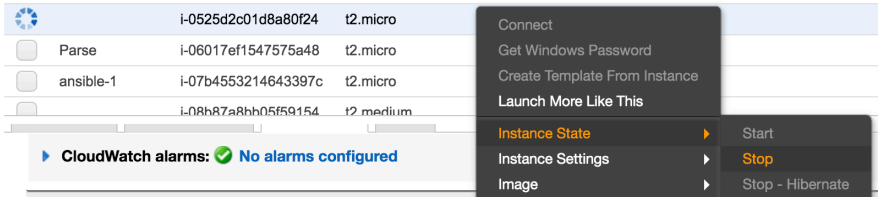
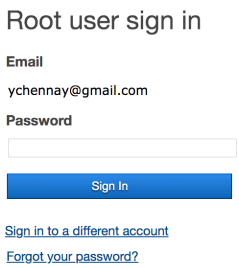
This walkthrough is created so that groups who are attempting to run very large datasets on their own local MacBooks can experiment with running their Python programs on the cloud. **Please make sure to shut down your instance after you are done.**

You can shut down your instance by **right clicking it in the EC2 console**, hovering over **Instance State**, and clicking on Stop:

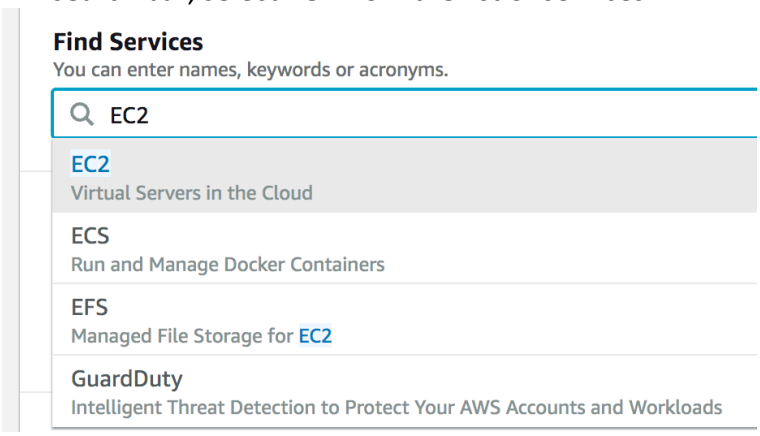


Creating Your Server

1. After you have created your AWS account, log in:



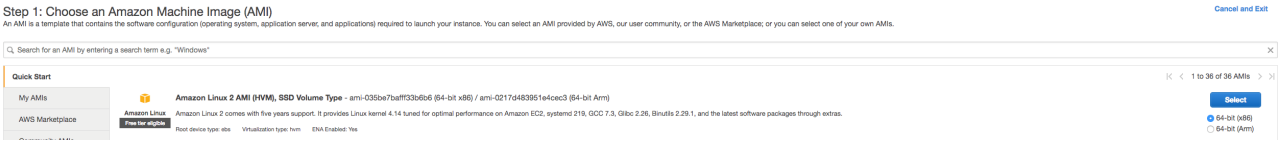
2. Then, from the dropdown search bar, select **EC2** from the list of services:



3. Take a note of what **region** you are in. If you switch to a different region, you will not see the same instances (servers that are running):

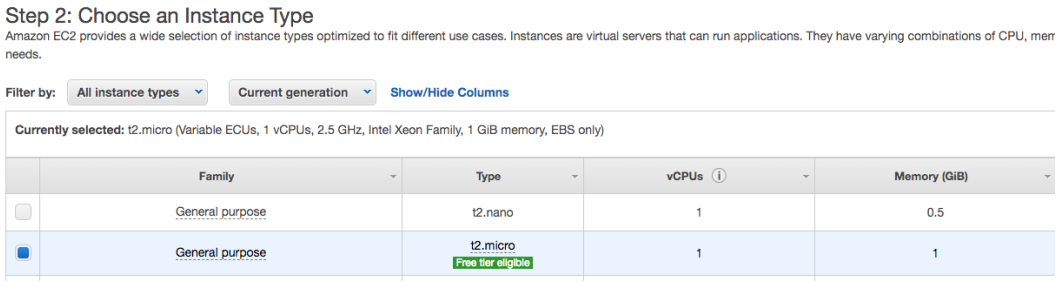
4. Click on **Launch Instance:**

5. Select the default AMI (Amazon Machine Image):



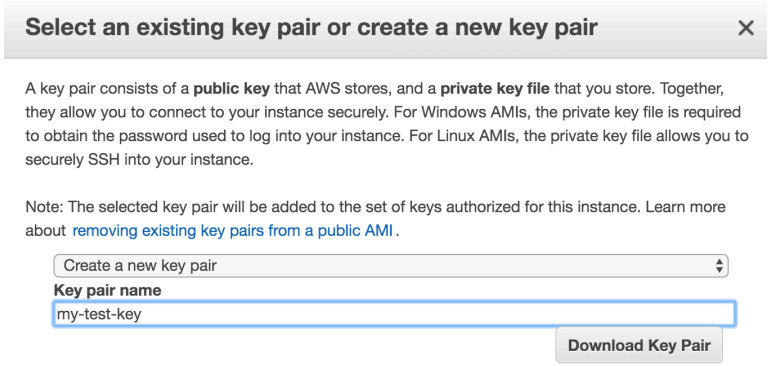
6. Pick whatever instance type (size of the server) you need. Keep in mind that a standard MacBook Pro is around **8GB memory**, so you may want to pick a larger instance type. However, ***please make sure to shut off your instance when you are done, or you will rack up a very, very large bill if you forget.***

   In this example, I am just going to pick the small **t2.micro** (probably too small to do actual machine learning on) just to avoid paying anything:



   After you have picked your instance type, click **Review and Launch**.

7. In the next screen, click the blue Launch button. The following popup will appear:



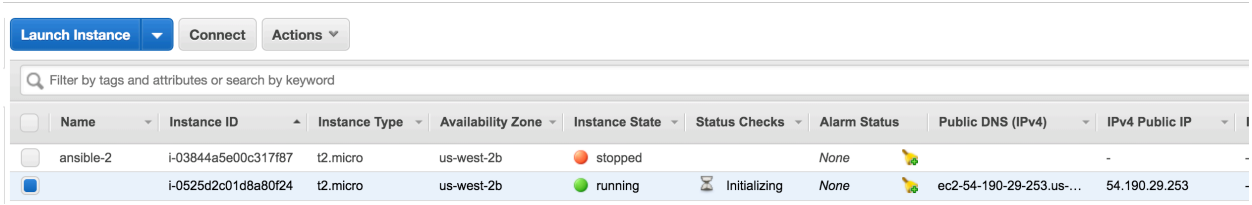
   Create a new key pair. This key pair is what will be used to SSH into your instance (essentially log in). Do not lose this key pair, or give it to anyone via an unencrypted channel (ie. email). Then **Download Key Pair.**

   Then click **Launch Instances.** This means that AWS is creating a server for you in which region of the world you selected (in my case, Oregon).

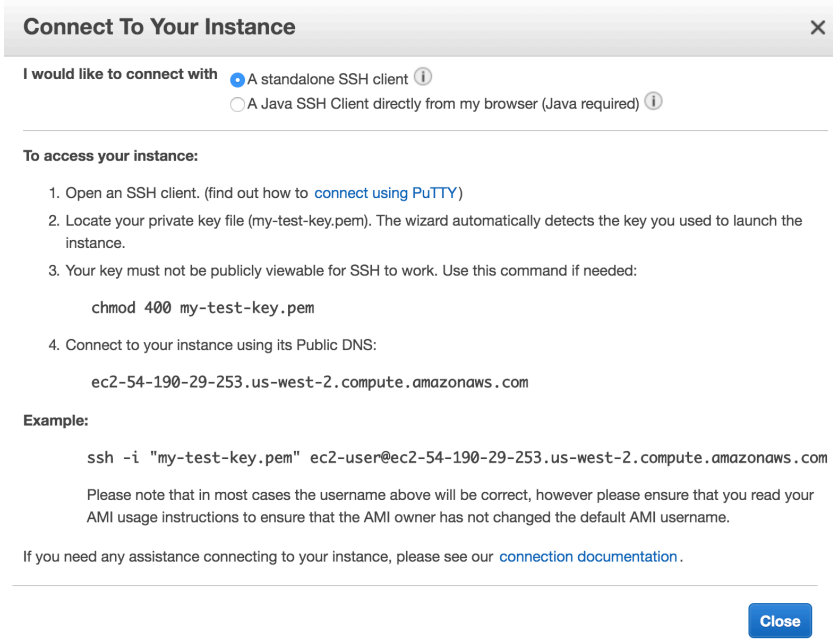
Logging Into Your Server

Note: if you are using Windows, the following instructions will not work for you. It is similar, but you'll have to install a tool called Putty. Please watch [this video for a good walkthrough.]

8. Click **View Instances**, and you'll be taken to a screen that lists all the server instances you have running. In my screenshot, I'll likely have a few more instances listed than you since I use AWS fairly regularly for personal projects:



   Find your instance, and take note of its **IPv4 Public IP address**. This is the "address" on the internet you will go to find your server. Right click on the instance, and click **Connect**. The following pop up will appear:



9. In your terminal, navigate to the folder where your **key pair .pem** file is stored (likely in your Downloads folder). Then, issue the following command: **chmod 400 my-test-key.pem**

```
➜ Downloads chmod 400 my-test-key.pem
➜ Downloads
```

This is a safety precaution by AWS – it will refuse to allow connections from key pairs that allow other users besides yourself read/write/execute this key pair file. This is why you need to change its permissions (using **chmod**).

Then, issue the command right underneath in the popup window to connect:

```
➜ Downloads ssh -i "my-test-key.pem" ec2-user@ec2-54-190-29-253.us-west-2.compute.amazonaws.com
The authenticity of host 'ec2-54-190-29-253.us-west-2.compute.amazonaws.com (54.190.29.253)' can't b
e established.
ECDSA key fingerprint is SHA256:BDAWM0v8YBIFEoiYrOguXCFXfxIxnlLovmLXgECtsQU.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'ec2-54-190-29-253.us-west-2.compute.amazonaws.com,54.190.29.253' (ECDSA)
 to the list of known hosts.

       __|  __|_  )
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      ___|\___|___|

https://aws.amazon.com/amazon-linux-2/
9 package(s) needed for security, out of 14 available
Run "sudo yum update" to apply all updates.
[ec2-user@ip-172-31-21-84 ~]$
```

When you are asked ***Are you sure you want to continue connecting***, type **yes.**

Congrats! You're logged into your EC2 instance!

Setting Up Your Server

10. Amazon's EC2 instances, by default, come with Python 2.7, but not Python 3. We'll need to install Python 3 ourselves. You can do this by using the following command: **sudo yum -y update && sudo yum install -y python3**

After about a minute or two, you'll see something like this:

```
Total                                                          30 MB/s |  12 MB  00:00:00
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : python3-setuptools-38.4.0-3.amzn2.0.6.noarch                                1/4
  Installing : python3-libs-3.7.2-4.amzn2.0.1.x86_64                                       2/4
  Installing : python3-pip-9.0.3-1.amzn2.0.1.noarch                                        3/4
  Installing : python3-3.7.2-4.amzn2.0.1.x86_64                                            4/4
  Verifying  : python3-3.7.2-4.amzn2.0.1.x86_64                                            1/4
  Verifying  : python3-libs-3.7.2-4.amzn2.0.1.x86_64                                       2/4
  Verifying  : python3-setuptools-38.4.0-3.amzn2.0.6.noarch                                3/4
  Verifying  : python3-pip-9.0.3-1.amzn2.0.1.noarch                                        4/4

Installed:
  python3.x86_64 0:3.7.2-4.amzn2.0.1

Dependency Installed:
  python3-libs.x86_64 0:3.7.2-4.amzn2.0.1              python3-pip.noarch 0:9.0.3-1.amzn2.0.1
  python3-setuptools.noarch 0:38.4.0-3.amzn2.0.6

Complete!
[ec2-user@ip-172-31-21-84 ~]$
```

To verify that Python 3 is correctly installed, type **python3** in the command line, and you should enter Python's interactive prompt:

```
[ec2-user@ip-172-31-21-84 ~]$ python3
Python 3.7.2 (default, Feb 26 2019, 20:08:16)
[GCC 7.3.1 20180303 (Red Hat 7.3.1-5)] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

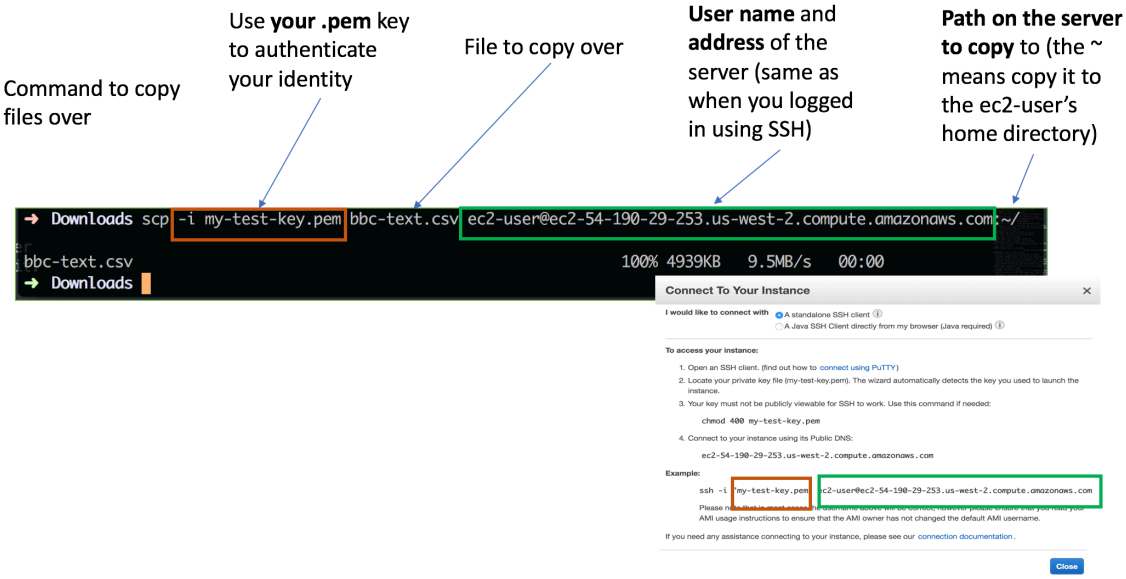
Type **exit()** to exit out of Python 3.

Copying Files To Your Instance

After you've set up Python, you'll need to now copy over your data and files (your **.py Python files** and **.csv data files**, for instance). You can do so by using **scp**. Let's say I want to copy over a file called **bbc-text.csv** located in my Downloads folder. I can do by using

scp -i my-test-key.pem bbc-text.csv ec2-user@ec2-54-190-29-253.us-west-2.compute.amazonaws.com:~/

However, your command will be slightly different, depending on what file you want to copy and the address of your server.



Running A Python Program

Note: it's not recommended to use Jupyter notebooks on an EC2 instance. You should run your programs as Python scripts. Simply copy over all of your code into a **.py** file (including the import statements) and save it. You should be able to execute the same just by typing **python3 name_of_your_file.py**.

I am going to copy over a simple Python program called **sleepy.py,** which just prints out messages each second for 100 seconds:

```
complete-shakespeare.txt    sleepy.py
from time import sleep

if __name__ == "__main__":

    for i in range(100):
        print("I am sleeping:", i)
        sleep(1)
```

I copy it over to my server:

```
➜ Downloads scp -i my-test-key.pem sleepy.py ec2-user@ec2-54-190-29-253.us-west-2.compute.amazonaws.com:~/
sleepy.py                                                    100%  113     3.1KB/s   00:00
```

Then I log into my server and type **ls**, which will list all the contents in that folder:

```
➜ Downloads ssh -i "my-test-key.pem" ec2-user@ec2-54-190-29-253.us-west-2.compute.amazonaws.com
Last login: Sun Apr 28 23:23:25 2019 from 146-128-239-64.lax1.corp.oprm.net

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

https://aws.amazon.com/amazon-linux-2/
[ec2-user@ip-172-31-21-84 ~]$ ls
bbc-text.csv  sleepy.py
[ec2-user@ip-172-31-21-84 ~]$
```

Notice the **bbc-text.csv** and **sleepy.py** files, both copied over from my local MacBook. I can run my sleepy.py program like any other Python program:

```
[ec2-user@ip-172-31-21-84 ~]$ python3 sleepy.py
I am sleeping: 0
I am sleeping: 1
I am sleeping: 2
I am sleeping: 3
^CTraceback (most recent call last):
  File "sleepy.py", line 7, in <module>
    sleep(1)
KeyboardInterrupt
[ec2-user@ip-172-31-21-84 ~]$
```

I ran the program using **python3 sleepy.py** (and then pressed CTRL + C to keep the process after about 4 seconds).

Note: you'll need to install the packages we've used in class like scikit-learn, pandas, etc. if your program uses those: **pip3 install –user scikit-learn pandas spacy genism.**

This can take a bit of time, depending on how large the packages you are installing – do not try installing everything on a **t2.micro** small instance- it can take quite a while to finish.

Running A Long-Running Python Program

Sometimes, the programs you want to run can be extremely long, or take hours. It's a pain to keep your computer open the entire time (ie. if your terminal window closes, the SSH connection is broken, and your Python program will hang up.)

A very useful command is **nohup**, which stands for no-hangup. This will make your Python program run in the background, regardless of whether you exit the shell, disconnect from SSH and reconnect later, etc.

You can use the command **nohup python3 -u name_of_file_to_run.py &**. This will run **name_of_file_to_run.py** in the background, allowing you to go to sleep, do other things, etc. and come back and check the status later:

```
[ec2-user@ip-172-31-21-84 ~]$ nohup python3 -u sleepy.py &
[2] 3343
[1]   Done                    nohup python3 -u sleepy.py
[ec2-user@ip-172-31-21-84 ~]$ nohup: ignoring input and appending output to 'nohup.out'
^C
```

As the output states, it is no longer taking any commands from input, and any output is being written to a file called **nohup.out**. You can see that I immediately pressed **CTRL + C,** and exited out. You may even log out of your instance if you wish. The Python program will still run (as long as it doesn't encounter an error). You can see what **nohup.out** looks like by typing **cat nohup.out** to check on the progress of your program:

```
[ec2-user@ip-172-31-21-84 ~]$ cat nohup.out
I am sleeping: 0
I am sleeping: 1
I am sleeping: 2
I am sleeping: 3
I am sleeping: 4
I am sleeping: 5
I am sleeping: 6
I am sleeping: 7
I am sleeping: 8
I am sleeping: 9
I am sleeping: 10
I am sleeping: 11
I am sleeping: 12
I am sleeping: 13
I am sleeping: 14
I am sleeping: 15
I am sleeping: 16
I am sleeping: 17
I am sleeping: 18
I am sleeping: 19
I am sleeping: 20
I am sleeping: 21
I am sleeping: 22
I am sleeping: 23
I am sleeping: 24
I am sleeping: 25
I am sleeping: 26
I am sleeping: 27
```

If you really need to stop your program from running, you can do so by typing **kill -9 3343** (that was the process ID outputted when I used **nohup**, to let me know what process ID the Python program is running as in the background).