GETTING STARTED WITH AMAZON WEB SERVICES

Note: You are responsible for managing your own account and cluster. You should **terminate** your cluster after you are done. You should manage your account carefully so that you do not exceed the education credits provided by Amazon. The instructor is not responsible for any financial loss or charges that you may incur.

Pre-Requisites

Before getting started, make sure you have the following:

1. AWS account –

Sign up for an account at https://aws.amazon.com/

You can apply for AWS Educate credit here:

https://aws.amazon.com/education/awseducate/

2. SSH client:

Mac OS X: Already has a built-in SSH client using Terminal App

Windows:

- You can download a SSH client like PuTTY. You can find a list at:

https://www.ssh.com/ssh/client

Unix: Already has lot of support for command line and SSH

3. AWS Key Pair:

Follow the instructions below to create a key pair. Note the region where you created the key pair.

https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-key-pairs.html#having-ec2-create-your-key-pair

Note: If you are using a Windows SSH client like PuTTY, you need to convert .pem key to .ppk format. Follow the instructions here:

https://docs.aws.amazon.com/quickstarts/latest/vmlaunch/step-2-connect-to-instance.html

4. Local Development Tools:

You need a way to build projects locally and generate jar files. The following are required:

- **Java installation** with JDK (JDK 1.8 works best, JDK 9 is not compatible with many applications). You should be able to type **java -version** in cmder and get an output.

- **Scala installation**: can be downloaded from: https://www.scala-lang.org/download/. You should be able to type **scala -version** in cmdr and get an output. Scala version 2.11.8 is recommended.

- **Spark installation:**

    For Mac OS X:
    https://medium.freecodecamp.org/installing-scala-and-apache-spark-on-mac-os-837ae57d283f

    For Windows 10 (Pro Edition):
    You have to follow **all** instructions on this page:
    https://hernandezpaul.wordpress.com/2016/01/24/apache-spark-installation-on-windows-10/

    or on this page:
    https://hernandezpaul.wordpress.com/2016/01/24/apache-spark-installation-on-windows-10/

- **IntelliJ with Scala support:**
    Install the IDE IntelliJ and make sure to install the Scala plugin. Follow the instructions here:
https://docs.scala-lang.org/getting-started-intellij-track/getting-started-with-scala-in-intellij.html
and make sure you can build and compile some sample code.

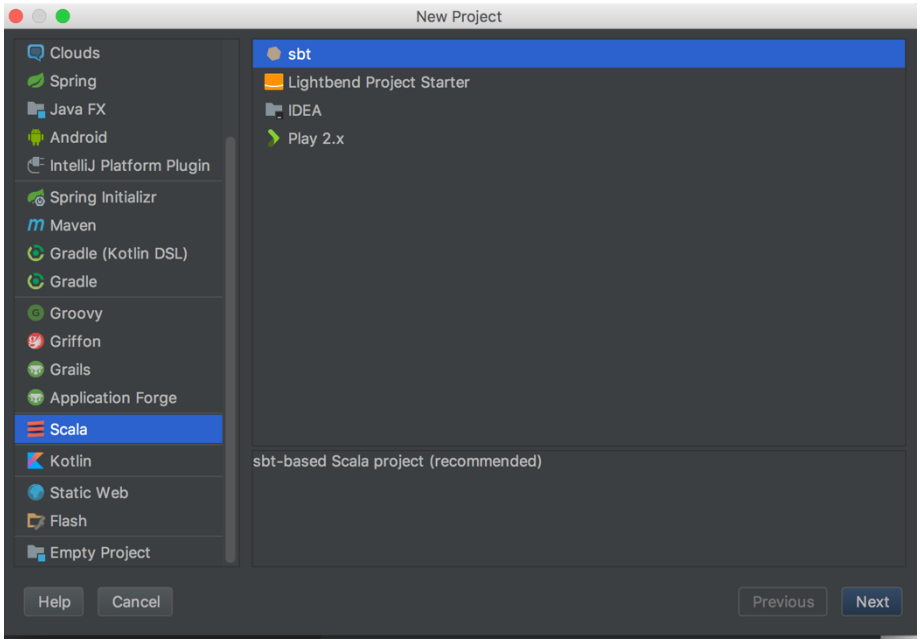
Building and Running a Simple Application

We are going to build a very simple application locally, generate jar file, and run it on AWS EMR. Please follow the steps below completely:

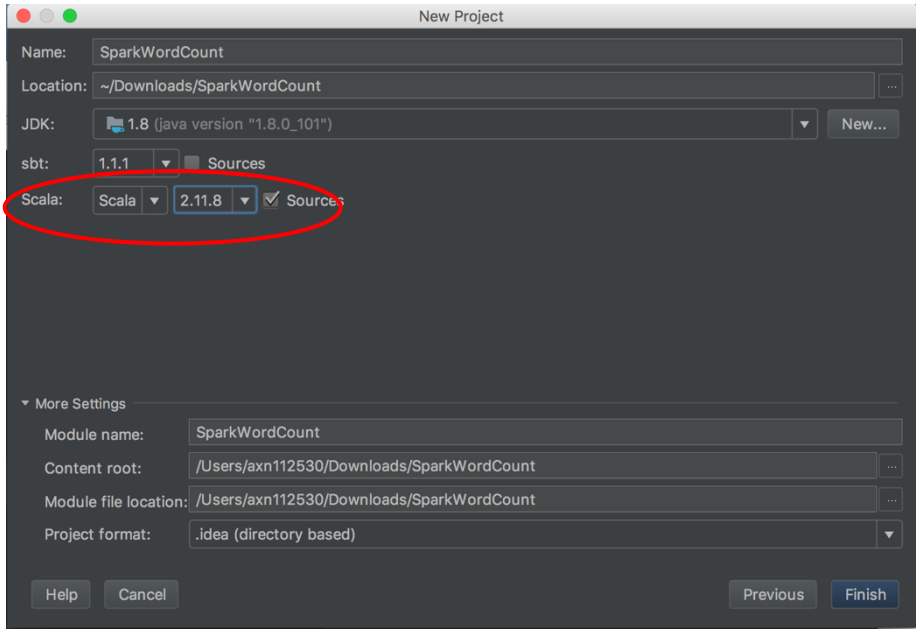
Step I: Building the Application

Note: You can download this project from
http://www.utdallas.edu/~axn112530/cs6350/spark/SparkWordCount.zip

Open IntelliJ Idea and choose "Create New Project". Choose "Scala" on the left pane, and "sbt" in the center pane:

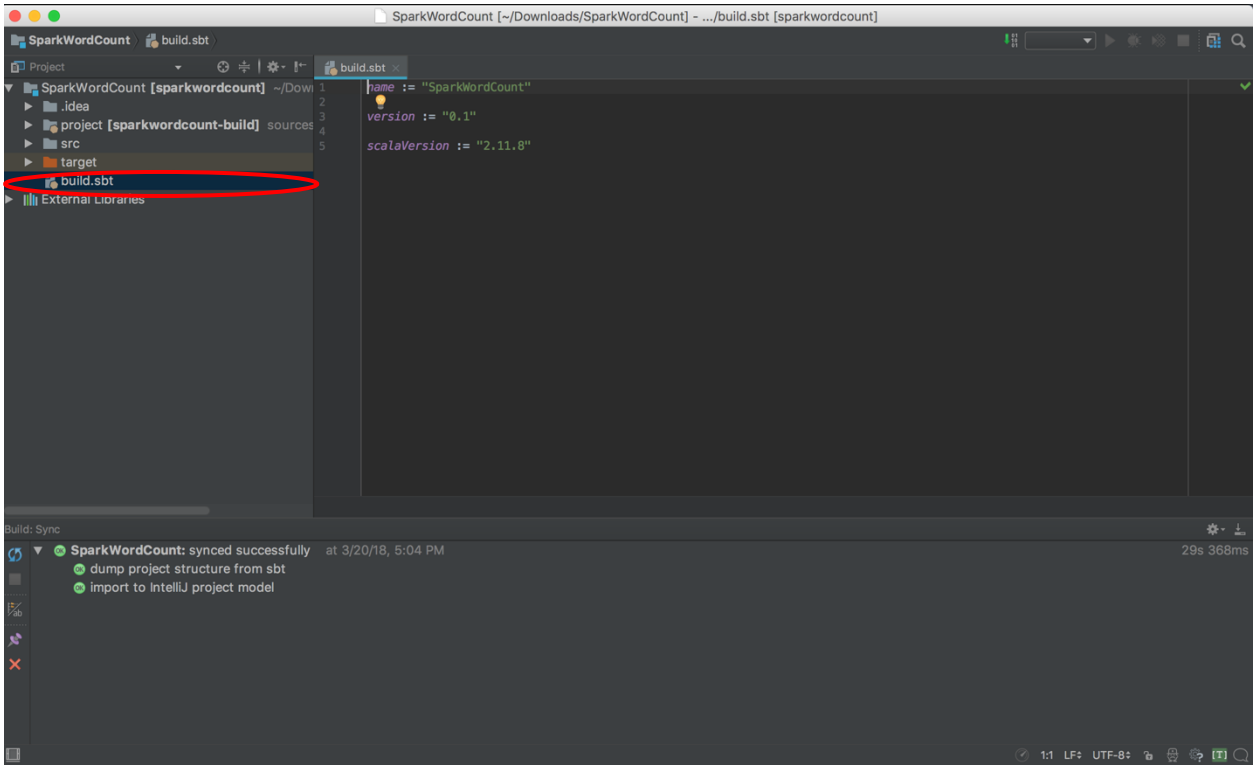


In the next screen, choose a name for your application ("SparkWordCount") and choose Scala version 2.11.8 (Important)



If you are performing these steps for the first time, it might take a bit for sbt project structure to be dumped. Be patient ☺

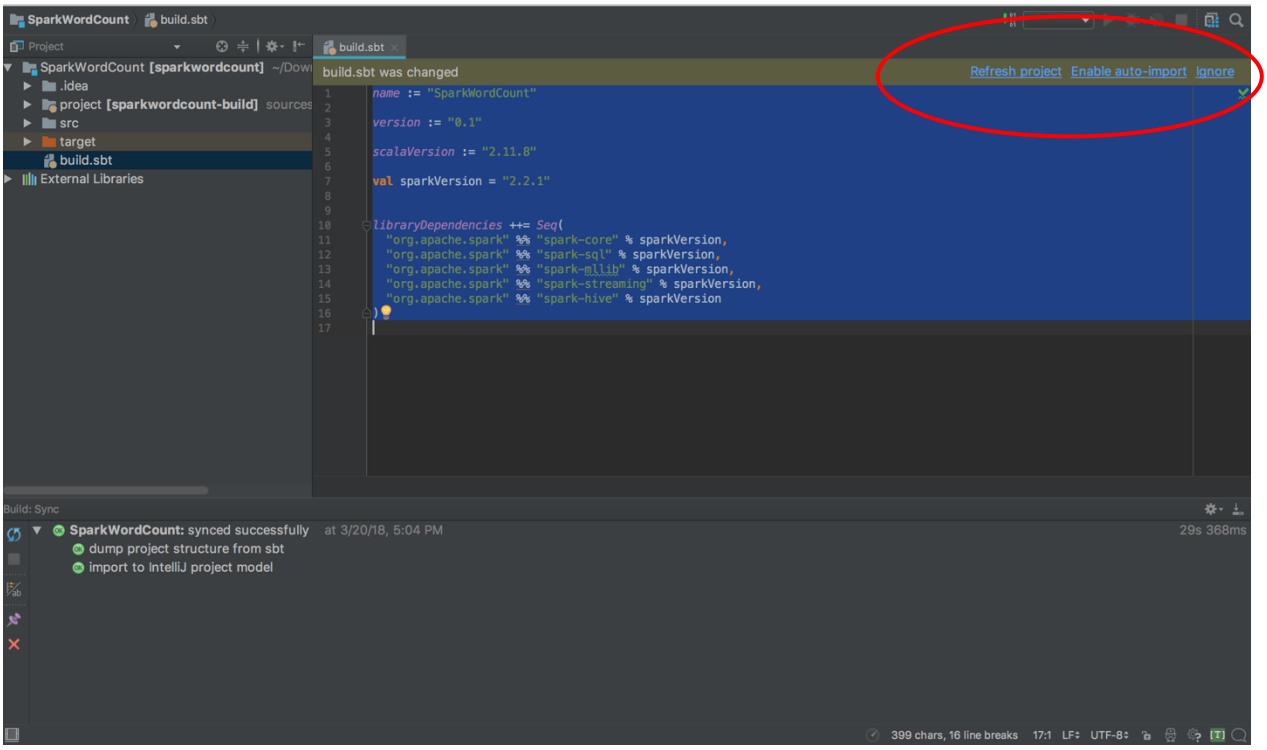
Open the build.sbt file. This file is used for managing dependencies and downloading jar files that your program needs.



Modify this file so that it contains the following:

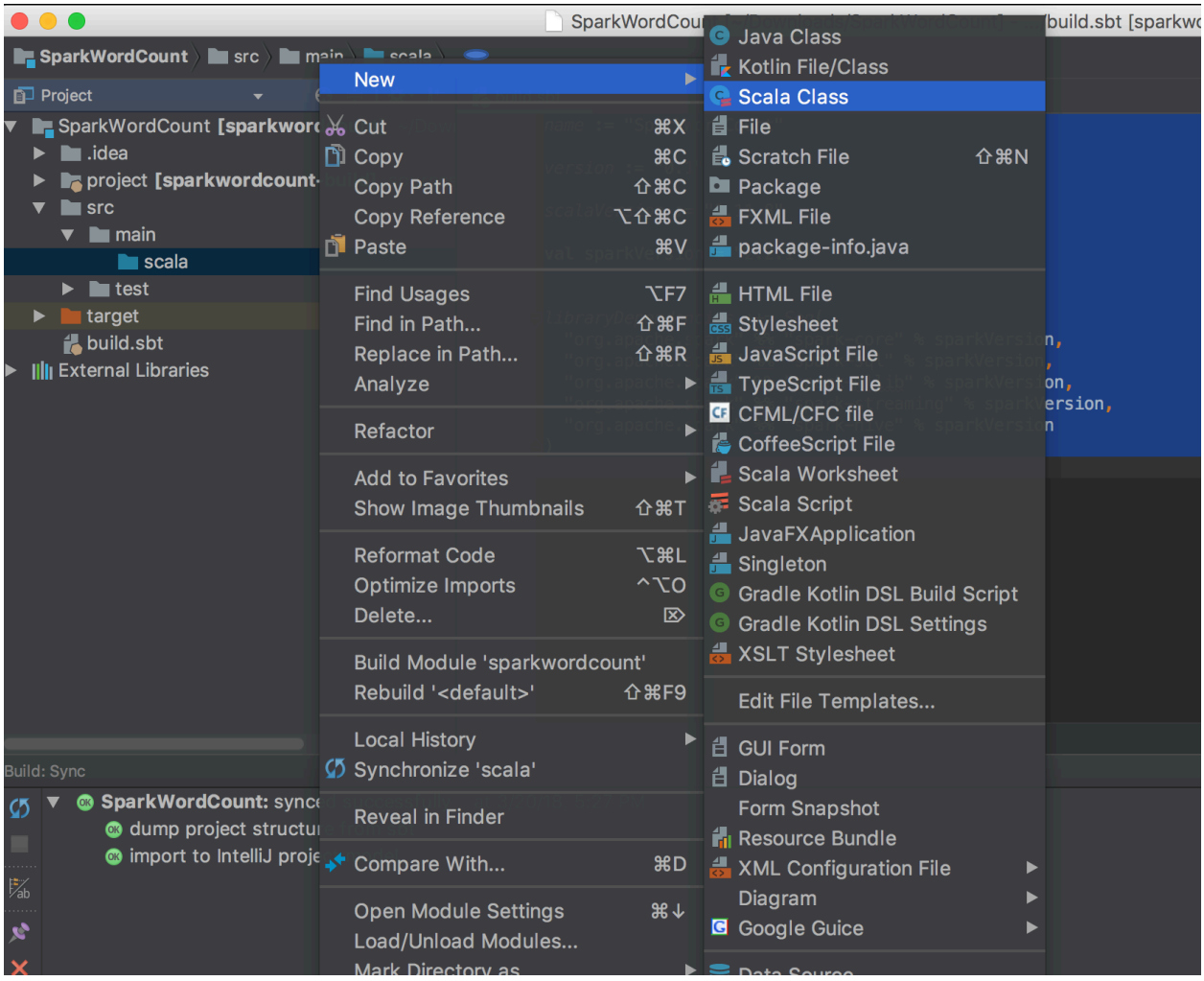
```
name := "SparkWordCount"

version := "0.1"

scalaVersion := "2.11.8"

val sparkVersion = "2.2.1"


libraryDependencies ++= Seq(
  "org.apache.spark" %% "spark-core" % sparkVersion,
  "org.apache.spark" %% "spark-sql" % sparkVersion,
  "org.apache.spark" %% "spark-mllib" % sparkVersion,
  "org.apache.spark" %% "spark-streaming" % sparkVersion,
  "org.apache.spark" %% "spark-hive" % sparkVersion
)
```

When you do this, the IDE might show a message on top

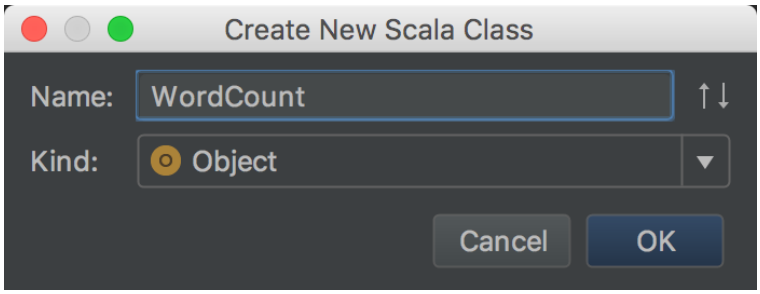


Click on either “Refresh Project” or “Enable auto-import” to import the dependencies. This might take a while if you are doing this for the first time. If everything succeeds, you should see a bunch of jar files appear under the “External Libraries” folder.

Now click on src -> main -> scala in the Project Explorer pane on the left, and then *right click* on "scala" to open the dialog box as shown in the next figure. Choose "Scala Class"



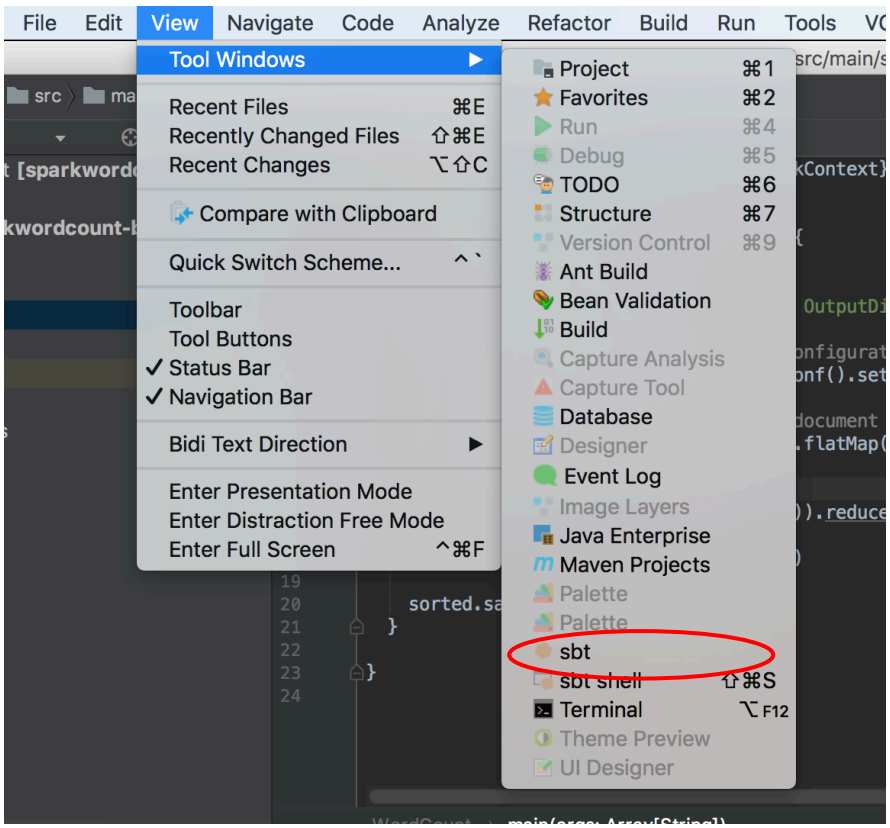
In the next dialog box, name your class and change the "kind" property to be "Object"



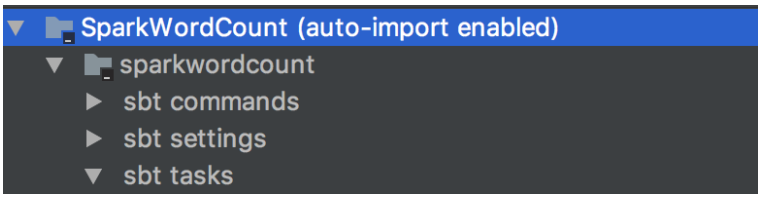
Next, we will write the code below in the file WordCount.scala

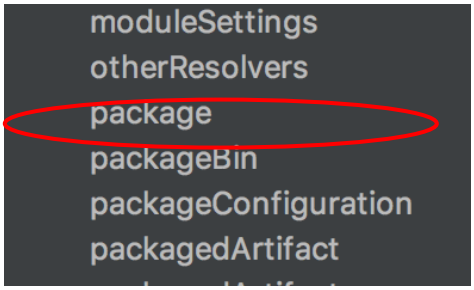
```scala
import org.apache.spark.{SparkConf, SparkContext}

object WordCount {
  def main(args: Array[String]): Unit = {

    if (args.length != 2) {
      println("Usage: WordCount InputDir OutputDir")
    }
    // create Spark context with Spark configuration
    val sc = new SparkContext(new SparkConf().setAppName("Spark Count"))

    // read in text file and split each document into words
    val tokenized = sc.textFile(args(0)).flatMap(_.split(" "))

    // count the occurrence of each word
    val wordCounts = tokenized.map((_, 1)).reduceByKey(_ + _)

    val sorted = wordCounts.sortBy(-_._2)

    sorted.saveAsTextFile(args(1))
  }

}
```

Now go to “View” menu and then click on “Tool Windows” and then click “sbt”

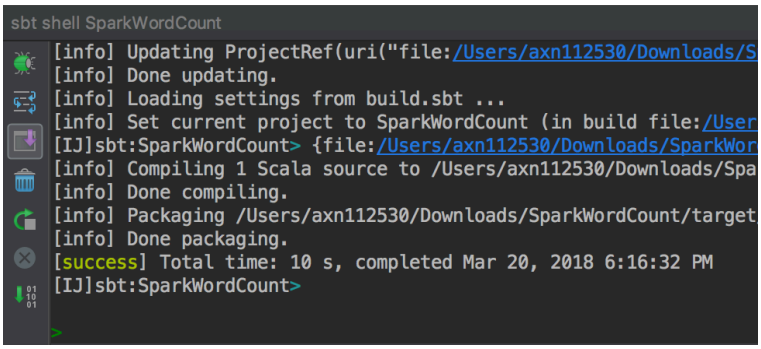


On the “sbt projects” pane on the right, expand “sbt tasks” and then go down to the “package” task and double click on it.

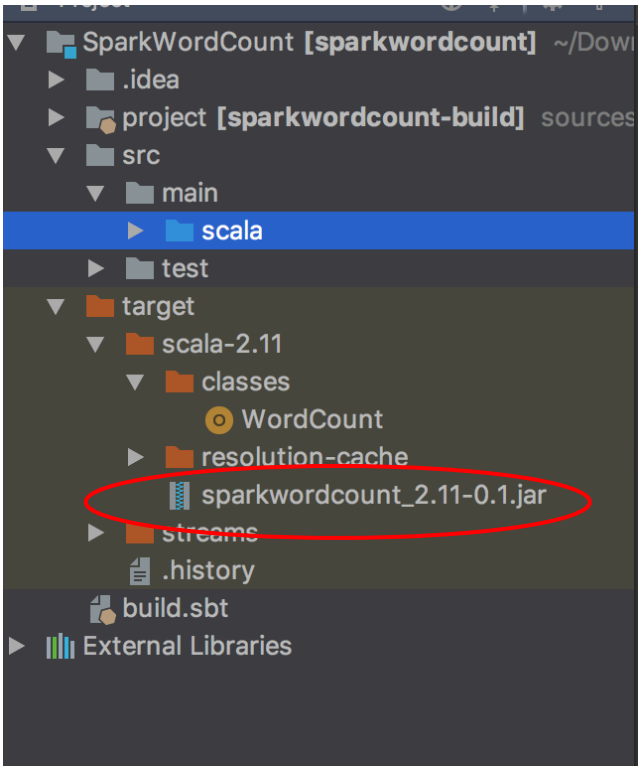




If everything goes OK, you should see a success message in the output window:



You should also see a jar file in the target/scala-2.11/classes folder:

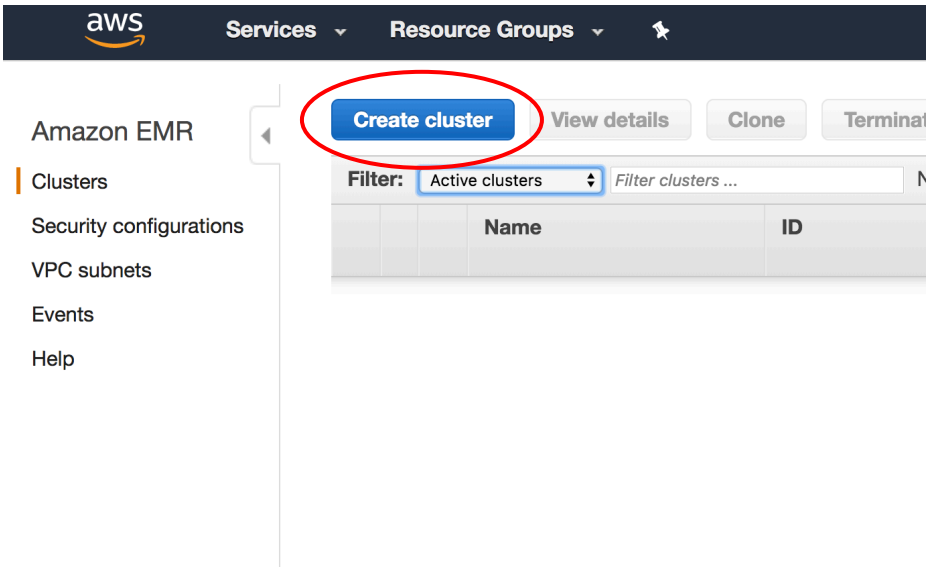


Now, we can run this jar file on AWS cluster.

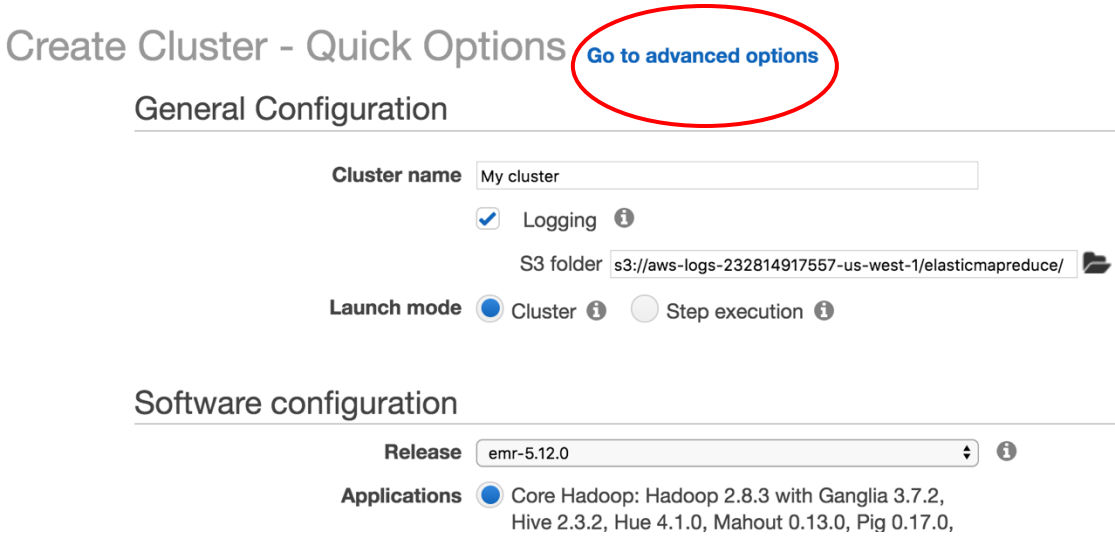
Step II: Launching AWS Cluster

Go to the link https://aws.amazon.com/emr/ and sign into your account. Make sure the region matches the region where you created your key pair. For example, if you created a key pair in N.California, you should start your cluster also in N.California.

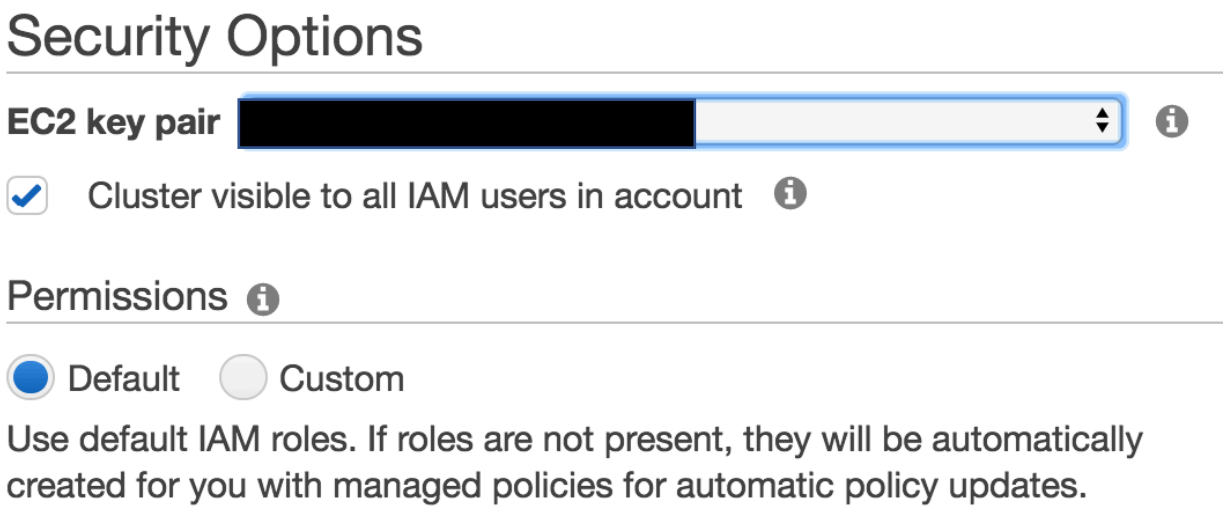
Create on the "Create Cluster" button:



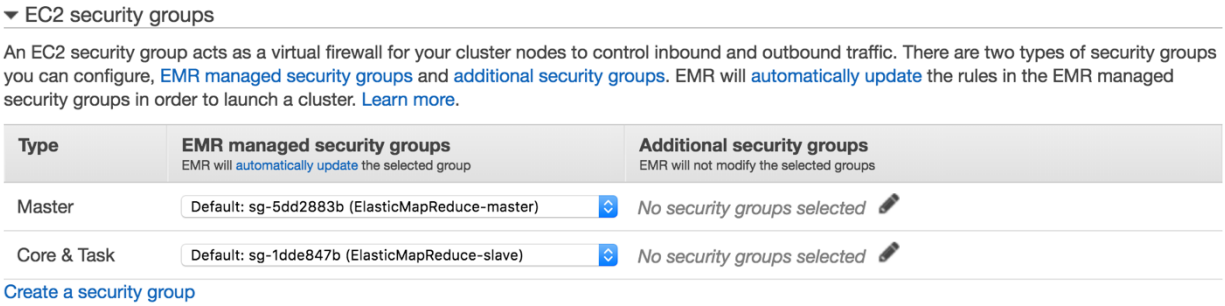
In the next screen, click on “Go to advanced options” link:



In the advanced options screen, choose “Spark 2.2.1” and leave everything else as it is. Click next and accept other default values. Accept defaults on the next screen for Hardware Configuration also. In the General Options screen also, accept the default values. In the Security Options screen, make sure to select a valid key pair and default permissions:



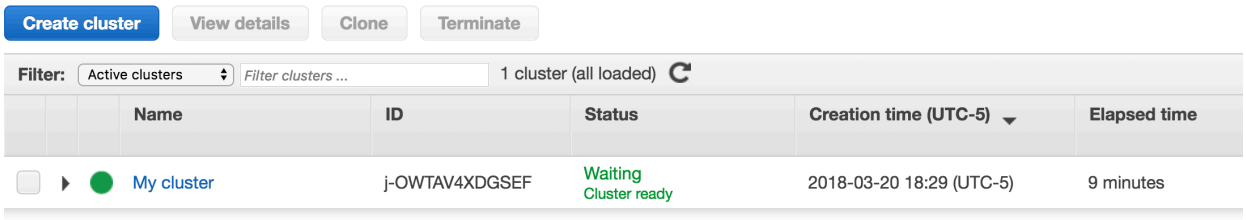
In the “EC2 security group”, it should show you the name of the managed security group.



Optional: Some people have found the step below useful. It’s not required for most cases.

Note the name of the security group for the master. Then go to https://console.aws.amazon.com/vpc/ and then click on “Security Groups” on left pane. Look for the name of the security group and check the box next to it. Modify the inbound and outbound rules to allow traffic from all TCP or your own IP.

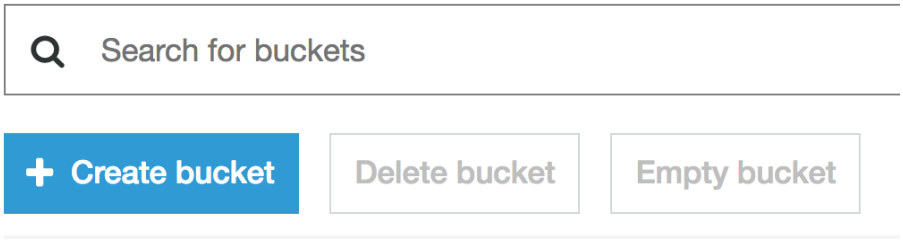
Finally click on “Create Cluster” button. The cluster creation process should take about 10-15 minutes. If it takes much longer, it’s likely that you made a mistake in one of the choices. When the cluster is ready, it will go to the “Waiting” stage:



Step III: Running the jar file

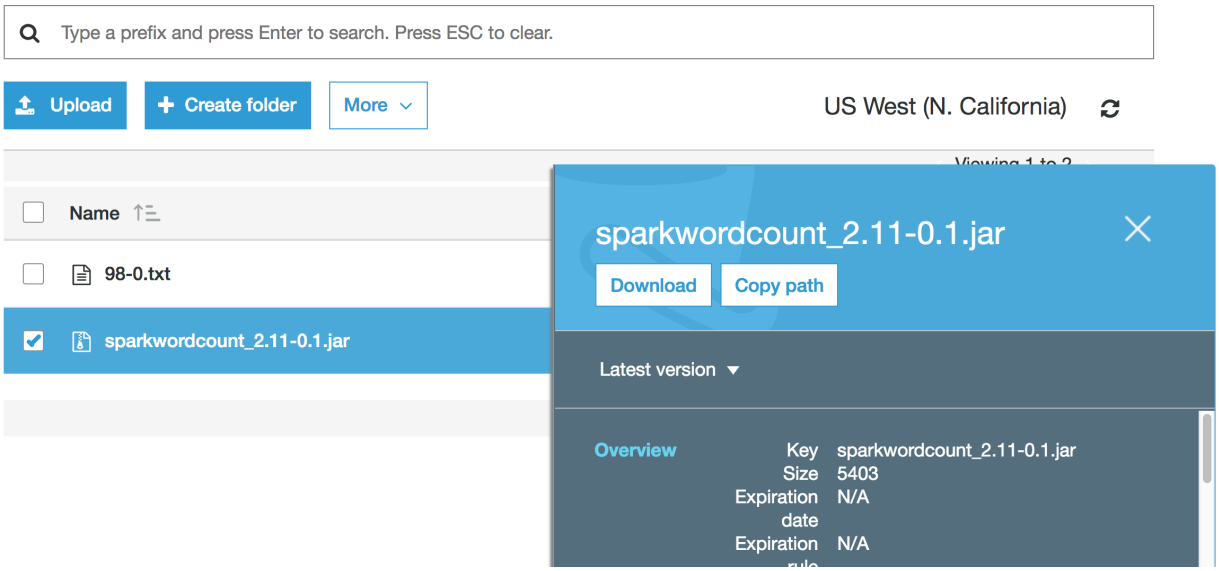
Run your jar file as below:

Login into your S3 account: https://aws.amazon.com/s3/ and create bucket in the same region (e.g. N. California)

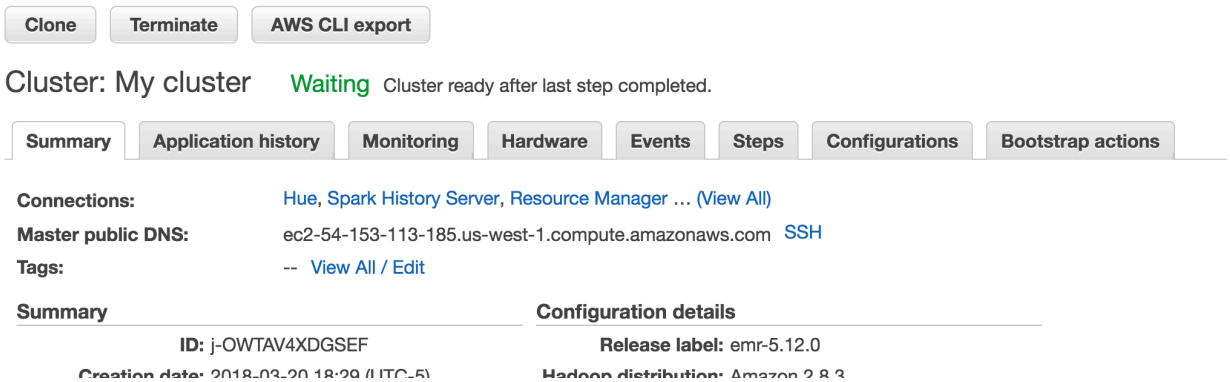


Make sure your bucket name is unique. Accept all default values and create the bucket.

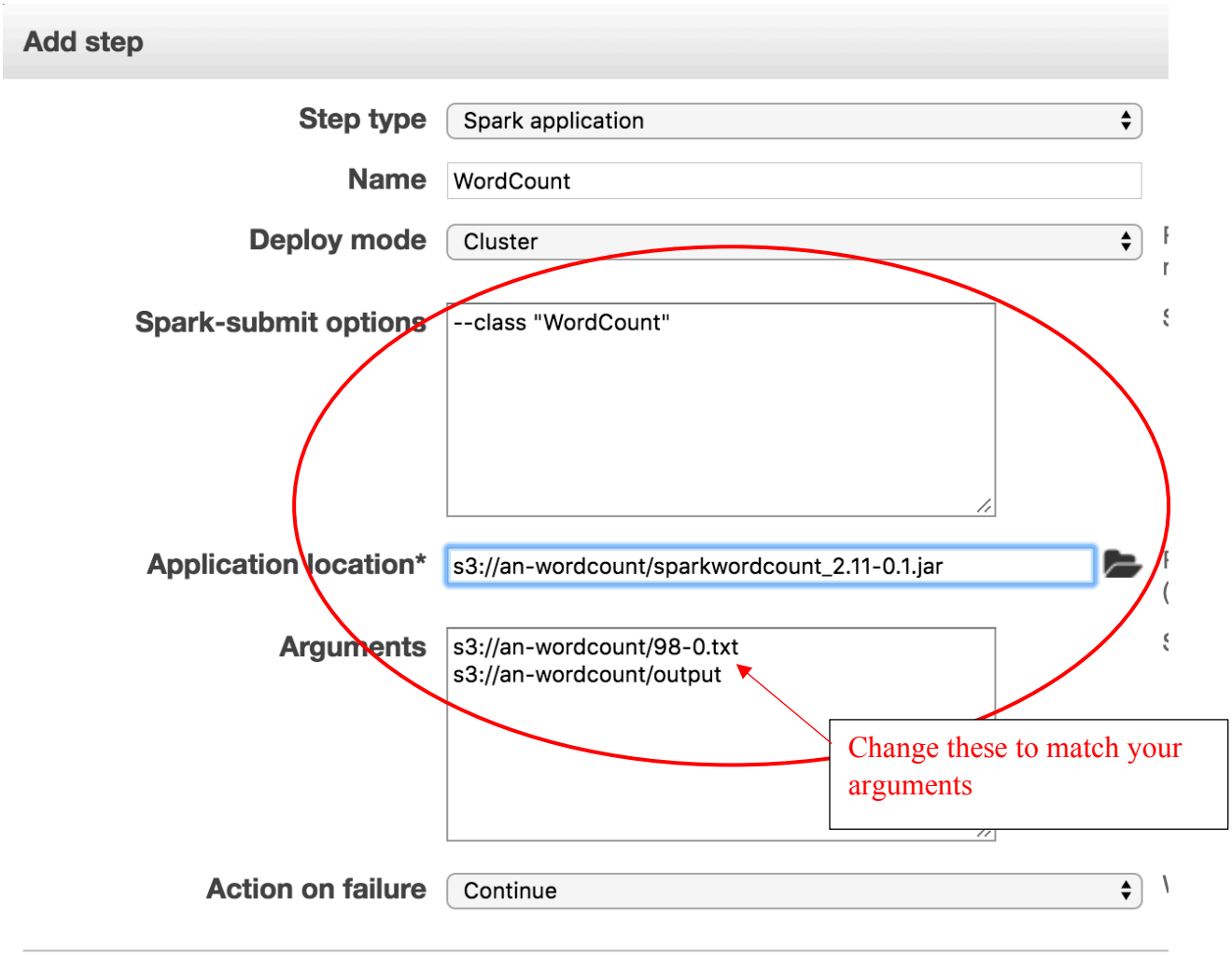
Download any text file from the Gutenberg project (http://www.gutenberg.org/) to your computer and then upload it to S3 bucket. Also upload the jar file that you created earlier to your S3 bucket. You can click on the files in S3 to copy their paths to your clipboard:



Now go back to your EMR cluster, click on the cluster name and then click on the “Steps” tab.

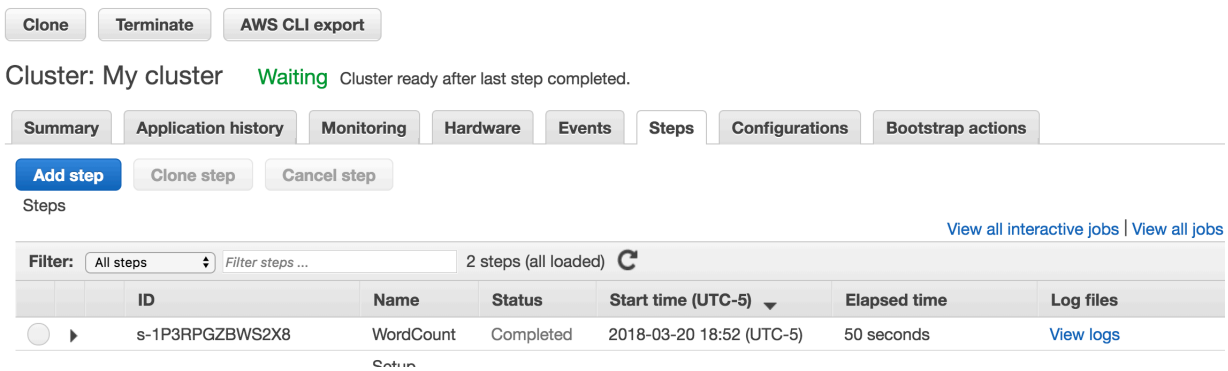


Click on “Add Step” and then fill in the values as shown below:

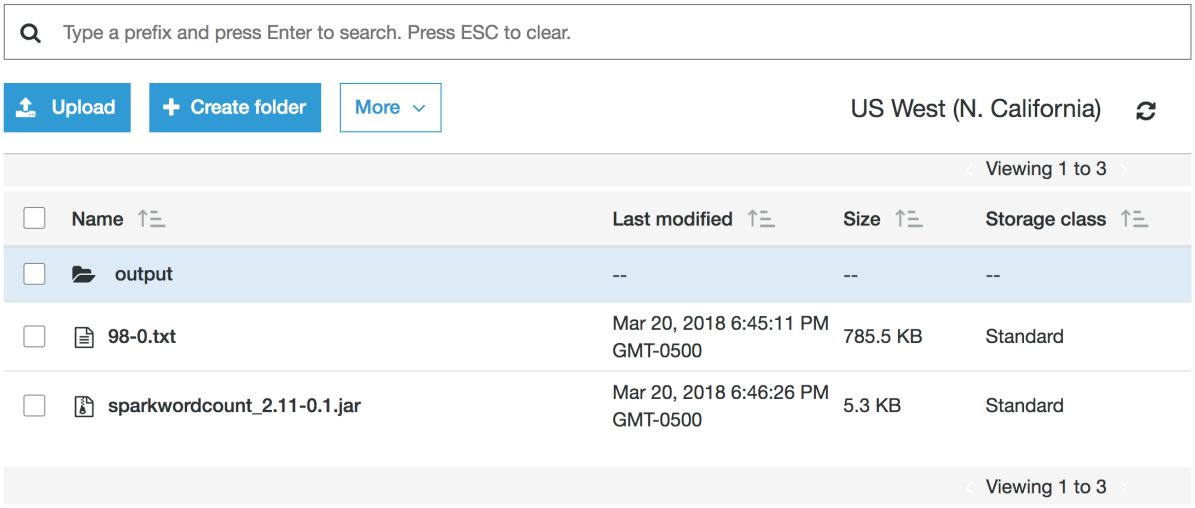


Use your own bucket’s path. My bucket name is “**an-wordcount**” -> change it to match your s3 path, and my file name was “**98-0.txt**” -> change it to match your file name.

Run this step and wait for it to be completed:



After completion, in your S3 bucket, you will have a directory called “output” (the second parameter), with the code output:



Please complete all the steps above. If you have questions, please post on Piazza. **Remember to terminate your cluster after you are done.**

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