INSTALLATION OF SPARK ON UBUNTU

Install Packages Required for Spark

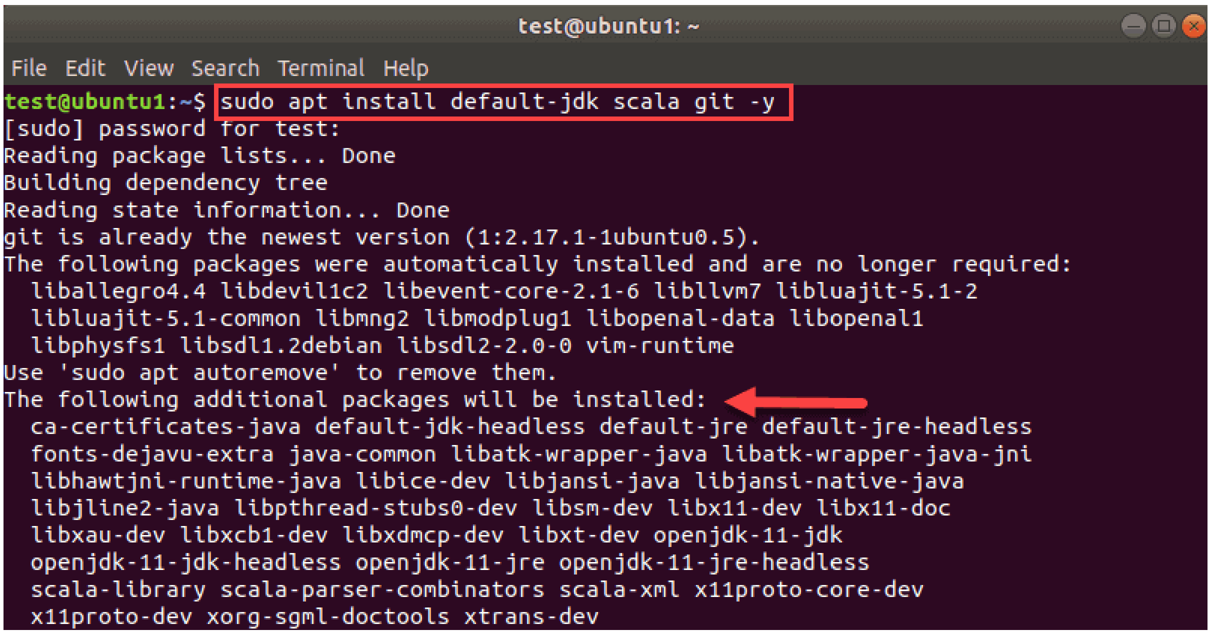
Before downloading and setting up Spark, you need to install necessary dependencies. This step includes installing the following packages:

- JDK
- Scala
- Git

Open a terminal window and run the following command to install all three packages at once:

```
sudo apt install default-jdk scala git -y
```

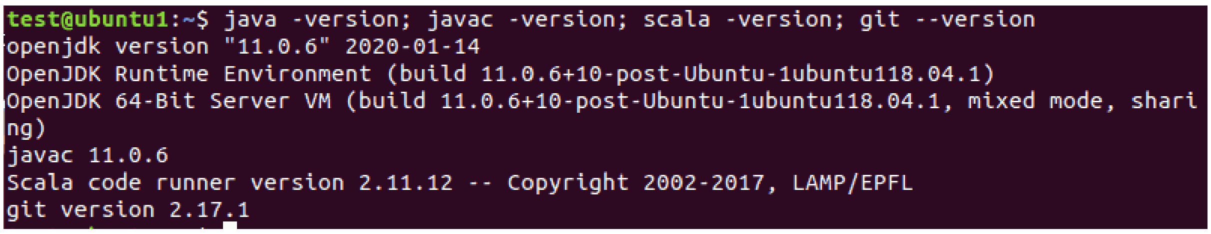
You will see which packages will be installed.



```
test@ubuntu1:~$ sudo apt install default-jdk scala git -y
[sudo] password for test:
Reading package lists... Done
Building dependency tree
Reading state information... Done
git is already the newest version (1:2.17.1-1ubuntu0.5).
The following packages were automatically installed and are no longer required:
  liballegro4.4 libdevil1c2 libevent-core-2.1-6 libllvm7 libluajit-5.1-2
  libluajit-5.1-common libmng2 libmodplug1 libopenal-data libopenal1
  libphysfs1 libsdl1.2debian libsdl2-2.0-0 vim-runtime
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  ca-certificates-java default-jdk-headless default-jre default-jre-headless
  fonts-dejavu-extra java-common libatk-wrapper-java libatk-wrapper-java-jni
  libhawtjni-runtime-java libice-dev libjansi-java libjansi-native-java
  libjline2-java libpthread-stubs0-dev libsm-dev libx11-dev libx11-doc
  libxau-dev libxcb1-dev libxdmcp-dev libxt-dev openjdk-11-jdk
  openjdk-11-jdk-headless openjdk-11-jre openjdk-11-jre-headless
  scala-library scala-parser-combinators scala-xml x11proto-core-dev
  x11proto-dev xorg-sgml-doctools xtrans-dev
```

Once the process completes, **verify the installed dependencies** by running these commands:

```
java -version; javac -version; scala -version; git --version
```



```
test@ubuntu1:~$ java -version; javac -version; scala -version; git --version
openjdk version "11.0.6" 2020-01-14
OpenJDK Runtime Environment (build 11.0.6+10-post-Ubuntu-1ubuntu118.04.1)
OpenJDK 64-Bit Server VM (build 11.0.6+10-post-Ubuntu-1ubuntu118.04.1, mixed mode, shari
ng)
javac 11.0.6
Scala code runner version 2.11.12 -- Copyright 2002-2017, LAMP/EPFL
git version 2.17.1
```

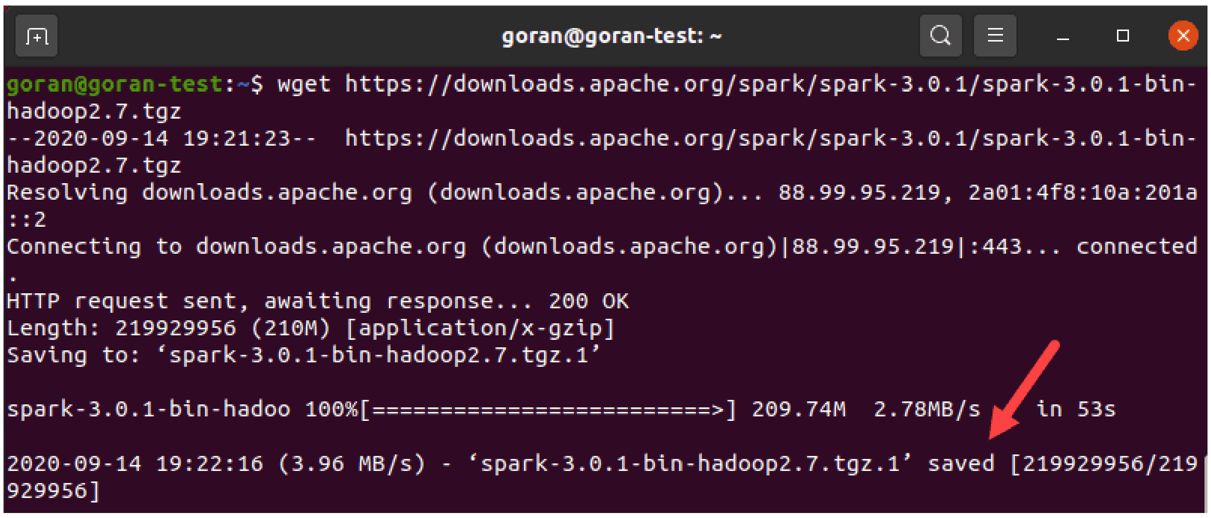
The output prints the versions if the installation completed successfully for all packages.

Download and Set Up Spark on Ubuntu

Now, **you need to download the version of Spark you want** form their website. We will go for *Spark 3.0.1* with *Hadoop 3.2*.
Use the **wget** command and the direct link to download the Spark archive:

```
wget https://downloads.apache.org/spark/spark-3.0.1/spark-3.0.1-bin-hadoop3.2.tgz
```

When the download completes, you will see the *saved* message.



```
goran@goran-test:~$ wget https://downloads.apache.org/spark/spark-3.0.1/spark-3.0.1-bin-
hadoop2.7.tgz
--2020-09-14 19:21:23--  https://downloads.apache.org/spark/spark-3.0.1/spark-3.0.1-bin-
hadoop2.7.tgz
Resolving downloads.apache.org (downloads.apache.org)... 88.99.95.219, 2a01:4f8:10a:201a
::2
Connecting to downloads.apache.org (downloads.apache.org)|88.99.95.219|:443... connected
.
HTTP request sent, awaiting response... 200 OK
Length: 219929956 (210M) [application/x-gzip]
Saving to: ‘spark-3.0.1-bin-hadoop2.7.tgz.1’

spark-3.0.1-bin-hadoo 100%[=========================>] 209.74M  2.78MB/s    in 53s

2020-09-14 19:22:16 (3.96 MB/s) - ‘spark-3.0.1-bin-hadoop2.7.tgz.1’ saved [219929956/219
929956]
```

Now, extract the saved archive using the **tar** command:

```
tar xvf spark-*
```

Let the process complete. The output shows the files that are being unpacked from the archive.

Finally, move the unpacked directory *spark-3.0.1-bin-hadoop3.2* to the ***opt/spark*** directory.
Use the **mv** command to do so:

```
sudo mv spark-3.0.1-bin-hadoop3.2 /opt/spark
```

Configure Spark Environment

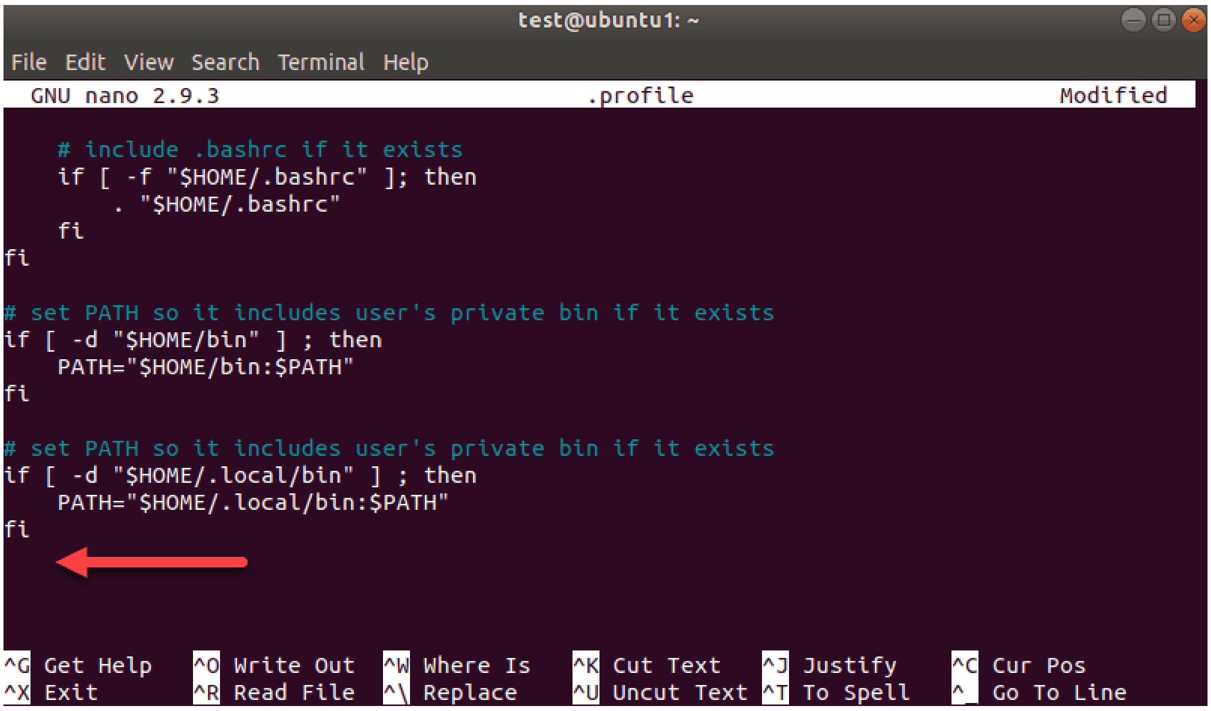
Before starting a master server, you need to configure environment variables. There are a few Spark home paths you need to add to the user profile.

You can add the export paths by editing the *.profile* file in the editor of your choice, such as nano or vim.

For example, to use nano, enter:

```
nano  .profile
```

When the profile loads, scroll to the bottom of the file.



```
test@ubuntu1: ~
File  Edit  View  Search  Terminal  Help
  GNU nano 2.9.3                    .profile                         Modified

    # include .bashrc if it exists
    if [ -f "$HOME/.bashrc" ]; then
        . "$HOME/.bashrc"
    fi
fi

# set PATH so it includes user's private bin if it exists
if [ -d "$HOME/bin" ] ; then
    PATH="$HOME/bin:$PATH"
fi

# set PATH so it includes user's private bin if it exists
if [ -d "$HOME/.local/bin" ] ; then
    PATH="$HOME/.local/bin:$PATH"
fi



^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos
^X Exit       ^R Read File  ^\ Replace    ^U Uncut Text ^T To Spell   ^_ Go To Line
```

Then, add these three lines:

```
export SPARK_HOME=/opt/spark


export PATH=$PATH:$SPARK_HOME/bin:$SPARK_HOME/sbin

export PYSPARK_PYTHON=/usr/bin/python3
```

Exit and save changes when prompted.

When you finish adding the paths, load the *.profile* file in the command line by typing:

```
source ~/.profile
```

Start Standalone Spark Master Server

Now that you have completed configuring your environment for Spark, you can start a master server.

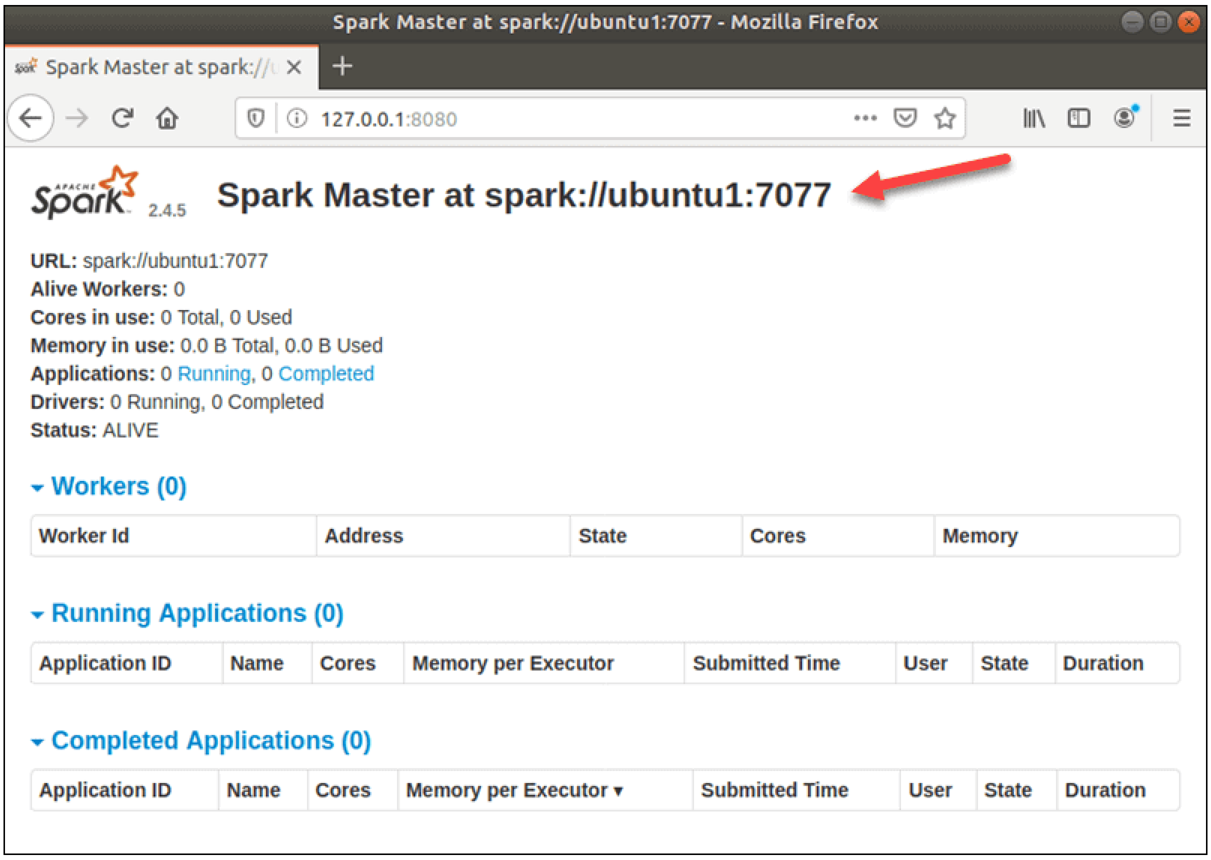
In the terminal, type:

```
start-master.sh
```

To view the Spark Web user interface, open a web browser and enter the localhost IP address on port 8080.

```
http://127.0.0.1:8080/
```

The page shows your **Spark URL**, status information for workers, hardware resource utilization, etc.


Spark Master at spark://ubuntu1:7077 - Mozilla Firefox
Spark Master at spark://u
127.0.0.1:8080
2.4.5

Spark Master at spark://ubuntu1:7077

URL: spark://ubuntu1:7077
Alive Workers: 0
Cores in use: 0 Total, 0 Used
Memory in use: 0.0 B Total, 0.0 B Used
Applications: 0 Running, 0 Completed
Drivers: 0 Running, 0 Completed
Status: ALIVE

Workers (0)

Worker Id	Address	State	Cores	Memory

Running Applications (0)

Application ID	Name	Cores	Memory per Executor	Submitted Time	User	State	Duration

Completed Applications (0)

Application ID	Name	Cores	Memory per Executor ▾	Submitted Time	User	State	Duration

The URL for Spark Master is the name of your device on port 8080. In our case, this is ***ubuntu1:8080***. So, there are three possible ways to load Spark Master's Web UI:

1. 127.0.0.1:8080
2. localhost:8080
3. *deviceName*:8080

Start Spark Slave Server (Start a Worker Process)

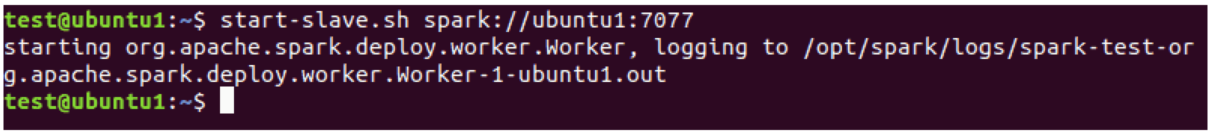
In this single-server, standalone setup, we will start one slave server along with the master server.

To do so, run the following command in this format:

```
start-slave.sh spark://master:port
```

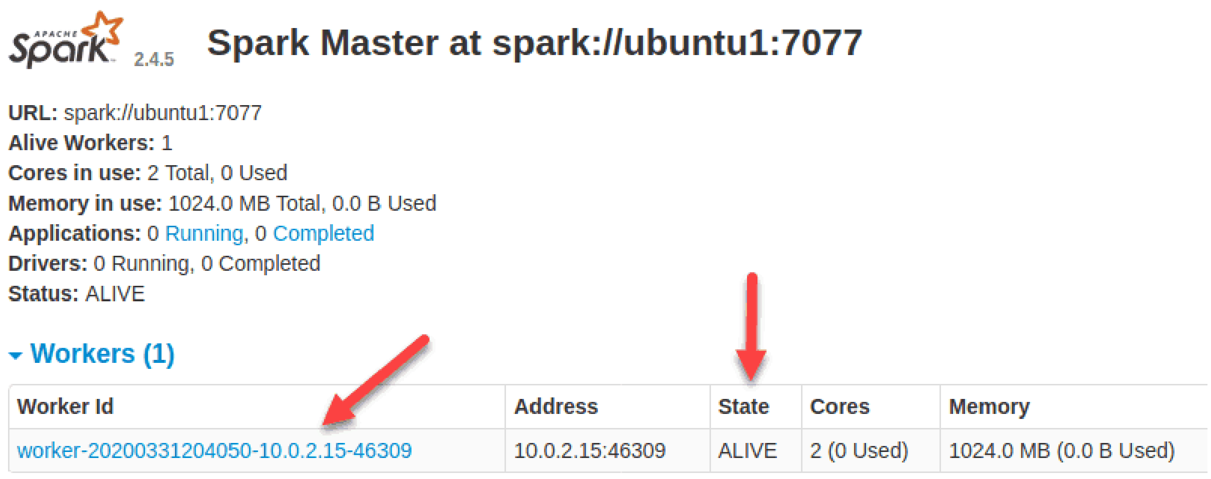
The **master** in the command can be an IP or hostname.
In our case it is **ubuntu1**:

```
start-slave.sh spark://ubuntu1:7077
```



```
test@ubuntu1:~$ start-slave.sh spark://ubuntu1:7077
starting org.apache.spark.deploy.worker.Worker, logging to /opt/spark/logs/spark-test-or
g.apache.spark.deploy.worker.Worker-1-ubuntu1.out
test@ubuntu1:~$
```

Now that a worker is up and running, if you reload Spark Master's Web UI, you should see it on the list:



Spark Master at spark://ubuntu1:7077

URL: spark://ubuntu1:7077
Alive Workers: 1
Cores in use: 2 Total, 0 Used
Memory in use: 1024.0 MB Total, 0.0 B Used
Applications: 0 Running, 0 Completed
Drivers: 0 Running, 0 Completed
Status: ALIVE

Workers (1)

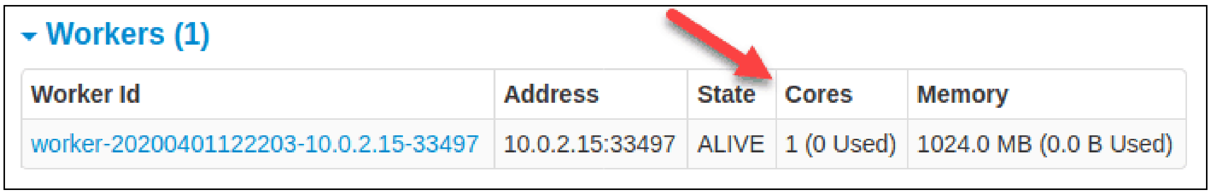
Worker Id	Address	State	Cores	Memory
worker-20200331204050-10.0.2.15-46309	10.0.2.15:46309	ALIVE	2 (0 Used)	1024.0 MB (0.0 B Used)

Specify Resource Allocation for Workers
The default setting when starting a worker on a machine is to use all available CPU cores. You can specify the number of cores by passing the **-c** flag to the **start-slave** command.

For example, to start a worker and assign only **one CPU core** to it, enter this command:

```
start-slave.sh -c 1 spark://ubuntu1:7077
```

Reload Spark Master's Web UI to confirm the worker's configuration.



Workers (1)

Worker Id	Address	State	Cores	Memory
worker-20200401122203-10.0.2.15-33497	10.0.2.15:33497	ALIVE	1 (0 Used)	1024.0 MB (0.0 B Used)

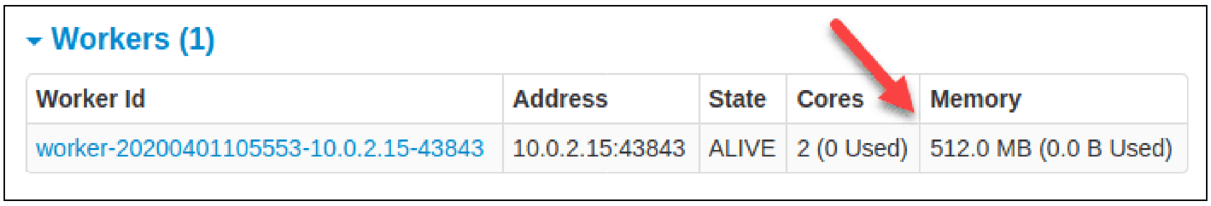
Similarly, you can assign a specific amount of memory when starting a worker. The default setting is to use whatever amount of RAM your machine has, minus 1GB.

To start a worker and assign it a specific amount of memory, add the **-m** option and a number. For gigabytes, use **G** and for megabytes, use **M**.

For example, to start a worker with 512MB of memory, enter this command:

```
start-slave.sh -m 512M spark://ubuntu1:7077
```

Reload the Spark Master Web UI to view the worker's status and confirm the configuration.



Workers (1)

Worker Id	Address	State	Cores	Memory
worker-20200401105553-10.0.2.15-43843	10.0.2.15:43843	ALIVE	2 (0 Used)	512.0 MB (0.0 B Used)

Test Spark Shell

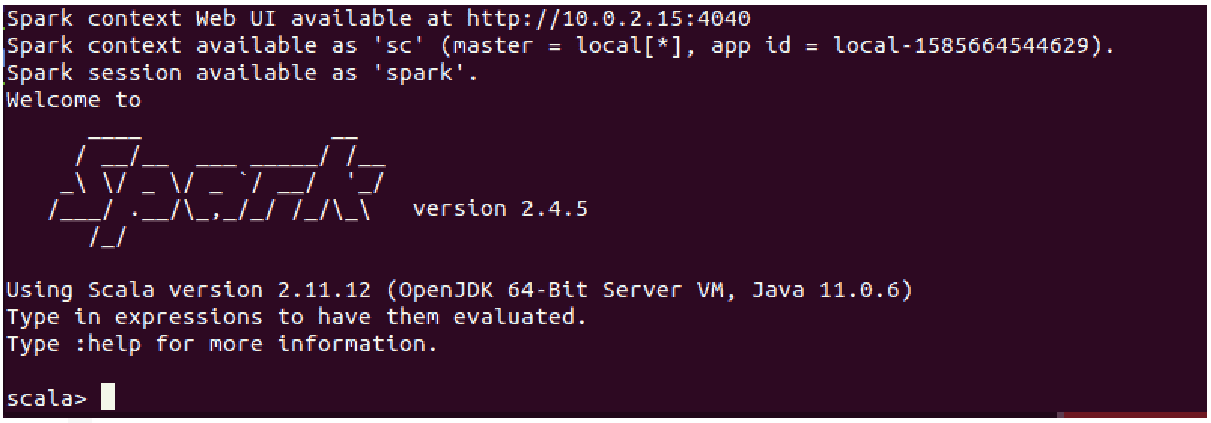
After you finish the configuration and start the master and slave server, test if the Spark shell works.

Load the shell by entering:

```
spark-shell
```

You should get a screen with notifications and Spark information. Scala is the default interface, so that shell loads when you run *spark-shell*.

The ending of the output looks like this for the version we are using at the time of writing this guide:



```
Spark context Web UI available at http://10.0.2.15:4040
Spark context available as 'sc' (master = local[*], app id = local-1585664544629).
Spark session available as 'spark'.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 2.4.5
      /_/

Using Scala version 2.11.12 (OpenJDK 64-Bit Server VM, Java 11.0.6)
Type in expressions to have them evaluated.
Type :help for more information.

scala> 
```

Type **:q** and press **Enter** to exit Scala.

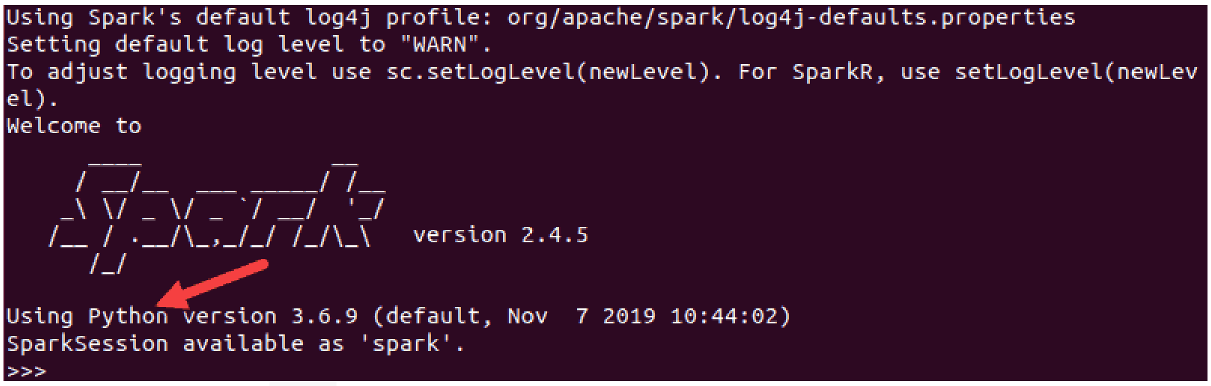
Test Python in Spark

If you do not want to use the default Scala interface, you can switch to Python.

Make sure you quit Scala and then run this command:

```
pyspark
```

The resulting output looks similar to the previous one. Towards the bottom, you will see the version of Python.



```
Using Spark's default log4j profile: org/apache/spark/log4j-defaults.properties
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLev
el).
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /__ / .__/\_,_/_/ /_/\_\   version 2.4.5
      /_/

Using Python version 3.6.9 (default, Nov  7 2019 10:44:02)
SparkSession available as 'spark'.
>>>
```

To exit this shell, type **quit()** and hit **Enter**.

Basic Commands to Start and Stop Master Server and Workers

Below are the basic commands for starting and stopping the Apache Spark master server and workers. Since this setup is only for one machine, the scripts you run default to the localhost.

To start a master server instance on the current machine, run the command we used earlier in the guide:

```
start-master.sh
```

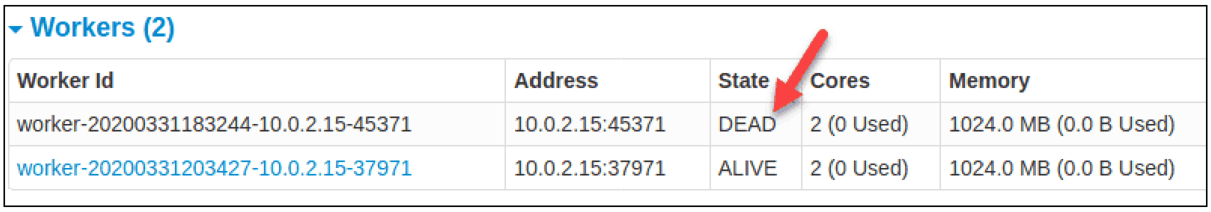
To stop the master instance started by executing the script above, run:

```
stop-master.sh
```

To stop a running worker process, enter this command:

```
stop-slave.sh
```

The Spark Master page, in this case, shows the worker status as DEAD.



Workers (2)

Worker Id	Address	State	Cores	Memory
worker-20200331183244-10.0.2.15-45371	10.0.2.15:45371	DEAD	2 (0 Used)	1024.0 MB (0.0 B Used)
worker-20200331203427-10.0.2.15-37971	10.0.2.15:37971	ALIVE	2 (0 Used)	1024.0 MB (0.0 B Used)

You can **start both master and server** instances by using the start-all command:

```
start-all.sh
```

Similarly, you **can stop all instances** by using the following command:

```
stop-all.sh
```