

CS6712 Grid and Cloud Computing Lab

GRID COMPUTING LAB

Use Globus Toolkit or equivalent and do the following:

1. Develop a new Web Service for Calculator.
2. Develop new OGSA-compliant Web Service.
3. Using Apache Axis develop a Grid Service.
4. Develop applications using Java or C/C++ Grid APIs
5. Develop secured applications using basic security mechanisms available in Globus Toolkit.
6. Develop a Grid portal, where user can submit a job and get the result. Implement it with and without GRAM concept.

CLOUD COMPUTING LAB

Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate.

1. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
2. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
3. Install a C compiler in the virtual machine and execute a sample program.
4. Show the virtual machine migration based on the certain condition from one node to the other.
5. Find procedure to install storage controller and interact with it.
6. Find procedure to set up the one node Hadoop cluster.
7. Mount the one node Hadoop cluster using FUSE.
8. Write a program to use the API's of Hadoop to interact with it.
9. Write a wordcount program to demonstrate the use of Map and Reduce tasks

TOTAL= 45 PERIODS

GCC Exercises - Prerequisites

1. Install Java
2. Install GCC

```
$ sudo add-apt-repository ppa:ubuntu-toolchain-r/test  
$ sudo apt-get update  
$ sudo apt-get install gcc-4.9
```

3. Installing Perl

```
$ sudo apt-get install perl
```

4. Installing Grid Essential

```
$ wget http://www.globus.org/ftppub/gt6/installers/repo/globus-toolkit-repo\_latest\_all.deb  
$ sudo dpkg -i globus-toolkit-repo_latest_all.deb
```

if error comes ==> \$ sudo apt-get update

```
$ sudo apt-get install globus-data-management-client  
$ sudo apt-get install globus-gridftp  
$ sudo apt-get install globus-gram5  
$ sudo apt-get install globus-gsi  
$ sudo apt-get install globus-data-management-server  
  
$ sudo apt-get install globus-data-management-sdk  
$ sudo apt-get install globus-resource-management-server  
$ sudo apt-get install globus-resource-management-client  
$ sudo apt-get install globus-resource-management-sdk  
$ sudo apt-get install myproxy  
$ sudo apt-get install gsi.openssh  
$ sudo apt-get install globus-gridftp globus-gram5 globus-gsi myproxy myproxy-server  
myproxy-admin
```

5. Installing Eclipse or Netbeans

```
$ wget http://download.netbeans.org/netbeans/8.1/final/bundles/netbeans-8.1-javaee-linux.sh
```

```
$ chmod +x netbeans-8.1-javaee-linux.sh  
$ ./netbeans-8.1-javaee-linux.sh
```

6. Installing Apache Axis

```
from :http://mirror.fibergrid.in/apache/axis/axis2/java/core/1.7.3/
```

In eclipse --> windows--> preference -> add the axis file--> apply --> ok

Download tomcat and install and start the service

in terminal go to tomcat folder \$ bin/startup.sh

in webbrowser --> localhost:8080

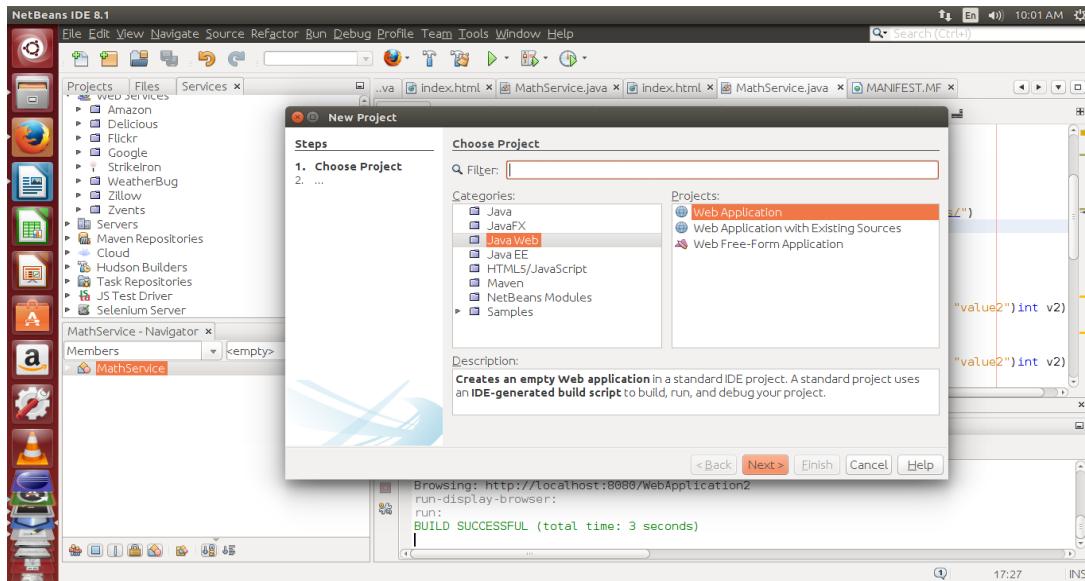
Develop a new Web Service for Calculator

Aim:

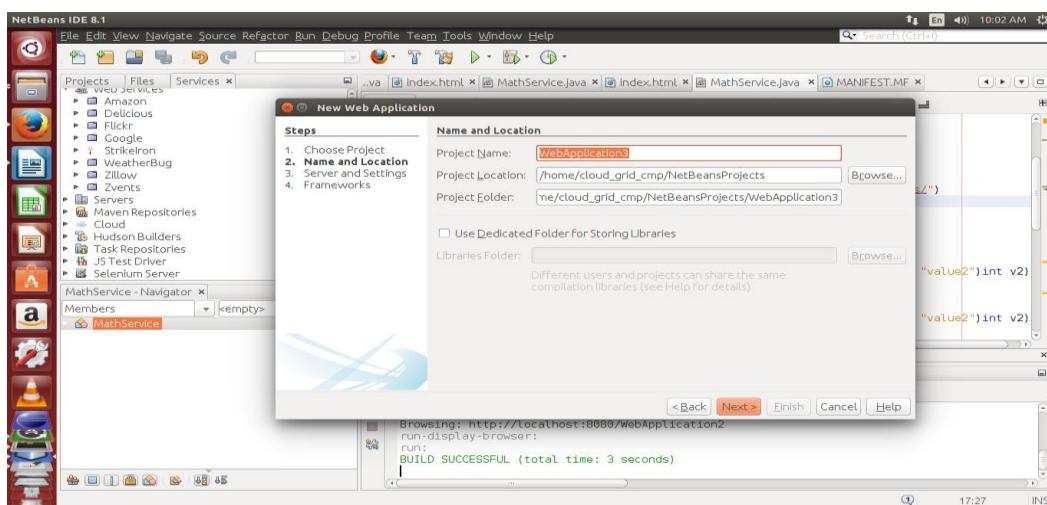
To develop a web service program for a calculator.

Procedures:

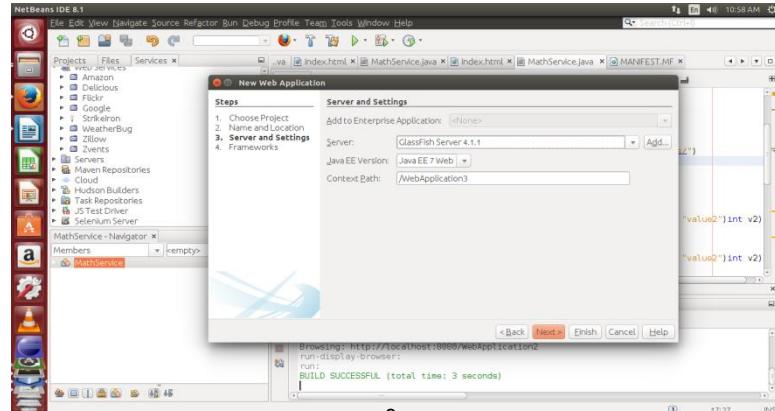
Step1. Open netbeans and go to New



Step 2. Choose Java Web and select Web Application and give next.

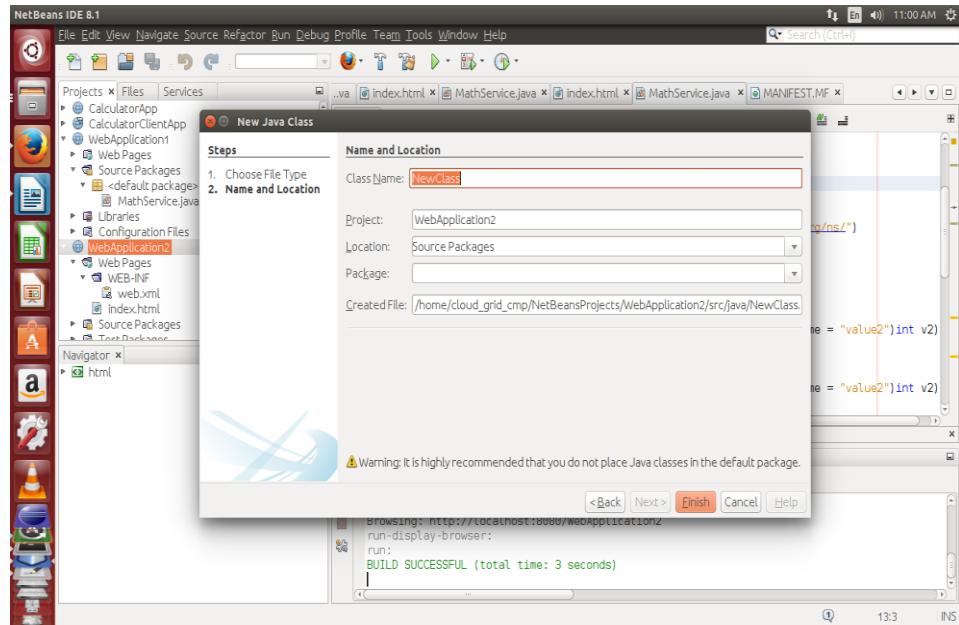


Step 3. Enter the project name and give next and Select the Server either tomcat or glassfish



Step 4. Give next and select finish

Step 5. Right click the WebApplication (Projec Name) and Select New, and choose Java Class



Step 6. Type the following code

```
import javax.jws.WebMethod;
import javax.jws.WebParam;
import javax.jws.WebService;

/*
 * To change this license header, choose License Headers in Project Properties.
 * To change this template file, choose Tools | Templates
 * and open the template in the editor.
 */

/**
 *
 * @author cloud_grid_cmp
 */
@WebService(serviceName="MathService", targetNamespace = "http://my.org/ns/")
public class MathService {
    @WebMethod(operationName = "hello")
    public String hello(@WebParam(name="name")String txt){
        return "Hello"+txt+"!";
    }
    @WebMethod(operationName = "addSer")
    public String addSer(@WebParam(name="value1")int v1, @WebParam(name = "value2")int v2){
        return "Answer: "+(v1+v2)+"!";
    }
    @WebMethod(operationName = "subSer")
    public String subSer(@WebParam(name="value1")int v1, @WebParam(name = "value2")int v2){
```

```

return "Answer:" +(v1-v2)+"!";
}
@WebMethod(operationName = "mulSer")
public String mulSer(@WebParam(name="value1")int v1, @WebParam(name = "value2")int v2){
return "Answer:" +(v1*v2)+"!";
}
@WebMethod(operationName = "divSer")
public String divSer(@WebParam(name="value1")int v1, @WebParam(name = "value2")int v2){
float res = 0;
try
{
res = ((float)v1)/((float) v2);
return "Answer:" +res+"!";
}
catch(ArithmetricException e){
System.out.println("Can't be divided by Zero"+e);
return "Answer:" +e.getMessage().toString()+"!!!";
}
}
}
}

```

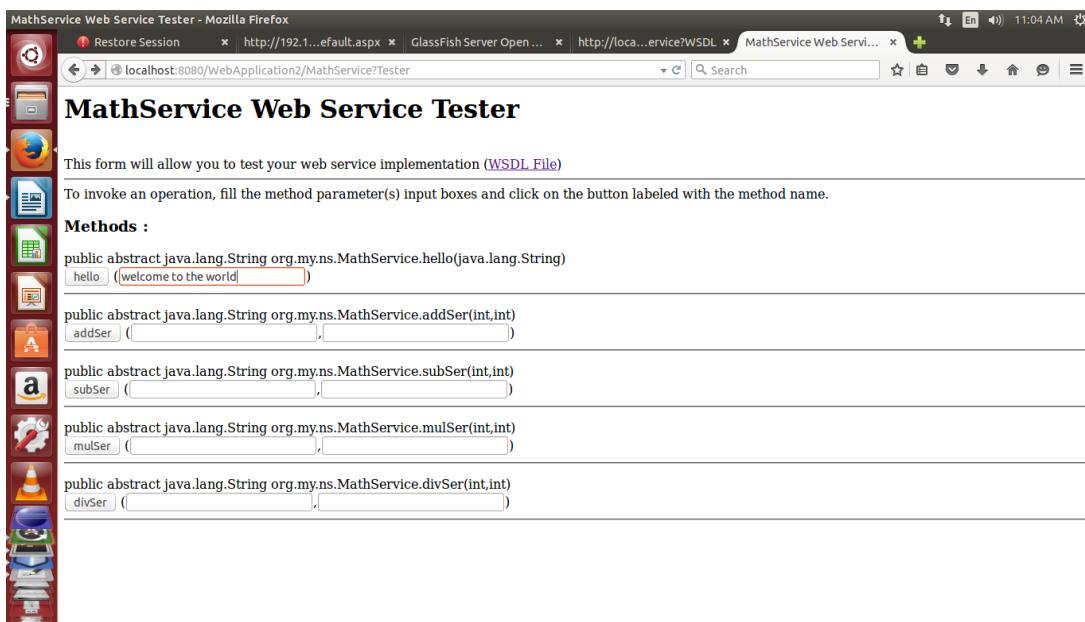
Step 7. Run Project by pressing F6 key or Run button.

Step 8. Check Web browser

for the following name is available else give it

<http://localhost:8080/WebApplication2/MathService?Tester>

MathService?Tester ---> represents the java class name



Output Screen:

Give some value in the fields and check the out put by pressing enter key.

Method parameter(s)

Type	Value
int	45
int	90

Method returned

java.lang.String : "Answer:135!"

SOAP Request

```
<?xml version="1.0" encoding="UTF-8"?><S:Envelope xmlns:S="http://schemas.xmlsoap.org/soap/envelope/" xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
  <S:Header>
    <SOAP-ENV:Header/>
  <S:Body>
    <ns2:addSer xmlns:ns2="http://my.org/ns/">
      <value1>45</value1>
      <value2>90</value2>
    </ns2:addSer>
  </S:Body>
</S:Envelope>
```

SOAP Response

```
<?xml version="1.0" encoding="UTF-8"?><S:Envelope xmlns:S="http://schemas.xmlsoap.org/soap/envelope/" xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
```

```
<!--
-->
<!--
Generated by JAX-WS RI (http://jax-ws.java.net). RI's version is Metro/2.3.2-b688 (trunk-7979; 2015-01-21T12:50:19+0000) JAXWS-RI/2.2.11-b150120.1832 JAXWS-API/2.2.12 JAXB-RI/2.2.11-b150120.1832 JAXB-API/2.2.12
-->
<definitions targetNamespace="http://my.org/ns/" name="MathService">
  <types>
    <xsd:schema>
      <xsd:import namespace="http://my.org/ns/" schemaLocation="http://localhost:8080/WebApplication2/MathService?xsd=1"/>
    </xsd:schema>
  </types>
  <message name="hello">
    <part name="parameters" element="tns:hello"/>
  </message>
  <message name="helloResponse">
    <part name="parameters" element="tns:helloResponse"/>
  </message>
  <message name="addSer">
    <part name="parameters" element="tns:addSer"/>
  </message>
  <message name="addSerResponse">
    <part name="parameters" element="tns:addSerResponse"/>
  </message>
  <message name="subSer">
    <part name="parameters" element="tns:subSer"/>
  </message>
  <message name="subSerResponse">
    <part name="parameters" element="tns:subSerResponse"/>
  </message>
  <message name="mulSer">
    <part name="parameters" element="tns:mulSer"/>
  </message>
  <message name="mulSerResponse">
    <part name="parameters" element="tns:mulSerResponse"/>
  </message>
</definitions>
```

Finally select the WSDL link

Result:

Thus the program on calculator for web services is executed successfully.

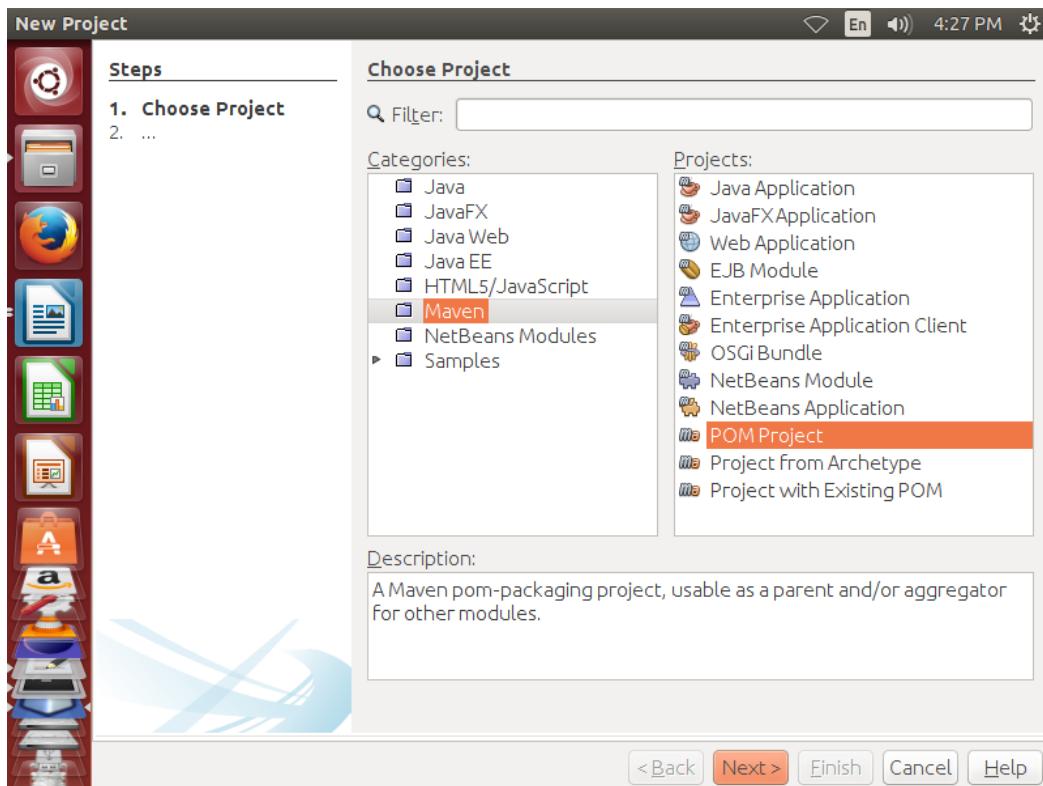
To develop a new OGSA complaint Webservice.

Aim:

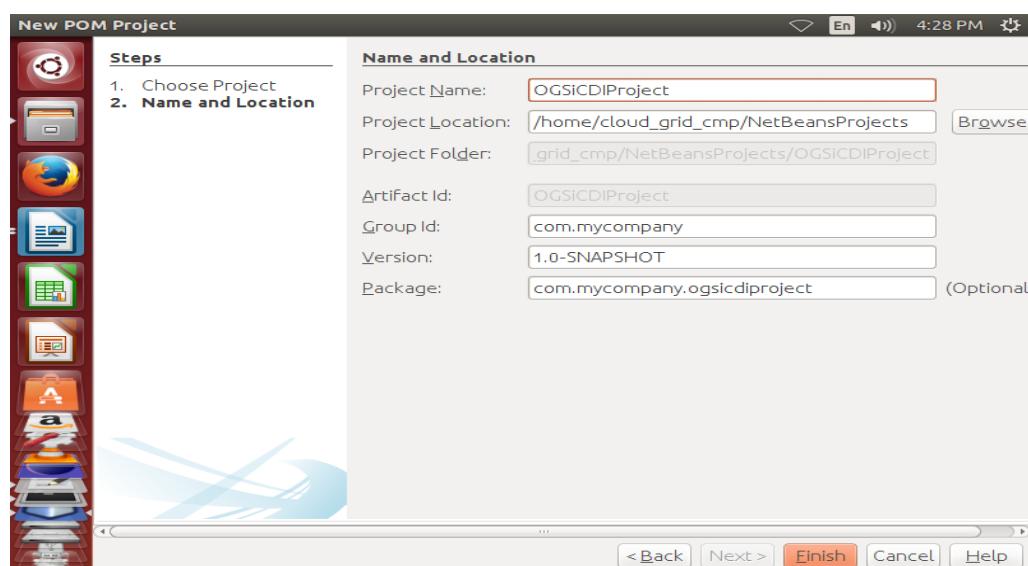
To develop a new OGSA complaint Webservice

Procedure:

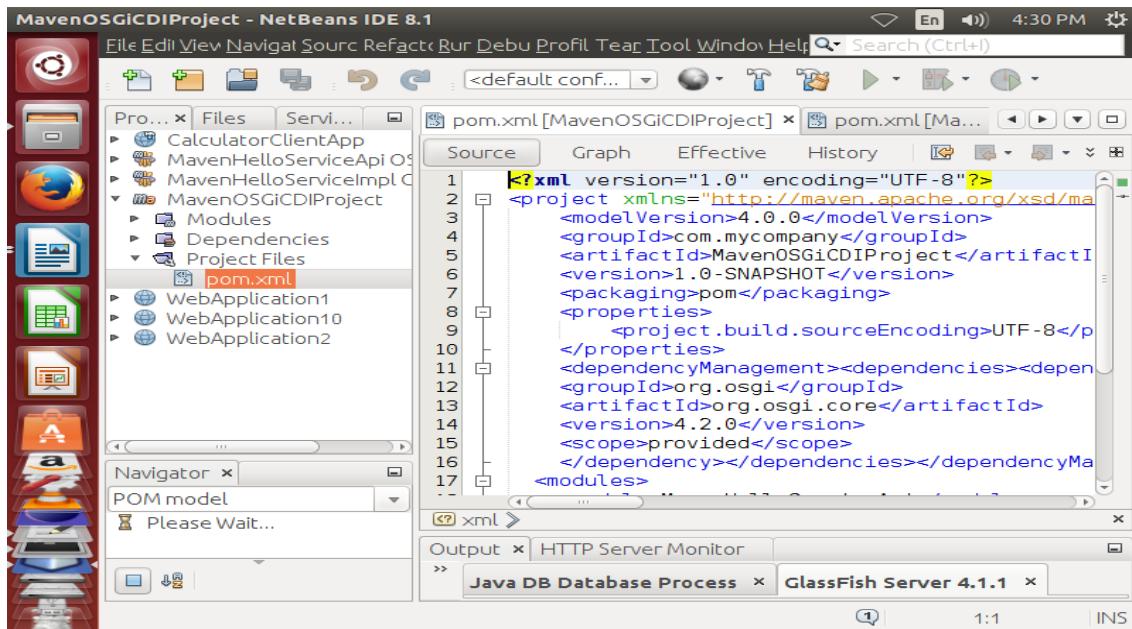
Step 1: Choose New Project from the main menu



Step 2: Select POM project from the maven category



Step 3: Type MavenOSGiCDIProject as the project name and click finish. When you click finish, the IDE creates the POM project and opens the project in the project window.



Step 4: Expand the project files node in the project window and double - click pom.xml to open the file in editor and do the modification in the file and save.

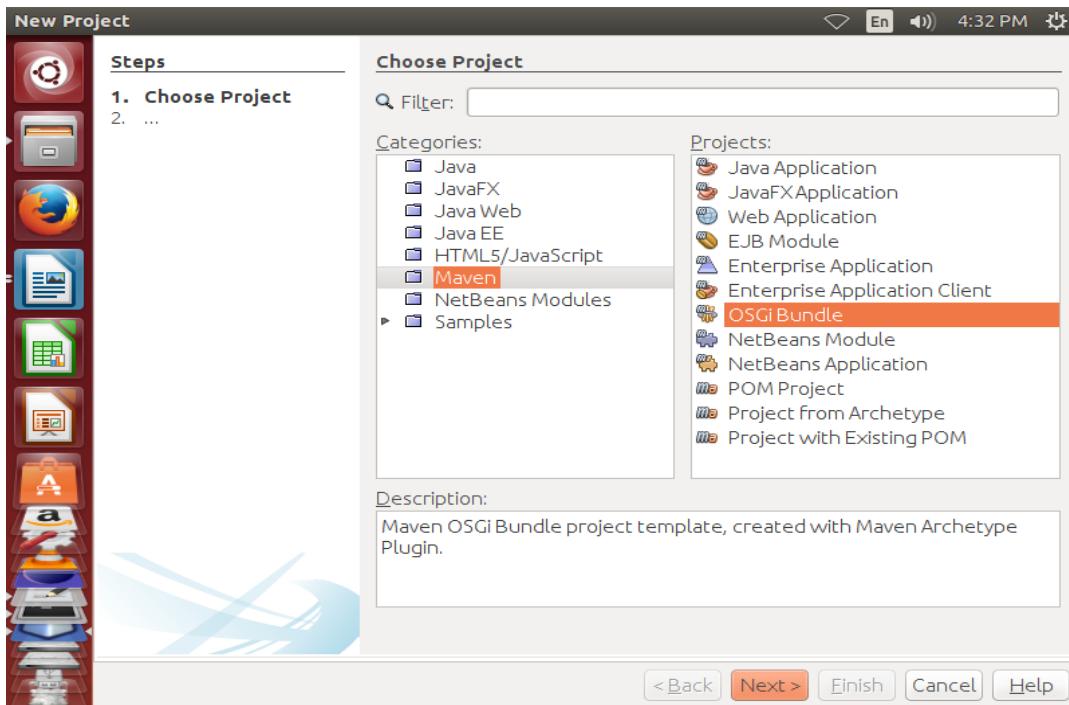
In pom.xml file

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/xsd/maven-4.0.0.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
  http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>com.mycompany</groupId>
  <artifactId>MavenOSGiCDIProject</artifactId>
  <version>1.0-SNAPSHOT</version>
  <packaging>pom</packaging>
  <properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
  </properties>
  <dependencyManagement><dependencies><dependency>
    <groupId>org.osgi</groupId>
    <artifactId>org.osgi.core</artifactId>
    <version>4.2.0</version>
    <scope>provided</scope>
  </dependency></dependencies></dependencyManagement>
</project>
```

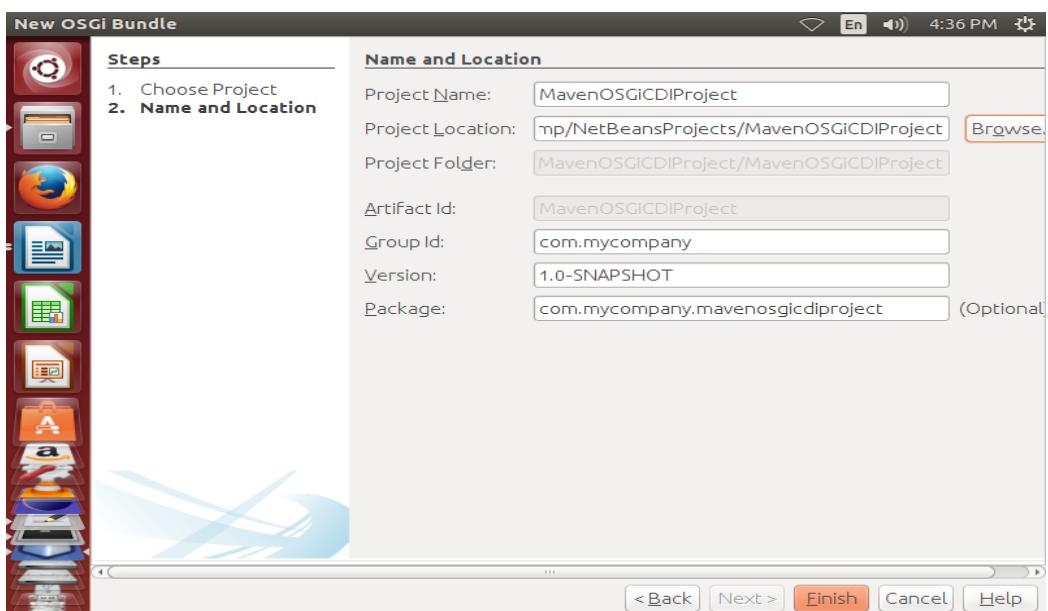
Step 5:Creating OGSi Bundle Projects

Choose File -> New Project to open the New Project Wizard

Step 5 : Choose OGSi Bundle from Maven category. Click Next

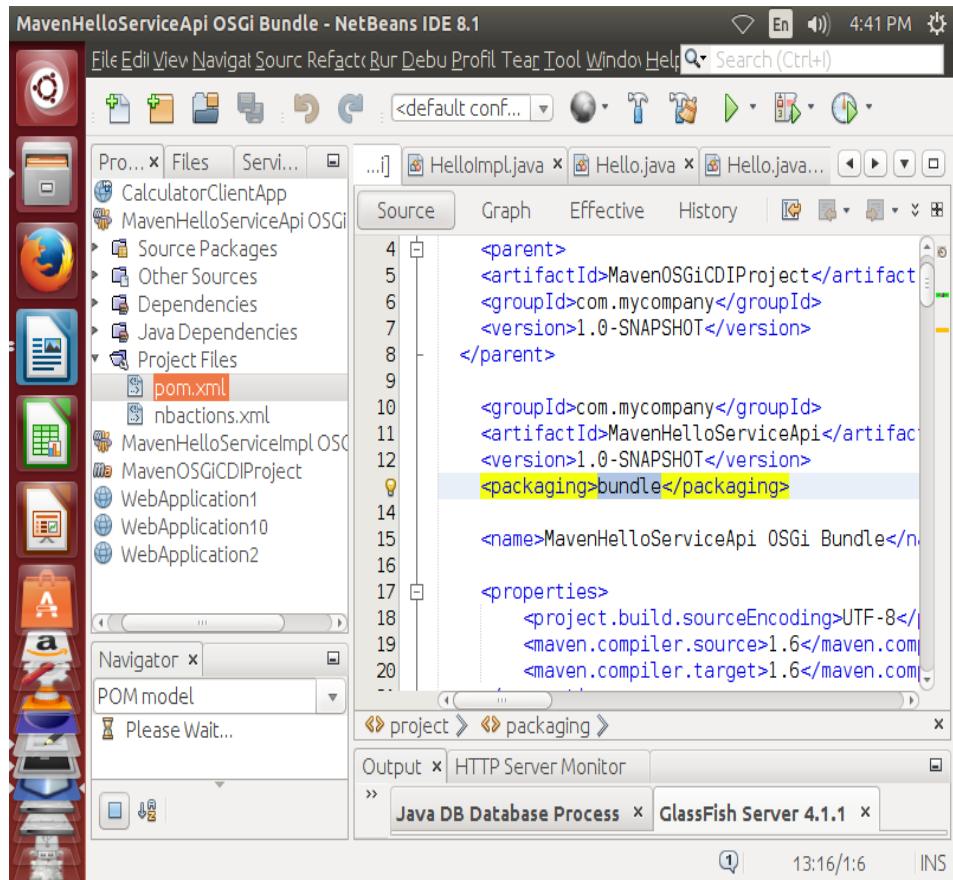


Step 6: Creating MavenHelloServiceApi as the Project Name for OGSi Bundle



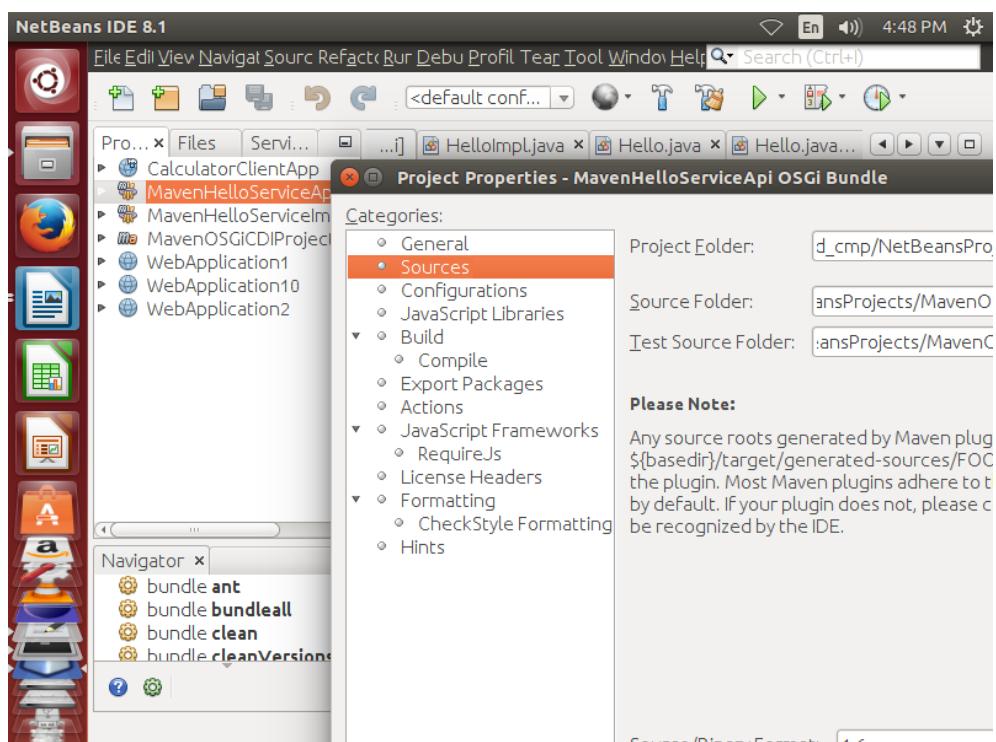
The IDE creates the bundle project and opens the project in the Project Window. And check the building pugins at pom.xml under project files.

As well as it will create org.osgi.core artifact as default and it can be view at under Dependencies.

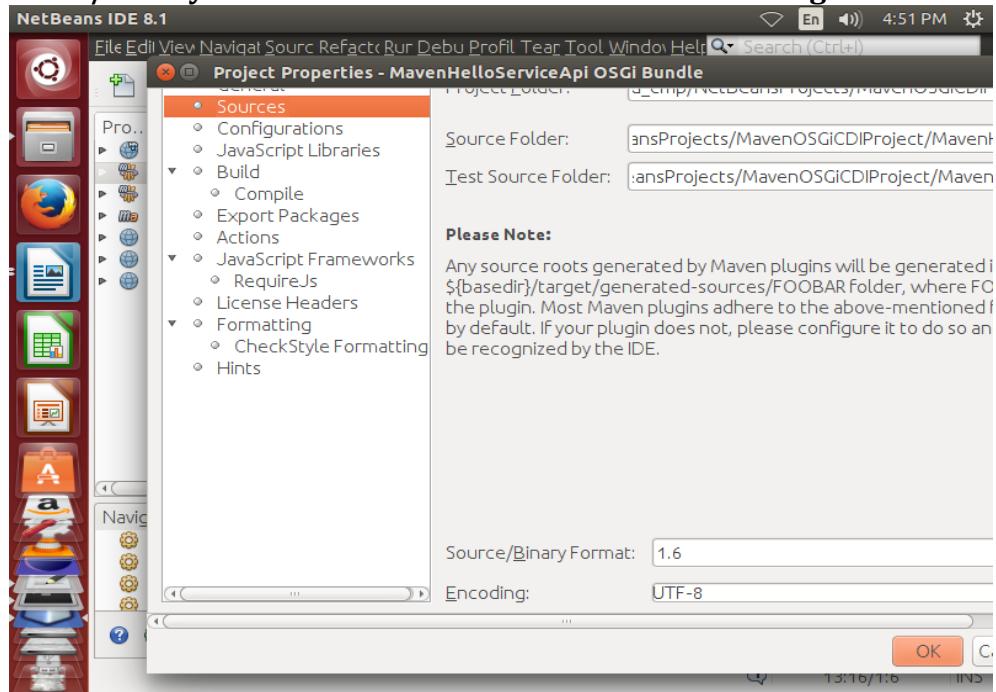


Step 7: Build the MavenHelloServiceApi Project by

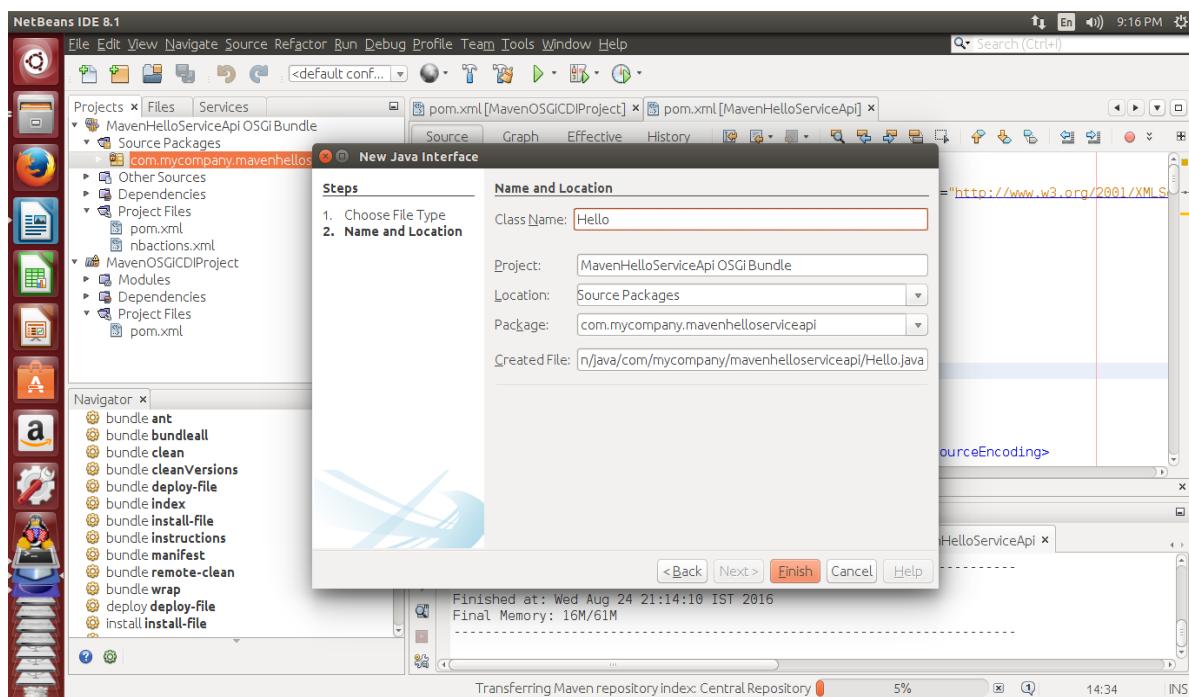
1. Right Click the MavenHelloServiceApi project node in the project window and choose properties.



2. Select the source category in the project project dialog box
3. Set the **Source/Binary Format** to 1.6 and confirm that the **Encoding** is UTF-8 and click ok



4. Right click the source package node in the project window and choose New -> JavaInterface
5. Type **Hello** for the Class Name.

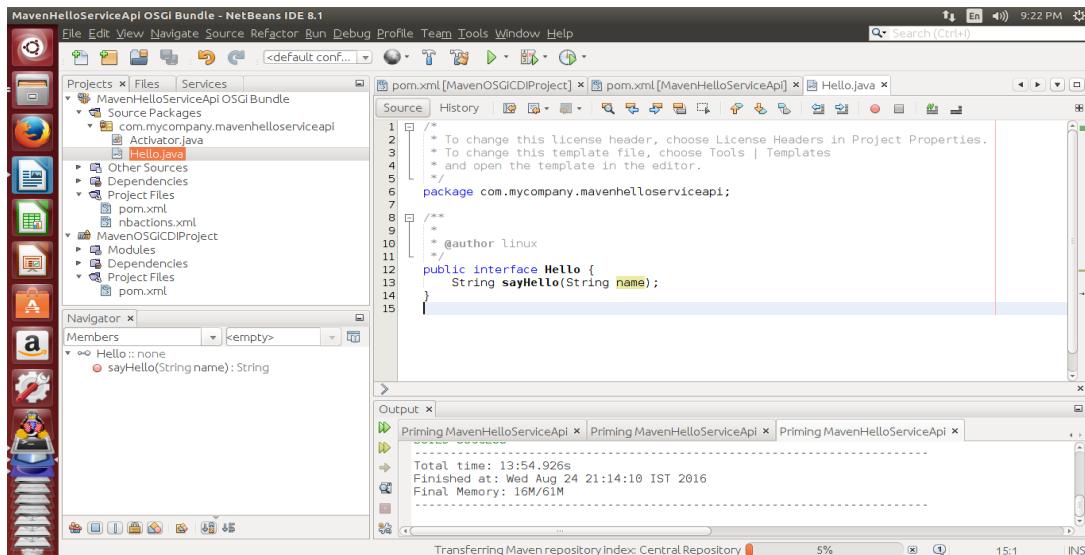


6. Select **com.mycompany.mavenhelloserviceapi** as the Package. Click finish.
7. Add the following sayHello method to the interface and save the changes.

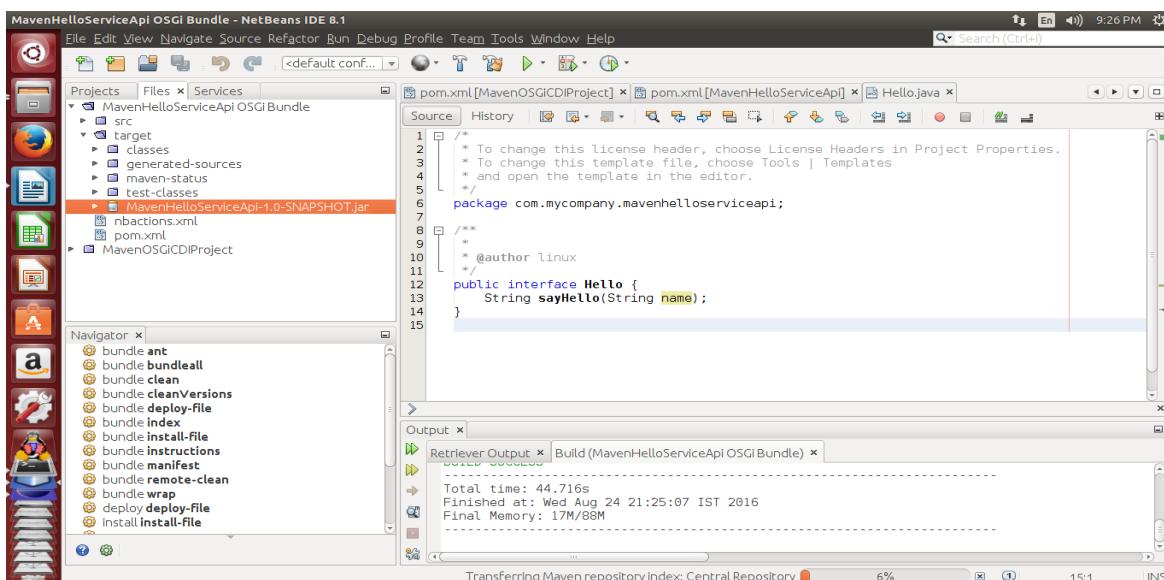
```

package com.mycompany.mavenhelloserviceapi;
public interface Hello {
    String sayHello(String name);
}

```



8. Right click the project node in the project window and choose build.
9. After building the project, open files window and expand the project node such that you can see MavenHelloServiceApi-1.0-SNAPSHOT.jar is created in the target folder.



Step 8: Creating the MavenHelloServiceImpl Implementation Bundle

Here you will create the MavenHelloServiceImpl in the POM Project.

1. Choose File -> New Project to open the New Project Wizard
2. Choose OSGi Bundle from the Maven category. Click Next.
3. Type **MavenHelloServiceImpl** for the Project Name
4. Click Browse and select the MavenOSGiCDIProject POM project as the Location. Click Finish.(As earlier step).
5. Right click the project node in the Projects window and choose Properties.

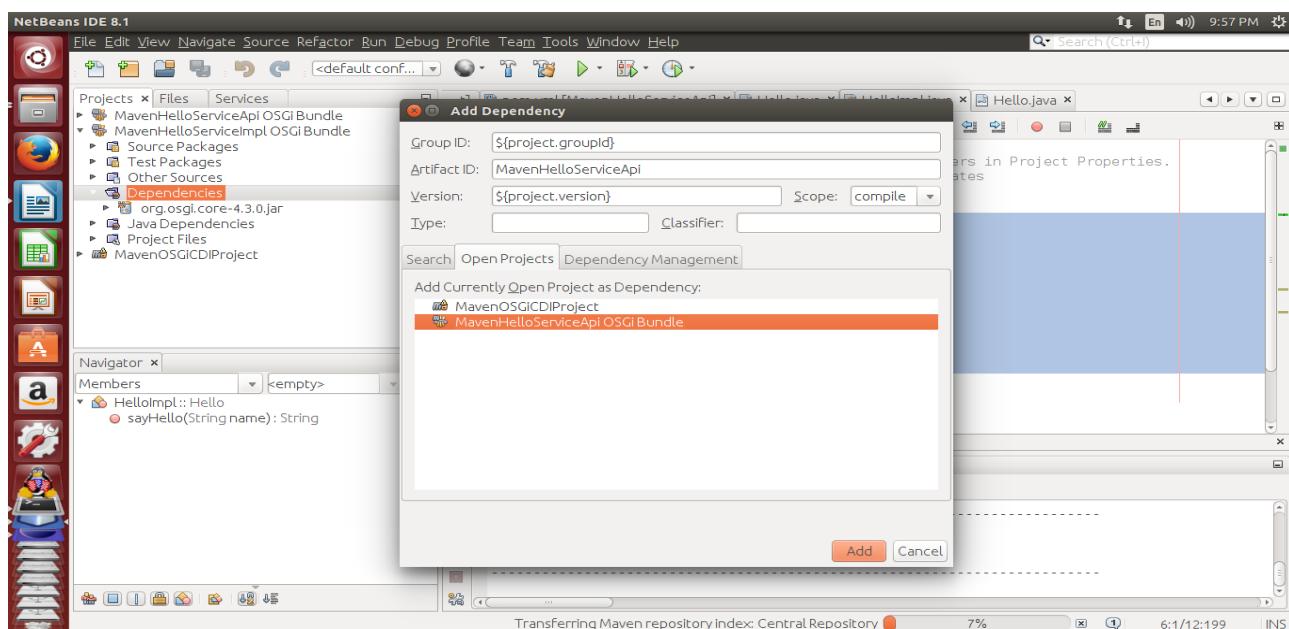
6. Select the Sources category in the Project Properties dialog box.
7. Set the **Source/Binary Format** to 1.6 and confirm that the **Encoding** is UTF-8. Click OK.
8. Right click Source Packages node in the Projects window and choose New -> Java Class.
9. Type **HelloImpl** for the Class Name.
10. Select **com.mycompany.mavenhelloserviceimpl** as the Package. Click Finish.
11. Type the following and save your changes.

```
package com.mycompany.mavenhelloserviceimpl;

/**
 *
 * @author linux
 */
public class HelloImpl implements Hello {
    public String sayHello(String name)
    {
        return "Hello" +name;
    }
}
```

When you implement Hello, the IDE will display an error that you need to resolve by adding the MavenHelloServiceApi project as a dependency.

12. Right click the Dependencies folder of **MavenHelloServiceImpl** in the Projects window and choose Add Dependency.
13. Click the Open Projects tab in the Add Library dialog.
14. Select **MavenHelloServiceApi OSGi Bundle**. Click Add



14. Expand the **com.mycompany.mavenhelloserviceimpl** package and double click **Activator.java** and open the file in editor.
The IDE automatically creates the Activator.java bundle and its manage the lifecycle of bundle.
By default it includes start() and stop().
15. Modify the start() and Stop() methods in the bundle activator class by adding the

following lines.

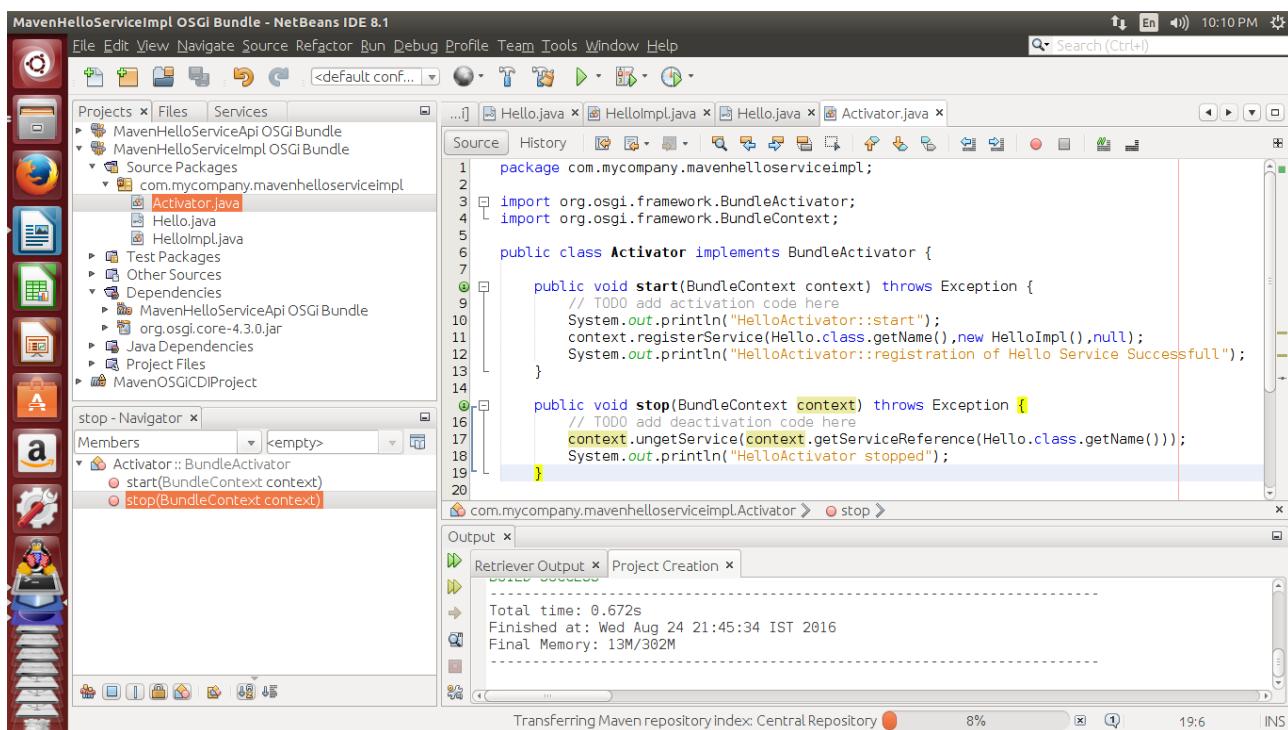
```
ackage com.mycompany.mavenhelloserviceimpl;

import org.osgi.framework.BundleActivator;
import org.osgi.framework.BundleContext;

public class Activator implements BundleActivator {

    public void start(BundleContext context) throws Exception {
        // TODO add activation code here
System.out.println("HelloActivator::start");
context.registerService(Hello.class.getName(),new HelloImpl(),null);
System.out.println("HelloActivator::registration of Hello Service Successfull");
    }

    public void stop(BundleContext context) throws Exception {
        // TODO add deactivation code here
        context.ungetService(context.getServiceReference(Hello.class.getName()));
System.out.println("HelloActivator stopped");
    }
}
```

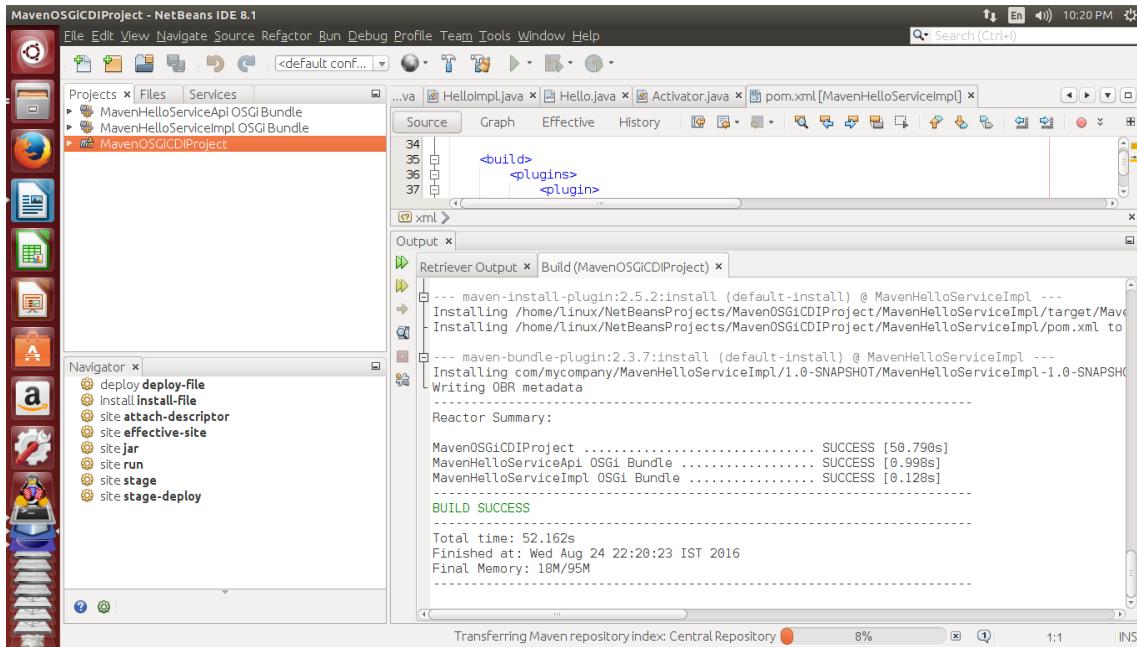


Step 9: Building and Deploying the OSGi Bundles

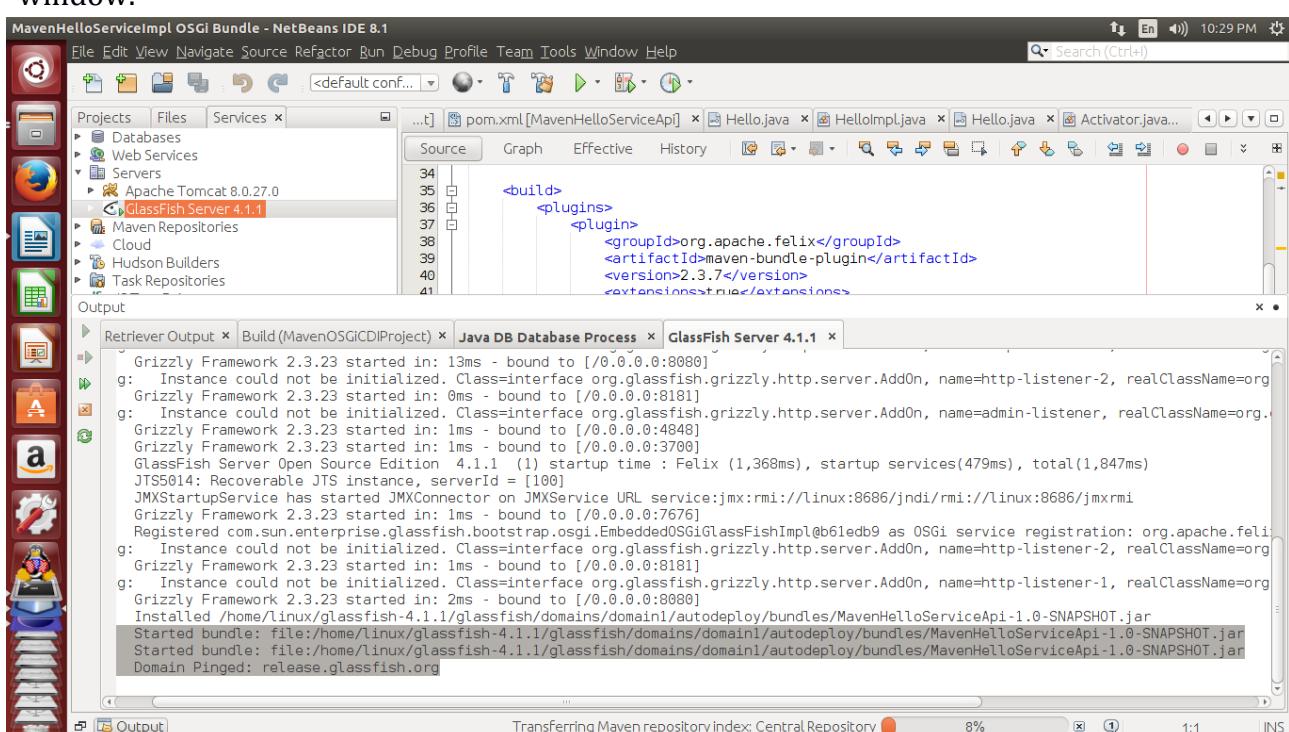
Here you will build the OSGi bundles and deploy the bundles to GlassFish

1. Right click the MavenOSGiCDIProject folder in the Projects window and choose Clean and Build.
When you build the project the IDE will create the JAR files in the target folder and also install the snapshot JAR in the local repository.

In file window, by expanding the target folder of each of the two bundle projects it will show two JAR archieves(MavenHelloServiceApi-1.0-SNAPSHOT.jar and MavenHelloServiceImpl-1.0-SNAPSHOT.jar.)



2. Start the GlassFish server (if not already started)
3. Copy the MavenHelloServiceApi-1.0-SNAPSHOT.jar to the **/home/linux/glassfish-4.1.1/glassfish/domains/domain1/autodeploy/bundles** (GlassFish installed Directory)
4. You can see output similar to the following in the GlassFish Server log in the output window.



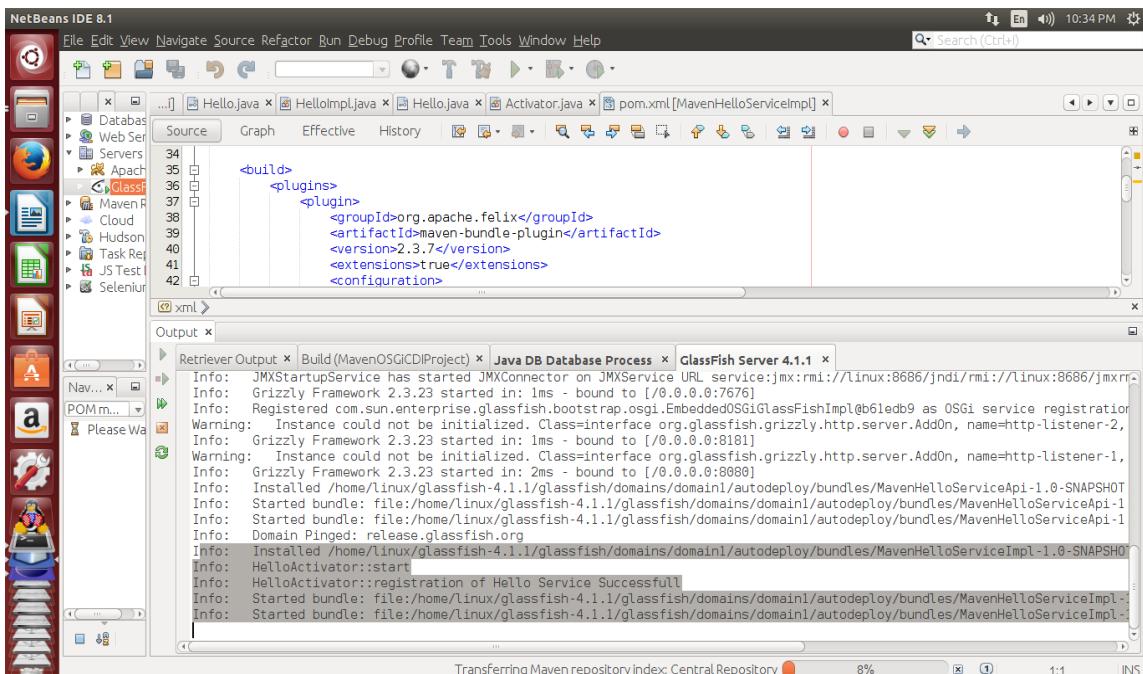
Info: Installed /home/linux/glassfish-4.1.1/glassfish/domains/domain1/autodeploy/bundles/MavenHelloServiceApi-1.0-SNAPSHOT.jar
Info: Started bundle: file:/home/linux/glassfish-

4.1.1/glassfish/domains/domain1/autodeploy/bundles/MavenHelloServiceApi-1.0-SNAPSHOT.jar

Info: Started bundle: <file:/home/linux/glassfish-4.1.1/glassfish/domains/domain1/autodeploy/bundles/MavenHelloServiceApi-1.0-SNAPSHOT.jar>

5. Repeat the step of copying the MavenHelloServiceImpl-1.0-SNAPSHOT.jar to the **/home/linux/glassfish-4.1.1/glassfish/domains/domain1/autodeploy/bundles** (GlassFish installed Directory)

6. You can see the output at the glassfish server log



Info: Installed /home/linux/glassfish

4.1.1/glassfish/domains/domain1/autodeploy/bundles/MavenHelloServiceImpl-1.0-SNAPSHOT.jar

Info: HelloActivator::start

Info: HelloActivator::registration of Hello Service Successfull

Info: Started bundle: file:/home/linux/glassfish-

4.1.1/glassfish/domains/domain1/autodeploy/bundles/MavenHelloServiceImpl-1.0-SNAPSHOT.jar

Info: Started bundle: file:/home/linux/glassfish-

4.1.1/glassfish/domains/domain1/autodeploy/bundles/MavenHelloServiceImpl-1.0-SNAPSHOT.jar

Result:

Thus a new OGSA- compliant web service has been executed successfully.

Using Apache Axis Develop a Grid Service

Aim:

To develop a Grid Service using Apache Axis

Procedure:

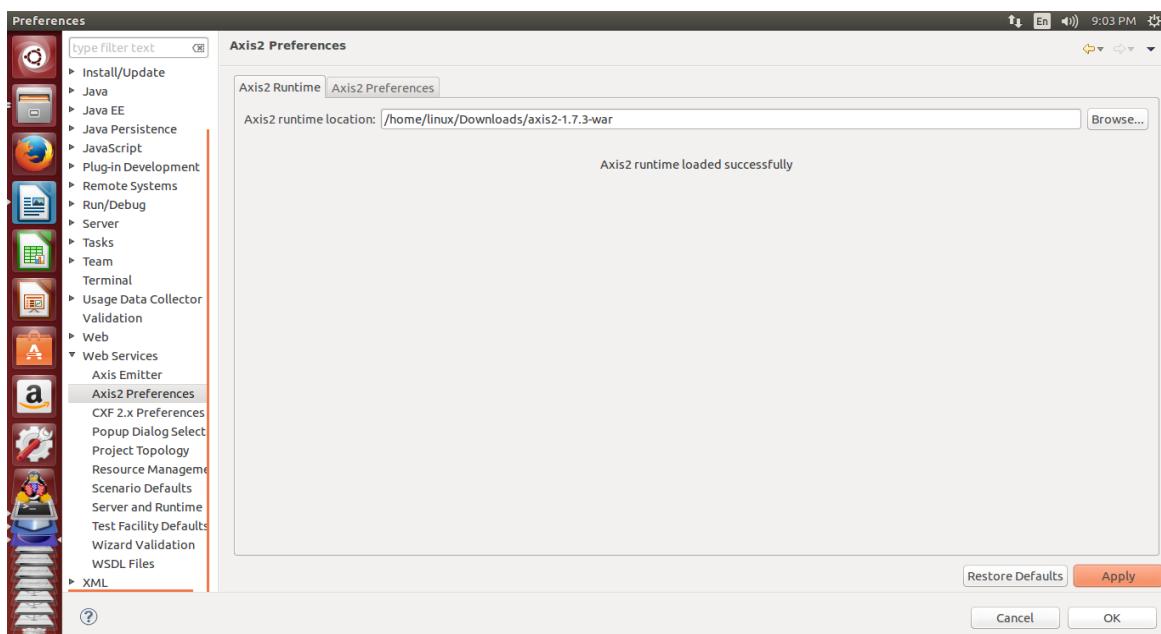
Step1. Prerequisites;

- Installing Apache Axis, Download it from :

<http://mirror.fibergrid.in/apache/axis/axis2/java/core/1.7.3/>

- Extract the axis file

- Open Eclipse, Click window and choose preference and select the Axis2 preference from Web Services. Finally map the extracted path of Axis2 and click apply and ok.



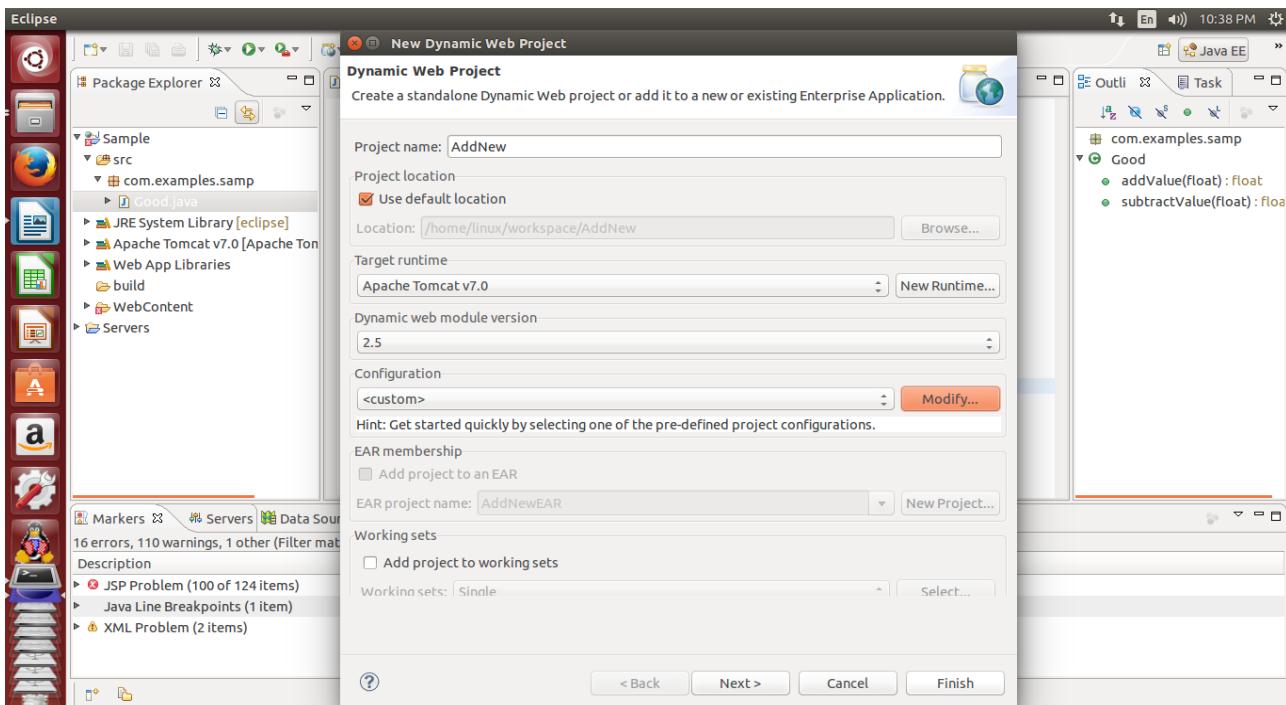
- Download apache-tomcat and install the services by unzipping the rar file of apache tomcat. Check in terminal by moving to tomcat folder

\$ bin/startup.sh

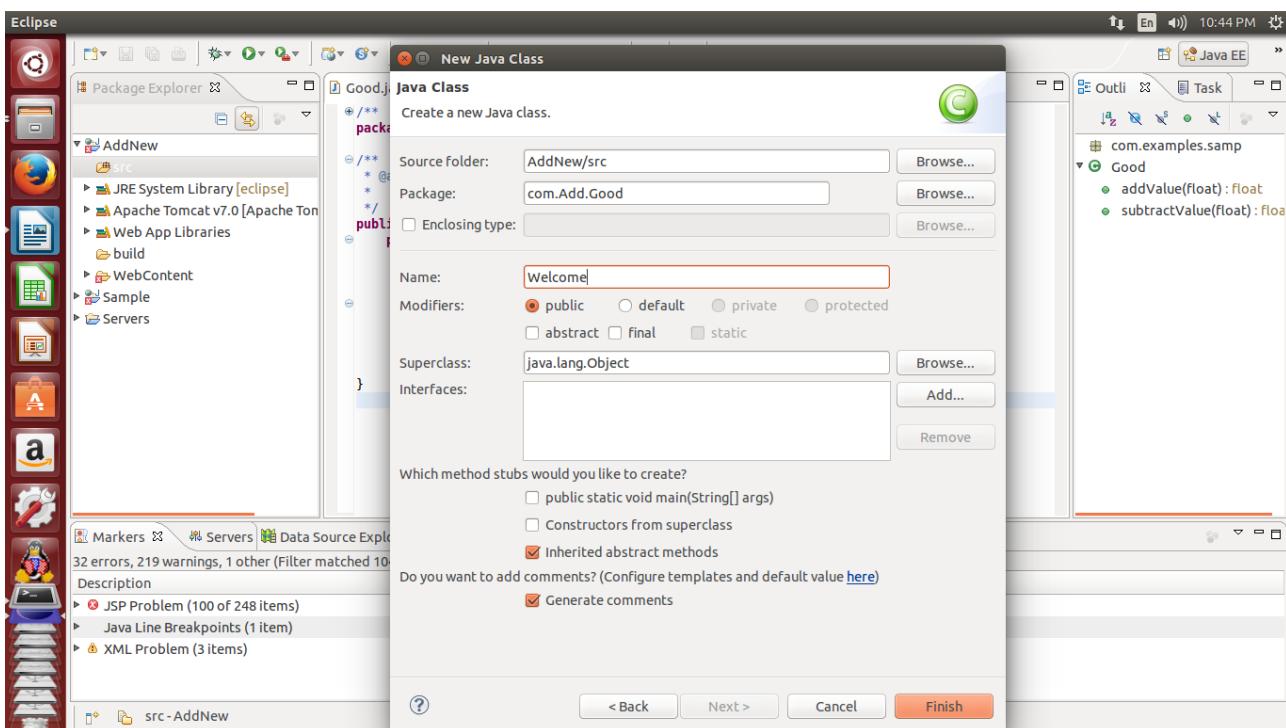
Check the tomcat service in webbrowser by visiting--> **localhost:8080**

Step 2. Open Eclipse and select new dynamic web project by selecting new.

Step 3. Enter the name as **AddNew** and select tomcat server environment as **7.0** and Dynamic web module version as **2.5**. In configuration select Modify and tick the **Axis2 Web services**. Give Finish.



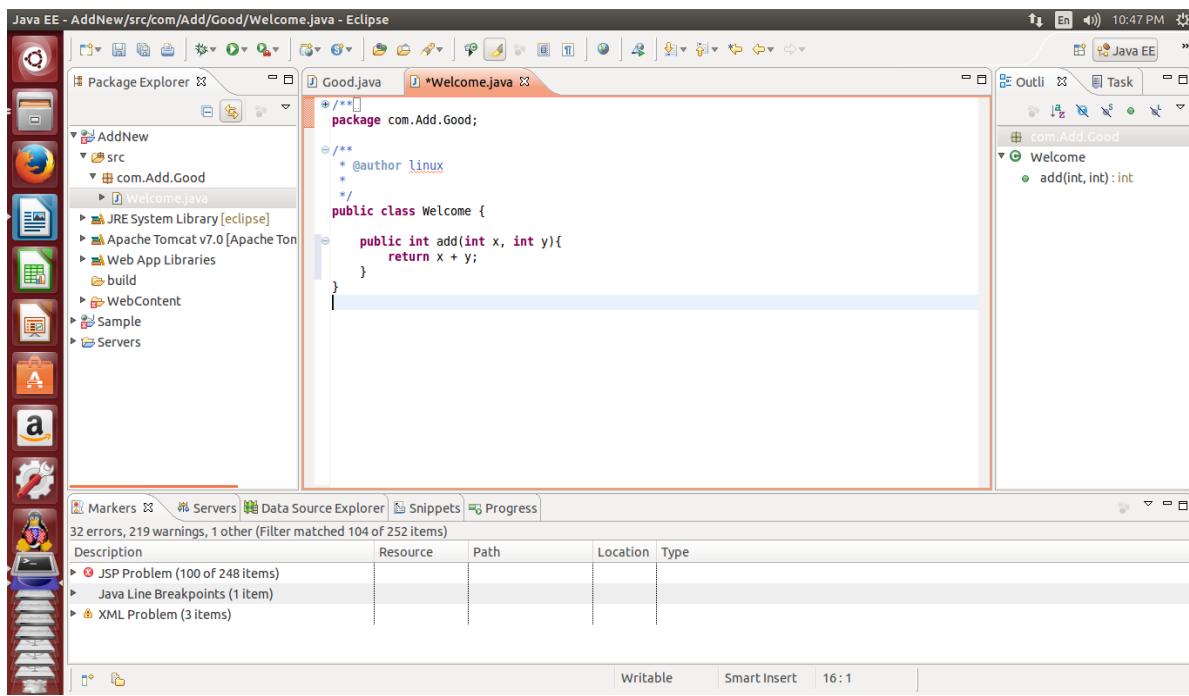
Step 4. Right click the project and add new class as Welcome and give finish.



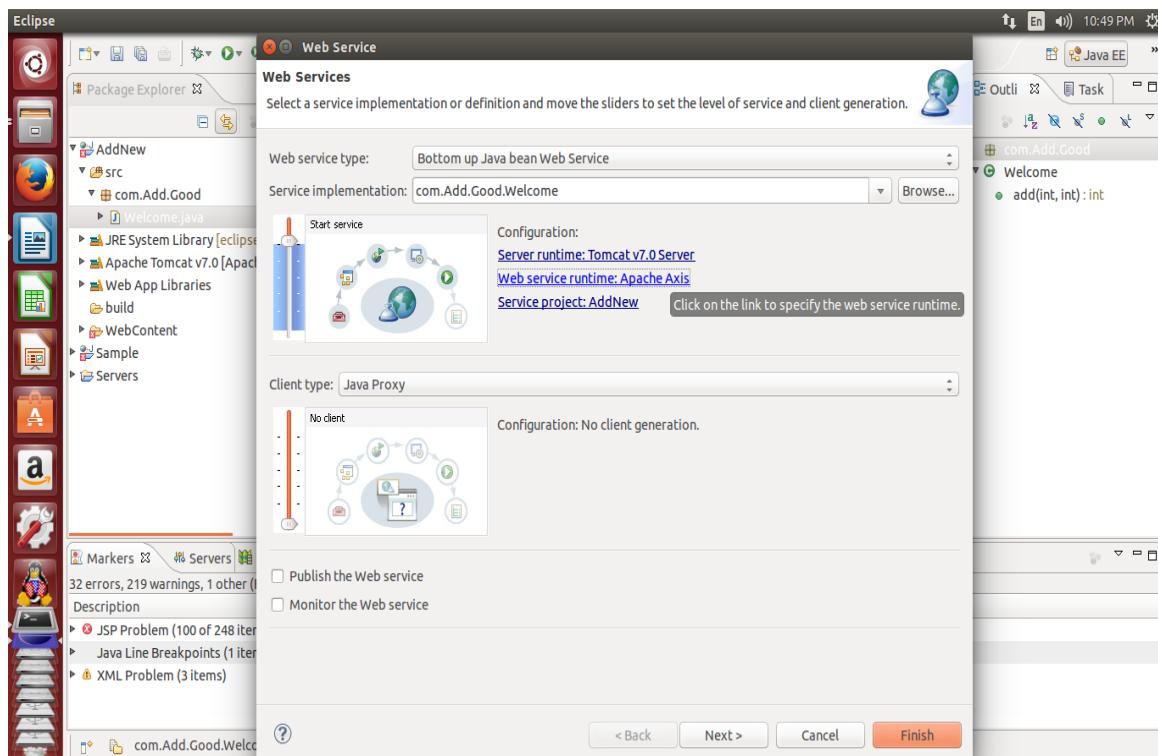
Step 5. Type the following sample code in the class.

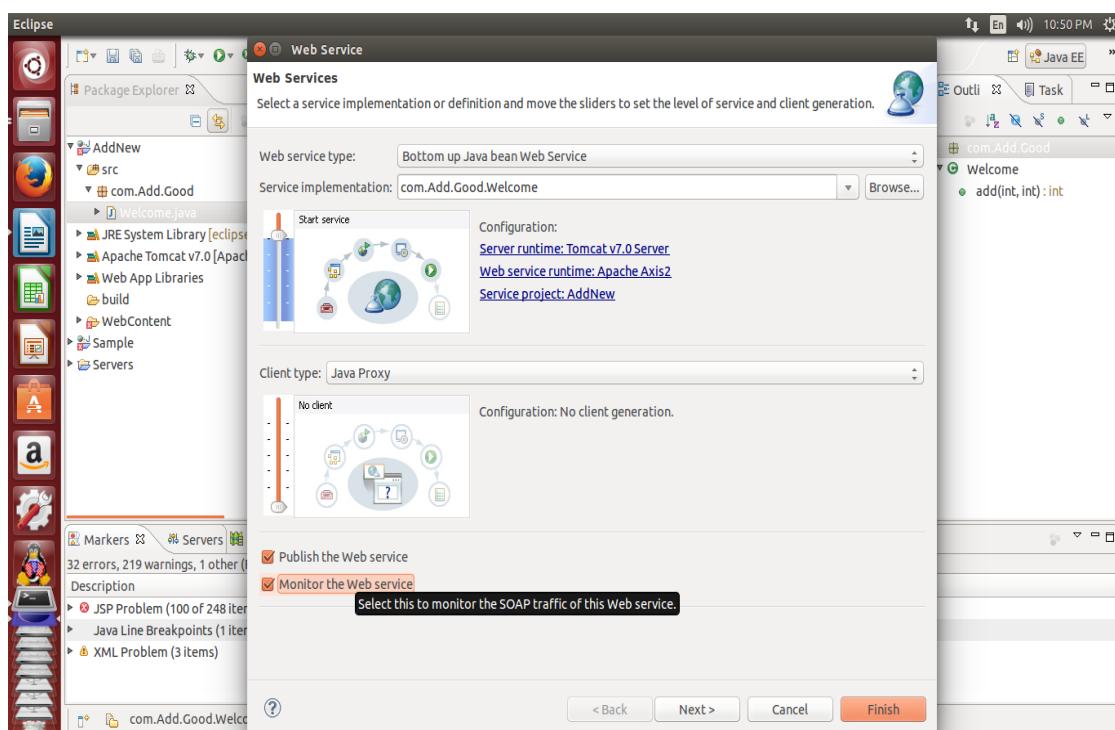
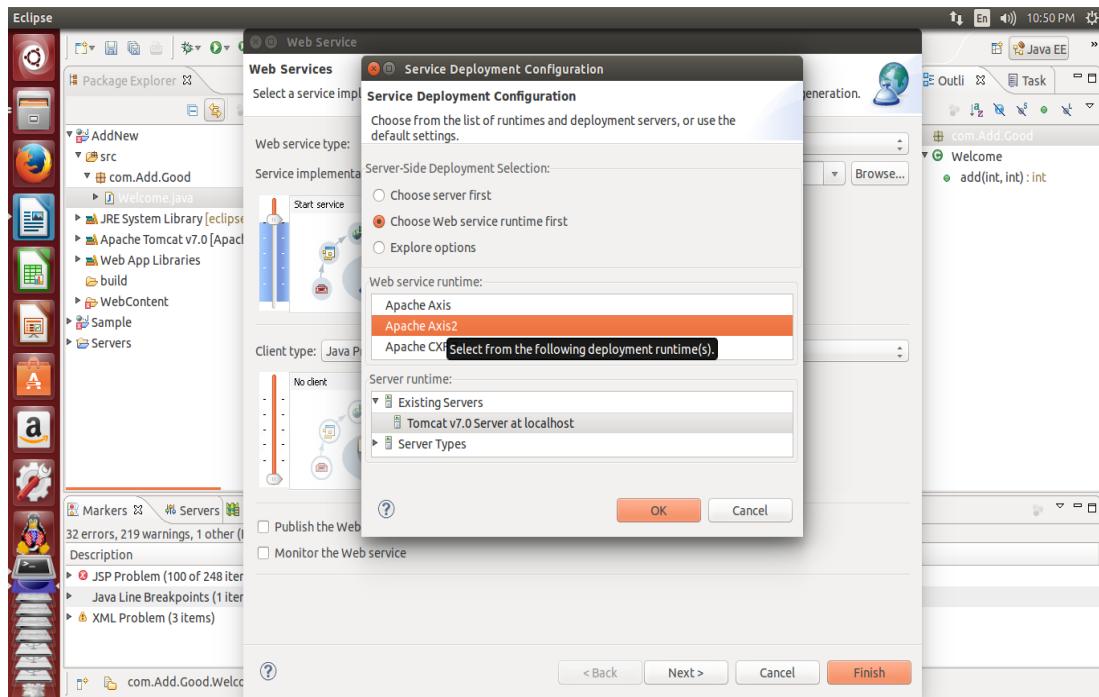
```
package com.Add.Good;
public class Welcome {
```

```
    public int add(int x, int y){
        return x + y;
    }
}
```

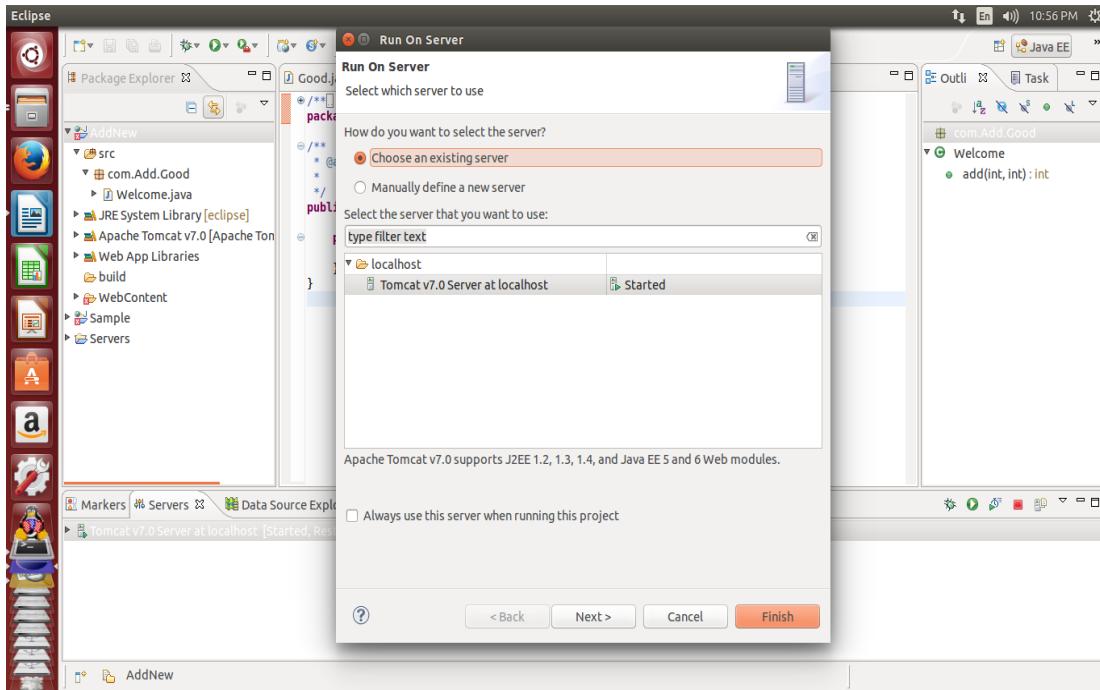


Step 6. Right click the Welcome.java and select new --> Web Service
 Click Web Service runtime Apache axis and select Apache Axis 2 and Tomcat 7.0, select publis and monitor check box finally give finish.

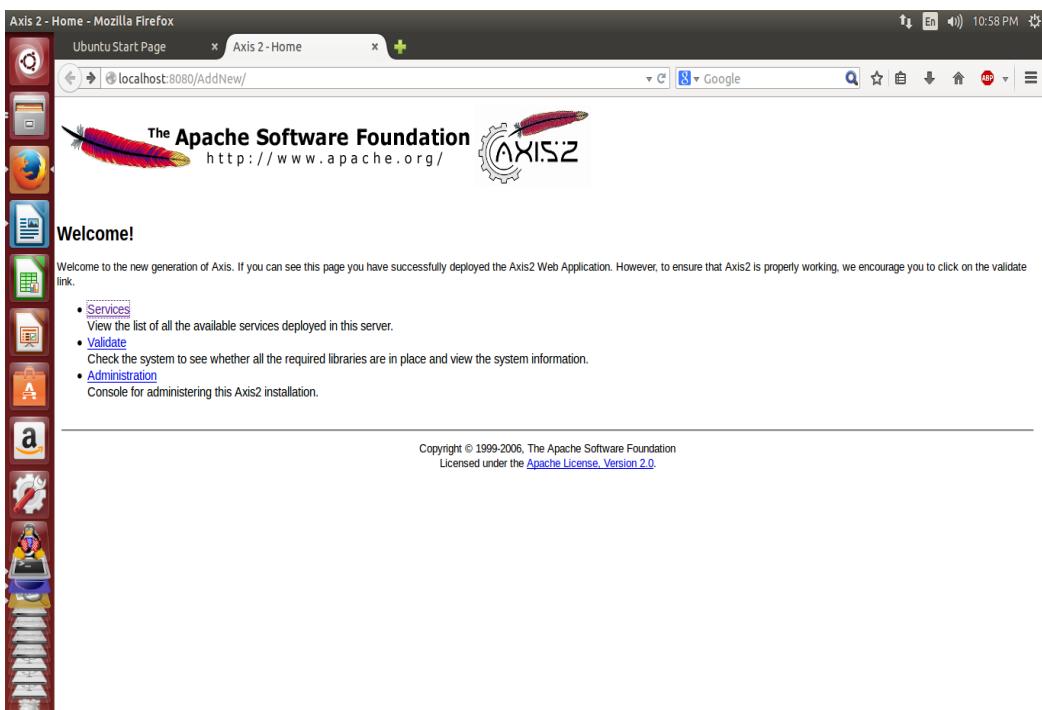




Step 7. Right Click the project and select Run as by Run on server



Step 8. Give finish by checking the above selected field in the figure. As output in web browser automatically a page will open. **localhost:8080/AddNew/**

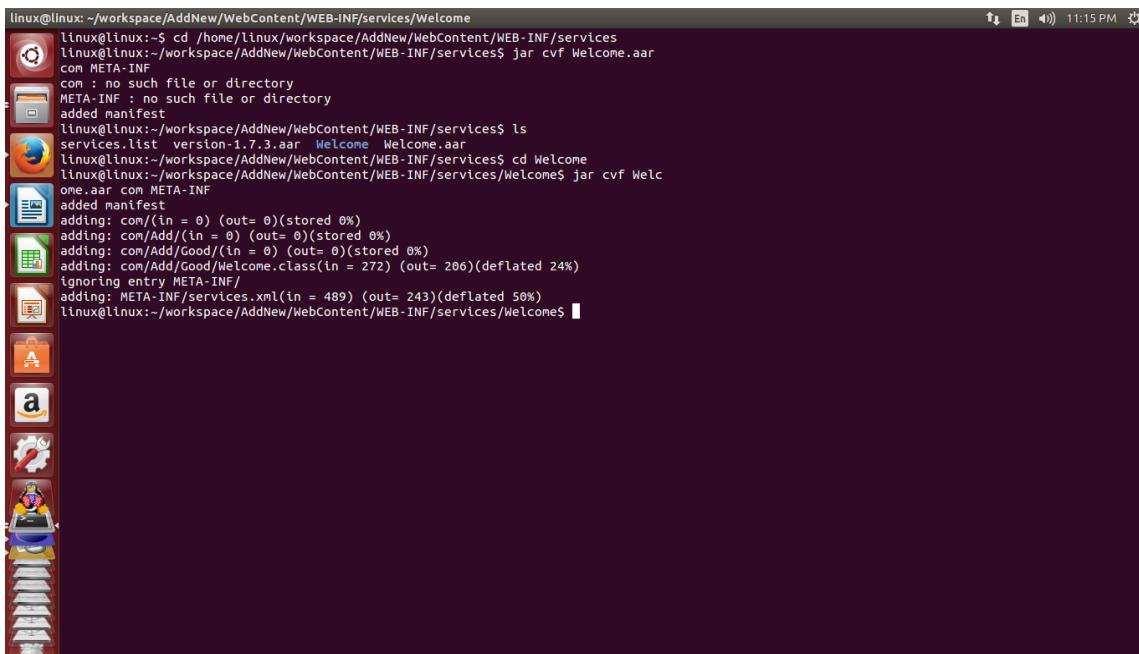


Once you click the service, all the methods will show as output.

Step 9. Creating the .aar(Axis Archive) file and Deploying Service

a. In our eclipse workspace, go to Welcome folder at /home/linux/workspace/AddNew/WebContent/WEB-INF/services/Welcome. Go to that directory through terminal and give the command as

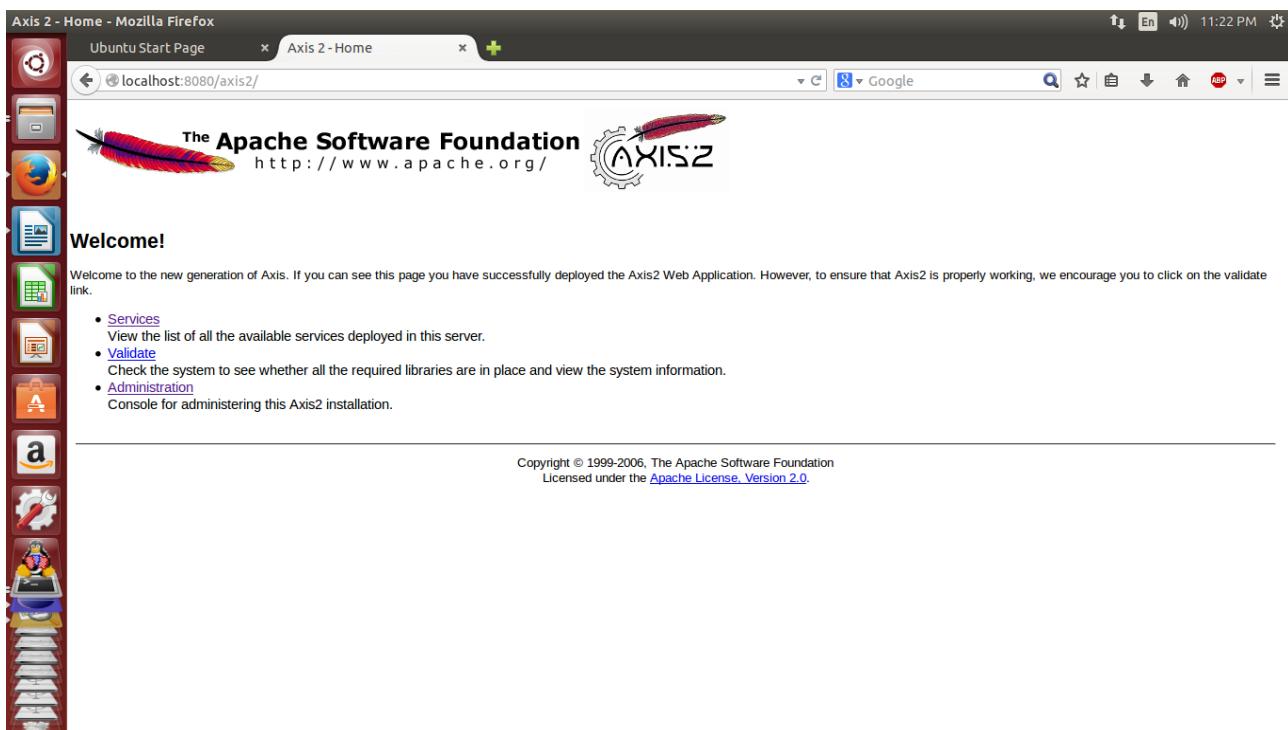
\$ jar cvf Welcome.aar com META-INF



```
linux@linux: ~/workspace/AddNew/WebContent/WEB-INF/services>Welcome
linux@linux:~/workspace/AddNew/WebContent/WEB-INF/services$ cd /home/linux/workspace/AddNew/WebContent/WEB-INF/services
linux@linux:~/workspace/AddNew/WebContent/WEB-INF/services$ jar cvf Welcome.aar
com META-INF
com : no such file or directory
META-INF : no such file or directory
added manifest
linux@linux:~/workspace/AddNew/WebContent/WEB-INF/services$ ls
services.list version-1.7.3.jar Welcome Welcome.aar
linux@linux:~/workspace/AddNew/WebContent/WEB-INF/services$ cd Welcome
linux@linux:~/workspace/AddNew/WebContent/WEB-INF/services/Welcome$ jar cvf Welcome.aar com META-INF
added manifest
adding: com/(in = 0) (out= 0)(stored 0%)
adding: com/Add/(in = 0) (out= 0)(stored 0%)
adding: com/Add/Good/(in = 0) (out= 0)(stored 0%)
adding: com/Add/Good/Welcome.class(in = 272) (out= 206)(deflated 24%)
ignoring entry META-INF/
adding: META-INF/services.xml(in = 489) (out= 243)(deflated 50%)
linux@linux:~/workspace/AddNew/WebContent/WEB-INF/services/Welcome$
```

b. Then copy the axis2.war file which is inside Apache axis 2 war distribution. (Which is downloaded earlier) to the webapps directory of Apache Tomcat.

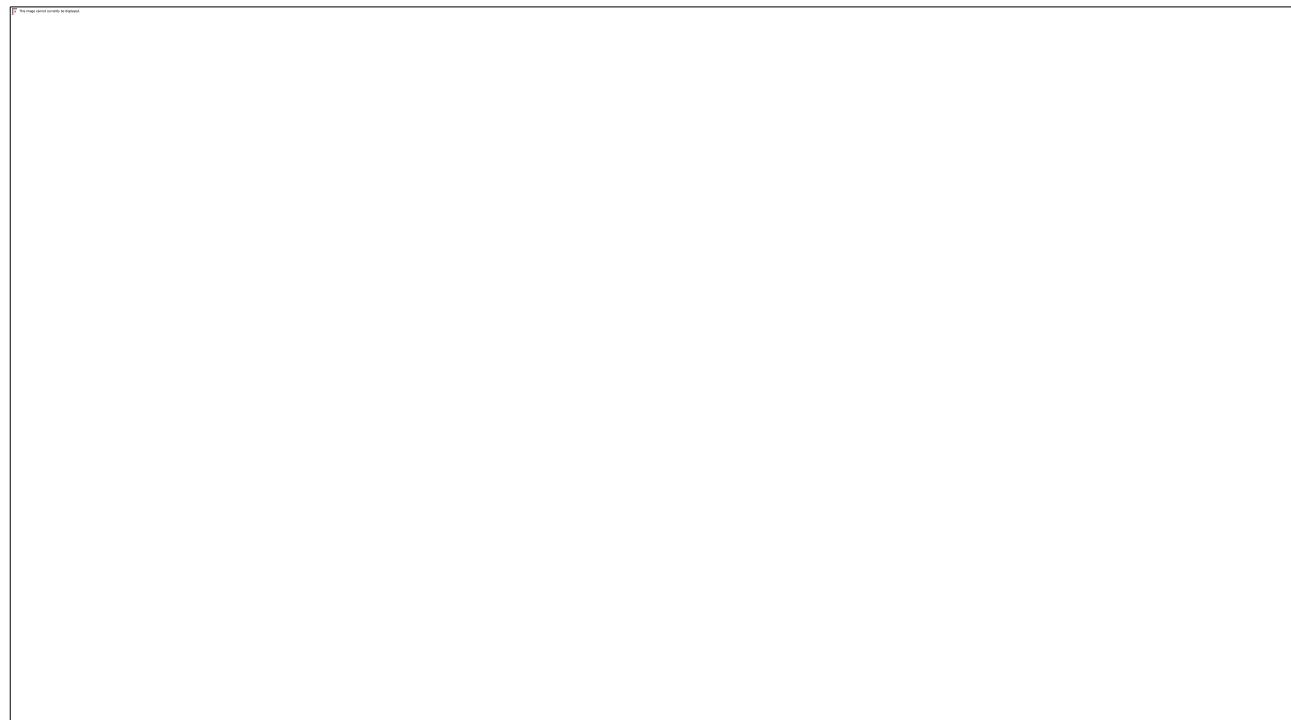
c. Now start the Tomcat service through terminal (bin/startup.sh). Now there will be a new directory called axis2 inside the webapps folder. Now go to <http://localhost:8080/axis2/> and you can find the homepage of Axis2 Web Application.



d. Now, click the Administration Link and login by using username: admin and password : axis2.

There you can find the upload service link on top left and you can upload the created Welcome.aar file. This is equal to manually copying the Welcome.aar to webapps/axis2/WEB-INF/services folder.

e. Now you can list the services by visiting localhost:8080/axis2/services/listServices, you can able to see our newly added service.



Result:

Thus the grid service has been implemented successfully using Apache Axis.

Develop secured applications using basic security mechanism available in Globus Toolkit.

Aim:

To develop a secured applications using basic security mechanisms available in Globus toolkit.

Procedures:

Step 1. Installing and setup of Certificate Authority. Open Terminal and move to root user and give command as

```
root@linux:~# apt-get install
```

```
root@linux:~# sudo grid-ca-create -noint
```

Certificate Authority Setup

This script will setup a Certificate Authority for signing Globus users certificates. It will also generate a simple CA package that can be distributed to the users of the CA.

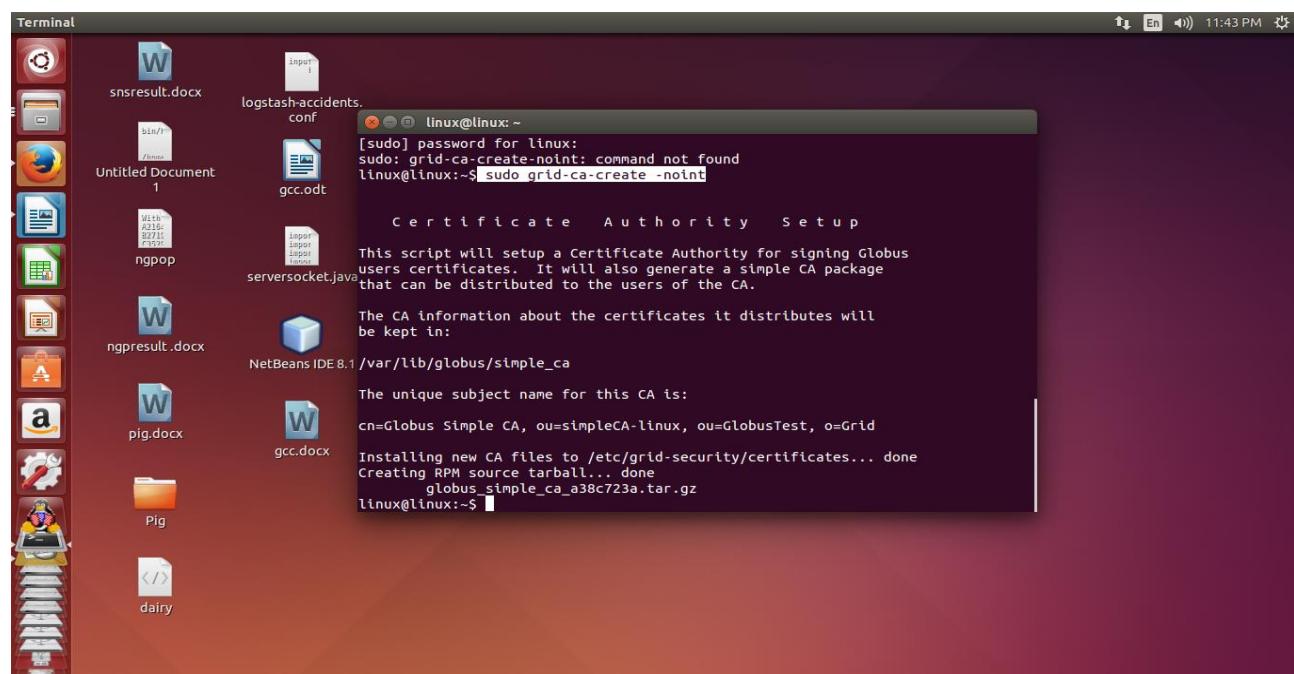
The CA information about the certificates it distributes will be kept in:

/var/lib/globus/simple_ca

The unique subject name for this CA is:

cn=Globus Simple CA, ou=simpleCA-ubuntu, ou=GlobusTest, o=Grid

Insufficient permissions to install CA into the trusted certificate directory (tried \${sysconfdir}/grid-security/certificates and \${datadir}/certificates) Creating RPM source tarball... done

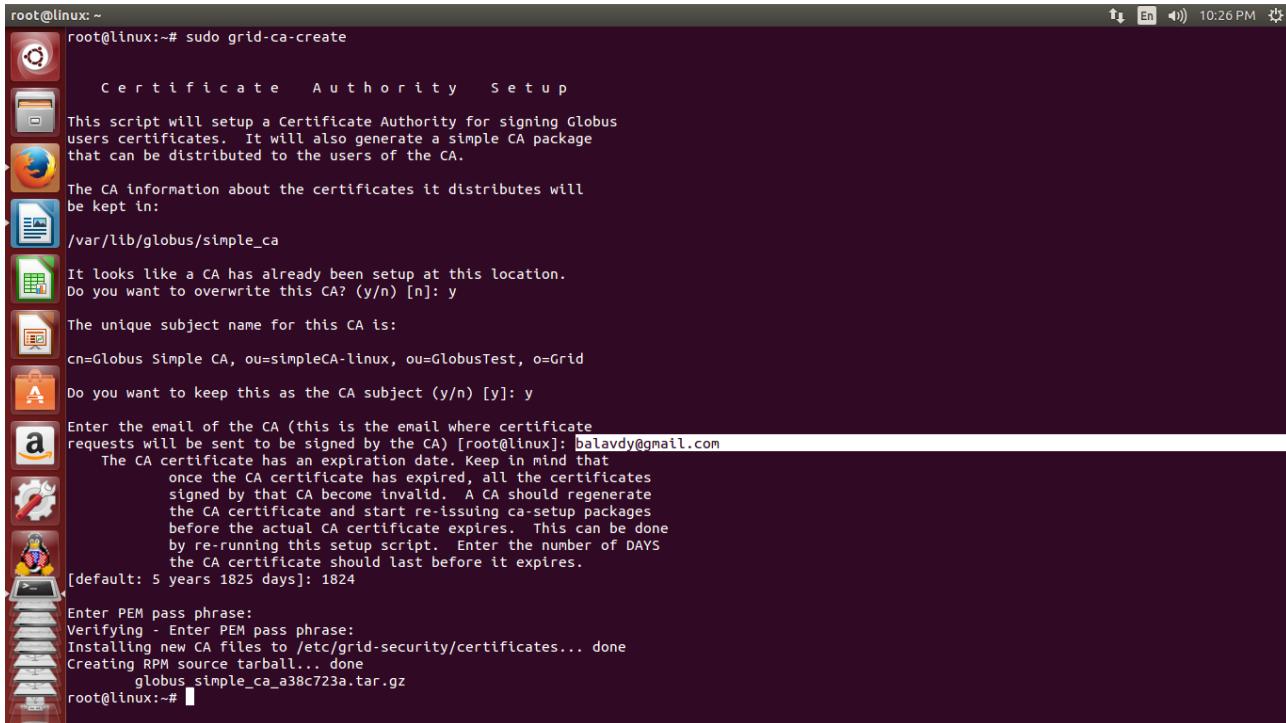


globus_simple_ca_388f6778.tar.gz

Configure the subject name

The grid-ca-create program next prompts you for information about the name of CA you wish to create:

root@linux:~# sudo grid-ca-create



```
root@linux:~# sudo grid-ca-create
C e r t i f i c a t e   A u t h o r i t y   S e t u p
This script will setup a Certificate Authority for signing Globus
users certificates. It will also generate a simple CA package
that can be distributed to the users of the CA.
The CA information about the certificates it distributes will
be kept in:
/var/lib/globus/simple_ca
It looks like a CA has already been setup at this location.
Do you want to overwrite this CA? (y/n) [n]: y
The unique subject name for this CA is:
cn=Globus Simple CA, ou=simpleCA-linux, ou=GridTest, o=Grid
Do you want to keep this as the CA subject (y/n) [y]: y
Enter the email of the CA (this is the email where certificate
requests will be sent to be signed by the CA) [root@linux]: balavdy@gmail.com
The CA certificate has an expiration date. Keep in mind that
once the CA certificate has expired, all the certificates
signed by that CA become invalid. A CA should regenerate
the CA certificate and start re-issuing ca-setup packages
before the actual CA certificate expires. This can be done
by re-running this setup script. Enter the number of DAYS
the CA certificate should last before it expires.
[default: 5 years 1825 days]: 1824
Enter PEM pass phrase:
Verifying - Enter PEM pass phrase:
Installing new CA files to /etc/grid-security/certificates... done
Creating RPM source tarball... done
globus_simple_ca_a38c723a.tar.gz
root@linux:~#
```

It will ask few things in command prompt and give the things

- i. Permission
- ii. Unique subject name
- iii. Mailid
- iv. expiration date
- v. password.

Generating Debian Packages

Get into the default simple_ca path **/var/lib/globus/simple_ca**

Examining a Certificate Request

To examine a certificate request, use the command **openssl req -text -in**
Get into the path /etc/grid-security/

root@linux:/etc/grid-security# openssl req -noout -text -in hostcert_request.pem

```

root@linux:/etc/grid-security
root@linux:/etc/grid-security# openssl req -noout -text -in hostcert_request.pem
Certificate Request:
Data:
    Version: 0 (0x0)
    Subject: O=Grid, OU=GlobusTest, OU=simpleCA-linux, CN=linux
    Subject Public Key Info:
        Public Key Algorithm: rsaEncryption
            Public-Key: (2048 bit)
                Modulus:
                    00:f4:0b:1e:65:3f:35:54:36:cc:25:1f:b6:d1:01:
                    22:24:70:76:31:38:2e:30:1d:8c:25:12:ec:7b:17:
                    96:5b:dd:2b:0f:e5:be:be:f7:2f:1f:0a:ab:cfc:bc:
                    91:50:25:1d:ea:c1:03:f9:47:5b:1f:05:70:04:43:
                    bc:4e:12:df:56:98:dd:b9:f8:a5:7f:79:38:e7:25:
                    7a:27:ba:6a:5c:fc:36:fe:d7:4b:72:15:29:d4:e0:
                    74:99:a2:8f:93:c8:fc:e3:b5:0f:41:be:c9:2b:cd:
                    4a:bd:b3:8c:e9:42:d3:1f:7d:99:58:ed:b0:19:0f:
                    b7:12:07:ca:85:32:e5:44:44:39:d9:19:53:88:84:
                    a8:84:c1:b4:7c:f8:af:fe:4:28:93:f2:7c:0c:f0:85:
                    99:2d:98:33:62:c4:08:ef:d8:03:a3:38:19:16:ef:
                    45:77:9b:ef:3d:0e:5b:58:d4:5b:b2:0c:bf:c0:f8:
                    8d:11:70:15:74:7a:f4:ea:fa:a3:31:31:9a:36:d8:
                    63:00:0d:e7:d8:5a:4d:6c:54:c0:b8:55:be:97:bf:
                    af:58:fe:c3:96:94:67:36:51:2d:8b:d1:b0:06:1a:
                    9f:62:70:4f:b2:96:7c:30:e0:cf:f5:88:77:di:74:
                    33:4e:36:c8:10:ff:19:29:85:a8:b3:7c:ac:00:ef:
                    d1:33
                Exponent: 65537 (0x10001)
Attributes:
Requested Extensions:
    Netscape Cert Type:
        SSL CA, S/MIME CA, Object Signing CA
Signature Algorithm: sha256WithRSAEncryption
    44:c0:b6:0f:6c:18:fc:a2:fa:e4:ce:59:b6:8e:b9:3e:ae:9e:
    93:d6:a9:bc:37:68:ea:bd:67:21:6d:59:15:be:8c:bf:52:91:
    99:7b:95:ae:44:8f:8c:c7:27:f0:8e:e9:8f:4d:f4:26:f2:17:
    c5:f3:c4:f6:21:92:aa:50:6e:b6:b6:4a:b3:4e:c7:5b:be:45:
    38:e9:ce:4c:3e:21:aa:7f:a6:2f:ea:d1:cc:90:8d:6e:21:fe:
    9c:22:f8:28:bd:ac:a8:94:04:dc:e0:3d:35:9a:54:9e:fd:bb:
    24:c7:99:3e:1f:22:0f:63:2e:e4:89:6d:45:3a:31:c1:b4:c6:
```

Signing a Certificate Request:

[root@linux:/var/lib/globus/simple_ca# grid-ca-sign -in certreq.pem -out cert.pem](#)

```

root@linux:/var/lib/globus/simple_ca
root@linux:/var/lib/globus/simple_ca# grid-ca-sign -in cacert.pem -out cert.pem
To sign the request
Please enter the password for the CA key:
ERROR running command:
openssl ca -passin stdin \
    -batch -config /var/lib/globus/simple_ca/grid-ca-ssl.conf \
    -in cacert.pem -out cert.pem
===== ERROR MESSAGES FROM OPENSSL =====
Using configuration from /var/lib/globus/simple_ca/grid-ca-ssl.conf
Error reading certificate request in cacert.pem
140708224325280:error:0906D06C:PEM routines:PEM_read_bio:no start line:pem_llb.c
:701:Expecting: CERTIFICATE REQUEST
=====
root@linux:/var/lib/globus/simple_ca# grid-ca-sign -in cacert.pem -out cert1.pem
To sign the request
please enter the password for the CA key:
ERROR running command:
openssl ca -passin stdin \
    -batch -config /var/lib/globus/simple_ca/grid-ca-ssl.conf \
    -in cacert.pem -out cert1.pem
===== ERROR MESSAGES FROM OPENSSL =====
Using configuration from /var/lib/globus/simple_ca/grid-ca-ssl.conf
Error reading certificate request in cacert.pem
140541101045408:error:0906D06C:PEM routines:PEM_read_bio:no start line:pem_llb.c
:701:Expecting: CERTIFICATE REQUEST
=====
root@linux:/var/lib/globus/simple_ca# grid-ca-create
      Certificate Authority Setup
```

Revoking a Certificate

SimpleCA does not yet provide a convenient interface to revoke a signed certificate, but it can be done with the openssl command.

[root@linux:/var/lib/globus/simple_ca# openssl ca -config grid-ca-ssl.conf -revoke newcerts/01.pem](#)

Using configuration from /home/simpleca/.globus/simpleCA/grid-ca-ssl.conf
Enter pass phrase for /home/simpleca/.globus/simpleCA/private/cakey.pem:
Revoking Certificate 01.

Data Base Updated

Renewing a CA

```
root@linux:/var/lib/globus/simple_ca# openssl req -key private/cakey.pem -new -x509 -days 1825 -out newca.pem -config grid-ca-ssl.conf
```

output:

You are about to be asked to enter information that will be incorporated into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.

There are quite a few fields but you can leave some blank

For some fields there will be a default value,

If you enter '.', the field will be left blank.

Level 0 Organization [Grid]:

Level 0 Organizational Unit [GlobusTest]:

Level 1 Organizational Unit [simpleCA-elephant.globus.org]:

Name (E.g., John M. Smith) []:bala

```
root@linux:/var/lib/globus/simple_ca# grid-ca-package -d -cadir ~/.globus/simple_ca/  
Creating RPM source tarball... done
```

 globus_simple_ca_388f6778.tar.gz

Creating debian binary...dpkg-buildpackage: source package globus-simple-ca-388f6778

dpkg-buildpackage: source version 0.0

dpkg-buildpackage: source distribution UNRELEASED

dpkg-buildpackage: source changed by gcclab <gcclab@>

dpkg-buildpackage: host architecture amd64

dpkg-source --before-build globus-simple-ca-388f6778

debian/rules clean

test -x debian/rules

dh_clean

dh_clean debian/*.install

dpkg-source -b globus-simple-ca-388f6778

dpkg-source: warning: no source format specified in debian/source/format, see dpkg-source(1)

dpkg-source: info: using source format `1.0'

dpkg-source: warning: source directory 'globus-simple-ca-388f6778' is not <sourcepackage>-<upstreamversion> 'globus-simple-ca-388f6778-0.0'

dpkg-source: info: building globus-simple-ca-388f6778 in globus-simple-ca-388f6778_0.0.tar.gz

dpkg-source: info: building globus-simple-ca-388f6778 in globus-simple-ca-388f6778_0.0.dsc

dpkg-source: warning: missing information for output field Standards-Version

debian/rules build

```

test -x debian/rules
mkdir -p "."
debian/rules binary
test -x debian/rules
dh_testroot
dh_clean -k
dh_clean: dh_clean -k is deprecated; use dh_prep instead
dh_installdirs -A
mkdir -p "."
Adding cdbs dependencies to debian/globus-simple-ca-388f6778.substvars
dh_installdirs -pglobus-simple-ca-388f6778
dh_testdir
dh_testroot
dh_clean -k
dh_clean: dh_clean -k is deprecated; use dh_prep instead
[ -d /tmp/globus_simple_ca.FHnB8mnm/globus-simple-ca-388f6778/debian/tmp/etc/grid-
security/certificates ] || \
    mkdir -p /tmp/globus_simple_ca.FHnB8mnm/globus-simple-ca-
388f6778/debian/tmp/etc/grid-security/certificates
rm -f debian/globus-simple-ca-388f6778.install || true
touch debian/globus-simple-ca-388f6778.install
for file in 388f6778.0 388f6778.signing_policy globus-host-ssl.conf.388f6778 globus-user-
ssl.conf.388f6778 grid-security.conf.388f6778; do \
    if [ -f "$file" ]; then \
        cp "$file" "/tmp/globus_simple_ca.FHnB8mnm/globus-simple-ca-
388f6778/debian/tmp/etc/grid-security/certificates" ; \
        echo "debian/tmp/etc/grid-security/certificates/$file" etc/grid-security/certificates
    >> debian/globus-simple-ca-388f6778.install; \
    fi ; \
done
dh_installdocs -pglobus-simple-ca-388f6778
dh_installexamples -pglobus-simple-ca-388f6778
dh_installman -pglobus-simple-ca-388f6778
dh_installinfo -pglobus-simple-ca-388f6778
dh_installmenu -pglobus-simple-ca-388f6778
dh_installcron -pglobus-simple-ca-388f6778
dh_installinit -pglobus-simple-ca-388f6778
dh_installdebconf -pglobus-simple-ca-388f6778
dh_installemacsen -pglobus-simple-ca-388f6778
dh_installcatalogs -pglobus-simple-ca-388f6778
dh_installpam -pglobus-simple-ca-388f6778
dh_installlogrotate -pglobus-simple-ca-388f6778
dh_installogcheck -pglobus-simple-ca-388f6778
dh_installchangelogs -pglobus-simple-ca-388f6778
dh_installudev -pglobus-simple-ca-388f6778
dh_lintian -pglobus-simple-ca-388f6778
dh_bugfiles -pglobus-simple-ca-388f6778
dh_install -pglobus-simple-ca-388f6778
dh_link -pglobus-simple-ca-388f6778
dh_installmime -pglobus-simple-ca-388f6778
dh_installgsettings -pglobus-simple-ca-388f6778

```

```

dh_strip -pglobus-simple-ca-388f6778
dh_compress -pglobus-simple-ca-388f6778
dh_fixperms -pglobus-simple-ca-388f6778
dh_makeshlibs -pglobus-simple-ca-388f6778
dh_installdeb -pglobus-simple-ca-388f6778
dh_perl -pglobus-simple-ca-388f6778
dh_shlibdeps -pglobus-simple-ca-388f6778
dh_gencontrol -pglobus-simple-ca-388f6778
dpkg-gencontrol: warning: Depends field of package globus-simple-ca-388f6778: unknown
substitution variable ${shlibs:Depends}
# only call dh_scour for packages in main
if grep -q '^Component:[[:space:]]*main' /CurrentlyBuilding 2>/dev/null; then dh_scour -
pglobus-simple-ca-388f6778 ; fi
dh_md5sums -pglobus-simple-ca-388f6778
dh_builddeb -pglobus-simple-ca-388f6778
dpkg-deb: building package `globus-simple-ca-388f6778' in `../globus-simple-ca-
388f6778_0.0_all.deb'.
dpkg-genchanges >../globus-simple-ca-388f6778_0.0_amd64.changes
dpkg-genchanges: including full source code in upload
dpkg-source --after-build globus-simple-ca-388f6778
dpkg-buildpackage: full upload; Debian-native package (full source is included)

```

388f6778 -- Can use the same 8digit certificate to all machine

linux@linux:~\$ dpkg -i globus-simple-ca-388f6778_0.0_all.deb ### used for loading to other machines through pendrive

linux@linux:~\$ sudo dpkg -i globus-simple-ca-388f6778_0.0_all.deb
Selecting previously unselected package globus-simple-ca-388f6778.
(Reading database ... 260415 files and directories currently installed.)
Preparing to unpack globus-simple-ca-388f6778_0.0_all.deb ...
Unpacking globus-simple-ca-388f6778 (0.0) ...
Setting up globus-simple-ca-388f6778 (0.0) ...

linux@linux:~\$ cd .globus/simpleCA/
linux@linux:~\$ cd .globus/simpleCA/
linux@linux:~/.globus/simpleCA\$ sudo cp globus-* grid-* /etc/grid-security/

linux@linux:~/.globus/simpleCA\$ ls -l /etc/grid-security/
total 28
drwxr-xr-x 2 root root 4096 Jul 2 07:50 certificates
-rw-r--r-- 1 root root 2929 Jul 2 07:53 globus-host-ssl.conf
-rw-r--r-- 1 root root 3047 Jul 2 07:53 globus-user-ssl.conf
-rw-r--r-- 1 root root 2929 Jul 2 07:53 grid-ca-ssl.conf
-rw-r--r-- 1 root root 1251 Jul 2 07:53 grid-security.conf
drwxr-xr-x 2 root root 4096 Nov 29 2013 myproxy
lrwxrwxrwx 1 root root 19 Jul 2 02:29 sshftp -> /etc/gridftp-sshftp

```
drwxr-xr-x 2 root root 4096 Dec 2 2013 vomsdir
```

```
linux@linux:~/globus/simpleCA$ hostname  
Ubuntu
```

```
root@linux:~/globus/simpleCA# gedit /etc/hosts
```

```
192.168.0.28 bala.globus.in  
192.168.0.10 baas.globus.in
```

```
Password -- bala
```

Create the fully qualified domain name

```
linux@linux:~/globus/simpleCA$ sudo bash  
root@linux:~/globus/simpleCA# gedit /etc/hosts
```

```
linux@linux:~$./globus/simpleCA$ grid-cert-request  
Enter your name, e.g., John Smith: bala m  
A certificate request and private key is being created.  
You will be asked to enter a PEM pass phrase.  
This pass phrase is akin to your account password,  
and is used to protect your key file.  
If you forget your pass phrase, you will need to  
obtain a new certificate.
```

Generating a 1024 bit RSA private key

```
.....+++++
```

```
.....+++++
```

```
writing new private key to '/home/gcclab/.globus/userkey.pem'
```

```
Enter PEM pass phrase:
```

```
140306478339744:error:28069065:lib(40):UI_set_result:result too small:ui_lib.c:869:You  
must type in 4 to 1024 characters
```

```
140306478339744:error:0906406D:PEM routines:PEM_def_callback:problems getting  
password:pem_lib.c:111:
```

```
140306478339744:error:0907E06F:PEM routines:DO_PK8PKEY:read key:pem_pk8.c:130:  
Error number 1 was returned by  
/usr/bin/openssl
```

```
linux@linux:~$./globus/simpleCA$ grid-cert-request -force
```

```
/home/linux/.globus/usercert.pem already exists  
/home/linux/.globus/userkey.pem already exists
```

Enter your name, e.g., John Smith: bala m
A certificate request and private key is being created.
You will be asked to enter a PEM pass phrase.
This pass phrase is akin to your account password,
and is used to protect your key file.

If you forget your pass phrase, you will need to obtain a new certificate.

Generating a 1024 bit RSA private key

```
.....+++++
....+++++
writing new private key to '/home/gcclab/.globus/userkey.pem'
Enter PEM pass phrase:
Verifying - Enter PEM pass phrase:
```

You are about to be asked to enter information that will be incorporated into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.

Level 0 Organization [Grid]:Level 0 Organizational Unit [GlobusTest]:Level 1 Organizational Unit [simpleCA-ubuntu]:Level 2 Organizational Unit [local]:Name (E.g., John M. Smith) []:

A private key and a certificate request has been generated with the subject:

/O=Grid/OU=GlobusTest/OU=simpleCA-ubuntu/OU=local/CN=bala m

If the CN=bala m is not appropriate, rerun this script with the -force -cn "Common Name" options.

Your private key is stored in /home/gcclab/.globus/userkey.pem
Your request is stored in /home/gcclab/.globus/usercert_request.pem

Please e-mail the request to the Globus Simple CA gcclab@ubuntu
You may use a command similar to the following:

cat /home/gcclab/.globus/usercert_request.pem | mail gcclab@ubuntu

Only use the above if this machine can send AND receive e-mail. if not, please mail using some other method.

Your certificate will be mailed to you within two working days.
If you receive no response, contact Globus Simple CA at gcclab@ubuntu

```
linux@linux:~/globus/simpleCA$ cd newcerts/
linux@linux:~/globus/simpleCA/newcerts$ ls
linux@linux:~/globus/simpleCA/newcerts$ cd ..
linux@linux:~/globus/simpleCA$ pwd
/home/gcclab/.globus/simpleCA
linux@linux:~/globus/simpleCA$ cd ..
```

```
linux@linux:~/globus$ pwd
/home/linux.globus
linux@linux:~$ ./globus$ ls -l
```

```
total 12
drwx----- 6 gcclab gcclab 4096 Jul  2 07:43 simpleCA
-rw-r--r-- 1 gcclab gcclab  0 Jul  2 08:05 usercert.pem
-rw-r--r-- 1 gcclab gcclab 1351 Jul  2 08:05 usercert_request.pem
-r----- 1 gcclab gcclab 1041 Jul  2 08:05 userkey.pem
```

```
linux@linux:~/globus$ sudo grid-cert-request -host bala.globus.in
Generating a 1024 bit RSA private key
.....+++++
.....+++++
writing new private key to '/etc/grid-security/hostkey.pem'
```

You are about to be asked to enter information that will be incorporated into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.

Level 0 Organization [Grid]:Level 0 Organizational Unit [GlobusTest]:Level 1 Organizational Unit [simpleCA-ubuntu]:Name (E.g., John M. Smith) []:

A private host key and a certificate request has been generated with the subject:

```
/O=Grid/OU=GlobusTest/OU=simpleCA-ubuntu/CN=host/bala.globus.in
```

The private key is stored in /etc/grid-security/hostkey.pem
The request is stored in /etc/grid-security/hostcert_request.pem

Please e-mail the request to the Globus Simple CA gcclab@ubuntu
You may use a command similar to the following:

```
cat /etc/grid-security/hostcert_request.pem | mail gcclab@ubuntu
```

Only use the above if this machine can send AND receive e-mail. if not, please mail using some other method.

Your certificate will be mailed to you within two working days.
If you receive no response, contact Globus Simple CA at gcclab@ubuntu

```
glinux@linux:~/globus$ ls -l
total 12
drwx----- 6 gcclab gcclab 4096 Jul  2 07:43 simpleCA
-rw-r--r-- 1 gcclab gcclab  0 Jul  2 08:05 usercert.pem
-rw-r--r-- 1 gcclab gcclab 1351 Jul  2 08:05 usercert_request.pem
-r----- 1 gcclab gcclab 1041 Jul  2 08:05 userkey.pem
```

```
gcclab@ubuntu:~/globus$ ls -l /etc/grid-security/
total 36
drwxr-xr-x 2 root root 4096 Jul 2 07:50 certificates
-rw-r--r-- 1 root root 2929 Jul 2 07:53 globus-host-ssl.conf
-rw-r--r-- 1 root root 3047 Jul 2 07:53 globus-user-ssl.conf
-rw-r--r-- 1 root root 2929 Jul 2 07:53 grid-ca-ssl.conf
-rw-r--r-- 1 root root 1251 Jul 2 07:53 grid-security.conf
-rw-r--r-- 1 root root 0 Jul 2 08:09 hostcert.pem
-rw-r--r-- 1 root root 1349 Jul 2 08:09 hostcert_request.pem
-r----- 1 root root 916 Jul 2 08:09 hostkey.pem
drwxr-xr-x 2 root root 4096 Nov 29 2013 myproxy
lrwxrwxrwx 1 root root 19 Jul 2 02:29 sshftp -> /etc/gridftp-sshftp
drwxr-xr-x 2 root root 4096 Dec 2 2013 vomsdir
```

```
linux@linux:~/globus$ cp usercert_request.pem usercert.pem
gcclab@ubuntu:~/globus$ ls -l /etc/grid-security/
total 36
drwxr-xr-x 2 root root 4096 Jul 2 07:50 certificates
-rw-r--r-- 1 root root 2929 Jul 2 07:53 globus-host-ssl.conf
-rw-r--r-- 1 root root 3047 Jul 2 07:53 globus-user-ssl.conf
-rw-r--r-- 1 root root 2929 Jul 2 07:53 grid-ca-ssl.conf
-rw-r--r-- 1 root root 1251 Jul 2 07:53 grid-security.conf
-rw-r--r-- 1 root root 0 Jul 2 08:09 hostcert.pem
-rw-r--r-- 1 root root 1349 Jul 2 08:09 hostcert_request.pem
-r----- 1 root root 916 Jul 2 08:09 hostkey.pem
drwxr-xr-x 2 root root 4096 Nov 29 2013 myproxy
lrwxrwxrwx 1 root root 19 Jul 2 02:29 sshftp -> /etc/gridftp-sshftp
drwxr-xr-x 2 root root 4096 Dec 2 2013 vomsdir
gcclab@ubuntu:~/globus$ ls -l
total 16
drwx----- 6 gcclab gcclab 4096 Jul 2 07:43 simpleCA
-rw-r--r-- 1 gcclab gcclab 1351 Jul 2 08:12 usercert.pem
-rw-r--r-- 1 gcclab gcclab 1351 Jul 2 08:05 usercert_request.pem
-r----- 1 gcclab gcclab 1041 Jul 2 08:05 userkey.pem
linux@linux:~/globus$ cp usercert_request.pem usercert.pem
linux@linux:~/globus$ ls -l
total 16
drwx----- 6 gcclab gcclab 4096 Jul 2 07:43 simpleCA
-rw-r--r-- 1 gcclab gcclab 1351 Jul 2 08:13 usercert.pem
-rw-r--r-- 1 gcclab gcclab 1351 Jul 2 08:05 usercert_request.pem
-r----- 1 gcclab gcclab 1041 Jul 2 08:05 userkey.pem
linux@linux:~/globus$ ls -l /etc/grid-security/
total 36
drwxr-xr-x 2 root root 4096 Jul 2 07:50 certificates
-rw-r--r-- 1 root root 2929 Jul 2 07:53 globus-host-ssl.conf
-rw-r--r-- 1 root root 3047 Jul 2 07:53 globus-user-ssl.conf
-rw-r--r-- 1 root root 2929 Jul 2 07:53 grid-ca-ssl.conf
-rw-r--r-- 1 root root 1251 Jul 2 07:53 grid-security.conf
-rw-r--r-- 1 root root 0 Jul 2 08:09 hostcert.pem
-rw-r--r-- 1 root root 1349 Jul 2 08:09 hostcert_request.pem
```

```
-r----- 1 root root 916 Jul 2 08:09 hostkey.pem
drwxr-xr-x 2 root root 4096 Nov 29 2013 myproxy
lrwxrwxrwx 1 root root 19 Jul 2 02:29 sshftp -> /etc/gridftp-sshftp
drwxr-xr-x 2 root root 4096 Dec 2 2013 vomsdir
```

```
linux@linux:~/globus$ cd /etc/grid-security
gcclab@ubuntu:/etc/grid-security$ sudo cp hostcert_request.pem hostcert.pem
linux@linux:/etc/grid-security$ ls -
total 40
drwxr-xr-x 2 root root 4096 Jul 2 07:50 certificates
-rw-r--r-- 1 root root 2929 Jul 2 07:53 globus-host-ssl.conf
-rw-r--r-- 1 root root 3047 Jul 2 07:53 globus-user-ssl.conf
-rw-r--r-- 1 root root 2929 Jul 2 07:53 grid-ca-ssl.conf
-rw-r--r-- 1 root root 1251 Jul 2 07:53 grid-security.conf
-rw-r--r-- 1 root root 1349 Jul 2 08:16 hostcert.pem
-rw-r--r-- 1 root root 1349 Jul 2 08:09 hostcert_request.pem
-r----- 1 root root 916 Jul 2 08:09 hostkey.pem
drwxr-xr-x 2 root root 4096 Nov 29 2013 myproxy
lrwxrwxrwx 1 root root 19 Jul 2 02:29 sshftp -> /etc/gridftp-sshftp
drwxr-xr-x 2 root root 4096 Dec 2 2013 vomsdi
```

Result:

Thus the secured applications using basic security mechanism availability in Globus Toolkit has been developed successfully.

Installation of Opennebula

Aim:

To install opennebula in ubuntu operating system for creating virtualization in cloud.

Procedure:

Step 1. Installation of opennenula in the Frontend

1.1. Install the repo

1. Open Terminal (ctrl+alt+t) or from dashboard type terminal
2. Here # indirectly tells to work on root.
\$ indirectly tells to work on normal user

Add the OpenNebula repository: # - root user

```
# wget -q -O- http://downloads.opennebula.org/repo/Ubuntu/repo.key | apt-key add -  
# echo "deb http://downloads.opennebula.org/repo/4.12/Ubuntu/14.04/ stable  
opennebula" \  
> /etc/apt/sources.list.d/opennebula.list
```

1.2. Install the required packages

```
# apt-get update  
# apt-get install opennebula opennebula-sunstone nfs-kernel-server
```

1.3. Configure and Start the services

There are two main processes that must be started, the main OpenNebula daemon: **oned**, and the graphical user interface: **sunstone**.

Sunstone listens only in the loopback interface by default for security reasons. To change it edit

```
# gedit /etc/one/sunstone-server.conf  
and change :host: 127.0.0.1 to :host: 0.0.0.0.
```

Now we must restart Sunstone:

```
# /etc/init.d/opennebula-sunstone restart
```

1.4. Configure SSH Public Key

OpenNebula will need SSH for passwordless from any node (including the frontend) to any

other node.

To do so run the following commands:

```
# su - oneadmin  
$ cp ~/.ssh/id_rsa.pub ~/.ssh/authorized_keys
```

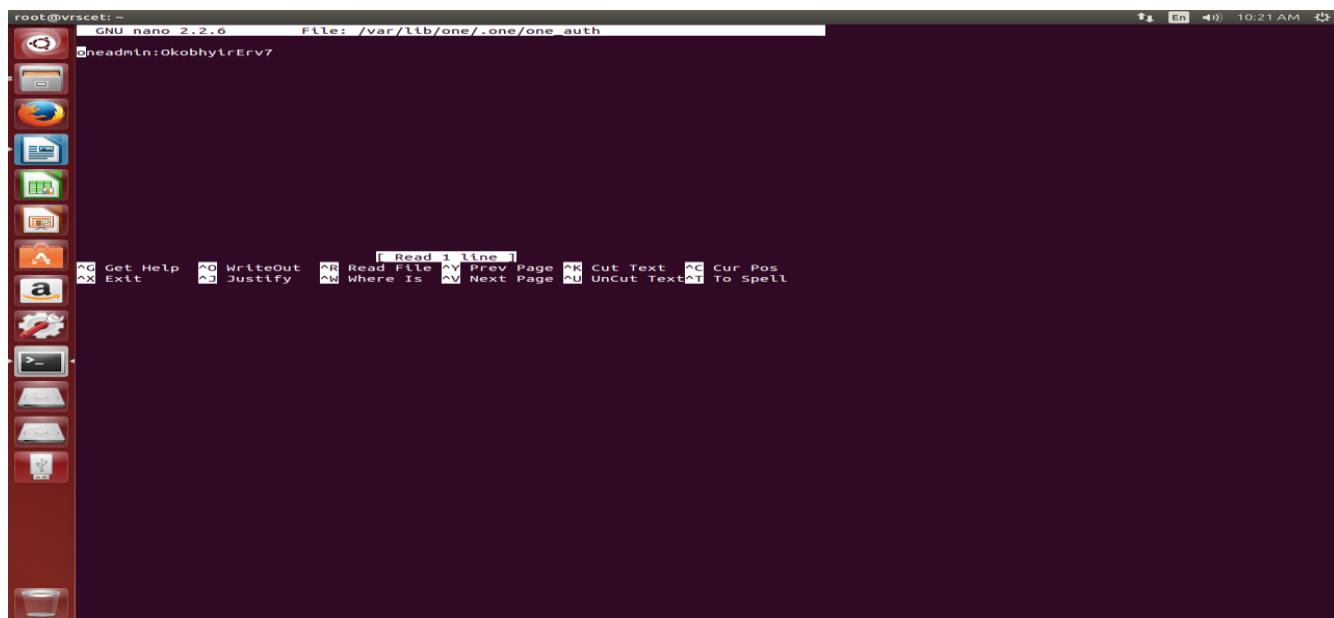
Add the following snippet to `~/.ssh/config` so it doesn't prompt to add the keys to the `known_hosts` file:

```
$ cat<< EOT > ~/.ssh/config#Type the below commands  
Host *  
  StrictHostKeyChecking no  
  UserKnownHostsFile /dev/null  
EOT  
$ chmod 600 ~/.ssh/config
```

Step 3. Basic Usage

The default password for the `oneadmin` user can be found in `~/.one/one_auth` which is randomly generated on every installation.

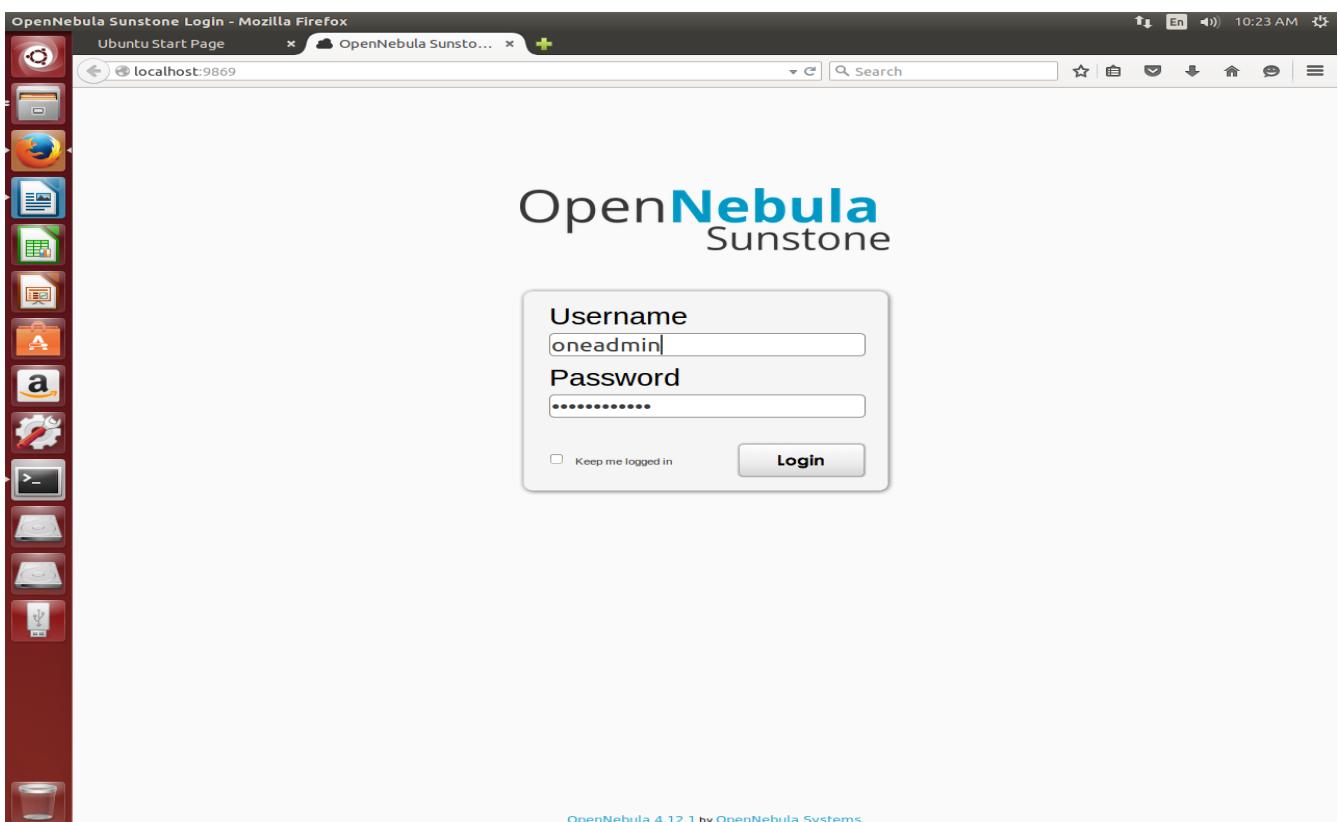
```
$ nano ~/.one/one_auth
```



```
root@vrscet:~  
cloud_grid_cpm@vrscet:~$ sudo bash  
[sudo] password for cloud_grid_cpm:  
root@vrscet:~# su - oneadmin  
oneadmin@vrscet:~$ nano ~/.one/one_auth  
oneadmin@vrscet:~$
```

**Open mozilla firefox
localhost:9869**

**Enter Username : oneadmin
Password : from ~/.one/one_auth (file)**



The screenshot shows the OpenNebula Sunstone Dashboard interface. On the left, there is a vertical sidebar with various icons for different management functions like System, Virtual Resources, Infrastructure, Marketplace, and OneFlow. The main dashboard area has three main sections:

- Virtual Machines**: Shows 0 TOTAL VMs, 0 ACTIVE VMs, and 0 FAILED VMs. It also indicates "There is no information available" for CPU hours and Memory GB hours. Buttons for "VMs" and "+ Create" are present.
- Hosts**: Shows 0 TOTAL hosts, 0 ON hosts, 0 OFF hosts, and 0 ERROR hosts. It displays allocated and real CPU and memory usage. Buttons for "Hosts" and "+ Create" are present.
- Users**: Shows 2 USERS and 2 GROUPS. It indicates "There is no information available" for CPU hours and Memory GB hours. Buttons for "Users" and "+ Create" are present.

A top navigation bar shows the URL as localhost:9869, the browser as Mozilla Firefox, and the time as 10:24 AM. The user is logged in as oneadmin.

Result :

Thus, opennebula has been installed successfully.

Find procedure to run the virtual machine of different configuration. Check how many virtual Machines can be utilized at particular time

Aim:

To find the procedure to run the virtual machine of different configuration and to Check how many virtual can be create.

```
root@linux:$ /etc/init.d/opennebula-sunstone restart
```

Procedures:

Step 1: Check the processor virtualization – in boot settings.

Step 2: Execute all the commands in root user if the command start with #, and one admin user if command start with \$.

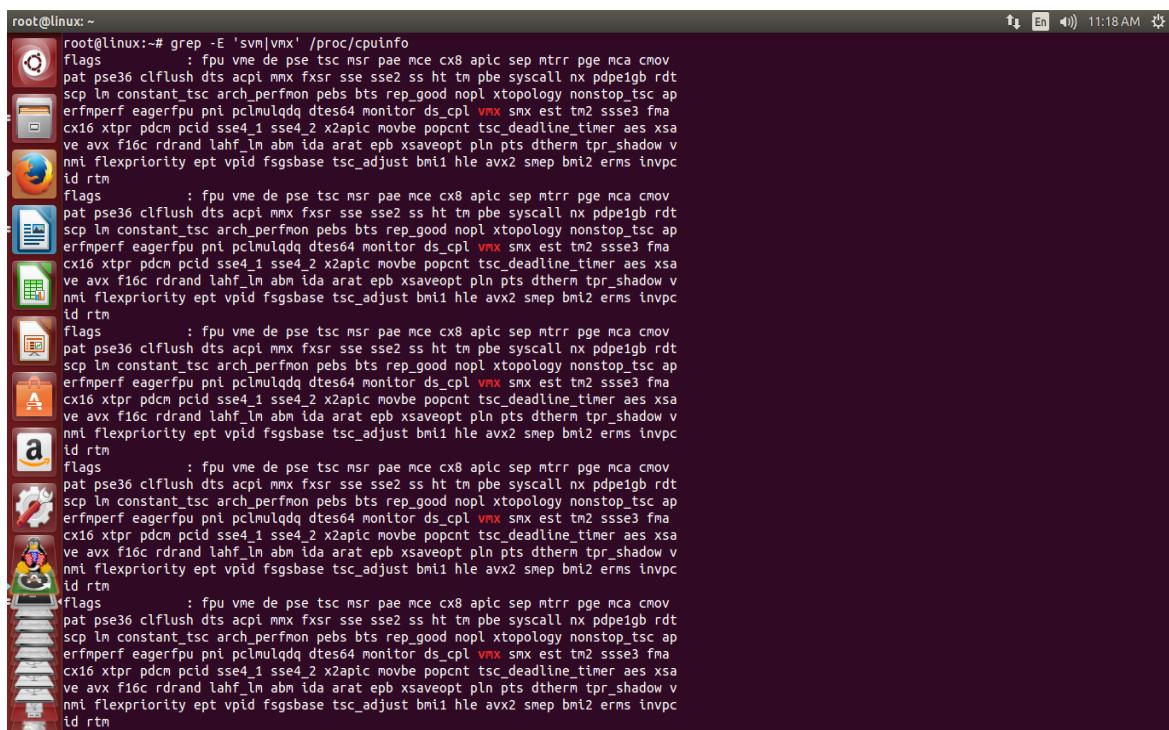
- a. Moving to roo user in terminal

```
linux@linux:~$ sudo bash  
[sudo] password for linux:
```

Enter the password.

Step 3: Checking the virtualization support in terminal from root user.

```
root@linux:~# grep -E 'svm|vmx' /proc/cpuinfo
```



```
root@linux:~# grep -E 'svm|vmx' /proc/cpuinfo
flags    : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdt
scp lm constant_tsc arch_perfmon pebs bts rep_good nopl xttopology nonstop_tsc ap
erfmperf eagerfpn pml pmlvlqqd dtes64 monitor ds_cpl vmx smx est tm2 sse3 fma
cx16 xtr pdcm pcd sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsa
ve avx f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow v
nmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smp bm12 erms invpc
id rtm
flags    : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdt
scp lm constant_tsc arch_perfmon pebs bts rep_good nopl xttopology nonstop_tsc ap
erfmperf eagerfpn pml pmlvlqqd dtes64 monitor ds_cpl vmx smx est tm2 sse3 fma
cx16 xtr pdcm pcd sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsa
ve avx f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow v
nmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smp bm12 erms invpc
id rtm
flags    : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdt
scp lm constant_tsc arch_perfmon pebs bts rep_good nopl xttopology nonstop_tsc ap
erfmperf eagerfpn pml pmlvlqqd dtes64 monitor ds_cpl vmx smx est tm2 sse3 fma
cx16 xtr pdcm pcd sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsa
ve avx f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow v
nmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smp bm12 erms invpc
id rtm
flags    : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdt
scp lm constant_tsc arch_perfmon pebs bts rep_good nopl xttopology nonstop_tsc ap
erfmperf eagerfpn pml pmlvlqqd dtes64 monitor ds_cpl vmx smx est tm2 sse3 fma
cx16 xtr pdcm pcd sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsa
ve avx f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow v
nmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smp bm12 erms invpc
id rtm
flags    : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdt
scp lm constant_tsc arch_perfmon pebs bts rep_good nopl xttopology nonstop_tsc ap
erfmperf eagerfpn pml pmlvlqqd dtes64 monitor ds_cpl vmx smx est tm2 sse3 fma
cx16 xtr pdcm pcd sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsa
ve avx f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow v
nmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smp bm12 erms invpc
id rtm
flags    : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdt
scp lm constant_tsc arch_perfmon pebs bts rep_good nopl xttopology nonstop_tsc ap
erfmperf eagerfpn pml pmlvlqqd dtes64 monitor ds_cpl vmx smx est tm2 sse3 fma
cx16 xtr pdcm pcd sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsa
ve avx f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow v
nmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smp bm12 erms invpc
id rtm
flags    : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdt
scp lm constant_tsc arch_perfmon pebs bts rep_good nopl xttopology nonstop_tsc ap
erfmperf eagerfpn pml pmlvlqqd dtes64 monitor ds_cpl vmx smx est tm2 sse3 fma
cx16 xtr pdcm pcd sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsa
ve avx f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow v
nmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smp bm12 erms invpc
id rtm
```

Step 4: Checking the Kernel Virtual Machine location and availability

```
root@linux:~# ls -l /dev/kvm
crw-rw----+ 1 root kvm 10, 232 Jul 1 04:09 /dev/kvm
```

Step 5: Setting up the opennebula dependencies and it's packages by downloading the following using command.

```
root@linux:~# dpkg -l opennebula-common ruby-opennebula opennebula opennebula-
node opennebula-sunstone opennebula-tools opennebula-gate opennebula-flow
libopennebula-java
```

```
root@linux:~# dpkg -l opennebula-common ruby-opennebula opennebula opennebula-node opennebula-sunstone opennebula-tools opennebula-gate opennebula-flow libopennebula-java  
Desired=Unknown/Install/Remove/Purge/Hold  
| Status=Not/Inst/Conf-files/Unpacked/half-inst/trig-aWait/Trig-pend  
|| Err?=(none)/Reinst-required (Status,Err: uppercase=bad)  
||/ Name Version Architecture Description  
====-====-====-====-  
ii opennebula 4.12.1-1 amd64 controller which executes the OpenNebula cluster services  
ii opennebula-common 4.12.1-1 all empty package to create OpenNebula users and directories  
ii opennebula-sunstone 4.12.1-1 all web interface to which executes the OpenNebula cluster services  
ii opennebula-tools 4.12.1-1 all Command-line tools for OpenNebula Cloud  
ii ruby-opennebula 4.12.1-1 all Ruby bindings for OpenNebula Cloud API (OCA)  
dpkg-query: no packages found matching opennebula-node  
dpkg-query: no packages found matching opennebula-gate  
dpkg-query: no packages found matching opennebula-flow  
dpkg-query: no packages found matching libopennebula-java  
root@linux:~#
```

Have to install the missing packages with the following commands in terminal.

```
root@linux:~# sudo apt-get install opennebula-node
```

```
root@linux:~# sudo apt-get install opennebula-gate
```

```
root@linux:~# sudo apt-get install opennebula-flow
```

```
root@linux:~# sudo apt-get install libopennebula-java
```

Now check the dependencies by giving the command in terminal where all packages shows as installed

```
root@linux:~# dpkg -l opennebula-common ruby-opennebula opennebula  
opennebula-node opennebula-sunstone opennebula-tools opennebula-gate  
opennebula-flow libopennebula-java
```

```
root@linux:~# dpkg -l opennebula-common ruby-opennebula opennebula opennebula-node opennebula-sunstone opennebula-tools opennebula-gate opennebula-flow libopennebula-java  
Desired=Unknown/Install/Remove/Purge/Hold  
| Status=Not/Inst/Conf-files/Unpacked/half-conf/Half-inst/trig-aWait/Trig-pend  
|/ Err?=(none)/Reinst-required (Status,Err: uppercase=bad)  
||/ Name Version Architecture Description  
+++-====-====-====-  
ii libopennebula-java 4.12.1-1 all Java bindings for OpenNebula Cloud API (OCA)  
ii opennebula 4.12.1-1 amd64 controller which executes the OpenNebula cluster services  
ii opennebula-common 4.12.1-1 all empty package to create OpenNebula users and directories  
ii opennebula-flow 4.12.1-1 all Manage services.  
ii opennebula-gate 4.12.1-1 all send information to OpenNebula from the Virtual Machines.  
ii opennebula-node 4.12.1-1 all empty package to prepare a machine as OpenNebula Node  
ii opennebula-sunstone 4.12.1-1 all web interface to which executes the OpenNebula cluster services  
ii opennebula-tools 4.12.1-1 all Command-line tools for OpenNebula Cloud  
ii ruby-opennebula 4.12.1-1 all Ruby bindings for OpenNebula Cloud API (OCA)  
root@linux:~#
```

Step 6: Checking the opennebula and it's services status.

```
root@linux:~# service opennebula status    ## package name
* one is running
```

```
root@linux:~# service opennebula-sunstone status  ### Web interface name sunstone
* sunstone-server is running
```

```
root@linux:~#service nfs-kernel-server status
```

```
nfsd running
```

```
root@linux:~#service opennebula restart
```

```
* Restarting OpenNebula cloud one
oned and scheduler stopped
```

```
[ OK ]
```

```
root@linux:~# service opennebula-sunstone restart
```

```
* Restarting Sunstone Web interface sunstone-server
sunstone-server stopped
```

```
VNC proxy started
```

```
sunstone-server started
```

```
[ OK ]
```

```
root@linux:~#service nfs-kernel-server restart
```

```
* Stopping NFS kernel daemon
```

```
[ OK ]
```

```
* Unexporting directories for NFS kernel daemon...
```

```
[ OK ]
```

```
* Exporting directories for NFS kernel daemon...
```

```
[ OK ]
```

```
* Starting NFS kernel daemon
```

Step 7: Setting up the physical bridge interface(br0)

```
root@linux:~# ifconfig
```

```
root@linux: ~
root@linux:~# ifconfig
eth0      Link encap:Ethernet HWaddr 20:25:64:74:5b:c8
          UP BROADCAST MULTICAST MTU:1500 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
          Interrupt:20 Memory:f7100000-f7120000

eth1      Link encap:Ethernet HWaddr 00:1e:10:1f:00:00
          inet addr:192.168.8.101 Bcast:192.168.8.255 Mask:255.255.255.0
          inet6 addr: fe80::1e10:fffe%eth1/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:26637 errors:0 dropped:0 overruns:0 frame:0
          TX packets:23855 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:33119108 (33.1 MB) TX bytes:1759780 (1.7 MB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:8092 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8092 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:1804037 (1.8 MB) TX bytes:1804037 (1.8 MB)

virbr0   Link encap:Ethernet HWaddr 02:fb:53:89:73:a6
          inet addr:192.168.122.1 Bcast:192.168.122.255 Mask:255.255.255.0
          UP BROADCAST MULTICAST MTU:1500 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

virbr1   Link encap:Ethernet HWaddr 02:fb:53:89:73:a7
          inet addr:192.168.122.2 Bcast:192.168.122.255 Mask:255.255.255.0
          UP BROADCAST MULTICAST MTU:1500 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root@linux:~#
```

Step 8: Changing the network interface and bridge configuration manually. The network configuration in the ubuntu is stored under /etc/network/interfaces

root@linux:~# gedit /etc/network/interfaces

It has only few lines.

interfaces(5) file used by ifup(8) and ifdown(8)

auto lo

iface lo inet loopback

Now we have to change the br0.cfg file manually which is located at
/etc/network/interfaces.d/br0.cfg

root@linux:~# gedit /etc/network/interfaces.d/br0.cfg

And paste the following lines there.

```
#auto br0
iface br0 inet static
    address 192.168.0.10
    network 192.168.0.0
    netmask 255.255.255.0
    broadcast 192.168.0.255
    gateway 192.168.0.1
    bridge_ports em1
    bridge_fd 9
    bridge_hello 2
    bridge_maxage 12
    bridge_stp off
```

Now move the configuration file to the interfaces.

root@linux:~# cat /etc/network/interfaces.d/br0.cfg >> /etc/network/interfaces

Now, open and view the interface file.

root@linux:~# gedit /etc/network/interfaces

(or)

root@linux:~# cat /etc/network/interfaces

interfaces(5) file used by ifup(8) and ifdown(8)

auto lo

iface lo inet loopback

#auto br0

iface br0 inet static

address 192.168.0.10

network 192.168.0.0

netmask 255.255.255.0

broadcast 192.168.0.255

gateway 192.168.0.1

bridge_ports em1

```

bridge_fd 9
bridge_hello 2
bridge_maxage 12
bridge_stp off

```

Step 9: Change the settings at /etc/network/interfaces as

```

# interfaces(5) file used by ifup(8) and ifdown(8)
auto lo
iface lo inet loopback
auto br0
iface br0 inet static
    address 192.168.0.28
    network 192.168.0.0
    netmask 255.255.255.0
    broadcast 192.168.0.255
    gateway 192.168.0.1
    bridge_ports p5p1
    bridge_fd 9
    bridge_hello 2
    bridge_maxage 12
    bridge_stp off

```

Step 10: Up the changes of bridge through

Getting interface which changed for bridge bro by ifup br0

root@linux:~# ifup br0 #####error

Waiting for br0 to get ready (MAXWAIT is 20 seconds).

root@linux:~# ifconfig

```

root@linux: ~# ifconfig
br0      Link encap:Ethernet HWaddr aa:bc:6f:a9:ae:87
        inet addr:192.168.0.10  Bcast:192.168.0.255  Mask:255.255.255.0
        inet6 addr: fe80::abbc:6fff:fea9:ae87/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:67 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:29003 (29.0 KB)

eth0      Link encap:Ethernet HWaddr 20:25:64:74:5b:c8
        UP BROADCAST MULTICAST  MTU:1500  Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
        Interrupt:20 Memory:f7100000-f7120000

eth1      Link encap:Ethernet HWaddr 00:1e:10:1f:00:00
        inet addr:192.168.8.101  Bcast:192.168.8.255  Mask:255.255.255.0
        inet6 addr: fe80::21e:10ff:fe1f:0/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:27051 errors:0 dropped:0 overruns:0 frame:0
          TX packets:23895 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:33280209 (33.2 MB)  TX bytes:1763051 (1.7 MB)

lo       Link encap:Local Loopback
        inet addr:127.0.0.1  Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:9386 errors:0 dropped:0 overruns:0 frame:0
          TX packets:9386 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:1935862 (1.9 MB)  TX bytes:1935862 (1.9 MB)

virbr0   Link encap:Ethernet HWaddr 02:fb:53:89:73:a6
        inet addr:192.168.122.1  Bcast:192.168.122.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0

```

Step 11: Moving to Oneadmin user and doing configuration changes.

Open opennebula in webinterface

root@linux:~# su - oneadmin

oneadmin@linux:~\$ **pwd**

/var/lib/one ##### default home dir for opennebula

Step 12: Checking the default configurations of opennebula.

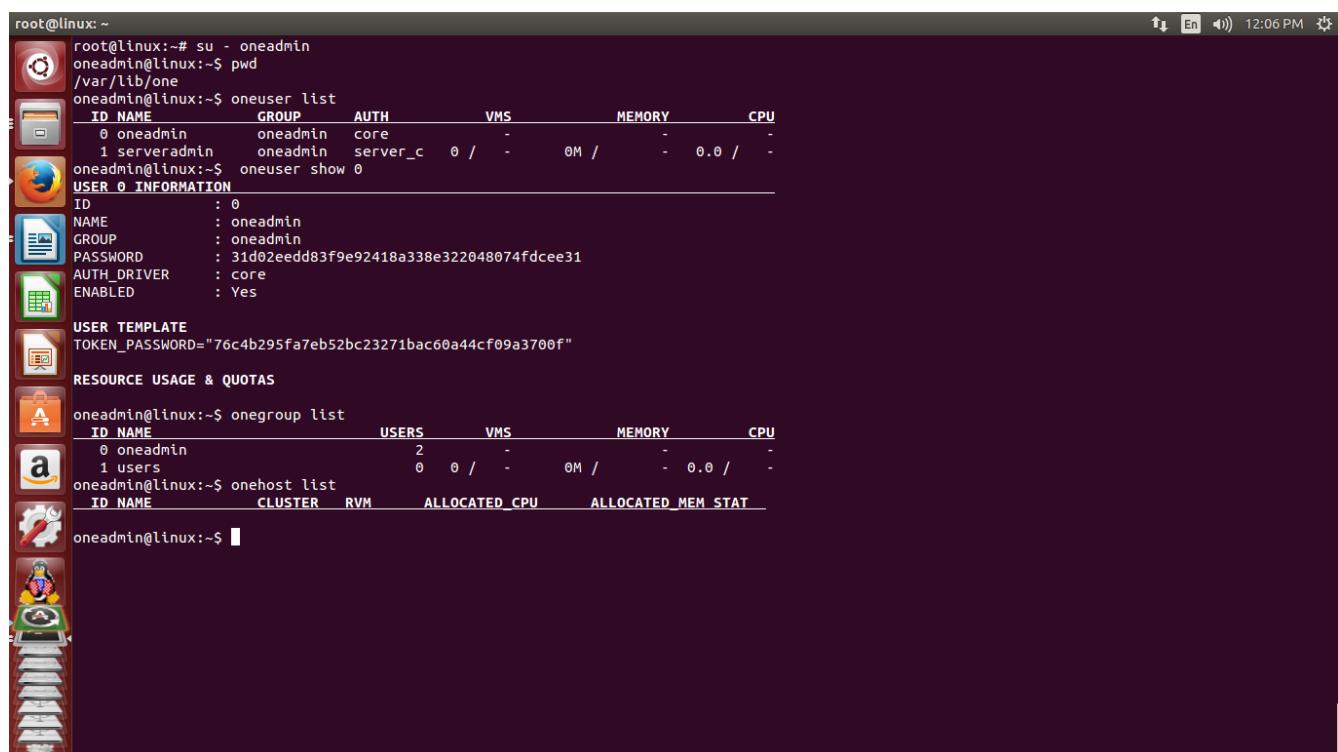
oneadmin@linux:~\$ **oneuser list**

oneadmin@linux:~\$ **oneuser show 0**

0 represents the id of oneuser. Here usind id only we can do all activities like delete, show, status and etc.,

oneadmin@linux:~\$ **onegroup list**

oneadmin@linux:~\$ **onehost list**



```
root@linux: ~
root@linux:~# su - oneadmin
oneadmin@linux:~$ pwd
/var/lib/one
oneadmin@linux:~$ oneuser list
  ID NAME      GROUP     AUTH      VMS      MEMORY      CPU
  0 oneadmin   oneadmin   core      -        -         -
  1 serveradmin oneadmin   server_c  0 /      -        0.0 /
oneadmin@linux:~$ oneuser show 0
USER 0 INFORMATION
ID : 0
NAME : oneadmin
GROUP : oneadmin
PASSWORD : 31d02eedd83f9e92418a338e322048074fdcee31
AUTH_DRIVER : core
ENABLED : Yes

USER TEMPLATE
TOKEN_PASSWORD="76c4b295fa7eb52bc23271bac60a44cf09a3700f"

RESOURCE USAGE & QUOTAS
oneadmin@linux:~$ onegroup list
  ID NAME      USERS      VMS      MEMORY      CPU
  0 oneadmin    2         -        -         -
  1 users       0 /      -        0M /      -        0.0 /
oneadmin@linux:~$ onehost list
  ID NAME      CLUSTER      RVM      ALLOCATED_CPU      ALLOCATED_MEM_STAT
oneadmin@linux:~$
```

Step 13: Creating the kvm for localhost. It helps to create image, template and template instantiate to work.

oneadmin@linux:~\$ **onehost create localhost -i kvm -v kvm -n dummy**

ID: 0

- I -information driver v- virtual driver n – network driver

oneadmin@linux:~\$ **onehost list**

```
oneadmin@linux:~$ onehost show 0
```

```
root@linux: ~
oneadmin@linux:~$ onehost create localhost -i kvm -v kvm -n dummy
ID: 0
oneadmin@linux:~$ onehost list
      ID NAME          CLUSTER   RVM    ALLOCATED_CPU   ALLOCATED_MEM STAT
      0 localhost        -       0           -           -         - init
oneadmin@linux:~$ onehost show 0
HOST 0 INFORMATION
ID          : 0
NAME        : localhost
CLUSTER     : -
STATE       : MONITORED
IM_MAD      : kvm
VM_MAD      : kvm
VN_MAD      : dummy
LAST MONITORING TIME : 08/25 12:09:40

HOST SHARES
TOTAL MEM      : 15.6G
USED MEM (REAL) : 1.4G
USED MEM (ALLOCATED) : 0K
TOTAL CPU      : 800
USED CPU (REAL) : 4
USED CPU (ALLOCATED) : 0
RUNNING VMs    : 0

a MONITORING INFORMATION
ARCH="x86_64"
CPUSPEED="800"
HOSTNAME="linux"
HYPERVISOR="kvm"
MODELNAME="Intel(R) Core(TM) i7-4770 CPU @ 3.40GHz"
NETX="33428771"
NETTX="1777601"
RESERVED_CPU=""
RESERVED_MEM=""
VERSION="4.12.1"

VIRTUAL MACHINES
      ID USER GROUP NAME          STAT UCPU UMEM HOST      TIME

```

```
oneadmin@linux:~$ ls -l
```

```
total 312
-rw-rw-r-- 1 oneadmin oneadmin 3339 Jul  1 05:04 config
drwxr-xr-x 5 oneadmin oneadmin 4096 Jul  1 04:12 datastores
-rw-r--r-- 1 dovenull nova     93 May 28 16:07 mynetwork.one
-rw-r--r-- 1 oneadmin oneadmin 287744 Jul  1 05:51 one.db
drwxr-xr-x 9 oneadmin oneadmin 4096 Jun 14 01:55 remotes
drwxrwxr-x 2 oneadmin oneadmin 4096 Jun 14 16:52 sunstone_vnc_tokens
drwxr-xr-x 2 oneadmin oneadmin 4096 Nov 26 2015 vms
```

Step 14: Create and Modifying the mynetwork.one at /var/lib/onemynetwork.one

```
oneadmin@linux:~$ sudo bash
root@linux:~# cd /var/lib/one
```

```

root@linux:/var/lib/one# gedit mynetwork.one                                # paste the below lines.
NAME = "private"
BRIDGE = br0

AR = [
    TYPE = IP4,
    IP = 192.168.0.141,
    SIZE = 5
]
root@linux:/var/lib/one# sudo - oneadmin
oneadmin@linux:~$ cat mynetwork.one
NAME = "private"
BRIDGE = br0

AR = [
    TYPE = IP4,
    IP = 192.168.0.141,
    SIZE = 5
]

```

Step 15: Creating the virtualnetwork as onevnet and viewing it's properties.

```
oneadmin@linux:~$ onevnet create mynetwork.one
```

```
oneadmin@linux:~$ onevnet list
```

```
oneadmin@linux:~$ onevnet show 0
```

```

root@linux: /var/lib/one
oneadmin@linux:~$ onevnet create mynetwork.one
ID: 0
oneadmin@linux:~$ onevnet list
-- ID USER      GROUP      NAME      CLUSTER      BRIDGE      LEASES
  0 oneadmin    oneadmin   private     -          br0        0
oneadmin@linux:~$ onevnet show 0
VIRTUAL NETWORK 0 INFORMATION
ID : 0
NAME : private
USER : oneadmin
GROUP : oneadmin
CLUSTER : -
BRIDGE : br0
VLAN : No
USED LEASES : 0

PERMISSIONS
OWNER : um-
GROUP : ---
OTHER : ----

VIRTUAL NETWORK TEMPLATE
BRIDGE="br0"
PHYDEV=""
SECURITY_GROUPS="0"
VLAN="NO"
VLAN_ID=""

ADDRESS RANGE POOL
AR_0
SIZE : 5
LEASES : 0

RANGE
MAC           FIRST          LAST
IP            02:00:c0:a8:00:8d  02:00:c0:a8:00:91
              192.168.0.141    192.168.0.145

LEASES
AR OWNER      MAC          IP          IP6 GLOBAL
oneadmin@linux:~$ 

```

Step 16: Installing Virtual Machines, before that check list of oneimage, onetemplate and onevm.

oneadmin@linux:~\$ oneimage list

ID	USER	GROUP	NAME	DATASTORE	SIZE	TYPE	PER STAT	RVMS
----	------	-------	------	-----------	------	------	----------	------

oneadmin@linux:~\$ onetemplate list

oneadmin@linux:~\$ onevmlist

```
root@linux:/var/lib/one
oneadmin@linux:~$ oneimage list
+-----+-----+-----+-----+-----+
| ID   | USER | GROUP | NAME  | DATASTORE | SIZE  | TYPE | PER STAT | RVMS |
+-----+-----+-----+-----+-----+
oneadmin@linux:~$ onetemplate list
+-----+-----+-----+-----+
| ID   | USER | GROUP | NAME  |          | REGTIME |
+-----+-----+-----+-----+
oneadmin@linux:~$ onevm list
+-----+-----+-----+-----+-----+
| ID   | USER | GROUP | NAME  | STAT | UCPU | UMEM | HOST  | TIME  |
+-----+-----+-----+-----+-----+
oneadmin@linux:~$
```

Step 17: Updating the .ssh for passwordless handshaking with oneadmin web service.

oneadmin@linux:~\$ cat ~/.ssh/id_rsa.pub

You can see the key, copy that fully and paste it in by visiting localhost:9869/

Click oneadmin and choose configuration and deselect the public ssh and finally paste it.

The screenshot shows the 'Configuration' page for the 'oneadmin' user in the OpenNebula Sunstone web interface. The 'Public SSH Key' section displays a long RSA public key. The 'TOKEN_PASSWORD' field contains the value '76c4b295fa7eb52bc23271bac60a44cf09a3700f'. The interface includes a sidebar with various navigation links and a bottom navigation bar with tabs for Hosts and Create.

Step 18: Creating Oneimage, onetemplate and one vm.

Move to the datastores folder.

```
oneadmin@linux:~$ cd datastores  
oneadmin@linux:~/datastores$
```

Creating oneimage

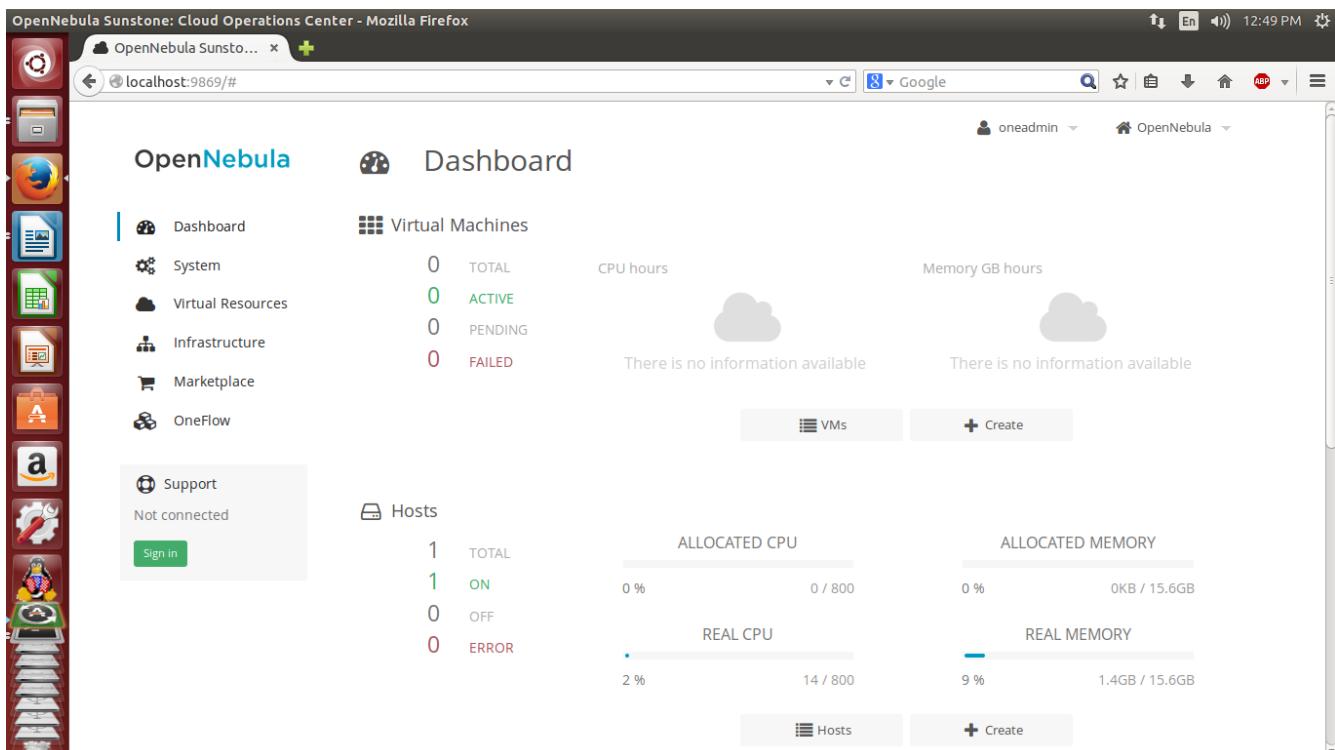
```
oneadmin@linux:~/datastores$ oneimage create --name "ttylinux" -path  
"/home/linux/Downloads/source/ttylinux.img" --driver raw --datastore default
```

Creating One Template:

```
oneadmin@linux:~/datastores$ onetemplate create --name "ttylinux" --cpu 1 --vcpu 1 -  
-memory 512 --arch x86_64 --disk "ttylinux" --nic "private" --vnc --ssh
```

Instantiating OneVm (oneemplate)

```
oneadmin@linux:~/datastores$ onetemplate instantiate "ttylinux"
```



The above image before creating the vm. Refresh and check once the above commands are executed.

The screenshot shows the OpenNebula Sunstone dashboard. On the left is a vertical sidebar with icons for various management functions like Dashboard, System, Virtual Resources, and Marketplace. The main area has a title "OpenNebula Dashboard". Below it, there's a section for "Virtual Machines" with a summary table:

	TOTAL	CPU hours	Memory GB hours
ACTIVE	1	0.020	0.010
PENDING	0	0.015	0.005
FAILED	0	0.010	0.000

Below this are two bar charts: one for CPU usage from 16/08/19 to 16/08/25, and another for Memory usage over the same period. There are "VMs" and "+ Create" buttons. Another section below shows "Hosts" with similar summary data and resource usage graphs for CPU and memory.

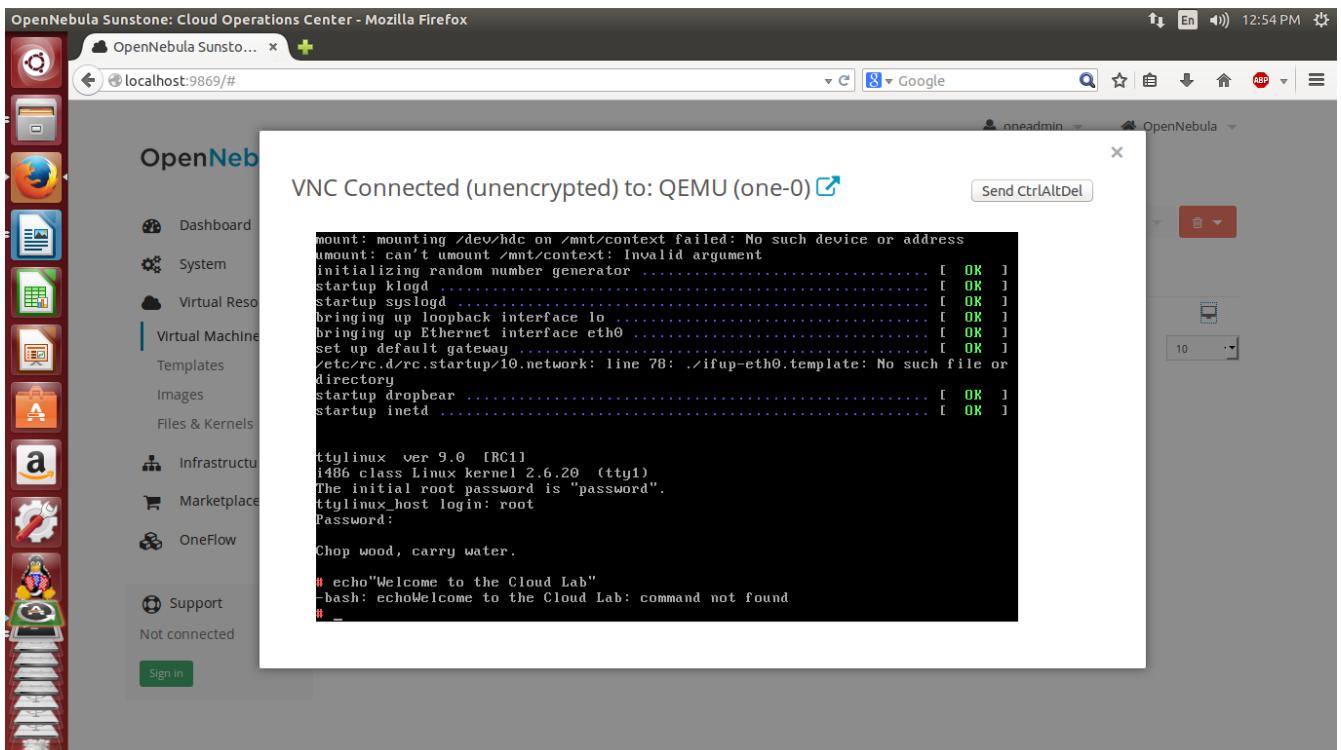
Step 19: Opening the VM through opennebula.

This screenshot shows the "Virtual Machines" list page. The sidebar on the left is identical to the previous dashboard view. The main area has a title "Virtual Machines" and a table listing one entry:

ID	Owner	Group	Name	Status	Host	IPs
0	oneadmin	oneadmin	ttylinux-0	RUNNING	localhost	192.168.0.141

Below the table, it says "Showing 1 to 1 of 1 entries". At the bottom, there are links for "Previous" (with page number 1), "Next", and a dropdown for "10" items per page. A note at the bottom right says "OpenNebula 4.12.1 by OpenNebula Systems." The address bar at the bottom shows "localhost:9869/#".

Click the corner computer symbol icon, it will ask for the username and password. By default the username is root and password is password.



Through terminal you can access the vm by
 oneadmin@linux:~/datastores\$ sshroot@192.168.0.141
 and give password

```
root@linux: /var/lib/one
[...]
oneadmin@linux:~$ cd datastores
oneadmin@linux:~/datastores$ ls
0 1 2
oneadmin@linux:~/datastores$ oneimage create --name "ttylinux" --path "/home/linux/Downloads/source/ttylinux.img" --driver raw --datastore default
ID: 0
oneadmin@linux:~/datastores$ onetemplate create --name "ttylinux" --cpu 1 --vcpu 1 --memory 512 --arch x86_64 --disk "ttylinux" --nic "private"
--vnc --ssh
ID: 0
oneadmin@linux:~/datastores$ oneimage list


| ID | USER     | GROUP    | NAME     | DATASTORE | SIZE | TYPE | PER | STAT | RVMS |
|----|----------|----------|----------|-----------|------|------|-----|------|------|
| 0  | oneadmin | oneadmin | ttylinux | default   | 40M  | OS   | No  | rdy  | 0    |


oneadmin@linux:~/datastores$ onetemplate list


| ID | USER     | GROUP    | NAME     | REGTIME        |
|----|----------|----------|----------|----------------|
| 0  | oneadmin | oneadmin | ttylinux | 08/25 12:46:17 |


oneadmin@linux:~/datastores$ onetemplate instantiate "ttylinux"
VM ID: 0
oneadmin@linux:~/datastores$ ssh root@192.168.0.141
Warning: Permanently added '192.168.0.141' (RSA) to the list of known hosts.
root@192.168.0.141's password:
'Chop wood, carry water.

# echo"Welcome"
-bash: echoWelcome: command not found
# logout
Connection to 192.168.0.141 closed.
oneadmin@linux:~/datastores$
```

Step 20: Similarly you can create as much vm your machine supports and can access only 5vm at a time since we limited our ip range upto 5 in mynetwork.one
 You can install ubuntu, centos and etc.,

Change the unbold data in the below command and install for various vm size.

Creating One Template:

```
oneadmin@linux:~/datastores$ onetemplate create --name "ttylinux" --cpu1 --vcpu 1 --memory 512 --arch x86_64 --disk "ttylinux" --nic "private" --vnc -ssh
```

Instantiating OneVm (oneemplate)

```
oneadmin@linux:~/datastores$ onetemplate instantiate "ttylinux"
```

Result:

Thus the procedure for running the virtual machine of different configuration has been successfully implemented in opennebula.

Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.

Aim:

To Find the procedure for attaching virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.

Procedure:

Step 1: Create the Oneimage, onetemplate and onevm through the commands

Creating oneimage

```
oneadmin@linux:~/datastores$ oneimage create --name "ttylinux" -path  
"/home/linux/Downloads/source/ttylinux.img" --driver raw --datastore default
```

Creating One Template:

```
oneadmin@linux:~/datastores$ onetemplate create --name "ttylinux" --cpu 1 --vcpu 1 -  
-memory 512 --arch x86_64 --disk "ttylinux" --nic "private" --vnc --ssh
```

Instantiating OneVm (oneemplate)

```
oneadmin@linux:~/datastores$ onetemplate instantiate "ttylinux"
```

Creating oneimage

```
oneadmin@linux:~/datastores$ oneimage create --name "Ubuntu" -path  
"/home/linux/Downloads/source/tubuntu1404-5.0.1.qcow2c" --driver qcow2 --  
datastore default
```

Creating One Template:

```
oneadmin@linux:~/datastores$ onetemplate create --name "ubuntu1" --cpu 1 --vcpu 1  
--memory 1024 --arch x86_64 --disk "Ubuntu" --nic "private" --vnc --ssh
```

Instantiating OneVm (oneemplate)

```
oneadmin@linux:~/datastores$ onetemplate instantiate "ubuntu1"
```

Step 2: Power off Virtual os

```
oneadmin@ubuntu:~/datastores$ onevm poweroff 1  
oneadmin@ubuntu:~/datastores$ onevm poweroff 2  
oneadmin@ubuntu:~/datastores$ onevm list
```

Step 3: Starting service

```
oneadmin@ubuntu:~/datastores$ onevm resume 0
```

Step 4: Deleting created VM

After power off do the operations

```
oneadmin@ubuntu:~/datastores$ onevm delete 1  
oneadmin@ubuntu:~/datastores$ onevm list  
oneadmin@ubuntu:~/datastores$ onevm delete 2  
oneadmin@ubuntu:~/datastores$ onevm list
```

ID	USER	GROUP	NAME	STAT	UCPU	UMEM	HOST	TIME	
0	oneadmin	oneadmin	CentOS-6.5	Virt	runn	0.0	512M	localhost	0d 01h43
3	oneadmin	oneadmin	ttylinux	Virtua	runn	9.5	256M	localhost	0d 00h05

Step 5: Deleting image, template and vm

Rollback the operations

For deleting the template

```
oneadmin@ubuntu:~/datastores$ onetemplate delete 1
```

For deleting the image

```
oneadmin@ubuntu:~/datastores$ oneimage delete 1
```

Step 6: Deploying, undeploying, disable and enabling the services of onehost.

```
oneadmin@ubuntu:~/datastores$ onevm undeploy 0,3,4,5
```

```
oneadmin@ubuntu:~/datastores$ onevm list
```

ID	USER	GROUP	NAME	STAT	UCPU	UMEM	HOST	TIME	
0	oneadmin	oneadmin	CentOS-6.5	Virt	unde	0.0	0K	localhost	0d 02h11
3	oneadmin	oneadmin	ttylinux	Virtua	shut	11.0	256M	localhost	0d 00h34
4	oneadmin	oneadmin	Debian 7	Virtua	unde	0.0	0K	localhost	0d 00h23
5	oneadmin	oneadmin	Ubuntu 14.04	Vi	unde	0.0	0K	localhost	0d 00h21

```
oneadmin@ubuntu:~/datastores$ onehost list
```

ID	NAME	CLUSTER	RVM	ALLOCATED_CPU	ALLOCATED_MEM	STAT
0	localhost	-	0	0 / 400 (0%)	0K / 3.7G (0%)	on

```
oneadmin@ubuntu:~/datastores$ onehost disable 0
```

```
oneadmin@ubuntu:~/datastores$ onehost list
```

ID	NAME	CLUSTER	RVM	ALLOCATED_CPU	ALLOCATED_MEM	STAT
0	localhost	-	0	-	- off	

```
oneadmin@ubuntu:~/datastores$ onehost enable 0
```

```
oneadmin@ubuntu:~/datastores$ onehost list
```

ID	NAME	CLUSTER	RVM	ALLOCATED_CPU	ALLOCATED_MEM	STAT
0	localhost	-	0	0 / 400 (0%)	0K / 3.7G (0%)	on

Step 7: Password generation for root user (Ubuntu)

For Passwrod Generation through root user-guide

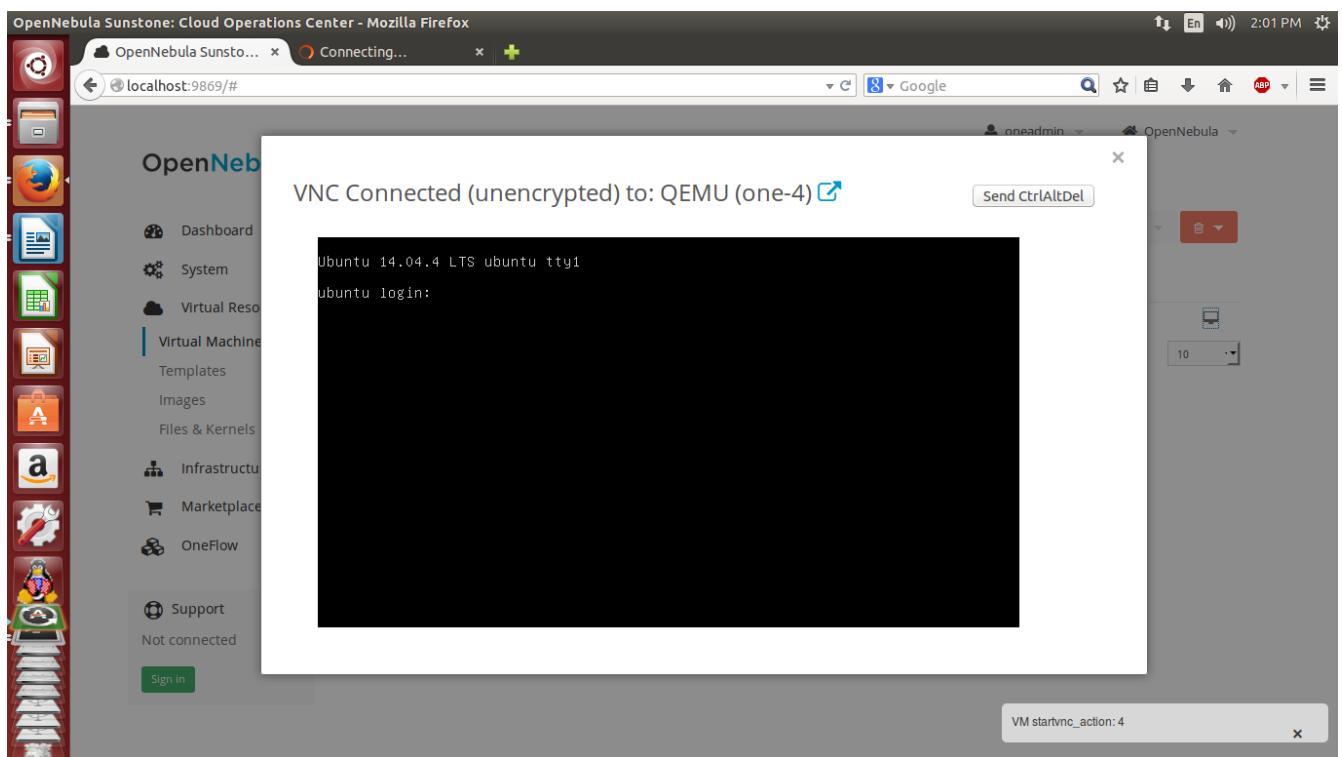
```
[root@localhost ~]# ls -al
```

```
[root@localhost ~]# cd .ssh/
```

```
[root@localhost .ssh]# cat authorized_keys
```

```
ssh-rsa
```

```
AAAAAB3NzaC1yc2EAAAQABAAQCPZ7VExltM+8w36OsQZdzBsINiIRTBqU6934vS2wIRZvhjzT4R06QS314gG3K0ghFk4cVAIS8ykMMjqW11G0LtIIqMYaKUYOG4oWfiB2hkeQoGGJCPbjMzs3RKXkOsn/bzgo2iYXldiCTVLaj5d+c8ZxXHIErCK0K3AM2JYoeN/iR88nP6h8vCdJwaahpcysggpKyHTAsJ+TBaXF13TGhVH9W0AAw6qM/OA2+FNKqCnR+b57KI7fXeBBVc/MckJfjI5PQXm+ZDrKa2LtFV9L5f71Vv0mc8YWIBmDfZ2Bx/FcHuCEphq7Sh8WLNrLuqNW+Kf9lRcr33DBYIROm9w2B root@gcc-server
```



Result:

Thus the procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine has been successfully implemented.

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

Aim :

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

Procedure:

step1:

Install the centos or ubuntu in the opennebula as per previous commands.

Step 2:

Login into the VM of installed OS.

Step 3:

If it is ubuntu then, for gcc installation

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

Step 4:

Write a sample program like

```
Welcome.cpp  
#include<iostream.h>  
using namespace std;  
int main()  
{  
cout<<"Hello world";  
return 0;  
}
```

Step 5:

First we need to compile and link our program. Assuming the source code is saved in a file welcome.cpp, we can do that using GNU C++ compiler g++, for example

```
g++ -Wall -o welcome welcome.cpp
```

And output can be executed by ./welcome

Result:

Thus the GCC compiler has been successfully installed and executed a sample program.

Show the virtual machine migration based on the certain condition from one node to the other

Aim:

To show the virtual machine migration based on the certain condition from one node to the other.

Procedure:

Step 1: Open Opennebula service from root user and view in localhost:9869

```
root@linux:$ /etc/init.d/opennebula-sunstone restart
```

Step 2: Create oneimage, onetemplate and onevm as like earlier

Creating oneimage

```
oneadmin@linux:~/datastores$ oneimage create --name "Ubuntu" --path  
"/home/linux/Downloads/source/tubuntu1404-5.0.1.qcow2c" --driver qcow2 --datastore  
default
```

Creating One Template:

```
oneadmin@linux:~/datastores$ onetemplate create --name "ubuntu1" --cpu 1 --vcpu 1 --  
memory 1024 --arch x86_64 --disk "Ubuntu" --nic "private" --vnc --ssh
```

Instantiating OneVm (oneemplate)

```
oneadmin@linux:~/datastores$ onetemplate instantiate "ubuntu1"
```

Step 3: To perform a migration. We use onevm command with VM id as VID = 0 to host02(HID=1)

```
oneadmin@linux:~/datastores$ onevm migrate --live 0 1
```

This will move the VM from host01 to host02. The onevm list shows something like the following

```
oneadmin@linux:~/datastores$ onevm list
```

ID	USER	GROUP	NAME	STAT	CPU	MEM	HOSTNAME	TIME
0	oneadmin	oneadmin	one-0	runn	0	0k	host02	00:00:48

Result :

Thus the virtual machine migration based on the certain condition from one node to the other has been executed successfully.

Find procedure to set up the one node Hadoop cluster

Aim:

To find the procedure for setting up the one hadoop cluster in the linux platform.

Procedures:

Step 1:

Download the latest sun java and apache hadoop from the official website.

Step 2:

To install Java and Hadoop follow the below lines

1. Install Java

- a. Extract the Downloaded java.tar.gz file in Downloads / Documents folder
 - b. Open Terminal by pressing **ctrl+alt+t**
 - c. In Terminal, type
\$gedit ~/.bashrc

d. At the bottom paste the following lines by changing the path alone

#--insert JAVA_HOME

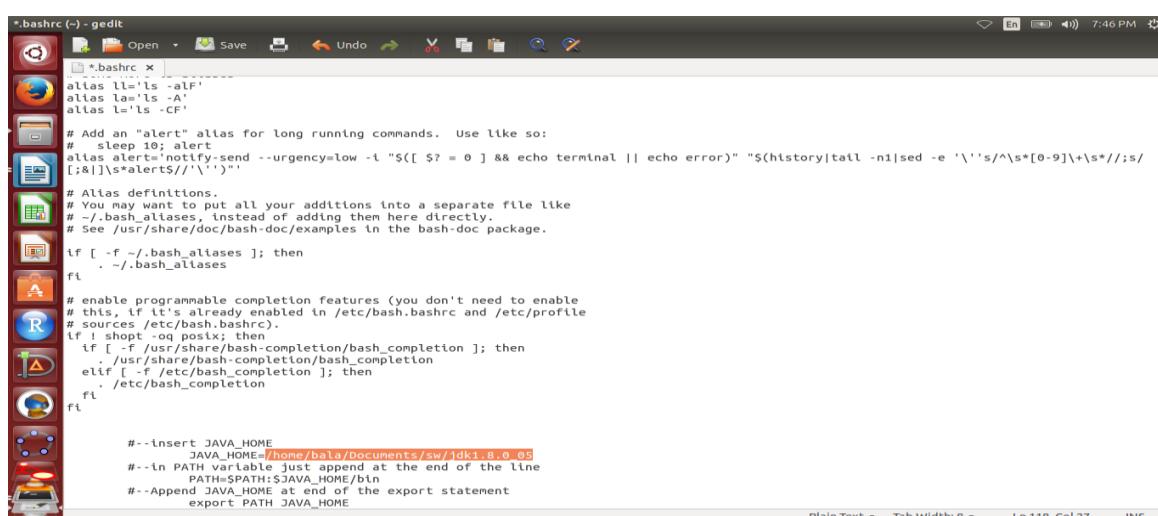
JAVA_HOME= /opt/jdk1.8.0_05

#--in PATH variable just append at the end of the line

PATH=\$PATH:\$JAVA_HOME/bin

#--Append JAVA_HOME at end of the export statement

```
export PATH JAVA_HOME
```

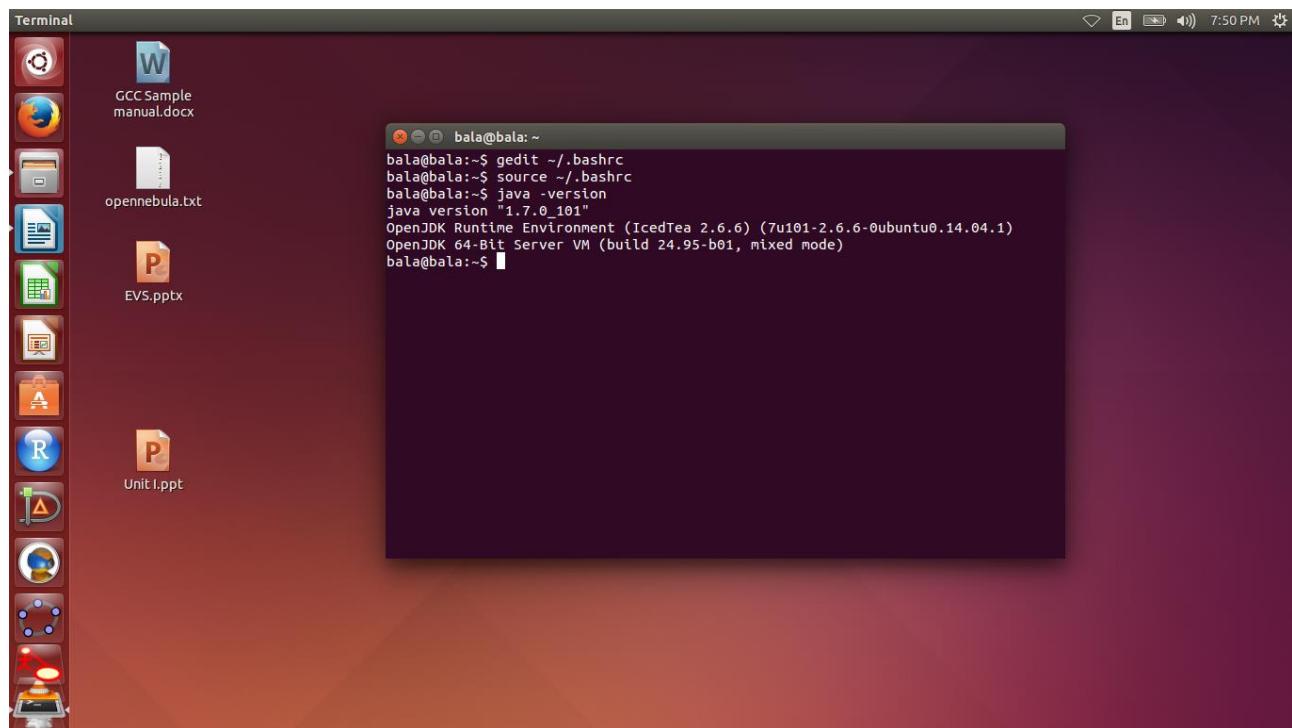


e. Save the configuring by giving command as

```
$ source ~/.bashrc
```

f. Check java has been successfully installed by typing

\$java -version



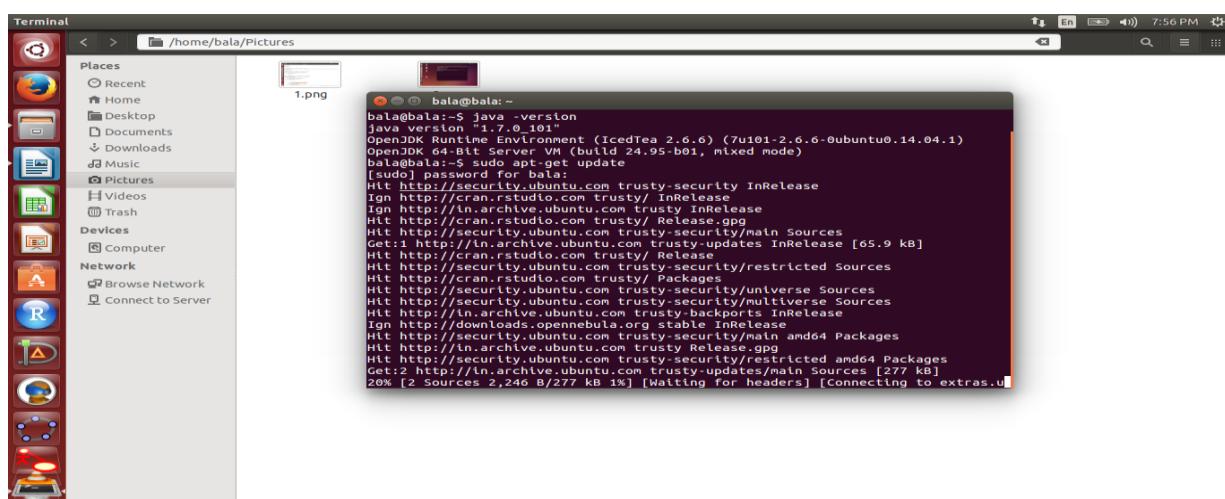
Step 3. Install ssh for passwordless authentication

For passwordless authentication we need to do certain changes by following the below procedure and we need internet connection.

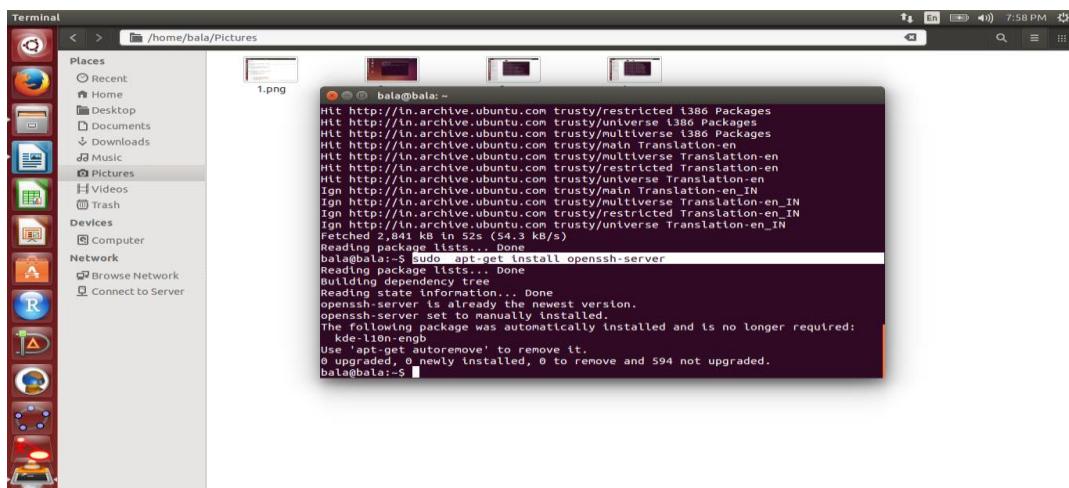
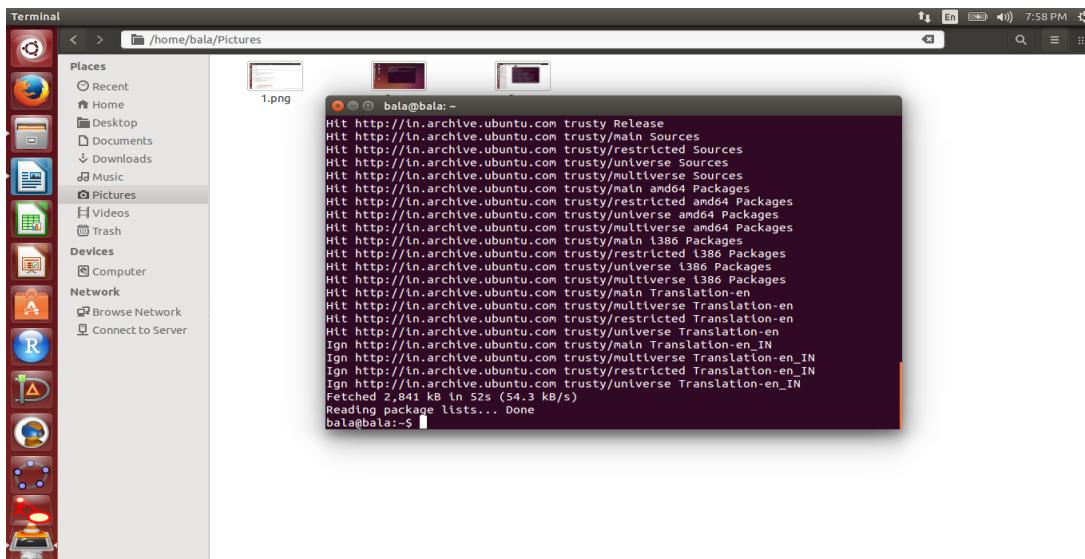
In Terminal: copy and the paste the below lines

```
$ sudo apt-get update
```

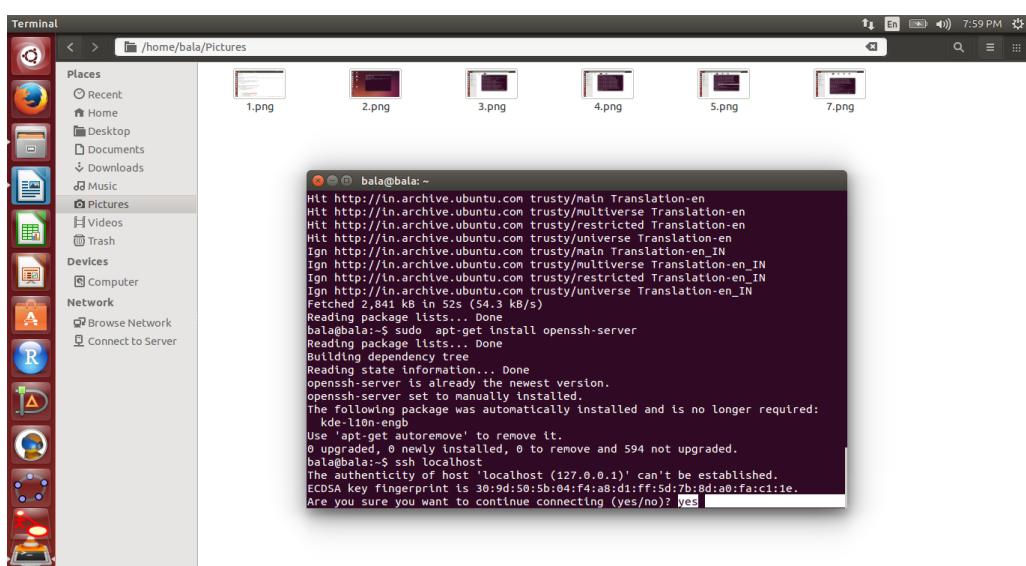
It will ask your root password. Give it



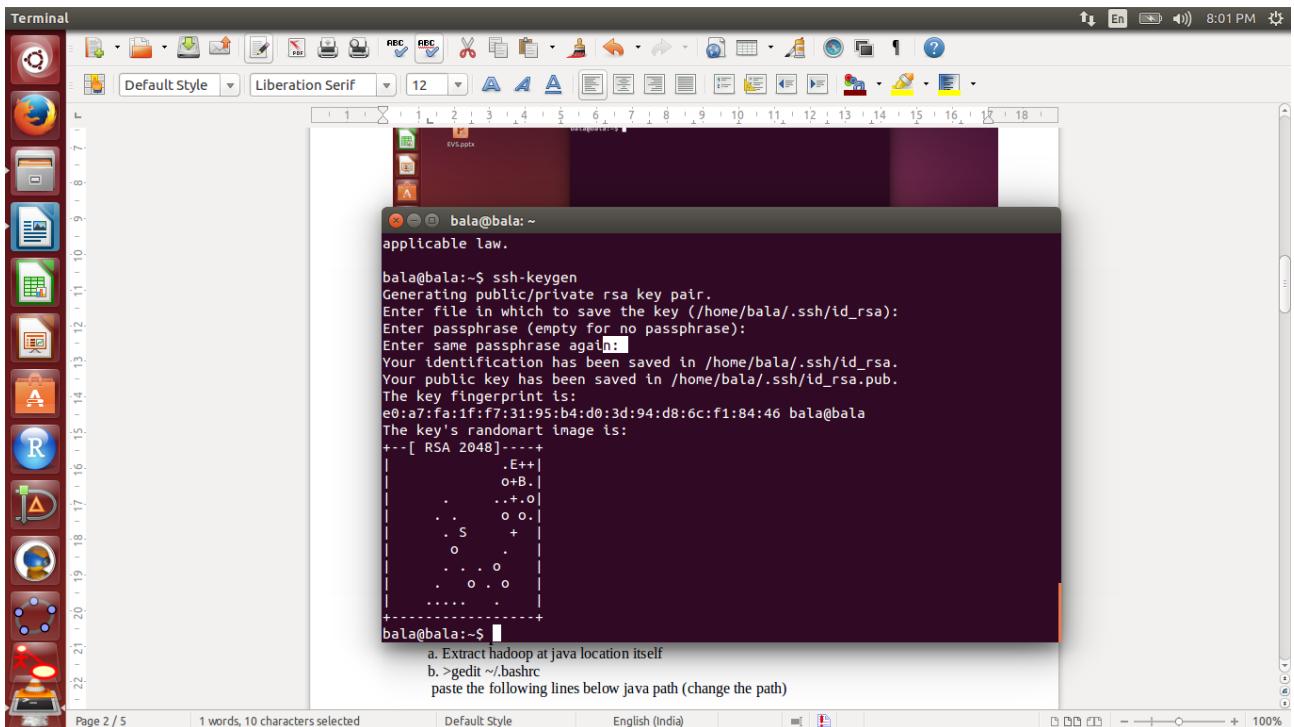
```
$ sudo apt-get install openssh-server
```



```
$ sshlocalhost  
### It also will ask ask root password
```



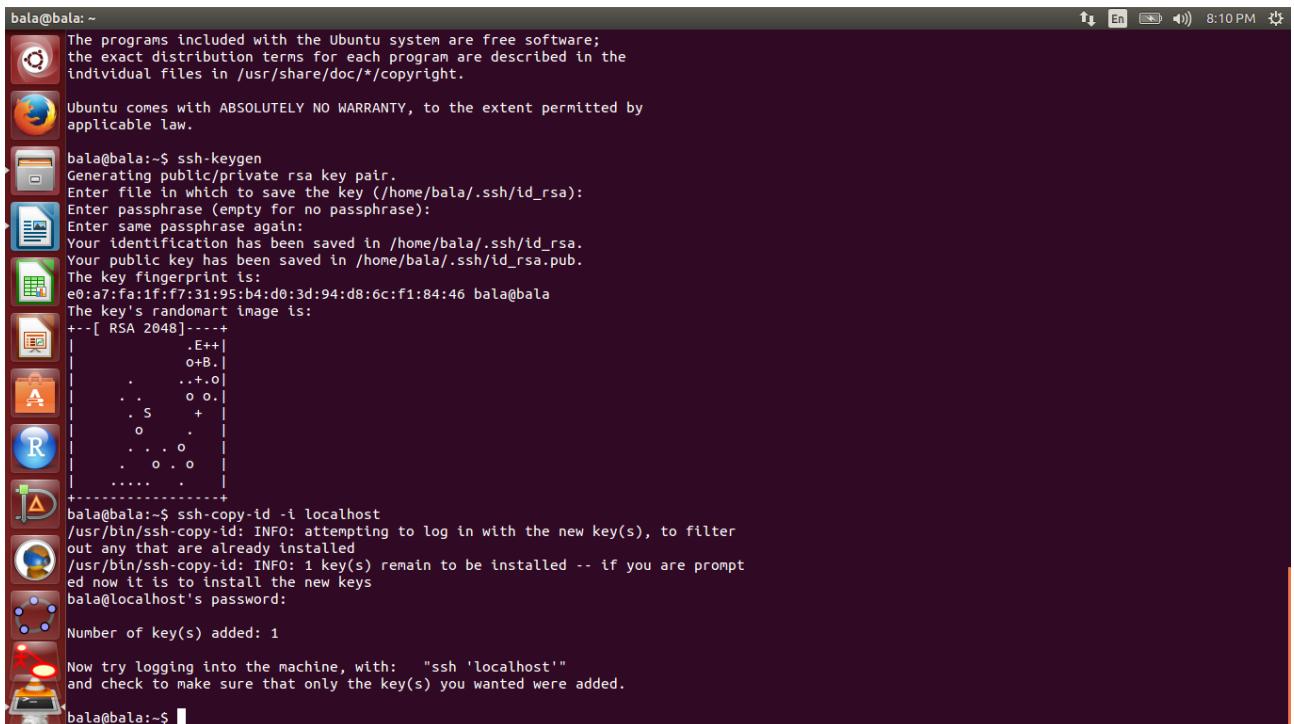
\$ ssh-keygen (*Don't mention any path during key generation*)



A screenshot of a Linux desktop environment. On the left is a dock with various icons for applications like a terminal, file manager, browser, and system tools. In the center is a terminal window titled 'Terminal' with the command 'ssh-keygen' running. The output shows the generation of an RSA key pair, including the public key fingerprint and a randomart image. Below the terminal, a message provides instructions for copying the key to the Java location.

```
bala@bala:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/bala/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/bala/.ssh/id_rsa.
Your public key has been saved in /home/bala/.ssh/id_rsa.pub.
The key fingerprint is:
e0:a7:fa:1f:f7:31:95:b4:d0:3d:94:d8:6c:f1:84:46 bala@bala
The key's randomart image is:
+--[ RSA 2048]----+
|          .E++|
|          o+B.|
|          . .+.o|
|          . o .|
|          . S + |
|          o . .|
|          . . . o|
|          . o . o|
|          .... .|
+-----+
bala@bala:~$ 
a. Extract hadoop at java location itself
b. >gedit ~/.bashrc
paste the following lines below java path (change the path)
```

\$ ssh-copy-id -i localhost



A screenshot of a Linux desktop environment. The terminal window shows the execution of 'ssh-copy-id -i localhost'. It displays informational messages from the command, including a warning about attempting to log in with new keys and a prompt for the password. The process is completed successfully, adding one key and providing instructions for logging in.

```
bala@bala:~$ 
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.

bala@bala:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/bala/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/bala/.ssh/id_rsa.
Your public key has been saved in /home/bala/.ssh/id_rsa.pub.
The key fingerprint is:
e0:a7:fa:1f:f7:31:95:b4:d0:3d:94:d8:6c:f1:84:46 bala@bala
The key's randomart image is:
+--[ RSA 2048]----+
|          .E++|
|          o+B.|
|          . .+.o|
|          . o .|
|          . S + |
|          o . .|
|          . . . o|
|          . o . o|
|          .... .|
+-----+
bala@bala:~$ ssh-copy-id -i localhost
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompt
ed now it is to install the new keys
bala@localhost's password:
Number of key(s) added: 1

Now try logging into the machine, with: "ssh 'localhost'"
and check to make sure that only the key(s) you wanted were added.

bala@bala:~$ 
```

Step 4. Installation Procedure of Hadoop

As like java, extract hadoop tar.gz file also and do the changes in **bashrc** file by copy and paste the following line

- a. Extract hadoop at java located folder itself (Downloads or Documents)
- b. **\$ gedit ~/.bashrc**
paste the following lines below java path (change the path)

```

--insert HADOOP_PREFIX
HADOOP_PREFIX=/opt/hadoop-2.7.0
--in PATH variable just append at the end of the line
PATH=$PATH:$HADOOP_PREFIX/bin
--Append HADOOP_PREFIX at end of the export statement
export PATH JAVA_HOME HADOOP_PREFIX

```

- c. save it by typing the below command in terminal
\$ source ~/.bashrc
- d. To check the installed path of Hadoop. Type the command
\$ echo \$HADOOP_PREFIX
- e. Command is to get into the hadoop directory is
\$ cd \$HADOOP_PREFIX
- f. To check the installed hadoop version
\$bin/hadoop version

```

bala@bala: ~/Documents/sw/hadoop-2.7.0
balagbala:~$ gedit ~/.bashrc
balagbala:~$ source ~/.bashrc
balagbala:~$ echo $HADOOP_PREFIX
/home/bala/Documents/sw/hadoop-2.7.0
balagbala:~$ cd HADOOP_PREFIX
bash: cd: HADOOP_PREFIX: No such file or directory
balagbala:~$ cd $HADOOP_PREFIX
balagbala:~/Documents/sw/hadoop-2.7.0$ cd $HADOOP_PREFIX
balagbala:~/Documents/sw/hadoop-2.7.0$ bin/hadoop version
Hadoop 2.7.0
Subversion https://git-wip-us.apache.org/repos/asf/hadoop.git -r d4c8d4d4d203c93
4e8074b31289a28724c0842cf
Compiled by jenkins on 2015-04-10T18:40Z
Compiled with protoc 2.5.0
From source with checksum a9e90912c37a35c3195d23951fd18f
This command was run using /home/bala/Documents/sw/hadoop-2.7.0/share/hadoop/com
mon/hadoop-common-2.7.0.jar
bala@bala:~/Documents/sw/hadoop-2.7.0$ 

```

Step 5. Modifying the Hadoop configuration files

Do the things as like we did before using terminal

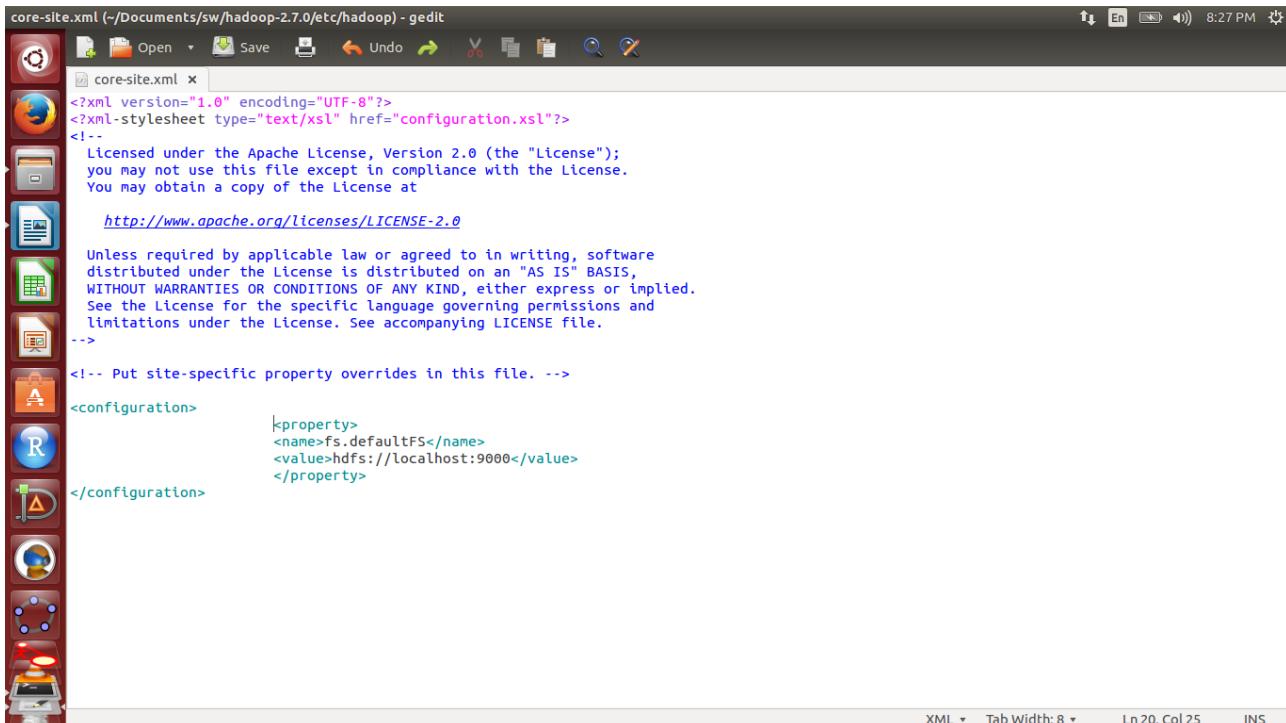
- (i) **cd \$HADOOP_PREFIX/etc/hadoop**
\$ gedit hadoop-env.sh
(paste the java and hadoop path as the first two lines)
export JAVA_HOME=/usr/local/jdk1.8.0_05
export HADOOP_PREFIX=/opt/hadoop-2.7.0

(ii) Modify the core-site.xml

\$ gedit core-site.xml

Paste the line within <configuration></configuration>

```
<configuration>
    <property>
        <name>fs.defaultFS</name>
        <value>hdfs://localhost:9000</value>
    </property>
</configuration>
```



```
core-site.xml (~/.Documents/sw/hadoop-2.7.0/etc/hadoop) - gedit
core-site.xml x
<?xml version="1.0" encoding="UTF-8"?>
<xm...stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
  Licensed under the Apache License, Version 2.0 (the "License");
  you may not use this file except in compliance with the License.
  You may obtain a copy of the License at

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

  Unless required by applicable law or agreed to in writing, software
  distributed under the License is distributed on an "AS IS" BASIS,
  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
  See the License for the specific language governing permissions and
  limitations under the License. See accompanying LICENSE file.
-->
<!-- Put site-specific property overrides in this file. -->
<configuration>
    <property>
        <name>fs.defaultFS</name>
        <value>hdfs://localhost:9000</value>
    </property>
</configuration>
```

(iii) Modify the hdfs-site.xml

\$ gedit hdfs-site.xml

Paste the configuration file

```
<configuration>
    <property>
        <name>dfs.replication</name>
        <value>1</value>
    </property>
</configuration>
```

(iv) modify the mapred-site.xml

\$ cpmapred-site.xml.template mapred-site.xml

\$ gedit mapred-site.xml

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

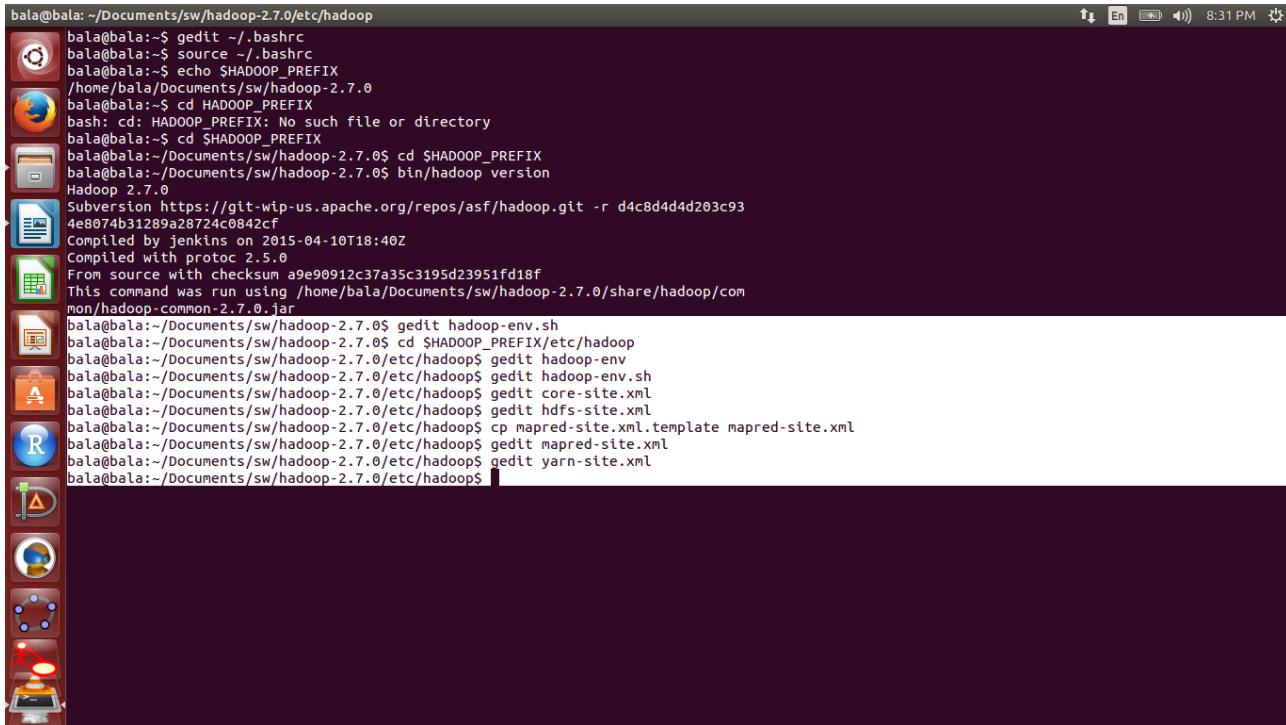
```

    </property>
</configuration>
```

(v) Modiy yarn-site.xml

```

>gedit yarn-site.xml
<configuration>
    <property>
        <name>yarn.nodemanager.aux-services</name>
        <value>mapreduce_shuffle</value>
    </property>
</configuration>
```



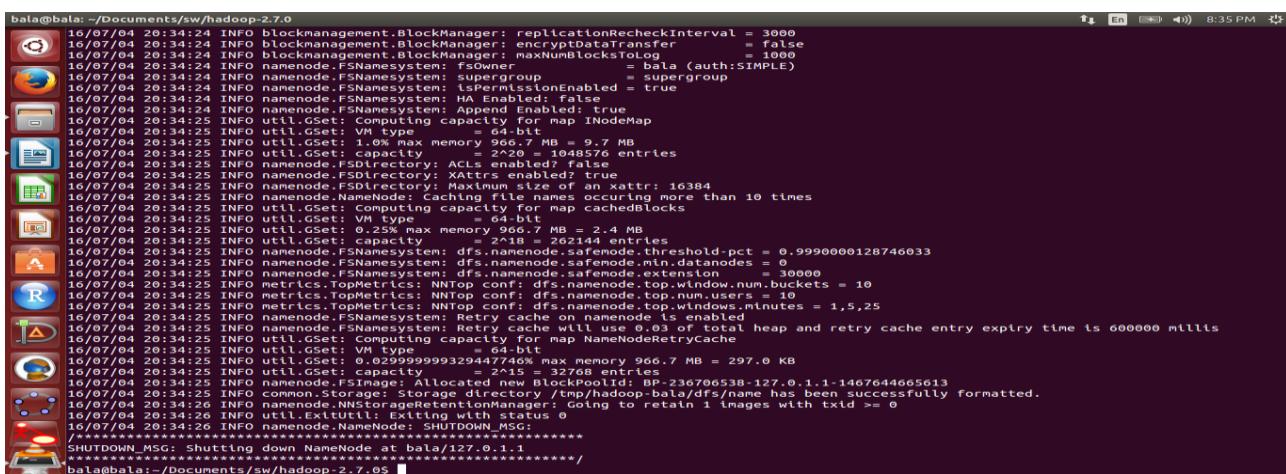
```

bala@bala: ~/Documents/sw/hadoop-2.7.0/etc/hadoop
bala@bala:~$ gedit ~/.bashrc
balagbala:~$ source ~/.bashrc
balagbala:~$ echo SHADOOP_PREFIX
balagbala:~$ cd HADOOP_PREFIX
bash: cd: HADOOP_PREFIX: No such file or directory
balagbala:~$ cd $HADOOP_PREFIX
balagbala:~/Documents/sw/hadoop-2.7.0$ cd $HADOOP_PREFIX
balagbala:~/Documents/sw/hadoop-2.7.0$ bin/hadoop version
Hadoop 2.7.0
Subversion https://git-wip-us.apache.org/repos/asf/hadoop.git -r d4c8d4d4d203c93
4e8074b1289a28724c0842f
Compiled by jenkins on 2015-04-10T18:40Z
Compiled with protoc 2.5.0
From source with checksum a9e90912c37a35c3195d23951fd18f
This command was run using /home/bala/Documents/sw/hadoop-2.7.0/share/hadoop/com
mon/hadoop-common-2.7.0.jar
balagbala:~/Documents/sw/hadoop-2.7.0$ gedit hadoop-env.sh
balagbala:~/Documents/sw/hadoop-2.7.0$ cd $HADOOP_PREFIX/etc/hadoop
balagbala:~/Documents/sw/hadoop-2.7.0/etc/hadoop$ gedit hadoop-env
balagbala:~/Documents/sw/hadoop-2.7.0$ gedit core-site.xml
balagbala:~/Documents/sw/hadoop-2.7.0$ gedit hdfs-site.xml
balagbala:~/Documents/sw/hadoop-2.7.0/etc/hadoop$ cp mapred-site.xml.template mapred-site.xml
balagbala:~/Documents/sw/hadoop-2.7.0/etc/hadoop$ gedit mapred-site.xml
balagbala:~/Documents/sw/hadoop-2.7.0/etc/hadoop$ gedit yarn-site.xml
balagbala:~/Documents/sw/hadoop-2.7.0/etc/hadoop$
```

Step 7. Formatting the HDFS file-system via the NameNode

```

$ cd $HADOOP_PREFIX
$ bin/hadoopnamenode -format
```



```

bala@bala: ~/Documents/sw/hadoop-2.7.0
16/07/04 20:34:24 INFO blockmanagement.BlockManager: replicationRecheckInterval = 3000
16/07/04 20:34:24 INFO blockmanagement.BlockManager: encryptDataTransfer = false
16/07/04 20:34:24 INFO blockmanagement.BlockManager: maxNumBlocksForSync = 1000
16/07/04 20:34:24 INFO namenode.FSNamesystem: fsOwner = bala (auth:SIMPLE)
16/07/04 20:34:24 INFO namenode.FSNamesystem: supergroup = supergroup
16/07/04 20:34:24 INFO namenode.FSNamesystem: isPermissionEnabled = true
16/07/04 20:34:24 INFO namenode.FSNamesystem: HA Enabled? false
16/07/04 20:34:24 INFO util.GSet: GSet enabled=true
16/07/04 20:34:24 INFO util.GSet: Computing capacity for map INodeMap
16/07/04 20:34:25 INFO util.GSet: VM type = 64-bit
16/07/04 20:34:25 INFO util.GSet: 966.7 MB = 9.7 MB
16/07/04 20:34:25 INFO util.GSet: capacity = 2^18 = 262144 entries
16/07/04 20:34:25 INFO util.GSet: threshold = 0.9990000128746033
16/07/04 20:34:25 INFO namenode.FSDirectory: ACLs enabled? false
16/07/04 20:34:25 INFO namenode.FSDirectory: XAttrs enabled? true
16/07/04 20:34:25 INFO namenode.FSDirectory: Maximum size of an xattr: 16384
16/07/04 20:34:25 INFO namenode.Namenode: Caching file names occurring more than 10 times
16/07/04 20:34:25 INFO util.GSet: Computing capacity for map cachedBlocks
16/07/04 20:34:25 INFO util.GSet: VM type = 64-bit
16/07/04 20:34:25 INFO util.GSet: 0.25% max memory 966.7 MB = 2.4 MB
16/07/04 20:34:25 INFO util.GSet: capacity = 2^18 = 262144 entries
16/07/04 20:34:25 INFO namenode.FSNamesystem: dfs.namenode.safemode.threshold-pct = 0.9990000128746033
16/07/04 20:34:25 INFO namenode.FSNamesystem: dfs.namenode.safemode.min.datanodes = 0
16/07/04 20:34:25 INFO namenode.FSNamesystem: dfs.namenode.safemode.extension = 30000
16/07/04 20:34:25 INFO metrics.TopMetrics: NNTop conf: dfs.namenode.top.window.num.buckets = 10
16/07/04 20:34:25 INFO metrics.TopMetrics: NNTop conf: dfs.namenode.top.window.minutes = 10
16/07/04 20:34:25 INFO metrics.TopMetrics: NNTop conf: dfs.namenode.top.window.minutes = 1,5,25
16/07/04 20:34:25 INFO namenode.FSNamesystem: Retry cache on namenode is enabled
16/07/04 20:34:25 INFO namenode.FSNamesystem: Retry cache will use 0.03 of total heap and retry cache entry expiry time is 600000 millis
16/07/04 20:34:25 INFO util.GSet: Computing capacity for map NameNodeRetryCache
16/07/04 20:34:25 INFO util.GSet: capacity = 2^15 = 32768 entries
16/07/04 20:34:25 INFO util.GSet: 0.029999999329447740% max memory 966.7 MB = 297.0 KB
16/07/04 20:34:25 INFO namenode.FSImage: Allocated new BlockPoolId: BP-236706538-127.0.1.1-1467644605613
16/07/04 20:34:25 INFO common.Storage: storage directory /tmp/hadoop-bala/dfs/name has been successfully formatted.
16/07/04 20:34:26 INFO namenode.NameNode: ANRStorageRetentionCounter: Going to retain 1 images with txid >= 0
16/07/04 20:34:26 INFO util.ExitUtil: Exiting with status 0
16/07/04 20:34:26 INFO namenode: SHUTDOWN_MSG:
*****Shutdown of Namenode at bala/127.0.1.1*****
```

after formatting, start the services

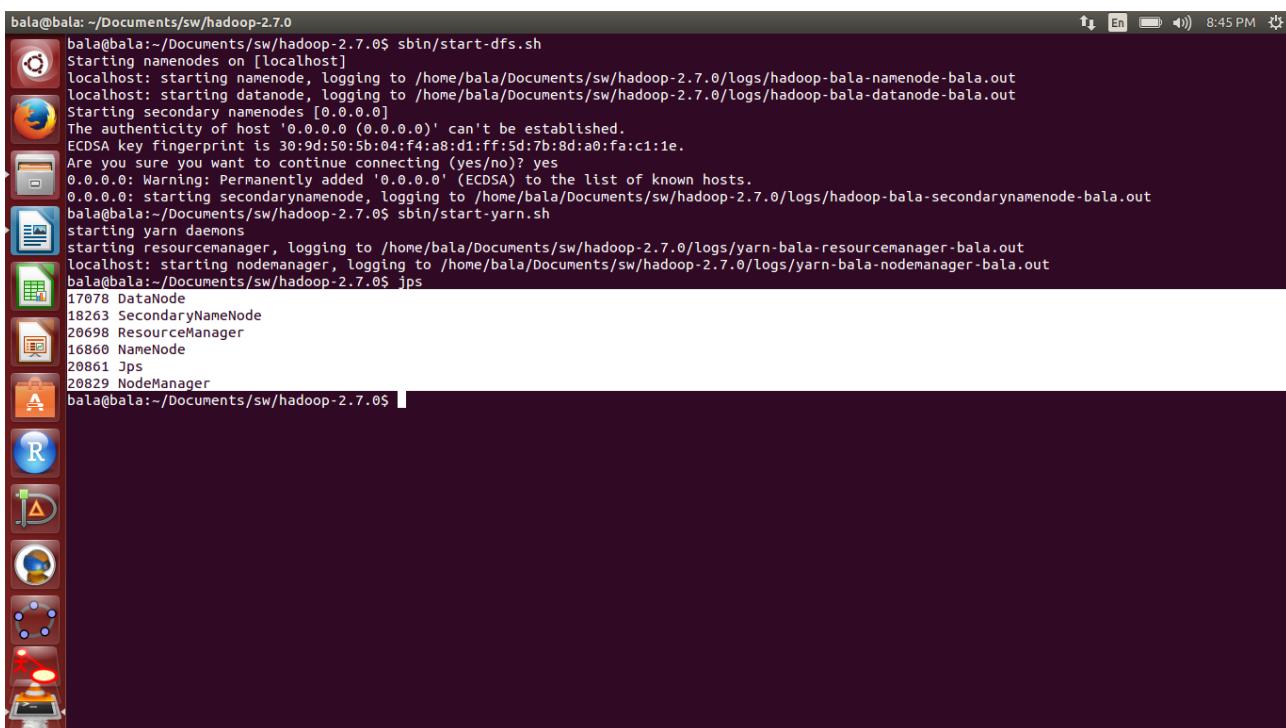
7. Starting the services.

\$sbin/start-dfs.sh#####it will start services by taking some time and it will ask permission give yes.

```
$sbin/start-yarn.sh  
else  
$ sbin/start-all.sh
```

to check running services

```
>jps  
3200 DataNode  
12563 Jps  
4036 ResourceManager  
4172 NodeManager  
5158NameNode  
3685 SecondaryNameNode
```



```
bala@bala: ~/Documents/sw/hadoop-2.7.0$ sbin/start-dfs.sh  
Starting namenodes on [localhost]  
localhost: starting namenode, logging to /home/bala/Documents/sw/hadoop-2.7.0/logs/hadoop-bala-namenode-bala.out  
localhost: starting datanode, logging to /home/bala/Documents/sw/hadoop-2.7.0/logs/hadoop-bala-datanode-bala.out  
Starting secondary namenodes [0.0.0.0]  
The authenticity of host '0.0.0.0 (0.0.0.0)' can't be established.  
ECDSA key fingerprint is 30:9d:50:5b:04:f4:a8:d1:ff:5d:7b:8d:a0:fa:c1:1e.  
Are you sure you want to continue connecting (yes/no)? yes  
0.0.0.0: Warning: Permanently added '0.0.0.0' (ECDSA) to the list of known hosts.  
0.0.0.0: starting secondarynamenode, logging to /home/bala/Documents/sw/hadoop-2.7.0/logs/hadoop-bala-secondarynamenode-bala.out  
bala@bala:~/Documents/sw/hadoop-2.7.0$ sbin/start-yarn.sh  
starting yarn daemons  
starting resourcemanager, logging to /home/bala/Documents/sw/hadoop-2.7.0/logs/yarn-bala-resourcemanager-bala.out  
localhost: starting nodemanager, logging to /home/bala/Documents/sw/hadoop-2.7.0/logs/yarn-bala-nodemanager-bala.out  
bala@bala:~/Documents/sw/hadoop-2.7.0$ jps  
17078 DataNode  
18263 SecondaryNameNode  
20698 ResourceManager  
16860 NameNode  
20861 Jps  
20829 NodeManager  
bala@bala:~/Documents/sw/hadoop-2.7.0$
```

Step 9. Stopping Services

```
>sbin/stop-dfs.sh  
>sbin/stop-yarn.sh
```

```
(or)  
>sbin/stop-all.sh
```

Once you start the services after stopped means it shows only 4 services.

```
>jps  
12563 Jps
```

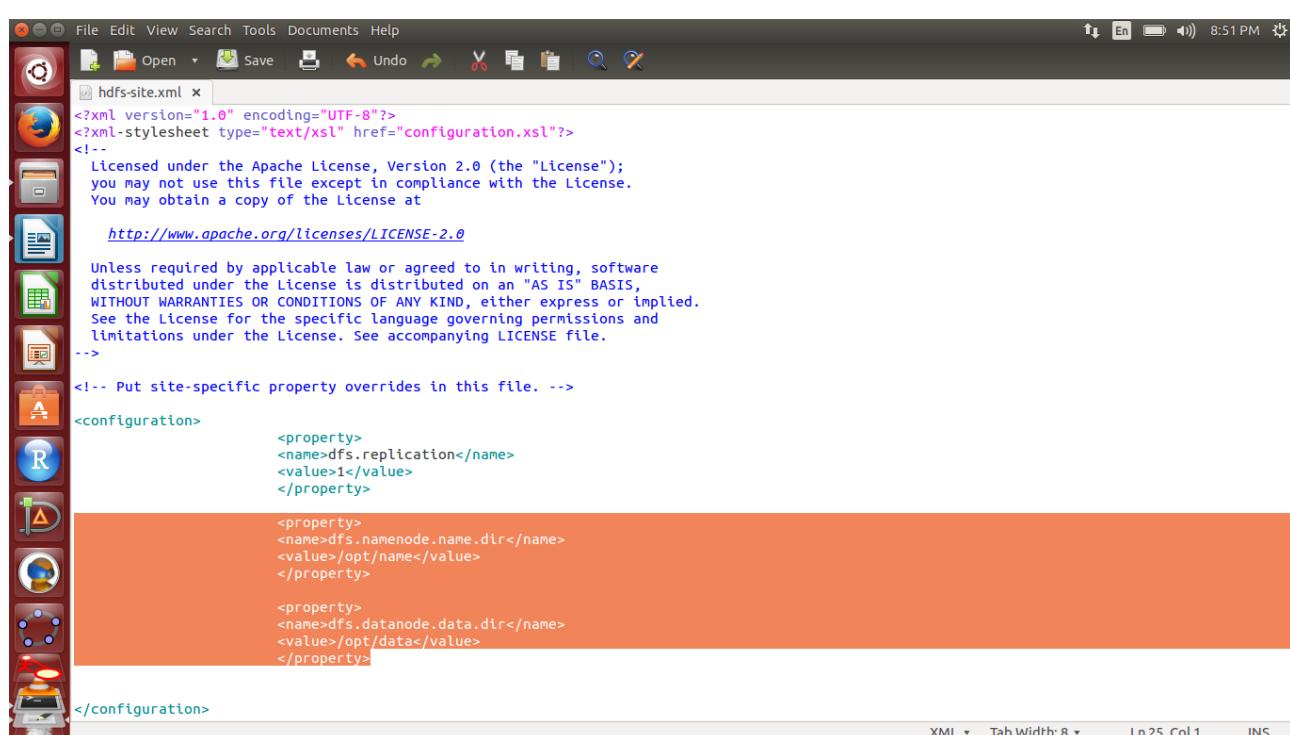
4036 ResourceManager
4172 NodeManager
3685 SecondaryNameNode

Step 10. only four services will run. To start datanode and name node we have to add some lines in **hdfs-site.xml**

In Terminal

```
$ cd $HADOOP_PREFIX/etc/hadoop  
$gedit hdfs-site.xml          (Paste the below lines)
```

```
<property>  
<name>dfs.namenode.name.dir</name>  
<value>/opt/name</value>  
</property>  
  
<property>  
<name>dfs.datanode.data.dir</name>  
<value>/opt/data</value>  
</property>
```



```
File Edit View Search Tools Documents Help  
Open Save Undo Redo Cut Copy Paste Find Replace  
8:51 PM  
hdfs-site.xml x  
<?xml version="1.0" encoding="UTF-8"?>  
<?xmlstylesheet type="text/xsl" href="configuration.xsl"?>  
<!--  
Licensed under the Apache License, Version 2.0 (the "License");  
you may not use this file except in compliance with the License.  
You may obtain a copy of the License at  
http://www.apache.org/licenses/LICENSE-2.0  
Unless required by applicable law or agreed to in writing, software  
distributed under the License is distributed on an "AS IS" BASIS,  
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
See the License for the specific language governing permissions and  
limitations under the License. See accompanying LICENSE file.  
-->  
<!-- Put site-specific property overrides in this file. -->  
<configuration>  
    <property>  
        <name>dfs.replication</name>  
        <value>1</value>  
    </property>  
    <property>  
        <name>dfs.namenode.name.dir</name>  
        <value>/opt/name</value>  
    </property>  
    <property>  
        <name>dfs.datanode.data.dir</name>  
        <value>/opt/data</value>  
    </property>  
</configuration>
```

Next do these procedures, for creating permanent log storage to namenode and datanode.

```
$ sudo mkdir /opt/name  
$ sudo mkdir /opt/data  
$ ls /opt/  
$ ls -l /opt/  ##To change the directory from root user to admin user  
$ sudo chown vrscet:vrscet -R /opt  (root should be replaced by your system  
username)  
$ ls -l /opt/
```

Step 11. Format the namenode

```
$ cd $HADOOP_PREFIX  
$ bin/hadoopnamenode -format
```

Step 12. Start services

```
$sbin/start-dfs.sh  
$sbin/start-yarn.sh  
$jps  
3200 DataNode  
12563 Jps  
4036 ResourceManager  
4172 NodeManager  
5158 NameNode  
3685 SecondaryNameNode
```

Step 13. To view in Browser (Open Firefox and enter the below address)

localhost:50070

localhost:8088

The screenshot shows a Firefox browser window titled "Namenode information - Mozilla Firefox". The address bar displays "localhost:50070/dfshealth.html#tab-overview". The main content area is titled "Overview 'localhost:9000' (active)". It contains a table with the following data:

Started:	Mon Jul 04 21:11:46 IST 2016
Version:	2.7.0, rd4c8d4d4d203c934e8074b31289a28724c0842cf
Compiled:	2015-04-10T18:40Z by jenkins from (detached from d4c8d4d)
Cluster ID:	CID-5bcaeb8e-89da-4dd6-a104-94ade0e21b65
Block Pool ID:	BP-24067461-127.0.1.1-1467646854273

Below the table, the "Summary" section includes the following status information:

- Security is off.
- Safemode is off.
- 1 files and directories, 0 blocks = 1 total filesystem object(s).
- Heap Memory used 37.17 MB of 65.57 MB Heap Memory. Max Heap Memory is 966.69 MB.
- Non Heap Memory used 45.86 MB of 46.46 MB Committed Non Heap Memory. Max Non Heap Memory is -1 B.

A message at the bottom states: "Firefox automatically sends some data to Mozilla so that we can improve your experience." with a "Choose What I Share" button.

All Applications - Mozilla Firefox

Ubuntu Start Page | Namenode information | All Applications

localhost:8088/cluster

Google

hadoop

All Applications

Cluster Metrics

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	Memory Total	Memory Reserved	VCores Used	VCores Total	VCores Reserved	Active Nodes	Decommissioned Nodes
0	0	0	0	0	0 B	8 GB	0 B	0	8	0	1	0

Scheduler Metrics

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

Show 20 entries

No data available in table

Showing 0 to 0 of 0 entries

Firefox automatically sends some data to Mozilla so that we can improve your experience.

Choose What I Share

The screenshot shows the Hadoop NameNode web interface running on port 8088. The main page title is "All Applications". On the left, there's a sidebar with icons for various Hadoop components like JobHistory, FileBrowser, and YARN. The main content area has two tables: "Cluster Metrics" and "Scheduler Metrics". The "Cluster Metrics" table shows zero applications across all categories and zero memory usage. The "Scheduler Metrics" table shows a Capacity Scheduler with memory allocation settings. Below these tables is a search bar and a message stating "No data available in table". At the bottom, there's a note about Firefox sending data to Mozilla and a "Choose What I Share" button.

Result:

Thus single node hadoop cluster has been successfully created.

Write a program to use the API's of Hadoop to interact with it

Aim:

To write a program for using the API's on hadoop and as well as to interact with it.

Procedure:

Step 1:

Start the hadoop services by giving the following command in terminal

\$ sbin/start-all.sh

\$ jps

Step 2:

Open web browser and open

localhost:50070

localhost:8088

Step 3:

Creating folder in web interface (HDFS) from terminal.

\$ bin/hadoop fs -mkdir /bala

Wait until the command executes.

Step 4:

Open the localhost:50070

Utilities --> Browse the filesystem.

An folder has been created which we had given in terminal

bin/hadoop ----> represents the location of hdfs

fs -----> file system

-mkdir -----> create a folder

/ -----> root in hdfs

bala -----> folder name

Step 5: Loading the data into the folder we created in hdfs

\$bin/hadoop fs -copyFromLocal /home/bala/Pictures /bala2

Open web browser and under utilities, browse the filesystem and check whether the content is moved

Browsing HDFS - Mozilla Firefox

Ubuntu Start Page x Browsing HDFS x All Applications x +

localhost:50070/explorer.html#/bala2

Google

Hadoop Overview Datanodes Snapshot Startup Progress Utilities

Browse Directory

/bala2

Go!

Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
-rw-r--r--	bala	supergroup	182.62 KB	4/7/2016 9:29:30 pm	1	128 MB	1.png
-rw-r--r--	bala	supergroup	151.64 KB	4/7/2016 9:29:31 pm	1	128 MB	10.png
-rw-r--r--	bala	supergroup	204.71 KB	4/7/2016 9:29:32 pm	1	128 MB	13.png
-rw-r--r--	bala	supergroup	157.95 KB	4/7/2016 9:29:32 pm	1	128 MB	14.png
-rw-r--r--	bala	supergroup	203.54 KB	4/7/2016 9:29:32 pm	1	128 MB	15.png
-rw-r--r--	bala	supergroup	314.49 KB	4/7/2016 9:29:32 pm	1	128 MB	16.png
-rw-r--r--	bala	supergroup	170.96 KB	4/7/2016 9:29:32 pm	1	128 MB	18.png
-rw-r--r--	bala	supergroup	169.05 KB	4/7/2016 9:29:33 pm	1	128 MB	19.png
-rw-r--r--	bala	supergroup	615.77 KB	4/7/2016 9:29:33 pm	1	128 MB	2.png
-rw-r--r--	bala	supergroup	236.27 KB	4/7/2016 9:29:33 pm	1	128 MB	21.png

Firefox automatically sends some data to Mozilla so that we can improve your experience. Choose What I Share

Step 6: Space took by datanode

Namenode information - Mozilla Firefox

Ubuntu Start Page x Namenode information x All Applications x +

localhost:50070/dfshealth.html#tab-datanode

Google

Hadoop Overview Datanodes Datanode Volume Failures Snapshot Startup Progress Utilities

Datanode Information

In operation

Node	Last contact	Admin State	Capacity	Used	Non DFS Used	Remaining	Blocks	Block pool used	Failed Volumes	Version
bala:50010 (127.0.0.1:50010)	0	In Service	225.26 GB	4.06 MB	169.54 GB	55.71 GB	18	4.06 MB (0%)	0	2.7.0

Decommissioning

Node	Last contact	Under replicated blocks	Blocks with no live replicas	Under Replicated Blocks In files under construction

Hadoop, 2014.

Firefox automatically sends some data to Mozilla so that we can improve your experience. Choose What I Share

The screenshot shows a Mozilla Firefox window with the address bar set to `http://bala:8042/node`. The main content area displays the Hadoop NodeManager interface. On the left, there is a vertical toolbar with various icons. The main panel has a title "hadoop" with a yellow elephant logo. A sidebar on the left lists "ResourceManager", "NodeManager" (which is expanded to show "Node Information", "List of Applications", and "List of Containers"), and "Tools". The central content area is titled "NodeManager information" and contains the following configuration details:

Total Vmem allocated for Containers	16.80 GB
Vmem enforcement enabled	true
Total Pmem allocated for Container	8 GB
Pmem enforcement enabled	true
Total VCores allocated for Containers	8
NodeHealthyStatus	true
LastNodeHealthTime	Mon Jul 04 21:34:46 IST 2016
NodeHealthReport	
Node Manager Version:	2.7.0 from d4c8d4d4d203c934e8074b31289a28724c0842cf by jenkins source checksum d6b55a4deb48efc41b01a735ba1e86 on 2015-04-10T18:48Z
Hadoop Version:	2.7.0 from d4c8d4d4d203c934e8074b31289a28724c0842cf by jenkins source checksum a9e90912c37a35c3195d23951fd18f on 2015-04-10T18:40Z

At the bottom of the browser window, there is a message about Firefox sending data to Mozilla and a "Choose What I Share" button.

Result:

Thus an API program has been developed for creating folder and copying files into it.

Write a wordcount program to demonstrate the use of Map and Reduce tasks

Aim:

To write a wordcount program for demonstrating the use of map and reduce task.

Procedure:

Step 1:

Write a map reduce program on java

Step 2:

Create a folder in HDFS by using the command

```
$ bin/hadoop fs -mkdir /bala2
```

Step 3:

Move the number of text file into the hdfs

```
$ bin/hadoop fs -copyFromLocal /home/bala/Downloads/data /bala
```

Step 4:

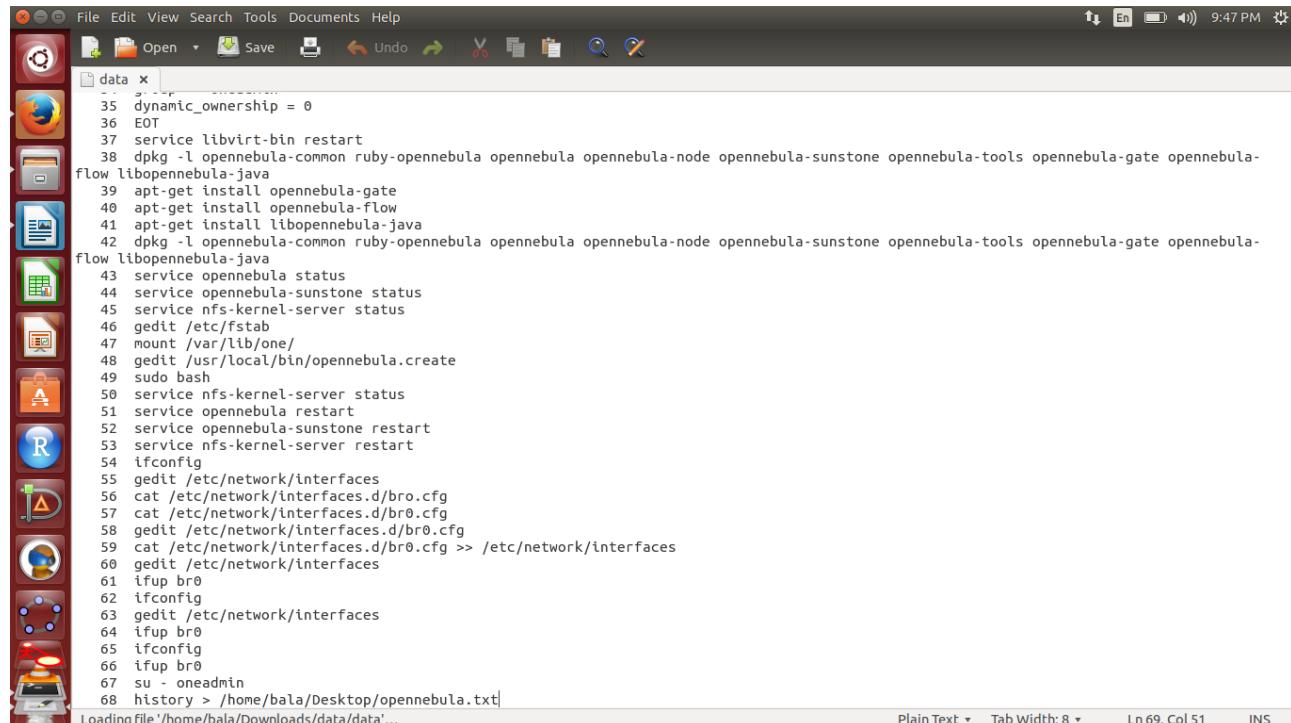
use the hadoop-mapreduce-examples-2.7.0.jar which is already available in hadoop.

Step 5:

Run the Mapreduce program by the following command.

```
$ bin/hadoop jar share/hadoop/mapreduce/hadoop-mapreduce-examples-2.7.0.jar wordcount /bala/data /output
```

Input file



```
data x
35 dynamic_ownership = 0
36 EOT
37 service libvirt-bin restart
38 dpkg -l opennebula-common ruby-opennebula opennebula opennebula-node opennebula-sunstone opennebula-tools opennebula-gate opennebula-flow libopennebula-java
39 apt-get install opennebula-gate
40 apt-get install opennebula-flow
41 apt-get install libopennebula-java
42 dpkg -l opennebula-common ruby-opennebula opennebula opennebula-node opennebula-sunstone opennebula-tools opennebula-gate opennebula-flow libopennebula-java
43 service opennebula status
44 service opennebula-sunstone status
45 service nfs-kernel-server status
46 gedit /etc/fstab
47 mount /var/lib/one/
48 gedit /usr/local/bin/opennebula.create
49 sudo bash
50 service nfs-kernel-server status
51 service opennebula restart
52 service opennebula-sunstone restart
53 service nfs-kernel-server restart
54 ifconfig
55 gedit /etc/network/interfaces
56 cat /etc/network/interfaces.d/br0.cfg
57 cat /etc/network/interfaces.d/br0.cfg
58 gedit /etc/network/interfaces.d/br0.cfg
59 cat /etc/network/interfaces.d/br0.cfg >> /etc/network/interfaces
60 gedit /etc/network/interfaces
61 ifup br0
62 ifconfig
63 gedit /etc/network/interfaces
64 ifup br0
65 ifconfig
66 ifup br0
67 su - oneadmin
68 history > /home/bala/Desktop/opennebula.txt|
```

Plain Text ▾ Tab Width: 8 ▾ Ln 69, Col 51 INS

Loading file '/home/bala/Downloads/data/data'...

Loaded file

Browsing HDFS - Mozilla Firefox

Ubuntu Start Page × Browsing HDFS × http://bala:8042/node × +

localhost:50070/explorer.html#/bala/data

Hadoop Overview Datanodes Snapshot Startup Progress Utilities

Browse Directory

/bala/data Go!

Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
-rw-r--r--	bala	supergroup	2.9 KB	4/7/2016 9:48:43 pm	1	128 MB	data

Hadoop, 2014.

Firefox automatically sends some data to Mozilla so that we can improve your experience. Choose What I Share

Word Count Program:

```
package org.myorg;

import java.io.IOException;
import java.util.*;

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

public class WordCount {

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

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

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

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

```

}

}

}

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

public void reduce(Text key, Iterator<IntWritable> values, Context context)
throws IOException, InterruptedException {
int sum =0;
while(values.hasNext()){
sum+= values.next().get();
}
context.write(key,new IntWritable(sum));
}
}

public static void main(String[] args) throws Exception {
Configuration conf =new Configuration();
Job job =new Job(conf,"wordcount");

job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);

job.setMapperClass(Map.class);
job.setReducerClass(Reduce.class);

job.setInputFormatClass(TextInputFormat.class);
job.setOutputFormatClass(TextOutputFormat.class);

FileInputFormat.addInputPath(job,new Path(args[0]));
FileOutputFormat.setOutputPath(job,new Path(args[1]));

job.waitForCompletion(true);
}
}

```

```

bala@bala: ~/Documents/sw/hadoop-2.7.0
bala@bala:~/Documents/sw/hadoop-2.7.0$ bin/hadoop fs -copyFromLocal /home/bala/Downloads/data /bala
bala@bala:~/Documents/sw/hadoop-2.7.0$ bin/hadoop jar share/hadoop/mapreduce/hadoop-mapreduce-examples-2.7.0.jar wordcount /bala/data /output
16/07/04 21:53:00 INFO client.RMProxy: Connecting to ResourceManager at /0.0.0.0:8032
16/07/04 21:53:08 INFO input.FileInputFormat: Total input paths to process : 1
16/07/04 21:53:10 INFO mapreduce.JobSubmitter: number of splits:1
16/07/04 21:53:12 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1467646969920_0001
16/07/04 21:53:16 INFO impl.YarnClientImpl: Submitted application application_1467646969920_0001
16/07/04 21:53:17 INFO mapreduce.Job: Running job: job_1467646969920_0001
16/07/04 21:53:12 INFO mapreduce.Job: Job job_1467646969920_0001 running in uber mode : false
16/07/04 21:55:12 INFO mapreduce.Job: map 0% reduce 0%
16/07/04 21:59:06 INFO mapreduce.Job: map 100% reduce 0%
16/07/04 22:00:43 INFO mapreduce.Job: map 100% reduce 100%
16/07/04 22:00:53 INFO mapreduce.Job: Job job_1467646969920_0001 completed successfully
16/07/04 22:01:02 INFO mapreduce.Job: Counters: 49
File System Counters
    FILE: Number of bytes read=2250
    FILE: Number of bytes written=233575
    FILE: Number of read operations=0
    FILE: Number of large read operations=0
    FILE: Number of write operations=0
    HDFS: Number of bytes read=3070
    HDFS: Number of bytes written=1596
    HDFS: Number of read operations=6
    HDFS: Number of large read operations=0
    HDFS: Number of write operations=2
Job Counters
    Launched map tasks=1
    Launched reduce tasks=1
    Data-local map tasks=1
    Total time spent by all maps in occupied slots (ms)=230369
    Total time spent by all reduces in occupied slots (ms)=79328
    Total time spent by all map tasks (ms)=230369
    Total time spent by all reduce tasks (ms)=79328
    Total vcore-seconds taken by all map tasks=230369
    Total vcore-seconds taken by all reduce tasks=79328
    Total megabyte-seconds taken by all map tasks=235897856
    Total megabyte-seconds taken by all reduce tasks=81231872
Map-Reduce Framework
    Map input records=69
    Map output records=299

```

Executing Map reduce program

Open Localhost --->ouput folder ----> open

The screenshot shows a Mozilla Firefox window titled "Browsing HDFS - Mozilla Firefox". The address bar shows "localhost:50070/explorer.html#/output". The main content area displays a "Browse Directory" page for the "/output" directory. A modal dialog box is open, titled "File information - part-r-00000", showing details about a specific file block. The dialog includes fields for "Block information" (set to "Block 0"), "Block ID" (1073741850), "Block Pool ID" (BP-24067461-127.0.1.1-1467646854273), "Generation Stamp" (1026), "Size" (1596), and "Availability" (bala). To the right of the dialog, a table lists two blocks: one 128 MB block named "_SUCCESS" and another 128 MB block named "part-r-00000". At the bottom of the dialog is a "Close" button.

Block Size	Name
128 MB	_SUCCESS
128 MB	part-r-00000

Browsing HDFS - Mozilla Firefox

Ubuntu Start Page x Browsing HDFS x http://bala:8042/node x +

localhost:50070/explorer.html#/output

Google

Hadoop Overview Datanodes Snapshot Startup Progress Utilities

File information - part-r-00000

Download

/output

Block information - Block 0

Block ID: 1073741850
Block Pool ID: BP-24067461-127.0.1.1-1467646854273
Generation Stamp: 1026
Size: 1596
Availability:
• bala

Block Size Name
128 MB _SUCCESS
128 MB part-r-00000

Close

localhost:50070/webhdfs/v1/output/part-r-00000?op=OPEN

Choose What I Share

Output :

```
part-r-00000 (~/Downloads) - gedit
part-r-00000 x
Big      1
EOT      2
Government 1
Researchers 1
add      2
apt-get  6
apt-key  2
are      1
area     2
bash     5
bitg     1
br0      3
bridge-utils 1
cat      4
cd      1
contribution 1
data     2
dpkg     3
dynamic_ownership 1
echo     2
emerging 1
expecting 1
from     1
gedit    9
grep     3
group    1
has      1
history  2
http://downloads.opennebula.org/repo/4.12/Ubuntu/14.04/ 2
http://downloads.opennebula.org/repo/Ubuntu/repo.key 2
ifconfig 3
ifup     3
in      1
install 5
is      2
libopennebula-java 4
```

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Result:

Thus the wordcount program has been executed successfully.

Mount the one node Hadoop cluster using FUSE

AIM

To mount the one node Hadoop cluster using FUSE and access files on HDFS in the same way as we do on Linux operating systems.

PROCEDURE

FUSE (Filesystem in Userspace) enables you to write a normal user application as a bridge for a traditional filesystem interface.

The hadoop-hdfs-fuse package enables you to use your HDFS cluster as if it were a traditional filesystem on Linux. It is assumed that you have a working HDFS cluster and know the hostname and port that your NameNode exposes.

To install fuse-dfs on Ubuntu systems:

```
hdpuser@jiju-PC:~$ wget http://archive.cloudera.com/cdh5/one-click-
install/trusty/amd64/cdh5-repository_1.0_all.deb
--2016-07-24 09:10:33-- http://archive.cloudera.com/cdh5/one-click-
install/trusty/amd64/cdh5-repository_1.0_all.deb
Resolving archive.cloudera.com (archive.cloudera.com)... 151.101.8.167
Connecting to archive.cloudera.com (archive.cloudera.com)|151.101.8.167|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 3508 (3.4K) [application/x-debian-package]
Saving to: 'cdh5-repository_1.0_all.deb'

100%[=====] 3,508 --.-K/s in 0.09s
```

```
2016-07-24 09:10:34 (37.4 KB/s) - 'cdh5-repository_1.0_all.deb' saved [3508/3508]
```

```
hdpuser@jiju-PC:~$ sudo dpkg -i cdh5-repository_1.0_all.deb
```

```
Selecting previously unselected package cdh5-repository.
(Reading database ... 170607 files and directories currently installed.)
Preparing to unpack cdh5-repository_1.0_all.deb ...
Unpacking cdh5-repository (1.0) ...
Setting up cdh5-repository (1.0) ...
gpg: keyring '/etc/apt/secreng.gpg' created
gpg: keyring '/etc/apt/trusted.gpg.d/cloudera-cdh5.gpg' created
gpg: key 02A818DD: public key "Cloudera Apt Repository" imported
gpg: Total number processed: 1
gpg:      imported: 1
```

```
hdpuser@jiju-PC:~$ sudo apt-get update
```

```
hdpuser@jiju-PC:~$ sudo apt-get install hadoop-hdfs-fuse
Reading package lists... Done
Building dependency tree
Reading state information... Done
```

The following extra packages will be installed:

avro-libs bigtop-jsvc bigtop-utils curl hadoop hadoop-0.20-mapreduce
hadoop-client hadoop-hdfs hadoop-mapreduce hadoop-yarn libcurl3 libhdfs0
parquet parquet-format zookeeper

The following NEW packages will be installed:

avro-libs bigtop-jsvc bigtop-utils curl hadoop hadoop-0.20-mapreduce
hadoop-client hadoop-hdfs hadoop-hdfs-fuse hadoop-mapreduce hadoop-yarn
libhdfs0 parquet parquet-format zookeeper

The following packages will be upgraded:

 libcurl3

1 upgraded, 15 newly installed, 0 to remove and 702 not upgraded.

Need to get 222 MB of archives.

After this operation, 267 MB of additional disk space will be used.

Do you want to continue? [Y/n] Y

Get:1 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libcurl3 amd64 7.35.0-1ubuntu2.7 [173 kB]

Get:2 https://archive.cloudera.com/cdh5/ubuntu/trusty/amd64/cdh/ trusty-cdh5/contrib
avro-libs all 1.7.6+cdh5.8.0+112-1.cdh5.8.0.p0.74~trusty-cdh5.8.0 [47.0 MB]

Get:3 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main curl amd64 7.35.0-1ubuntu2.7 [123 kB]

Get:4 https://archive.cloudera.com/cdh5/ubuntu/trusty/amd64/cdh/ trusty-cdh5/contrib
parquet-format all 2.1.0+cdh5.8.0+12-1.cdh5.8.0.p0.70~trusty-cdh5.8.0 [479 kB]

Get:5 https://archive.cloudera.com/cdh5/ubuntu/trusty/amd64/cdh/ trusty-cdh5/contrib
parquet all 1.5.0+cdh5.8.0+174-1.cdh5.8.0.p0.71~trusty-cdh5.8.0 [27.1 MB]

Get:6 https://archive.cloudera.com/cdh5/ubuntu/trusty/amd64/cdh/ trusty-cdh5/contrib
hadoop all 2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0 [28.2 MB]

Get:7 https://archive.cloudera.com/cdh5/ubuntu/trusty/amd64/cdh/ trusty-cdh5/contrib
libhdfs0 amd64 2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0 [320 kB]

Get:8 https://archive.cloudera.com/cdh5/ubuntu/trusty/amd64/cdh/ trusty-cdh5/contrib
hadoop-hdfs-fuse amd64 2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0 [317 kB]

Fetched 222 MB in 3min 28s (1,064 kB/s)

(Reading database ... 170612 files and directories currently installed.)

Preparing to unpack .../libcurl3_7.35.0-1ubuntu2.7_amd64.deb ...

Unpacking libcurl3:amd64 (7.35.0-1ubuntu2.7) over (7.35.0-1ubuntu2) ...

Selecting previously unselected package curl.

Preparing to unpack .../curl_7.35.0-1ubuntu2.7_amd64.deb ...

Unpacking curl (7.35.0-1ubuntu2.7) ...

Selecting previously unselected package avro-libs.

Preparing to unpack .../avro-libs_1.7.6+cdh5.8.0+112-1.cdh5.8.0.p0.74~trusty-cdh5.8.0_all.deb ...

Unpacking avro-libs (1.7.6+cdh5.8.0+112-1.cdh5.8.0.p0.74~trusty-cdh5.8.0) ...

Selecting previously unselected package bigtop-utils.

Preparing to unpack .../bigtop-utils_0.7.0+cdh5.8.0+0-1.cdh5.8.0.p0.72~trusty-cdh5.8.0_all.deb ...

Unpacking bigtop-utils (0.7.0+cdh5.8.0+0-1.cdh5.8.0.p0.72~trusty-cdh5.8.0) ...

Selecting previously unselected package bigtop-jsvc.

Preparing to unpack .../bigtop-jsvc_0.6.0+cdh5.8.0+847-1.cdh5.8.0.p0.74~trusty-cdh5.8.0_amd64.deb ...

Unpacking bigtop-jsvc (0.6.0+cdh5.8.0+847-1.cdh5.8.0.p0.74~trusty-cdh5.8.0) ...

Selecting previously unselected package zookeeper.

```
Preparing to unpack .../zookeeper_3.4.5+cdh5.8.0+94-1.cdh5.8.0.p0.76~trusty-cdh5.8.0_all.deb ...
Unpacking zookeeper (3.4.5+cdh5.8.0+94-1.cdh5.8.0.p0.76~trusty-cdh5.8.0) ...
Selecting previously unselected package parquet-format.
Preparing to unpack .../parquet-format_2.1.0+cdh5.8.0+12-1.cdh5.8.0.p0.70~trusty-cdh5.8.0_all.deb ...
Unpacking parquet-format (2.1.0+cdh5.8.0+12-1.cdh5.8.0.p0.70~trusty-cdh5.8.0) ...
Selecting previously unselected package hadoop-yarn.
Preparing to unpack .../hadoop-yarn_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_all.deb ...
Unpacking hadoop-yarn (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...
Selecting previously unselected package hadoop-mapreduce.
Preparing to unpack .../hadoop-mapreduce_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_all.deb ...
Unpacking hadoop-mapreduce (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...
Selecting previously unselected package hadoop-hdfs.
Preparing to unpack .../hadoop-hdfs_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_all.deb ...
Unpacking hadoop-hdfs (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...
Selecting previously unselected package hadoop-0.20-mapreduce.
Preparing to unpack .../hadoop-0.20-mapreduce_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_amd64.deb ...
Unpacking hadoop-0.20-mapreduce (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0)
...
Selecting previously unselected package hadoop-client.
Preparing to unpack .../hadoop-client_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_all.deb ...
Unpacking hadoop-client (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...
Selecting previously unselected package parquet.
Preparing to unpack .../parquet_1.5.0+cdh5.8.0+174-1.cdh5.8.0.p0.71~trusty-cdh5.8.0_all.deb ...
Unpacking parquet (1.5.0+cdh5.8.0+174-1.cdh5.8.0.p0.71~trusty-cdh5.8.0) ...
Selecting previously unselected package hadoop.
Preparing to unpack .../hadoop_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_all.deb ...
Unpacking hadoop (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...
Selecting previously unselected package libhdfs0.
Preparing to unpack .../libhdfs0_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_amd64.deb ...
Unpacking libhdfs0 (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...
Selecting previously unselected package hadoop-hdfs-fuse.
Preparing to unpack .../hadoop-hdfs-fuse_2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0_amd64.deb ...
Unpacking hadoop-hdfs-fuse (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...
Processing triggers for man-db (2.6.7.1-1) ...
Setting up libcurl3:amd64 (7.35.0-1ubuntu2.7) ...
Setting up curl (7.35.0-1ubuntu2.7) ...
Setting up avro-libs (1.7.6+cdh5.8.0+112-1.cdh5.8.0.p0.74~trusty-cdh5.8.0) ...
Setting up bigtop-utils (0.7.0+cdh5.8.0+0-1.cdh5.8.0.p0.72~trusty-cdh5.8.0) ...
Setting up bigtop-jsvc (0.6.0+cdh5.8.0+847-1.cdh5.8.0.p0.74~trusty-cdh5.8.0) ...
Setting up zookeeper (3.4.5+cdh5.8.0+94-1.cdh5.8.0.p0.76~trusty-cdh5.8.0) ...
```

```
update-alternatives: using /etc/zookeeper/conf.dist to provide /etc/zookeeper/conf  
(zookeeper-conf) in auto mode  
Setting up parquet-format (2.1.0+cdh5.8.0+12-1.cdh5.8.0.p0.70~trusty-cdh5.8.0) ...  
Setting up parquet (1.5.0+cdh5.8.0+174-1.cdh5.8.0.p0.71~trusty-cdh5.8.0) ...  
Setting up hadoop (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...  
update-alternatives: using /etc/hadoop/conf.empty to provide /etc/hadoop/conf (hadoop-  
conf) in auto mode  
Setting up hadoop-yarn (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...  
Setting up libhdfs0 (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...  
Setting up hadoop-mapreduce (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...  
Setting up hadoop-hdfs (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...  
Setting up hadoop-0.20-mapreduce (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0)  
...  
Setting up hadoop-client (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...  
Setting up hadoop-hdfs-fuse (2.6.0+cdh5.8.0+1601-1.cdh5.8.0.p0.93~trusty-cdh5.8.0) ...  
Processing triggers for libc-bin (2.19-0ubuntu6) ...
```

```
hdpuser@jiju-PC:~$ sudo mkdir -p /home/hdpuser/hdfs  
[sudo] password for hdpuser:
```

```
hdpuser@jiju-PC:~$ sudo hadoop-fuse-dfs dfs://localhost:54310 /home/hdpuser/hdfs/
```

```
INFO /data/jenkins/workspace/generic-package-ubuntu64-14-04/CDH5.8.0-Packaging-  
Hadoop-2016-07-12_15-43-10/hadoop-2.6.0+cdh5.8.0+1601-  
1.cdh5.8.0.p0.93~trusty/hadoop-hdfs-project/hadoop-hdfs/src/main/native/fuse-  
dfs/fuse_options.c:164 Adding FUSE arg /home/hdpuser/hdfs/
```

```
hdpuser@jiju-PC:~$ ls /home/hdpuser/hdfs/
```

```
hdpuser@jiju-PC:~$ mkdir /home/hdpuser/hdfs/new
```

Permission	Owner	Group	Size	Replication	Block Size	Name
drwxr-xr-x	hdpuser	supergroup	0 B	0	0 B	new

```
hdpuser@jiju-PC:~$ ls /home/hdpuser/hdfs/  
new
```

```
hdpuser@jiju-PC:~$ mkdir /home/hdpuser/hdfs/example
```

```
hdpuser@jiju-PC:~$ ls -l /home/hdpuser/hdfs/
total 8
drwxr-xr-x 2 hdpuser 99 4096 Jul 24 15:28 example
drwxr-xr-x 2 hdpuser 99 4096 Jul 24 15:19 new
```

Permission	Owner	Group	Size	Replication	Block Size	Name
drwxr-xr-x	hdpuser	supergroup	0 B	0	0 B	example
drwxr-xr-x	hdpuser	supergroup	0 B	0	0 B	new

To Unmount the file system

Using umount command the filesystem can be unmounted.

```
hdpuser@jiju-PC:~$ sudo umount /home/hdpuser/hdfs
```

NOTE: You can now add a permanent HDFS mount which persists through reboots.

To add a system mount:

Open /etc/fstab and add lines to the bottom similar to these: (sudo vi /etc/fstab)

```
hadoop-fuse-dfs#dfs://<name_node_hostname>:<namenode_port><mount_point>
fuse allow_other,usetrash,rw 2 0
```

For example:

```
sudo hadoop-fuse-dfs#dfs://localhost:54310 /home/hdpuser/hdfs fuse
allow_other,usetrash,rw 2 0
```

Test to make sure everything is working properly:

```
$ mount <mount_point>
```

```
hdpuser@jiju-PC:~$ sudo mount /home/hdpuser/hdfs
```

Result:

Thus fuse has been installed successfully.