**Installing Tomcat 7 on CentOS 7**
David J. Walling, March 8th, 2017
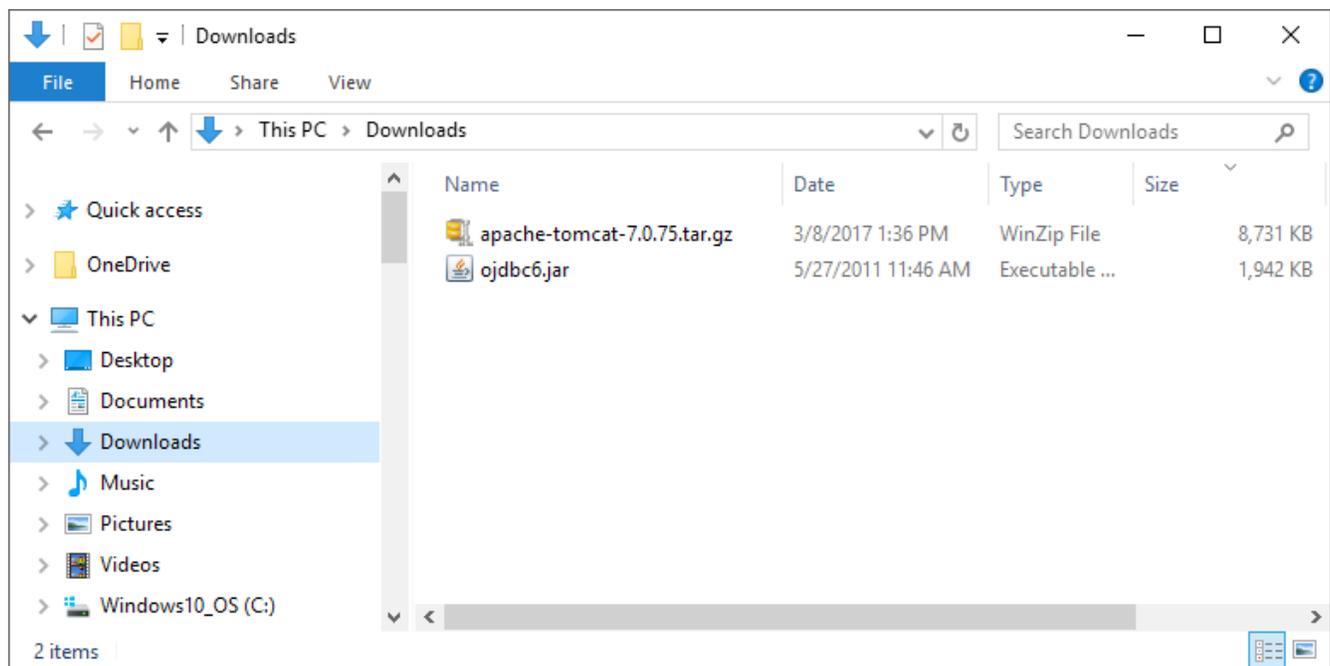Email: david@davidjwalling.com


This "how to" describes a process to download and install Apache Tomcat 7 on a CentOS 7 virtual machine using the Oracle VirtualBox hypervisor on a Windows 10 host. This "how to" is part of a series and continues from the point where a CentOS 7 "Minimal" distribution ISO has been downloaded and used to install and configure CentOS 7 and Oracle XE 11g.

We start by downloading the compressed archive of Apache Tomcat 7 and an OJDBC driver for Java 6. We are using Java 6 because our environment will be used to support applications that require it.

Open a browser and download the Apache Tomcat 7 and Oracle JDBC 6 JAR from these locations. The Oracle site may require that you register as a user.

http://www.trieuvan.com/apache/tomcat/tomcat-7/v7.0.75/bin/apache-tomcat-7.0.75.tar.gz
http://www.oracle.com/technetwork/apps-tech/jdbc-112010-090769.html



After downloading these files, consider storing them in an organized download hierarchy in case you want or need to reinstall again.

Next, we'll upload these files to CentOS. In a previous "how to", we established secure connectivity into our CentOS using SFTP or secure shell (SSH). Here, we're leveraging this configuration to connect to CentOS from a file transfer application, FileZilla. This tool allows the upload by dragging and dropping the archive file from our Windows 10 host to our CentOS virtual machine.
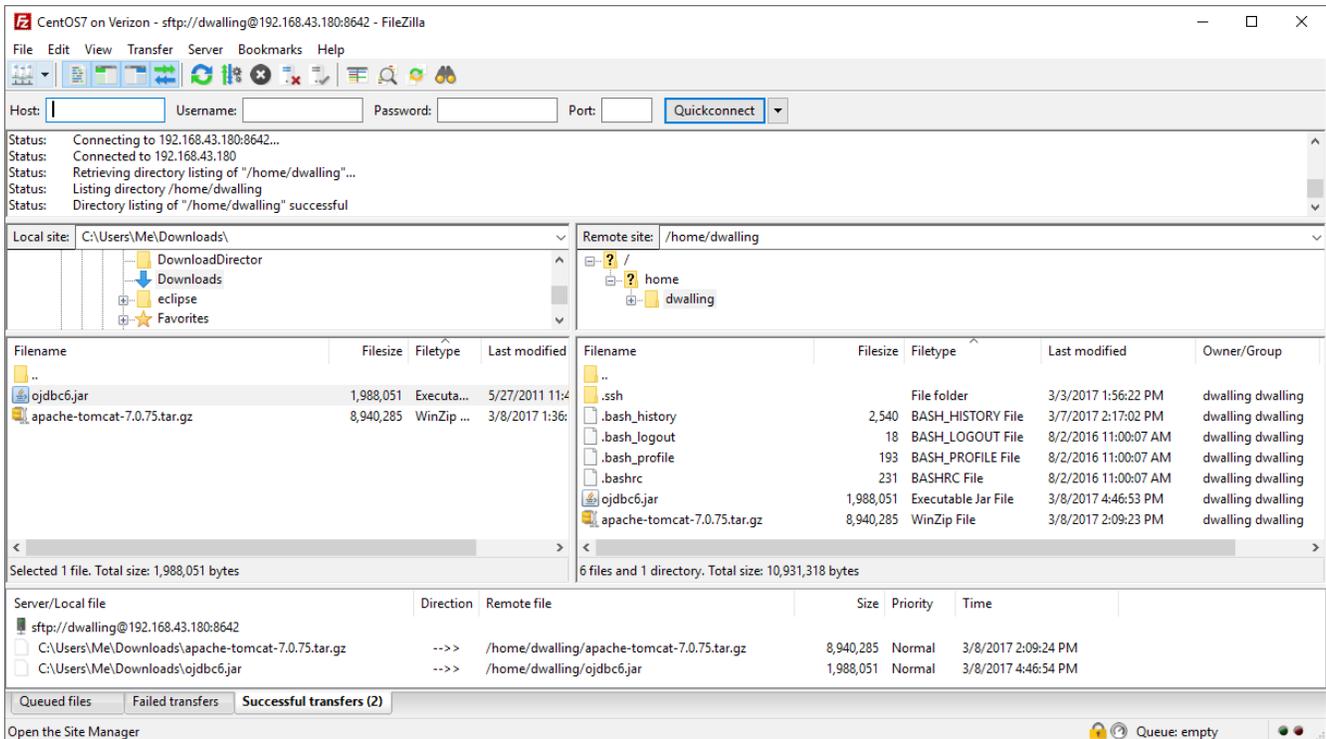


Recall that we setup one user for all SSH connections into CentOS. For better security, do not allow the "root" user or any other user with elevated privileges to remotely connect to CentOS over SSH.

We will also demonstrate the use of SSH connections using the PuTTY client program. Since we have not (yet) installed support for a GUI in our CentOS VM, the PuTTY client at least allows us to dynamically resize the client window dimensions and to open multiple concurrent sessions (windows) as needed.
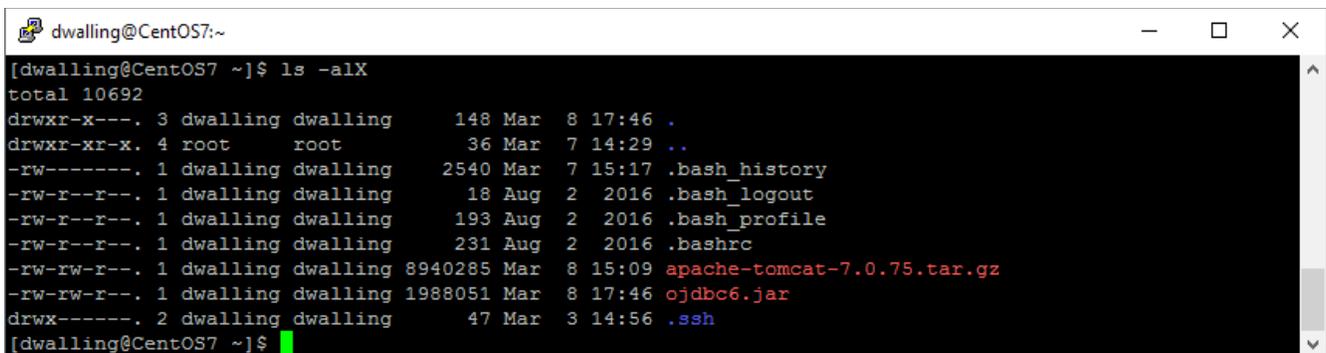
The next set of commands is issued as the "root" user, which we access using the "su" (superuser) command. Create the "tomcat" group and define the "tomcat" user. Provide the tomcat user a secure password, please.

```
tomcat@CentOS7:~                                                    —   □   ×

[dwalling@CentOS7 ~]$ su - root
Password:
Last login: Wed Mar  8 14:06:04 EST 2017 on tty1
[root@CentOS7 ~]# groupadd tomcat
[root@CentOS7 ~]# useradd -m -d /home/tomcat -g tomcat -G wheel tomcat
[root@CentOS7 ~]# passwd tomcat
Changing password for user tomcat.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[root@CentOS7 ~]# mv /home/dwalling/apache-tomcat-7.0.75.tar.gz /home/tomcat
[root@CentOS7 ~]# chown tomcat /home/tomcat/apache-tomcat-7.0.75.tar.gz
[root@CentOS7 ~]# chgrp tomcat /home/tomcat/apache-tomcat-7.0.75.tar.gz
[root@CentOS7 ~]# su - tomcat
[tomcat@CentOS7 ~]$ tar -zxvf apache-tomcat-7.0.75.tar.gz█
```

After creating the "tomcat" user, move the compressed archive from the administrative user's home folder to the "tomcat" user's home folder and change the owner and group attributes of the archive to "tomcat". Change the current user to the "tomcat" user with "su". Uncompress and unload the compressed archive using the "tar" command.

```
tomcat@CentOS7:~                                                    —   □   ×

[tomcat@CentOS7 ~]$ ls -al
total 8748
drwx------. 3 tomcat tomcat     146 Mar  9 17:47 .
drwxr-xr-x. 5 root   root        50 Mar  9 17:37 ..
drwxrwxr-x. 9 tomcat tomcat     160 Mar  9 17:42 apache-tomcat-7.0.75
-rw-rw-r--. 1 tomcat tomcat 8940285 Mar  9 17:35 apache-tomcat-7.0.75.tar.gz
-rw-------. 1 tomcat tomcat      75 Mar  9 17:47 .bash_history
-rw-r--r--. 1 tomcat tomcat      18 Dec  6 18:19 .bash_logout
-rw-r--r--. 1 tomcat tomcat     193 Dec  6 18:19 .bash_profile
-rw-r--r--. 1 tomcat tomcat     231 Dec  6 18:19 .bashrc
[tomcat@CentOS7 ~]$ sudo mv apache-tomcat-7.0.75/ /usr/local/tomcat

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.

[sudo] password for tomcat:
[tomcat@CentOS7 ~]$ sudo mv /home/dwalling/ojdbc6.jar /usr/local/tomcat/lib
[tomcat@CentOS7 ~]$ sudo chown tomcat /usr/local/tomcat/lib/ojdbc6.jar
[tomcat@CentOS7 ~]$ sudo chgrp tomcat /usr/local/tomcat/lib/ojdbc6.jar
[tomcat@CentOS7 ~]$ █
```

Now we can move the entire uncompressed apache-tomcat-7.0.75 folder into /usr/local. Note the slash after the first parameter of the first "mv" command above. We'll want to use the "sudo" command to perform these actions as "root". Also move the OJDBC6 JAR to /usr/local/tomcat/lib and change the owner and group of this library.

```
tomcat@CentOS7:~                                                    —   □   ✕

[tomcat@CentOS7 ~]$ ls -al /usr/local/tomcat/lib
total 8964
drwxr-xr-x. 2 tomcat tomcat    4096 Mar  8 18:16 .
drwxrwxr-x. 9 tomcat tomcat     160 Mar  8 18:05 ..
-rw-r--r--. 1 tomcat tomcat   15978 Jan 18 15:56 annotations-api.jar
-rw-r--r--. 1 tomcat tomcat   55150 Jan 18 15:56 catalina-ant.jar
-rw-r--r--. 1 tomcat tomcat  131125 Jan 18 15:56 catalina-ha.jar
-rw-r--r--. 1 tomcat tomcat 1669590 Jan 18 15:56 catalina.jar
-rw-r--r--. 1 tomcat tomcat  267169 Jan 18 15:56 catalina-tribes.jar
-rw-r--r--. 1 tomcat tomcat 2310271 Jan 18 15:56 ecj-4.4.2.jar
-rw-r--r--. 1 tomcat tomcat   55504 Jan 18 15:56 el-api.jar
-rw-r--r--. 1 tomcat tomcat  125480 Jan 18 15:56 jasper-el.jar
-rw-r--r--. 1 tomcat tomcat  600895 Jan 18 15:56 jasper.jar
-rw-r--r--. 1 tomcat tomcat   87803 Jan 18 15:56 jsp-api.jar
-rw-rw-r--. 1 tomcat tomcat 1988051 Mar  8 18:16 ojdbc6.jar
-rw-r--r--. 1 tomcat tomcat  197994 Jan 18 15:56 servlet-api.jar
-rw-r--r--. 1 tomcat tomcat  217098 Jan 18 15:56 tomcat7-websocket.jar
-rw-r--r--. 1 tomcat tomcat    6521 Jan 18 15:56 tomcat-api.jar
-rw-r--r--. 1 tomcat tomcat  795060 Jan 18 15:56 tomcat-coyote.jar
-rw-r--r--. 1 tomcat tomcat  234042 Jan 18 15:56 tomcat-dbcp.jar
-rw-r--r--. 1 tomcat tomcat   71856 Jan 18 15:56 tomcat-i18n-es.jar
-rw-r--r--. 1 tomcat tomcat   43792 Jan 18 15:56 tomcat-i18n-fr.jar
-rw-r--r--. 1 tomcat tomcat   47035 Jan 18 15:56 tomcat-i18n-ja.jar
-rw-r--r--. 1 tomcat tomcat  132479 Jan 18 15:56 tomcat-jdbc.jar
-rw-r--r--. 1 tomcat tomcat   35181 Jan 18 15:56 tomcat-util.jar
-rw-r--r--. 1 tomcat tomcat   36270 Jan 18 15:56 websocket-api.jar
[tomcat@CentOS7 ~]$
```

The ojdbc6.jar file is now included among the tomcat libraries.

```
root@CentOS7:~                                                      —   □   ✕

[tomcat@CentOS7 ~]$ exit
logout
[root@CentOS7 ~]# vi /etc/profile
```

Exiting the "tomcat" user shell back to "root", we now edit /etc/profile to define environment variables for tomcat.

```
root@CentOS7:~                                                      —   □   ✕

export TOMCAT_HOME=usr/local/tomcat
export CATALINA_HOME=/usr/local/tomcat
export CLASSPATH=$CLASSPATH:$CATALINA_HOME/common/lib


~
~
~
~
"/etc/profile" 85L, 2073C written
```

Also, we update the CLASSPATH variable to include tomcat's common library folder.

```
root@CentOS7:~                                          —   □   ×

[root@CentOS7 ~]# source /etc/profile
[root@CentOS7 ~]# vi /usr/local/tomcat/conf/tomcat-users.xml
```

We can "source" the updated profile to make the changes active for our session. Next, we edit the tomcat-users.xml file to define a user for the tomcat manager.

```
root@CentOS7:~                                          —   □   ×

<!--
  NOTE:  The sample user and role entries below are intended for use with the
  examples web application. They are wrapped in a comment and thus are ignored
  when reading this file. If you wish to configure these users for use with the
  examples web application, do not forget to remove the <!.. ..> that surrounds
  them. You will also need to set the passwords to something appropriate.
-->
<!--
  <role rolename="tomcat"/>
  <role rolename="role1"/>
  <user username="tomcat" password="<must-be-changed>" roles="tomcat"/>
  <user username="both" password="<must-be-changed>" roles="tomcat,role1"/>
  <user username="role1" password="<must-be-changed>" roles="role1"/>
-->
  <role rolename="tomcat"/>
  <role rolename="manager-gui"/>
  <user username="tomcat" password="tomcat" roles="tomcat,manager-gui"/>
</tomcat-users>
"/usr/local/tomcat/conf/tomcat-users.xml" 44L, 2084C written
```

Our update adds definitions for the "tomcat" and "manager-gui" roles and a user that has both roles.

```
root@CentOS7:~                                                    —   □   ×

#!/bin/bash
#
# tomcat
#
# chkconfig:
# description: Start up the Tomcat servlet engine

# Source function library.
. /etc/init.d/functions

RETVAL=$?
CATALINA_HOME=/usr/local/tomcat

case "$1" in
 start)
        if [ -f $CATALINA_HOME/bin/startup.sh ];
          then
            echo $"Starting Tomcat"
            /bin/su tomcat $CATALINA_HOME/bin/startup.sh
        fi
        ;;
 stop)
        if [ -f $CATALINA_HOME/bin/shutdown.sh ];
          then
            echo $"Stopping Tomcat"
            /bin/su tomcat $CATALINA_HOME/bin/shutdown.sh
        fi
        ;;
 *)
        echo $"Usage: $0 {start|stop}"
        exit 1
        ;;
esac

exit $RETVAL
~
"/etc/rc.d/init.d/tomcat" [New] 35L, 555C written
```

Tomcat is now installed and configured. But, we'd like the service to start when the system boots. We create a "tomcat" file in /etc/rc.d/init.d and provide handlers for the service "start" and "stop" options.

```
root@CentOS7:/etc/rc5.d                                           —   □   ×

[root@CentOS7 ~]# vi /etc/init.d/tomcat
[root@CentOS7 ~]# cd /etc/init.d
[root@CentOS7 init.d]# chmod 755 tomcat
[root@CentOS7 init.d]# cd /etc/rc5.d
[root@CentOS7 rc5.d]# ln -s ../init.d/tomcat S81tomcat
[root@CentOS7 rc5.d]#
```

We make the "tomcat" script executable and create a symbolic link to the script in the /etc/rc5.d folder. This enables tomcat to automatically start when the system enters run level 5 (graphical multi-user).

```
root@CentOS7:/etc/rc5.d                                          —    □    ✕

[root@CentOS7 rc5.d]# semanage port -a -t http_port_t -p tcp 8080
ValueError: Port tcp/8080 already defined
[root@CentOS7 rc5.d]# firewall-cmd --permanent --add-port=8080/tcp
success
[root@CentOS7 rc5.d]# firewall-cmd --reload
success
[root@CentOS7 rc5.d]#
```

Next, we want to make our default HTTP port for tomcat accessible to remote clients. To do this, we again use the "semanage" and "firewall-cmd" tools to enable port 8080 and allow external access to it.

Note that we are not exposing the tomcat AJP port (8009) to the outside world.

```
root@CentOS7:/etc/rc5.d                                          —    □    ✕

[root@CentOS7 rc5.d]# service tomcat start
Reloading systemd:                                    [  OK  ]
Starting tomcat (via systemctl):                      [  OK  ]
[root@CentOS7 rc5.d]# netstat -an | grep "LISTEN "
tcp        0      0 0.0.0.0:8642          0.0.0.0:*             LISTEN
tcp6       0      0 :::8080               :::*                  LISTEN
tcp6       0      0 :::1521               :::*                  LISTEN
tcp6       0      0 :::42302              :::*                  LISTEN
tcp6       0      0 127.0.0.1:8005        :::*                  LISTEN
tcp6       0      0 :::8009               :::*                  LISTEN
tcp6       0      0 :::8521               :::*                  LISTEN
[root@CentOS7 rc5.d]#
```

We start the service with "service tomcat start", which runs the "start" portion of our tomcat init.d script. Now, if we check our listening ports using "netstat", we can see ports 8080, 8005 and 8009 actively listening.
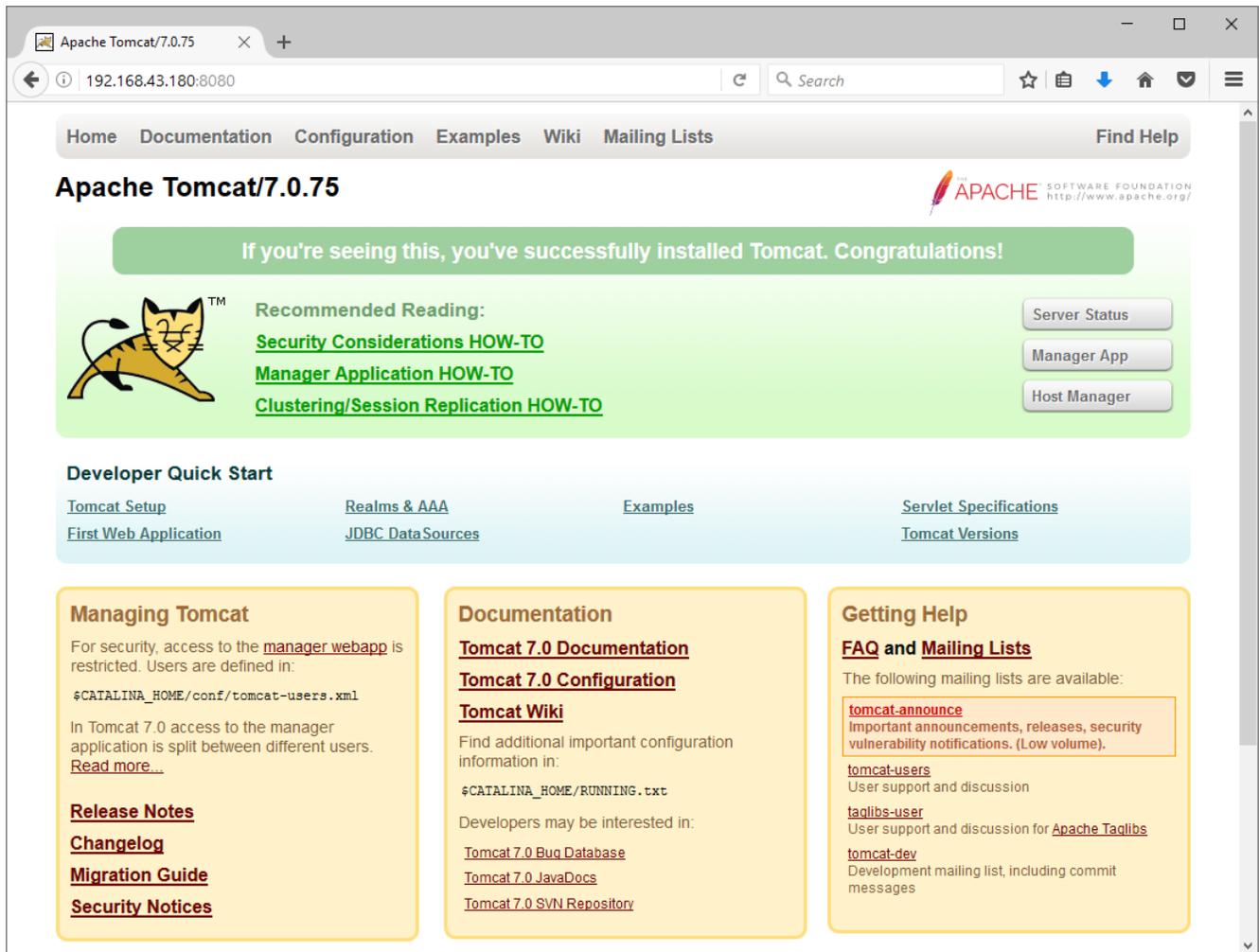
From our host system, we can open a browser and navigate to our CentOS virtual machine IP address and connect on tomcat's default port, 8080. If all went well, we'll see the welcome screen shown above.
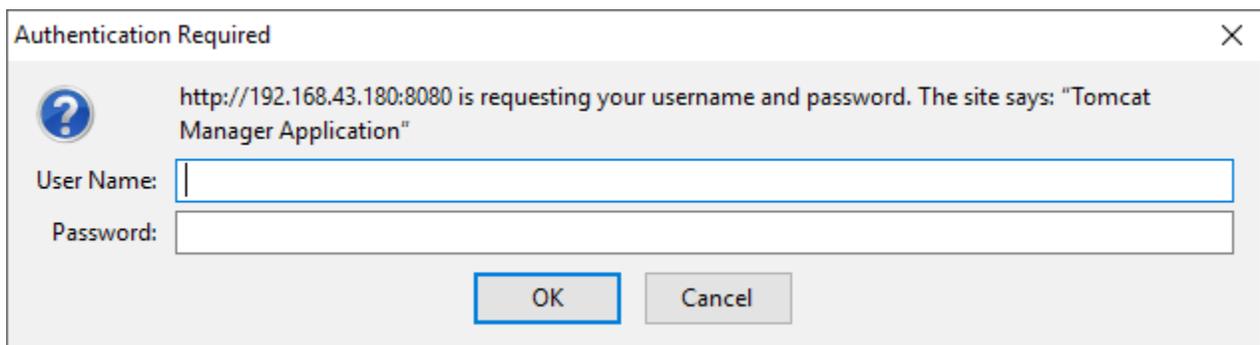


Now, we want to test our access the tomcat manager. Click on the "Manager App" button or the "manager webapp" link and enter our "tomcat" credentials we defined in the tomcat-users.xml file.

## Server Status

### Manager

| List Applications | HTML Manager Help | Manager Help | Complete Server Status |
|---|---|---|---|

### Server Information

| Tomcat Version | JVM Version | JVM Vendor | OS Name | OS Version | OS Architecture | Hostname | IP Address |
|---|---|---|---|---|---|---|---|
| Apache Tomcat/7.0.75 | 1.6.0_45-b06 | Sun Microsystems Inc. | Linux | 3.10.0-514.10.2.el7.x86_64 | amd64 | CentOS7 | 192.168.43.180 |

### JVM

Free memory: 25.42 MB Total memory: 43.12 MB Max memory: 688.31 MB

| Memory Pool | Type | Initial | Total | Maximum | Used |
|---|---|---|---|---|---|
| Eden Space | Heap memory | 11.93 MB | 12.00 MB | 189.93 MB | 9.06 MB (4%) |
| Survivor Space | Heap memory | 1.43 MB | 1.43 MB | 23.68 MB | 0.00 MB (0%) |
| Tenured Gen | Heap memory | 29.68 MB | 29.68 MB | 474.68 MB | 8.63 MB (1%) |
| Code Cache | Non-heap memory | 2.43 MB | 2.43 MB | 48.00 MB | 1.42 MB (2%) |
| Perm Gen | Non-heap memory | 20.75 MB | 27.00 MB | 82.00 MB | 26.78 MB (32%) |

### "ajp-bio-8009"

Max threads: 200 Current thread count: 0 Current thread busy: 0
Max processing time: 0 ms Processing time: 0.0 s Request count: 0 Error count: 0 Bytes received: 0.00 MB Bytes sent: 0.00 MB

| Stage | Time | B Sent | B Recv | Client (Forwarded) | Client (Actual) | VHost | Request |
|---|---|---|---|---|---|---|---|

P: Parse and prepare request S: Service F: Finishing R: Ready K: Keepalive

The tomcat manager window is displayed. If we click on the "List Applications" link, we will see the status of deployed servlets.

So far, so good. Everything appears to be running. Now let's restart our CentOS virtual machine to see if tomcat starts up automatically, like we configured it to.
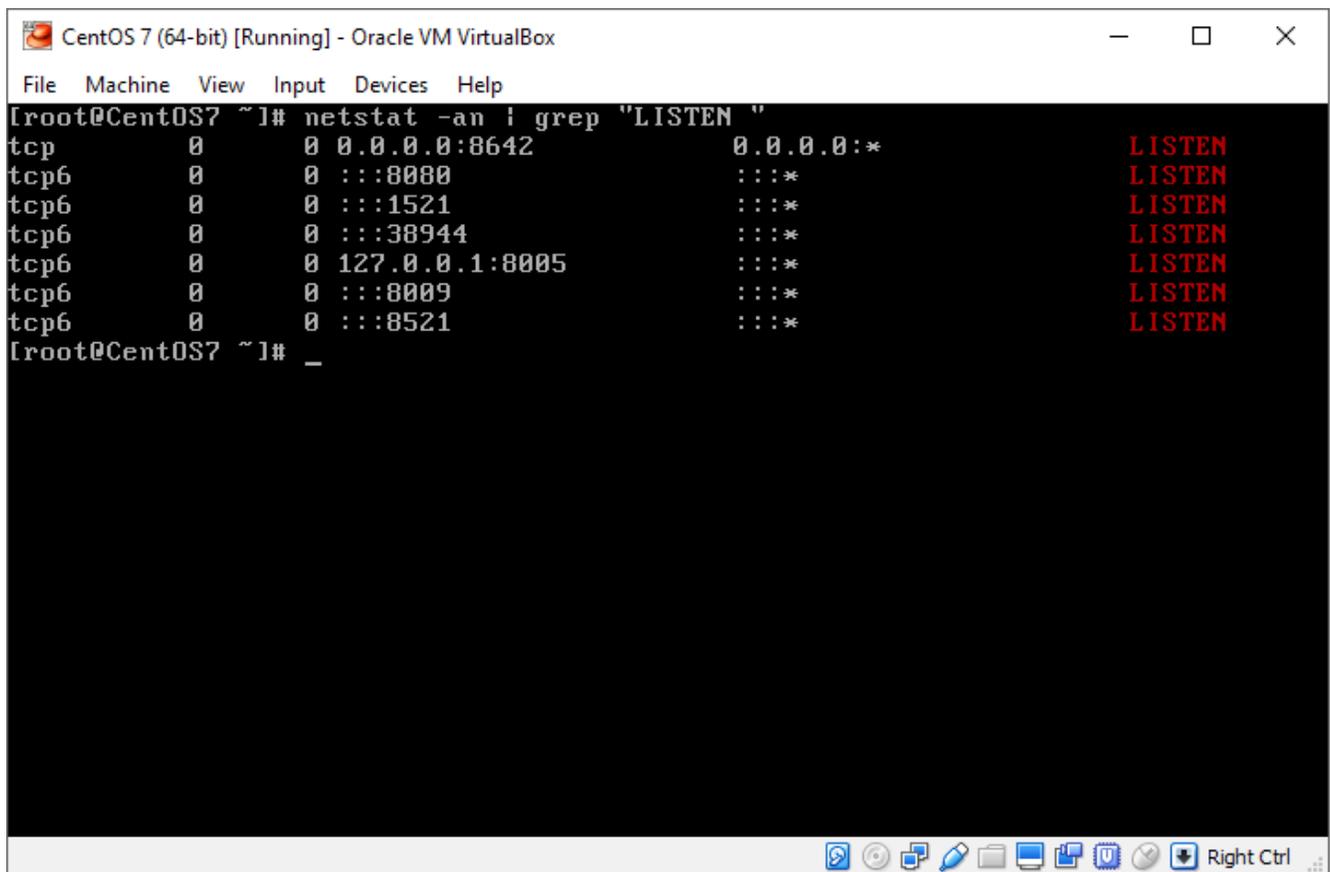
```
CentOS 7 (64-bit) [Running] - Oracle VM VirtualBox            —    □    ×

File   Machine   View   Input   Devices   Help
[root@CentOS7 etc]# netstat -an | grep "LISTEN "
tcp        0        0 0.0.0.0:8642            0.0.0.0:*              LISTEN
tcp6       0        0 :::1521                 :::*                   LISTEN
tcp6       0        0 :::39507                :::*                   LISTEN
tcp6       0        0 :::8521                 :::*                   LISTEN
[root@CentOS7 etc]# who -r
         run-level 3  2017-03-09 18:26
[root@CentOS7 etc]# ls /etc/rc3.d
K50netconsole   S10network   S80oracle-xe   S95jexec
[root@CentOS7 etc]# ls /etc/rc5.d
K50netconsole   S10network   S80oracle-xe   S81tomcat   S95jexec
[root@CentOS7 etc]# _
```

After our virtual machine restarts, we issue a "netstat" command to see our actively listening ports. But, there's a problem. The tomcat ports are not active. A quick check of our initialization configuration reveals the problem. We created an initializer for run level 5 (multi-user GUI), but not for run level 3 (multi-user text). The "who -r" command shows that we are running at run level 3.

A simple "ln" command will create new link in /etc/rc3.d. We confirm this by listing the contents of the folder after creating the link. Now, the tomcat startup script should be run when we reboot CentOS into run level 3.

```
CentOS 7 (64-bit) [Running] - Oracle VM VirtualBox                    —    □    ✕

File   Machine   View   Input   Devices   Help
[root@CentOS7 ~]# netstat -an | grep "LISTEN "
tcp        0       0 0.0.0.0:8642          0.0.0.0:*              LISTEN
tcp6       0       0 :::8080               :::*                   LISTEN
tcp6       0       0 :::1521               :::*                   LISTEN
tcp6       0       0 :::38944              :::*                   LISTEN
tcp6       0       0 127.0.0.1:8005        :::*                   LISTEN
tcp6       0       0 :::8009               :::*                   LISTEN
tcp6       0       0 :::8521               :::*                   LISTEN
[root@CentOS7 ~]# _



                                              🖥 ⊙ 🖧 ✏ ▭ 🖥 🖥 🖰 ⊘ ⬇ Right Ctrl
```

A quick reboot and another "netstat" command confirms our fix. Now, our SFTP, Oracle and Tomcat services are starting up automatically on reboot.