AmazonEMRIntro

Introduction

Amazon EMR provides a managed Hadoop framework that makes it easy, fast, and cost-effective to process vast amounts of data across dynamically scalable Amazon EC2 instances.

You can run popular distributed frameworks such as Apache Spark, HBase, Presto, and Flink in Amazon EMR, and interact with data in other AWS (Amazon Web Services) data stores such as Amazon S3 and Amazon DynamoDB.

Amazon EMR securely and reliably handles a broad set of big data use cases, including log analysis, web indexing, data transformations (ETL), machine learning, financial analysis, scientific simulation, and bioinformatics.

Primary references:

Amazon Elastic MapReduce

https://aws.amazon.com/emr/

Amazon EMR Management Guide
http://docs.aws.amazon.com/emr/latest/ManagementGuide/emr-what-is-emr.html

Amazon Elastic MapReduce API
http://docs.aws.amazon.com/ElasticMapReduce/latest/API/Welcome.html

Amazon EMR Release Guide
http://docs.aws.amazon.com/emr/latest/ReleaseGuide/emr-hadoop-application.html

Apache Hadoop

http://hadoop.apache.org/

Programming Elastic MapReduce Using AWS Services to Build an End-to-End Application, Kevin Schmidt, Christopher Phillips, O'Reilly Media, December 2013.
http://shop.oreilly.com/product/0636920029304.do

Key components

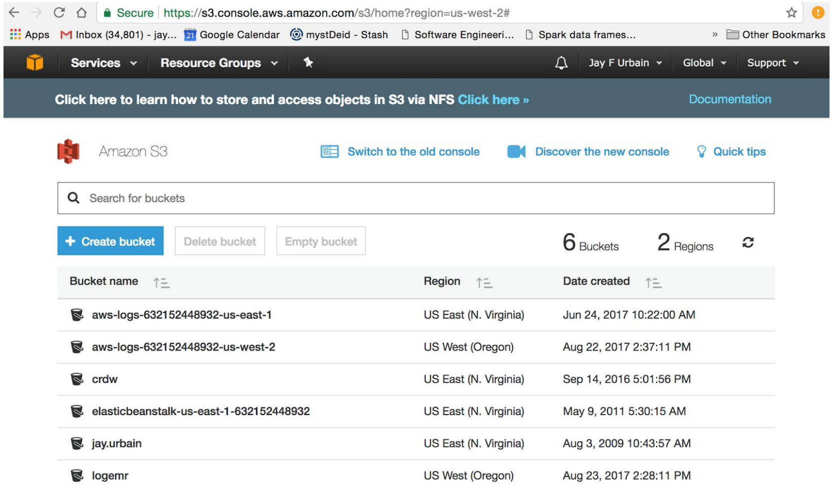
Amazon Elastic MapReduce (EMR)

Amazon EMR is an in-the-cloud platform of the Hadoop framework. Amazon EMR makes heavy use of the Amazon Simple Storage Service (S3) to store analysis results and host data sets for processing, and leverages Amazon Elastic Cloud Compute (EC2) resources to run applications.

There is an additional charge of about 30 percent for the EMR EC2 instances. To read Amazon's overview of EMR, visit the Amazon EMR web page.

Amazon Simple Storage Service (S3)

Amazon S3 is the persistent storage for AWS. It provides a web services interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the Web. There are some restrictions. Data in S3 must be stored in named buckets, and any single object can be no more than 5 terabytes in size. The data stored in S3 is highly durable and is stored in multiple facilities and multiple devices within a facility.



Bucket name	Region	Date created
aws-logs-632152448932-us-east-1	US East (N. Virginia)	Jun 24, 2017 10:22:00 AM
aws-logs-632152448932-us-west-2	US West (Oregon)	Aug 22, 2017 2:37:11 PM
crdw	US East (N. Virginia)	Sep 14, 2016 5:01:56 PM
elasticbeanstalk-us-east-1-632152448932	US East (N. Virginia)	May 9, 2011 5:30:15 AM
jay.urbain	US East (N. Virginia)	Aug 3, 2009 10:43:57 AM
logemr	US West (Oregon)	Aug 23, 2017 2:28:11 PM

There are standard REST- and SOAP-based web service APIs to interact with files stored on S3.

Amazon S3's permanent storage will be used to store data sets and computed result sets generated by Amazon EMR Job Flows. Applications built with Amazon EMR need to use some S3 services for data storage.

Amazon Elastic Compute Cloud (EC2)

Amazon EC2 makes it possible to run multiple instances of virtual machines on demand inside any one of the AWS regions. You can start as many or as few instances as you need without having to buy or rent physical hardware like in traditional hosting services. In the case of Amazon EMR, this means we can scale the size of your Hadoop cluster to any size needed. Individual EC2 instances come in a variety of sizes and specifications to meet the needs of different types of applications. There are instances tailored for high CPU load, high memory, high I/O, etc.

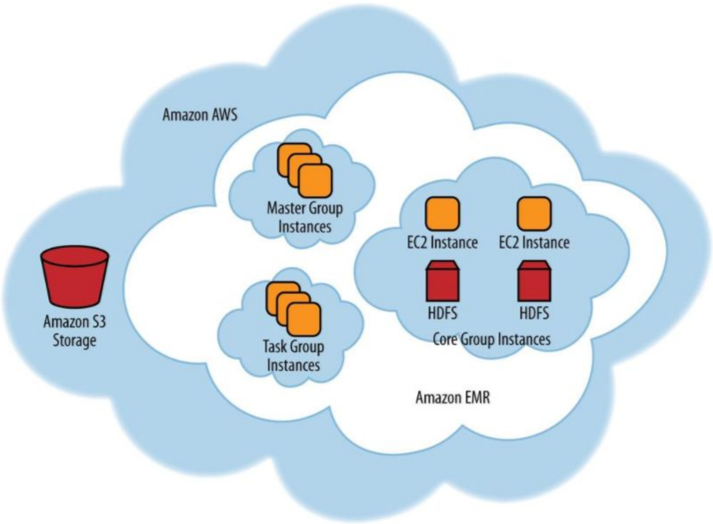
To read Amazon's overview of EC2, visit the Amazon EC2 web page. Amazon EC2 instances are used as part of an Amazon EMR cluster.

Amazon Elastic MapReduce Architecture

Amazon EMR allows users to launch and use resizable Hadoop clusters inside of Amazon's infrastructure. Amazon EMR, like Hadoop, can be used to analyze large data sets. EMR greatly simplifies the setup and management of the cluster of Hadoop and MapReduce components.

EMR instances use Amazon's pre-built and customized EC2 instances, which can take full advantage of Amazon's infrastructure and other AWS services. These EC2 instances are invoked when a new Job Flow is started to form an EMR cluster. A *Job Flow* is Amazon's term for the complete data processing that occurs through a number of compute steps in Amazon EMR. A Job Flow is specified by the MapReduce application and its input and output parameters.

https://aws.amazon.com/emr/



Amazon EMR performs the computational analysis using the MapReduce framework. The MapReduce framework splits the input data into smaller fragments, or shards, that are distributed to the nodes that compose the cluster

Master group instance

The master group instance manages the Job Flow and allocates all the needed executables, JARs, scripts, and data shards to the core and task instances. The master node monitors the health and status of the core and task instances and also collects the data from these instances and writes it back to Amazon S3.

The master group instances serve a critical function in our Amazon EMR cluster. If a master node is lost, you lose the work in progress by the master *and* the core and task nodes to which it had delegated work.

Core group instance

Core group instance members run the map and reduce portions of our Job Flow, and store intermediate data to the Hadoop Distributed File System (HDFS) storage in our Amazon EMR cluster.

The master node manages the tasks and data delegated to the core and task nodes. Due to the HDFS storage aspects of core nodes, a loss of a core node will result in data loss and possible failure of the complete Job Flow.

Task group instance

The task group is optional. It can do some of the dirty computational work of the map and reduce jobs, but does not have HDFS storage of the data and intermediate results.

The lack of HDFS storage on these instances means the data needs to be transferred to these nodes by the master for the task group to do the work in the Job Flow.

Amazon EMR and the Hadoop Ecosystem

Amazon EMR uses Hadoop and its MapReduce framework at its core. Accordingly, many of the other core Apache Software Foundation projects that work with Hadoop also work with Amazon EMR. There are also many other AWS services that may be useful when you're running and monitoring Amazon EMR applications. For example:

Hive

Hive is a distributed data warehouse that allows you to create a Job Flow using a SQL-like language. Hive can be run from a script loaded in S3 or interactively inside of a running EMR instance.

Pig

Pig is a data flow language. The language is called *Pig Latin*. Pig scripts can be loaded into S3 and used to perform the data analysis in a Job Flow. Pig, like Hive, is one of the Job Flow types that can be run interactively inside of a running EMR instance.

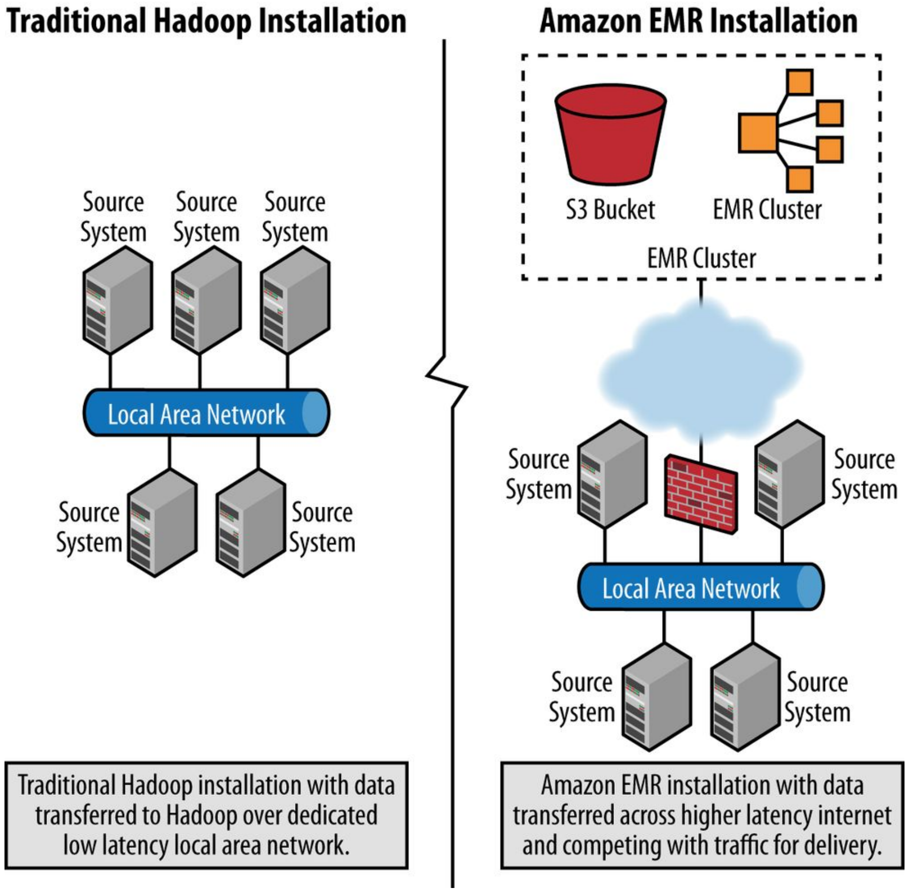
Amazon Cloudwatch

Cloudwatch allows you to monitor the health and progress of Job Flows. It also allows you to set alarms when metrics are outside of normal execution parameters.

Amazon Elastic MapReduce Versus Traditional Hadoop Installs

Amazon EMR uses S3 storage for the input and output of data sets to be processed and analyzed. In order to process data, you need to transport it to Amazon's cloud into S3 buckets.

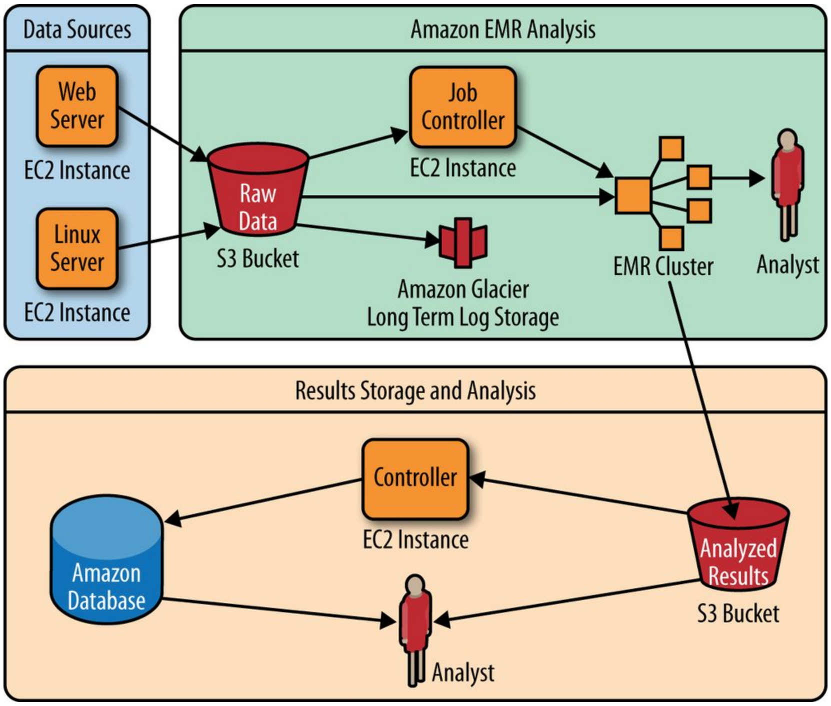
In the traditional Hadoop install, data transport between the current source locations and the Hadoop cluster may be collocated in the same data center on high-speed internal networks. This lowers the data transport barriers and the amount of time to get data into Hadoop for analysis.


Traditional Hadoop Installation
Source System
Source System
Source System
Local Area Network
Source System
Source System
Traditional Hadoop installation with data transferred to Hadoop over dedicated low latency local area network.
Amazon EMR Installation
S3 Bucket
EMR Cluster
EMR Cluster
Source System
Source System
Local Area Network
Source System
Source System
Amazon EMR installation with data transferred across higher latency internet and competing with traffic for delivery.

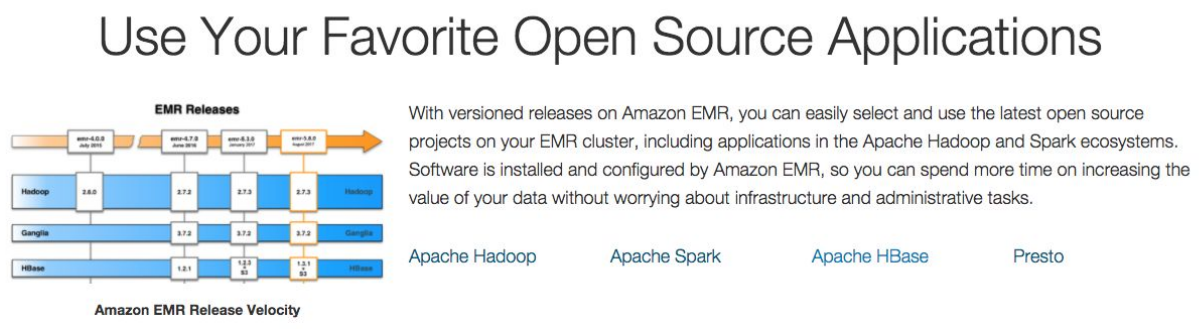
Note: Amazon has S3 Import and Export services.

Application Building Blocks

- ingest large volumes of log data,
- perform real-time and
- batch analysis, and ultimately produce results that can be shared with end users.



Application Integration



Use Your Favorite Open Source Applications

Amazon EMR Release Velocity

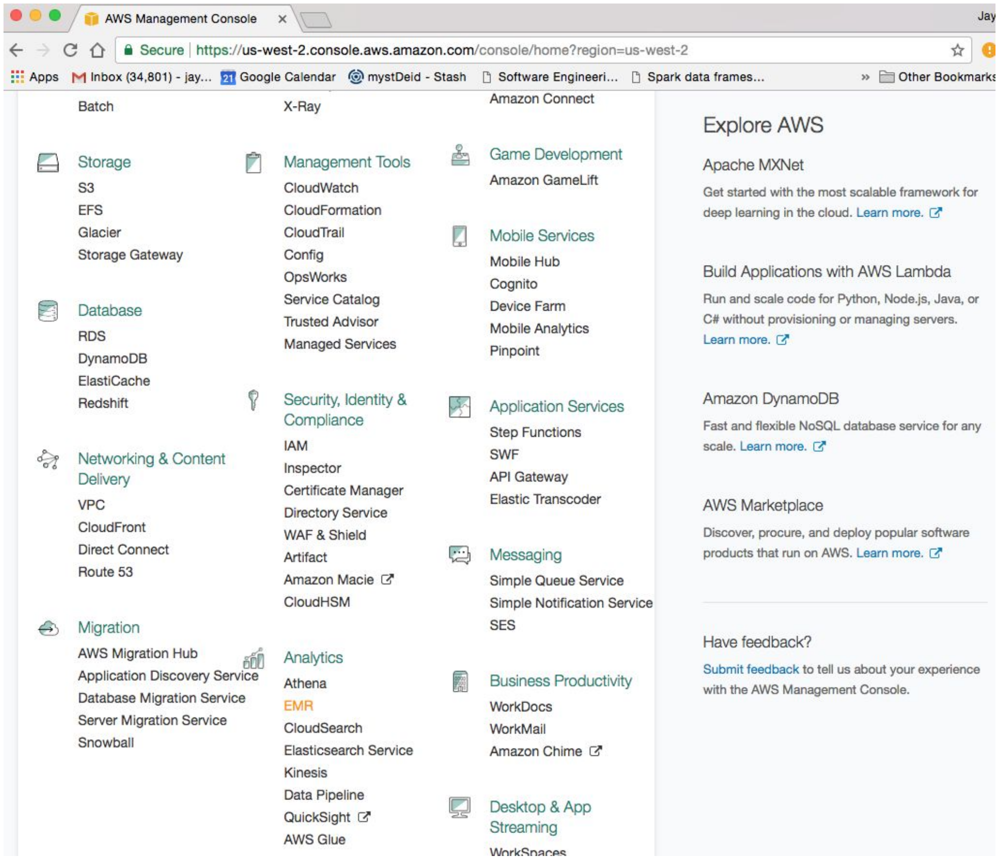
With versioned releases on Amazon EMR, you can easily select and use the latest open source projects on your EMR cluster, including applications in the Apache Hadoop and Spark ecosystems. Software is installed and configured by Amazon EMR, so you can spend more time on increasing the value of your data without worrying about infrastructure and administrative tasks.

Apache Hadoop Apache Spark Apache HBase Presto

Creating and deploying a MapReduce App on Amazon EMR

Go to aws.amzon.com create an AWS account.

Log on to AWS. You should see the following services.



Apache MXNet

Get started with the most scalable framework for deep learning in the cloud. Learn more.

Build Applications with AWS Lambda

Run and scale code for Python, Node.js, Java, or C# without provisioning or managing servers. Learn more.

Amazon DynamoDB

Fast and flexible NoSQL database service for any scale. Learn more.

AWS Marketplace

Discover, procure, and deploy popular software products that run on AWS. Learn more.

Have feedback?

Submit feedback to tell us about your experience with the AWS Management Console.

Amazon EMR Management Guide
http://docs.aws.amazon.com/emr/latest/ManagementGuide/emr-what-is-emr.html

Amazon Elastic MapReduce API
http://docs.aws.amazon.com/ElasticMapReduce/latest/API/Welcome.html

Amazon EMR Release Guide
http://docs.aws.amazon.com/emr/latest/ReleaseGuide/emr-hadoop-application.html

Basic steps for creating a job:

- Upload
- Create
- Monitor

Standard approach:

1. Upload data from S3 (cloud storage) into HDFS (Hadoop File System)
2. Can do MapReduce directly against S3, or you can upload your data from S3 into the HDFS file systems that's part of the EC2 (Elastic Cloud Compute) instances with the JBMs with the Hadoop daemons installed on them.

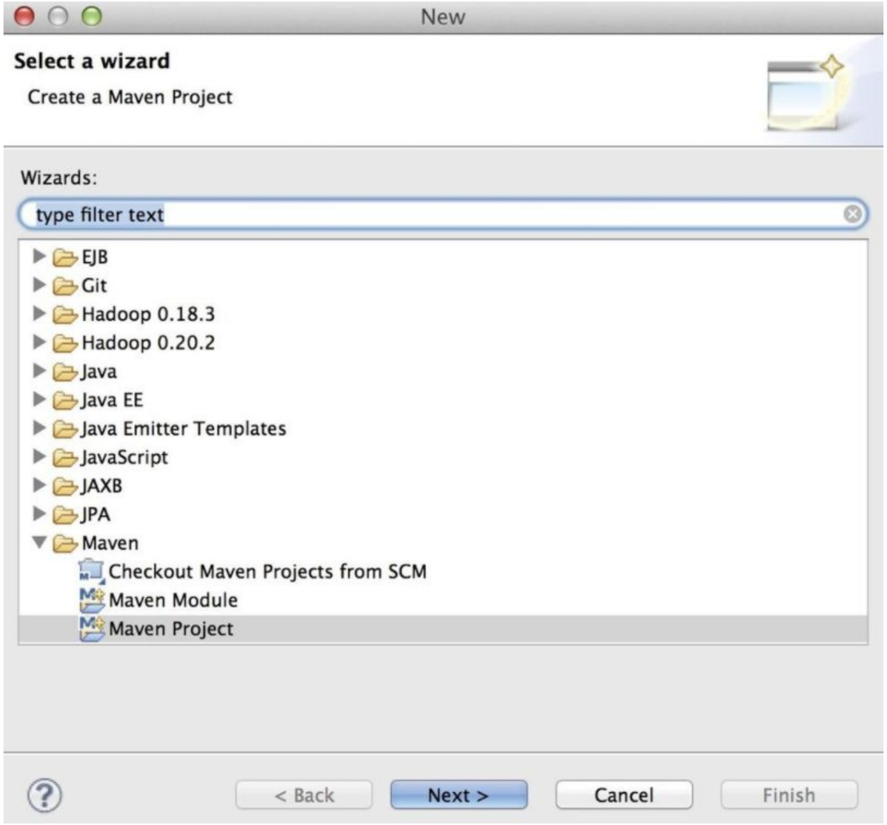
Building MapReduce Applications

This example uses Eclipse Java IDE and the Eclipse Maven plug-in, m2eclipse, to manage application dependencies.

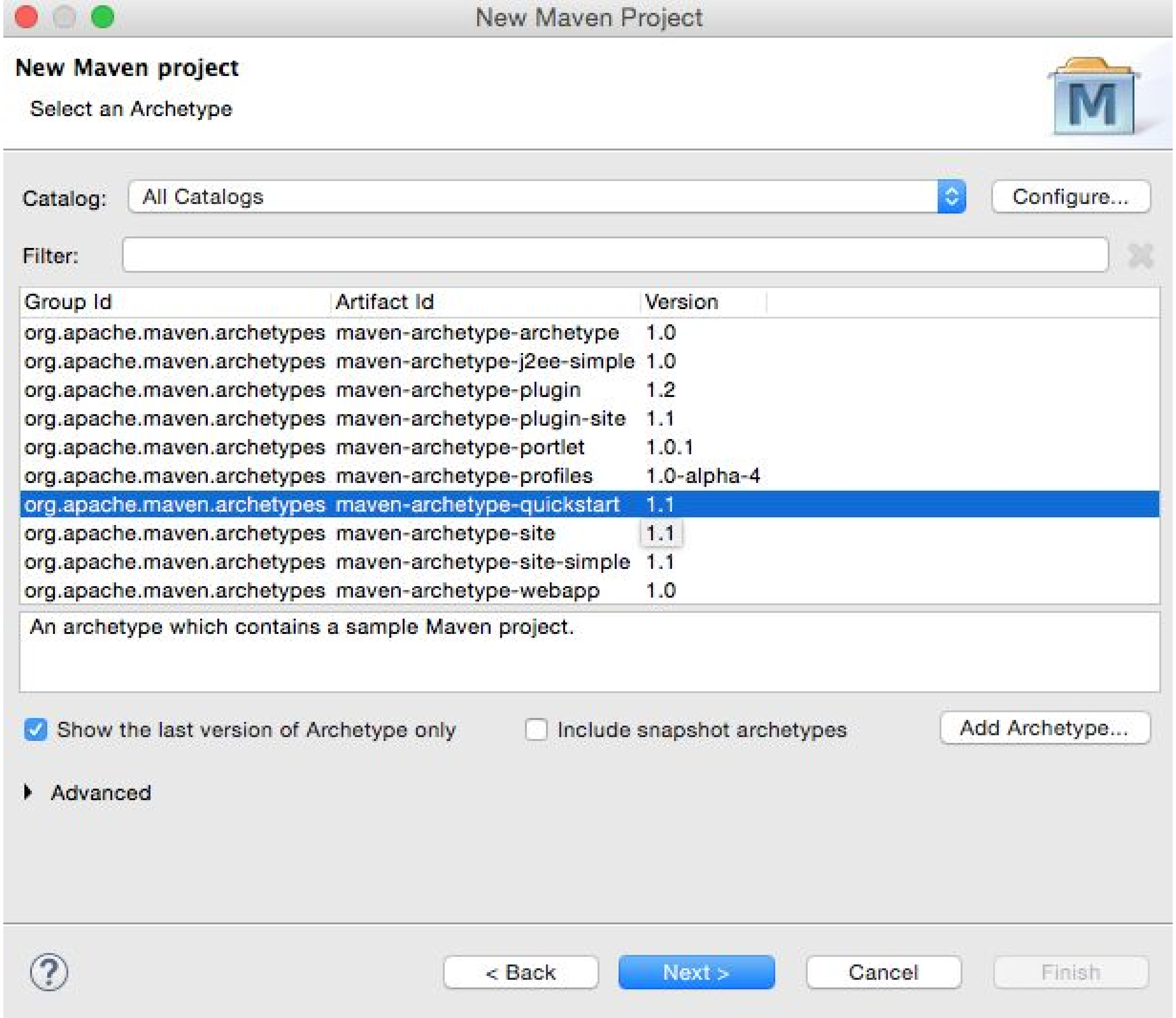
You can install the *m2eclipse plug-in* through the *Install New Software* option inside of Eclipse.

To include the dependencies needed to build the MapReduce applications:

Create a Maven project inside of Eclipse by selecting *File→New→Other*. The Maven project option should be available after you install the m2eclipse plug-in.



Select the program and project name of your application when going through the Eclipse New Project Wizard.



New Maven project

Select an Archetype

Catalog: All Catalogs

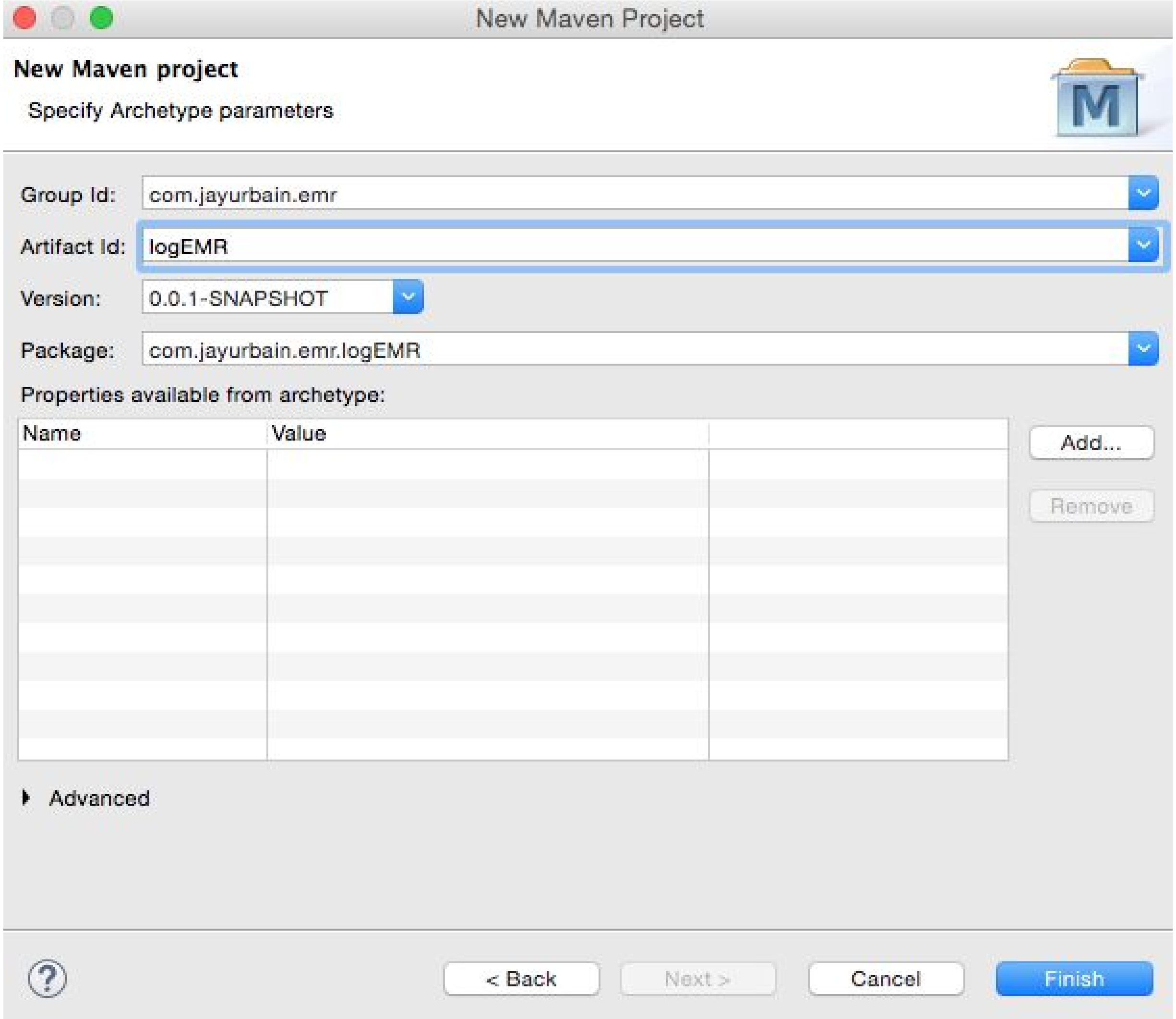
Filter:

Group Id	Artifact Id	Version
org.apache.maven.archetypes	maven-archetype-archetype	1.0
org.apache.maven.archetypes	maven-archetype-j2ee-simple	1.0
org.apache.maven.archetypes	maven-archetype-plugin	1.2
org.apache.maven.archetypes	maven-archetype-plugin-site	1.1
org.apache.maven.archetypes	maven-archetype-portlet	1.0.1
org.apache.maven.archetypes	maven-archetype-profiles	1.0-alpha-4
org.apache.maven.archetypes	maven-archetype-quickstart	1.1
org.apache.maven.archetypes	maven-archetype-site	1.1
org.apache.maven.archetypes	maven-archetype-site-simple	1.1
org.apache.maven.archetypes	maven-archetype-webapp	1.0

An archetype which contains a sample Maven project.

☑ Show the last version of Archetype only ☐ Include snapshot archetypes

▸ Advanced



New Maven Project

New Maven project

Specify Archetype parameters

Group Id: com.jayurbain.emr

Artifact Id: logEMR

Version: 0.0.1-SNAPSHOT

Package: com.jayurbain.emr.logEMR

Properties available from archetype:

Name	Value

FYI: Maven naming conventions:
https://maven.apache.org/guides/mini/guide-naming-conventions.html

After the project is created, the Hadoop dependencies will need to be added to the project so the application can make use of the Hadoop base classes, types, and methods. You can add the Hadoop core dependencies by opening the *pom.xml* file that is in the root of the project.

Add the following to your project pom.xml text

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>

  <groupId>com.jayurbain.emr</groupId>
  <artifactId>logEMR</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>jar</packaging>
  <name>com.jayurbain.emr</name>
  <url>http://maven.apache.org</url>

  <properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
  </properties>
  <build>
                <plugins>
                        <plugin>
                                <groupId>org.apache.maven.plugins</groupId>
                                <artifactId>maven-shade-plugin</artifactId>
                                <executions>
                                        <execution>
                                                <phase>package</phase>
                                                <goals>
                                                        <goal>shade</goal>
                                                </goals>
                                        </execution>
                                </executions>
                                <configuration>
                                        <finalName>uber-${artifactId}-${version}</finalName>
                                </configuration>
                        </plugin>
                </plugins>
        </build>

  <dependencies>
        <!--  deid -->
    <dependency>
      <groupId>junit</groupId>
      <artifactId>junit</artifactId>
      <version>4.11</version>
      <scope>test</scope>
    </dependency>
    <dependency>
                <groupId>org.apache.hadoop</groupId>
                <artifactId>hadoop-client</artifactId>
                <version>2.2.0</version>
        </dependency>
  </dependencies>
</project>
```

In your application:

Create a package *com.jayurbain.emr*

Create a new Java class file *WordCount.java* as follows:

```
//////////////////
package com.jayurbain.emr.wordcount;

import java.io.IOException;
import java.util.*;

import org.apache.hadoop.fs.Path;
import org.apache.hadoop.conf.*;
import org.apache.hadoop.io.*;
import org.apache.hadoop.mapreduce.*;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.input.TextInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.mapreduce.lib.output.TextOutputFormat;

public class WordCount {

  public static class Map extends Mapper<LongWritable, Text, Text, IntWritable> {
    private final static IntWritable one = new IntWritable(1);
    private Text word = new Text();

    public void map(LongWritable key, Text value, Context context) throws IOException,
InterruptedException {
      String line = value.toString();
      StringTokenizer tokenizer = new StringTokenizer(line);
      while (tokenizer.hasMoreTokens()) {
        word.set(tokenizer.nextToken());
        context.write(word, one);
      }
    }
  }

  public static class Reduce extends Reducer<Text, IntWritable, Text, IntWritable> {
    public void reduce(Text key, Iterable<IntWritable> values, Context context)
      throws IOException, InterruptedException {
      int sum = 0;
      for (IntWritable val : values) {
        sum += val.get();
      }
      context.write(key, new IntWritable(sum));
    }
  }

  public static void main(String[] args) throws Exception {
    Configuration conf = new Configuration();

    Job job = new Job(conf, "wordcount");

    job.setJarByClass(WordCount.class);
    job.setOutputKeyClass(Text.class);
    job.setOutputValueClass(IntWritable.class);

    job.setMapperClass(Map.class);
    job.setReducerClass(Reduce.class);

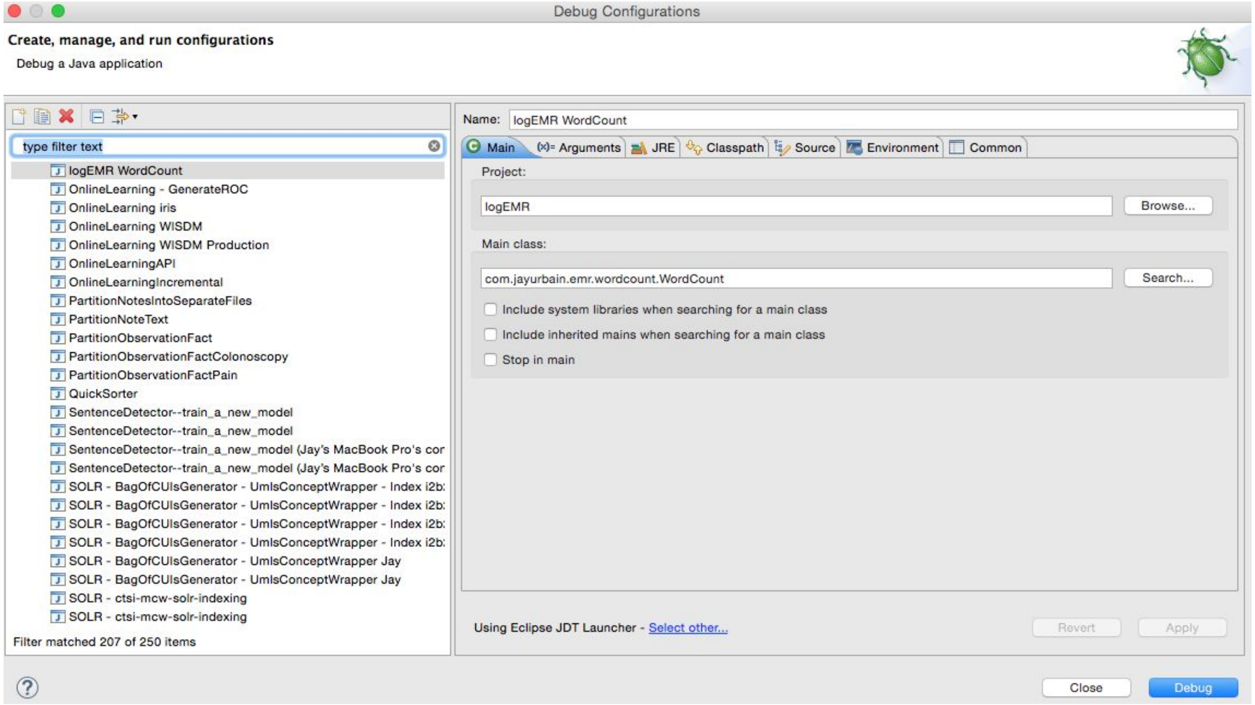
    job.setInputFormatClass(TextInputFormat.class);
    job.setOutputFormatClass(TextOutputFormat.class);

    FileInputFormat.addInputPath(job, new Path(args[0]));
    FileOutputFormat.setOutputPath(job, new Path(args[1]));

    job.waitForCompletion(true);
  }

}
///////////////
```

You can run the application locally first to test the application. Parameters: input text file, and output text file.



Create, manage, and run configurations

Debug a Java application

type filter text

- logEMR WordCount
- OnlineLearning - GenerateROC
- OnlineLearning iris
- OnlineLearning WISDM
- OnlineLearning WISDM Production
- OnlineLearningAPI
- OnlineLearningIncremental
- PartitionNotesIntoSeparateFiles
- PartitionNoteText
- PartitionObservationFact
- PartitionObservationFactColonoscopy
- PartitionObservationFactPain
- QuickSorter
- SentenceDetector--train_a_new_model
- SentenceDetector--train_a_new_model
- SentenceDetector--train_a_new_model (Jay's MacBook Pro's cor
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- SOLR - BagOfCUIsGenerator - UmlsConceptWrapper Jay
- SOLR - ctsi-mcw-solr-indexing
- SOLR - ctsi-mcw-solr-indexing

Filter matched 207 of 250 items

Name: logEMR WordCount

Project: logEMR

Main class: com.jayurbain.emr.wordcount.WordCount

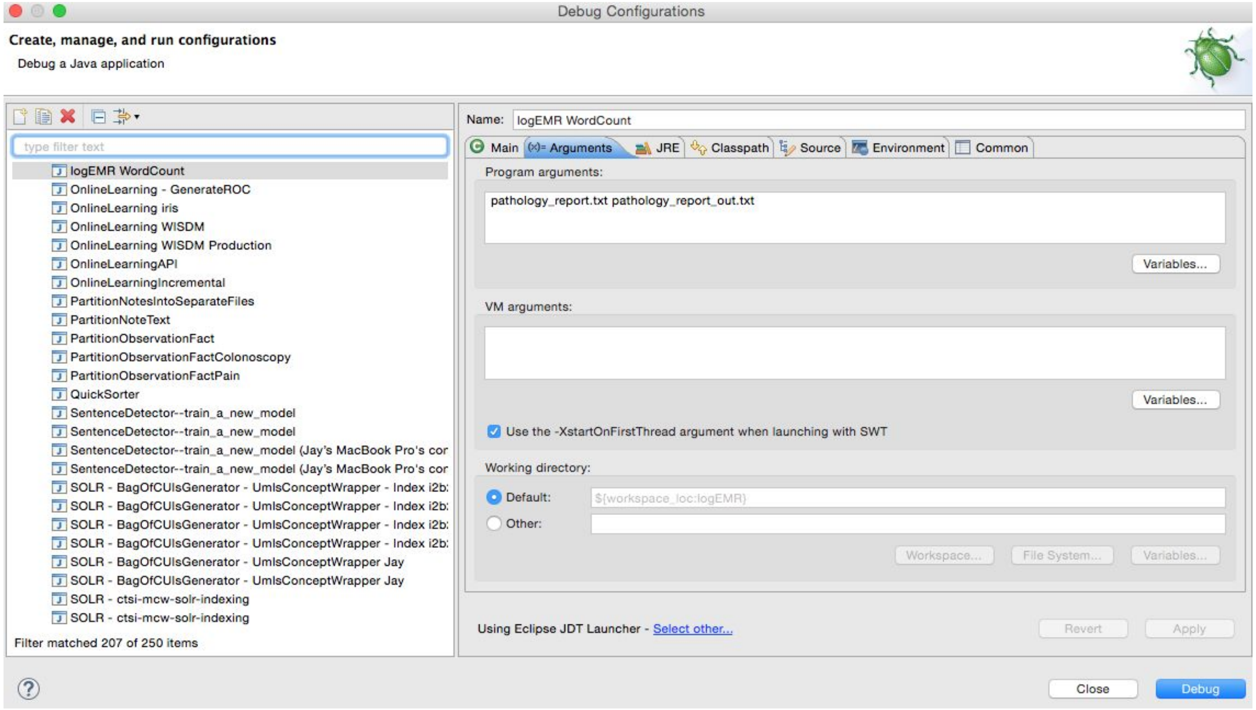
☐ Include system libraries when searching for a main class

☐ Include inherited mains when searching for a main class

☐ Stop in main

Using Eclipse JDT Launcher - Select other...

Select arguments.



Create, manage, and run configurations

Debug a Java application

type filter text

- logEMR WordCount
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- OnlineLearning iris
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- OnlineLearningAPI
- OnlineLearningIncremental
- PartitionNotesIntoSeparateFiles
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- SOLR - BagOfCUIsGenerator - UmlsConceptWrapper - Index i2b:
- SOLR - BagOfCUIsGenerator - UmlsConceptWrapper Jay
- SOLR - BagOfCUIsGenerator - UmlsConceptWrapper Jay
- SOLR - ctsi-mcw-solr-indexing
- SOLR - ctsi-mcw-solr-indexing

Filter matched 207 of 250 items

Name: logEMR WordCount

Program arguments:

```
pathology_report.txt pathology_report_out.txt
```

VM arguments:

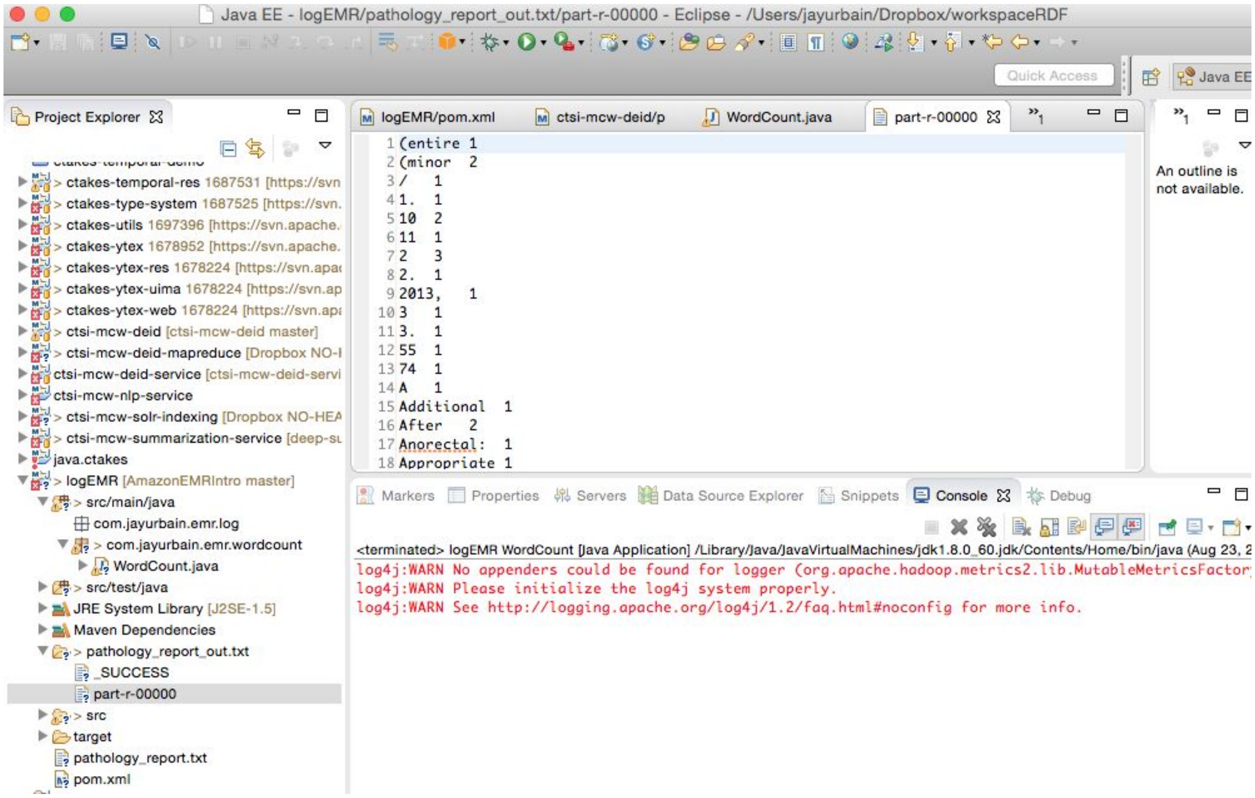
☑ Use the -XstartOnFirstThread argument when launching with SWT

Working directory:

● Default: ${workspace_loc:logEMR}

○ Other:

Using Eclipse JDT Launcher - Select other...


Java EE - logEMR/pathology_report_out.txt/part-r-00000 - Eclipse - /Users/jayurbain/Dropbox/workspaceRDF
Quick Access
Java EE
Project Explorer
ctakes-temporal-demo
> ctakes-temporal-res 1687531 [https://svn
> ctakes-type-system 1687525 [https://svn.
> ctakes-utils 1697396 [https://svn.apache.
> ctakes-ytex 1678952 [https://svn.apache.
> ctakes-ytex-res 1678224 [https://svn.apac
> ctakes-ytex-uima 1678224 [https://svn.ap
> ctakes-ytex-web 1678224 [https://svn.apa
> ctsi-mcw-deid [ctsi-mcw-deid master]
> ctsi-mcw-deid-mapreduce [Dropbox NO-I
ctsi-mcw-deid-service [ctsi-mcw-deid-servi
ctsi-mcw-nlp-service
> ctsi-mcw-solr-indexing [Dropbox NO-HEA
> ctsi-mcw-summarization-service [deep-su
java.ctakes
> logEMR [AmazonEMRIntro master]
> src/main/java
com.jayurbain.emr.log
> com.jayurbain.emr.wordcount
WordCount.java
> src/test/java
JRE System Library [J2SE-1.5]
Maven Dependencies
> pathology_report_out.txt
_SUCCESS
part-r-00000
> src
target
pathology_report.txt
pom.xml
logEMR/pom.xml
ctsi-mcw-deid/p
WordCount.java
part-r-00000
»1
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Markers
Properties
Servers
Data Source Explorer
Snippets
Console
Debug

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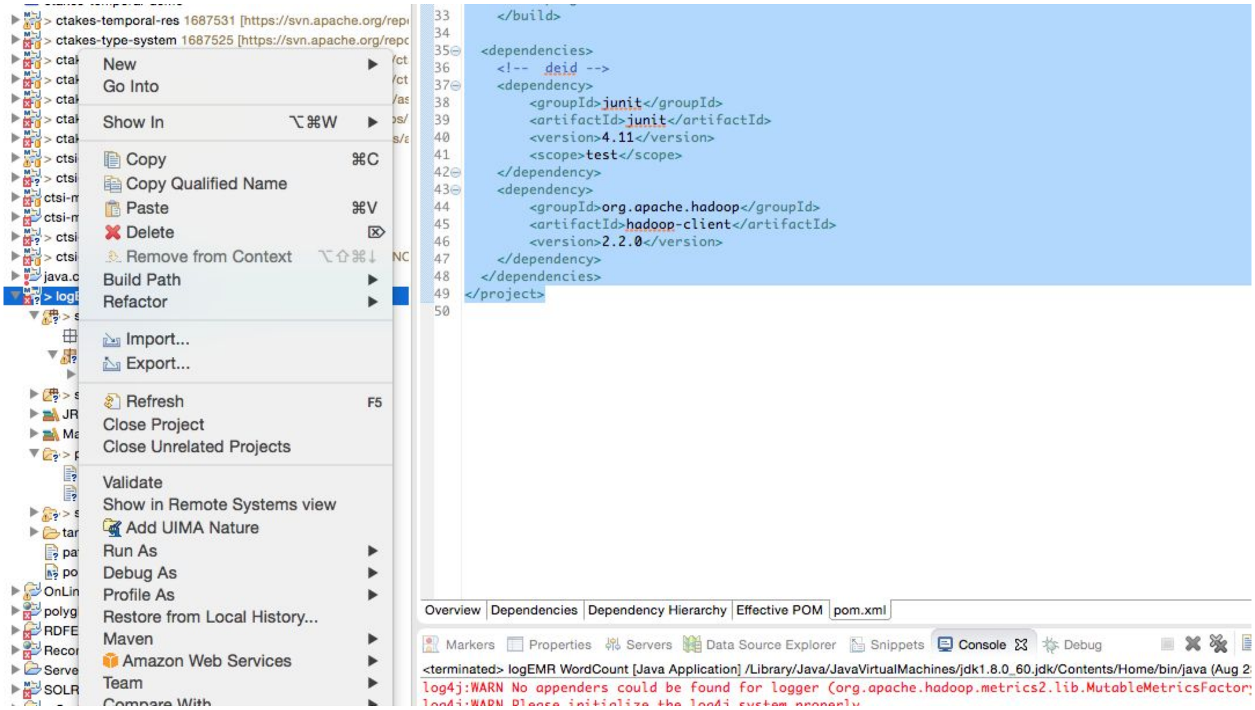
3.  1
55  1
74  1
A   1
Additional  1
After   2
Anorectal:  1
Appropriate 1
```

```
<terminated> logEMR WordCount [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_60.jdk/Contents/Home/bin/java (Aug 23, 2
log4j:WARN No appenders could be found for logger (org.apache.hadoop.metrics2.lib.MutableMetricsFactor
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
```

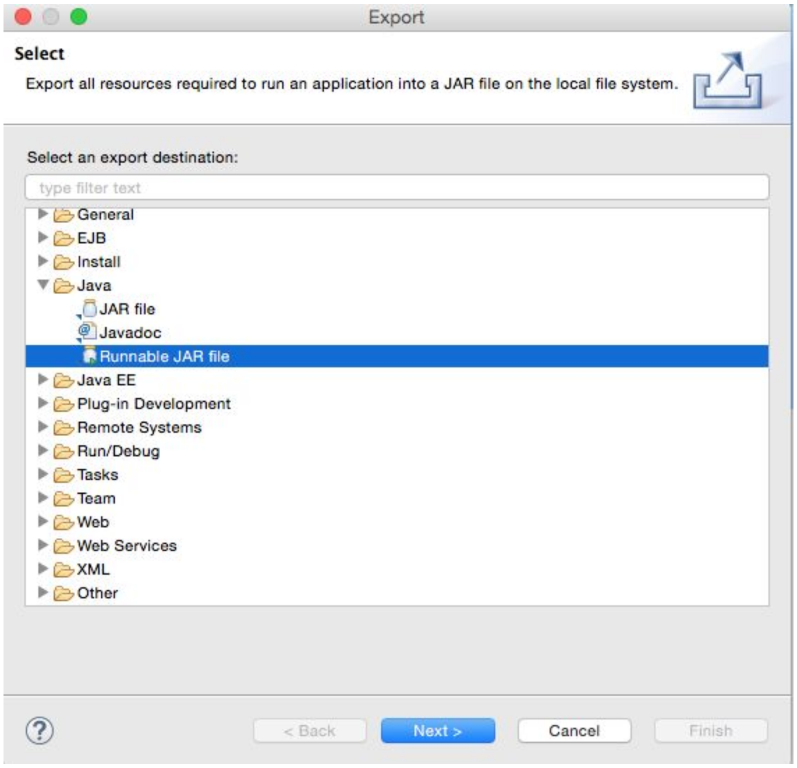
Export as executable jar file:



```
    </build>

  <dependencies>
    <!--  deid -->
    <dependency>
        <groupId>junit</groupId>
        <artifactId>junit</artifactId>
        <version>4.11</version>
        <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.apache.hadoop</groupId>
        <artifactId>hadoop-client</artifactId>
        <version>2.2.0</version>
    </dependency>
  </dependencies>
</project>
```

```
<terminated> logEMR WordCount [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_60.jdk/Contents/Home/bin/java (Aug 2
log4j:WARN No appenders could be found for logger (org.apache.hadoop.metrics2.lib.MutableMetricsFactory
log4j:WARN Please initialize the log4j system properly.
```

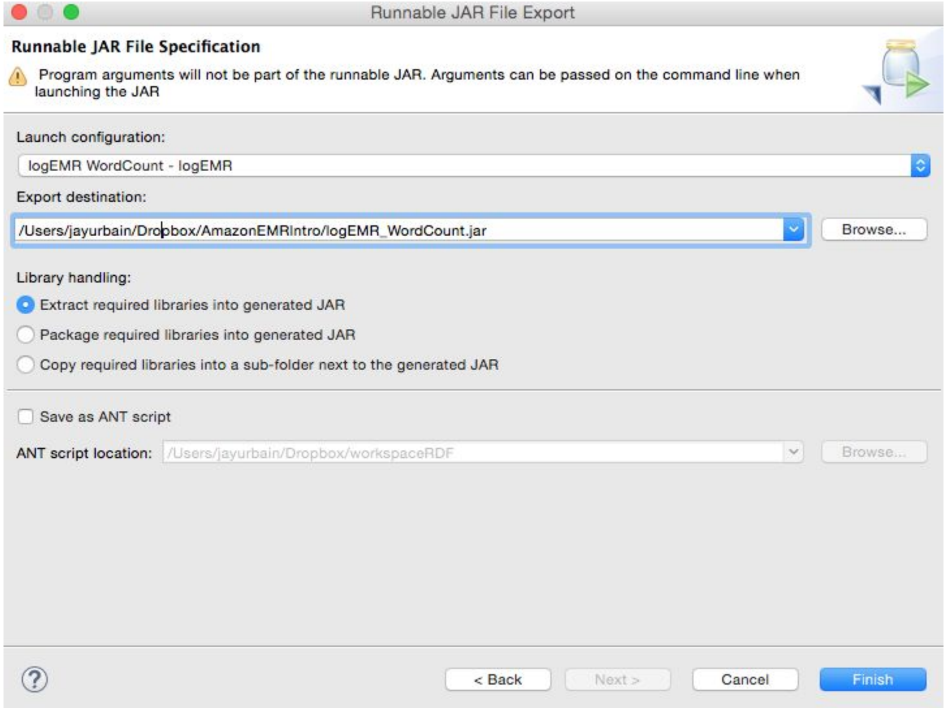


Select

Export all resources required to run an application into a JAR file on the local file system.

Select an export destination:

Select launch configuration, and export destination.



Runnable JAR File Export

Runnable JAR File Specification

Program arguments will not be part of the runnable JAR. Arguments can be passed on the command line when launching the JAR

Launch configuration: logEMR WordCount - logEMR

Export destination: /Users/jayurbain/Dropbox/AmazonEMRIntro/logEMR_WordCount.jar

Library handling:

● Extract required libraries into generated JAR

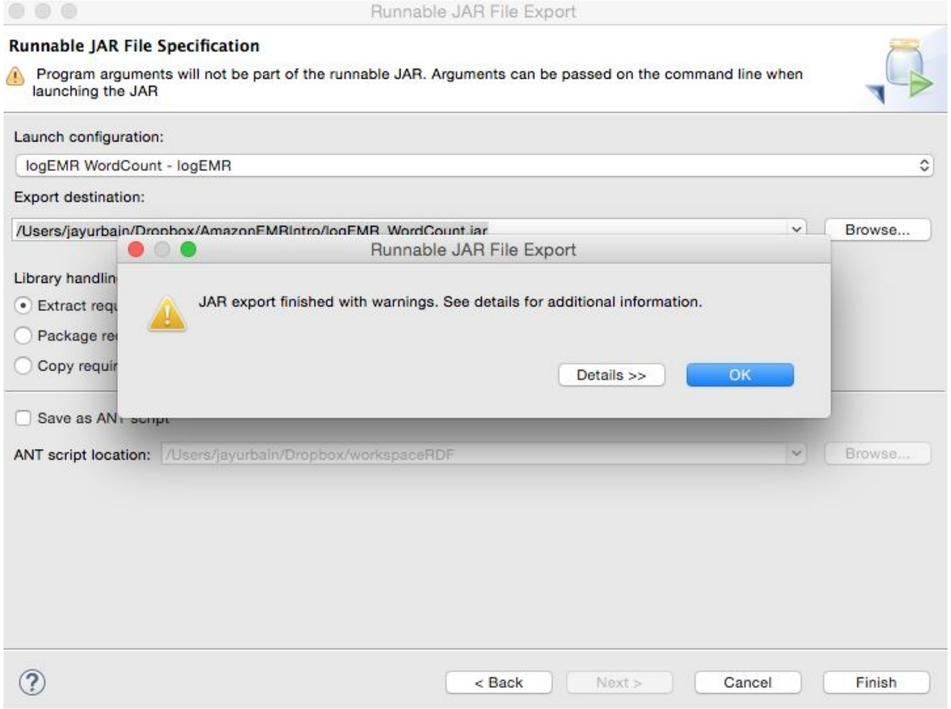
○ Package required libraries into generated JAR

○ Copy required libraries into a sub-folder next to the generated JAR

□ Save as ANT script

ANT script location: /Users/jayurbain/Dropbox/workspaceRDF

Select Ok.



Runnable JAR File Export

JAR export finished with warnings. See details for additional information.

Just hit Ok. Only duplicate packaging warnings.

To run the app on a Hadoop with local file system. (See end of this file for installing Hadoop locally).

```
$ hadoop jar logEMR_WordCount patholgoy_report.txt pathology_report_out.txt
```

Run (for hdfs file system):

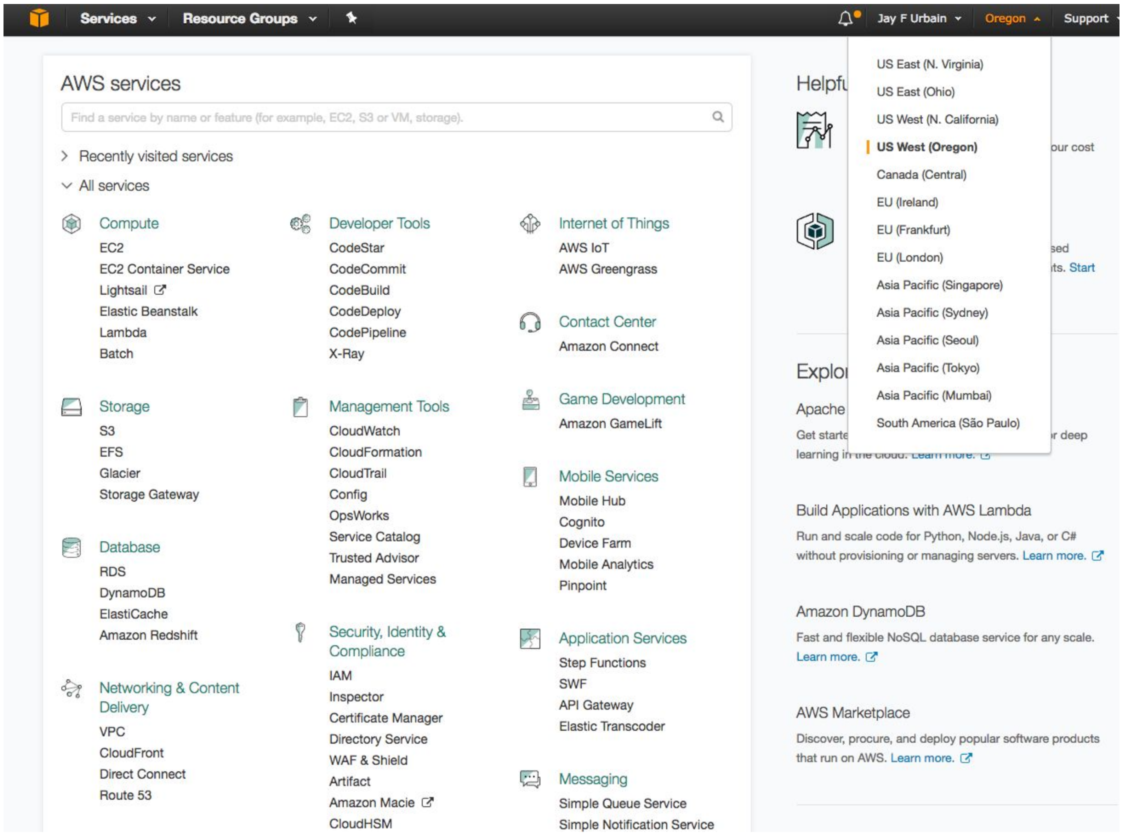
```
$hadoop jar logEMR_WordCount hdfs:///xxx//patholgoy_report.txt hdfs:///xxx//pathology_report_out.txt
```

In either case, result file will be in pathology_report_out.txt/part-r-00000 (or something similar).

To run on AmazonEMR:

Sign into AWS Console.

Select S3. Take note of the region. In this case **US West (Oregon)**



Build Applications with AWS Lambda

Run and scale code for Python, Node.js, Java, or C# without provisioning or managing servers. Learn more.

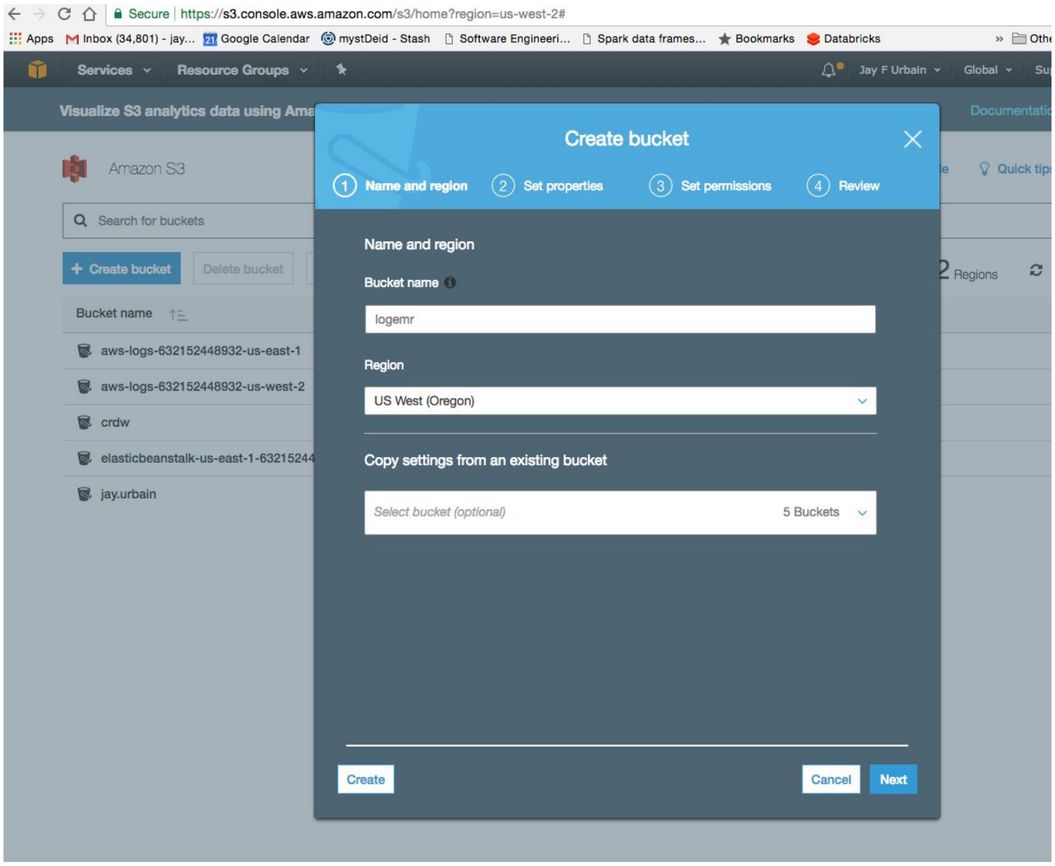
Amazon DynamoDB

Fast and flexible NoSQL database service for any scale. Learn more.

AWS Marketplace

Discover, procure, and deploy popular software products that run on AWS. Learn more.

Create an S3 bucket.



Create bucket

1 Name and region 2 Set properties 3 Set permissions 4 Review

Name and region

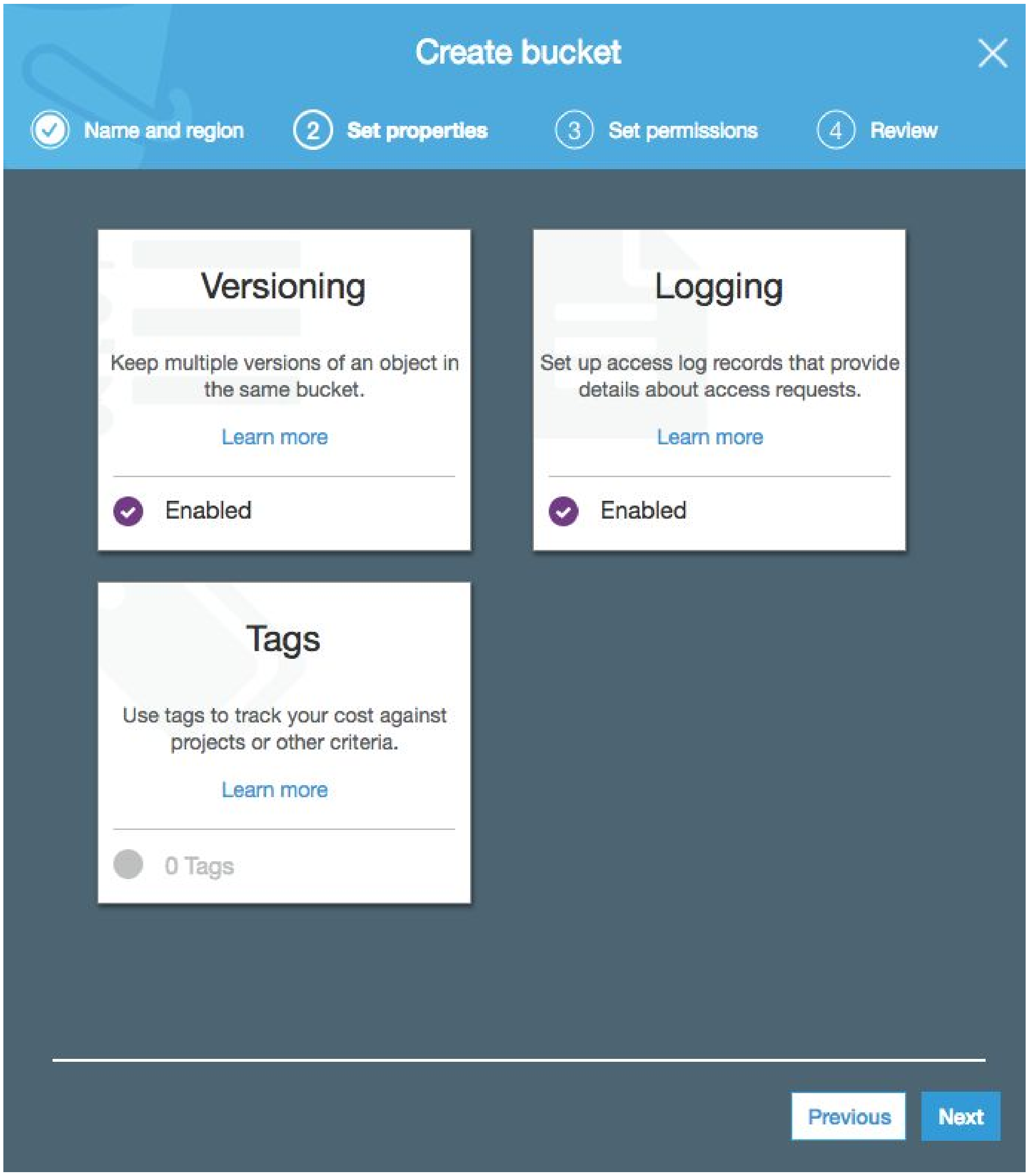
Bucket name: logemr

Region: US West (Oregon)

Copy settings from an existing bucket

Select bucket (optional) 5 Buckets

You can skip the following. Or set properties. They can be changed later.



Versioning

Keep multiple versions of an object in the same bucket.

Learn more

✓ Enabled

Logging

Set up access log records that provide details about access requests.

Learn more

✓ Enabled

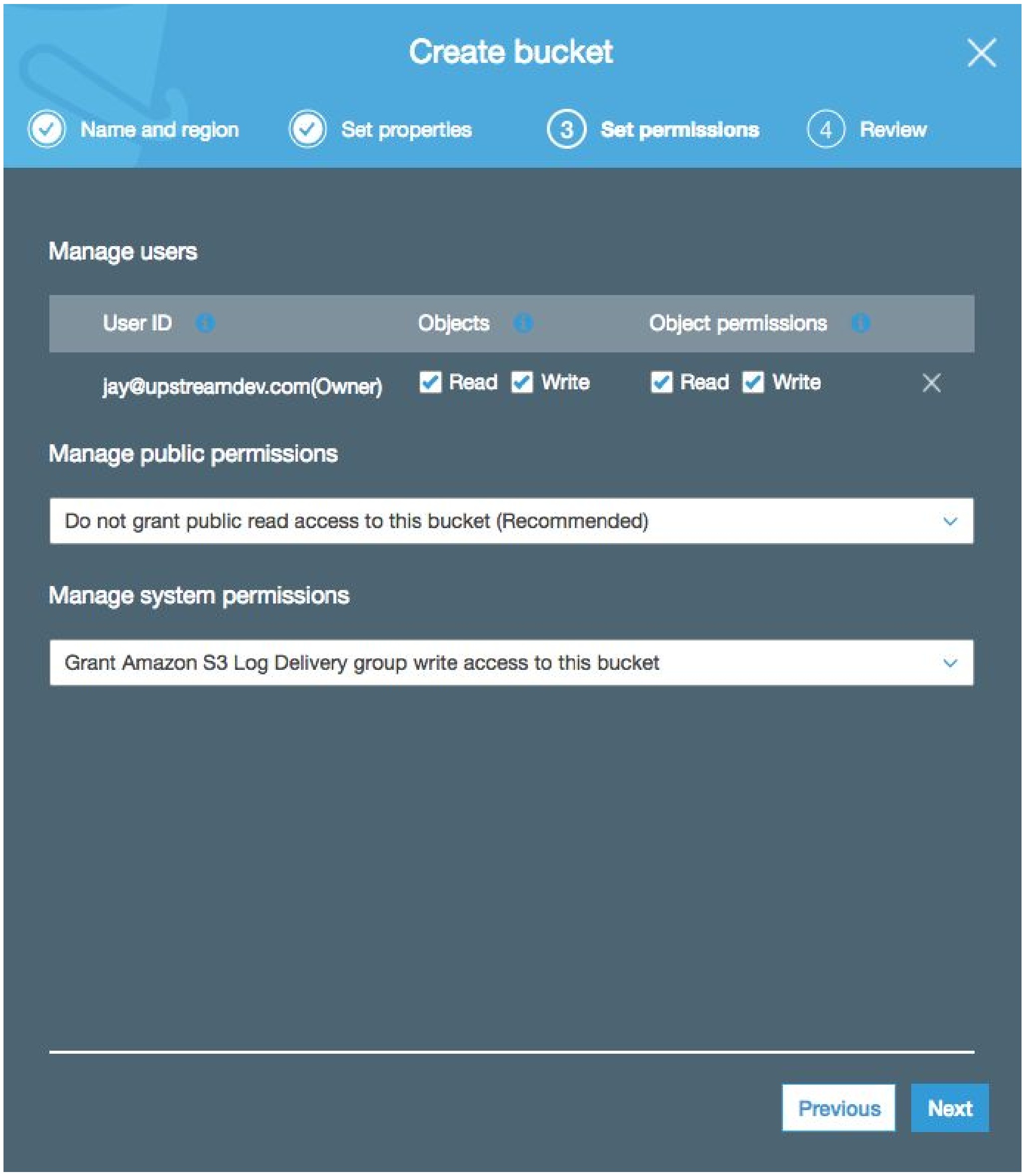
Tags

Use tags to track your cost against projects or other criteria.

Learn more

● 0 Tags

Select next.



Manage users

User ID	Objects	Object permissions
jay@upstreamdev.com(Owner)	☑ Read ☑ Write	☑ Read ☑ Write

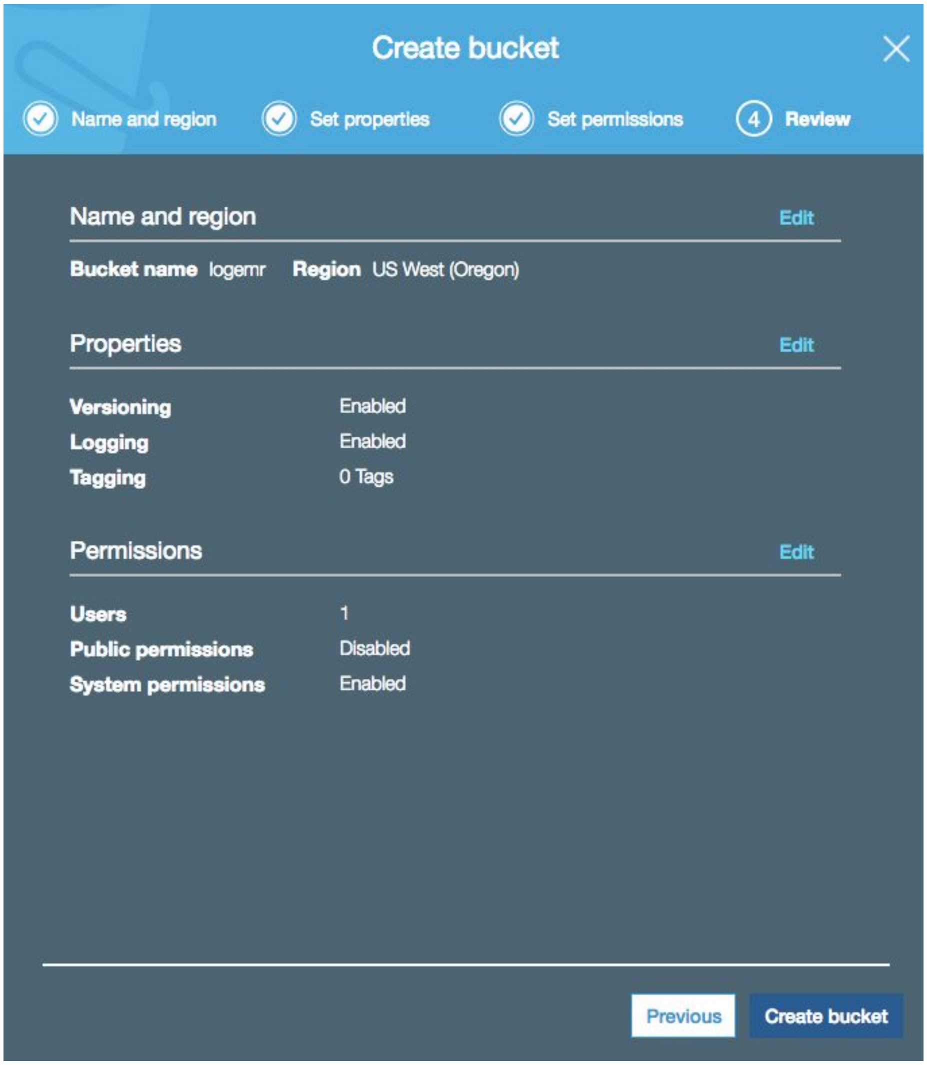
Manage public permissions

Do not grant public read access to this bucket (Recommended)

Manage system permissions

Grant Amazon S3 Log Delivery group write access to this bucket

Select Create bucket.



Name and region

Bucket name logemr **Region** US West (Oregon)

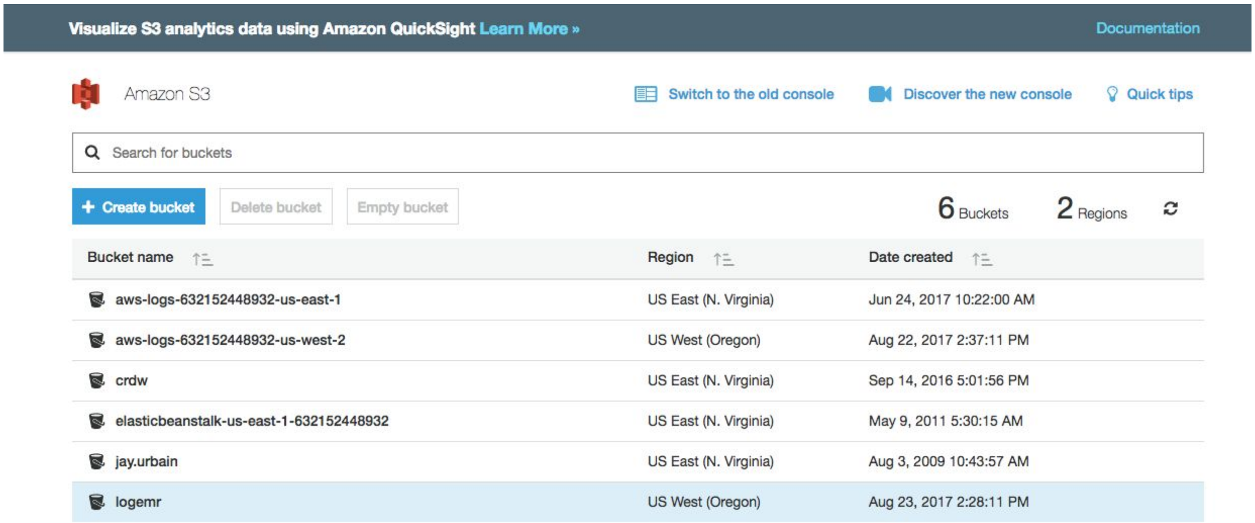
Properties

Versioning	Enabled
Logging	Enabled
Tagging	0 Tags

Permissions

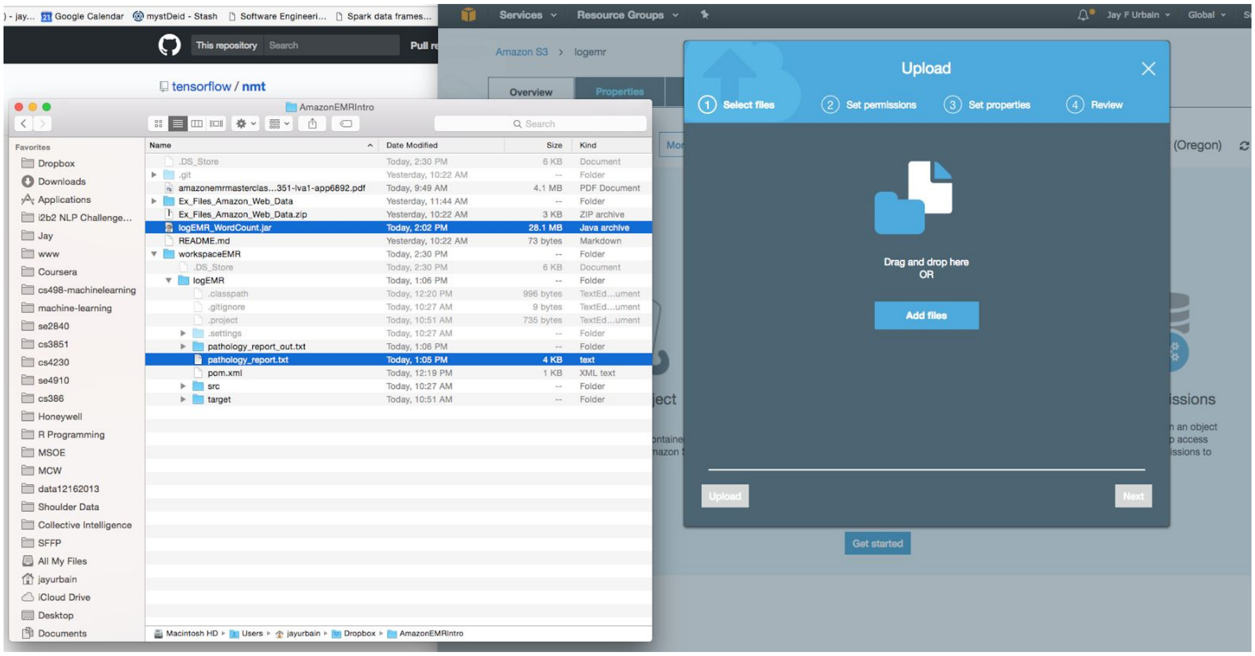
Users	1
Public permissions	Disabled
System permissions	Enabled

You should see the following.

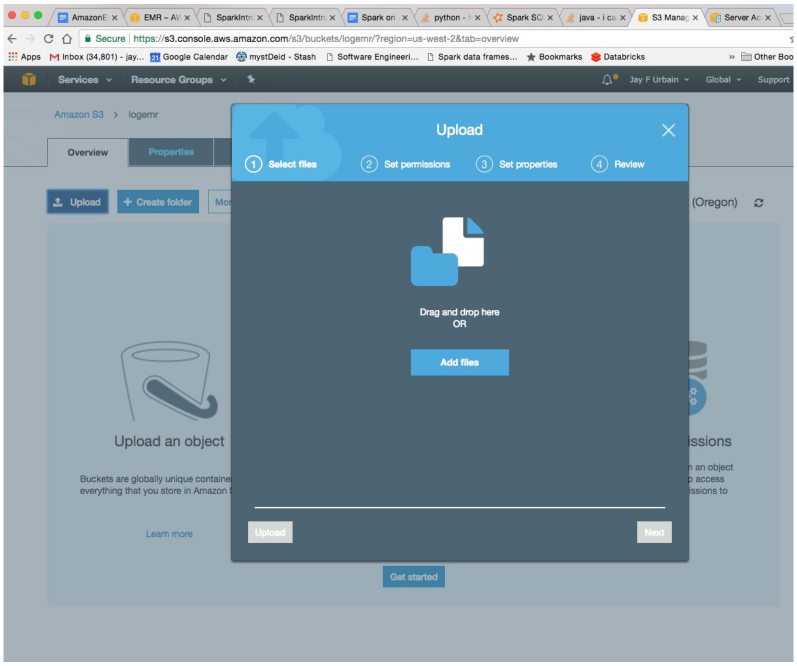


Bucket name	Region	Date created
aws-logs-632152448932-us-east-1	US East (N. Virginia)	Jun 24, 2017 10:22:00 AM
aws-logs-632152448932-us-west-2	US West (Oregon)	Aug 22, 2017 2:37:11 PM
crdw	US East (N. Virginia)	Sep 14, 2016 5:01:56 PM
elasticbeanstalk-us-east-1-632152448932	US East (N. Virginia)	May 9, 2011 5:30:15 AM
jay.urbain	US East (N. Virginia)	Aug 3, 2009 10:43:57 AM
logemr	US West (Oregon)	Aug 23, 2017 2:28:11 PM

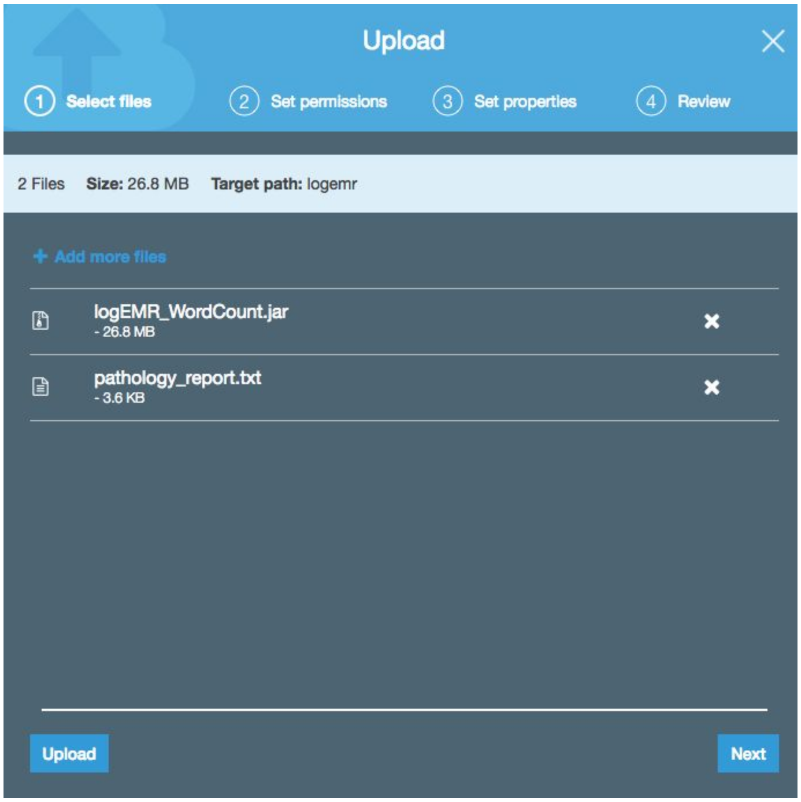
Select your logerr bucket and upload your jar and *text input* file.



Name	Date Modified	Size	Kind
.DS_Store	Today, 2:30 PM	6 KB	Document
.git	Yesterday, 10:22 AM	--	Folder
amazonemrmasterclas...351-lva1-app6892.pdf	Today, 9:49 AM	4.1 MB	PDF Document
Ex_Files_Amazon_Web_Data	Yesterday, 11:44 AM	--	Folder
Ex_Files_Amazon_Web_Data.zip	Yesterday, 10:22 AM	3 KB	ZIP archive
logEMR_WordCount.jar	Today, 2:02 PM	28.1 MB	Java archive
README.md	Yesterday, 10:22 AM	73 bytes	Markdown
workspaceEMR	Today, 2:30 PM	--	Folder
.DS_Store	Today, 2:30 PM	6 KB	Document
logEMR	Today, 1:06 PM	--	Folder
.classpath	Today, 12:20 PM	996 bytes	TextEd...ument
.gitignore	Today, 10:27 AM	9 bytes	TextEd...ument
.project	Today, 10:51 AM	735 bytes	TextEd...ument
.settings	Today, 10:27 AM	--	Folder
pathology_report_out.txt	Today, 1:06 PM	--	Folder
pathology_report.txt	Today, 1:05 PM	4 KB	text
pom.xml	Today, 12:19 PM	1 KB	XML text
src	Today, 10:27 AM	--	Folder
target	Today, 10:51 AM	--	Folder



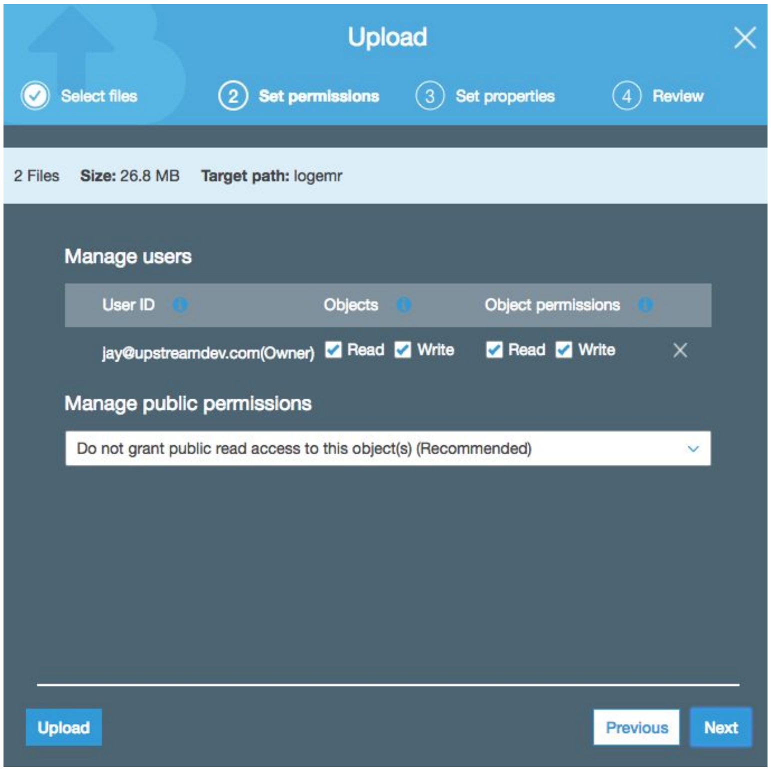
https://s3.console.aws.amazon.com/s3/buckets/logemr/?region=us-west-2&tab=overview



2 Files **Size:** 26.8 MB **Target path:** logemr

logEMR_WordCount.jar
- 26.8 MB

pathology_report.txt
- 3.6 KB



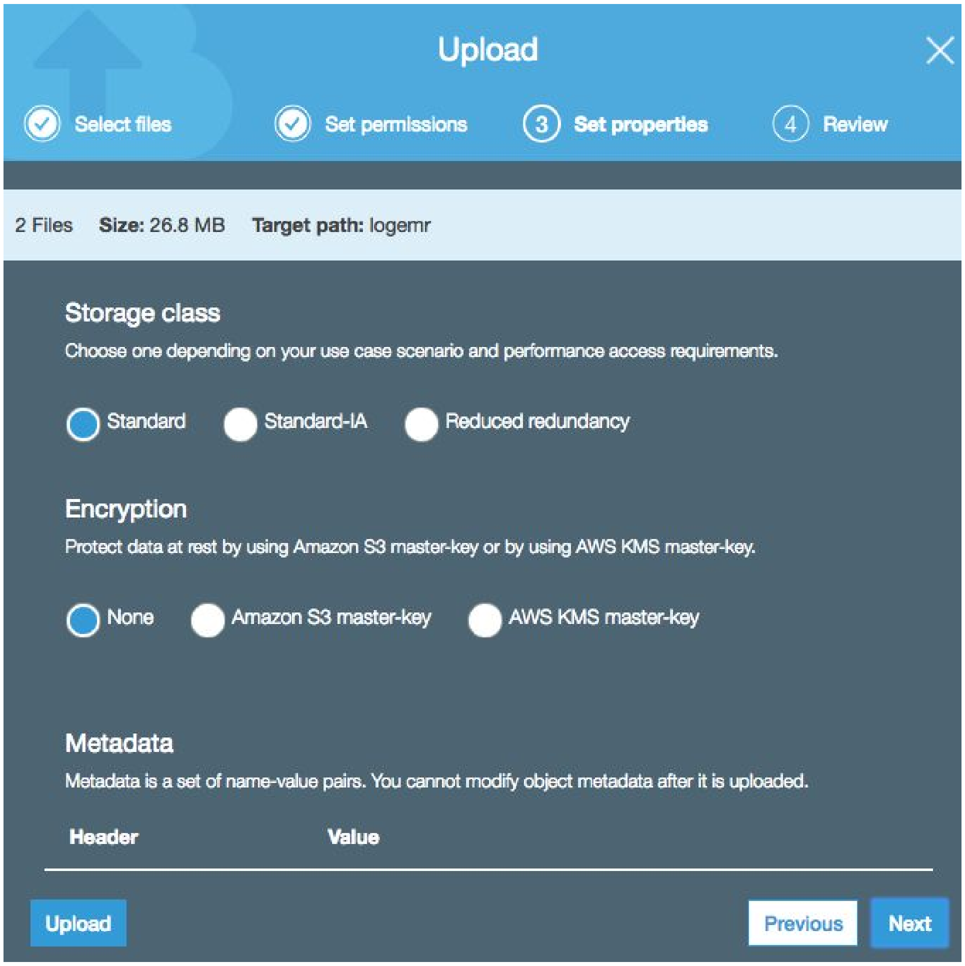
2 Files **Size:** 26.8 MB **Target path:** logemr

Manage users

User ID	Objects	Object permissions	
jay@upstreamdev.com(Owner)	☑ Read ☑ Write	☑ Read ☑ Write	×

Manage public permissions

Do not grant public read access to this object(s) (Recommended)



2 Files **Size:** 26.8 MB **Target path:** logemr

Storage class

Choose one depending on your use case scenario and performance access requirements.

● Standard ○ Standard-IA ○ Reduced redundancy

Encryption

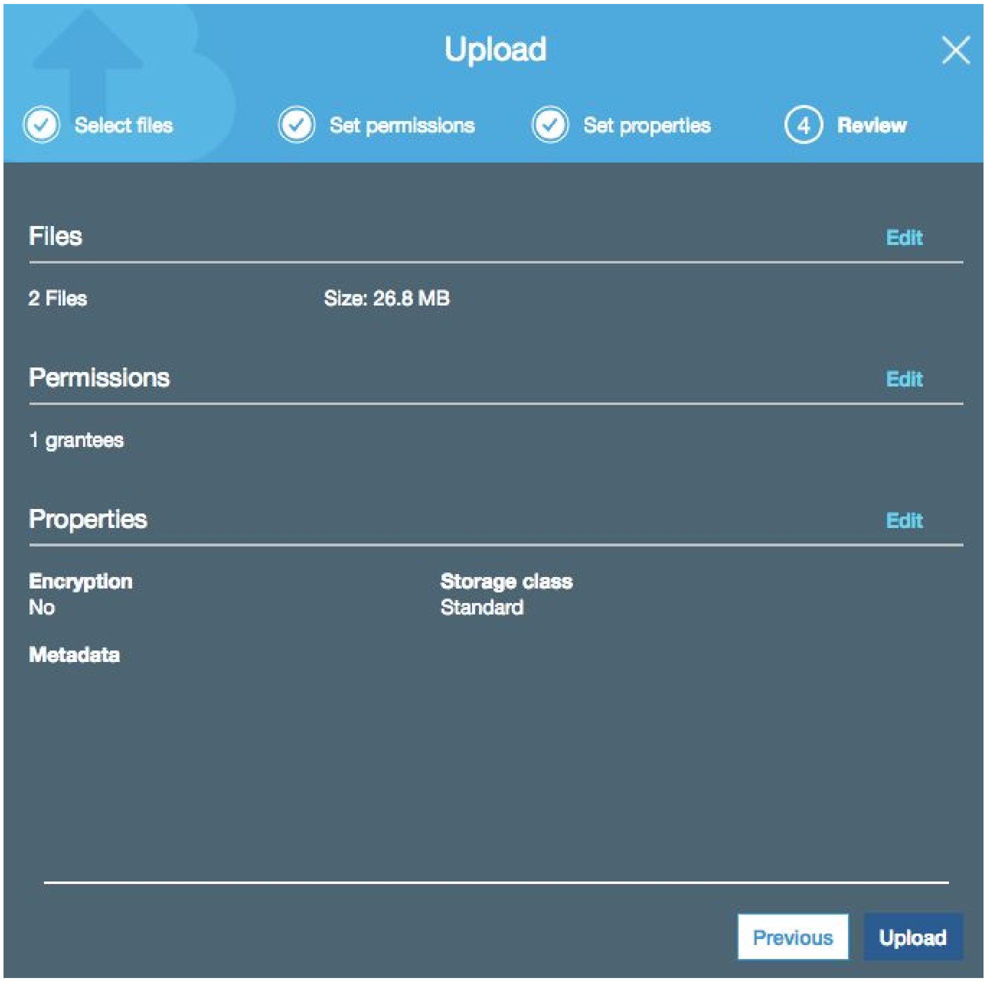
Protect data at rest by using Amazon S3 master-key or by using AWS KMS master-key.

● None ○ Amazon S3 master-key ○ AWS KMS master-key

Metadata

Metadata is a set of name-value pairs. You cannot modify object metadata after it is uploaded.

Header	Value



Files

2 Files Size: 26.8 MB

Permissions

1 grantees

Properties

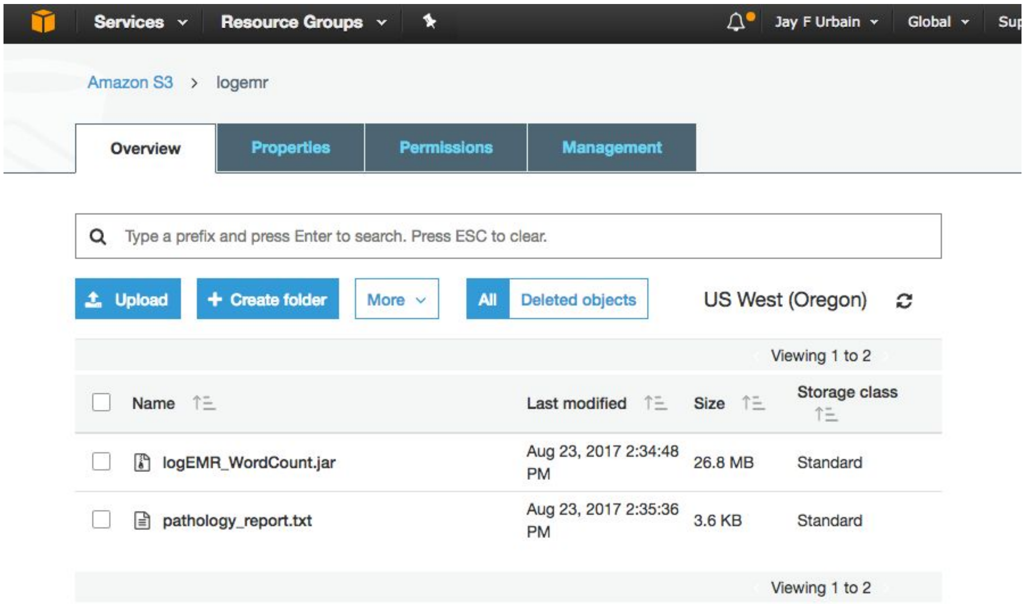
Encryption
No

Storage class
Standard

Metadata

Sure asks a lot of questions. Select Upload.

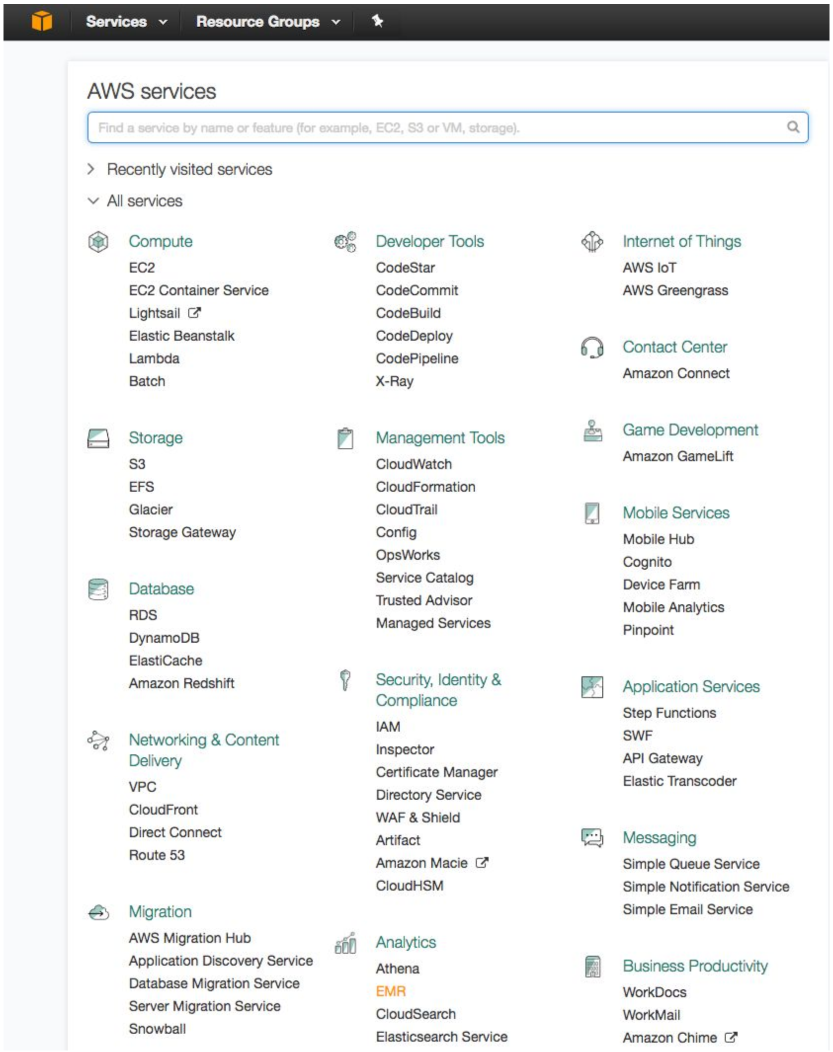
Be patient.



□	Name	Last modified	Size	Storage class
□	logEMR_WordCount.jar	Aug 23, 2017 2:34:48 PM	26.8 MB	Standard
□	pathology_report.txt	Aug 23, 2017 2:35:36 PM	3.6 KB	Standard

tada!

Select EMR from AWS Services



Services · Resource Groups

AWS services

Find a service by name or feature (for example, EC2, S3 or VM, storage).

› Recently visited services

⌄ All services

Compute
EC2
EC2 Container Service
Lightsail
Elastic Beanstalk
Lambda
Batch

Storage
S3
EFS
Glacier
Storage Gateway

Database
RDS
DynamoDB
ElastiCache
Amazon Redshift

Networking & Content Delivery
VPC
CloudFront
Direct Connect
Route 53

Migration
AWS Migration Hub
Application Discovery Service
Database Migration Service
Server Migration Service
Snowball

Developer Tools
CodeStar
CodeCommit
CodeBuild
CodeDeploy
CodePipeline
X-Ray

Management Tools
CloudWatch
CloudFormation
CloudTrail
Config
OpsWorks
Service Catalog
Trusted Advisor
Managed Services

Security, Identity & Compliance
IAM
Inspector
Certificate Manager
Directory Service
WAF & Shield
Artifact
Amazon Macie
CloudHSM

Analytics
Athena
EMR
CloudSearch
Elasticsearch Service

Internet of Things
AWS IoT
AWS Greengrass

Contact Center
Amazon Connect

Game Development
Amazon GameLift

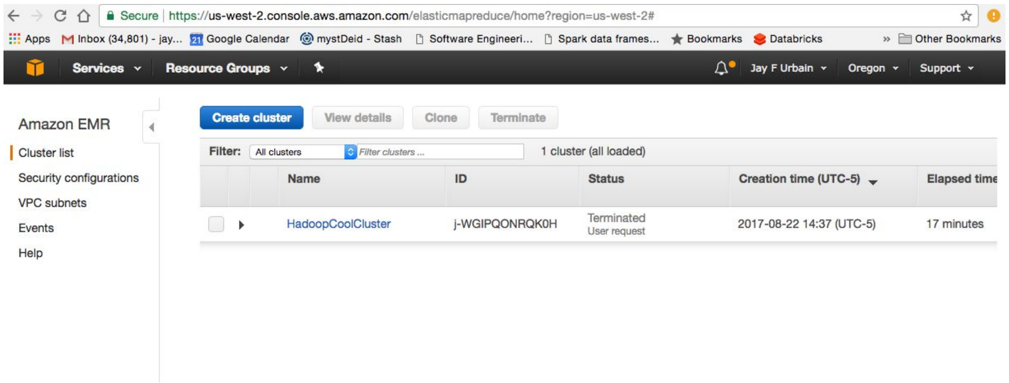
Mobile Services
Mobile Hub
Cognito
Device Farm
Mobile Analytics
Pinpoint

Application Services
Step Functions
SWF
API Gateway
Elastic Transcoder

Messaging
Simple Queue Service
Simple Notification Service
Simple Email Service

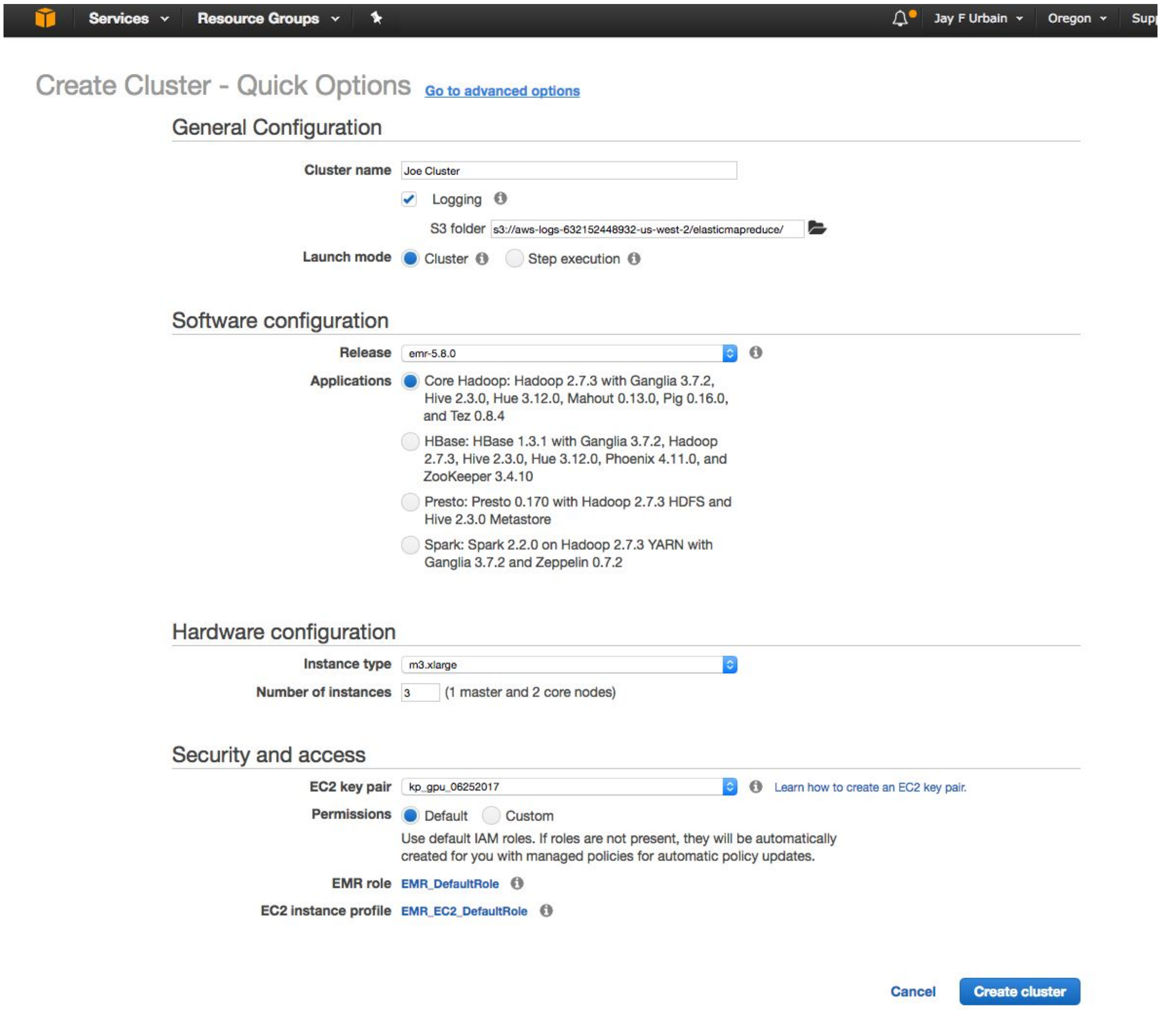
Business Productivity
WorkDocs
WorkMail
Amazon Chime

Select Create Cluster:



Name	ID	Status	Creation time (UTC-5)	Elapsed time
HadoopCoolCluster	j-WGIPQONRQK0H	Terminated User request	2017-08-22 14:37 (UTC-5)	17 minutes

Make the following selections (do NOT select Create cluster until you scroll down):



General Configuration

Cluster name: Joe Cluster

☑ Logging

S3 folder: s3://aws-logs-632152448932-us-west-2/elasticmapreduce/

Launch mode: ● Cluster ○ Step execution

Software configuration

Release: emr-5.8.0

Applications:

- ● Core Hadoop: Hadoop 2.7.3 with Ganglia 3.7.2, Hive 2.3.0, Hue 3.12.0, Mahout 0.13.0, Pig 0.16.0, and Tez 0.8.4
- ○ HBase: HBase 1.3.1 with Ganglia 3.7.2, Hadoop 2.7.3, Hive 2.3.0, Hue 3.12.0, Phoenix 4.11.0, and ZooKeeper 3.4.10
- ○ Presto: Presto 0.170 with Hadoop 2.7.3 HDFS and Hive 2.3.0 Metastore
- ○ Spark: Spark 2.2.0 on Hadoop 2.7.3 YARN with Ganglia 3.7.2 and Zeppelin 0.7.2

Hardware configuration

Instance type: m3.xlarge

Number of instances: 3 (1 master and 2 core nodes)

Security and access

EC2 key pair: kp_gpu_06252017 Learn how to create an EC2 key pair.

Permissions: ● Default ○ Custom

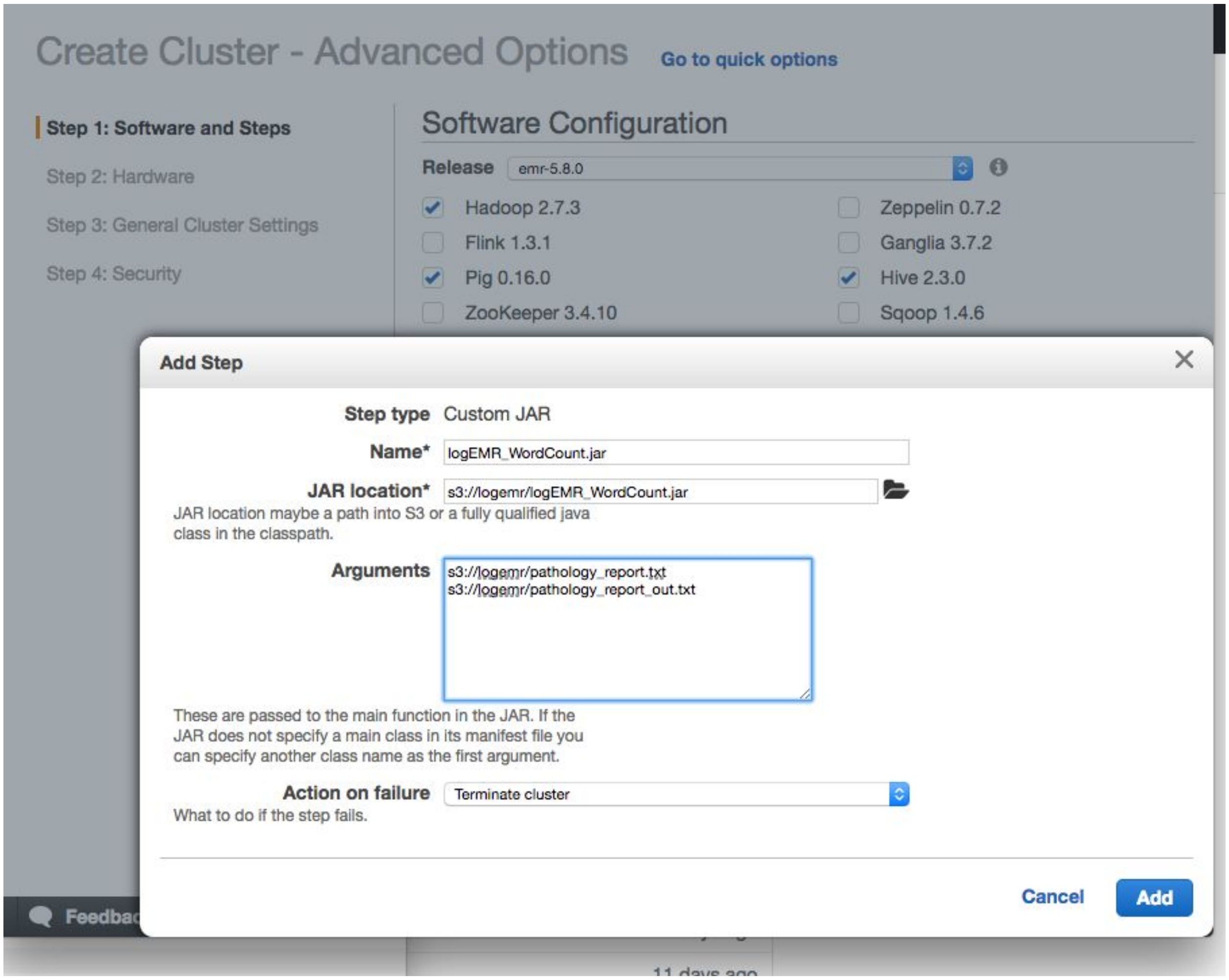
Use default IAM roles. If roles are not present, they will be automatically created for you with managed policies for automatic policy updates.

EMR role: EMR_DefaultRole

EC2 instance profile: EMR_EC2_DefaultRole

Select Go to advanced options

Create a custom JAR



Create Cluster - Advanced Options

Step 1: Software and Steps

Software Configuration

Release: emr-5.8.0

☑ Hadoop 2.7.3
☐ Zeppelin 0.7.2
☐ Flink 1.3.1
☐ Ganglia 3.7.2
☑ Pig 0.16.0
☑ Hive 2.3.0
☐ ZooKeeper 3.4.10
☐ Sqoop 1.4.6

Add Step

Step type: Custom JAR

Name*: logEMR_WordCount.jar

JAR location*: s3://logemr/logEMR_WordCount.jar

JAR location maybe a path into S3 or a fully qualified java class in the classpath.

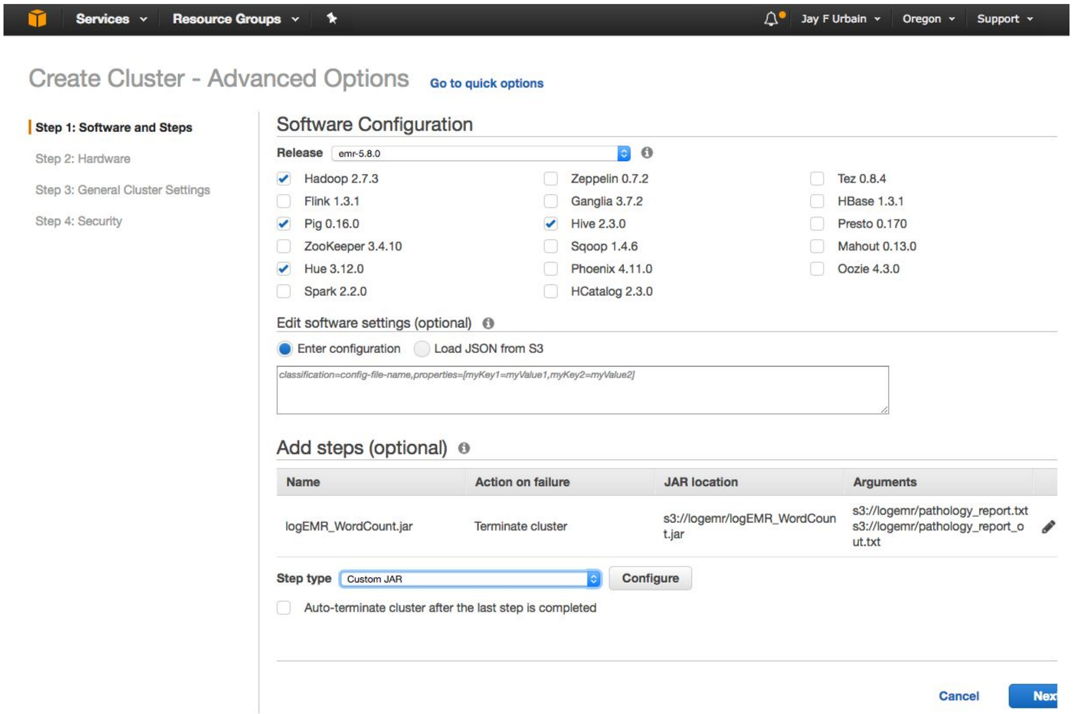
Arguments:

```
s3://logemr/pathology_report.txt
s3://logemr/pathology_report_out.txt
```

These are passed to the main function in the JAR. If the JAR does not specify a main class in its manifest file you can specify another class name as the first argument.

Action on failure: Terminate cluster

What to do if the step fails.



Create Cluster - Advanced Options

Software Configuration

Release: emr-5.8.0

☑ Hadoop 2.7.3 □ Zeppelin 0.7.2 □ Tez 0.8.4
□ Flink 1.3.1 □ Ganglia 3.7.2 □ HBase 1.3.1
☑ Pig 0.16.0 ☑ Hive 2.3.0 □ Presto 0.170
□ ZooKeeper 3.4.10 □ Sqoop 1.4.6 □ Mahout 0.13.0
☑ Hue 3.12.0 □ Phoenix 4.11.0 □ Oozie 4.3.0
□ Spark 2.2.0 □ HCatalog 2.3.0

Edit software settings (optional)

● Enter configuration ○ Load JSON from S3

classification=config-file-name,properties=[myKey1=myValue1,myKey2=myValue2]

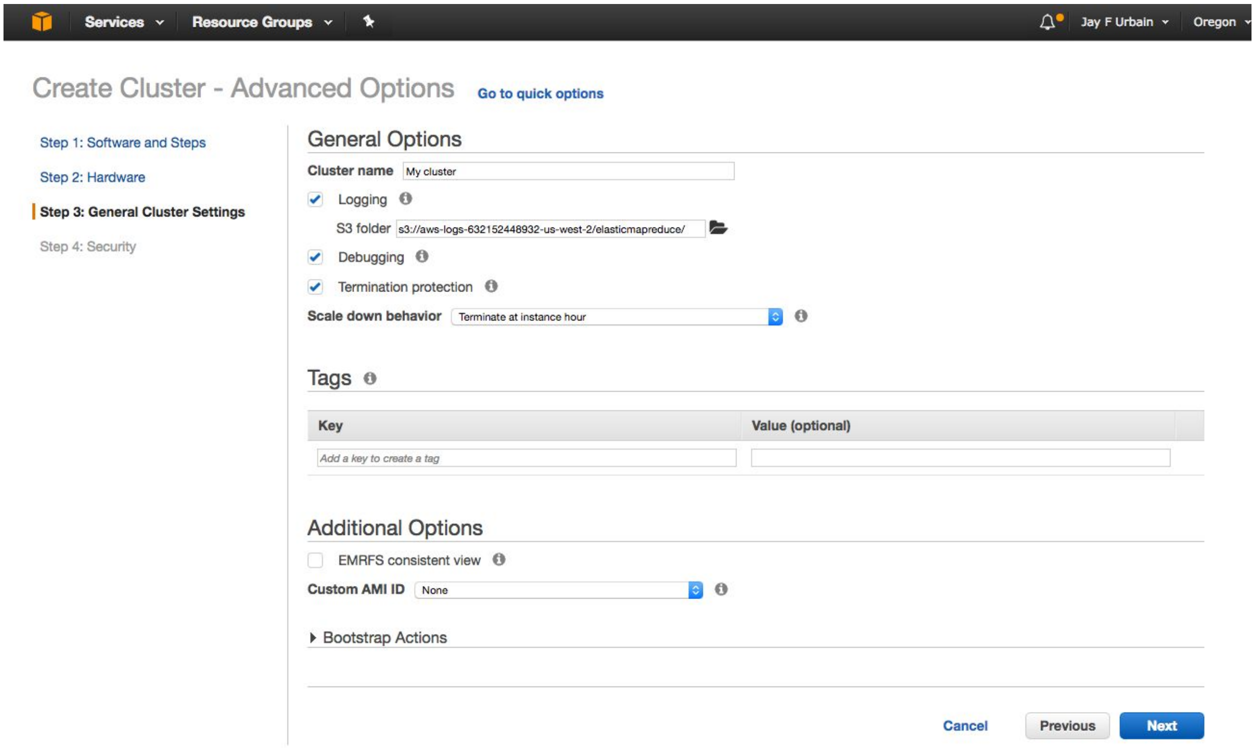
Add steps (optional)

Name	Action on failure	JAR location	Arguments
logEMR_WordCount.jar	Terminate cluster	s3://logemr/logEMR_WordCount.jar	s3://logemr/pathology_report.txt s3://logemr/pathology_report_out.txt

Step type: Custom JAR

□ Auto-terminate cluster after the last step is completed

Select next.



Create Cluster - Advanced Options

General Options

Cluster name: My cluster

☑ Logging

S3 folder: s3://aws-logs-632152448932-us-west-2/elasticmapreduce/

☑ Debugging

☑ Termination protection

Scale down behavior: Terminate at instance hour

Tags

Key	Value (optional)
Add a key to create a tag	

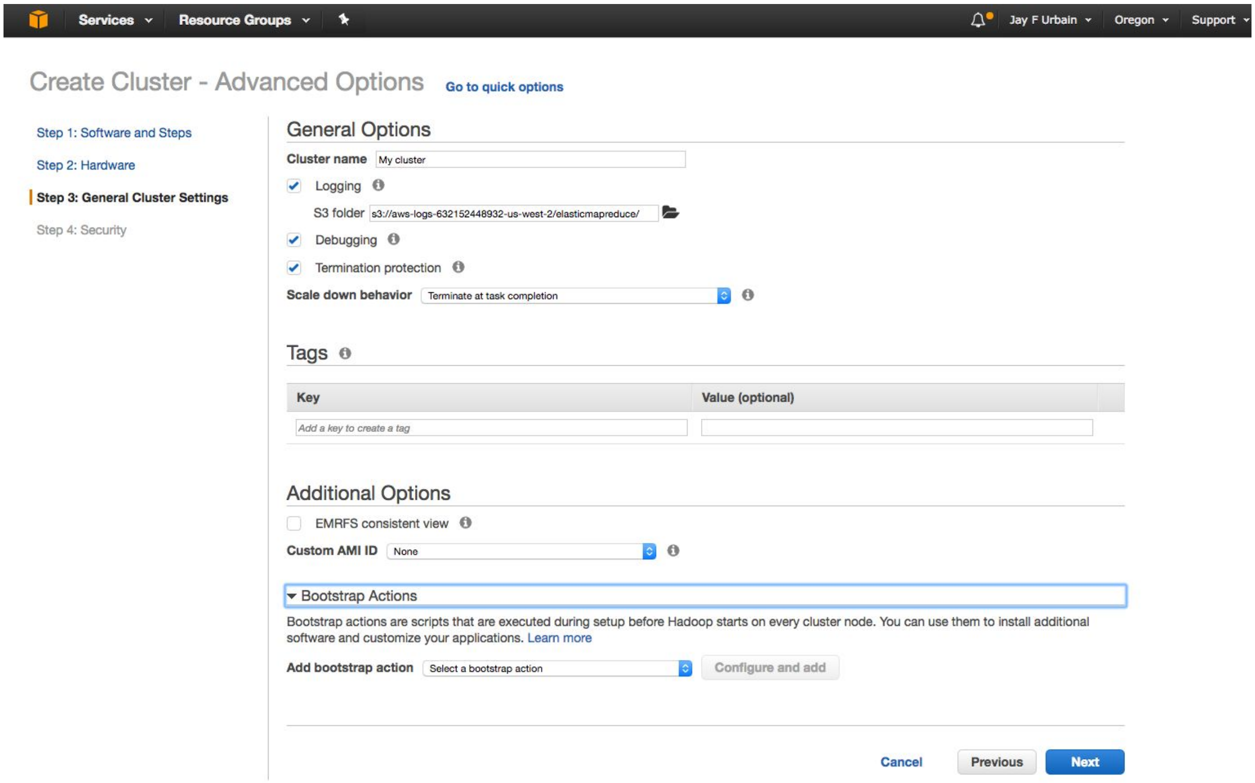
Additional Options

□ EMRFS consistent view

Custom AMI ID: None

Some serious computer power here.

Select terminate at task completion



Create Cluster - Advanced Options

General Options

Cluster name: My cluster

☑ Logging

S3 folder: s3://aws-logs-632152448932-us-west-2/elasticmapreduce/

☑ Debugging

☑ Termination protection

Scale down behavior: Terminate at task completion

Tags

Key	Value (optional)
Add a key to create a tag	

Additional Options

☐ EMRFS consistent view

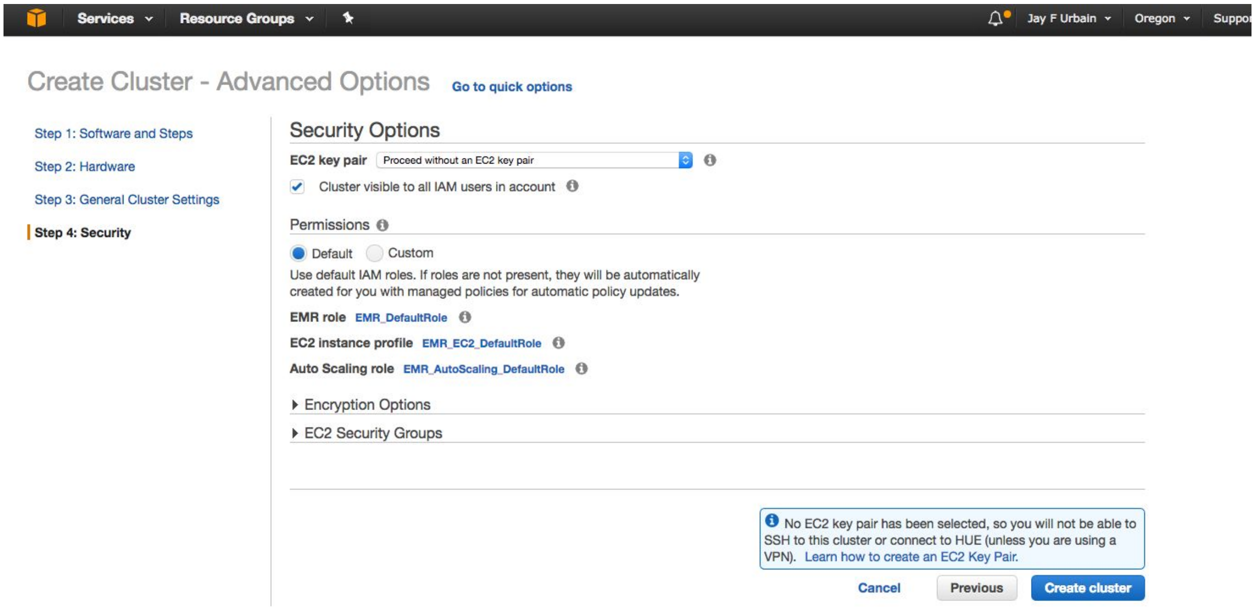
Custom AMI ID: None

Bootstrap Actions

Bootstrap actions are scripts that are executed during setup before Hadoop starts on every cluster node. You can use them to install additional software and customize your applications. Learn more

Add bootstrap action: Select a bootstrap action

Next.



Create Cluster - Advanced Options Go to quick options

Step 1: Software and Steps
Step 2: Hardware
Step 3: General Cluster Settings
Step 4: Security

Security Options

EC2 key pair Proceed without an EC2 key pair

☑ Cluster visible to all IAM users in account

Permissions

● Default ○ Custom

Use default IAM roles. If roles are not present, they will be automatically created for you with managed policies for automatic policy updates.

EMR role EMR_DefaultRole

EC2 instance profile EMR_EC2_DefaultRole

Auto Scaling role EMR_AutoScaling_DefaultRole

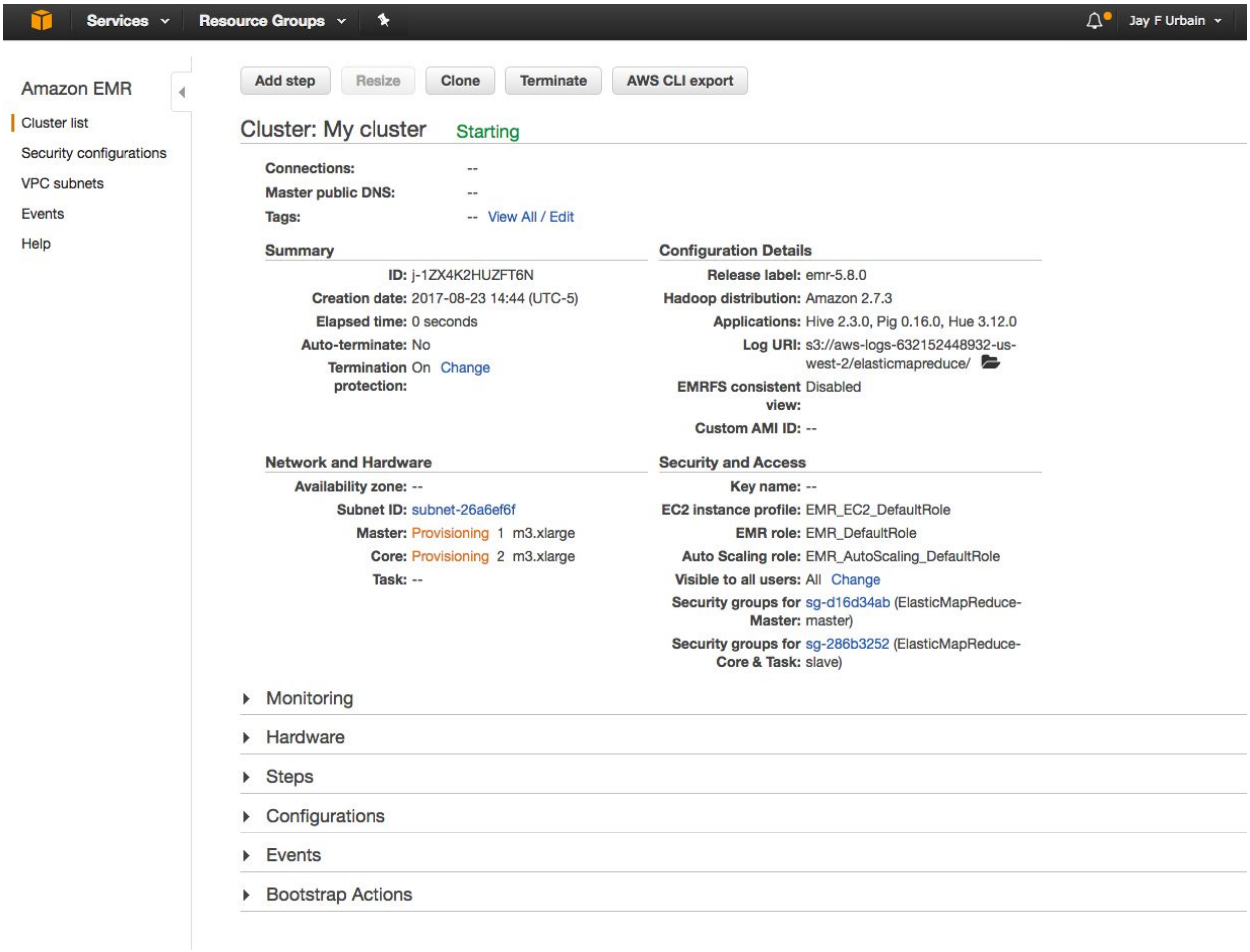
▸ Encryption Options

▸ EC2 Security Groups

No EC2 key pair has been selected, so you will not be able to SSH to this cluster or connect to HUE (unless you are using a VPN). Learn how to create an EC2 Key Pair.

Cancel Previous Create cluster

Create cluster



Cluster: My cluster Starting

Connections: --
Master public DNS: --
Tags: -- View All / Edit

Summary

ID: j-1ZX4K2HUZFT6N
Creation date: 2017-08-23 14:44 (UTC-5)
Elapsed time: 0 seconds
Auto-terminate: No
Termination protection: On Change

Configuration Details

Release label: emr-5.8.0
Hadoop distribution: Amazon 2.7.3
Applications: Hive 2.3.0, Pig 0.16.0, Hue 3.12.0
Log URI: s3://aws-logs-632152448932-us-west-2/elasticmapreduce/
EMRFS consistent view: Disabled
Custom AMI ID: --

Network and Hardware

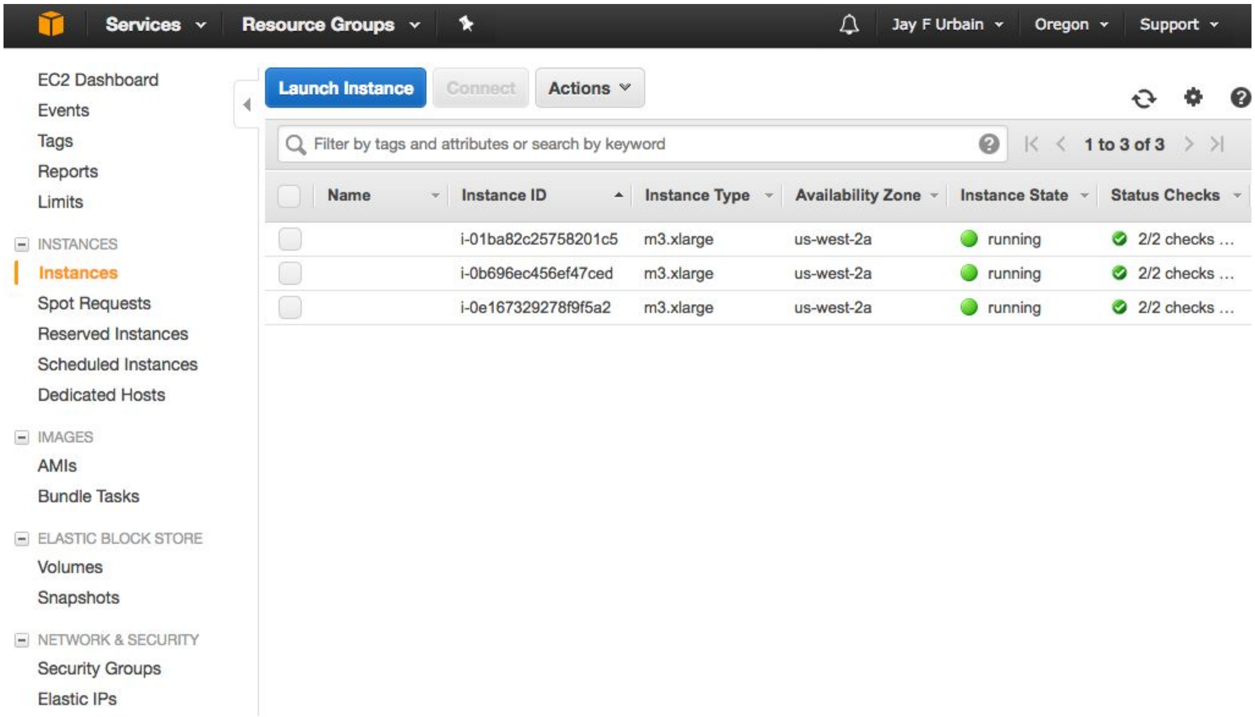
Availability zone: --
Subnet ID: subnet-26a6ef6f
Master: Provisioning 1 m3.xlarge
Core: Provisioning 2 m3.xlarge
Task: --

Security and Access

Key name: --
EC2 instance profile: EMR_EC2_DefaultRole
EMR role: EMR_DefaultRole
Auto Scaling role: EMR_AutoScaling_DefaultRole
Visible to all users: All Change
Security groups for Master: sg-d16d34ab (ElasticMapReduce-master)
Security groups for Core & Task: sg-286b3252 (ElasticMapReduce-slave)

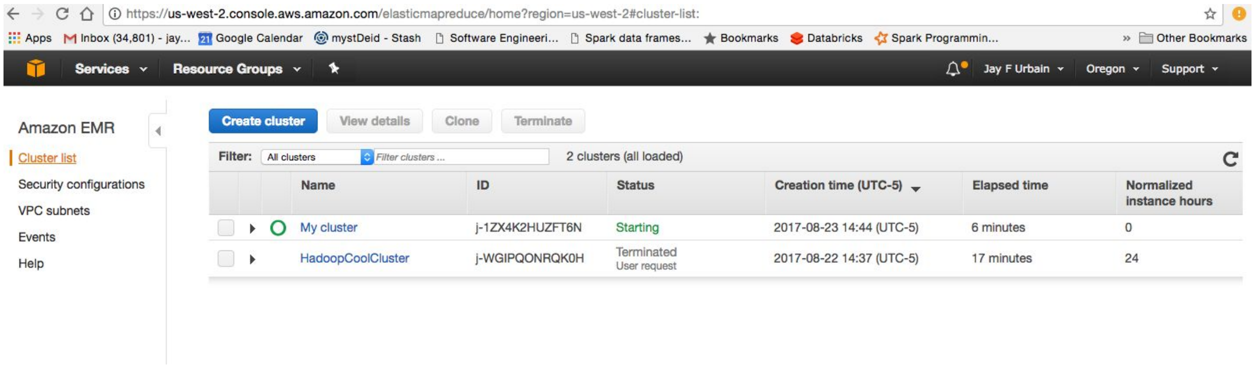
Be patient. If you're bored, you can look at the instances starting:

Go back to services, select EC2, and then select EC2 instances running:



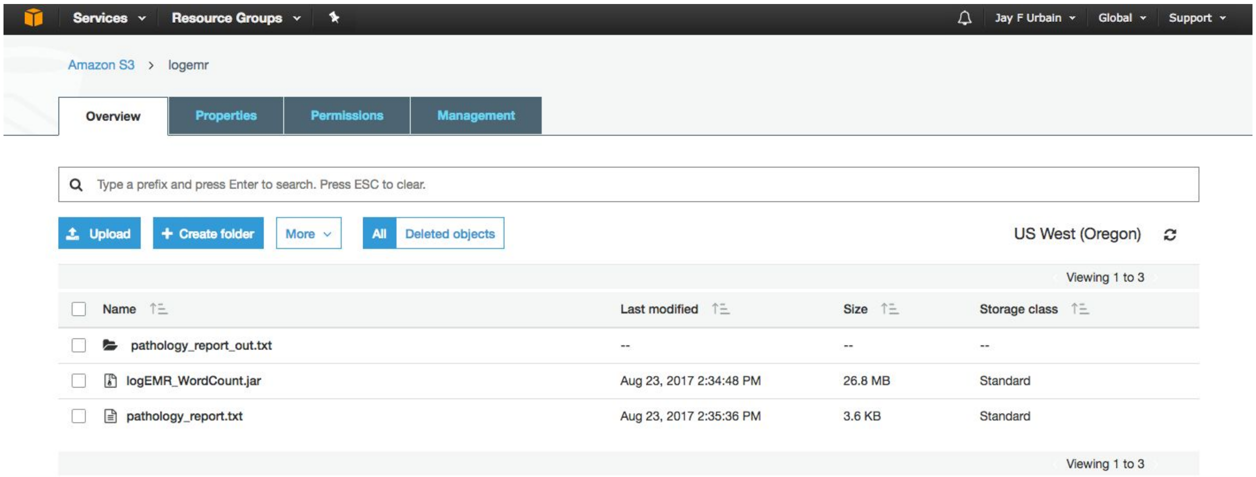
Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks
	i-01ba82c25758201c5	m3.xlarge	us-west-2a	● running	✓ 2/2 checks ...
	i-0b696ec456ef47ced	m3.xlarge	us-west-2a	● running	✓ 2/2 checks ...
	i-0e167329278f9f5a2	m3.xlarge	us-west-2a	● running	✓ 2/2 checks ...

Go back to your clusters.



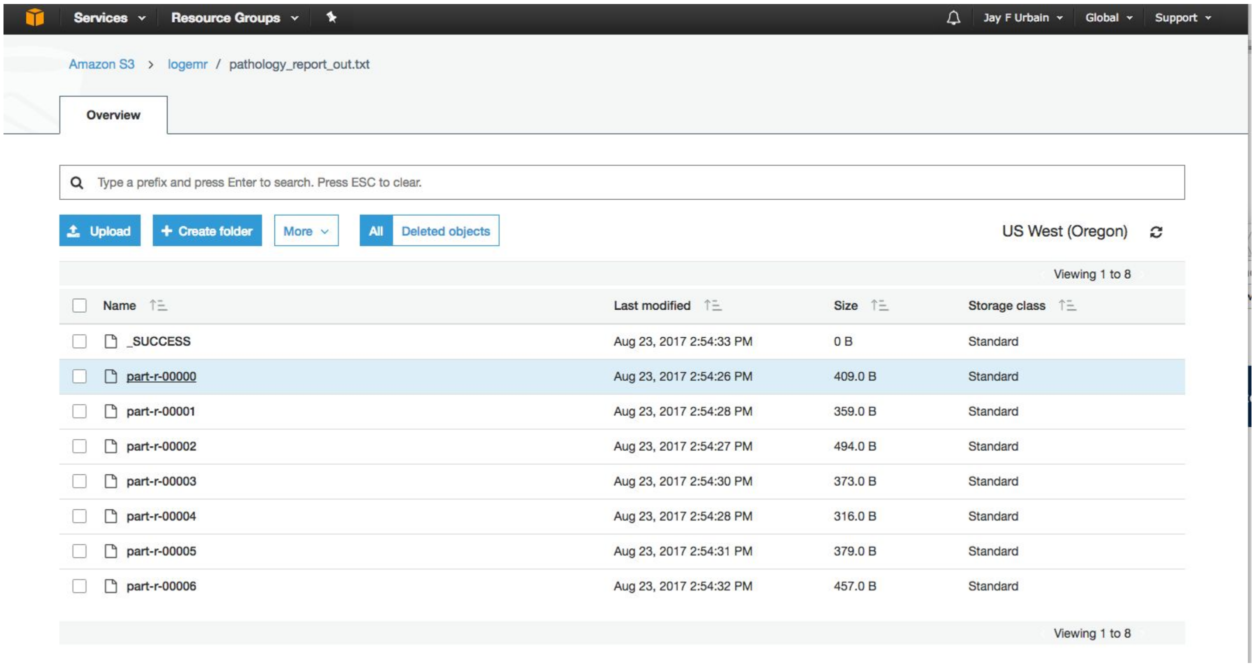
Name	ID	Status	Creation time (UTC-5)	Elapsed time	Normalized instance hours
○ My cluster	j-1ZX4K2HUZFT6N	Starting	2017-08-23 14:44 (UTC-5)	6 minutes	0
HadoopCoolCluster	j-WGIPQONRQK0H	Terminated User request	2017-08-22 14:37 (UTC-5)	17 minutes	24

Check S3



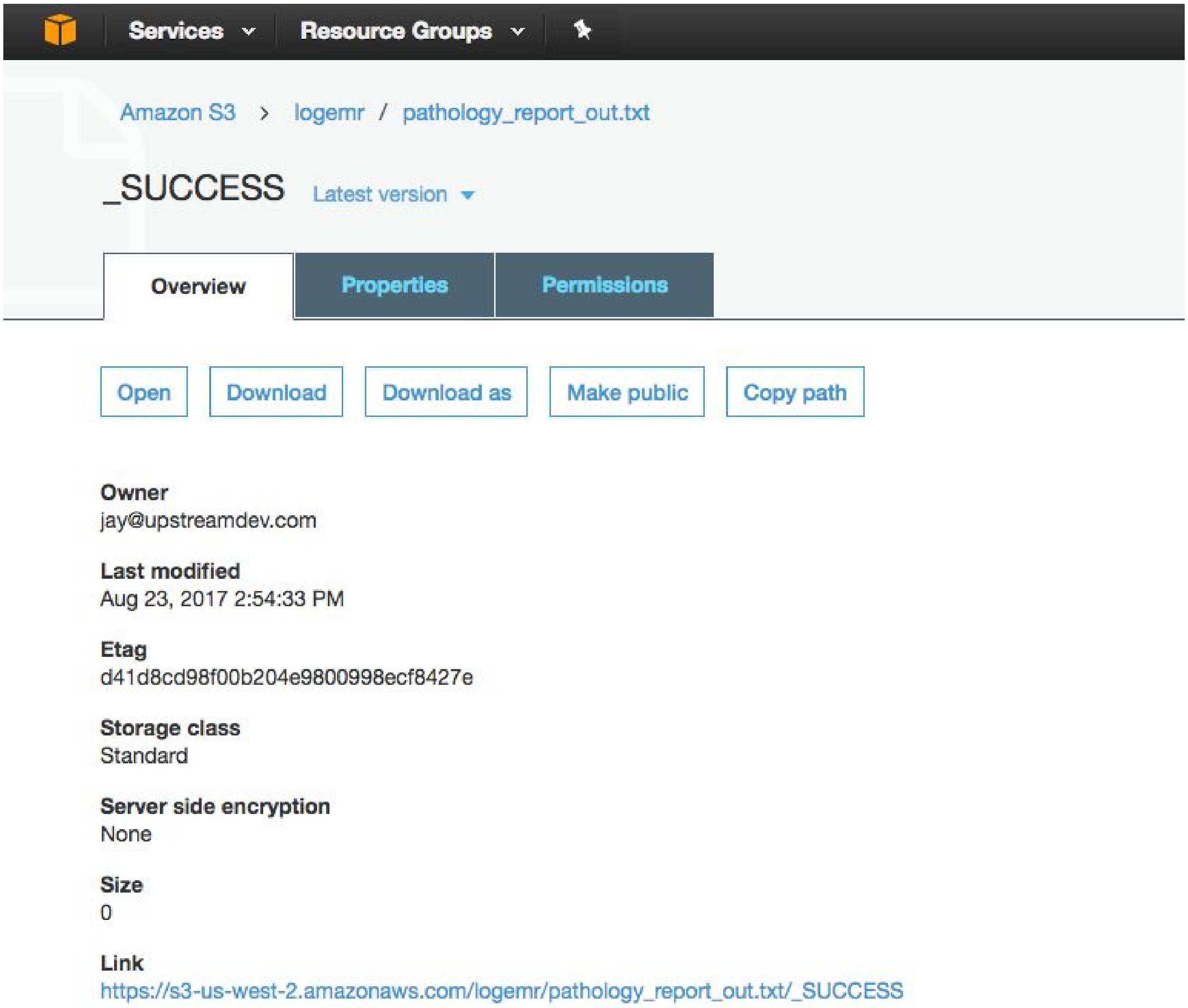
Name	Last modified	Size	Storage class
pathology_report_out.txt	--	--	--
logEMR_WordCount.jar	Aug 23, 2017 2:34:48 PM	26.8 MB	Standard
pathology_report.txt	Aug 23, 2017 2:35:36 PM	3.6 KB	Standard

This is exciting! Select your output directory.



Name	Last modified	Size	Storage class
_SUCCESS	Aug 23, 2017 2:54:33 PM	0 B	Standard
part-r-00000	Aug 23, 2017 2:54:26 PM	409.0 B	Standard
part-r-00001	Aug 23, 2017 2:54:28 PM	359.0 B	Standard
part-r-00002	Aug 23, 2017 2:54:27 PM	494.0 B	Standard
part-r-00003	Aug 23, 2017 2:54:30 PM	373.0 B	Standard
part-r-00004	Aug 23, 2017 2:54:28 PM	316.0 B	Standard
part-r-00005	Aug 23, 2017 2:54:31 PM	379.0 B	Standard
part-r-00006	Aug 23, 2017 2:54:32 PM	457.0 B	Standard

SUCCESS!!!



Owner
jay@upstreamdev.com

Last modified
Aug 23, 2017 2:54:33 PM

Etag
d41d8cd98f00b204e9800998ecf8427e

Storage class
Standard

Server side encryption
None

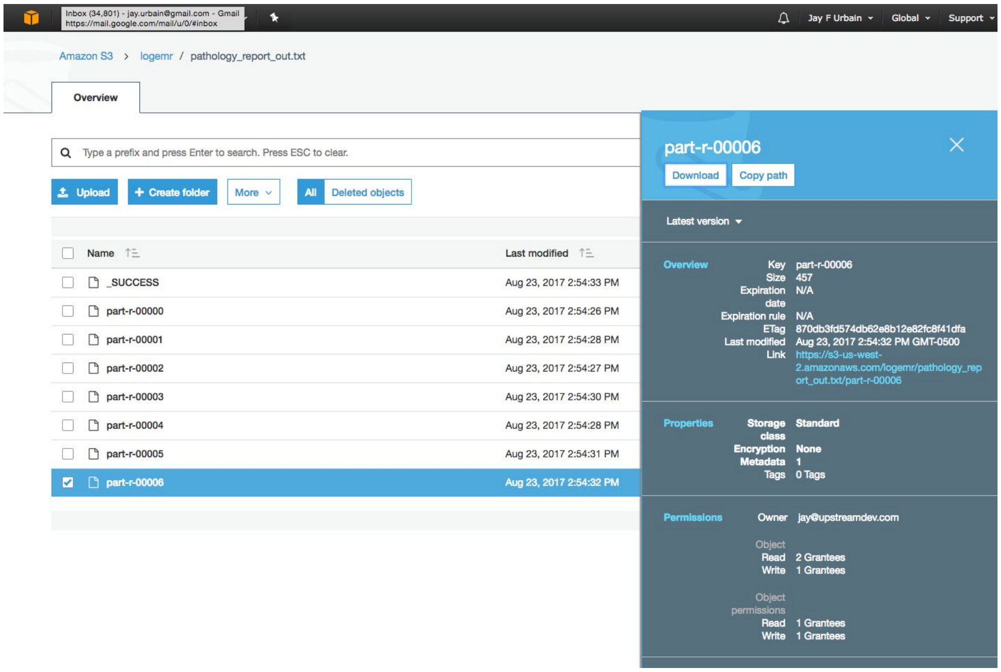
Size
0

Link
https://s3-us-west-2.amazonaws.com/logemr/pathology_report_out.txt/_SUCCESS

You can download output files individually. S3 is not designed for browsing file contents.

Note: if you install the command line tools, you can do the following:

```
aws s3 sync s3://mybucket .
```


Inbox (34,801) - jay.urbain@gmail.com - Gmail
https://mail.google.com/mail/u/0/#inbox
Jay F Urbain
Global
Support

Amazon S3 › logemr / pathology_report_out.txt

Overview
Type a prefix and press Enter to search. Press ESC to clear.
Upload
+ Create folder
More
All
Deleted objects

	Name	Last modified
□	_SUCCESS	Aug 23, 2017 2:54:33 PM
□	part-r-00000	Aug 23, 2017 2:54:26 PM
□	part-r-00001	Aug 23, 2017 2:54:28 PM
□	part-r-00002	Aug 23, 2017 2:54:27 PM
□	part-r-00003	Aug 23, 2017 2:54:30 PM
□	part-r-00004	Aug 23, 2017 2:54:28 PM
□	part-r-00005	Aug 23, 2017 2:54:31 PM
☑	part-r-00006	Aug 23, 2017 2:54:32 PM

part-r-00006

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Overview

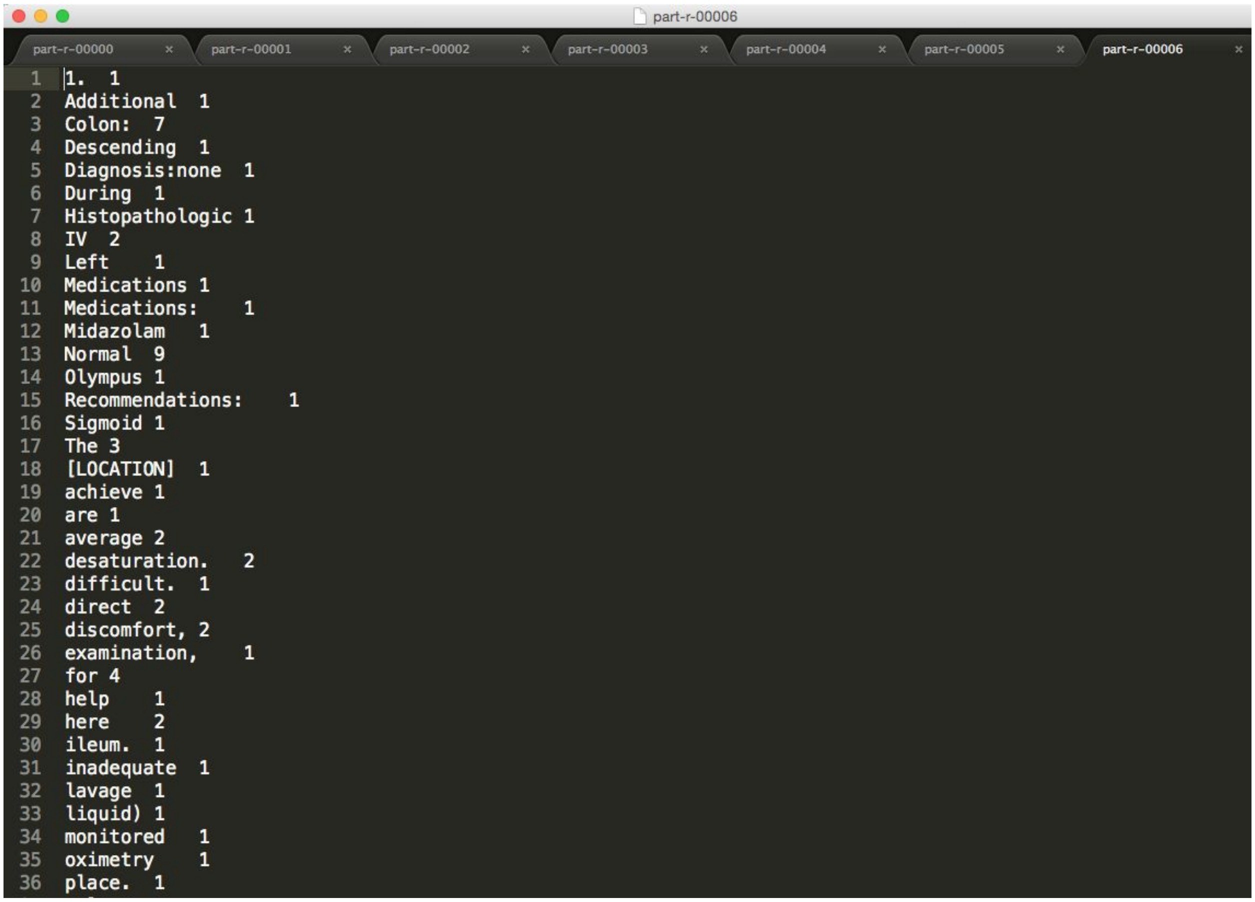
Key	part-r-00006
Size	457
Expiration date	N/A
Expiration rule	N/A
ETag	870db3fd574db62e8b12e82fc8f41dfa
Last modified	Aug 23, 2017 2:54:32 PM GMT-0500
Link	https://s3-us-west-2.amazonaws.com/logemr/pathology_report_out.txt/part-r-00006

Properties

Storage class	Standard
Encryption	None
Metadata	1
Tags	0 Tags

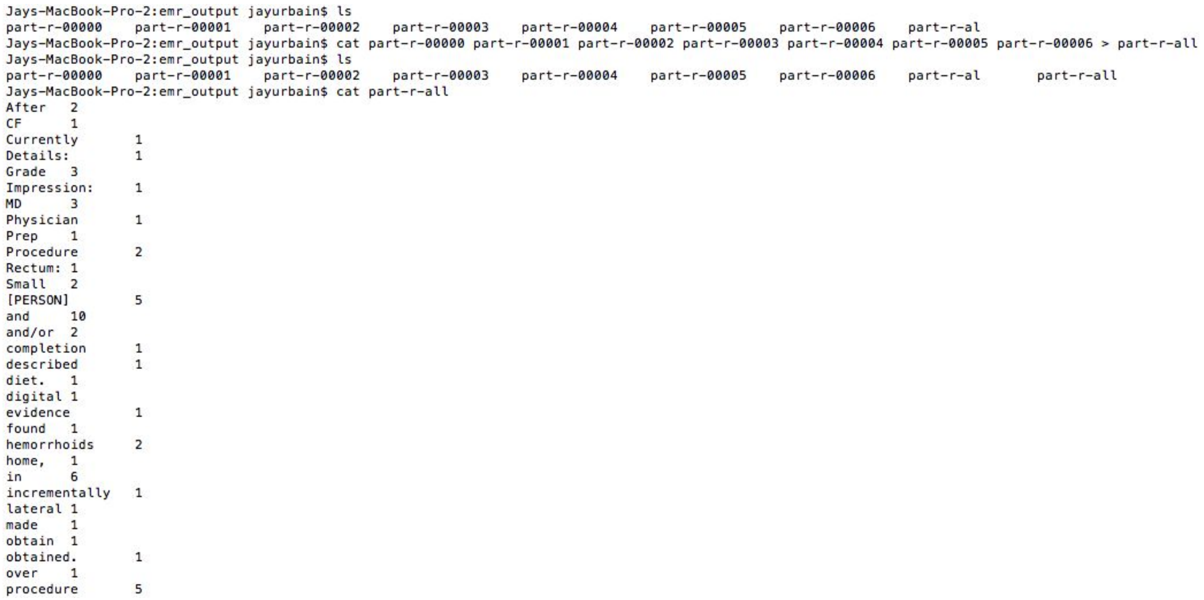
Permissions

Owner	jay@upstreamdev.com
Object	
Read	2 Grantees
Write	1 Grantees
Object permissions	
Read	1 Grantees
Write	1 Grantees



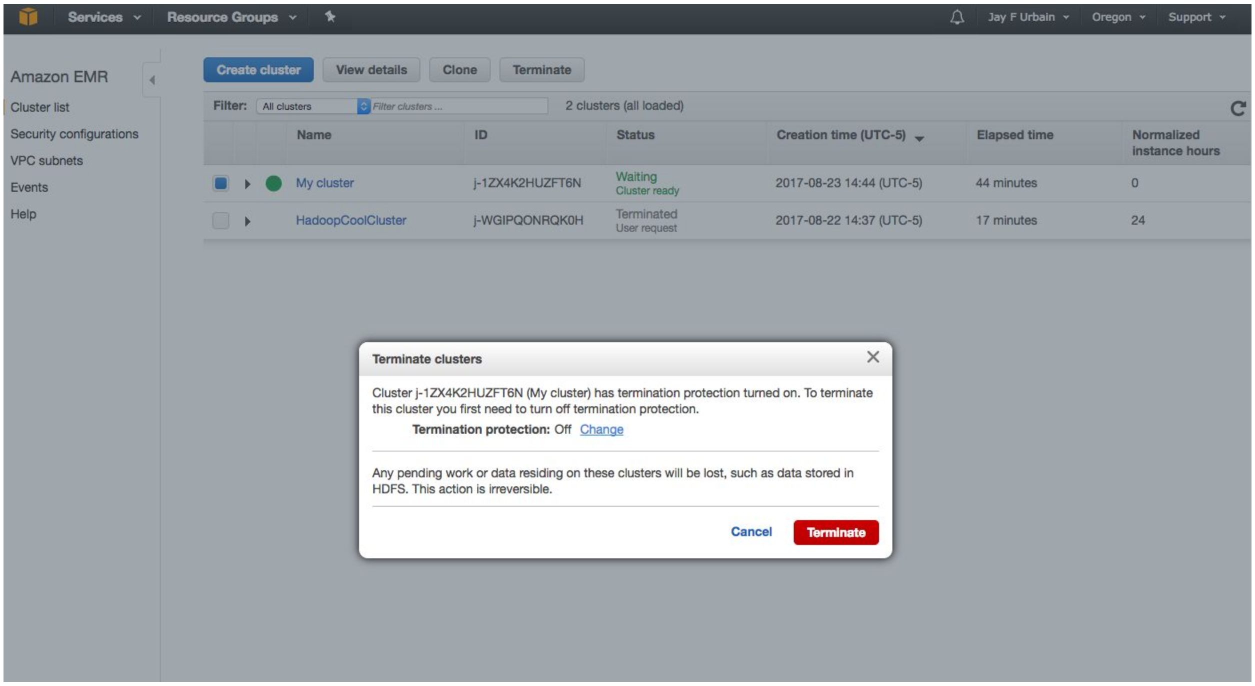
```
1.  1
Additional  1
Colon:  7
Descending  1
Diagnosis:none  1
During  1
Histopathologic 1
IV  2
Left    1
Medications 1
Medications:    1
Midazolam   1
Normal  9
Olympus 1
Recommendations:    1
Sigmoid 1
The 3
[LOCATION]  1
achieve 1
are 1
average 2
desaturation.   2
difficult.  1
direct  2
discomfort, 2
examination,    1
for 4
help    1
here    2
ileum.  1
inadequate  1
lavage  1
liquid) 1
monitored   1
oximetry    1
place.  1
```

You can create a single file using cat:



```
Jays-MacBook-Pro-2:emr_output jayurbain$ ls
part-r-00000    part-r-00001    part-r-00002    part-r-00003    part-r-00004    part-r-00005    part-r-00006    part-r-al
Jays-MacBook-Pro-2:emr_output jayurbain$ cat part-r-00000 part-r-00001 part-r-00002 part-r-00003 part-r-00004 part-r-00005 part-r-00006 > part-r-all
Jays-MacBook-Pro-2:emr_output jayurbain$ ls
part-r-00000    part-r-00001    part-r-00002    part-r-00003    part-r-00004    part-r-00005    part-r-00006    part-r-al       part-r-all
Jays-MacBook-Pro-2:emr_output jayurbain$ cat part-r-all
After   2
CF      1
Currently       1
Details:        1
Grade   3
Impression:     1
MD      3
Physician       1
Prep    1
Procedure       2
Rectum: 1
Small   2
[PERSON]        5
and     10
and/or  2
completion      1
described       1
diet.   1
digital 1
evidence        1
found   1
hemorrhoids     2
home,   1
in      6
incrementally   1
lateral 1
made    1
obtain  1
obtained.       1
over    1
procedure       5
```

Return to EMR screen, make sure your cluster is dead. The meter is running, Select Terminate.



	Name	ID	Status	Creation time (UTC-5)	Elapsed time	Normalized instance hours
☑	My cluster	j-1ZX4K2HUZFT6N	Waiting Cluster ready	2017-08-23 14:44 (UTC-5)	44 minutes	0
□	HadoopCoolCluster	j-WGIPQONRQK0H	Terminated User request	2017-08-22 14:37 (UTC-5)	17 minutes	24

Terminate clusters

Cluster j-1ZX4K2HUZFT6N (My cluster) has termination protection turned on. To terminate this cluster you first need to turn off termination protection.

Termination protection: Off Change

Any pending work or data residing on these clusters will be lost, such as data stored in HDFS. This action is irreversible.

AWS Command line tools

You can install AWS command line tools and interact with AWS through a terminal window. https://aws.amazon.com/cli/?sc_channel=PS&sc_campaign=acquisition_US&sc_publisher=google&sc_medium=command_line_b&sc_content=aws_cli_p&sc_detail=aws%20cli&sc_category=command_line&sc_segment=159752350313&sc_matchtype=p&sc_country=US&s_kwcid=AL!4422!3!159752350313!p!!g!!aws%20cli&ef_id=WM1YAAAAHwO1Q7Z:20170823201900:s

Download Hadoop and run locally

http://hadoop.apache.org/releases.html

Download source tar ball.

You should install Cygwin or better yet, buy a Mac. When installing Cygwin, make sure to select the Bash shell and OpenSSL features to be able to develop and run the MapReduce examples locally on Windows systems.

Hadoop, Hive, and Pig require the JAVA_HOME environment variable to be set. It is also typically good practice to have Java in the PATH so scripts and applications can easily find it. On a Linux machine, you can use the following command to specify these settings:

```
export JAVA_HOME=/usr/java/latest
export PATH=$PATH:$JAVA_HOME/bin
```

After you install Hadoop, it is convenient to add Hadoop to the path and define a variable that references the location of Hadoop for other scripts and routines that use it. The following example shows these variables being added to the .bash_profile on a Linux system to define the home location and add Hadoop to the path:

```
   $ export HADOOP_INSTALL=/home/user/hadoop-0.20.205.0
   $ export PATH=$PATH:$HADOOP_INSTALL/bin
```

You can confirm the installation and setup of Hadoop by running it at the command line. The following example shows running the hadoop command line and the version installed:

```
   $ hadoop version
   Hadoop 0.20.205.0
   Subversion https://svn.apache.org/repos/asf/hadoop/
```

```
common/branches/branch-0.20-security-205 -r 1179940
Compiled by hortonfo on Fri Oct  7 06:26:14 UTC 2011
```