/hadoop-3.2.2/lib/nativ': not a valid identifier
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ source ~/ .bashrc
-bash: source: /home/hadoop/: is a directory
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ source .bashrc
bash: export: `HADOOP_OPTS-Djava.library.path=/home/hadoop/hadoop-3.2.2/lib/nativ': not a valid identifier

```



```

GNU nano 2.5.3
File: .bashrc

# sleep 10; alert
alias alert='notify-send --urgency=low -i "$([ $? = 0 ] && echo terminal || echo error)" "$(history|tail -n1|sed -e '\''$s/^$s*[0-9]\+\$s*//;s/$'`"
# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/._bash_aliases ]; then
    . ~/._bash_aliases
fi

# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
    if [ -f /usr/share/bash-completion/bash_completion ]; then
        . /usr/share/bash-completion/bash_completion
    elif [ -f /etc/bash_completion ]; then
        . /etc/bash_completion
    fi
fi

#Hadoop Related Options
export HADOOP_HOME=/home/hadoop/hadoop-3.2.2
export HADOOP_INSTALL=$HADOOP_HOME
export HADOOP_MAPRED_HOME=$HADOOP_HOME
export HADOOP_COMMON_HOME=$HADOOP_HOME
export HADOOP_HDFS_HOME=$HADOOP_HOME
export YARN_HOME=$HADOOP_HOME
export HADOOP_COMMON_LIB_NATIVE_DIR=$HADOOP_HOME/lib/native
export PATH=$PATH:$HADOOP_HOME/sbin:$HADOOP_HOME/bin
export HADOOP_OPTS="-Djava.library.path=$HADOOP_HOME/lib/nativ"

```

File menu: Terminal, File, Edit, View, Search, Terminal, Help. Status bar: 2:22 PM.

## 15. Edit.hadoop-env.sh File

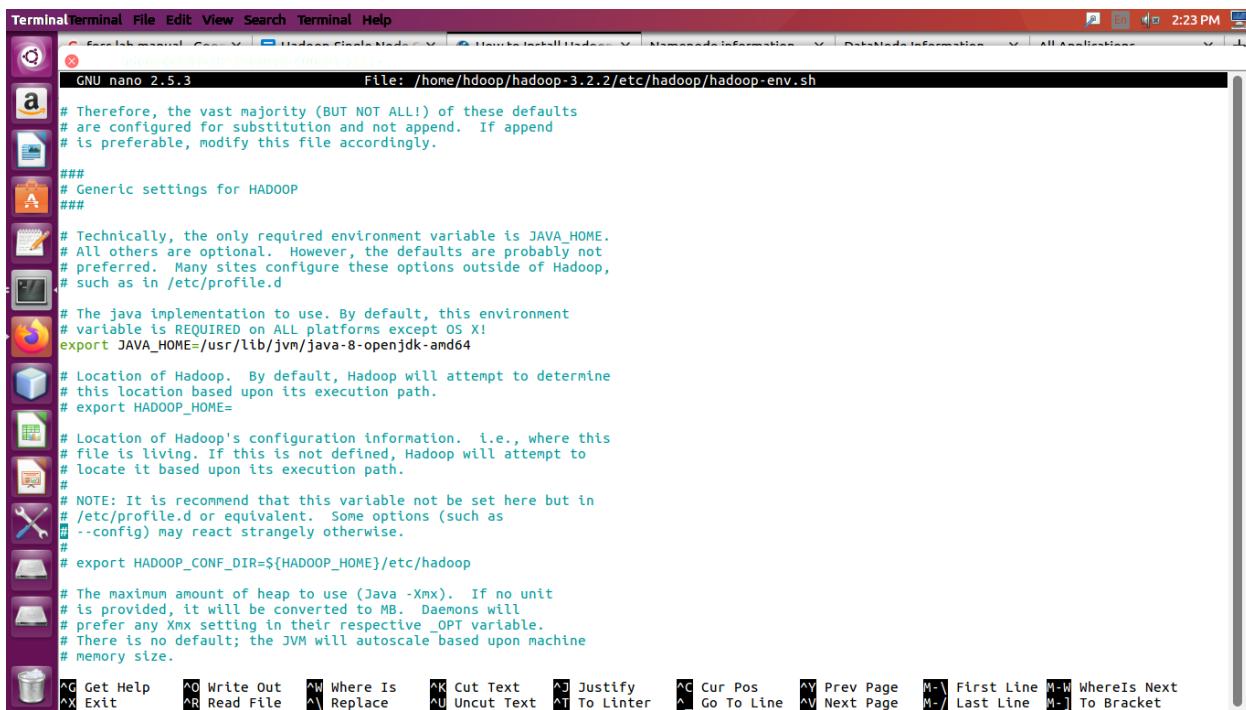
15. 1. The *hadoop-env.sh* file serves as a master file to configure YARN, HDFS, MapReduce, and Hadoop-related project settings.

When setting up a **single node Hadoop cluster**, you need to define which Java implementation is to be utilized. Use the previously created **\$HADOOP\_HOME** variable to access the *hadoop-env.sh* file:

**nano \$HADOOP\_HOME/etc/hadoop/hadoop-env.sh**

15.2. Uncomment the **\$JAVA\_HOME** variable (i.e., remove the # sign) and add the full path to the OpenJDK installation on your system. If you have installed the same version as presented in the first part of this tutorial, add the following line and type **ctrl+o** and click ‘enter’ key and then **ctrl+x**:

**export JAVA\_HOME=/usr/lib/jvm/java-8-openjdk-amd64**



```

Terminal Terminal File Edit View Search Terminal Help
File: /home/hadoop/hadoop-3.2.2/etc/hadoop/hadoop-env.sh
GNU nano 2.5.3
# Therefore, the vast majority (BUT NOT ALL!) of these defaults
# are configured for substitution and not append. If append
# is preferable, modify this file accordingly.

####
## Generic settings for HADOOP
###

# Technically, the only required environment variable is JAVA_HOME.
# All others are optional. However, the defaults are probably not
# preferred. Many sites configure these options outside of Hadoop,
# such as in /etc/profile.d

# The java implementation to use. By default, this environment
# variable is REQUIRED on ALL platforms except OS X!
export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64

# Location of Hadoop. By default, Hadoop will attempt to determine
# this location based upon its execution path.
# export HADOOP_HOME=

# Location of Hadoop's configuration information. i.e., where this
# file is living. If this is not defined, Hadoop will attempt to
# locate it based upon its execution path.

# NOTE: It is recommend that this variable not be set here but in
# /etc/profile.d or equivalent. Some options (such as
# --config) may react strangely otherwise.
#
# export HADOOP_CONF_DIR=${HADOOP_HOME}/etc/hadoop

# The maximum amount of heap to use (Java -Xmx). If no unit
# is provided, it will be converted to MB. Daemons will
# prefer any Xmx setting in their respective _OPT variable.
# There is no default; the JVM will autoscale based upon machine
# memory size.

AG Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify   ^C Cur Pos   ^Y Prev Page   M-\ First Line   M-W WhereIs Next
AX Exit      ^R Read File   ^A Replace    ^U Uncut Text  ^T To Linter  ^G Go To Line  ^V Next Page   M-/ Last Line   M-] To Bracket

```

15.3 If you need help to locate the correct Java path, run the following command in your terminal window:

**which javac**

```
hadoop@pnap-VirtualBox:~$ which javac
/usr/bin/javac
```

Use the provided path to find the OpenJDK directory with the following command:

**readlink -f /usr/bin/javac**

The section of the path just before the `/bin/javac` directory needs to be assigned to the `$JAVA_HOME` variable.

```
hadoop@pnap-VirtualBox:~$ readlink -f /usr/bin/javac
/usr/lib/jvm/java-8-openjdk-amd64/bin/javac
```

## **16. Edit core-site.xml File**

The `core-site.xml` file defines HDFS and Hadoop core properties.

To set up Hadoop in a pseudo-distributed mode, you need to **specify the URL** for your NameNode, and the temporary directory Hadoop uses for the map and reduce process.

### 16.1 Open the *core-site.xml* file in a text editor:

```
sudo nano $HADOOP_HOME/etc/hadoop/core-site.xml
```

16.2 Add the following configuration to override the default values for the temporary directory and add your HDFS URL to replace the default local file system setting and type **ctrl+o** and click ‘enter’ key and then **ctrl+x**:

## **<configuration>**

<property>

<name>hadoop.tmp.dir</name>

<value>/home/hadoop/tmpdata</value>

</property>

```

<property>
    <name>fs.default.name</name>
    <value>hdfs://127.0.0.1:9000</value>
</property>
</configuration>

```

### 16.3 Create the directory mentioned in the configuration

**mkdir /home/hadoop/tmpdata**

```

GNU nano 2.5.3           File: /home/hadoop/hadoop-3.2.2/etc/hadoop/core-site.xml
?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
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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>hadoop.tmp.dir</name>
    <value>/home/hadoop/tmpdata</value>
</property>
<property>
    <name>fs.default.name</name>
    <value>hdfs://127.0.0.1:9000</value>
</property>
</configuration>

```

### 17. Edit hdfs-site.xml File

The properties in the *hdfs-site.xml* file govern the location for storing node metadata, fsimage file, and edit log file. Configure the file by defining the **NameNode** and **DataNode storage directories**.

Additionally, the default **dfs.replication** value of **3** needs to be changed to **1** to match the single node setup.

17.1 Use the following command to open the *hdfs-site.xml* file for editing:

```
nano $HADOOP_HOME/etc/hadoop/hdfs-site.xml
```

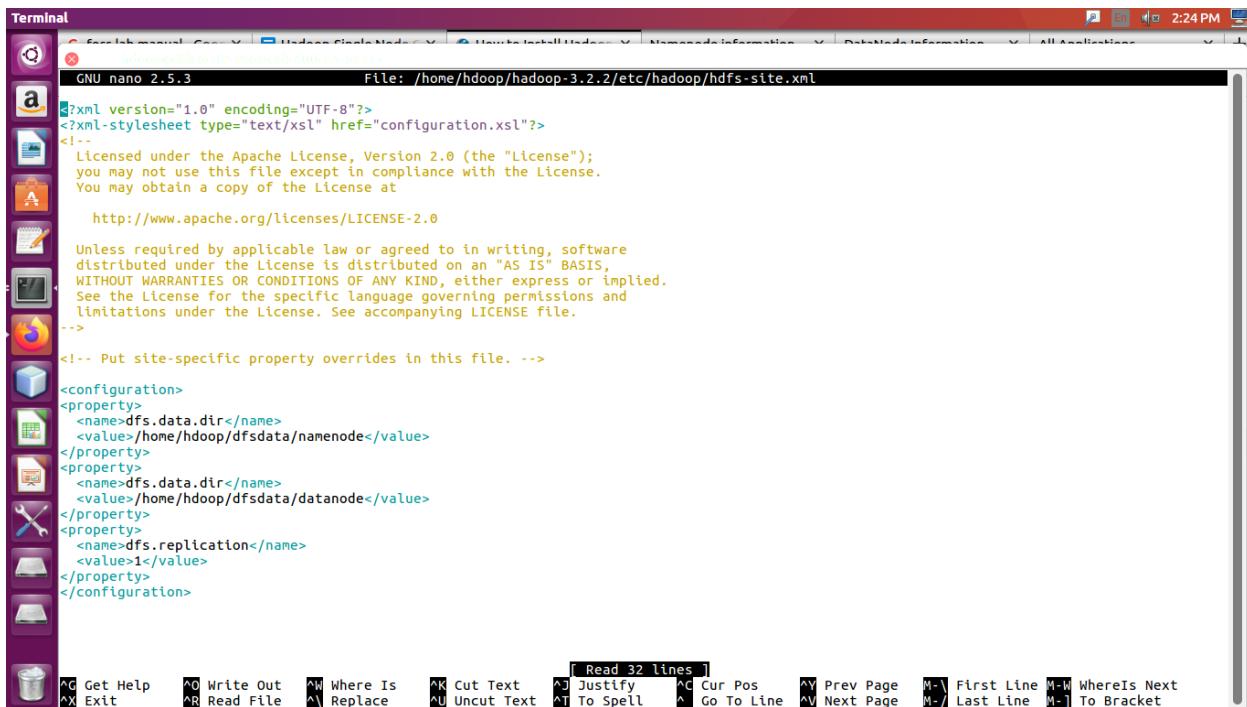
17.2 Add the following configuration to the file and, if needed, adjust the NameNode and DataNode directories to your custom locations and type **ctrl+o** and click ‘enter’ key and then **ctrl+x**:

```
<configuration>
  <property>
    <name>dfs.data.dir</name>
    <value>/home/hdoop/dfsdata/namenode</value>
  </property>
  <property>
    <name>dfs.data.dir</name>
    <value>/home/hdoop/dfsdata/datanode</value>
  </property>
  <property>
    <name>dfs.replication</name>
    <value>1</value>
  </property>
</configuration>
```

17.3 If necessary, create the specific directories you defined for the **dfs.data.dir** value.

```
mkdir /home/hdoop/dfsdata/namenode
```

```
mkdir home/hdoop/dfsdata/datanode
```



```

GNU nano 2.5.3          File: /home/hadoop/hadoop-3.2.2/etc/hadoop/hdfs-site.xml
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
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 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>dfs.data.dir</name>
<value>/home/hadoop/dfsdata/namenode</value>
</property>
<property>
<name>dfs.data.dir</name>
<value>/home/hadoop/dfsdata/datanode</value>
</property>
<property>
<name>dfs.replication</name>
<value>1</value>
</property>
</configuration>

[ Read 32 lines ]
[G] Get Help   [W] Write Out   [W] Where Is   [C] Cut Text   [J] Justify   [C] Cur Pos   [Y] Prev Page   [F] First Line   [W] WhereIs Next
[X] Exit      [R] Read File   [R] Replace   [U] Uncut Text  [T] To Spell   [G] Go To Line   [N] Next Page   [L] Last Line   [B] To Bracket

```

## 18. Edit mapred-site.xml File

18.1 Use the following command to access the *mapred-site.xml* file and **define MapReduce values:**

**nano \$HADOOP\_HOME/etc/hadoop/mapred-site.xml**

18.2 Add the following configuration to change the default MapReduce framework name value to **yarn** and type **ctrl+o** and click ‘enter’ key and then **ctrl+x**:

```

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

```

```

Terminal                               File: /home/hadoop/hadoop-3.2.2/etc/hadoop/mapred-site.xml
GNU nano 2.5.3
?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
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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>

```

[ Read 24 lines ]

Get Help Write Out Where Is Cut Text Justify Cur Pos Prev Page First Line WhereIs Next  
Exit Read File Replace Uncut Text To Spell Go To Line Next Page Last Line To Bracket

## 19. Edit yarn-site.xml File

The *yarn-site.xml* file is used to define settings relevant to **YARN**. It contains configurations for the **Node Manager**, **Resource Manager**, **Containers**, and **Application Master**.

19.1 Open the *yarn-site.xml* file in a text editor :

```
nano $HADOOP_HOME/etc/hadoop/yarn-site.xml
```

19.2 Append the following configuration to the file and type **ctrl+o** and click ‘enter’ key and then **ctrl+x**:

```

<configuration>
<property>
<name>yarn.nodemanager.aux-services</name>
<value>mapreduce_shuffle</value>
</property>
<property>
<name>yarn.nodemanager.aux-services.mapreduce.shuffle.class</name>
```

```

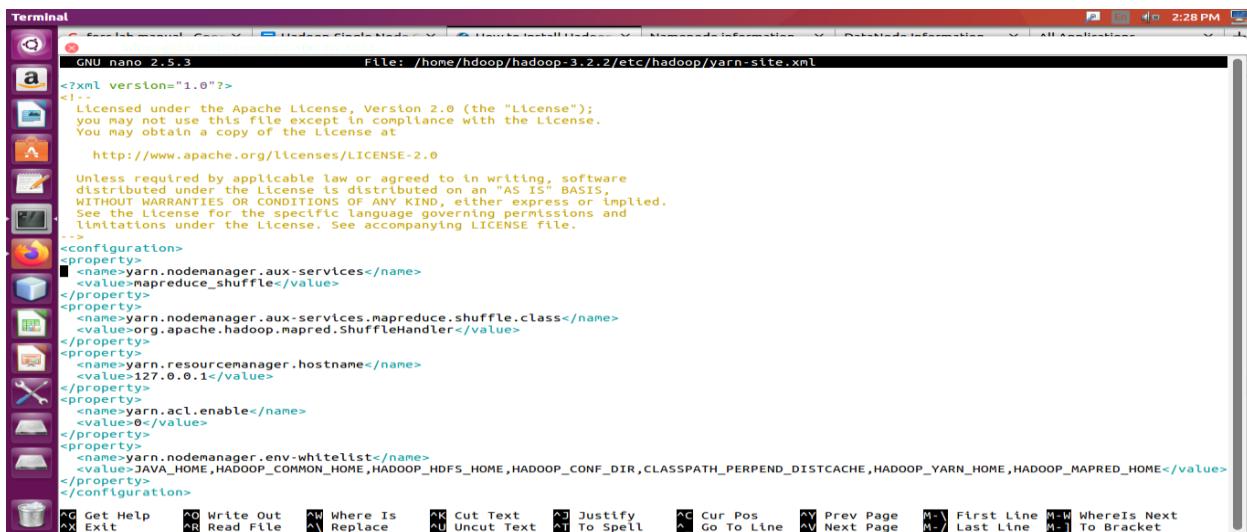
<value>org.apache.hadoop.mapred.ShuffleHandler</value>
</property>

<property>
    <name>yarn.resourcemanager.hostname</name>
    <value>127.0.0.1</value>
</property>

<property>
    <name>yarn.acl.enable</name>
    <value>0</value>
</property>

<property>
    <name>yarn.nodemanager.env-whitelist</name>
    <value>JAVA_HOME,HADOOP_COMMON_HOME,HADOOP_HDFS_HOME,
HADOOP_CONF_DIR,CLASSPATH_PERPEND_DISTCACHE,HADOOP_YARN_HOME,HADOOP_MAPRED_HOME</value>
</property>
</configuration>

```



```

Terminal
GNU nano 2.5.3
File: /home/hadoop/hadoop-3.2.2/etc/hadoop/yarn-site.xml
<?xml version="1.0"?>
<!--
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http://www.apache.org/licenses/LICENSE-2.0

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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>
    <property>
        <name>yarn.resourcemanager.hostname</name>
        <value>127.0.0.1</value>
    </property>
    <property>
        <name>yarn.acl.enable</name>
        <value>0</value>
    </property>
    <property>
        <name>yarn.nodemanager.env-whitelist</name>
        <value>JAVA_HOME,HADOOP_COMMON_HOME,HADOOP_HDFS_HOME,HADOOP_CONF_DIR,CLASSPATH_PERPEND_DISTCACHE,HADOOP_YARN_HOME,HADOOP_MAPRED_HOME</value>
    </property>
</configuration>

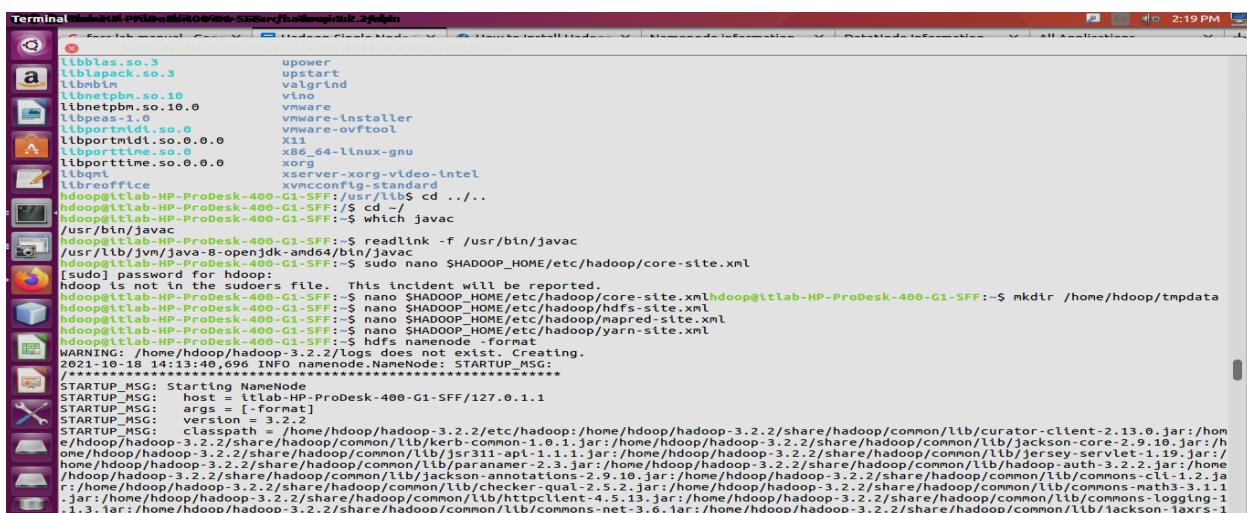
```

20. Format HDFS NameNode

It is important to **format the NameNode** before starting Hadoop services for the first time:

**hdfs namenode -format**

The shutdown notification signifies the end of the NameNode format process.



```
Terminal - itlab@itlab-HP-ProDesk-400-G1-SFF: ~
libblas.so.3      upower
liblapack.so.3    upstart
libmbm            valgrind
libepm.so.10     vim
libnetbn.so.10.0  vmware
libpeas.so.1.0    vmware-installer
libportndl.so.0   vmware-ovftool
libportndl.so.0.0 x11
libportndl.so.0.0 x64-64-linux-gnu
libporttme.so.0.0 xorg
libqmi             xserver-xorg-video-intel
libreoffice        xvncconfig-standard
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ /usr/lib$ cd ../..
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ cd ..
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ which javac
/usr/bin/javac
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ readlink -f /usr/bin/javac
/usr/lib/jvm/java-8-openjdk-amd64/bin/javac
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ sudo nano $SHADOOP_HOME/etc/hadoop/core-site.xml
[sudo] password for hadoop:
hadoop is not in the sudoers file. This incident will be reported.
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ nano $SHADOOP_HOME/etc/hadoop/core-site.xml$ hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ mkdir /home/hadoop/tmpdata
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ nano $SHADOOP_HOME/etc/hadoop/mapred-site.xml
hadoopgitlab-HP-ProDesk-400-G1-SFF:~$ nano $SHADOOP_HOME/etc/hadoop/yarn-site.xml
WARNING: /home/hadoop/hadoop-3.2.2/Logs does not exist. Creating.
2021-10-10 14:13:40,696 INFO namenode.NameNode: STARTUP_MSG:
*****STARTUP_MSG: Starting NameNode
STARTUP_MSG:  host = itlab-HP-Prodesk-400-G1-SFF/127.0.1.1
STARTUP_MSG:  args = [-format]
STARTUP_MSG:  version = 3.2.2
STARTUP_MSG:  Casspath = /home/hadoop/hadoop-3.2.2/etc/hadoop:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/curator-client-2.13.0.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/kerb-common-1.0.1.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/jackson-core-2.9.10.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/jsr311-apl-1.1.1.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/jersey-servlet-1.19.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/jwt-jwt-0.10.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/json-lib-2.4.2.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/paranamer-2.3.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/hadoop-auth-3.2.2.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/hadoop-mapreduce-client-core-3.2.2.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/hadoop-mapreduce-client-jobclient-3.2.2.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/httpclient-4.5.13.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/commons-math3-3.1.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/commons-net-3.6.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/commons-logging-1.1.3.jar:/home/hadoop/hadoop-3.2.2/share/hadoop/common/lib/jackson-jaxrs-1
```

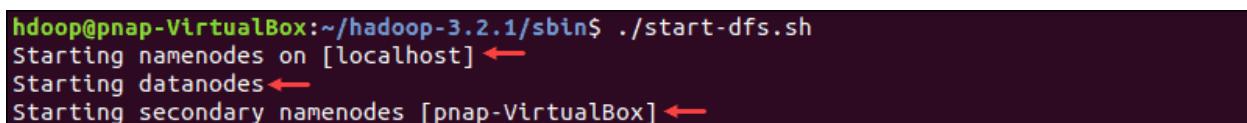
### Start Hadoop Cluster

21. Navigate to the *hadoop-3.2.2/sbin* directory and execute the following commands to start the NameNode and DataNode:

**cd hadoop-3.2.2/sbin**

**./start-dfs.sh**

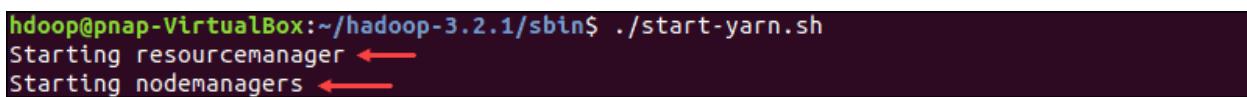
The system takes a few moments to initiate the necessary nodes.



```
hadoop@pnap-VirtualBox:~/hadoop-3.2.1/sbin$ ./start-dfs.sh
Starting namenodes on [localhost] ←
Starting datanodes ←
Starting secondary namenodes [pnap-VirtualBox] ←
```

22. Once the namenode, datanodes, and secondary namenode are up and running, start the YARN resource and nodemanagers by typing:

**./start-yarn.sh**



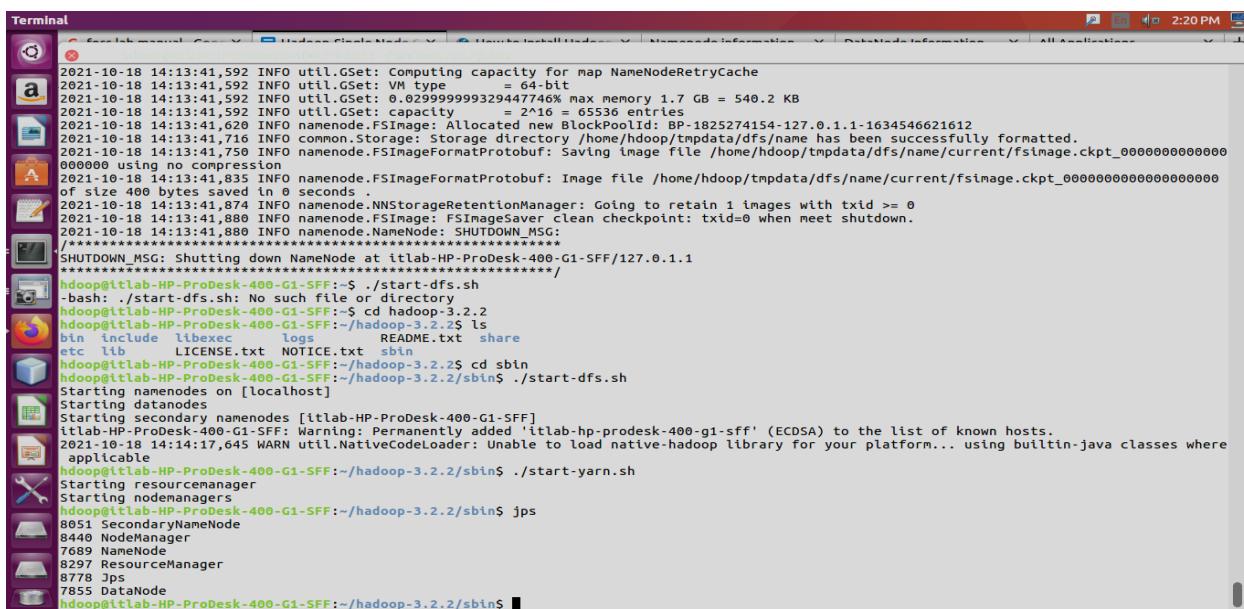
```
hadoop@pnap-VirtualBox:~/hadoop-3.2.1/sbin$ ./start-yarn.sh
Starting resourcemanager ←
Starting nodemanagers ←
```

23. Type this simple command to check if all the daemons are active and running as Java processes:

**Jps**

```
hadoop@pnap-VirtualBox:~/hadoop-3.2.1/sbin$ jps
469 DataNode
742 SecondaryNameNode
32759 NameNode
31180 NodeManager
31020 ResourceManager
988 Jps
```

If everything is working as intended, the resulting list of running Java processes contains all the HDFS and YARN daemons.



```
2021-10-18 14:13:41,592 INFO util.GSet: Computing capacity for map NameNodeRetryCache
2021-10-18 14:13:41,592 INFO util.GSet: VM type      = 64-bit
2021-10-18 14:13:41,592 INFO util.GSet: 0.0299999993294477469 max memory 1.7 GB = 540.2 KB
2021-10-18 14:13:41,592 INFO util.GSet: capacity     = 2^16 = 65536 entries
2021-10-18 14:13:41,629 INFO namenode.FSImage: Allocated new BlockPoolId: BP-1825274154-127.0.1.1-1634546621612
2021-10-18 14:13:41,716 INFO common.Storage: Storage directory /home/hadoop/tmpdata/dfs/name has been successfully formatted.
2021-10-18 14:13:41,750 INFO namenode.FSImageFormatProtobuf: Saving image file /home/hadoop/tmpdata/dfs/name/current/fstImage.ckpt_00000000000000000000000000000000 using no compression
2021-10-18 14:13:41,835 INFO namenode.FSImageFormatProtobuf: Image file /home/hadoop/tmpdata/dfs/name/current/fsimage.ckpt_00000000000000000000000000000000 of size 400 bytes saved in 0 seconds .
2021-10-18 14:13:41,874 INFO namenode.NNStorageRetentionManager: Going to retain 1 images with txid >= 0
2021-10-18 14:13:41,880 INFO namenode.FSImage: FSImageSaver clean checkpoint: txid=0 when meet shutdown.
2021-10-18 14:13:41,880 INFO namenode.NameNode: SHUTDOWN_MSG:
*****STARTUP_MSG*****
SHUTDOWN_MSG: Shutting down NameNode at itlab-HP-ProDesk-400-G1-SFF/127.0.1.1
*****STARTUP_MSG*****
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ ./start-dfs.sh
-bash: ./start-dfs.sh: No such file or directory
hadoop@itlab-HP-ProDesk-400-G1-SFF:~$ cd hadoop-3.2.2
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2$ ls
bin  include  libexec  logs  README.txt  share
etc  lib  LICENSE.txt  NOTICE.txt  sbin
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2$ cd sbin
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$ ./start-dfs.sh
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [itlab-HP-ProDesk-400-G1-SFF]
itlab-HP-ProDesk-400-G1-SFF: Warning: Permanently added 'itlab-hp-prodesk-400-g1-sff' (ECDSA) to the list of known hosts.
2021-10-18 14:14:17,645 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$ ./start-yarn.sh
Starting resourcemanager
Starting nodemanagers
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$ jps
8051 SecondaryNameNode
8440 NodeManager
7689 NameNode
8297 ResourceManager
8778 Jps
7855 DataNode
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$
```

### Access Hadoop UI from Browser

24. Use your preferred browser and navigate to your localhost URL or IP. The default port number **9870** gives you access to the Hadoop NameNode UI:

**http://localhost:9870**

**Overview 'localhost:9000' (active)**

Started:	Mon Oct 18 14:14:10 +0530 2021
Version:	3.2.2, r7a3bc90b05f257c8ace2f76d74264906f0f7a932
Compiled:	Sun Jan 03 14:56:00 +0530 2021 by hexiaoqiao from branch-3.2.2
Cluster ID:	CID-ff73e25c-4b04-453a-bff1-05428a6ee2f2
Block Pool ID:	BP-1825274154-127.0.1.1-1634546621612

**Summary**

Security is off.  
Safemode is off.  
1 files and directories, 0 blocks (0 replicated blocks, 0 erasure coded block groups) = 1 total filesystem object(s).  
Heap Memory used 84.49 MB of 277 MB Heap Memory. Max Heap Memory is 1.72 GB.  
Non Heap Memory used 47.73 MB of 49.4 MB Committed Non Heap Memory. Max Non Heap Memory is <unbounded>.

**Configured Capacity:** 86.07 GB

25. The default port **9864** is used to access individual DataNodes directly from your browser:  
**http://localhost:9864**

**DataNode on itlab-HP-ProDesk-400-G1-SFF:9866**

Cluster ID:	CID-ff73e25c-4b04-453a-bff1-05428a6ee2f2
Version:	3.2.2, r7a3bc90b05f257c8ace2f76d74264906f0f7a932

**Block Pools**

Namenode Address	Block Pool ID	Actor State	Last Heartbeat	Last Block Report	Last Block Report Size (Max Size)
localhost:9000	BP-1825274154-127.0.1.1-1634546621612	RUNNING	2s	a few seconds	0 B (64 MB)

**Volume Information**

Directory	StorageType	Capacity Used	Capacity Left	Capacity Reserved	Reserved Space for Replicas	Blocks
/home/hadoop/dfsdata/datanode	DISK	24 KB	67 GB	0 B	0 B	0

The screenshot shows the 'Datanode Information' page of the Hadoop Single Node Cluster interface. At the top, there's a legend for node status: In service (green checkmark), Down (red circle), Decommissioning (blue circle), Decommissioned (orange circle), Decommissioned & dead (pink circle), Entering Maintenance (green plus), In Maintenance (orange plus), and In Maintenance & dead (pink plus). Below the legend is a histogram titled 'Datanode usage histogram' showing disk usage of each DataNode (%). A single bar at 0% is labeled '1'. The main table below is titled 'In operation' and lists one node: 'itlab-HP-ProDesk-400-G1-SFF:9866 (127.0.0.1:9866)'. The table columns include Node, Http Address, Last contact, Last Block Report, Capacity, Blocks, Block pool used, and Version. The capacity is listed as 86.07 GB.

27. The YARN Resource Manager is accessible on port **8088**:

**<http://localhost:8088>**

The Resource Manager is an invaluable tool that allows you to monitor all running processes in your Hadoop cluster.

The screenshot shows the 'All Applications' interface of the Hadoop Single Node Cluster. The title bar includes tabs for 'Namenode information', 'DataNode Information', and 'All Applications'. The main area is titled 'All Applications' and features a large yellow elephant logo. On the left, there's a sidebar with sections for 'Cluster' (About, Nodes, Node Labels, Applications, Scheduler, Tools), 'Scheduler Metrics' (Active Nodes, Decommissioning Nodes, Decommissioned Nodes, Lost Nodes), and a table for 'Capacity Scheduler' (Scheduler Type, Scheduling Resource Type, Minimum Allocation, Maximum Allocation). The table has columns for ID, User, Name, Application Type, Queue, Application Priority, StartTime, LaunchTime, FinishTime, State, FinalStatus, Running Containers, Allocated CPU Vcores, Allocated Memory MB, and Allocated GPUs. A message at the bottom of the table says 'No data available in table'.

The screenshot shows a Mozilla Firefox browser window with the title "All Applications — Mozilla Firefox". The address bar shows "localhost:8088/cluster". The main content area displays a table titled "All Applications" with the following data:

Completed	Containers Running	Used Resources	Total Resources	Reserved Resources	Physical Mem Used %	Physical Vcores Used %
0	<memory:0, vCores:0>	<memory:8192, vCores:8>	<memory:0, vCores:0>	62	0	

Below this, there are sections for "Decommissioned Nodes", "Lost Nodes", "Unhealthy Nodes", "Rebooted Nodes", and "Shutdown Nodes", all showing 0.

Further down, there's a section for "source Type" with values "<memory:1024, vCores:1>" and "<memory:8192, vCores:4>".

A search bar and a set of sorting and filtering columns are at the bottom of the table area. The columns include:

- LaunchTime, FinishTime, State, FinalStatus, Running Containers, Allocated CPU VCores, Allocated Memory MB, Allocated GPUs, Reserved CPU VCores, Reserved Memory MB, Reserved GPUs, % of Queue, % of Cluster, Progress, Tracking UI, Blacklisted Nodes.

A message "No data available in table" is displayed below the table.

## Copy Files to Namenode Filesystem

28. Move to bin directory of hadoop folder

```
cd $HADOOP_HOME/bin
```

29. Create the input directory

```
hdfs dfs -mkdir -p /user/hadoop/input
```

30. Copy some text file to hadoop filesystem inside input directory. Here I am copying LICENSE.txt to it. You can copy more than one file.

```
hdfs dfs -put LICENSE.txt /user/hadoop/input/
```

## Running Wordcount Command

31. Now run the wordcount mapreduce example using the following command. Below command will read all files from the input folder and process with mapreduce jar file. After successful completion of task results will be placed in the output directory.

```
cd $HADOOP_HOME
```

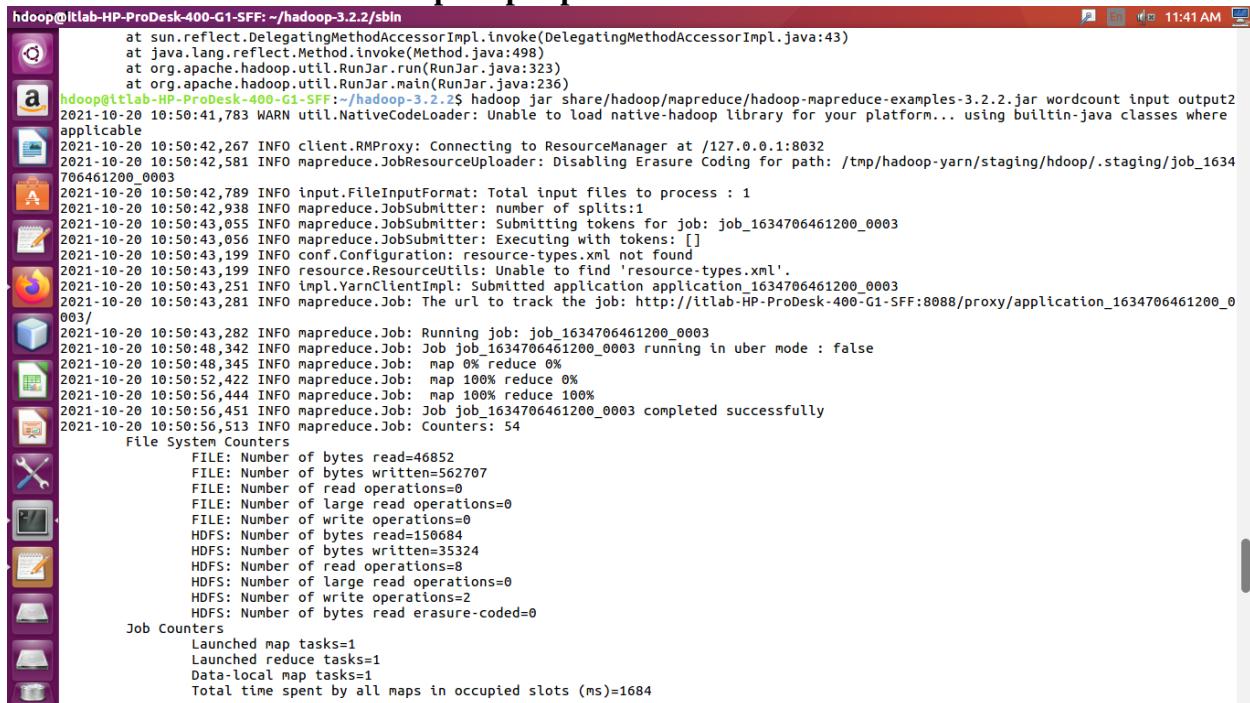
```
hadoop jar share/hadoop/mapreduce/hadoop-mapreduce-examples-3.2.2.jar  
wordcount input output
```

32. First check the names of the result file created under `dfs@/user/hadoop/output` filesystem using the following command.

```
hdfs dfs -ls /user/hadoop/output
```

33. Now show the content of the result file where you will see the result of wordcount. You will see the count of each word.

```
hdfs dfs -cat /user/hadoop/output/part-r-00000
```



```
hadoop@ltlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin
at sun.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:43)
at java.lang.reflect.Method.invoke(Method.java:498)
at org.apache.hadoop.util.RunJar.run(RunJar.java:323)
at org.apache.hadoop.util.RunJar.main(RunJar.java:236)
hadoop@ltlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2$ hadoop jar share/hadoop/mapreduce/hadoop-mapreduce-examples-3.2.2.jar wordcount input output2
2021-10-20 10:50:41,783 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
2021-10-20 10:50:42,267 INFO client.RMProxy: Connecting to ResourceManager at /127.0.0.1:8032
2021-10-20 10:50:42,581 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/hadoop/.staging/job_1634706461200_0003
2021-10-20 10:50:42,789 INFO input.FileInputFormat: Total input files to process : 1
2021-10-20 10:50:42,938 INFO mapreduce.JobSubmitter: number of splits:1
2021-10-20 10:50:43,055 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1634706461200_0003
2021-10-20 10:50:43,056 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-10-20 10:50:43,199 INFO conf.Configuration: resource-types.xml not found
2021-10-20 10:50:43,199 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-10-20 10:50:43,251 INFO impl.YarnClientImpl: Submitted application application_1634706461200_0003
2021-10-20 10:50:43,281 INFO mapreduce.Job: The url to track the job: http://ltlab-HP-ProDesk-400-G1-SFF:8088/proxy/application_1634706461200_0003/
2021-10-20 10:50:43,282 INFO mapreduce.Job: Running job: job_1634706461200_0003
2021-10-20 10:50:48,342 INFO mapreduce.Job: Job job_1634706461200_0003 running in uber mode : false
2021-10-20 10:50:48,345 INFO mapreduce.Job: map 0% reduce 0%
2021-10-20 10:50:52,422 INFO mapreduce.Job: map 100% reduce 0%
2021-10-20 10:50:56,444 INFO mapreduce.Job: map 100% reduce 100%
2021-10-20 10:50:56,451 INFO mapreduce.Job: Job job_1634706461200_0003 completed successfully
2021-10-20 10:50:56,513 INFO mapreduce.Job: Counters: 54
File System Counters
FILE: Number of bytes read=46852
FILE: Number of bytes written=562707
FILE: Number of read operations=0
FILE: Number of large read operations=0
FILE: Number of write operations=0
HDFS: Number of bytes read=150684
HDFS: Number of bytes written=35324
HDFS: Number of read operations=8
HDFS: Number of large read operations=0
HDFS: Number of write operations=2
HDFS: Number of bytes read erasure-coded=0
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)=1684
```

```
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$ 
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=150569
File Output Format Counters
  Bytes Written=35324
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2$ hdfs dfs -ls /user/hadoop/output
2021-10-20 10:51:30,977 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
ls: '/user/hadoop/output': No such file or directory
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2$ hdfs dfs -ls /user/hadoop/output
2021-10-20 10:51:38,301 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 2 items
-rw-r--r-- 1 hdoop supergroup 0 2021-10-20 10:38 /user/hadoop/output/_SUCCESS
-rw-r--r-- 1 hdoop supergroup 0 2021-10-20 10:38 /user/hadoop/output/part-r-00000
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2$ hdfs dfs -cat /user/hadoop/output/part-r-00000
2021-10-20 10:51:50,288 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2$ cd sbin
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$ ls
distribute-exclude.sh  start-all.sh  stop-balancer.sh
FederationStateStore  start-balancer.sh  stop-dfs.cmd
hadoop-daemon.sh  start-dfs.cmd  stop-dfs.sh
hadoop-daemons.sh  start-dfs.sh  stop-secure-dns.sh
httpfs.sh  start-secure-dns.sh  stop-yarn.cmd
kms.sh  start-yarn.cmd  stop-yarn.sh
mr-jobhistory-daemon.sh  start-yarn.sh  workers.sh
refresh-namenodes.sh  stop-all.cmd  yarn-daemon.sh
start-all.cmd  stop-all.sh  yarn-daemons.sh
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$ jps
2944 NameNode
3079 DataNode
3575 ResourceManager
3720 NodeManager
3326 SecondaryNameNode
0862 Jps
hadoop@itlab-HP-ProDesk-400-G1-SFF:~/hadoop-3.2.2/sbin$
```

Firefox Web Browser

The screenshot shows a Firefox browser window with the following details:

- Title Bar:** Firefox Web Browser
- Address Bar:** localhost:9870/explorer.html#/user/hadoop
- Toolbar:** Standard browser controls (Back, Forward, Stop, Refresh, Home, etc.)
- Header:** Hadoop Overview Datanodes Datanode Volume Failures Snapshot Startup Progress Utilities
- Main Content:**
  - Section:** Browse Directory
  - Path:** /user/hadoop
  - Search:** Go!
  - Table:** A table listing 4 entries:
 

	Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
<input type="checkbox"/>	drwxr-xr-x	hdoop	supergroup	0 B	Oct 20 10:49	0	0 B	input
<input type="checkbox"/>	drwxr-xr-x	hdoop	supergroup	0 B	Oct 20 10:38	0	0 B	output
<input type="checkbox"/>	drwxr-xr-x	hdoop	supergroup	0 B	Oct 20 10:43	0	0 B	output1
<input type="checkbox"/>	drwxr-xr-x	hdoop	supergroup	0 B	Oct 20 10:50	0	0 B	output2
  - Page Footer:** Hadoop, 2021.



A screenshot of the gedit text editor window titled "part-r-00000(1) (~/Downloads) - gedit". The window displays a list of words and their frequency counts. The list includes:

- "AS" 2
- "AS" 25
- "AS-IS" 1
- "Adaptation" 1
- "COPYRIGHTS" 1
- "Collection" 1
- "Collective" 1
- "Contribution" 2
- "Contributor" 2
- "Creative" 1
- "Derivative" 2
- "Distribute" 1
- "French" 2
- "JDOM" 2
- "JDOM", 1
- "Java" 1
- "LICENSE"). 2
- "Legal" 1
- "License" 1
- "License"); 3
- "Licensed" 1
- "Licenser" 3
- "Losses") 1
- "NOTICE" 1
- "Not" 1
- "Object" 1
- "Original" 2
- "Program" 1
- "Publicly" 1
- "Recipient" 1
- "Reproduce" 1
- "Screenplay" 2
- "Software"), 9
- "Source" 1
- "The" 2
- "This" 1
- "Work" 3
- "You" 3
- "Your") 1
- "r" 1

The status bar at the bottom shows "Plain Text" and "Tab Width: 8".

## RESULT: