10

Oracle Compute Cloud Service Block Storage Volumes

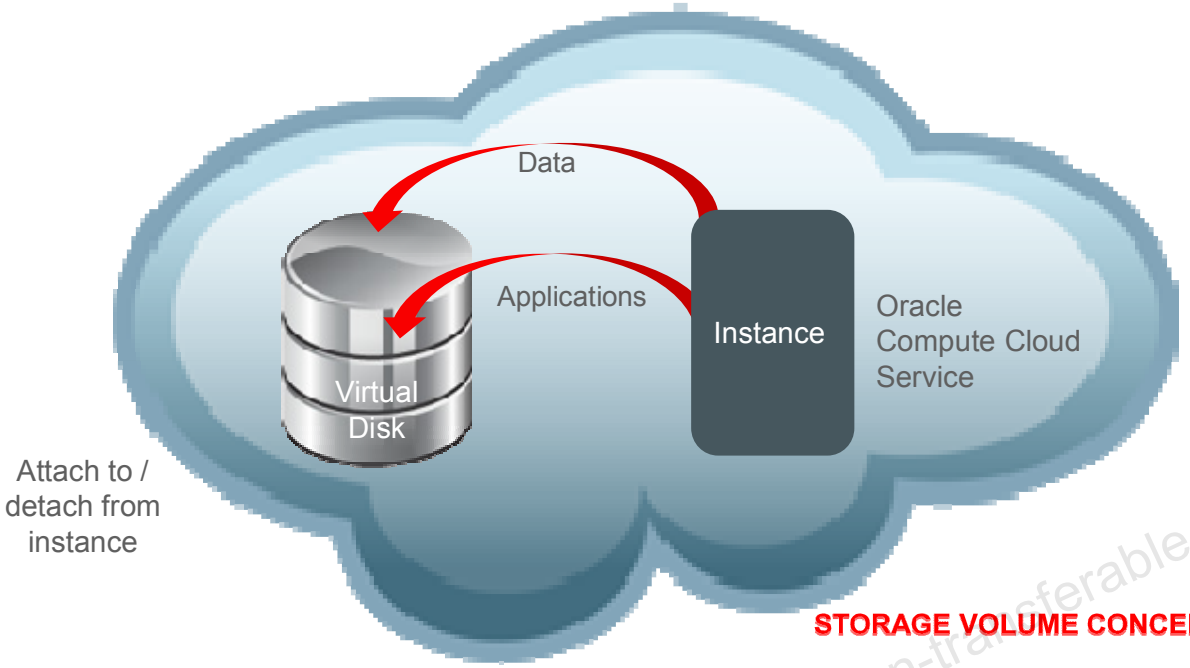
Objectives

After completing this lesson, you should be able to:

- Describe the process of adding block storage to an instance
- Create a block storage volume and add it to an instance
- Remove a block storage volume from an instance and delete it

The virtual machine (VM) is referred to as an instance henceforth in this course.

How Can I Use Block Storage with My Instance?



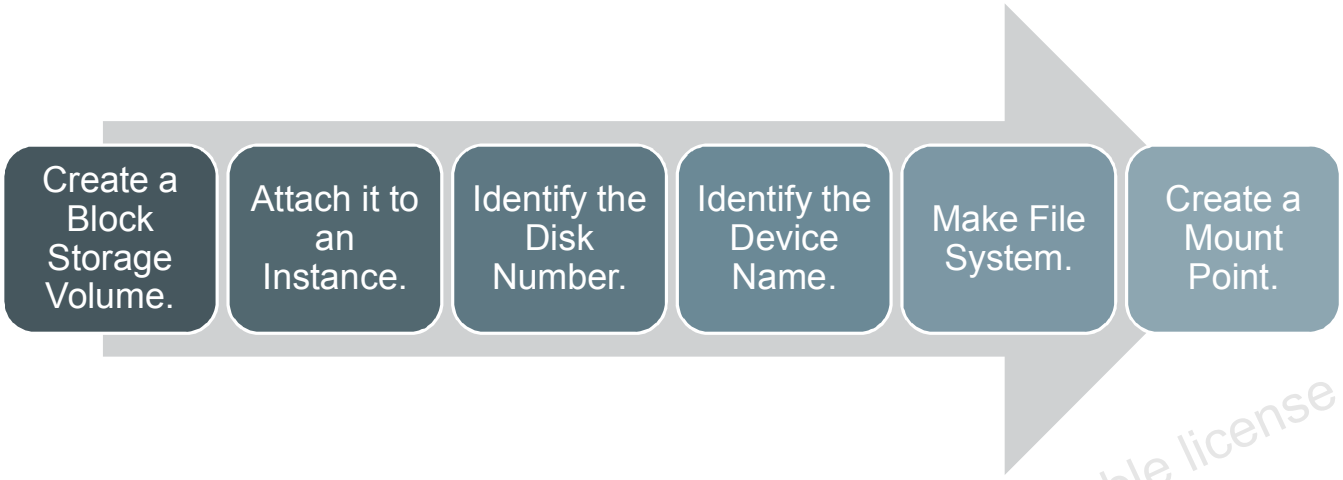
A storage volume is a virtual disk that provides persistent block storage for virtual machines.

You can use storage volumes to store data and applications.

Oracle Compute Cloud Service allows you to:

- Create block storage volumes and attach them to your instances. When you create a storage volume, you can specify the capacity that you need. The permitted range is between 1 GB and 2 TB, in increments of 1 GB.
- Attach up to 10 storage volumes to each Oracle Compute Cloud Service instance. However, note that a storage volume can be attached to only one instance at a time.
- Attach one or more storage volumes to an instance either while creating the instance or later, while the instance is running.
- Scale up or scale down the block storage capacity for the instance by attaching or detaching storage volumes even while the instance is running. However, note that you can detach a storage volume only if it was attached to a running instance. You cannot detach a storage volume that was attached to an instance during instance creation. Also, remember that, when a storage volume is detached from an instance or when the instance is deleted, data stored on the storage volume is not lost.

Workflow for Using a Block Storage Volume



- **CREATE:** You can use the Oracle Compute Cloud Service web console to create block storage volumes.
- **ATTACH:** After creating a block storage volume, you can attach it, or associate it with an instance by using the web console. You can do this either while creating the instance or later, while the instance is running. You can also use the web console to view details of a storage volume, such as its status, size, and the instance to which it is attached.
- **IDENTIFY DISK NUMBER, DEVICE NAME:** When you attach a storage volume to an instance, you must specify an index number. You can use this index number to identify the device name of a storage volume on the instance when you log in to the instance by using SSH.
- **MAKE FILE SYSTEM:** To make a file system, log in to your instance and use a tool such as mkfs to create a file system on the storage volume.
- **CREATE A MOUNT POINT:** On your instance, create a mount point for each storage volume. A mount point is like a directory where the storage volume is mounted. After you have created the mount point, you can cd to this directory to read/write data on the attached storage volume.

How Do I Create a Block Storage Volume?

1. Go to the Oracle Compute Cloud Service web console.
2. Click the Storage tab.
3. Click Create Storage Volume.
4. The Create Storage Volume Wizard starts. Enter the following:
   - Name
   - Boot Image
   - Size, in GB
   - Storage property
   - Description
5. Click Create.

Creating a Storage Volume

1. Go to the Oracle Compute Cloud Service web console.
2. Click the Storage tab.
3. Click Create Storage Volume. The Create Storage Volume wizard starts.
4. Select or enter the required information:
   - Enter a name for the storage volume. Note this name. You'll need it later to search for the storage volume on the Storage page. Select a name that you can use later to quickly identify the key characteristics of the storage volume.
   - If you intend to use this storage volume as a boot disk, choose the boot image from the drop down menu. Later, while creating an instance, you can specify this volume as the boot disk for the instance. Do not select this option for now.
   - Enter the size, in GB, of the storage volume. The allowed range is 1 GB to 2 TB. Consider the storage capacity needs of the applications that you plan to deploy on the instance, and leave some room for attaching more storage volumes in future. This approach helps you to use the available block storage capacity efficiently in the long run.
   - Select a storage property. For storage volumes that require low latency and high IOPS, such as for storing database files, select `/oracle/public/storage/latency`. For all other storage volumes, select `/oracle/public/storage/default`.
   - Enter a description for the storage volume.

   Note: The web console might show other storage properties. But do not select any of them.

How Do I Add a Block Storage Volume to an Existing Instance?

1. Go to the Oracle Compute Cloud Service web console.
2. Click the Storage tab.
3. Select the storage volume to attach and from the menu, select Attach Instance.
4. Select the instance to attach the storage volume to.
5. The Attach as Disk # field is auto-populated.
6. Click Attach.

Attaching a Storage Volume to an Instance

You can provide or increase block storage capacity for an instance by attaching storage volumes.

1. Go to the web console.
2. Click the Storage tab.
3. Identify the storage volume that you want to attach. From the menu, select Attach Instance.
4. Select the instance to which you want to attach the volume.
5. The Attach as Disk # field is filled automatically with the next available index at which the volume can be attached. You can leave this field at the automatically selected disk number or enter a higher number up to 10.

   Make a note of the disk number. You will need it when you mount the storage volume on the instance.
6. Click Attach.

How Do I Find the Storage Volume on My Instance?

1. Identify the disk number of the storage volume to mount.
2. Log in to the instance by using SSH.
3. List the devices available on your instance.
4. Identify the device name corresponding to the disk number.

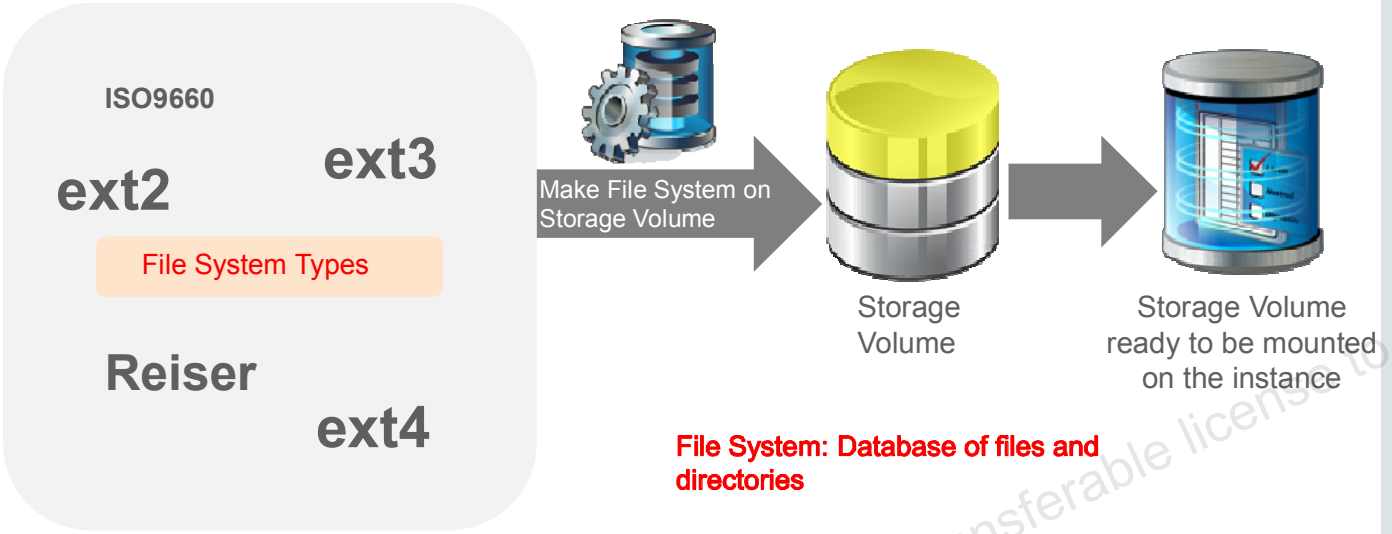
Identifying the New Storage Volume

1. After attaching a storage volume to an instance, identify the disk number of the storage volume.
2. Log in to the instance by using SSH.
3. List the devices available on your instance:

```
ls /dev/xvd*
```

   Device names start from `/dev/xvdb` and are determined by the index number that you assigned when you attached the storage volumes. For example, if you attached a storage volume at index 1, the volume gets the device name, `/dev/xvdb`. The storage volume at index 2 would be `/dev/xvdc`; the storage volume at index 3 would be `/dev/xvdd`, and so on.
4. Identify the device name corresponding to the index number that you noted earlier.

What Should I Know About File Systems?



About File Systems

- A file system is a database of files and directories created on a storage volume.
- A file system enables you to access the physical locations on the storage device.
- You cannot store files on a storage volume that does not contain a file system.
- You should create a file system just once for each new storage volume that has no pre-existing data (or data that you want to remove). Creating a new file system on top of an existing file system will effectively remove the old data.
- After creating a file system, you must mount the file system on Linux, before you can access the storage volume and use it for data storage and retrieval.

The following are some of the most common types of file systems for data storage:

- The Second Extended file system (ext2): Nearly every Linux system uses ext2 or its newer version, ext3.
- The Third Extended file system (ext3): This is a newer version of the ext2 file system, augmented with journal support.
- The Fourth Extended file system (ext4)
- ISO9660 (iso9660): A CD-ROM standard, supported on Linux
- The Reiser filesystem (reiserfs): Journaled computer file system, supported by Linux

To create a file system on the target device, use mkfs.

How Do I Create a File System on the Storage Volume?

Use a tool such as `mkfs` to create a file system on the storage volume. For example, to create an ext3 file system on `/dev/xvdd`, run the following command:

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

Creating a File System on Your Storage Volume

1. After attaching a storage volume to an instance, identify the disk number of the storage volume.
2. Log in to the instance by using SSH.
3. List the devices available on your instance:

   ```
   ls /dev/xvd*
   ```

   Device names start from /`dev/xvdb` and are determined by the index number that you assigned when you attached the storage volumes. For example, if you attached a storage volume at index 1, the volume gets the device name, /`dev/xvdb`. The storage volume at index 2 would be /`dev/xvdc`; the storage volume at index 3 would be /`dev/xvdd`, and so on.
4. Identify the device name corresponding to the disk number that you noted earlier.
5. Use a tool such as `mkfs` to create a file system on the storage volume. For example, to create an ext3 file system on /`dev/xvdd`, run the following command:

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

Note: If the Extended File System utilities are not available on your instance, a message such as the following is displayed:

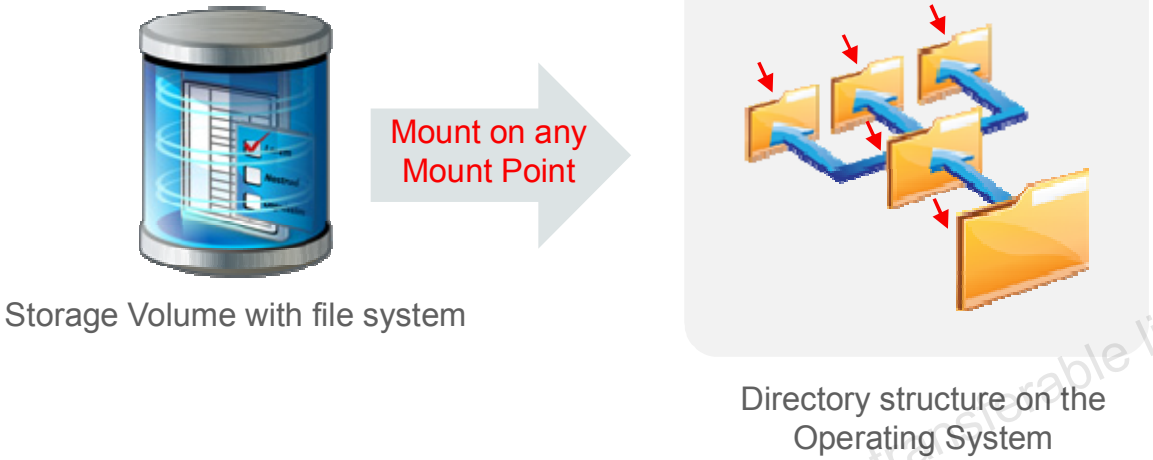
mkfs.ext3: No such file or directory

To install the Extended File System utilities, run the following command:

```
sudo yum install e4fsprogs
```

After the Extended File System utilities are installed, re-run the `mkfs` command.

What's a Mount Point?



About Mount Points

The process of associating a storage volume with an operating system is called **mounting**.

A **mount point** is the place in the current system's directory hierarchy where the storage volume and its file system will be attached. The mount point is always a normal directory. The mount point doesn't have to be created directly at the root (/); it can be created anywhere in the hierarchy of the system.

The `/etc/fstab` File System Table

Linux systems maintain a list of file systems and options in the `/etc/fstab` file. This is a plain text file. To ensure that your storage volumes are mounted at boot time, add the mount point details as an entry in the `/etc/fstab` file.

How Do I Mount the Storage Volume on My Instance?

1. Create a mount point on your instance.
2. Mount the storage volume on the mount point.
3. Make the mount persistent across instance restarts (optional).

Mounting the Storage Volume on Your Instance

1. Create a mount point on your instance. For example, to create the mount point `/mnt/store`, run the following command:

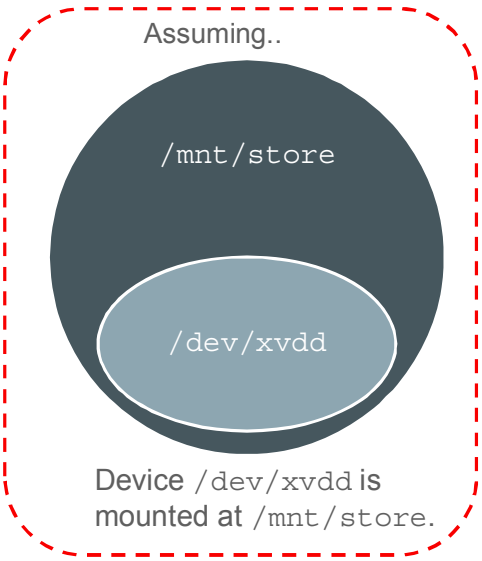
   ```
   sudo mkdir /mnt/store
   ```

2. Mount the storage volume on the mount point that you created on your instance. For example, to mount the device `/dev/xvdd` at the `/mnt/store` directory, run the following command:

   ```
   sudo mount /dev/xvdd /mnt/store
   ```

3. To make the mount persist across instance restarts, edit the `/etc/fstab` file and add the mount point as an entry in that file.

Now Can I Use the Storage Volume?



I/O Operations:

- The `sudo cd /mnt/store` command lands you in the storage volume.
- All data storage and retrieval at `/mnt/store` executes at the device.

Storage Volume Capacity:

- To view the size and utilization of the storage volume, use the command `sudo df`.

Accessing the Storage Volume from Your Instance

After the storage volume is mounted, you can access the storage volume by going to the mount point directory.

For example:

If the device `/dev/xvdd` is mounted at the path /`mnt/store`, any access of the storage volume further occurs via the path /`mnt/store`.

So, to check the contents of the device, perform the following operation:

```
sudo cd /mnt/store
sudo ls -l
```

This lists all the files and directories currently available on the device `xvdd`. Further, any file stored in the directory path /`mnt/store` is effectively stored on the /`dev/xvdd` storage volume.

To view the size and utilization of the storage volume, use the command `sudo df`. The output looks similar to the following:

```
Filesystem   1024-blocks    Used      Available    Capacity   Mounted On
/dev/xvdc    1011928        71400     889124       7%         /usr
/dev/xvdd    17710044       9485296   7325108      56%        /mnt/store
```

What If I Don't Need a Storage Volume Anymore?

1. Identify the disk number of the storage volume to unmount.
2. Log in to your instance by using SSH.
3. List the devices available on your instance and their mount points.
4. Identify the device name corresponding to the disk number to unmount.
5. Note the mount point for that device.
6. Run the `umount` command.
7. Edit `/etc/fstab` and remove the mount.

If you no longer need a storage volume, here's what you can do:

- Unmount the storage volume from your instance.
- Detach the storage volume from your instance.
- Now, you can either keep the storage volume and use it later with the same instance or a different instance, or you can delete the storage volume.

Unmounting a Storage Volume from an Oracle Linux Instance

To detach a storage volume from your instance, or to delete the instance that a storage volume is attached to, you must first unmount the storage volume.

To unmount a storage volume from an Oracle Linux instance, perform the following steps:

1. Identify the disk number of the storage volume that you want to unmount.
2. Log in to the instance by using SSH.
3. List the devices available on your instance and their mount points:

sudo df -hT

```
Filesystem          Type           Size   Used   Avail  Use%
     Mounted on
   /dev/xvdb2       ext4           16G    2.9G   12G    20%    /
   tmpfs            tmpfs          3.7G          0      3.7G    0%
     /dev/shm
   /dev/xvdb1       ext4           194M   90M    94M    49%
     /boot
   /dev/mapper/vg_binaries-lv_tools
                            ext4           9.9G   156M   9.2G   2%
     /u01/app/oracle/tools
   /dev/mapper/vg_backup-lv_backup
                            ext4           20G    4.0G   15G    21%
     /u01/data/backup
   /dev/mapper/vg_domains-lv_domains
                            ext4           9.9G   1.2G   8.3G   12%
     /u01/data/domains
   /dev/mapper/vg_binaries-lv_mw
                            ext4           9.9G   2.0G   7.4G   21%
     /u01/app/oracle/middleware
   /dev/mapper/vg_binaries-lv_jdk
                            ext4           2.0G   334M   1.6G   18%
     /u01/jdk
```

Device names start from /dev/xvdb and are determined by the index number that you assigned when you attached the storage volumes. For example, if you attached a storage volume at index 1, the volume gets the device name, /dev/xvdb. The storage volume at index 2 would be /dev/xvdc; the storage volume at index 3 would be /dev/xvdd; and so on.

Note: For an instance that is set up to boot from a non-persistent boot disk, /dev/xvda is used for the boot disk.

4. Identify the device name corresponding to the disk number that you want to unmount, and note the mount point for that device.

   For example, to unmount the storage volume that is attached at index 3, you must unmount /dev/xvdd.

5. Run the umount command.

   sudo umount mount_point

   For example, to unmount the device that is mounted at /mnt/store, run the following command:

   sudo umount /mnt/store

6. If you had defined this mount point in the /etc/fstab file, edit /etc/fstab and remove the mount.

If you no longer need the volume that you just unmounted, you can detach it from the instance and delete it.

I’ve Unmounted the Storage Volume. Now How Do I Detach It?

1. Go to the web console.
2. Click the Storage tab.
3. Go to the storage volume that you want to detach.
4. From the menu, select Detach Instance.

Detaching a Storage Volume from an Instance

When you no longer require access to a storage volume, you can unmount it and detach it from your instance.

After you detach a storage volume from an instance, you can no longer read from or write data to the storage volume, unless you attach it to any instance.

Note: You cannot detach or delete a storage volume that was attached while creating an instance. If you are sure that a storage volume is no longer required, back up the data elsewhere and delete the storage volume. Perform the following steps:

1. Go to the web console.
2. Click the Storage tab.
3. Go to the storage volume that you want to detach.
4. From the menu, select Detach Instance.

You can also detach a storage volume from the Instances page.

Note: After detaching a block storage from one instance, you can attach and mount it on another instance.

How Do I Delete the Block Storage Volume?

1. Go to the web console.
2. Click the Storage tab.
3. Go to the storage volume that you want to delete.
4. From the menu, select Delete.

Deleting a Block Storage Volume from an Instance

If you delete a storage volume, all the data and applications that were saved on that storage volume are lost. Delete a storage volume only when you are sure that you no longer need any of the data that is stored on that volume.

Ensure that the storage volume that you want to delete is not attached to any instance.

1. Go to the web console.
2. Click the Storage tab.
3. Go to the storage volume that you want to delete.
4. From the menu, select Delete.

Quiz

Which of the following steps is required to ensure that a storage volume is available to an instance when an instance is restarted?

a. Attach the storage volume to the instance while creating the instance.
b. Run the `mount` command after the instance is running.
c. Add an entry in the `/etc/fstab` file with the disk details of the storage volume.

Quiz

Which of the following statements is true?

a. A storage volume must be created before the instance you want to attach it to.
b. You can access a storage volume and perform read/write operations after attaching the storage volume to an instance.
c. You cannot detach a storage volume that was attached to an instance during instance creation.

Quiz

Identify the correct sequence of steps for deleting a storage volume. (Select all that apply.)

a. Detach > Unmount > Remove the entry from `/etc/fstab` > Delete
b. Unmount > Detach > Remove the entry from `/etc/fstab` > Delete
c. Remove the entry from `/etc/fstab` > Unmount > Delete > Detach
d. Remove the entry from `/etc/fstab` > Unmount > Detach > Delete

Summary

In this lesson, you should have learned how to:

- Describe the process of adding block storage to an instance
- Create a block storage volume and add it to an instance
- Remove a block storage volume from an instance and delete it

Resource: Links

For more information about Oracle Compute Cloud Service, visit http://docs.oracle.com/cloud/latest/stcomputecs/index.html.