

Instituto Politécnico Nacional
Escuela Superior de Cómputo

Implementación de un servicio web estilo REST

Tarea 6

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Grupo 4CV12

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INTRODUCCIÓN

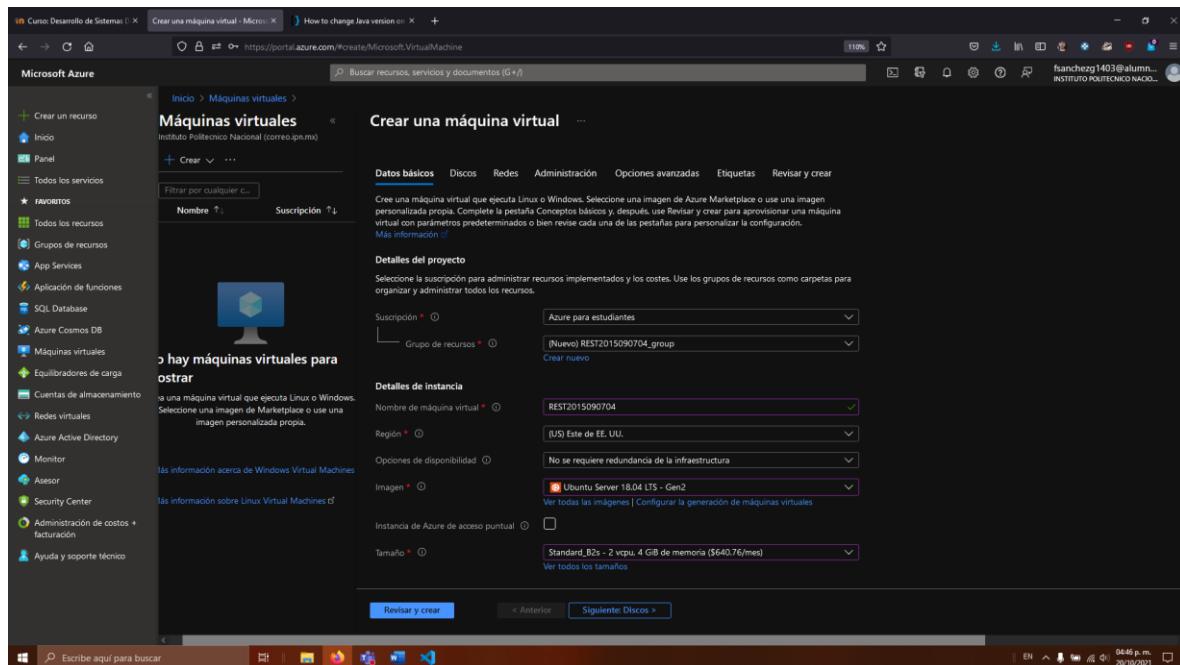
El uso de servicios REST ha estado en auge desde hace varios años gracias a que está basado en el protocolo HTTP y permite la manipulación y operación de datos a gran escala. Presenta grandes ventajas como poder ser consumidas a través de una Vista siguiendo el patrón de diseño MVC (modelo, vista, controlador). A continuación, se muestra cómo se crea una máquina virtual en Microsoft Azure y los pasos necesarios para levantar el servicio Tomcat, la conexión a MySQL y finalmente la compilación y despliegue del servicio REST.

DESARROLLO

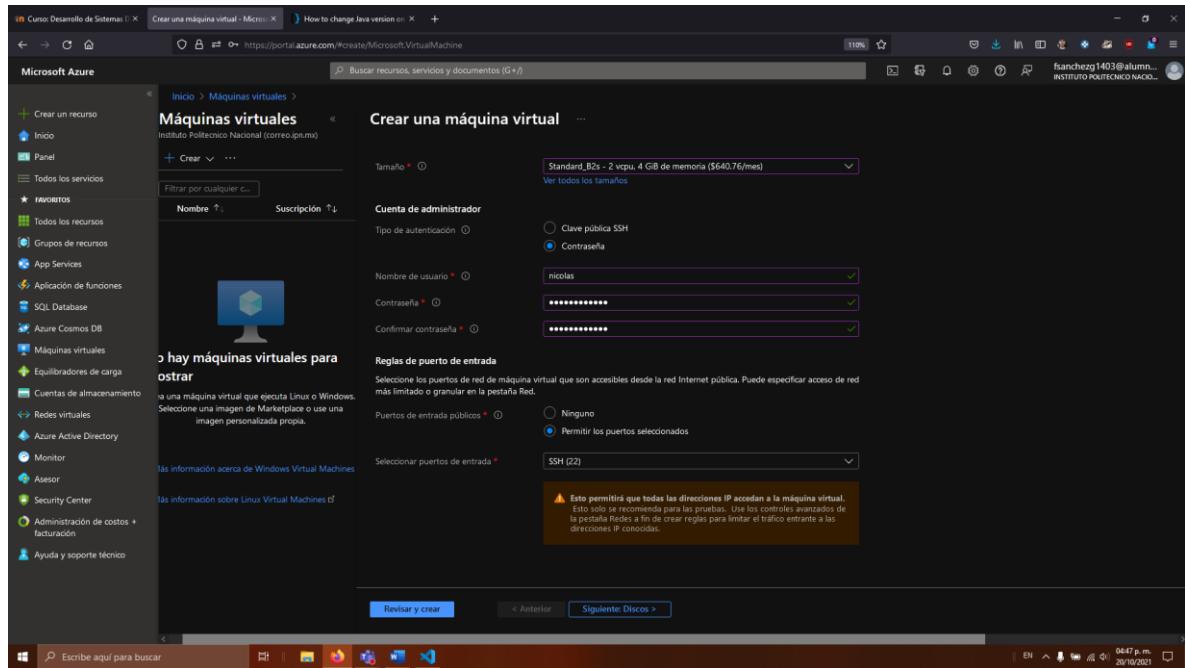
Creación de máquina virtual

Instalación de Tomcat con soporte REST

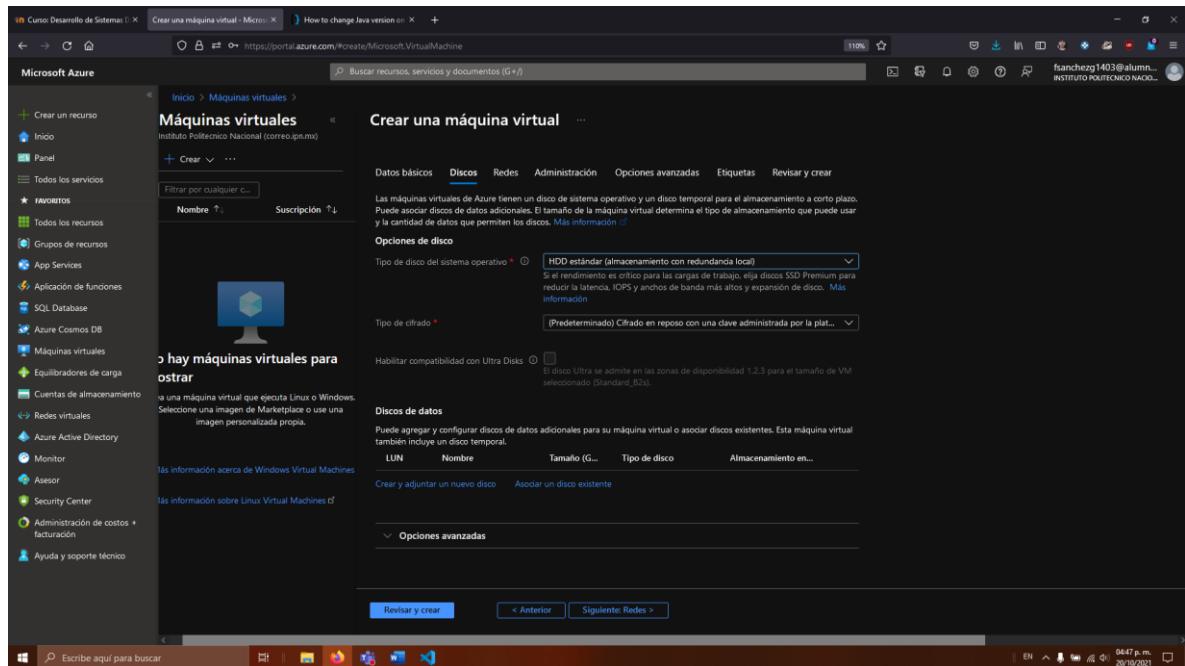
1. Crear una máquina virtual con Ubuntu 18 con al menos 1GB de memoria RAM. Abrir el puerto 8080 para el protocolo TCP.



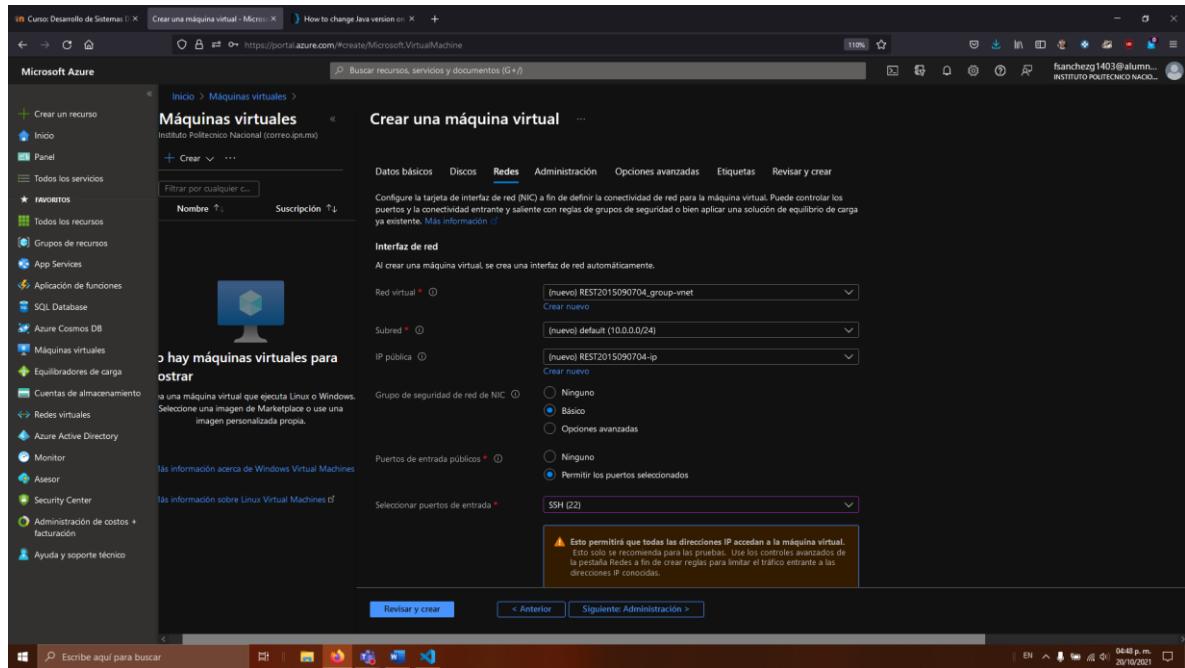
Datos de máquina virtual para la creación.



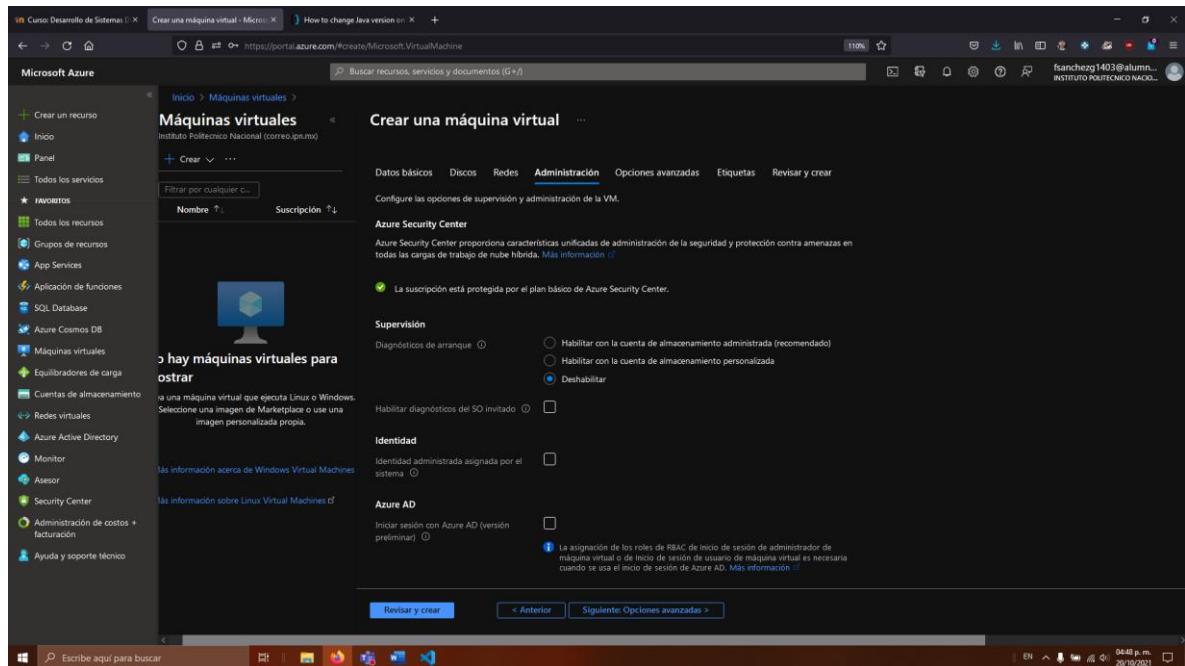
Cuenta por contraseña y dejamos abierto el puerto 22 (SSH).



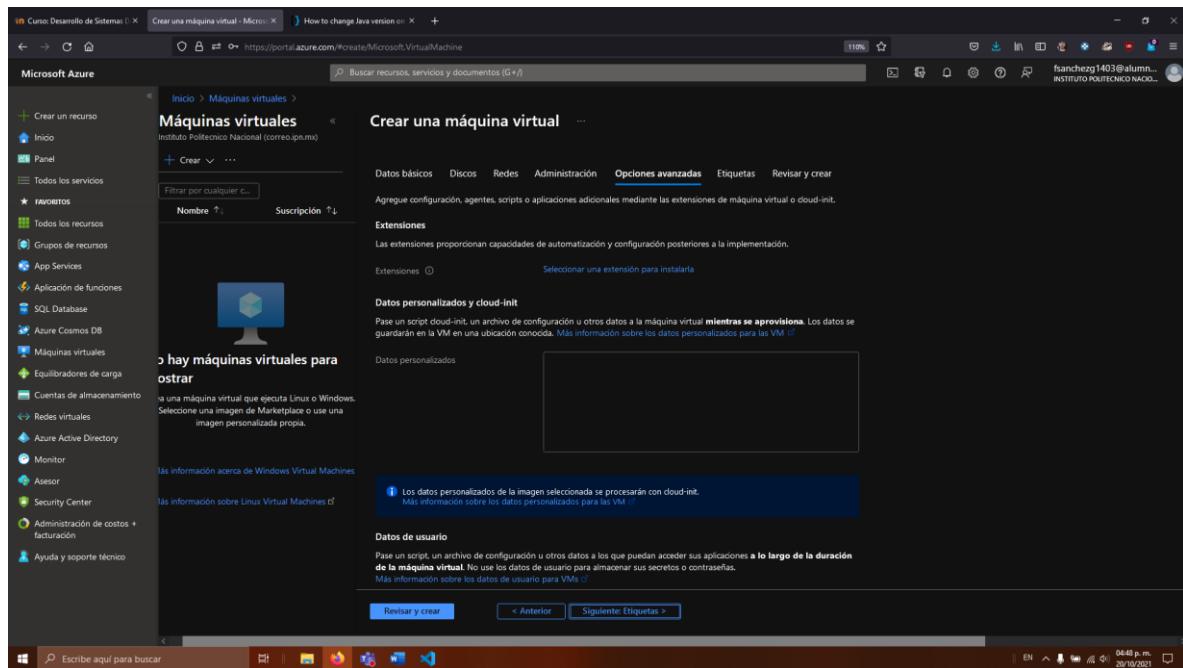
En Discos cambiamos a la opción de un HDD estándar.



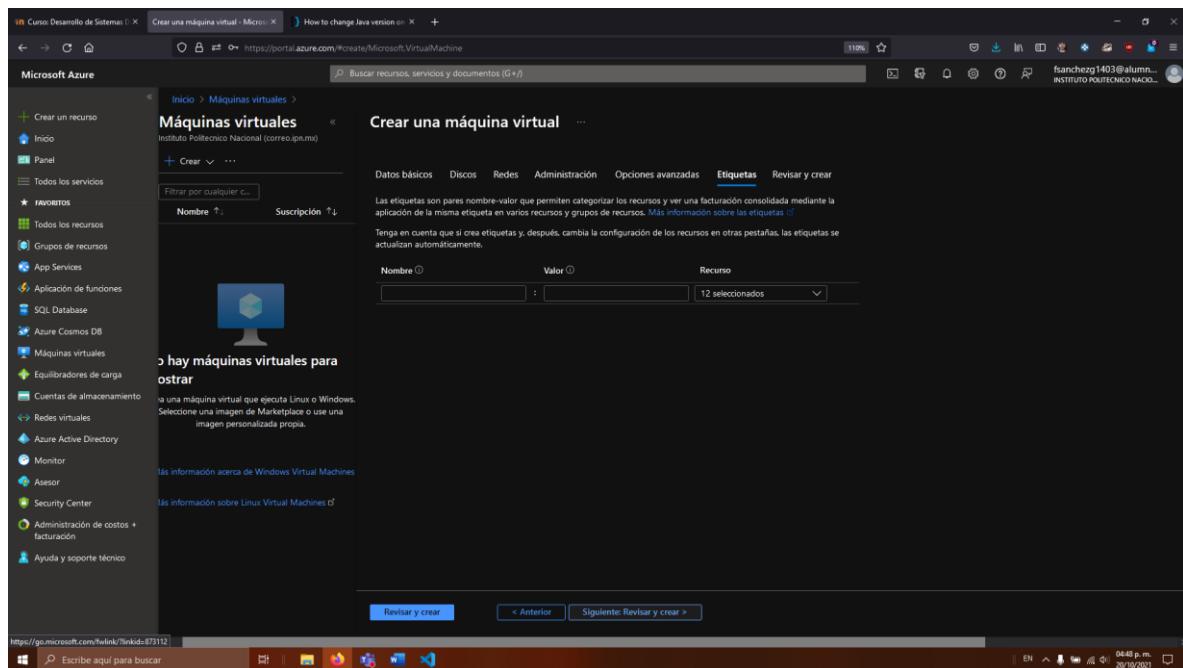
En Redes no se modifica nada.



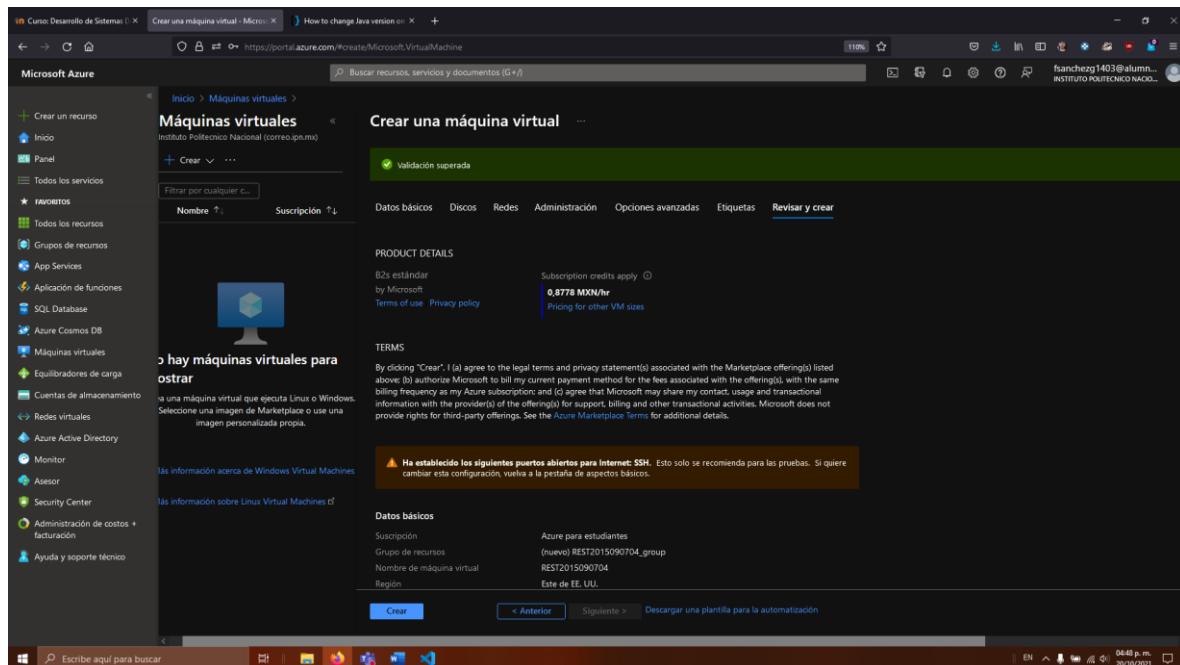
En Administración se deshabilita el diagnóstico de arranque.



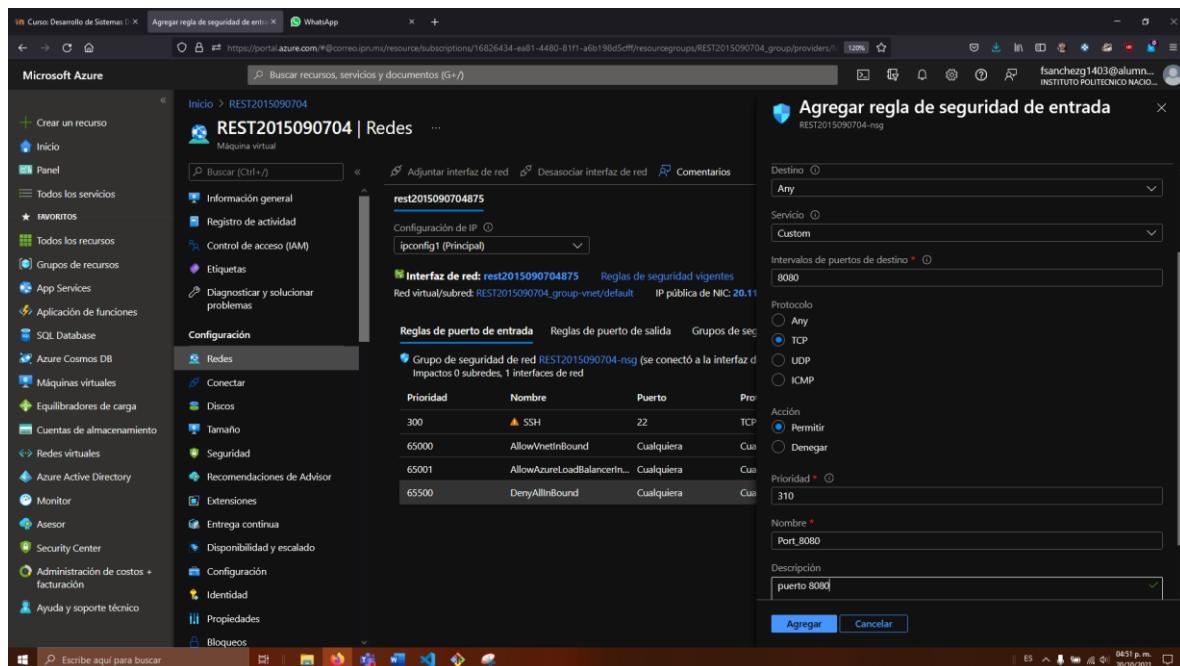
No se agregan opciones avanzadas.



No se agregan etiquetas.



Verificamos que la máquina virtual pase la validación y la creamos.



Abrimos el puerto 8080 para el servicio de Tomcat.

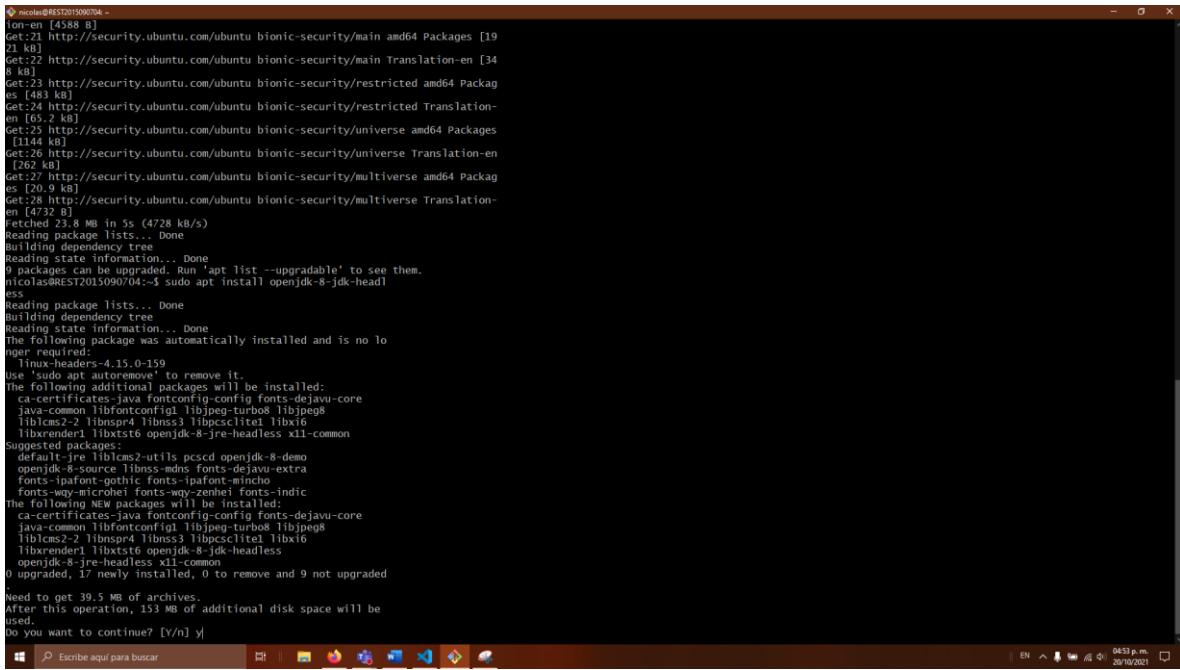
2. Instalar JDK8 ejecutando los siguientes comandos en la máquina virtual:

```
sudo apt update  
sudo apt install openjdk-8-jdk-headless
```

Conexión vía SSH y actualización de paquetes.

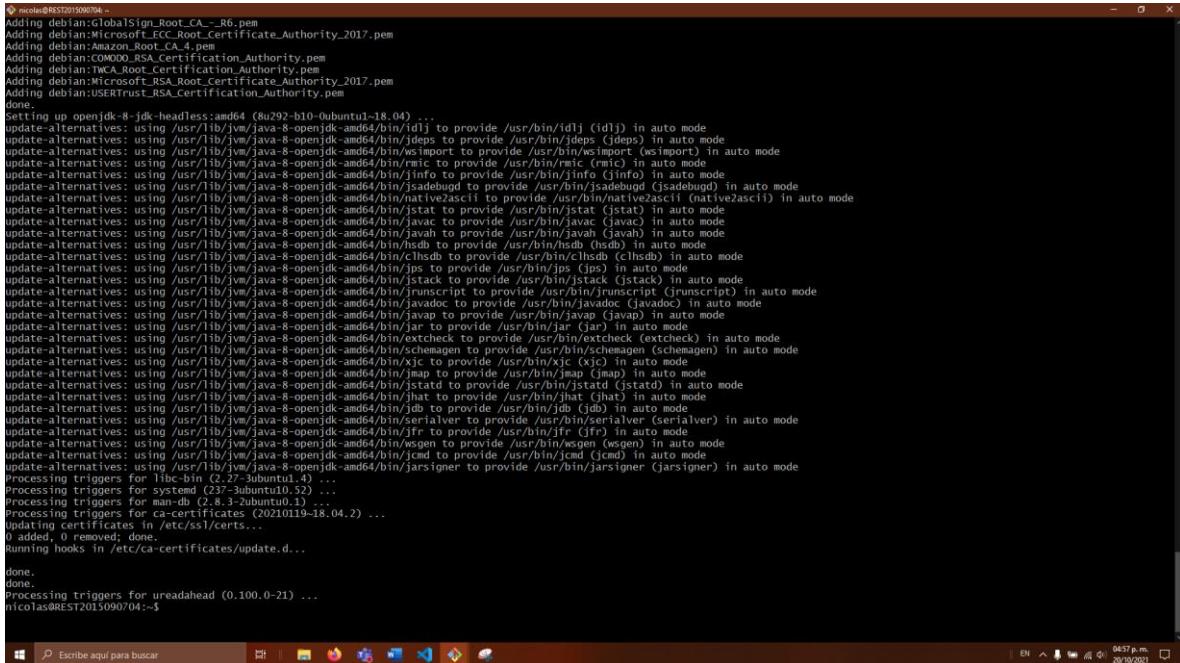
```
nicolas@REST2015090704:~$ apt update
Get:1 http://azure.archive.ubuntu.com/ubuntu bionic/multiverse Translation-en [1
08 kB]
Get:9 http://azure.archive.ubuntu.com/ubuntu bionic-updates/main amd64 Packages
[2289 kB]
Get:10 http://azure.archive.ubuntu.com/ubuntu bionic-updates/main Translation-en
[441 kB]
Get:11 http://azure.archive.ubuntu.com/ubuntu bionic-updates/restricted amd64 Pa
ckages [512 kB]
Get:12 http://azure.archive.ubuntu.com/ubuntu bionic-updates/restricted Translat
ion-en [69.6 kB]
Get:13 http://azure.archive.ubuntu.com/ubuntu bionic-updates/universe amd64 Pack
ages [1758 kB]
Get:14 http://azure.archive.ubuntu.com/ubuntu bionic-updates/universe Translatio
n-en [313 kB]
Get:15 http://azure.archive.ubuntu.com/ubuntu bionic-updates/multiverse amd64 Pa
ckages [27.3 kB]
Get:16 http://azure.archive.ubuntu.com/ubuntu bionic-updates/multiverse Translat
ion-en [6808 kB]
Get:17 http://azure.archive.ubuntu.com/ubuntu bionic-backports/main amd64 Packag
es [10.0 kB]
Get:18 http://azure.archive.ubuntu.com/ubuntu bionic-backports/main Translation-
en [4764 kB]
Get:19 http://azure.archive.ubuntu.com/ubuntu bionic-backports/universe amd64 Pa
ckage [10.3 kB]
Get:20 http://azure.archive.ubuntu.com/ubuntu bionic-backports/universe Translat
ion-en [4588 kB]
Get:21 http://security.ubuntu.com/ubuntu bionic-security/main amd64 Packages [19
2 kB]
Get:22 http://security.ubuntu.com/ubuntu bionic-security/main Translation-en [34
8 kB]
Get:23 http://security.ubuntu.com/ubuntu bionic-security/restricted amd64 Packag
es [483 kB]
Get:24 http://security.ubuntu.com/ubuntu bionic-security/restricted Translation-
en [65.2 kB]
Get:25 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 Packages
[114 kB]
Get:26 http://security.ubuntu.com/ubuntu bionic-security/universe Translation-en
[262 kB]
Get:27 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 Packag
es [20.9 kB]
Get:28 http://security.ubuntu.com/ubuntu bionic-security/multiverse Translation-
en [773 kB]
Fetched 23.8 MB in 5s (4728 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
9 packages can be upgraded. Run 'apt list --upgradable' to see them.
nicolas@REST2015090704:~$
```

Finalización de actualización de repositorios.



```
nicolas@RESTD015090704:~  
ion-en [4588 B]  
Get:21 http://security.ubuntu.com/ubuntu bionic-security/main amd64 Packages [19  
21 kB]  
Get:22 http://security.ubuntu.com/ubuntu bionic-security/main Translation-en [34  
kB]  
Get:23 http://security.ubuntu.com/ubuntu bionic-security/restricted amd64 Packag  
es [481 kB]  
Get:24 http://security.ubuntu.com/ubuntu bionic-security/restricted Translation-  
en [65.2 kB]  
Get:25 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 Packages  
[544 kB]  
Get:26 http://security.ubuntu.com/ubuntu bionic-security/universe Translation-en  
[262 kB]  
Get:27 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 Packag  
es [20.9 kB]  
Get:28 http://security.ubuntu.com/ubuntu bionic-security/multiverse Translation-  
en [4732 B]  
Fetched 23.8 MB in 5s (4728 kB/s)  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
Reading state information... Done  
Reading packages can be upgraded. Run 'apt list --upgradable' to see them.  
nicolas@RESTD015090704:~$ sudo apt install openjdk-8-jdk-headless  
exit  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following package was automatically installed and is no lo  
nger required:  
  linux-headers-4.15.0-159  
Use 'sudo apt autoremove' to remove it.  
The following additional packages will be installed:  
  ca-certificates-java fontconfig-config fonts-dejavu-core  
  fonts-dejavu-ttf libfontconfig1 libjpeg-turbo8 libjpeg8  
  liblcms2-2 liblcms2 liblens3 libpcselite libx16  
  libxrender1 libxtst6 openjdk-8-jre-headless x11-common  
Suggested packages:  
  default-jre liblcms2-utils pccsd openjdk-8-demo  
  openjdk-8-source libnss-mdns fonts-dejavu-extra  
  fonts-ipafont-gothic fonts-ipafont-mincho  
  fonts-ipafont-mincho fonts-ipafont-mincho-indic  
The following NEW packages will be installed:  
  ca-certificates-java fontconfig-config fonts-dejavu-core  
  java-common libfontconfig1 libjpeg-turbo8 libjpeg8  
  liblcms2-2 liblens3 libpcselite libx16  
  libxrender1 libxtst6 openjdk-8-jre-headless  
  openjdk-8-jre-headless x11-common  
0 upgraded, 17 newly installed, 0 to remove and 9 not upgraded  
.  
Need to get 39.5 MB of archives.  
After this operation, 153 MB of additional disk space will be  
used.  
Do you want to continue? [Y/n] y|
```

Instalación del JDK.

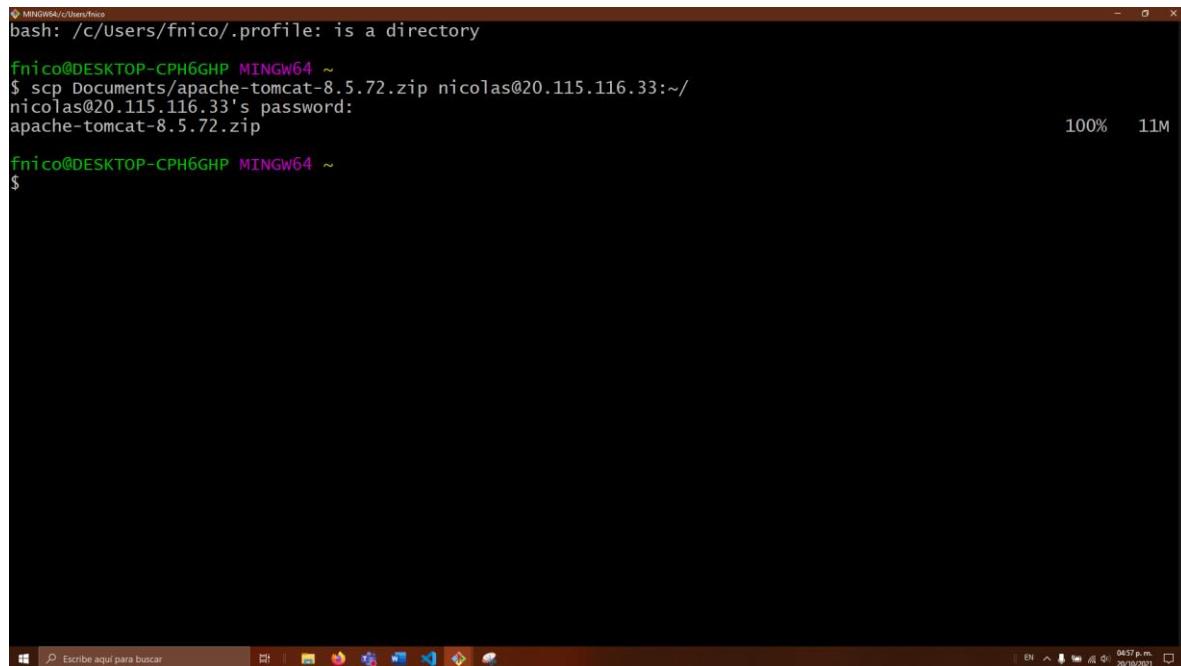


```
nicolas@RESTD015090704:~  
Adding debian:GlobalSign_Root_CA_-R6.pem  
Adding debian:Microsoft_ECC_Root_Certificate_Authority_2017.pem  
Adding debian:Amazon_Root_CA_4.pem  
Adding debian:COMODO_RSA_Certification_Authority.pem  
Adding debian:TWCRoot_Certification_Authority.pem  
Adding debian:Microsoft_RSA_Root_Certificate_Authority_2017.pem  
Adding debian:USERTrust_RSA_Certification_Authority.pem  
done  
Setting up openjdk-8-jdk-headless:amd64 (8u292-b10~Ubuntu18.04) ...  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jdk1j to provide /usr/bin/1dk1j (1dk1j) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jdeps to provide /usr/bin/jdeps (jdeps) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/wsimport to provide /usr/bin/wsimport (wsimport) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/xjc to provide /usr/bin/xjc (xjc) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/info to provide /usr/bin/jinfo (jinfo) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/sadebug to provide /usr/bin/sadebug (sadebug) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/native2ascii to provide /usr/bin/native2ascii (native2ascii) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jstat to provide /usr/bin/jstat (jstat) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jstatd to provide /usr/bin/jstatd (jstatd) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jdb to provide /usr/bin/jdb (jdb) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/hprof to provide /usr/bin/hprof (hprof) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/hsdb to provide /usr/bin/hsdb (hsdb) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/chsdb to provide /usr/bin/chsdb (chsdb) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jps to provide /usr/bin/jps (jps) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jstack to provide /usr/bin/jstack (jstack) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jhat to provide /usr/bin/jhat (jhat) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/javac to provide /usr/bin/javac (javac) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/javadoc to provide /usr/bin/javadoc (javadoc) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jar to provide /usr/bin/jar (jar) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/excheck to provide /usr/bin/excheck (excheck) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/schemagen to provide /usr/bin/schemagen (schemagen) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jmap to provide /usr/bin/jmap (jmap) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jstatd to provide /usr/bin/jstatd (jstatd) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jhat to provide /usr/bin/jhat (jhat) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jdb to provide /usr/bin/jdb (jdb) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/serialver to provide /usr/bin/serialver (serialver) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jarcmd to provide /usr/bin/jarcmd (jarcmd) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jcmd to provide /usr/bin/jcmd (jcmd) in auto mode  
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/bin/jarsigner to provide /usr/bin/jarsigner (jarsigner) in auto mode  
Processing triggers for libl-1n (2.27~ubunt18.04) ...  
Processing triggers for systemd (237-3ubuntu10.32) ...  
Processing triggers for ca-certificates (20210119-18.04.2) ...  
Updating certificates in /etc/ssl/certs...  
0 added, 0 removed; done.  
Running hooks in /etc/ca-certificates/update.d...  
done.  
done.  
Processing triggers for ureadahead (0.100.0-21) ...  
nicolas@RESTD015090704:~$
```

Finalización de instalación del JDK.

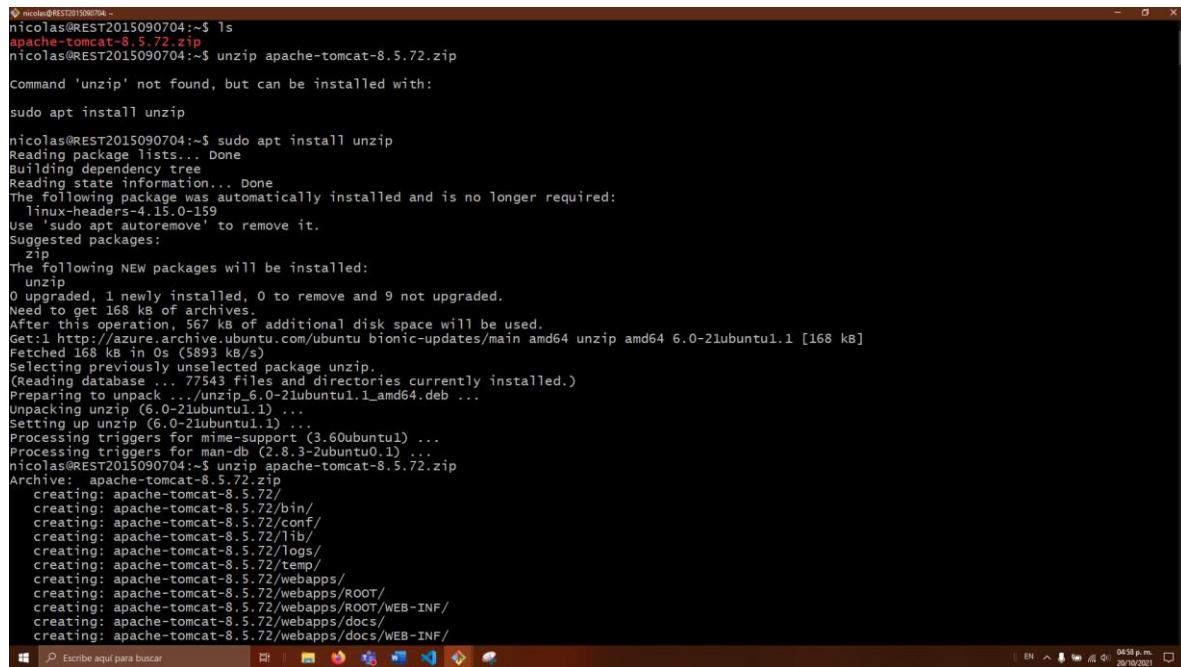
2. descargar la distribucion binaria de tomcat 8

4. Copiar a la máquina virtual el archivo ZIP descargado anteriormente y desempacarlo utilizando el comando unzip.



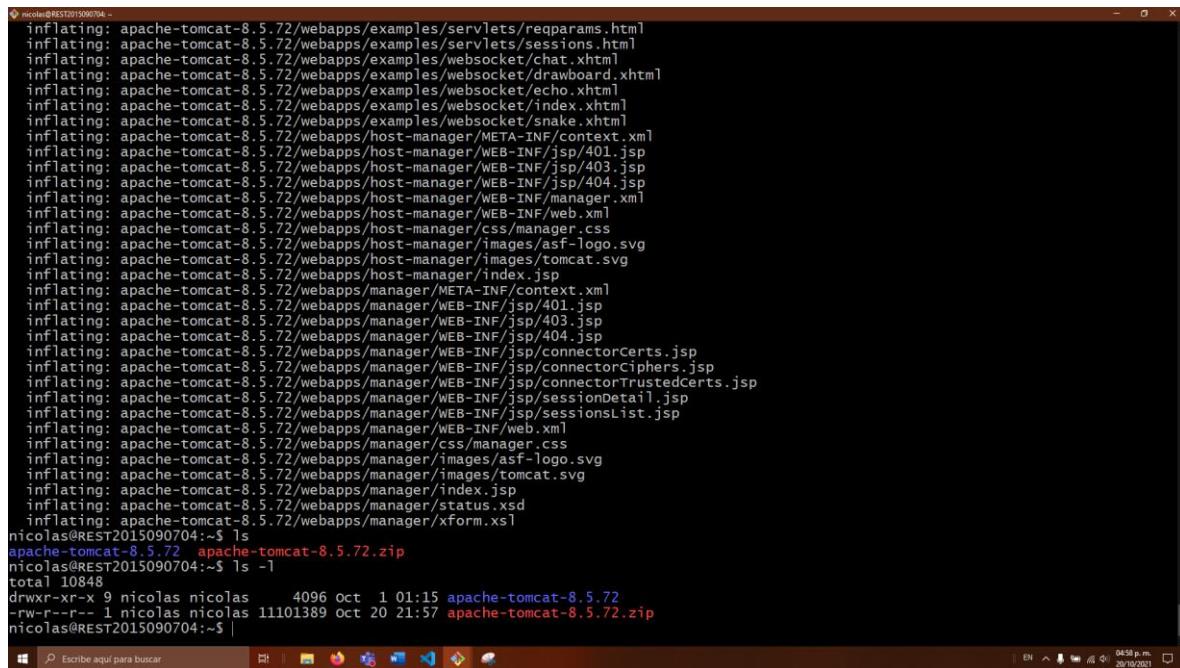
```
MINGW64 /c/Users/fnico
bash: /c/Users/fnico/.profile: is a directory
fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/apache-tomcat-8.5.72.zip nicolas@20.115.116.33:~/nicolas@20.115.116.33's password:
apache-tomcat-8.5.72.zip                                         100%   11M
fnico@DESKTOP-CPH6GHP MINGW64 ~
$
```

Envío de Apache Tomcat vía scp.



```
nicolas@REST2015090704:~$ ls
apache-tomcat-8.5.72.zip
nicolas@REST2015090704:~$ unzip apache-tomcat-8.5.72.zip
Command 'unzip' not found, but can be installed with:
sudo apt install unzip
nicolas@REST2015090704:~$ sudo apt install unzip
Reading package lists... done
Building dependency tree
Reading state information... done
The following package was automatically installed and is no longer required:
  linux-headers-4.15.0-159
Use 'sudo apt autoremove' to remove it.
Suggested packages:
  zip
The following NEW packages will be installed:
  unzip
0 upgraded, 1 newly installed, 0 to remove and 9 not upgraded.
Need to get 168 kB of archives.
After this operation, 567 kB of additional disk space will be used.
Get:1 http://azure.archive.ubuntu.com/ubuntu bionic-updates/main amd64 unzip amd64 6.0-21ubuntu1.1 [168 kB]
Fetched 168 kB in 0s (5893 kB/s)
Selecting previously unselected package unzip.
(Reading database ... 77543 files and directories currently installed.)
Preparing to unpack .../unzip_6.0-21ubuntu1.1_amd64.deb ...
Unpacking unzip (6.0-21ubuntu1.1) ...
Setting up unzip (6.0-21ubuntu1.1) ...
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
nicolas@REST2015090704:~$ unzip apache-tomcat-8.5.72.zip
Archive:  apache-tomcat-8.5.72.zip
  creating: apache-tomcat-8.5.72/
  creating: apache-tomcat-8.5.72/bin/
  creating: apache-tomcat-8.5.72/conf/
  creating: apache-tomcat-8.5.72/lib/
  creating: apache-tomcat-8.5.72/logs/
  creating: apache-tomcat-8.5.72/temp/
  creating: apache-tomcat-8.5.72/webapps/
  creating: apache-tomcat-8.5.72/webapps/ROOT/
  creating: apache-tomcat-8.5.72/webapps/ROOT/WEB-INF/
  creating: apache-tomcat-8.5.72/webapps/docs/
  creating: apache-tomcat-8.5.72/webapps/docs/WEB-INF/
nicolas@REST2015090704:~$
```

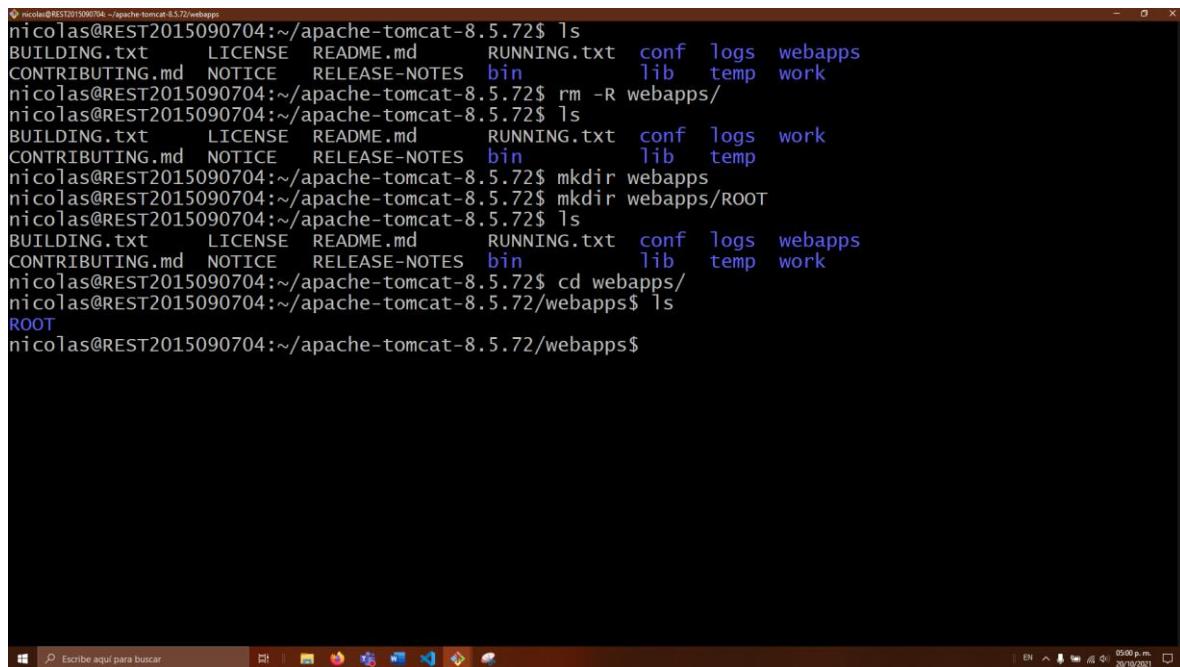
Recepción de archivo y descompresión del mismo.



```
nicolas@REST2015090704:~$ inflate: apache-tomcat-8.5.72/webapps/examples/servlets/reparams.html
inflating: apache-tomcat-8.5.72/webapps/examples/servlets/sessions.html
inflating: apache-tomcat-8.5.72/webapps/examples/websocket/chat.xhtml
inflating: apache-tomcat-8.5.72/webapps/examples/websocket/drawboard.xhtml
inflating: apache-tomcat-8.5.72/webapps/examples/websocket/ech.xhtml
inflating: apache-tomcat-8.5.72/webapps/examples/websocket/index.xhtml
inflating: apache-tomcat-8.5.72/webapps/examples/websocket/snake.xhtml
inflating: apache-tomcat-8.5.72/webapps/host-manager/META-INF/context.xml
inflating: apache-tomcat-8.5.72/webapps/host-manager/WEB-INF/isp/401.jsp
inflating: apache-tomcat-8.5.72/webapps/host-manager/WEB-INF/isp/403.jsp
inflating: apache-tomcat-8.5.72/webapps/host-manager/WEB-INF/isp/404.jsp
inflating: apache-tomcat-8.5.72/webapps/host-manager/WEB-INF/manager.xml
inflating: apache-tomcat-8.5.72/webapps/host-manager/WEB-INF/web.xml
inflating: apache-tomcat-8.5.72/webapps/host-manager/css/manager.css
inflating: apache-tomcat-8.5.72/webapps/host-manager/images/asf-logo.svg
inflating: apache-tomcat-8.5.72/webapps/host-manager/images/tomcat.svg
inflating: apache-tomcat-8.5.72/webapps/host-manager/index.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/META-INF/context.xml
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/isp/401.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/isp/403.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/isp/404.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/jsp/connectorcerts.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/jsp/connectorciphers.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/jsp/connectorTrustedcerts.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/jsp/sessionDetail.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/WEB-INF/jsp/sessionsList.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/web.xml
inflating: apache-tomcat-8.5.72/webapps/manager/css/manager.css
inflating: apache-tomcat-8.5.72/webapps/manager/images/asf-logo.svg
inflating: apache-tomcat-8.5.72/webapps/manager/images/tomcat.svg
inflating: apache-tomcat-8.5.72/webapps/manager/index.jsp
inflating: apache-tomcat-8.5.72/webapps/manager/status.xsd
inflating: apache-tomcat-8.5.72/webapps/manager/xform.xsl
nicolas@REST2015090704:~$ ls
apache-tomcat-8.5.72 apache-tomcat-8.5.72.zip
nicolas@REST2015090704:~$ ls -l
total 10848
drwxr-xr-x 9 nicolas nicolas 4096 oct 1 01:15 apache-tomcat-8.5.72
-rw-r--r-- 1 nicolas nicolas 11101389 oct 20 21:57 apache-tomcat-8.5.72.zip
nicolas@REST2015090704:~$
```

Archivos descomprimidos en la carpeta.

5.Eliminar el directorio webapps el cual se encuentra dentro del directorio de Tomcat. Crear un nuevo directorio webapps y dentro de éste se deberá crear el directorio ROOT.



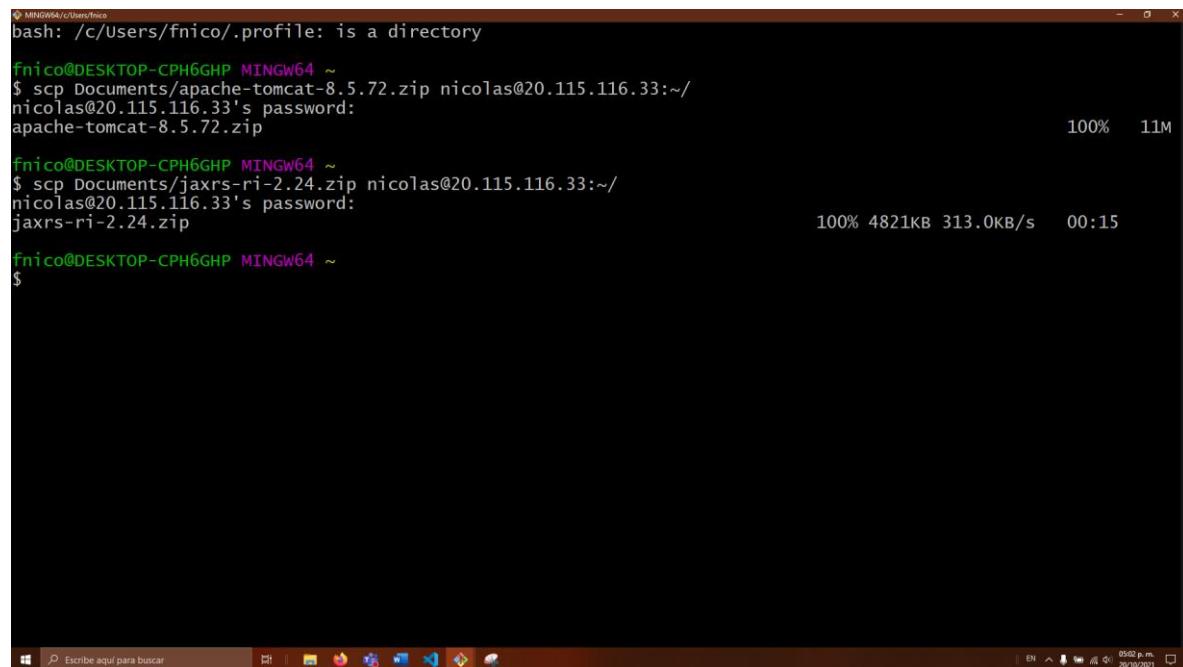
```
nicolas@REST2015090704:~/apache-tomcat-8.5.72$ ls
BUILDING.txt LICENSE README.md RUNNING.txt conf logs webapps
CONTRIBUTING.md NOTICE RELEASE-NOTES bin lib temp work
nicolas@REST2015090704:~/apache-tomcat-8.5.72$ rm -R webapps/
nicolas@REST2015090704:~/apache-tomcat-8.5.72$ ls
BUILDING.txt LICENSE README.md RUNNING.txt conf logs work
CONTRIBUTING.md NOTICE RELEASE-NOTES bin lib temp
nicolas@REST2015090704:~/apache-tomcat-8.5.72$ mkdir webapps
nicolas@REST2015090704:~/apache-tomcat-8.5.72$ mkdir webapps/ROOT
nicolas@REST2015090704:~/apache-tomcat-8.5.72$ ls
BUILDING.txt LICENSE README.md RUNNING.txt conf logs webapps
CONTRIBUTING.md NOTICE RELEASE-NOTES bin lib temp work
nicolas@REST2015090704:~/apache-tomcat-8.5.72$ cd webapps/
nicolas@REST2015090704:~/apache-tomcat-8.5.72/webapps$ ls
ROOT
nicolas@REST2015090704:~/apache-tomcat-8.5.72/webapps$
```

Se elimina lo que hay en el directorio webapps y se crea el directorio ROOT de nuevo.

6. Descargar la biblioteca "Jersey" de la siguiente URL. Jersey es una implementación de JAX-RS lo cual permite ejecutar servicios web estilo REST sobre Tomcat:

<https://repo1.maven.org/maven2/org/glassfish/jersey/bundles/jaxrs-ri/2.24/jaxrs-ri-2.24.zip>

7. Copiar a la máquina virtual el archivo descargado anteriormente, desempacarlo y copiar todos los archivos con extensión ".jar" de todos los directorios desempacados, al directorio "lib" de Tomcat.



```
MINGW64 /c/Users/fnico
bash: /c/Users/fnico/.profile: is a directory
fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/apache-tomcat-8.5.72.zip nicolas@20.115.116.33:~/nicolas@20.115.116.33's password:
apache-tomcat-8.5.72.zip                                              100%   11M
fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/jaxrs-ri-2.24.zip nicolas@20.115.116.33:~/nicolas@20.115.116.33's password:
jaxrs-ri-2.24.zip                                              100% 4821KB 313.0KB/s  00:15
fnico@DESKTOP-CPH6GHP MINGW64 ~
$
```

Copia del jar de jaxrs a la máquina virtual.

```
nicolas@REST2015090704:~$ ls
apache-tomcat-8.5.72 apache-tomcat-8.5.72.zip jaxrs-ri-2.24.zip
nicolas@REST2015090704:~$ unzip jaxrs-ri-2.24.zip
Archive: jaxrs-ri-2.24.zip
  creating: jaxrs-ri/
  inflating: jaxrs-ri/Jersey-LICENSE.txt
  inflating: jaxrs-ri/third-party-license-readme.txt
  creating: jaxrs-ri/api/
 extracting: jaxrs-ri/api/javax.ws.rs-api-2.0.1.jar
  creating: jaxrs-ri/lib/
 extracting: jaxrs-ri/lib/jersey-common.jar
 extracting: jaxrs-ri/lib/jersey-media-jaxb.jar
 extracting: jaxrs-ri/lib/jersey-client.jar
 extracting: jaxrs-ri/lib/jersey-server.jar
 extracting: jaxrs-ri/lib/jersey-container-servlet-core.jar
 extracting: jaxrs-ri/lib/jersey-container-servlet.jar
  creating: jaxrs-ri/ext/
 extracting: jaxrs-ri/ext/javax.inject-2.5.0-b05.jar
 extracting: jaxrs-ri/ext/osgi-resource-locator-1.0.1.jar
 extracting: jaxrs-ri/ext/javax.annotation-api-1.2.jar
 extracting: jaxrs-ri/ext/jersey-guava-2.24.jar
 extracting: jaxrs-ri/ext/hk2-api-2.5.0-b05.jar
 extracting: jaxrs-ri/ext/hk2-utils-2.5.0-b05.jar
 extracting: jaxrs-ri/ext/aopalliance-repackaged-2.5.0-b05.jar
 extracting: jaxrs-ri/ext/hk2-locator-2.5.0-b05.jar
 extracting: jaxrs-ri/ext/javassist-3.20.0-GA.jar
 extracting: jaxrs-ri/ext/validation-api-1.1.0.Final.jar
 extracting: jaxrs-ri/ext/org.osgi.core-4.2.0.jar
 extracting: jaxrs-ri/ext/jaxb-api-2.2.7.jar
 extracting: jaxrs-ri/ext/javax.servlet-api-3.0.1.jar
 extracting: jaxrs-ri/ext/persistence-api-1.0.jar
nicolas@REST2015090704:~$ ls
apache-tomcat-8.5.72 apache-tomcat-8.5.72.zip jaxrs-ri jaxrs-ri-2.24.zip
nicolas@REST2015090704:~$
```

Una vez recibido el zip se descomprime.

```
nicolas@REST2015090704:~$ tree apache-tomcat-8.5.72/lib/
apache-tomcat-8.5.72/lib/
├── jersey-media-jaxb.jar
├── jersey-server.jar
└── third-party-license-readme.txt

3 directories, 23 files
nicolas@REST2015090704:~$ cp jaxrs-ri/api/javax.ws.rs-api-2.0.1.jar .
.bash_logout          .gnupg/           .sudo_as_admin_successful  jaxrs-ri/
.bashrc                .profile          apache-tomcat-8.5.72/    jaxrs-ri-2.24.zip
.cache/               .ssh/             apache-tomcat-8.5.72.zip
nicolas@REST2015090704:~$ cp jaxrs-ri/api/javax.ws.rs-api-2.0.1.jar .
.bash_logout          .gnupg/           .sudo_as_admin_successful  jaxrs-ri/
.bashrc                .profile          apache-tomcat-8.5.72/    jaxrs-ri-2.24.zip
.cache/               .ssh/             apache-tomcat-8.5.72.zip
nicolas@REST2015090704:~$ cp jaxrs-ri/api/javax.ws.rs-api-2.0.1.jar apache-tomcat-8.5.72/lib/
nicolas@REST2015090704:~$ cp jaxrs-ri/ext/%.jar apache-tomcat-8.5.72/lib/
nicolas@REST2015090704:~$ cp jaxrs-ri/lib/*.* apache-tomcat-8.5.72/lib/
nicolas@REST2015090704:~$ tree apache-tomcat-8.5.72/lib/
apache-tomcat-8.5.72/lib/
├── annotations-api.jar
├── aopalliance-repackaged-2.5.0-b05.jar
├── catalina-ant.jar
├── catalina-ha.jar
├── catalina-storeconfig.jar
├── catalina-tribes.jar
├── catalina.jar
├── ejc-4.6.3.jar
├── el-api.jar
├── hk2-api-2.5.0-b05.jar
├── hk2-locator-2.5.0-b05.jar
├── hk2-utils-2.5.0-b05.jar
├── jasper-el.jar
├── jasper.jar
├── jaspic-api.jar
├── javassist-3.20.0-GA.jar
└── javax.annotation-api-1.2.jar
nicolas@REST2015090704:~$
```

Archivo descomprimido y copiado a la librería de Apache Tomcat.

```

nicolas@REST2015090704:~$ ls apache-tomcat-8.5.72/lib/
annotations-api.jar           javax.inject-2.5.0-b05.jar      tomcat-coyote.jar
aopalliance-repackaged-2.5.0-b05.jar   javax.servlet-api-3.0.1.jar    tomcat-dbcp.jar
catalina-ant.jar                javax.ws.rs-api-2.0.1.jar    tomcat-i18n-de.jar
catalina-ha.jar                 jaxb-api-2.2.7.jar        tomcat-i18n-es.jar
catalina-storeconfig.jar        jersey-client.jar       tomcat-i18n-fr.jar
catalina-tribes.jar             jersey-common.jar      tomcat-i18n-ja.jar
catalina.jar                   jersey-container-servlet-core.jar tomcat-i18n-ko.jar
ecj-4.6.3.jar                  jersey-container-servlet.jar tomcat-i18n-ru.jar
el-api.jar                     jersey-guava-2.24.jar     tomcat-i18n-zh-CN.jar
hk2-api-2.5.0-b05.jar          jersey-media-jaxb.jar   tomcat-jdbc.jar
hk2-locator-2.5.0-b05.jar       jersey-server.jar      tomcat-jni.jar
hk2-utils-2.5.0-b05.jar         jsp-api.jar            tomcat-util-scan.jar
jasper-el.jar                  org.osgi.core-4.2.0.jar   tomcat-util.jar
jasper.jar                     osgi-resource-locator-1.0.1.jar tomcat-websocket.jar
jaspic-api.jar                 persistence-api-1.0.jar  validation-api-1.1.0.Final.jar
javassist-3.20.0-GA.jar         servlet-api.jar        websocket-api.jar
javax.annotation-api-1.2.jar    tomcat-api.jar
nicolas@REST2015090704:~$ 0

```

Se muestra que el archivo ya está en la carpeta lib.

8. Borrar el archivo javax.servlet-api-3.0.1.jar del directorio "lib" de Tomcat (esto debe hacerse ya que existe una incompatibilidad entre Tomcat y Jersey 2).

```

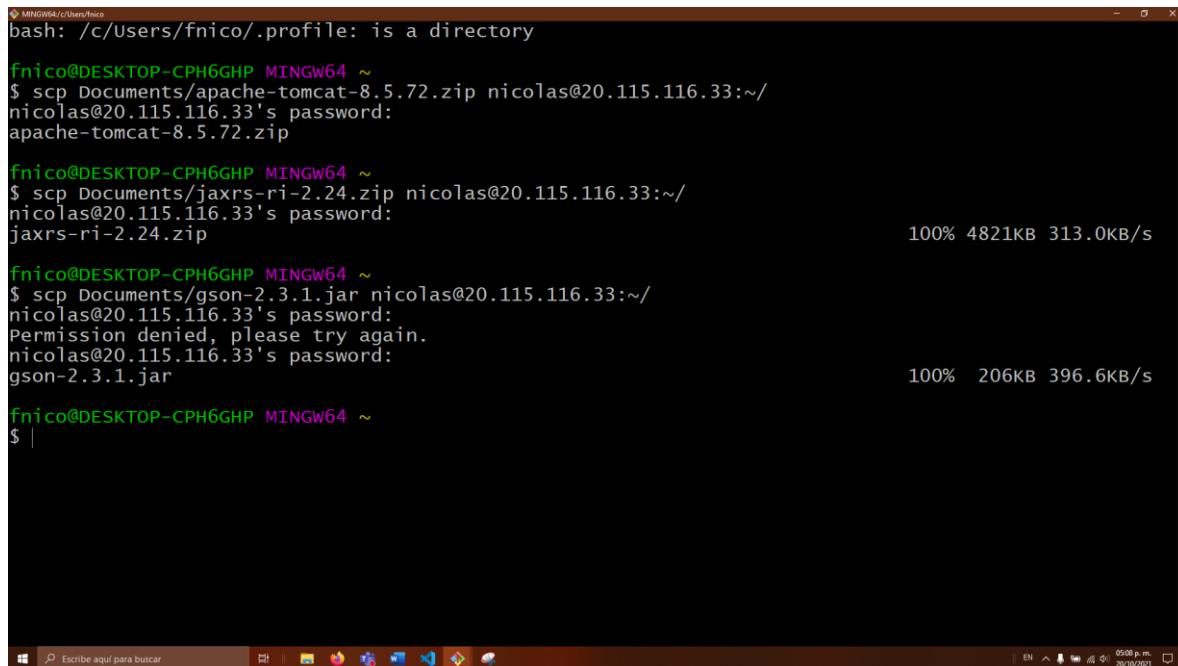
nicolas@REST2015090704:~$ rm apache-tomcat-8.5.72/lib/javax.servlet-
api-3.0.1.jar
nicolas@REST2015090704:~$ ls apache-tomcat-8.5.72/lib/
annotations-api.jar           servlet-api.jar        websocket-api.jar
aopalliance-repackaged-2.5.0-b05.jar   tomcat-api.jar
catalina-ant.jar                tomcat-coyote.jar
catalina-ha.jar                 tomcat-dbcp.jar
catalina-storeconfig.jar        tomcat-i18n-de.jar
catalina-tribes.jar             tomcat-i18n-es.jar
catalina.jar                   tomcat-i18n-fr.jar
ecj-4.6.3.jar                  tomcat-i18n-ja.jar
el-api.jar                     tomcat-i18n-ko.jar
hk2-api-2.5.0-b05.jar          tomcat-i18n-ru.jar
hk2-locator-2.5.0-b05.jar       tomcat-i18n-zh-CN.jar
hk2-utils-2.5.0-b05.jar         tomcat-jdbc.jar
jasper-el.jar                  tomcat-jni.jar
jasper.jar                     tomcat-util-scan.jar
jaspic-api.jar                 tomcat-util.jar
javassist-3.20.0-GA.jar         tomcat-websocket.jar
javax.annotation-api-1.2.jar    validation-api-1.1.0.Final.jar
javax.inject-2.5.0-b05.jar      websocket-api.jar
javax.ws.rs-api-2.0.1.jar
jaxb-api-2.2.7.jar
jersey-client.jar
jersey-common.jar
jersey-container-servlet-core.jar
jersey-container-servlet.jar
jersey-guava-2.24.jar
jersey-media-jaxb.jar
jersey-server.jar
jsp-api.jar
org.osgi.core-4.2.0.jar
osgi-resource-locator-1.0.1.jar
persistence-api-1.0.jar
servlet-api.jar
tomcat-api.jar
tomcat-coyote.jar
tomcat-dbcp.jar

```

Se elimina el archivo javax.servlet-api del directorio lib de Tomcat.

9. Descargar el archivo gson-2.3.1.jar de la URL:

<https://repo1.maven.org/maven2/com/google/code/gson/2.3.1/gson-2.3.1.jar>



```
MINGW64/c/Users/fnico
bash: /c/Users/fnico/.profile: is a directory
fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/apache-tomcat-8.5.72.zip nicolas@20.115.116.33:~/
nicolas@20.115.116.33's password:
apache-tomcat-8.5.72.zip

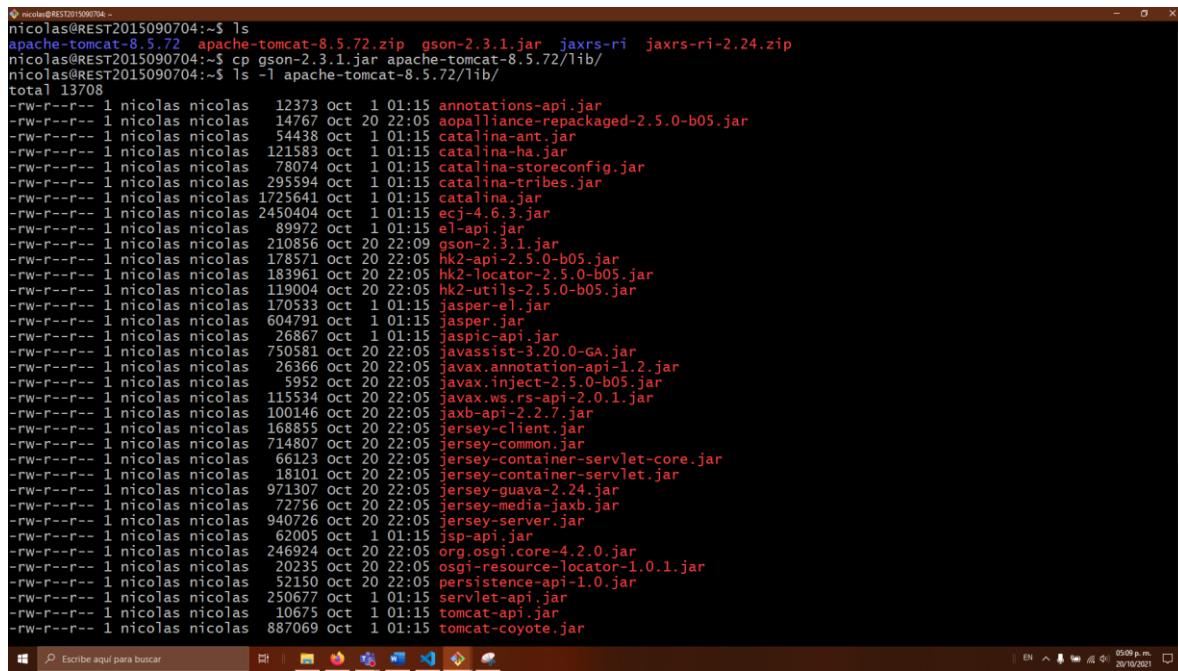
fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/jaxrs-ri-2.24.zip nicolas@20.115.116.33:~/
nicolas@20.115.116.33's password:
100% 4821KB 313.0KB/s
jaxrs-ri-2.24.zip

fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/gson-2.3.1.jar nicolas@20.115.116.33:~/
nicolas@20.115.116.33's password:
Permission denied, please try again.
nicolas@20.115.116.33's password:
gson-2.3.1.jar
100% 206KB 396.6KB/s

fnico@DESKTOP-CPH6GHP MINGW64 ~
$ |
```

Se envía el jar de gson a la máquina virtual.

10. Copiar el archivo gson-2.3.1.jar al directorio "lib" de Tomcat.



```
nicolas@REST2015090704:~$ ls
apache-tomcat-8.5.72 apache-tomcat-8.5.72.zip gson-2.3.1.jar jaxrs-ri jaxrs-ri-2.24.zip
nicolas@REST2015090704:~$ cp gson-2.3.1.jar apache-tomcat-8.5.72/lib/
nicolas@REST2015090704:~$ ls -l apache-tomcat-8.5.72/lib/
total 13708
-rw-r--r-- 1 nicolas nicolas 12373 oct 1 01:15 annotations-api.jar
-rw-r--r-- 1 nicolas nicolas 14767 oct 20 22:05 appaliance-repackaged-2.5.0-b05.jar
-rw-r--r-- 1 nicolas nicolas 54438 oct 1 01:15 catalina-ant.jar
-rw-r--r-- 1 nicolas nicolas 121583 oct 1 01:15 catalina-ha.jar
-rw-r--r-- 1 nicolas nicolas 78074 oct 1 01:15 catalina-storeconfig.jar
-rw-r--r-- 1 nicolas nicolas 295594 oct 1 01:15 catalina-tribes.jar
-rw-r--r-- 1 nicolas nicolas 1725641 oct 1 01:15 catalina.jar
-rw-r--r-- 1 nicolas nicolas 2450404 oct 1 01:15 ejb-4.6.3.jar
-rw-r--r-- 1 nicolas nicolas 89972 oct 1 01:15 el-api.jar
-rw-r--r-- 1 nicolas nicolas 210856 oct 20 22:09 gson-2.3.1.jar
-rw-r--r-- 1 nicolas nicolas 178571 oct 20 22:05 hk2-api-2.5.0-b05.jar
-rw-r--r-- 1 nicolas nicolas 183961 oct 20 22:05 hk2-locator-2.5.0-b05.jar
-rw-r--r-- 1 nicolas nicolas 119004 oct 20 22:05 hk2-utils-2.5.0-b05.jar
-rw-r--r-- 1 nicolas nicolas 170533 oct 1 01:15 jasper-el.jar
-rw-r--r-- 1 nicolas nicolas 604791 oct 1 01:15 jasper.jar
-rw-r--r-- 1 nicolas nicolas 26867 oct 1 01:15 jaspic-api.jar
-rw-r--r-- 1 nicolas nicolas 750581 oct 20 22:05 javassist-3.20.0-GA.jar
-rw-r--r-- 1 nicolas nicolas 26366 oct 20 22:05 javax.annotation-api-1.2.jar
-rw-r--r-- 1 nicolas nicolas 5952 oct 20 22:05 javax.inject-2.5.0-b05.jar
-rw-r--r-- 1 nicolas nicolas 115534 oct 20 22:05 javax.ws.rs-api-2.0.1.jar
-rw-r--r-- 1 nicolas nicolas 100146 oct 20 22:05 jAXB-API-2.2.7.jar
-rw-r--r-- 1 nicolas nicolas 168855 oct 20 22:05 jersey-client.jar
-rw-r--r-- 1 nicolas nicolas 714807 oct 20 22:05 jersey-common.jar
-rw-r--r-- 1 nicolas nicolas 66123 oct 20 22:05 jersey-container-servlet-core.jar
-rw-r--r-- 1 nicolas nicolas 18101 oct 20 22:05 jersey-container-servlet.jar
-rw-r--r-- 1 nicolas nicolas 971307 oct 20 22:05 jersey-guava-2.24.jar
-rw-r--r-- 1 nicolas nicolas 72756 oct 20 22:05 jersey-media-jaxb.jar
-rw-r--r-- 1 nicolas nicolas 940726 oct 20 22:05 jersey-server.jar
-rw-r--r-- 1 nicolas nicolas 62005 oct 1 01:15 jsp-api.jar
-rw-r--r-- 1 nicolas nicolas 246924 oct 20 22:05 org.osgi.core-4.2.0.jar
-rw-r--r-- 1 nicolas nicolas 20235 oct 20 22:05 osgi-resource-locator-1.0.1.jar
-rw-r--r-- 1 nicolas nicolas 52150 oct 20 22:05 persistence-api-1.0.jar
-rw-r--r-- 1 nicolas nicolas 250677 oct 1 01:15 servlet-api.jar
-rw-r--r-- 1 nicolas nicolas 10675 oct 1 01:15 tomcat-api.jar
-rw-r--r-- 1 nicolas nicolas 887069 oct 1 01:15 tomcat-coyote.jar
```

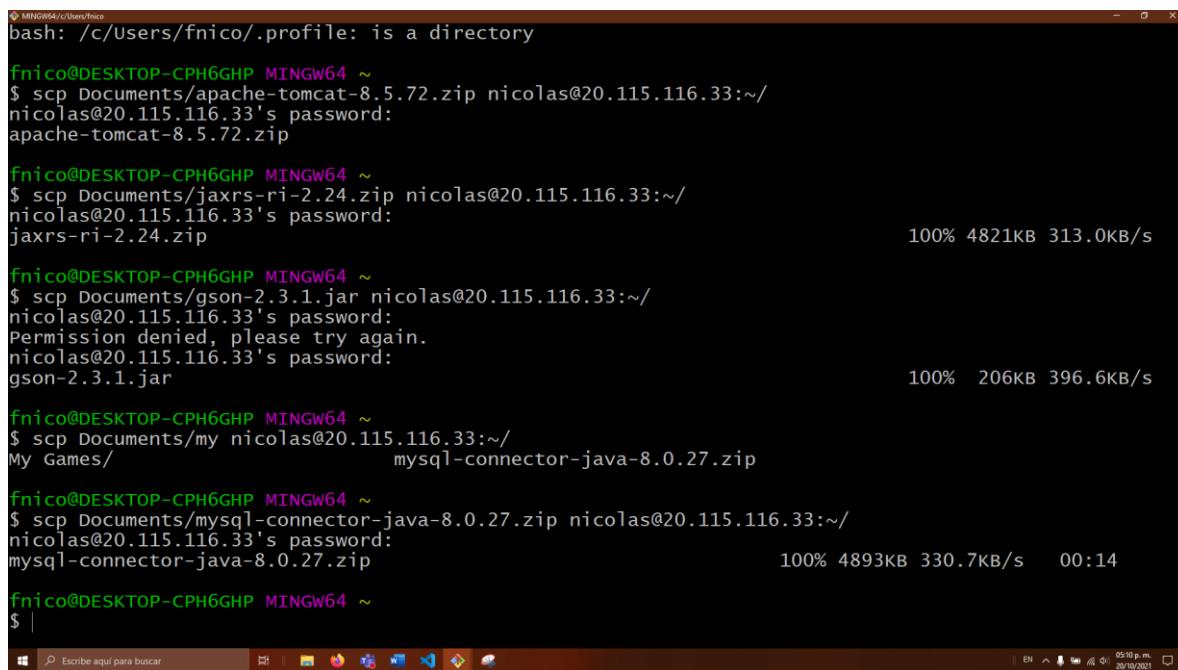
Recepción y copiado del jar gson al directorio lib de Tomcat.

11. Ahora vamos a instalar el driver de JDBC para MySQL. Ingresar a la siguiente URL:

<https://dev.mysql.com/downloads/connector/j/>

Seleccionar "Platform independent" y descargar el archivo ZIP.

12. Copiar el archivo descargado a la máquina virtual, desempacarlo y copiar el archivo mysql-connector...jar al directorio "lib" de Tomcat.



```
MINGW64 /c/Users/fnico
bash: /c/Users/fnico/.profile: is a directory
fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/apache-tomcat-8.5.72.zip nicolas@20.115.116.33:~/nicolas@20.115.116.33's password:
apache-tomcat-8.5.72.zip

fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/jaxrs-ri-2.24.zip nicolas@20.115.116.33:~/nicolas@20.115.116.33's password:
jaxrs-ri-2.24.zip                                         100% 4821KB 313.0KB/s

fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/gson-2.3.1.jar nicolas@20.115.116.33:~/nicolas@20.115.116.33's password:
Permission denied, please try again.
nicolas@20.115.116.33's password:
gson-2.3.1.jar                                              100% 206KB 396.6KB/s

fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/my nicolas@20.115.116.33:~/My Games/
mysql-connector-java-8.0.27.zip

fnico@DESKTOP-CPH6GHP MINGW64 ~
$ scp Documents/mysql-connector-java-8.0.27.zip nicolas@20.115.116.33:~/nicolas@20.115.116.33's password:
mysql-connector-java-8.0.27.zip                           100% 4893KB 330.7KB/s   00:14

fnico@DESKTOP-CPH6GHP MINGW64 ~
$ |
```

Se envía el conector de MySQL a la máquina virtual.

```

nicolas@REST2015090704:~$ ls
apache-tomcat-8.5.72 apache-tomcat-8.5.72.zip gson-2.3.1.jar jaxrs-ri jaxrs-ri-2.24.zip mysql-connector-java-8.0.27.zip
nicolas@REST2015090704:~$ unzip mysql-connector-java-8.0.27.zip
Archive: mysql-connector-java-8.0.27.zip
  creating: mysql-connector-java-8.0.27/
  creating: mysql-connector-java-8.0.27/src/
  creating: mysql-connector-java-8.0.27/src/build/
  creating: mysql-connector-java-8.0.27/src/build/java/
  creating: mysql-connector-java-8.0.27/src/build/java/documentation/
  creating: mysql-connector-java-8.0.27/src/build/java/instrumentation/
  creating: mysql-connector-java-8.0.27/src/build/java/com/
  creating: mysql-connector-java-8.0.27/src/build/java/com/mysql/
  creating: mysql-connector-java-8.0.27/src/build/java/com/mysql/cj/
  creating: mysql-connector-java-8.0.27/src/build/java/com/mysql/cj/x/
  creating: mysql-connector-java-8.0.27/src/build/java/com/mysql/cj/x/protobuf/
  creating: mysql-connector-java-8.0.27/src/legacy/
  creating: mysql-connector-java-8.0.27/src/legacy/java/
  creating: mysql-connector-java-8.0.27/src/legacy/java/com/
  creating: mysql-connector-java-8.0.27/src/legacy/java/com/mysql/
  creating: mysql-connector-java-8.0.27/src/legacy/java/com/mysql/cj/
  creating: mysql-connector-java-8.0.27/src/legacy/java/com/mysql/cj/x/
  creating: mysql-connector-java-8.0.27/src/main/
  creating: mysql-connector-java-8.0.27/src/main/core-api/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/com/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/com/mysql/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/com/mysql/cj/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/com/mysql/cj/callback/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/com/mysql/cj/conf/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/com/mysql/cj/exceptions/
  creating: mysql-connector-java-8.0.27/src/main/core-api/java/com/mysql/cj/interceptors/

```

Recepción del conector para posteriormente descomprimirlo.

```

nicolas@REST2015090704:~$ ls
mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/SessionTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/TableDeleteTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/TableInsertTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/TableSelectTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/TableTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/TableUpdateTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/TransactionTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/devapi/package-info.java
inflating: mysql-connector-java-8.0.27/src/test/java/internal/InternalXBaseTestCase.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/internal/MysqlXSessionTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/internal/XProtocolAsyncTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/internal/XProtocolAuthTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/internal/XProtocolTest.java
inflating: mysql-connector-java-8.0.27/src/test/java/testsuite/x/internal/package-info.java
nicolas@REST2015090704:~$ ls
apache-tomcat-8.5.72 gson-2.3.1.jar jaxrs-ri-2.24.zip mysql-connector-java-8.0.27.zip
apache-tomcat-8.5.72.zip jaxrs-ri mysql-connector-java-8.0.27
nicolas@REST2015090704:~$ cp mysql-connector-java-8.0.27/
CHANGES           INFO_SRC          README          mysql-connector-java-8.0.27.jar
INFO_BIN          LICENSE          build.xml      src/
nicolas@REST2015090704:~$ cp mysql-connector-java-8.0.27/mysql-connector-java-8.0.27.jar apache-tomcat-8.5.72/lib/
nicolas@REST2015090704:~$ ls apache-tomcat-8.5.72/lib/
annotations-api.jar javax.annotation-api-1.2.jar tomcat-api.jar
aopalliance-repackaged-2.5.0-b05.jar javax.inject-2.5.0-b05.jar tomcat-coyote.jar
catalina-ant.jar javax.ws.rs-api-2.0.1.jar tomcat-dbcp.jar
catalina-ha.jar jaxb-api-2.2.7.jar tomcat-i18n-de.jar
catalina-storeconfig.jar jersey-client.jar tomcat-i18n-es.jar
catalina-tribes.jar jersey-common.jar tomcat-i18n-fr.jar
catalina.jar jersey-container-servlet-core.jar tomcat-i18n-ja.jar
ejc-4.6.3.jar jersey-container-servlet.jar tomcat-i18n-ko.jar
el-api.jar jersey-guava-2.24.jar tomcat-i18n-ru.jar
gson-2.3.1.jar jersey-media-jaxb.jar tomcat-i18n-zh-CN.jar
hk2-api-2.5.0-b05.jar jersey-server.jar jsp-api.jar
hk2-locator-2.5.0-b05.jar mysql-connector-java-8.0.27.jar tomcat-jdbc.jar
hk2-utils-2.5.0-b05.jar org.osgi.core-4.2.0.jar tomcat-jni.jar
jasper-el.jar osgi-resource-locator-1.0.1.jar tomcat-util.jar
jasper.jar persistence-api-1.0.jar tomcat-websocket.jar
jaspic-api.jar servlet-api.jar validation-api-1.1.0.Final.jar
javassist-3.20.0-ga.jar
nicolas@REST2015090704:~$ |

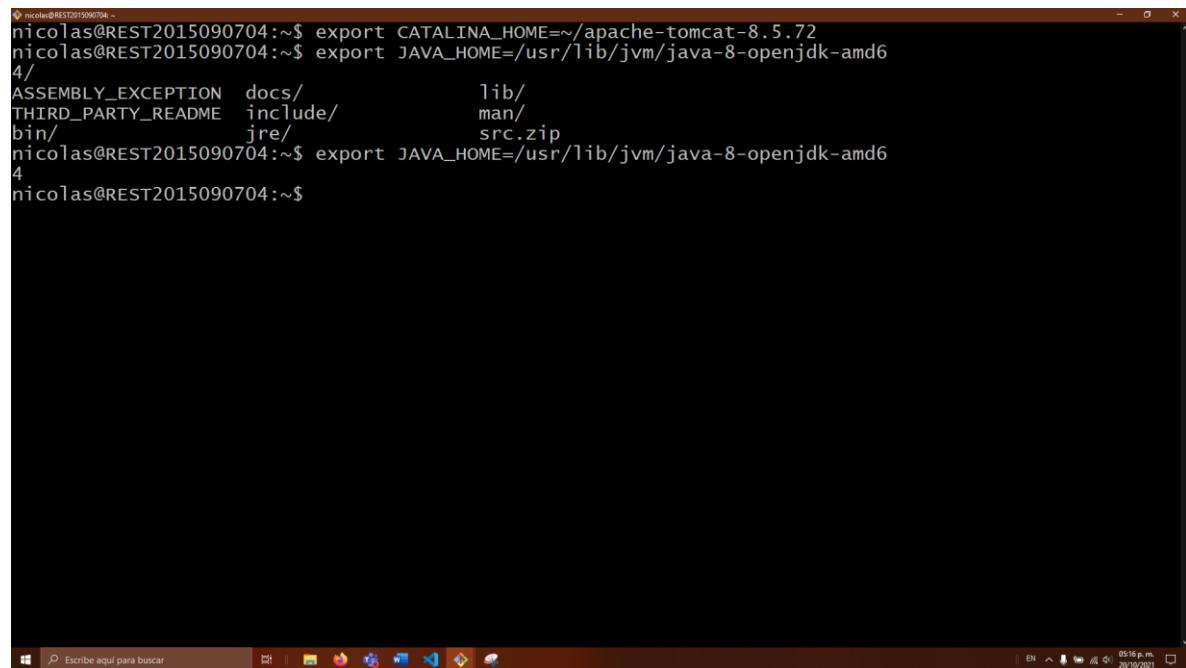
```

Se copia el conector de MySQL al directorio lib de Tomcat.

Iniciar/detener el servidor Tomcat

1. Para iniciar el servidor Tomcat es necesario definir las siguientes variables de entorno:

```
export CATALINA_HOME=aquí va la ruta del directorio de Tomcat 8
export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
```

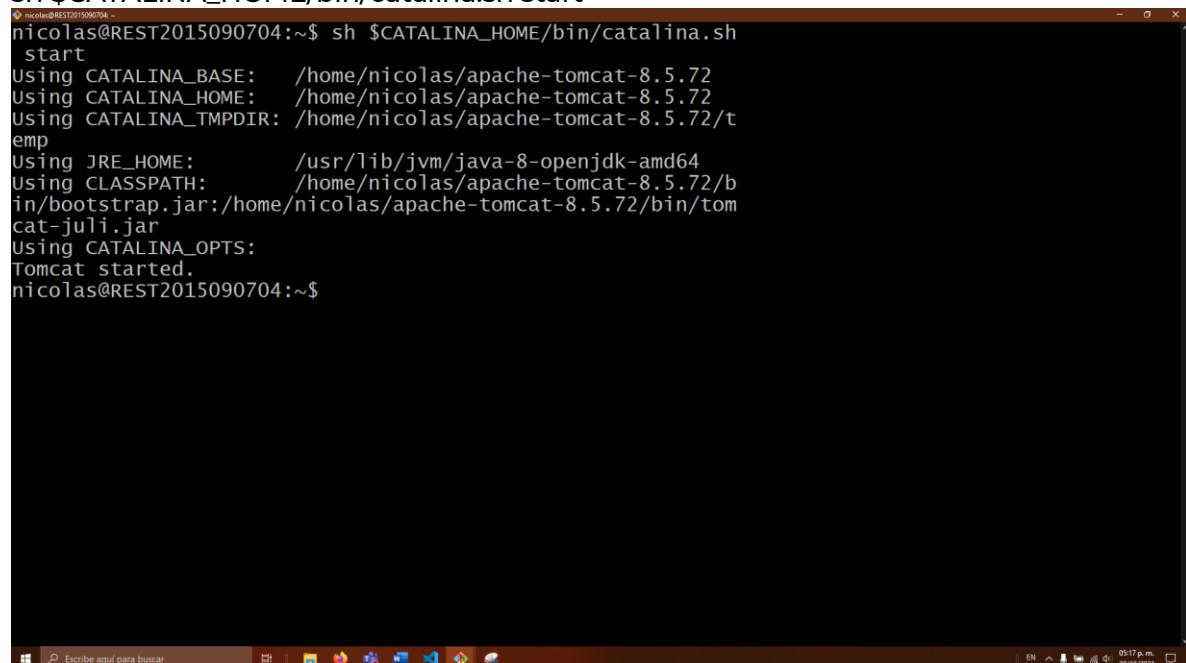


```
nicolas@REST2015090704:~$ export CATALINA_HOME=~/apache-tomcat-8.5.72
nicolas@REST2015090704:~$ export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
4/
ASSEMBLY_EXCEPTION  docs/          lib/
THIRD_PARTY_README  include/       man/
bin/                jre/           src.zip
nicolas@REST2015090704:~$ export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
4
nicolas@REST2015090704:~$
```

Se crean las variables de entorno para Tomcat y para Java.

2. Iniciar la ejecución de Tomcat ejecutando el siguiente comando:

```
sh $CATALINA_HOME/bin/catalina.sh start
```

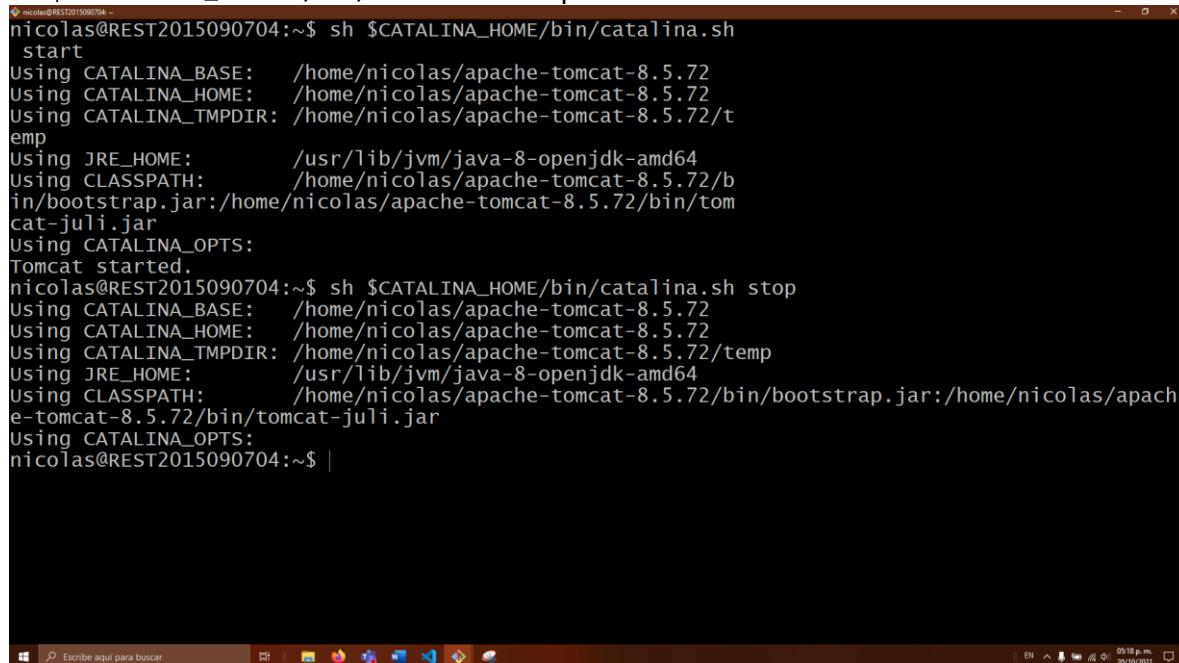


```
nicolas@REST2015090704:~$ sh $CATALINA_HOME/bin/catalina.sh
  start
Using CATALINA_BASE:      /home/nicolas/apache-tomcat-8.5.72
Using CATALINA_HOME:      /home/nicolas/apache-tomcat-8.5.72
Using CATALINA_TMPDIR:    /home/nicolas/apache-tomcat-8.5.72/tmp
Using JRE_HOME:           /usr/lib/jvm/java-8-openjdk-amd64
Using CLASSPATH:          /home/nicolas/apache-tomcat-8.5.72/bootstrap.jar:/home/nicolas/apache-tomcat-8.5.72/bin/tomcat-juli.jar
Using CATALINA_OPTS:
Tomcat started.
nicolas@REST2015090704:~$
```

Iniciación del servidor Apache Tomcat.

3. Para detener la ejecución de Tomcat se deberá ejecutar el siguiente comando:

```
sh $CATALINA_HOME/bin/catalina.sh stop
```



A terminal window titled 'nicolas@REST2015090704:~\$' displays the command 'sh \$CATALINA_HOME/bin/catalina.sh stop'. The output shows the configuration of Tomcat, including CATALINA_BASE, CATALINA_HOME, CATALINA_TMPDIR, JRE_HOME, and CLASSPATH. It then shows the start of Tomcat and finally its shutdown. The window has a standard Windows taskbar at the bottom.

```
nicolas@REST2015090704:~$ sh $CATALINA_HOME/bin/catalina.sh start
Using CATALINA_BASE:      /home/nicolas/apache-tomcat-8.5.72
Using CATALINA_HOME:      /home/nicolas/apache-tomcat-8.5.72
Using CATALINA_TMPDIR:   /home/nicolas/apache-tomcat-8.5.72/temp
Using JRE_HOME:          /usr/lib/jvm/java-8-openjdk-amd64
Using CLASSPATH:         /home/nicolas/apache-tomcat-8.5.72/bin/bootstrap.jar:/home/nicolas/apache-tomcat-8.5.72/bin/tomcat-juli.jar
Using CATALINA_OPTS:
Tomcat started.
nicolas@REST2015090704:~$ sh $CATALINA_HOME/bin/catalina.sh stop
Using CATALINA_BASE:      /home/nicolas/apache-tomcat-8.5.72
Using CATALINA_HOME:      /home/nicolas/apache-tomcat-8.5.72
Using CATALINA_TMPDIR:   /home/nicolas/apache-tomcat-8.5.72/temp
Using JRE_HOME:          /usr/lib/jvm/java-8-openjdk-amd64
Using CLASSPATH:         /home/nicolas/apache-tomcat-8.5.72/bin/bootstrap.jar:/home/nicolas/apache-tomcat-8.5.72/bin/tomcat-juli.jar
Using CATALINA_OPTS:
nicolas@REST2015090704:~$ |
```

Prueba de parado del servicio Tomcat.

Notar que Tomcat se ejecuta sin permisos de administrador (no se usa "sudo"), lo cual es muy importante para prevenir que algún atacante pueda entrar a nuestro sistema con permisos de super-usuario.

Instalación de MySQL

1. Actualizar los paquetes en la máquina virtual ejecutando el siguiente comando:

```
sudo apt update
```

2. Instalar el paquete default de MySQL:

```
sudo apt install mysql-server
```

Instalación de MySQL.

```
nicolas@REST2015090704:~$ Preparing to unpack .../14-mysql-server_5.7.35-0ubuntu0.18.04.2_all.deb ...
Unpacking mysql-server (5.7.35-0ubuntu0.18.04.2) ...
Setting up libhtml-tagset-perl (3.20-3) ...
Setting up libevent-core-2.1-6:amd64 (2.1.8-stable-4build1)
...
Setting up libencode-locale-perl (1.05-1) ...
Setting up libtimedate-perl (2.3000-2) ...
Setting up libio-html-perl (1.001-1) ...
Setting up liblwp-mediatypes-perl (6.02-1) ...
Setting up libaiol1:amd64 (0.3.110-5ubuntu0.1) ...
Progress: 19% [#####
Setting up libhtml-parser-perl (3.72-3build1) ...
Setting up libcgi-pm-perl (4.38-1) ...
Setting up mysql-client-core-5.7 (5.7.35-0ubuntu0.18.04.2)
...
Setting up libfcgi-perl (0.78-2build1) ...
Setting up libhttp-date-perl (6.02-1) ...
Setting up libhtml-template-perl (2.97-1) ...
Setting up mysql-server-core-5.7 (5.7.35-0ubuntu0.18.04.2)
...
Setting up libcgi-fast-perl (1:2.13-1) ...
Setting up libhttp-message-perl (6.14-1) ...
Setting up mysql-client-5.7 (5.7.35-0ubuntu0.18.04.2) ...
Setting up mysql-server-5.7 (5.7.35-0ubuntu0.18.04.2) ...
update-alternatives: using /etc/mysql/mysql.cnf to provide
/etc/mysql/my.cnf (my.cnf) in auto mode
Renaming removed key_buffer and myisam-recover options (if
present)

Created symlink /etc/systemd/system/multi-user.target.wants
/mysql.service → /lib/systemd/system/mysql.service.
Setting up mysql-server (5.7.35-0ubuntu0.18.04.2) ...
Processing triggers for libc-bin (2.27-3ubuntu1.4) ...
Processing triggers for systemd (237-3ubuntu10.52) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for ureadahead (0.100.0-21) ...
nicolas@REST2015090704:~$
```

Instalación de MySQL terminada.

3. Ejecutar el script de seguridad:

```
sudo mysql_secure_installation
```

Press y|Y for Yes, any other key for No: N

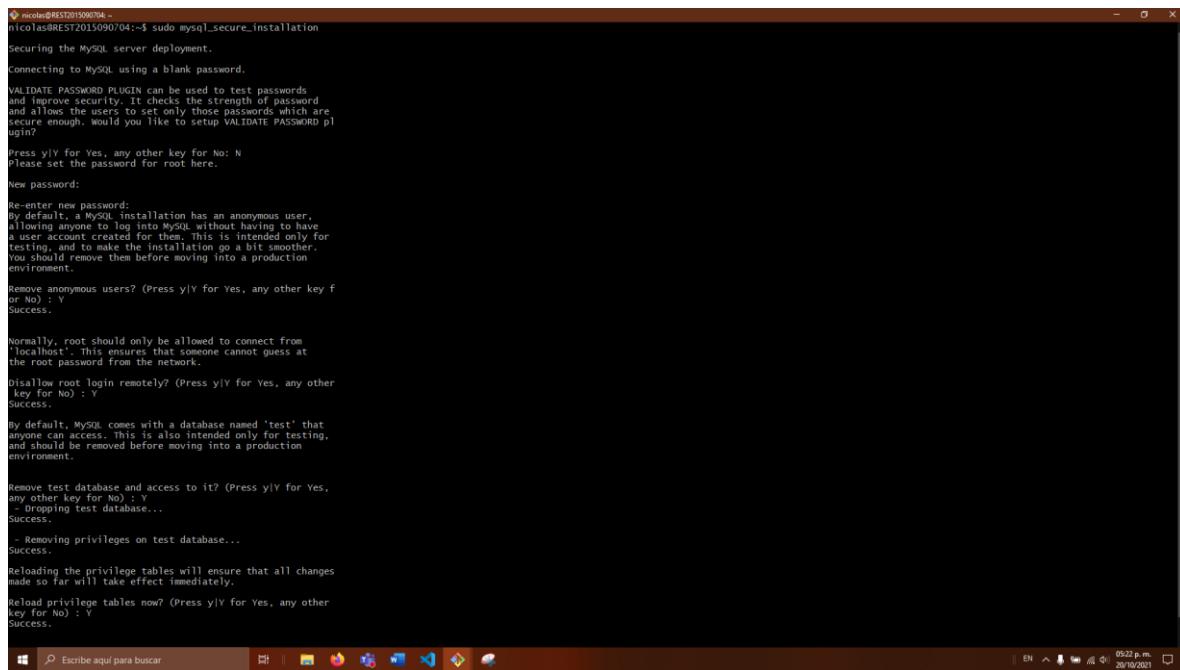
New password: *contraseña-de-root-en-mysql*

Re-enter new password: *contraseña-de-root-en-mysql*

Remove anonymous users? (Press y|Y for Yes, any other key for No) : Y
Disallow root login remotely? (Press y|Y for Yes, any other key for No) : Y

Remove test database and access to it? (Press y|Y for Yes, any other key for No) : Y

Reload privilege tables now? (Press y|Y for Yes, any other key for No) : Y



```
nicolas@REST2015090704:~$ sudo mysql_secure_installation
Securing the MySQL server deployment.

Connecting to MySQL using a blank password.

VALIDATE PASSWORD PLUGIN can be used to test passwords
and improve security. It checks the strength of password
and allows the users to set only those passwords which are
secure enough. Would you like to setup VALIDATE PASSWORD p
ugin? [Y/n] n

Press y|Y for Yes, any other key for No.
Please set the password for root here.

New password:
Re-enter new password:
The MySQL setup has an anonymous user,
allowing anyone to log into MySQL without having to have
a user account created for them. This is intended only for
testing, and to make the installation go a bit smoother.
You should remove them before moving into a production
environment.

Remove anonymous users? (Press y|Y for Yes, any other key f
or No) : N
Success.

Normally, root should only be allowed to connect from
'localhost'. This ensures that someone cannot guess at
the root password from the network.

Disallow root login remotely? (Press y|Y for Yes, any other
key for No) : Y
Success.

By default, MySQL comes with a database named 'test' that
anyone can access. This is also intended only for testing,
and should be removed before moving into a production
environment.

Remove test database and access to it? (Press y|Y for Yes,
any other key for No) : Y
Success.
Dropping test database...
Success.

Removing privileges on test database...
Success.

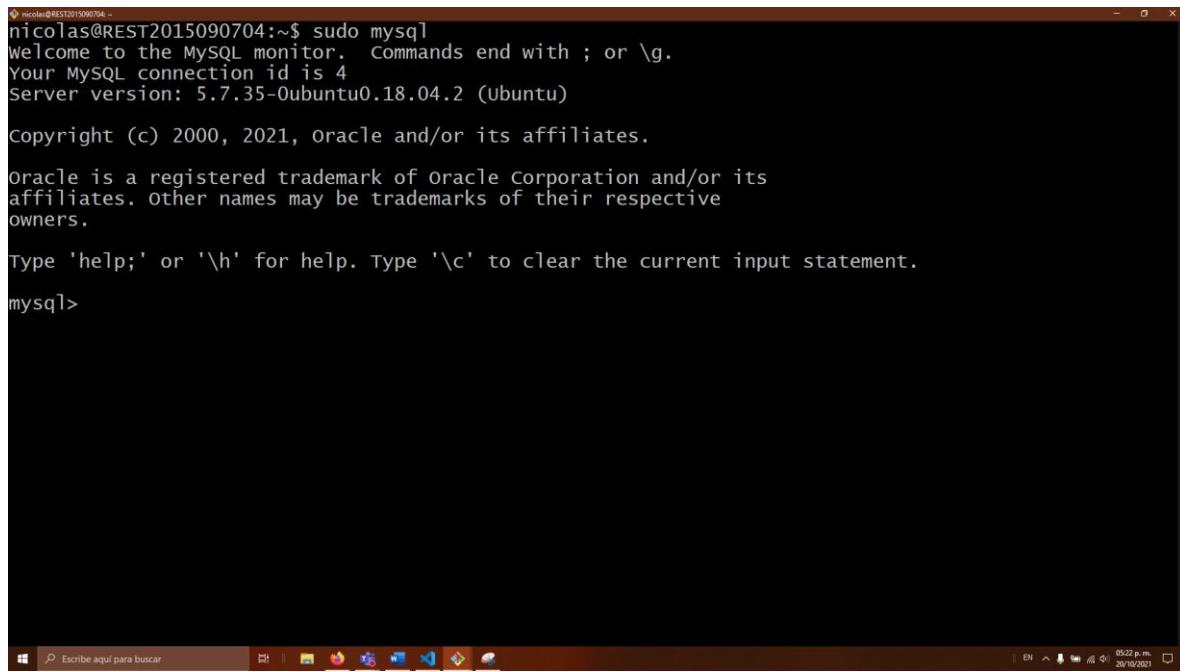
Reloading the privilege tables will ensure that all changes
made so far will take effect immediately.

Reload privilege tables now? (Press y|Y for Yes, any other
key for No) : Y
Success.
```

Ejecución de script de instalación de MySQL siguiente las instrucciones previamente dadas.

4. Ejecutar el monitor de MySQL:

`sudo mysql`



```
nicolas@REST2015090704:~$ sudo mysql
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 4
Server version: 5.7.35-Ubuntu0.18.04.2 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql>
```

Ejecución del monitor de MySQL.

5. Ejecutar el siguiente comando SQL para modificar la contraseña de root:

```
ALTER USER 'root'@'localhost' IDENTIFIED WITH mysql_native_password BY
'contraseña-de-root-en-mysql';
```

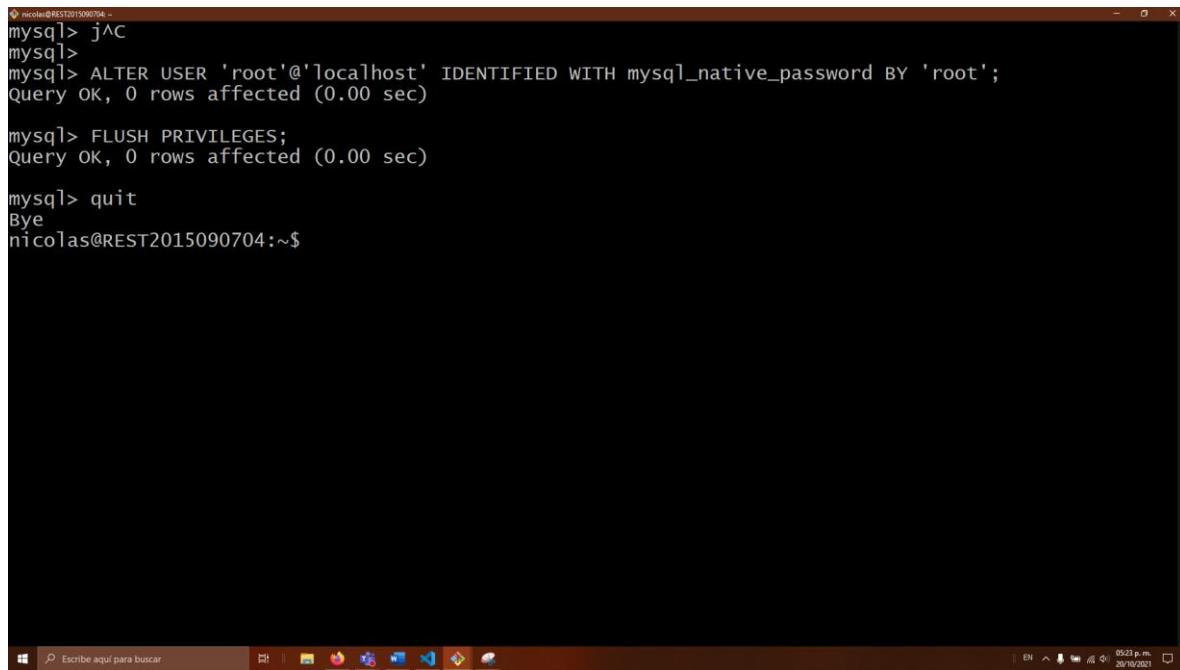
```
ALTER USER 'root'@'localhost' IDENTIFIED WITH mysql_native_password BY 'root';
```

6. Actualizar los privilegios:

```
FLUSH PRIVILEGES;
```

7. Ejecutar el siguiente comando para salir del monitor de MySQL:

```
quit
```



```
nicolas@REST2015090704:~$ mysql> j^C
mysql>
mysql> ALTER USER 'root'@'localhost' IDENTIFIED WITH mysql_native_password BY 'root';
Query OK, 0 rows affected (0.00 sec)

mysql> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.00 sec)

mysql> quit
Bye
nicolas@REST2015090704:~$
```

Modificación de contraseña del root y eliminación de privilegios.

Crear un usuario en MySQL

1. Ejecutar el monitor de MySQL:

```
mysql -u root -p
```

2. Crea el usuario "hugo":

```
create user hugo@localhost identified by 'contraseña-del-usuario-hugo';
create user hugo@localhost identified by 'hugo';
```

3. Otorgar todos los permisos al usuario "hugo" sobre la base de datos "servicio_web":

```
grant all on servicio_web.* to hugo@localhost;
```

4. Ejecutar el siguiente comando para salir del monitor de MySQL:

Quit

```

mysql> j^C
mysql> ALTER USER 'root'@'localhost' IDENTIFIED WITH mysql_native_password BY 'root';
Query OK, 0 rows affected (0.00 sec)

mysql> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.00 sec)

mysql> quit
Bye
nicolas@REST2015090704:~$ mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 5
Server version: 5.7.35-Ubuntu0.18.04.2 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> create user hugo@localhost identified by 'hugo';
Query OK, 0 rows affected (0.01 sec)

mysql> grant all on servicio_web.* to hugo@localhost;
Query OK, 0 rows affected (0.00 sec)

mysql> quit
Bye
nicolas@REST2015090704:~$ 

```

Creación de usuario Hugo y permisos para la base de datos servicio_web.

Crear la base de datos

- Ejecutar el monitor de MySQL (notar que ahora se utiliza el usuario "hugo"):

```
mysql -u hugo -p
```

- Crear la base de datos "servicio_web":

```
create database servicio_web;
```

- Conectar a la base de datos creada anteriormente:

```
use servicio_web;
```

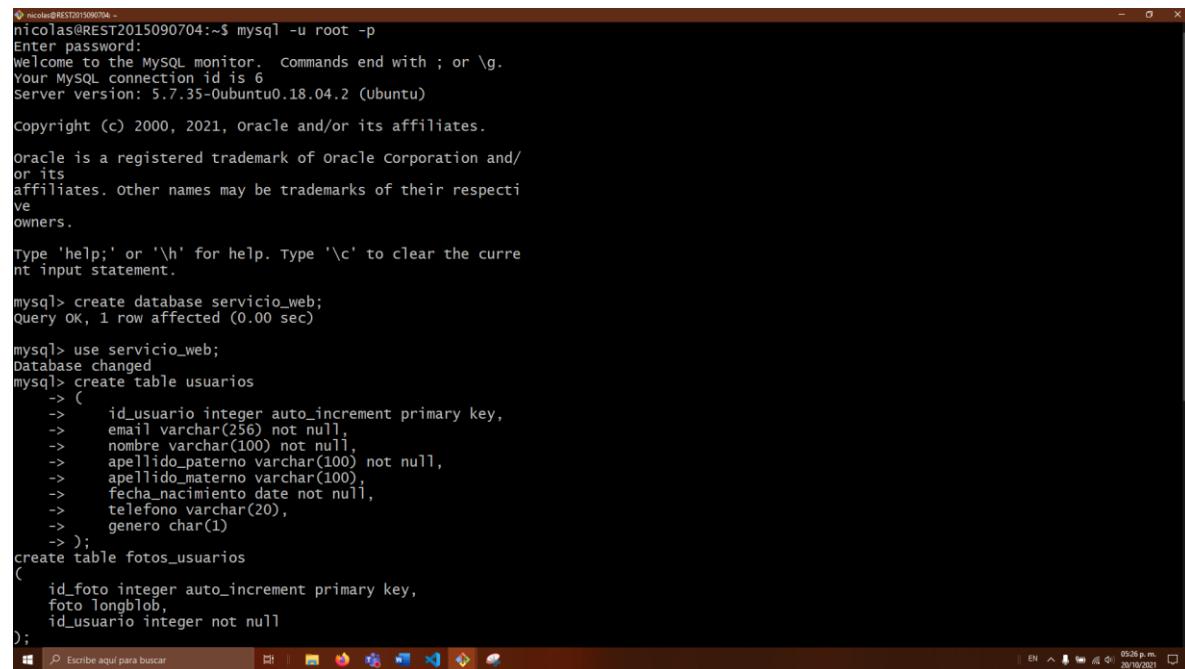
- Crear las tablas "usuarios" y "fotos_usuarios", así mismo, se crea una regla de integridad referencial y un índice único:

	table		usuarios	
create				
(
id_usuario	integer	auto_increment	primary	key,
email	varchar(256)		not	null,
nombre	varchar(100)		not	null,
apellido_paterno	varchar(100)		not	null,
apellido_materno		varchar(100),		
fecha_nacimiento	date		not	null,

```

        telefono          varchar(20),
        genero           char(1)
);
create table fotos_usuarios
(
    id_foto      integer      auto_increment primary key,
    foto          longblob,
    id_usuario    integer      not null
);
alter table fotos_usuarios add foreign key (id_usuario) references
usuarios(id_usuario);
create unique index usuarios_1 on usuarios(email);

```



```

nicolas@REST2015090704:~$ mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 6
Server version: 5.7.35-Ubuntu0.18.04.2 (Ubuntu)

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or its
affiliates. other names may be trademarks of their respecti
ve
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the curre
nt input statement.

mysql> create database servicio_web;
Query OK, 1 row affected (0.00 sec)

mysql> use servicio_web;
Database changed
mysql> create table usuarios
  -> (
  ->     id_usuario integer auto_increment primary key,
  ->     email varchar(256) not null,
  ->     nombre varchar(100) not null,
  ->     apellido_paterno varchar(100) not null,
  ->     apellido_materno varchar(100),
  ->     fecha_nacimiento date not null,
  ->     telefono varchar(20),
  ->     genero char(1)
  -> );
create table fotos_usuarios
(
    id_foto integer auto_increment primary key,
    foto longblob,
    id_usuario integer not null
);

```

Creación de la base de datos y de la tabla de usuarios y foto_usuarios.

```

nicolas@REST2015090704:~$ 
-->     email varchar(256) not null,
-->     nombre varchar(100) not null,
-->     apellido_paterno varchar(100) not null,
-->     apellido_materno varchar(100),
-->     fecha_nacimiento date not null,
-->     telefono varchar(20),
-->     genero char(1)
--> );
create table fotos_usuarios
(
    id_foto integer auto_increment primary key,
    foto longblob,
    id_usuario integer not null
);
query OK, 0 rows affected (0.16 sec)

mysql> create table fotos_usuarios
--> (
-->     id_foto integer auto_increment primary key,
-->     foto longblob,
-->     id_usuario integer not null
--> );
alter table fotos_usuarios add foreign key (id_usuario) references usuarios(id_usuario);
create unique index usuarios_1 on usuarios(email);
Query OK, 0 rows affected (0.10 sec)

mysql> alter table fotos_usuarios add foreign key (id_usuario) references usuarios(id_usuario);
Query OK, 0 rows affected (0.29 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> create unique index usuarios_1 on usuarios(email);
Query OK, 0 rows affected (0.07 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> exit
Bye
nicolas@REST2015090704:~$
```

Se agregan la regla de integridad relacional.

5. Salir del monitor de MySQL:

Compilar, empacar y desplegar el servicio web

1. Descargar de la plataforma y desempacar el archivo [Servicio.zip](#).

2. Definir la variable de ambiente CATALINA_HOME:

`export CATALINA_HOME=aquí va la ruta completa del directorio de Tomcat 8`

3. Cambiar al directorio dónde se desempacó el archivo [Servicio.zip](#) (en ese directorio se encuentra el directorio "negocio").

4. Compilar la clase Servicio.java:

`javac -cp $CATALINA_HOME/lib/javax.ws.rs-api-2.0.1.jar:$CATALINA_HOME/lib/gson-2.3.1.jar:. negocio/Servicio.java`

```

nicolas@REST2015090704:~/Servicio
  creating: Servicio/META-INF/
  inflating: Servicio/META-INF/context.xml
  creating: Servicio/negocio/
  inflating: Servicio/negocio/AdaptadorGsonBase64.java
  inflating: Servicio/negocio/Error.java
  inflating: Servicio/negocio/Foto.java
  inflating: Servicio/negocio/servicio.java
  inflating: Servicio/negocio/usuario.java
  creating: Servicio/WEB-INF/
  creating: Servicio/WEB-INF/classes/
  creating: Servicio/WEB-INF/classes/negocio/
  inflating: Servicio/WEB-INF/web.xml
nicolas@REST2015090704:~$ 
nicolas@REST2015090704:~$ tree servicio
servicio
├── META-INF
│   └── context.xml
├── WEB-INF
│   ├── classes
│   │   └── negocio
│   │       └── web.xml
│   └── negocio
│       ├── AdaptadorGsonBase64.java
│       ├── Error.java
│       ├── Foto.java
│       ├── Servicio.java
│       └── Usuario.java
5 directories, 7 files
nicolas@REST2015090704:~$ cd servicio/
nicolas@REST2015090704:~/servicio$ javac -cp $CATALINA_HOME
/lib/javax.ws.rs-api-2.0.1.jar:$CATALINA_HOME/lib/gson-2.3.
1.jar:. negocio/Servicio.java
nicolas@REST2015090704:~/servicio$ ls
META-INF WEB-INF negocio
nicolas@REST2015090704:~/servicio$ ls negocio/
AdaptadorGsonBase64.class Error.class Foto.java Servicio.java Usuario.java
AdaptadorGsonBase64.java Error.java Servicio.class Usuario.class
nicolas@REST2015090704:~/servicio$
```

Se compila la Clase Servicio.java.

5. Editar el archivo "context.xml" que está en el directorio "META-INF" y definir el username de la base de datos y el password correspondiente. El usuario "hugo" fue creado en el paso 2 de la sección Crear un usuario en MySQL.

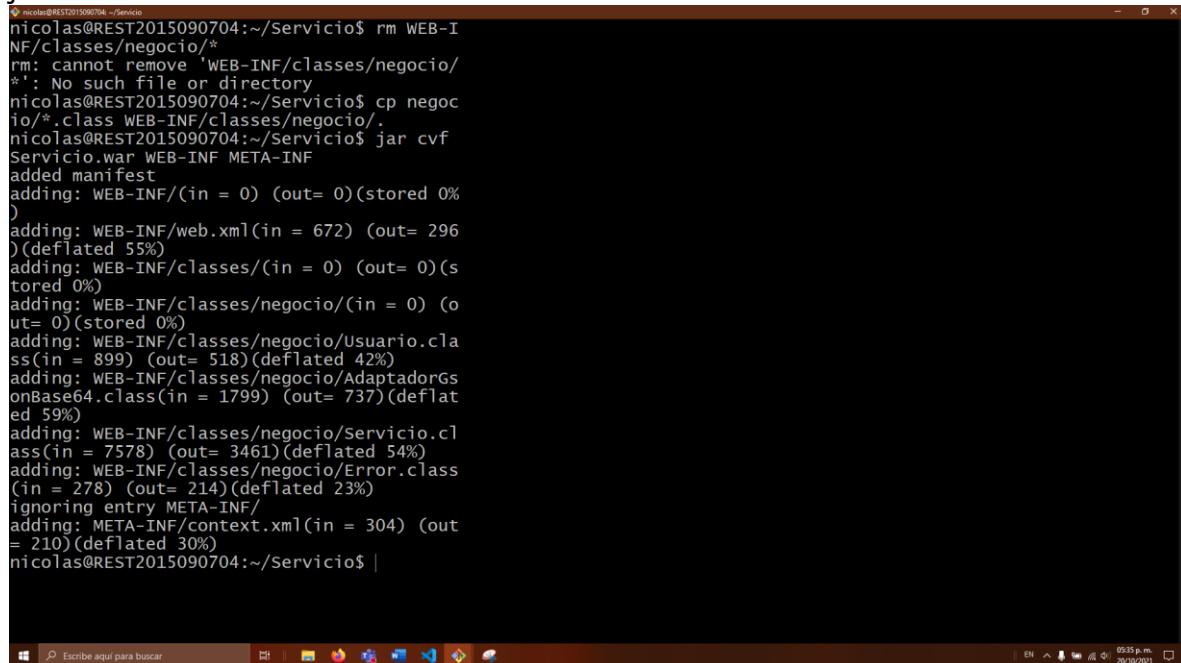
```

nicolas@REST2015090704:~/Servicio$ ls
META-INF WEB-INF negocio
nicolas@REST2015090704:~/Servicio$ vim META-INF/context.xml
nicolas@REST2015090704:~/Servicio$ cat META-INF/context.xml
<Context>
    <Resource name="jdbc/datasource_servicio" auth="Container" type="javax.sql.DataSource"
        maxActive="100" maxIdle="30" maxWait="10000"
        username="hugo" password="hugo"
        driverClassName="com.mysql.jdbc.Driver"
        url="jdbc:mysql://localhost/servicio_web?serverTimezone=UTC"/>
</Context>
nicolas@REST2015090704:~/Servicio$
```

Se agregan las credenciales para la conexión a la base de datos con el usuario previamente creado “hugo”.

6. Ejecutar los siguientes comandos para crear el servicio web para Tomcat (notar que los servicios web para Tomcat son archivos JAR con la extensión .war):

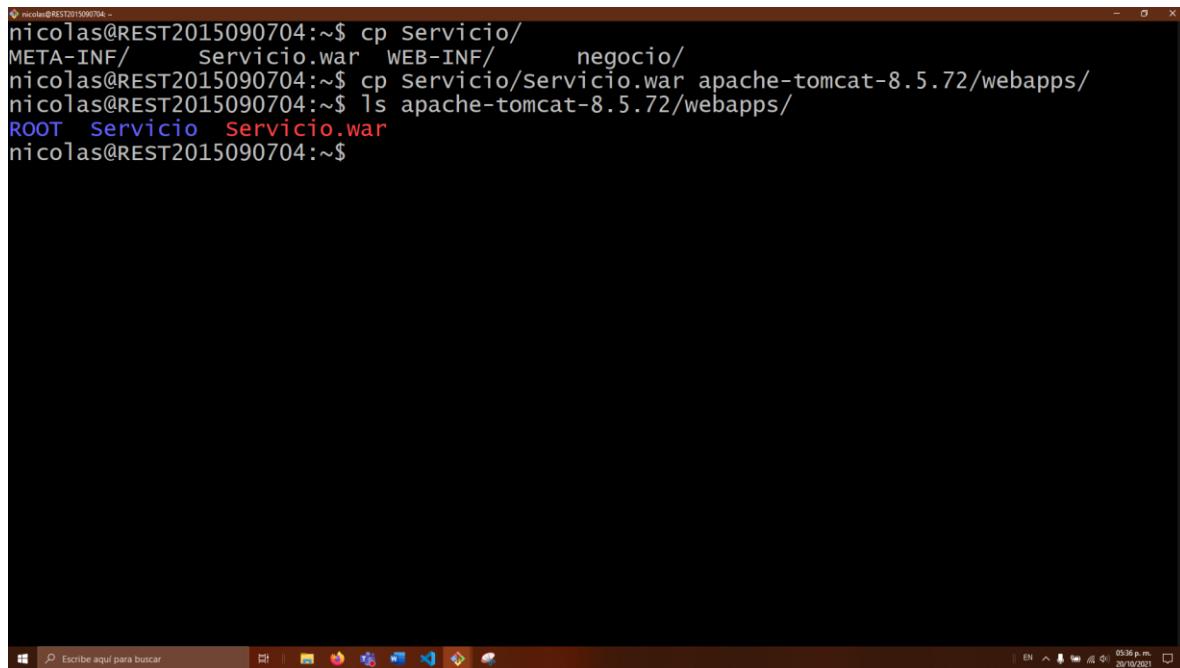
```
rm WEB-INF/classes/negocio/*  
cp negocio/*.class WEB-INF/classes/negocio/.  
jar cvf Servicio.war WEB-INF META-INF
```



```
nicolas@REST2015090704:~/servicio$ rm WEB-INF/classes/negocio/*  
rm: cannot remove 'WEB-INF/classes/negocio/*': No such file or directory  
nicolas@REST2015090704:~/Servicio$ cp negocio/*.class WEB-INF/classes/negocio/.  
nicolas@REST2015090704:~/servicio$ jar cvf Servicio.war WEB-INF META-INF  
added manifest  
adding: WEB-INF/(in = 0) (out= 0)(stored 0%)  
adding: WEB-INF/web.xml(in = 672) (out= 296)(deflated 55%)  
adding: WEB-INF/classes/(in = 0) (out= 0)(stored 0%)  
adding: WEB-INF/classes/negocio/(in = 0) (out= 0)(stored 0%)  
adding: WEB-INF/classes/negocio/Usuario.class(in = 899) (out= 518)(deflated 42%)  
adding: WEB-INF/classes/negocio/AdaptadorGsonBase64.class(in = 1799) (out= 737)(deflated 59%)  
adding: WEB-INF/classes/negocio/Servicio.class(in = 7578) (out= 3461)(deflated 54%)  
adding: WEB-INF/classes/negocio/Error.class(in = 278) (out= 214)(deflated 23%)  
ignoring entry META-INF/  
adding: META-INF/context.xml(in = 304) (out= 210)(deflated 30%)  
nicolas@REST2015090704:~/servicio$ |
```

Creación del archivo war para el proyecto Servicio.

7. Para desplegar (*deploy*) el servicio web, copiar el archivo Servicio.war al directorio “webapps” de Tomcat. Notar que Tomcat desempaca automáticamente los archivos con extensión .war que se encuentran en el directorio webapps de Tomcat.



```
nicolas@REST2015090704:~$ cp Servicio/
META-INF/    Servicio.war  WEB-INF/    negocio/
nicolas@REST2015090704:~$ cp Servicio/Servicio.war apache-tomcat-8.5.72/webapps/
nicolas@REST2015090704:~$ ls apache-tomcat-8.5.72/webapps/
ROOT  Servicio  Servicio.war
nicolas@REST2015090704:~$
```

Copiamos el archivo war al directorio de webapps de Tomcat.

Para eliminar el servicio web se deberá eliminar el archivo "Servicio.war" y el directorio "Servicio", en éste orden.

Cada vez que se modifique el archivo Servicio.java se deberá compilar, generar el archivo Servicio.war, borrar el archivo Servicio.war y el directorio Servicio del directorio webapps de Tomcat, y copiar el archivo Servicio.war al directorio webapps de Tomcat.

Probar el servicio web utilizando HTML-Javascript

1. Copiar el archivo [usuario_sin_foto.png](#) al subdirectorio webapps/ROOT de Tomcat.

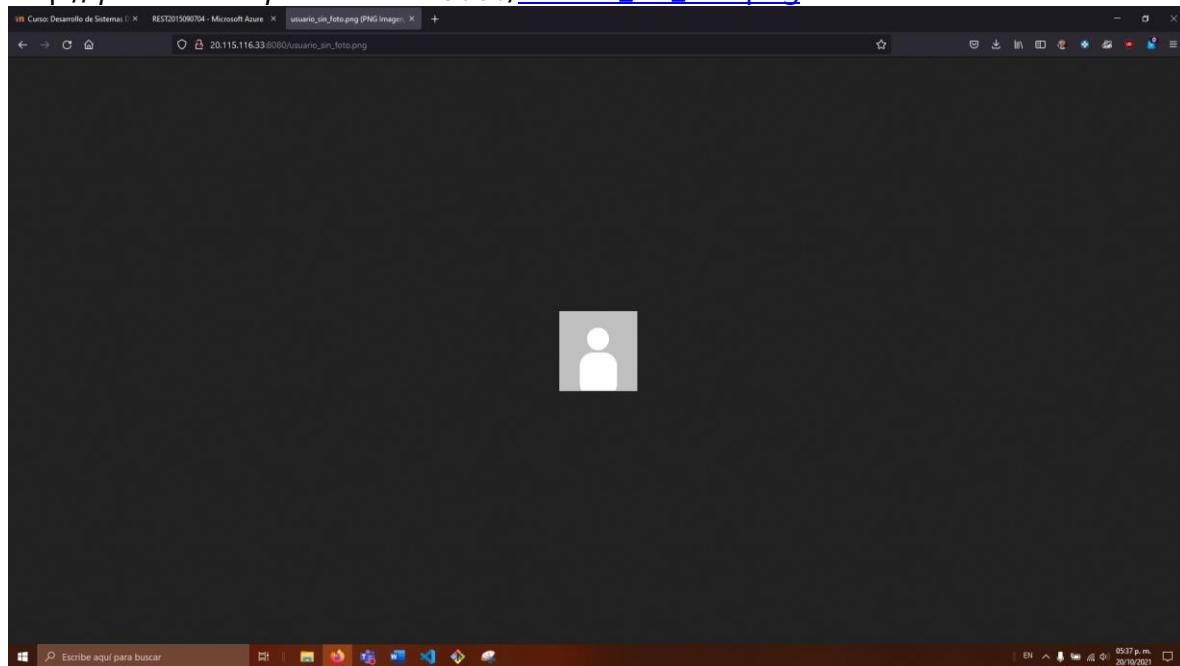
```
MINGW64 /c/Users/fnico/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos
cd bash: /c/Users/fnico/.profile: is a directory
fnico@DESKTOP-CPH6GHP MINGW64 ~
$ cd Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos/
fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos/main
$ cd Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos/^C
fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos/main
$ scp
prueba.html      Servicio.zip      wsClient.js
Servicio/        usuario_sin_foto.png
fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos/main
$ scp Servicio.zip nicolas@20.115.116.33:~
nicolas@20.115.116.33's password:
Servicio.zip          100% 4972     39.4KB/s  00:00
fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos/main
$ scp usuario_sin_foto.png nicolas@20.115.116.33:~/apache-tomcat-8.5.72/webapps/
ROOT/
nicolas@20.115.116.33's password:
usuario_sin_foto.png          100% 1662     13.3KB/s  00:00
fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos/main
$
```

Copiamos la imagen a la máquina virtual.

Notar que todos los archivos que se encuentran en el directorio webapps/ROOT de Tomcat son accesibles públicamente.

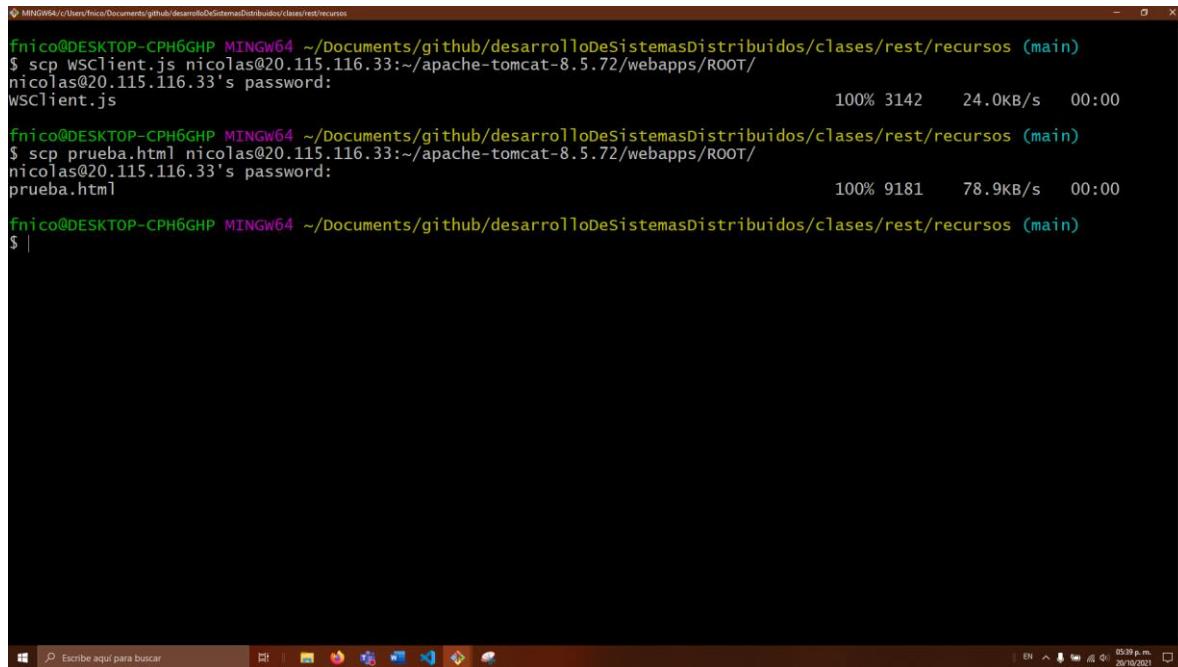
Para probar que Tomcat esté en línea y el puerto 8080 esté abierto, ingresar la siguiente URL en un navegador:

http://ip-de-la-máquina-virtual:8080/usuario_sin_foto.png



Se muestra la imagen alojada en la máquina virtual.

2. Copiar el archivo [WSClient.js](#) al directorio webapps/ROOT de Tomcat.
3. Copiar el archivo [prueba.html](#) al directorio webapps/ROOT de Tomcat.



```
MINGW64 /c/Users/nicolas/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos
fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos (main)
$ scp WSClient.js nicolas@20.115.116.33:~/apache-tomcat-8.5.72/webapps/ROOT/
nicolas@20.115.116.33's password: wsclient.js
100% 3142    24.0KB/s   00:00

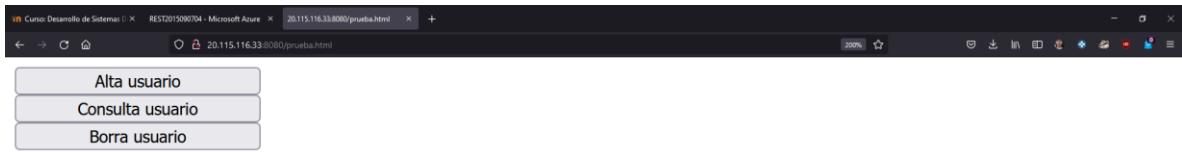
fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos (main)
$ scp prueba.html nicolas@20.115.116.33:~/apache-tomcat-8.5.72/webapps/ROOT/
nicolas@20.115.116.33's password: prueba.html
100% 9181    78.9KB/s   00:00

fnico@DESKTOP-CPH6GHP MINGW64 ~/Documents/github/desarrolloDeSistemasDistribuidos/clases/rest/recursos (main)
$ |
```

Copiamos el archivo js y el html a la máquina virtual.

4. Ingresar la siguiente URL en un navegador:

<http://ip-de-la-máquina-virtual:8080/prueba.html>



Ingreso a la url para verificar la prueba.html.

5. Dar clic en el botón “Alta usuario” para dar de alta un nuevo usuario. Capturar los campos y dar clic en el botón “Alta”.

6. Intentar dar de alta otro usuario con el mismo email (se deberá mostrar una ventana de error indicando que el email ya existe)

The screenshot shows a form titled "Alta de usuario". The fields are as follows:

- Email *: prueba@gmail.com
- Nombre *: prueba
- Apellido paterno *: apellido1
- Apellido materno *: apellido2
- Fecha de nacimiento *: 10 / 10 / 1998
- Teléfono: 5555555555
- Género: Masculino
- File input: Examinar... wordpress captura1.PNG (with a thumbnail preview of a person in a red shirt).
- Buttons: Alta, Regresa



Alta de usuario.

Si se intenta dar de alta con mismo mail salta la alerta de que el email ya existe.

7. Dar clic en el botón “Consulta usuario” para consultar el usuario dado de alta en el paso 5. Capturar el email y dar clic en el botón “Consulta”,

Consulta usuario del creado anteriormente.

Consulta/Modifica usuario

Email *
prueba@gmail.com

Nombre *
prueba

Apellido paterno *
apellido1

Apellido materno
apellido2

Fecha de nacimiento *
10 / 10 / 1998

Teléfono
5555555555

Género
Masculino


Examinar... Ningún archivo seleccionado.

Consulta
Modifica
Regresa



Se muestra el usuario ingresado previamente.

8. Modificar algún dato del usuario y dar clic en el botón “Modifica”:

Consulta/Modifica usuario

Email *
prueba@gmail.com

Nombre *
prueba

Apellido paterno *
apellido1

Apellido materno
apellido2

Fecha de nacimiento *
10 / 10 / 1998

Teléfono
5555555000

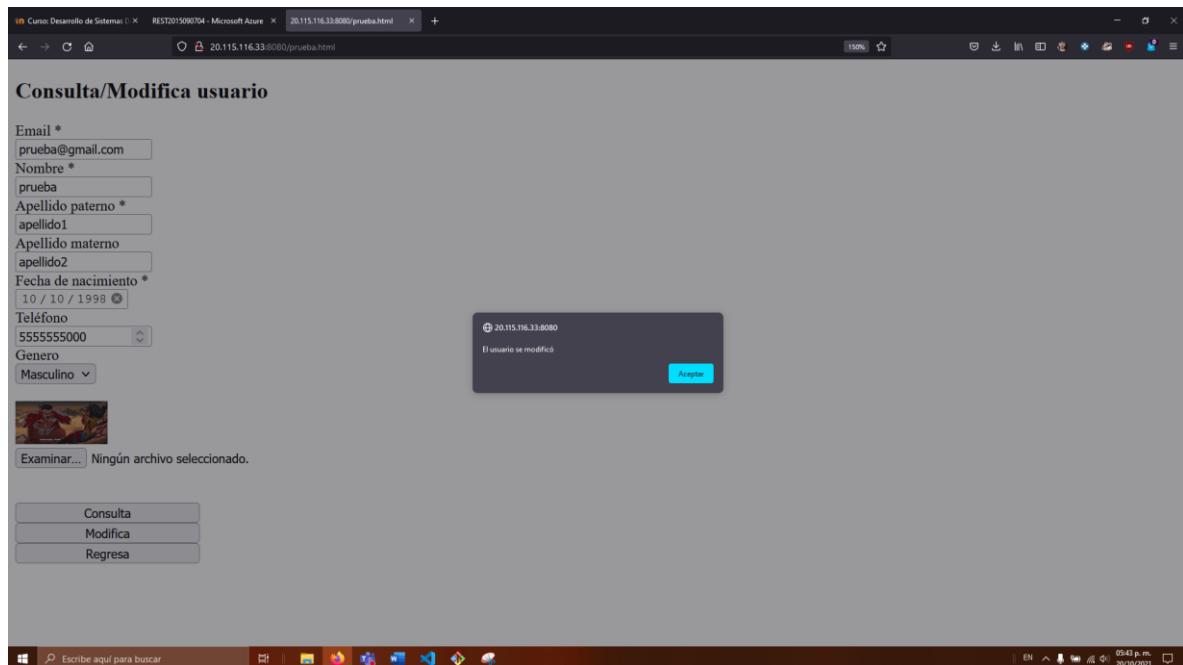
Género
Masculino


Examinar... Ningún archivo seleccionado.

Consulta
Modifica
Regresa

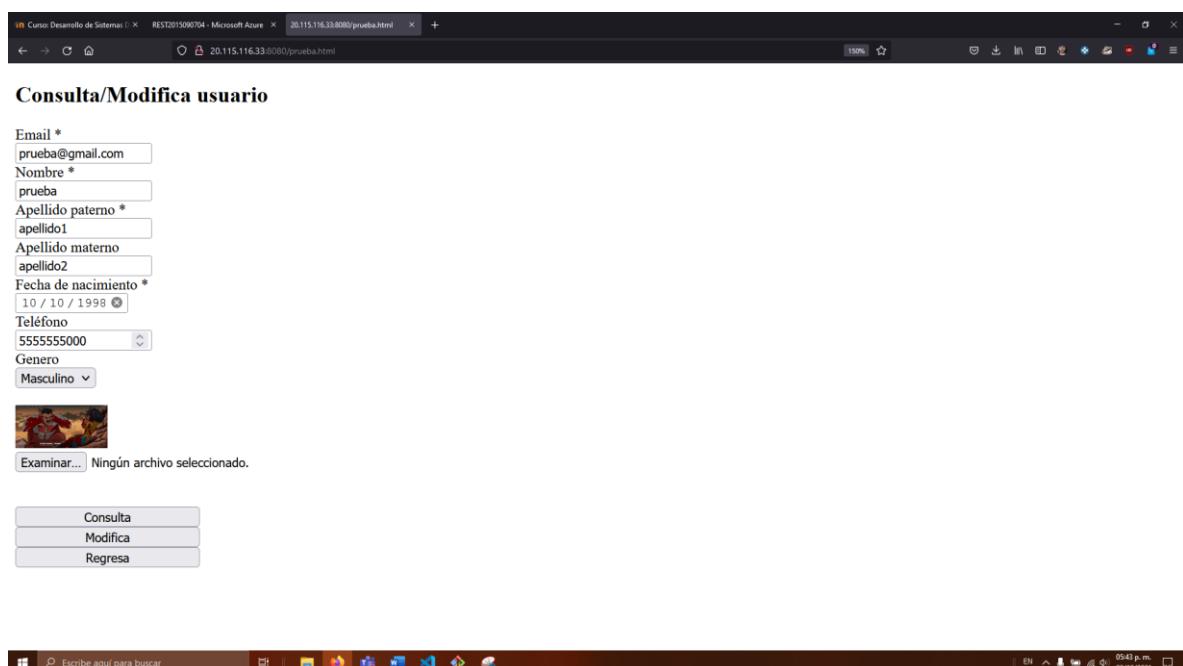


Se modifica el número de teléfono con tres ceros al final y se selecciona el botón de modifica.



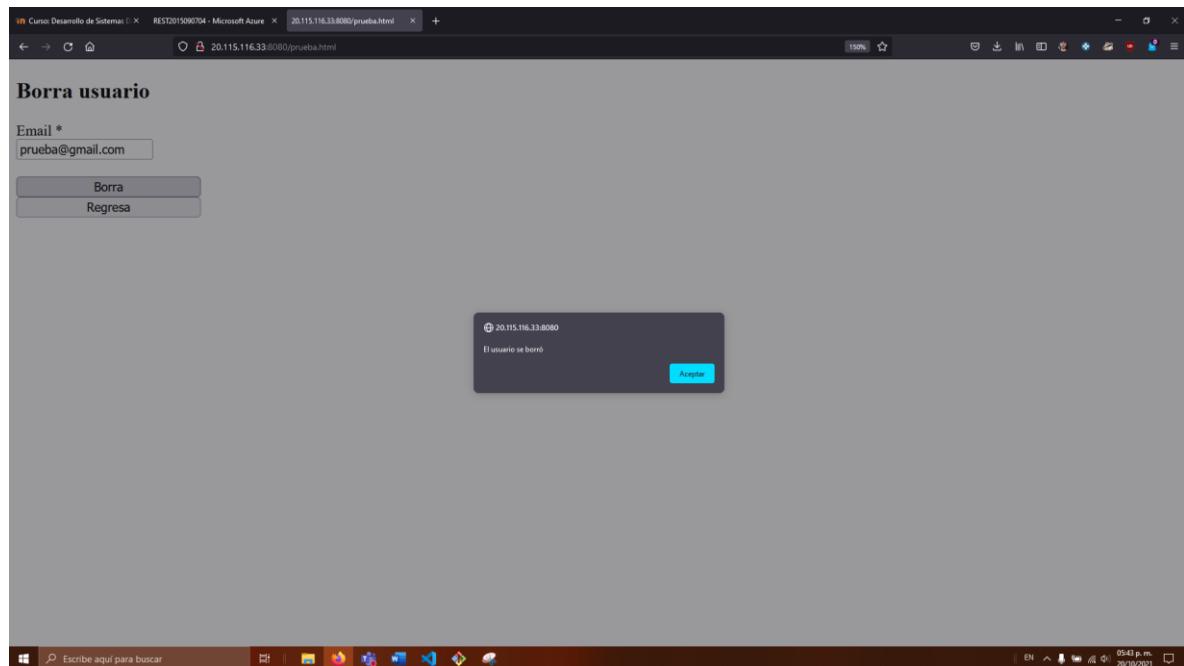
Se muestra una alerta indicando la modificación del usuario.

9. Recargar la página actual y consultar el usuario modificado, para verificar que la modificación se realizó.



Recargamos la página y volvemos a buscar al usuario, como podemos ver, el teléfono anteriormente modificado ha sido cambiado.

10. Dar clic en el botón “Borra usuario” para borrar el usuario. Capturar el email del usuario a borrar y dar clic en el botón “Consulta”.



Borrado del usuario previamente modificado.

11. Utilizando un teléfono inteligente y/o una tableta, probar el servicio web accediendo la siguiente URL en un navegador:

<http://ip-de-la-máquina-virtual:8080/prueba.html>



Captura de pantalla de la aplicación desde un dispositivo móvil.

CONCLUSIONES

Al tener algo de experiencia previa levantando servicios en Apache Tomcat y usando de igual manera MySQL me ha permitido concentrarme en conocer a fondo como es que sucede toda la parte del deploy de forma manual ya que normalmente lo hacía con un IDE. Siguiendo las recomendaciones en clase y prestando atención a los comandos que ejecutaba puede terminar la práctica en el primer intento para finalmente crear mi imagen a partir de los cambios hechos en la máquina virtual.