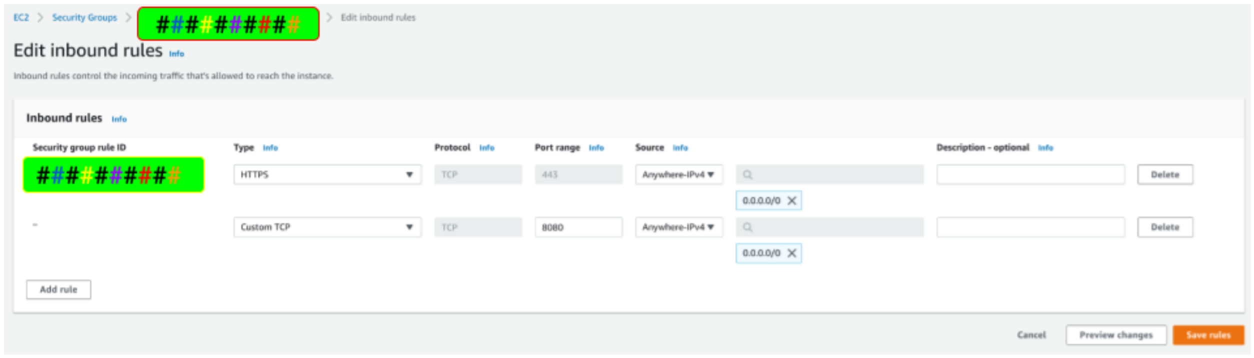
#### aws_public_ec2_setup

# Publicly Accessible AWS EC2

The main goal of this article is creating and configuring an AWS EC2 instance (basically a cloud-computer, a web-server, that potentially is open to the public) (and configuring that) to be indeed open to the public. Aside from security, one of the main factors determining how things can and should be done is what project this is for and what software this EC2 cloud-computer/server needs to run. Another factor is whether the software is ~free to use, or whether you will be using a proprietary service. The focus here is still getting you to the main goal finding the "Edit inbound rules" screen in AWS (which is tragically buried and not easy to find even though it should be the obvious front-and-center part of EC2 configuration).



EC2 > Security Groups > [redacted] > Edit inbound rules

Edit inbound rules Info

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

Inbound rules Info

Security group rule ID	Type	Protocol	Port range	Source		Description - optional	
[redacted]	HTTPS	TCP	443	Anywhere-IPv4	0.0.0.0/0		Delete
-	Custom TCP	TCP	8080	Anywhere-IPv4	0.0.0.0/0		Delete

But once you get to this holey-grail setup screen...what exactly should this be set to? You may need to try a few things and test what works. And please test it, do not just assume you will be able to connect or just rely on whatever documentation you might be trying to follow. Deploying a rest-api-endpoint is different from deploying a graphical interactive dashboard; for me this project is focused on the graphical interactive dashboard deployment.

Is this for ~production, or "only" for development and testing?
- running the

The set of choices and options become tangled rather quickly.

django
flask
fast-api

When you run flask or dash you get a warning saying that you should be using a production server, in particular a wsgi production server.

#### Choice: flask/dash vanilla vs. "production fancy" flask/dash

#### Production Choices

- flask -> apache2 web server (used to run most of internet)
- flask -> ngnix web server (increasingly runs most of internet)
- flask -> wsgi web server (obscure)
- flask -> gunicorn (obscure)

For example: There are many articles online which describe how to host a flask web server on EC2. Yet while flask is very easy to run locally, and while plotly dash uses flask, and while flask can be set up in various was on

There may be several ways that one can create a public facing server (an endpoint, a dashboard, etc.) using EC2 (essentially a cheap mini-web-server with which you can do many things...if not easily...).

### Factors:
1. Purpose & Tools
2. Budget

Setting up an EC2 server for flask, or for a plotly dash dashboard, or for fastapi, or for django, or for a rest-api-endpoint (or some combination of those), can be different case-by-case.

### List of AWS EC2 Methods
1. Simply hosting a micro-server directly (dash, flask, fast-api, etc)
2. Intermediation "production" server:
- WSGI Server
- Apache Server
- Nginx
3. Docker + AWS
- running docker in EC2
- uploading a pre-built docker image (maybe not EC2?)
- maybe some weird hybrid mix of things?

The approach taken in this guide will be the direct-microserver-method.

### Alternative AWS Services:
- Lambda function
- lambda function + api gateway
- api + gateway
- elastic beanstalk
- lightsail
- step function + anything above

### Alternative NOT-AWS Services:
- heroku
- google cloud services

- your own hardware server

If you have lots of money and or specific needs, you may be best served by AWS's pre-built services. If you don't have lots of money, often working directly with EC2 (or lambda, etc.) is most practical.

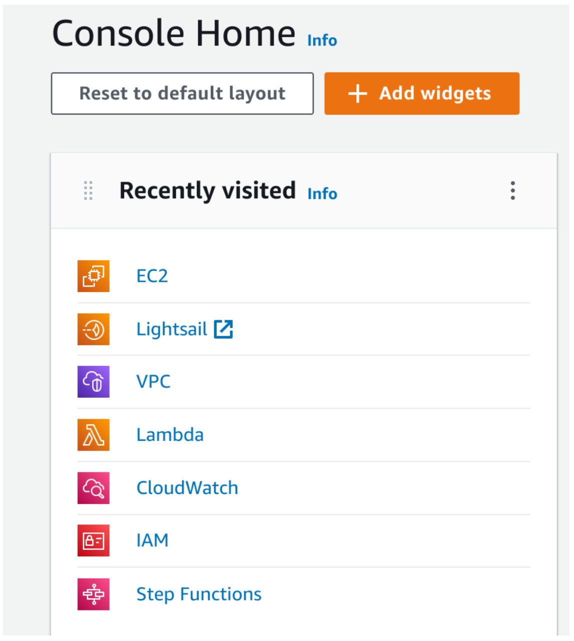
See: https://github.com/lineality/aws_rules_of_thumb_and_warnings

# Instructions to set up public AWS EC2

e.g. to host a flask server, dashboard, REST api endpoint, etc.
(See picture version as pdf in repo, pictures may help!)

### Getting Started:
- You will need a computer and an internet connection.
- Depending on the project, you may be able to use a table, or phone, but for some projects you will need a laptop or desktop with more complete resources. MacOS(bsd) or linux are recommended.
- You will need an AWS account (yours, employers, schools, etc.).

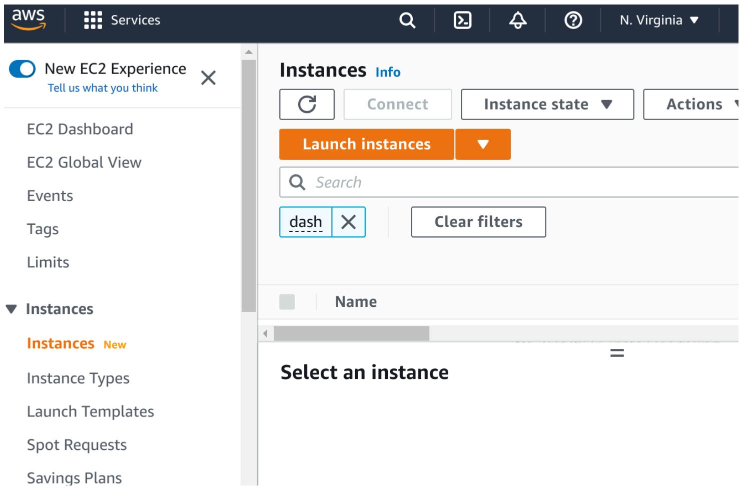
### Go to: AWS
Log in and go to the console.
https://us-east-1.console.aws.amazon.com



### Go to: EC2
https://us-east-1.console.aws.amazon.com/ec2/

### Go to: instances

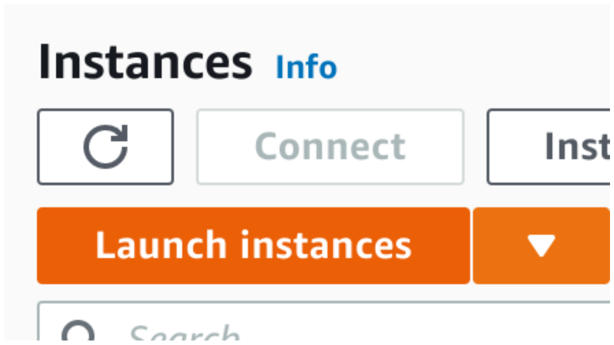
the instances tab



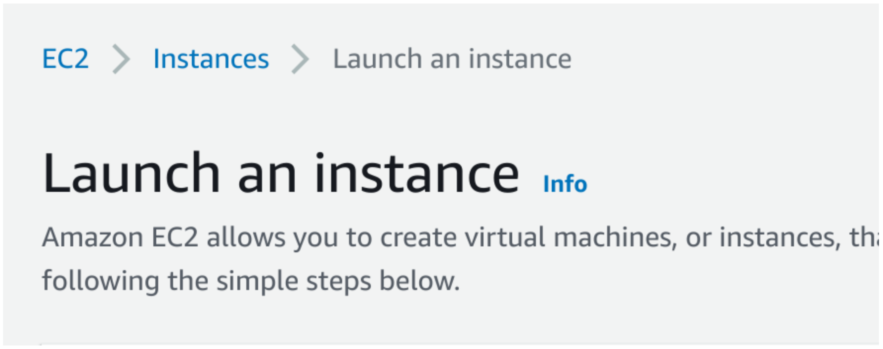
## Launch Instance:

Hit the big orange button that says "Launch instances"

(plural...for some reason...which of course takes to you "launch an instance" singular)



# *"launch an instance" singular*

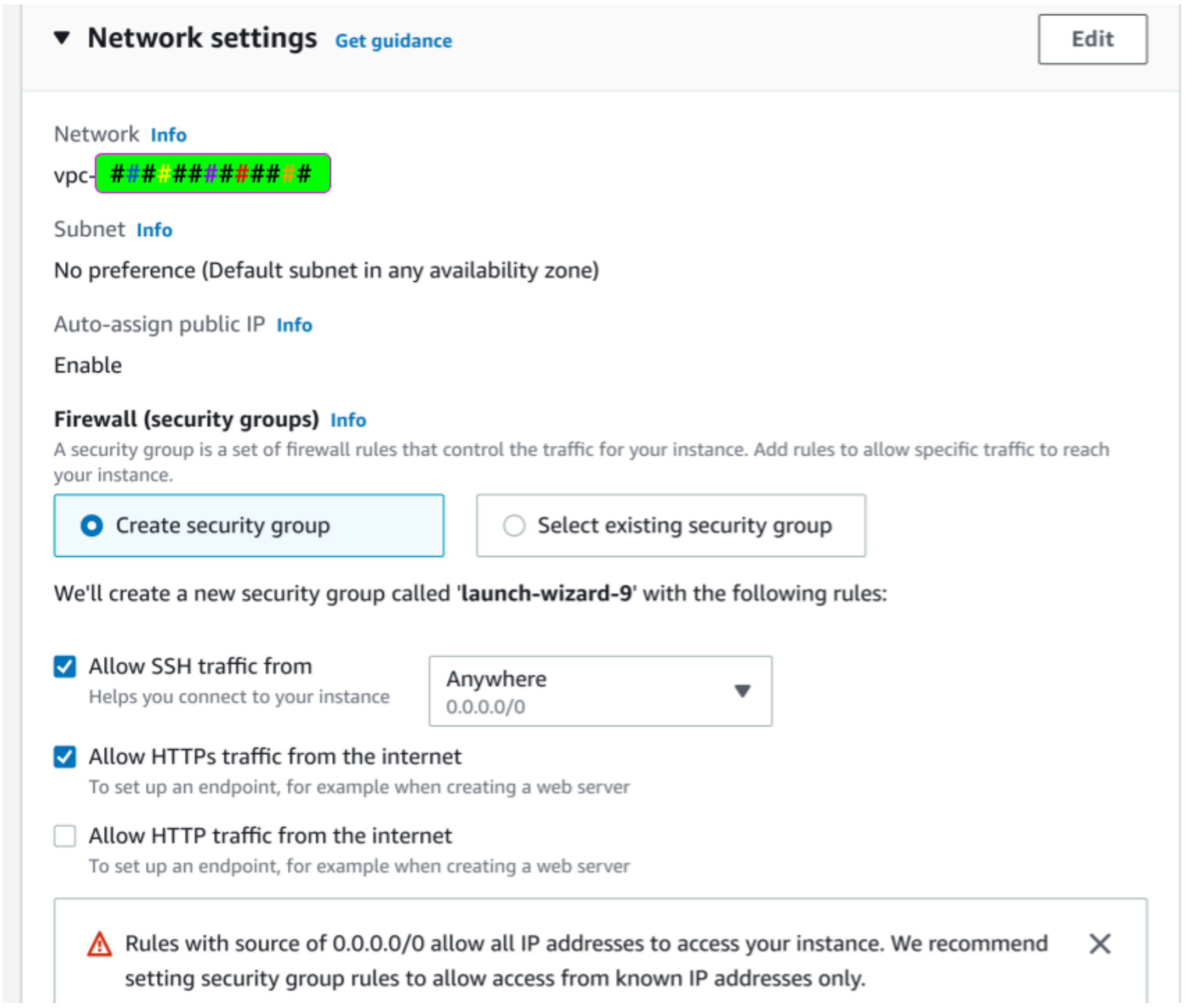

EC2 > Instances > Launch an instance

Launch an instance Info

Amazon EC2 allows you to create virtual machines, or instances, th
following the simple steps below.

## Configure:
1. Name and tags -> clear meaningful name, nothing is too obvious. recommended format: "ec2_purpose_yourname_datetime"
2. Application and OS Images (Amazon Machine Image) -> default amazon linux
3. Instance type -> nano (scroll down)
4. Key pair (login) -> select or make new pair
5. Network settings...(see below)

# Network settings:
1. firewall security group: create or select
2. "Allow SSH traffic from": must be on to use EC2 connect later (or SSH in yourself)
3. "Allow HTTPs traffic from the internet": If you want this to be public, allow.
4. http may be needed in the mess of aws connection issues, leave it on for now


Network settings Get guidance Edit

Network Info
vpc-############

Subnet Info
No preference (Default subnet in any availability zone)

Auto-assign public IP Info
Enable

Firewall (security groups) Info
A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

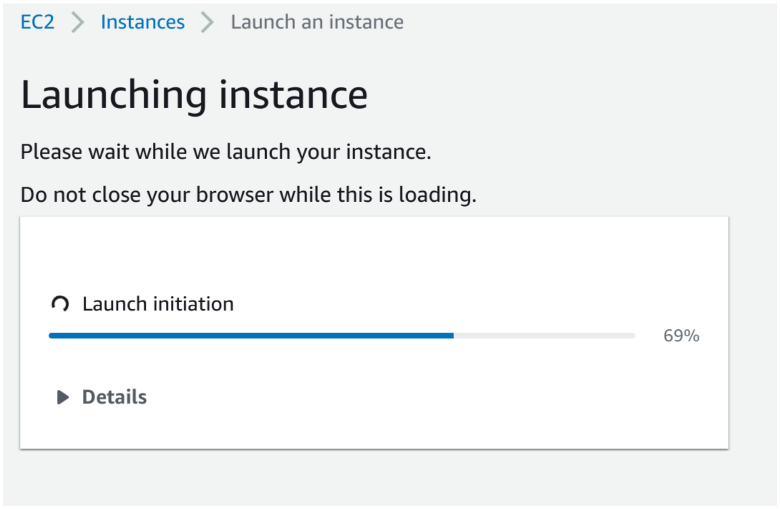
[✓ Create security group] Select existing security group

We'll create a new security group called '**launch-wizard-9**' with the following rules:

- [✓] Allow SSH traffic from — Anywhere 0.0.0.0/0
  Helps you connect to your instance
- [✓] Allow HTTPs traffic from the internet
  To set up an endpoint, for example when creating a web server
- [ ] Allow HTTP traffic from the internet
  To set up an endpoint, for example when creating a web server

Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.

### Network settings (continued...)
6. Storage (volumes -> use default
7. Advanced details Info -> ignore
8. Summary -> nothing to do or change here, examine if you want.
## Select: Launch Instance


EC2 > Instances > Launch an instance

Launching instance

Please wait while we launch your instance.

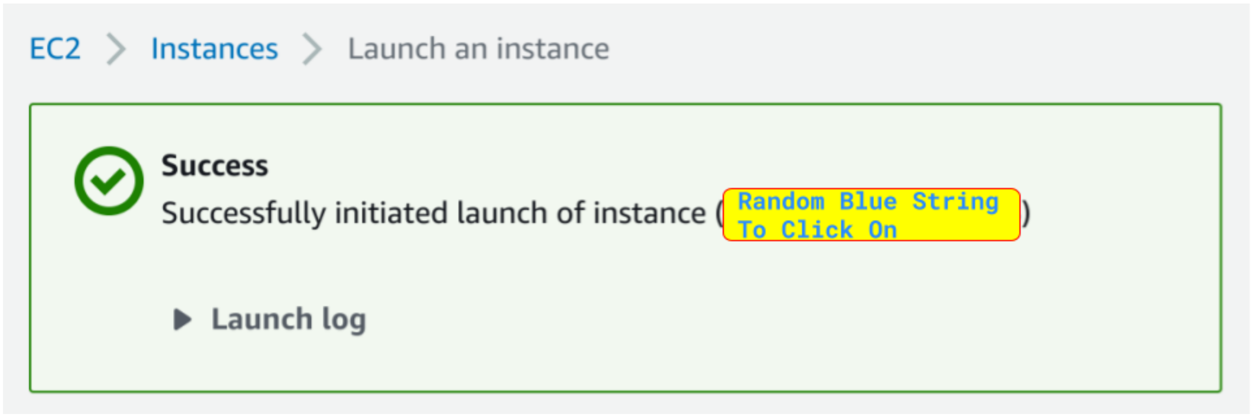
Do not close your browser while this is loading.

Launch initiation

69%

Details

## Click on the blue random string .... (obviously...?)

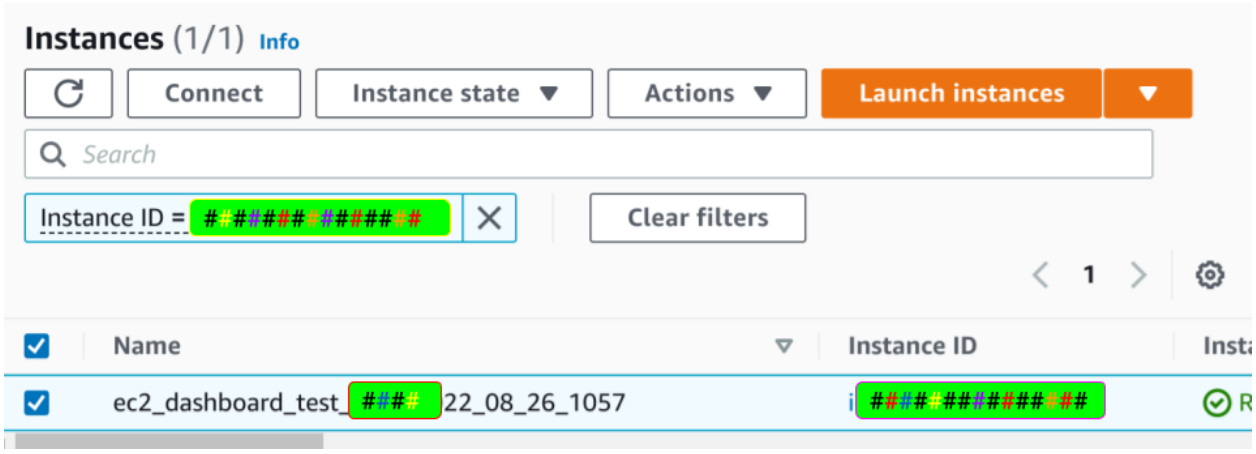

EC2 > Instances > Launch an instance

Success

Successfully initiated launch of instance (Random Blue String To Click On)

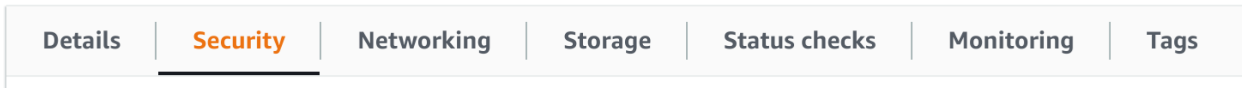
Launch log

## Back at instances window:
your instance should now be highlighted: click on "connect" to connect via web
This is much easier that local-cli ssh (web connect is one of the few actually useful working advances AWS has made.

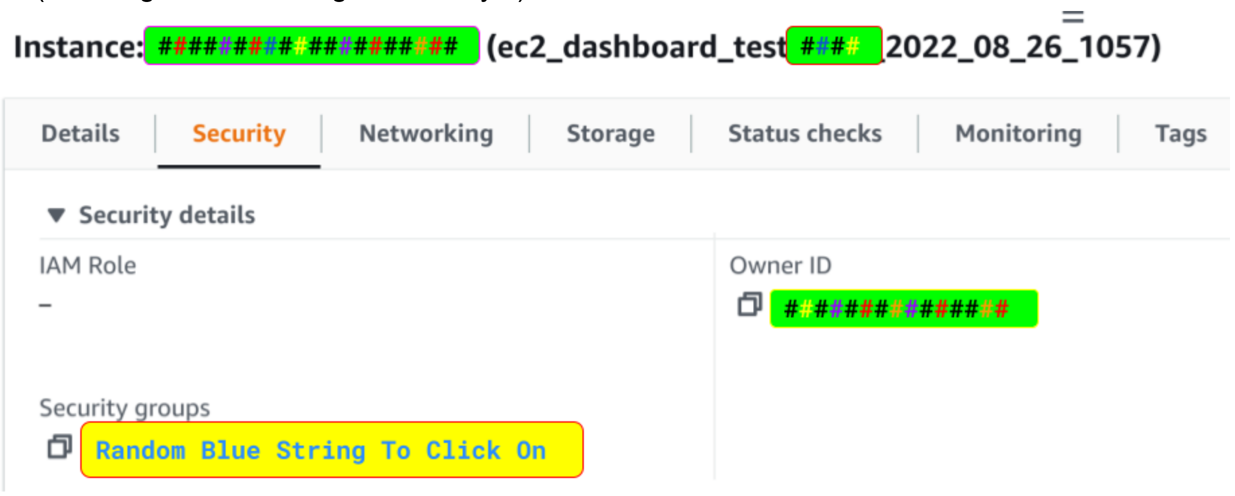


Name	Instance ID	Insta
ec2_dashboard_test_####22_08_26_1057	i#############	R

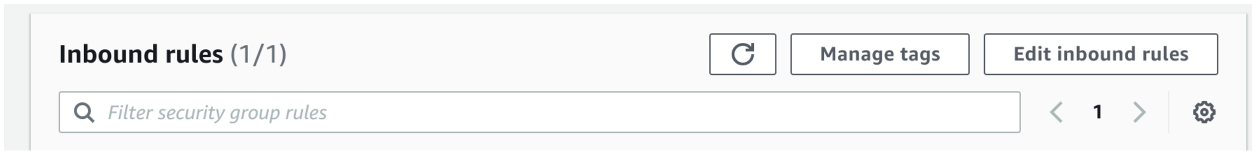
# configure in "security"
(Obviously, since you want to do network configuration, and you have the choice of 'networking' you instead need to go to "security." So user friendly.)



## Another random blue-string-click
In the "Security" tab, under "security groups" (plural?) you see a random blue-string-link. click on that (to configure networking...obviously...)

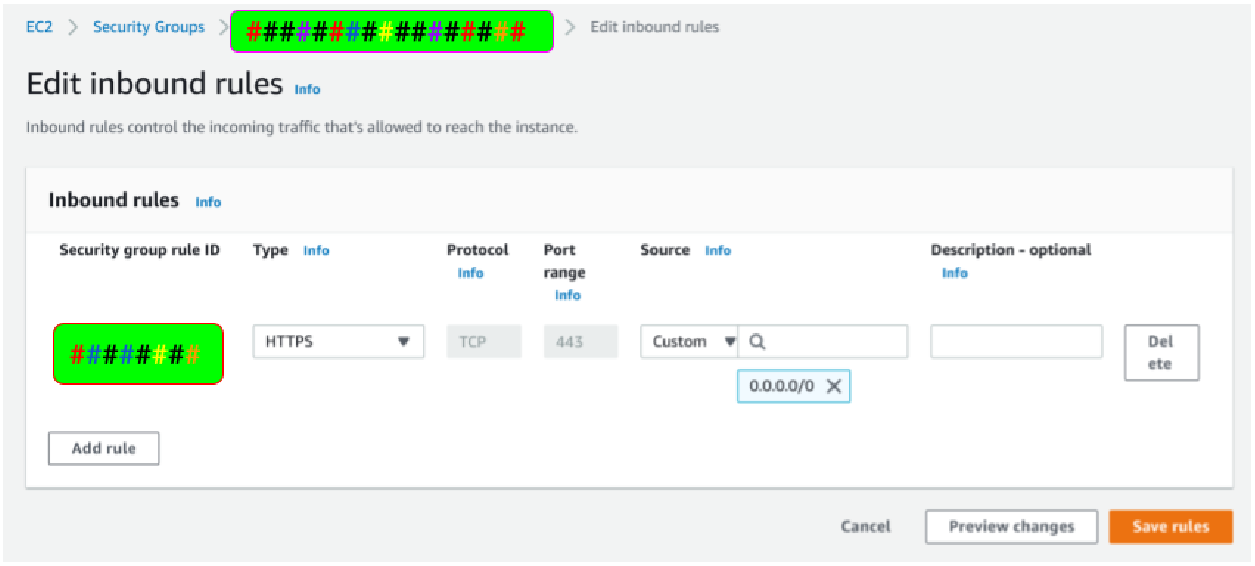


## "Inbound rules" You are here!
Finally: This is the basic, rudimentary, necessary, "start here" configuration menu that all this has been leading up to (and should have started with), yet for some obscene reason AWS makes it impossible to even find.



### Click "edit inbound rules"

### Make and save new rules.
Using the following tool (which you should see now),



EC2 > Security Groups > ################# > Edit inbound rules

Edit inbound rules Info

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

Inbound rules Info

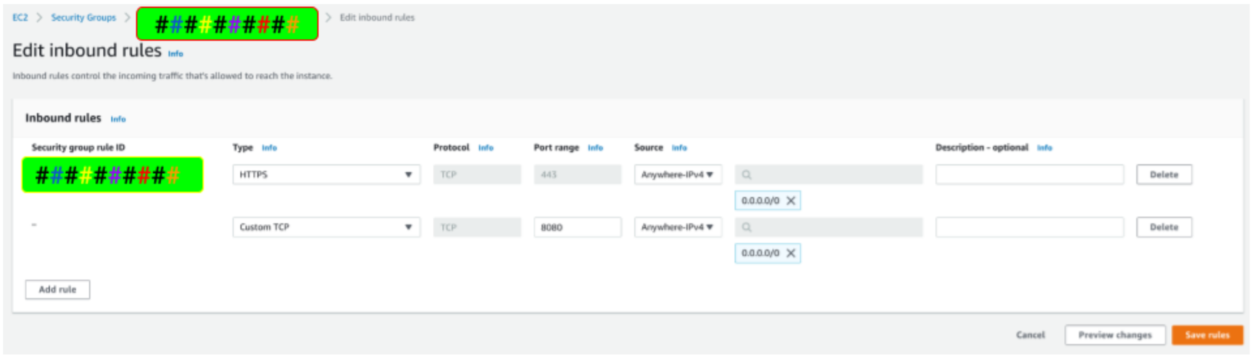
Security group rule ID	Type	Protocol	Port range	Source		Description - optional	
########	HTTPS	TCP	443	Custom	0.0.0.0/0		Delete

Add rule

Cancel | Preview changes | Save rules

Create and save (using the big orange "Save rules" button) the rules in this table.
Existing rules may need to be modified or replaced (e.g. HTTPS may be set to custom, set it to Anywhere IPV4)

```
     Type         (Protocol)  Port Range  Source         (to)
1.   HTTPS TCP    TCP         443         Anywhere IPV4  0.0.0.0/0
2.   Custom TCP   TCP         8080        Anywhere IPV4  0.0.0.0/0
3.   SSH          TCP         22          Custom         0.0.0.0/0
```



EC2 > Security Groups > ########## > Edit inbound rules

Edit inbound rules Info

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

Inbound rules Info

Security group rule ID	Type	Protocol	Port range	Source		Description - optional	
##########	HTTPS	TCP	443	Anywhere-IPv4	0.0.0.0/0		Delete
-	Custom TCP	TCP	8080	Anywhere-IPv4	0.0.0.0/0		Delete

Add rule

Cancel | Preview changes | Save rules

Another example rule set:

Set **Type** *HTTP*, **Protocol** *TCP*, **Port range** *80*, and **Source** to "*0.0.0.0/0*".

Set **Type** *HTTP*, **Protocol** *TCP*, **Port range** *80*, and **Source** to "*::/0*".

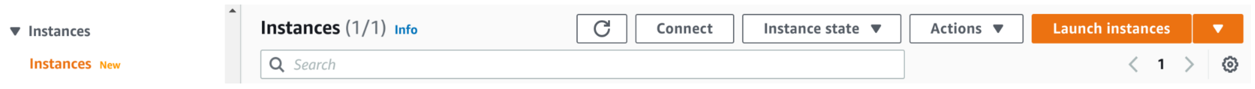
Set **Type** *Custom TCP*, **Protocol** *TCP*, **Port range** *8080*, and **Source** to "*0.0.0.0/0*".

Set **Type** *SSH*, **Protocol** *TCP*, **Port range** *22*, and **Source** to "*0.0.0.0/0*".

Set **Type** *HTTPS*, **Protocol** *TCP*, **Port range** *443*, and **Source** to "*0.0.0.0/0*".

Done.

### Go back to the instances tab



# Note!

The exact ports you need to select (e.g. 8080 vs. 8050) etc, may depend on what you are doing, and on how your project is configured (flask, dash, fast-api, etc.)

For plotly dash you may need to use 8050 and use this line in your app.run command:

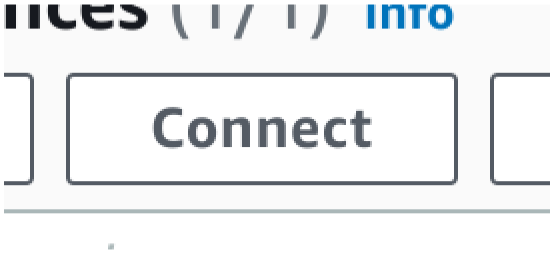
```
if __name__ == '__main__':
    app.run_server(host= '0.0.0.0',port=80)
```

And you may need to add a port suffix after the ipv4URL you get from AWS.
#### In these working examples, plotly-dash's port 8050 was added to the end of the original url.

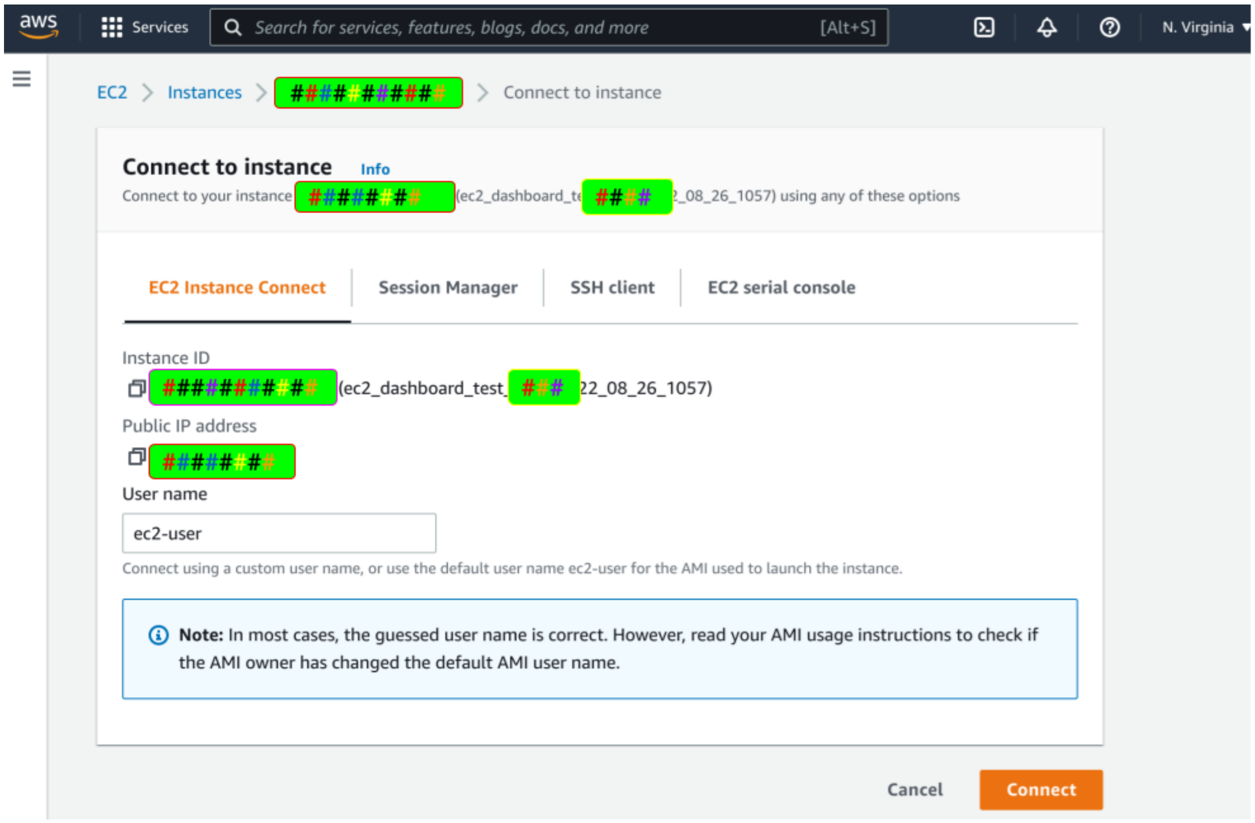
```
http://3.94.153.137:8050/
or
http://ec2-3-94-153-137.compute-1.amazonaws.com:8050/
```

# Web Connect

## click on "connect"



### In the 'connect to instance' window
in the "EC2 Instance Connect" tab...



Connect to instance Info

Connect to your instance #######(ec2_dashboard_te####2_08_26_1057) using any of these options

Instance ID

##########(ec2_dashboard_test_###22_08_26_1057)

Public IP address

#######

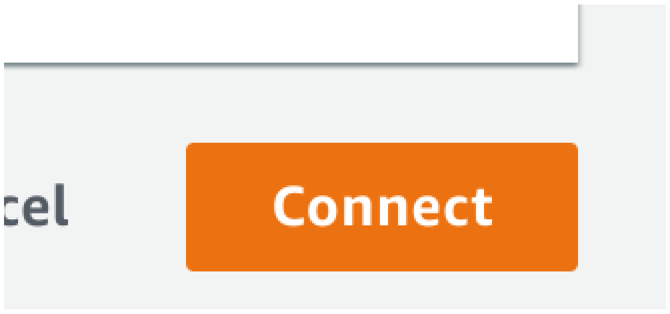
User name

ec2-user

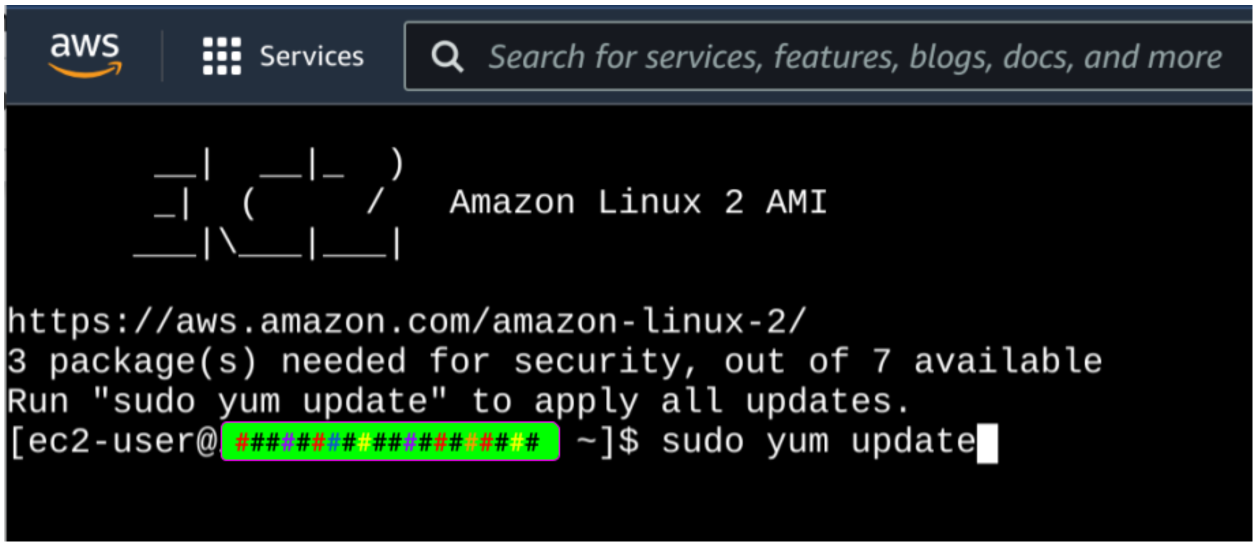
Connect using a custom user name, or use the default user name ec2-user for the AMI used to launch the instance.

Note: In most cases, the guessed user name is correct. However, read your AMI usage instructions to check if the AMI owner has changed the default AMI user name.

### Click on "Connect" (the big orange button)...(dejavu?)



### Like SSH but with no convoluted local aws-cli setup nightmare. (This is a good thing.)



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

https://aws.amazon.com/amazon-linux-2/
3 package(s) needed for security, out of 7 available
Run "sudo yum update" to apply all updates.
[ec2-user@##################  ~]$ sudo yum update
```

### Optional steps: for using github
If you are going to get files from github
```
$ sudo yum update -y
$ sudo yum install git -y
```

# Run server in EC2
The code you run in your EC2 to start the server will likely look something like this:

#### Steps:
```
$ sudo yum update -y

$ sudo yum install git -y

$ git clone https://github.com/lineality/plotly_dash_geomap_points_energy1.git

$ mkdir viz; dc viz

$ git clone https://github.com/lineality/plotly_dash_geomap_points_energy1.git

$ cd plotly_dash_geomap_points_energy1

$ python3 -m venv env; source env/bin/activate

(ENV)$ python3 -m pip install --upgrade pip

(ENV)$ pip install -r requirements.txt

(ENV)$ nohup python3 app.py &

```

## Why 'in background'?

For 'testing only' you can run the flask server with:
```
(ENV)$ python3 app.py
```
BUT this will stop when you end your terminal session. As long as your terminal is open you are fine (e.g. for you testing at that moment), but if you want anyone online to be able to access that server any time, then the server must be running 'in the background' (or whatever equivalent) so that the server does not shut down for everyone else as soon as you close your terminal.

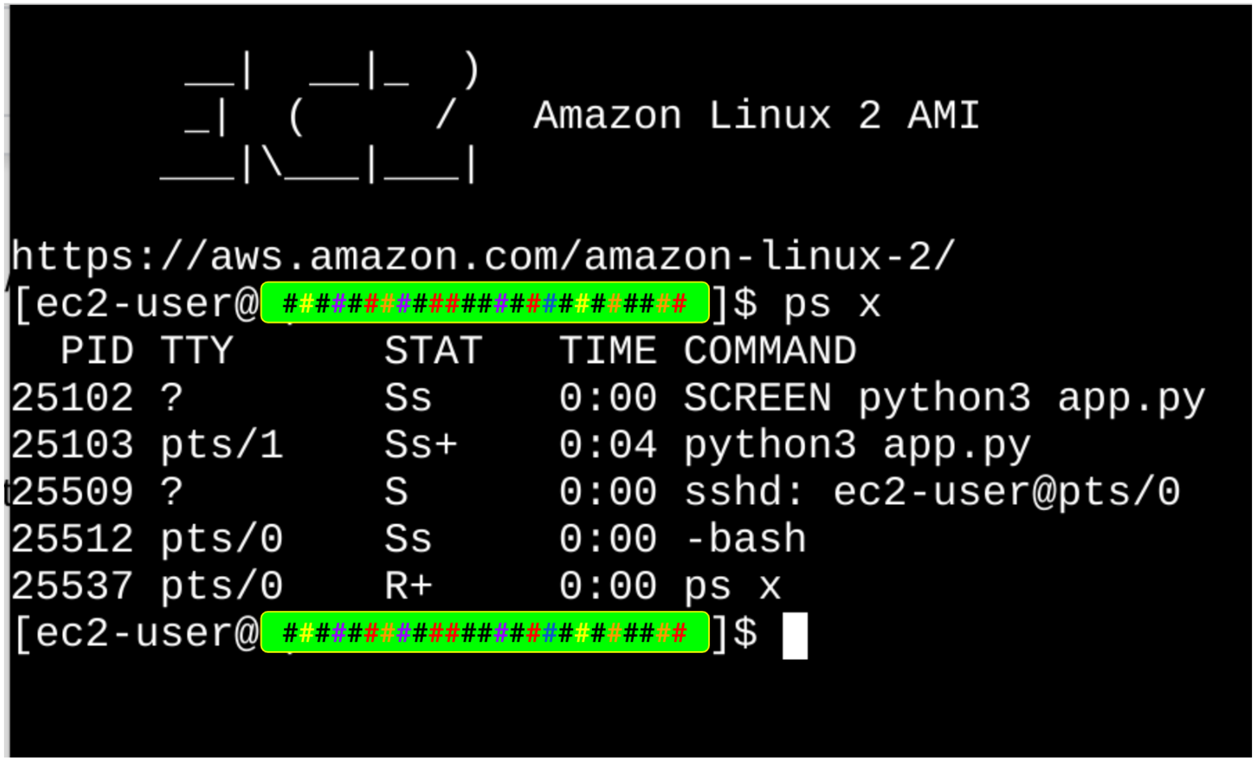
To run your app in the background, use this:
```
(ENV)$ nohup python3 app.py &
```

or
(
```

The output may look like this (not the normal output saying what IP etc.)
```
(env) [ec2-user@XXX]$ nohup: ignoring input and appending output to ‘nohup.out’
```
You may want to wait until you have tested etc. before you run this.

## Check Connection:

#### Reminder:
You may need to add a port suffix after the ipv4URL you get from AWS.

#### In these working examples, plotly-dash's port 8050 was added to the end of the original url.
```
(These are just examples that will not refer to your server; note the added port number at the end. "8050" This number will depend on what you set up and on what your software requires.)
http://3.94.153.137:8050/
or
http://ec2-3-94-153-137.compute-1.amazonaws.com:8050/
```

## See what processes are running:

```
$ ps -x

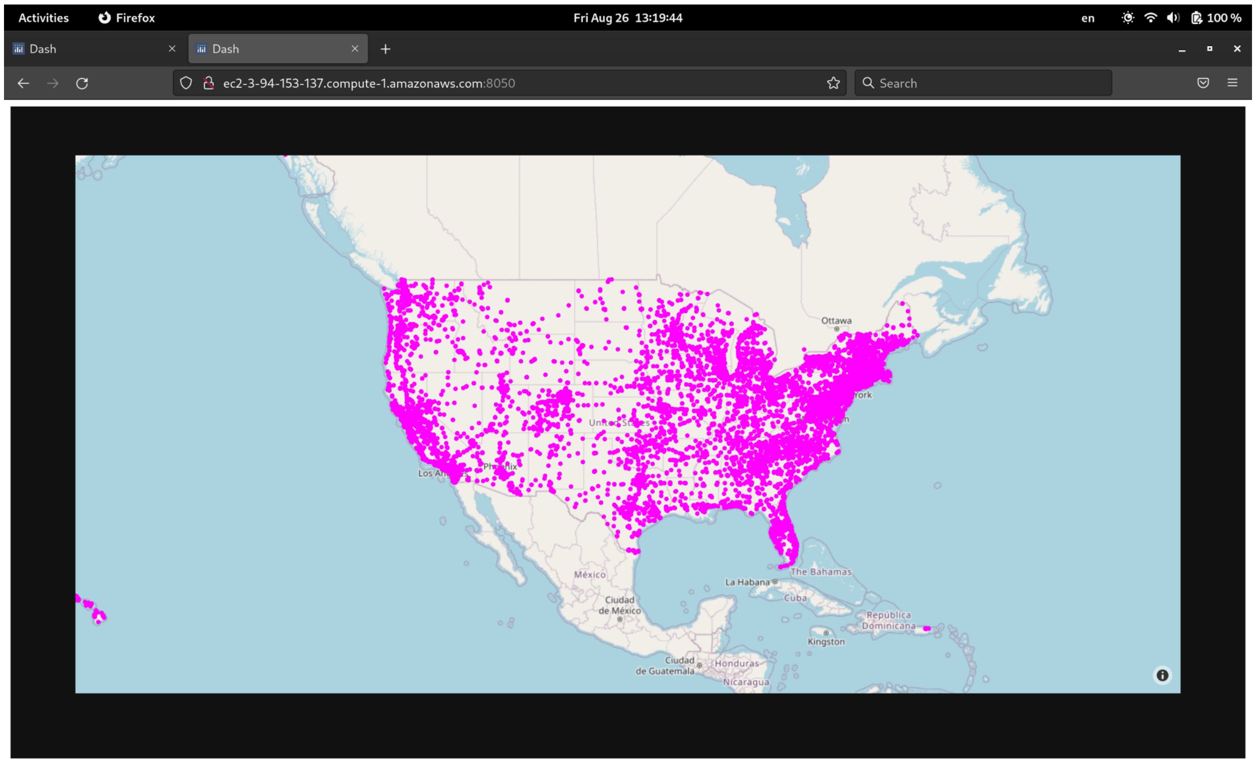
or

$ ps x
```
more suggestions here:
https://www.freecodecamp.org/news/linux-list-processes-how-to-check-running-processes/

Terms:
```
        PID = process ID (use this to 'kill' the process)

TTY = name of controlling terminal for process

STAT = process state code, such as Z (zombie), S (sleeping), and R (running),
note: 'sleeping' can me waiting for user-input,
```

Note: Your running-in-background process may appear as multiple processes, so do not kill one by mistake thinking it is a leftover from past testing or some other error.



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

https://aws.amazon.com/amazon-linux-2/
[ec2-user@[redacted]]$ ps x
  PID TTY      STAT   TIME COMMAND
25102 ?        Ss     0:00 SCREEN python3 app.py
25103 pts/1    Ss+    0:04 python3 app.py
25509 ?        S      0:00 sshd: ec2-user@pts/0
25512 pts/0    Ss     0:00 -bash
25537 pts/0    R+     0:00 ps x
[ec2-user@[redacted]]$
```

## How to End a Process
Get the process id (PID) number by running ps -x (or something similar)
```
$ kill PID_NUMBER_HERE
```
More here https://linuxize.com/post/how-to-kill-a-process-in-linux/

## Example:
EC2 deployed plotly dash app viewed in browser via public access setup:
```



# Resources:
- https://stackoverflow.com/questions/67166003/dash-app-not-working-when-deployed-on-amazon-ec2-instance

#### Gunicorn WSGI server / systemd / Nginx Webserver
1. https://medium.com/techfront/step-by-step-visual-guide-on-deploying-a-flask-application-on-aws-ec2-8e3e8b82c4f7

#### Direct
2. https://www.twilio.com/blog/deploy-flask-python-app-aws
You can view your live application by appending *8080* to your public IPv4Public IP address. In the example of this article, the URL would be "http://52.15.127.3:8080/".

#### apache webserver and mod_wsgi
3. https://medium.com/innovation-incubator/deploy-a-flask-app-on-aws-ec2-d1d774c275a2
4. **https://www.datasciencebytes.com/bytes/2015/02/24/running-a-flask-app-on-aws-ec2/**

#### Docker
5. https://github.com/TPhil10/Bourbonhuntr

# Readings

1. Flask: Deploy to Production
https://flask.palletsprojects.com/en/2.2.x/tutorial/deploy/

2. https://kinsta.com/blog/nginx-vs-apac he/

3. "How to Serve a Flask App with Amazon Lightsail Containers"
https://aws.amazon.com/getting-started/hands-on/serve-a-flask-app/

4. Flask EC2 Ubuntu Apache
https://medium.com/innovation-incubator/deploy-a-flask-app-on-aws-ec2-d1d774c275a2

5. Gunicorn: Standalone WSGI Containers
(old) https://flask.palletsprojects.com/en/1.1.x/deploying/wsgi-standalone/
https://flask.palletsprojects.com/en/2.2.x/deploying/
https://flask.palletsprojects.com/en/2.1.x/quickstart/

6. make server independent of ssh session and run continuously
https://stackoverflow.com/questions/23029443/run-python-flask-on-ec2-in-the-background#23030970

7. examine running processes in EC2
https://www.freecodecamp.org/news/linux-list-processes-how-to-check-running-processes/

8. End a process
https://linuxize.com/post/how-to-kill-a-process-in-linux/