

# ACF Lab 2: Working with EBS

## Lab Overview

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This lab focuses on Amazon Elastic Block Store (Amazon EBS), a key underlying storage mechanism for Amazon EC2 instances. In this lab, you will learn how to create an Amazon EBS volume, attach it to an instance, apply a file system to the volume, and then take a snapshot backup.

## What is Amazon Elastic Block Store (Amazon EBS)?

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**Amazon EBS** offers persistent storage for Amazon EC2 instances. Amazon EBS volumes are network-attached and persist independently from the life of an instance. Amazon EBS volumes are highly available, highly reliable volumes that can be leveraged as an Amazon EC2 instances boot partition or attached to a running Amazon EC2 instance as a standard block device.

When used as a boot partition, Amazon EC2 instances can be stopped and subsequently restarted, enabling you to pay only for the storage resources used while maintaining your instance's state. Amazon EBS volumes offer greatly improved durability over local Amazon EC2 instance stores because Amazon EBS volumes are automatically replicated on the backend (in a single Availability Zone).

For those wanting even more durability, Amazon EBS provides the ability to create point-in-time consistent snapshots of your volumes that are then stored in Amazon Simple Storage Service (Amazon S3) and automatically replicated across multiple Availability Zones. These snapshots can be used as the starting point for new Amazon EBS volumes and can protect your data for long-term durability. You can also easily share these snapshots with co-workers and other AWS developers.

## Amazon EBS Volume Features

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Amazon EBS volumes deliver the following features:

- **Persistent storage:** Volume lifetime is independent of any particular Amazon EC2 instance.
- **General purpose:** Amazon EBS volumes are raw, unformatted block devices that can be used from any operating system.
- **High performance:** Amazon EBS volumes are equal to or better than local Amazon EC2 drives.
- **High reliability:** Amazon EBS volumes have built-in redundancy within an Availability Zone.
- **Designed for resiliency:** The AFR (Annual Failure Rate) of Amazon EBS is between 0.1% and 1%.
- **Variable size:** Volume sizes range from 1 GB to 16 TB.

- **Easy to use:** Amazon EBS volumes can be easily created, attached, backed up, restored, and deleted.

This lab guide explains basic concepts of Amazon EBS in a step-by-step fashion. However, it can only give a brief overview of Amazon EBS concepts. For further information, see the [Amazon EBS documentation](#).

## The Amazon EBS Volume Lifecycle

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You can perform many actions on an EBS volume:

Action	Description
<b>Create</b>	New Amazon EBS volumes are created out of a vast amount of available space. They can have a size of 1 GB to 16 TB.
<b>Attach</b>	An Amazon EBS volume can be attached to an instance. After attachment, it becomes visible to the operating system as a regular block device, just like a hard drive. Each Amazon EBS volume can only be attached to a single instance at a time.
<b>Attached and In Use</b>	The operating system can now format and set up a file system on the Amazon EBS volume and use it as a regular storage device.
<b>Create Snapshot</b>	Snapshots can be created at any time while the volume is in-use.
<b>Detach</b>	When the operating system no longer uses the volume, it can be detached from the instance. Data remains stored on the Amazon EBS volume, and the volume remains available for attachment to any other instance within the same Availability Zone.
<b>Delete</b>	When the volume and its contents are no longer needed, the Amazon EBS volume can be deleted.

## Amazon EBS, AMIs, and Termination

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You can boot Amazon EC2 instances from Amazon EBS volumes. Such instances are created from Amazon Machine Images (AMIs) that reference Amazon EBS snapshots containing the initial operating system image to boot from. When you create such an instance, a new Amazon EBS volume for the root file system is created from a volume snapshot containing the operating system image.

When an instance is terminated, the default behavior for most instances is to simply delete the Amazon EBS volume because it can be recreated at any time out of the underlying AMI.

If you want to retain the Amazon EBS volume's contents after terminating an instance (for example to keep some customized configuration), you can specify the *DeleteOnTermination = False* flag for the instance. In this case, the Amazon EBS volume will only be detached from the instance when the instance is terminated.

## Technical knowledge prerequisites

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To successfully complete this lab, you should be familiar with basic Amazon EBS usage and with basic Linux server administration. You should feel comfortable using the Linux command-line tools.

## Lab Objectives

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By the end of this lab, you will be able to:

- Create an Amazon EBS volume
- Attach the volume to an instance
- Configure the instance to use the virtual disk
- Create an Amazon EBS snapshot
- Restore the snapshot

## Other AWS Services

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Other AWS Services than the ones needed for this lab are disabled by IAM policy during your access time in this lab. In addition, the capabilities of the services used in this lab are limited to what's required by the lab and in some cases are even further limited as an intentional aspect of the lab design. Expect errors when accessing other services or performing actions beyond those provided in this lab guide.

### Duration

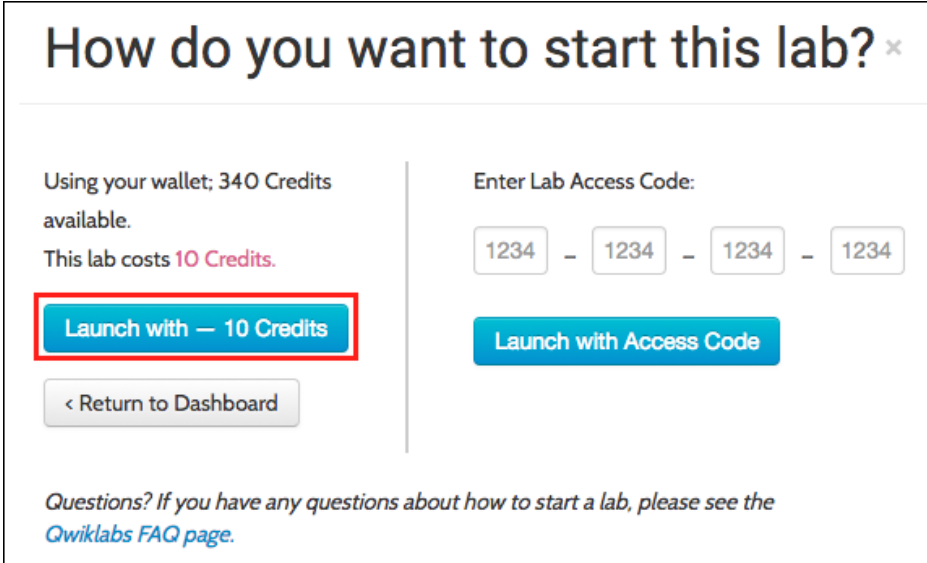
This lab takes approximately **45 minutes** to complete.

## Accessing the AWS Management Console

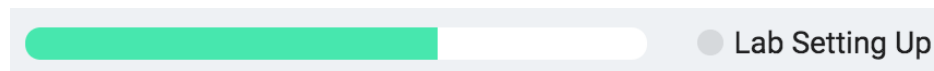
1. At the top of these instructions, click **START LAB** to launch your lab.

A green rectangular button with the text "START LAB" in white capital letters.

2. When asked *How do you want to start this lab*, click **Launch with credits**.

A dialog box titled "How do you want to start this lab?" with a close button (x) in the top right. It has two main sections. The left section shows "Using your wallet; 340 Credits available." and "This lab costs 10 Credits." Below this is a blue button labeled "Launch with — 10 Credits" which is highlighted with a red rectangle. Below that is a grey button labeled "< Return to Dashboard". The right section is titled "Enter Lab Access Code:" and contains four input boxes, each with "1234", separated by minus signs. Below this is a blue button labeled "Launch with Access Code". At the bottom, there is a link: "Questions? If you have any questions about how to start a lab, please see the Qwiklabs FAQ page."

A status bar shows the progress of the lab environment creation process. The AWS Management Console is accessible during lab resource creation, but your AWS resources may not be fully available until the process is complete.



3. Click **Open Console**.

A yellow rectangular button with the text "OPEN CONSOLE" in black capital letters.

4. Sign in using the **Username** and **Password** shown to the left of these instructions.

You will be taken to the AWS Management Console.

## Task 1: Create a New EBS Volume

In this task, you will create and attach an Amazon EBS volume to a new Amazon EC2 instance.

5. In the AWS Management Console, on the **Services** menu, click **EC2**.

6. In the left navigation pane, click **Instances**.

An Amazon EC2 instance named **Lab** has already been launched for your lab.

7. Note the **Availability Zone** of the instance. It will look similar to *us-west-2a* which is located in the blue banner under the Availability Zone header.

8. In the left navigation pane, click **Volumes**.

You will see an existing volume that is being used by the Amazon EC2 instance. This volume has a size of 8 GiB, which makes it easy to distinguish from the volume you will create next, which will be 1 GiB in size.

9. Click **Create Volume**.

The **Create Volume** page will appear. Point to the information icons ⓘ to obtain information about each field.

10. Enter the following values, leaving other fields at their default values:

- **Volume Type:** General Purpose SSD (GP2)
- **Size (GiB):** 1
- **Availability Zone:** Select the same availability zone as your EC2 instance. It is also shown to the left of the instructions you are currently reading.
- **Tags:** Create additional tags. Select Add Tag and enter the following in the respective boxes:
  - **Key:** Name (Case-sensitive, so type it exactly as shown)
  - **Value:** My Volume

11. Click **Create Volume**, then click **Close**.

Your new volume will appear in the list, and will move from the *creating* state to the *available* state as indicated by the green and blue icons, respectively under the State column in the banner.

## Task 2: Attach the Volume to an Instance

You can now attach your new volume to the Amazon EC2 instance.

12. Select ☒ **My Volume** so that the row is highlighted.

💬 If you cannot see the volume, click the refresh icon.

13. In the **Actions** menu, select **Attach Volume**.

14. Click in the **Instance** field, then select the instance that appears (Lab).

Note that the **Device** field is set to `/dev/sdf`. You will use this device identifier in a later task.

15. Click **Attach**.

The volume state is now *in-use* as indicated by the blue icon turned to green.

## Task 3: Login to your Amazon EC2 instance

To perform the next operations on your volume, you will login to the Amazon EC2 instance. Windows users should follow Task 3.1. Mac/Linux users should follow Task 3.2.

Mac/Linux users - [click here for Login instructions](#)

### Task 3.1: Windows SSH

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This section is for **Windows users only**. If you are running Mac operating system or Linux, please click the "Mac/Linux Users" link above.

In this task, you will download a Keypair and use it to connect to your Amazon EC2 instance using PuTTY.

16. From the qwikLABS page in your browser, in the **Connect** section, click **Download PEM/PPK > Download PPK**. (It is in the section below the Username and Password - scroll down to see it.)

17. Save the file to your **Downloads** folder or any other easy to access location on your local computer. Make note of the location of the saved file for future use.

You will be using PuTTY to connect to the Amazon EC2 instance. If you do not have PuTTY installed on your computer, [download it here](#).

18. Launch **PuTTY** by running the putty.exe file you downloaded. The PuTTY Configuration dialog box that will be used for the next steps will appear.

19. For **Host Name**, enter the public IP address of your EC2 instance, which is shown to the left of the instructions you are currently reading in the Lab's **Connection Details**.

20. In the **Connection** list, expand **SSH**.

21. Click **Auth**.

22. In the **Private key file for authentication** box, browse to the .ppk file that you downloaded earlier, then click **Open**.

23. In the **PuTTY Security Alert** dialog box that opens, click **Yes** to add the key to PuTTY's cache.

24. For **login as:** type `ec2-user` and press **Enter**. You are now logged in to your **Web Server** instance.



```
login as: ec2-user
Authenticating with public key "imported-openssh-key"
Last login: Thu Jun 15 03:49:40 2017 from 205.251.233.178

  _| _|_ )
 _| ( _| /  Amazon Linux AMI
 _|\_|_|_|

https://aws.amazon.com/amazon-linux-ami/2017.03-release-notes/
8 package(s) needed for security, out of 12 available
Run "sudo yum update" to apply all updates.
[ec2-user@ip-172-31-43-90 ~]$
```

(The actual text you see may differ slightly from the above.)

25. Windows Users: Click [here](#) to skip ahead to the next task.

## Task 3.2: Mac/Linux SSH

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This section is for **Linux** and **Mac operating system** users only. If you are running **Windows**, click [here](#) to skip ahead to the next task.

In this task, you will download a Keypair and use it to connect to your Amazon EC2 instance.

26. From the qwikLABS page in your browser, in the **Connect** section, click **Download PEM/PPK > Download PEM**. (It is in the section below the Username and Password - scroll down to see it.)

27. Save the file to your computer in a place where you can easily access it.

28. Open the Terminal application on your computer.

29. To connect to your EC2 instance, run the following commands in Terminal (but substituting values as explained below):

```
chmod 400 <path and name of pem file>
```

```
ssh -i <path and name of pem> ec2-user@<Public IP>
```

- For **<path and name of pem file>**, substitute the path/filename to the .pem file you downloaded.
- For **<Public IP>**, enter the public IP address of your EC2 instance, which is shown to the left of the instructions you are currently reading.

## Task 4: Create and Configure Your File System

In this task, you will add an the new volume to a Linux instance as an ext3 file system under the /mnt/data-store mount point.

① If you are using PuTTY, you can paste text by right-clicking in the PuTTY window.

30. Copy and paste this command to view the current storage available on your instance:

```
df -h
```

You should see output similar to:

Filesystem	Size	Used	Avail	Use%	Mounted on
devtmpfs	488M	60K	488M	1%	/dev
tmpfs	497M	0	497M	0%	/dev/shm
/dev/xvda1	7.8G	982M	6.7G	13%	/

This is showing the original 8GB disk volume. Your new volume is not yet shown.

31. Copy and paste this command to create an ext3 file system on the new volume:

```
sudo mkfs -t ext3 /dev/sdf
```

32. Create a directory for mounting the new storage volume:

```
sudo mkdir /mnt/data-store
```

33. Mount the new volume:

```
sudo mount /dev/sdf /mnt/data-store
```

To configure the Linux instance to mount this volume whenever the instance is started, you will need to add a line to */etc/fstab*.

34. Run this command to add the configuration line:

```
echo "/dev/sdf    /mnt/data-store ext3 defaults,noatime 1 2" | sudo tee -a /etc/fstab
```

35. View the configuration file to see the setting on the last line:

```
cat /etc/fstab
```

36. View the available storage again:

```
df -h
```

The output will now contain an additional line, shown here as */dev/xvdf*.

Filesystem	Size	Used	Avail	Use%	Mounted on
devtmpfs	488M	60K	488M	1%	/dev
tmpfs	497M	0	497M	0%	/dev/shm
/dev/xvda1	7.8G	982M	6.7G	13%	/
/dev/xvdf	976M	1.3M	924M	1%	/mnt/data-store

Compare this to the output generated in step 30.

37. Close your SSH session window.

## Task 5: Create an Amazon EBS Snapshot

In this task, you will create a snapshot of your EBS volume. Snapshots are incremental backups, which means that only the blocks on the device that have changed after your most recent snapshot are saved. Additional information on [snapshots](#) is available on the AWS site.

You can create any number of point-in-time, consistent snapshots from Amazon EBS volumes at any time. Amazon EBS snapshots are stored in Amazon S3 with high durability. New Amazon EBS volumes can be created out of snapshots for cloning or restoring backups. Amazon EBS snapshots can also be easily shared among AWS users or copied over AWS regions.

38. Return to the EC2 Management Console in your web browser.

You should still be on the **Volumes** page. If not, click **Volumes** in the left navigation pane.

39. Select ☒ your volume so that the row is highlighted.

40. In the **Actions** menu, select **Create Snapshot**.

41. In the **Create Snapshot** dialog box, for **Name**, type: `My Snapshot`

42. Click **Create**, then click **Close**.

Your snapshot will be listed in the **Snapshots** console.

43. In the left navigation pane, click **Snapshots**.

Your snapshot is displayed. The state will start with a state of *pending*, which means that the snapshot is being created. It will then change to a state of *completed*. Only used storage blocks are copied to snapshots, so empty blocks do not take any snapshot storage space.

## Task 6: Restore the Amazon EBS Snapshot

Creating a snapshot is like backing up your hard drive on Monday morning at 11:00 a.m. Sometimes disaster strikes and on Friday something goes wrong on your laptop and you need to restore your laptop to the state it was on Monday at 11:00 a.m. (when the last snapshot was taken). To retrieve data stored in a snapshot, you can [Restore](#) the snapshot to a new EBS volume.

44. Select ☒ your snapshot so that the row is highlighted.

45. In the **Actions** menu, select **Create Volume**.

When restoring a snapshot to a new volume, you can also modify the configuration, such as changing the volume type, size or Availability Zone.

46. Enter the following values, leaving other fields at their default values:

- **Availability Zone:** Choose a different availability zone this time
- **Tags:** ☒ Create additional tags
- In the Tag Editor, enter:
  - **Key:** Name (Case-sensitive, so type it exactly as shown)
  - **Value:** Restored Volume

47. Click **Create Volume**, then click **Close**.

48. In the left navigation pane, click **Volumes**.

You should now see your new *Restored Volume*.

## Conclusion

Congratulations! You now have learned how to:

- Create an Amazon EBS volume
- Attach the volume to an instance
- Configure the instance to use the virtual disk
- Create an Amazon EBS snapshot
- Restore the snapshot

## Lab Complete

You have successfully completed the lab. To clean up your lab environment, do the following:

49. To sign out of the **AWS Management Console** click **awsstudent** in the navigation bar, and then click **Sign Out**.
50. Return to the **qwikLABS** page where you launched your lab and click **END LAB**.

## Lab Feedback

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For feedback, suggestions, or corrections, please email us at *[aws-course-feedback@amazon.com](mailto:aws-course-feedback@amazon.com)*.