Installation of Apache Spark

Prerequisites

- An Ubuntu system.
- Access to a terminal or command line.
- A user with sudo or **root** permissions.

Install Packages Required for Spark

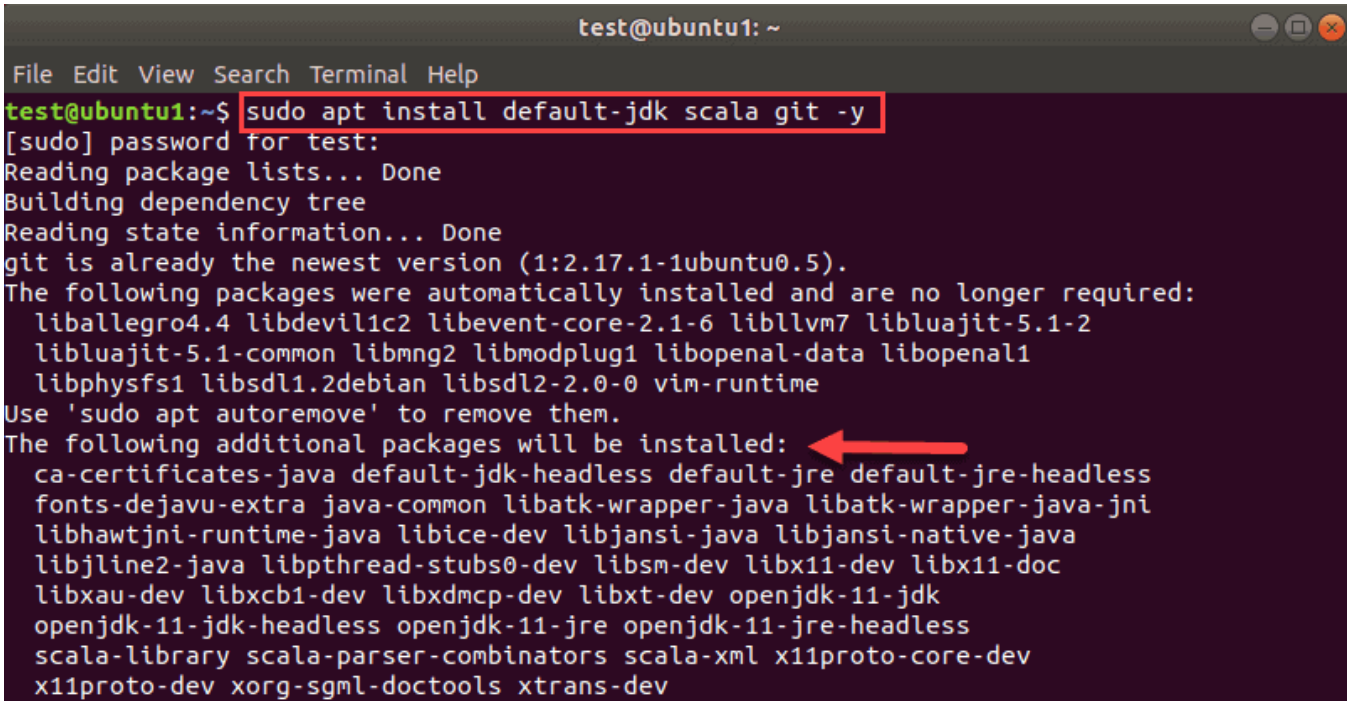
Before downloading and setting up Spark, you need to install necessary dependencies. This step includes installing the following packages:

- 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.



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

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

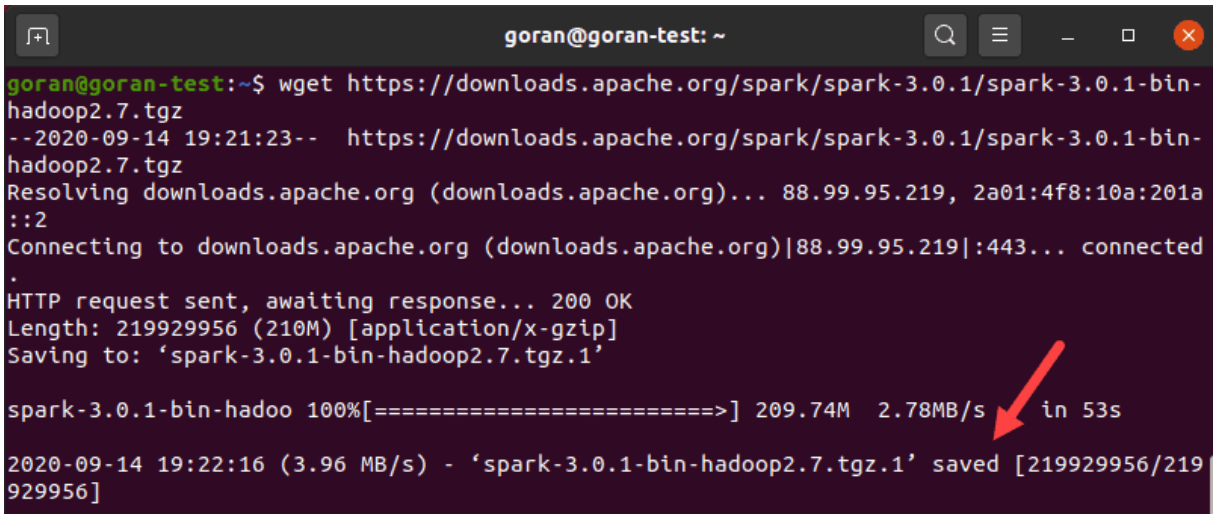
```
test@ubuntu1:~$ java -version; javac -version; scala -version; git --version
openjdk version "11.0.6" 2020-01-14
OpenJDK Runtime Environment (build 11.0.6+10-post-Ubuntu-1ubuntu118.04.1)
OpenJDK 64-Bit Server VM (build 11.0.6+10-post-Ubuntu-1ubuntu118.04.1, mixed mode, shari
ng)
javac 11.0.6
Scala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

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* as it is the latest version at the time of writing this article.

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-
hadoop2.7.tgz
```

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



Note: If the URL does not work, please go to the Apache Spark download page to check for the latest version. Remember to replace the Spark version number in the subsequent commands if you change the download URL.

Now, extract the saved archive using tar:

```
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-hadoop2.7* to the ***/usr/local*** directory.

Use the **`mv`** command to do so:

```
sudo mv spark-3.0.1-bin-hadoop2.7 /usr/local
```

The terminal returns no response if it successfully moves the directory. If you mistype the name, you will get a message similar to:

```
mv: cannot stat 'spark-3.0.1-bin-hadoop2.7': No such file or directory.
```

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. Add following lines to .bashrc

```
export SPARK_HOME=/usr/local/spark
export PATH=$PATH:$SPARK_HOME/bin
export PATH=$PATH:$SPARK_HOME/sbin
export PYSPARK_PYTHON=/usr/bin/python3
```

Exit and save changes when prompted.

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

```
source .bashrc
```

Start Standalone Spark Master Server

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

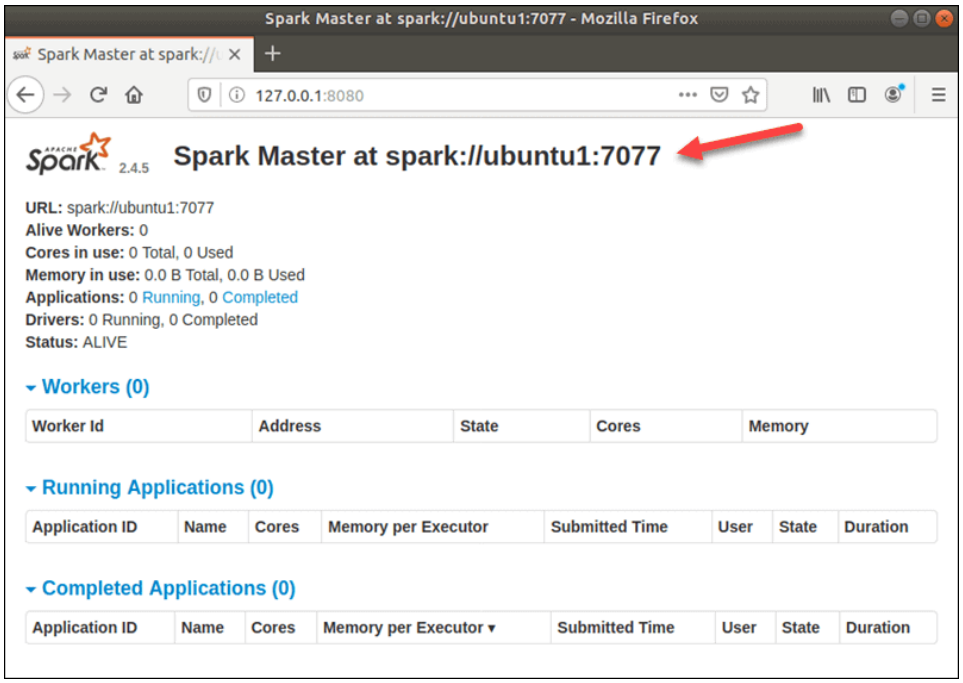
In the terminal, type:

```
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.



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
```

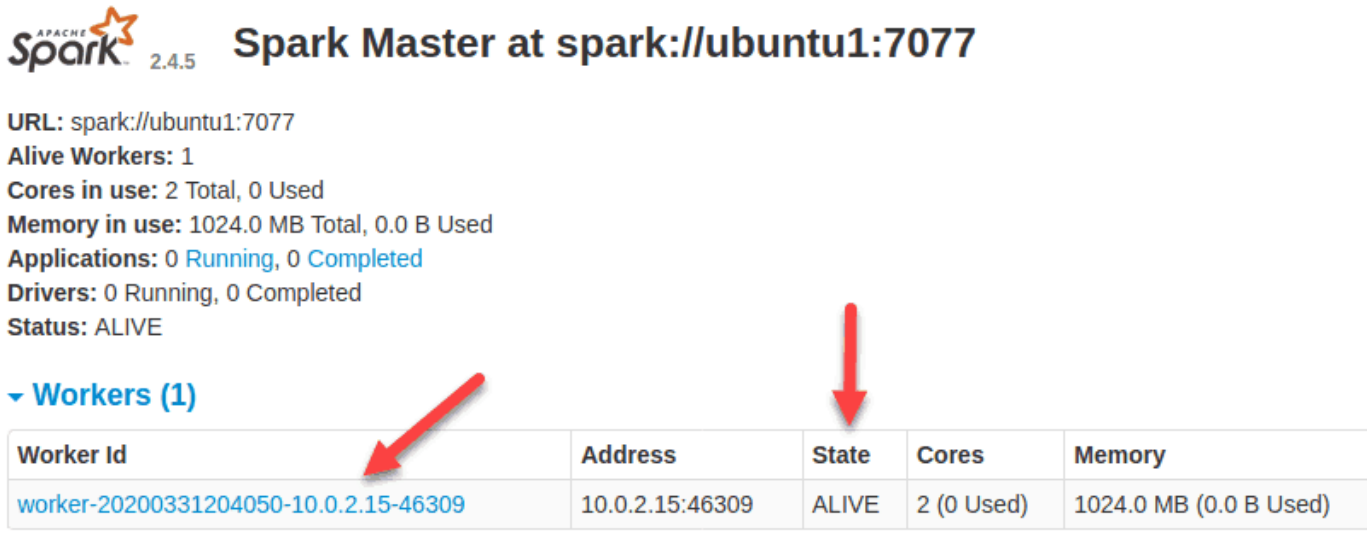
The **`master`** in the command can be an IP or hostname.

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:



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.

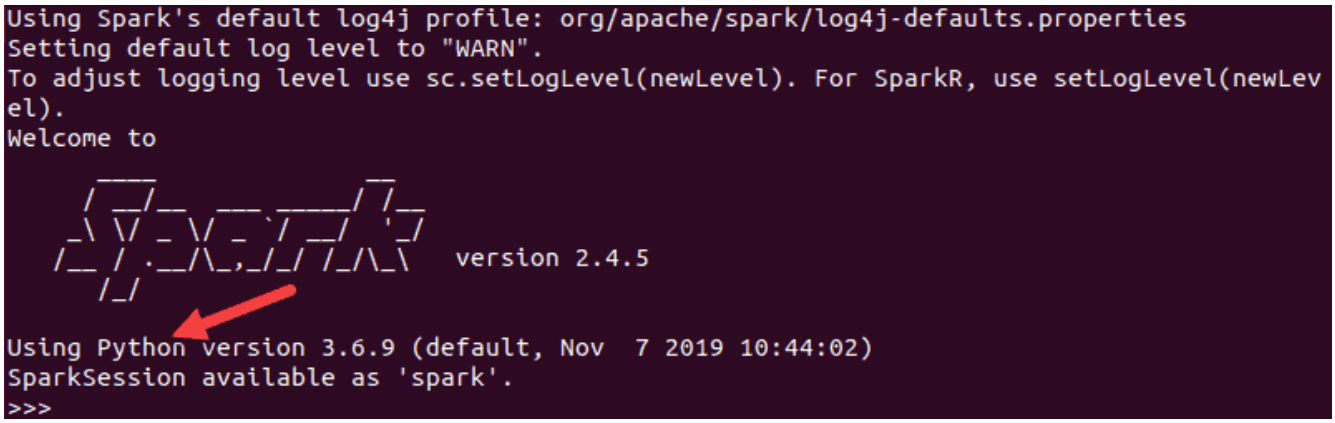
Test Python in Spark

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.



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
```

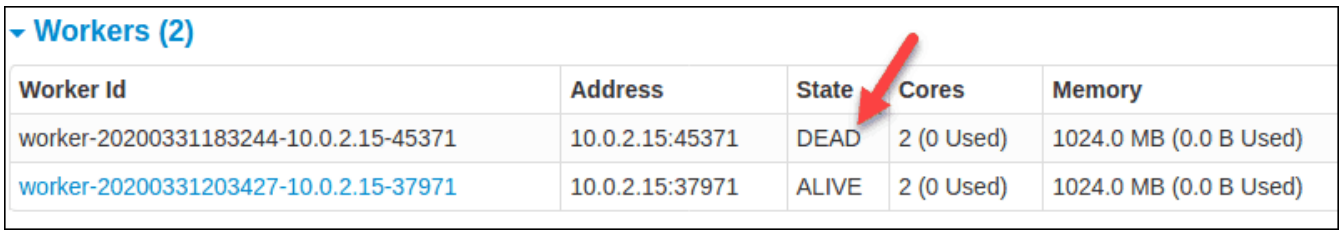
To stop the master instance started by executing the script above, run:

```
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
```
