



Deep Learning - Recitation 1

# What is Amazon Web Services (AWS)

Cloud Based Computational Resource



# What does AWS offer?

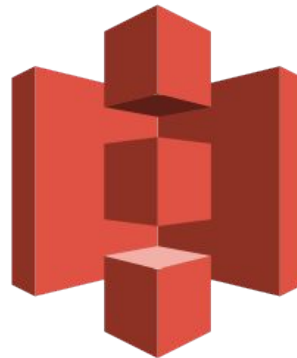
Many many things but here are the two main things to care about for DL...

EC2 - Compute Resources



Train the models

S3 - Data Storage



Store training data,  
models, etc

# EC2 - What kinds of machines are available?

Different types and different subtypes (you can mix and match what you want)...  
Here are the ones you may care about

## General Purpose:

**T2 - Webservices**

M3/M4 - Databases,  
Fileservers, etc

## Compute Optimized:

C2 - Multiplayer Gaming  
Servers, scientific  
computing

C3/C4 - Ad serving  
machines, MMO servers,  
etc

## GPU Optimized:

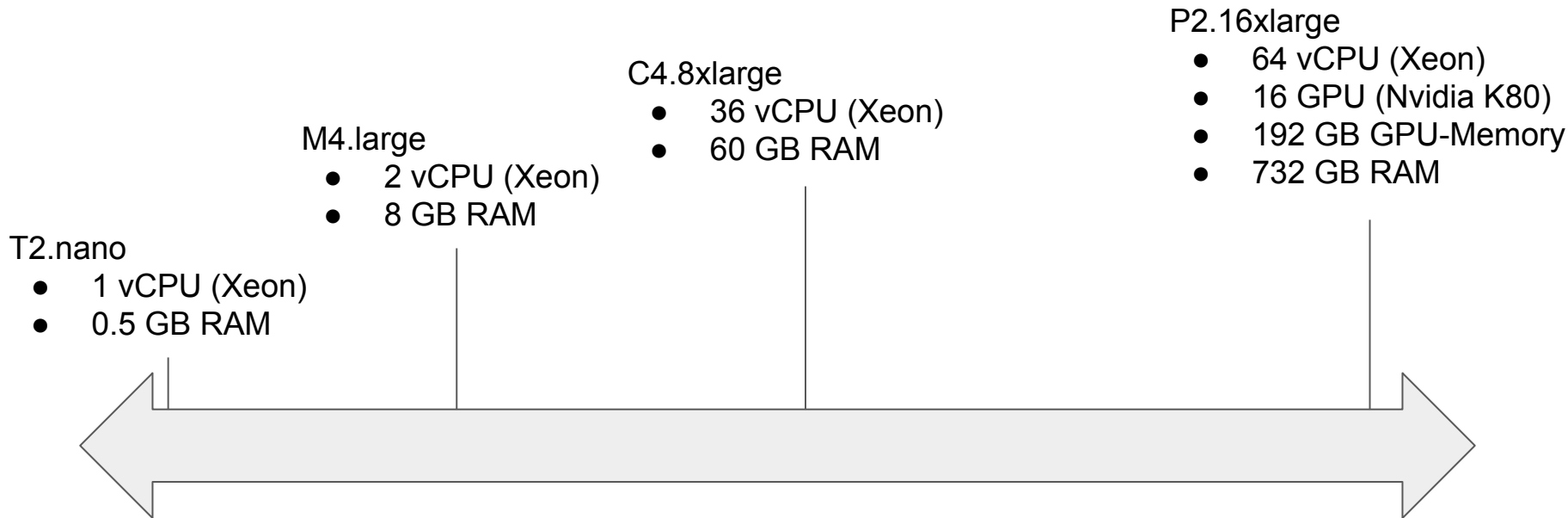
**P3/P2 - Machine  
Learning**

G3 - Fluid dynamics,  
graphics rendering, etc

Machine sizes - nano, micro, medium, large, xlarge, 2xlarge, ..., 16xlarge

# EC2 - What kinds of machines are available?

Different types and different subtypes (you can mix and match what you want)...



# EC2 - So what do we put on these machines?

## Amazon Machine Instances (AMIs)

- Virtual images of existing machines
  - You can create an image of your machine
    - Transfer it to a different machine
    - Save it as a backup
- Use cases
  - Software packages that are incredibly difficult to install
  - Need to create multiple different machines with the exact same data for parameters servers
  - Load balancing - create a new machine with the same AMI to be used in a different region depending on load

Now you know what AWS is and what you  
can do with it

Create An Account:

<https://aws.amazon.com>

Click “Sign Up” in the top right and follow the instructions

(If you already have an account you can skip this step)



# Start Building on AWS Today

Whether you're looking for compute power, database storage, content delivery or other functionality, AWS has the services to help you build sophisticated applications with increased flexibility, scalability and reliability.

[Create A Free Account](#)[View AWS Free Tier Details »](#)

**AWS re:Invent**

**AWS re:Invent Live Streams**

We'll send you a reminder with more information closer to the event

[Register Now](#)

#### Broad & Deep Platform

AWS has more than 90 services and is continually launching new features and functionality.

[Learn more »](#)

#### Customer Success

Explore how millions of active customers every month are innovating with AWS.

[Learn more »](#)

#### Pace of Innovation

The AWS Cloud platform expands daily. Take a look at what we launched this week.

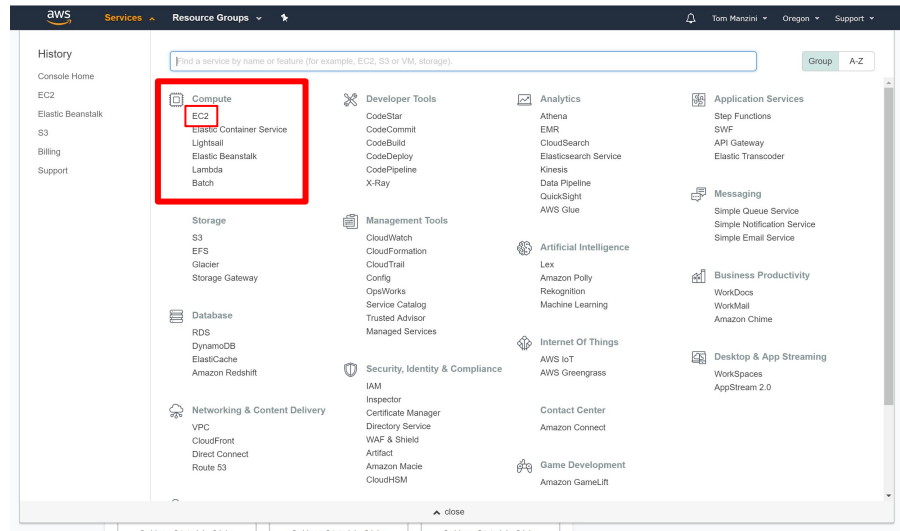
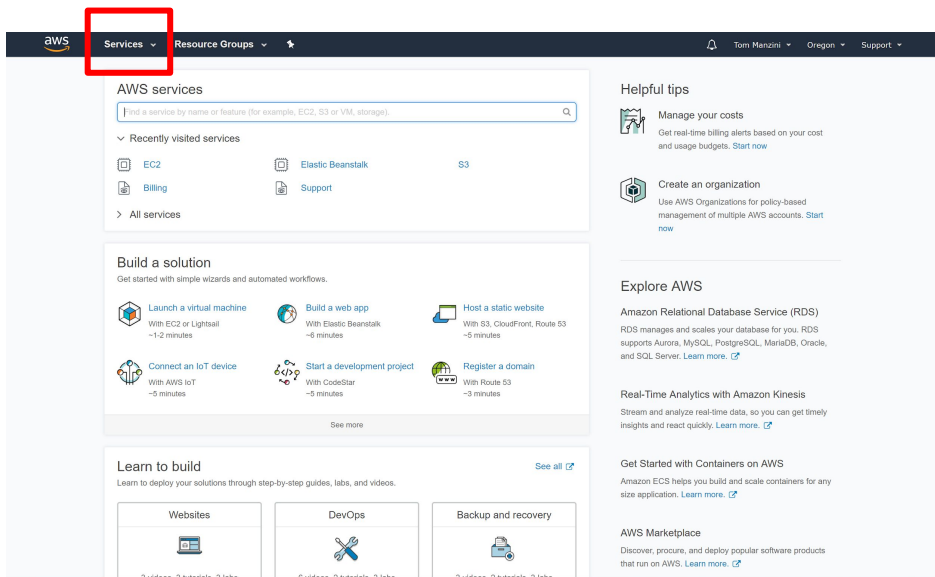
[Learn more »](#)

#### Global Infrastructure

AWS operates 43 Availability Zones within 16 geographic Regions around the world, with 11 more Availability Zones and 4 more Regions coming online soon.

[Learn more »](#)

# Let's set up a basic machine



Then, under “Compute”, select “EC2”

Click on “Services” in the top left

# Let's set up a basic machine

Make sure you  
are in the “US  
West (Oregon)”  
region

Then Click on  
“Running  
Instances”

The screenshot shows the AWS Management Console interface. In the top navigation bar, the 'Oregon' region is selected and highlighted with a red box. The main content area is titled 'Resources' and shows a list of EC2 resources in the US West (Oregon) region. The '0 Running Instances' link is highlighted with a red box. Below this, there is a 'Create Instance' section with a 'Launch Instance' button. The 'Service Health' section shows that the US West (Oregon) service is operating normally. The 'Scheduled Events' section shows no events. The right sidebar contains 'Account Attributes', 'Additional Information', and 'AWS Marketplace' sections.

**Resources**

You are using the following Amazon EC2 resources in the US West (Oregon) region:

- 0 Running Instances
- 0 Elastic IPs
- 0 Dedicated Hosts
- 4 Snapshots
- 1 Volumes
- 0 Load Balancers
- 2 Key Pairs
- 9 Security Groups
- 0 Placement Groups

EC2 Spot. Save up to 90% off On-Demand Prices. Turbo Boost your Workloads. [Get started with Amazon EC2 Spot Instances.](#)

**Create Instance**

To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 Instance.

[Launch Instance](#)

Note: Your instances will launch in the US West (Oregon) region

**Service Health**

**Service Status:**

- US West (Oregon): This service is operating normally

**Availability Zone Status:**

- us-west-2a: Availability zone is operating normally
- us-west-2b: Availability zone is operating normally
- us-west-2c: Availability zone is operating normally

[Service Health Dashboard](#)

**Scheduled Events**

**US West (Oregon):**

- No events

**Account Attributes**

**Supported Platforms**

- VPC

**Default VPC**

vpc-f6d6a891

**Resource ID length management**

**Additional Information**

- [Getting Started Guide](#)
- [Documentation](#)
- [All EC2 Resources](#)
- [Forums](#)
- [Pricing](#)
- [Contact Us](#)

**AWS Marketplace**

Find free software trial products in the AWS Marketplace from the [EC2 Launch Wizard](#). Or try these popular AMIs:

[Barracuda NextGen Firewall F-Series - PAYG](#)

Provided by Barracuda Networks, Inc.  
Rating ★★★★★  
Starting from \$0.60/hr or from \$4,599/yr (12% savings) for software + AWS usage fees  
[View all Software Infrastructure](#)

[Splunk Insights for AWS Cloud Monitoring](#)

Provided by Splunk Inc.  
Rating ★★★★★  
Bring Your Own License + AWS usage fees  
[View all Developer Tools](#)

**Feedback** **English (US)**

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# Let's set up a basic machine

The screenshot shows the AWS Management Console interface. The top navigation bar includes the AWS logo, 'Services', 'Resource Groups', and user information (Tom Manzini, Oregon, Support). The left sidebar contains a navigation menu with categories like INSTANCES, IMAGES, ELASTIC BLOCK STORE, NETWORK & SECURITY, and LOAD BALANCING. The main content area is titled 'Launch Instance' and shows a table of instances. A single instance is listed with ID 'i-02d40dd9b0a1975...', type 't2.micro', availability zone 'us-west-2a', and state 'stopped'. Below the table, the details for this instance are displayed in a tabbed view under the 'Description' tab. The details are organized into two columns, showing various attributes like Instance ID, state, type, availability zone, security groups, VPC ID, subnet ID, network interfaces, and lifecycle information.

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)
	i-02d40dd9b0a1975...	t2.micro	us-west-2a	stopped		None	

Description	
Instance ID	i-02d40dd9b0a197529
Instance state	stopped
Instance type	t2.micro
Elastic IPs	
Availability zone	us-west-2a
Security groups	launch-wizard-1. <a href="#">view inbound rules</a>
Scheduled events	
AMI ID	Loading ami-92f420ea...
Platform	-
IAM role	-
Key pair name	tmanzini-personal
Owner	180942078756
Launch time	November 7, 2017 at 11:35:49 PM UTC-5 (448 hours)
Termination protection	-
Lifecycle	normal
Monitoring	basic
Alarm status	None
Kernel ID	-
Public DNS (IPv4)	-
IPv4 Public IP	-
IPv6 IPs	-
Private DNS	ip-172-31-45-0.us-west-2.compute.internal
Private IPs	172.31.45.0
Secondary private IPs	
VPC ID	vpc-f6d6a891
Subnet ID	subnet-18ed4551
Network interfaces	eth0
Source/dest. check	True
EBS-optimized	False
Root device type	ebs
Root device	/dev/sda1
Block devices	/dev/sda1
Elastic GPU	-
Elastic GPU type	-
Elastic GPU status	-

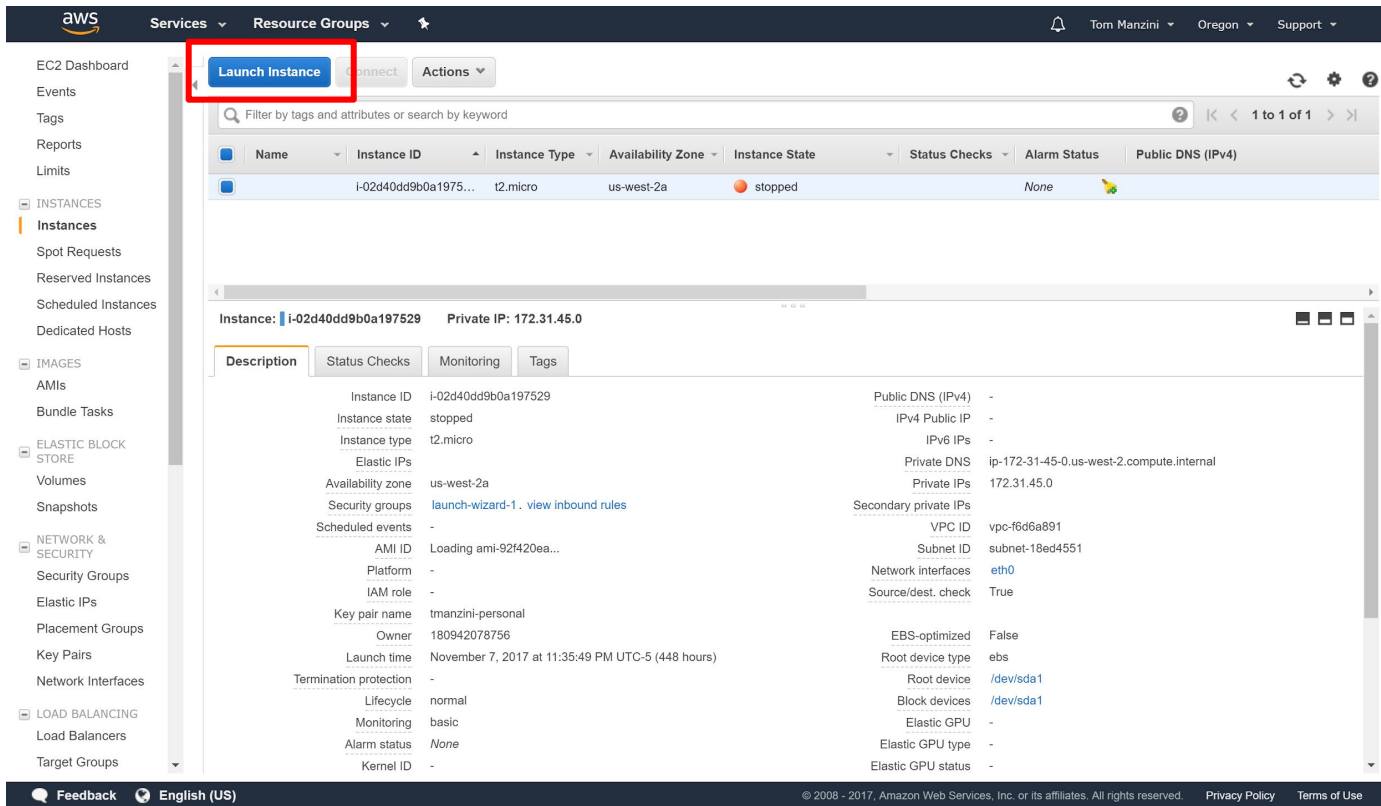
Here you see your current instances

(I have 1 that is stopped, you shouldn't have any)

Here are the details of that instance

# Let's set up a basic machine

Click “Launch Instance”




The screenshot displays the AWS Management Console interface. The top navigation bar includes the AWS logo, 'Services', 'Resource Groups', and user information (Tom Manzini, Oregon, Support). The left sidebar lists various AWS services, with 'INSTANCES' and 'Instances' highlighted. The main content area shows the 'Launch Instance' button, which is highlighted with a red box. Below this, a table lists existing instances. The instance 'i-02d40dd9b0a197529' is selected, and its details are shown in the 'Description' tab. The details include Instance ID, Instance state (stopped), Instance type (t2.micro), Availability zone (us-west-2a), Security groups, and various network and storage configurations.

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)
	i-02d40dd9b0a197529	t2.micro	us-west-2a	stopped		None	

Instance: i-02d40dd9b0a197529 Private IP: 172.31.45.0

Description		Status Checks	Monitoring	Tags
Instance ID	i-02d40dd9b0a197529	Public DNS (IPv4)	-	
Instance state	stopped	IPv4 Public IP	-	
Instance type	t2.micro	IPv6 IPs	-	
Elastic IPs		Private DNS	ip-172-31-45-0.us-west-2.compute.internal	
Availability zone	us-west-2a	Private IPs	172.31.45.0	
Security groups	launch-wizard-1 - view inbound rules	Secondary private IPs		
Scheduled events	-	VPC ID	vpc-f6d6a891	
AMI ID	Loading ami-92f420ea...	Subnet ID	subnet-18ed4551	
Platform	-	Network interfaces	eth0	
IAM role	-	Source/dest. check	True	
Key pair name	tmanzini-personal	EBS-optimized	False	
Owner	180942078756	Root device type	ebs	
Launch time	November 7, 2017 at 11:35:49 PM UTC-5 (448 hours)	Root device	/dev/sda1	
Termination protection	-	Block devices	/dev/sda1	
Lifecycle	normal	Elastic GPU	-	
Monitoring	basic	Elastic GPU type	-	
Alarm status	None	Elastic GPU status	-	
Kernel ID	-			

# Let's set up a basic machine


 **Services** ▾ **Resource Groups** ▾ ⭐

🔔 DavidLBick ▾ Oregon ▾ Support ▾


1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

## Step 1: Choose an Amazon Machine Image (AMI)


Cancel and Exit

**Amazon RDS**  
of commercial databases. [Learn more about RDS](#)


Launch a database using RDS

**Ubuntu Server 16.04 LTS (HVM), SSD Volume Type** - ami-076e276d85f524150 (64-bit x86) / ami-05e1b2aec3b47890f (64-bit Arm)  
**Free tier eligible**  
Ubuntu Server 16.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).  
Root device type: ebs    Virtualization type: hvm    ENA Enabled: Yes


Select  
☒ 64-bit (x86)  
☐ 64-bit (Arm)

**Microsoft Windows Server 2016 Base** - ami-019e99815e07ceb49  
**Windows**  
**Free tier eligible**  
Microsoft Windows 2016 Datacenter edition. [English]  
Root device type: ebs    Virtualization type: hvm    ENA Enabled: Yes


Select  
64-bit (x86)

**Deep Learning AMI (Ubuntu) Version 20.0** - ami-0d0ff0945ae093aea  
With latest deep learning frameworks pre-installed: MXNet, TensorFlow, PyTorch, Keras, Chainer, Caffe/2, Theano & CNTK, configured with NVIDIA CUDA, cuDNN, NCCL & Intel MKL-DNN. For a fully managed experience, check: <https://aws.amazon.com/sagemaker>  
Root device type: ebs    Virtualization type: hvm    ENA Enabled: Yes

Select  
64-bit (x86)

**Deep Learning AMI (Amazon Linux) Version 20.0** - ami-0305a0d7a68489e58  
With latest deep learning frameworks pre-installed: MXNet, TensorFlow, PyTorch, Keras, Chainer, Caffe/2, Theano & CNTK, configured with NVIDIA CUDA, cuDNN, NCCL & Intel MKL-DNN. For a fully managed experience, check: <https://aws.amazon.com/sagemaker>  
Root device type: ebs    Virtualization type: hvm    ENA Enabled: Yes

Select  
64-bit (x86)

**Deep Learning Base AMI (Ubuntu) Version 14.0** - ami-015eb46ac552e435f  
Comes with foundational platform of NVidia CUDA, cuDNN, NCCL, GPU Drivers, Intel MKL-DNN and other system libraries to deploy your own custom deep learning environment. For a fully managed experience, check: <https://aws.amazon.com/sagemaker>  
Root device type: ebs    Virtualization type: hvm    ENA Enabled: Yes

Select  
64-bit (x86)

Feedback

English (US)

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# Let's set up a basic machine

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

## Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: All instance types Current generation Show/Hide Columns

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance	IPv6 Support
<input type="checkbox"/>	General purpose	t2.nano	1	0.5	EBS only	-	Low to Moderate	Yes
<input checked="" type="checkbox"/>	General purpose	t2.micro Free tier eligible	1	1	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	General purpose	t2.small	1	2	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	General purpose	t2.medium	2	4	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	General purpose	t2.large	2	8	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	General purpose	t2.xlarge	4	16	EBS only	-	Moderate	Yes
<input type="checkbox"/>	General purpose	t2.2xlarge	8	32	EBS only	-	Moderate	Yes
<input type="checkbox"/>	General purpose	m4.large	2	8	EBS only	Yes	Moderate	Yes
<input type="checkbox"/>	General purpose	m4.xlarge	4	16	EBS only	Yes	High	Yes
<input type="checkbox"/>	General purpose	m4.2xlarge	8	32	EBS only	Yes	High	Yes
<input type="checkbox"/>	General purpose	m4.4xlarge	16	64	EBS only	Yes	High	Yes

Cancel

Previous

Review and Launch

Next: Configure Instance Details

Select the t2-micro because it is “free tier eligible”

Select Next

# Let's set up a basic machine

aws

Services ▾ Resource Groups ▾ ☆

🔔 Tom Manzini ▾ Oregon ▾ Support ▾

[1. Choose AMI](#) [2. Choose Instance Type](#) [3. Configure Instance](#) [4. Add Storage](#) [5. Add Tags](#) [6. Configure Security Group](#) [7. Review](#)

## Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances ⓘ

1

[Launch into Auto Scaling Group ⓘ](#)

Purchasing option ⓘ

☐ Request Spot instances

Network ⓘ

vpc-f6d6a891 (default) [Create new VPC](#)

Subnet ⓘ

No preference (default subnet in any Availability Zone) [Create new subnet](#)

Auto-assign Public IP ⓘ

Use subnet setting (Enable)

IAM role ⓘ

None [Create new IAM role](#)

Shutdown behavior ⓘ

Stop

Enable termination protection ⓘ

☐ Protect against accidental termination

Monitoring ⓘ

☐ Enable CloudWatch detailed monitoring  
[Additional charges apply.](#)

Tenancy ⓘ

Shared - Run a shared hardware instance  
[Additional charges will apply for dedicated tenancy.](#)

▶ Advanced Details

Cancel

Previous

Review and Launch

Next: Add Storage

Feedback

English (US)

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Just select next



# Let's set up a basic machine

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

## Step 4: Add Storage

Your instance will be launched with the following storage device settings. You can attach additional EBS volumes and instance store volumes to your instance, or edit the settings of the root volume. You can also attach additional EBS volumes after launching an instance, but not instance store volumes. [Learn more](#) about storage options in Amazon EC2.

Volume Type	Device	Snapshot	Size (GiB)	Volume Type	IOPS	Throughput (MB/s)	Delete on Termination	Encrypted
Root	/dev/sda1	snap-0b9c16d670f4e2685	8	General Purpose SSD (GP2)	100 / 3000	N/A	<input checked="" type="checkbox"/>	Not Encrypted

Add New Volume

Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage. [Learn more](#) about free usage tier eligibility and usage restrictions.

Make sure you choose 8 GB of SSD Storage Space

Cancel

Previous

Review and Launch

Next: Add Tags

Select next

# Let's set up a basic machine

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

## Step 5: Add Tags

A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key = Name and value = Webserver.

A copy of a tag can be applied to volumes, instances or both.

Tags will be applied to all instances and volumes. [Learn more](#) about tagging your Amazon EC2 resources.

Key (127 characters maximum)	Value (255 characters maximum)	Instances ⓘ	Volumes ⓘ
------------------------------	--------------------------------	-------------	-----------

*This resource currently has no tags*

Choose the Add tag button or [click to add a Name tag](#).

Make sure your [IAM policy](#) includes permissions to create tags.

Add Tag (Up to 50 tags maximum)

Cancel

Previous

Review and Launch

Next: Configure Security Group

Select next

# Let's set up a basic machine

aws Services Resource Groups

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

## Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more](#) about Amazon EC2 security groups.

Assign a security group: ☐ Create a new security group ☒ Select an existing security group

Security group name:

Description:

Type	Protocol	Port Range	Source	Description
SSH	TCP	22	Custom 0.0.0.0/0	e.g. SSH for Admin Desktop
Custom TCP	TCP	8888	Anywhere 0.0.0.0/0, ::/0	e.g. SSH for Admin Desktop

Add Rule

**Warning**  
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.

Cancel Previous **Review and Launch**

Feedback English (US)

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Make sure you have an SSH rule set (This should be default) & a TCP rule for 8888 so you can connect your Ipython Notebook

You can set HTTP or other rules here too if you want

Select Review and Launch

# Let's set up a basic machine

Services

Resource Groups

Tom Manzini

Oregon

Support

1. Choose AMI

2. Choose Instance Type

3. Configure Instance

4. Add Storage

5. Add Tags

6. Configure Security Group

7. Review

## Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

Improve your instances' security. Your security group, launch-wizard-4, is open to the world.

Your instances may be accessible from any IP address. We recommend that you update your security group rules to allow access from known IP addresses only.

You can also open additional ports in your security group to facilitate access to the application or service you're running, e.g., HTTP (80) for web servers. [Edit security groups](#)

AMI Details

Edit AMI

Free tier eligible

Ubuntu Server 16.04 LTS (HVM), SSD Volume Type - ami-0a00ce72

Ubuntu Server 16.04 LTS (HVM),EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).  
Root Device Type: ebs    Virtualization type: hvm

Instance Type

Edit instance type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

Security Groups

Edit security groups

Security group name

launch-wizard-4

Description

launch-wizard-4 created 2017-11-26T17:20:35.221-05:00

Type ⓘ	Protocol ⓘ	Port Range ⓘ	Source ⓘ	Description ⓘ
SSH	TCP	22	0.0.0.0/0	

Instance Details

Edit instance details

Cancel

Previous

Launch

Feedback

English (US)

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Take one last look to make sure you are happy with everything...

Select Launch

# Let's set up a basic machine

This window allows you to create a private key to access your machine... when you ssh you will need it

Download your key and save it

Make sure it's in a place where it won't get lost - this key is the only way to connect to this specific instance!

Enter a name for your private key

### Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. [Learn more about removing existing key pairs from a public AMI.](#)

Create a new key pair

Key pair name

Demo\_key

Download Key Pair

You have to download the **private key file** (\*.pem file) before you can continue. **Store it in a secure and accessible location.** You will not be able to download the file again after it's created.

Cancel

Launch Instances

Now you have a basic AWS machine up  
and running

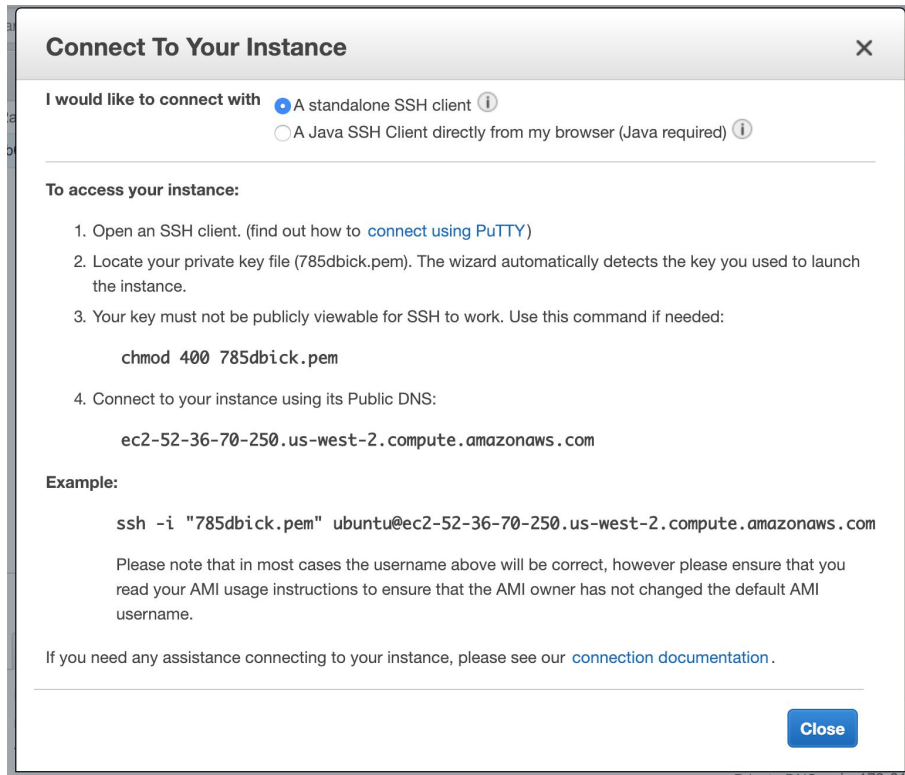
## Now let's connect to it

Your instance is now identified by its IP address. You can ssh to your instance by using this public IP address and your address key.

Let's start by changing the instance type. For student accounts, t2.micro is free-tier eligible, but let's still start on a t2.nano instance.

Remember your instance's IP address changes every time you restart it

# Connect to launched instance



Right-click and click connect

The ssh command shown includes the currently assigned IP address.

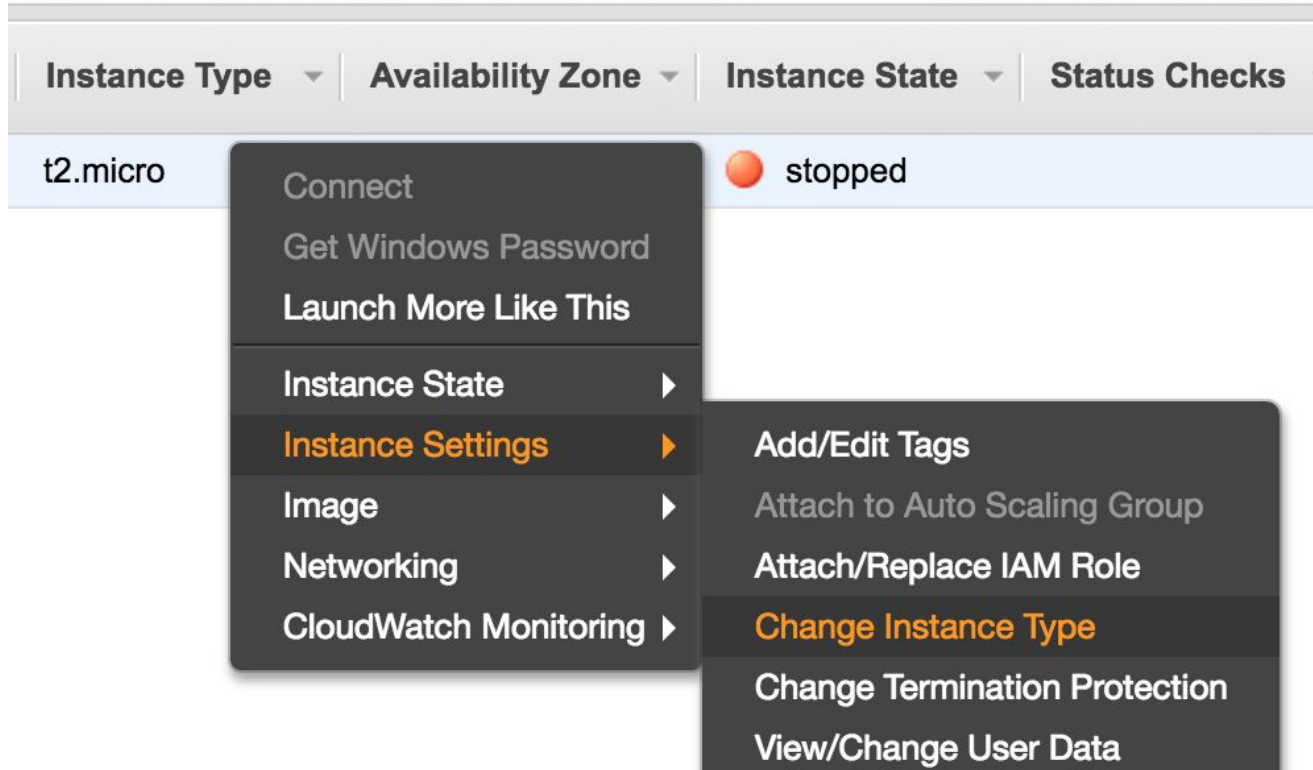
This will change at each launch!

Note - the ssh command will use the path to the key associated with this instance.

**Important** - will need to run chmod command every time you have a new key

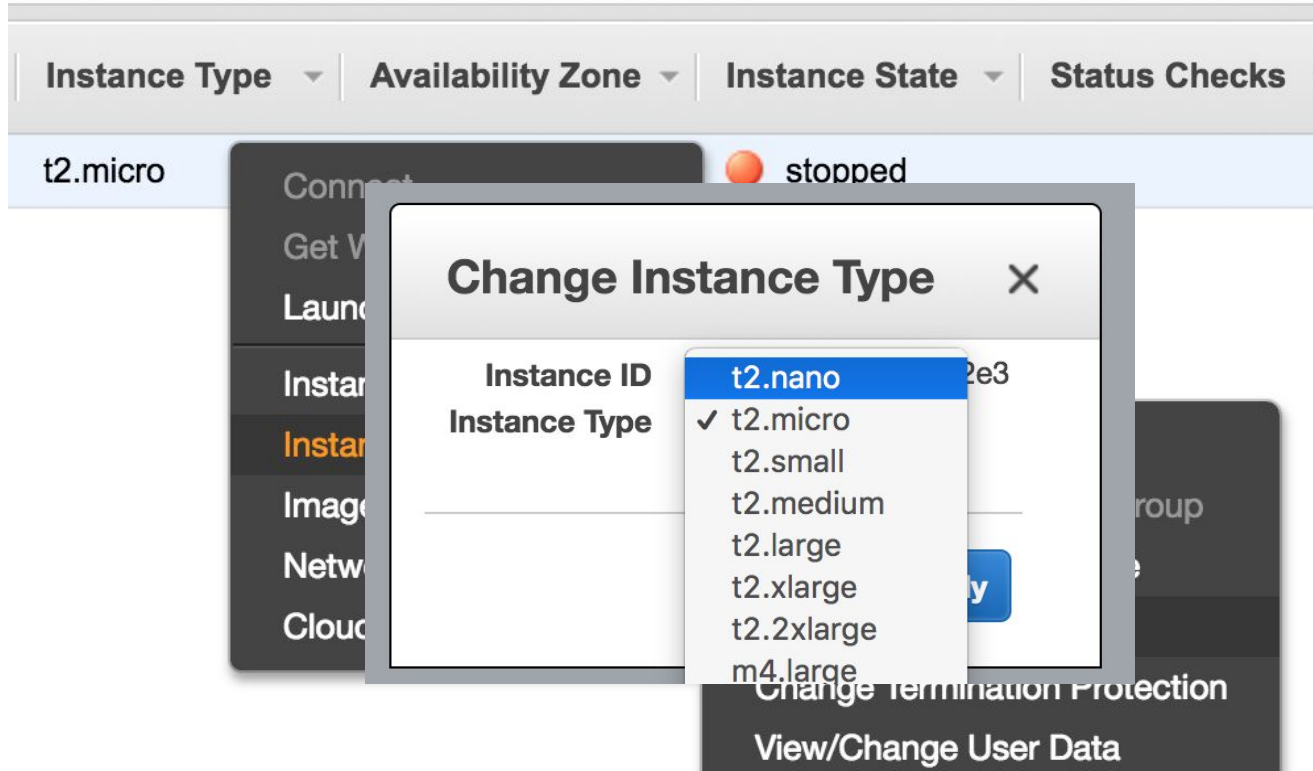


# Set instance type



Right-click on your instance under the instance tab, go to instance settings and change instance type to t2.nano

# Set instance type



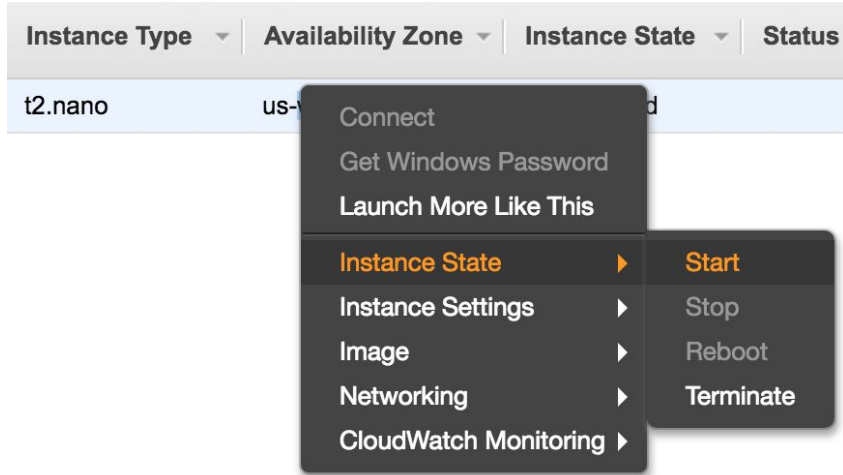
Right-click on your instance under the instance tab, go to instance settings and change instance type to t2.nano

# Note

You can spin up a t2.micro for development (which allows access to all the packages in the AMI and can put all your data on the instance), and then change the instance type to a p2.xlarge for GPU access (training).

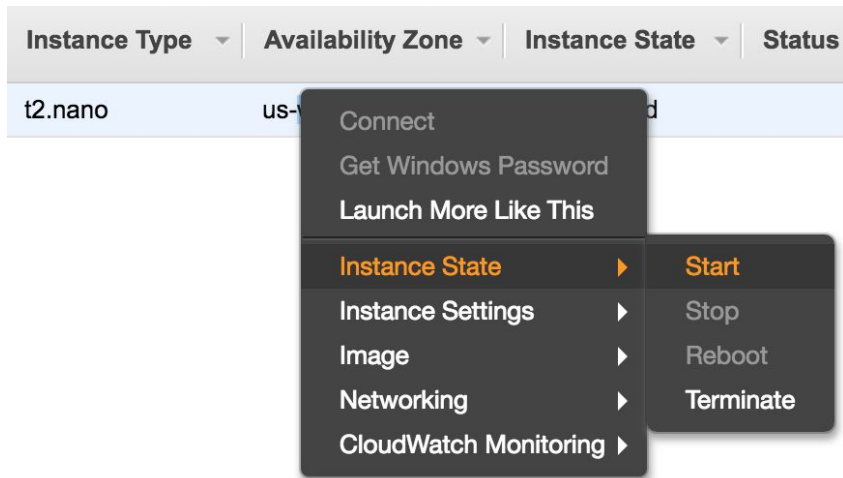
p2.xlarge is what I used for all my training, about \$1 per hour, so with 3 credits of \$50 that's more than enough hours of training for almost all cases.

# Launch instance



Right-click and Start your instance.

# Launch instance

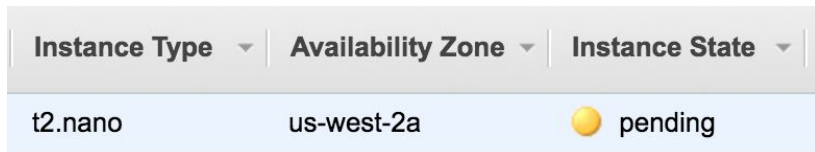


Right-click and Start your instance.

This will start the process of allocating resources to your instance. Once this is completed, your instance will be running and you can connect to it.

Stopping this instance removes the compute associated with the current session.

Do NOT terminate! This will wipe the slate clean. Terminate ONLY when you are sure of 'throwing away' the data.



Now you have a running AWS machine  
and you can connect

Now you know how to use machines on  
EC2

Let's run a trivial little problem



# A Toy Problem to Test your AWS Instance

## Will Test:

- Working instance
- Good Python installation
- Working PyTorch installed
- GPU / CUDA support
- Your ability to login and execute code on AWS

```
import torch

def main():
    GPU = torch.cuda.is_available()
    mat_size = (100, 100)
    cpu_mat_0 = torch.zeros(size = mat_size)
    cpu_mat_1 = torch.ones(size = mat_size)
    gpu_mat_0 = torch.zeros(size = mat_size)
    gpu_mat_1 = torch.ones(size = mat_size)

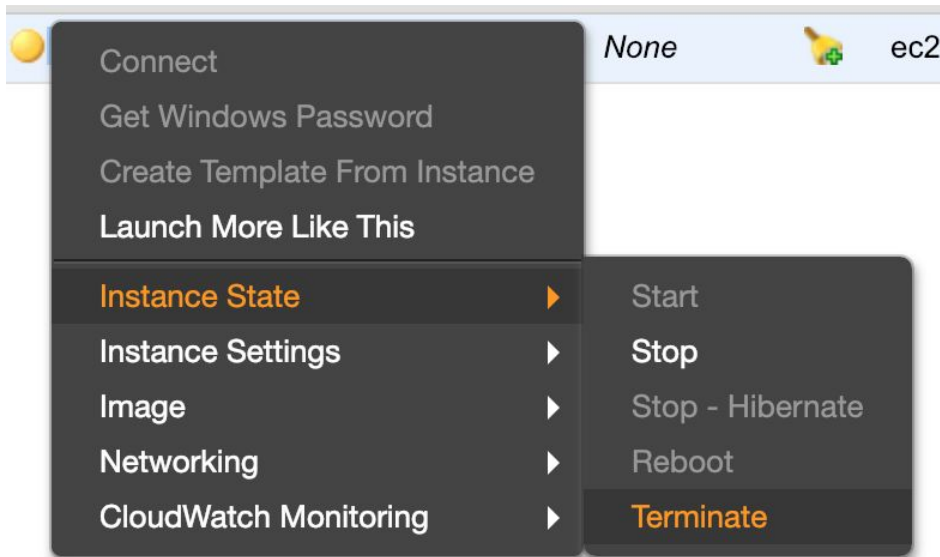
    if GPU:
        gpu_mat_0 = gpu_mat_0.cuda()
        gpu_mat_1 = gpu_mat_1.cuda()
        print("Using GPU")

    cpu_res = cpu_mat_0 + cpu_mat_1
    gpu_res = gpu_mat_0 + gpu_mat_1

    try:
        print(bool(torch.all(cpu_res == gpu_res)))
        return 0
    except:
        print("If using GPU, should be here")
        gpu_res = gpu_res.detach().cpu() # detach is for gradient computations
        print(bool(torch.all(cpu_res == gpu_res)))
        return 0

main()
```

# And let's shut it down so you don't get billed



If you stop the instance you can just start the instance and resume whenever you want.

If you are done, terminate.

# Now lets redeem some AWS credits

The screenshot shows the AWS Management Console interface. At the top, the navigation bar includes the AWS logo, 'Services', 'Resource Groups', and a user profile dropdown menu. The user profile menu is open, showing options: 'My Account', 'My Organization', 'My Billing Dashboard' (highlighted with a red box), 'My Security Credentials', and 'Sign Out'. The main content area is divided into three sections: 'AWS services' with a search bar and 'Recently visited services' (EC2, IAM, Billing, Support, Elastic Beanstalk); 'Build a solution' with various guided solutions like 'Launch a virtual machine', 'Build a web app', 'Host a static website', 'Connect an IoT device', 'Start a development project', and 'Register a domain'; and 'Learn to build' with categories like 'Websites', 'DevOps', 'Backup and recovery', 'Big data', 'Databases', and 'Mobile'. On the right side, there are sections for 'Helpful tips' (Manage your costs, Create an organization), 'Explore AWS' (Amazon RDS, Amazon Kinesis), and 'Get Started with Containers on AWS'. At the bottom right, there is a 'Have feedback?' link.

aws Services Resource Groups Tom Manzini Oregon Support

**AWS services**  
Find a service by name or feature (for example, EC2, S3 or VM, storage).  
Recently visited services  
EC2 IAM Billing Support Elastic Beanstalk  
All services

**Build a solution**  
Get started with simple wizards and automated workflows.  
Launch a virtual machine With EC2 or Lightsail ~1-2 minutes  
Build a web app With Elastic Beanstalk ~6 minutes  
Host a static website With S3, CloudFront, Route 53 ~5 minutes  
Connect an IoT device With AWS IoT ~5 minutes  
Start a development project With CodeStar ~5 minutes  
Register a domain With Route 53 ~3 minutes  
See more

**Learn to build**  
See all  
Learn to deploy your solutions through step-by-step guides, labs, and videos.  
Websites 3 videos, 3 tutorials, 3 labs  
DevOps 6 videos, 2 tutorials, 3 labs  
Backup and recovery 3 videos, 2 tutorials, 3 labs  
Big data Databases Mobile

**Helpful tips**  
Manage your costs Get real-time billing alerts based on your costs and usage budgets. Start now  
Create an organization Use AWS Organizations for policy-based management of multiple AWS accounts. Start now

**Explore AWS**  
Amazon Relational Database Service (RDS)  
RDS manages and scales your database for you. RDS supports Aurora, MySQL, PostgreSQL, MariaDB, Oracle, and SQL Server. Learn more  
Real-Time Analytics with Amazon Kinesis  
Stream and analyze real-time data, so you can get timely insights and react quickly. Learn more  
Get Started with Containers on AWS  
Amazon ECS helps you build and scale containers for any size application. Learn more  
AWS Marketplace  
Discover, procure, and deploy popular software products that run on AWS. Learn more  
Have feedback?

# Now lets redeem some AWS credits

The screenshot displays the AWS Billing & Cost Management Dashboard. On the left, a navigation menu lists various options, with 'Credits' highlighted by a red rectangle. The main content area is titled 'Billing & Cost Management Dashboard' and includes a 'What's New' section, a 'Spend Summary' section showing a current month-to-date balance of \$0.00, and a 'Month-to-Date Spend by Service' section with a donut chart and a table. The table shows a total of \$0.00. At the bottom, there are 'Alerts & Notifications' regarding the AWS Free Usage Tier and billing alerts.

**Navigation Menu:**

- Dashboard
- Bills
- Cost Explorer
- Budgets
- Reports
- Cost Allocation Tags
- Payment Methods
- Payment History
- Consolidated Billing
- Credits**
- Amazon Chime
- DevPay

**Billing & Cost Management Dashboard**

**What's New in AWS Billing and Cost Management?**

- Manage your spend with AWS Budgets
- Visualize your costs and usage with the newly-optimized Cost Explorer
- Easily upload your Cost and Usage Reports into Redshift and QuickSight

**Spend Summary** [Cost Explorer](#)

Welcome to the AWS Account Billing console. Your last month, month-to-date, and month-end forecasted costs appear below.

Current month-to-date balance for December 2017

**\$0.00**

Month-to-Date Spend by Service

The chart below shows the proportion of costs spent for each service you use.

**\$0**

No Amount Due	\$0.00
Tax	\$0.00
<b>Total</b>	<b>\$0.00</b>

**Alerts & Notifications**

- You are eligible for the AWS Free Usage Tier. See the [Getting Started Guide AWS Free Usage Tier](#) to learn how to get started with the free usage tier.
- Monitor your estimated charges. [Enable Now](#) to begin setting billing alerts that automatically e-mail you when charges reach a threshold you define.
- IAM access to your account's billing information is not enabled. You can enable it on the [Account](#)

# Now lets redeem some AWS credits

aws

Services

Resource Groups

Dashboard

Bills

Cost Explorer

Budgets

Reports

Cost Allocation Tags

Payment Methods

Payment History

Consolidated Billing

Preferences

Credits

Tax Settings

DevPay

Credits

?

Please enter your code below to redeem your credits.

Promo Code

Security Check

y b 8 n d 5

Refresh Image

Please type the characters as shown above

By clicking "Redeem" you indicate that you have read and agree to the terms of the AWS Promotional Credit Terms & Conditions located [here](#).

Redeem

Below are all the credits you have redeemed with AWS. Credits will automatically be applied to your bill. Only credits that apply to a specific service can be used.

Expiration Date	Credit Name	Credits Used	Credits Remaining	Applicable Products
2018-03-31	EDU_ENG_FY2017_Q1_1_CMU_50USD	\$44.22	\$5.78	<a href="#">See complete list</a>
2018-03-31	EDU_ENG_FY2017_Q1_1_CMU_50USD	\$45.05	\$4.95	<a href="#">See complete list</a>

Total Amount of Credits Remaining: \$10.73

Now you know how to use machines on  
EC2 and you can afford to use the  
expensive ones

# Finally, some useful tidbits

Remember to refer back here later in the semester, likely won't remember all this right now

# Editing Volume

If you run out of space, you can adjust your volume without shutting off the instance, happened to me on hw2p2

<https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-modify-volume.html>

<https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/console-modify.html>



EC2 Dashboard

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Change Auto-Enable IO Setting

Add/Edit Tags

Filter by tags



Name



Volume Type

IOPS

Snapshot

Created

Availability Zone

State

Alarm Status

Attachment Information

Monitoring

gp2

225

snap-014390f4...

December 21, 2018...

us-west-2a

in-use

None

i-08d9e0db1b613edb...

Volumes: vol-0adb44e78d8f4ab21

Description

Status Checks

Monitoring

Tags

Volume ID vol-0adb44e78d8f4ab21

Size 75 GiB

Created December 21, 2018 at 12:37:08 AM UTC-5

State in-use

Attachment information i-08d9e0db1b613edb5 :/dev/sda1 (attached)

Volume type gp2

Alarm status None

Snapshot snap-014390f4a84518e09

Availability Zone us-west-2a

Encrypted Not Encrypted

KMS Key ID

KMS Key Aliases



Services ▾

Resource Groups ▾



DavidLBick ▾

Oregon ▾

Support ▾

EC2 Dashboard

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Filter by tags and attributes or search by keyword



1 to 1 of 1

	Name	Volume ID	Size	Volume Type	IOPS	Snapshot	Created	Availability Zone	State	Alarm Status	Attachment Information	Monitoring
		vol-0adb44e...	75 GiB	gp2	225	snap-014390f4...	December 21, 2018...	us-west-2a	in-use	None	i-08d9e0db1b613edb...	

## Modify Volume



Volume ID vol-0adb44e78d8f4ab21

Volume Type General Purpose SSD (gp2) ⓘ

Size 75 (Min: 1 GiB, Max: 16384 GiB) ⓘ

IOPS 225 / 3000 (Baseline of 3 IOPS per GiB with a minimum of 100 IOPS, burstable to 3000 IOPS) ⓘ

Cancel

Modify

Volumes: vol-0adb44e78d8f4ab21

Description

Status Checks

Mo

Volume ID vol-0adb44e78d8f4ab21  
Size 75 GiB  
Created December 21, 2018  
State in-use  
Attachment information i-08d9e0db1b613edb5 /dev/sda1 (attached)  
Volume type gp2

None  
snap-014390f4a84518e09  
s-west-2a  
Not Encrypted  
Encrypted  
KMS Key ID  
KMS Key Aliases

# Here's How to Connect to Jupyter Notebook

Call `ssh -N -L localhost:8888:localhost:8887 -i ~/path/to/key ubuntu@ip`

Create new terminal window, ssh into instance

In ssh window, source activate `pytorch_p36`

Call `jupyter notebook --no-browser --port=8887`

Go to browser, enter `localhost:8888`

# Parting wisdom

- Remember to shut down your machines
  - Just because you don't have an open ssh connection doesn't mean your machine is off
  - When you're not running code, Stop; when you can get rid of the data, Terminate
- Use PyTorch on the previously given AMI
  - After you ssh into the instance, run command 'source activate pytorch\_p36'
  - Without this you cannot import torch
  - Unless you are already very comfortable with tensorflow, it is much easier to get help from TAs on PyTorch

# Parting wisdom

- You need permission to launch a GPU instance
  - You will need to create a support ticket to launch GPU Machines
  - If you attempt to launch on you will be guided through the process
  - You are typically only allowed to launch 1 GPU machine at a time
- Only launch an expensive instance when it is time to train, not develop
  - Launch a basic instance with everything you need to develop and test your code
  - When it comes time to train your system for real, then launch a decked out instance
  - Saves you money

# Parting wisdom

If you want to use a local IDE instead of VIM on your ssh window, you can develop locally and run an scp to transfer the file to the aws instance

```
scp -i ~/path/to/key ~/path/to/file/ ubuntu@ec2...
```

If you use jupyter notebook connected to aws, no need to worry about this.

While writing code, I kept a note with common commands that I could just change the IP address on, such as an ssh command, and scp of my local code

# Requesting Instances

Must request access to instances from AWS in the Support Center section of AWS. Check the latest status on AWS, as they may have changed something or upgraded offerings. Currently, should request EC2 instance limit increase, but be sure that it has not changed.

# How to Request

## Instructions to apply for GPU access on AWS

Starting from [aws.amazon.com](https://aws.amazon.com)

Top right corner, “My Account” -> “Account Settings”

At top right corner click “Support” -> Support Center

Click “Create case”

Click “Service Limit increase”

Limit type -> EC2 Instance

If Pitt, select Region US East (Ohio). If SV, select Region US West (Oregon)

New limit value -> 1 Instance type -> p2.xlarge (can also request other instance types)

Use case description -> Describe that you are in this class at CMU and you need a GPU to train deep learning models for the homeworks

Specify your contact method