Performance of the program

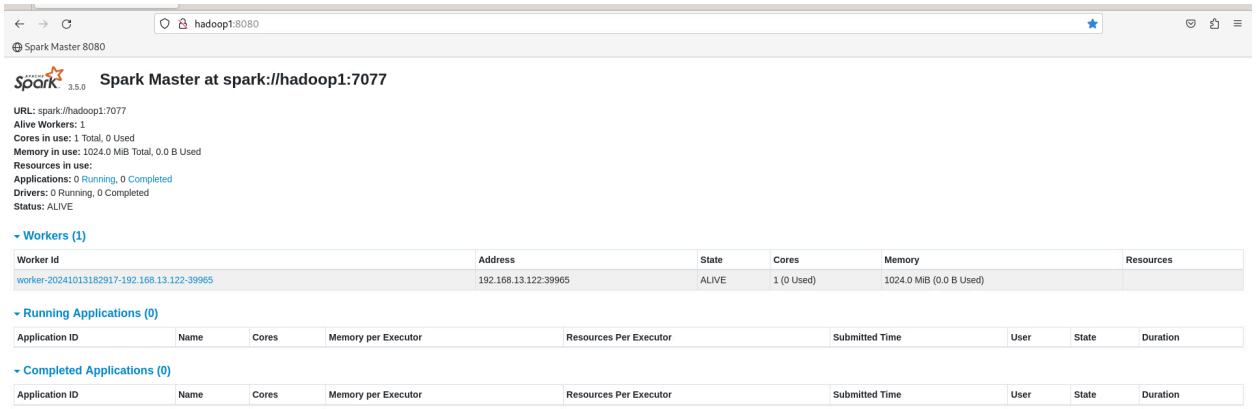
1. Submit a spark job for only one vm (hadoop1)

I started the master VM using command- /opt/spark/sbin/start-master.sh
Then I started the worker VM (only hadoop 1) using this command
/opt/spark/sbin/start-worker.sh spark://hadoop1:7077

```
[root@hadoop1 bin]# /opt/spark/sbin/start-master.sh
starting org.apache.spark.deploy.master.Master, logging to /opt/spark/logs/spark
-sat3812-org.apache.spark.deploy.master.Master-1-hadoop1.out
```

```
[root@hadoop1 spark]# sbin/start-worker.sh spark://hadoop1:7077
starting org.apache.spark.deploy.worker.Worker, logging to /opt/spark/logs/spark
-sat3812-org.apache.spark.deploy.worker.Worker-1-hadoop1.out
[root@hadoop1 spark]# jps
5058 SparkSubmit
6004 Jps
5944 Worker
5835 Master
[root@hadoop1 spark]#
```

Here, I am only considering one worker that is (hadoop1 VM).



Now I am running my python code using only on this vm(hadoop1) using command

opt/spark/bin/spark-submit --master spark://hadoop1:7077 /opt/preprocessing.py

Spark Master 8080

Spark 3.5.0 **Spark Master at spark://hadoop1:7077**

URL: spark://hadoop1:7077
Alive Workers: 1
Cores in use: 1 Total, 0 Used
Memory in use: 1024.0 MiB Total, 0.0 B Used
Resources in use:
Applications: 0 Running, 2 Completed
Drivers: 0 Running, 0 Completed
Status: ALIVE

Workers (1)

Worker Id	Address	State	Cores	Memory	Resources
worker-20241013184718-192.168.13.122-39759	192.168.13.122:39759	ALIVE	1 (0 Used)	1024.0 MiB (0.0 B Used)	

Running Applications (0)

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

Completed Applications (2)

Application ID	Name	Cores	Memory per Executor	Resources Per Executor	Submitted Time	User	State	Duration
app-20241013185149-0001	StudentPerformanceFactors	1	1024.0 MiB		2024/10/13 18:51:49	root	FINISHED	2.4 min
app-20241013184829-0000	StudentPerformanceFactors	1	1024.0 MiB		2024/10/13 18:48:29	root	FINISHED	2.3 min

I observed that the duration for completing the action using only 1 Vm was approximately 2.4 minutes. When I ran the command again to check for consistency, the time remained almost the same at 2.3 minutes. This indicates that running the Python code on a single VM (using Hadoop 1 only) consistently takes about 2.4 minutes.

Now Let's check how this duration will be changed if we use 2 workers (VMs).

2. Submit a spark job for two Vms (hadoop1 and hadoop2)

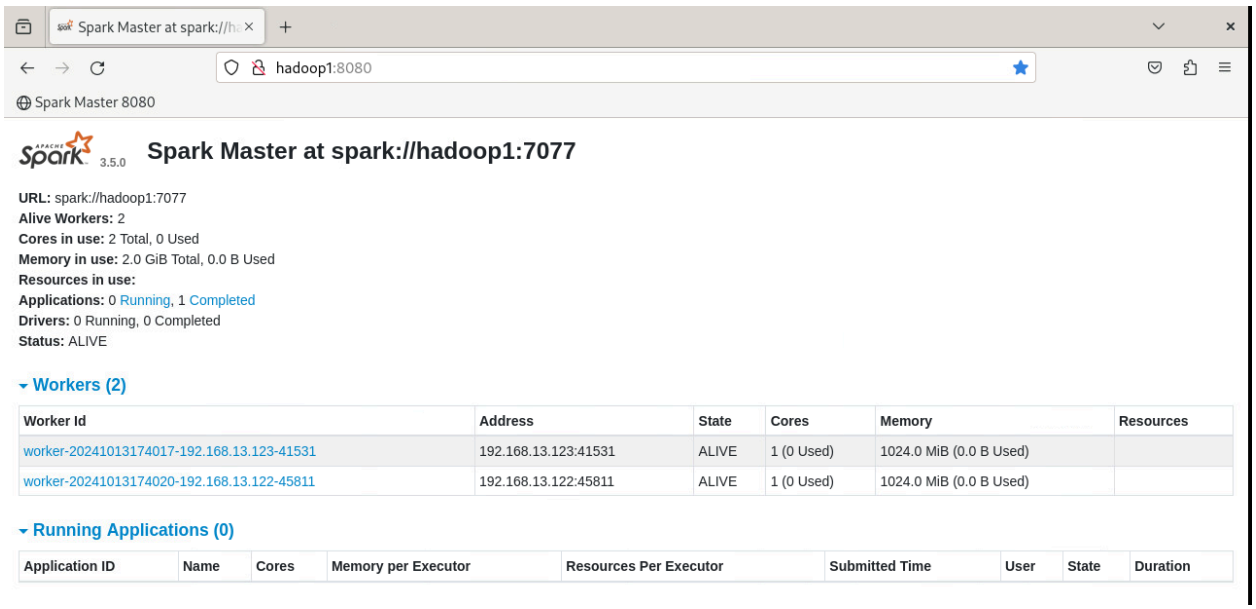
I started all (master and worker) Vms using command - /opt/spark/sbin/start-all.sh

```
[root@hadoop1 ~]# /opt/spark/sbin/start-all.sh
starting org.apache.spark.deploy.master.Master, logging to /opt/spark/logs/spark
-sat3812-org.apache.spark.deploy.master.Master-1-hadoop1.out
192.168.13.123: starting org.apache.spark.deploy.worker.Worker, logging to /opt/
spark/logs/spark-root-org.apache.spark.deploy.worker.Worker-1-hadoop2.out
192.168.13.122: starting org.apache.spark.deploy.worker.Worker, logging to /opt/
spark/logs/spark-root-org.apache.spark.deploy.worker.Worker-1-hadoop1.out
[root@hadoop1 ~]# jps
4096 Master
4325 Jps
4234 Worker
[root@hadoop1 ~]#
```

I also checked for my second vm (hadoop2) using jps, and it shows that it started as a worker.

```
[root@hadoop2 sat3812]# jps
2932 Worker
3006 Jps
[root@hadoop2 sat3812]#
```

Here, I am considering 2 Vms (2 workers - hadoop1 and hadoop2)



The duration for completing a specific action using two VMs was about 27 seconds. This is approximately five times faster than the time taken when using only one VM, which was around 2.4 minutes. Running the Python code using both VMs (Hadoop 1 and Hadoop 2) demonstrates a significant improvement in processing speed.