

Cloud Computing Course Project Part 1

Cloudification & Migration

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Introduction

In this project, we use the ArchNav application as a complex business cloudification and migration case study.

We first deployed our ArchNav applications without scalability running on our local environment. After confirming everything is going properly, we decided to migrate our application to cloud computing platform. The most challenging parts are cloudification and migration since we firstly deployed it on local machine.

In this report, we illustrate all steps from installation to cloudification with screenshots.

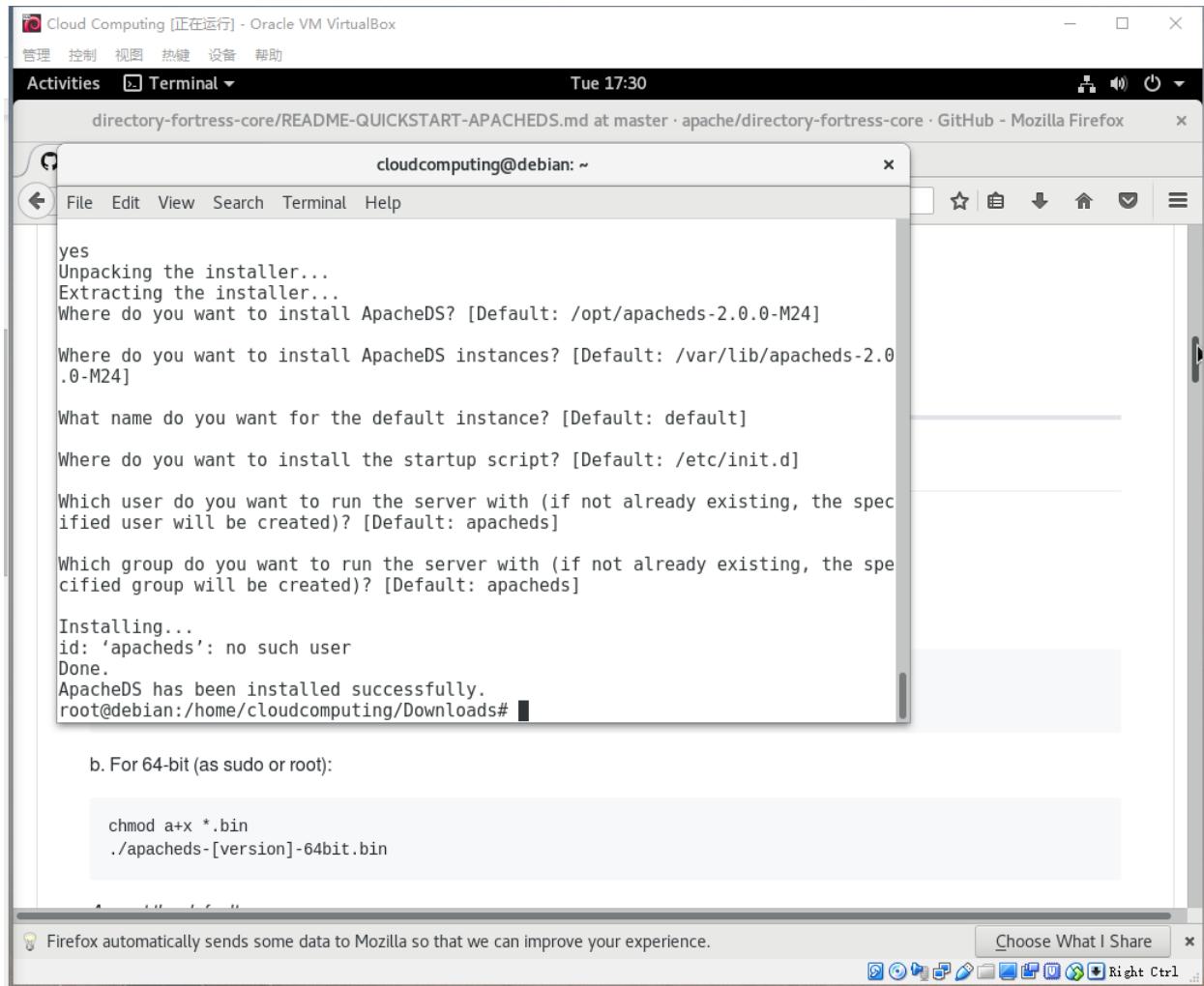
Requirements

1. **Debian 9.4:** Debian is a free operating system (OS) for your computer. An operating system is the set of basic programs and utilities that make your computer run.
2. **Windows 10:** Windows 10 is an operating system from Microsoft Corporation for servers, desktop PCs, laptops, tablets, phones, and other connected devices.
3. **GlassFish:** GlassFish is the Open Source Java EE Reference Implementation; as such, we welcome external contributions.
4. **Java 7:** Java technology allows you to work and play in a secure computing environment.
5. **Apache Fortress:** A standards-based access management system, written in Java, supports ANSI INCITS 359 RBAC and more.
6. **Maven:** Apache Maven is a software project management and comprehension tool.
7. **MySQL:** MySQL is an open-source relational database management system (RDBMS).
8. **ApacheDS:** ApacheDS is an extensible and embeddable directory server entirely written in Java, which has been certified LDAPv3 compatible by the Open Group.
9. **Vim:** Vim is a highly configurable text editor for efficiently creating and changing any kind of text
10. **JDeveloper:** Oracle JDeveloper is a free integrated development environment that simplifies the development of Java-based applications addressing every step of the application lifecycle.

Step 1: Install ApacheDS and Fortress

1. Download and install Apache Directory Server

```
chmod a+x *.bin  
./apacheds-[version]-64bit.bin
```



The screenshot shows a terminal window titled "Cloud Computing [正在运行] - Oracle VM VirtualBox". The window title bar includes "管理 控制 视图 热键 设备 帮助" and "Activities Terminal". The status bar shows "Tue 17:30". The terminal content is as follows:

```
cloudcomputing@debian: ~  
File Edit View Search Terminal Help  
  
yes  
Unpacking the installer...  
Extracting the installer...  
Where do you want to install ApacheDS? [Default: /opt/apacheds-2.0.0-M24]  
Where do you want to install ApacheDS instances? [Default: /var/lib/apacheds-2.0.  
.0-M24]  
What name do you want for the default instance? [Default: default]  
Where do you want to install the startup script? [Default: /etc/init.d]  
Which user do you want to run the server with (if not already existing, the spec  
ified user will be created)? [Default: apacheds]  
Which group do you want to run the server with (if not already existing, the spe  
cified group will be created)? [Default: apacheds]  
Installing...  
id: 'apacheds': no such user  
Done.  
ApacheDS has been installed successfully.  
root@debian:/home/cloudcomputing/Downloads#
```

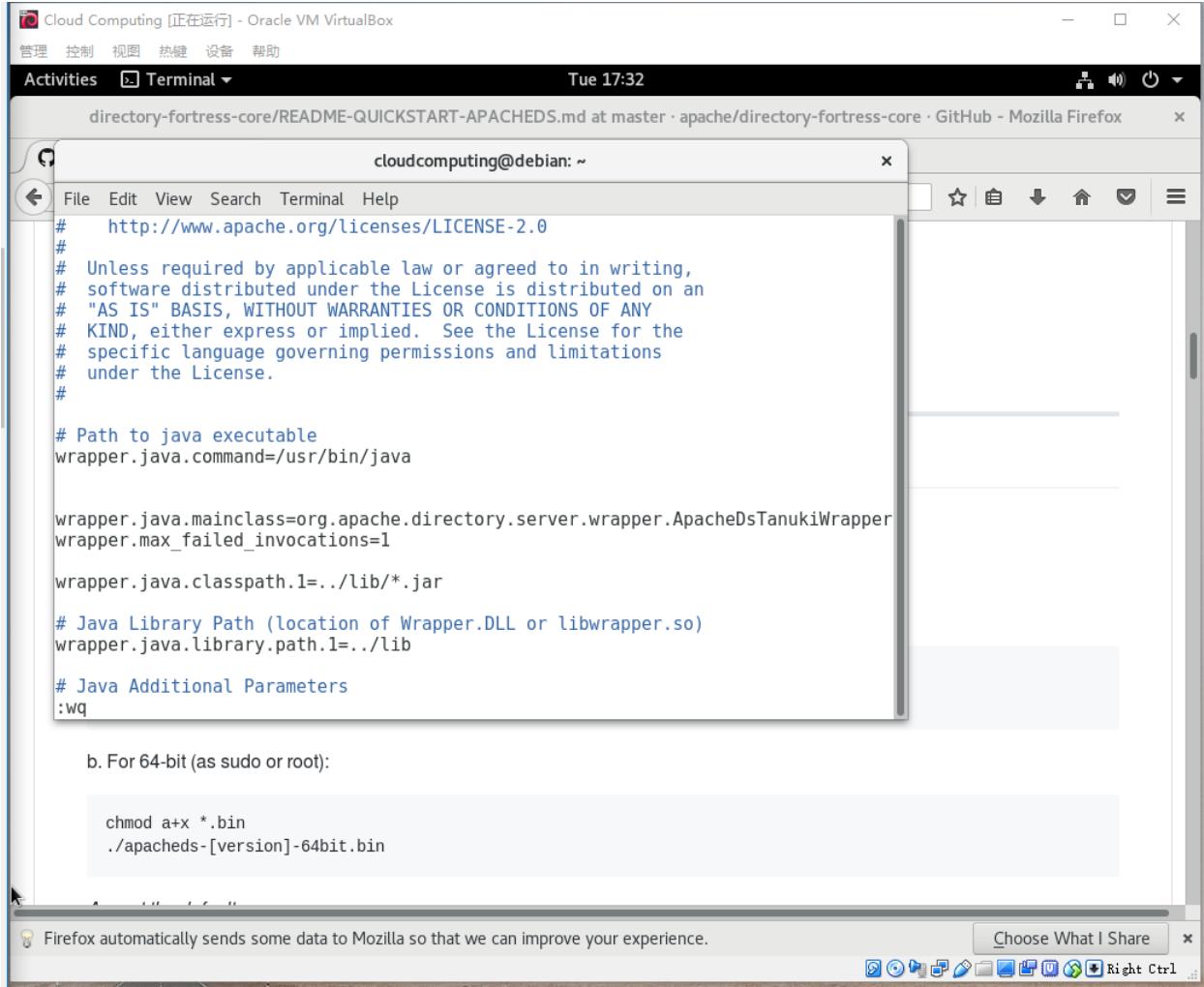
b. For 64-bit (as sudo or root):

```
chmod a+x *.bin  
./apacheds-[version]-64bit.bin
```

At the bottom of the terminal window, there is a Firefox status bar message: "Firefox automatically sends some data to Mozilla so that we can improve your experience." and "Choose What I Share".

2. Edit ApacheDS conf file

```
sudo vi /opt/apacheds-[version]/conf/wrapper.conf
```



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "cloudcomputing@debian: ~". The command "sudo vi /opt/apacheds-[version]/conf/wrapper.conf" has been run, and the file content is displayed in the terminal:

```
# 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.
#
# Path to java executable
wrapper.java.command=/usr/bin/java

wrapper.java.mainclass=org.apache.directory.server.wrapper.ApacheDsTanukiWrapper
wrapper.max_failed_invocations=1

wrapper.java.classpath.1=../lib/*.jar

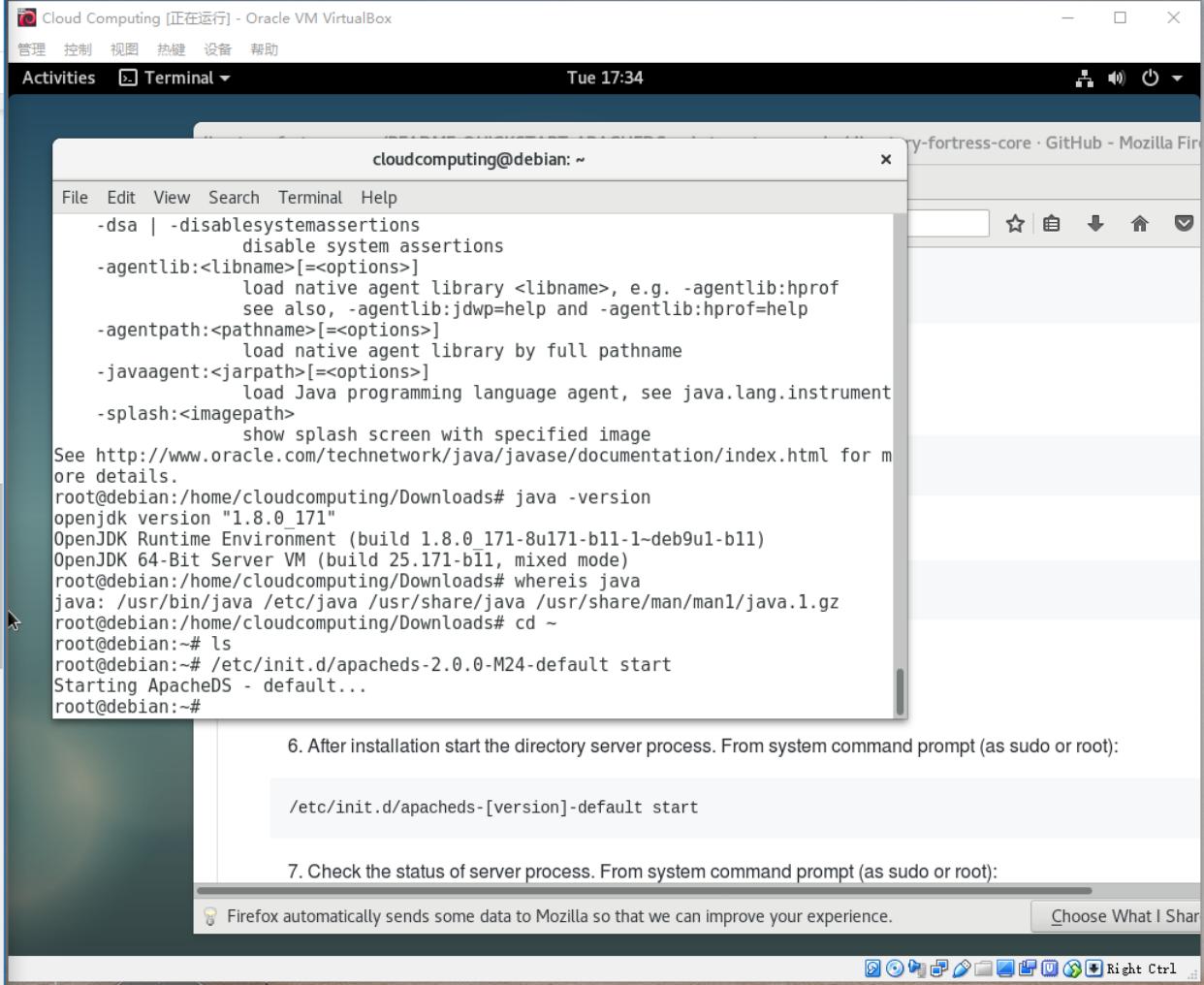
# Java Library Path (location of Wrapper.DLL or libwrapper.so)
wrapper.java.library.path.1=../lib

# Java Additional Parameters
:wq
```

Below the terminal window, there is a Firefox browser window. A status bar message at the bottom of the Firefox window reads: "Firefox automatically sends some data to Mozilla so that we can improve your experience." To the right of this message is a "Choose What I Share" button.

3. Start the directory server process

```
/etc/init.d/apacheds-[version]-default start
```



The screenshot shows a terminal window titled "Activities Terminal" running on a Debian system. The window displays the following command-line session:

```
cloudcomputing@debian: ~
File Edit View Search Terminal Help
-dsa | -disablesystemassertions
    disable system assertions
-agentlib:<libname>[=<options>]
    load native agent library <libname>, e.g. -agentlib:hprof
    see also, -agentlib:jdwp=help and -agentlib:hprof=help
-agentpath:<pathname>[=<options>]
    load native agent library by full pathname
-javaagent:<jarpath>[=<options>]
    load Java programming language agent, see java.lang.instrument
-splash:<imagepath>
    show splash screen with specified image
See http://www.oracle.com/technetwork/java/javase/documentation/index.html for more details.
root@debian:/home/cloudcomputing/Downloads# java -version
openjdk version "1.8.0_171"
OpenJDK Runtime Environment (build 1.8.0_171-8u171-b11-1~deb9u1-b11)
OpenJDK 64-Bit Server VM (build 25.171-b11, mixed mode)
root@debian:/home/cloudcomputing/Downloads# whereis java
java: /usr/bin/java /etc/java /usr/share/java /usr/share/man/man1/java.1.gz
root@debian:/home/cloudcomputing/Downloads# cd ~
root@debian:~# ls
root@debian:~# /etc/init.d/apacheds-2.0.0-M24-default start
Starting ApacheDS - default...
root@debian:~#
```

Below the terminal window, there are two numbered instructions:

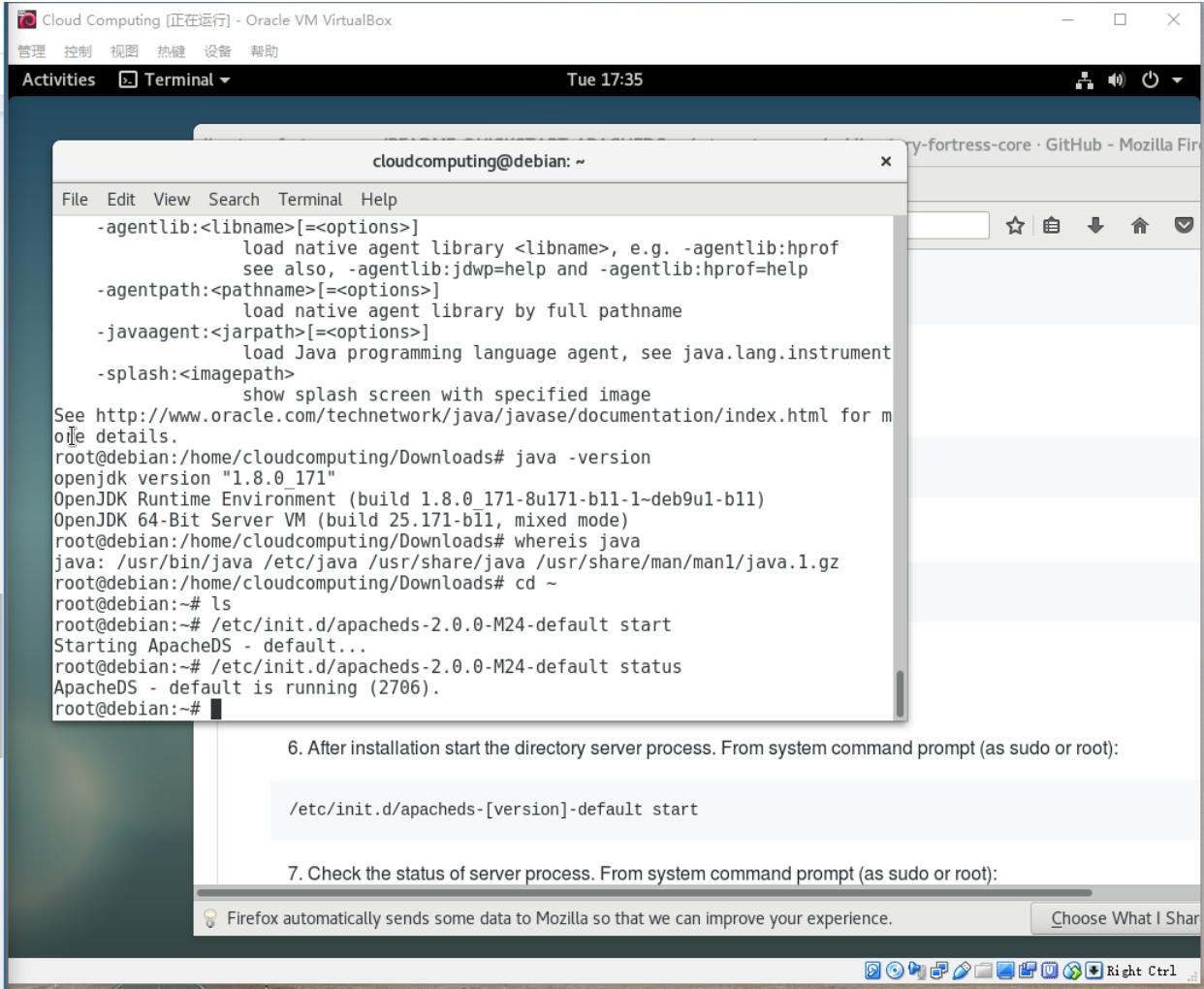
6. After installation start the directory server process. From system command prompt (as sudo or root):

```
/etc/init.d/apacheds-[version]-default start
```
7. Check the status of server process. From system command prompt (as sudo or root):

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

4. Check the status

```
/etc/init.d/apacheds-[version]-default status
```



The screenshot shows a terminal window titled "Terminal" running on a Debian system. The window title bar says "Cloud Computing [正在运行] - Oracle VM VirtualBox". The terminal content is as follows:

```
cloudcomputing@debian: ~
File Edit View Search Terminal Help
-agentlib:<libname>[=<options>]
    load native agent library <libname>, e.g. -agentlib:hprof
    see also, -agentlib:jdw=help and -agentlib:hprof=help
-agentpath:<pathname>[=<options>]
    load native agent library by full pathname
-javaagent:<jarpath>[=<options>]
    load Java programming language agent, see java.lang.instrument
-splash:<imagepath>
    show splash screen with specified image
See http://www.oracle.com/technetwork/java/javase/documentation/index.html for more details.
root@debian:/home/cloudcomputing/Downloads# java -version
openjdk version "1.8.0_171"
OpenJDK Runtime Environment (build 1.8.0_171-8u171-b11-1~deb9u1-b11)
OpenJDK 64-Bit Server VM (build 25.171-b11, mixed mode)
root@debian:/home/cloudcomputing/Downloads# whereis java
java: /usr/bin/java /etc/java /usr/share/java /usr/share/man/man1/java.1.gz
root@debian:/home/cloudcomputing/Downloads# cd ~
root@debian:~# ls
root@debian:~# /etc/init.d/apacheds-2.0.0-M24-default start
Starting ApacheDS - default...
root@debian:~# /etc/init.d/apacheds-2.0.0-M24-default status
ApacheDS - default is running (2706).
root@debian:~#
```

Below the terminal window, there are two numbered steps:

6. After installation start the directory server process. From system command prompt (as sudo or root):
`/etc/init.d/apacheds-[version]-default start`
7. Check the status of server process. From system command prompt (as sudo or root):

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

5. Download the package from git

```
git clone --branch 2.0.0  
https://git-wip-us.apache.org/repos/asf/directory-fortress-core.git  
cd directory-fortress-core
```

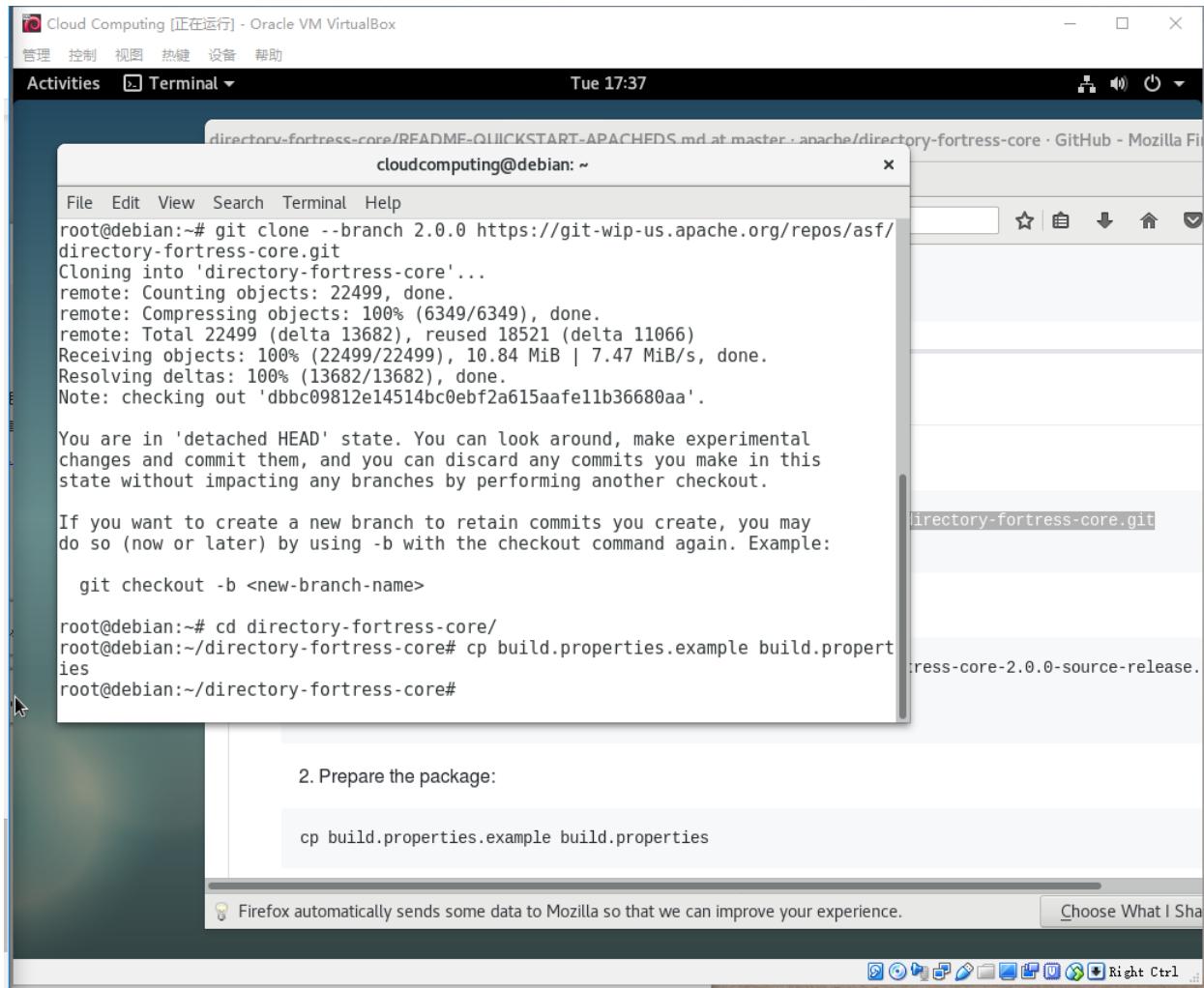
The screenshot shows a terminal window titled "Cloud Computing [正在运行] - Oracle VM VirtualBox". The window title bar includes "管理 控制 视图 热键 设备 帮助" and the date "Tue 17:36". The terminal window has tabs: "Activities" and "Terminal". The main pane displays the following terminal session:

```
directory-fortress-core/README-QUICKSTART-APACHEFS.md at master · apache/directory-fortress-core · GitHub - Mozilla Firefox  
cloudcomputing@debian: ~  
File Edit View Terminal Help  
root@debian:~# git clone --branch 2.0.0 https://git-wip-us.apache.org/repos/asf/directory-fortress-core.git  
Cloning into 'directory-fortress-core'...  
remote: Counting objects: 22499, done.  
remote: Compressing objects: 100% (6349/6349), done.  
remote: Total 22499 (delta 13682), reused 18521 (delta 11066).  
Receiving objects: 100% (22499/22499), 10.84 MiB | 7.47 MiB/s, done.  
Resolving deltas: 100% (13682/13682), done.  
Note: checking out 'dbbc09812e14514bc0ebf2a615aafellb36680aa'.  
  
You are in 'detached HEAD' state. You can look around, make experimental  
changes and commit them, and you can discard any commits you make in this  
state without impacting any branches by performing another checkout.  
  
If you want to create a new branch to retain commits you create, you may  
do so (now or later) by using -b with the checkout command again. Example:  
  
git checkout -b <new-branch-name>  
root@debian:~# cd directory-fortress-core/  
root@debian:~/directory-fortress-core#
```

The terminal window is part of a desktop environment with a dark theme. A Firefox browser window is visible in the background, showing a message about sending data to Mozilla. The bottom of the screen shows a dock with various icons.

6. Prepare the package

```
cp build.properties.example build.properties
```

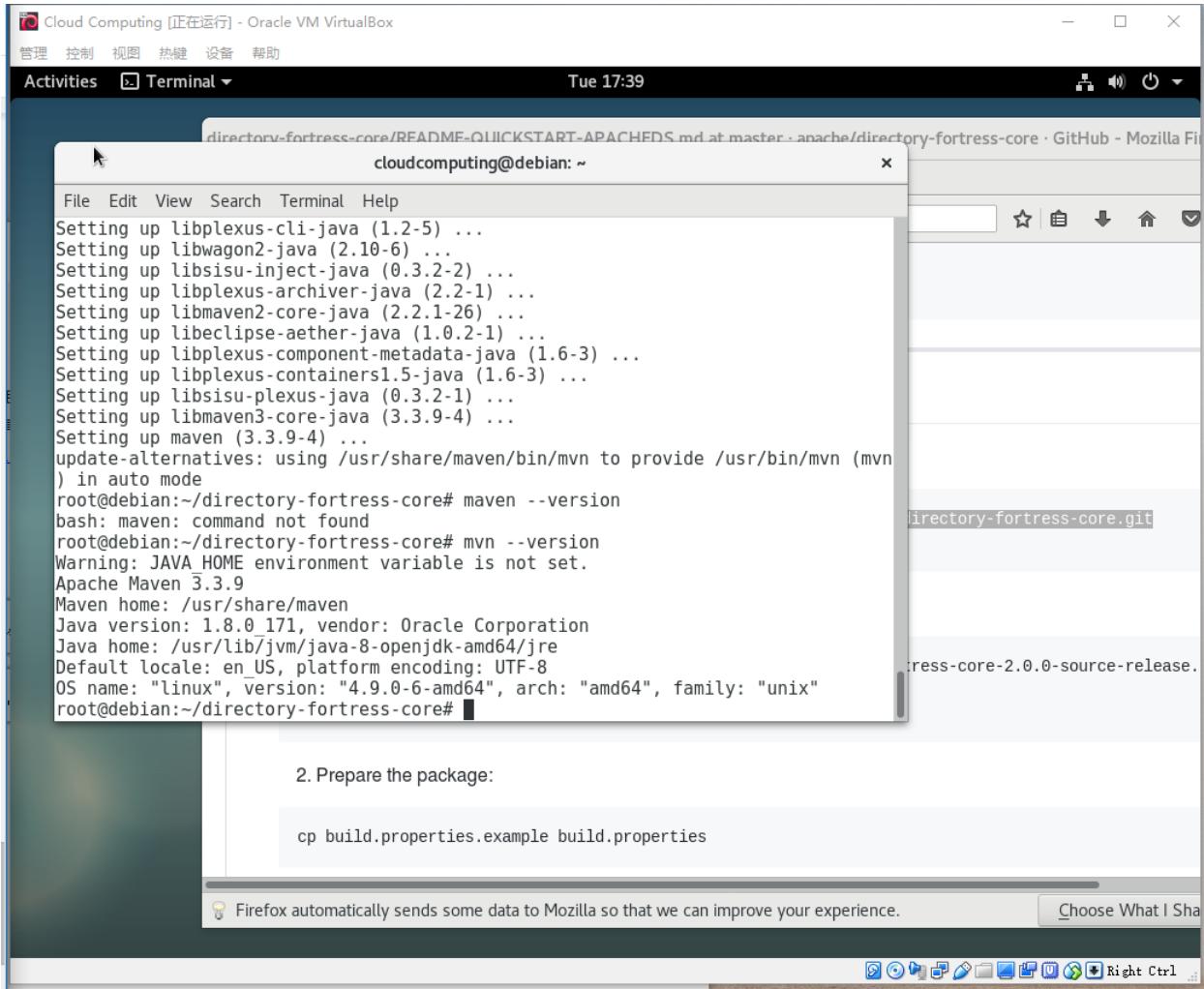


2. Prepare the package:

```
cp build.properties.example build.properties
```

7. Install Maven

Apt install maven



```
Cloud Computing [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
Activities Terminal ▾ Tue 17:39
directory-fortress-core/README-QUICKSTART-APACHEFS.md at master · apache/directory-fortress-core · GitHub - Mozilla Firefox
clouddcomputing@debian: ~
File Edit View Terminal Help
Setting up libplexus-cli-java (1.2-5) ...
Setting up libwagon2-java (2.10-6) ...
Setting up libsisu-inject-java (0.3.2-2) ...
Setting up libplexus-archiver-java (2.2-1) ...
Setting up libmaven2-core-java (2.2.1-26) ...
Setting up libeclipse-aether-java (1.0.2-1) ...
Setting up libplexus-component-metadata-java (1.6-3) ...
Setting up libplexus-containers1.5-java (1.6-3) ...
Setting up libsisu-plexus-java (0.3.2-1) ...
Setting up libmaven3-core-java (3.3.9-4) ...
Setting up maven (3.3.9-4) ...
update-alternatives: using /usr/share/maven/bin/mvn to provide /usr/bin/mvn (mvn)
) in auto mode
root@debian:~/directory-fortress-core# maven --version
bash: maven: command not found
root@debian:~/directory-fortress-core# mvn --version
Warning: JAVA_HOME environment variable is not set.
Apache Maven 3.3.9
Maven home: /usr/share/maven
Java version: 1.8.0_171, vendor: Oracle Corporation
Java home: /usr/lib/jvm/java-8-openjdk-amd64/jre
Default locale: en_US, platform encoding: UTF-8
OS name: "linux", version: "4.9.0-6-amd64", arch: "amd64", family: "unix"
root@debian:~/directory-fortress-core#
```

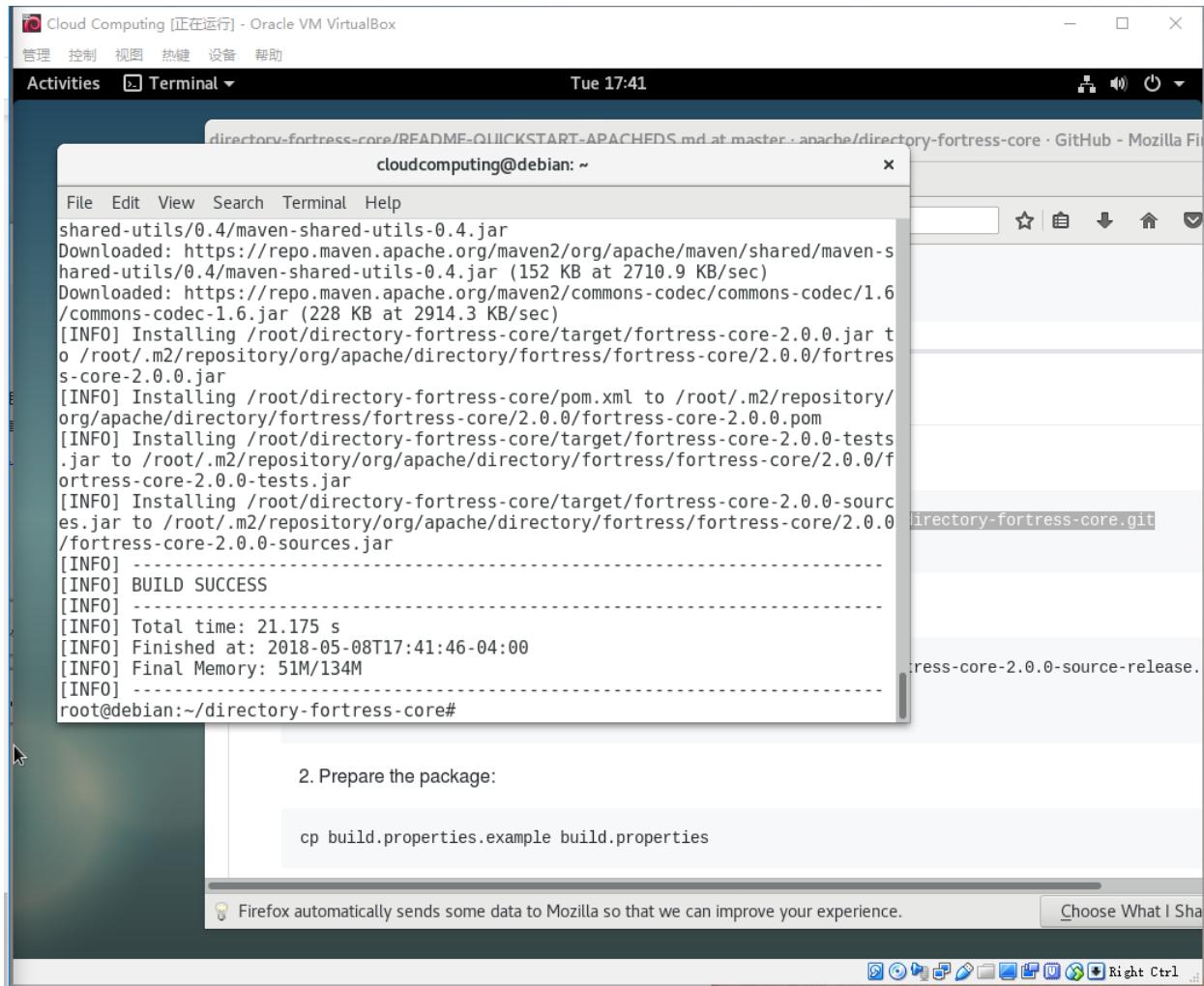
2. Prepare the package:

```
cp build.properties.example build.properties
```

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

8. Build fortress core

```
mvn install
```



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "cloudcomputing@debian: ~". The terminal content shows the output of the "mvn install" command. The output includes Maven dependency download logs, build logs, and a successful build message. The desktop background is dark, and there are other windows visible in the background.

```
mvn install
Cloud Computing [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
Activities Terminal Tue 17:41
directory-fortress-core/README-QUICKSTART-APACHEFS.md at master · apache/directory-fortress-core · GitHub - Mozilla Firefox
cloudcomputing@debian: ~
File Edit View Search Terminal Help
shared-utils/0.4/maven-shared-utils-0.4.jar
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/shared/maven-shared-utils/0.4/maven-shared-utils-0.4.jar (152 KB at 2710.9 KB/sec)
Downloaded: https://repo.maven.apache.org/maven2/commons-codec/commons-codec/1.6/commons-codec-1.6.jar (228 KB at 2914.3 KB/sec)
[INFO] Installing /root/directory-fortress-core/target/fortress-core-2.0.0.jar to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0.jar
[INFO] Installing /root/directory-fortress-core/pom.xml to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0.pom
[INFO] Installing /root/directory-fortress-core/target/fortress-core-2.0.0-tests.jar to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0-tests.jar
[INFO] Installing /root/directory-fortress-core/target/fortress-core-2.0.0-sources.jar to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0-sources.jar
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 21.175 s
[INFO] Finished at: 2018-05-08T17:41:46-04:00
[INFO] Final Memory: 51M/134M
[INFO] -----
root@debian:~/directory-fortress-core#
```

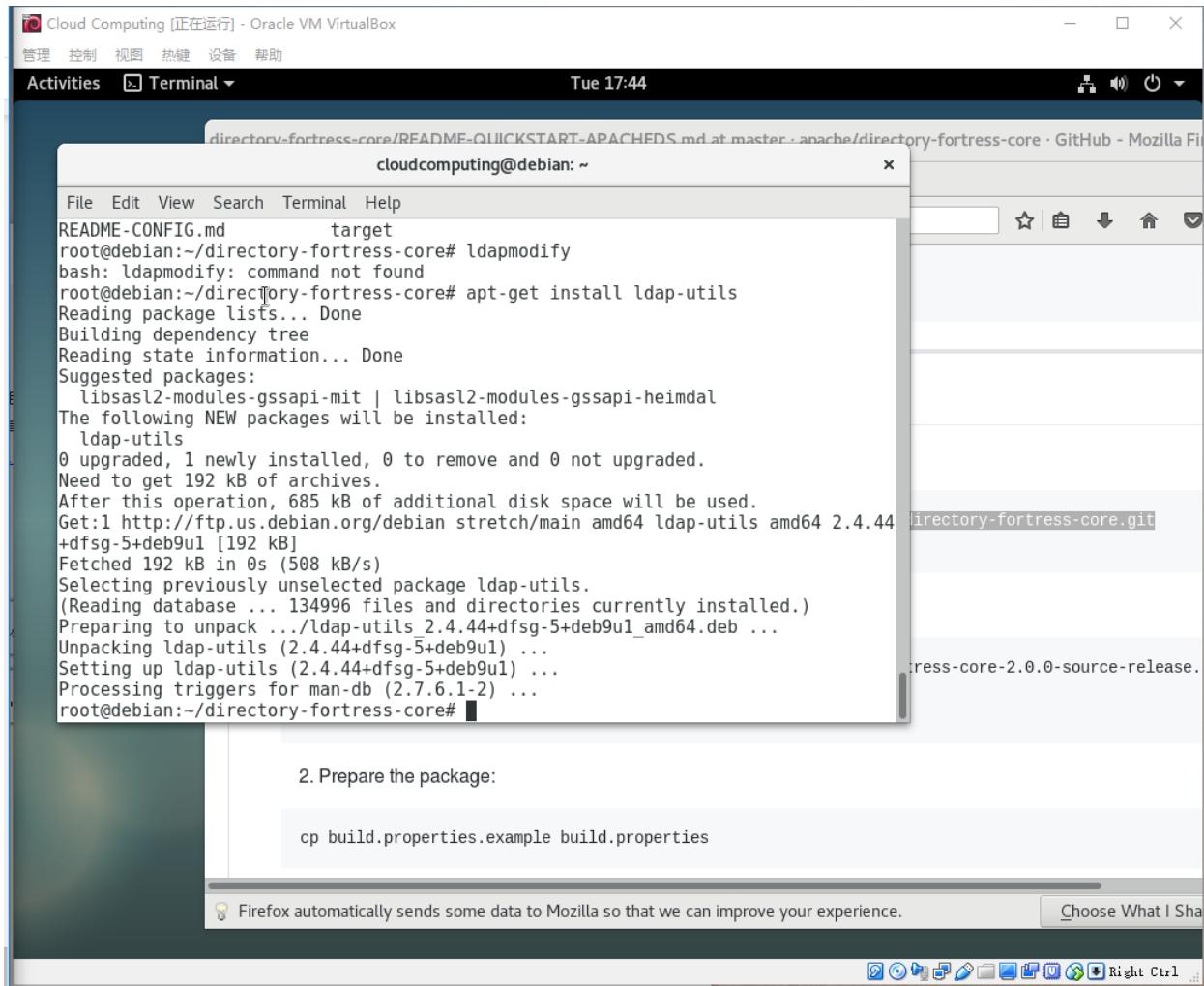
2. Prepare the package:

```
cp build.properties.example build.properties
```

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

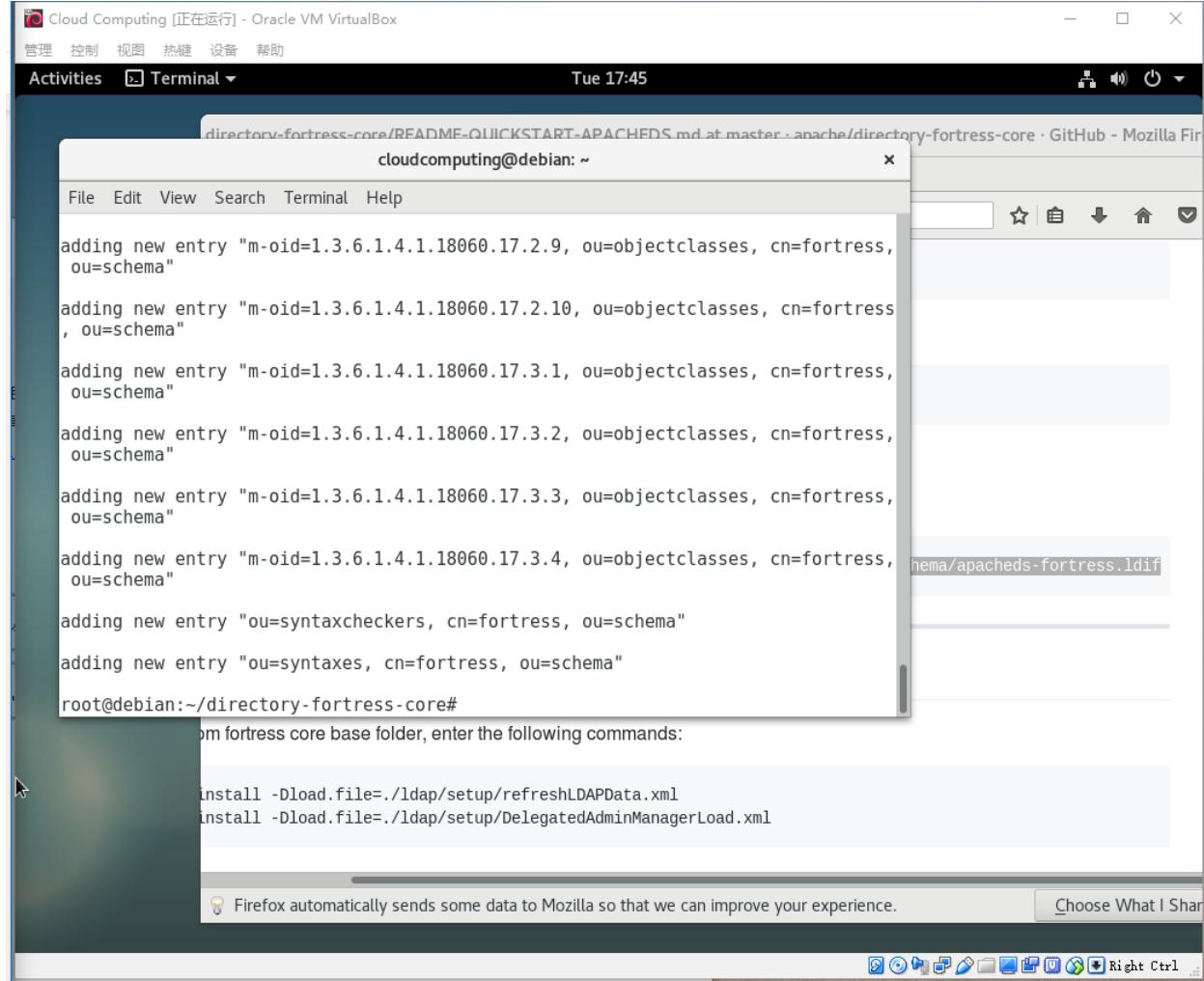
9. Install OpenLDAP

```
apt-get install ldap-utils
```



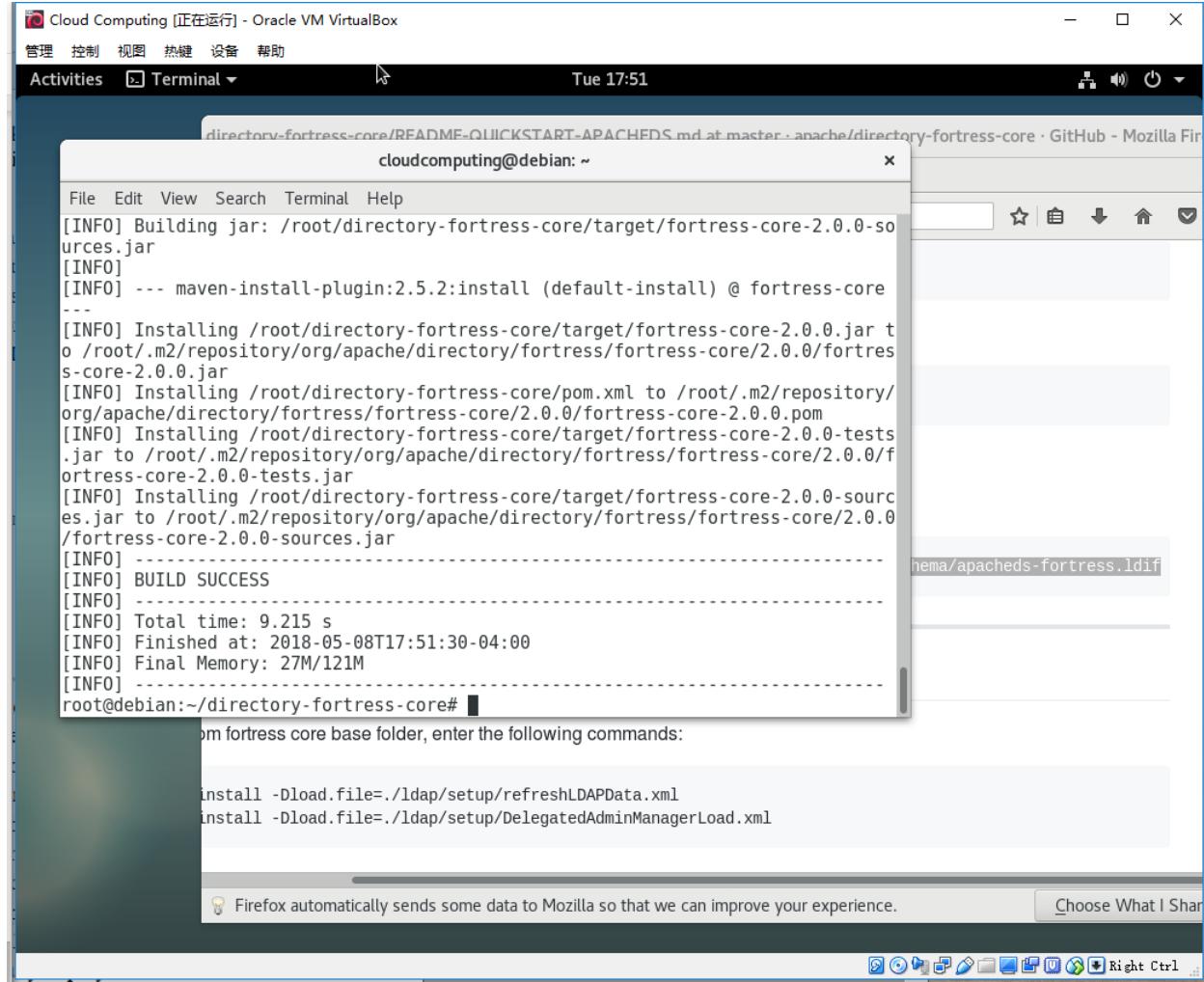
10. Import Fortress ldap schema into ApacheDS server

```
ldapmodify -h localhost -p 10389 -D uid=admin,ou=system -w secret -a -f  
.ldap/schema/apacheds-fortress.ldif
```



11. Apache Fortress Core Integration Test

```
mvn install -Dload.file=./ldap/setup/refreshLDAPData.xml
```



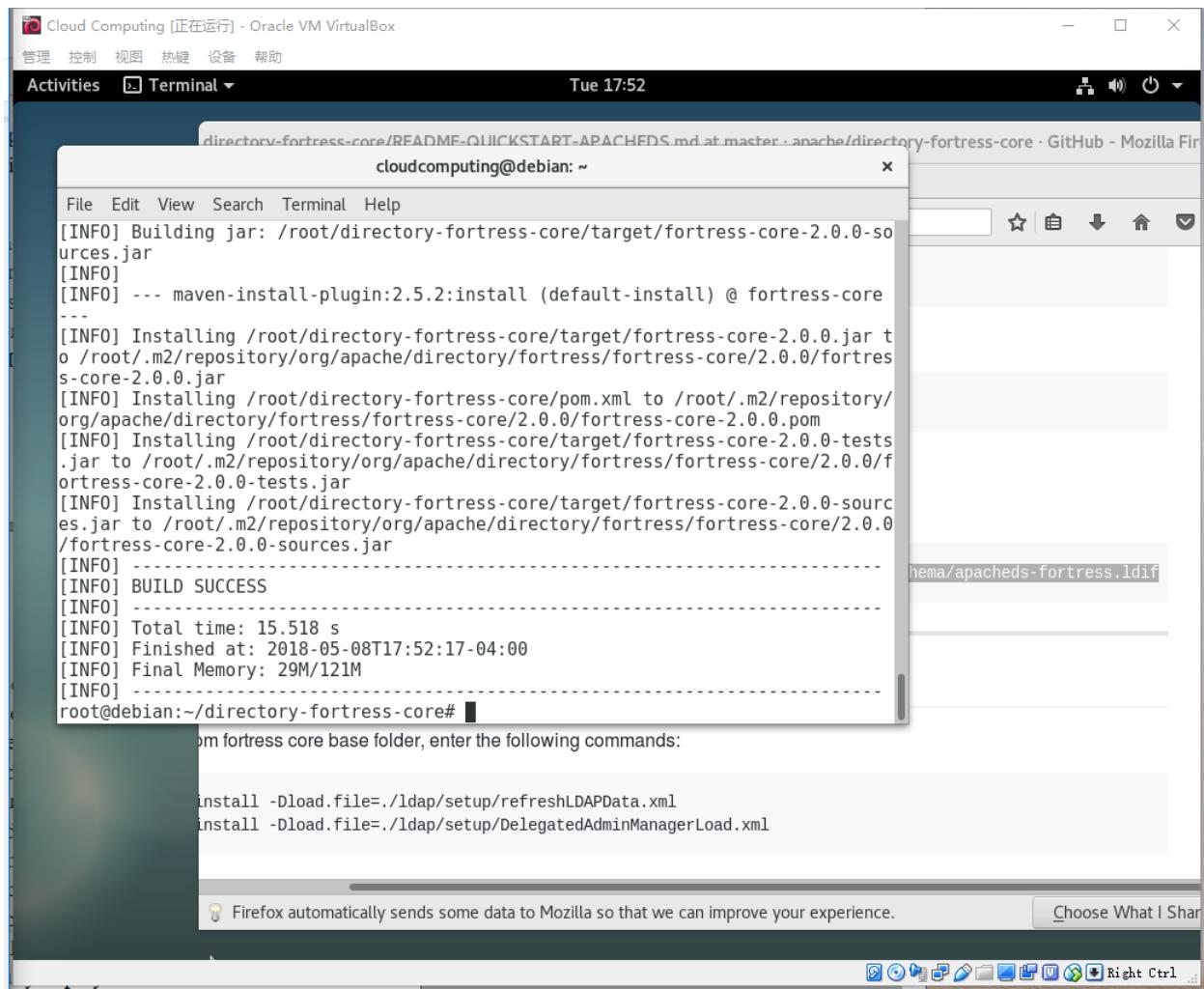
The screenshot shows a terminal window titled "Cloud Computing (正在运行) - Oracle VM VirtualBox". The window is running on a Debian system, as indicated by the "Activities Terminal" menu bar and the "Tue 17:51" timestamp. The terminal session is for user "cloudcomputing" at the prompt "cloudcomputing@debian: ~". The output of the command "mvn install -Dload.file=./ldap/setup/refreshLDAPData.xml" is displayed, showing the Maven build process for the Apache Fortress Core project. The build is successful, producing a jar file at "/root/directory-fortress-core/target/fortress-core-2.0.0-sources.jar". The terminal also displays instructions to run additional commands from the fortress core base folder.

```
[INFO] Building jar: /root/directory-fortress-core/target/fortress-core-2.0.0-sources.jar
[INFO]
[INFO] --- maven-install-plugin:2.5.2:install (default-install) @ fortress-core ---
[INFO] Installing /root/directory-fortress-core/target/fortress-core-2.0.0.jar to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0.jar
[INFO] Installing /root/directory-fortress-core/pom.xml to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0.pom
[INFO] Installing /root/directory-fortress-core/target/fortress-core-2.0.0-tests.jar to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0-tests.jar
[INFO] Installing /root/directory-fortress-core/target/fortress-core-2.0.0-sources.jar to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0-sources.jar
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 9.215 s
[INFO] Finished at: 2018-05-08T17:51:30-04:00
[INFO] Final Memory: 27M/121M
[INFO] -----
root@debian:~/directory-fortress-core#
```

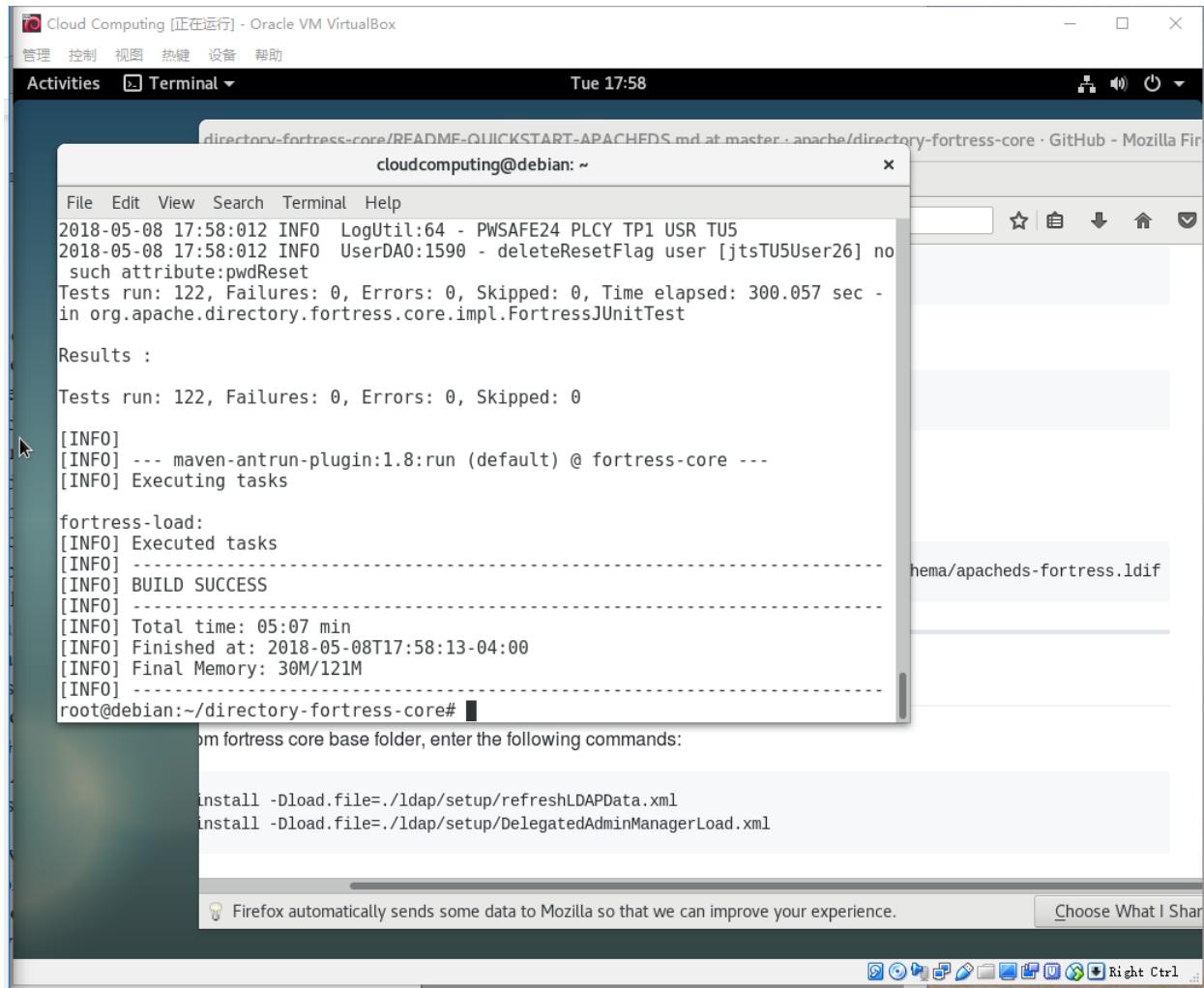
From fortress core base folder, enter the following commands:

```
mvn install -Dload.file=./ldap/setup/refreshLDAPData.xml
mvn install -Dload.file=./ldap/setup/DelegatedAdminManagerLoad.xml
```

```
mvn install -Dload.file=./ldap/setup/DelegatedAdminManagerLoad.xml
```



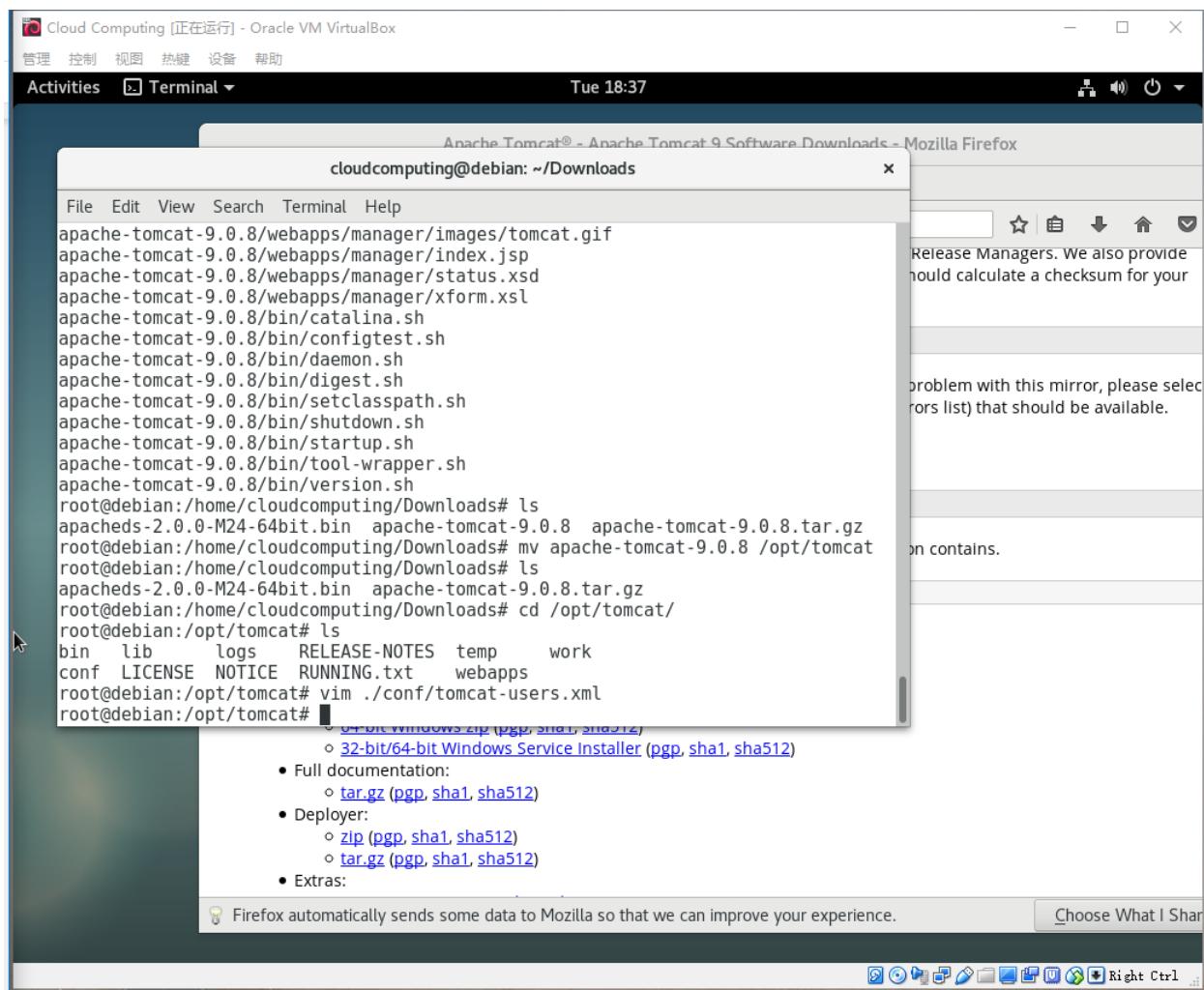
```
mvn -Dtest=FortressJUnitTest test
```



Step 2: Install Apache Tomcat

1. Download and unzip Tomcat

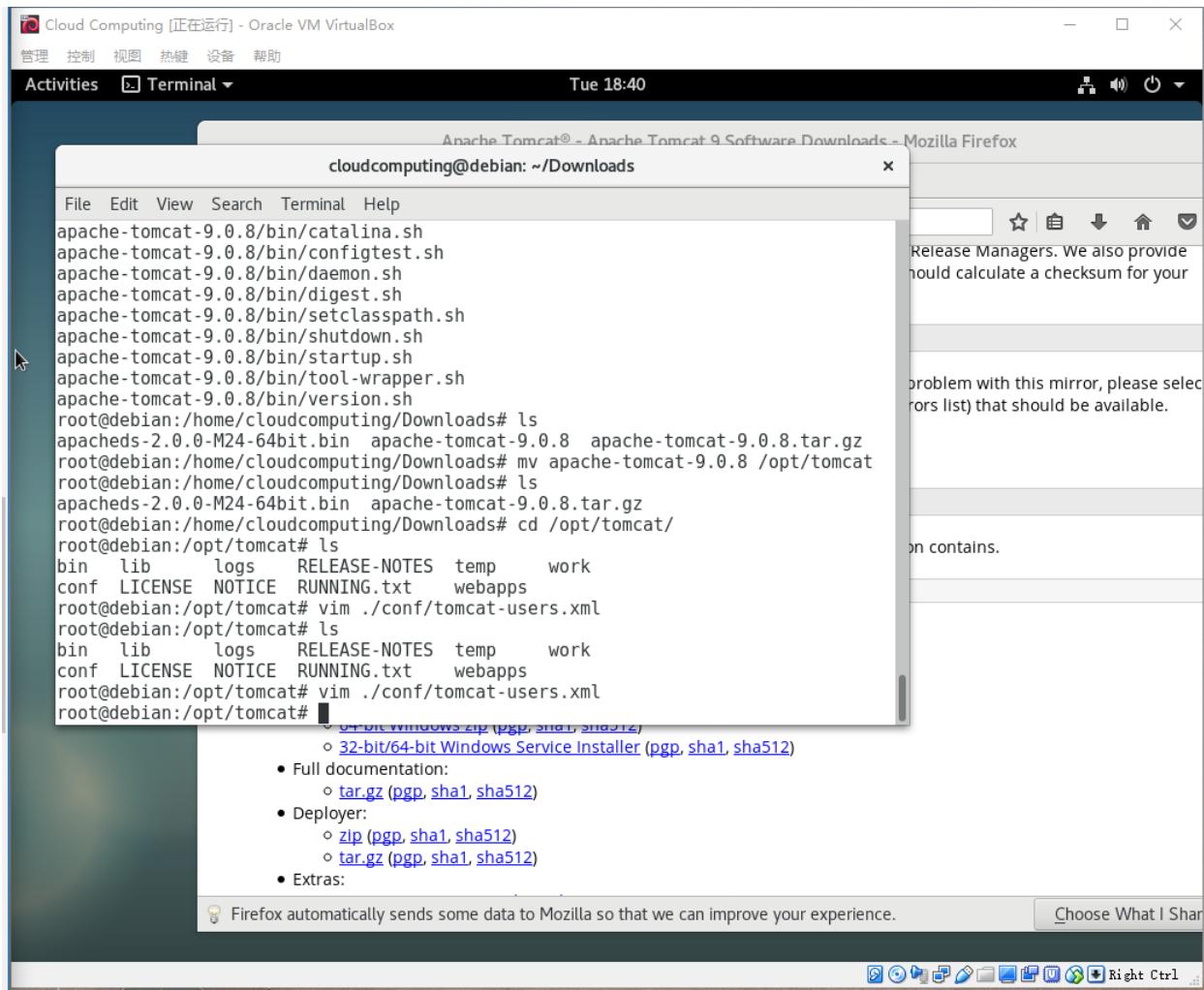
```
curl -O  
http://apache.mirrors.tds.net/tomcat/tomcat-9/v9.0.7/bin/apache-tomca  
t-9.0.7.tar.gz  
tar -xzvf apache-tomcat-9.0.7.tar.gz  
mv apache-tomcat-9.0.7 /opt/tomcat
```



2. Modify userlist of Tomcat

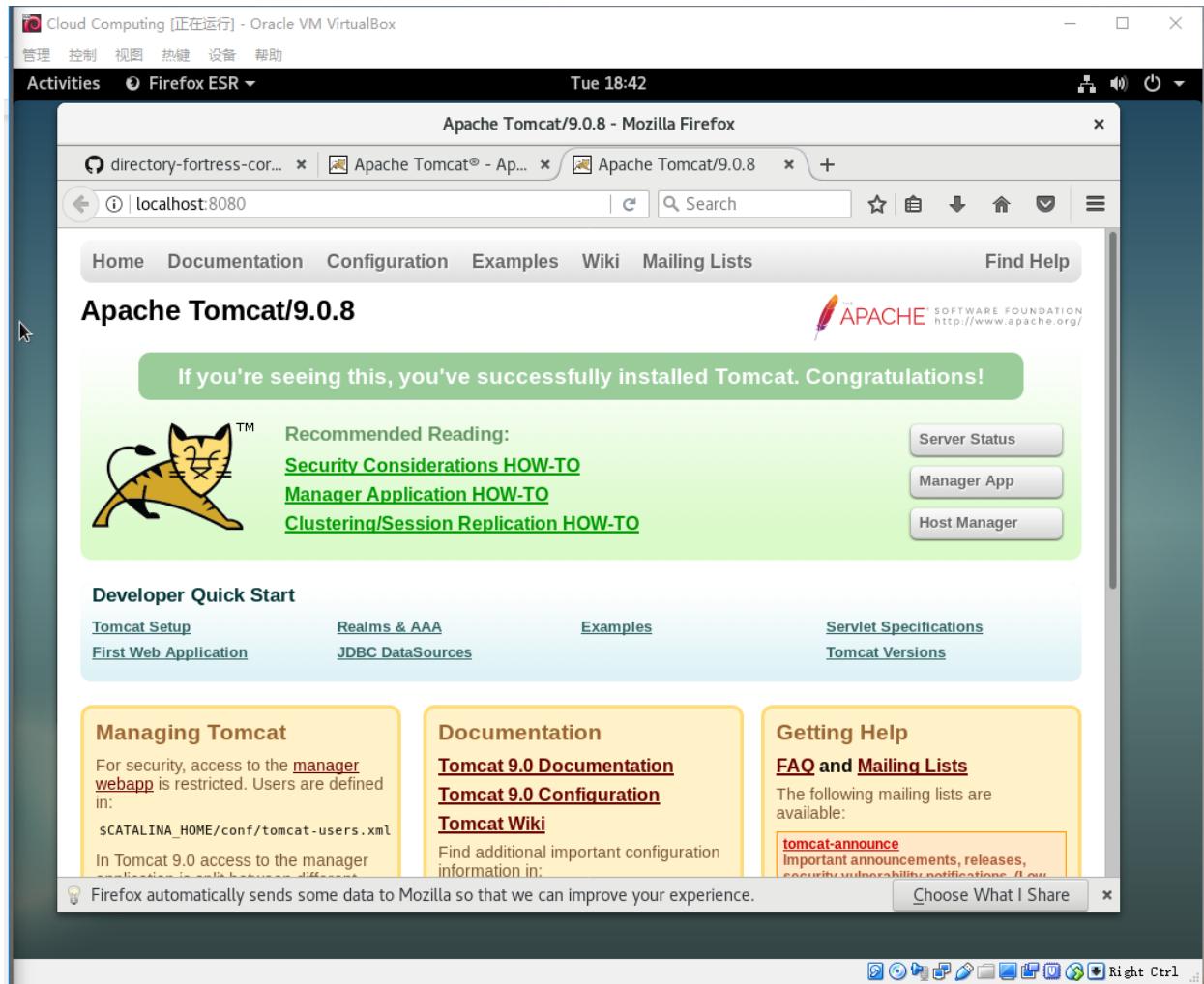
```
vim /opt/tomcat/conf/tomcat-users.xml
```

```
<role rolename="admin-gui" />
<user username="admin" password="PASSWORD"
roles="manager-gui,admin-gui" />
```



3. START/STOP TOMCAT SERVICE

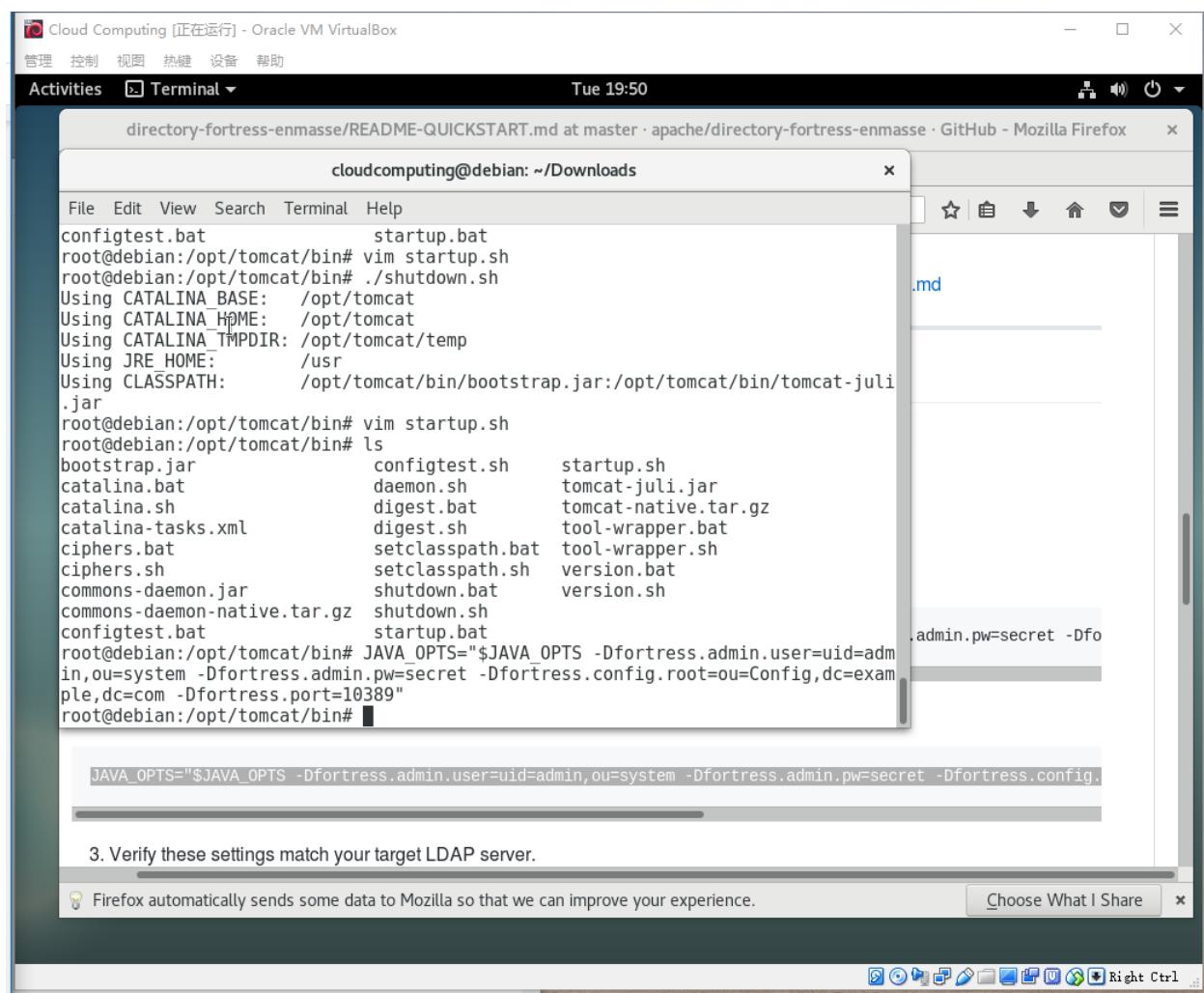
```
/opt/tomcat/bin/startup.sh
```



Step 3: Fortress Web and Rest Setup with Tomcat

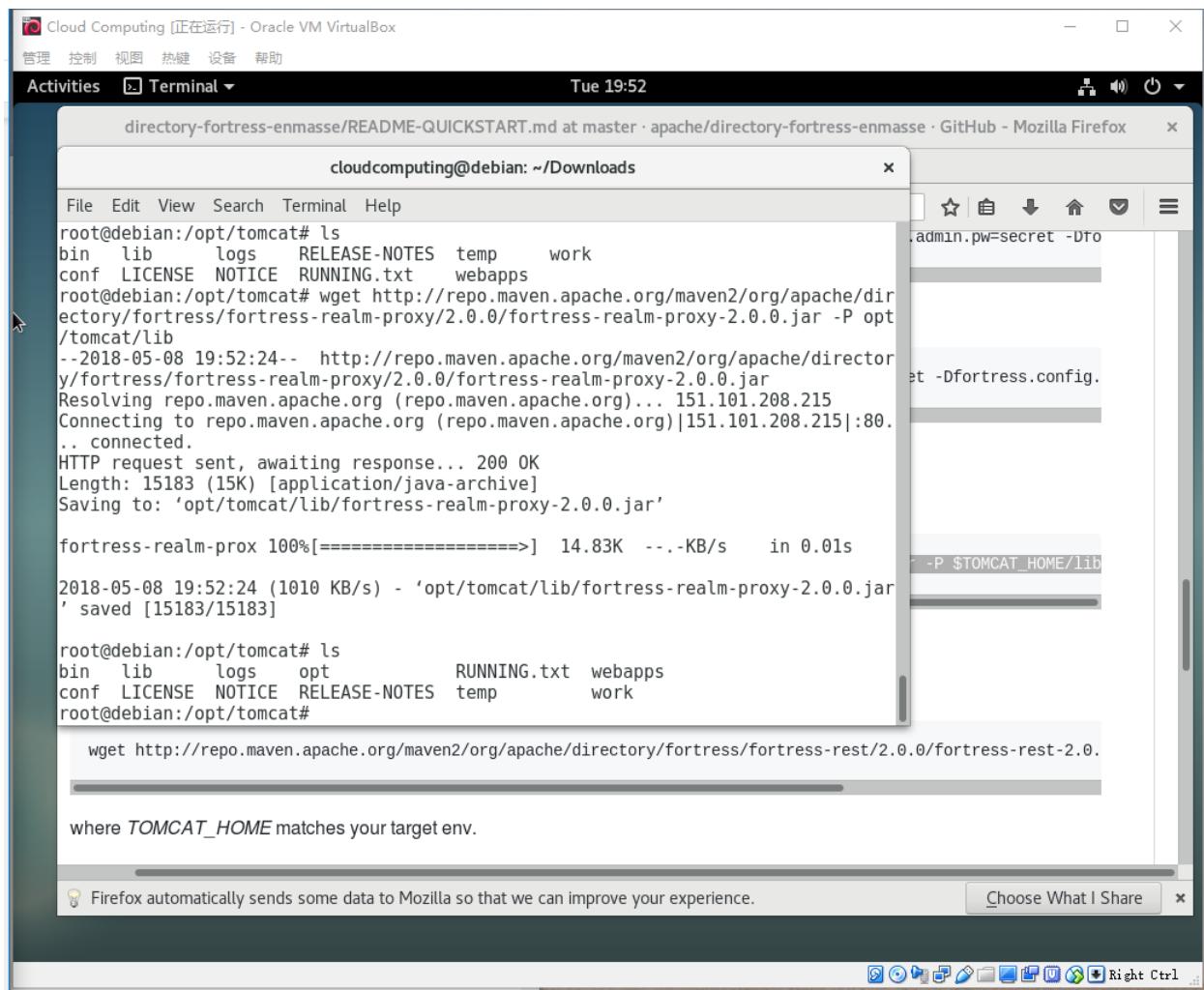
1. Set the java system properties in tomcat with the ApacheDS

```
JAVA_OPTS="$JAVA_OPTS -Dfortress.admin.user=uid=admin,ou=system  
-Dfortress.admin.pw=secret -Dfortress.config.root=ou=Config,dc=example,dc=com  
-Dfortress.port=10389"
```



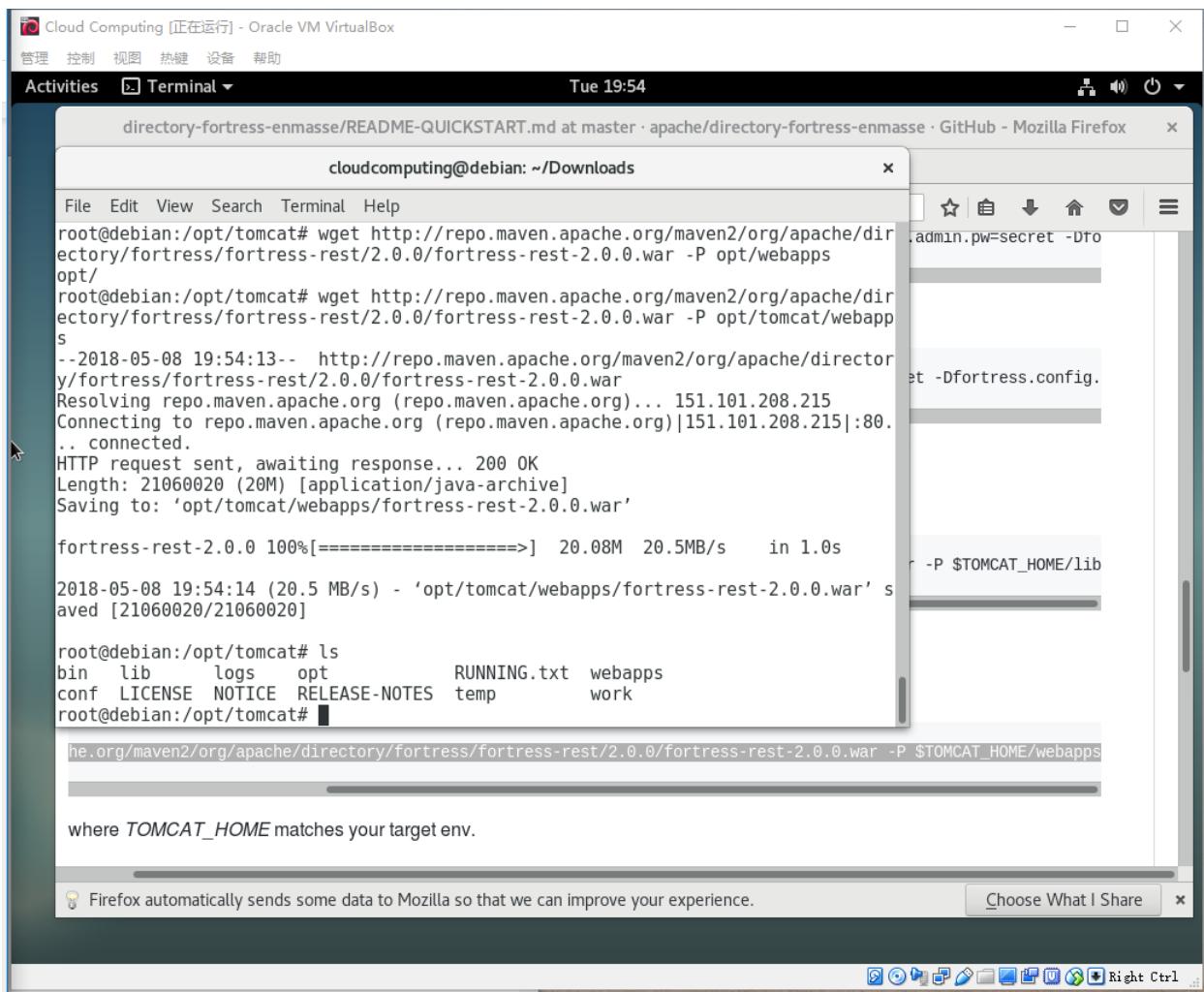
2. Download the fortress realm proxy jar into tomcat/lib folder

```
wget  
http://repo.maven.apache.org/maven2/org/apache/directory/fortress/fortress-realm-prox  
y/2.0.0/fortress-realm-proxy-2.0.0.jar -P $TOMCAT_HOME/lib
```



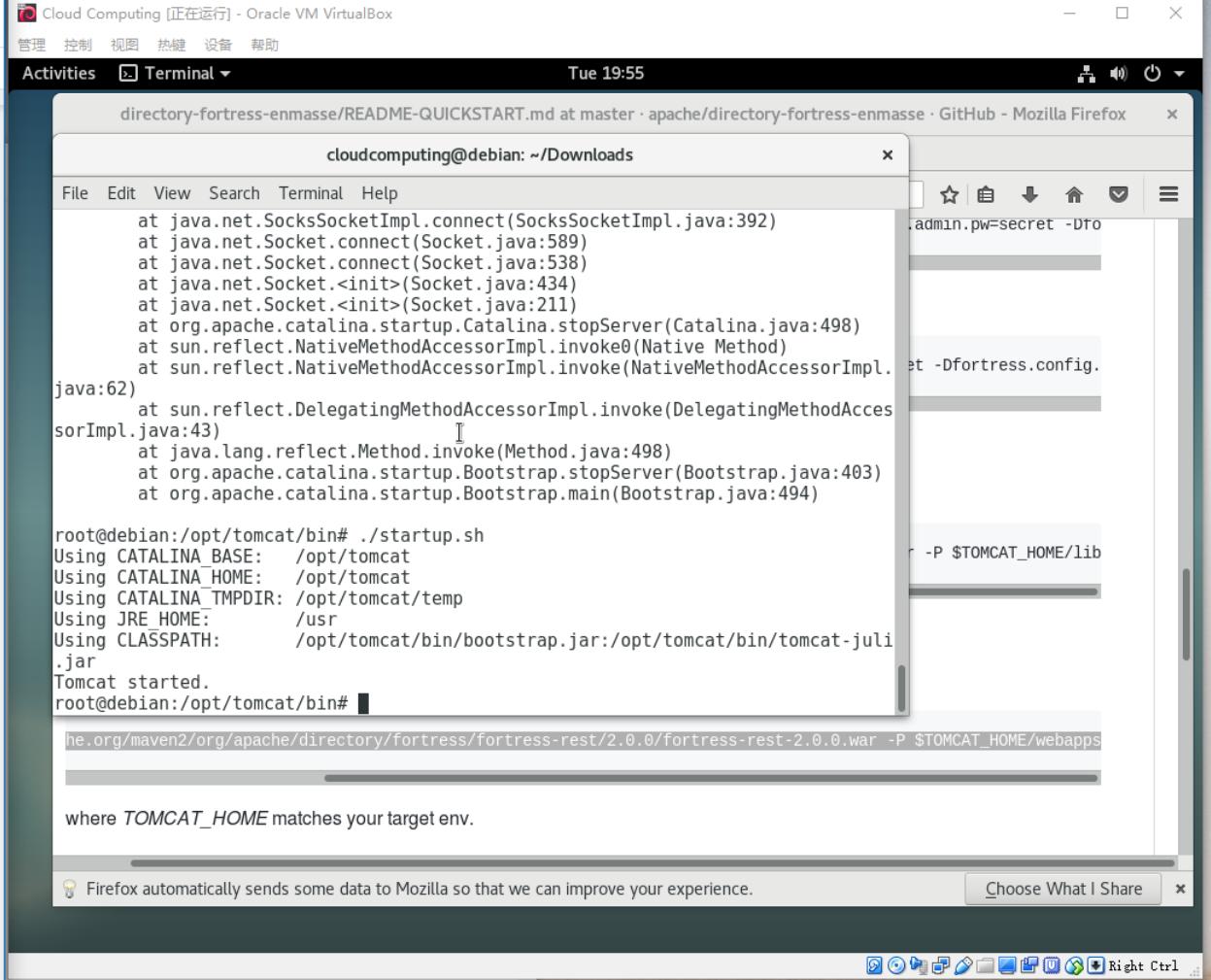
3. Download the fortress rest war into tomcat/webapps folder

```
wget  
http://repo.maven.apache.org/maven2/org/apache/directory/fortress/fortress-rest/2.0.0/f  
ortress-rest-2.0.0.war -P $TOMCAT_HOME/webapps
```



4. Restart Tomcat.

```
./shutdown.sh  
./startup.sh
```

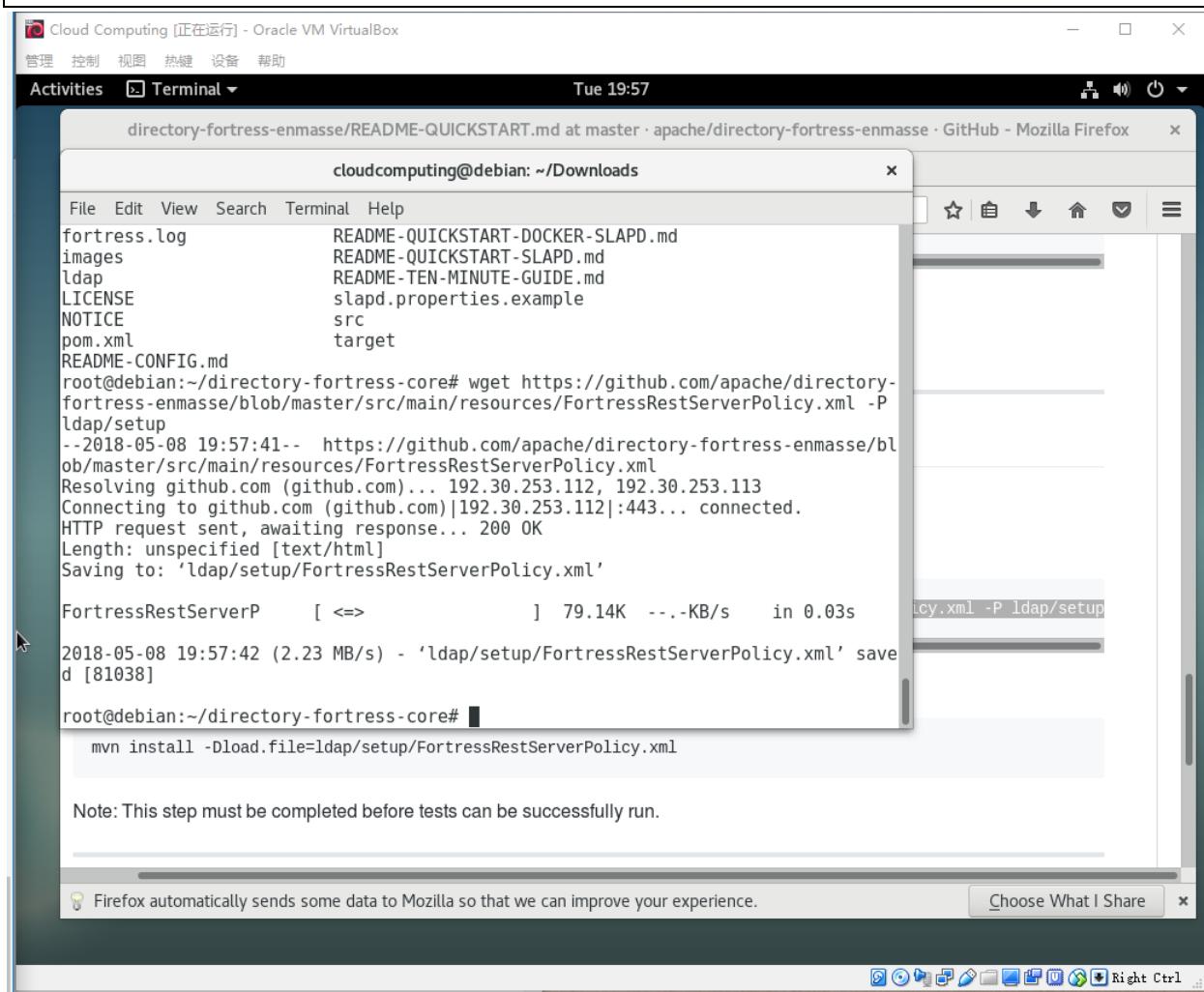


The screenshot shows a terminal window titled "Terminal" running on a Linux system. The terminal session is for user "cloudcomputing" at the prompt "cloucomputing@debian: ~/Downloads". The window displays the output of the command "root@debian:/opt/tomcat/bin# ./startup.sh". The output shows the configuration of Tomcat variables like CATALINA_HOME, CATALINA_TMPDIR, JRE_HOME, and CLASSPATH. It also shows the startup of the Tomcat service, indicated by the message "Tomcat started.". Below the terminal window, a Firefox browser window is open, showing the URL "http://org/maven2/org/apache/directory/fortress/fortress-rest/2.0.0/fortress-rest-2.0.0.war -P \$TOMCAT_HOME/webapps". A tooltip from Firefox states: "Firefox automatically sends some data to Mozilla so that we can improve your experience." The desktop environment includes a dock with various icons at the bottom.

```
./shutdown.sh  
./startup.sh  
  
Cloud Computing [正在运行] - Oracle VM VirtualBox  
管理 控制 视图 热键 设备 帮助  
Activities Terminal Tue 19:55  
directory-fortress-enmasse/README-QUICKSTART.md at master · apache/directory-fortress-enmasse · GitHub - Mozilla Firefox  
File Edit View Search Terminal Help  
at java.net.SocksSocketImpl.connect(SocksSocketImpl.java:392)  
at java.net.Socket.connect(Socket.java:589)  
at java.net.Socket.connect(Socket.java:538)  
at java.net.Socket.<init>(Socket.java:434)  
at java.net.Socket.<init>(Socket.java:211)  
at org.apache.catalina.startup.Catalina.stopServer(Catalina.java:498)  
at sun.reflect.NativeMethodAccessorImpl.invoke0(Native Method)  
at sun.reflect.NativeMethodAccessorImpl.invoke(NativeMethodAccessorImpl.java:62)  
at sun.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:43)  
at java.lang.reflect.Method.invoke(Method.java:498)  
at org.apache.catalina.startup.Bootstrap.stopServer(Bootstrap.java:403)  
at org.apache.catalina.startup.Bootstrap.main(Bootstrap.java:494)  
  
root@debian:/opt/tomcat/bin# ./startup.sh  
Using CATALINA_BASE: /opt/tomcat  
Using CATALINA_HOME: /opt/tomcat  
Using CATALINA_TMPDIR: /opt/tomcat/temp  
Using JRE_HOME: /usr  
Using CLASSPATH: /opt/tomcat/bin/bootstrap.jar:/opt/tomcat/bin/tomcat-juli.jar  
Tomcat started.  
root@debian:/opt/tomcat/bin#  
  
http://org/maven2/org/apache/directory/fortress/fortress-rest/2.0.0/fortress-rest-2.0.0.war -P $TOMCAT_HOME/webapps  
  
where $TOMCAT_HOME matches your target env.  
  
Choose What I Share  
Choose What I Share  
Right Ctrl
```

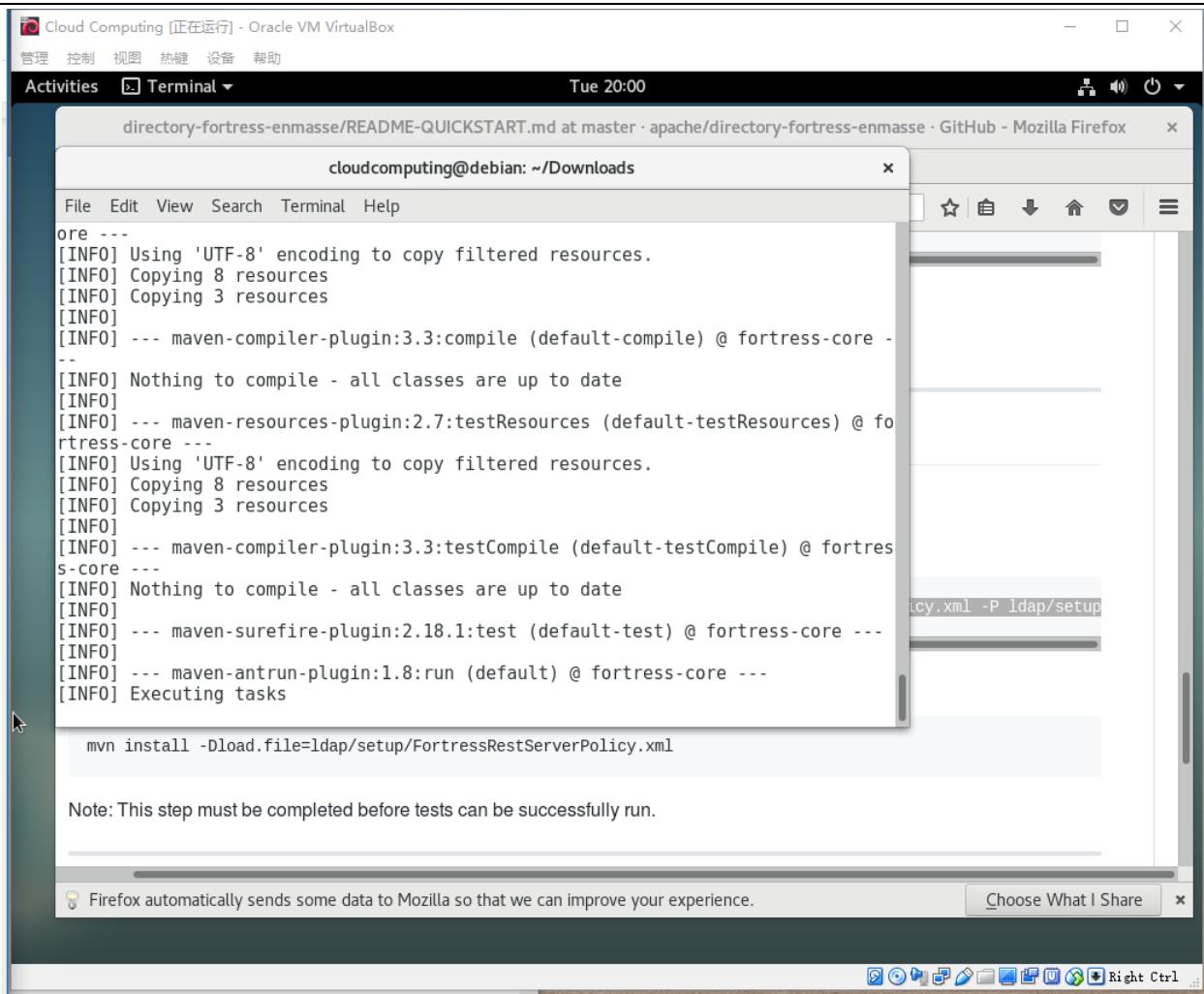
5. Load Sample Security Policy

```
wget  
https://github.com/apache/directory-fortress-enmasse/blob/master/src/main/resources/F  
ortressRestServerPolicy.xml -P ldap/setup
```



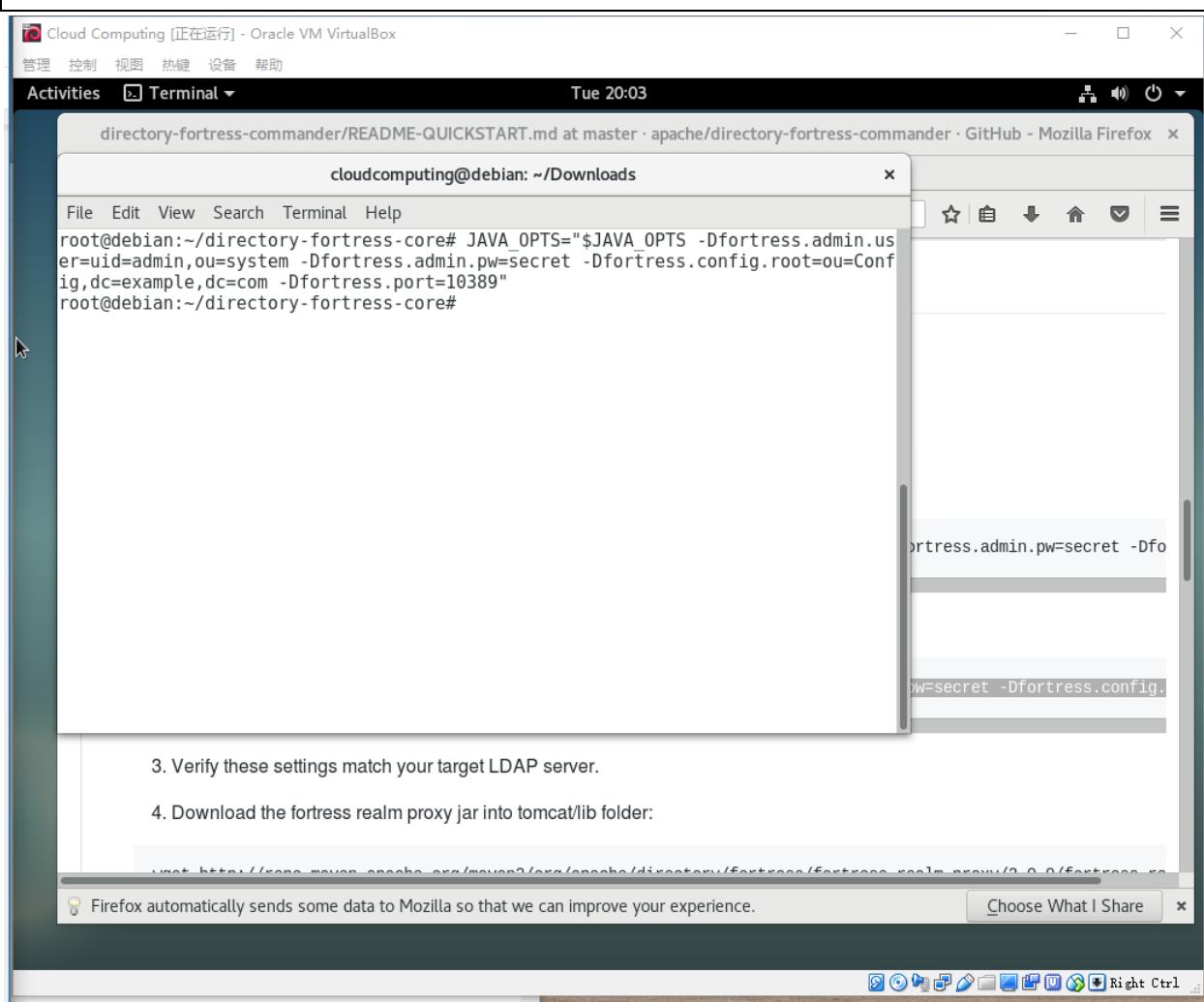
6. Run maven install with load file:

```
mvn install -Dload.file=ldap/setup/FortressRestServerPolicy.xml
```



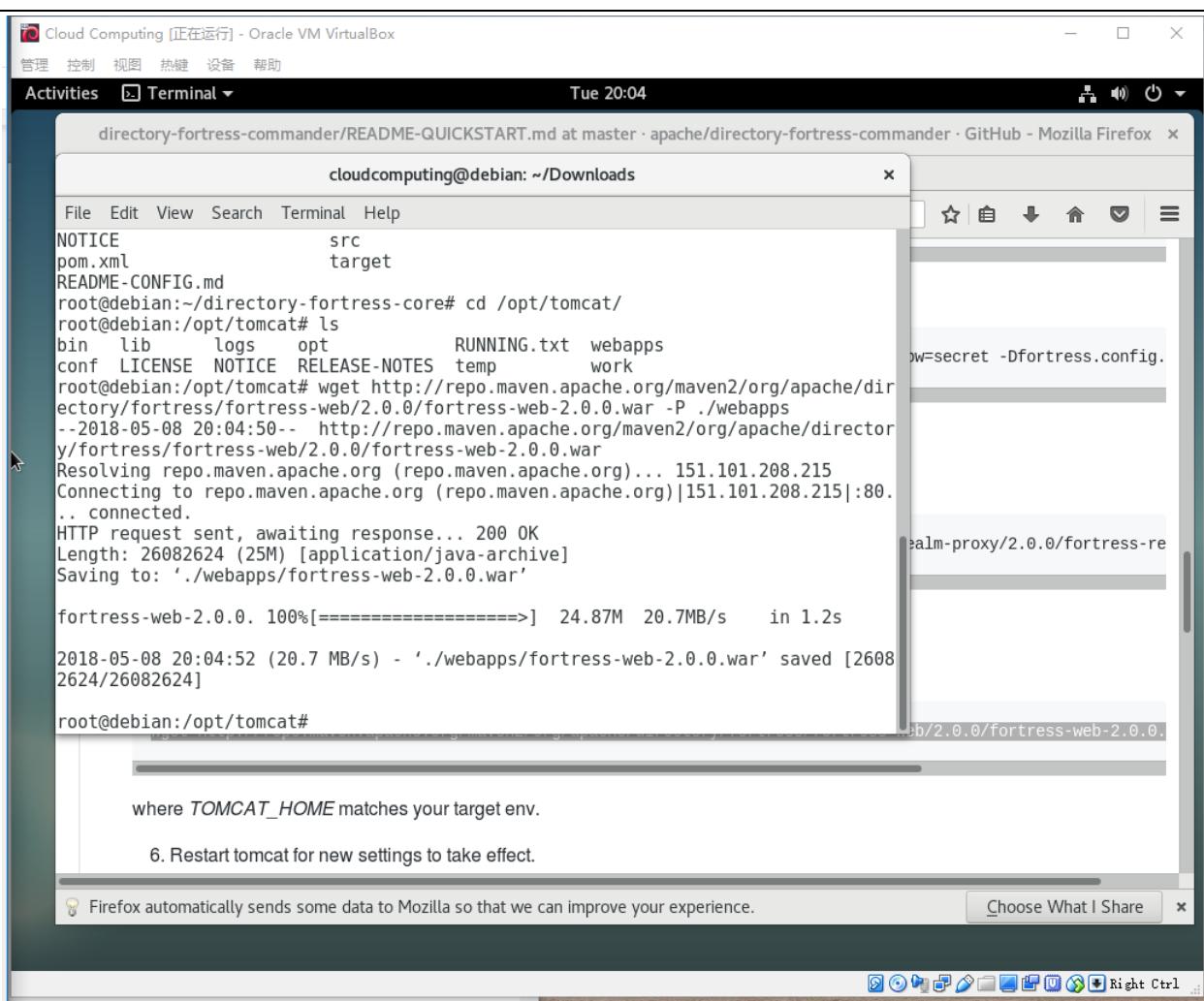
7. Set the java opts for fortress-web

```
JAVA_OPTS="$JAVA_OPTS -Dfortress.admin.user=uid=admin,ou=system  
-Dfortress.admin.pw=secret -Dfortress.config.root=ou=Config,dc=example,dc=com  
-Dfortress.port=10389"
```



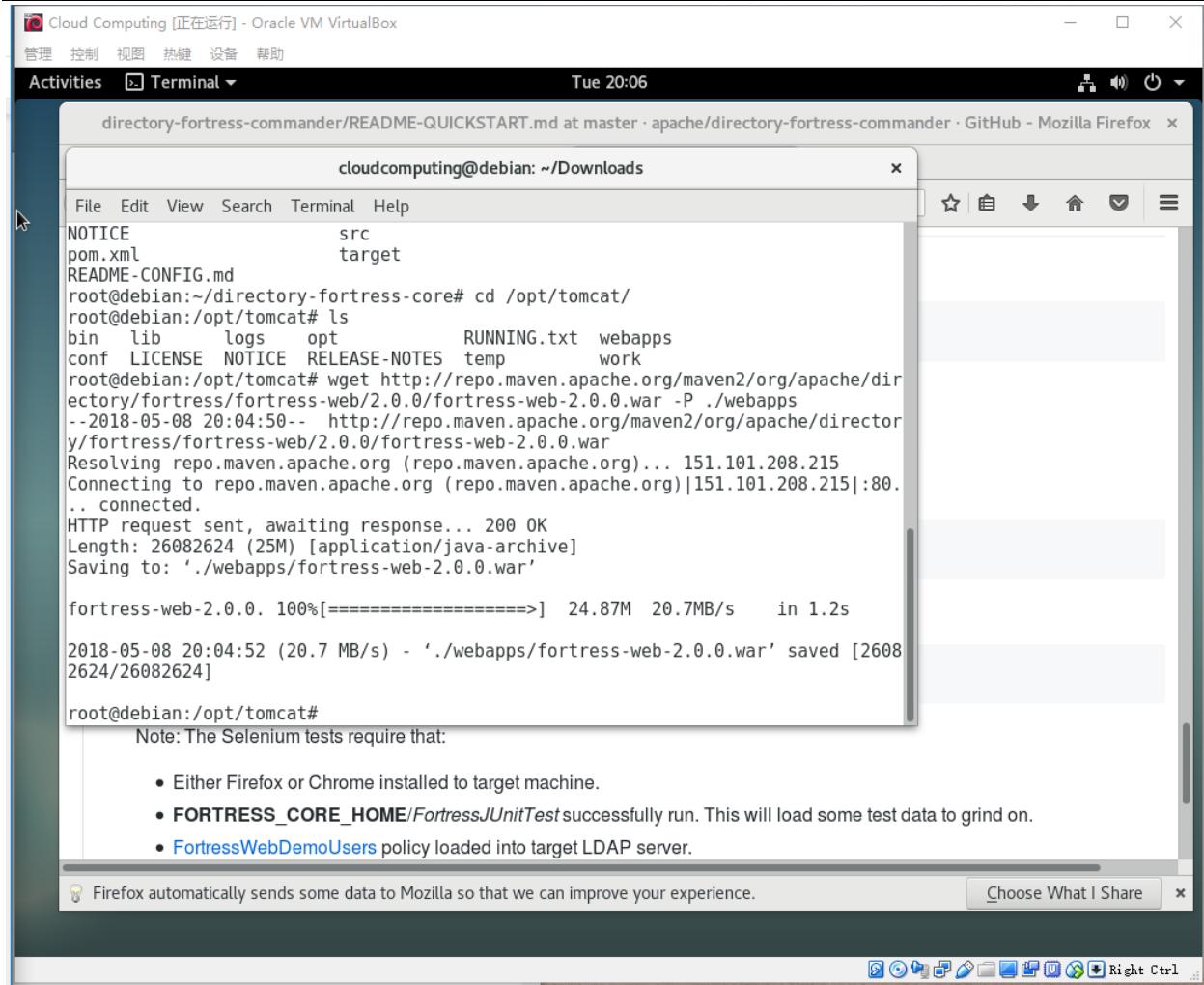
8. Download the fortress web war into tomcat/webapps folder:

```
wget  
http://repo.maven.apache.org/maven2/org/apache/directory/fortress/fortress-web/2.0.0/  
fortress-web-2.0.0.war -P $TOMCAT_HOME/webapps
```



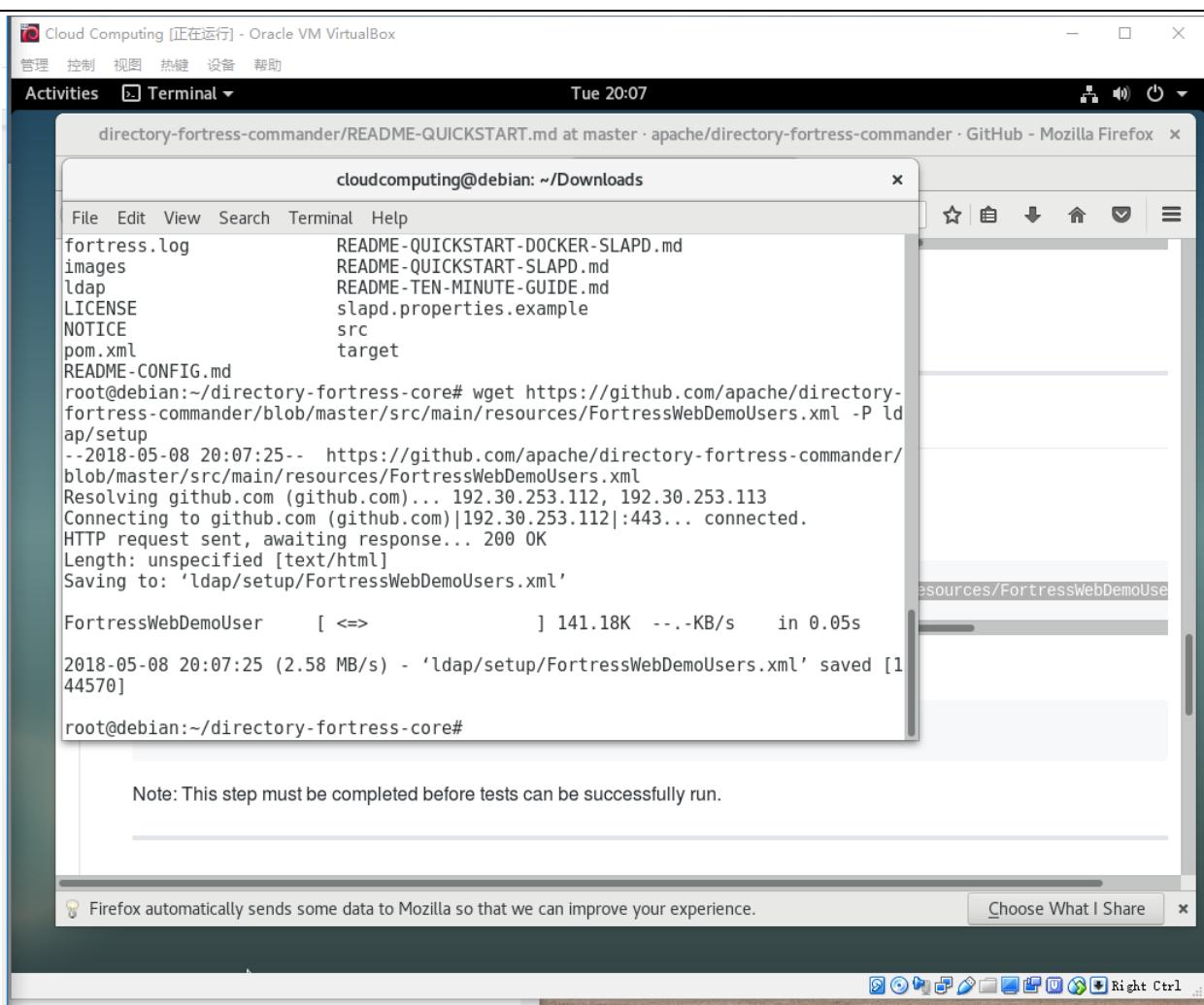
9. Restart tomcat for new settings to take effect

```
./opt/tomcat/shutdown.sh  
./opt/tomcat/startup.sh
```



10. Download the fortress web sample security policy from git

```
wget  
https://github.com/apache/directory-fortress-commander/blob/master/src/main/resource  
s/FortressWebDemoUsers.xml -P ldap/setup
```



11. Run maven install with -Dload.file file

```
mvn install -Dload.file=ldap/setup/FortressWebDemoUsers.xml
```

The screenshot shows a Firefox browser window titled "Apache Tomcat/9.0.8 - Mozilla Firefox". The address bar displays "localhost:8080/fortress-web". The page content is a user interface for managing roles and users. At the top, there's a section for "Authorized Links for poweruser" with links for PAGE1, PAGE2, PAGE3, and LOGOUT. Below this is a "Activate and Deactivate Roles in Session" section. The "Inactive Roles" dropdown contains "PAGE1_123, PAGE1_456, PAGE2_123, PAGE2_456, PAGE2_789, PAGE3_113, PAGE3_456, PAGE3_789". The "Active Roles" dropdown contains "DEMO2_ALL_PAGES, PAGE1_789". There are "activate" and "deactivate" buttons next to each dropdown. The main area is titled "Page1" and contains a message: "If you see this page, ROLE_DEMO2_SUPER_USER or ROLE_PAGE1 is activated within your session". It has sections for "Page 1 Entry Fields" (Customer Number: 789, Attribute A, Attribute B, Attribute C) and "Page 1 Buttons" (Obj: Page1, Cr: Add, Obj: Page1, Up: Update, Obj: Page1, Op: Delete, Obj: Page1, Op: Search, Search). At the bottom, there's a "Page 1 List" table with columns: ID, Customer, Attribute A, Attribute B, Attribute C. The data in the table is as follows:

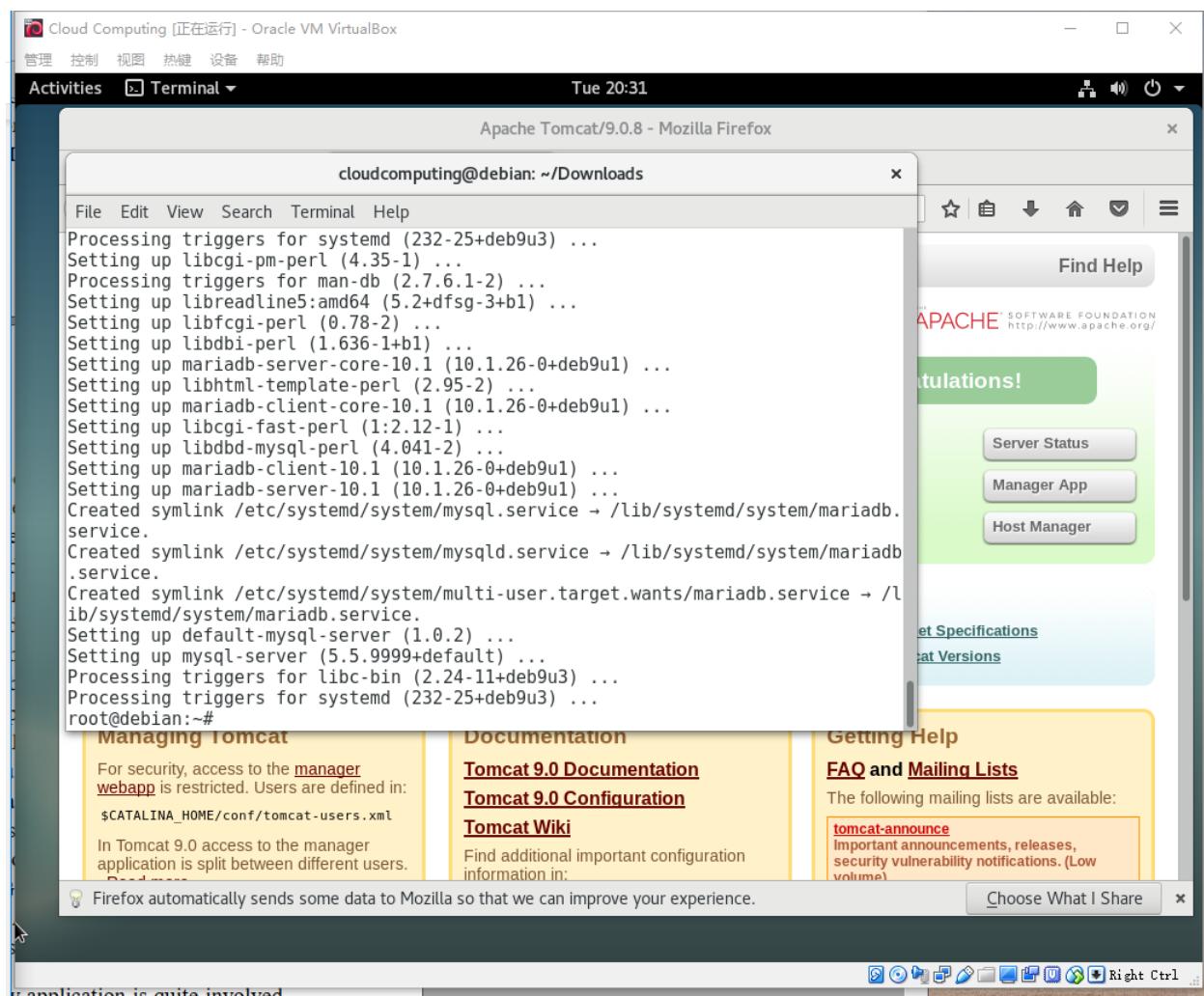
ID	Customer	Attribute A	Attribute B	Attribute C
LOC21	789	789.1.a	789.1.b	789.1.c
LOC30	789	789.10.a	789.10.b	789.10.c
LOC22	789	789.2.a	789.2.b	789.2.c
LOC23	789	789.3.a	789.3.b	789.3.c
LOC21	789	789.4.a	789.4.b	789.4.c
LOC25	789	789.5.a	789.5.b	789.5.c

A status bar at the bottom of the browser window says: "Firefox automatically sends some data to Mozilla so that we can improve your experience." and "Choose What I Share".

Step 4 Setup MySQL, Glassfish and ArchNav

1. Install MySQL from apt-get

```
apt-get install mysql-server
```



2. Download the latest version of Glassfish from GitHub

```
Git clone git@github.com:javaee/glassfish.git
```

```
Setting up libdbd-mysql-perl (4.041-2) ...
Setting up mariadb-client-10.1 (10.1.26-0+deb9u1) ...
Setting up mariadb-server-10.1 (10.1.26-0+deb9u1) ...
Created symlink /etc/systemd/system/mysql.service → /lib/systemd/system/mariadb.service.
Created symlink /etc/systemd/system/mysqld.service → /lib/systemd/system/mariadb.service.
Created symlink /etc/systemd/system/multi-user.target.wants/mariadb.service → /lib/systemd/system/mariadb.service.
Setting up default-mysql-server (1.0.2) ...
Setting up mysql-server (5.5.9999+default) ...
Processing triggers for libc-bin (2.24-11+deb9u3) ...
Processing triggers for systemd (232-25+deb9u3) ...
root@debian:~# ls
directory-forress-core
root@debian:~# git clone https://github.com/javaee/glassfish.git
Cloning into 'glassfish'...
remote: Counting objects: 843438, done.
remote: Compressing objects: 100% (17/17), done.
remote: Total 843438 (delta 9), reused 13 (delta 5), pack-reused 843415
Receiving objects: 100% (843438/843438), 324.56 MiB | 21.50 MiB/s, done.
Resolving deltas: 100% (442969/442969), done.
Checking out files: 100% (30769/30769), done.
root@debian:~#
```

The GitHub page for the cloned repository shows 83 contributors and a 'Clone or download' button. It also provides links for 'HTTPS' and 'Download ZIP'.

File .gitignore CONTRIBUTING.md LICENSE

PR: Update nucleus security test (#22300) PR: Repackaging and other cleanup (#22394)

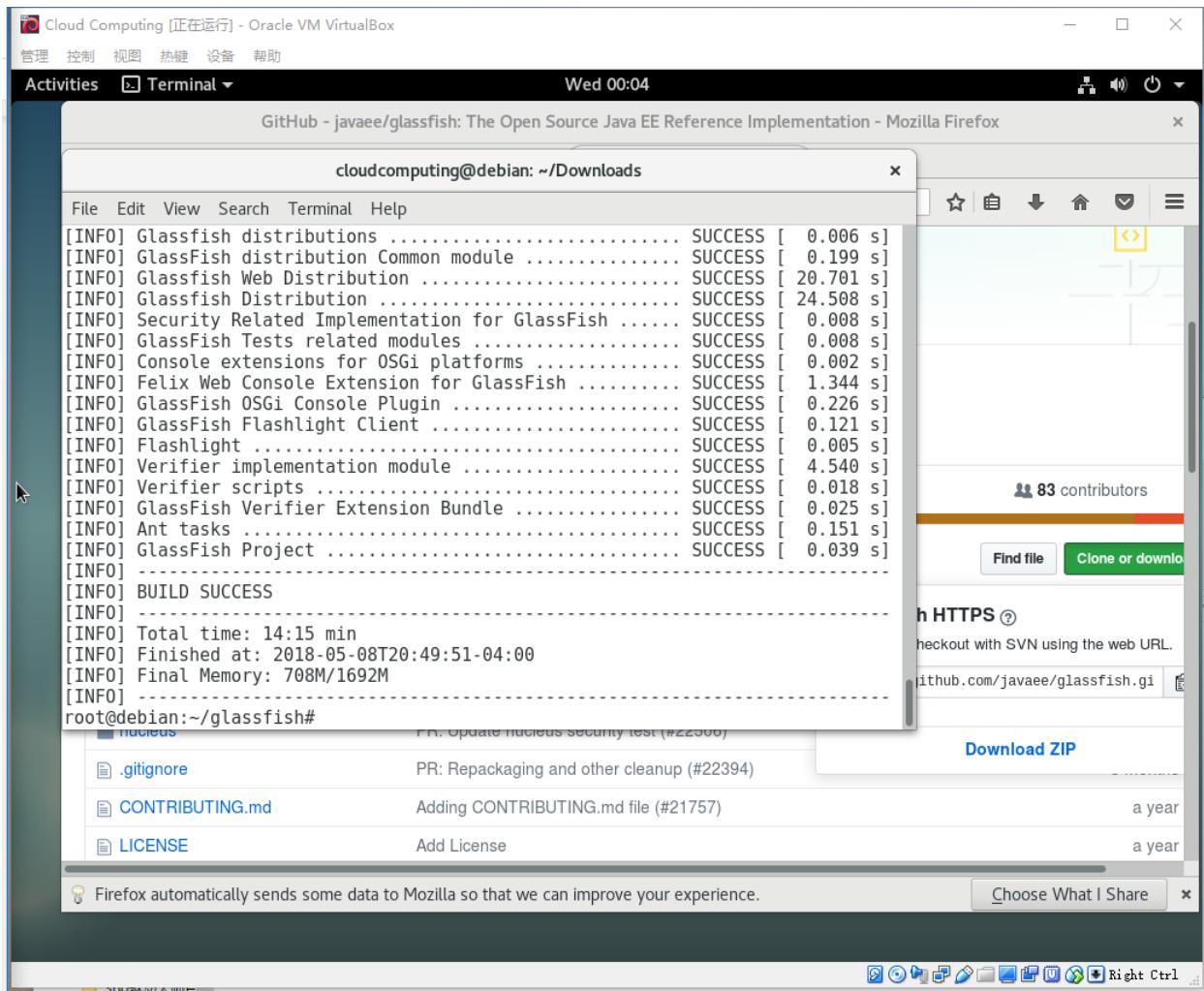
Adding CONTRIBUTING.md file (#21757) Add License

a year a year

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

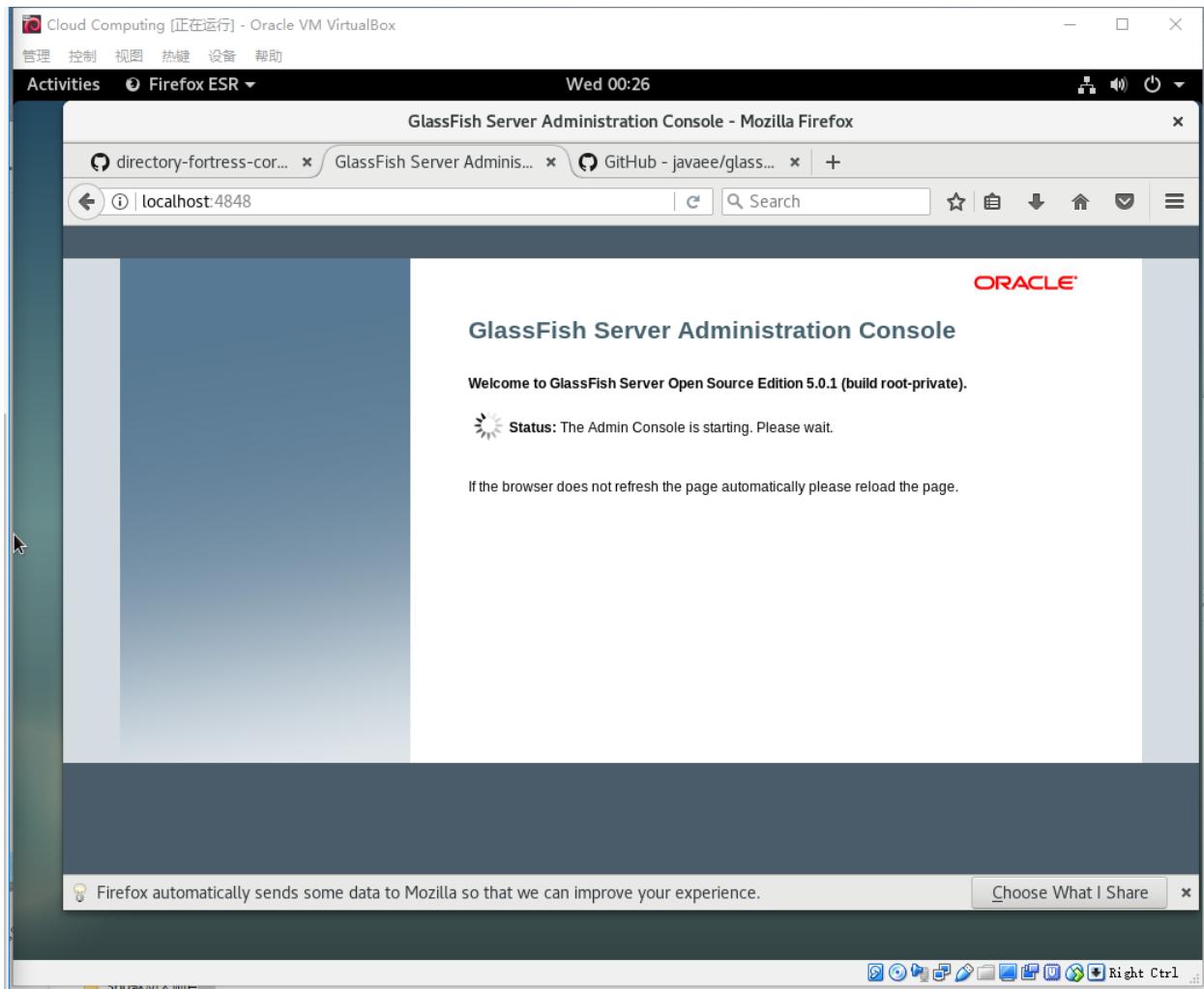
3. Use Maven to setup Glassfish

```
Cd glassfish  
Mvn install
```

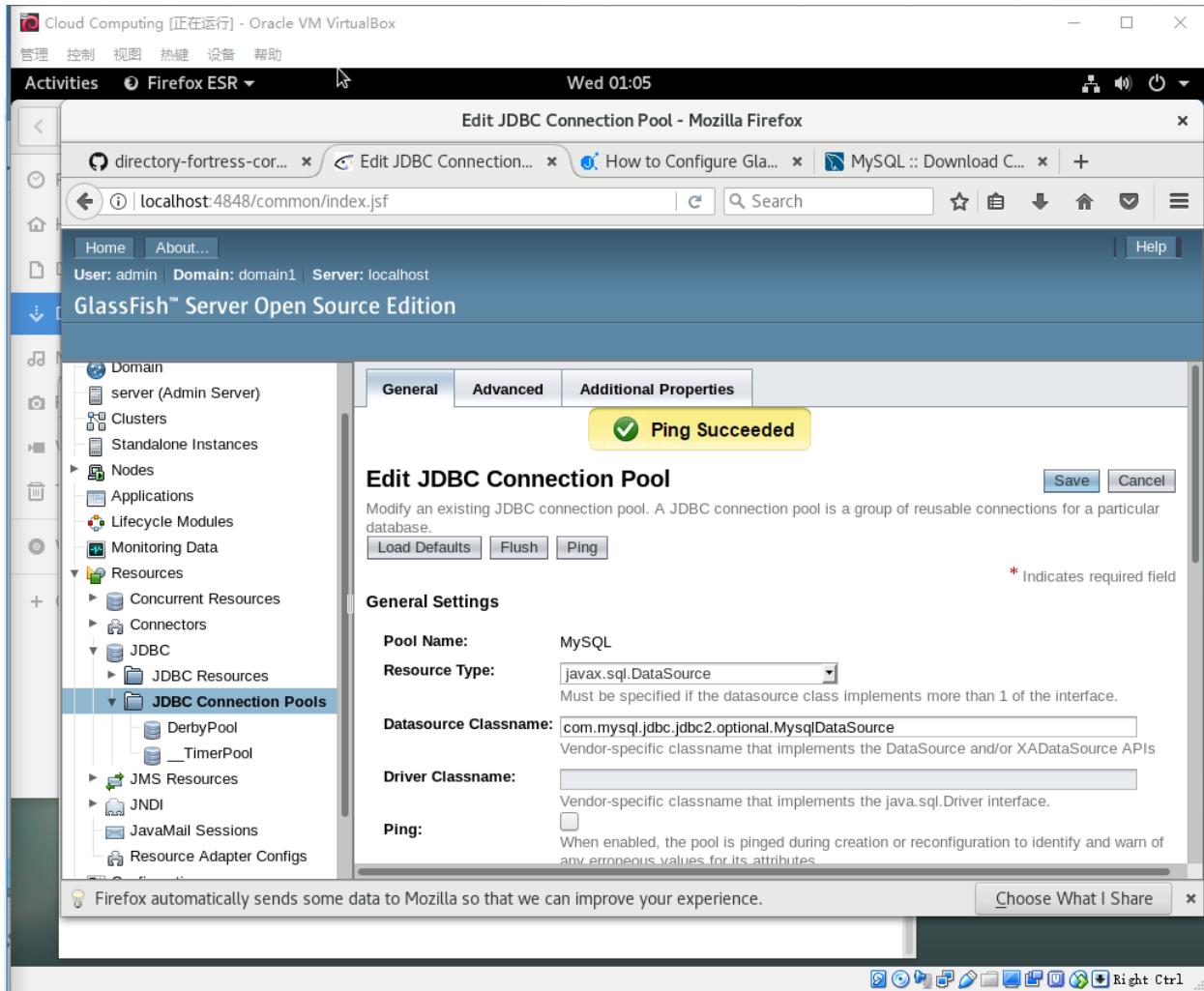


4. Start Glassfish server

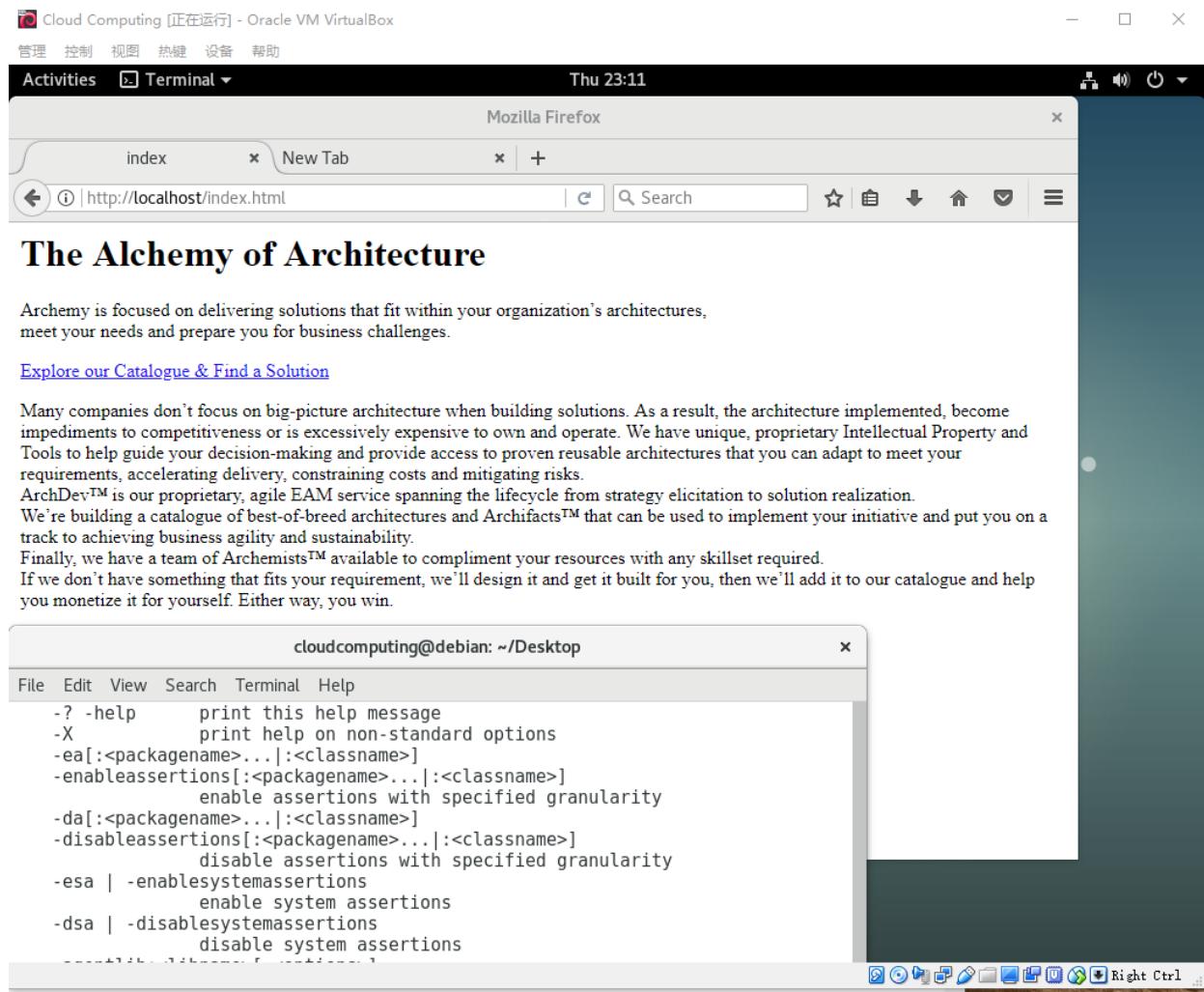
```
./glassfish5/bin/asadmin start-domain domain1
```



5. Setup all MySQL Connector/J and Glassfish, and Ping



6. Follow the instruction PDF file, deploy ArchNav on localhost



Step 5 Cloudification & Migration

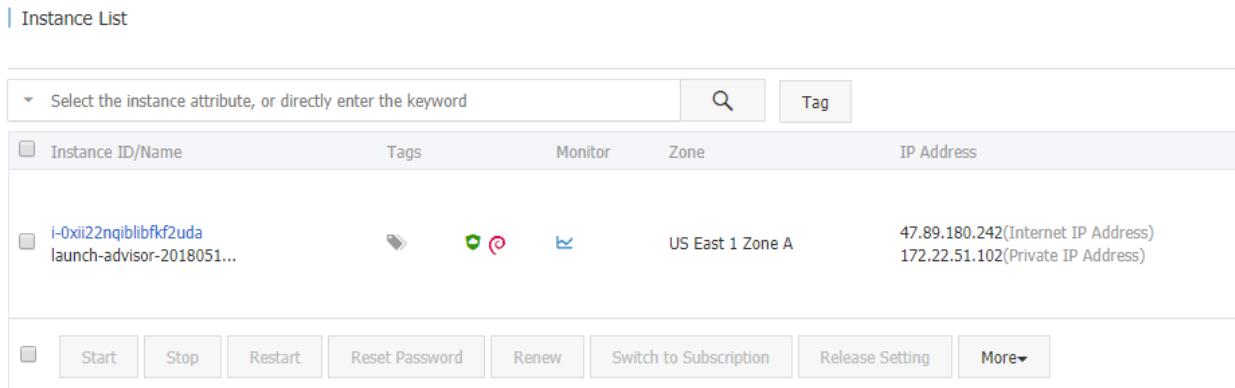
1. Buy a cloud instance on Alibaba Cloud

Instance List

Select the instance attribute, or directly enter the keyword

Instance ID/Name	Tags	Monitor	Zone	IP Address
i-0xii22nqplibfkf2uda launch-advisor-2018051...				US East 1 Zone A 47.89.180.242(Internet IP Address) 172.22.51.102(Private IP Address)

Start Stop Restart Reset Password Renew Switch to Subscription Release Setting More



2. Setup PuTTY to connect to cloud server.



The screenshot shows a PuTTY terminal window titled "47.89.180.242 - PuTTY". The session has been established with the IP address 47.89.180.242. The terminal displays the following text:

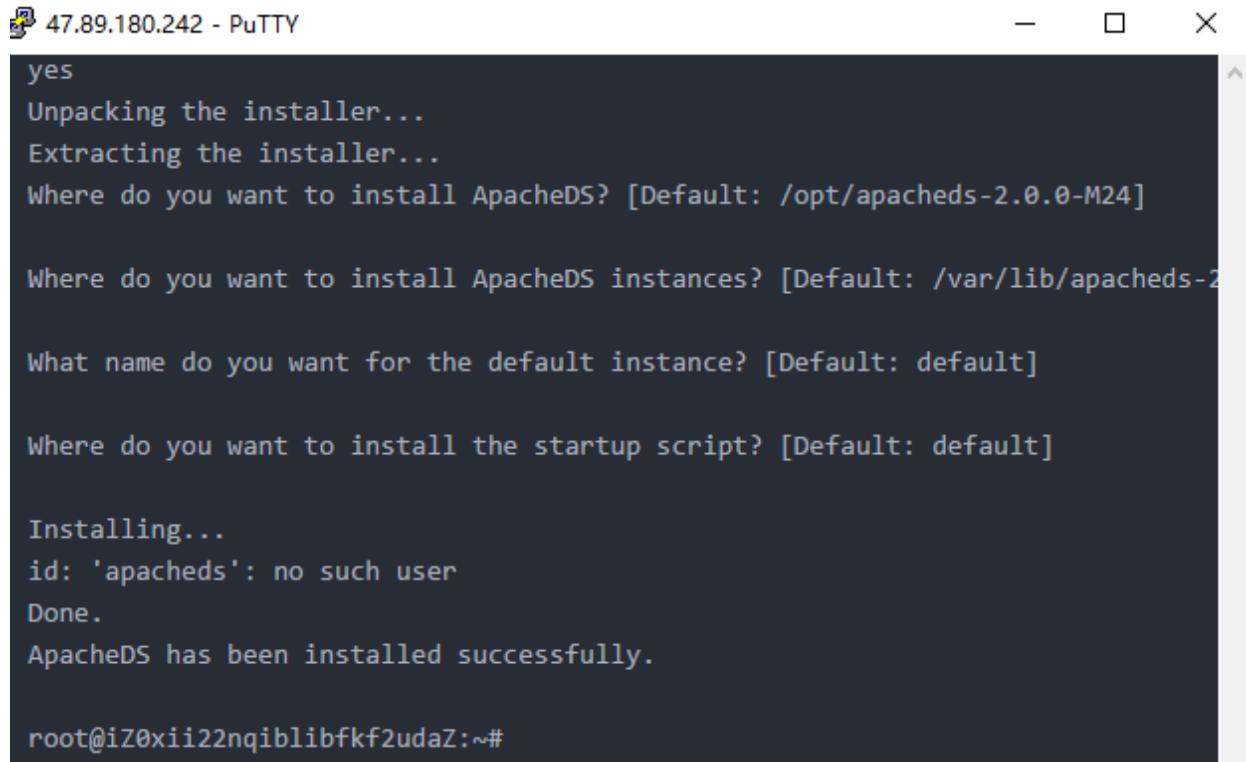
```
login as: root
root@47.89.180.242's password:
Linux iZ0xi22nqiblibfkf2udaZ 4.9.0-4-amd64 #1 SMP Debian 4.9.51-1
(2017-09-28) x86_64

Welcome to Alibaba Cloud Elastic Compute Service !

root@iZ0xi22nqiblibfkf2udaZ:~# whoami
root
root@iZ0xi22nqiblibfkf2udaZ:~#
```

3. Since we also use Debian 9.4 on our cloud machine, follow all steps in Step 1-4 can directly migrate our applications to the cloud. Here are some screenshots for most important and challenging parts.

Install ApacheDS:



A screenshot of a PuTTY terminal window titled "47.89.180.242 - PuTTY". The window shows the command-line interface for installing ApacheDS. The user has responded with "yes" to the first question. Subsequent questions ask for the installation path, instance path, default instance name, startup script path, and the user account to run the service under. The user specifies "/opt/apacheds-2.0.0-M24" for the first three, "default" for the fourth, and "apacheds" for the fifth. The process continues with "Installing...", a warning about the non-existent user, and finally "Done." and "ApacheDS has been installed successfully." The session ends with the root prompt "root@iZ0xi22nqiblibfkf2udaZ:~#".

```
yes
Unpacking the installer...
Extracting the installer...
Where do you want to install ApacheDS? [Default: /opt/apacheds-2.0.0-M24]
Where do you want to install ApacheDS instances? [Default: /var/lib/apacheds-2
What name do you want for the default instance? [Default: default]
Where do you want to install the startup script? [Default: default]
Installing...
id: 'apacheds': no such user
Done.
ApacheDS has been installed successfully.

root@iZ0xi22nqiblibfkf2udaZ:~#
```

Install Apache Fortress Core:

```

[INFO] Installing /root/directory-fortress-core/target/fortress-core-2.0.0-sources.jar to /root/.m2/repository/org/apache/directory/fortress/fortress-core/2.0.0/fortress-core-2.0.0-sources.jar
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 29.457 s
[INFO] Finished at: 2018-05-08T19:25:12-04:00
[INFO] Final Memory: 51M/135M
[INFO] -----
root@iZ0xi22nqiblibfkf2udaZ:~#

```

Install Tomcat:

The screenshot shows the Apache Tomcat 9.0.8 homepage. At the top, there's a navigation bar with tabs for "Apache Tomcat/9.0.8" and "Mozilla Firefox". Below the bar, the URL is "47.89.180.242:8080". On the left, there's a cartoon cat logo. To its right, under "Recommended Reading:", are links to "Security Considerations HOW-TO", "Manager Application HOW-TO", and "Clustering/Session Replication HOW-TO". To the right of these links are three buttons: "Server Status", "Manager App", and "Host Manager".

Developer Quick Start

- [Tomcat Setup](#)
- [First Web Application](#)
- [Realms & AAA](#)
- [JDBC DataSources](#)
- [Examples](#)
- [Servlet Specifications](#)
- [Tomcat Versions](#)

Managing Tomcat

For security, access to the [manager webapp](#) is restricted. Users are defined in: `$CATALINA_HOME/conf/tomcat-users.xml`

In Tomcat 9.0 access to the manager application is split between different users. [Read more...](#)

Release Notes

[Changelog](#)

[Migration Guide](#)

[Security Notices](#)

Documentation

[Tomcat 9.0 Documentation](#)

[Tomcat 9.0 Configuration](#)

[Tomcat Wiki](#)

Find additional important configuration information in: `$CATALINA_HOME RUNNING.txt`

Developers may be interested in:

- [Tomcat 9.0 Bug Database](#)
- [Tomcat 9.0 JavaDocs](#)
- [Tomcat 9.0 SVN Repository](#)

Getting Help

[FAQ and Mailing Lists](#)

The following mailing lists are available:

- tomcat-announce**
Important announcements, releases, security vulnerability notifications. (Low volume).
- tomcat-users**
User support and discussion
- taglibs-user**
User support and discussion for [Apache Taglibs](#)
- tomcat-dev**
Development mailing list, including commit messages

Other Downloads
[Tomcat Connectors](#)

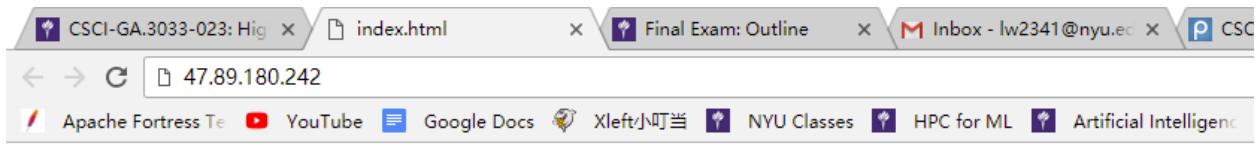
Other Documentation
[Tomcat Connectors](#)

Get Involved
[Overview](#)

Miscellaneous
[Contact](#)

Apache Software Foundation

Deploy ArchNav:



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[Explore our Catalogue & Find a Solution](#)

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If we don't have something that fits your requirement, we'll design it and get it built for you, then we'll add it to our catalogue and make it available to you.

- 1.
- 2.
- 3.



[Previous](#) [Next](#)