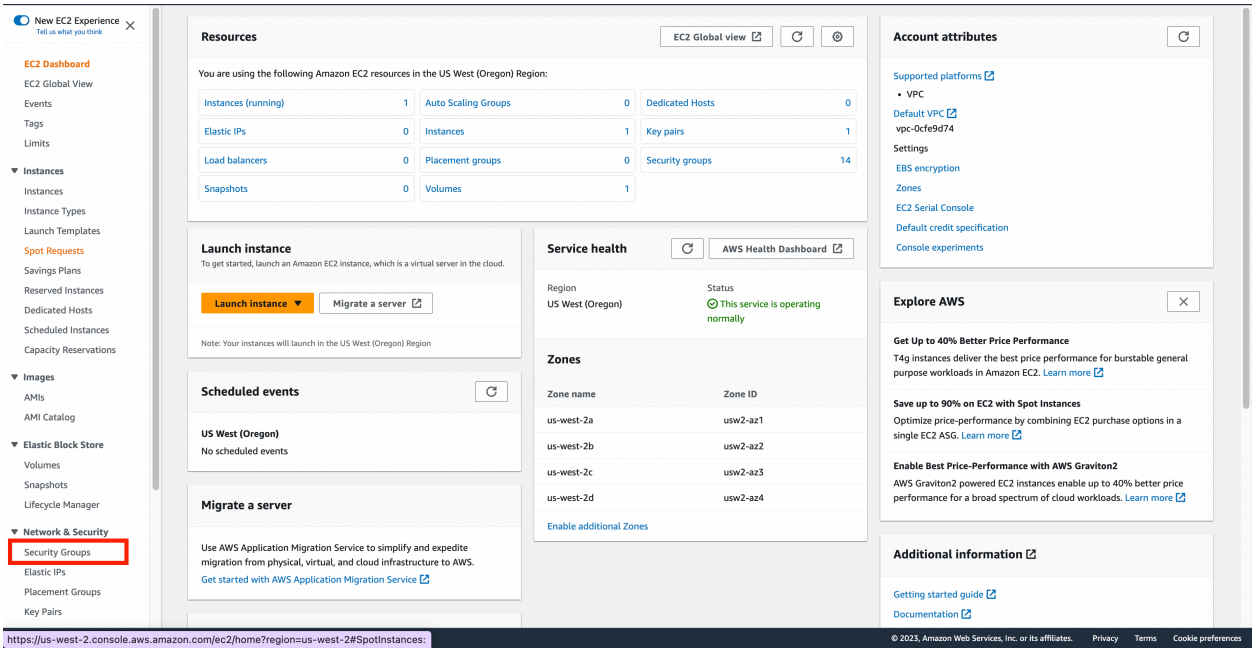
# AWS SETUP

The AWS setup is very similar to PA0.
For launching multiple instances, there are three differences.

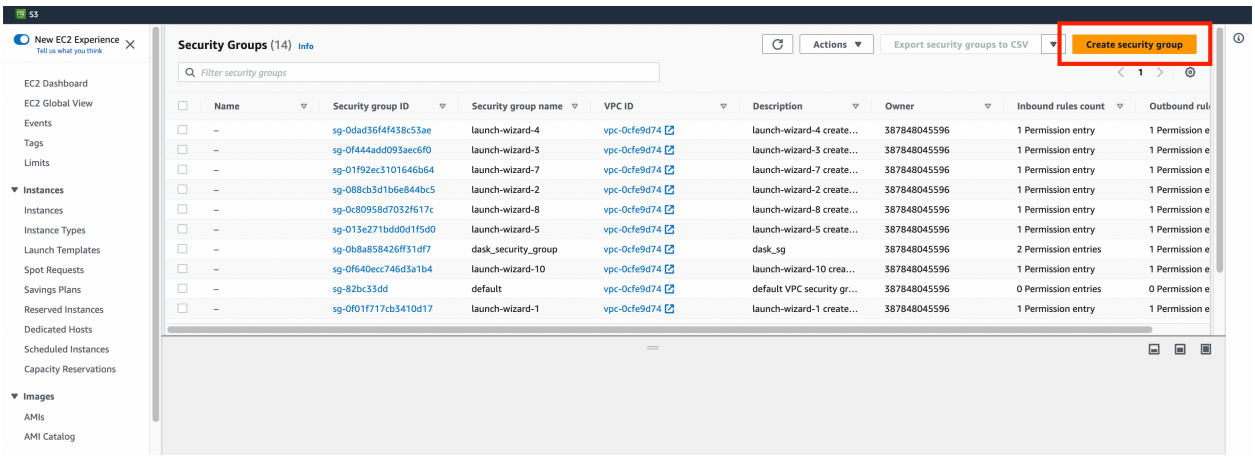
- Firstly, we will specify 5 instances instead of 1.
- One of these instances will run our Jupyter Notebook and Dask Scheduler, and the remaining 4 instances will run our Dask workers.
- Each of these instances will have 100GB SSD storage instead of 40GB.
- We will create a new security group for our 5 instances that allow each of the instances to communicate with each other. Follow the below steps one by one.

1. Access your ETS account using single sign-on ID: https://ets-apps.ucsd.edu/individual/DSC102_SP23_A00/. To open the AWS console click “Click here to access AWS" at the bottom of the page. To get your AWS credentials for CLI / API usage click “Generate API Keys (for CLI/scripting)".

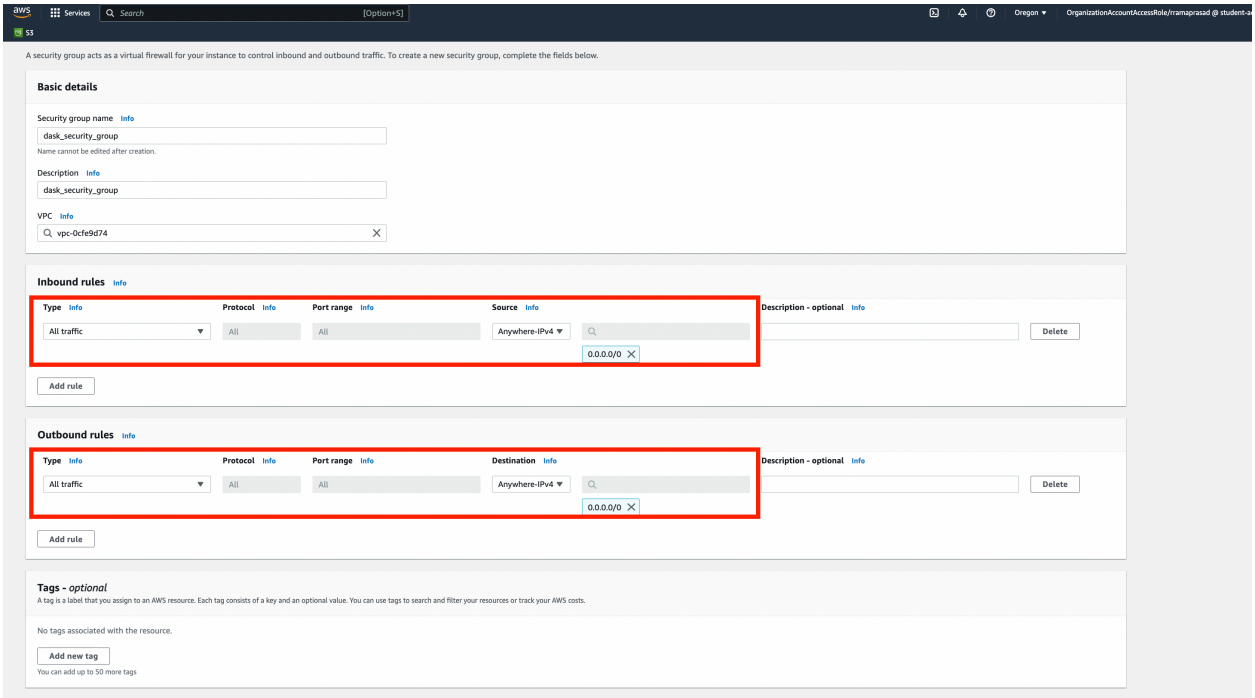
2. Open AWS Dashboard. We will first create a new security group so that we can apply it to all of our instances later. Click on "Security Groups" on the left menu.




3. Click on create security group.

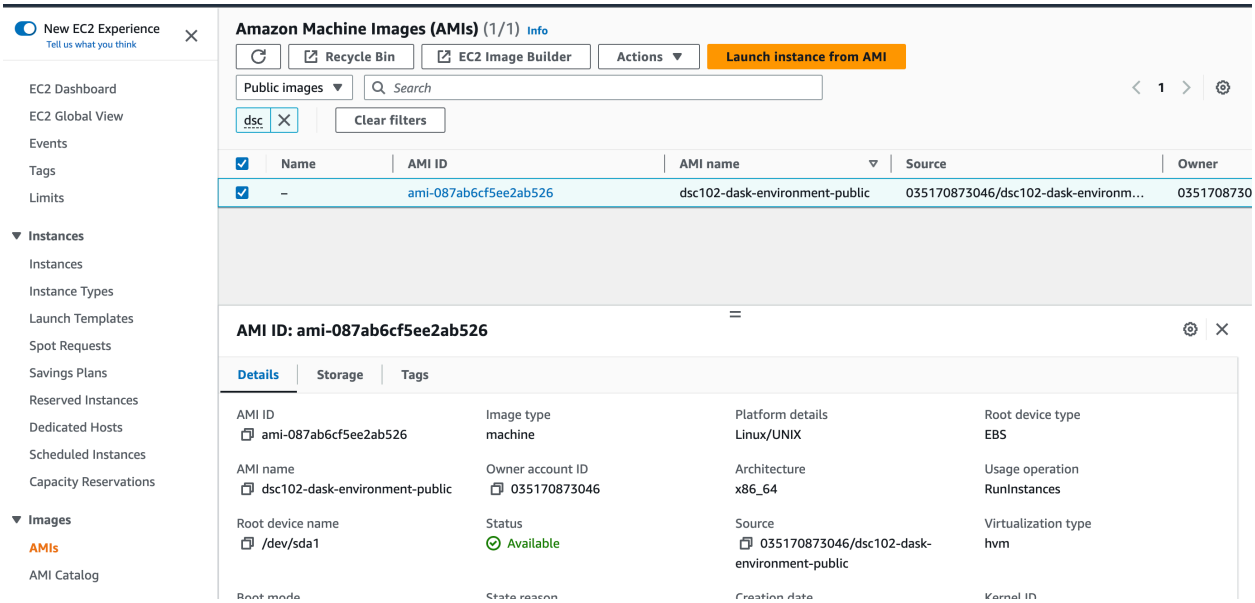



4. Choose any name and description for your security group. Change both the inbound and outbound rules to have "Type=All Traffic", "Source/Destination = Anywhere-IPv4". See image below.




5. Lastly, click on "Create Security Group" at the bottom right.

6. Now, we will create our 5 instances which will use this new security group. We have setup the Dask environment on an AMI with the name "dsc102-dask-environment-public" Go to "AMIs" (under "Images") in your EC2 dashboard, select private images, and then search by name to find it. Select this AMI.




7. After selecting the AMI, click "Launch Instance from AMI" as shown below.
8. Now, strictly follow the below instructions to launch the EC2 Spot instances.
   a. Give any name for your instance.
   b. Number of instances to launch is 5.
   c. The instance type is "t2.xlarge".
   d. Create a new key or use the key previously used for PA0.
   e. Under "Network Settings", click "Select Existing Security Group" and choose the name of the security group you just created.
   f. Choose 100GB SSD gp2 storage.
   g. Open advanced details. Select "Request Spot Instances". Then click on "customize" just on the right. Open the dropdown for "Request type" and select "One-time" and limit the "Set your maximum price (per instance/hour) to as low as possible. (Start From 0.07)

9. Lastly, click "Launch Instance".

# SETUP CLIENT AND SCHEDULER :

(For the 1st EC2 Instance)

## Step 1 : Setup Client i.e Jupyter Notebook and Port Forwarding for Jupyter Notebook onto localhost.

| Name | Instance ID | Instance state | Instance type | Status check | Alarm status | Availability Zone | Public IPv4 DNS | Public IPv4 ... | Elastic IP |
|---|---|---|---|---|---|---|---|---|---|
| pa1 | i-08b49961db3e69fc2 | Running | t2.xlarge | 2/2 checks passed | No alarms | us-west-2c | ec2-34-221-146-31.us-... | 34.221.146.31 | - |
| pa1 | i-03cb9d140d2fe869e | Running | t2.xlarge | 2/2 checks passed | No alarms | us-west-2c | ec2-34-217-137-104.us... | 34.217.137.104 | - |
| pa1 | i-0454ae152445fadc8 | Running | t2.xlarge | 2/2 checks passed | No alarms | us-west-2c | ec2-35-92-24-86.us-we... | 35.92.24.86 | - |
| pa1 | i-0c1b1002e1d2f8469 | Running | t2.xlarge | 2/2 checks passed | No alarms | us-west-2c | ec2-54-203-131-59.us-... | 54.203.131.59 | - |
| pa1 | i-0517c357f8857adad | Running | t2.xlarge | 2/2 checks passed | No alarms | us-west-2c | ec2-34-219-174-56.us-... | 34.219.174.56 | - |

1. Open a terminal and Do the following:
   a. **SSH Into the Scheduler EC2 Instance :**
   ssh -i <pem_key_name>.pem ubuntu@34.221.146.31

   b. **Activate the Dask Environment** :
   source dask_env/bin/activate

   c. **Launch Jupyter Notebook on the EC2 :**
   jupyter notebook --port=8888

```
ubuntu@ip-172-31-12-224:~$ source dask_env/bin/activate
(dask_env) ubuntu@ip-172-31-12-224:~$ jupyter notebook --port=8888
[I 19:04:18.101 NotebookApp] Writing notebook server cookie secret to /home/ubuntu/.local/share/jupyter/runtime/notebook_cookie_secret
[I 19:04:20.632 NotebookApp] Serving notebooks from local directory: /home/ubuntu
[I 19:04:20.632 NotebookApp] Jupyter Notebook 6.4.10 is running at:
[I 19:04:20.632 NotebookApp] http://localhost:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
[I 19:04:20.632 NotebookApp]  or http://127.0.0.1:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
[I 19:04:20.632 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[W 19:04:20.639 NotebookApp] No web browser found: could not locate runnable browser.
[C 19:04:20.639 NotebookApp]

    To access the notebook, open this file in a browser:
        file:///home/ubuntu/.local/share/jupyter/runtime/nbserver-12027-open.html
    Or copy and paste one of these URLs:
        http://localhost:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
     or http://127.0.0.1:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
```

2. Open New Terminal And run the following commands –

   1. **Port Forwarding Jupyter Notebook running on port 8888 on the EC2 to port 8000 on local system (localhost:8000):**
   ssh -i <pem_key_name>.pem ubuntu@34.221.4.2 -L 8000:localhost:8888

```
ubuntu@ip-172-31-12-224: ~ (ssh)

 * Ubuntu Pro delivers the most comprehensive open source security and
   compliance features.

   https://ubuntu.com/aws/pro

6 updates can be applied immediately.
To see these additional updates run: apt list --upgradable


*** System restart required ***
Last login: Thu Jan 19 06:07:19 2023 from 24.43.123.81
ubuntu@ip-172-31-12-224:~$ source dask_env/bin/activate
(dask_env) ubuntu@ip-172-31-12-224:~$ jupyter notebook --port=8888
[I 19:04:18.101 NotebookApp] Writing notebook server cookie secret to /home/ubuntu/.local/share/jupyter/runtime/notebook_cookie_se
cret
[I 19:04:20.632 NotebookApp] Serving notebooks from local directory: /home/ubuntu
[I 19:04:20.632 NotebookApp] Jupyter Notebook 6.4.10 is running at:
[I 19:04:20.632 NotebookApp] http://localhost:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
[I 19:04:20.632 NotebookApp]  or http://127.0.0.1:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
[I 19:04:20.632 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[W 19:04:20.639 NotebookApp] No web browser found: could not locate runnable browser.
[C 19:04:20.639 NotebookApp]

    To access the notebook, open this file in a browser:
        file:///home/ubuntu/.local/share/jupyter/runtime/nbserver-12027-open.html
    Or copy and paste one of these URLs:
        http://localhost:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
     or http://127.0.0.1:8888/?token=fac098e07f82116c3c0b8c9539cb94eaf45d5e4a14ab773a
```

```
ubuntu@ip-172-31-12-224: ~ (ssh)
(base) golokeshpatra@Golokeshs-MacBook-Air ~ % cd ~/Downloads/Q2/DSC102/Assignments/PA1
(base) golokeshpatra@Golokeshs-MacBook-Air PA1 % ssh -i dsc102-pa1.pem ubuntu@34.221.146.31 -L 8000:localhost:8888
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-1092-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Thu Feb  2 19:06:42 UTC 2023

  System load:  0.01              Processes:           124
  Usage of /:   2.8% of 96.73GB   Users logged in:     1
  Memory usage: 2%                IP address for eth0: 172.31.12.224
  Swap usage:   0%

 * Ubuntu Pro delivers the most comprehensive open source security and
   compliance features.

   https://ubuntu.com/aws/pro

6 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

New release '20.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.


*** System restart required ***
Last login: Thu Feb  2 19:03:52 2023 from 24.43.123.92
ubuntu@ip-172-31-12-224:~$
```

## Step 2 : Setup Dask Scheduler on the same EC2.

On the same node, we must start the dask-scheduler. To establish this, we need to follow these instructions:

1. Open a New Terminal :
    a. **SSH Into the EC2 Instance**

    b. **Activate the Dask Environment :**
    source dask_env/bin/activate

    c. **Activate the dask-scheduler :**
    dask scheduler --host 0.0.0.0

```
(dask_env) ubuntu@ip-172-31-2-152:~$ dask scheduler --host=0.0.0.0
2023-04-26 20:20:07,694 - distributed.scheduler - INFO - -----------------------------------------------
2023-04-26 20:20:08,220 - distributed.http.proxy - INFO - To route to workers diagnostics web server please install jupyter-server-prox
y: python -m pip install jupyter-server-proxy
2023-04-26 20:20:08,265 - distributed.scheduler - INFO - State start
2023-04-26 20:20:08,267 - distributed.scheduler - INFO - -----------------------------------------------
2023-04-26 20:20:08,268 - distributed.scheduler - INFO -   Scheduler at:   tcp://172.31.2.152:8786
2023-04-26 20:20:08,268 - distributed.scheduler - INFO -   dashboard at:  http://172.31.2.152:8787/status
```

**NOTE**: The '**Scheduler at**' shown above will be required while setting up workers

## Step 3 : Dask UI/Dashboard Port forwarding .

1. Open a New Terminal:
    a. **Port Forward the dask dashboard UI from the EC2's 8787 port to local systems Port 8001 (localhost:8001) :**
    ssh -i dsc102-pa1.pem ubuntu@34.221.4.2 -L 8001:localhost:8787

## Step 4 : Downlaod data from S3 :

1. In the same terminal opened or in a new terminal :
    a. **If New Terminal then activate the dask environment**

    b. **Copy and paste the AWS_ACCESS_KEY and SECRET ACCESS KEYS**

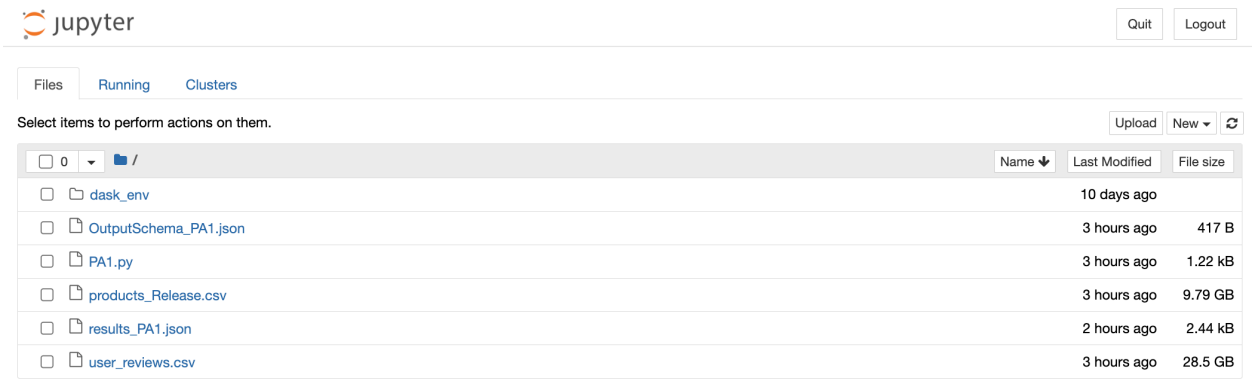
    c. **Download all the files from the S3 :**
    aws s3 sync s3://dsc102-public /home/ubuntu/

## Step 5 : Check Dask UI and Jupyter Notebook.

**NOTE** : Unlike PA0 , when you go to the Info tab on Dask UI, you SHOULD NOT OBSERVE ANY WORKERS .

**DASK UI :**


**Jupyter Notebook :**



# SETUP DASK WORKER:

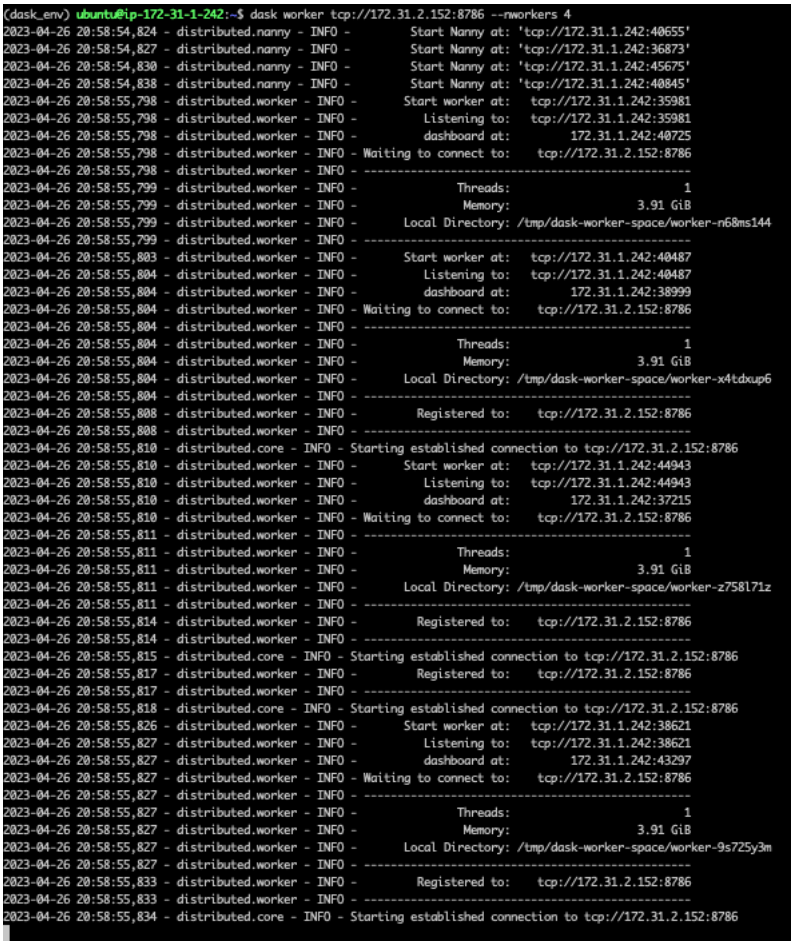
(For other 4 EC2 Instances)

## Step 1 : SSH into the worker node

## Step 2: Setup dask worker on the worker node.

1. To get the Dask Workers Up, we need to follow these instructions :
    a. **After SSH into the worker EC2, Activate the Dask Environment :**
    source dask_env/bin/activate
    b. **Now activate the dask worker with the following command:**
    dask worker tcp://172.31.152:8786 --nworkers 4

    **NOTE** : The dask scheduler IP can be obtained from Step 2 of Setting up Scheduler



Now if we check the Worker Info on the DASK UI then –

Scheduler tcp://172.31.8.102:8786

Logs Bokeh

| Worker | Name | Cores | Memory | Memory use | Occupancy | Processing | In-memory | Services | Logs | Last seen |
|---|---|---|---|---|---|---|---|---|---|---|
| tcp://172.31.5.152:35911 | tcp://172.31.5.152:35911 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 510.11 ms |
| tcp://172.31.5.152:38641 | tcp://172.31.5.152:38641 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 510.62 ms |
| tcp://172.31.5.152:41199 | tcp://172.31.5.152:41199 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 508.22 ms |
| tcp://172.31.5.152:41637 | tcp://172.31.5.152:41637 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 514.77 ms |

## Step 3: Download the data from s3 to the worker nodes too.

1. Open a new Terminal:
   Repeat the Step 4 in the scheduler setup section

## Step 4 : Check the DASK Dashboard/UI for Information of the workers.

We should observe 16 Worker nodes i.e 4 Workers * 4 nodes = 16 Nodes
For Reference -

localhost:8001/info/main/workers.html

Scheduler tcp://172.31.12.224:8786

Logs Bokeh

| Worker | Name | Cores | Memory | Memory use | Occupancy | Processing | In-memory | Services | Logs | Last seen |
|---|---|---|---|---|---|---|---|---|---|---|
| tcp://172.31.12.248:33483 | tcp://172.31.12.248:33483 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 766.98 ms |
| tcp://172.31.12.248:36339 | tcp://172.31.12.248:36339 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 771.40 ms |
| tcp://172.31.12.248:42139 | tcp://172.31.12.248:42139 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 770.26 ms |
| tcp://172.31.12.248:46435 | tcp://172.31.12.248:46435 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 769.32 ms |
| tcp://172.31.12.96:33965 | tcp://172.31.12.96:33965 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 719.89 ms |
| tcp://172.31.12.96:34225 | tcp://172.31.12.96:34225 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 720.44 ms |
| tcp://172.31.12.96:39611 | tcp://172.31.12.96:39611 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 721.26 ms |
| tcp://172.31.12.96:41441 | tcp://172.31.12.96:41441 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 722.73 ms |
| tcp://172.31.13.222:39279 | tcp://172.31.13.222:39279 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 316.18 ms |
| tcp://172.31.13.222:40447 | tcp://172.31.13.222:40447 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 316.58 ms |
| tcp://172.31.13.222:40543 | tcp://172.31.13.222:40543 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 318.89 ms |
| tcp://172.31.13.222:46063 | tcp://172.31.13.222:46063 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 318.49 ms |
| tcp://172.31.2.228:33005 | tcp://172.31.2.228:33005 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 714.36 ms |
| tcp://172.31.2.228:33185 | tcp://172.31.2.228:33185 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 717.33 ms |
| tcp://172.31.2.228:35339 | tcp://172.31.2.228:35339 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 717.03 ms |
| tcp://172.31.2.228:39095 | tcp://172.31.2.228:39095 | 1 | 4.20 GB | | 0.00 us | 0 | 0 | dashboard | logs | 721.38 ms |

## Step 5 : Repeat All the above steps on each and every Worker EC2 Instance.