

Aims

This exercise aims to get you to practice:

- AWS EC2
- AWS S3
- Hadoop MapReduce on AWS EMR

Background

AWS EC2:

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) cloud. Using Amazon EC2 eliminates your need to invest in hardware up front, so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. See more documentation at:

<http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/concepts.html>.

AWS S3:

Amazon Simple Storage Service (Amazon S3) is storage for the Internet. You can use Amazon S3 to store and retrieve any amount of data at any time, from anywhere on the web. You can accomplish these tasks using the AWS Management Console, which is a simple and intuitive web interface. See more documentation at:

<http://docs.aws.amazon.com/AmazonS3/latest/gsg/GetStartedWithS3.html>

AWS EMR:

Amazon EMR is a web service that makes it easy to quickly and cost-effectively process vast amounts of data. Amazon EMR simplifies big data processing, providing a managed Hadoop framework that makes it easy, fast, and cost-effective for you to distribute and process vast amounts of your data across dynamically scalable Amazon EC2 instances. You can also run other popular distributed frameworks such as Apache Spark in Amazon EMR, and interact with data in other AWS data stores such as Amazon S3. See more documentation at:

<http://docs.aws.amazon.com/ElasticMapReduce/latest/DeveloperGuide/emr-what-is-emr.html>

Caution: Before doing the lab, please make sure that you have redeemed your \$100 credits!!! If not, follow the instructions below:

- After login, in the upper right corner, click on the arrow next to your name and go to “My Account”
- In your Dashboard menu on the left, click on “Credits”
- Enter the credit code and the captcha, and you should be done. You should see a table appear which shows how many credits you have left. You should see:

Credits

Please enter your code below to redeem your credits.

Promo Code

Security Check

Please type the characters as shown above

By clicking "Redeem" you indicate that you have read and agree to the terms of the AWS Promotional Credit Terms & Conditions located [here](#).

[Redeem](#)

Below are all the credits you have redeemed with AWS. Credits will automatically be applied to your bill. Only credits that apply to a specific service can be used.

Expiration Date	Credit Name	Credits Used	Credits Remaining	Applicable Products
2017-05-31	ENG_FY2016_Q2_05_100USD	\$0.00	\$100.00	See complete list

We are NOT responsible for any charge of your credit cards if you do not follow the lab instructions.

Try AWS EC2 Using Free Tier Accounts

1. Log in AWS using your own account. Once you have signed in, you will be greeted by a page like this:

Quick Starts [Hide](#)

- Build a web app [Start now](#)
- Launch a Virtual Machine (EC2 Instance) [Learn more](#)
- Back up your files [Learn more](#)
- Build a back end for your mobile app [Start now](#)
- Host a static website [Learn more](#)
- Analyze big data [Learn more](#)

AWS Services [Show categories](#)

Search services

- Compute**
 - EC2
 - EC2 Container Service
 - Elastic Beanstalk
 - Lambda
- Storage & Content Delivery**
 - S3
 - CloudFront
 - Elastic File System
 - Glacier
 - Snowball
 - Storage Gateway
- Developer Tools**
 - CodeCommit
 - CodeDeploy
 - CodePipeline
- Management Tools**
 - CloudWatch
 - CloudFormation
 - CloudTrail
 - Config
 - OpsWorks
 - Service Catalog
 - Trusted Advisor
- Internet of Things**
 - AWS IoT
- Game Development**
 - GameLift
- Mobile Services**
 - Mobile Hub
 - Cognito
 - Device Farm
 - Mobile Analytics
 - SNS

Service Health [View Dashboard](#)

All services are operating normally. Updated Oct 02 2016 11:37:00 GMT+1100

Getting Started
Read our [documentation](#) or view our [training](#) to learn more about AWS.

AWS Console Mobile App
View your resources on the go with our AWS Console mobile app, available from [Amazon Appstore](#), [Google Play](#), or [iTunes](#).

AWS Marketplace
[Find and buy software](#), launch with 1-Click, and pay by the hour.

Feedback
[Tell us what you think](#) about the new console home page.

Make sure that the region information on the top right is set to “Sydney”. If it is not, change it to Sydney by selecting from the dropdown menu there.

2. Click on the EC2 link (first link under the Compute category). You will go to a dashboard page like this:

The screenshot shows the AWS Management Console EC2 Dashboard for the Sydney region. The left sidebar contains navigation links for EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES (Instances, Spot Requests, Reserved Instances, Dedicated Hosts), IMAGES (AMIs, Bundle Tasks), ELASTIC BLOCK STORE (Volumes, Snapshots), NETWORK & SECURITY (Security Groups, Elastic IPs, Placement Groups, Key Pairs, Network Interfaces), and LOAD BALANCING. The main content area is titled 'Resources' and lists EC2 resources in the Asia Pacific (Sydney) region: 0 Running Instances, 0 Elastic IPs, 0 Dedicated Hosts, 0 Snapshots, 0 Volumes, 0 Load Balancers, 0 Key Pairs, 1 Security Groups, and 0 Placement Groups. A blue box promotes 'Amazon Simple Workflow Service'. Below this is the 'Create Instance' section with a 'Launch Instance' button. The 'Service Health' section shows 'Asia Pacific (Sydney): This service is operating normally'. The 'Scheduled Events' section shows 'No events'. The right sidebar contains 'Account Attributes' (Supported Platforms, Default VPC, Resource ID length management), 'Additional Information' (Getting Started Guide, Documentation, All EC2 Resources, Forums, Pricing, Contact Us), and 'AWS Marketplace' (Find free software trial products, Launch Wizard, Or try these popular AMIs: Tableau Server (10 users)).

3. Click the blue “Launch Instance” button, and you will be redirected to a page like the following:

The screenshot shows the 'Step 1: Choose an Amazon Machine Image (AMI)' page in the AWS Management Console. The top navigation bar includes 'AWS', 'Services', 'Edit', and the user 'Xin Cao' in the 'Sydney' region. The page has a progress bar with seven steps: 1. Choose AMI (active), 2. Choose Instance Type, 3. Configure Instance, 4. Add Storage, 5. Tag Instance, 6. Configure Security Group, and 7. Review. The main content area is titled 'Step 1: Choose an Amazon Machine Image (AMI)' and includes a 'Cancel and Exit' link. Below the title is a 'Quick Start' section with a list of AMIs. The list includes: Amazon Linux AMI 2016.09.0 (HVM), SSD Volume Type - ami-55d4e436; Red Hat Enterprise Linux 7.2 (HVM), SSD Volume Type - ami-e0c19f83; SUSE Linux Enterprise Server 12 SP 1 (HVM), SSD Volume Type - ami-0f510a6c; and Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-ba3e14d9. Each AMI entry includes a logo, a 'Free tier eligible' badge, a description, root device type, virtualization type, and a 'Select' button. The left sidebar shows 'My AMIs', 'AWS Marketplace', and 'Community AMIs' with a 'Free tier only' filter.

You can use many AMIs (Amazon Machine Image) to finish your task. In this lab, we will use the Ubuntu AMI, and continue to the next step to choose your instance type.

4. Choose the instance type t2.micro, and click on “Review and Launch”.

Caution: This is the only one that is free tier eligible. You will be billed if you select other instance types!

Step 2: Choose an Instance Type
Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: All instance types Current generation Show/Hide Columns

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
<input type="checkbox"/>	General purpose	t2.nano	1	0.5	EBS only	-	Low to Moderate
<input checked="" type="checkbox"/>	General purpose	t2.micro <small>Free tier eligible</small>	1	1	EBS only	-	Low to Moderate
<input type="checkbox"/>	General purpose	t2.small	1	2	EBS only	-	Low to Moderate
<input type="checkbox"/>	General purpose	t2.medium	2	4	EBS only	-	Low to Moderate
<input type="checkbox"/>	General purpose	t2.large	2	8	EBS only	-	Low to Moderate
<input type="checkbox"/>	General purpose	m4.large	2	8	EBS only	Yes	Moderate

Cancel Previous **Review and Launch** Next: Configure Instance Details

5. In the next page, click on Launch.

Step 7: Review Instance Launch
Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

⚠ Improve your instances' security. Your security group, launch-wizard-1, is open to the world.
Your instances may be accessible from any IP address. We recommend that you update your security group rules to allow access from known IP addresses only. You can also open additional ports in your security group to facilitate access to the application or service you're running, e.g., HTTP (80) for web servers. [Edit security groups](#)

▼ AMI Details [Edit AMI](#)

Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-ba3e14d9
Free tier eligible Ubuntu Server 14.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).
Root Device Type: ebs Virtualization type: hvm

▼ Instance Type [Edit instance type](#)

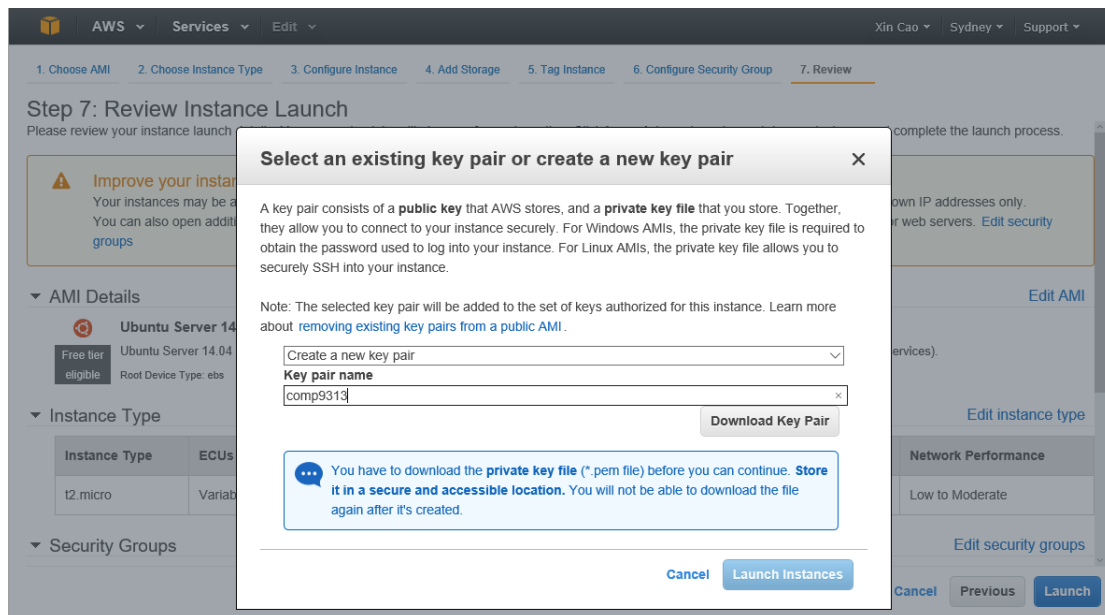
Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

▼ Security Groups [Edit security groups](#)

Cancel Previous **Launch**

6. You will be then prompted to create or use an existing key-pair. Create a new one by choosing “Create a new key pair” from the drop-down menu and giving it some name of your choice (e.g., “comp9313”). You should then download the key pair, and keep it somewhere that you won’t accidentally delete. **Remember that there is NO WAY to get to your instance if you lose your key.**

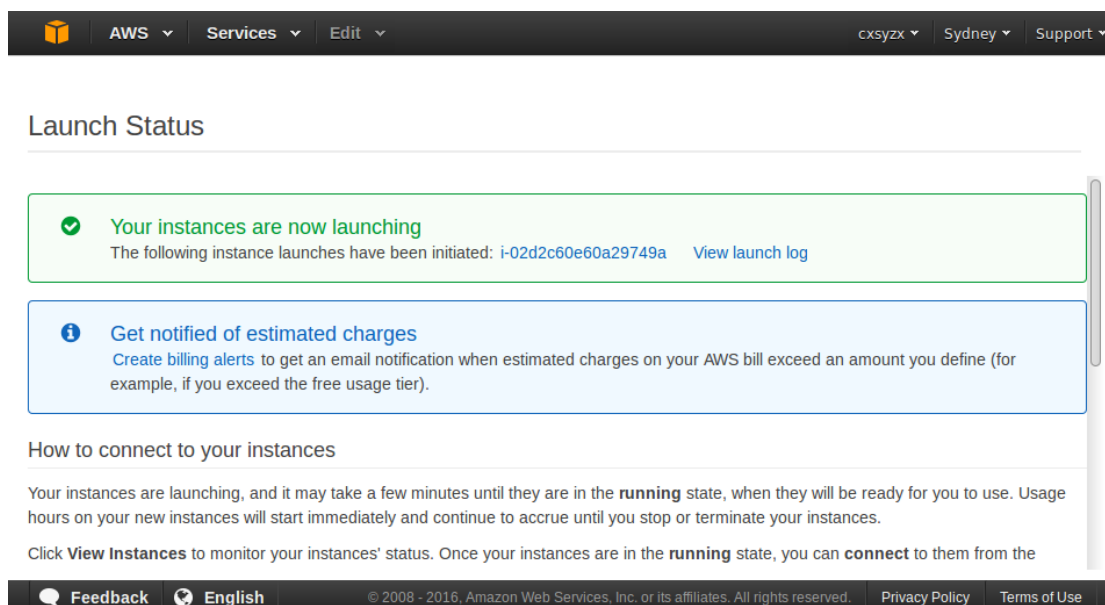
Caution: Don't select the Proceed without a key pair option. If you launch your instance without a key pair, then you can't connect to it.



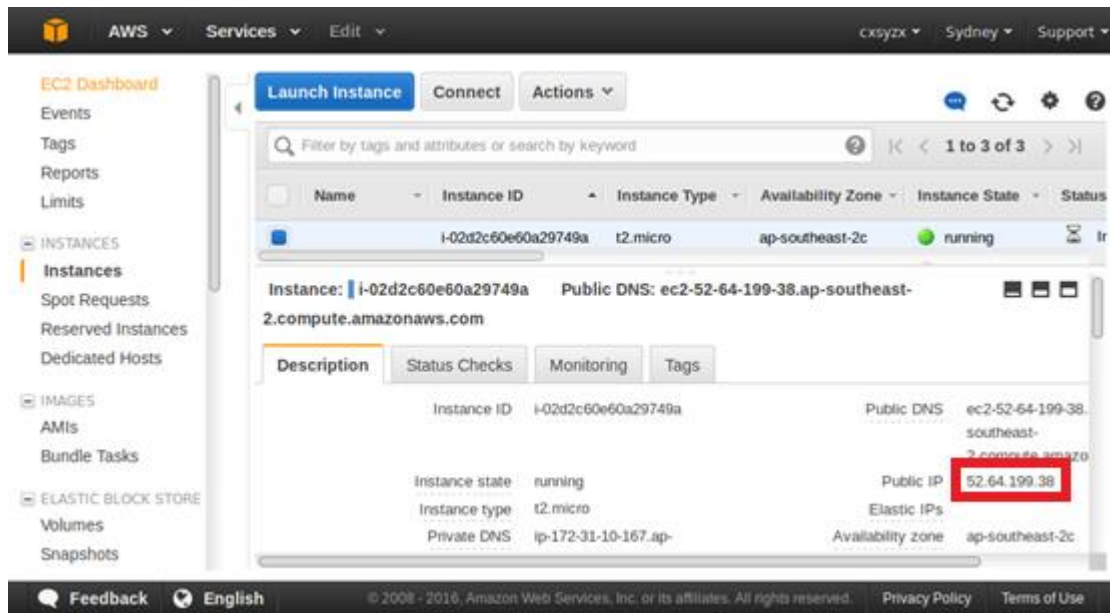
7. Once you download your key, you should change the permissions of the key to user-only RW. Move the file to your home folder, and then do:

```
$ chmod 600 comp9313.pem
```

8. After this is done, click on “Launch Instances”, and you should see a screen showing that your instances are launching:



9. Click on “View Instances” to see your instance state. It should change to “Running” and “2/2 status checks passed” as shown below within some time. You are now ready to ssh into the instance.



10. Note down the Public IP of the instance from the instance listing (in the example, it is 52.64.199.38). Then, do:

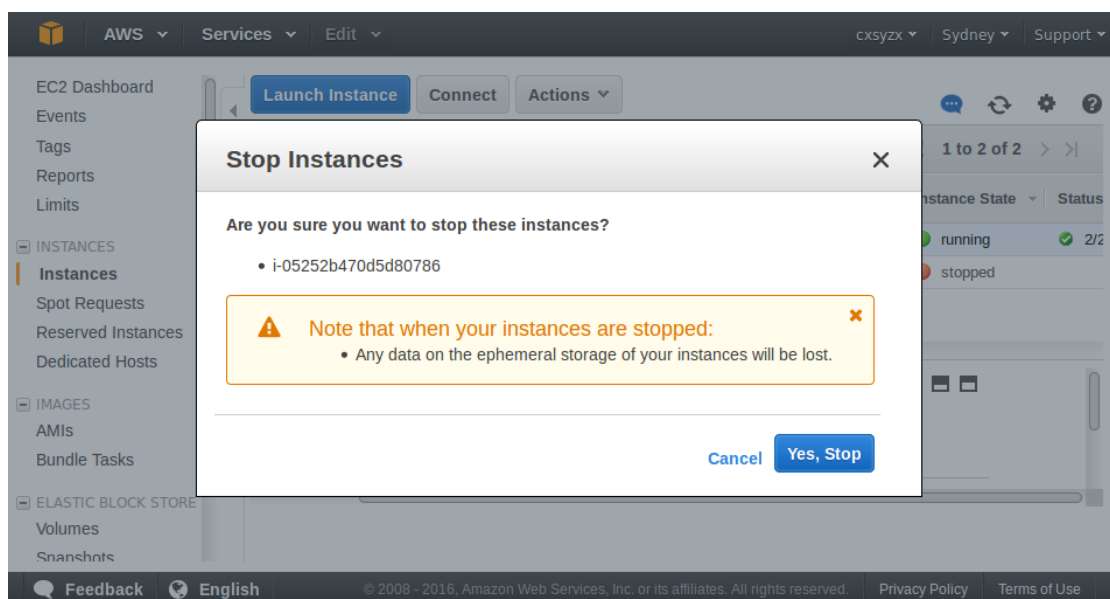
```
$ ssh -i ~/comp9313.pem ubuntu@52.64.199.38
```

Alternatively, you can also use the public DNS to connect to the instance.

If everything works fine, you should be able to ssh to the AWS instance.

11. To shut down the instance, right click the instance and select “Instance State -> Stop”. Then confirm to stop the instance.

Caution: If you choose terminate, then all the files in this instance will be lost permanently, and you cannot use it again!



12. You can also launch another instance. This time, after the step “Review and Launch”, click “Edit security groups” (a security group is a set of firewall rules that control the traffic for your instance).

▼ Security Groups [Edit security groups](#)

Security group name	launch-wizard-2
Description	launch-wizard-2 created 2016-10-03T04:38:25.934+11:00

Type ⓘ	Protocol ⓘ	Port Range ⓘ	Source ⓘ
SSH	TCP	22	0.0.0.0/0

Then, choose the existing security group you created for the first instance.

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more](#) about Amazon EC2 security groups.

Assign a security group: ☐ Create a new security group
☒ Select an existing security group

Security Group ID	Name	Description	Actions
<input type="checkbox"/> sg-c3133aa7	default	default VPC security group	Copy to new
<input checked="" type="checkbox"/> sg-be9cb5da	launch-wizard-1	launch-wizard-1 created 2016-10-03T04:32:26.947+11:00	Copy to new

Inbound rules for sg-be9cb5da (Selected security groups: sg-be9cb5da)

Type ⓘ	Protocol ⓘ	Port Range ⓘ	Source ⓘ
SSH	TCP	22	0.0.0.0/0

Next, you can use your existing key pair to launch the instance.

Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about [removing existing key pairs from a public AMI](#).

Choose an existing key pair
Select a key pair
comp9313

☒ I acknowledge that I have access to the selected private key file (comp9313.pem), and that without this file, I won't be able to log into my instance.

[Cancel](#) [Launch Instances](#)

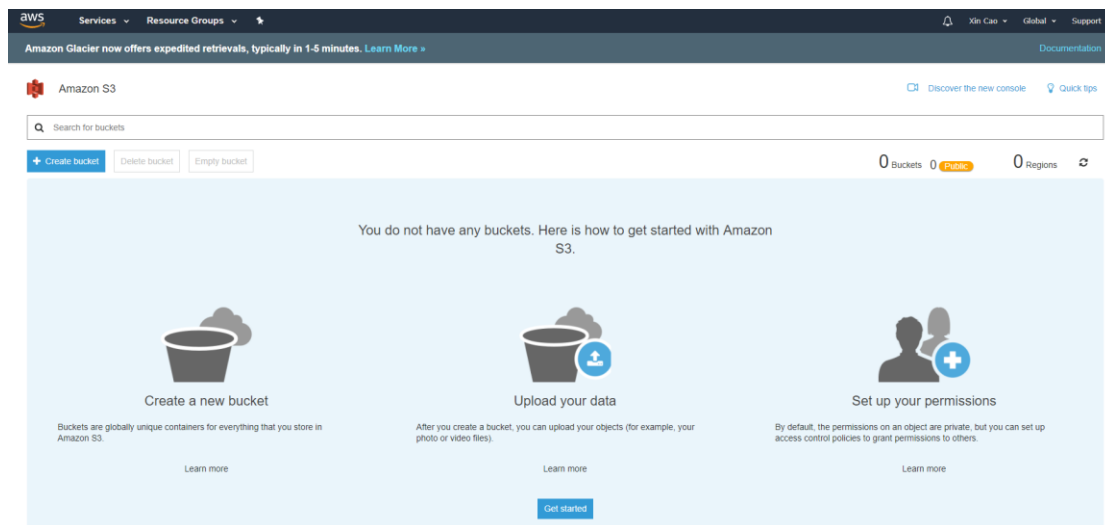
Caution: You will be billed for AWS instances as they are alive, so you will want to terminate them when they aren't in direct use! Here are the Amazon

instructions. Always remember to terminate the instances if they will not be used any more. You can stop an instance if you still need to use it later.

Store Data in AWS S3

Create a Bucket in S3

1. Every object in Amazon S3 is stored in a bucket (like a folder in your local file system). Before you can store data in Amazon S3 you must create a bucket. Go back to the AWS Management Console and open the Amazon S3 console.



2. Click Create Bucket. The “Create bucket” dialog box appears.

The screenshot shows the 'Create bucket' dialog box with a blue header and a close button. It has a progress bar with four steps: 1. Name and region, 2. Set properties, 3. Set permissions, and 4. Review. The first step is active. The 'Name and region' section includes a 'Bucket name' field with the value 'comp9313.z3515164', a 'Region' dropdown menu set to 'Asia Pacific (Sydney)', and a 'Copy settings from an existing bucket' dropdown menu set to 'You have no buckets' (showing '0 Buckets'). At the bottom, there are three buttons: 'Create', 'Cancel', and 'Next'.

Enter a bucket name in the Bucket Name field. The bucket name you choose must be unique across all existing bucket names in Amazon S3. For example, the tutorial names the bucket as “comp9313”.

Bucket names must comply with the following requirements:

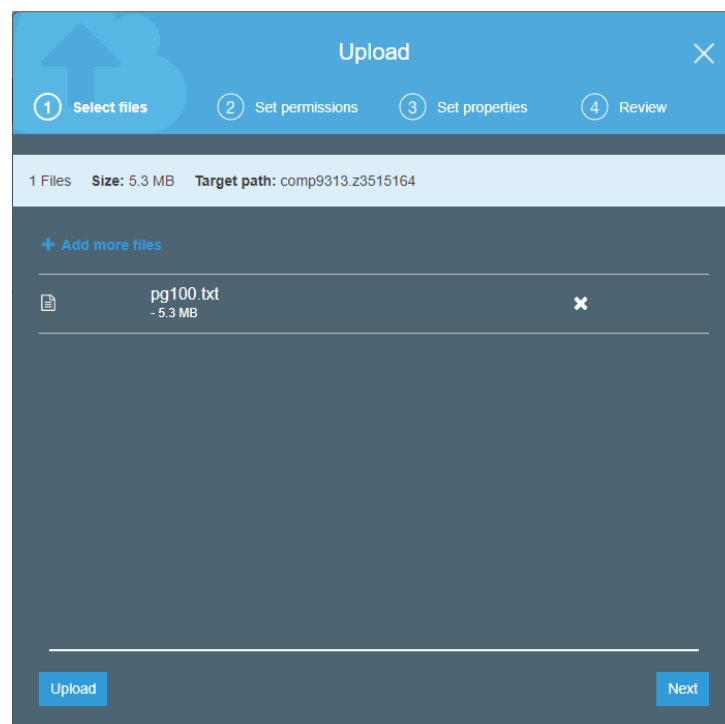
- Can contain lowercase letters, numbers, periods (.) and dashes (-)
- Must start with a number or letter
- Must be between 3 and 255 characters long
- Must not be formatted as an IP address (e.g., 265.255.5.4)

Caution: Because S3 allows your bucket to be used as a URL that can be accessed publicly, the bucket name that you choose must be globally unique. If some other account has already created a bucket with the name that you chose, you must use another name. Therefore, it is recommended to name your bucket as “comp9313.<YOUR_StudentID>” (e.g., comp9313.z3515164).

In the Region drop-down list box, select region “Asia Pacific (Sydney)”, and click “Create”. You would see a bucket created for you in S3.

Add and Manage Files in a Bucket:

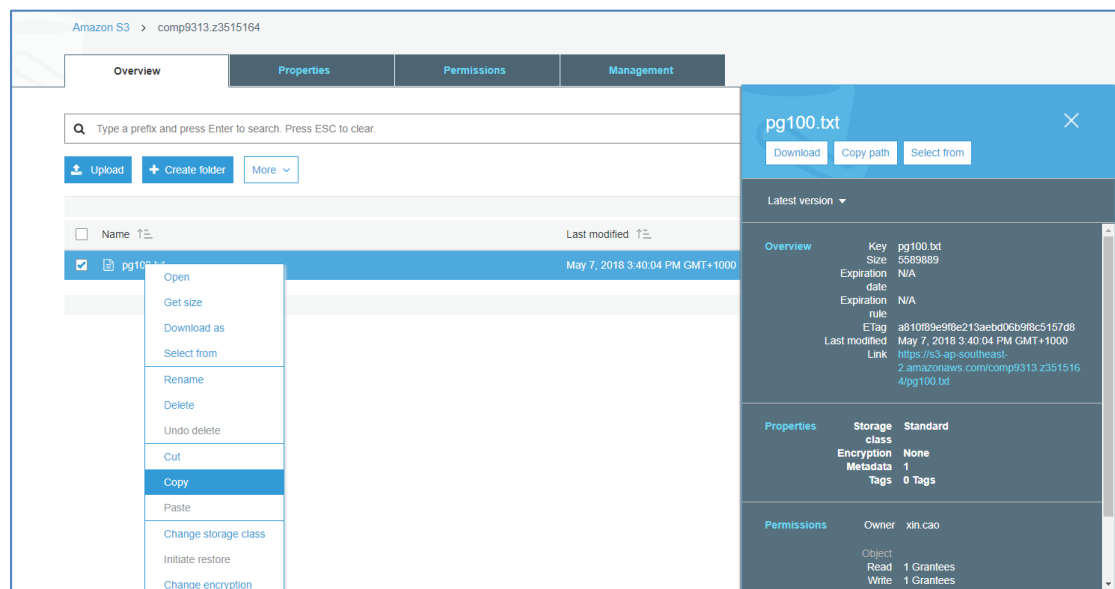
Now that you've created a bucket, you're ready to add an object to it. An object can be any kind of file: a text file, a photo, a video and so forth. When you add a file to Amazon S3, you have the option of including metadata with the file and setting permissions to control access to the file.



In the Amazon S3 console click the bucket you want to upload an object into and then click “Upload”. The Upload dialog box then opens (appearance may differ slightly in different browsers). Download the pg100.txt file, create a folder “input” in your bucket, and upload it into the folder.

Caution: The free tier account only has 5GB S3 storage. If your files exceed this space limit, you will be billed for the service!!!

You can do various actions on the files in your bucket. Select the file to be managed, then click “Actions”, in the menu you can see all the actions you can do, such as Rename, Cut, and Copy. You can also view the properties of the file.



Finally, prepare a WordCount jar file, and upload it to AWS S3.

a) Download the WordCount.java used in Lab 3 from the course home page. Set the number of Reducers as 3. Compile the file and package the MapReduce program as a jar file wc.jar.

c) Test the jar file in your local machine first before uploading to S3.

Run MapReduce Tasks on AWS EMR (Part 1)

1. Go back to the AWS Management console and open the EMR console.



2. Choose Create cluster. On the Create Cluster page, you need to do the following:

In General Configuration section:

a) Cluster name: comp9313.lab9

b) Logging: Select

By default, clusters created using the console have logging enabled. This option determines whether Amazon EMR writes detailed log data to Amazon S3.

When this value is set, Amazon EMR copies the log files from the EC2 instances in the cluster to Amazon S3. Logging to Amazon S3 can only be enabled when the cluster is created.

Logging to Amazon S3 prevents the log files from being lost when the cluster ends and the EC2 instances hosting the cluster are terminated. These logs are useful for troubleshooting purposes.

c) S3 folder: use default. The folder is used to store the logs.

You can also type or browse to your Amazon S3 bucket to store the Amazon EMR logs; for example, `s3://YOUR_BUCKET/logs`, or you can allow Amazon EMR to generate an Amazon S3 path for you. If you type the name of a folder that does not exist in the bucket, it is created for you.

d) Launch mode: select “Step execution. “

If you select “Cluster”, the instances will keep running after your MapReduce task is finished. However, you can do more jobs without creating a new cluster. By selecting “Step execution”, the instances will be terminated once the task is completed.

General Configuration

Cluster name

☒ Logging ⓘ

S3 folder

Launch mode ☐ Cluster ⓘ ☒ Step execution ⓘ

In Add steps section:

a) Set the step type as Custom JAR

b) Click “Configure”, set Name as “WordCount”, set JAR location as “s3://comp9313.<YOUR_StudentID>/wc.jar”, set Arguments as “comp9313.lab3.WordCount s3://comp9313.<YOUR_StudentID>/input s3://comp9313.<YOUR_StudentID>/output”, select “Terminate cluster” for Action on Failure, and finally click Add.

Add Step

Step type: Custom JAR

Name*:

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

Arguments: ⓘ 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: ⓘ What to do if the step fails.

Then, in the Add steps section, you will see:

Add steps

A step is a unit of work submitted to an application running on your EMR cluster. EMR programmatically installs the applications needed to execute the added steps. [Learn more](#)

Name	Action on failure	JAR location	Arguments	
WordCount	Terminate cluster	s3://comp9313/wc.jar	comp9313.lab3.WordCount s3://comp9313/input s3://comp9313/output	

Step type:

In the Software Configuration section:

Release: select emr-5.0.0 (Hadoop 2.7.2, consistent with our lab setting) or emr-5.13.0 (Hadoop 2.8.3, the newest release in AWS)

In the Hardware Configuration section:

a) Instance type: use m4.large (much cheaper than the default m3.xlarge)

b) Number of instances: 2

In the Security and Access section:

Accept the remaining default options.

6. Choose Create cluster. You should see:

The screenshot shows the AWS Management Console interface for an Amazon EMR cluster. The top navigation bar includes the AWS logo, 'AWS', 'Services', 'Edit', and user information 'cxsyzx', 'Sydney', and 'Support'. On the left, a sidebar lists 'Amazon EMR' with sub-links for 'Cluster list', 'Security configurations', 'VPC subnets', and 'Help'. The main content area displays the cluster details for 'comp9313.lab8' in the 'Starting' state. At the top of the details are buttons: 'Add step', 'Resize', 'Clone', 'Terminate', and 'AWS CLI export'. Below these, the cluster's 'Connections', 'Master public DNS', and 'Tags' are listed as '--'. A 'Summary' section shows the cluster ID 'j-1MVVTVS9TE9G0', creation date '2016-10-03 05:25 (UTC+11)', elapsed time, and termination protection settings. A 'Configuration Details' section lists the release label 'emr-5.0.0', Hadoop distribution 'Amazon 2.7.2', applications (Ganglia 3.7.2, Hive 2.1.0, Hue 3.10.0, Mahout 0.12.2, Pig 0.16.0, Tez 0.8.4), Log URI, and EMRFS status 'Disabled'.

Later, you will see the information for Connections and Master public DNS is updated, since the cluster is already started.

Click “Steps”, and you should see two jobs listed.

The screenshot shows the 'Steps' section of the AWS Management Console. It includes a filter dropdown set to 'All steps' and a table with two steps. The table has columns for ID, Name, Status, Start time (UTC+11), Elapsed time, Log files, and Actions. Both steps are in the 'Pending' state.

ID	Name	Status	Start time (UTC+11)	Elapsed time	Log files	Actions
s-1LNGF60SCX88U	Setup hadoop debugging	Pending			View logs	View jobs
s-TVET1HK7UM3H	WordCount	Pending			View logs	View jobs

7. Wait until the WordCount task is finished. **Note that this may take several minutes.**

In the meantime, you can begin working on the next section, and go back to check the results later.

8. If the task is completed, you should see:

Cluster: comp9313.lab8 **Terminated** steps completed

Connections: --
Master public DNS: ec2-52-63-32-210.ap-southeast-2.compute.amazonaws.com SSH
Tags: --

Summary
ID: j-f46WABPVF356
Creation date: 2016-10-03 06:03 (UTC+11)
End date: 2016-10-03 06:09 (UTC+11)
Elapsed time: 6 minutes
Auto-terminate: Yes
Termination protection: Off

Configuration Details
Release label: emr-5.0.0
Hadoop Amazon 2.7.2 distribution:
Applications: --
Log URI: s3://aws-logs-375729410947-ap-southeast-2-elasticmapreduce/
EMRFS consistent view: Disabled

Network and Hardware
Availability zone: ap-southeast-2b
Subnet ID: subnet-1d824d6b
Master: Terminated 1 m3.xlarge
Core: Terminated 2 m3.xlarge
Task: --

Security and Access
Key name: --
EC2 Instance Profile: EMR_EC2_DefaultRole
EMR role: EMR_DefaultRole
Visible to all users: All Change
Security groups for sg-60b39a02 (ElasticMapReduce-Master: master)
Security groups for sg-60b39a04 (ElasticMapReduce-Core & Task: slave)

► Monitoring
► Hardware
▼ Steps

Add step Clone step

Steps
Filter: All steps Filter steps 2 steps (all loaded) View all interactive jobs View all jobs

ID	Name	Status	Start time (UTC+11)	Elapsed time	Log files	Actions
s-7QH2VHTCHMD	WordCount	Completed	2016-10-03 06:07 (UTC+11)	42 seconds	View logs	View jobs
s-29PROAZEIWF8R	Setup hadoop debugging	Completed	2016-10-03 06:07 (UTC+11)	2 seconds	View logs	View jobs

Go to your S3 bucket, the results should be stored there.

Upload Create Folder Actions

All Buckets / comp9313.z3515164 / output

Name
<input type="checkbox"/> _SUCCESS
<input type="checkbox"/> part-r-00000
<input type="checkbox"/> part-r-00001
<input type="checkbox"/> part-r-00002

Run MapReduce Tasks on AWS EMR (Part 2)

In the previous section, we add a step to the cluster, and wait for the completion of the job. In this section, we will ssh to the cluster to do a MapReduce job.

1. Choose Create cluster. On the Create Cluster page, click “Go to advanced options”.
2. In Step 1, select emr-5.0.0 for Release, and only use “Hadoop 2.7.2” in the cluster. Accept the other default configurations, and click “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

Software Configuration

Release: emr-5.0.0

☒ Hadoop 2.7.2
☐ Ganglia 3.7.2
☐ Hive 2.1.0
☐ Sqoop 1.4.6
☐ Phoenix 4.7.0
☐ HCatalog 2.1.0

☐ Zeppelin 0.6.1
☐ HBase 1.2.2
☐ Presto 0.150
☐ Mahout 0.12.2
☐ Oozie 4.2.0

☐ Tez 0.8.4
☐ Pig 0.16.0
☐ ZooKeeper 3.4.8
☐ Hue 3.10.0
☐ Spark 2.0.0

Edit software settings (optional)

☒ Enter configuration ☐ Load JSON from S3

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

3. In Step 2, use the default root device EBS volume size, and select the default m3.xlarge as the instance type for both Master and Core. Click “Next”

The screenshot shows the 'Create Cluster - Advanced Options' page, specifically Step 2: Hardware Configuration. The left sidebar indicates the steps: Step 1: Software and Steps, Step 2: Hardware (selected), Step 3: General Cluster Settings, and Step 4: Security. The main content area is titled 'Hardware Configuration' and includes a link 'Go to quick options'. Below the title, there is a note: 'If you need more than 20 EC2 instances, see this topic:'. The configuration includes a 'Network' dropdown set to 'vpc-dac9d2bf (172.31.0.0/16) (default)' with a 'Create a VPC' link, an 'EC2 Subnet' dropdown set to 'subnet-49e32210 | Default in ap-southeast-2c', and a 'Root device EBS volume size' input set to '10' GiB. A table below lists the instance configurations:

Node type	Instance type	Instance count	Purchasing option	Auto Scaling
Master Master - 1	m3.xlarge 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none	1 Instances	<input checked="" type="radio"/> On-demand <input type="radio"/> Spot Maximum Spot price: \$	Not available for Master
Core Core - 2	m3.xlarge 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none	2 Instances	<input checked="" type="radio"/> On-demand <input type="radio"/> Spot Maximum Spot price: \$	Not enabled
Task Task - 3	m3.xlarge 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none	0 Instances	<input checked="" type="radio"/> On-demand <input type="radio"/> Spot Maximum Spot price: \$	Not enabled

4. In Step 3, name your cluster and accept all default configurations and click “Next”.

5. In Step 4, use your key pair for the cluster. Click “EC2 Security Groups”, configure the security groups for both Master and Core as “launch-wizard-1”. Finally, click “Create Cluster”.

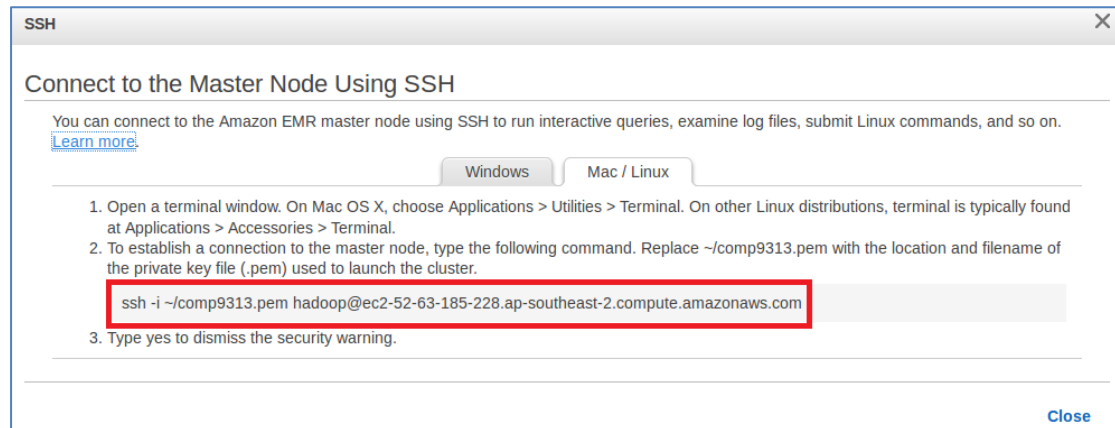
The screenshot shows the 'Create Cluster - Advanced Options' page, specifically Step 4: Security. The left sidebar indicates the steps: Step 1: Software and Steps, Step 2: Hardware, Step 3: General Cluster Settings, and Step 4: Security (selected). The main content area is titled 'Security Options' and includes a link 'Go to quick options'. Below the title, there is a dropdown for 'EC2 key pair' set to 'comp9313'. A checkbox 'Cluster visible to all IAM users in account' is checked. Under 'Permissions', the 'Default' radio button is selected. Below this, there is a note: 'Use default IAM roles. If roles are not present, they will be automatically created for you with managed policies for automatic policy updates.' The 'EMR role' is set to 'EMR_DefaultRole' and the 'EC2 instance profile' is set to 'EMR_EC2_DefaultRole'. Under 'Encryption Options', the 'EC2 Security Groups' section is expanded. It contains a table with two columns: 'Type' and 'Security Groups'. The 'Type' column has two rows: 'Master' and 'Core & Task'. The 'Security Groups' column has two rows: 'Default: sg-66b39a02 (ElasticMapReduce-master)' and 'sg-591f363d (launch-wizard-1)'. The 'Core & Task' row has 'Default: sg-60b39a04 (ElasticMapReduce-slave)' and 'sg-591f363d (launch-wizard-1)'. Below the table, there is a link 'Create a security group'. At the bottom right, there are three buttons: 'Cancel', 'Previous', and 'Create cluster'.

6. Waiting for the starting of the cluster. You can go back to check the results of your first cluster.

Once the information for “Connection” and “Master public DNS” is updated, your cluster is started, and you can ssh to the master node now.

Cluster: My cluster Waiting Cluster ready after last step completed.	
Connections:	Enable Web Connection – Resource Manager ... (View All)
Master public DNS:	ec2-52-63-185-228.ap-southeast-2.compute.amazonaws.com SSH
Tags:	-- View All / Edit

Click SSH in the line of “Master public DNS:”, you will see:



SSH to the master node by copying the command as shown in the dialog:

```
$ ssh -i ~/comp9313.pem hadoop@YOUR_INSTANCE
```

```
comp9313@comp9313-VirtualBox:~$ ssh -i ~/comp9313.pem hadoop@ec2-52-63-185-228.ap-southeast-2.compute.amazonaws.com
The authenticity of host 'ec2-52-63-185-228.ap-southeast-2.compute.amazonaws.com (52.63.185.228)' can't be established.
ECDSA key fingerprint is 1f:7b:ac:f4:d7:fa:d7:68:32:be:ac:b9:c7:41:78:17.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'ec2-52-63-185-228.ap-southeast-2.compute.amazonaws.com,52.63.185.228' (ECDSA) to the list of known hosts.
Last login: Tue Oct  4 21:17:21 2016

  _ | _ | _ )
  _ | ( _ /   Amazon Linux AMI
 _|\_|_|_|_|
```

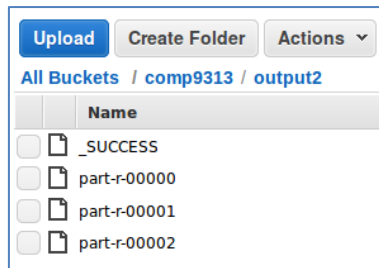
7. Download the jar file from S3 by the following command:

```
$ hadoop fs -get s3://comp9313.<YOUR_StudentID>/wc.jar
```

8. Run the MapReduce task. Generate the results in a different folder!

```
$ hadoop jar wc.jar comp9313.lab3.WordCount
s3://comp9313.<YOUR_StudentID>/input
s3://comp9313.<YOUR_StudentID>/output2
```

9. Wait for the completion of the task, and check the results in your S3 bucket. You should see:



10. You can also download “pg100.txt” from S3, and put the file to HDFS, and run the MapReduce task by reading/writing files from/to HDFS instead of S3.

```
$ hdfs dfs -mkdir input
```

```
$ hdfs dfs -put pg100.txt input
```

```
$ hadoop jar wc.jar comp9313.lab3.WordCount input output
```

Caution: The I/O between the cluster and S3 is also billed if your transfer exceeds the free tier limit!!!

11. You can also add a new step to this cluster to run a MapReduce task. Try it by yourself.

12. Caution: Do not forget to terminate the cluster after you finish all labs!!! (Click “Terminate” and turn termination protection off)