CYDEO

Selenium Grid with Docker

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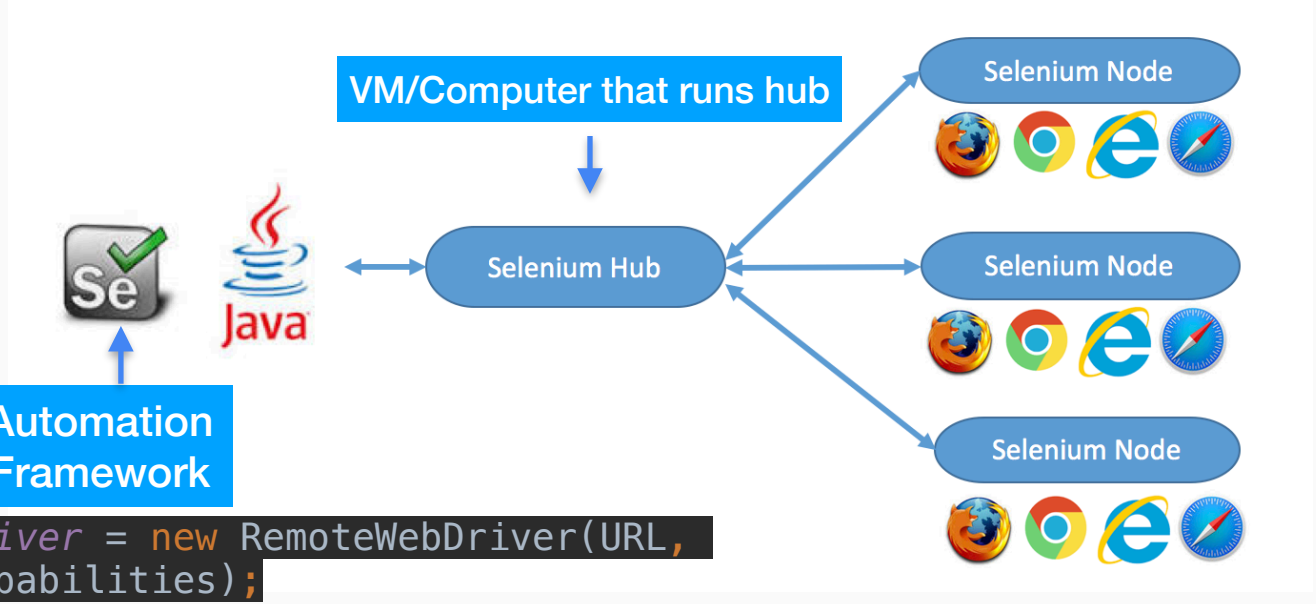
SELENIUM GRID

What is Selenium Grid ?

The ***Selenium Grid*** is a testing tool which allows us to run our tests on different machines against different browsers. It is a part of the Selenium Suite which specialize in running multiple tests across different browsers, operating system and machines. You can connect to it with Selenium Remote by specifying the browser, browser version, and operating system you want. You specify these values through Selenium Remote's Capabilities. There are two main elements to ***Selenium Grid*** — a ***hub*** and ***node***.




```
driver = new RemoteWebDriver(URL, capabilities);
```

Every node runs on different VM/Server. Connection happens based on IP address of the hub.

Node can be running on same machine as hub.

What is Selenium Grid ?

Grid allows you to :

- scale by distributing tests on several machines (parallel execution)
- manage multiple environments from a central point, making it easy to run the tests against a vast combination of browsers / OS.
- minimize the maintenance time for the grid by allowing you to implement custom hooks to leverage virtual infrastructure for instance.

HUB

- The hub is the central point where you load your tests into.
- There should only be one hub in a grid.
- The hub is launched only on a single machine, say, a computer whose O.S is Windows 10 and whose browser is Chrome.
- The machine containing the hub is where the tests will be run, but you will see the browser being automated on the node.
- The hub can be parametrized with json file.

NODE

- Nodes are the Selenium instances that will execute the tests that you loaded on the hub.
- There can be one or more nodes in a grid.
- Nodes can be launched on multiple machines with different platforms and browsers.
- Nodes can be located on different machines.
- Nodes can be parametrized with json file.

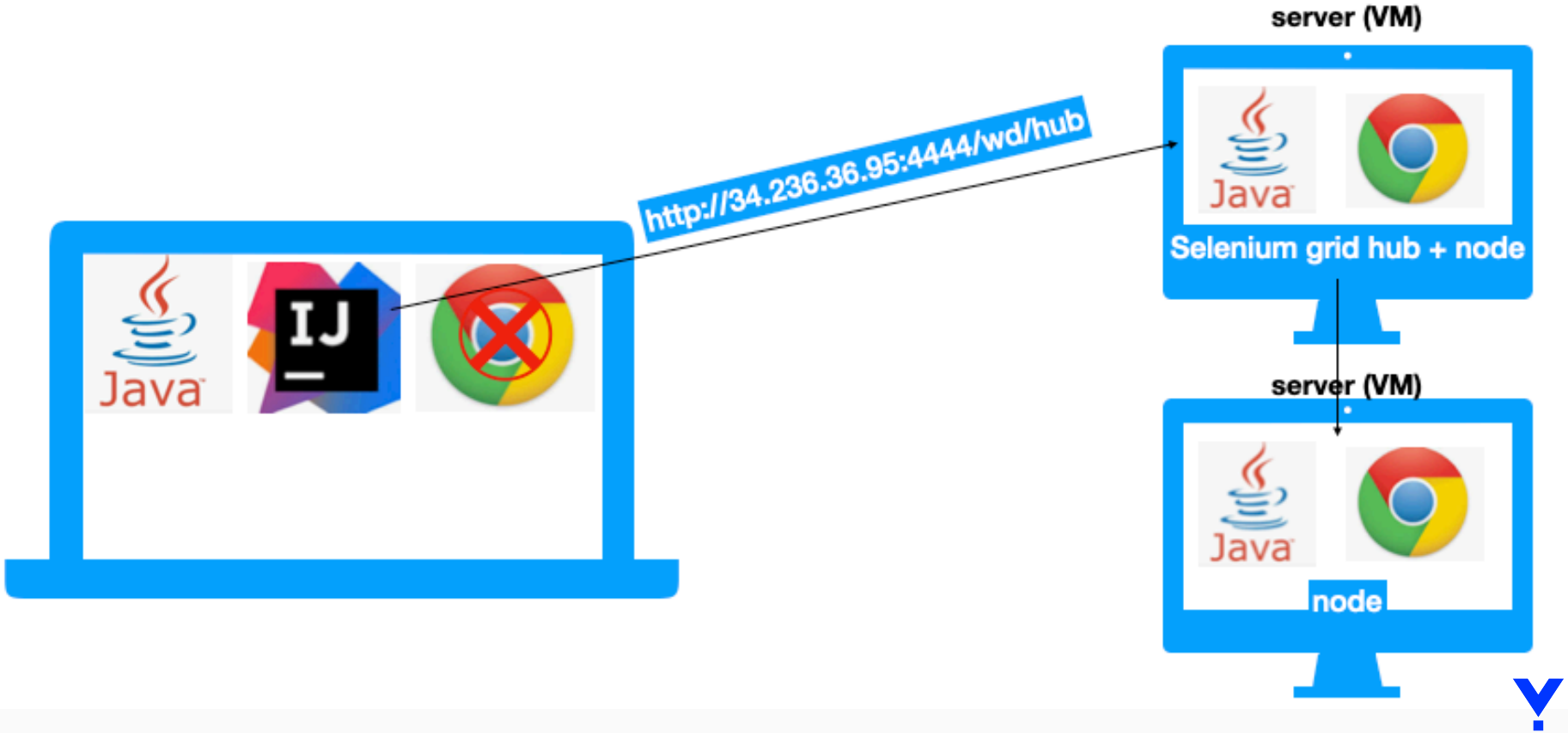
How Selenium Grid Works

A grid consists of a single hub, and one or more nodes. Both are started using the selenium-server.jar executable.

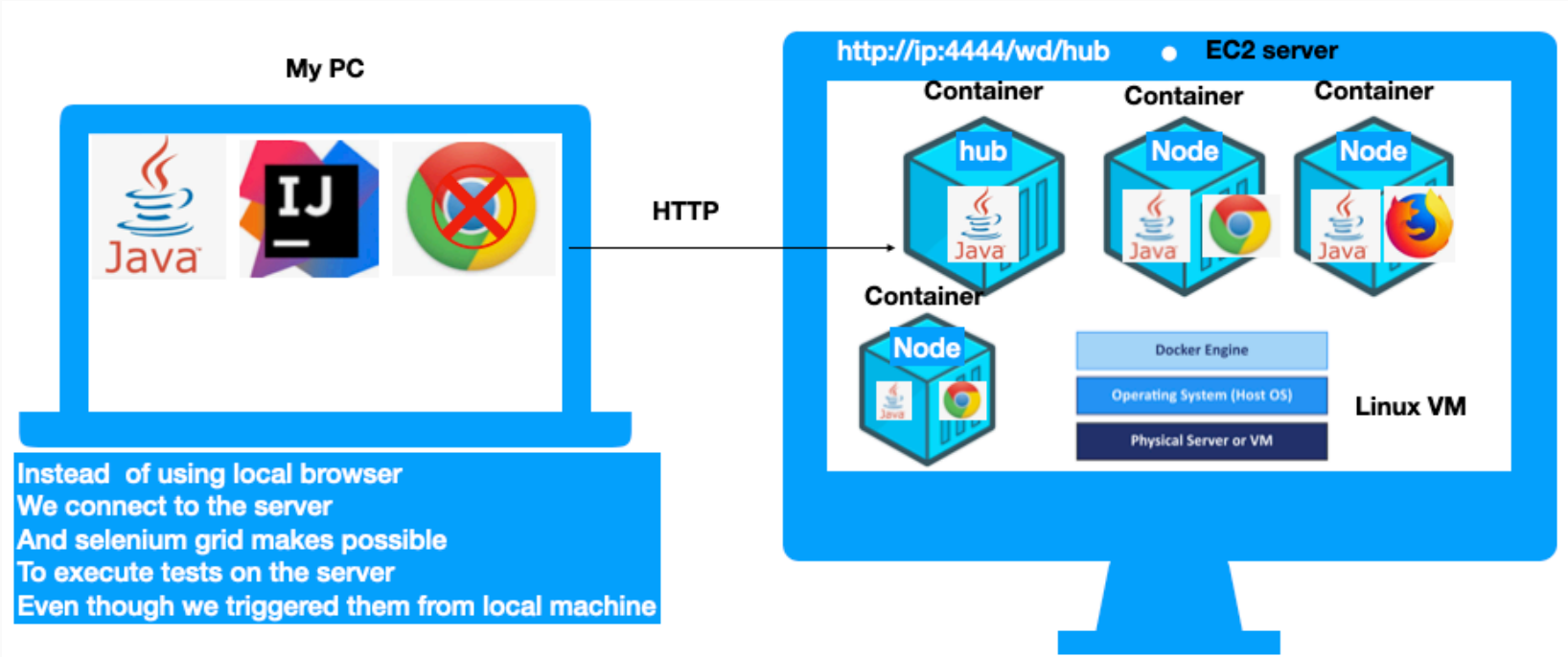
The hub receives a test to be executed along with information on which browser and ‘platform’ (i.e. WINDOWS, LINUX, etc) where the test should be run. It ‘knows’ the configuration of each node that has been ‘registered’ to the hub. Using this information it selects an available node that has the requested browser-platform combination.

Once a node has been selected, Selenium commands initiated by the test are sent to the hub, which passes them to the node assigned to that test. The node runs the browser, and executes the Selenium commands within that browser against the application under test.

Execution Happens on the Server



Execution Happens on the Server



Configure the nodes by Command Line

By default, starting the node allows for concurrent use of 11 browsers... : 5 Firefox, 5 Chrome, 1 Internet Explorer. The maximum number of concurrent tests is set to 5 by default.

To change this and other browser settings, you can pass in parameters to each -browser switch (each switch represents a node based on your parameters). If you use the -browser parameter, the default browsers will be ignored and only what you specify command line will be used.

-browser
browserName=firefox,version=3.6,maxInstances=5,platform=LINUX

Terminologies used in Grid Configuration

role = When launching a node, it will forward the parameter to server on the node like, -role node.
host = Though it not needed and determined automatically. For some network configuration, network with VPN, specifying the host might be necessary.
port = the port the remote/hub will listen on. Default to 4444.
throwIn Capability Not Present = Default value is true; if no proxy is currently registered hub will reject the test request. On contrast, the request queued until a node supporting the capability which is added to the grid.
new Session Wait_Timeout = Default to no timeout (-1)ms after which a new test waiting for a node to become available will timeout else test will throw an exception before starting a browser.
hubConfig = It defines the hub properties in JSON format.
nodeConfig = It defines the node properties in JSON format.
cleanupCycle = It will check the timeout thread in ms.
node Timeout = The timeout in seconds prior to hub automatically ends the test so that browser will be released for another test to run.
browser Timeout= The browser gets hang after defined timeout in ms.
hub = It used to post the registration request using url – <http://localhost:4444/grid/register>
proxy =This will be used to represent the node. By default org.openqa.grid.selenium.proxy.DefaultRemoteProxy.
maxSession = Maximum number of sessions to run multiple tests at same time independently in different browsers.
register Cycle = It defines how often registered node will try to register itself again in ms,however, without restarting the node command file.
nodePolling = How often the hub checks if the node is still alive in ms.

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AWS

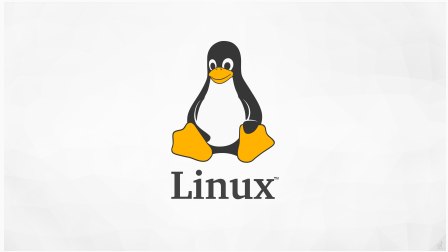
What is AWS ?

Amazon Web Services (AWS) is a secure cloud services platform, offering compute power, database storage, content delivery and other functionality to help businesses scale and grow.
In simple words AWS allows you to do the following things

- Running web and application servers in the cloud to host dynamic websites.
- Securely store all your files on the cloud so you can access them from anywhere.
- Using managed databases like MySQL, PostgreSQL, Oracle or SQL Server to store information.
- Deliver static and dynamic files quickly around the world using a Content Delivery Network (CDN).
- Send bulk email to your customers

What is AWS ?

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale cloud computing easier for developers. Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment.



What is Linux ?

From smartphones to cars, supercomputers and home appliances, home desktops to enterprise servers, the Linux operating system is everywhere.

Linux has been around since the mid-1990s and has since reached a user-base that spans the globe. Linux is actually everywhere: It’s in your phones, your thermostats, in your cars, refrigerators, Roku devices, and televisions. It also runs most of the Internet, all of the world’s top 500 supercomputers, and the world’s stock exchanges.

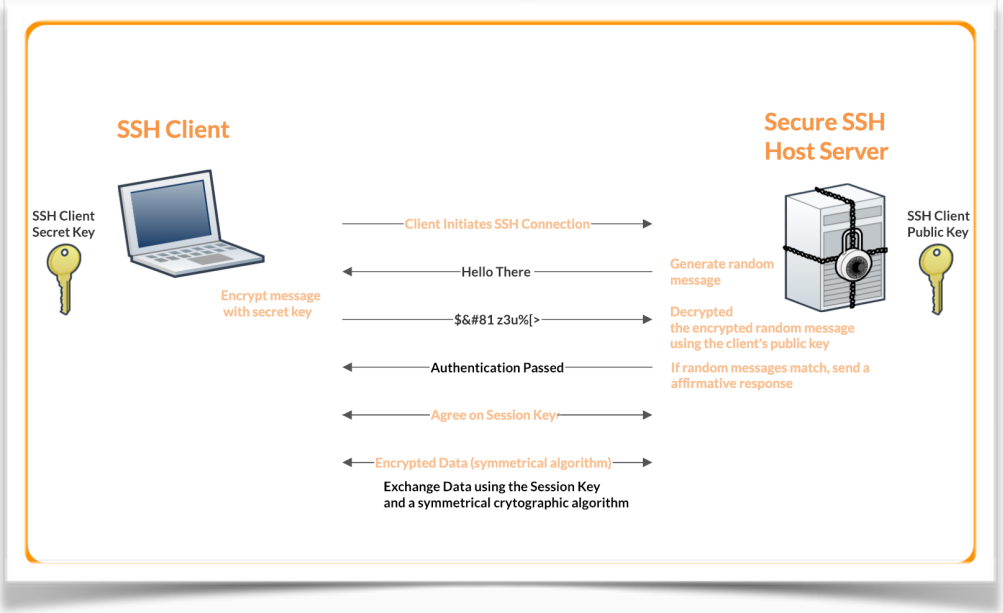
But besides being the platform of choice to run desktops, servers, and embedded systems across the globe, Linux is one of the most reliable, secure and worry-free operating systems available.

Just like Windows, iOS, and Mac OS, Linux is an operating system. In fact, one of the most popular platforms on the planet, Android, is powered by the Linux operating system. An operating system is software that manages all of the hardware resources associated with your desktop or laptop. To put it simply, the operating system manages the communication between your software and your hardware. Without the operating system (OS), the software wouldn't function.

SSH (Secure Shell)

An SSH client allows you to connect to a remote computer running an SSH server.

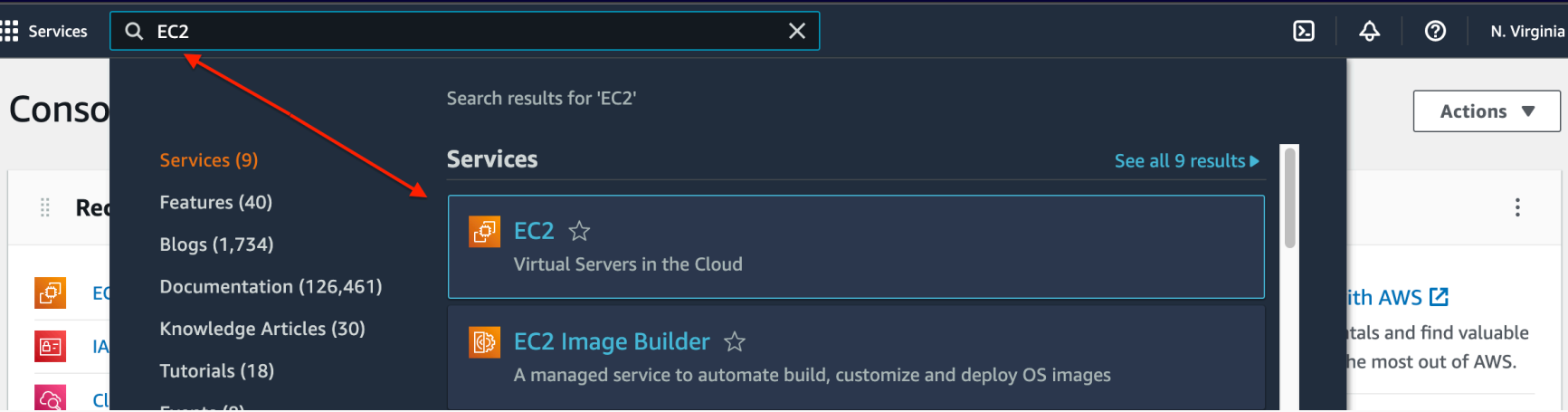
The Secure Shell (SSH) protocol is often used for remote terminal connections, allowing you to access a text-mode terminal on a remote computer as if you were sitting of it.



CYDEO

Launch EC2 INSTANCE (GRID)

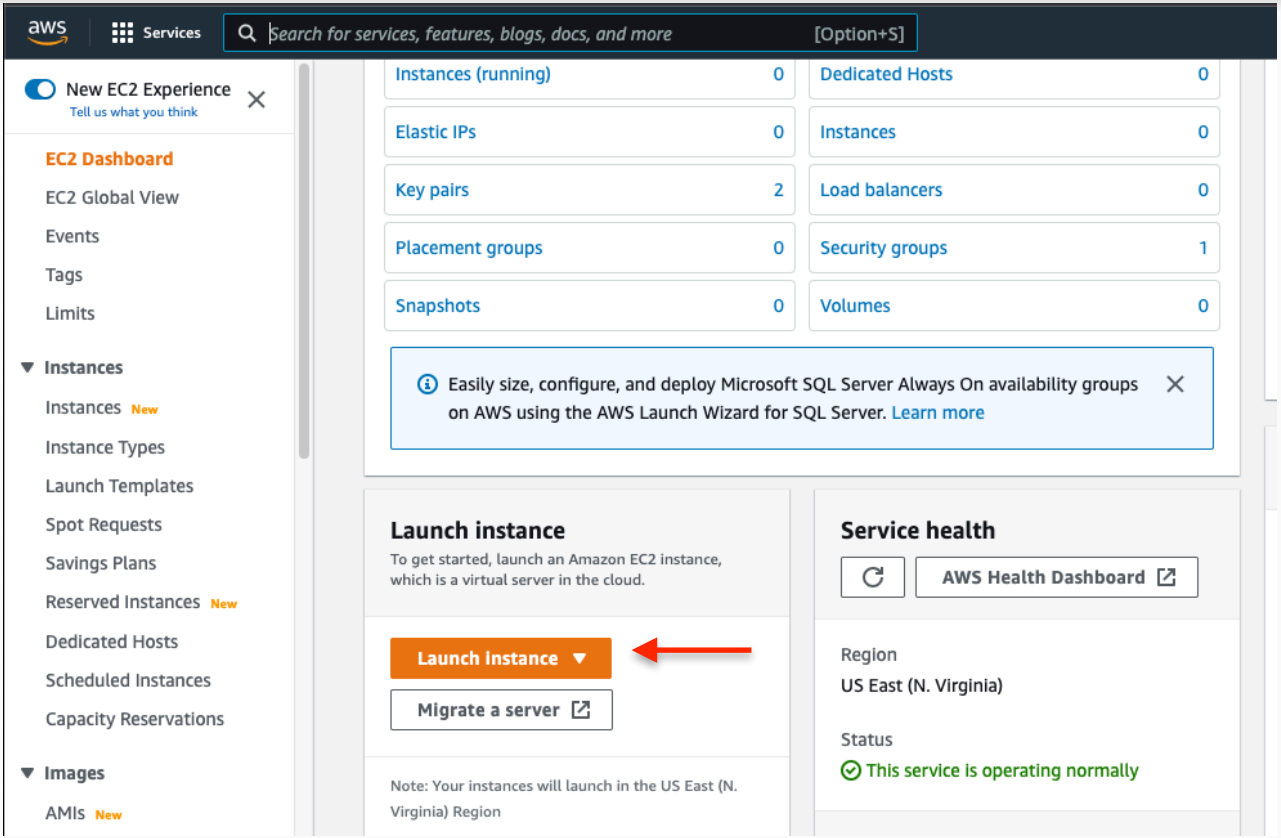
Launch EC2



- Type EC2 in search bar

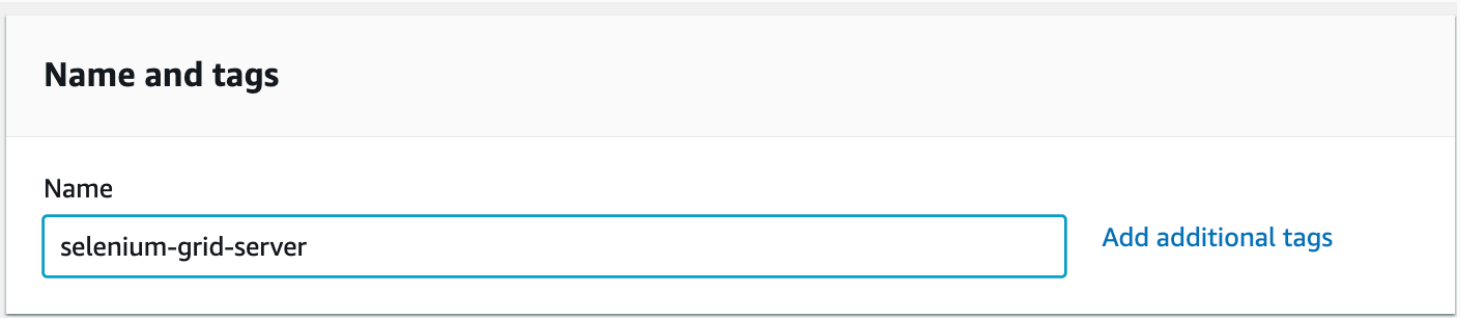
  Choose EC2 from list

Launch EC2



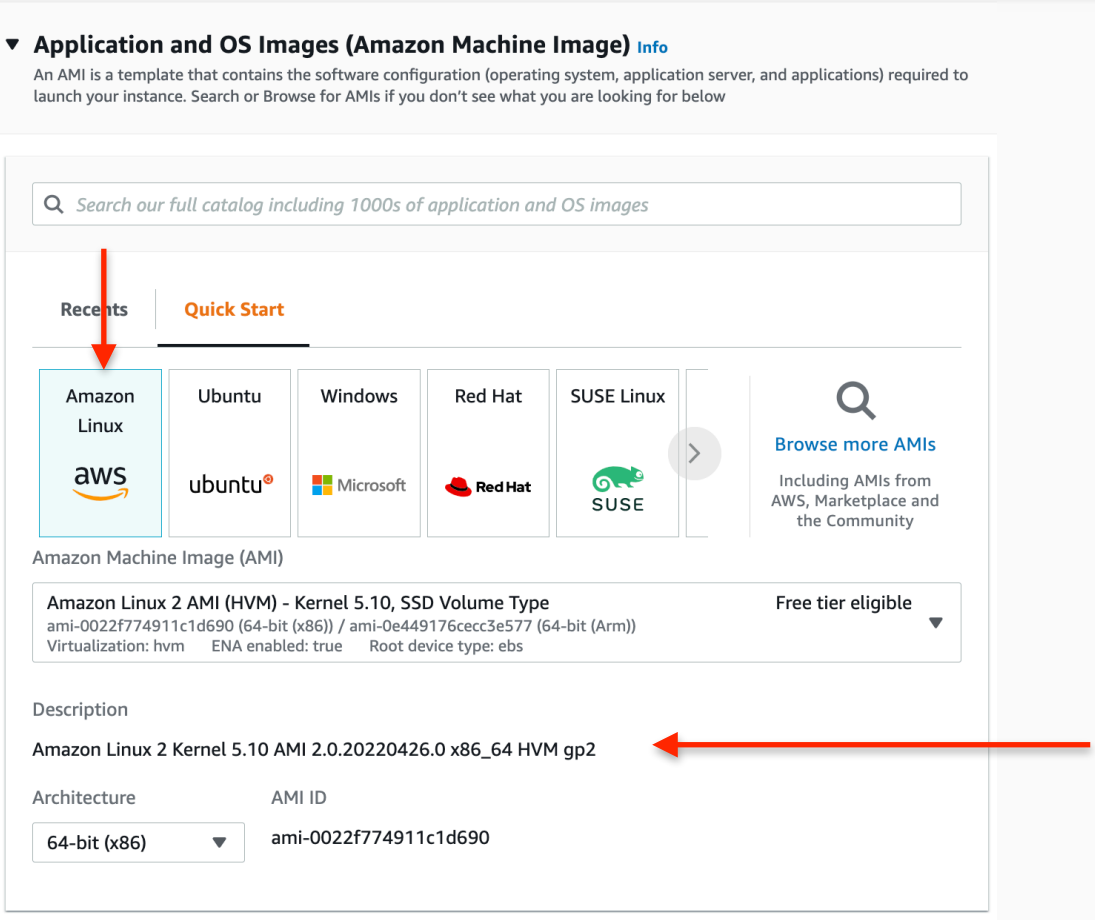
- Click Launch Instance

Launch EC2



- Type here your server name (name is not an issue)

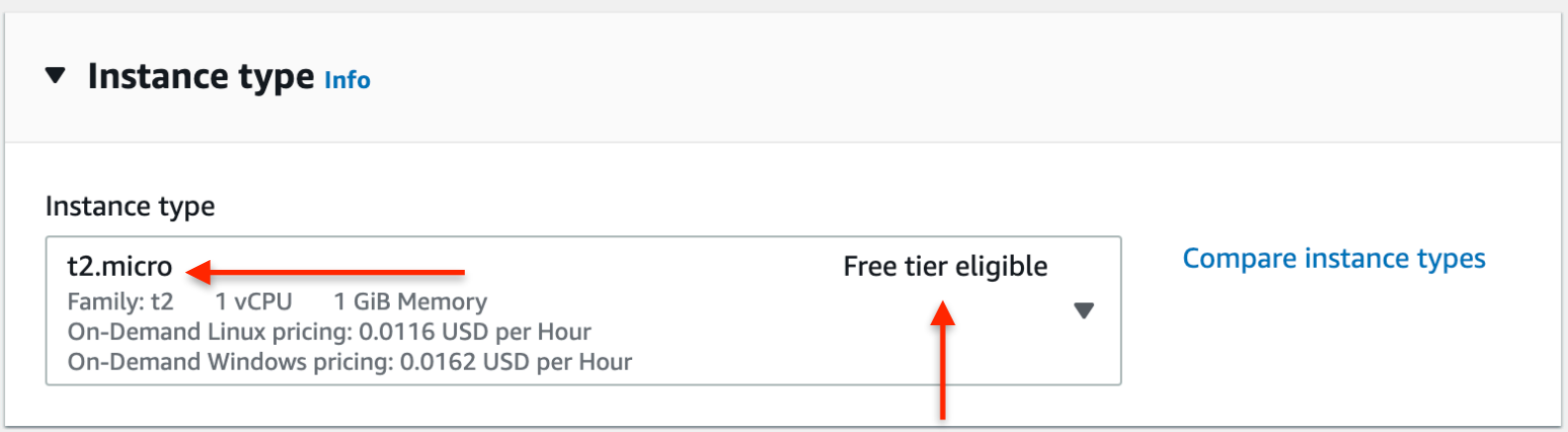
Launch EC2



- Choose Default One

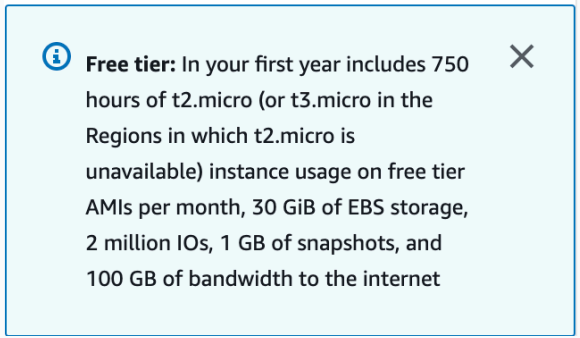
Amazon Linux Server

AWS

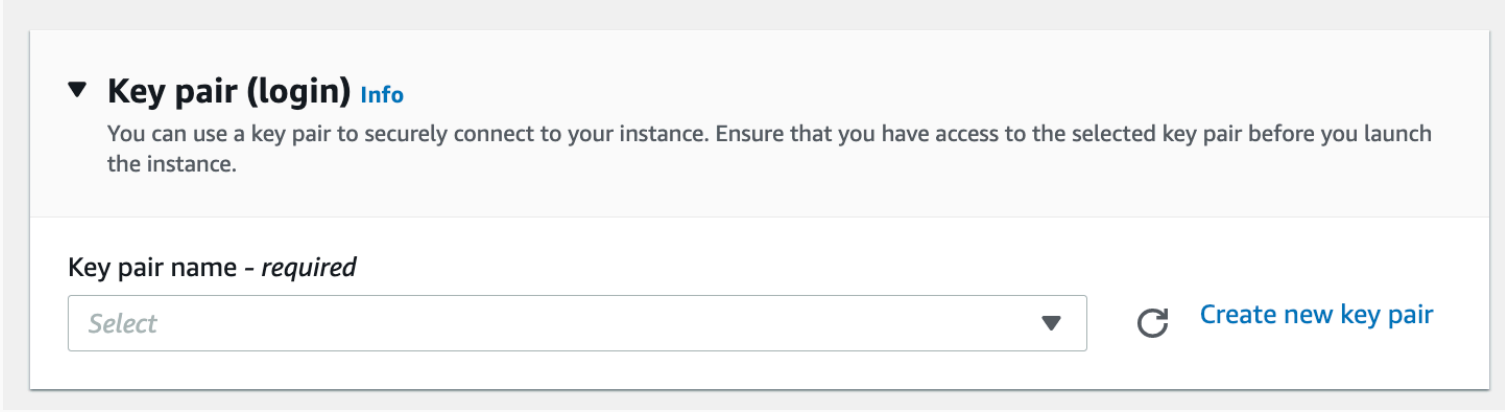


NOTES

- Make sure that Instance type is chosen as t2.micro free tier eligible
- Only one type of server is free
  750 hours per month for 12 month -> only for first year
  31 day x 24 hours = 744
  It means you need to have only one server at a time

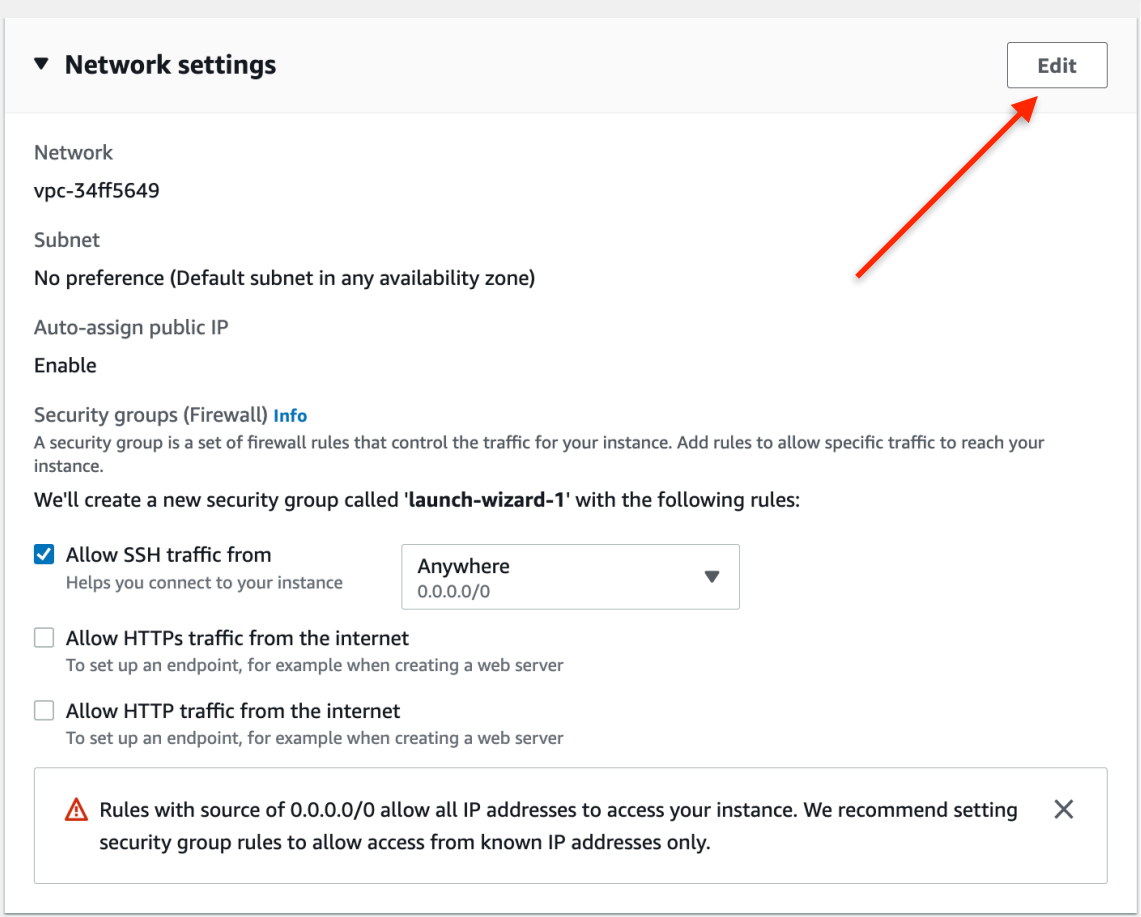


Launch EC2



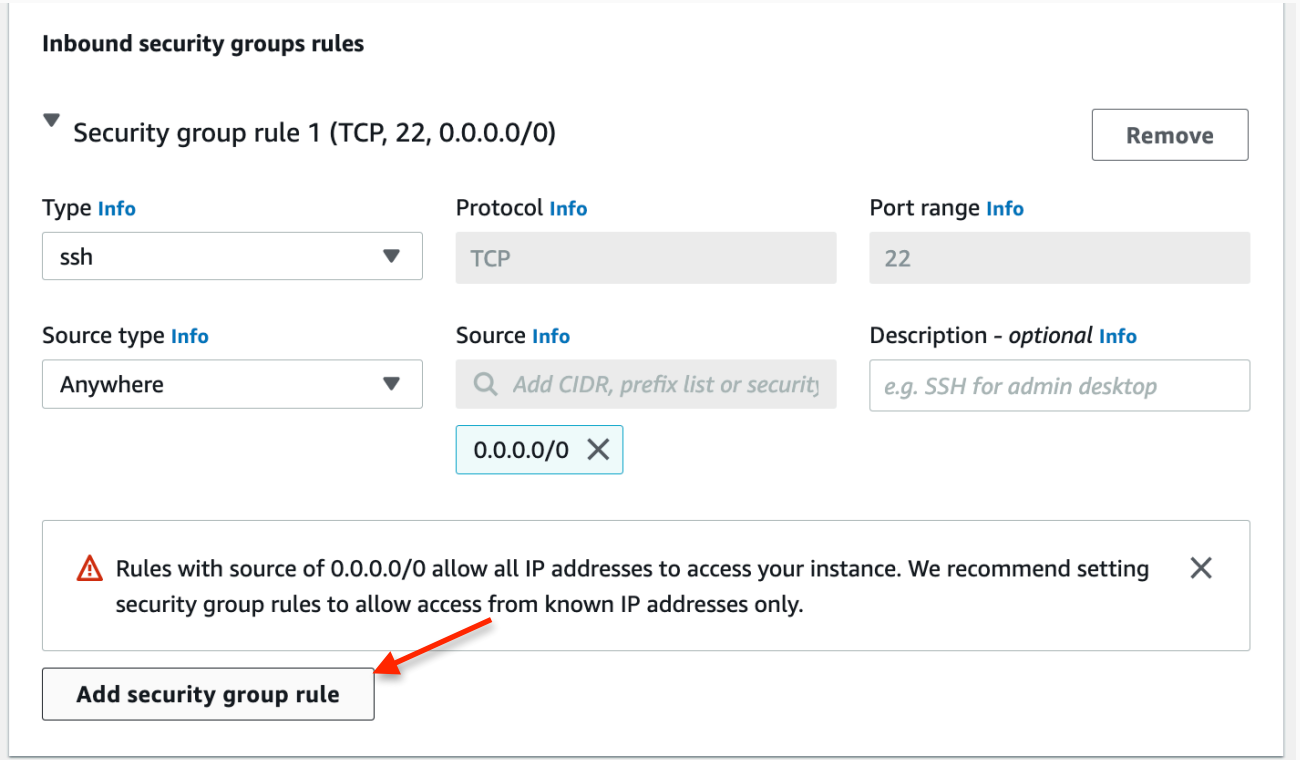
☑ For now just skip this step.We will handle this after click Launch instance

Launch EC2



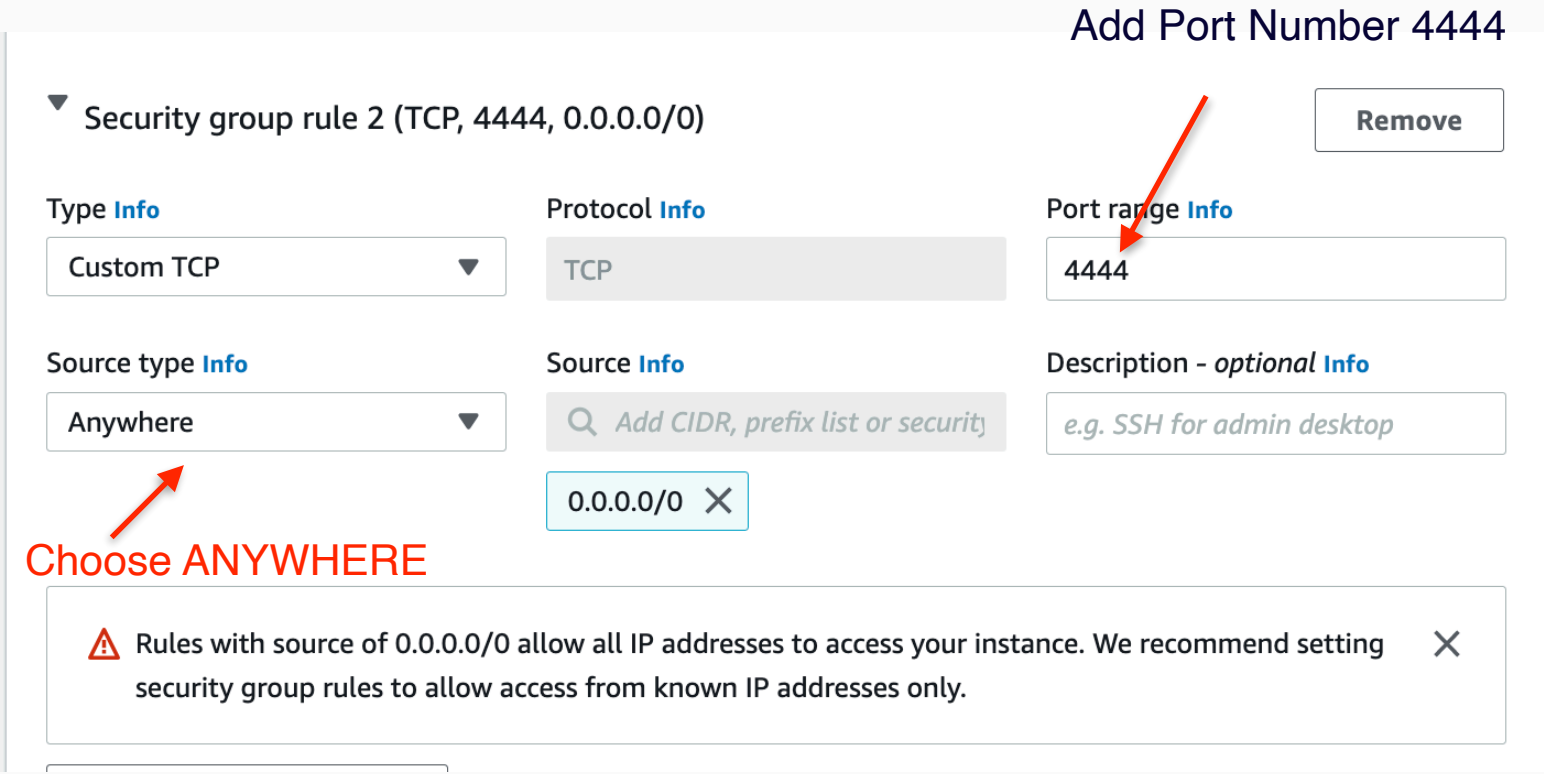
- Click Edit button

Launch EC2

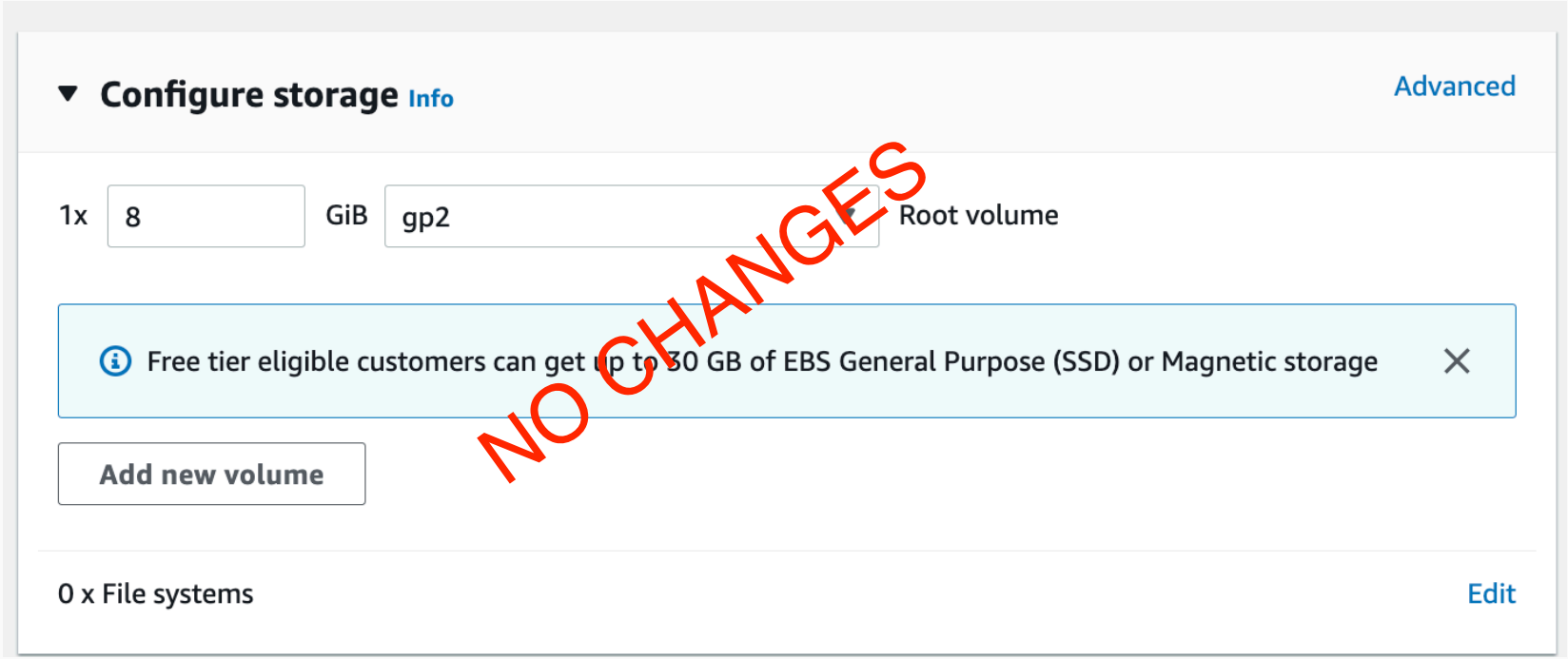


- Click Add Security Group Rule

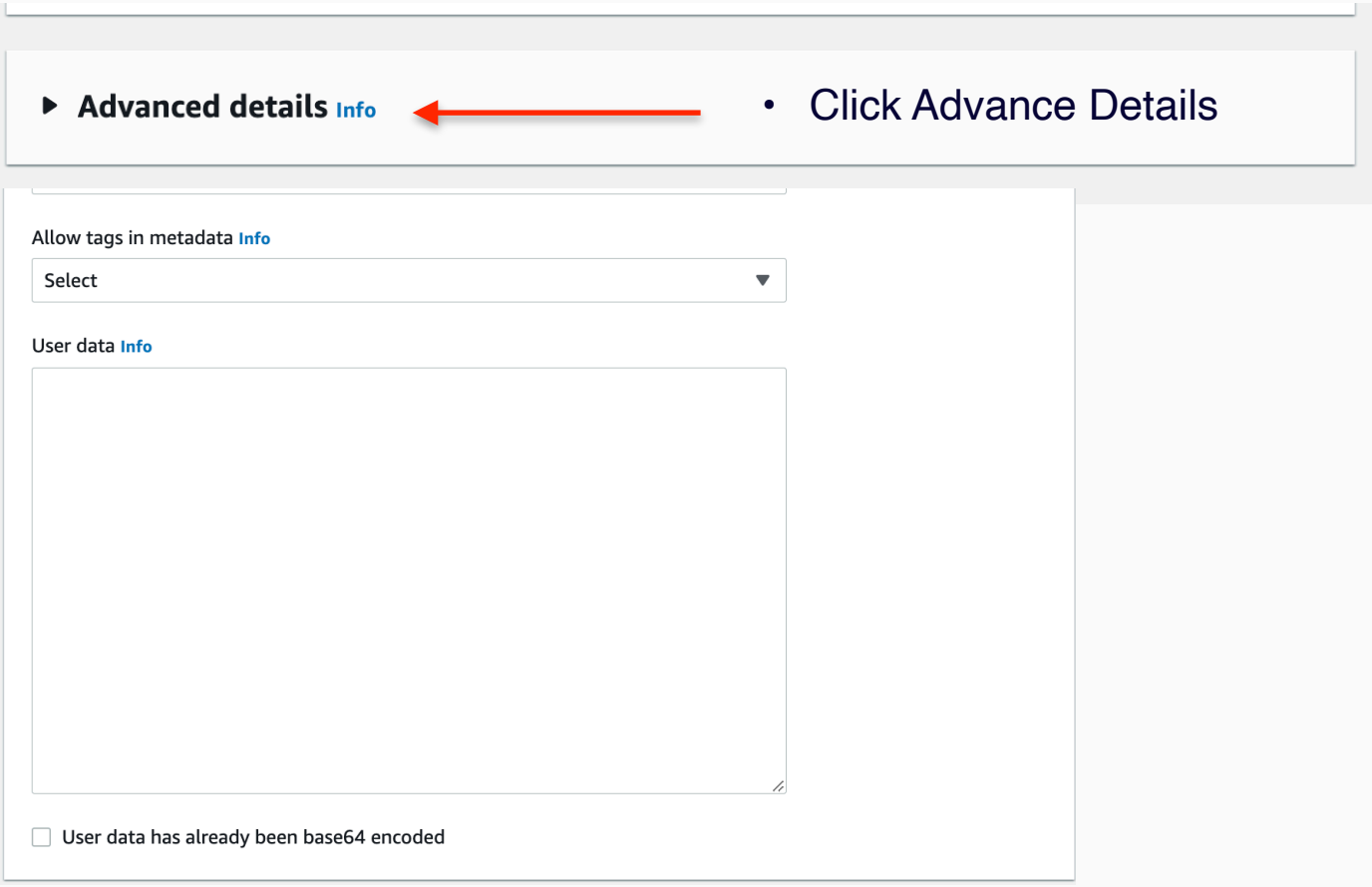
Launch EC2


Add Port Number 4444
Security group rule 2 (TCP, 4444, 0.0.0.0/0)
Remove
Type Info
Custom TCP
Protocol Info
TCP
Port range Info
4444
Source type Info
Anywhere
Source Info
Add CIDR, prefix list or securit
0.0.0.0/0
Description - optional Info
e.g. SSH for admin desktop
Choose ANYWHERE
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.

Launch EC2


Configure storage Info
Advanced
1x
8
GiB
gp2
Root volume
Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage
NO CHANGES
Add new volume
0 x File systems
Edit

Launch EC2


Advanced details Info
Click Advance Details
Allow tags in metadata Info
Select
User data Info
User data has already been base64 encoded

Setup.sh

```
#!/bin/bash
sudo yum update -y &&
sudo amazon-linux-extras install -y docker &&
sudo service docker start &&
sudo usermod -a -G docker ec2-user &&
sudo chkconfig docker on &&
sudo yum install -y git &&
sudo curl -L https://github.com/docker/compose/releases/latest/download/docker-compose-$(uname -s)-$(uname -m) -o /usr/local/bin/docker-compose &&
sudo chmod +x /usr/local/bin/docker-compose &&
docker-compose version &&
sudo curl -L https://cybertek-shared.s3.amazonaws.com/docker-compose.yml -o /home/ec2-user/docker-compose.yml &&
sudo reboot
```

Launch EC2

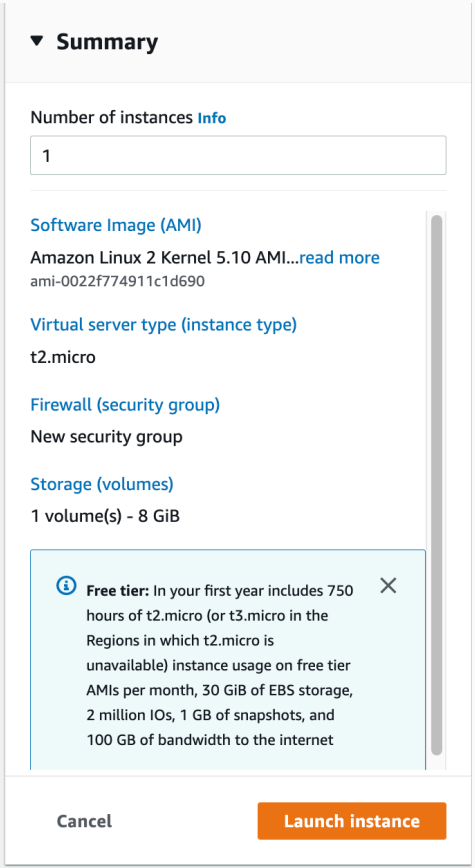
☑ Paste setup.sh commands here as it is from previous slide

User data Info

```
#!/bin/bash
sudo yum update -y && sudo amazon-linux-extras install -y docker && sudo service docker start && sudo usermod -a -G docker ec2-user && sudo chkconfig docker on && sudo yum install -y git && sudo curl -L https://github.com/docker/compose/releases/latest/download/docker-compose-$(uname -s)-$(uname -m) -o /usr/local/bin/docker-compose && sudo chmod +x /usr/local/bin/docker-compose && docker-compose version && sudo curl -L https://cybertek-shared.s3.amazonaws.com/docker-compose.yml -o /home/ec2-user/docker-compose.yml && sudo reboot
```

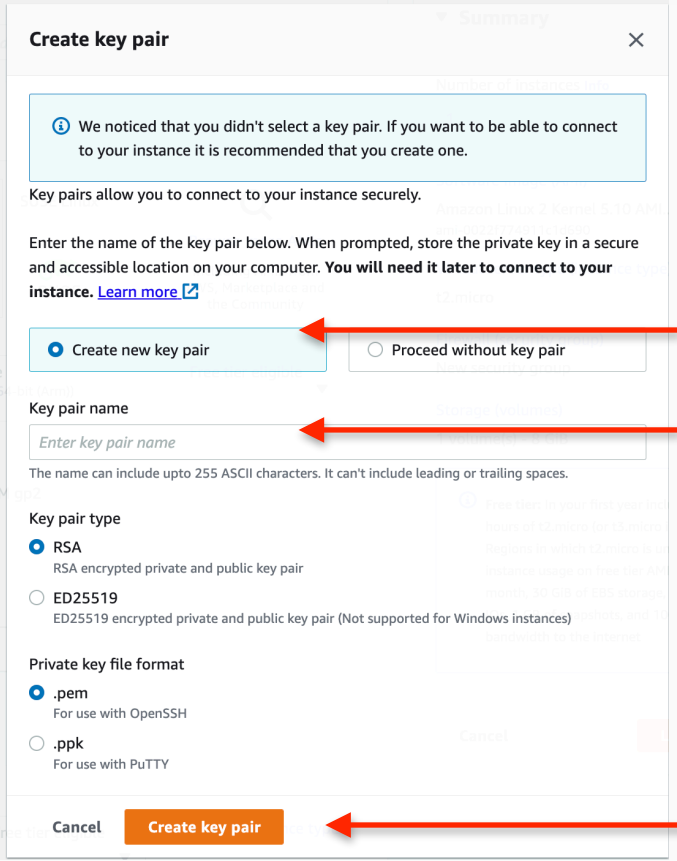
☐ User data has already been base64 encoded

Launch EC2



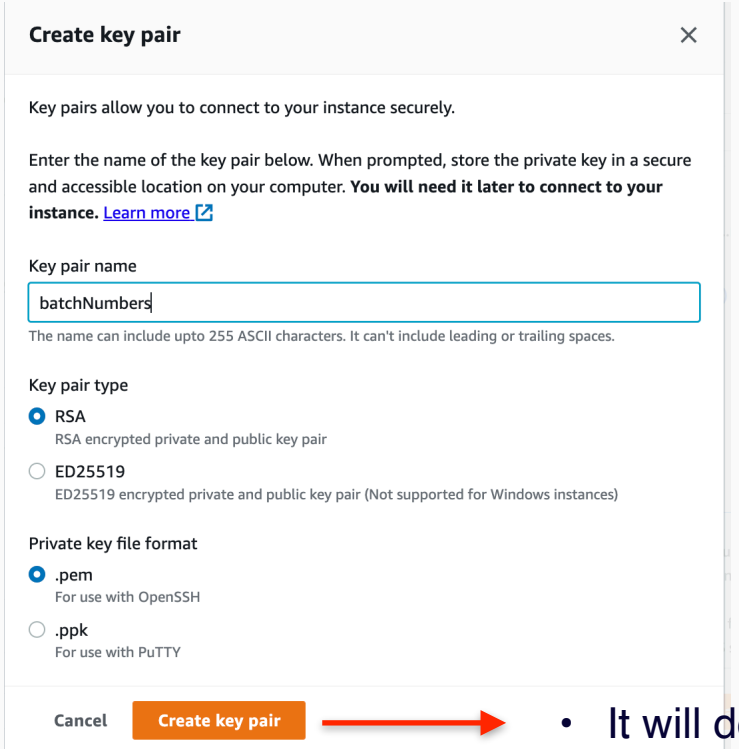
- Launch Instance

Launch EC2

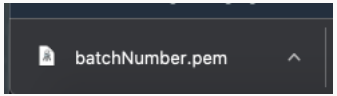


- Create new key pair
- Give a key pair name (batchNumber)
- Create key pair

Launch EC2

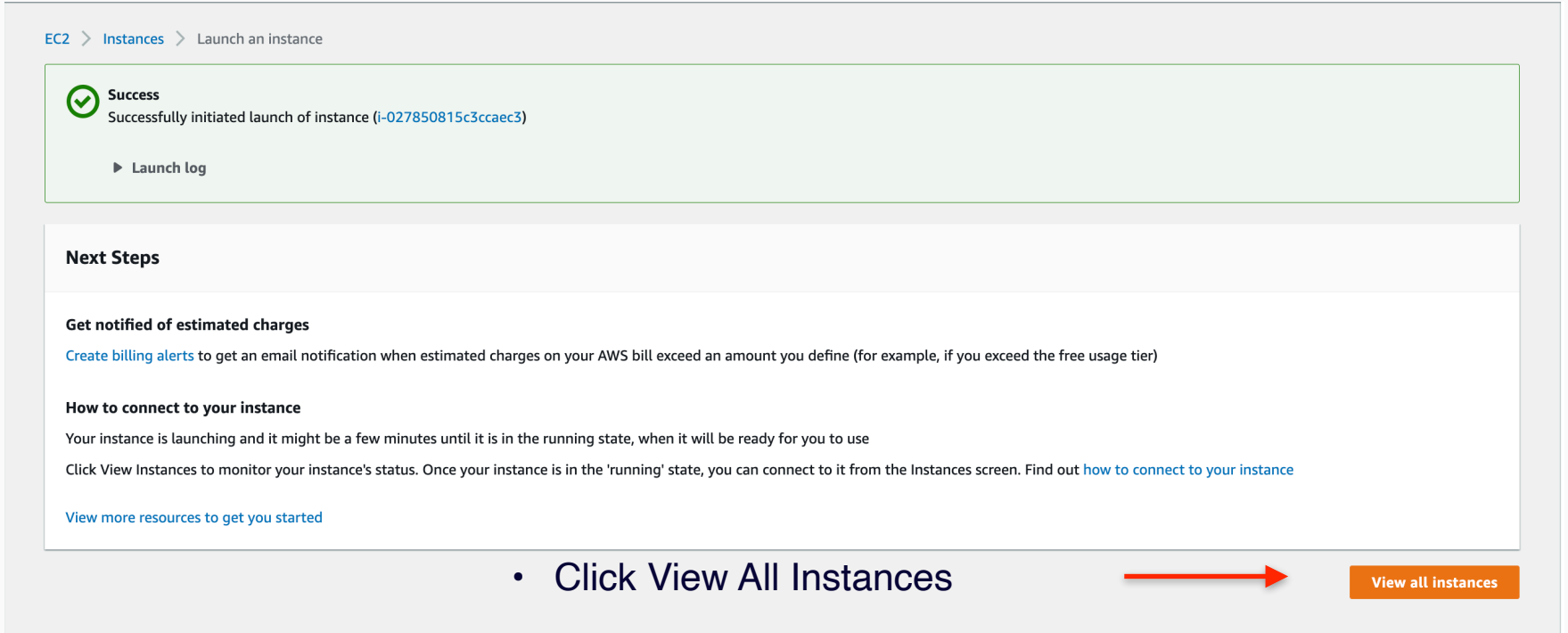


- It will download it for you



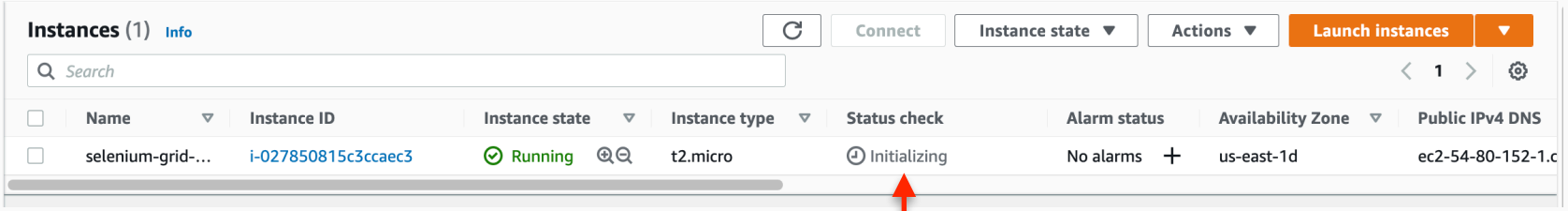
Put this file into Desktop

Launch EC2

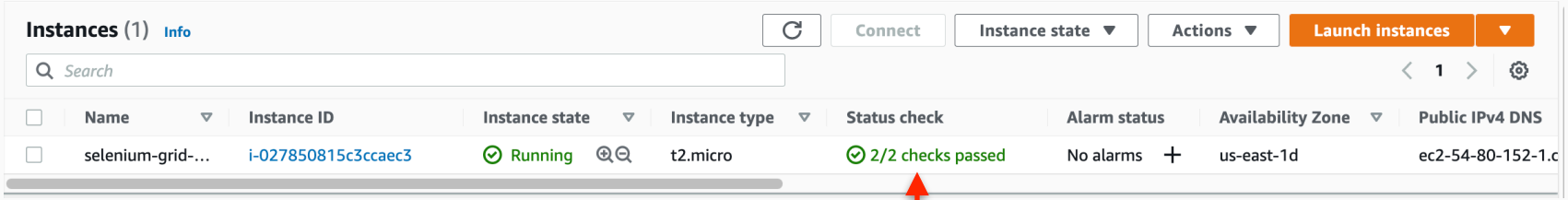


- Click View All Instances

Launch EC2



Wait for 2/2 checks passed



READY TO USE

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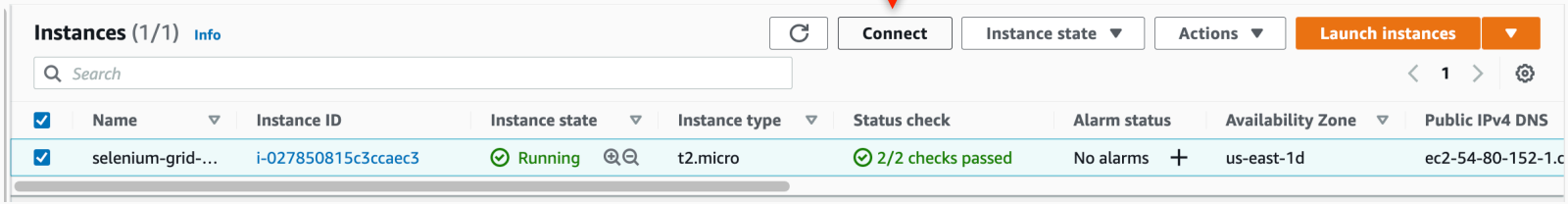
CONNECTION

Connection

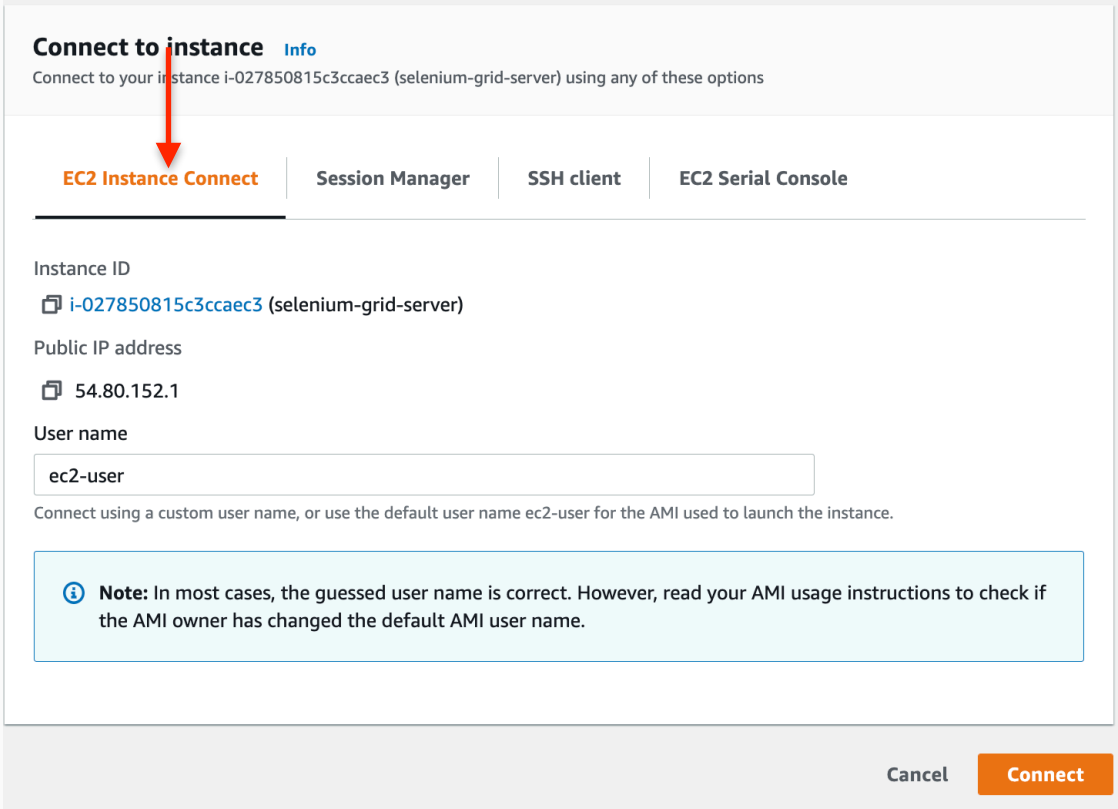
- Click CONNECT



- Select Server

Connection

- Select EC2 Instance Connect



- Click CONNECT

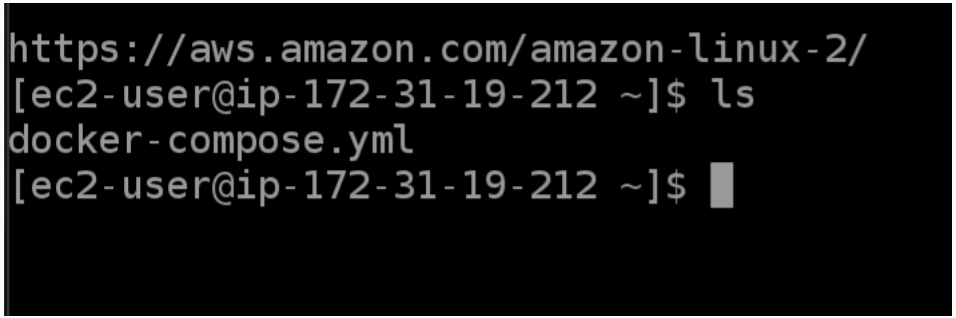
Connection

- Welcome to Linux SERVER

Run Docker Containers

- Type here docker -v to see version

- Type here ls to see docker file



Run Selenium Grid

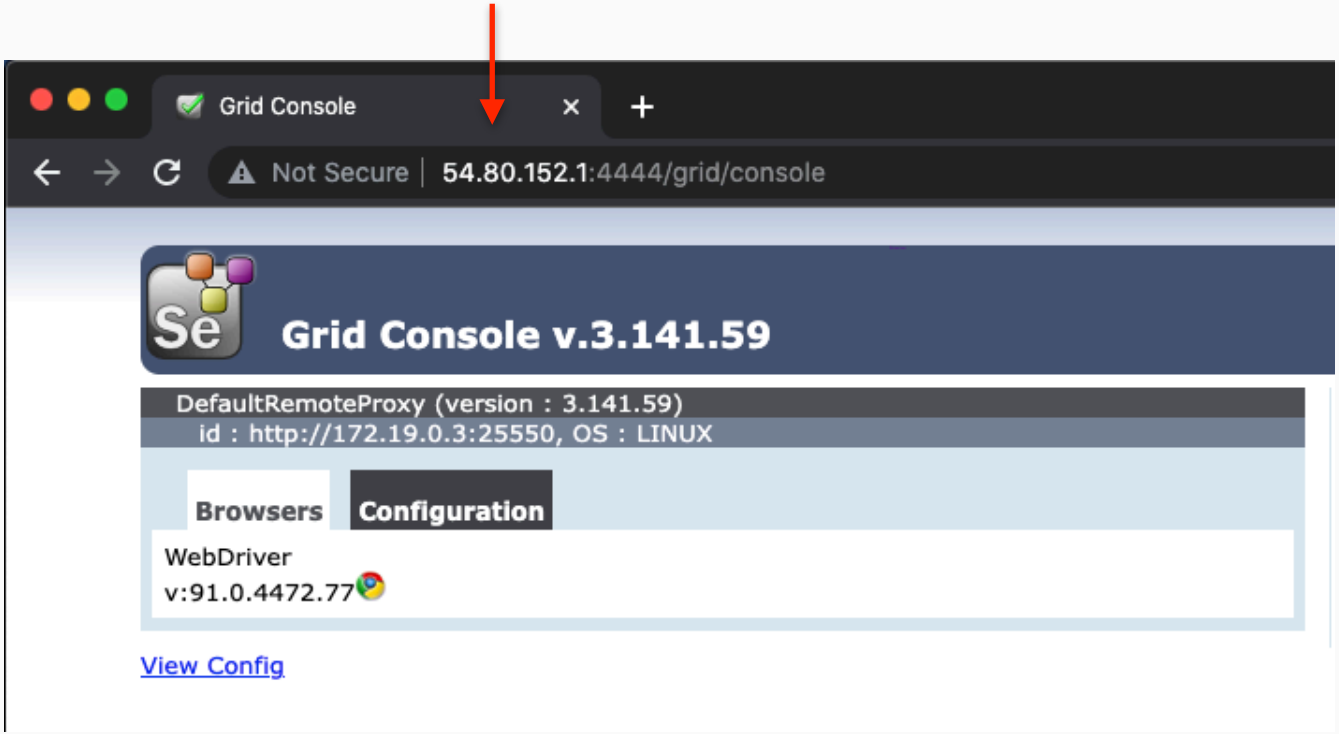
- docker-compose up -d

```
ec2-user@ip-172-31-19-212 ~]$ docker-compose up -d
+] Running 3/3
 ⠿ Network ec2-user_default     Created
 ⠿ Container ec2-user-hub-1     Started
 ⠿ Container ec2-user-chrome-1  Started
```

```
[+] Running 3/3
 ⠿ Network ec2-user_default     Created
 ⠿ Container ec2-user-hub-1     Started
 ⠿ Container ec2-user-chrome-1  Started
[ec2-user@ip-172-31-19-212 ~]$
```

Check Grid Console

http://server-ip:4444/grid/console



Stop Selenium Grid

- ☑ docker-compose down

```
ec2-user@ip-172-31-19-212 ~]$ docker-compose down
+] Running 3/2
⠿ Container ec2-user-chrome-1  Removed
⠿ Container ec2-user-hub-1     Removed
⠿ Network ec2-user_default     Removed
ec2-user@ip-172-31-19-212 ~]$
```

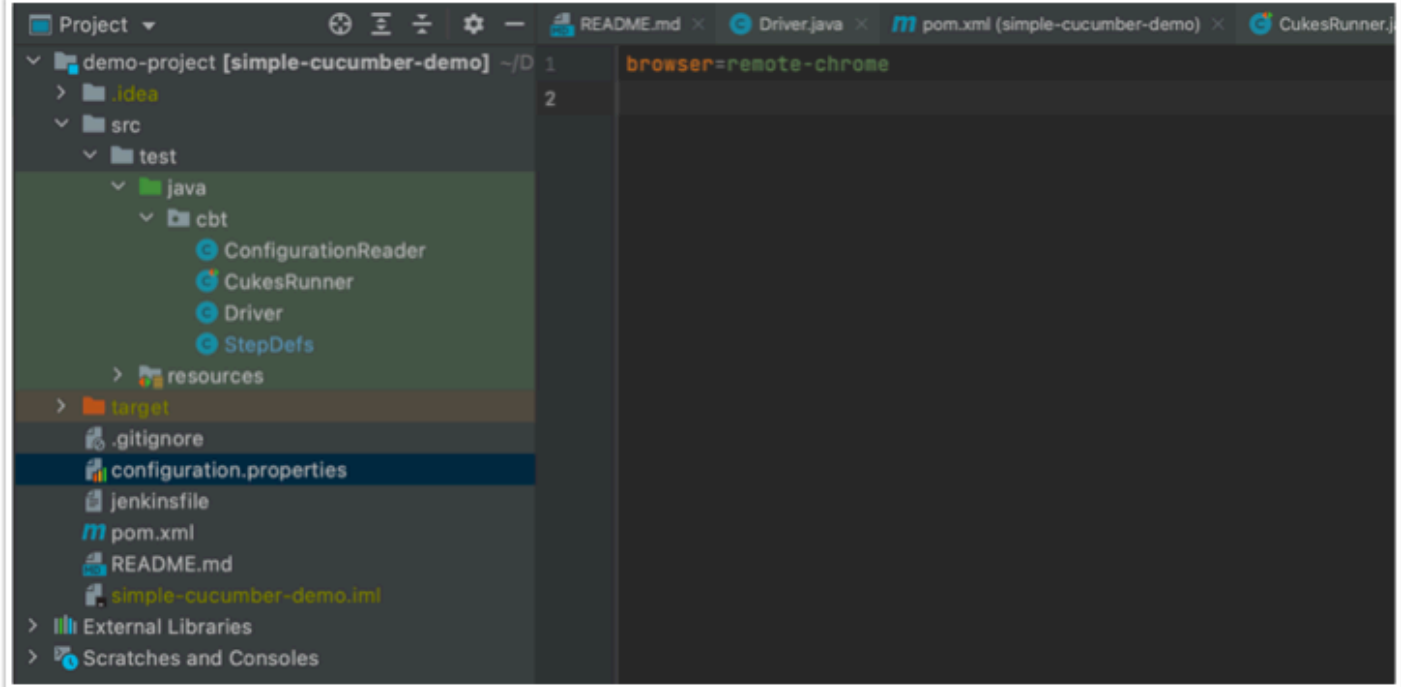
Driver Setup

Add new case for remote-chrome and use your gridAddress from EC2

```
switch (browser) {
    case "remote-chrome":
        try {
            // assign your grid server address
            String gridAddress = "54.235.53.73";
            URL url = new URL( spec: "http://" + gridAddress + ":4444/wd/hub");
            DesiredCapabilities desiredCapabilities = new DesiredCapabilities();
            desiredCapabilities.setBrowserName("chrome");
            driver = new RemoteWebDriver(url, desiredCapabilities);
        } catch (Exception e) {
            e.printStackTrace();
        }
        break;
```

Driver Setup

Update properties file to use remote-chrome



CYDEO

DOCKER

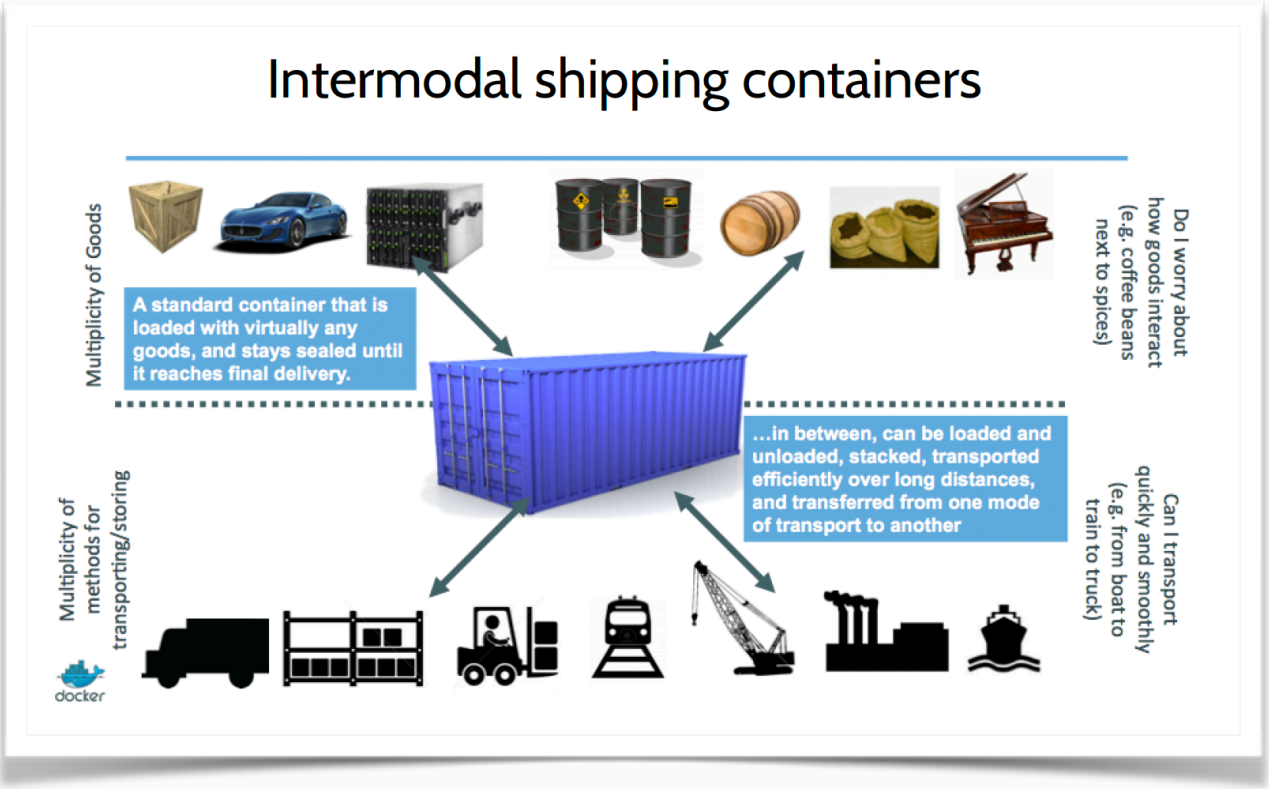
Docker

Docker is a tool designed to make it easier to create, deploy, and run applications by using containers. Containers allow a developer to package up an application with all of the parts it needs, such as libraries and other dependencies, and deploy it as one package. By doing so, thanks to the container, the developer can rest assured that the application will run on any other Linux machine regardless of any customized settings that machine might have that could differ from the machine used for writing and testing the code.

Docker

In simpler words, Docker is a tool that allows developers, sys-admins etc. to easily deploy their applications in a sandbox (called *containers*) to run on the host operating system i.e. Linux. The key benefit of Docker is that it allows users to **package an application with all of its dependencies into a standardized unit** for software development. Unlike virtual machines, containers do not have high overhead and hence enable more efficient usage of the underlying system and resources.

Docker


Intermodal shipping containers
Multiplicity of Goods
A standard container that is loaded with virtually any goods, and stays sealed until it reaches final delivery.
Do I worry about how goods interact (e.g. coffee beans next to spices)
...in between, can be loaded and unloaded, stacked, transported efficiently over long distances, and transferred from one mode of transport to another
Multiplicity of methods for transporting/storing
Can I transport quickly and smoothly (e.g. from boat to train to truck)
docker

Docker

This spawned a Shipping Container Ecosystem!

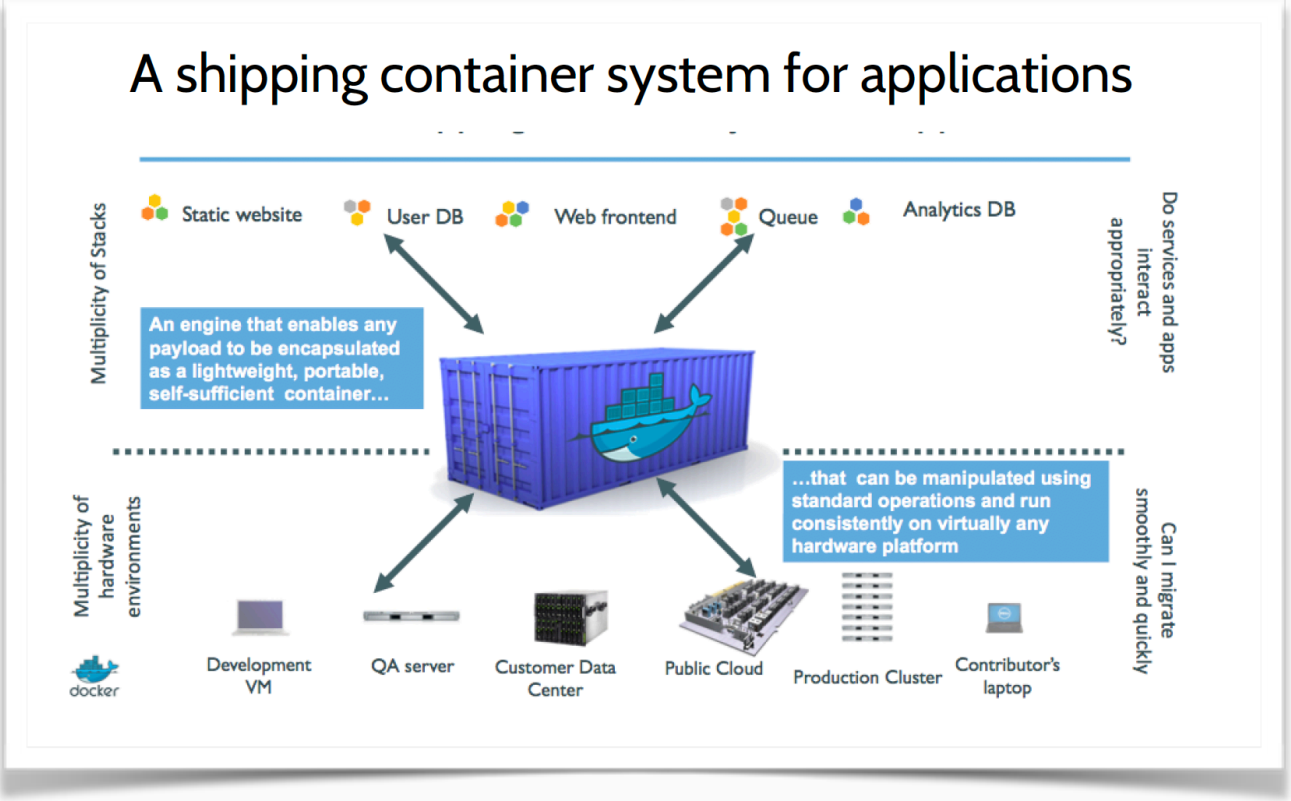
- 90% of all cargo now shipped in a standard container
- Order of magnitude reduction in cost and time to load and unload ships
- Massive reduction in losses due to theft or damage
- Huge reduction in freight cost as percent of final goods (from >25% to <3%)

→ massive globalization

- 5000 ships deliver 200M containers per year

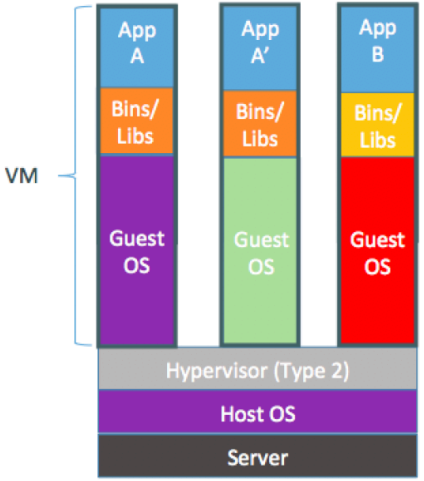
docker

Docker


A shipping container system for applications
Multiplicity of Stacks
Static website
User DB
Web frontend
Queue
Analytics DB
Do services and apps interact appropriately?
An engine that enables any payload to be encapsulated as a lightweight, portable, self-sufficient container...
...that can be manipulated using standard operations and run consistently on virtually any hardware platform
Multiplicity of hardware environments
Can I migrate smoothly and quickly
docker
Development VM
QA server
Customer Data Center
Public Cloud
Production Cluster
Contributor's laptop

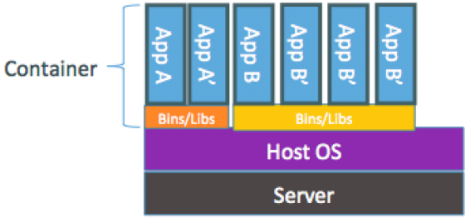
Docker

Step 1: containers as lightweight VMs



Containers are isolated, but share OS kernel and, where appropriate, bins/libraries

...result is significantly faster deployment, much less overhead, easier migration, faster restart



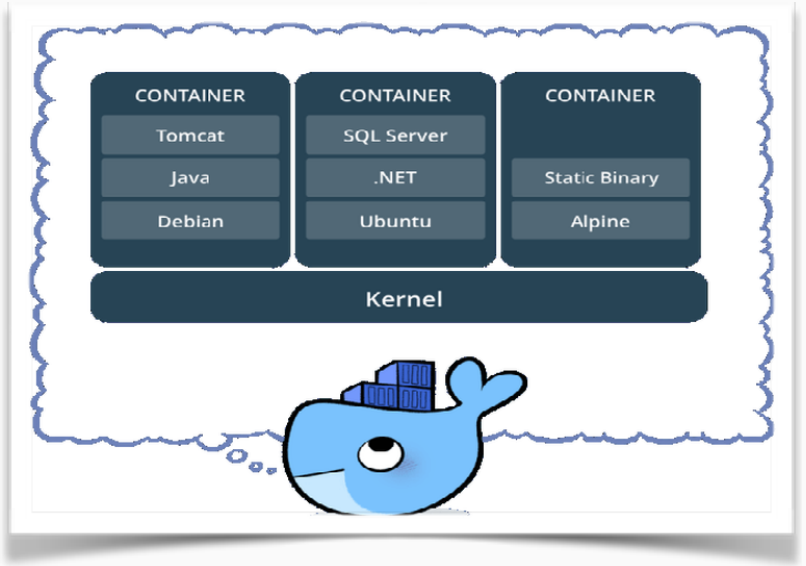
docker

VMs vs Containers

VMs	Containers
Heavyweight	Lightweight
Limited performance	Native performance
Each VM runs in its own OS	All containers share the host OS
Hardware-level virtualization	OS virtualization
Startup time in minutes	Startup time in milliseconds
Allocates required memory	Requires less memory space
Fully isolated and hence more secure	Process-level isolation, possibly less secure

Docker Container

- **Container** is built from an **image**.
- A container consists of an operating system, user-added **files**, and **meta-data**.
- That image tells Docker what the container **holds**, what process to **run** when the container is launched, and a variety of other **configuration** data.
- The Docker image is **read-only**.
- When Docker runs a container from an image, it adds a read-write layer on top of the image (using a union file system as we saw earlier) in which your application can then run.



Docker Compose

Compose is a tool for defining and running multi-container Docker applications. With Compose, you use a YAML file to configure your application's services.

Then, with a single command, you create and start all the services from your configuration. To learn more about all the features of Compose, see the list of features.

Compose works in all environments: production, staging, development, testing, as well as CI workflows. You can learn more about each case in Common Use Cases.

```
version: '2.0'
services:
  web:
    build: .
    ports:
    - "5000:5000"
    volumes:
    - .:/code
    - logvolume01:/var/log
    links:
    - redis
  redis:
    image: redis
volumes:
  logvolume01: {}
```

Some Docker Commands

```
docker build -t friendlyname .  # Create image using this directory's Dockerfile
docker run -p 4000:80 friendlyname  # Run "friendlyname" mapping port 4000 to 80
docker run -d -p 4000:80 friendlyname         # Same thing, but in detached mode
docker ps                                 # See a list of all running containers
docker stop <hash>                     # Gracefully stop the specified container
docker ps -a           # See a list of all containers, even the ones not running
docker kill <hash>                   # Force shutdown of the specified container
docker rm <hash>              # Remove the specified container from this machine
docker rm $(docker ps -a -q)           # Remove all containers from this machine
docker images -a                               # Show all images on this machine
docker rmi <imagename>            # Remove the specified image from this machine
docker rmi $(docker images -q)             # Remove all images from this machine
docker login             # Log in this CLI session using your Docker credentials
docker tag <image> username/repository:tag  # Tag <image> for upload to registry
docker push username/repository:tag            # Upload tagged image to registry
docker run username/repository:tag                   # Run image from a registry
```