Machine Learning Engineering Bootcamp

Created by
WeCloudData

1. Getting Started with AWS (EC2, S3)

1.1 - Launch an EC2 Instance

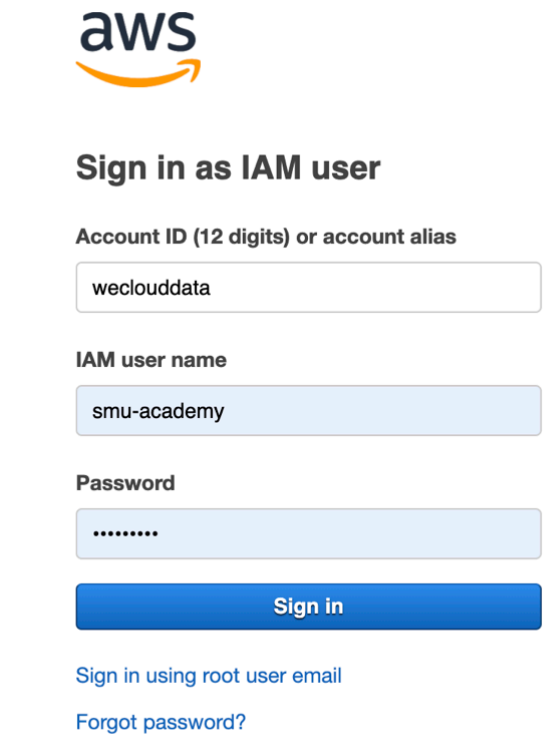
1.1.1 - Sign in to AWS

Click the link below to sign in to AWS console

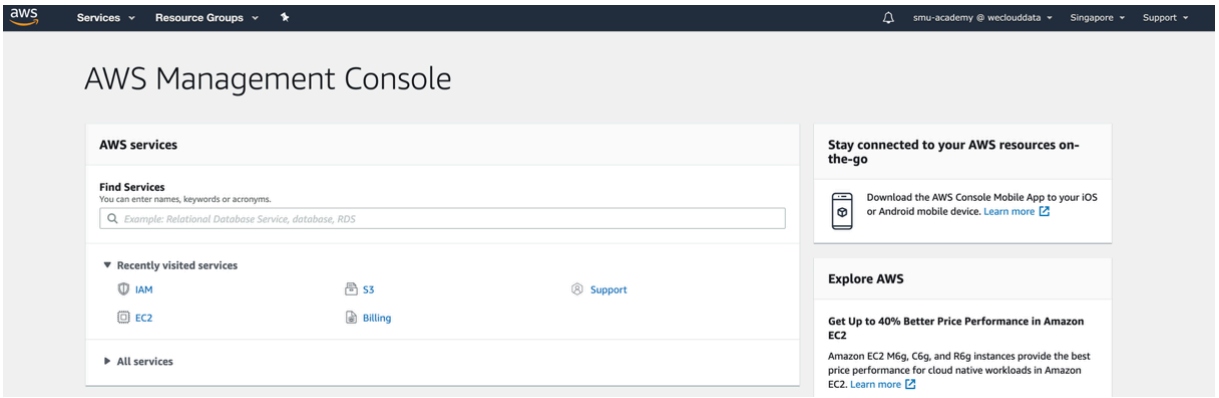
- https://weclouddata.signin.aws.amazon.com/console

An AWS account has been prepared for this lab, here's the log in credential:

- IAM user name:
- Password:



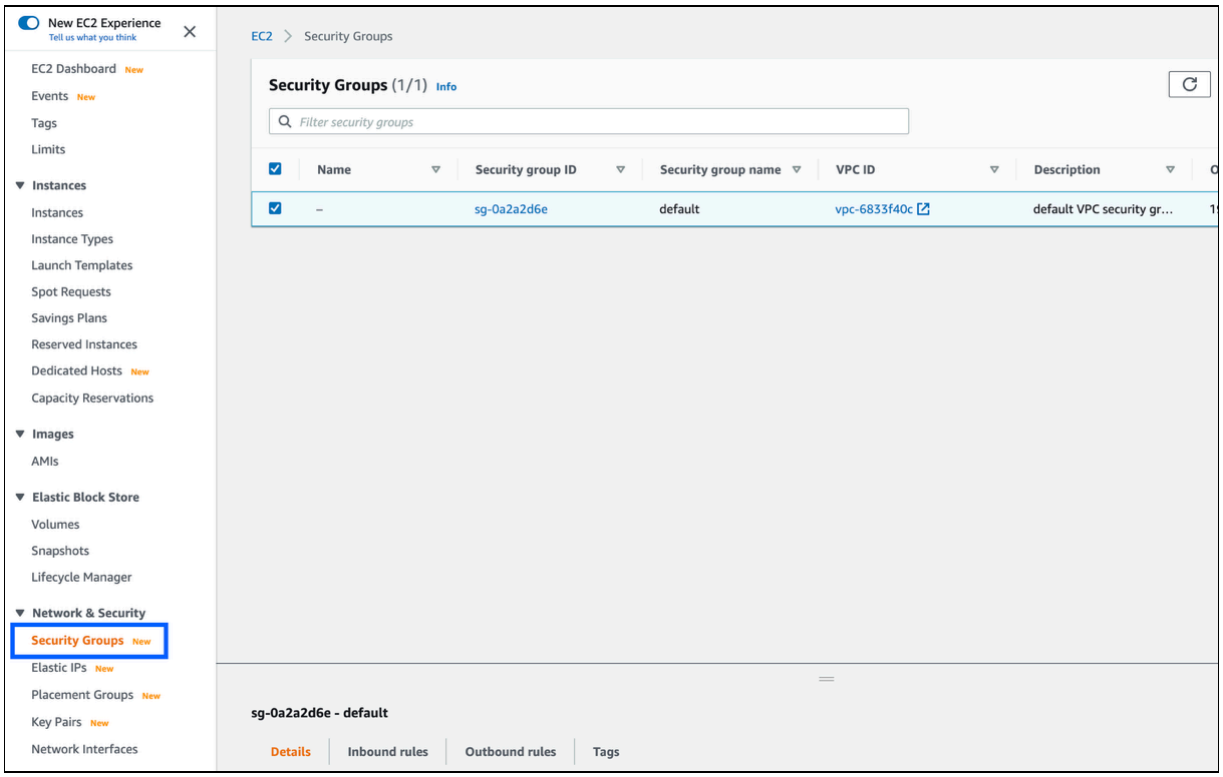
After successful signin, you will see the AWS Management Console



1.1.2 - Create a Security Group

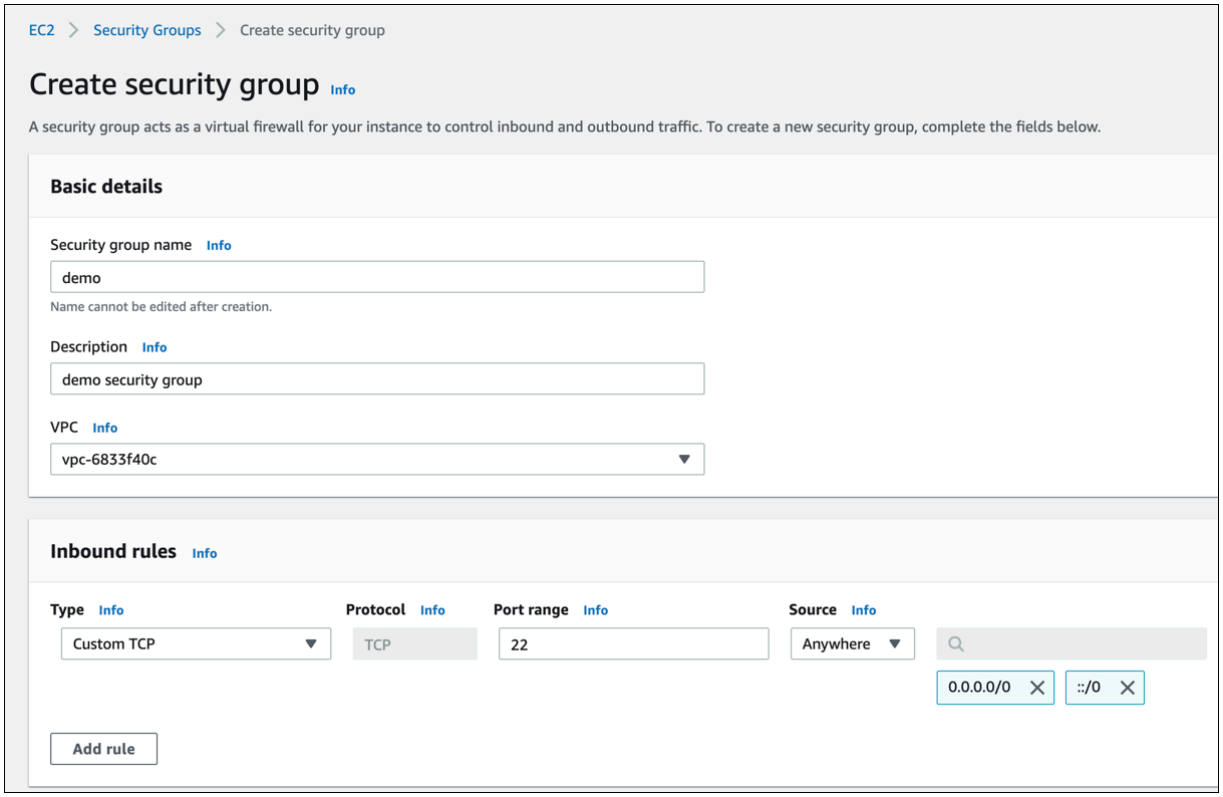
A security group allows us to control control the IP addresses that can access services on specific ports.

In the EC2 console, click **Network & Security -> Security Group**

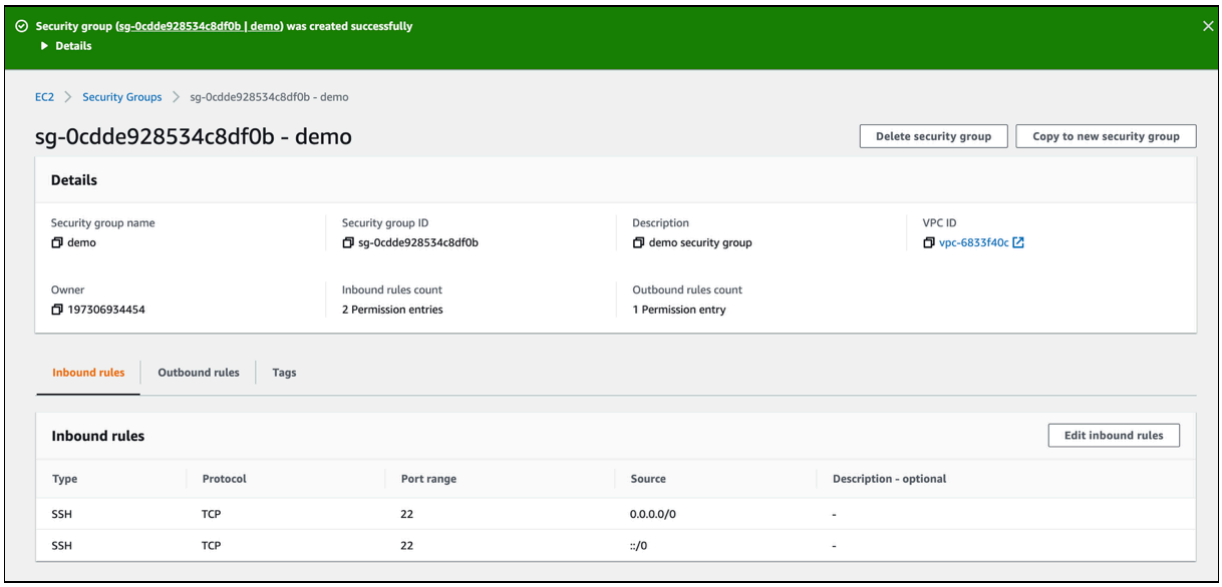


Click **Create Security Group** and enter a group name.

- Click `Add Rule` in **Inbound Rules** section to add an SSH rule
  - **Port Range** set to 22
  - **Source** set to your IP address or `anywhere` (less secure)



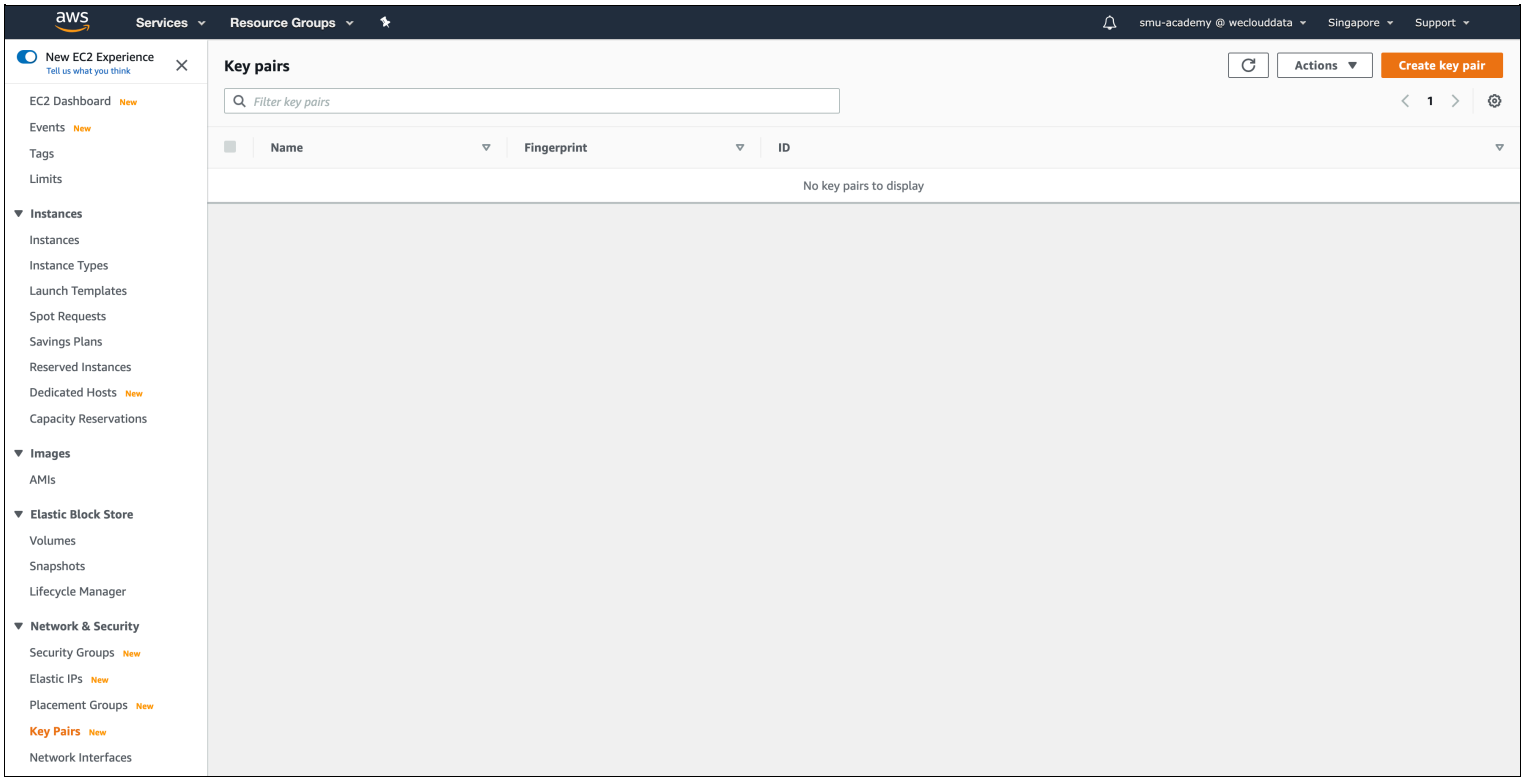
Click to create the security group and confirm in the next step



1.1.3 - Create a Key Pair

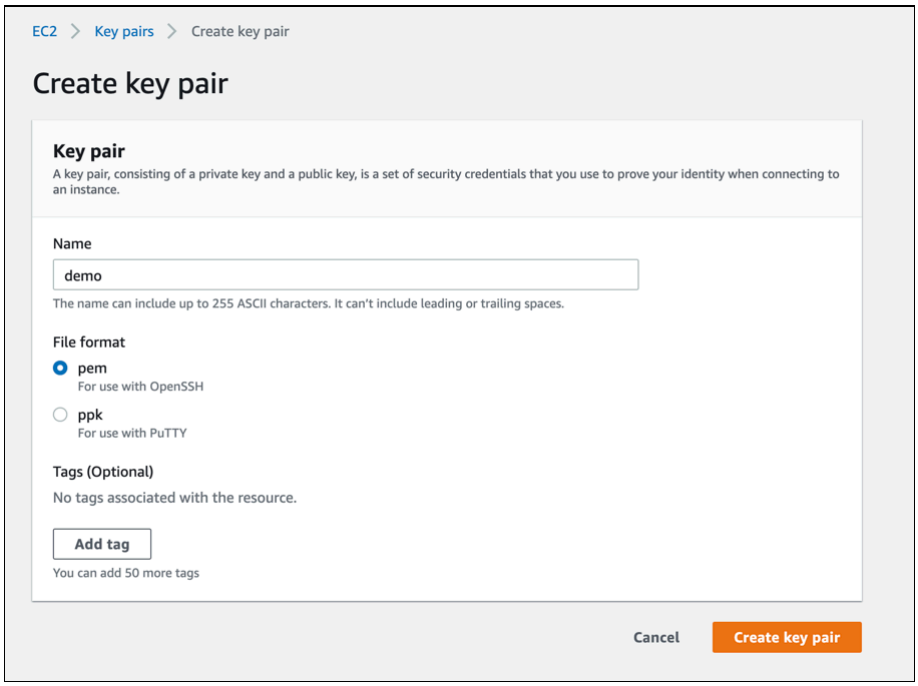
An EC2 key pair is a pair of security private/public keys. Amazon keep the public key while the user download the private key. When a user use SSH to connect to the remote EC2 instance (server), the private key will be uploaded to AWS and get compared to the public key that locates on the EC2 instance. User access will be authenticated if the two keys match.

In the EC2 console, click **Network & Security -> Key Pairs**



Click **Create Key Pair** button and enter the keypair name, then create the key pair

- After the create is created successfully, a `pem` file will be download to your local drive automatically.
- Please put this keypair in a `.ssh` folder. In linux/mac os, try `~/.ssh/`



Copy the downloaded `demo.pem` to `~/.ssh/` and change the permission of this private key file to 400.

```
chmod 400 ~/.ssh/demo.pem
```

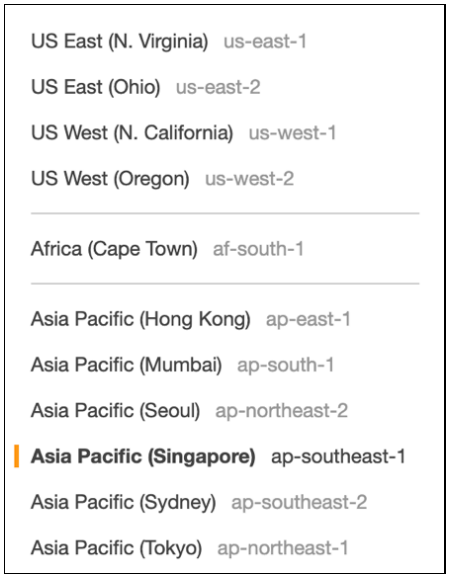
```
(base) ➜  Big Data Workshop cp ~/Downloads/demo.pem ~/.ssh/
(base) ➜  Big Data Workshop chmod 400 ~/.ssh/demo.pem
```

1.1.4 - Launch an EC2 Instance

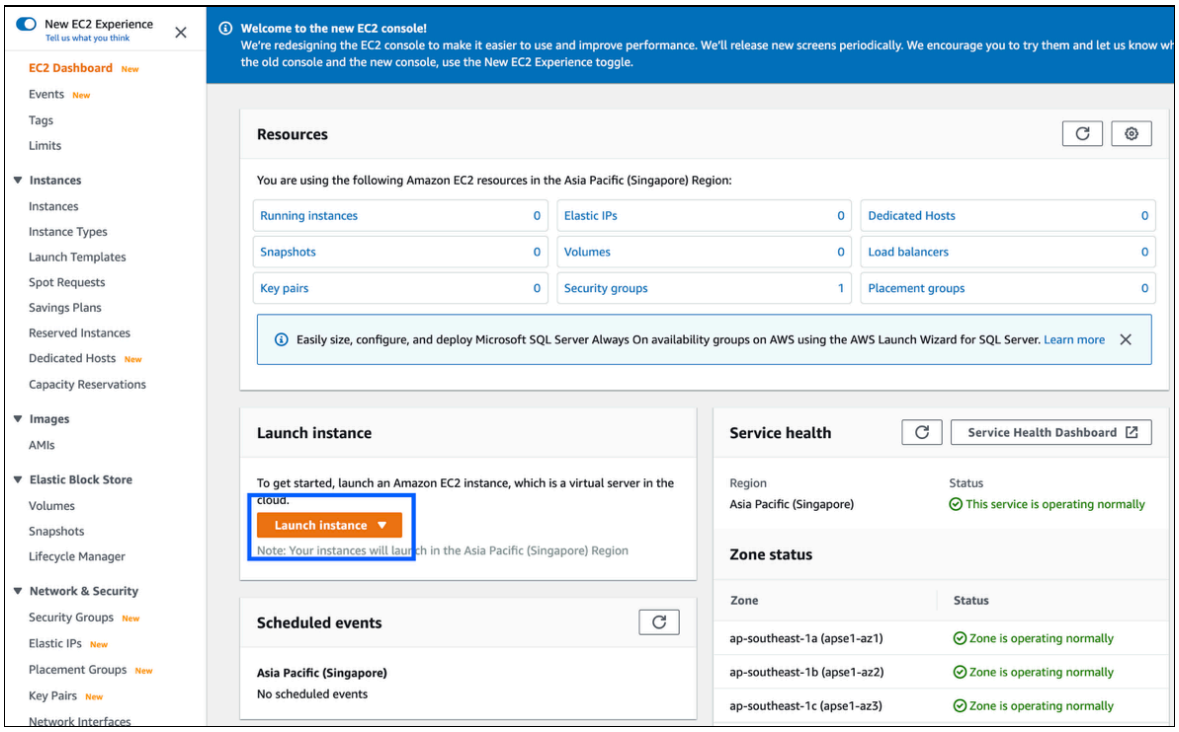
It takes 7 steps to launch an EC2 instance in the AWS console.

1. Before your launch an instance, make sure you're launching it to the right region. In the EC2 console, click the top right corner on **Region** tab, and select the region you want to use.

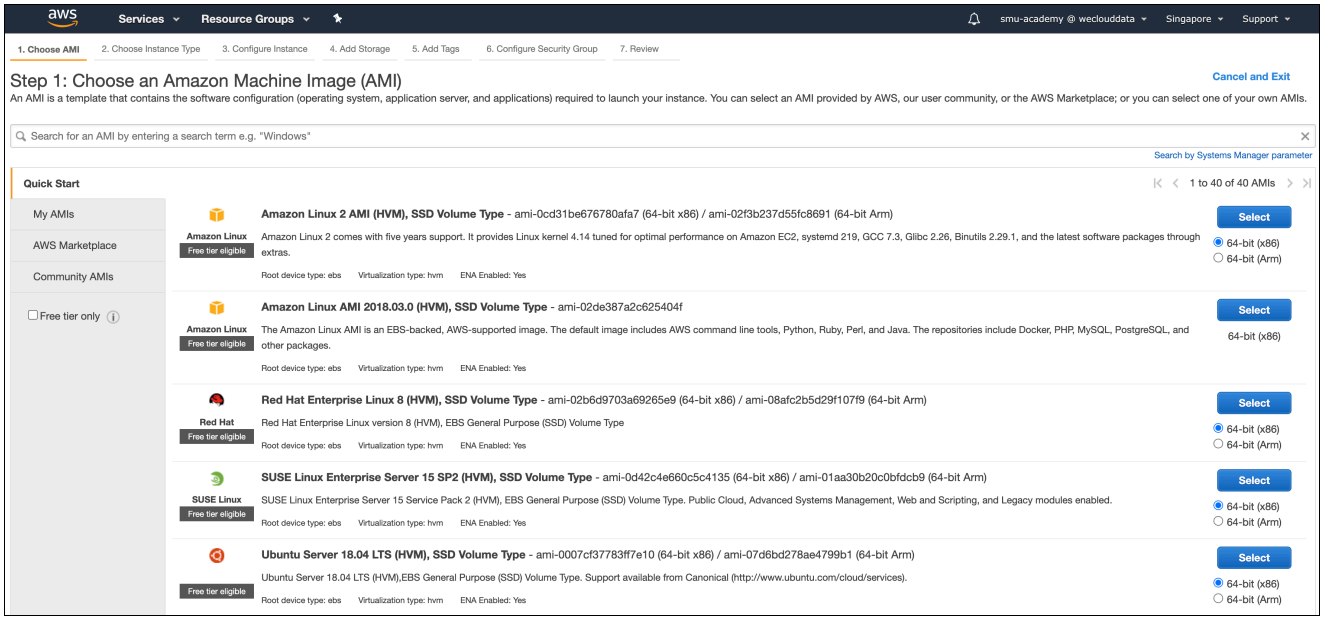
   For this workshop, we will stick to the **Asia-Pacific (Singapore)** region



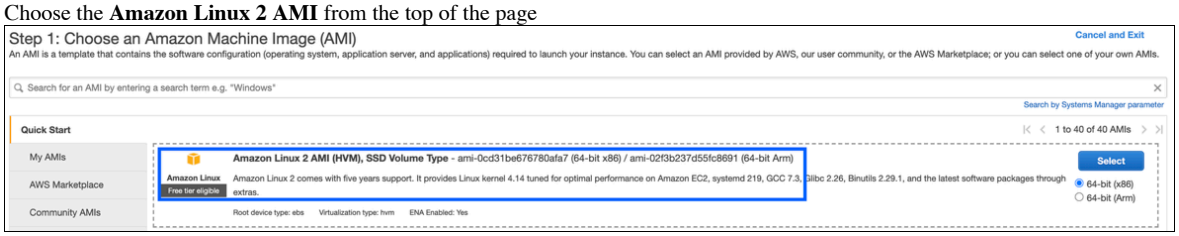
2. In the EC2 console, click **Launch Instance** and choose AMI



You will see the **Step 1** page

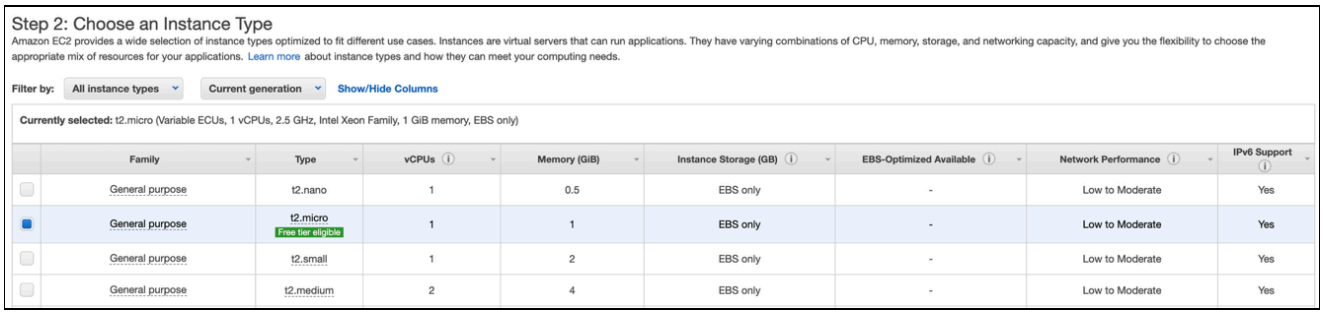


Choose the **Amazon Linux 2 AMI** from the top of the page



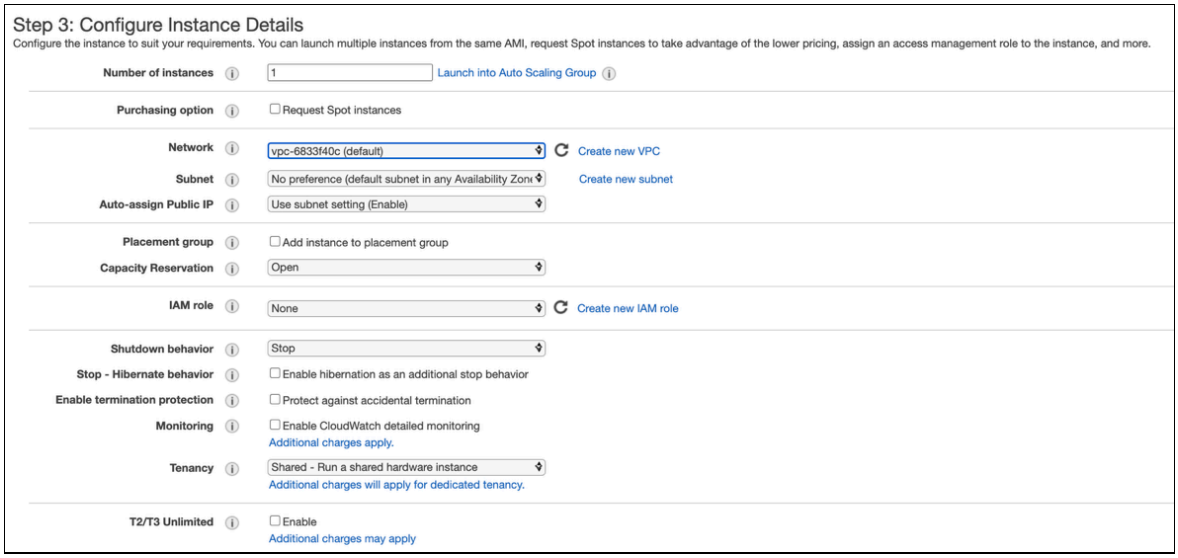
3. Choose **Instane Type**

   Choose `t2.micro` as the instance type



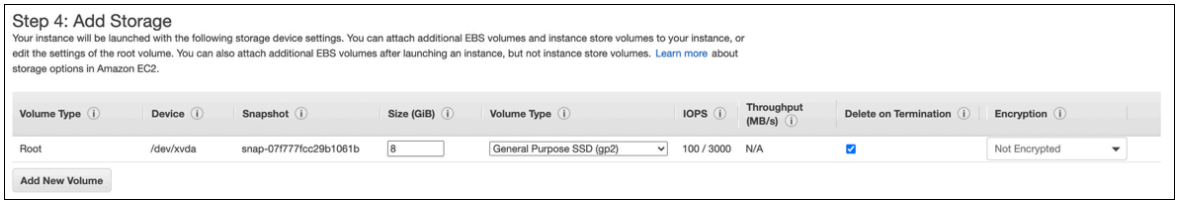
4. Configure **Instance Details**

   In this lab, choose the default setting



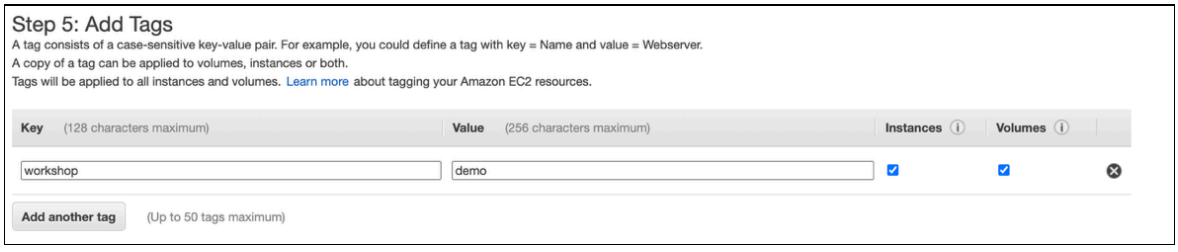
5. Add **Storage**

   On the next page, add storage (e.g., choose the default 8GB and click to the next step)



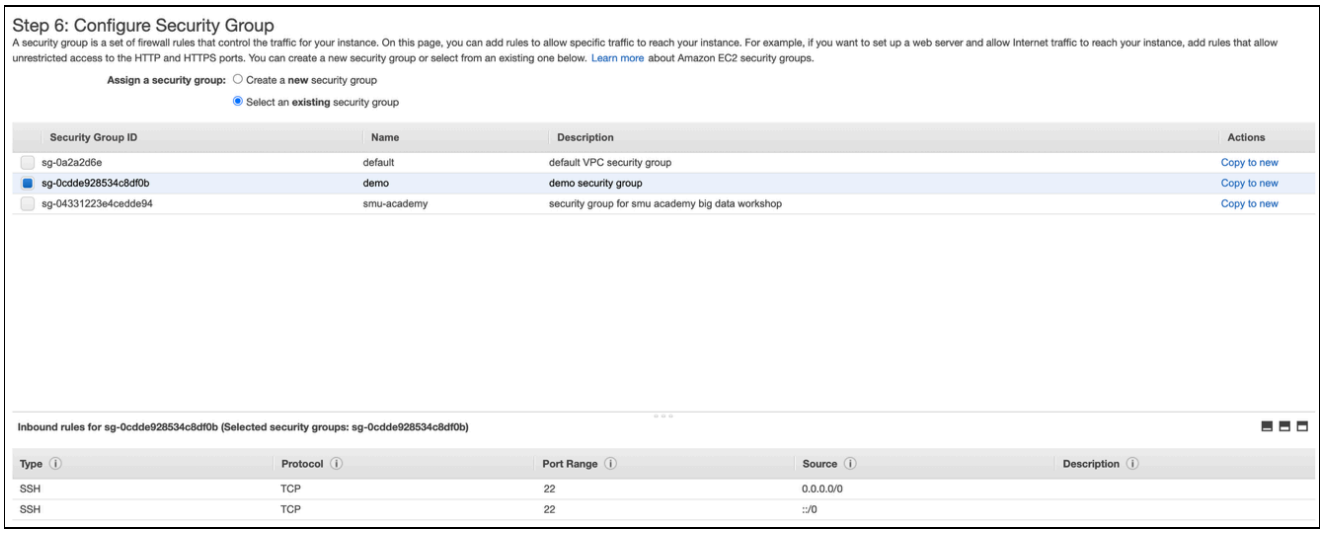
6. Add **Tag**

   You can add a tag for this lab or leave it empty



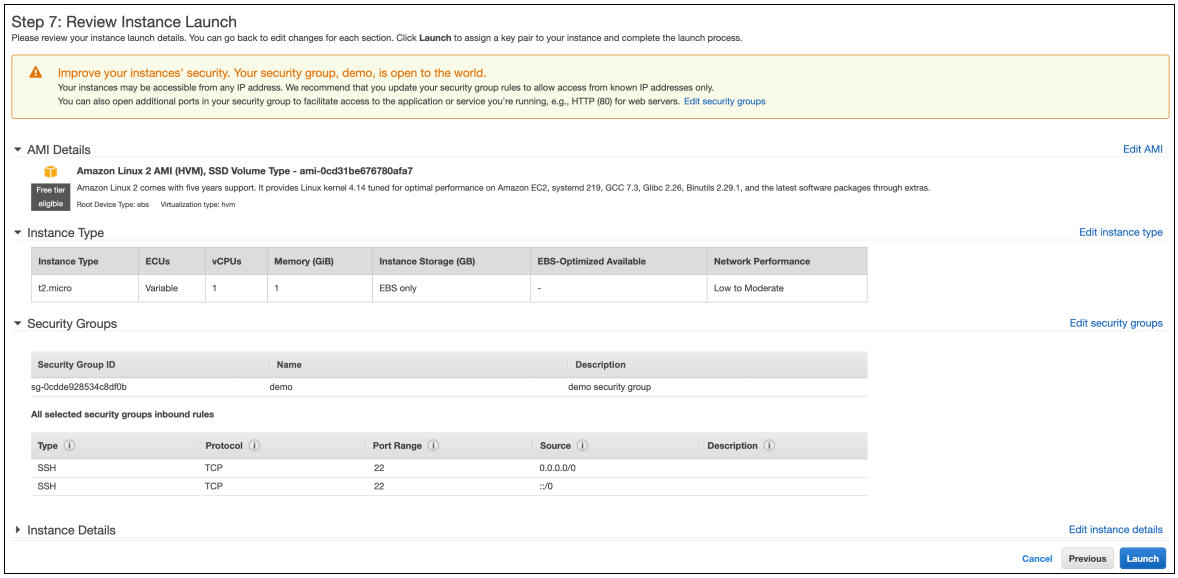
7. Choose the **Security Group**

   Choose the security group **demo** that you created earlier from the existing security group list



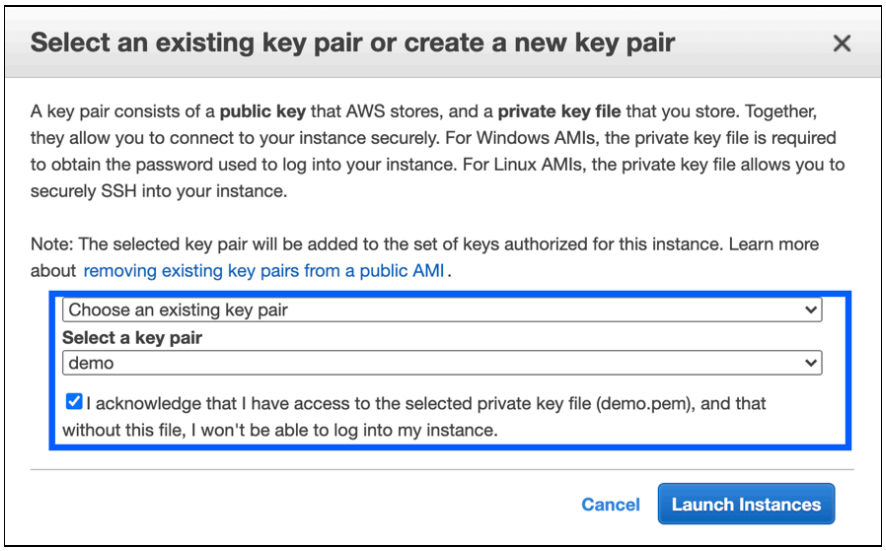
8. Review all the configurations

   Review the configurations and if everything looks ok, clikc **Launch**



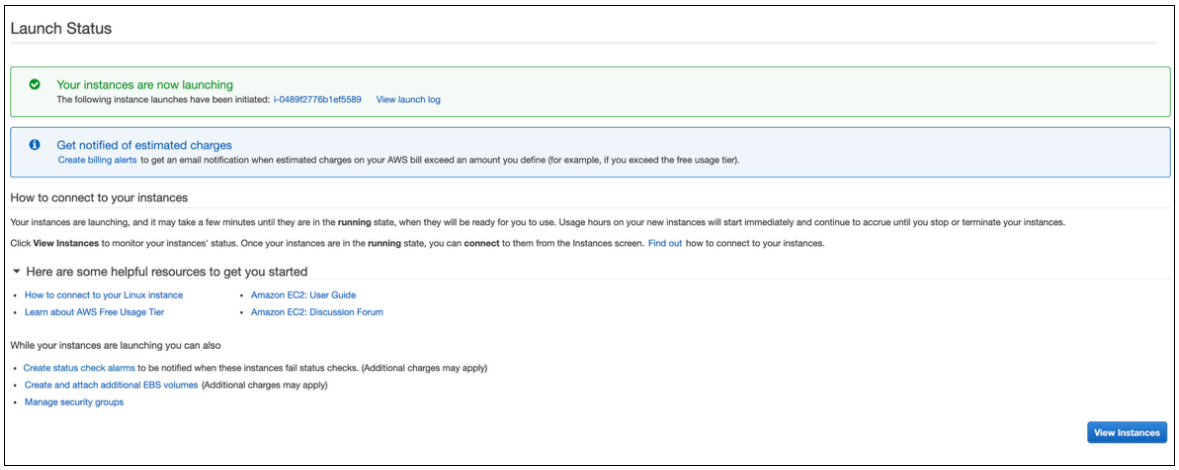
9. Choose a **Key Pair**

   The keypair selected at this step will be associated with this EC2 instance and cannot be changed later.
   Click **Create Instance** to launch the instance

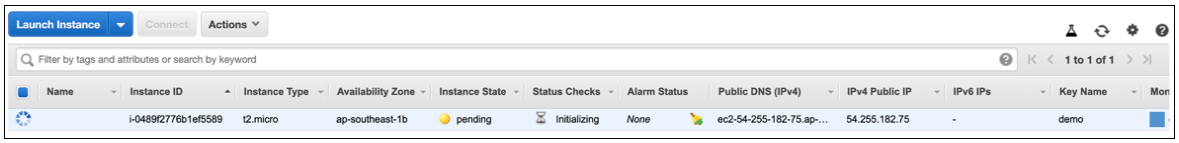


10. Wait for the instance to be launched

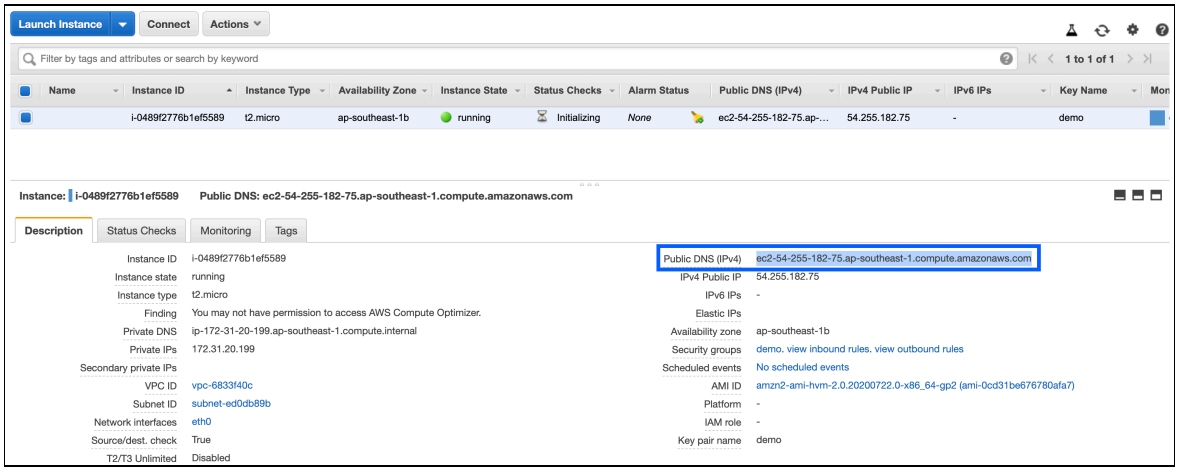
    Click **View Instances** to go back to the EC2 instance console



    Pending Status shows `yellow`



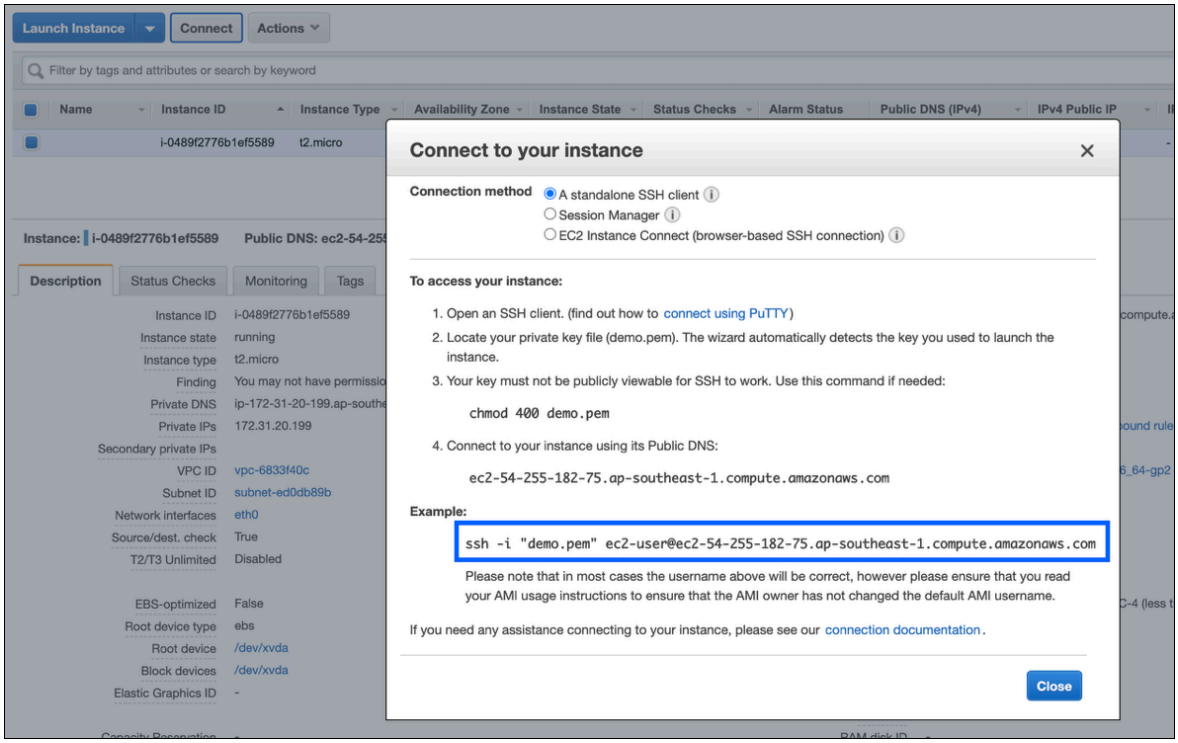
    Instance Status will change to `green` and the instance is good to go.
    Click on the instance name and find the `public dns name` or `public ip`



11. On the EC2 instance page, click the **Connect** button to see the connect options.

    In this lab, we will connect via SSH client.

    - Windows users can use `gitbash`
    - Mac users can use `ssh` in a terminal.



    In a terminal, type the following command to connect to the instance via `ssh`

    - Note:
        - `demo.pem` can be updated to your own pem file name accordingly
        - public dns name varies. You should have your own ip address instead
        - `ec2-user` is the default user name for an Amazon Linux AMI

```
ssh -i ~/.ssh/demo.pem ec2-user@ec2-54-255-182-75.ap-southeast-1.compute.amazonaws.com
```

```
(base) ➜  Big Data Workshop ssh -i ~/.ssh/demo.pem ec2-user@ec2-54-255-182-75.ap-southeast-1.compute.amazonaws.com
The authenticity of host 'ec2-54-255-182-75.ap-southeast-1.compute.amazonaws.com (54.255.182.75)' can't be established.
ECDSA key fingerprint is SHA256:I9aCyH6x3BwBfqU+GxEUKzMFXEdFPKvYXFrlgogEeNk.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'ec2-54-255-182-75.ap-southeast-1.compute.amazonaws.com,54.255.182.75' (ECDSA) to the list of known hosts.

       __|  __|_  )
       _|  (     /   Amazon Linux 2 AMI
      ___|\___|___|

https://aws.amazon.com/amazon-linux-2/
4 package(s) needed for security, out of 8 available
Run "sudo yum update" to apply all updates.
```

You will see the welcome message after successful SSH connection.

1.1.5 - Install Python Packages

Reference

- https://aws.amazon.com/premiumsupport/knowledge-center/ec2-linux-python3-boto3/

Check if python3 has been installed

```
[ec2-user ~]$ yum list installed | grep -i python3
```

If not, install Python3 on EC2 Linux

```
[ec2-user ~]$ sudo yum install python3 -y
```

```
[ec2-user@ip-172-31-20-199 ~]$ sudo yum install python3 -y
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
amzn2-core                                                                 | 3.7 kB  00:00:00
Resolving Dependencies
--> Running transaction check
---> Package python3.x86_64 0:3.7.8-1.amzn2.0.1 will be installed
--> Processing Dependency: python3-libs(x86-64) = 3.7.8-1.amzn2.0.1 for package: python3-3.7.8-1.amzn2.0.1.x86_64
--> Processing Dependency: python3-setuptools for package: python3-3.7.8-1.amzn2.0.1.x86_64
--> Processing Dependency: python3-pip for package: python3-3.7.8-1.amzn2.0.1.x86_64
--> Processing Dependency: libpython3.7m.so.1.0()(64bit) for package: python3-3.7.8-1.amzn2.0.1.x86_64
--> Running transaction check
---> Package python3-libs.x86_64 0:3.7.8-1.amzn2.0.1 will be installed
---> Package python3-pip.noarch 0:9.0.3-1.amzn2.0.2 will be installed
---> Package python3-setuptools.noarch 0:38.4.0-3.amzn2.0.6 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================================
 Package               Arch          Version                  Repository              Size
================================================================================================
Installing:
 python3               x86_64        3.7.8-1.amzn2.0.1        amzn2-core              72 k
Installing for dependencies:
 python3-libs          x86_64        3.7.8-1.amzn2.0.1        amzn2-core             9.2 M
 python3-pip           noarch        9.0.3-1.amzn2.0.2        amzn2-core             1.9 M
 python3-setuptools    noarch        38.4.0-3.amzn2.0.6       amzn2-core             617 k

Transaction Summary
================================================================================================
Install  1 Package (+3 Dependent packages)
```

Install Packages

```
[ec2-user ~]$ sudo pip3 install tweepy
[ec2-user ~]$ sudo pip3 install boto3
```

```
[ec2-user@ip-172-31-20-199 ~]$ sudo pip3 install tweepy
WARNING: Running pip install with root privileges is generally not a good idea. Try `pip3 install --user` instead.
Collecting tweepy
  Downloading https://files.pythonhosted.org/packages/bb/7c/99d51f80f3b77b107ebae2634108717362c059a41384a1810d13e2429a81/tweepy-3.9.0-py2.py3-none-any.whl
Collecting requests-oauthlib>=0.7.0 (from tweepy)
  Downloading https://files.pythonhosted.org/packages/a3/12/b92740d845ab62ea4edf04d2f4164d82532b5a0b03836d4d4e71c6f3d379/requests_oauthlib-1.3.0-py2.py3-none-any.whl
Requirement already satisfied: six>=1.10.0 in /usr/local/lib/python3.7/site-packages (from tweepy)
Collecting requests[socks]>=2.11.1 (from tweepy)
  Downloading https://files.pythonhosted.org/packages/45/1e/0c169c6a5381e241ba7404532c16a21d86ab872c9bed8bdcd4c423954103/requests-2.24.0-py2.py3-none-any.whl (61kB)
    100% |████████████████████████████████| 71kB 7.4MB/s
Collecting oauthlib>=3.0.0 (from requests-oauthlib>=0.7.0->tweepy)
  Downloading https://files.pythonhosted.org/packages/05/57/ce2e7a8fa7c0afb54a0581b14a65b56e62b5759dbc98e80627142b8a3704/oauthlib-3.1.0-py2.py3-none-any.whl (147kB)
    100% |████████████████████████████████| 153kB 4.8MB/s
Collecting idna<3,>=2.5 (from requests[socks]>=2.11.1->tweepy)
  Downloading https://files.pythonhosted.org/packages/a2/38/928ddce2273eaa564f6f50de919327bf3a00f091b5baba8dfa9460f3a8a8/idna-2.10-py2.py3-none-any.whl (58kB)
    100% |████████████████████████████████| 61kB 8.4MB/s
Collecting certifi>=2017.4.17 (from requests[socks]>=2.11.1->tweepy)
  Downloading https://files.pythonhosted.org/packages/5e/c4/6c4fe722df5343c33226f0b4e0bb042e4dc13483228b4718baf286f86d87/certifi-2020.6.20-py2.py3-none-any.whl (156kB)
    100% |████████████████████████████████| 163kB 6.1MB/s
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/site-packages (from requests[socks]>=2.11.1->tweepy)
Collecting chardet<4,>=3.0.2 (from requests[socks]>=2.11.1->tweepy)
  Downloading https://files.pythonhosted.org/packages/bc/a9/01ffebfb562e4274b6487b4bb1ddec7ca55ec7510b22e4c51f14098443b8/chardet-3.0.4-py2.py3-none-any.whl (133kB)
    100% |████████████████████████████████| 143kB 7.5MB/s
Collecting PySocks!=1.5.7,>=1.5.6; extra == "socks" (from requests[socks]>=2.11.1->tweepy)
  Downloading https://files.pythonhosted.org/packages/8d/59/b4572118e098ac8e46e399a1dd0f2d85403ce8bbaad9ec79373ed6badaf9/PySocks-1.7.1-py3-none-any.whl
Installing collected packages: idna, certifi, chardet, PySocks, requests, oauthlib, requests-oauthlib, tweepy
Successfully installed PySocks-1.7.1 certifi-2020.6.20 chardet-3.0.4 idna-2.10 oauthlib-3.1.0 requests-2.24.0 requests-oauthlib-1.3.0 tweepy-3.9.0
[ec2-user@ip-172-31-20-199 ~]$
```

1.2 - Working with S3 via AWS CLI

AWS supports several APIs to work with different services. If we want to work with the object store S3, we will either use the `AWS CLI` (command line) API or the `boto3` python API.

1.2.1 - Set up AWS Credential

Install AWSCLI on EC2 instance (or your laptop locally)

Make sure you're SSH connected to EC2 instance

```
sudo pip3 install awscli
```

Configure AWS Credential on EC2 (or your laptop locally)

To have programmatical access to AWS services, you will need to have credentials, a set of keys/secret. You can configure the credentials from the command line. Please choose the AWS region that your instructor asks you to use. It's good to use the same region as the instructor because she/he may share some data with you during the course.

```
aws configure
```

> Credentials for this lab (update accordingly):
>
> - **AWS Access Key ID**:
> - **AWS Secret Access Key**:
> - **Default region name**: `us-east-1`
> - **Default output format**: `json`

You're all set.

1.2.2 - Working with S3 via AWS CLI

The following s3 exercises can be done from the EC2 instance or your local laptop as long as the credentials are set up properly.

The demo below uses EC2 instance. Make sure you are connected to the instance via ssh.

> Note that AWS S3 bucket name needs to be unique. So for this exercise, please switch the `weclouddata-demo` with your own bucket name. You won't be able to access the bucket created by the instructor unless it's made accessible to you.
> The `weclouddata` s3 bucket has some sample dataset and is made public to all.

Make a bucket

```
aws s3 mb s3://weclouddata-demo
```

List buckets

```
aws s3 ls s3://weclouddata/
aws s3 ls s3://weclouddata-demo/
```

Copy file

Upload a file from s3 to ec2 or local

```
touch test.csv
aws s3 cp test.csv s3://weclouddata-demo/
aws s3 ls s3://weclouddata-demo/
```

Download a file from local/ec2 to s3

```
aws s3 cp s3://weclouddata-demo/test.csv ./test1.csv
ll
```

Sync folder

```
mkdir test
cd test && touch test2.csv
cd ..
aws s3 sync test s3://weclouddata-demo/test
aws s3 ls s3://weclouddata-demo/test
```

Delete object

```
aws s3 rm s3://weclouddata-demo/test
```

1.2.3 - AWS CLI Exercise

1. Explore the `weclouddata` s3 bucket
2. Download the `tweets_covid19.txt` from the `datasets/social/twitter/` folder
3. Upload a file `test_<yourname>.csv` to the `s3://<your-aws-s3-bucket>/datasets` folder
4. Delete the `test_<yourname>.csv` file.

▶ *Solution*

1.3 - Working with S3 via Boto3 SDK

Reference

- Boto3 S3 API Doc

SSH to EC2 instance and run Python3 from command line

```
python3
```

In python prompt

```
import boto3
# import os
```

1.3.1 - Get a `boto3` session

- Option 1: run `aws configure`
- Option 2: set ACCESS_KEY and SECRET_KEY in the OS environment variable
- Option 3: hard code (not suggested)

Option 1: create boto3 custom session

```
import boto3
session = boto3.Session()
```

Option 2: environment variable

```
import os
import boto3

ACCESS_KEY = os.getenv('ACCESS_KEY')
```

```
SECRET_KEY = os.getenv('SECRET_KEY')

session = boto3.Session(
    aws_access_key_id=ACCESS_KEY,
    aws_secret_access_key=SECRET_KEY
)
```

1.3.2 - Create s3 resource and client

```
s3 = session.resource('s3')
s3_client = session.client('s3')
```

1.3.3 - Working with s3 client

- client.list_buckets()
- client.list_objects()
- client.create_bucket()
- client.delete_bucket()
- client.put_object()
- client.copy()
- client.copy_object()
- client.delete_object()
- client.delete_objects()
- client.download_file()
- client.download_fileobj()
- upload_file()
- upload_fileobj()

create a new bucket ()

```
response = s3_client.create_bucket( Bucket='weclouddata-demo-bucket-20220106', CreateBucketConfiguration={'LocationConstraint': 'us-east-1'})

print(response)
```

list all buckets

```
for key in s3_client.list_buckets()['Buckets']:
    print(key['Name'])
```

list all objects (including folders) in a bucket/folder

```
objects = s3_client.list_objects(
    Bucket='weclouddata',
    Prefix='datasets/social'
)

for key in objects['Contents']:
    print(key['Key'])
```

Create a folder object in a bucket

```
response = s3_client.put_object(
    Bucket='weclouddata-demo-bucket',
    Key=('tmp/demo.csv'))

print(response)
```

List the folder

```
objects = s3_client.list_objects(
    Bucket='weclouddata-demo-bucket',
    Prefix='tmp'
)

for key in objects['Contents']:
    print(key['Key'])
```

Copy an object from one S3 location to another.

```
copy_source = {
    'Bucket': 'weclouddata-demo-bucket-20220106',
    'Key': 'tmp/demo.csv'
}
s3_client.copy(copy_source, 'weclouddata-demo-bucket-20220106', 'tmp1/demo1.csv')
eg: copy_result = s3_client.copy({'Bucket': 'jan6demo', 'Key': 'covid19_tweets.csv'}, 'weclouddata-demo-bucket-20220106', 'tmp1/demo1.csv')
objects = s3_client.list_objects(
    Bucket='weclouddata-demo-bucket',
```

```
    Prefix='tmp1'
)

for key in objects['Contents']:
    print(key['Key'])
```

Upload a file from local to s3

```
s3_client.upload_file('test.csv', 'weclouddata-demo-bucket', 'tmp/demo_local.csv')
```

Download from s3

```
s3_client.download_file('weclouddata-demo-bucket', 'tmp1/demo1.csv', 'demo1_s3.csv')
```

1.3.4 - Working with s3 session

- Bucket.copy()
- Bucket.create()
- Bucket.delete()
- Bucket.delete_objects()
- Bucket.download_file()
- Bucket.load()
- Bucket.put_object()
- Bucket.upload_file()
- Bucket.upload_fileobj()

list all objects in a bucket using resource

```
bucket = s3.Bucket('weclouddata-demo-bucket')
for obj in bucket.objects.all():
    print(obj.key)
```

upload a local file to s3 bucket

```
s3.Bucket('weclouddata-demo-bucket').Object('tmp/demo2.csv').upload_file('demo1_s3.csv')

for obj in bucket.objects.all():
    print(obj.key)
```

delete the bucket (need to delete all objects first)

```
bucket = s3.Bucket('weclouddata-demo-bucket')
bucket.delete()
```

delete all objects in a bucket

```
bucket = s3.Bucket('weclouddata-demo-bucket')
bucket.objects.all().delete()
bucket.delete()
```

1.4 - Working with EC2 via Boto3 (Optional)

Launch an ec2 instance

Required arguments:

- AMI ID
- Security Group Id
- VPC Subnet Id

```
import boto3
session = boto3.Session()
client = session.client('ec2', region_name='ap-southeast-1')

response = client.run_instances(
    BlockDeviceMappings=[
        {
            'DeviceName': '/dev/xvda',
            'Ebs': {
                'DeleteOnTermination': True,
                'VolumeSize': 8,
                'VolumeType': 'gp2'
            },
```

```
        },
    ],
    ImageId='ami-0cd31be676780afa7',
    InstanceType='t2.micro',
    MaxCount=1,
    MinCount=1,
    Monitoring={
        'Enabled': False
    },
    SecurityGroupIds=[
        'sg-04331223e4cedde94',
    ],
    SubnetId='subnet-ed0db89b'
)
```

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