

Java and JVM module practical task

Practical task

1. Download/install Tomcat server.
2. Verify that it works by visiting the root page.
 - a. What ports are used by the java process?
3. Remove all default applications (including manager), restart Tomcat.
4. Download Jenkins WAR and deploy into Tomcat.
5. Verify that application works (visit application URL).
6. Enable JMX in Tomcat.
 - a. What ports are used by the java process?
 - b. Change CATALINA_OPTS to use same for RMI as for JMX
 - c. What ports are used by the java process?
7. Rerun tomcat with min heap size 10M and max heap size 20M.
 - a. What type of error will you get?
 - b. Increase min heap size to 1G and max heap size to 3G, enable parallel garbage collector.
8. Connect by JConsole to Tomcat and look around.
9. Stop Tomcat.
10. Launch Jenkins WAR as a standalone application, verify that it works.

1. Download/install Tomcat server.

Java needs to be installed for tomcat to work

```
06:13:39 adrwal@olek-desktop-pc ~ → java --version
openjdk 21.0.4 2024-07-16
OpenJDK Runtime Environment (build 21.0.4+7-Ubuntu-1ubuntu224.04)
OpenJDK 64-Bit Server VM (build 21.0.4+7-Ubuntu-1ubuntu224.04, mixed mode, sharing)
06:13:45 adrwal@olek-desktop-pc ~ →
```

Now we can install tomcat

```
wget https://dlcdn.apache.org/tomcat/tomcat-10/v10.1.31/bin/apache-tomcat-10.1.31.tar.gz
sudo mkdir /opt/tomcat
sudo tar xzvf apache-tomcat-10.1.31.tar.gz -C /opt/tomcat --strip-components=1
```

And run it

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

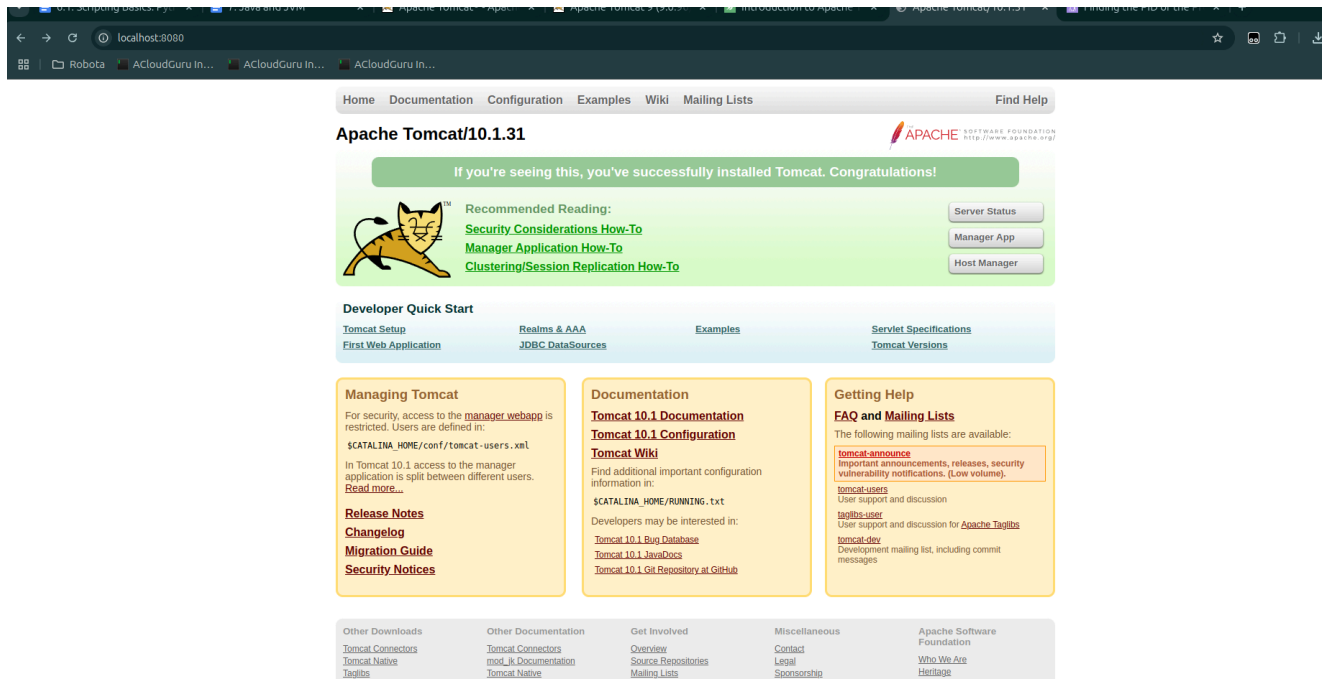
2. Verify that it works by visiting the root page.

Now tomcat server is available on port 8080

```
06:25:30 adrw@olek-desktop-pc tomcat → sudo ./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
Using CATALINA_OPTS:
Tomcat started.
06:25:53 adrw@olek-desktop-pc tomcat → sudo ss -lntp
```

State	Recv-Q	Send-Q	Local Address:Port	Peer Address:Port	Process
LISTEN	0	511	127.0.0.1:6463	0.0.0.0:*	users(("Discord",pid=8482,fd=131))
LISTEN	0	4096	127.0.0.54:53	0.0.0.0:*	users(("systemd-resolve",pid=1270,fd=17))
LISTEN	0	4096	127.0.0.1:631	0.0.0.0:*	users(("cupsd",pid=1903,fd=7))
LISTEN	0	4096	127.0.0.53%lo:53	0.0.0.0:*	users(("systemd-resolve",pid=1270,fd=15))
LISTEN	0	1	::ffff:127.0.0.1]:8005	:::*	users(("java",pid=87435,fd=52))
LISTEN	0	50	::ffff:127.0.0.1]:36359	:::*	users(("clion",pid=14402,fd=43))
LISTEN	0	4096	::ffff:127.0.0.1]:63342	:::*	users(("clion",pid=14402,fd=61))
LISTEN	0	100	:::*	:::*	users(("java",pid=87435,fd=44))
LISTEN	0	4096	:::1]:631	:::*	users(("cupsd",pid=1903,fd=6))

```
06:26:02 adrw@olek-desktop-pc tomcat →
```

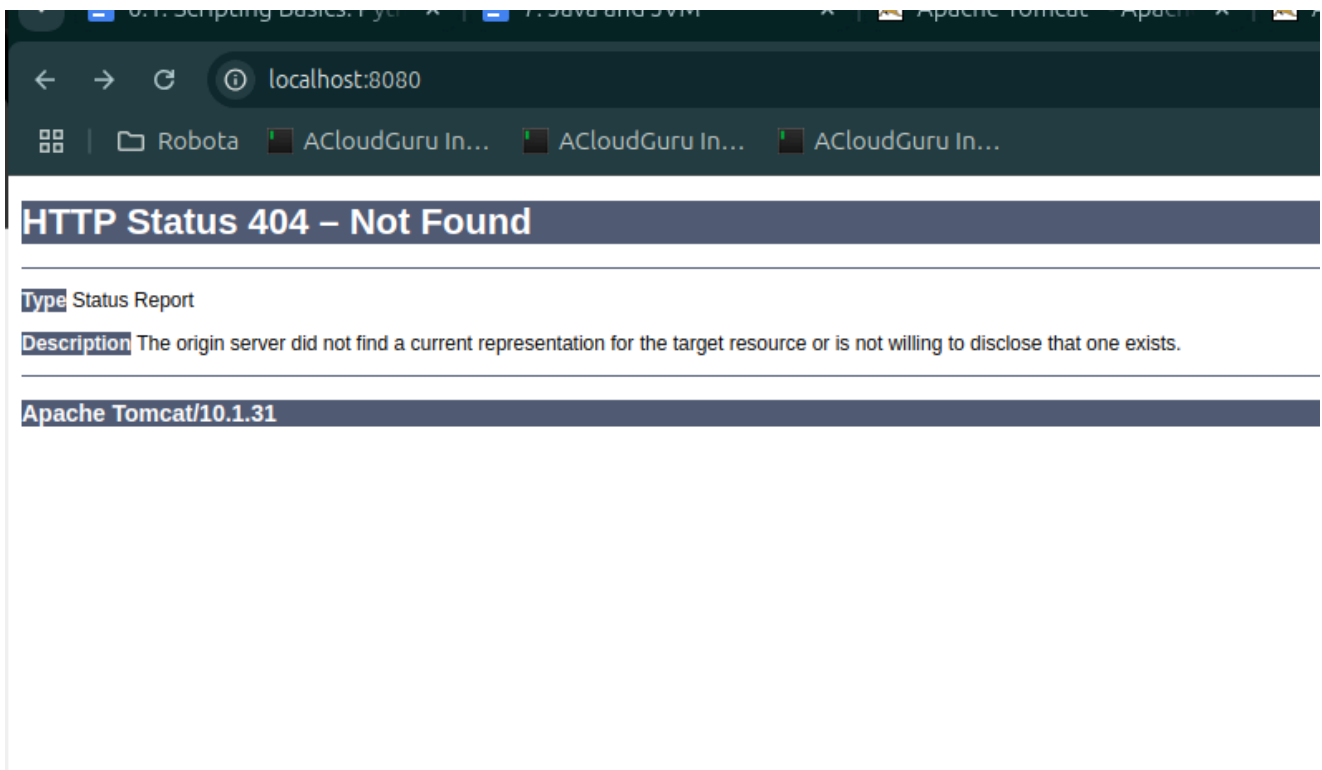


3. Remove all default applications (including manager), restart Tomcat.

```
sudo rm -rf /opt/tomcat/webapps/*
sudo /opt/tomcat/bin/shutdown.sh
sudo /opt/tomcat/bin/startup.sh
```

```
06:31:47 adrw@olek-desktop-pc tomcat → sudo ./bin/shutdown.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
Using CATALINA_OPTS:
06:31:51 adrw@olek-desktop-pc tomcat → sudo ./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
Using CATALINA_OPTS:
Tomcat started.
06:31:58 adrw@olek-desktop-pc tomcat →
```

All apps have now been deleted:



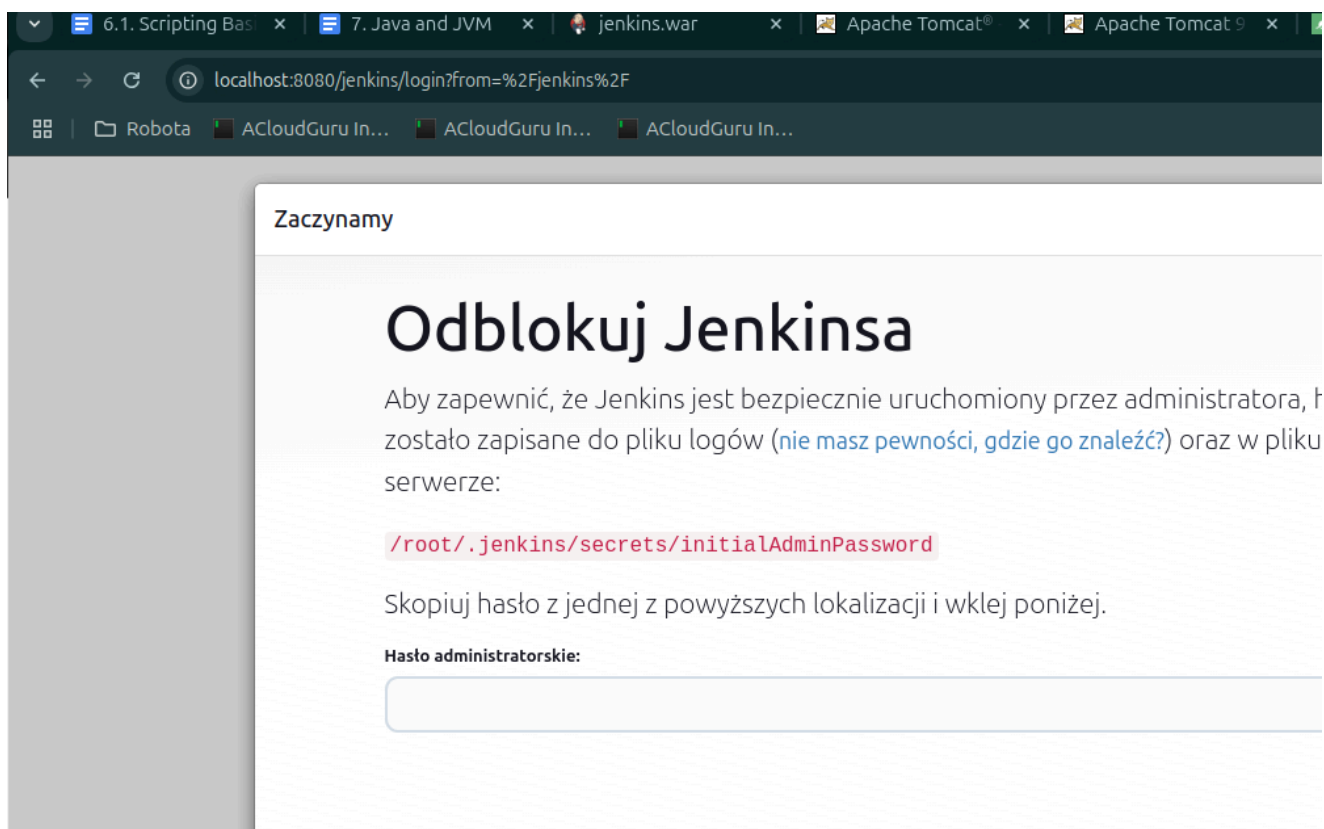
4. Download Jenkins WAR and deploy into Tomcat.

Download jenkins WAR to tomcat webapps directory

```
wget https://updates.jenkins-ci.org/download/war/2.484/jenkins.war
sudo mv jenkins.war /opt/tomcat/webapps/
```

5. Verify that application works (visit application URL).

Now jenkins is accessible at `http://localhost:8008/jenkins/`:



6. Enable JMX in Tomcat.

We need to create file `/opt/tomcat/bin/setenv.sh` which sets options for running tomcat

```
sudo nano /opt/tomcat/bin/setenv.sh
```

```
GNU nano 7.2                               ./bin/setenv.sh
CATALINA_OPTS="$CATALINA_OPTS -Dcom.sun.management.jmxremote \
-Dcom.sun.management.jmxremote.port=9090 \
-Dcom.sun.management.jmxremote.ssl=false \
-Dcom.sun.management.jmxremote.authenticate=false"
```

Now we restart tomcat to run it with new settings:

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

a. What ports are used by the java process?

We have set port for remote jmx to 9090, port for RMI and local connections will be set randomly:

```
06:53:37 adrwal@olek-desktop-pc tomcat → sudo ss -lntp | grep java
LISTEN 0      1      [::ffff:127.0.0.1]:8005      *:*      users:(("java",pid=92295,fd=97))
LISTEN 0      50     *:9090      *:*      users:(("java",pid=92295,fd=12))
LISTEN 0      50     *:34961     *:*      users:(("java",pid=92295,fd=10))
LISTEN 0      100    *:8080      *:*      users:(("java",pid=92295,fd=52))
LISTEN 0      50     *:37399     *:*      users:(("java",pid=92295,fd=14))
06:54:29 adrwal@olek-desktop-pc tomcat →
```

Ports 8005 and 8080 were opened by tomcat.

b. Change CATALINA_OPTS to use same for RMI as for JMX

```
sudo nano /opt/tomcat/bin/setenv.sh
```

```
GNU nano 7.2 /opt/tomcat/bin/setenv.sh
CATALINA_OPTS="$CATALINA_OPTS -Dcom.sun.management.jmxremote \
-Dcom.sun.management.jmxremote.port=9090 \
-Dcom.sun.management.jmxremote.local.port=9091 \
-Dcom.sun.management.jmxremote.rmi.port=9090 \
-Dcom.sun.management.jmxremote.ssl=false \
-Dcom.sun.management.jmxremote.authenticate=false"

```

c. What ports are used by the java process?

Restart tomcat and check opened ports:

```
07:00:43 adrwal@olek-desktop-pc tomcat → sudo ss -lntp | grep java
LISTEN 0      50     *:9090      *:*      users:(("java",pid=94011,fd=10))
LISTEN 0      50     *:9091      *:*      users:(("java",pid=94011,fd=12))
LISTEN 0      100    *:8080      *:*      users:(("java",pid=94011,fd=50))
07:00:45 adrwal@olek-desktop-pc tomcat →
```

We can see that port 9090 is now opened for JMX and RMI and that port 9091 is opened for local connections, as defined in `opt/tomcat/bin/setenv.sh`

7. Rerun tomcat with min heap size 10M and max heap size 20M.

We need to update our `opt/tomcat/bin/setenv.sh` file

```
GNU nano 7.2 /opt/tomcat/bin/setenv.sh
CATALINA_OPTS="$CATALINA_OPTS -Dcom.sun.management.jmxremote \
-Dcom.sun.management.jmxremote.port=9090 \
-Dcom.sun.management.jmxremote.local.port=9091 \
-Dcom.sun.management.jmxremote.rmi.port=9090 \
-Dcom.sun.management.jmxremote.ssl=false \
-Dcom.sun.management.jmxremote.authenticate=false \
-Xms10M \
-Xmx20M"

```

a. What type of error will you get?

When we restart tomcat we get OutOfMemoryError:

```
07:18:26 adrwal@olek-desktop-pc tomcat → sudo tail logs/catalina.out
05-Nov-2024 19:17:56.507 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Comm
Xms5M
05-Nov-2024 19:17:56.507 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Comm
Xmx6M
05-Nov-2024 19:17:56.507 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Comm
Dcatalina.base=/opt/tomcat
05-Nov-2024 19:17:56.507 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Comm
Dcatalina.home=/opt/tomcat
05-Nov-2024 19:17:56.507 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Comm
Djava.io.tmpdir=/opt/tomcat/temp
05-Nov-2024 19:17:56.510 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycleEver
[1.2.35] of the Apache Tomcat Native library is installed, while Tomcat recommends a minimum ver
05-Nov-2024 19:17:56.511 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycleEver
cat Native library [1.2.35] using APR version [1.7.2].
05-Nov-2024 19:17:56.514 INFO [main] org.apache.catalina.core.AprLifecycleListener.initializeSSL
ly initialized [OpenSSL 3.0.13 30 Jan 2024]

Exception: java.lang.OutOfMemoryError thrown from the UncaughtExceptionHandler in thread "main"
07:19:08 adrwal@olek-desktop-pc tomcat →
```

b. Increase min heap size to 1G and max heap size to 3G, enable parallel garbage collector.

We need to update our config at `opt/tomcat/bin/setenv.sh`

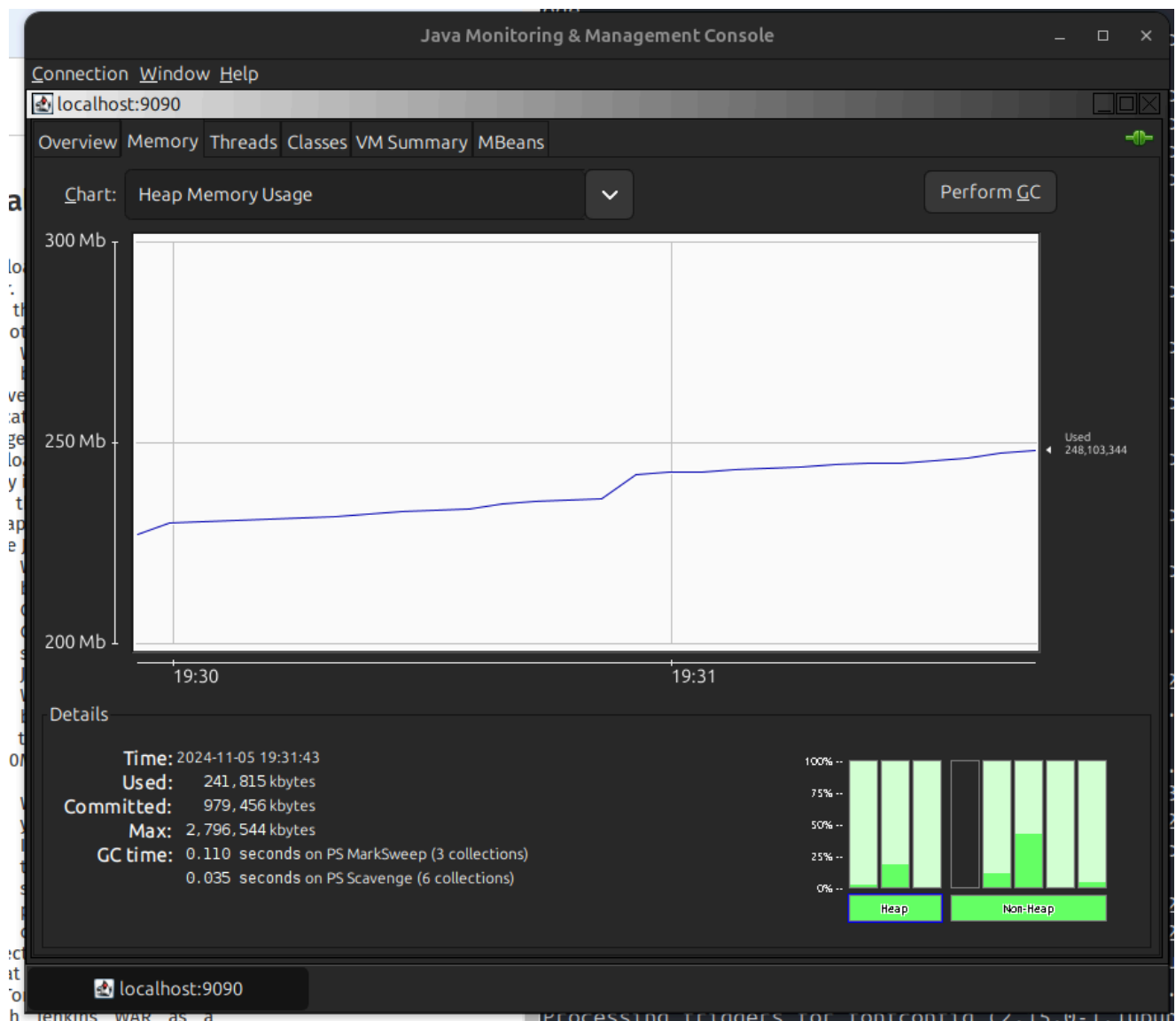
```
GNU nano 7.2 /opt/tomcat/bin/setenv.sh
CATALINA_OPTS="$CATALINA_OPTS -Dcom.sun.management.jmxremote \
-Dcom.sun.management.jmxremote.port=9090 \
-Dcom.sun.management.jmxremote.local.port=9091 \
-Dcom.sun.management.jmxremote.rmi.port=9090 \
-Dcom.sun.management.jmxremote.ssl=false \
-Dcom.sun.management.jmxremote.authenticate=false \
-Xms1G \
-Xmx3G \
-XX:+UseParallelGC"
```

And restart tomcat:

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

8. Connect by JConsole to Tomcat and look around.

Now we run `jconsole` command and connect to `localhost:9090` as defined in `opt/tomcat/bin/setenv.sh`



9. Stop Tomcat.

```
sudo /opt/tomcat/bin/shutdown.sh
```

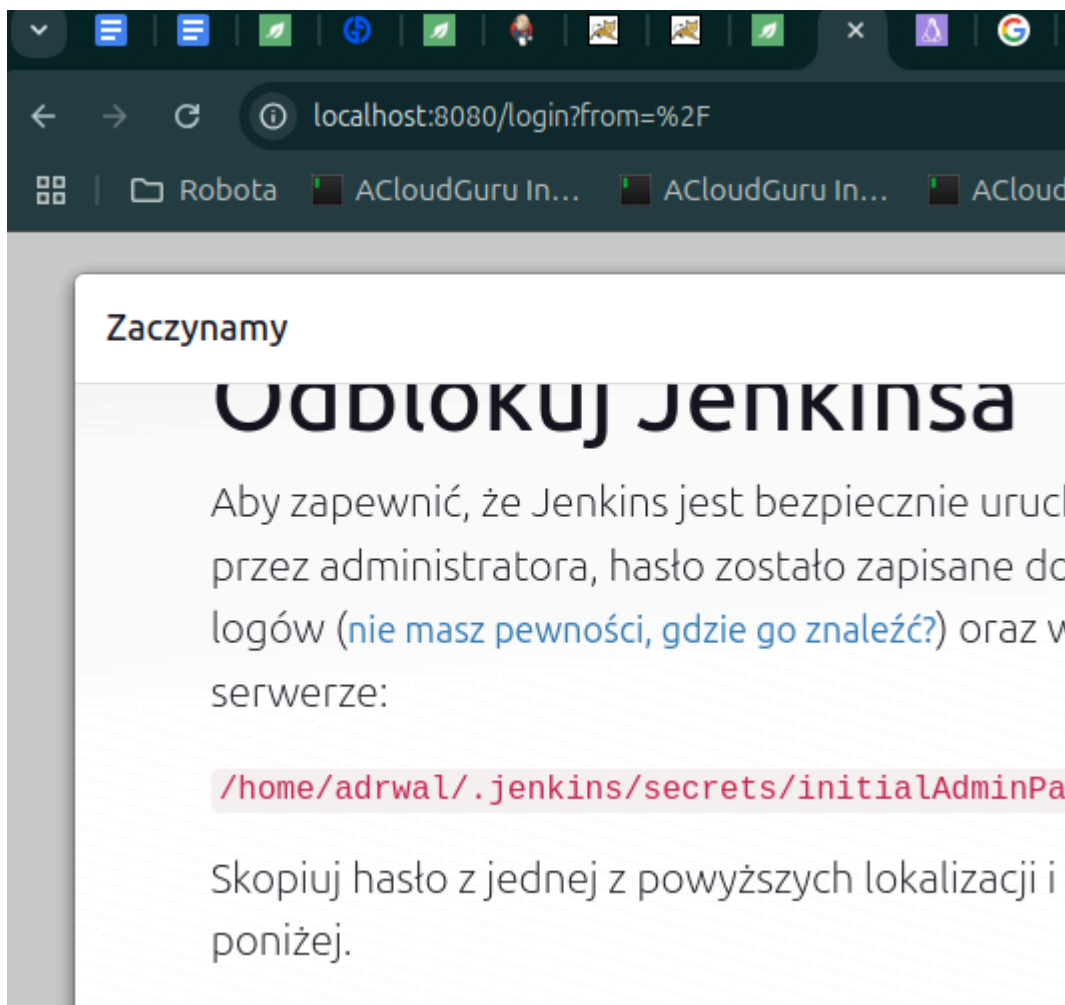
```
^C07:33:00 adrwal@olek-desktop-pc tomcat → sudo /opt/tomcat/bin/shutdown.sh
Using CATALINA_BASE:   /opt/tomcat
Using CATALINA_HOME:   /opt/tomcat
Using CATALINA_TMPDIR: /opt/tomcat/temp
Using JRE_HOME:        /usr
Using CLASSPATH:        /opt/tomcat/bin/bootstrap.jar:/opt/tomcat/bin/tomcat-juli.jar
Using CATALINA_OPTS:   -Dcom.sun.management.jmxremote -Dcom.sun.management.jmxremote.port=9091 -Dcom.sun.management.jmxremote.rmi.port=9090 -Dcom.sun.management.jmxremote.authenticate=false -Xms1G -Xmx3G -XX:+UseParallelGC
07:33:09 adrwal@olek-desktop-pc tomcat →
```

10. Launch Jenkins WAR as a standalone application, verify that it works.

We can also run jenkins directly:


```
java -jar /opt/tomcat/webapps/jenkins.war
```

```
07:35:16 adrwal@olek-desktop-pc webapps → java -jar jenkins.war
Running from: /opt/tomcat/webapps/jenkins.war
webroot: /home/adrwal/.jenkins/war
2024-11-05 18:35:22.041+0000 [id=1] INFO winstone.Logger#log
2024-11-05 18:35:22.597+0000 [id=1] WARNING o.e.j.ee9.nested.Co
2024-11-05 18:35:22.629+0000 [id=1] INFO org.eclipse.jetty.se
-09-30T14:22:54.197Z; git: e77516598a07cca826d27fa8a4f7c70e953921a6
2024-11-05 18:35:22.870+0000 [id=1] INFO o.e.j.e.w.StandardDe
for /, did not find org.eclipse.jetty.ee9.jsp.JettyJspServlet
2024-11-05 18:35:22.896+0000 [id=1] INFO o.e.j.s.DefaultSess
```



localhost:8080/login?from=%2F

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Zaczynamy

Odblokuj Jenkinsa

Aby zapewnić, że Jenkins jest bezpiecznie uruchomiony przez administratora, hasło zostało zapisane do logów ([nie masz pewności, gdzie go znaleźć?](#)) oraz w serwerze:

/home/adrwal/.jenkins/secrets/initialAdminPa

Skopiuj hasło z jednej z powyższych lokalizacji i poniżej.