**Storage**

Amazon EC2 provides you with flexible, cost effective, and easy-to-use data storage options for your instances. Each option has a unique combination of performance and durability. These storage options can be used independently or in combination to suit your requirements.

After reading this section, you should have a good understanding about how you can use the data storage options supported by Amazon EC2 to meet your specific requirements. These storage options include the following:

* [Amazon Elastic Block Store](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/AmazonEBS.html)
* [Amazon EC2 Instance Store](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/InstanceStorage.html)
* [Amazon Elastic File System (Amazon EFS)](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/AmazonEFS.html)
* [Amazon Simple Storage Service (Amazon S3)](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/AmazonS3.html)

The following figure shows the relationship between these types of storage.


        Storage options for Amazon EC2
      

**Amazon EBS**

Amazon EBS provides durable, block-level storage volumes that you can attach to a running instance You can use Amazon EBS as a primary storage device for data that requires frequent and granular updates. For example, Amazon EBS is the recommended storage option when you run a database on an instance.

An EBS volume behaves like a raw, unformatted, external block device that you can attach to a single instance. The volume persists independently from the running life of an instance. After an EBS volume is attached to an instance, you can use it like any other physical hard drive. As illustrated in the previous figure, multiple volumes can be attached to an instance. You can also detach an EBS volume from one instance and attach it to another instance. You can dynamically change the configuration of a volume attached to an instance. EBS volumes can also be created as encrypted volumes using the Amazon EBS encryption feature. For more information, see [Amazon EBS Encryption](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSEncryption.html).

To keep a backup copy of your data, you can create a *snapshot* of an EBS volume, which is stored in Amazon S3. You can create an EBS volume from a snapshot, and attach it to another instance. For more information, see [Amazon Elastic Block Store](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/AmazonEBS.html).

**Amazon EC2 Instance Store**

Many instances can access storage from disks that are physically attached to the host computer. This disk storage is referred to as *instance store*. Instance store provides temporary block-level storage for instances. The data on an instance store volume persists only during the life of the associated instance; if you stop or terminate an instance, any data on instance store volumes is lost. For more information, see [Amazon EC2 Instance Store](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/InstanceStorage.html).

**Amazon EFS File System**

Amazon EFS provides scalable file storage for use with Amazon EC2. You can create an EFS file system and configure your instances to mount the file system. You can use an EFS file system as a common data source for workloads and applications running on multiple instances. For more information, see [Amazon Elastic File System (Amazon EFS)](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/AmazonEFS.html).

**Amazon S3**

Amazon S3 provides access to reliable and inexpensive data storage infrastructure. It is designed to make web-scale computing easier by enabling you to store and retrieve any amount of data, at any time, from within Amazon EC2 or anywhere on the web. For example, you can use Amazon S3 to store backup copies of your data and applications. Amazon EC2 uses Amazon S3 to store EBS snapshots and instance store-backed AMIs.

# Amazon Elastic Block Store (Amazon EBS)

Amazon Elastic Block Store (Amazon EBS) provides block level storage volumes for use with EC2 instances. EBS volumes are highly available and reliable storage volumes that can be attached to any running instance that is in the same Availability Zone. EBS volumes that are attached to an EC2 instance are exposed as storage volumes that persist independently from the life of the instance. With Amazon EBS, you pay only for what you use.

**To create an EBS volume using the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. From the navigation bar, select the region in which you would like to create your volume. This choice is important because some Amazon EC2 resources can be shared between regions, while others can't. For more information, see [Resource Locations](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/resources.html).


            Launch instance start
          

1. In the navigation pane, under **ELASTIC BLOCK STORE**, choose **Volumes**.
2. Above the upper pane, choose **Create Volume**.
3. In the **Create Volume** dialog box, for **Volume Type**, choose **General Purpose SSD (GP2)**, **Provisioned IOPS SSD (IO1)**, **Throughput Optimized HDD (ST1)**, **Cold HDD (SC1)**, or **Magnetic**. For more information, see [Amazon EBS Volume Types](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSVolumeTypes.html).

**Note**

Some AWS accounts created before 2012 might have access to Availability Zones in us-west-1 or ap-northeast-1 that do not support Provisioned IOPS SSD (io1) volumes. If you are unable to create an io1 volume (or launch an instance with an io1 volume in its block device mapping) in one of these regions, try a different Availability Zone in the region. You can verify that an Availability Zone supports io1 volumes by creating a 4 GiB io1 volume in that zone.

1. For **Size**, enter the size of the volume, in GiB.
2. For io1 volumes, in the **IOPS** field, enter the maximum number of input/output operations per second (IOPS) that the volume should support.
3. For **Availability Zone**, select the Availability Zone in which to create the volume.
4. (Optional) To create an encrypted volume, select the **Encrypted** box and choose the master key you want to use when encrypting the volume. You can choose the default master key for your account, or you can choose any customer master key (CMK) that you have previously created using the AWS Key Management Service. Available keys are visible in the **Master Key** menu, or you can paste the full ARN of any key that you have access to. For more information, see the [AWS Key Management Service Developer Guide](http://docs.aws.amazon.com/kms/latest/developerguide/).

**Note**

Encrypted volumes can only be attached to selected instance types. For more information, see [Supported Instance Types](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSEncryption.html#EBSEncryption_supported_instances).

1. Choose **Yes, Create**.

**To restore an EBS volume from a snapshot using the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. From the navigation bar, select the region that your snapshot is located in. This choice is important because some Amazon EC2 resources can be shared between regions, while others can't. For more information, see [Resource Locations](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/resources.html). If you need to restore the snapshot to a volume in a different region, you can copy your snapshot to the new region and then restore it to a volume in that region. For more information, see [Copying an Amazon EBS Snapshot](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-copy-snapshot.html).


            Launch instance start
          

1. In the navigation pane, choose **Volumes**, **Create Volume**.
2. In the **Create Volume** dialog box, for **Volume Type**, choose **General Purpose SSD**, **Provisioned IOPS SSD**, or **Magnetic**. For more information, see [Amazon EBS Volume Types](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSVolumeTypes.html).

**Note**

Some AWS accounts created before 2012 might have access to Availability Zones in us-west-1 or ap-northeast-1 that do not support Provisioned IOPS SSD (io1) volumes. If you are unable to create an io1 volume (or launch an instance with an io1 volume in its block device mapping) in one of these regions, try a different Availability Zone in the region. You can verify that an Availability Zone supports io1 volumes by creating a 4 GiB io1 volume in that zone.

1. For **Snapshot**, start typing the ID or description of the snapshot from which you are restoring the volume, and select it from the list of suggested options.

**Note**

Volumes that are restored from encrypted snapshots can only be attached to instances that support Amazon EBS encryption. For more information, see [Supported Instance Types](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSEncryption.html#EBSEncryption_supported_instances).

1. For **Size**, enter the size of the volume in GiB, or verify that the default size of the snapshot is adequate.

If you specify both a volume size and a snapshot ID, the size must be equal to or greater than the snapshot size. When you select a volume type and a snapshot ID, minimum and maximum sizes for the volume are shown next to the **Size** list. Any AWS Marketplace product codes from the snapshot are propagated to the volume.

1. For io1 volumes, in the **IOPS** field, enter the maximum number of input/output operations per second (IOPS) that the volume can support.
2. In the **Availability Zone** list, select the Availability Zone in which to create the volume. EBS volumes can only be attached to EC2 instances within the same Availability Zone.
3. Choose **Yes, Create**.

**Important**

If you restored a snapshot to a larger volume than the default for that snapshot, you need to extend the file system on the volume to take advantage of the extra space. For more information, see [Modifying the Size, IOPS, or Type of an EBS Volume on Linux](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-expand-volume.html).

After you've restored a volume from a snapshot, you can attach it to an instance to begin using it. For more information, see [Attaching an Amazon EBS Volume to an Instance](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-attaching-volume.html).

**To attach an EBS volume to an instance using the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. In the navigation pane, choose **Volumes**.
3. Select a volume and choose **Actions**, **Attach Volume**.
4. In the **Attach Volume** dialog box, start typing the name or ID of the instance to attach the volume to for **Instance**, and select it from the list of suggestion options (only instances that are in the same Availability Zone as the volume are displayed).
5. You can keep the suggested device name, or enter a different supported device name.

**Important**

The block device driver for the instance assigns the actual volume name when mounting the volume, and the name assigned can be different from the name that Amazon EC2 recommends.

1. Choose **Attach**.
2. Connect to your instance and make the volume available. For more information, see [Making an Amazon EBS Volume Available for Use](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-using-volumes.html).

# Viewing Volume Information

You can view descriptive information for your Amazon EBS volumes in a selected region at a time in the AWS Management Console. You can also view detailed information about a single volume, including the size, volume type, whether or not the volume is encrypted, which master key was used to encrypt the volume, and the specific instance to which the volume is attached.

**View information about an EBS volume using the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. In the navigation pane, choose **Volumes**.
3. To view more information about a volume, select it. In the details pane, you can inspect the information provided about the volume.

**Learn what EBS (or other) volumes are attached to an Amazon EC2 instance**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. In the navigation pane, choose **Instances**.
3. To view more information about an instance, select it.
4. In the details pane, you can inspect the information provided about root and block devices.

## Working with an Impaired Volume

This section discusses your options if a volume is impaired because the volume's data is potentially inconsistent.

**Options**

* [Option 1: Perform a Consistency Check on the Volume Attached to its Instance](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/monitoring-volume-status.html#work_volumes_impaired_option1)
* [Option 2: Perform a Consistency Check on the Volume Using Another Instance](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/monitoring-volume-status.html#work_volumes_impaired_option2)
* [Option 3: Delete the Volume If You No Longer Need It](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/monitoring-volume-status.html#work_volumes_impaired_option3)

### Option 1: Perform a Consistency Check on the Volume Attached to its Instance

The simplest option is to enable I/O and then perform a data consistency check on the volume while the volume is still attached to its Amazon EC2 instance.

**To perform a consistency check on an attached volume**

1. Stop any applications from using the volume.
2. Enable I/O on the volume.
   1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
   2. In the navigation pane, choose **Volumes**.
   3. Select the volume on which to enable I/O operations.
   4. In the details pane, choose **Enable Volume IO**.


                                        Enable IO
                                    

* 1. In **Enable Volume IO**, choose **Yes, Enable**.

1. Check the data on the volume.
   1. Run the **fsck** (Linux) or **chkdsk** (Windows) command.
   2. (Optional) Review any available application or system logs for relevant error messages.
   3. If the volume has been impaired for more than 20 minutes you can contact support. Choose**Troubleshoot**, and then on the **Troubleshoot Status Checks** dialog box, choose **Contact Support** to submit a support case.

### Option 2: Perform a Consistency Check on the Volume Using Another Instance

Use the following procedure to check the volume outside your production environment.

**Important**

This procedure may cause the loss of write I/Os that were suspended when volume I/O was disabled.

**To perform a consistency check on a volume in isolation**

1. Stop any applications from using the volume.
2. Detach the volume from the instance.
   1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
   2. In the navigation pane, choose **Volumes**.
   3. Select the volume to detach.
   4. Choose **Actions**, **Force Detach Volume**. You'll be prompted for confirmation.
3. Enable I/O on the volume.
   1. In the navigation pane, choose **Volumes**.
   2. Select the volume that you detached in the previous step.
   3. In the details pane, choose **Enable Volume IO**.


                                        Enable IO
                                    

* 1. In the **Enable Volume IO** dialog box, choose **Yes, Enable**.

1. Attach the volume to another instance. For information, see [Launch Your Instance](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/LaunchingAndUsingInstances.html) and [Attaching an Amazon EBS Volume to an Instance](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-attaching-volume.html).
2. Check the data on the volume.
   1. Run the **fsck** (Linux) or **chkdsk** (Windows) command.
   2. (Optional) Review any available application or system logs for relevant error messages.
   3. If the volume has been impaired for more than 20 minutes, you can contact support. Choose**Troubleshoot**, and then in the troubleshooting dialog box, choose **Contact Support** to submit a support case.

### Option 3: Delete the Volume If You No Longer Need It

If you want to remove the volume from your environment, simply delete it. For information about deleting a volume, see [Deleting an Amazon EBS Volume](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-deleting-volume.html).

If you have a recent snapshot that backs up the data on the volume, you can create a new volume from the snapshot. For information about creating a volume from a snapshot, see [Restoring an Amazon EBS Volume from a Snapshot](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-restoring-volume.html).

## Working with the AutoEnableIO Volume Attribute

When Amazon EBS determines that a volume's data is potentially inconsistent, it disables I/O to the volume from any attached EC2 instances by default. This causes the volume status check to fail, and creates a volume status event that indicates the cause of the failure. If the consistency of a particular volume is not a concern, and you prefer that the volume be made available immediately if it's impaired, you can override the default behavior by configuring the volume to automatically enable I/O. If you enable the AutoEnableIO volume attribute, I/O between the volume and the instance is automatically re-enabled and the volume's status check will pass. In addition, you'll see an event that lets you know that the volume was in a potentially inconsistent state, but that its I/O was automatically enabled. When this event occurs, you should check the volume's consistency and replace it if necessary. For more information, see [Monitoring Volume Events](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/monitoring-volume-status.html#monitoring-vol-events).

This section explains how to view and modify the AutoEnableIO attribute of a volume using the Amazon EC2 console, the command line interface, or the API.

**To view the AutoEnableIO attribute of a volume in the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. In the navigation pane, choose **Volumes**.
3. Select the volume.
4. In the lower pane, choose **Status Checks**.
5. In the **Status Checks** tab, **Auto-Enable IO** displays the current setting for your volume, either Enabled or Disabled.


                            View Auto-Enable IO
                        

**To modify the AutoEnableIO attribute of a volume in the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. In the navigation pane, choose **Volumes**.
3. Select the volume.
4. At the top of the **Volumes** page, choose **Actions**.
5. Choose **Change Auto-Enable IO Setting**.


                            Change Auto-Enable IO setting
                        

1. In the **Change Auto-Enable IO Setting** dialog box, select the **Auto-Enable Volume IO** option to automatically enable I/O for an impaired volume. To disable the feature, clear the option.


                            Modify Auto-Enable IO setting
                        

1. Choose **Save**.

Alternatively, instead of completing steps 4-6 in the previous procedure, choose **Status Checks**, **Edit**.

# Deleting an Amazon EBS Volume

After you no longer need an Amazon EBS volume, you can delete it. After deletion, its data is gone and the volume can't be attached to any instance. However, before deletion, you can store a snapshot of the volume, which you can use to re-create the volume later.

To delete a volume, it must be in the available state (not attached to an instance).

**To delete an EBS volume using the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. In the navigation pane, choose **Volumes**.
3. Select a volume and choose **Actions**, **Delete Volume**.
4. In the confirmation dialog box, choose **Yes, Delete**.

## Modifying an EBS Volume from the Console

The following procedure shows how to apply available volume modifications from the Amazon EC2 console.

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. Choose **Volumes**, select the volume to modify and then choose **Actions**, **Modify Volume**.
3. The **Modify Volume** window displays the volume ID and the volume's current configuration, including type, size, and IOPS. You can change any or all of these settings in a single action. Set new configuration values as follows:
   * To modify the type, choose a value for **Volume Type**.
   * To modify the size, enter an allowed integer value for **Size**.
   * If you chose **Provisioned IOPS (IO1)** as your volume type, enter an allowed integer value for **IOPS**.
4. After you have specified all of the modifications to apply, choose **Modify**, **Yes**.

**Note**

Modifying volume size has no practical effect until you also extend the volume's file system to make use of the new storage capacity. For more information, see [Extending a Linux File System after Resizing the Volume](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-expand-volume.html#recognize-expanded-volume-linux).

**To monitor progress of a modification from the console**

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. Choose **Volumes**, and select the volume to inspect. The volume's status is displayed in the **State** column. In the example below, the modification state is **completed**. This state information is also displayed in the **State** field of the details pane.
3. Open the information icon next to the **State** field to display complete before and after information about the most recent modification action, as illustrated below.

