Table of Contents

1. Install Spark in centos Linux – 60 Minutes

Start the Linux server open a terminal to the host using putty. Perform the following activities in the console.

Download the required software

Install JDK if not done earlier

Untar spark-X.X.0-bin-hadoop.X.tar to /opt

```
#cd /Software
# tar -xvf  spark-* -C /opt/
```

It should create a folder inside spark.X, rename to spark folder.

```
#cd /opt
#mv  spark*  spark
```

Set the JAVA_HOME and initialize the PATH variable.

Open the profile and update with the following statements.

```
#vi  ~/.bashrc
```

```
export  JAVA_HOME=/opt/jdk
export PATH=$PATH:$JAVA_HOME/bin
export PATH=$PATH:/opt/spark/bin
```

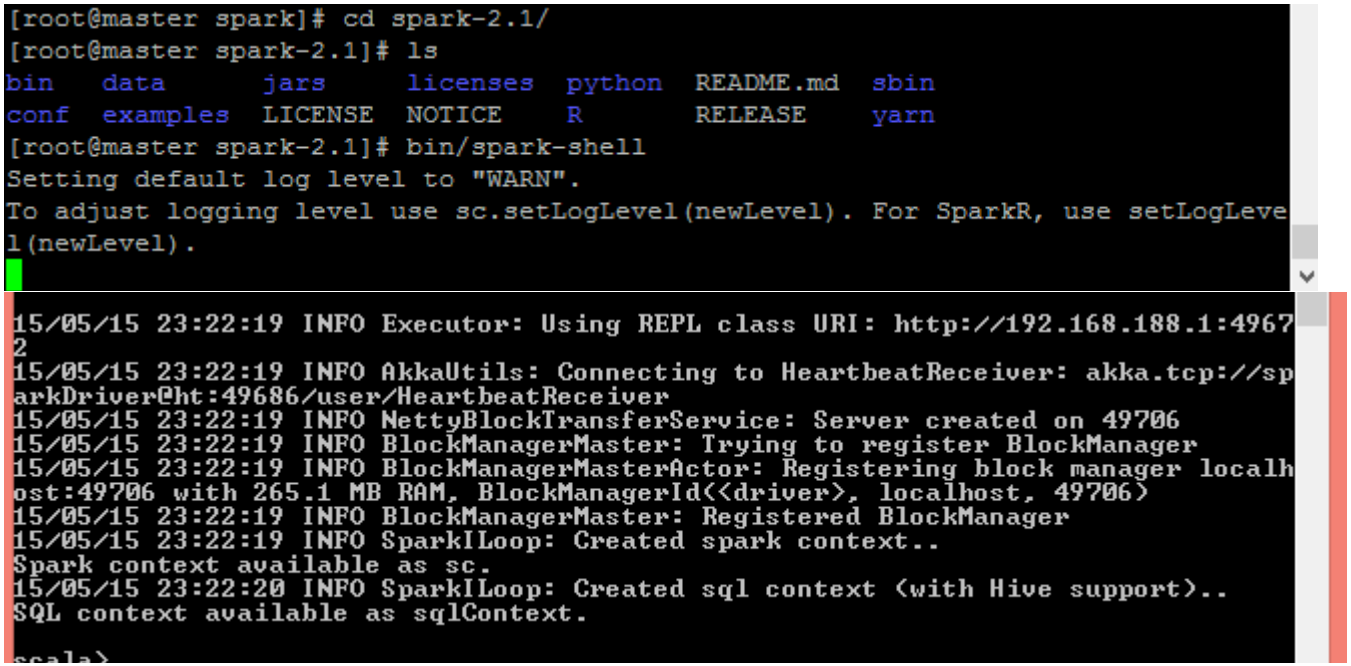
Type bash, to initialize the profile.

```
#bash
```

Go to the installation directory And execute:

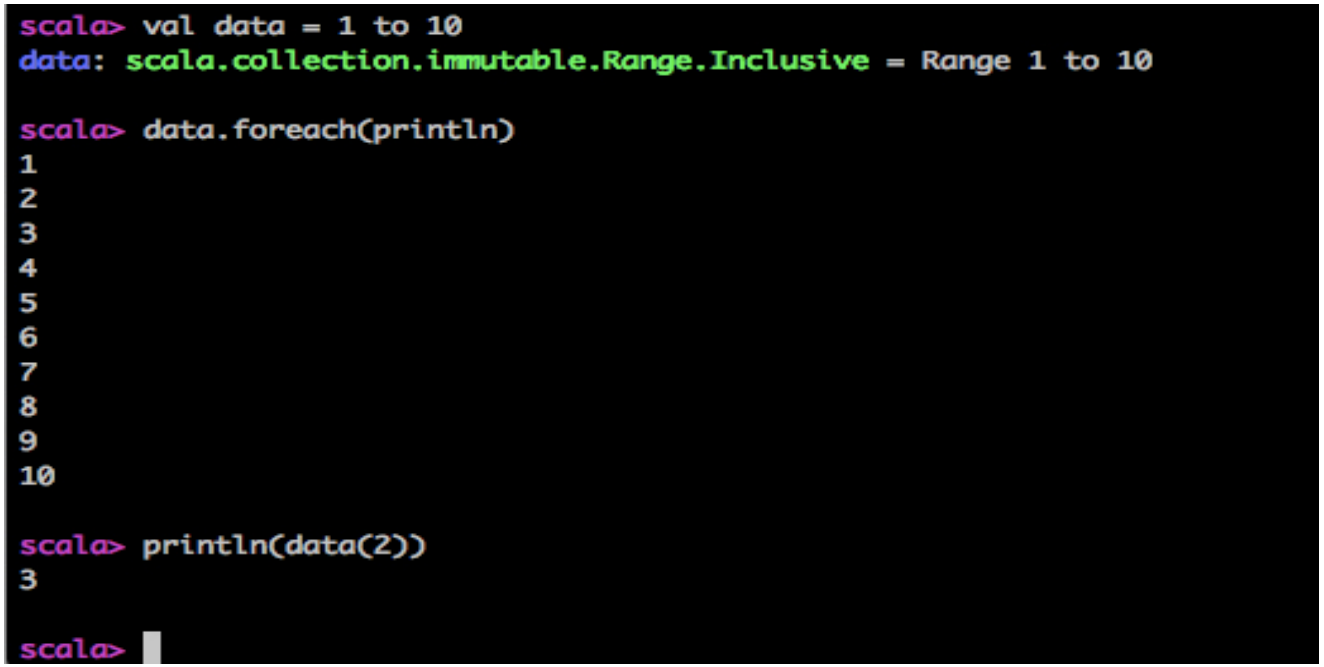
```
# cd /opt/spark/bin
```

```
#spark-shell
```



Enter the following command in the scala console to create a data set of 1...10 integers

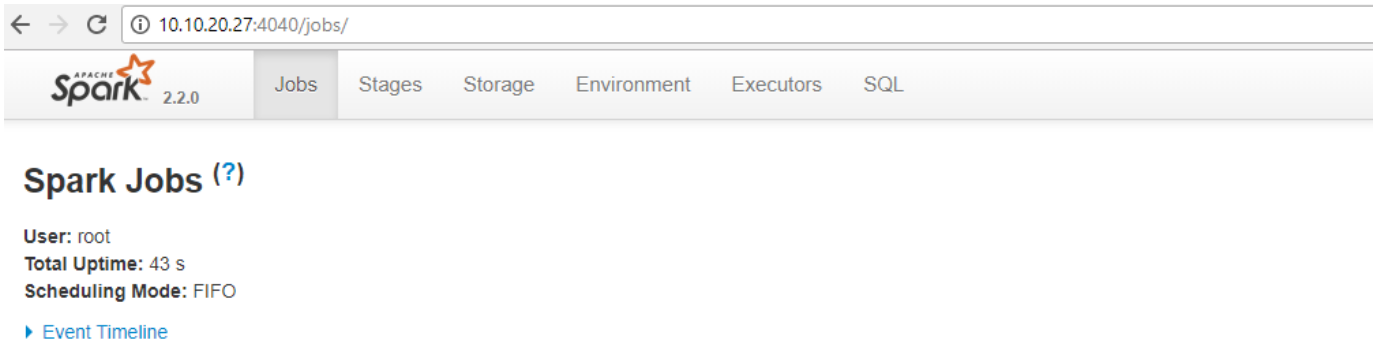
```
#val data = 1 to 10
#data.foreach(println)
#println(data(2))
```



As seen above, you have initialized data variable with range from 1 to 10.
Then print its value using foreach method of scala.
You can also access the data using index.

Web UI of the spark shell can be accessed using the following URL. You can click on each tab and verify the screen.

http://localhost:4040/jobs/



Further details on this web UI will be discussed later.

You have successfully installed spark for local development.

----------Lab Ends Here ----------

2. Spark Two Nodes Cluster – 90 Minutes

Architecture

master – spark0 and Slave – spark1

	Master	Slave
	Spark0	Spark1
Hostname	Hadoop0	Hadoop1

Let us start the Spark master.

Install the spark. You can refer the first lab.

Execute the following in Spark0/hadoop0

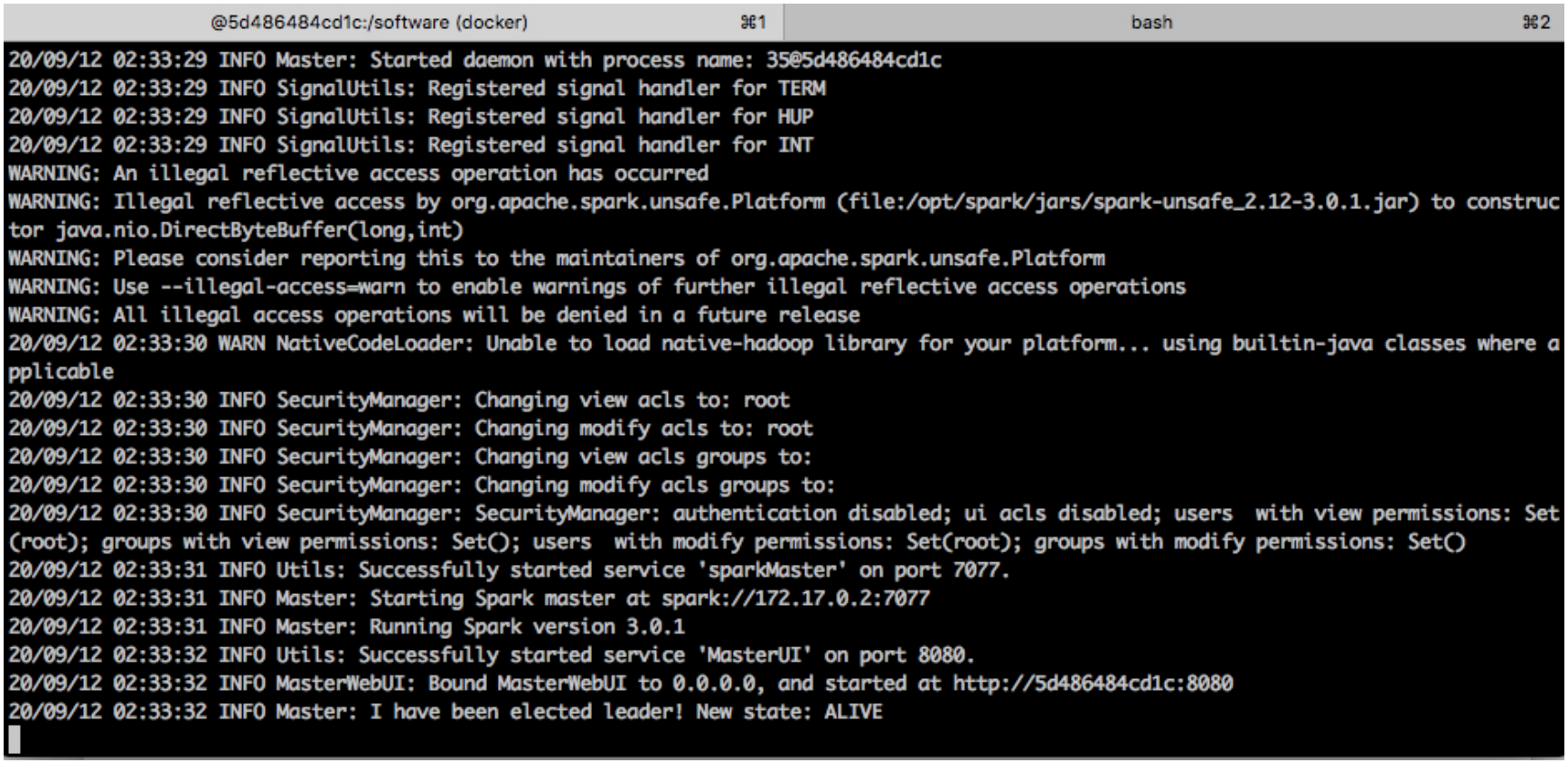
Setup a Spark master node

Change the Master Port to 8090, there is issue when it is executed in 7077 in docker environment.

Execute on the sparko – Terminal.

#export SPARK_MASTER_PORT=8090

#spark-class org.apache.spark.deploy.master.Master

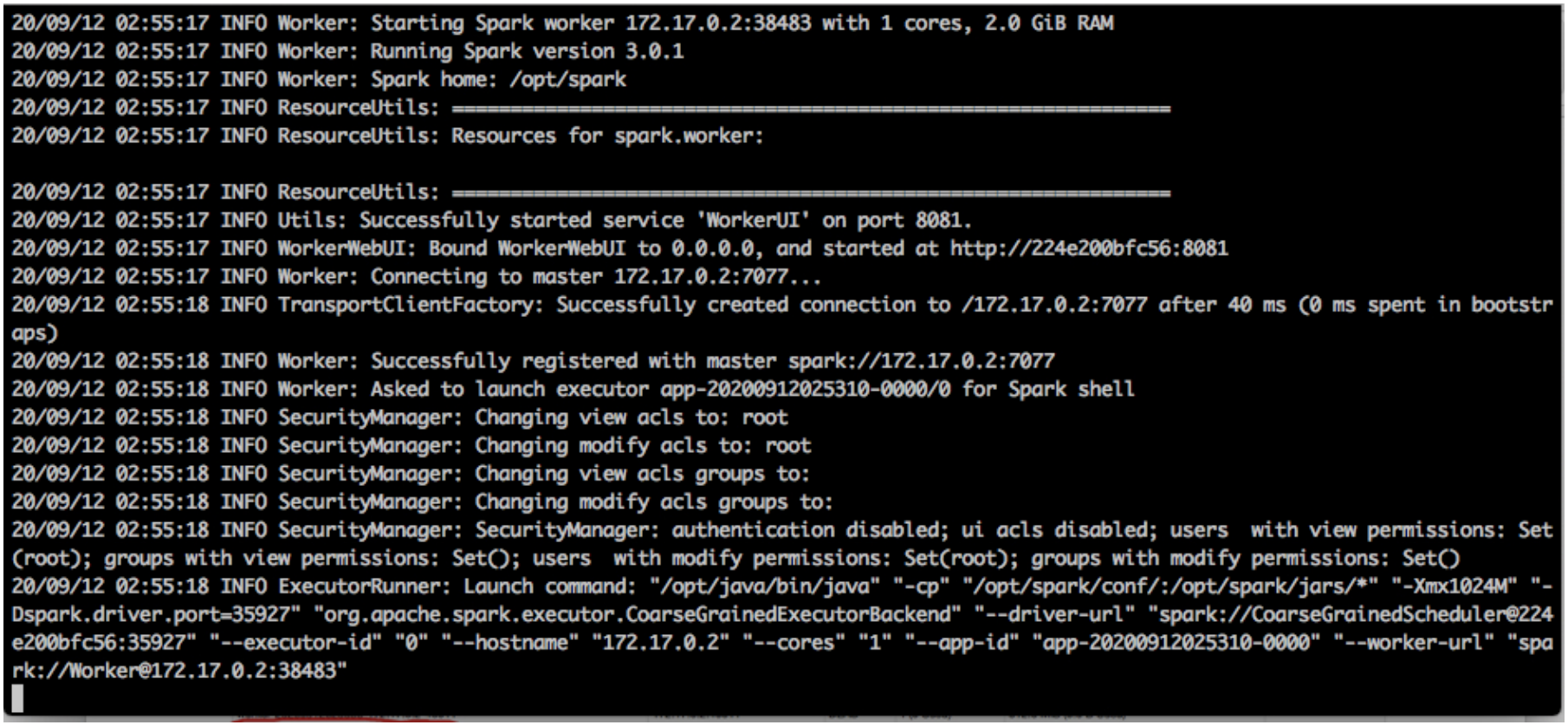


Start a worker process On Node/spark o: In a separate terminal.

Attach a worker node to the cluster, execute the following in the sparko container.

```
#spark-class org.apache.spark.deploy.worker.Worker -c 1 -m 1G spark://172.18.0.2:8090
```

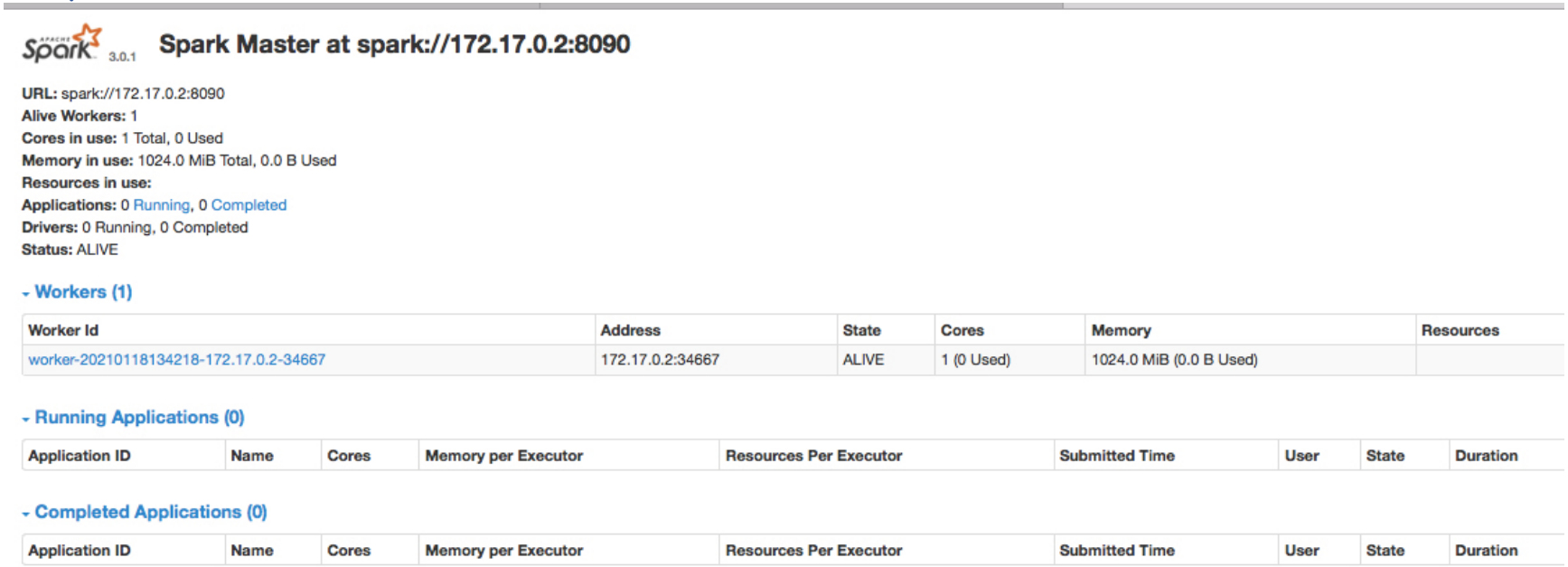
You need to replace with the IP of the sparko node. It can be retrieve using ifconfig command.



If unable to connect to localhost replace it with the container IP or the container alias i.e sparko.

Refresh the web ui, ensure that you can see a worker as shown below.

http://127.0.0.1:8080



Spark 3.0.1 **Spark Master at spark://172.17.0.2:8090**

URL: spark://172.17.0.2:8090
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, 0 Completed
Drivers: 0 Running, 0 Completed
Status: ALIVE

Workers (1)

Worker Id	Address	State	Cores	Memory	Resources
worker-20210118134218-172.17.0.2-34667	172.17.0.2:34667	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 (0)

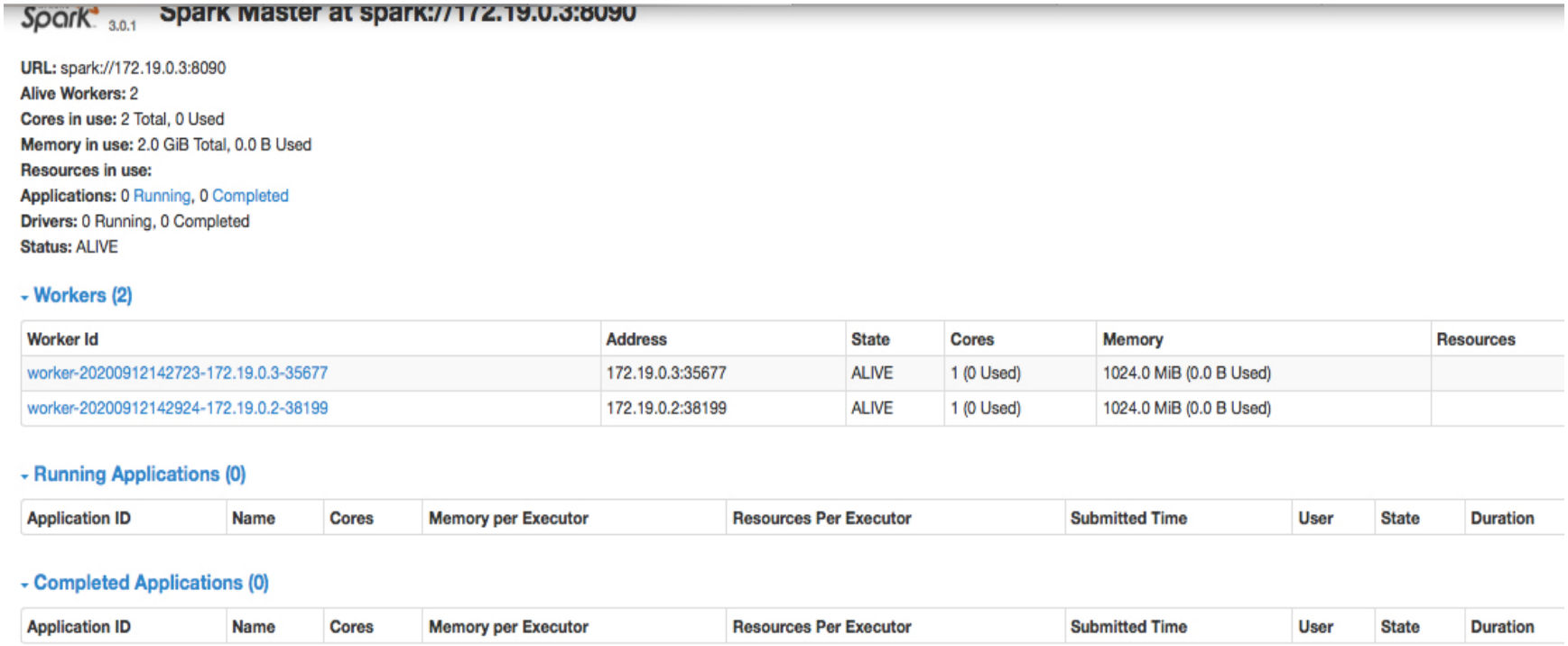
Application ID	Name	Cores	Memory per Executor	Resources Per Executor	Submitted Time	User	State	Duration

Start the Node on **spark1/hadoop1**
Ensure that you have install spark in the Spark1 too.

```
# spark-class org.apache.spark.deploy.worker.Worker -c 1 -m 1G spark://172.18.0.2:8090
```

Ensure to replace the IP of the master node. i.e ***hadoop0***

At the end of this step, you should have 2 worker nodes as shown below:



You can also verify from the master console.

```
23/02/22 17:37:49 INFO Utils: Successfully started service 'sparkMaster' on port 8090.
23/02/22 17:37:49 INFO Master: Starting Spark master at spark://172.18.0.2:8090
23/02/22 17:37:50 INFO Master: Running Spark version 3.3.0
23/02/22 17:37:51 INFO Utils: Successfully started service 'MasterUI' on port 8080.
23/02/22 17:37:51 INFO MasterWebUI: Bound MasterWebUI to 0.0.0.0, and started at http://hadoop0:8080
23/02/22 17:37:52 INFO Master: I have been elected leader! New state: ALIVE
23/02/22 17:40:33 INFO Master: Registering worker 172.18.0.2:43915 with 1 cores, 1024.0 MiB RAM
23/02/22 17:46:28 INFO Master: Registering worker 172.18.0.3:43643 with 1 cores, 1024.0 MiB RAM
```

Open a scala shell and connect to the Spark cluster – hadoop1

```
# spark-shell  --master spark://172.18.0.2:8090
```

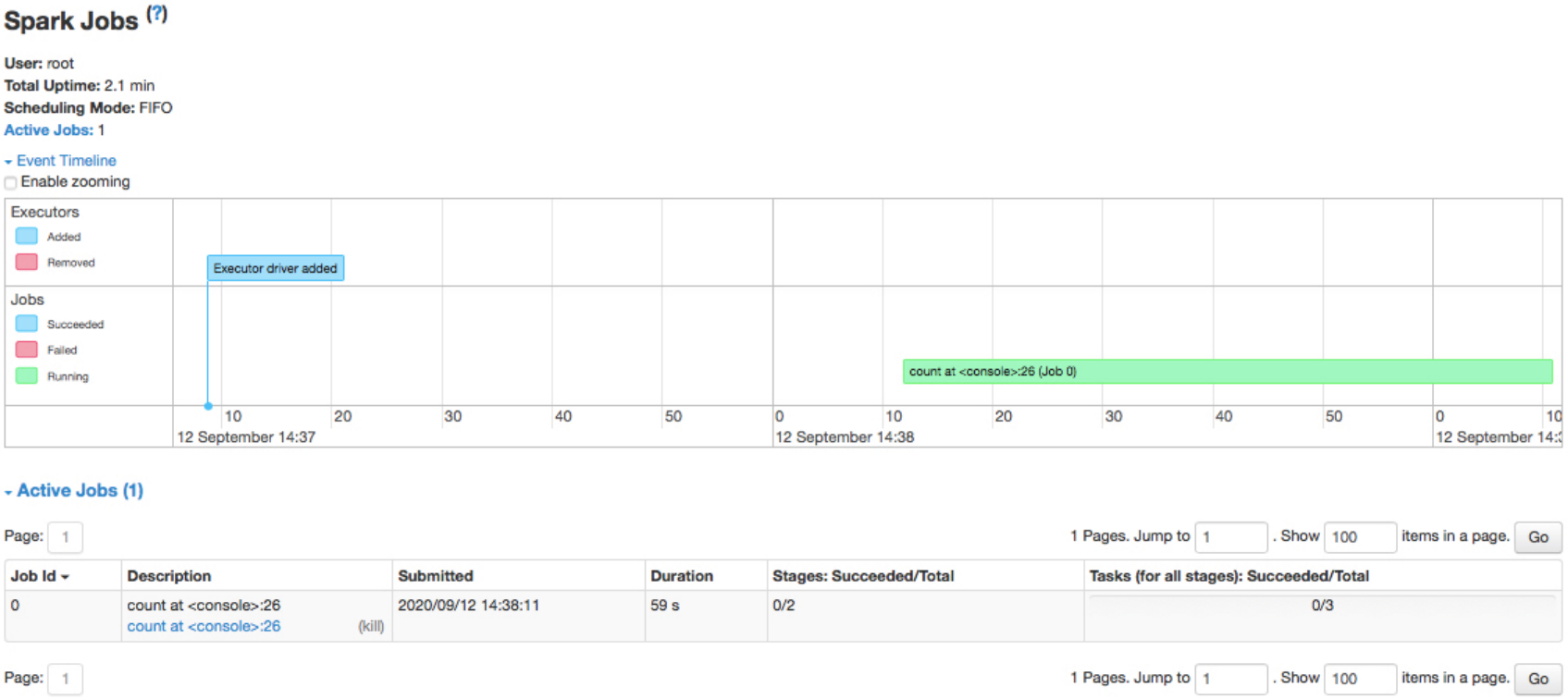
Or

```
#spark-shell --conf spark.executor.memory=512mb --conf spark.executor.cores=1 --
master spark://hadoop0:8090
```

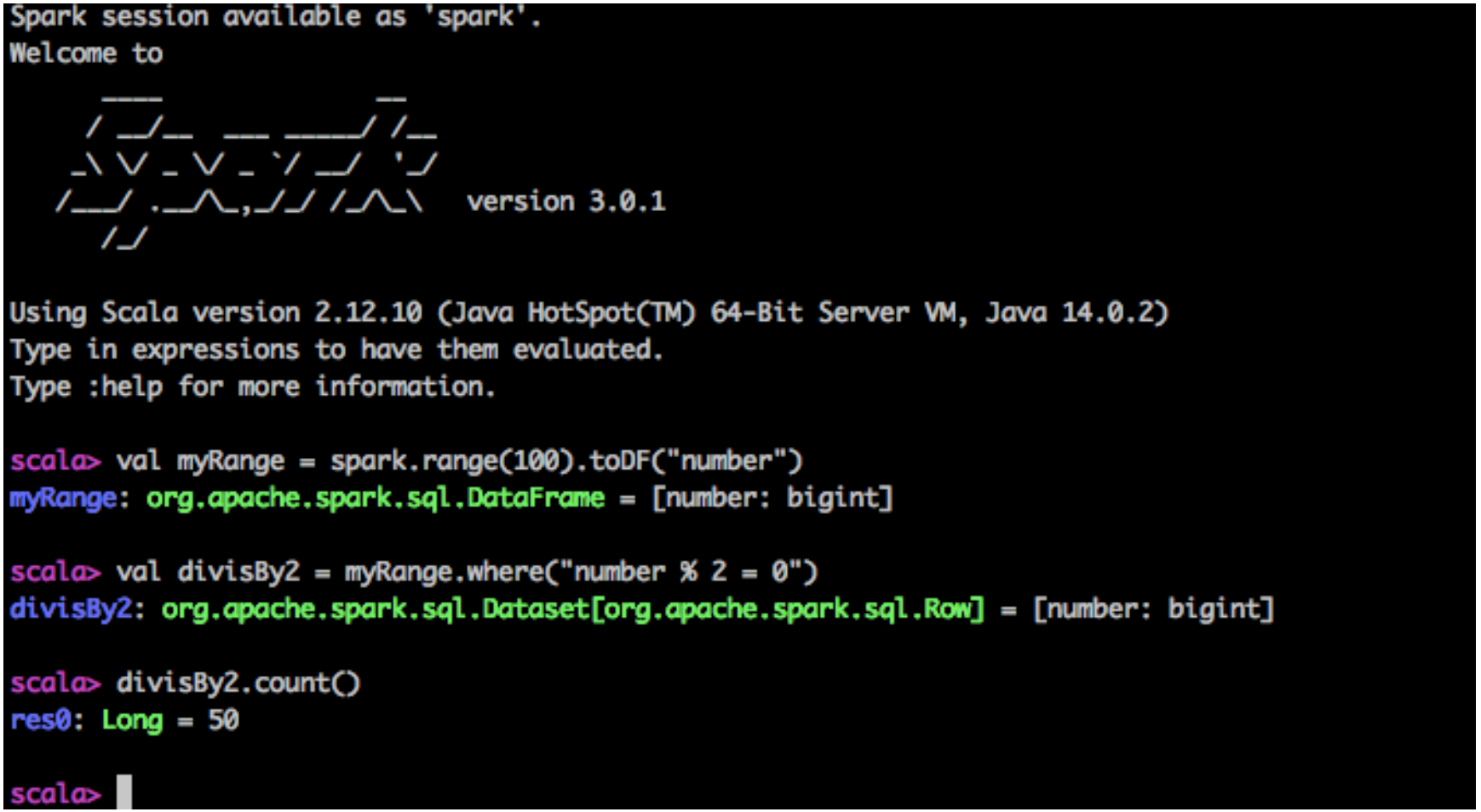
Run an example job in the interactive scala shell

```
val myRange = spark.range(100).toDF("number")
val divisBy2 = myRange.where("number % 2 = 0")
divisBy2.count()
```

Check the application UI by navigating to http://localhost:4040. You should see the following



The console should display the result as shown below:



---------- Lab Ends Here ----------

3. Launching Spark Job on a YARN Cluster– 120 Minutes (D)

In this lab, you will deploy Spark Application on Hadoop Cluster.

By now, you should have two nodes hadoop cluster : ***hadoop0*** and h***adoop1***.

You can run a MapReduce job on YARN in a pseudo-distributed mode

Start HDFS and YARN on the YARN Node.

At this point, you should have services and processes as shown below:

On hadoop0:

```
jps
```

```
2321 ResourceManager
1075 DataNode
1524 SecondaryNameNode
2632 NodeManager
761 NameNode
```

On hadoop1

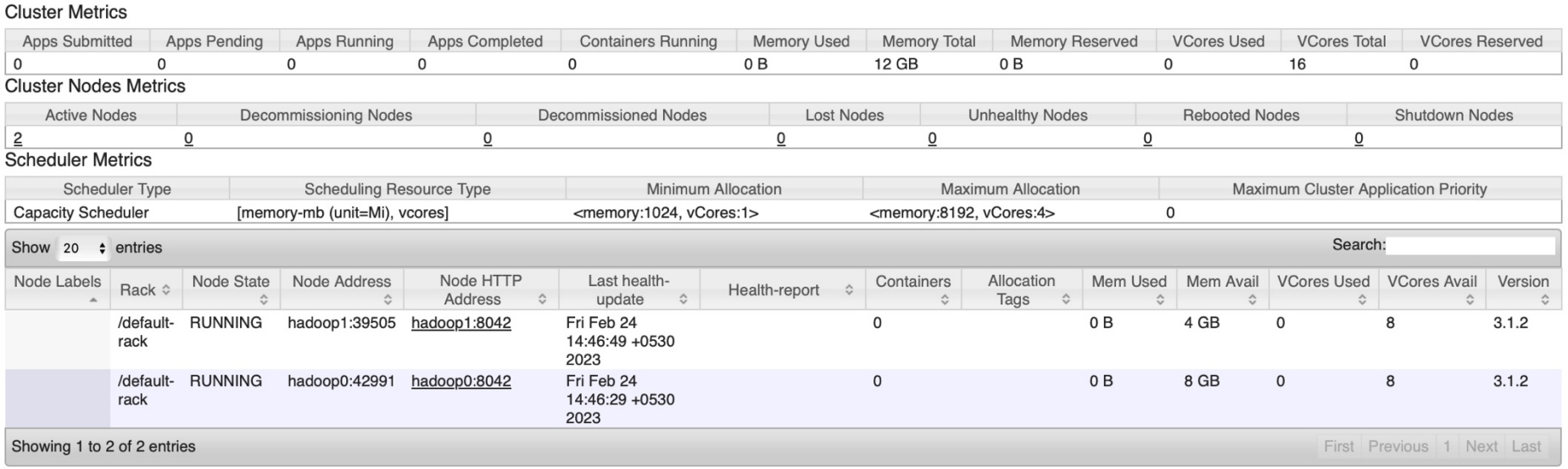
```
jps
```

883 NodeManager
931 Jps
332 DataNode

Browse the web interface for the ResourceManager; by default it is available at:

ResourceManager –

http://localhost:8088/



Cluster Metrics

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	Memory Total	Memory Reserved	VCores Used	VCores Total	VCores Reserved
0	0	0	0	0	0 B	12 GB	0 B	0	16	0

Cluster Nodes Metrics

Active Nodes	Decommissioning Nodes	Decommissioned Nodes	Lost Nodes	Unhealthy Nodes	Rebooted Nodes	Shutdown Nodes
2	0	0	0	0	0	0

Scheduler Metrics

Scheduler Type	Scheduling Resource Type	Minimum Allocation	Maximum Allocation	Maximum Cluster Application Priority
Capacity Scheduler	[memory-mb (unit=Mi), vcores]	<memory:1024, vCores:1>	<memory:8192, vCores:4>	0

Show 20 entries Search:

Node Labels	Rack	Node State	Node Address	Node HTTP Address	Last health-update	Health-report	Containers	Allocation Tags	Mem Used	Mem Avail	VCores Used	VCores Avail	Version
	/default-rack	RUNNING	hadoop1:39505	hadoop1:8042	Fri Feb 24 14:46:49 +0530 2023		0		0 B	4 GB	0	8	3.1.2
	/default-rack	RUNNING	hadoop0:42991	hadoop0:8042	Fri Feb 24 14:46:29 +0530 2023		0		0 B	8 GB	0	8	3.1.2

Showing 1 to 2 of 2 entries First Previous 1 Next Last

You should have two Nodemanager as shown above.

Let us create a temporary folder, that will be used for working space for the YARN cluster.

```
hdfs dfs -mkdir /tmp
hdfs dfs -chmod -R 1777 /tmp
hdfs dfs -mkdir /tmp/in
hdfs  dfs -ls /tmp
```

You can get the README.md file from the installation folder, which is provided along with the training. Copy the file on the hdfs cluster.

```
hdfs dfs -copyFromLocal /opt/hadoop/README.txt /tmp/in
hdfs dfs -ls /tmp/in

#hdfs dfs -mkdir  /tmp/spark-events
```

Congrats! You have successfully configure Yarn Cluster for spark job.

Let us copy the program, ***simple-project_2.12-1.0.jar*** to the spark node (***hadoop1***). It was developed earlier.

Create the following file in /opt on hadoop node and copy the file to hdfs /user/root/input folder.

File **names.json** contains:

{"firstName":"Grace","lastName":"Hopper"}
{"firstName":"Alan","lastName":"Turing"}
{"firstName":"Ada","lastName":"Lovelace"}
{"firstName":"Charles","lastName":"Babbage"}

```
#hdfs dfs -mkdir /user/root/input
# hdfs dfs -copyFromLocal /opt/names.json  /user/root/input/
```

You can verify the file using the following command:

```
# hdfs dfs -ls -R /user/root/input
```

Output:
[root@hadoop1 logs]# hdfs dfs -ls -R /user/root/input
-rw-r--r--   2 root supergroup   171 2023-02-24 14:56 /user/root/input/names.json

Open a console on **hadoop1** to execute the Spark jobs to submit on YARN.

```
#export HADOOP_CONF_DIR=/opt/hadoop/etc/hadoop
#export YARN_CONF_DIR=/opt/hadoop/etc/hadoop
#spark-submit --class "NameList"  --master yarn --deploy-mode cluster
/Software/simple-project_2.12-1.0.jar \
   hdfs://hadoop0:8020/user/root/input hdfs://hadoop0:8020/user/root/output
```

Note --> Application Jar should be in the local file system, In folder is in HDFS and Out should not be present in the HDFS,it will be automatically created.

You can verify the progress of the application using http://hp.com:8088/cluster

Click on Cluster-- >Application --> accepted

Cluster Metrics

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	Memory Total	Memory Reserved	VCores Used	VCores Total	VCores Reserved	Active Nodes	Decommissioned Nodes	Lost Nodes	Unhealthy Nodes	Re N
3	0	1	2	1	1 GB	8 GB	0 B	1	8	0	1	0	0	0	0

Show 20 entries Search:

ID	User	Name	Application Type	Queue	StartTime	FinishTime	State	FinalStatus	Progress	Trackin
application_1434297324587_0003	root	com.ht.sparks.WordCount	SPARK	default	Sun, 14 Jun 2015 17:55:58 GMT	N/A	ACCEPTED	UNDEFINED		UNASSI
application_1434297324587_0002	root	com.ht.sparks.WordCount	SPARK	default	Sun, 14 Jun 2015 16:27:58	Sun, 14 Jun 2015 16:30:02	FINISHED	SUCCEEDED		History

Wait for few moment and verify on Running tab.

Cluster Metrics

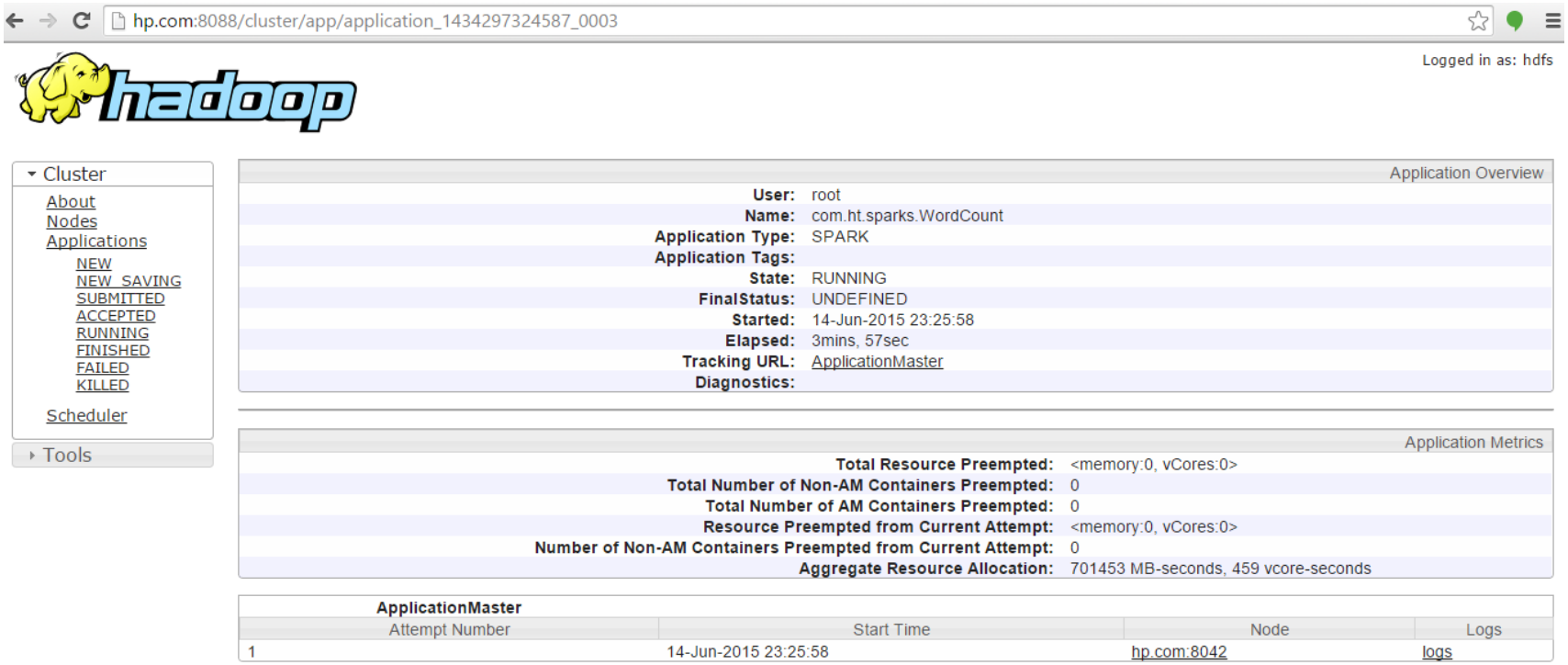
Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	Memory Total	Memory Reserved	VCores Used	VCores Total	VCores Reserved	Active Nodes	Decommissioned Nodes	Lost Nodes	Unhealthy Nodes	Rebo Noc
3	0	1	2	4	7 GB	8 GB	0 B	4	8	0	1	0	0	0	0

Show 20 ▼ entries Search:

ID	User	Name	Application Type	Queue	StartTime	FinishTime	State	FinalStatus	Progress	Tracking UI
application_1434297324587_0003	root	com.ht.sparks.WordCount	SPARK	default	Sun, 14 Jun 2015 17:55:58 GMT	N/A	RUNNING	UNDEFINED		ApplicationMa

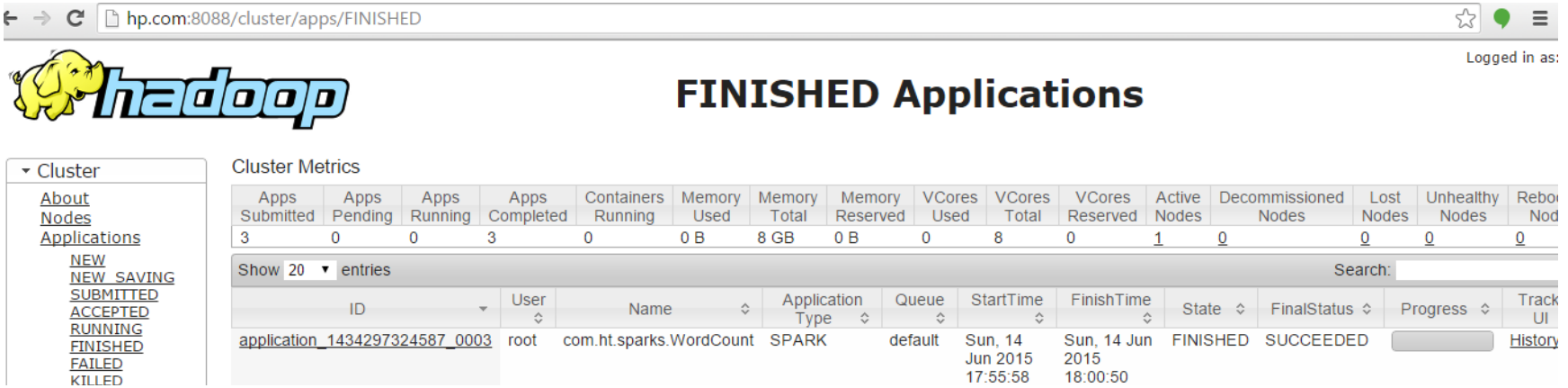
Showing 1 to 1 of 1 entries First Previous 1 Next L

Click on the Application ID --> Logs



Logs --> Stderr to get details as follows:

After sometimes click on Finished, after the console exit the program.



On the job submit console.

```
2021-01-22 16:36:11,589 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:12,662 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:13,765 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:14,896 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:16,011 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:17,296 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:18,725 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:19,914 INFO yarn.Client: Application report for application_1611331123305_0002 (state: RUNNING)
2021-01-22 16:36:21,041 INFO yarn.Client: Application report for application_1611331123305_0002 (state: FINISHED)
2021-01-22 16:36:21,401 INFO yarn.Client:
         client token: N/A
         diagnostics: N/A
         ApplicationMaster host: hadoop0
         ApplicationMaster RPC port: 38603
         queue: default
         start time: 1611333080086
         final status: SUCCEEDED
         tracking URL: http://hadoop0:8088/proxy/application_1611331123305_0002/
         user: root
2021-01-22 16:36:23,265 INFO util.ShutdownHookManager: Shutdown hook called
2021-01-22 16:36:23,442 INFO util.ShutdownHookManager: Deleting directory /tmp/spark-7b20b446-2b75-4550-9e2d-c84ad6
7c9b3b
2021-01-22 16:36:23,532 INFO util.ShutdownHookManager: Deleting directory /tmp/spark-89770943-febc-4bdb-bf6e-404103
88026d
[root@303b68143644 bin]#
```

You can verify the output file in the hdfs as shown below:

```
#hdfs dfs -ls -R /user/root/output
```

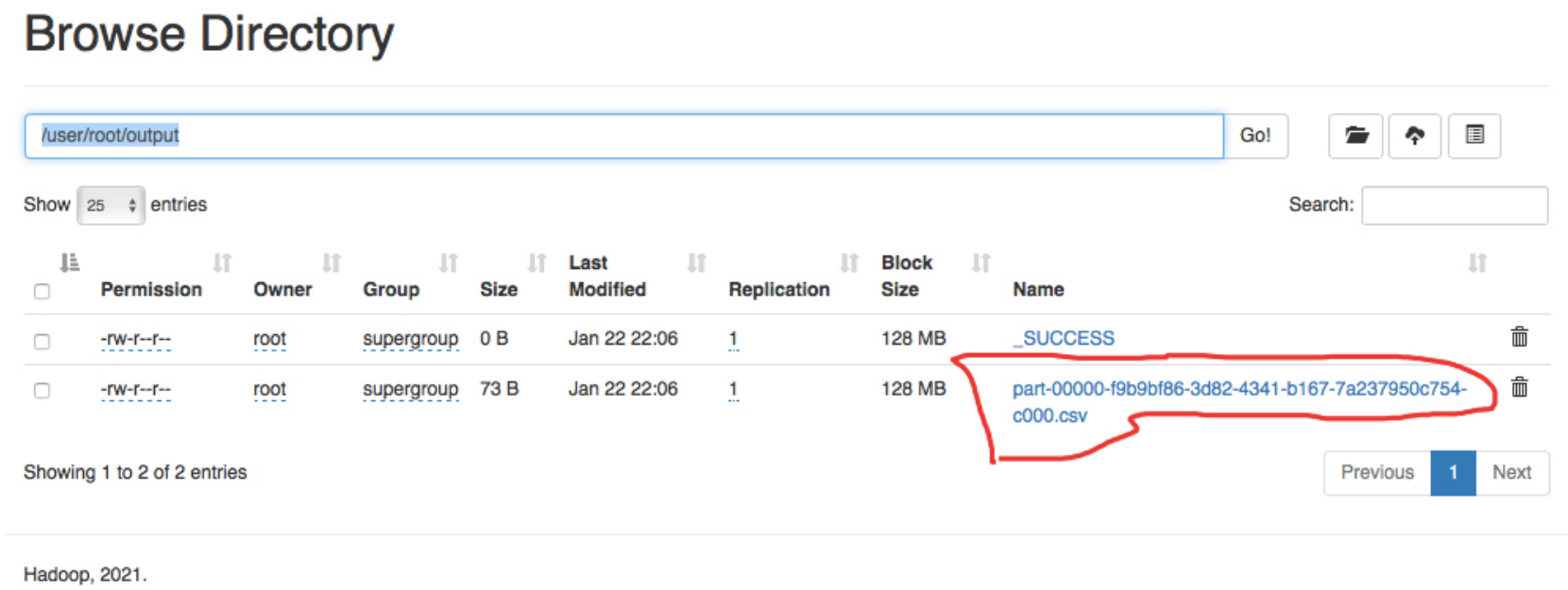
Substitute the file as listed from the above command.

```
#hdfs dfs -cat /user/root/output/part-00000-f9b9bf86-3d82-4341-b167-7a237950c754-c000.csv
```

Great! You have successfully executed spark job in YARN cluster. Let us verify the output now using HDFS browser.

http://localhost:9870/explorer.html#/

Click Utilities --> Browse the file system → /user/root/output (Enter in the Directory) - Go



Click on the above mark file.

Browse Directory

/tmp/out Go!

Permission	Owner	Group	Size	Replication	Block Size	Name
-rw-r--r--	root	supergroup	0 B	3	128 MB	_SUCCESS
-rw-r--r--	root	supergroup	60.71 KB	3	128 MB	part-00000
-rw-r--r--	root	supergroup	61.17 KB	3	128 MB	part-00001
-rw-r--r--	root	supergroup	60.76 KB	3	128 MB	part-00002
-rw-r--r--	root	supergroup	57.2 KB	3	128 MB	part-00003

Let us view one of the output. click on part-0001 --> Download.
Replace the hostname with localhost in the url if you can't access the hostname.

```
    +---+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9---
 1  (Kakrafoon,,1)
 2  (pitifully,1)
 3  (mattered,2)
 4  (propped,1)
 5  (House,2)
 6  (bone,8)
 7  ("Conceited,1)
 8  (afternoon's,1)
 9  (screen.",7)
10  (five.,1)
11  (gaping,2)
12  (tents,1)
13  (2~Imports:,1)
14  (envelope,1)
15  (tone.,4)
16  (consideration,,1)
17  (conclusively,3)
18  (activation.,1)
```

Congrats!.

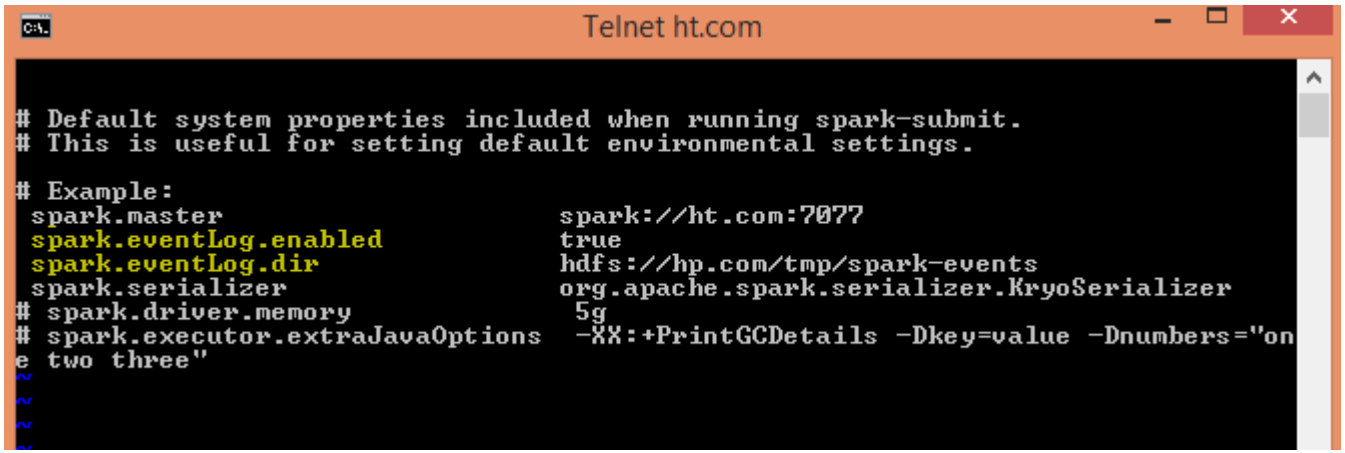
---------- End of Lab----------

Errata:

1) 15/06/14 21:50:46 INFO storage.BlockManagerMasterActor: Registering block manager ht.com:50475 with 267.3 MB RAM, BlockManagerId(<driver>, ht.com, 50475)
15/06/14 21:50:46 INFO storage.BlockManagerMaster: Registered BlockManager
Exception in thread "main" java.lang.IllegalArgumentException: Wrong FS: file:/tmp/spark-events/application_1434297324587_0001.inprogress, expected: hdfs://hp.com at org.apache.hadoop.fs.FileSystem.checkPath(FileSystem.java:643)
at org.apache.hadoop.hdfs.DistributedFileSystem.getPathName(DistributedFileSystem.java:191)
at org.apache.hadoop.hdfs.DistributedFileSystem.access$000(DistributedFileSystem.java:102)
at org.apache.hadoop.hdfs.DistributedFileSystem$22.doCall(DistributedFileSystem.java:1266)
at org.apache.hadoop.hdfs.DistributedFileSystem$22.doCall(DistributedFileSystem.java:1262)
at org.apache.hadoop.fs.FileSystemLinkResolver.resolve(FileSystemLinkResolver.java:81)
at org.apache.hadoop.hdfs.DistributedFileSystem.setPermission(DistributedFileSystem.java:1262)
at org.apache.spark.scheduler.EventLoggingListener.start(EventLoggingListener.scala:128)

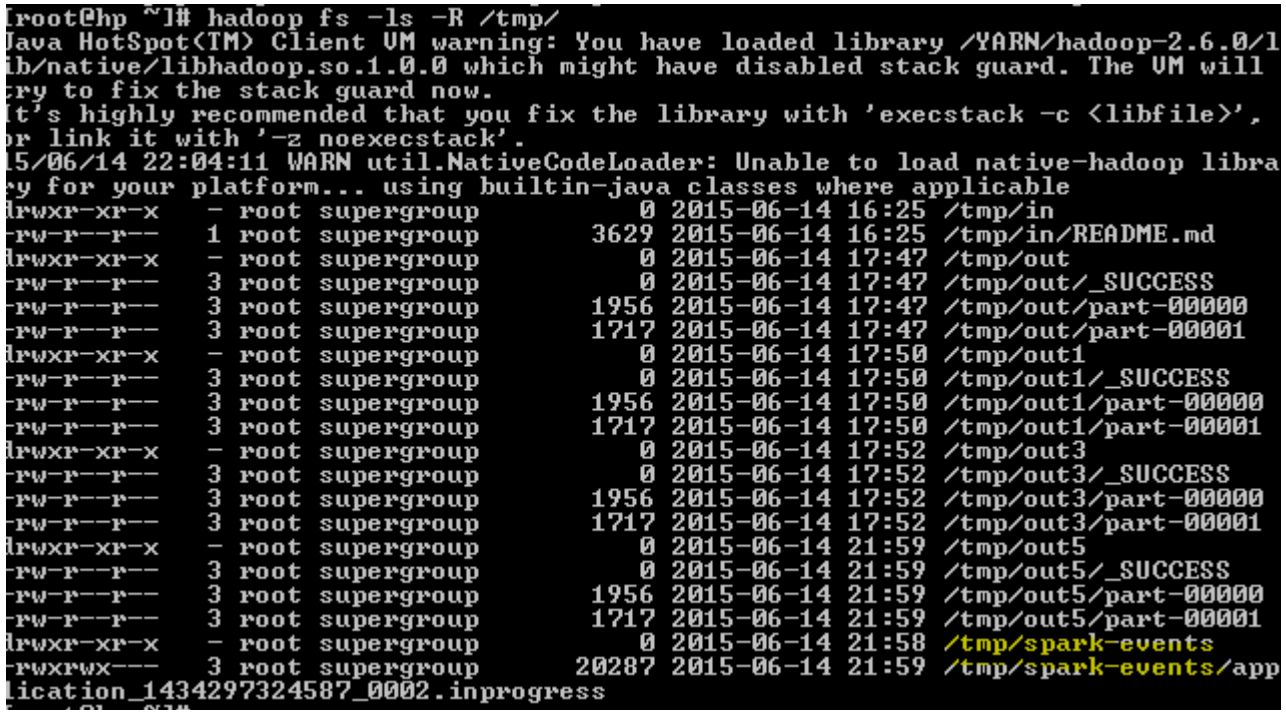
```
15/06/14 21:50:46 INFO storage.BlockManagerMasterActor: Registering block manage
r ht.com:50475 with 267.3 MB RAM, BlockManagerId(<driver>, ht.com, 50475)
15/06/14 21:50:46 INFO storage.BlockManagerMaster: Registered BlockManager
Exception in thread "main" java.lang.IllegalArgumentException: Wrong FS: file:/t
mp/spark-events/application_1434297324587_0001.inprogress, expected: hdfs://hp.c
om
        at org.apache.hadoop.fs.FileSystem.checkPath(FileSystem.java:643)
        at org.apache.hadoop.hdfs.DistributedFileSystem.getPathName(DistributedF
ileSystem.java:191)
        at org.apache.hadoop.hdfs.DistributedFileSystem.access$000(DistributedFi
leSystem.java:102)
        at org.apache.hadoop.hdfs.DistributedFileSystem$22.doCall(DistributedFil
eSystem.java:1266)
        at org.apache.hadoop.hdfs.DistributedFileSystem$22.doCall(DistributedFil
eSystem.java:1262)
        at org.apache.hadoop.fs.FileSystemLinkResolver.resolve(FileSystemLinkRes
olver.java:81)
        at org.apache.hadoop.hdfs.DistributedFileSystem.setPermission(Distribute
dFileSystem.java:1262)
        at org.apache.spark.scheduler.EventLoggingListener.start(EventLoggingLis
tener.scala:128)
        at org.apache.spark.SparkContext.<init>(SparkContext.scala:399)
        at org.apache.spark.api.java.JavaSparkContext.<init>(JavaSparkContext.sc
ala:61)
```

Solution: Verify default configuration of the spark installation. /spark/spark-1.3.0-bin-hadoop2.4/conf/spark-defaults.conf



Check that spark.eventLog.dir is begin with hdfs:// and the /tmp/spark-events is already created in HDFS system
You can verify on the YARN cluster only.

Verify using : hadoop fs -ls -R /tmp/



2) 15/06/14 00:41:20 INFO client.RMProxy: Connecting to ResourceManager at /0.0.0.0:8032

15/06/14 21:58:27 INFO yarn.Client: Application report for application_1434297324587_0002 (state: ACCEPTED)
Indefinite loop of above
Solution: Ensure that all configuration file are map to appropriate hostname and hostname to ip details are modified in the hosts file , Increase the resources and wait for few minutes to convert the status to running.

Yarn-site.xml
yarn.scheduler.minimum-allocation-mb: 256m
yarn.scheduler.increment-allocation-mb: 256m

<property>
<name>yarn.nodemanager.resource.memory-mb</name>
<value>4096</value>
</property>
<property>
<name>yarn.scheduler.minimum-allocation-mb</name>
<value>512</value>
</property>
<property>
<name>yarn.scheduler.increment-allocation-mb</name>
<value>256</value>
</property>

yarn-site.xml – Spark Node. (Specify the hostname of the Hadoop RM Node as shown below)

```
<property>
      <name>yarn.resourcemanager.hostname</name>
      <value>hadoop0</value>
      <description>The hostname of the RM.</description>
   </property>
<property>
      <name>yarn.resourcemanager.address</name>
      <value>hadoop0:8032</value>
      <description>The hostname of the RM.</description>
   </property>
```

3) If unhealthy nodes is being displayed in the cluster URL with 1/1 local-dirs are bad: /tmp/hadoop-yarn/nm-local-dir;

Solution: delete the folder using the following command and ensure that nodes are healthy before proceeding forward, you can restart if require

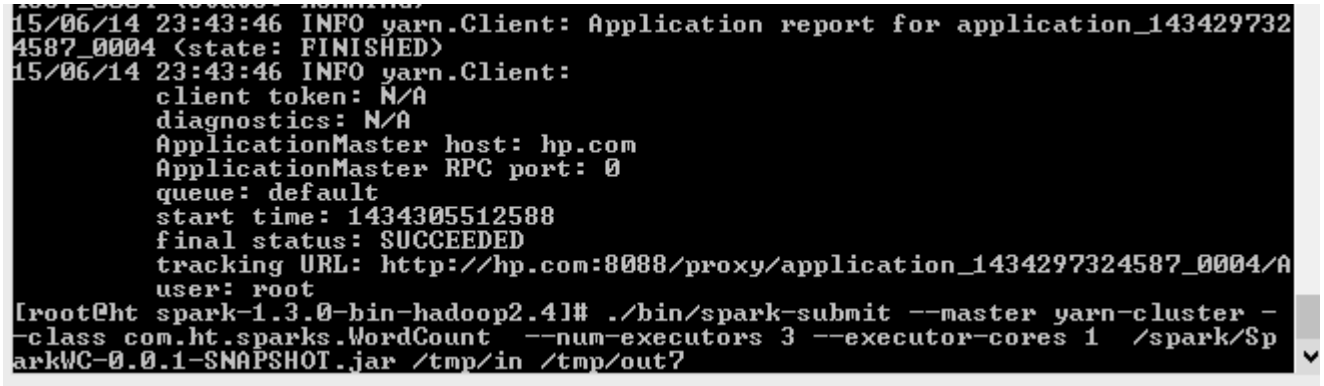
hadoop fs -rm -fr /tmp/hadoop-yarn/*

Try the following command:
yarn application -list

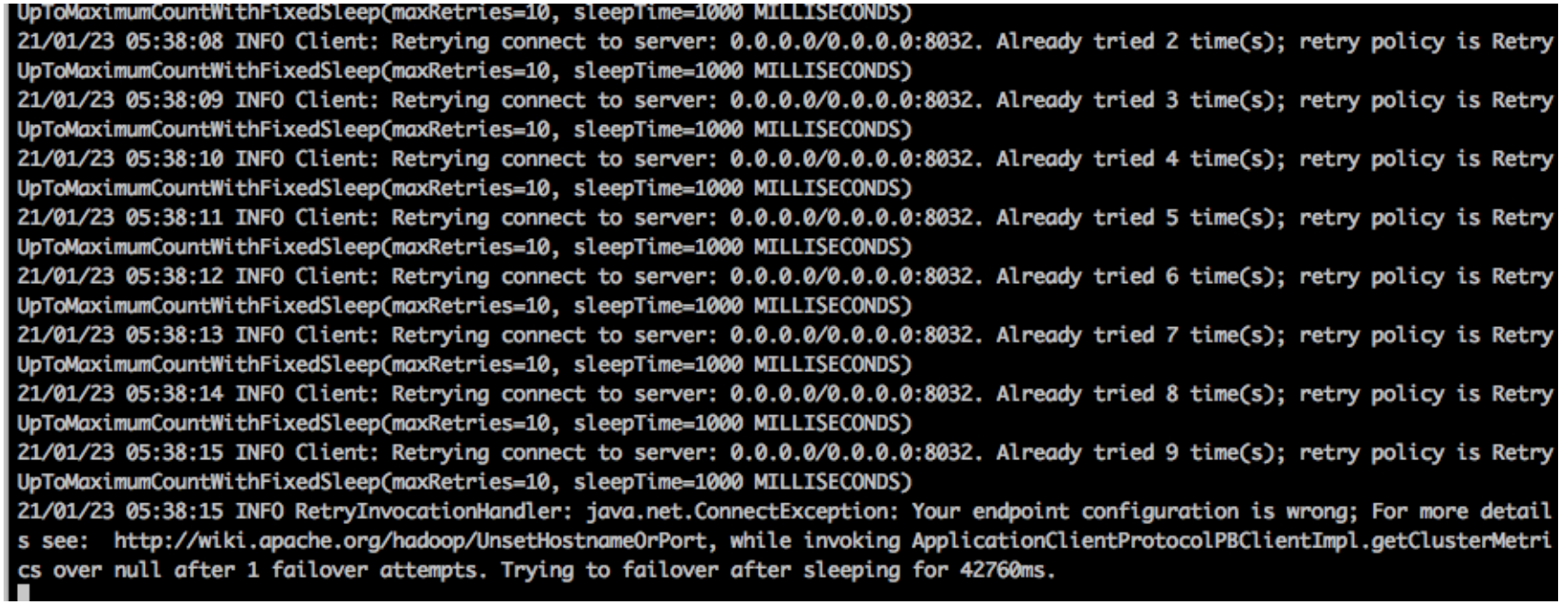
yarn application -kill [application name]

You can view jps in YARN cluster when spark job is executing. It will start Coarse* processes.

Even, cluster mode works



Issue:



Verify the ip of the resource manager and set the home directory appropriately.
Try updating the following setting in yarn-site.xml of Hadoop and spark node too..

```
<property>
      <name>yarn.resourcemanager.hostname</name>
      <value>hadoop0</value>
      <description>The hostname of the RM.</description>
   </property>
<property>
```

```
    <name>yarn.resourcemanager.address</name>
    <value>hadoop0:8032</value>
    <description>The hostname of the RM.</description>
  </property>
```

Error:
Failing this attempt.Diagnostics: [2022-06-18 03:01:08.210]Container [pid=1686,containerID=container_1655521013018_0001_02_000001] is running 32197120B beyond the 'VIRTUAL' memory limit. Current usage: 198.8 MB of 1 GB physical memory used; 2.1 GB of 2.1 GB virtual memory used. Killing container.

Add following property in yarn-site.xml

```
 <property>
  <name>yarn.nodemanager.vmem-check-enabled</name>
   <value>false</value>
   <description>Whether virtual memory limits will be enforced for containers</description>
 </property>
 <property>
  <name>yarn.nodemanager.vmem-pmem-ratio</name>
   <value>4</value>
   <description>Ratio between virtual memory to physical memory when setting memory limits for containers</description>
 </property>
```

Complete yarn-site.xml

```
<configuration>

<property>
      <name>yarn.nodemanager.aux-services</name>
      <value>mapreduce_shuffle</value>
   </property>
   <property>
      <name>yarn.nodemanager.env-whitelist</name>

<value>JAVA_HOME,HADOOP_COMMON_HOME,HADOOP_HDFS_HOME,HADOOP_CONF
_DIR,CLASSPATH_PREPEND_DISTCACHE,HADOOP_YARN_HOME,HADOOP_M
APRED_HOME</value>
</property>
<property>
      <name>yarn.resourcemanager.hostname</name>
      <value>master0</value>
      <description>The hostname of the RM.</description>
   </property>
<property>
      <name>yarn.resourcemanager.address</name>
      <value>master0:8032</value>
```

```
      <description>The hostname of the RM.</description>
   </property>
<property>
<name>yarn.nodemanager.resource.memory-mb</name>
<value>4096</value>
</property>
<property>
<name>yarn.scheduler.minimum-allocation-mb</name>
<value>512</value>
</property>
<property>
<name>yarn.scheduler.increment-allocation-mb</name>
<value>256</value>
</property>
<property>
  <name>yarn.nodemanager.vmem-check-enabled</name>
   <value>false</value>
   <description>Whether virtual memory limits will be enforced for containers</description>
 </property>
<property>
  <name>yarn.nodemanager.vmem-pmem-ratio</name>
   <value>4</value>
   <description>Ratio between virtual memory to physical memory when setting memory limits
for containers</description>
```

```
  </property>
</configuration>
```

Various ways of job submission.

```
./spark-submit --class "NameList"  --master yarn --driver-memory 1G --executor-memory 1G --num-executors 2 --deploy-mode cluster  /opt/data/simple-project_2.12-1.0.jar \
   hdfs://hadoop0:8020/user/root/input1 hdfs://hadoop0:8020/user/root/output7

./spark-submit --class "NameList"  --master yarn --driver-memory 512m --executor-memory 512m --num-executors 2 --deploy-mode cluster  /opt/data/simple-project_2.12-1.0.jar \
   hdfs://master0:8020/user/root/input hdfs://master0:8020/user/root/output7

./spark-submit --class "NameList"  --master yarn --driver-memory 512m --executor-memory 512m --num-executors 2 --deploy-mode client  /opt/data/simple-project_2.12-1.0.jar \
   hdfs://hadoop0:8020/user/root/input1 hdfs://hadoop0:8020/user/root/output7
```

or using spark-shell

Ensure that `HADOOP_CONF_DIR` or `YARN_CONF_DIR` points to the directory which contains the (client side) configuration files for the Hadoop cluster.

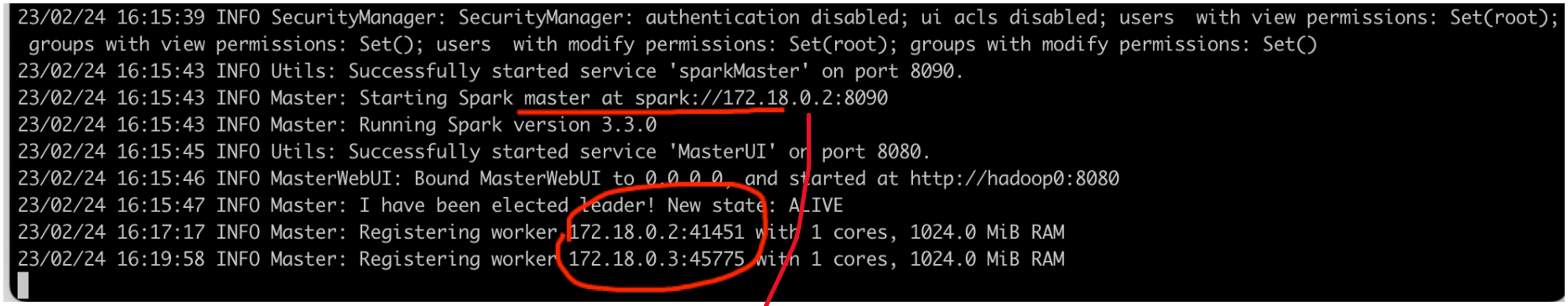
```
./bin/spark-shell --master yarn --deploy-mode client
```

---

4. Jobs Monitoring : Using Web UI. – 45 Minutes

Prerequisite:

Start two nodes Spark cluster. On the spark master terminal console, you should have the following two nodes entries.



Open a terminal on ***hadoop1***:

Note down the ip of the hadoop0 or the spark master and substitute below accordingly.

```
#spark-shell  --master spark://172.18.0.2:8090
```

Copy the input file in both the nodes ***(/Software/data/)***, if you are executing on the Standalone cluster.

File **names.json** contains:

{"firstName":"Grace","lastName":"Hopper"}
{"firstName":"Alan","lastName":"Turing"}
{"firstName":"Ada","lastName":"Lovelace"}
{"firstName":"Charles","lastName":"Babbage"}

The file should be in all the Executing node.

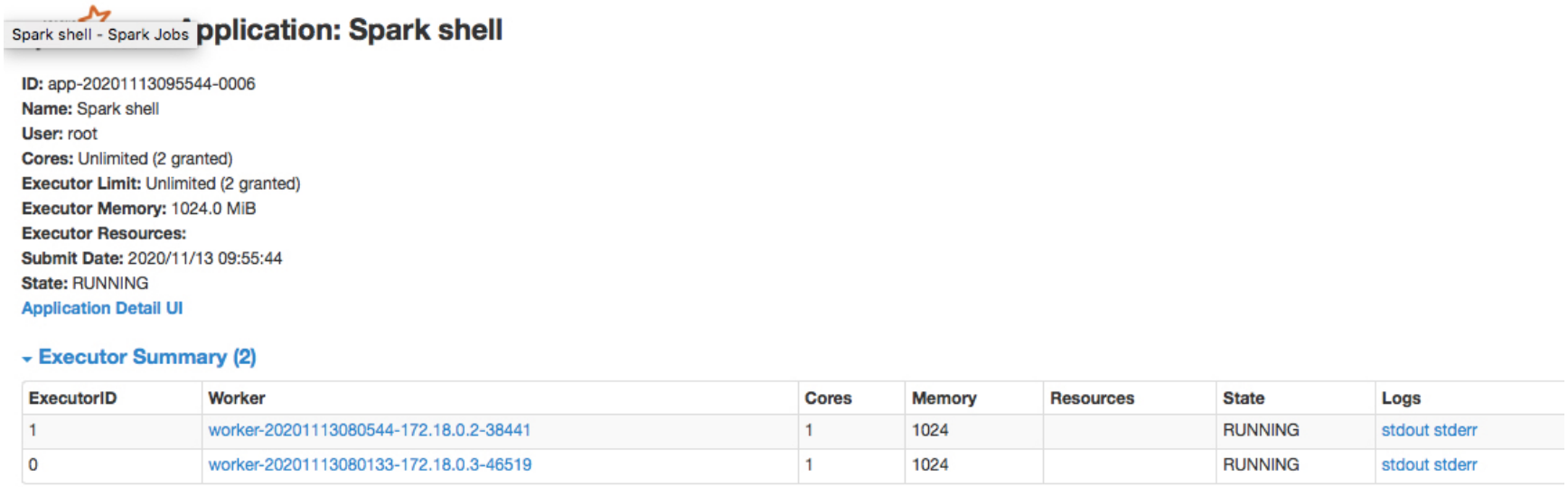
Execute the following jobs:

Enter the following commands one at a time on the spark shell.

```
val ip="/software/data/names.json"
val op="/software/data/nameop"
spark.sparkContext.setLogLevel("WARN")
val peopleDF = spark.read.json(ip)
val namesDF = peopleDF.select("firstName","lastName")
namesDF.write.option("header","true").csv(op)
```

You can access the spark Web UI using the following URL.
http://127.0.0.1:8080

Click on Application ID → Application Detail UI



Or You can verify the Jobs details Using: http://localhost:4040/jobs/

web UI comes with the following tabs (which may not all be visible at once as they are lazily created on demand, e.g. Streaming tab):

- Jobs
- Stages
- Storage with RDD size and memory use

- Environment
- Executors
- SQL

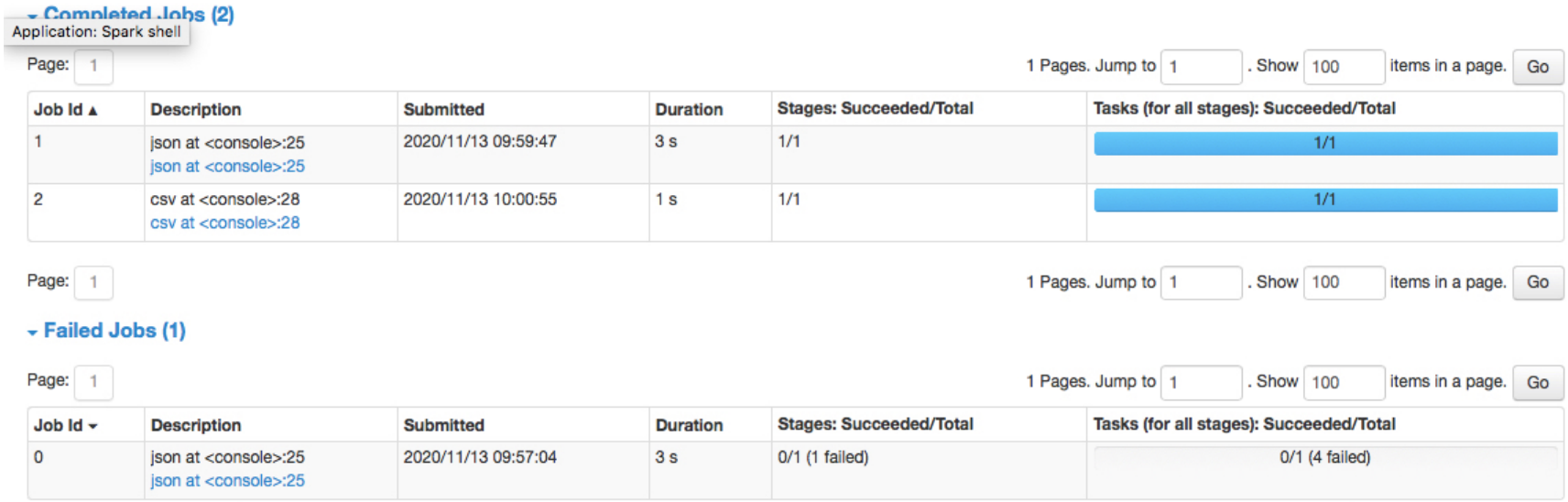
The **Jobs Tab** shows [status of all Spark jobs] in a Spark application

Display the timeline of Executor being added in the Job. When the Job Get completed etc. In above, you can verify that 2 executors have been added.

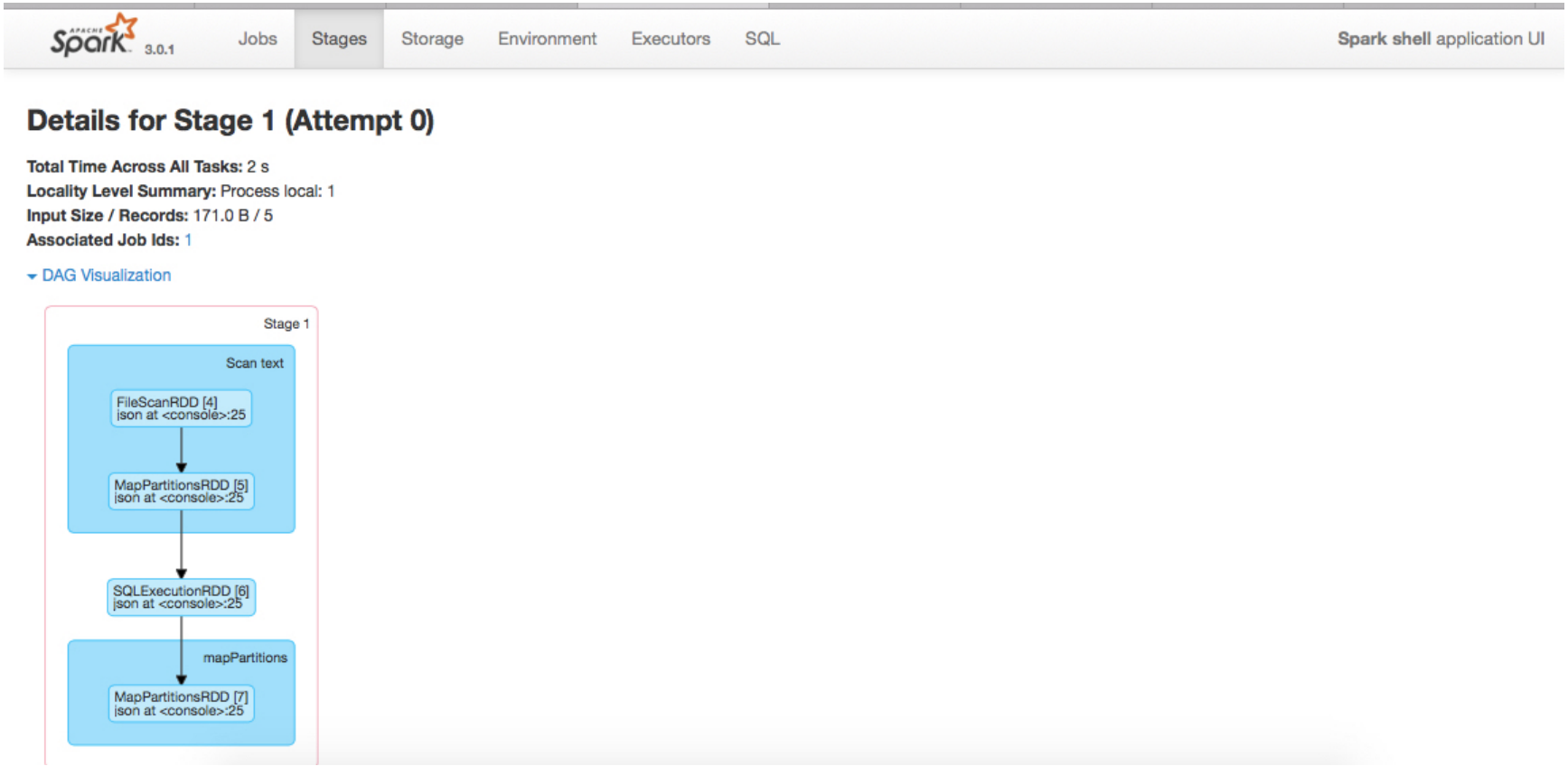
When you hover over a job in Event Timeline not only you see the job legend but also the job is highlighted in the Summary section.

The Event Timeline section shows not only jobs but also executors.

You can verify the completed and failed jobs too:



Click on On job -> for details on Description → stages to view DAG - When you click a job in All Jobs Page page, you see the **Details for Job** page.



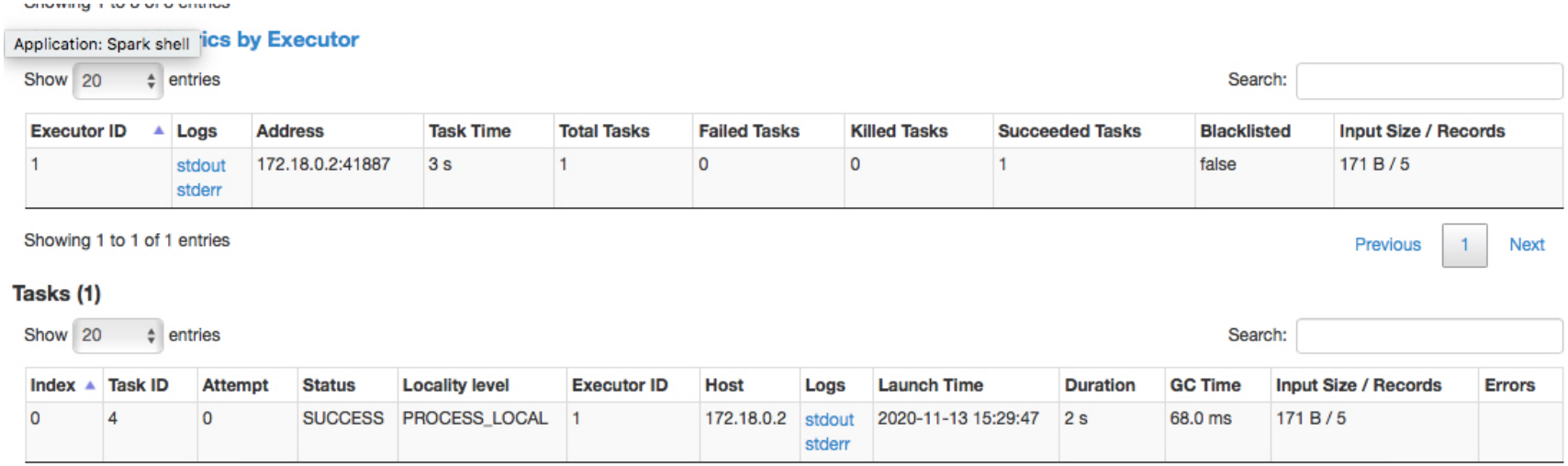
It shows the DAG graph and the stage details.

Summary Metrics for 1 Completed Tasks

Metric	Min	25th percentile	Median	75th percentile	Max
Duration	2 s	2 s	2 s	2 s	2 s
GC Time	68.0 ms	68.0 ms	68.0 ms	68.0 ms	68.0 ms
Input Size / Records	171 B / 5	171 B / 5	171 B / 5	171 B / 5	171 B / 5

Showing 1 to 3 of 3 entries

Scroll down to view the task metrics: which task take majority of the time etc. How much byte consume or output by each task and its statistics.



Executors Tab
Stats of each executor, how much time it spents on GC etc. How much data get shuffle?
Executors tab in web UI shows

Summary

	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write
Active(3)	1	23.4 KB / 1.3 GB	0.0 B	2	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B
Dead(4)	2	46.8 KB / 1.7 GB	0.0 B	4	0	0	7	7	1.0 min (6 s)	21 KB	0.0 B	0.0 B
Total(7)	3	70.2 KB / 3 GB	0.0 B	6	0	0	7	7	1.0 min (6 s)	21 KB	0.0 B	0.0 B

Executors

Show 20 entries Search:

Executor ID	Address	Status	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write	Logs	Thread Dump
driver	192.168.188.173:54112	Active	1	23.4 KB / 434 MB	0.0 B	0	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B		Thread Dump
0	192.168.188.173:54931	Dead	1	23.4 KB / 434 MB	0.0 B	1	0	0	4	4	37 s (6 s)	9.5 KB	0.0 B	0.0 B	stdout stderr	Thread Dump
1	192.168.188.174:34320	Dead	1	23.4 KB / 434 MB	0.0 B	1	0	0	3	3	25 s (0.3 s)	11.5 KB	0.0 B	0.0 B	stdout stderr	Thread Dump
2	192.168.188.174:46874	Dead	0	0.0 B / 434 MB	0.0 B	1	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B	stdout stderr	Thread Dump
3	192.168.188.173:34382	Dead	0	0.0 B / 434 MB	0.0 B	1	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B	stdout stderr	Thread Dump
4	192.168.188.174:44548	Active	0	0.0 B / 434 MB	0.0 B	1	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B	stdout stderr	Thread Dump

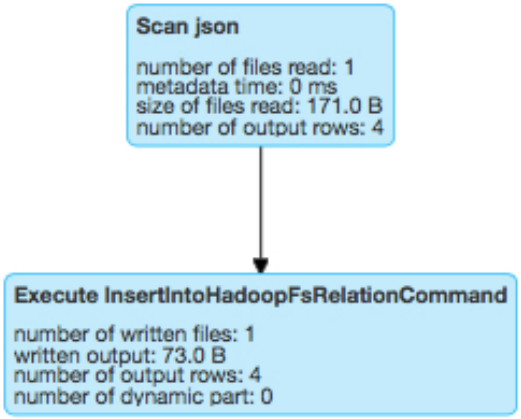
Click on SQl tab

Application: Spark shell

uery 0

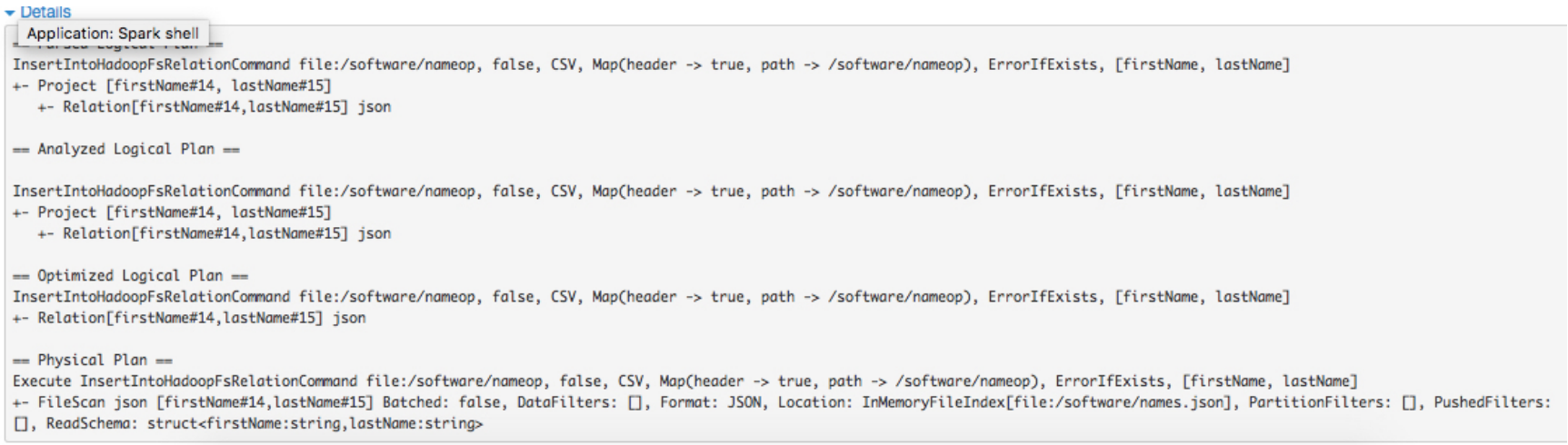
Submitted Time: 2020/11/13 10:00:55
Duration: 2 s
Succeeded Jobs: 2

☐ Show the Stage ID and Task ID that corresponds to the max metric



▼ Details

Verify the plan



---------- Lab Ends Here