Spark Tutorial

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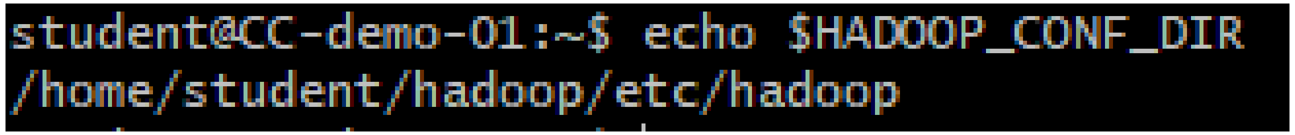
Preparation

- Download Spark package
  - wget http://us.mirrors.quenda.co/apache/spark/spark-2.4.0/spark-2.4.0-bin-hadoop2.7.tgz
- Unpack
  - tar zxvf spark-2.4.0-bin-hadoop2.7.tgz
  - ln -s spark-2.4.0-bin-hadoop2.7 spark
- Install scala: sudo apt install scala
- Try Spark shell (local mode)
  - bin/spark-shell --master local[2]

```
val NUM_SAMPLES = 1000
val count = sc.parallelize(1 to NUM_SAMPLES).filter { _ =>
  val x = math.random
  val y = math.random
  x*x + y*y < 1
}.count()
println(s"Pi is roughly ${4.0 * count / NUM_SAMPLES}")
```

Run Spark Shell with YARN

- Check HDFS and YARN services and environment configuration
  - jps
  - Add “$HADOOP_CONF_DIR=/home/student/hadoop/etc/hadoop” to the ~/.bashrc
  - source ~/.bashrc
  - echo $HADOOP_CONF_DIR



```
student@CC-demo-01:~$ echo $HADOOP_CONF_DIR
/home/student/hadoop/etc/hadoop
```

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

```
val NUM_SAMPLES = 1000
val count = sc.parallelize(1 to NUM_SAMPLES).filter { _ =>
  val x = math.random
  val y = math.random
  x*x + y*y < 1
}.count()
println(s"Pi is roughly ${4.0 * count / NUM_SAMPLES}")
```

Run Spark example program with YARN

-
  ```
  bin/spark-submit --class org.apache.spark.examples.SparkPi \
  --master yarn \
  --deploy-mode cluster \
  --driver-memory 512m \
  --executor-memory 512m \
  --executor-cores 1 \
  --queue default \
  examples/jars/spark-examples*.jar \
  10
  ```

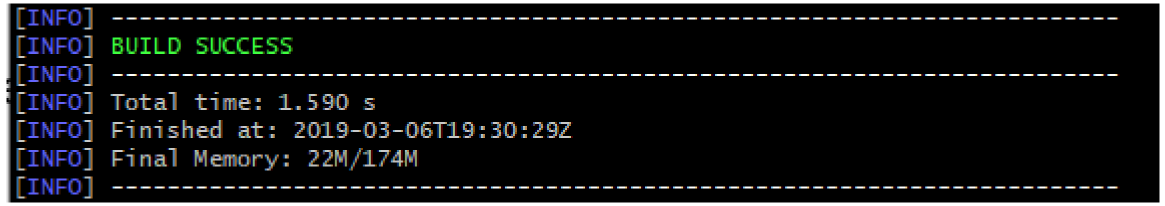
Package and Run your Spark JAVA program

- Directory Structure:
  - pom.xml
  - src/main/java/your_program.java
- SimpleApp.java (pom.xml is in the package)

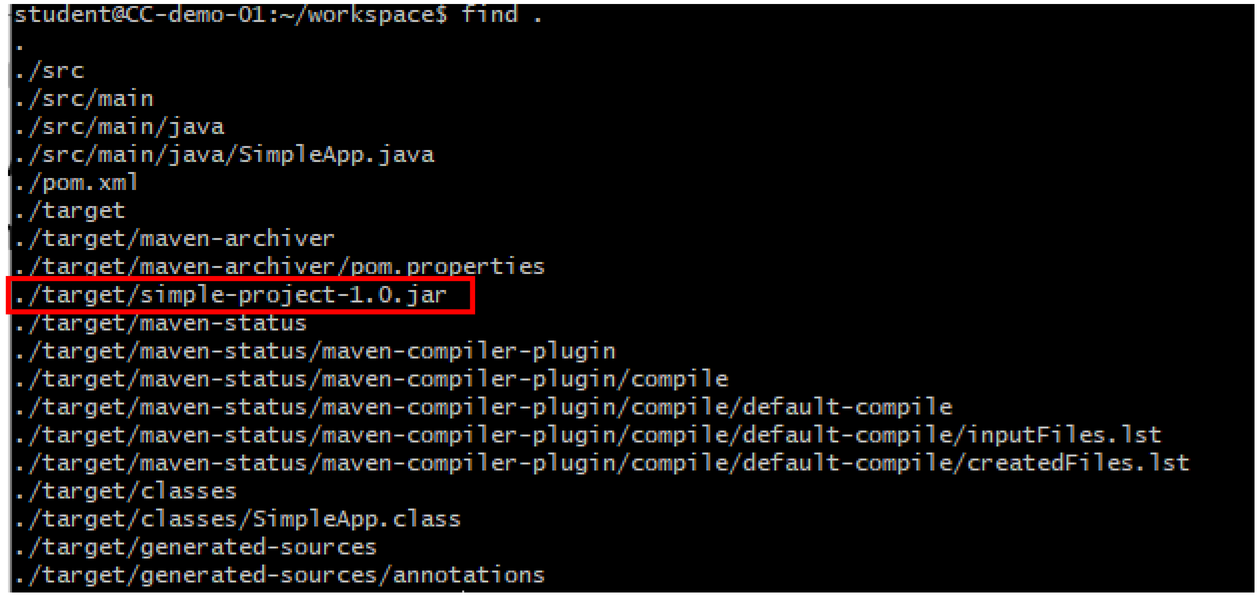
```
/* SimpleApp.java */
import org.apache.spark.sql.SparkSession;
import org.apache.spark.sql.Dataset;

public class SimpleApp {
  public static void main(String[] args) {
    String logFile = "README.md"; // Should be some file on your system
    SparkSession spark = SparkSession.builder().appName("Simple Application").getOrCreate();
    Dataset<String> logData = spark.read().textFile(logFile).cache();

    long numAs = logData.filter(s -> s.contains("a")).count();
    long numBs = logData.filter(s -> s.contains("b")).count();

    System.out.println("Lines with a: " + numAs + ", lines with b: " + numBs);

    spark.stop();
  }
}
```

Package and Run your Spark JAVA program

- Use maven to package the program:
  - Make sure you install maven on the client:
    - sudo apt-get install maven
  - Package the program:
    - mvn package
  - Check the output files
    - find .



```
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 1.590 s
[INFO] Finished at: 2019-03-06T19:30:29Z
[INFO] Final Memory: 22M/174M
[INFO] ------------------------------------------------------------------------
```

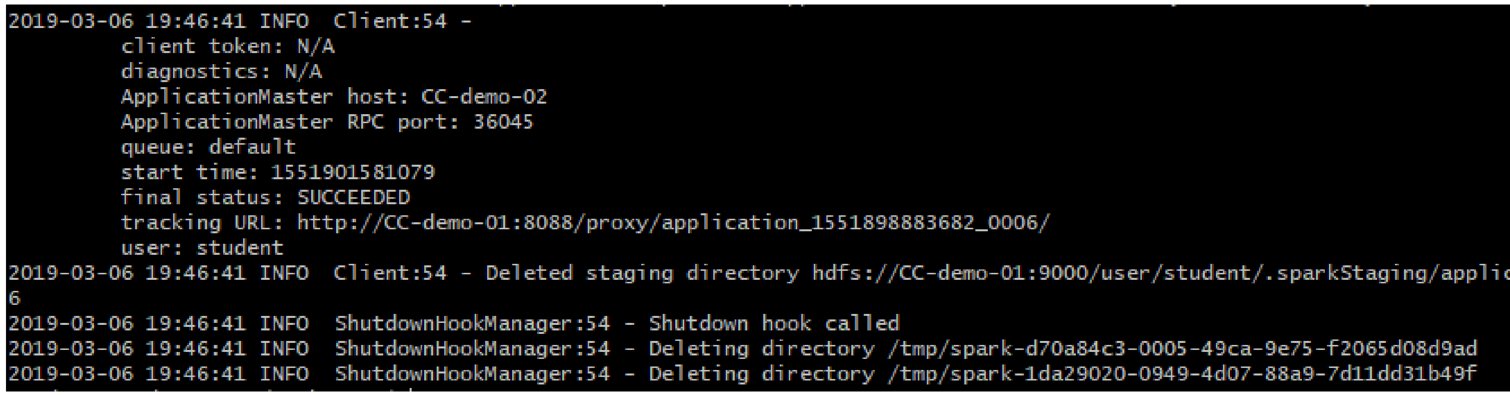


```
student@CC-demo-01:~/workspace$ find .
.
./src
./src/main
./src/main/java
./src/main/java/SimpleApp.java
./pom.xml
./target
./target/maven-archiver
./target/maven-archiver/pom.properties
./target/simple-project-1.0.jar
./target/maven-status
./target/maven-status/maven-compiler-plugin
./target/maven-status/maven-compiler-plugin/compile
./target/maven-status/maven-compiler-plugin/compile/default-compile
./target/maven-status/maven-compiler-plugin/compile/default-compile/inputFiles.lst
./target/maven-status/maven-compiler-plugin/compile/default-compile/createdFiles.lst
./target/classes
./target/classes/SimpleApp.class
./target/generated-sources
./target/generated-sources/annotations
```

Package and Run your Spark JAVA program

- Directory Structure:
  - pom.xml
  - src/main/java/your_program.java
  - target/your_program*.jar
- Put the example file into HDFS
  - hdfs dfs –put ~/spark/README.md
- Run the program with spark-submit
  - ~/spark/bin/spark-submit --class "SimpleApp" \

```
    --master yarn \
    --deploy-mode cluster\
     --driver-memory 1g \
     --executor-memory 1g \
    --executor-cores 1 \
    --queue default \
    target/simple*.jar
```



```
2019-03-06 19:46:41 INFO  Client:54 -
         client token: N/A
         diagnostics: N/A
         ApplicationMaster host: CC-demo-02
         ApplicationMaster RPC port: 36045
         queue: default
         start time: 1551901581079
         final status: SUCCEEDED
         tracking URL: http://CC-demo-01:8088/proxy/application_1551898883682_0006/
         user: student
2019-03-06 19:46:41 INFO  Client:54 - Deleted staging directory hdfs://CC-demo-01:9000/user/student/.sparkStaging/applic
6
2019-03-06 19:46:41 INFO  ShutdownHookManager:54 - Shutdown hook called
2019-03-06 19:46:41 INFO  ShutdownHookManager:54 - Deleting directory /tmp/spark-d70a84c3-0005-49ca-9e75-f2065d08d9ad
2019-03-06 19:46:41 INFO  ShutdownHookManager:54 - Deleting directory /tmp/spark-1da29020-0949-4d07-88a9-7d11dd31b49f
```

Q & A

FAQ

- The compatibility of Spark, Hadoop and JAVA
  - From Spark Official website:
  - Spark runs on Java 8+, Python 2.7+/3.4+ and R 3.1+. For the Scala API, Spark 2.4.0 uses Scala 2.11. You will need to use a compatible Scala version (2.11.x).
- The comparison in Part 3
  - Required: compare the performance of using the cached RDD feature and without using the cached RDD feature.
  - This means that you need to play with the spark RDD with comparing the way of writing the program with reusing the intermediate results and without reusing the intermediate results.

FAQ

- Do I need to do any configuration for Spark
  - No, you do not. Because if you indicate to use YARN to run spark, it will automatically use the environment parameter “HADOOP_CONF_DIR” to find the Hadoop configuration files.