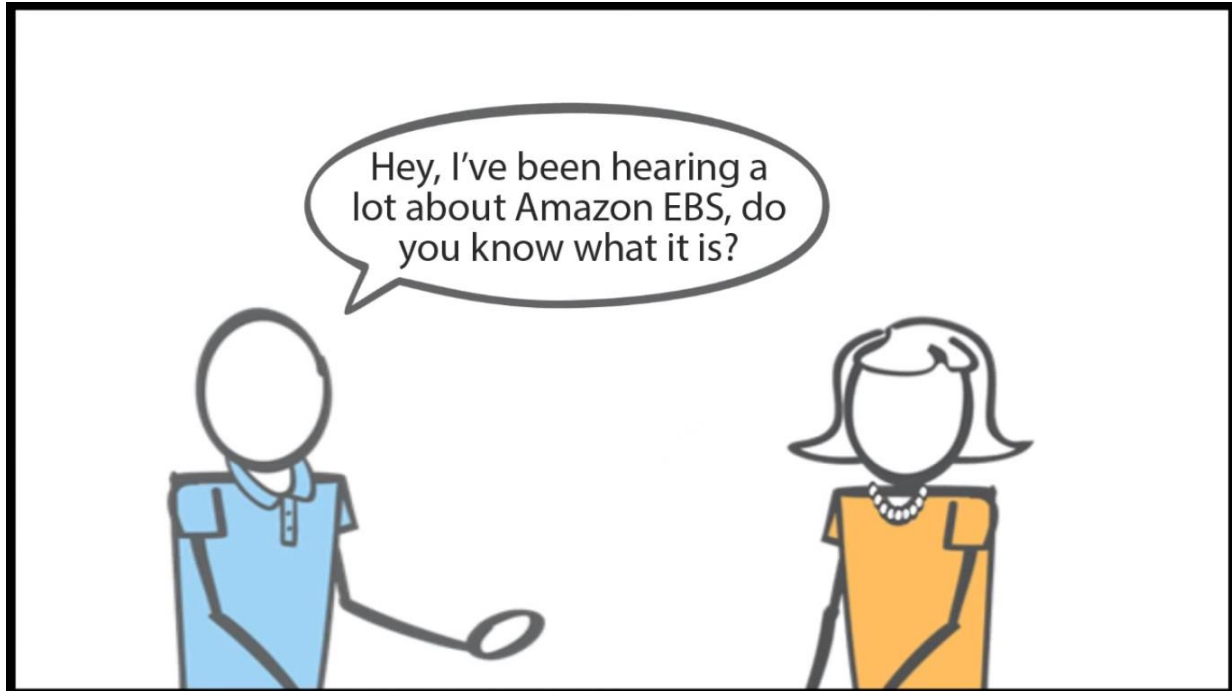
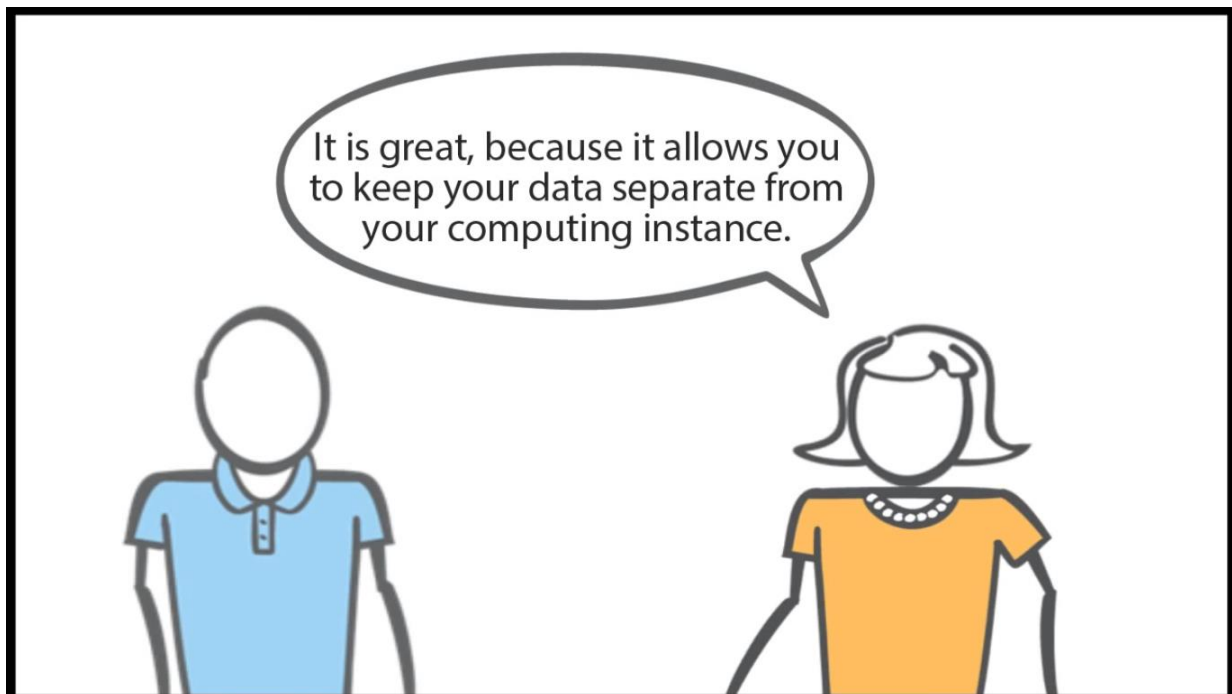
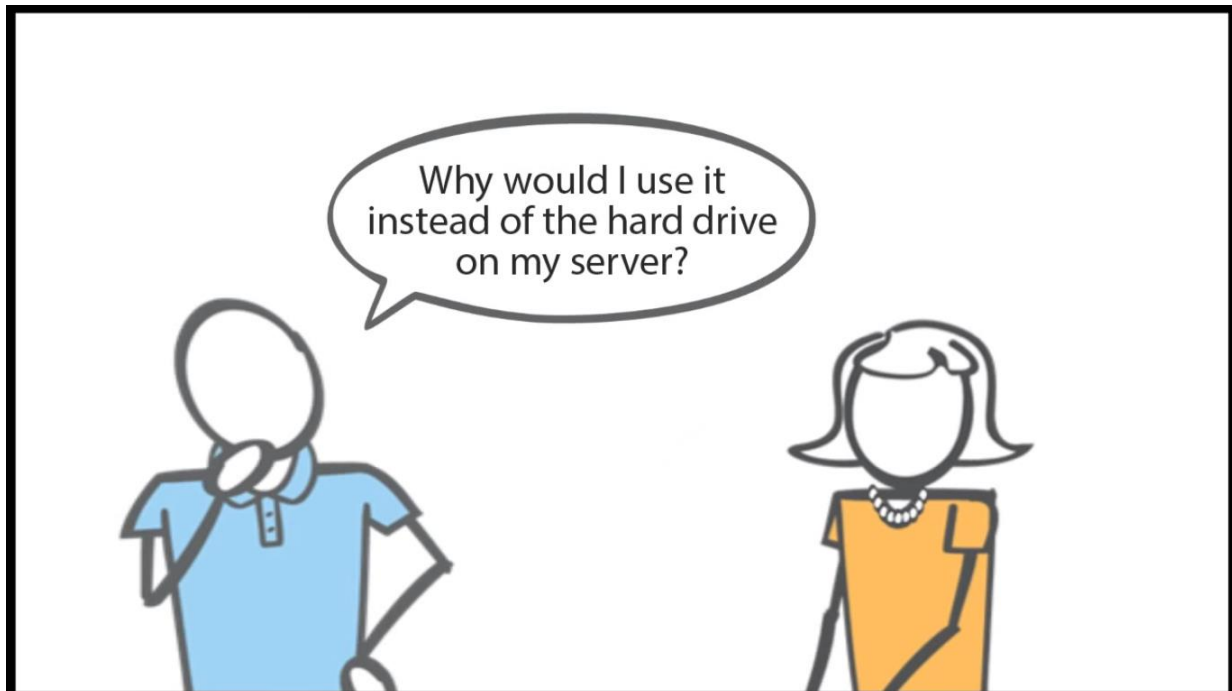
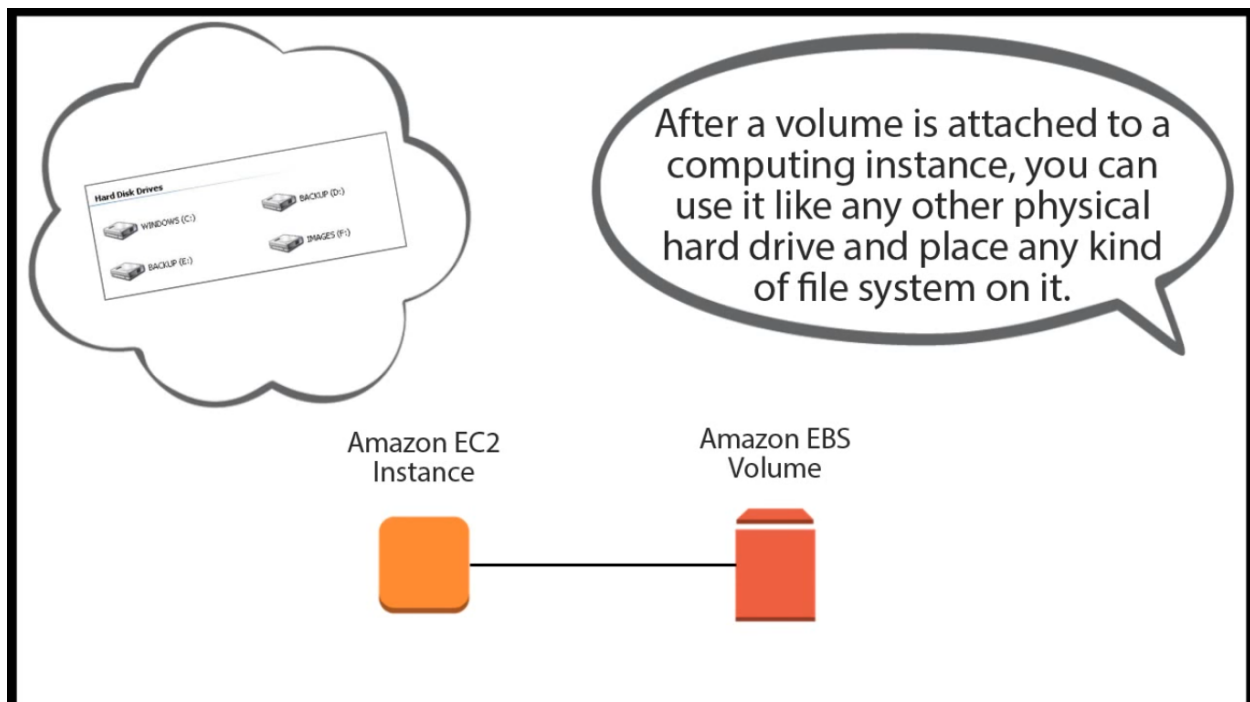
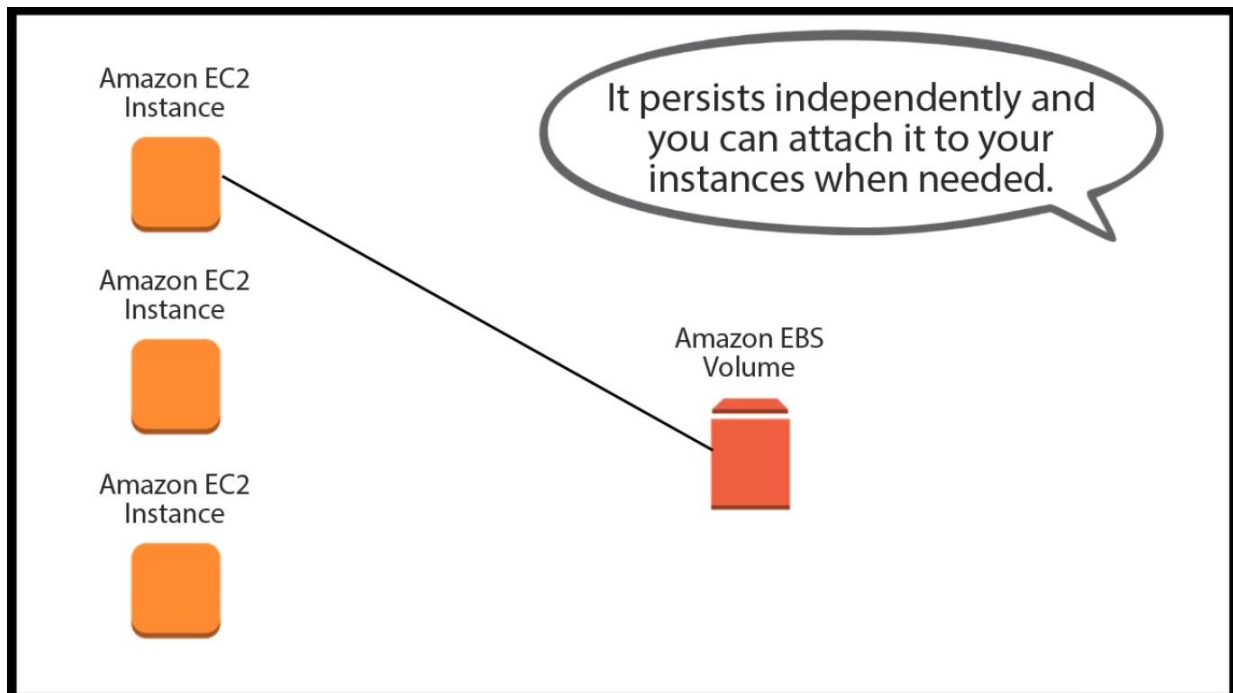


## Amazon EBS interactive tutorial and lab!







When you use Amazon EBS to store your data, if a computing instance fails, you don't have to worry about losing your data because it isn't housed on the instance - it's housed on your block storage volume.

Amazon EC2 Instance



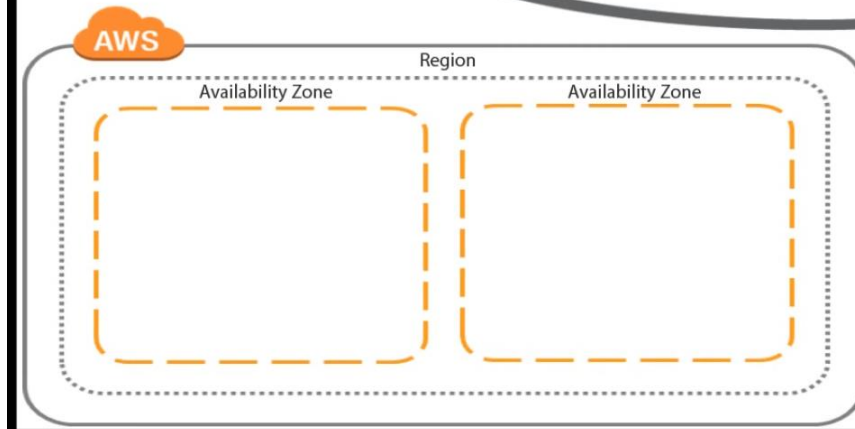
Amazon EBS Volume



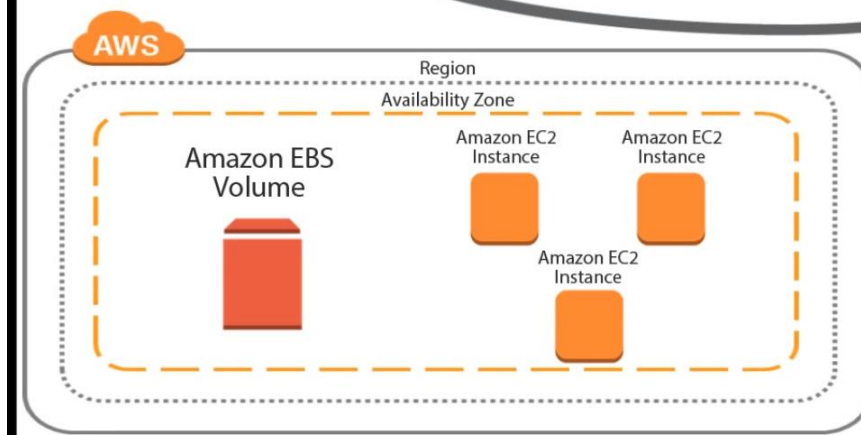
Amazon EBS volumes can be between 1 GB and 1 TB in size.

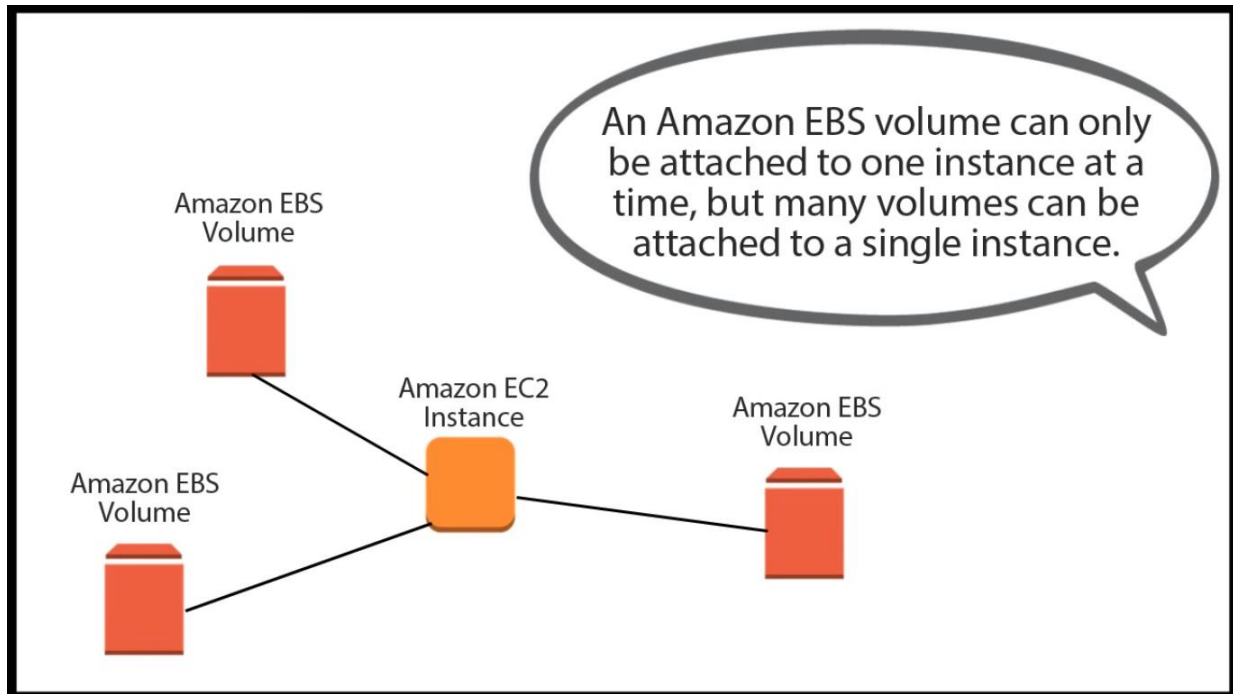


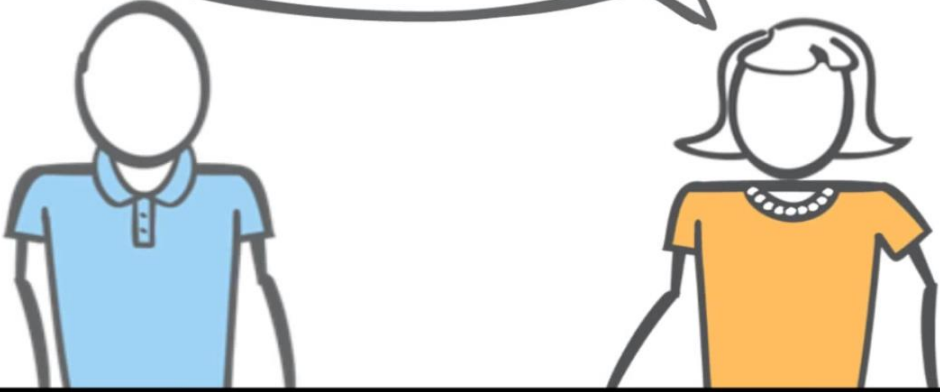
They are created in a particular Availability Zone, or AZ, which is a distinct physical location that contains computing resources, similar to a data center.



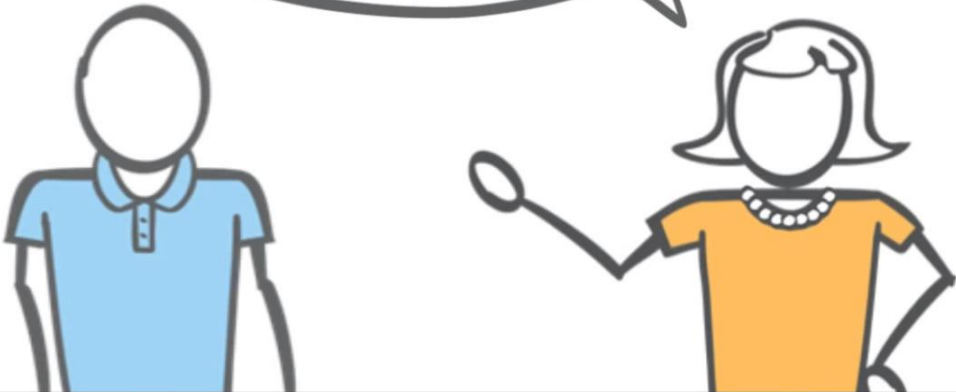
When you create an Amazon EBS volume in an AZ, it is automatically replicated within that zone to prevent data loss due to failure of any single hardware component.



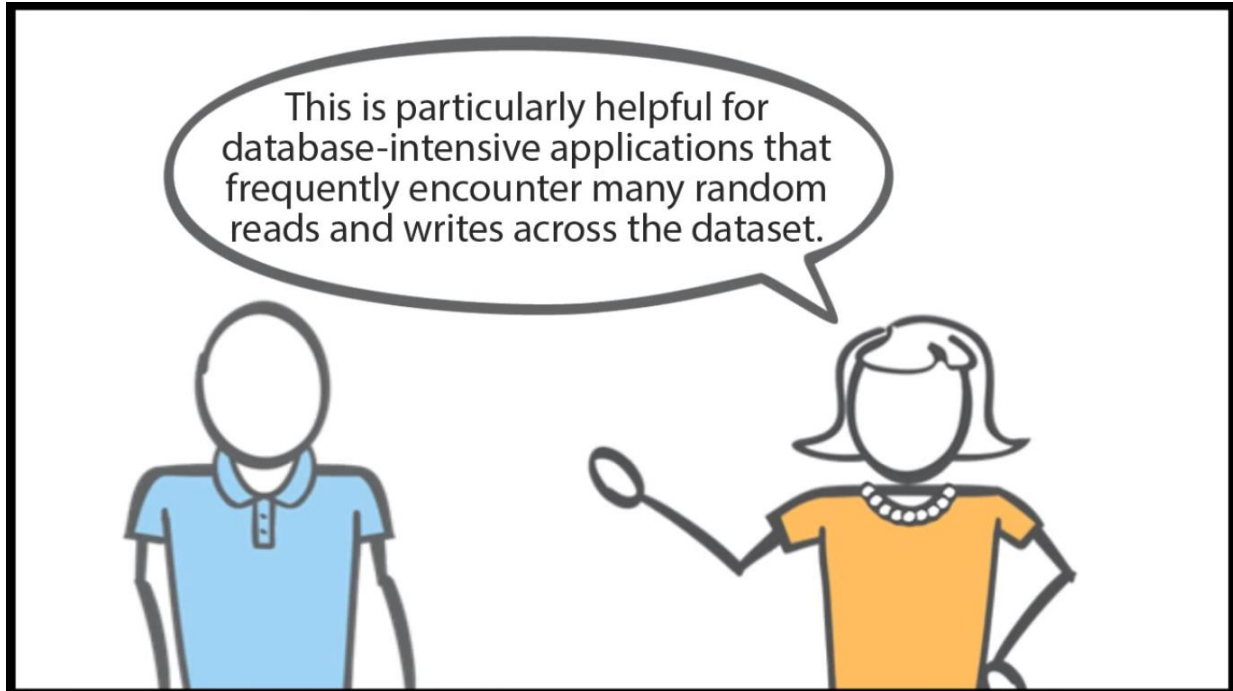




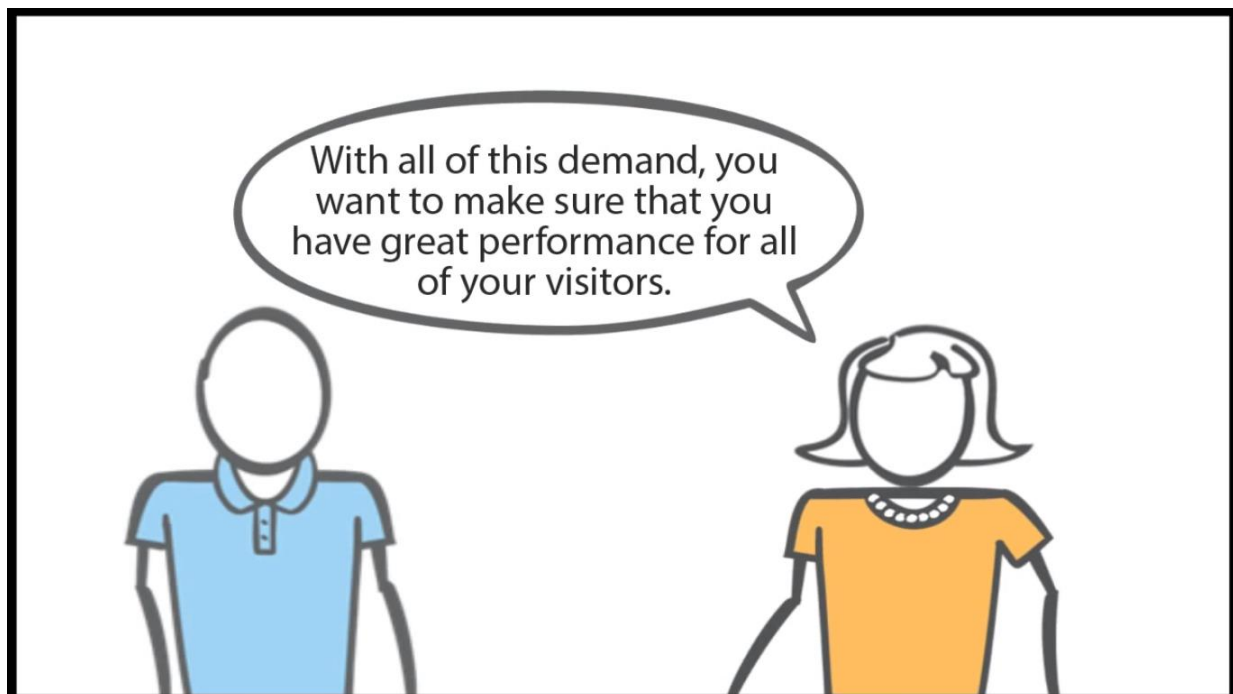
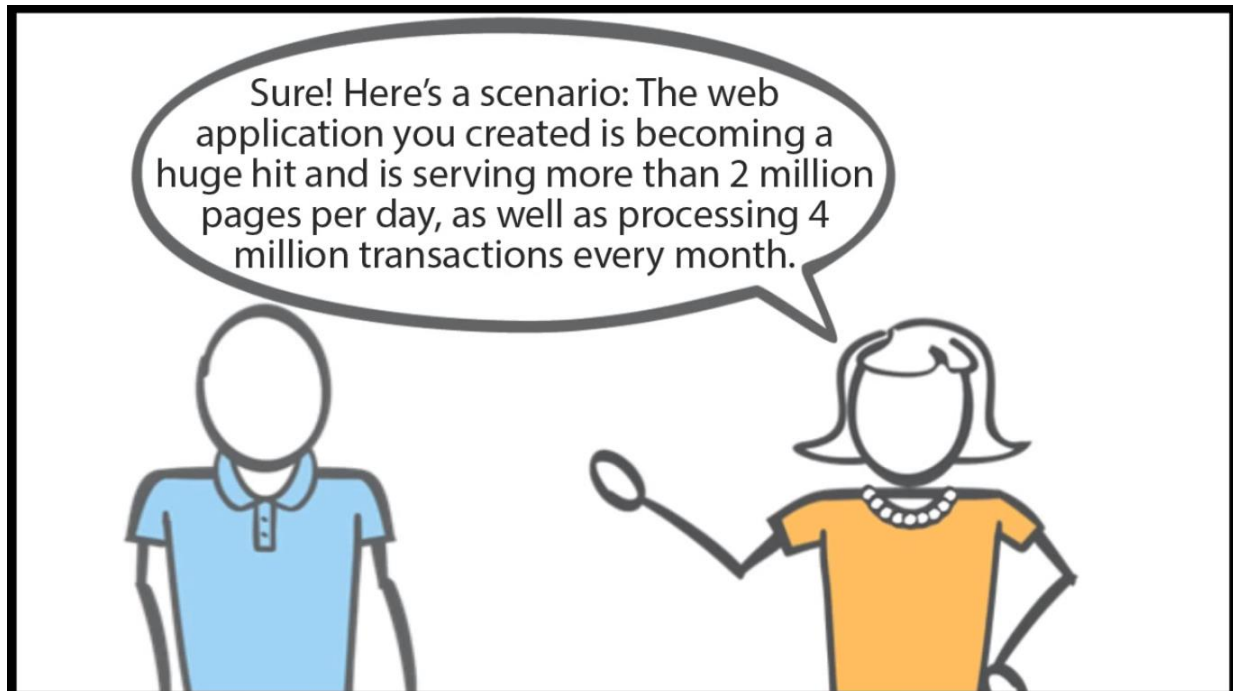
When you do, it will appear as a mounted device and the instance can interact with it similar to any hard drive or other storage device.

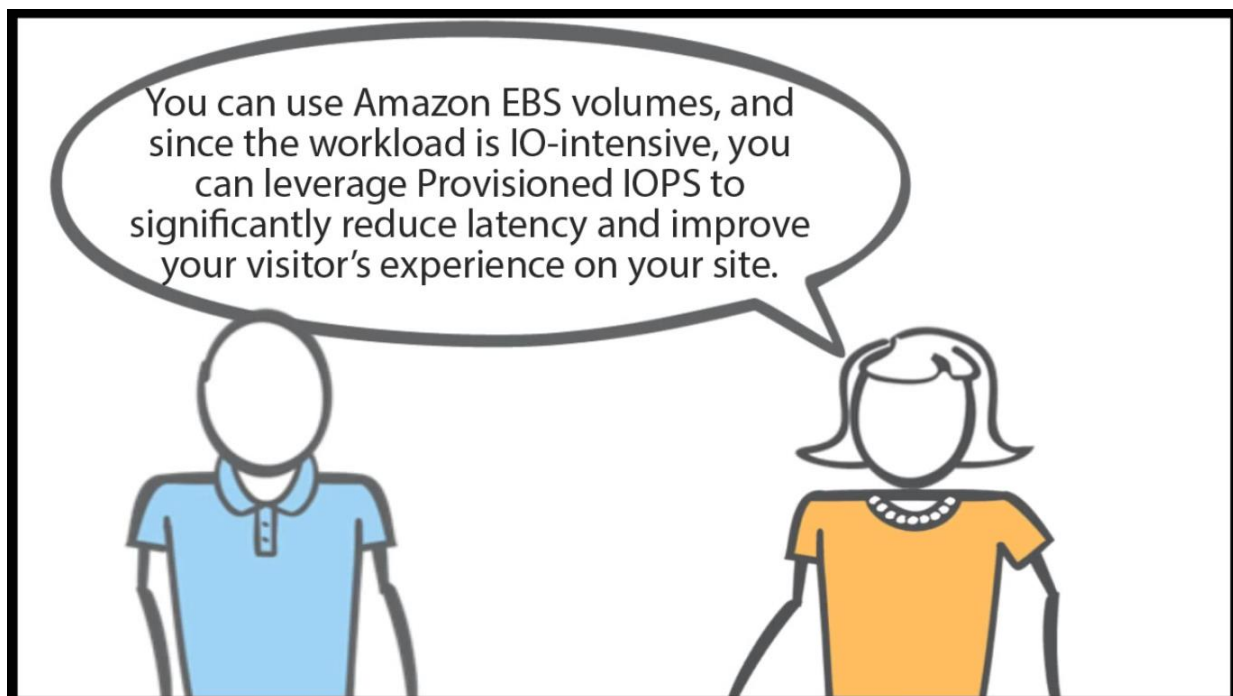
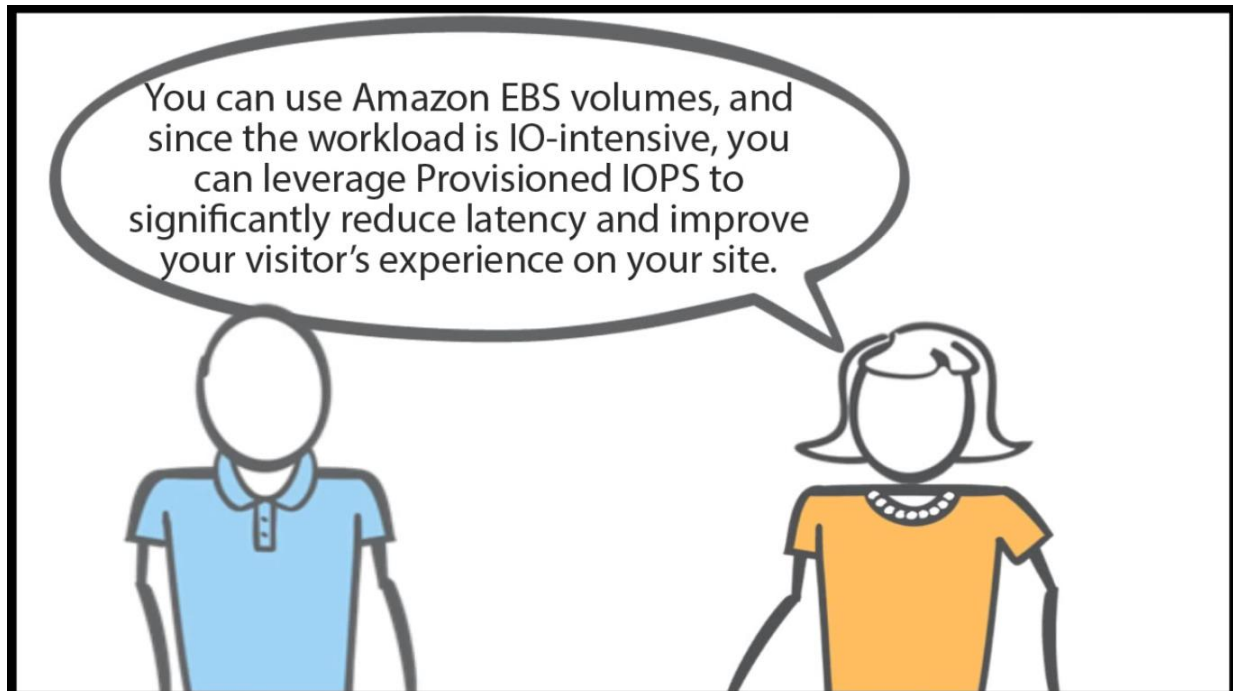


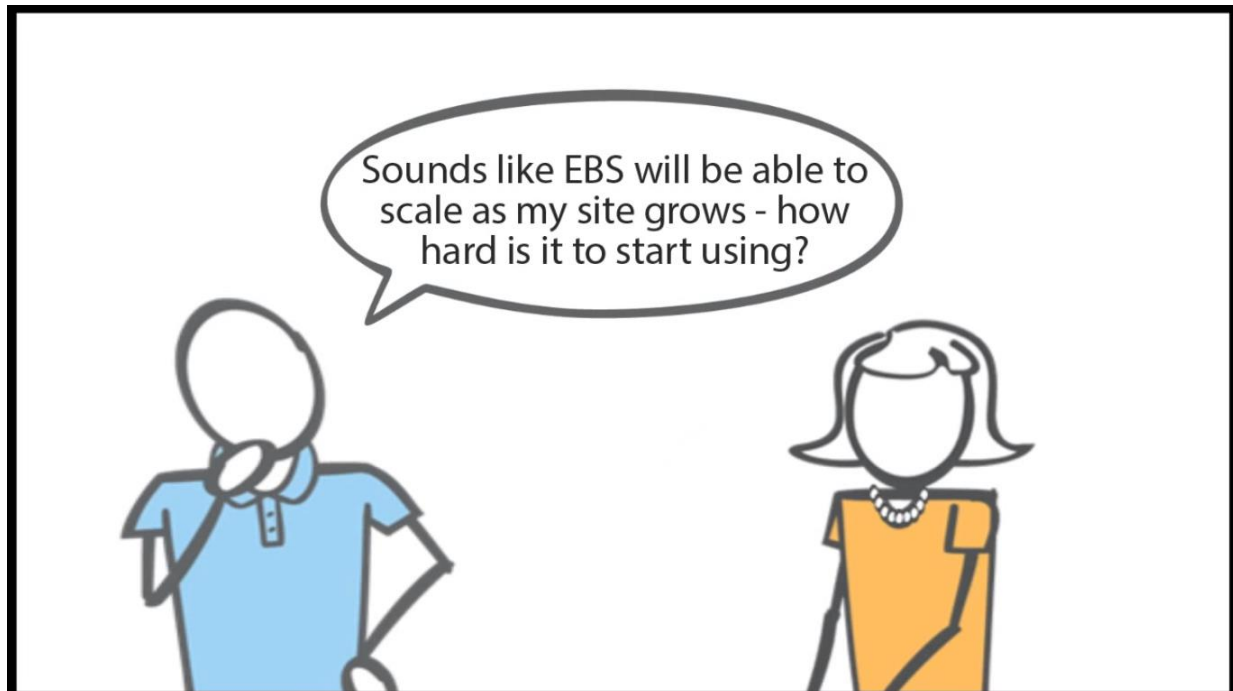
So, you can attach multiple volumes and stripe your data across them for increased I/O and throughput performance.











How hard is it to start using?

## Lets do a lab on working with EBS

Lab objective: Create an EBS backed instance and create a snapshot for it and use that snapshot as a root volume

### 1.Login to your console and click on EC2

## 2.Create a basic instance and SSH into it.

### a. Click on Launch instance:

The screenshot shows the AWS Management Console interface. The top navigation bar includes 'Services', 'Resource Groups', and a user profile 'student' with ID '8588-1204-0331' in the 'Oregon' region. The left sidebar shows the 'EC2 Dashboard' with links to Events, Tags, Reports, Limits, INSTANCES, IMAGES, ELASTIC BLOCK STORE, and NETWORK & SECURITY. The main content area is titled 'Resources' and displays a summary of EC2 resources in the US West (Oregon) region: 0 Running Instances, 0 Elastic IPs, 0 Dedicated Hosts, 0 Snapshots, 0 Volumes, Error retrieving resource count, 1 Key Pairs, 1 Security Groups, and 0 Placement Groups. A 'Launch Instance' button is prominently displayed. Below this, a note states that instances will launch in the US West (Oregon) region. The right sidebar contains 'Account Attributes' (Supported Platforms, VPC, Default VPC, Resource ID length management) and 'Additional Information' (Getting Started Guide, Documentation, All EC2 Resources, Forums, Pricing, Contact Us). The bottom of the console shows a footer with 'Feedback', 'English', and copyright information for 2008-2017.

### b.Choose AMI.I choose Linux AMI the first one

The screenshot shows the 'Step 1: Choose an Amazon Machine Image (AMI)' screen in the AWS Management Console. The top navigation bar is the same as the previous screenshot. The left sidebar shows the 'Quick Start' section with links to 'My AMIs', 'AWS Marketplace', and 'Community AMIs'. The main content area displays a list of AMIs. The first AMI, 'Amazon Linux AMI 2016.09.1 (HVM), SSD Volume Type - ami-f173cc91', is selected. The second AMI, 'Red Hat Enterprise Linux 7.3 (HVM), SSD Volume Type - ami-6f68cf0f', is also listed. The third AMI, 'SUSE Linux Enterprise Server 12 SP2 (HVM), SSD Volume Type - ami-e4a30084', is listed. The bottom of the console shows a footer with 'Feedback', 'English', and copyright information for 2008-2017.

## C.Choose the free tier:

The screenshot shows the 'Step 2: Choose an Instance Type' page in the AWS Management Console. The breadcrumb trail at the top indicates the sequence: 1. Choose AMI, 2. Choose Instance Type (current), 3. Configure Instance, 4. Add Storage, 5. Add Tags, 6. Configure Security Group, 7. Review. The page includes a 'Filter by' section with 'All instance types' selected, and a 'Current generation' filter. A table lists various instance types, with 't2.micro' highlighted as 'Free tier eligible'. The table columns include Family, Type, vCPUs, Memory (GiB), Instance Storage (GB), EBS-Optimized Available, Network Performance, and IPv6 Support. At the bottom, there are buttons for 'Cancel', 'Previous', 'Review and Launch', and 'Next: Configure Instance Details'.

	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 <small>Free tier eligible</small>	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

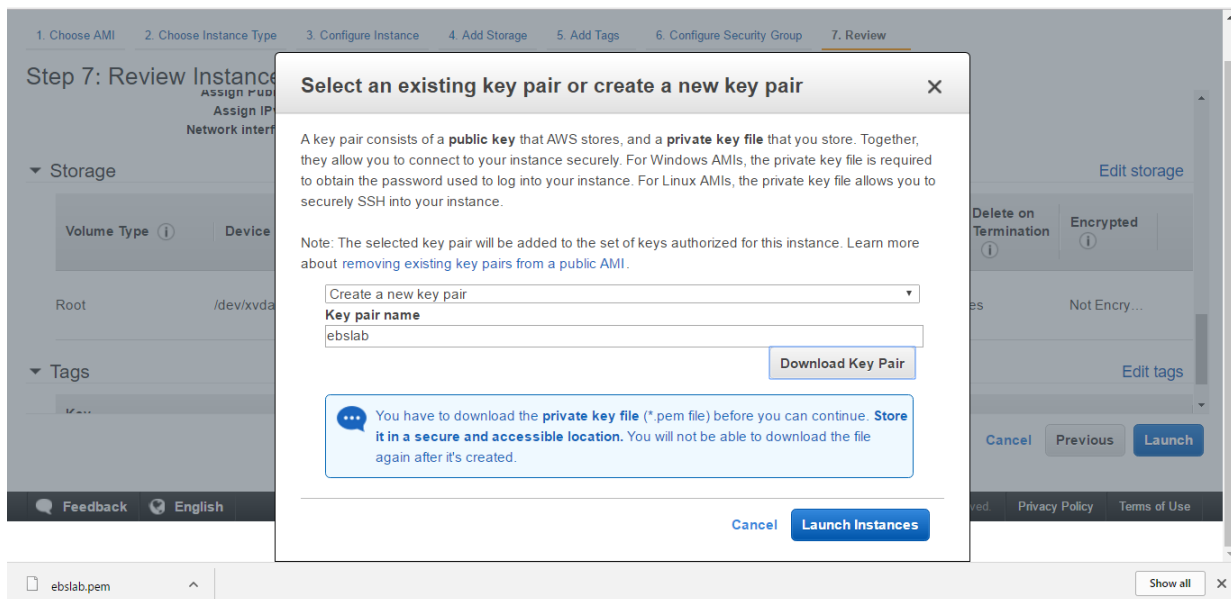
And keep everything defaults and click next until you reach 'Configure security groups'

## D.configure security groups then click Review and Launch

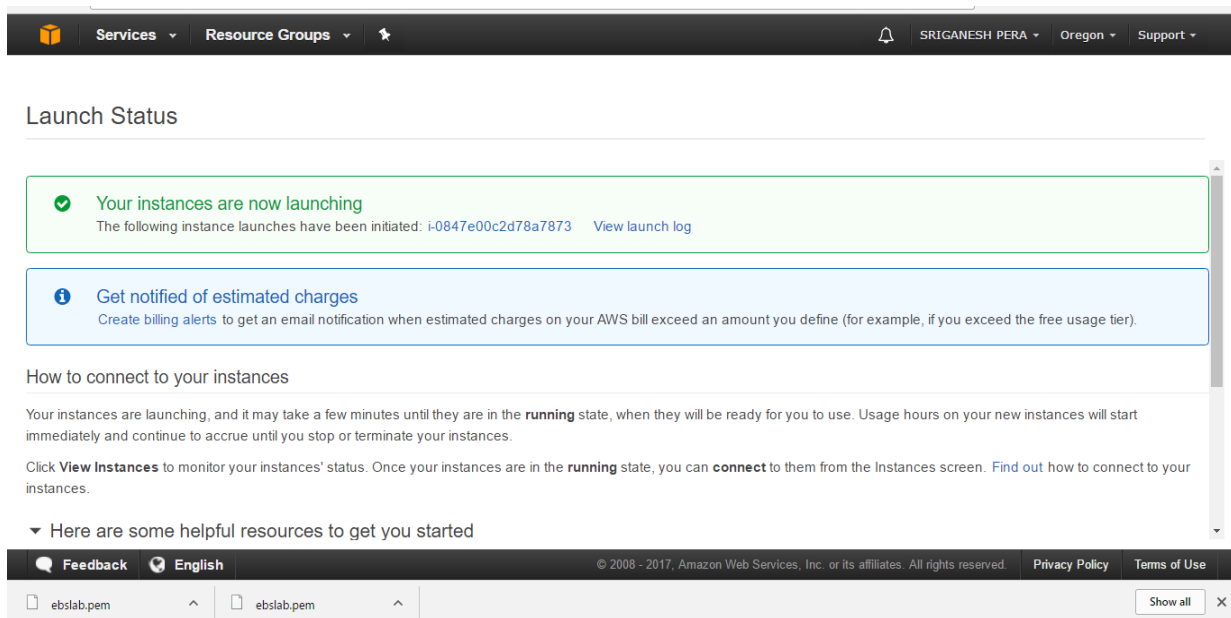
The screenshot shows the 'Step 6: Configure Security Group' page. It provides instructions on how to configure a security group. The 'Assign a security group' section has 'Create a new security group' selected. The 'Security group name' is 'launch-wizard-24' and the 'Description' is 'launch-wizard-24 created 2017-10-09T20:36:18.411+05:30'. Below this is a table for adding rules. Two rules are already added: one for SSH (TCP, port 22, source 0.0.0.0/0) and one for HTTP (TCP, port 80, source 0.0.0.0/0). A warning message at the bottom states: '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.' At the bottom right, there are buttons for 'Cancel', 'Previous', and 'Review and Launch'.

Type	Protocol	Port Range	Source	Description
SSH	TCP	22	Custom 0.0.0.0/0	e.g. SSH for Admin Desktop
HTTP	TCP	80	Custom 0.0.0.0/0	e.g. SSH for Admin Desktop

**e. Create a new key pair, download the key (I named my key as ebslab) and click on launch instance**



**f. go to EC2 dashboard to see your instance running**

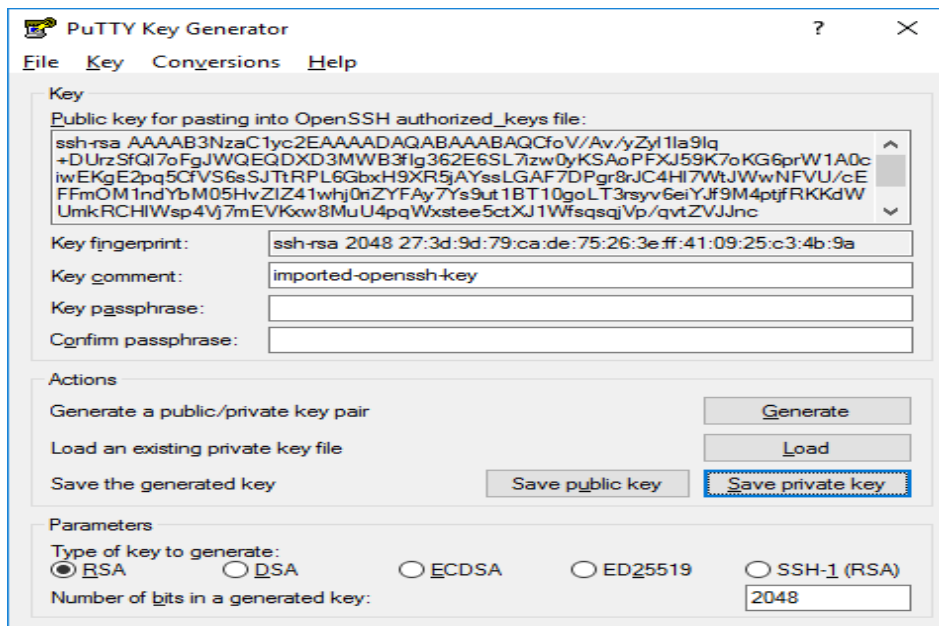


**(g) Now we connect to our instance and check whatever the 'drives' we have with our instacne**

(i) open Puttygen and convert my downloaded key ebsslabs.pem to ebsslabs.ppk

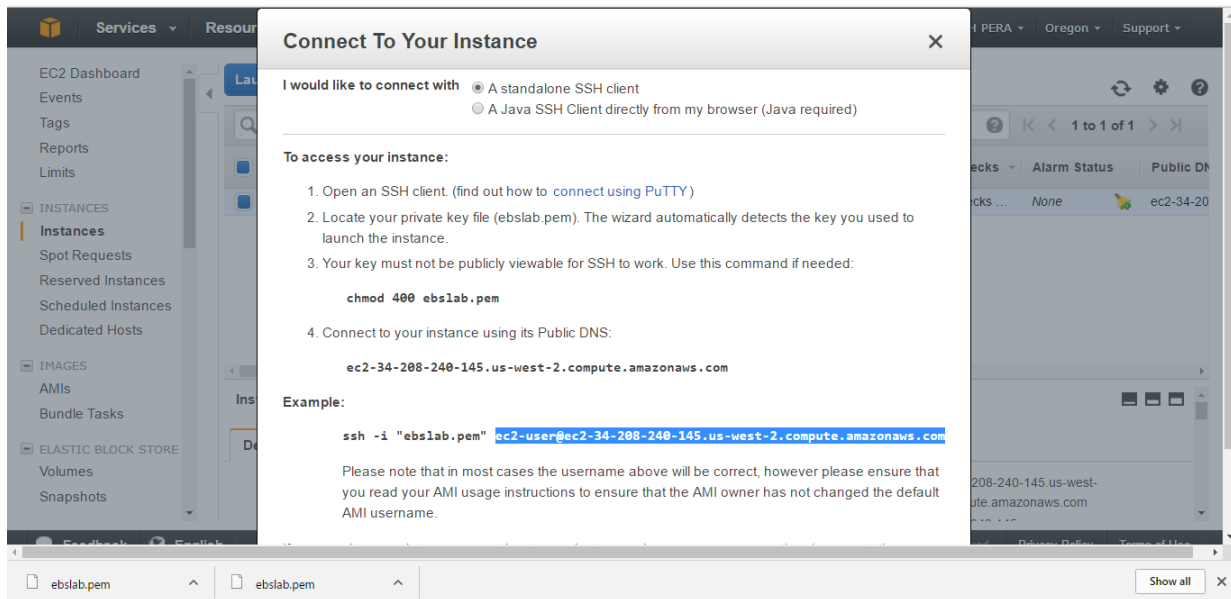
First you open Puttygen and click on Load button and locate the ebsslabs.pem key you have just download and then click on save private key and save it with the same name ebsslabs.ppk

This is how you convert the format of .pem to .ppk

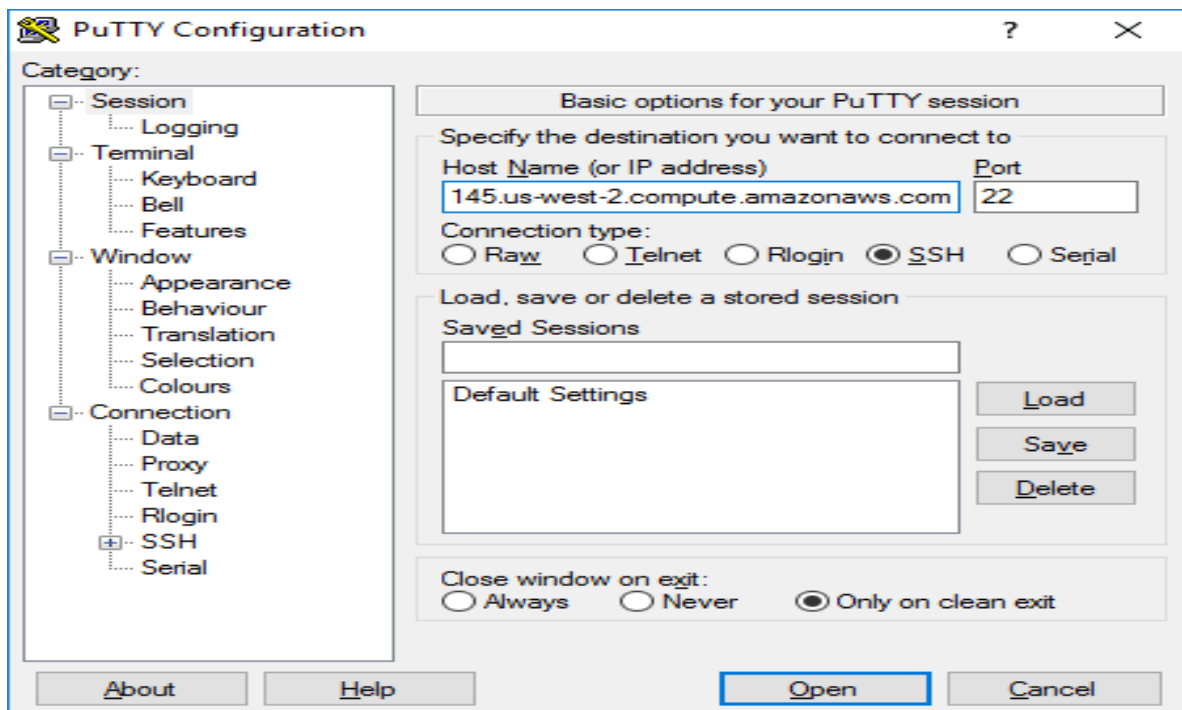


**(ii) Now open Putty and paste your Public IP of your instance in host**

You can find your public IP of your instance in EC2 dashboard -> actions -> connect to your instance.

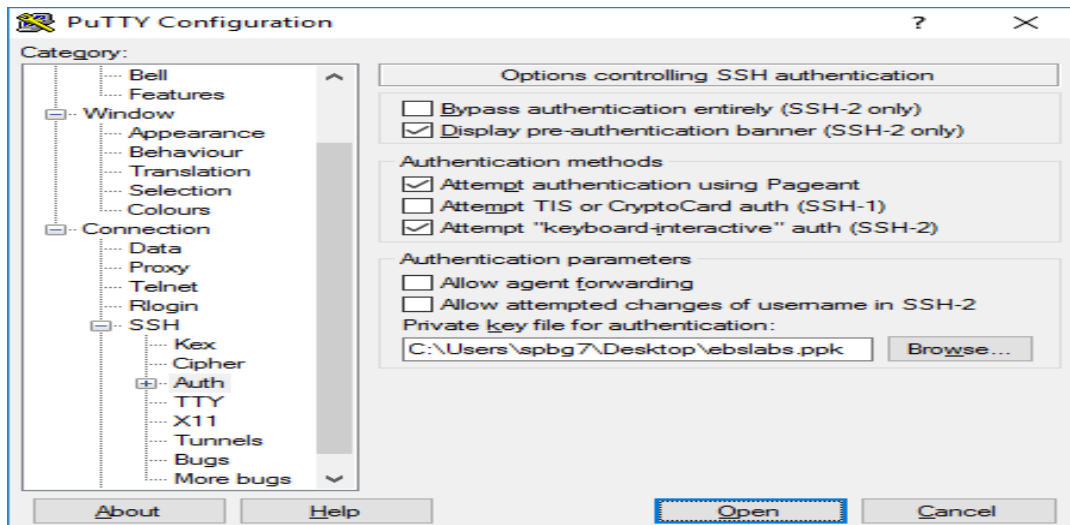


Copy that and past it in host field box of Putty



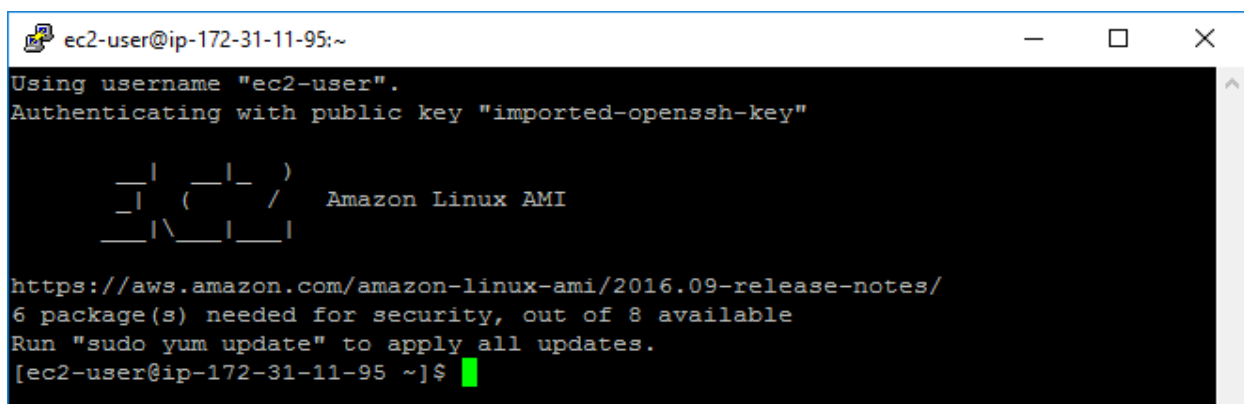


**Now click on SSH-> Auth and load the ebslab.ppk we just converted using PuttyGen and click on Open**



**If you get a pop-up box just click on Yes.**

**If you see the below screenshot then you've successfully connected to your EC2 instance**



**Now in the command prompt click on 'lsblk'**

**The lsblk command allows you to display a list of available block devices**

```
ec2-user@ip-172-31-22-185:~  
login as: ec2-user  
Authenticating with public key "imported-openssh-key"  
  
  _ | _ | _ )  
  _ | ( _ | /  Amazon Linux AMI  
  _ | \ _ | _ |  
  
https://aws.amazon.com/amazon-linux-ami/2017.09-release-notes/  
[ec2-user@ip-172-31-22-185 ~]$ lsblk  
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT  
xvda         202:0    0   8G  0 disk  
└─xvda1      202:1    0   8G  0 part /  
[ec2-user@ip-172-31-22-185 ~]$
```

As you notice there is one drive :xvda(root volume) .As you remember when were launching an instance you might have noticed ‘Add storage’

1. Choose AMI2. Choose Instance Type3. Configure Instance4. Add Storage5. Add Tags6. Configure Security Group7. 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/xvda	snap-0cfc1bfe4dc1b09e1	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.

CancelPreviousReview and LaunchNext: Add Tags

Where we have added a 8 GB root volume to our instance which is why it shows XVDA 8G in the shell.

**(h) Now we will install a webserver and create a simple static webpage and host it on our webserver**

```
ec2-user@ip-172-31-22-185:~  
[ec2-user@ip-172-31-22-185 ~]$ sudo yum install httpd  
  
Dependency Installed:  
  apr.x86_64 0:1.5.1-1.12.amzn1  
  apr-util.x86_64 0:1.4.1-4.17.amzn1  
  apr-util-ldap.x86_64 0:1.4.1-4.17.amzn1  
  httpd-tools.x86_64 0:2.2.34-1.15.amzn1  
  
Complete!  
[ec2-user@ip-172-31-22-185 ~]$
```

**As you noticed we've installed an Apache webserver(httpd) on our instances.**

**Now turn on the Apache webserver using the following commands:**

```
ec2-user@ip-172-31-22-185:~  
[ec2-user@ip-172-31-22-185 ~]$ sudo service httpd start  
Starting httpd:  
[ec2-user@ip-172-31-22-185 ~]$ sudo chkconfig httpd on  
[ec2-user@ip-172-31-22-185 ~]$
```

**Now we 'll create a static html webpage.Just follow the commands on the terminal.**

```
ec2-user@ip-172-31-22-185:~  
[ec2-user@ip-172-31-22-185 ~]$ sudo nano /var/www/html/index.html
```

As soon as you type the command a terminal pops out.Now write the following code on the terminal

```
GNU nano 2.5.3      File: /var/www/html/index.html      Modified  
  
<html>  
<body>  
<h1> Welcome to EBS lab </h1>  
<h2> <marquee color="red"> Training and Certification given by Sriganesh Pera </h2>  
</body>  
<html>
```

**Now save it and exit by typing ctrl O and Ctrl X.**

**Now we have created a static web page hosted on our server.Now copy and paste the Public DNS of ec2,which is located in bottom part of EC2 dashboard**

The screenshot shows the AWS Management Console interface. On the left, the navigation menu includes EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES, IMAGES, ELASTIC BLOCK STORE, and NETWORK & SECURITY. The main content area displays the details for an EC2 instance with ID i-0636796d1448cc330. The instance is a t2.micro in the us-west-2b availability zone, running in the us-west-2 region. The Public DNS (IPv4) is highlighted as ec2-52-89-139-174.us-west-2.compute.amazonaws.com. Below the instance details, there is a section for Instance state, Instance type, Elastic IPs, and Availability zone.

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)	IPv4
	i-0636796d1448cc330	t2.micro	us-west-2b	running	2/2 checks ...	None	ec2-52-89-139-174.us-west-2.compute.amazonaws.com	52.89.139.174

Instance ID: i-0636796d1448cc330  
 Instance state: running  
 Instance type: t2.micro  
 Elastic IPs: -  
 Availability zone: us-west-2b  
 Public DNS (IPv4): ec2-52-89-139-174.us-west-2.compute.amazonaws.com  
 IPv4 Public IP: 52.89.139.174  
 IPv6 IPs: -  
 Private DNS: ip-172-31-22-185.us-west-2.compute.internal  
 Private IPs: 172.31.22.185

Now copy and paste it in web browser.You'll see this.



Welcome to EBS lab

Training and Certification given by Sriganesh Pera

Now take the snapshot of EBS ,which contains this data(Web page hosted on a webserver)

### **(i) Taking snapshot of EBS volume and create volume from it.**

Now Check the region of ec2 instance and click on volumes on the left-handed column in EC2 dashboard.Now right click in the volume that we're using right now and click on create snapshot.

The screenshot shows the AWS Management Console interface for the 'Volumes' section. The left sidebar contains navigation links for EC2 Dashboard, INSTANCES, IMAGES, ELASTIC BLOCK STORE, and NETWORK & SECURITY. The main content area displays a table of EBS volumes. The first volume, 'vol-06fd1d98...', is highlighted, and a context menu is open over it. The menu includes options: 'Modify Volume', 'Delete Volume', 'Attach Volume', 'Detach Volume', 'Force Detach Volume', 'Create Snapshot' (highlighted in orange), 'Change Auto-Enable IO Setting', and 'Add/Edit Tags'. Below the table, detailed information for the selected volume is shown, including its creation time, state, attachment information, volume type, and IOPS.

Name	Volume ID	Size	Volume Type	IOPS	Snapshot	Created	Availability Zone	State	Alarm
<input checked="" type="checkbox"/>	vol-06fd1d98...	8 GiB	gp2	100		October 9, 2017 at ...	us-west-2b	in-use	None
<input type="checkbox"/>	vol-010b5e3...	8 GiB	gp2	100		October 9, 2017 at ...	us-west-2a	available	None
<input type="checkbox"/>	vol-09fcc7de...	8 GiB	gp2	100		October 9, 2017 at ...	us-west-2a	available	None
<input type="checkbox"/>	vol-0862179...	8 GiB	gp2	100		October 3, 2017 at ...	us-west-2b	in-use	None
<input type="checkbox"/>	vol-0260cfea...	8 GiB	gp2	100		October 3, 2017 at ...	us-west-2a	in-use	None
<input type="checkbox"/>	vol-0383809...	8 GiB	gp2	100		October 3, 2017 at ...	us-west-2b	available	None

**Volume Details:**

- Created: October 9, 2017 at 8:41:08 PM UTC+5:30
- State: in-use
- Attachment information: i-0636796d1448cc330 /dev/xvda (attached)
- Volume type: gp2
- Product codes: -
- IOPS: 100 / 3000
- Availability Zone: us-west-2b
- Encrypted: Not Encrypted
- KMS Key ID: -
- KMS Key Aliases: -
- KMS Key ARN: -

As you can see my volume which is in us-west-2b in the state of 'in-use' which means running..

Now name the snapshot with whatever the name you want and create it

This screenshot is identical to the one above, showing the AWS Management Console 'Volumes' page. The context menu for the first volume (vol-06fd1d98...) is open, and the 'Create Snapshot' option is highlighted in orange. The volume's state is 'in-use' and it is located in the 'us-west-2b' availability zone.

Create Snapshot

Volume

vol-06fd1d98e32fb28f5

Name

EBS Lab 1

Description

Today's lab

Encrypted

No

Cancel

Create

Create Snapshot

Snapshot Creation Started

View snapshot [snap-0e2f53c57f7e372e0](#)

Close

You will find the newly created snapshot under Snapshots column.

Now click on the snapshot and select the snapshot ,right click on it and create a volume from it.

aws

Services

Resource Groups

SRIGANESH PERA

Oregon

Support

EC2 Dashboard

Events

Tags

Reports

Limits

INSTANCES

Instances

Spot Requests

Reserved Instances

Scheduled Instances

Dedicated Hosts

IMAGES

AMIs

Bundle Tasks

ELASTIC BLOCK STORE

Volumes

**Snapshots**

NETWORK & SECURITY

Security Groups

Create Snapshot

Actions

Owned By Me

Filter by tags and attributes or search by keyword

1 to 8 of 8

	Name	Snapshot ID	Size	Description	Status	Started
	snap3	snap-001f3e5a76ed...	1 GiB	snap3	completed	September 27, 2017 at 8:32...
	snap1	snap-03f8efea8fb62...	8 GiB	snap1	completed	September 27, 2017 at 8:27...
	snap23	snap-05367925e4fd...	8 GiB	with file	completed	October 9, 2017 at 5:08:14 P...
	snap1	snap-079f1ea620de...	8 GiB		completed	September 27, 2017 at 6:38...
	snap4	snap-09cc3a732b5...	8 GiB	snap4	completed	September 27, 2017 at 8:32...
		snap-0a8f7476cc6a...	8 GiB	Created by CreateImage(i-0138d821b0ea1648c) for ami-eccb3...	completed	October 4, 2017 at 8:06:58 A...
	snap2	snap-0c9555807dfc...	1 GiB	snap2	completed	September 27, 2017 at 8:27...
	<b>ebs lab1</b>	<b>snap-0e2f53c57f7e...</b>		with file	completed	October 10, 2017 at 4:12:47...

Delete

Create Volume

Create Image

Copy

Modify Permissions

Add/Edit Tags

Snapshot: snap-0e2f53c57f7e372e0 (ebs lab1)

Description

Permissions

Tags

Snapshot ID	snap-0e2f53c57f7e372e0	Progress	100%
Status	completed	Capacity	8 GiB
Volume	vol-06fd1d98e32fb28f5	Encrypted	Not Encrypted

The reason why we create a volume from snapshot is that we will use the newly created volume which has our static webpage and use it to another instance, which demonstrates how our data is isolated from an instance and how we can keep back up of that data and use it for any instance we want it to.

Now I create the volume from the snapshot in availability zone: **US-west 2a**

Are you sure you want to perform this action?

Snapshot ID: snap-0e2f53c577e372e0 (ebs lab1)

Volume Type: General Purpose SSD (GP2)

Size (GiB): 8 (Min: 1 GiB, Max: 16384 GiB)

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

Availability Zone\*: us-west-2a

Throughput (MB/s): Not applicable

Encryption: Not Encrypted

Tags: ☐ Add tags to your volume

\* Required

Cancel Create Volume

Click on create Volume.

**\* Now terminate the instance we've created as we no longer required.**

	Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)	IPv4
<input type="checkbox"/>	webserver1	i-042b3ef8ffa8745	t2.micro	us-west-2a	running	2/2 checks ...	None	ec2-34-215-88-119 us-...	34.2
<input checked="" type="checkbox"/>	webserver2	i-0636796d1448c330	t2.micro	us-west-2b	terminated	2/2 checks ...	None	ec2-52-11-58-180 us-w...	52.1
<input type="checkbox"/>	webserver3	i-0921bdf6269bb922	t2.micro	us-west-2b	running	2/2 checks ...	None	ec2-52-11-58-180 us-w...	52.1

As you can see the instance is terminated.

## What have we done so far?

1. We launched an instance in us-west 2a
2. We installed an Apache webserver on our instance and created a static webpage on it.

3. We created a snapshot (backup) of the Root volume which contains a static webpage launched on a webserver.

4. We created a volume from the snapshot itself.

### What we are going to do now?

1. Terminate the previous instance and launch new instance with new volume
2. Detach new volume and attach volume created from snapshot as new volume
3. Check Public DNS to see the change of volume swap.

### (i) Launch a new instance

Repeat steps from (a) to (g)

Make sure that your instance is launched in **us-west 2a** (in 'Configure Instance select the subnet as 'us-west 2a') as our volume is created within the same region.

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.

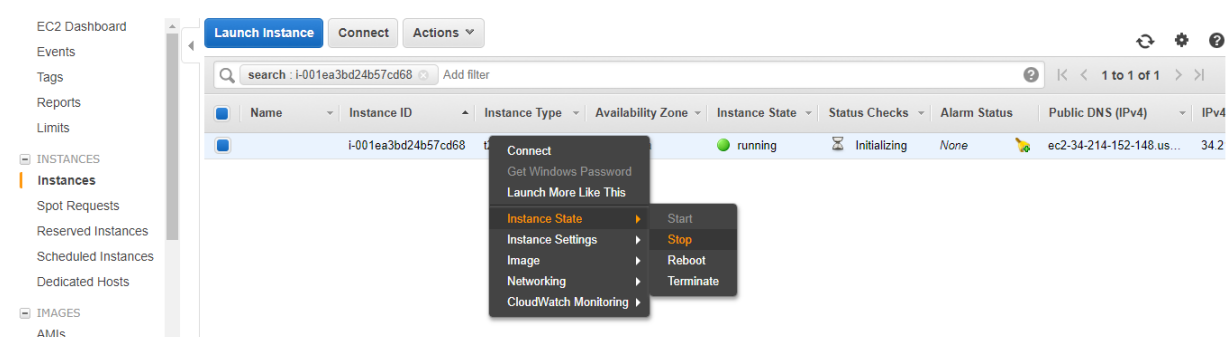
Number of instances: 1 [Launch into Auto Scaling Group](#)

Purchasing option: ☐ Request Spot instances

Network: vpc-d695eab3 (default) [Create new VPC](#)

Subnet: subnet-21fc9156 | Default in us-west-2a [Create new subnet](#)  
4089 IP Addresses available

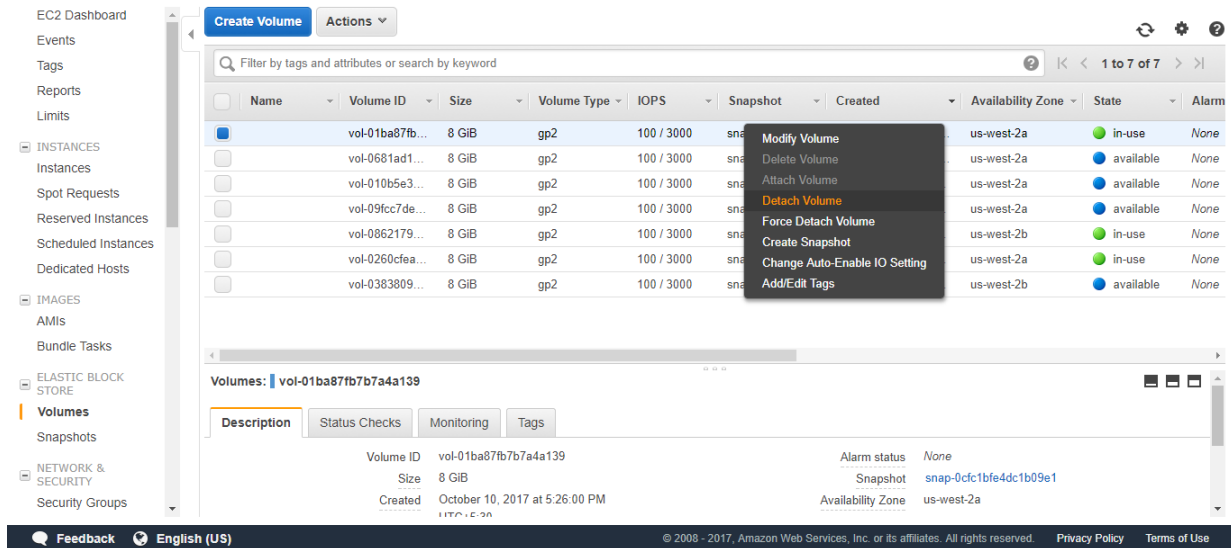
As soon as the instance is launched. Stop the instance.





**(k) Now go to volumes and detach the root volume of this new instance and attach the volume we created from snapshot as root volume**

**You can see that the volume 'in-use' is the volume we need to detach from the instance**



Name	Volume ID	Size	Volume Type	IOPS	Snapshot	Created	Availability Zone	State	Alarm
	vol-01ba87fb7b7a4a139	8 GiB	gp2	100 / 3000	sn		us-west-2a	in-use	None
	vol-0681ad173388e55b2	8 GiB	gp2	100 / 3000	sn		us-west-2a	available	None
	vol-010b5e33b2b2b2b2b	8 GiB	gp2	100 / 3000	sn		us-west-2a	available	None
	vol-09fc7de...	8 GiB	gp2	100 / 3000	sn		us-west-2a	available	None
	vol-0862179...	8 GiB	gp2	100 / 3000	sn		us-west-2b	in-use	None
	vol-0260cfa...	8 GiB	gp2	100 / 3000	sn		us-west-2a	in-use	None
	vol-0383809...	8 GiB	gp2	100 / 3000	sn		us-west-2b	available	None

**Volumes:** vol-01ba87fb7b7a4a139

**Description** | Status Checks | Monitoring | Tags

Volume ID: vol-01ba87fb7b7a4a139 | Alarm status: None  
Size: 8 GiB | Snapshot: snap-0cfc1bfe4dc1b09e1  
Created: October 10, 2017 at 5:26:00 PM | Availability Zone: us-west-2a

As soon as it is detached it goes to 'available' mode. Now attach the **volume created from snapshot** as root volume to the **stopped instance**, which is in the same region(us-west 2a) as that of the instance

And in the device change the 'sdf' to 'xvda' .

This change tells that our volume is attached as root volume xvda. If you go to page 18 we used lsblk command to see the location of root volume which is 'xvda'.

**Attach Volume**

**Volume** ⓘ vol-0681ad173388e55b2 in us-west-2a

**Instance** ⓘ  in us-west-2a

**Device** ⓘ

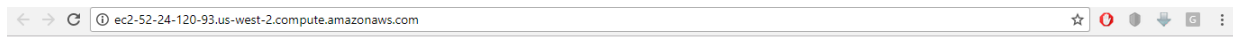
Linux Devices: /dev/sdf through /dev/sdp

Note: Newer Linux kernels may rename your devices to /dev/xvdf through /dev/xvdp internally, even when the device name entered here (and shown in the details) is /dev/sdf through /dev/sdp.

[Cancel](#) [Attach](#)

And click on Attach.

(l) Now start the instance and copy the public DNS and paste it in a browser and reload it. You'll see the same static website we built on volume for the 1<sup>st</sup> instance when we created it.



**Welcome to EBS lab**

*Training and Certification given by Sriganesh Pera*

This is how we create backup of data and use it for other instances depending on the need and requirement.

(m) **Cleanup:**

Terminate all the instances, and delete volumes and snapshots as it incurs costs if you keep it running.

**-----End of Lab 1-----**

Important questions to ponder:

**1. What is Amazon EBS?**

**Amazon Elastic Block Store (Amazon EBS)** provides **persistent block storage volumes** for use with Amazon EC2 instances in the AWS Cloud. Each Amazon EBS volume is automatically **replicated** within its Availability Zone to protect you from component failure, offering high availability and durability.'

**2. What are EBS volume types?**

## Amazon EBS Volume Types

The following table shows use cases and performance characteristics of current generation EBS volumes:

Volume Type	Solid State Drives (SSD)		Hard Disk Drives (HDD)	
	EBS Provisioned IOPS SSD (io1)	EBS General Purpose SSD (gp2)*	Throughput Optimized HDD (st1)	Cold HDD (sc1)
Short Description	Highest performance SSD volume designed for latency-sensitive transactional workloads	General Purpose SSD volume that balances price performance for a wide variety of transactional workloads	Low cost HDD volume designed for frequently accessed, throughput intensive workloads	Lowest cost HDD volume designed for less frequently accessed workloads
Use Cases	I/O-intensive NoSQL and relational databases	Boot volumes, low-latency interactive apps, dev & test	Big data, data warehouses, log processing	Colder data requiring fewer scans per day
API Name	io1	gp2	st1	sc1
Volume Size	4 GB - 16 TB	1 GB - 16 TB	500 GB - 16 TB	500 GB - 16 TB
Max IOPS**/Volume	20,000	10,000	500	250
Max Throughput/Volume	320 MB/s	160 MB/s	500 MB/s	250 MB/s
Max IOPS/Instance	65,000	65,000	65,000	65,000
Max Throughput/Instance	1,250 MB/s	1,250 MB/s	1,250 MB/s	1,250 MB/s
Price	\$0.125/GB-month \$0.065/provisioned IOPS	\$0.10/GB-month	\$0.045/GB-month	\$0.025/GB-month
Dominant Performance Attribute	IOPS	IOPS	MB/s	MB/s

### 3. What is an IOPS?

Input/output operations per second (IOPS, pronounced eye-ops) is a performance measurement used to characterize computer storage devices like hard disk drives (HDD), solid state drives (SSD), and storage area networks (SAN).

### 4.What are EBS snapshots?

1. Amazon EBS snapshots are nothing but back up of EBS volumes.

2. It provides the ability to save point-in-time snapshots of your volume which is saved in **Amazon S3**.

3. Amazon EBS Snapshots are stored incrementally: which means only the blocks that have changed after your last snapshot are saved, and you are billed only for the changed blocks. **When you delete a snapshot, only the data unique to that snapshot is removed.**

for ex: If you have a device with 100 GB of data but only 5 GB has changed after your last snapshot, a subsequent snapshot consumes only 5 additional GB and you are billed only for the additional 5 GB of snapshot storage, even though both the earlier and later snapshots appear complete.

4. Snapshots that are taken from encrypted volumes are automatically encrypted. Volumes that are created from encrypted snapshots are also automatically encrypted.

### **Features of Snapshots:**

1. **Immediate access to Amazon EBS volume data**
2. **Resizing Amazon EBS volumes**
3. **Sharing Amazon EBS Snapshots-** You can share with co-workers or with AWS community
4. **Copying Amazon EBS Snapshots across AWS regions-** Amazon EBS's ability to copy snapshots across AWS regions makes it easier to leverage multiple AWS regions for geographical expansion, data center migration and disaster recover.
5. **Amazon EBS Encryption and AWS Identity and Access Management-** Amazon EBS encryption offers seamless encryption of EBS data volumes, boot volumes and snapshots, eliminating the need to build and manage a secure key management infrastructure.

## 5.Can an EBS volume be attached to multiple instances?

Each **EBS volume** can be **attached** to only one **instance**.

## 6. What are elastic Volumes in EBS?

When you attach a **general-purpose** volume to your instance with a fixed size 8 GB, but you'd like to increase the size of EBS or change the type to provisioned IOPS. You need to detach the EBS volume and announce a downtime if your instance is a production instance.

If you use elastic volume to your instance you can dynamically increase capacity, tune performance, and change the type of live volumes with no downtime or performance impact unlike what you do with general purpose volume.

Further study: If you want to be a certified developer you need to dig deep into AWS documentation

1.<https://aws.amazon.com/premiumsupport/knowledge-center/instance-store-vs-ebs/>

2. <http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSVolumes.html>

3.Do it for yourself lab:

<http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/creating-an-ami-ebs.html>

After studying these make sure you understand and answer these questions:

Exam Scenario Questions :-

1. EC2 EBS-backed (EBS root) instance is stopped, what happens to the data on any ephemeral store volumes?
  - (a) Data is automatically saved in an EBS volume.
  - (b) Data is unavailable until the instance is restarted.
  - (c) Data will be deleted and will no longer be accessible.

(d) Data is automatically saved as an EBS snapshot.

2. When an EC2 instance that is backed by an S3-based AMI is terminated, what happens to the data on the root volume?

(A) Data is automatically saved as an EBS snapshot.

(b) Data is automatically saved as an EBS volume.

(c) Data is unavailable until the instance is restarted.

(d) Data is automatically deleted.

3. Which of the following will occur when an EC2 instance in a VPC (Virtual Private Cloud) with an associated Elastic IP is stopped and started? (Choose 2 answers)

The Elastic IP will be dissociated from the instance

(a) All data on instance-store devices will be lost

(b) All data on EBS (Elastic Block Store) devices will be lost

(c) The ENI (Elastic Network Interface) is detached

(d) The underlying host for the instance is changed