Using AWS Educate For CSCE 676

This document is a quick guide on how to apply for an AWS Educate account, create a Hadoop/Spark cluster, create an S3 storage bucket and how to create a Jupyter notebook to run code against the created cluster.

Thanks to Amazon for providing free credits for this course!

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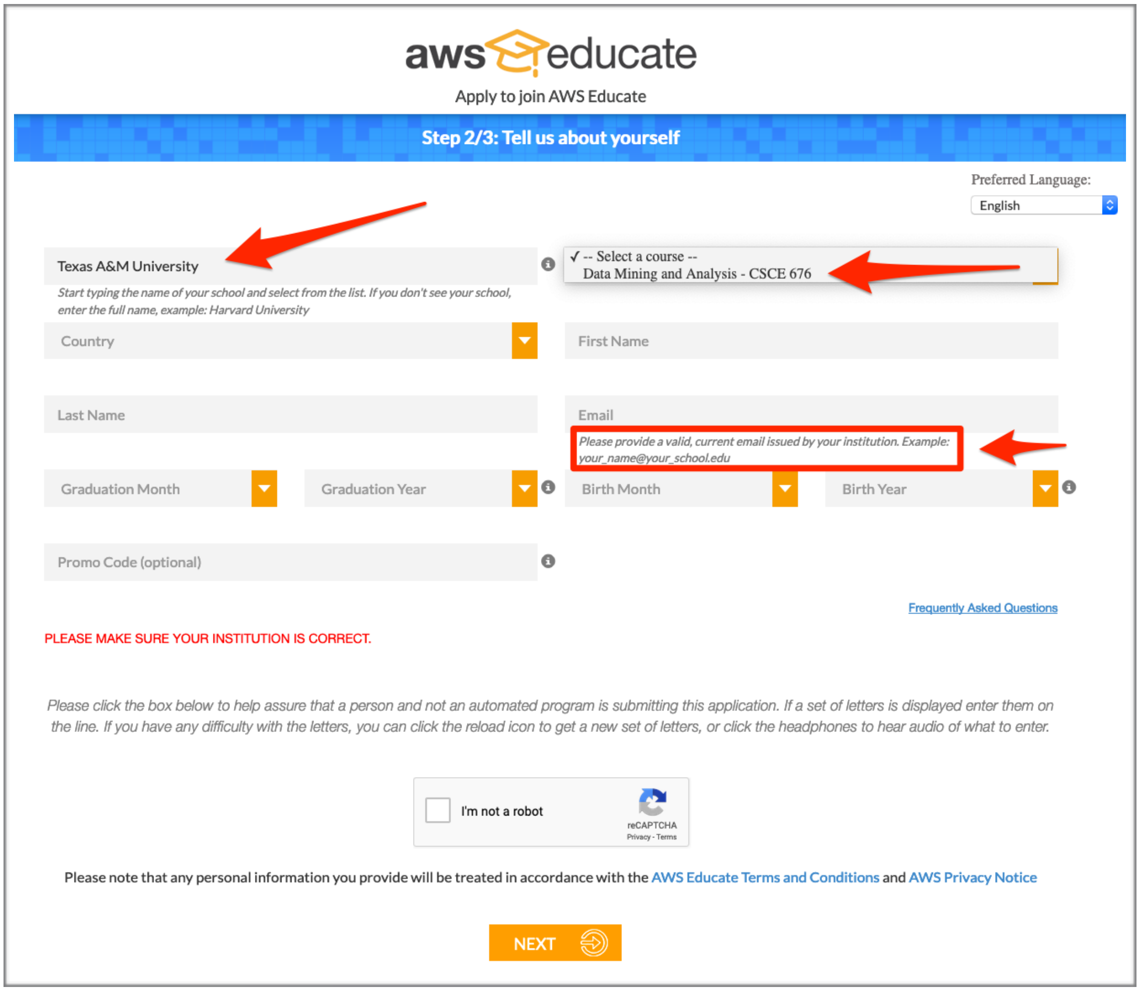
Applying to AWS Educate

To apply to join AWS Educate, follow the URL given in class and choose "Texas A&M University "and "Data Mining and Analysis - CSCE 676" course from the corresponding dropdown menus as show below. Click on an email confirmation link that will be sent to you. Your application should be approved within an hour.



Apply to join AWS Educate

Step 2/3: Tell us about yourself

Preferred Language: English

Texas A&M University

Start typing the name of your school and select from the list. If you don't see your school, enter the full name, example: Harvard University

✓ -- Select a course --
Data Mining and Analysis - CSCE 676

Please provide a valid, current email issued by your institution. Example: your_name@your_school.edu

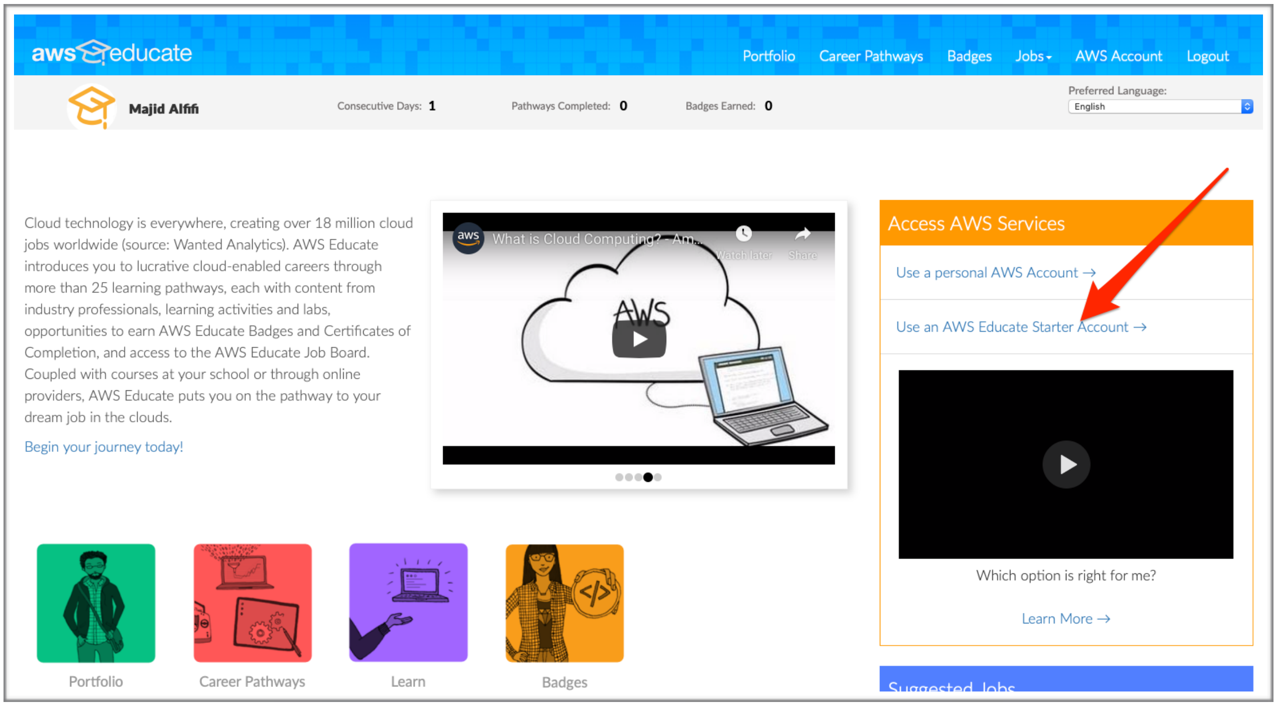
PLEASE MAKE SURE YOUR INSTITUTION IS CORRECT.

Please click the box below to help assure that a person and not an automated program is submitting this application. If a set of letters is displayed enter them on the line. If you have any difficulty with the letters, you can click the reload icon to get a new set of letters, or click the headphones to hear audio of what to enter.

□ I'm not a robot

Please note that any personal information you provide will be treated in accordance with the AWS Educate Terms and Conditions and AWS Privacy Notice

After your application gets approved, follow the link sent to you to set a password and to access your AWS Educate account. Once you have created your account and are able to access the starting page as shown below click on "Use an AWS Educate Starter Account" and then click "Create Starter Account"



Cloud technology is everywhere, creating over 18 million cloud jobs worldwide (source: Wanted Analytics). AWS Educate introduces you to lucrative cloud-enabled careers through more than 25 learning pathways, each with content from industry professionals, learning activities and labs, opportunities to earn AWS Educate Badges and Certificates of Completion, and access to the AWS Educate Job Board. Coupled with courses at your school or through online providers, AWS Educate puts you on the pathway to your dream job in the clouds.

Begin your journey today!

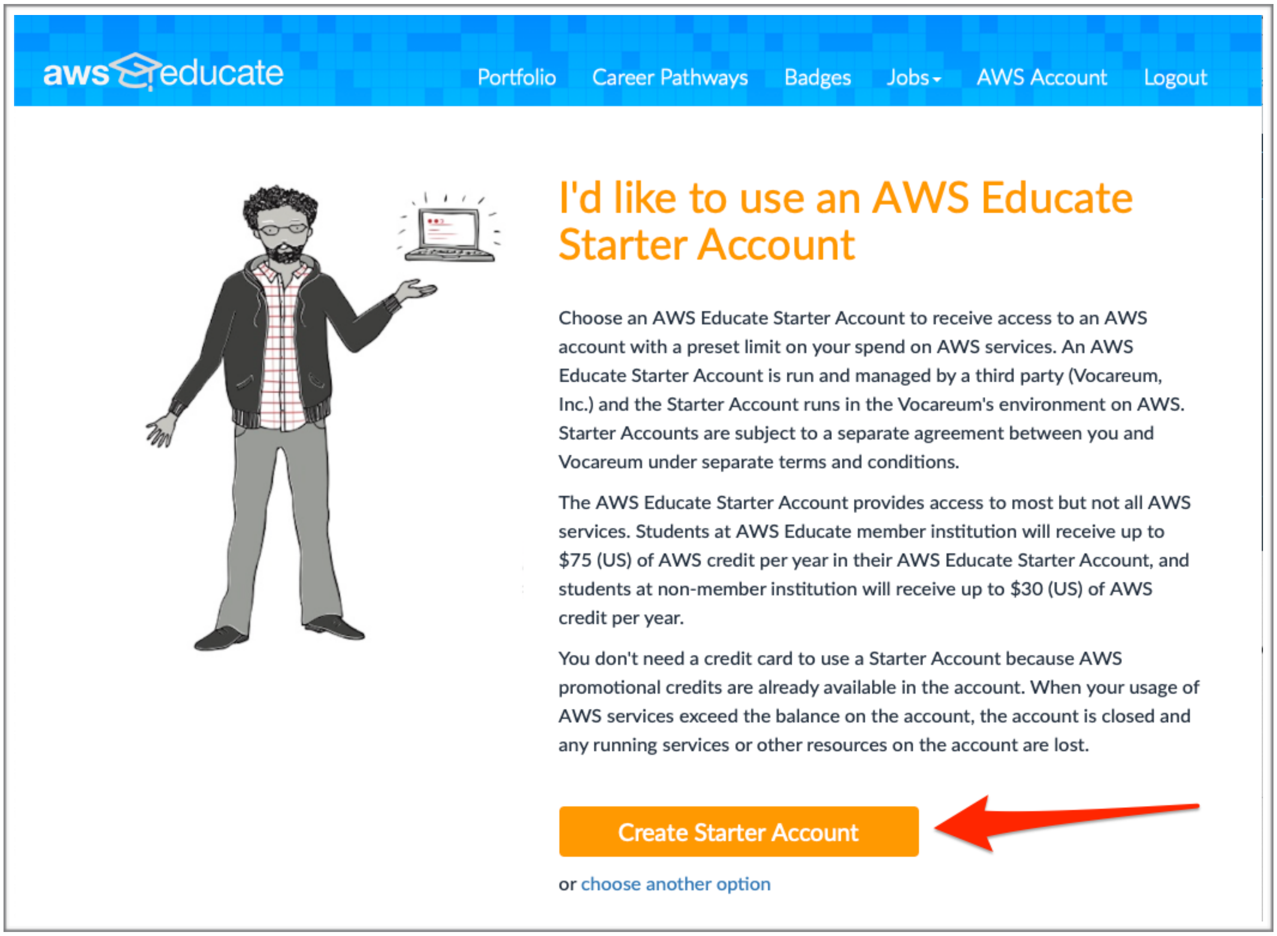
Access AWS Services

Use a personal AWS Account →

Use an AWS Educate Starter Account →

Which option is right for me?

Learn More →



I'd like to use an AWS Educate Starter Account

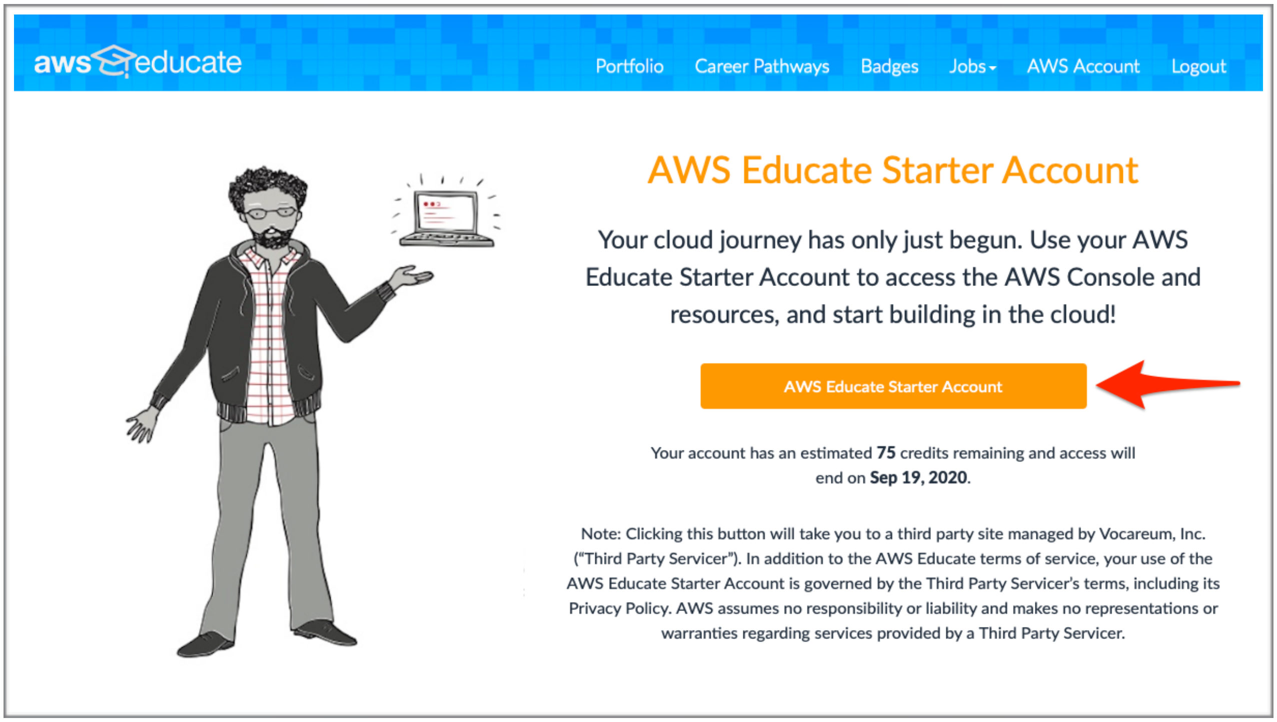
Choose an AWS Educate Starter Account to receive access to an AWS account with a preset limit on your spend on AWS services. An AWS Educate Starter Account is run and managed by a third party (Vocareum, Inc.) and the Starter Account runs in the Vocareum's environment on AWS. Starter Accounts are subject to a separate agreement between you and Vocareum under separate terms and conditions.

The AWS Educate Starter Account provides access to most but not all AWS services. Students at AWS Educate member institution will receive up to $75 (US) of AWS credit per year in their AWS Educate Starter Account, and students at non-member institution will receive up to $30 (US) of AWS credit per year.

You don't need a credit card to use a Starter Account because AWS promotional credits are already available in the account. When your usage of AWS services exceed the balance on the account, the account is closed and any running services or other resources on the account are lost.

Create Starter Account

or choose another option



AWS Educate Starter Account

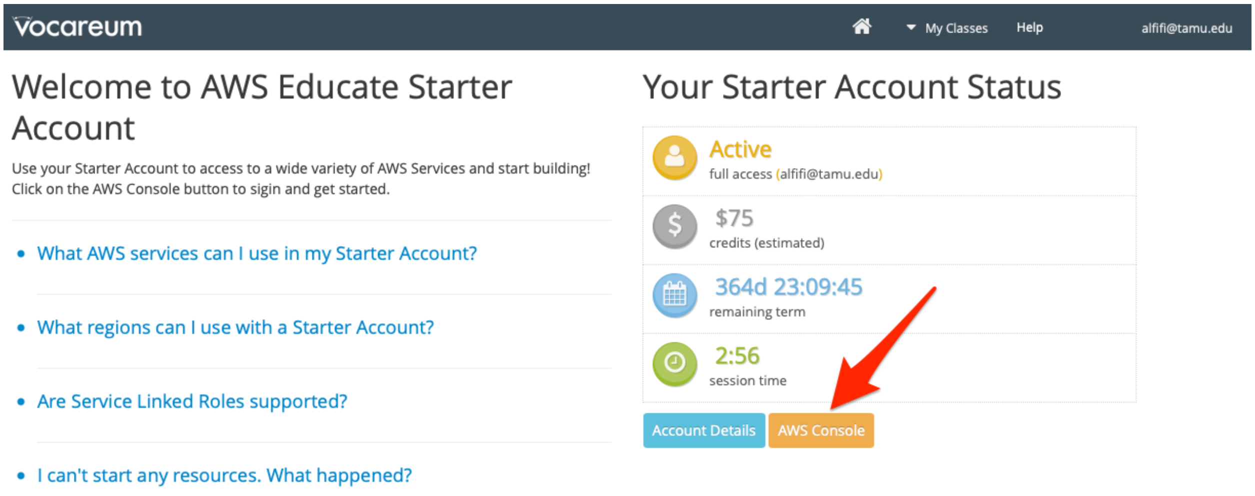
Your cloud journey has only just begun. Use your AWS Educate Starter Account to access the AWS Console and resources, and start building in the cloud!

Your account has an estimated **75** credits remaining and access will end on **Sep 19, 2020**.

Note: Clicking this button will take you to a third party site managed by Vocareum, Inc. ("Third Party Servicer"). In addition to the AWS Educate terms of service, your use of the AWS Educate Starter Account is governed by the Third Party Servicer's terms, including its Privacy Policy. AWS assumes no responsibility or liability and makes no representations or warranties regarding services provided by a Third Party Servicer.

Clicking on "AWS Educate Starter Account" takes you to the following page which has the access to AWS Console! You can always access your account your email and the password you created above by visiting the following link:

https://www.awseducate.com/signin



Welcome to AWS Educate Starter Account

Use your Starter Account to access to a wide variety of AWS Services and start building! Click on the AWS Console button to sigin and get started.

- What AWS services can I use in my Starter Account?
- What regions can I use with a Starter Account?
- Are Service Linked Roles supported?
- I can't start any resources. What happened?

Your Starter Account Status

Active
full access (alfifi@tamu.edu)

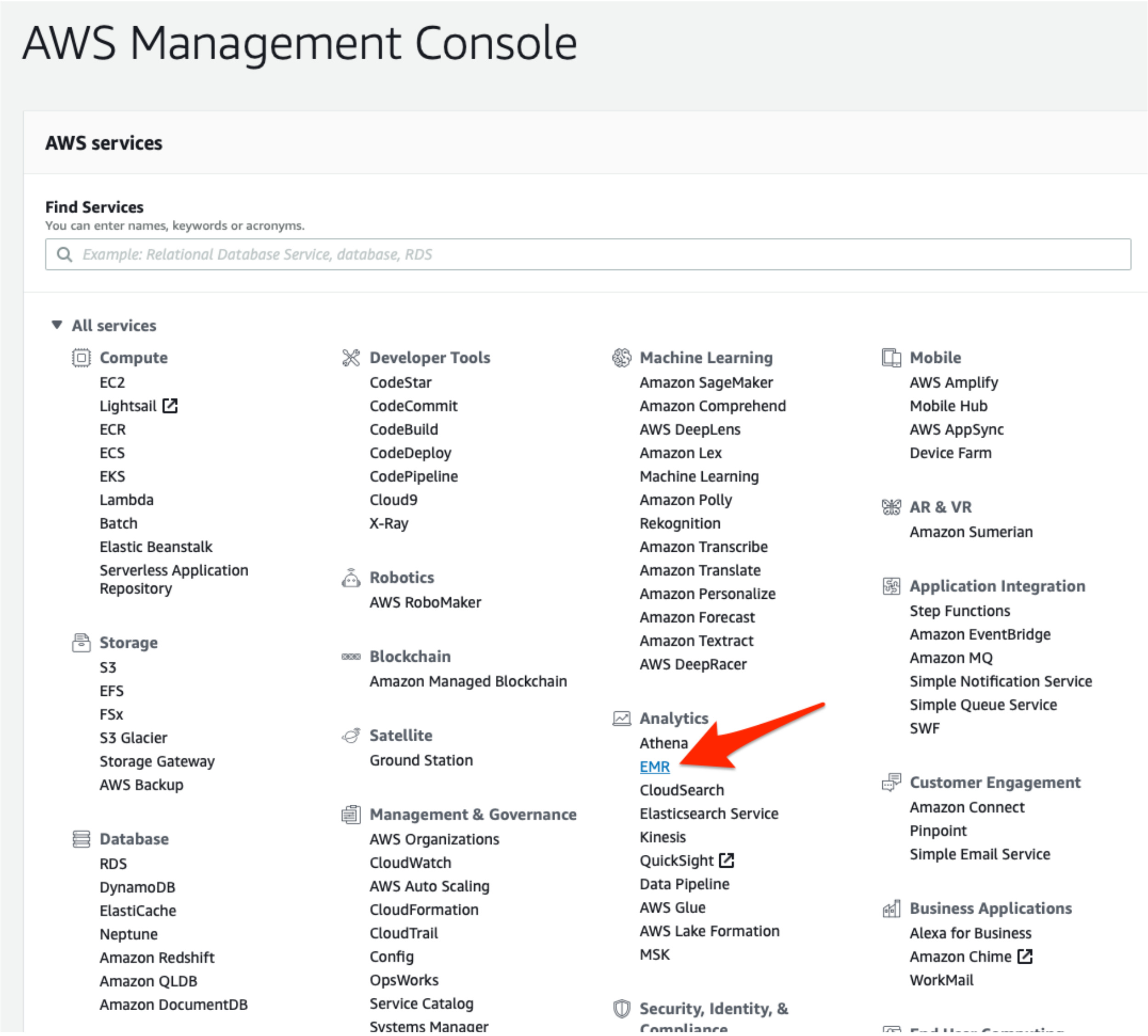
$75
credits (estimated)

364d 23:09:45
remaining term

2:56
session time

Creating A Hadoop/Spark Cluster

Click on"AWS Console" on the home page shown above. You may need to allow pop-ups for the AWS Console to open. On the AWS Management Console click on All services under "Find Services" and select EMR (Elastic MapReduce). You can also search for it in the search box.



AWS Management Console

AWS services

Find Services
You can enter names, keywords or acronyms.

Example: Relational Database Service, database, RDS

▼ All services

Compute
EC2
Lightsail
ECR
ECS
EKS
Lambda
Batch
Elastic Beanstalk
Serverless Application Repository

Storage
S3
EFS
FSx
S3 Glacier
Storage Gateway
AWS Backup

Database
RDS
DynamoDB
ElastiCache
Neptune
Amazon Redshift
Amazon QLDB
Amazon DocumentDB

Developer Tools
CodeStar
CodeCommit
CodeBuild
CodeDeploy
CodePipeline
Cloud9
X-Ray

Robotics
AWS RoboMaker

Blockchain
Amazon Managed Blockchain

Satellite
Ground Station

Management & Governance
AWS Organizations
CloudWatch
AWS Auto Scaling
CloudFormation
CloudTrail
Config
OpsWorks
Service Catalog
Systems Manager

Machine Learning
Amazon SageMaker
Amazon Comprehend
AWS DeepLens
Amazon Lex
Machine Learning
Amazon Polly
Rekognition
Amazon Transcribe
Amazon Translate
Amazon Personalize
Amazon Forecast
Amazon Textract
AWS DeepRacer

Analytics
Athena
EMR
CloudSearch
Elasticsearch Service
Kinesis
QuickSight
Data Pipeline
AWS Glue
AWS Lake Formation
MSK

Security, Identity, & Compliance

Mobile
AWS Amplify
Mobile Hub
AWS AppSync
Device Farm

AR & VR
Amazon Sumerian

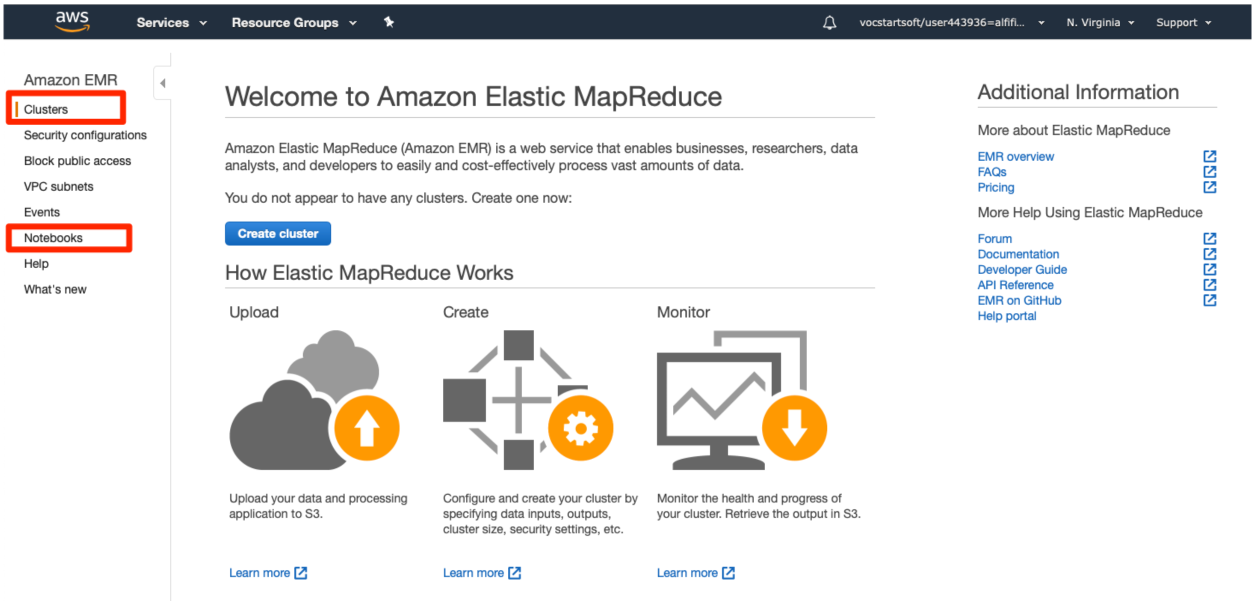
Application Integration
Step Functions
Amazon EventBridge
Amazon MQ
Simple Notification Service
Simple Queue Service
SWF

Customer Engagement
Amazon Connect
Pinpoint
Simple Email Service

Business Applications
Alexa for Business
Amazon Chime
WorkMail

End User Computing

This will open the page below. Under EMR, we will be mainly working on two tabs:
* Clusters where we will build the Hadoop/Spark cluster, and
* Notebooks where we will create a Jupyter notebook to access the cluster and operate on it.



Welcome to Amazon Elastic MapReduce

Amazon Elastic MapReduce (Amazon EMR) is a web service that enables businesses, researchers, data analysts, and developers to easily and cost-effectively process vast amounts of data.

You do not appear to have any clusters. Create one now:

How Elastic MapReduce Works

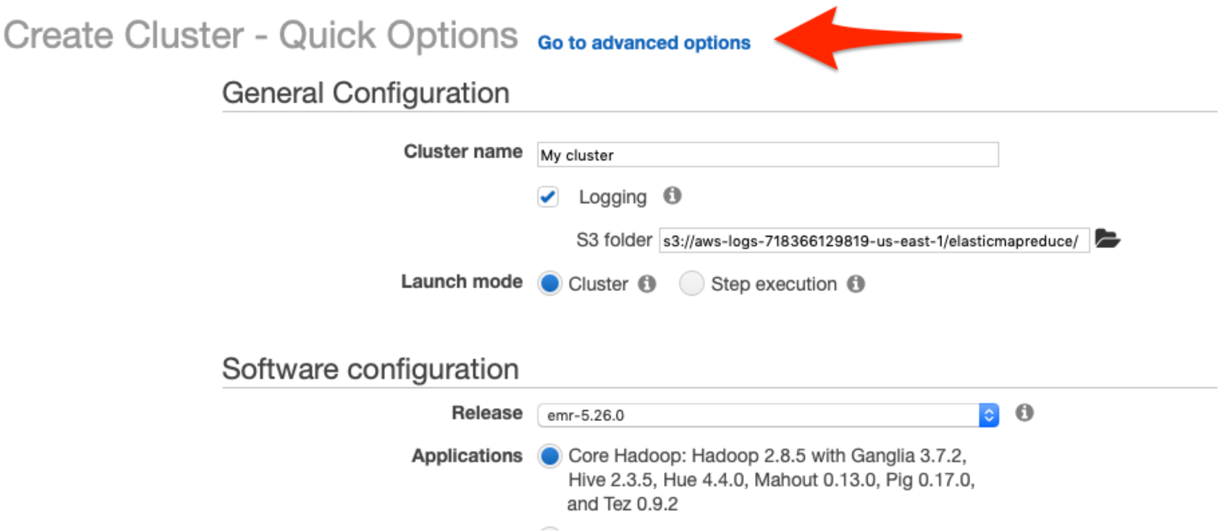
Upload your data and processing application to S3.

Configure and create your cluster by specifying data inputs, outputs, cluster size, security settings, etc.

Monitor the health and progress of your cluster. Retrieve the output in S3.

The steps to create a Hadoop/Spark cluster are as follows:

1. Click on the Create cluster button above.
2. Click on "Go to advanced options"



Cluster name: My cluster

☑ Logging

S3 folder: s3://aws-logs-718366129819-us-east-1/elasticmapreduce/

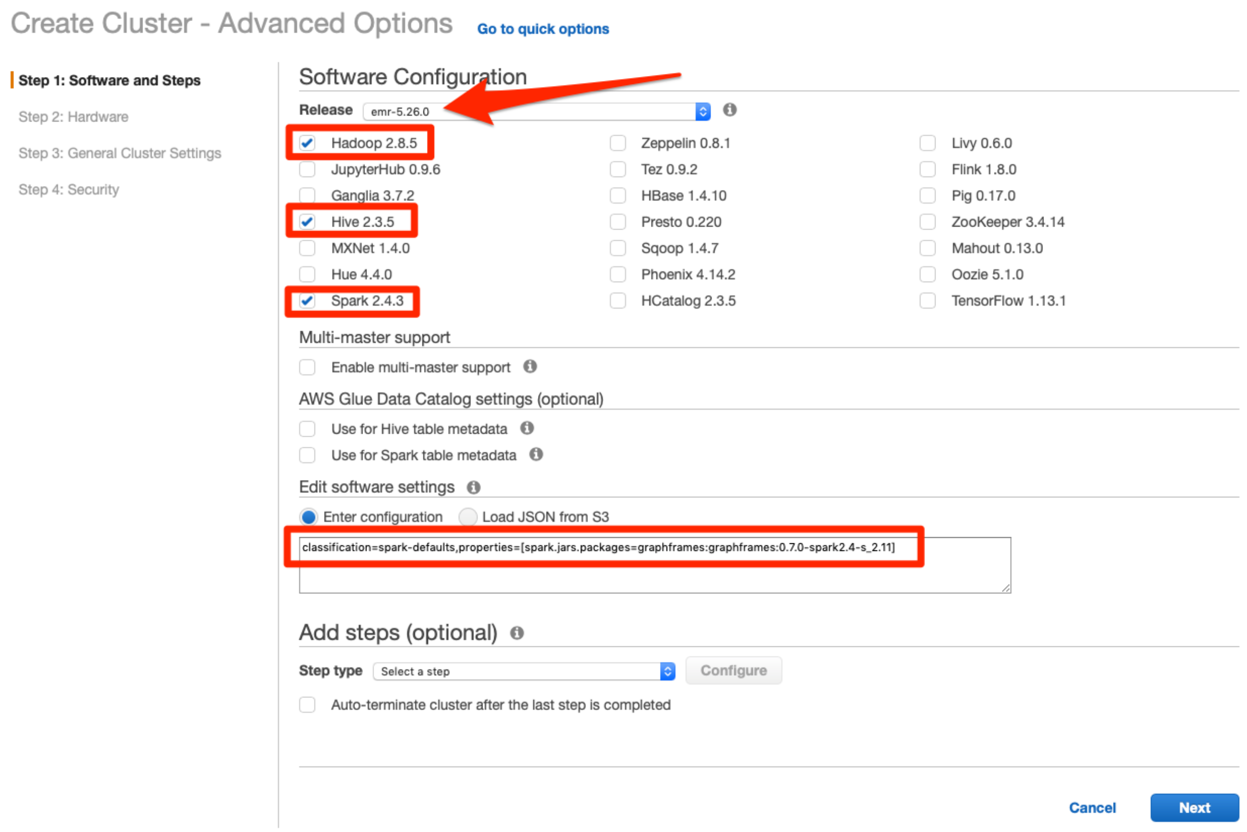
Launch mode: ● Cluster ○ Step execution

Release: emr-5.26.0

Applications: ● Core Hadoop: Hadoop 2.8.5 with Ganglia 3.7.2, Hive 2.3.5, Hue 4.4.0, Mahout 0.13.0, Pig 0.17.0, and Tez 0.9.2

3. Chose the Hadoop, Hive, and Spark and also copy the following configuration line and paste it under "Edit software settings" a

```
classification=spark-defaults,properties=[spark.jars.packages=graphframes:graphframes:0.7.0-spark2.4-s_2.11]
```



Create Cluster - Advanced Options

Software Configuration

Release: emr-5.26.0

☑ Hadoop 2.8.5	□ Zeppelin 0.8.1	□ Livy 0.6.0
□ JupyterHub 0.9.6	□ Tez 0.9.2	□ Flink 1.8.0
□ Ganglia 3.7.2	□ HBase 1.4.10	□ Pig 0.17.0
☑ Hive 2.3.5	□ Presto 0.220	□ ZooKeeper 3.4.14
□ MXNet 1.4.0	□ Sqoop 1.4.7	□ Mahout 0.13.0
□ Hue 4.4.0	□ Phoenix 4.14.2	□ Oozie 5.1.0
☑ Spark 2.4.3	□ HCatalog 2.3.5	□ TensorFlow 1.13.1

Multi-master support

□ Enable multi-master support

AWS Glue Data Catalog settings (optional)

□ Use for Hive table metadata

□ Use for Spark table metadata

Edit software settings

● Enter configuration ○ Load JSON from S3

```
classification=spark-defaults,properties=[spark.jars.packages=graphframes:graphframes:0.7.0-spark2.4-s_2.11]
```

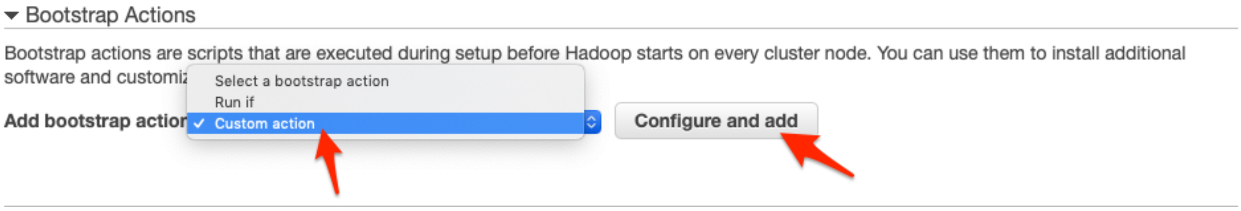
Add steps (optional)

Step type: Select a step

□ Auto-terminate cluster after the last step is completed

4. On "Step 2: Hardware" you can use the defaults (1 master node m5.xlarge, and 2 data nodes m5.xlarge). Use these for experimentation and learning but when you are ready to run your code on a bigger dataset, then you can create more core nodes (e.g. 10 nodes) which will cost more of your credits.

5. On "Step 3: General Cluster Settings", click on "Bootstrap Actions". From the drop-down menu, choose "Custom action" and then click "Configure and add"

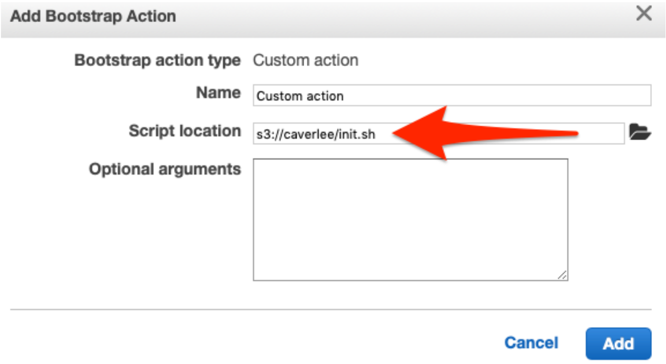


▾ Bootstrap Actions

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 customiz

Add bootstrap action ✓ Custom action

In the script location type `s3://caverlee/init.sh`



Add Bootstrap Action

Bootstrap action type Custom action

Name Custom action

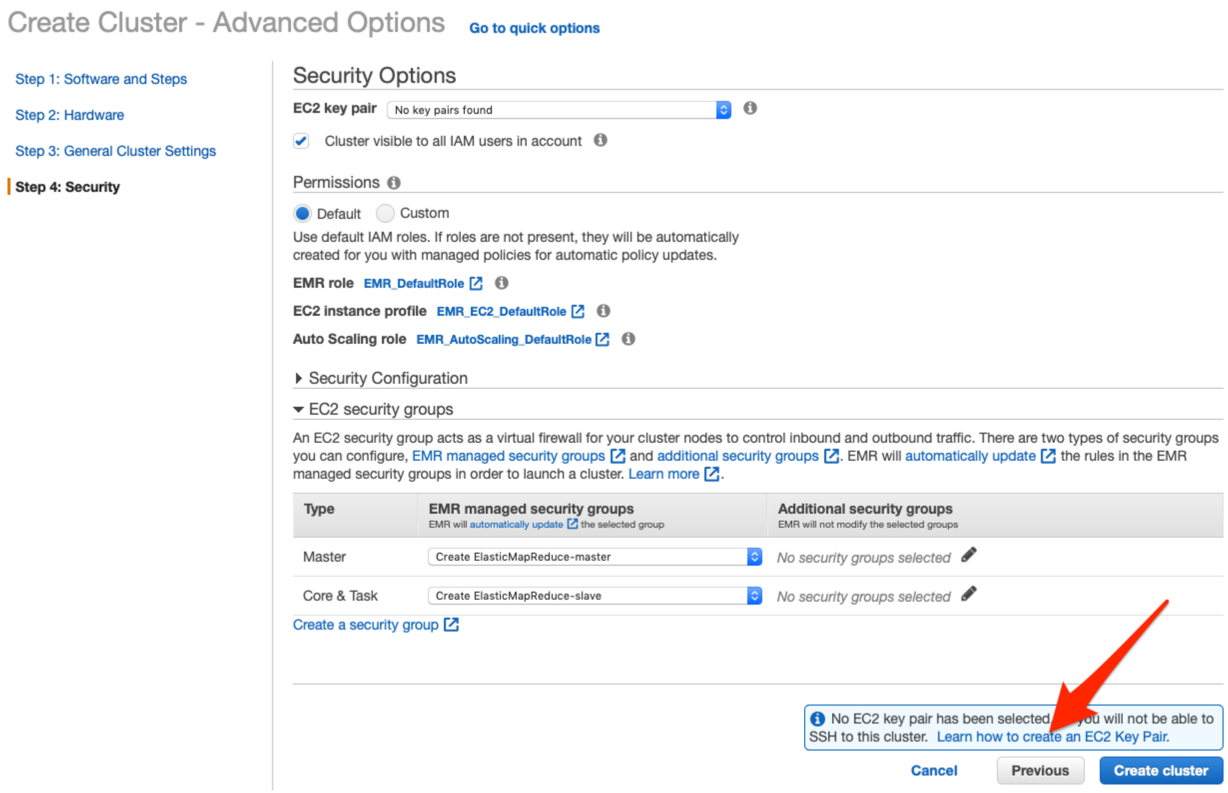
Script location s3://caverlee/init.sh

Optional arguments

Click add. This script will install Jupyter on the master node and download "start-jupyter.sh" script to use later.

6. On "Step 4: Security". We need to do two things:
   1. Create an EC2 Key Pair, and
   2. Allow SSH access.

To create an EC2 Key Pair, click on the link shown and follow instructions.



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 No key pairs found

☑ 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

▸ Security Configuration

▾ EC2 security groups

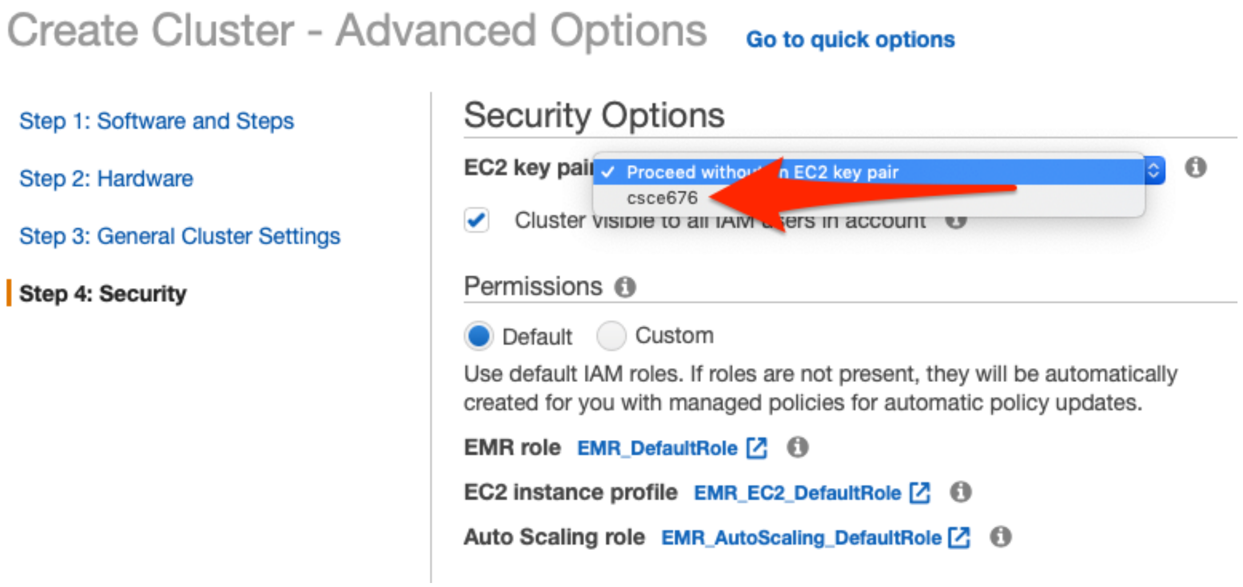
An EC2 security group acts as a virtual firewall for your cluster nodes to control inbound and outbound traffic. There are two types of security groups you can configure, EMR managed security groups and additional security groups. EMR will automatically update the rules in the EMR managed security groups in order to launch a cluster. Learn more.

Type	EMR managed security groups EMR will automatically update the selected group	Additional security groups EMR will not modify the selected groups
Master	Create ElasticMapReduce-master	*No security groups selected*
Core & Task	Create ElasticMapReduce-slave	*No security groups selected*

Create a security group

No EC2 key pair has been selected, you will not be able to SSH to this cluster. Learn how to create an EC2 Key Pair.

After you have created the key select it in the EC2 key pair dropdown list:



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
csce676

☑ Cluster visible to all IAM users in account

Permissions

● Default ○ Custom

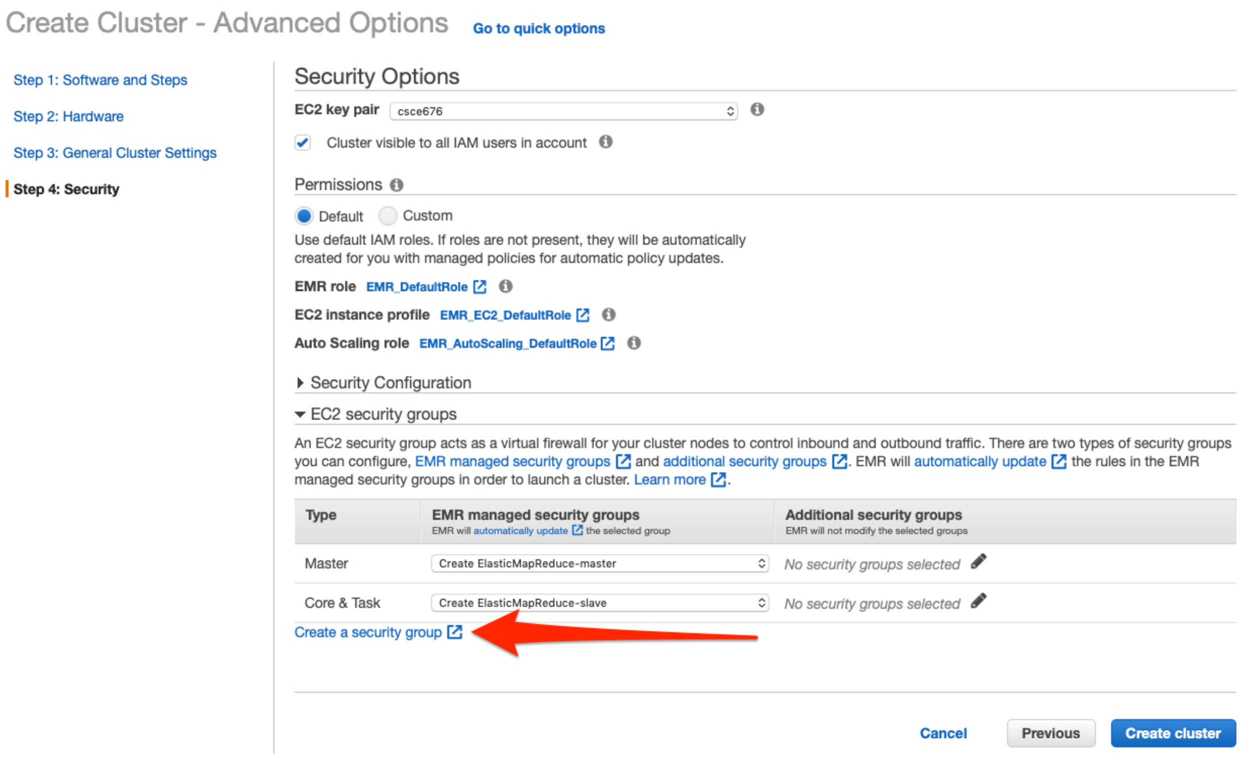
Use default IAM roles. If roles are not present, they will be automatically created for you with managed policies for automatic policy updates.

EMR role EMR_DefaultRole

EC2 instance profile EMR_EC2_DefaultRole

Auto Scaling role EMR_AutoScaling_DefaultRole

To allow SSH access to your cluster click on "Create a security group".



Create Cluster - Advanced Options

Security Options

EC2 key pair: csce676

☑ 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

▸ Security Configuration

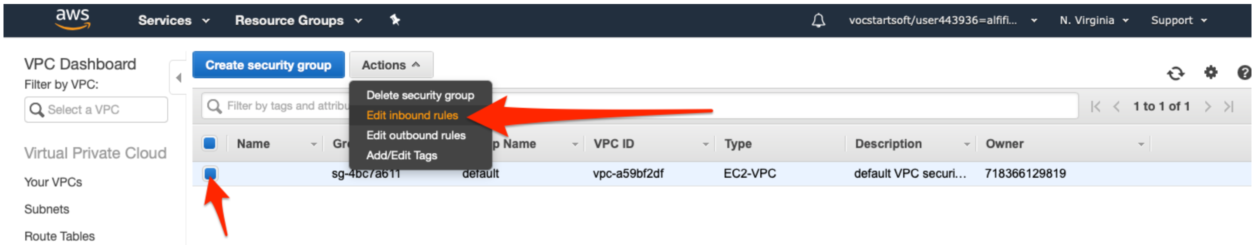
▾ EC2 security groups

An EC2 security group acts as a virtual firewall for your cluster nodes to control inbound and outbound traffic. There are two types of security groups you can configure, EMR managed security groups and additional security groups. EMR will automatically update the rules in the EMR managed security groups in order to launch a cluster. Learn more.

Type	EMR managed security groups EMR will automatically update the selected group	Additional security groups EMR will not modify the selected groups
Master	Create ElasticMapReduce-master	No security groups selected
Core & Task	Create ElasticMapReduce-slave	No security groups selected

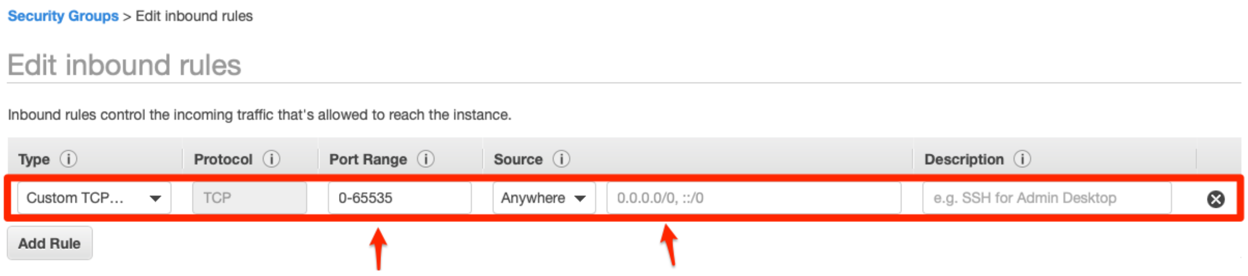
Create a security group

Select the "default" security group and choose edit inbound rules as shown below



Name	Gr	p Name	VPC ID	Type	Description	Owner
	sg-4bc7a611	default	vpc-a59bf2df	EC2-VPC	default VPC securi...	718366129819

Then click "Edit Rules" -> "Add Rule" and type 22 0-65535 in the Port Range and choose "Anywhere" for the Source. Click "Save rules". Note there is security risk but since this will live for only few hours after which you will terminate the cluster, it should be fine for this homework.



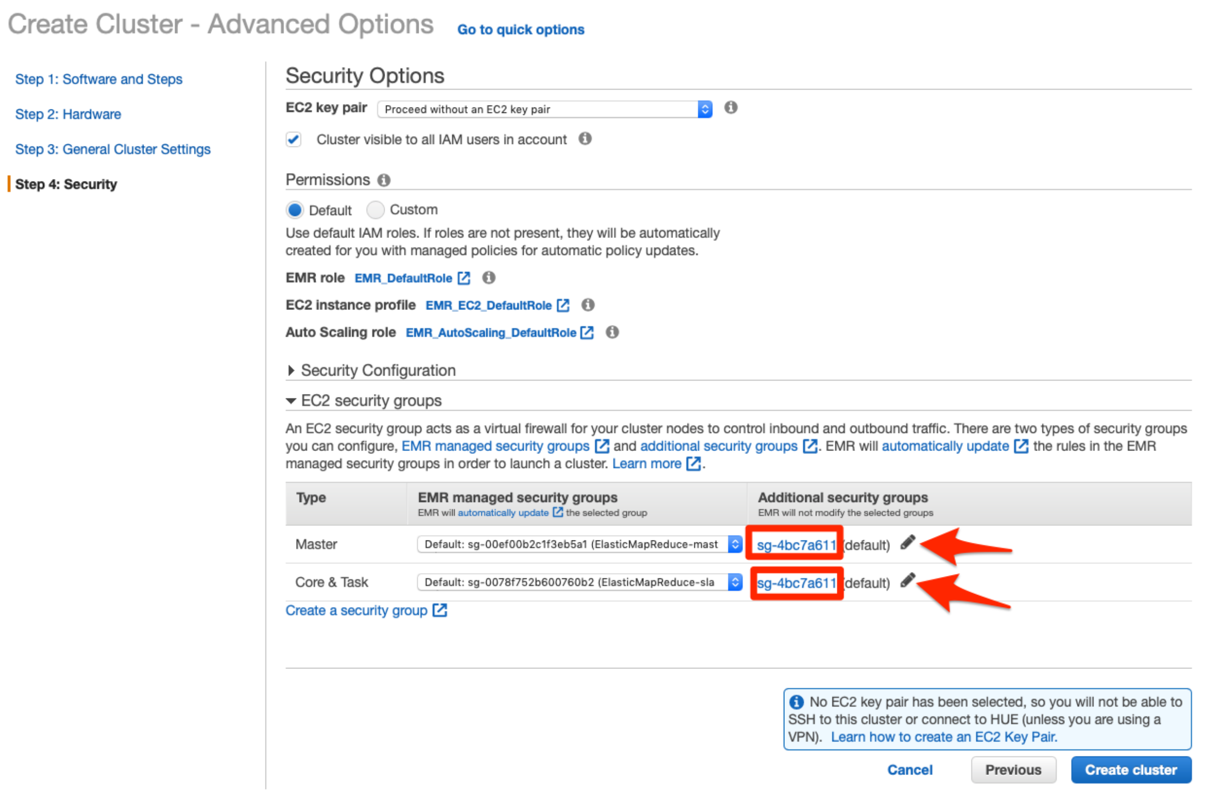
Security Groups > Edit inbound rules

Edit inbound rules

Inbound rules control the incoming traffic that's allowed to reach the instance.

Type	Protocol	Port Range	Source		Description
Custom TCP...	TCP	0-65535	Anywhere	0.0.0.0/0, ::/0	e.g. SSH for Admin Desktop

Finally in "Step 4: Security" click on "Additional security groups" links and add the "default" security group you just edited



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

▸ Security Configuration

▾ EC2 security groups

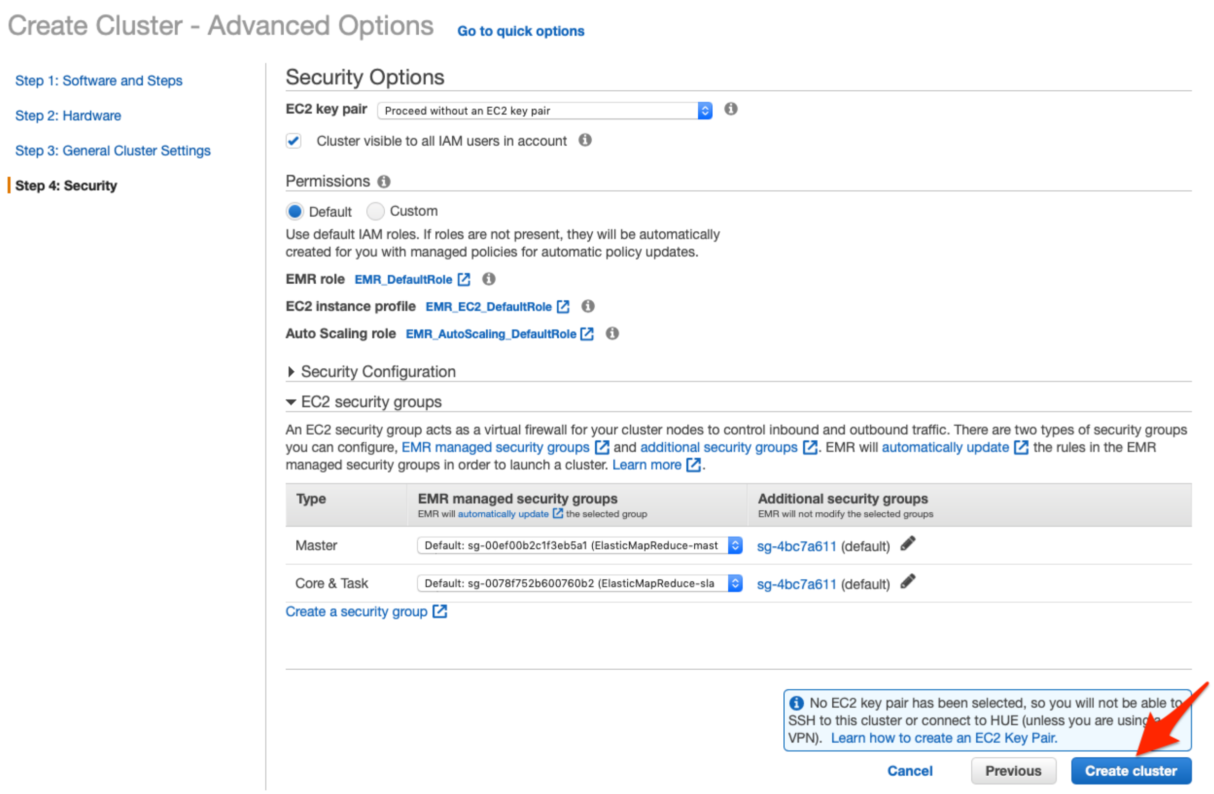
An EC2 security group acts as a virtual firewall for your cluster nodes to control inbound and outbound traffic. There are two types of security groups you can configure, EMR managed security groups and additional security groups. EMR will automatically update the rules in the EMR managed security groups in order to launch a cluster. Learn more.

Type	EMR managed security groups EMR will automatically update the selected group	Additional security groups EMR will not modify the selected groups
Master	Default: sg-00ef00b2c1f3eb5a1 (ElasticMapReduce-mast	sg-4bc7a611 (default)
Core & Task	Default: sg-0078f752b600760b2 (ElasticMapReduce-sla	sg-4bc7a611 (default)

Create a security group

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.

7. Now you are ready to click "Create cluster"



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

▸ Security Configuration

▾ EC2 security groups

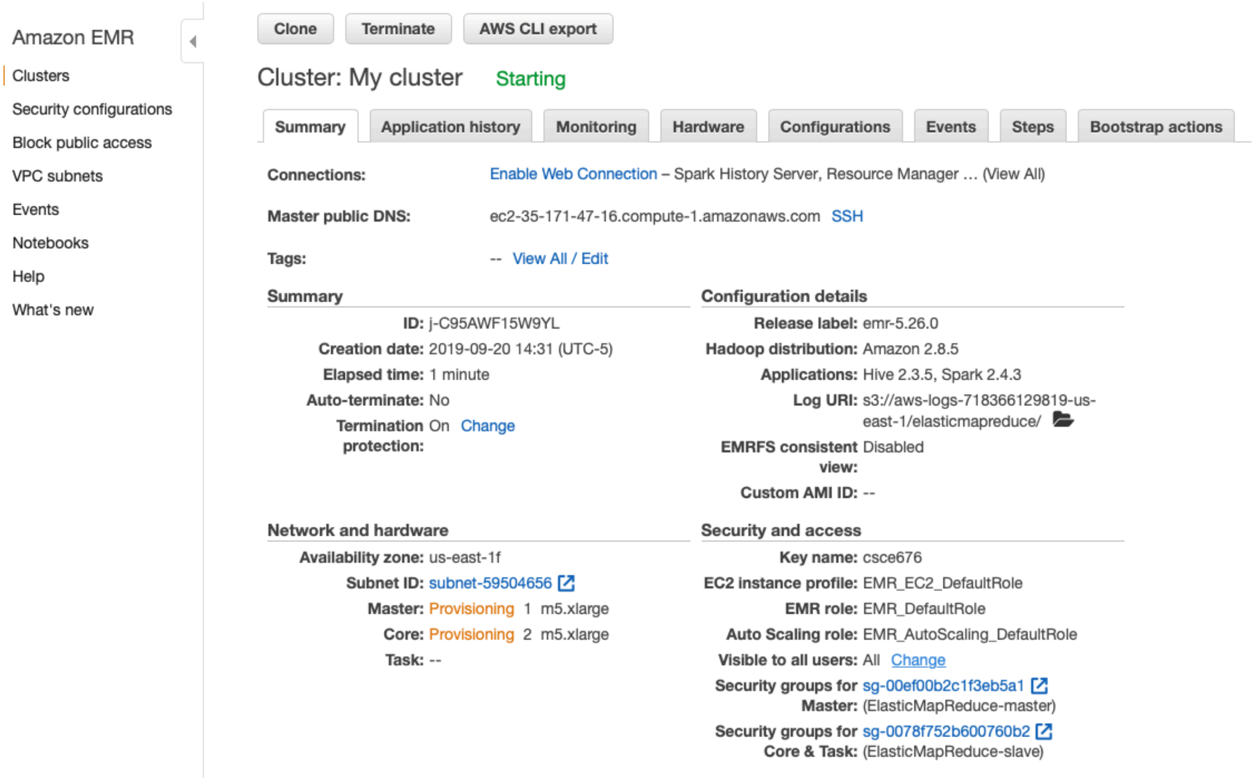
An EC2 security group acts as a virtual firewall for your cluster nodes to control inbound and outbound traffic. There are two types of security groups you can configure, EMR managed security groups and additional security groups. EMR will automatically update the rules in the EMR managed security groups in order to launch a cluster. Learn more.

Type	EMR managed security groups EMR will automatically update the selected group	Additional security groups EMR will not modify the selected groups
Master	Default: sg-00ef00b2c1f3eb5a1 (ElasticMapReduce-mast	sg-4bc7a611 (default)
Core & Task	Default: sg-0078f752b600760b2 (ElasticMapReduce-sla	sg-4bc7a611 (default)

Create a security group

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.

The cluster will take few minutes to start.



Cluster: My cluster Starting

Connections: Enable Web Connection – Spark History Server, Resource Manager ... (View All)

Master public DNS: ec2-35-171-47-16.compute-1.amazonaws.com SSH

Tags: -- View All / Edit

Summary

ID: j-C95AWF15W9YL
Creation date: 2019-09-20 14:31 (UTC-5)
Elapsed time: 1 minute
Auto-terminate: No
Termination protection: On Change

Configuration details

Release label: emr-5.26.0
Hadoop distribution: Amazon 2.8.5
Applications: Hive 2.3.5, Spark 2.4.3
Log URI: s3://aws-logs-718366129819-us-east-1/elasticmapreduce/
EMRFS consistent view: Disabled
Custom AMI ID: --

Network and hardware

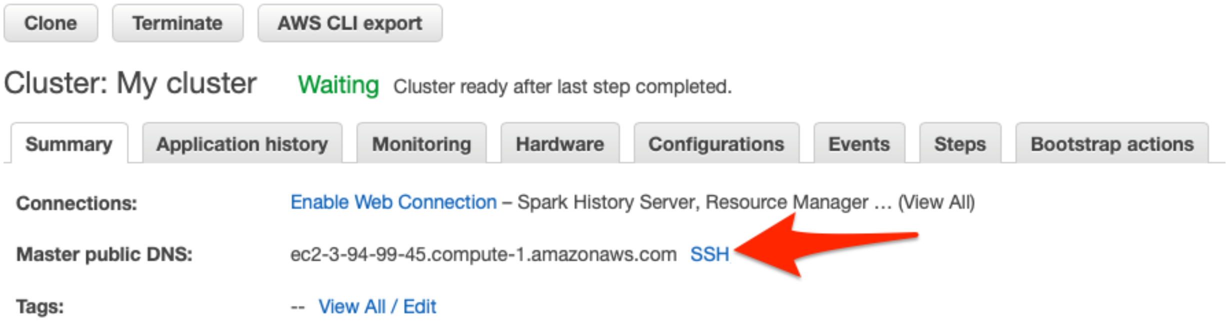
Availability zone: us-east-1f
Subnet ID: subnet-59504656
Master: Provisioning 1 m5.xlarge
Core: Provisioning 2 m5.xlarge
Task: --

Security and access

Key name: csce676
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-00ef00b2c1f3eb5a1 (ElasticMapReduce-master)
Security groups for Core & Task: sg-0078f752b600760b2 (ElasticMapReduce-slave)

Accessing the Cluster with SSH

You can SSH to the master node (or any of the worker nodes if you allow SSH access) and run any unix commands you like, or investigate logs, and so on. To do so, click on the "SSH" link as shown below



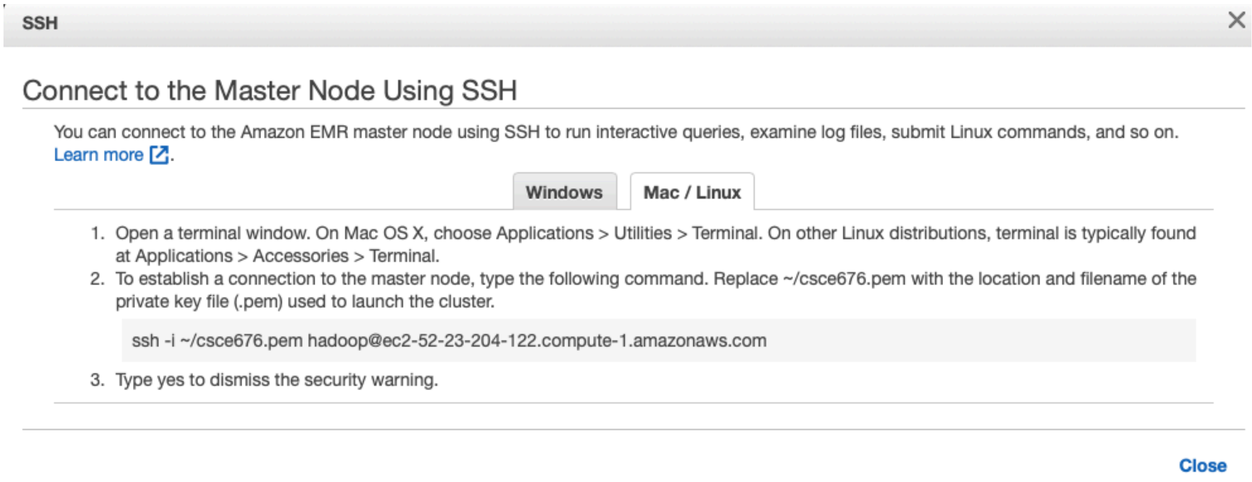
Cluster: My cluster Waiting Cluster ready after last step completed.

Connections: Enable Web Connection – Spark History Server, Resource Manager … (View All)

Master public DNS: ec2-3-94-99-45.compute-1.amazonaws.com SSH

Tags: -- View All / Edit

This will open a window like the following that will show you the domain name of the master node so you can ssh to it



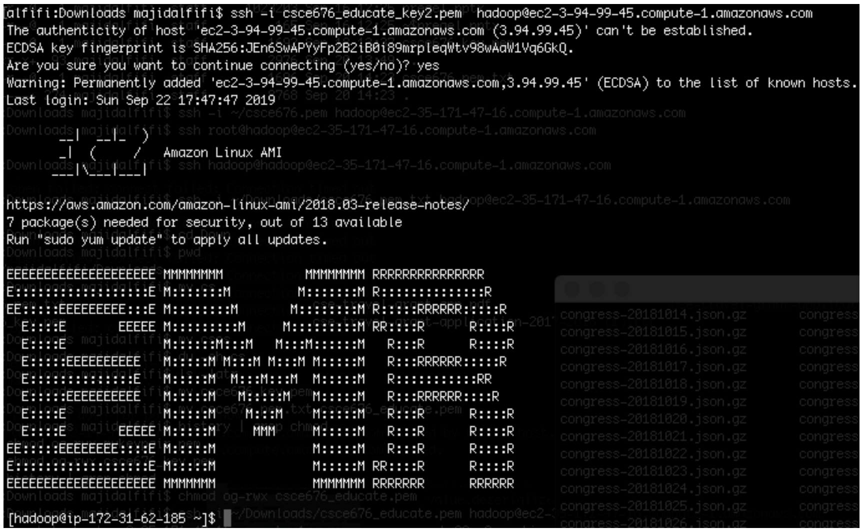
Connect to the Master Node Using SSH

You can connect to the Amazon EMR master node using SSH to run interactive queries, examine log files, submit Linux commands, and so on. Learn more.

1. Open a terminal window. On Mac OS X, choose Applications > Utilities > Terminal. On other Linux distributions, terminal is typically found at Applications > Accessories > Terminal.
2. To establish a connection to the master node, type the following command. Replace ~/csce676.pem with the location and filename of the private key file (.pem) used to launch the cluster.

```
ssh -i ~/csce676.pem hadoop@ec2-52-23-204-122.compute-1.amazonaws.com
```

3. Type yes to dismiss the security warning.



```
alfifi:Downloads majidalfifi$ ssh -i csce676_educate_key2.pem  hadoop@ec2-3-94-99-45.compute-1.amazonaws.com
The authenticity of host 'ec2-3-94-99-45.compute-1.amazonaws.com (3.94.99.45)' can't be established.
ECDSA key fingerprint is SHA256:JEn6SwAPYyFp2B2iB0i89mrpleqWtv98wAaW1Vq6GkQ.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'ec2-3-94-99-45.compute-1.amazonaws.com,3.94.99.45' (ECDSA) to the list of known hosts.
Last login: Sun Sep 22 17:47:47 2019

       __|  __|_  )
       _|  (     /   Amazon Linux AMI
      ___|\___|___|

https://aws.amazon.com/amazon-linux-ami/2018.03-release-notes/
7 package(s) needed for security, out of 13 available
Run "sudo yum update" to apply all updates.

EEEEEEEEEEEEEEEEEEEE MMMMMMMM           MMMMMMMM RRRRRRRRRRRRRRR
E::::::::::::::::::E M:::::::M         M:::::::M R::::::::::::::R
EE:::::EEEEEEEEE:::E M::::::::M       M::::::::M R:::::RRRRRR:::::R
  E::::E       EEEEE M:::::::::M     M:::::::::M RR::::R      R::::R
  E::::E             M::::::M:::M   M:::M::::::M   R:::R      R::::R
  E:::::EEEEEEEEEE   M:::::M M:::M M:::M M:::::M   R:::RRRRRR:::::R
  E::::::::::::::E   M:::::M  M:::M:::M  M:::::M   R:::::::::::RR
  E:::::EEEEEEEEEE   M:::::M   M:::::M   M:::::M   R:::RRRRRR::::R
  E::::E             M:::::M    M:::M    M:::::M   R:::R      R::::R
  E::::E       EEEEE M:::::M     MMM     M:::::M   R:::R      R::::R
EE:::::EEEEEEEE::::E M:::::M             M:::::M   R:::R      R::::R
E::::::::::::::::::E M:::::M             M:::::M RR::::R      R::::R
EEEEEEEEEEEEEEEEEEEE MMMMMMM             MMMMMMM RRRRRRR      RRRRRR

[hadoop@ip-172-31-62-185 ~]$ 
```

Accessing Hadoop/Spark Web Interfaces

Note: If you have opened all ports on the servers you can access the web interfaces directly using the public domain name without the steps below.

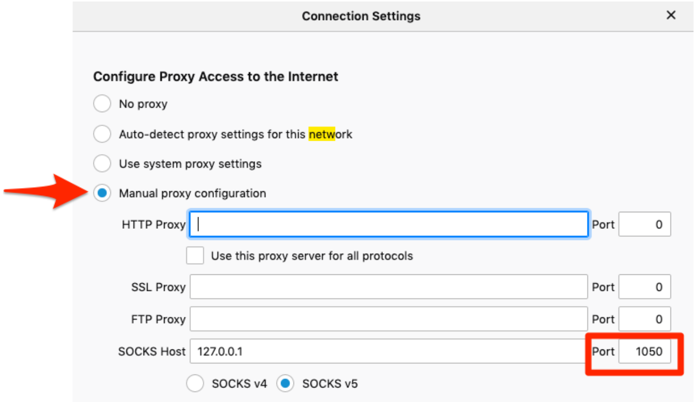
Hadoop/Spark provide web interfaces to investigate their status and logs. There are couple of ways to access those interfaces but the easiest maybe to use SSH tunnel and SOCKS proxy.

The steps are as follows:

1. When connecting to the master node with SSH, us -D option as follows ssh -D 1050

   ```
   ssh -D 1050 -i csce676.pem hadoop@ec2-34-239-180-133.compute-1.amazonaws.com
   ```

2. In your browser, forward all traffic through this port (1050) which makes your browser work as though it was running on the remote Amazon server. I use Firefox for this purpose because it's easy to setup SOCKs and I have this browser dedicated for my cluster work. In Firefox, set the connection settings as follows:



Connection Settings ×

Configure Proxy Access to the Internet

○ No proxy

○ Auto-detect proxy settings for this network

○ Use system proxy settings

● Manual proxy configuration

HTTP Proxy | Port 0

□ Use this proxy server for all protocols

SSL Proxy Port 0

FTP Proxy Port 0

SOCKS Host 127.0.0.1 Port 1050

○ SOCKS v4 ● SOCKS v5

3. Find out the IP of the master node and use it to access the web interfaces shown in the table below. (Hint: you can find the ip after you login in the prompt name. For example, `[hadoop@ip-172-31-62-185] $`

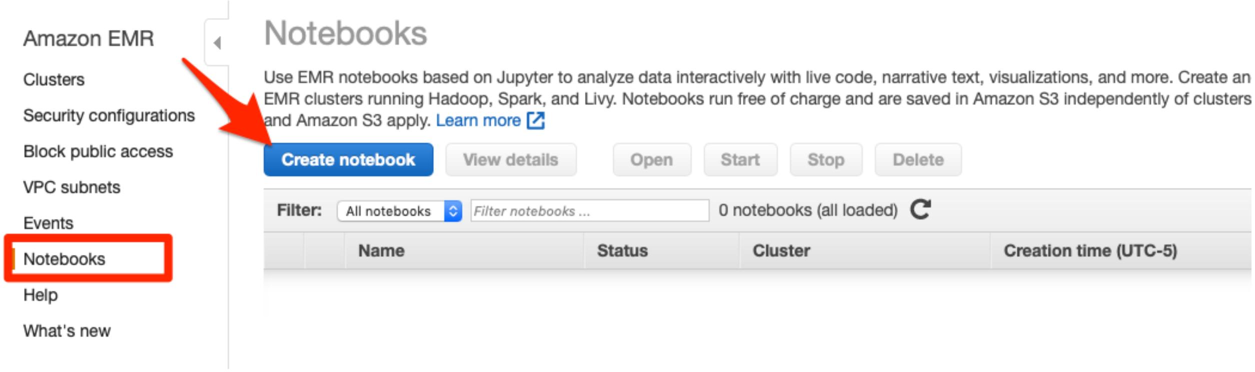
Name of interface	URI
YARN ResourceManager	http://*master-ip*:8088/
Hadoop HDFS NameNode	http://*master-ip*:50070/
Spark HistoryServer	http://*master-ip*:18080/

Note: if you want to consider other ways to access the web interfaces and for a longer list of interfaces, consult the AWS documentation.

~~Accessing the cluster with a Jupyter Notebook~~

Ignore this section (doesn’t work any more). Check the last section in this guide for an alternative way.

Click on the Notebooks Tab and then click on the "Create a notebook" button:



Amazon EMR

- Clusters
- Security configurations
- Block public access
- VPC subnets
- Events
- Notebooks
- Help
- What's new

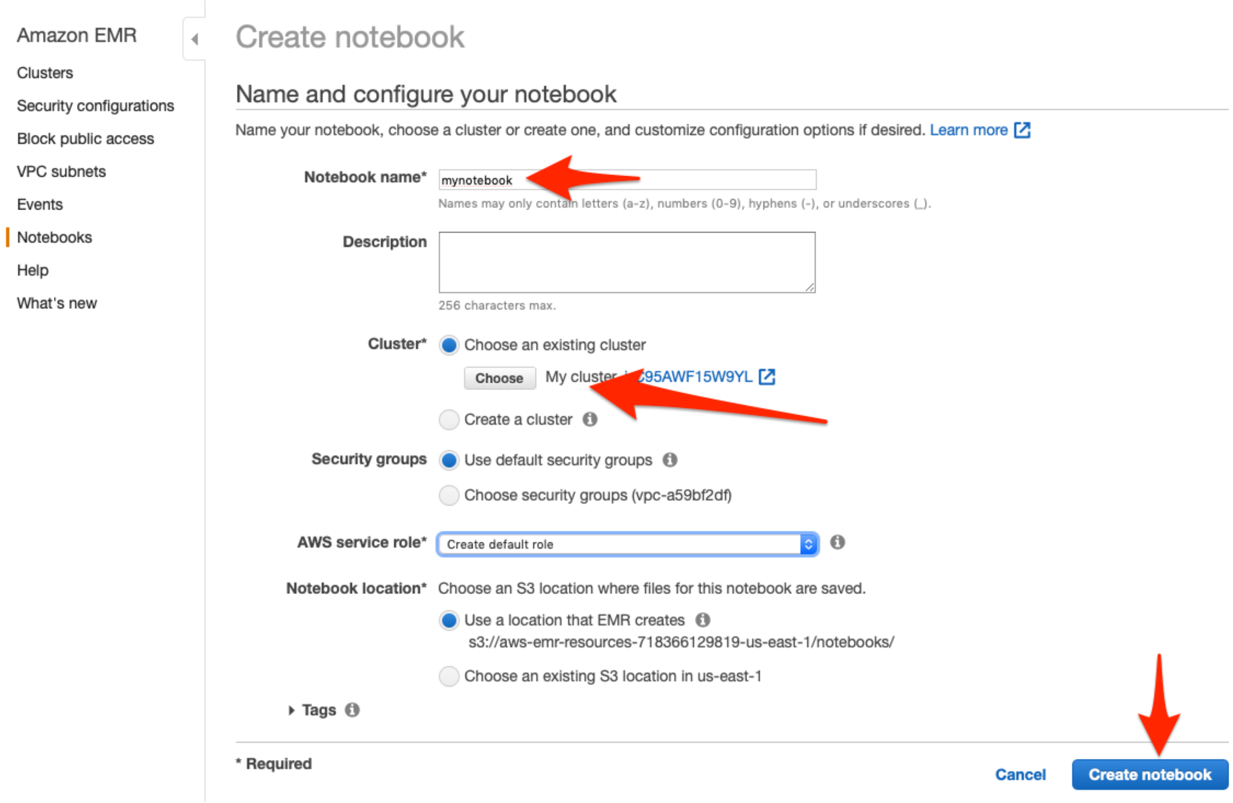
Notebooks

Use EMR notebooks based on Jupyter to analyze data interactively with live code, narrative text, visualizations, and more. Create and attach notebooks to EMR clusters running Hadoop, Spark, and Livy. Notebooks run free of charge and are saved in Amazon S3 independently of clusters and Amazon S3 apply. Learn more

Filter: All notebooks | Filter notebooks ... | 0 notebooks (all loaded)

	Name	Status	Cluster	Creation time (UTC-5)

Choose a name for your notebook and choose the cluster you created in the previous step as the cluster associated with this notebook. Finally click "create notebook".



Amazon EMR

- Clusters
- Security configurations
- Block public access
- VPC subnets
- Events
- Notebooks
- Help
- What's new

Create notebook

Name and configure your notebook

Name your notebook, choose a cluster or create one, and customize configuration options if desired. Learn more

Notebook name*: mynotebook

Names may only contain letters (a-z), numbers (0-9), hyphens (-), or underscores (_).

Description:

256 characters max.

Cluster*: ● Choose an existing cluster

Choose | My cluster [illegible]C95AWF15W9YL

○ Create a cluster

Security groups: ● Use default security groups

○ Choose security groups (vpc-a59bf2df)

AWS service role*: Create default role

Notebook location*: Choose an S3 location where files for this notebook are saved.

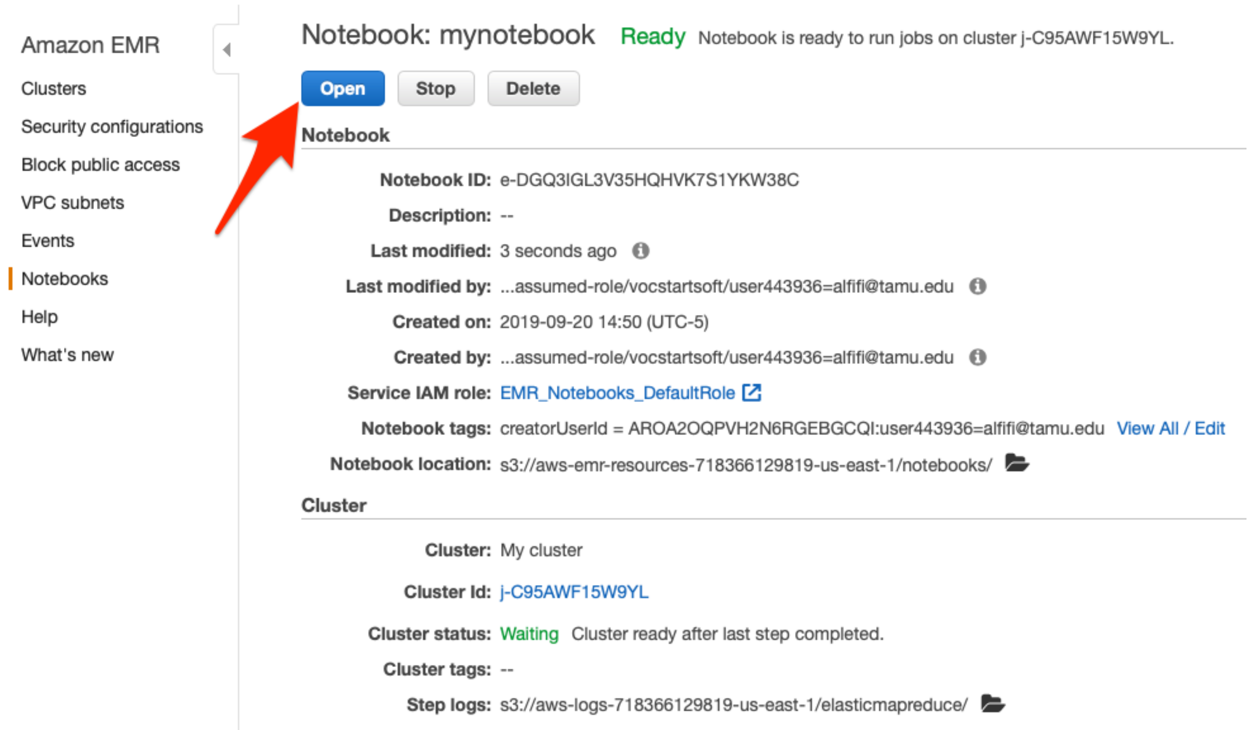
● Use a location that EMR creates

s3://aws-emr-resources-718366129819-us-east-1/notebooks/

○ Choose an existing S3 location in us-east-1

* Required

Note: your notebook will be saved in S3 and you will always find it there. However, you should create a cluster only when you need to work on your notebook and then terminate the cluster immediately after you are done to avoid wasting credits on an unused cluster. You can stop the notebook and leave it there for your next time to continue working where you left.



Notebook: mynotebook Ready Notebook is ready to run jobs on cluster j-C95AWF15W9YL.

Notebook

Notebook ID: e-DGQ3IGL3V35HQHVK7S1YKW38C

Description: --

Last modified: 3 seconds ago

Last modified by: ...assumed-role/vocstartsoft/user443936=alfifi@tamu.edu

Created on: 2019-09-20 14:50 (UTC-5)

Created by: ...assumed-role/vocstartsoft/user443936=alfifi@tamu.edu

Service IAM role: EMR_Notebooks_DefaultRole

Notebook tags: creatorUserId = AROA2OQPVH2N6RGEBGCQI:user443936=alfifi@tamu.edu View All / Edit

Notebook location: s3://aws-emr-resources-718366129819-us-east-1/notebooks/

Cluster

Cluster: My cluster

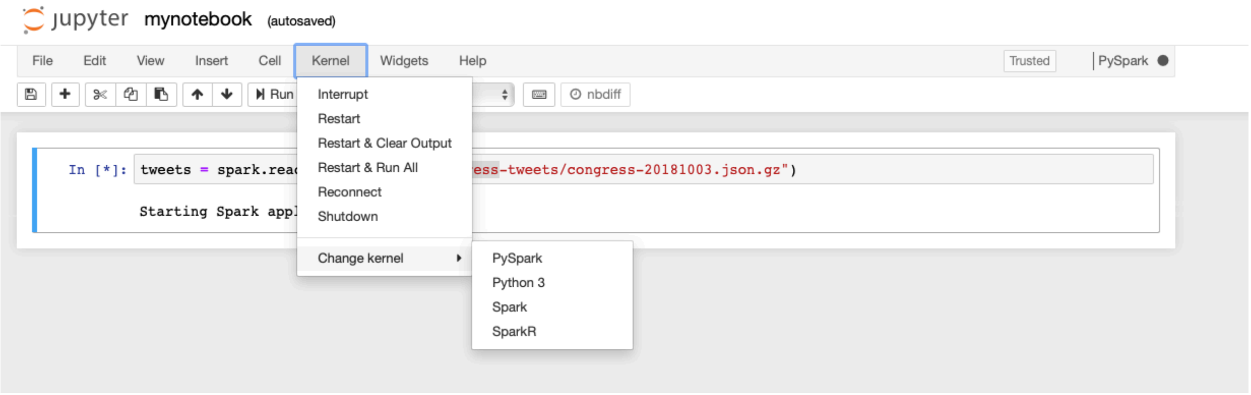
Cluster Id: j-C95AWF15W9YL

Cluster status: Waiting Cluster ready after last step completed.

Cluster tags: --

Step logs: s3://aws-logs-718366129819-us-east-1/elasticmapreduce/

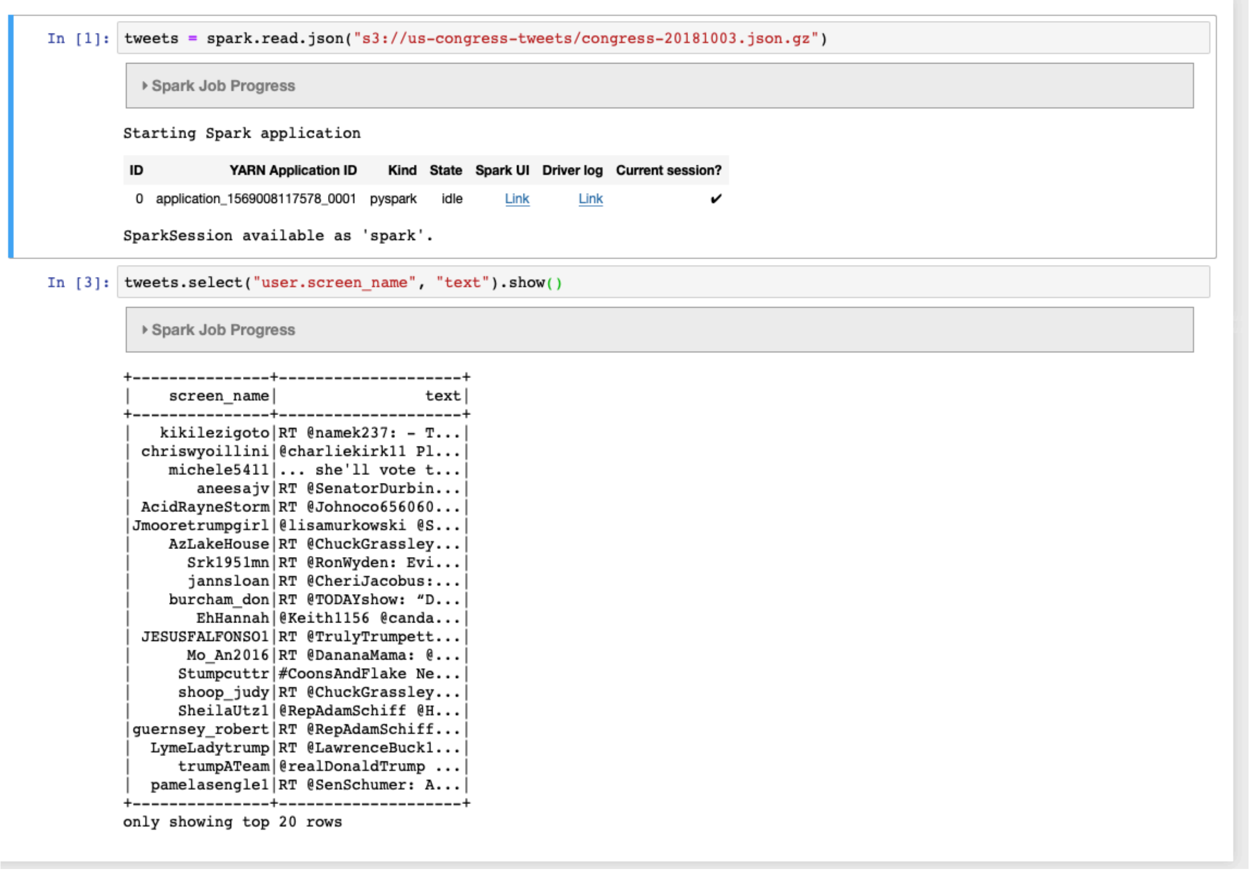
After opening the notebook, choose PySpark Kernel and you are now ready to run Spark code against your cluster!



```
In [*]: tweets = spark.read                    ess-tweets/congress-20181003.json.gz")

        Starting Spark appl
```

You will find a sample notebook in Piazza Resources to get you started.



In [1]:

```
tweets = spark.read.json("s3://us-congress-tweets/congress-20181003.json.gz")
```

```
Starting Spark application
```

ID	YARN Application ID	Kind	State	Spark UI	Driver log	Current session?
0	application_1569008117578_0001	pyspark	idle	Link	Link	✔

```
SparkSession available as 'spark'.
```

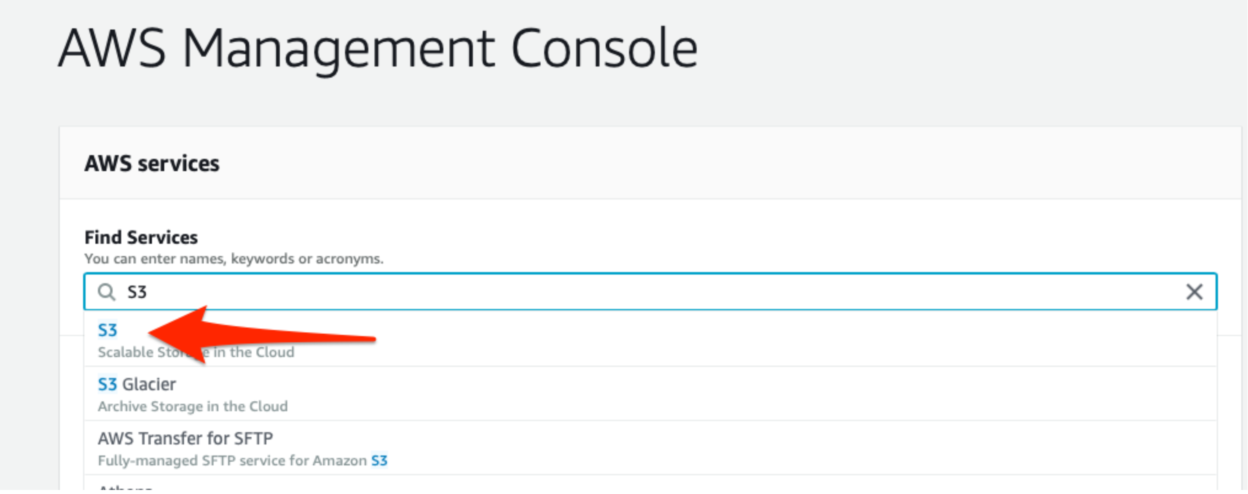
In [3]:

```
tweets.select("user.screen_name", "text").show()
```

```
+---------------+--------------------+
|    screen_name|                text|
+---------------+--------------------+
|   kikilezigoto|RT @namek237: - T...|
| chriswyoillini|@charliekirk11 Pl...|
|    michele5411|... she'll vote t...|
|       aneesajv|RT @SenatorDurbin...|
| AcidRayneStorm|RT @Johnoco656060...|
|Jmooretrumpgirl|@lisamurkowski @S...|
|    AzLakeHouse|RT @ChuckGrassley...|
|      Srk1951mn|RT @RonWyden: Evi...|
|      jannsloan|RT @CheriJacobus:...|
|    burcham_don|RT @TODAYshow: “D...|
|       EhHannah|@Keith1156 @canda...|
| JESUSFALFONSO1|RT @TrulyTrumpett...|
|      Mo_An2016|RT @DananaMama: @...|
|     Stumpcuttr|#CoonsAndFlake Ne...|
|     shoop_judy|RT @ChuckGrassley...|
|     SheilaUtz1|@RepAdamSchiff @H...|
|guernsey_robert|RT @RepAdamSchiff...|
|  LymeLadytrump|RT @LawrenceBuck1...|
|     trumpATeam|@realDonaldTrump ...|
|  pamelasengle1|RT @SenSchumer: A...|
+---------------+--------------------+
only showing top 20 rows
```

Creating An S3 Bucket

To avoid losing data when destroying a cluster, you can store your results in S3 but to do so you need to first create a bucket. To do that you go back to the AWS Management Console and this time choose S3 service rather than EMR. This is to store output of your operations. The Jupyter file itself will be stored by default in S3 without creating a specific bucket for it.



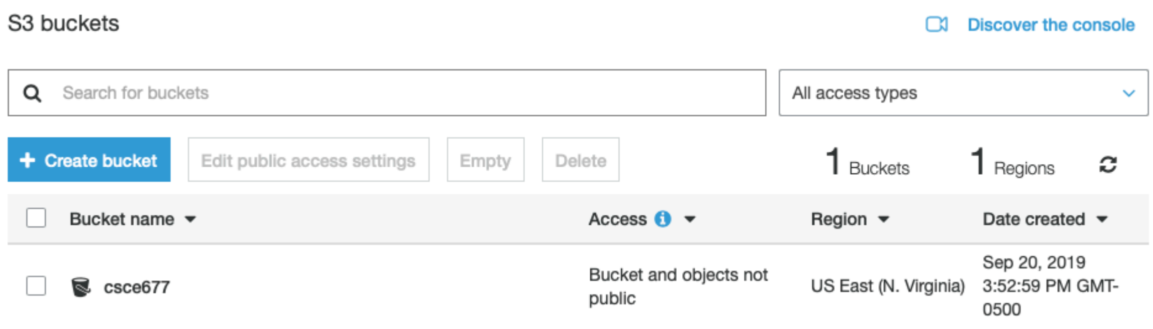
AWS Management Console

AWS services

Find Services
You can enter names, keywords or acronyms.

S3
S3
Scalable Storage in the Cloud
S3 Glacier
Archive Storage in the Cloud
AWS Transfer for SFTP
Fully-managed SFTP service for Amazon S3

Click "Create bucket" and follow the steps. You can use defaults for all steps. You should then have a bucket like the following:



□	Bucket name	Access	Region	Date created
□	csce677	Bucket and objects not public	US East (N. Virginia)	Sep 20, 2019 3:52:59 PM GMT-0500

You can now store your data produced in the Jupyter notebook to this bucket which will survive cluster terminations. For example, in PySpark you could extract tweet ids and store them in S3 as follows:

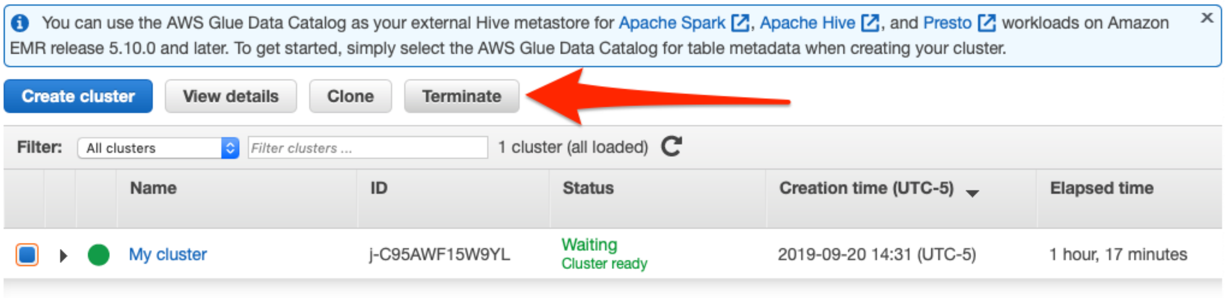
```
tweets.select("id").write.csv("s3://mybucket/mytweets")
```

You could also write the output to the cluster HDFS as follows but keep in mind these will be deleted with you terminate the cluster:

```
tweets.select("id").write.csv("hdfs://mybucket/mytweets")
```

Warning! Be a Terminator!

You should create a cluster before starting your work and terminate it immediately after you are done to avoid wasting credits. Your notebook will be save in S3 and next time you open the notebook there is an option to choose a new cluster to associate to the notebook.



You can use the AWS Glue Data Catalog as your external Hive metastore for Apache Spark, Apache Hive, and Presto workloads on Amazon EMR release 5.10.0 and later. To get started, simply select the AWS Glue Data Catalog for table metadata when creating your cluster.

Filter: All clusters | Filter clusters ... | 1 cluster (all loaded)

			Name	ID	Status	Creation time (UTC-5)	Elapsed time
☐	▸	●	My cluster	j-C95AWF15W9YL	Waiting Cluster ready	2019-09-20 14:31 (UTC-5)	1 hour, 17 minutes

Running Homework Jupyter Notebook

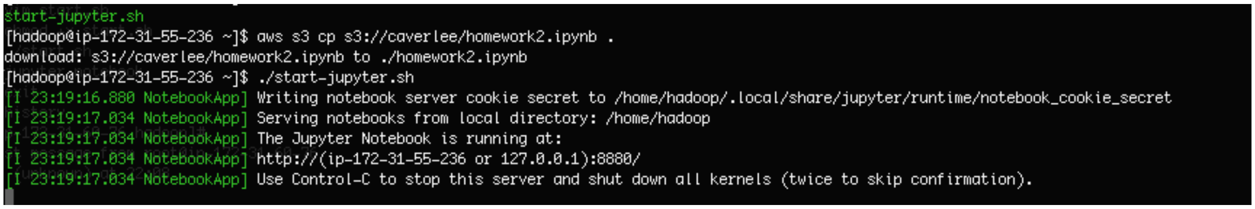
ssh to the master node of your cluster and run the following commands. If you haven't started working on the homework, then you can download the homework from S3 to the master node as follows:

```
$ aws s3 cp s3://caverlee/homework2.ipynb .
```

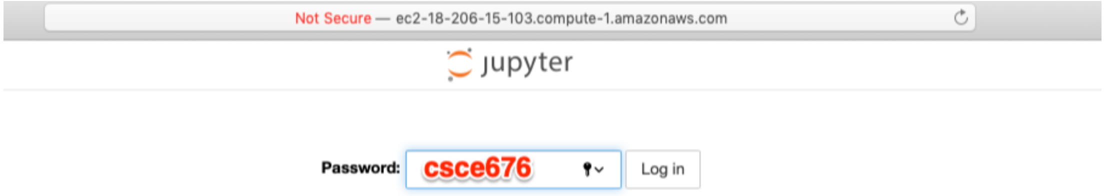
After that, you can start Jupyter in the terminal as follows:

```
$ ./start-jupyter.sh
```

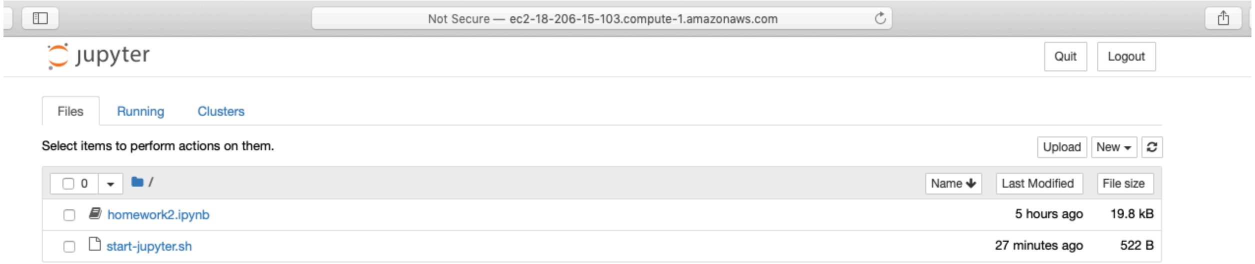
You can then access it on the web your master node public domain and the port is 8880. The password is csce676.



```
start-jupyter.sh
[hadoop@ip-172-31-55-236 ~]$ aws s3 cp s3://caverlee/homework2.ipynb .
download: s3://caverlee/homework2.ipynb to ./homework2.ipynb
[hadoop@ip-172-31-55-236 ~]$ ./start-jupyter.sh
[I 23:19:16.880 NotebookApp] Writing notebook server cookie secret to /home/hadoop/.local/share/jupyter/runtime/notebook_cookie_secret
[I 23:19:17.034 NotebookApp] Serving notebooks from local directory: /home/hadoop
[I 23:19:17.034 NotebookApp] The Jupyter Notebook is running at:
[I 23:19:17.034 NotebookApp] http://(ip-172-31-55-236 or 127.0.0.1):8880/
[I 23:19:17.034 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
```



Password: csce676



Select items to perform actions on them.

/

Name	Last Modified	File size
□ homework2.ipynb	5 hours ago	19.8 kB
□ start-jupyter.sh	27 minutes ago	522 B

Warning: Save homework2.ipynb before termination!

Remember to download your edited homework2.ipynb to your machine or create a bucket on s3 and upload there because when you terminal the cluster it will be deleted.