Image Management Guide BETA PREVIEW

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Contents

Image Management Overview

Welcome to the Eucalyptus Image Management Guide. This guide contains conceptual overview about what images are, as well as best practices and common tasks for using images in your cloud.

Note: This guide assumes a moderately high level of expertise with the Linux command line.

Note: Because of the wide variety of Linux distributions (and other operating systems) that may be running on an instance, specific examples may vary.

Document version:

Image Overview

An image defines what will run on a guest instance in your Eucalyptus cloud. An image contains everything necessary to boot and run an operating system: either one of the Linux distributions – CentOS, Fedora, Ubuntu, Debian, etc – or one of the supported Windows server versions.

Images of two types are supported by Eucalyptus:

- **HVM images** are raw disks that can boot independently. They can contain Linux or Windows operating systems. HVM stands for Hardware-assisted Virtual Machine because such images can only run efficiently on hardware that supports virtualization. When an HVM image is uploaded and registered, it becomes a Eucalyptus Machine Image (EMI) of type "hvm", with a unique ID.
- **Paravirtual images** are Linux images that can boot if they are paired with a kernel and ramdisk that are compatible with the host's hypervisor. Currently only root file system images are supported (on AWS, a paravirtual image can be a file system or a full disk). When a paravirtual image is uploaded and registered, it also becomes an EMI of "paravirtual" type, which needs to be paired with a kernel (EKI) and ramdisk (ERI) images to be usable. EKI contains a kernel (i.e., the ‘vmlinuz’ file typically found in the /boot directory of a Linux system). ERI contains the kernel modules (i.e., the ‘initrd’ file from the /boot directory).

Depending on the method used for upload, an instance's disk will reside on one of two types of storage:

- **Instance Store -** volumes are located on temporary disk space that is destroyed when instances shut down. These volumes are based on a template residing in Object Storage. Instance Store can host either HVM or paravirtual images.
- **Elastic Block Store (EBS) -** volumes are disks with lifetimes that can be independent of instances. These volumes are based on snapshots of EBS volumes (instead of templates in Object Storage). Only HVM images can be deployed on EBS in Eucalyptus (in AWS, EBS can also host paravirtual images).

To help get you started, Eucalyptus Systems provides pre-packaged virtual machine images that are ready to run in your cloud. You can download them from the *Eucalyptus Machine Images* page. Both HVM and paravirtual images are available there. Each paravirtual image comes bundled with a correspoding EKI and ERI.

If you find that the pre-packaged images don't meet your needs, you can migrate an image from another cloud system (such as vSphere or Amazon Web Services) or create your own image. See the rest of this guide for more information.

Tip: For a list of supported guest operating systems, go to *Eucalyptus Cloud Compatibility Matrix*.

Image Tasks

An image is the basis for instances that you spin up for your computing needs. This section explains how to create or acquire an image and then add it to your Eucalyptus cloud.

There are a few ways you can create or acquire an image for use in a Eucalyptus cloud:

- Add an image based on an existing image. Eucalyptus has stock images available to help you get started right away. For more information, see *Browse and Download from Eucalyptus*.
- Add an image that you create from scratch, by installing an operating system into a virtual machine. This is the only way to deploy a Windows instance, since Eucalyptus Systems does not distribute such images. For more information, see the *Create a New Image* section.
- Migrate an image or an instance from another cloud, such as Amazon Web Services (AWS) or a virtualization platform. For more information, see the *Migrate an Image* section.

Browse and Download from Eucalyptus

Eucalyptus Systems provides a few prebuilt "starter" images that you can download and install. This is one of the simplest ways to get started with Eucalyptus. Many other organizations, including Linux distributions, publish starter images for use on cloud systems, which can also be installed on Eucalyptus using the steps in this guide.

1. With your Web browser, explore the image catalog at *http://emis.eucalyptus.com/*
2. Download an image of your choice (we suggest starting with images that have "hvm" as their Virtualization Type, as they are easier to install and work for both Instance Store and EBS-backed instances).
3. Optionally, if the image is compressed (has a .tgz or .gz extension), you will have to uncompress it.

If you obtained an HVM image, you now have a raw disk file that can be installed using instructions in the *Install an HVM image* section. If you obtained a paravirtual image with kernel and ramdisk, you can install them with instructions in the *Install a paravirtual image* section.

Install an HVM Image

HVM (Hardware-assisted Virtual Machine) images are sequences of raw sectors of a complete bootable disk, including a boot loader and one or more partitions with an operating system. Such images are self-contained and can be booted on hardware that supports virtualization or on a full software emulation of hardware (QEMU).

At run time, HVM images can be deployed to disks local to the hypervisor (so-called Instance Store images) or they can run off of dynamic volumes on EBS (so-called EBS-backed instances or boot-from-EBS instances). This topic covers methods for installing an HVM image into either type of EMI.

Install an HVM image as an Instance Store EMI

Bundle, upload, and register the HVM image. All of this can be accomplished with a single command.

- For Linux images, the required options are:

```
euca-install-image -i /path/to/hvm-image -n name-of-the-image -r x86_64
--virtualization-type hvm -b bucket-name-for-image
```

- When installing a Windows image, an additional flag is necessary:

```
euca-install-image -i /path/to/hvm-image -n name-of-the-image -r x86_64
--virtualization-type hvm -b bucket-name-for-image --platform=windows
```

Install an HVM image as an EBS-Backed EMI

An EBS-backed image (sometimes referred to as a "bfEBS" image) is an image with a root device that is an EBS volume created from an EBS snapshot. An EBS-backed image has a number of advantages (over an Instance Store image), including:

- Faster boot time
- Larger volume size limits
- Changes to the data on the image persist after instance termination

Option A: Install an EBS image with euca-import-vol

With this method, a single command uploads image data into Object Store and triggers a conversion task, which copies the data into an EBS volume. The volume will be the source of the snapshot behind the EBS-backed EMI.

1. Import the HVM image file into Object Storage and then copy it into EBS. For example:

   ```
   euca-import-volume /path/to/hvm-image --format raw --availability-zone AZ-NAME
   --bucket bucket-for-hvm-image --owner-akid $EC2_ACCESS_KEY --owner-sak
   $EC2_SECRET_KEY --prefix image-name-prefix --description "textual description"
   ```

   

   Note:

   If the volume import process was interrupted, import can be resumed (within a one-week deadline) with the following command:

   ```
   euca-resume-import -t import-vol-fae1e94d /path/to/hvm-image
   ```

2. After the volume data has been uploaded to Object Store, an internal conversion task will copy the data into a new EBS volume. You can query the progress of this task with the following command:

   ```
   euca-describe-conversion-tasks import-vol-fae1e94d
   ```

3. Once the task has finished successfully and the volume is available, you can take a snapshot of the volume:

   ```
   euca-create-snapshot <volume-id>
   ```

4. You can now register the snapshot:

   ```
   euca-register --name <image-name> --snapshot <snapshot-id> --root-device-name
   <device>
   ```

You've now created a EBS-backed image. To maintain data persistence, be sure to use `euca-stop-instances` and `euca-start-instances` to stop and start your EBS-backed instance.

Option B: Install an EBS image with euca-import-instance

With this method, a single command uploads image data into the Object Store and triggers a conversion task; this conversion task copies the data into an EBS volumetakes a snapshot of the volume, registers the snapshot as an EMI, and deploys the EMI as an instance.

1. Turn an HVM image into a running EBS instance with a single command:

   

   Note: Just as with euca-run-instance, one can specify the Instance Type for the instance that will run, as well as the SSH key. For example:

   ```
   euca-import-instance /root/paravirtualimage/ubuntuJune06.img --format raw
   --architecture x86_64 --platform Linux --availability-zone EDU --bucket
   import_instance --owner-akid $EC2_ACCESS_KEY --owner-sak $EC2_SECRET_KEY
   --prefix eduii --description "import instance" --key admin --instance-type
   m1.small
   ```

   

   Note:

   If volume import process was interrupted (by an interruption of the command or due to a network mishap, import can be resumed (within a one-week deadline).

```
euca-resume-import -t import-i-b393f3f6 /path/to/hvm-image
```

2. After the volume data has been uploaded to Object Store, an internal conversion task will copy the data into a new EBS volume. You can query the progress of this task with the following command:

   ```
   euca-describe-conversion-tasks import-i-b393f3f6
   ```

Once the conversion task has finished successfully, you should see a running instance. You may log into that instance if you specified an SSH key. To maintain data persistence, be sure to use `euca-stop-instances` and `euca-start-instances` to stop and start your EBS-backed instance.

Option C: Install an EBS image using a helper instance

This is a more manual method for installing an HVM image into an EBS-backed EMI. Instead of importing the image data into an EBS volume directly, a helper instance is used to copy data from the image file into the volume. The helper instance can be either an instance store or an EBS-backed instance, and can be deleted when finished. The volume will be the source of the snapshot behind the EBS-backed EMI.

1. Create and launch a help instance.
2. Create a volume big enough to hold the bootable image file:

   ```
   euca-create-volume -z <cluster_name> -s <size_in_GB>
   ```

3. Attach the volume to the helper instance:

   ```
   euca-attach-volume <volume-id> -i <instance-id> -d <device>
   ```

4. Log in to the instance and copy the bootable image to the attached volume by performing one of the following steps:

   - If the bootable image is saved in an http or ftp repository, use `curl` or `wget` to download the .img file to the attached volume. For example:

     ```
     curl <path_to_bootable_image> > <device>
     ```

   - If the bootable image is from a source other than an http or FTP repository, copy the bootable image from its source to the helper instance, and then copy it to the attached volume using the `dd` command. For example:

     ```
     dd if=<path_to_bootable_image> of=<device> bs=1M
     ```

5. Detach the volume from the instance:

   ```
   euca-detach-volume <volume-id>
   ```

6. Create a snapshot of the volume:

   ```
   euca-create-snapshot <volume-id>
   ```

7. Register the snapshot:

   ```
   euca-register --name <image-name> --snapshot <snapshot-id> --root-device-name
   <device>
   ```

You've now created a EBS-backed image. To maintain data persistence, be sure to use `euca-stop-instances` and `euca-start-instances` to stop and start your EBS-backed instance.

Create an HVM Image

This section covers how to create a new image for use in your Eucalyptus cloud.

Create an HVM Image from a Linux Distribution ISO (KVM)

This topic shows how to install a Linux distribution ISO and prepare an image for registration with Eucalyptus.

1. Use the QEMU disk utility to create a disk image. In the following example, we create a 5GB disk image:

   ```
   qemu-img create -f raw centos6.img 5G
   ```

2. Use the `parted` utility to set the disk label.

   ```
   parted centos6.img mklabel msdos
   ```

3. Use `virt-install` to start a new virtual machine installation, as in the following example (note the example has been broken into multiple lines for formatting purposes):

   ```
   virt-install --name centos6 --ram 1024 --os-type linux --os-variant rhel6
    -c /tmp/CentOS-6.3-x86_64-bin-DVD1.iso --disk
   path=/tmp/centos6.img,device=disk,bus=virtio
    --graphics vnc,listen=0.0.0.0 --force
   ```

4. Use the VNC client of your choice to connect to the new virtual machine and complete the installation.
5. Modify the following `libvirt.xml` template to create the VM and run `virsh create <libvirt.xml>"`.

   ```
   <domain type='kvm'>
      <name>eucalyptus-centos</name>
      <os>
          <type>hvm</type>
      </os>
      <features>
          <acpi/>
      </features>
      <memory>1073741</memory>
      <vcpu>1</vcpu>
      <devices>
          <!--<emulator>/usr/bin/kvm</emulator>-->
          <disk type='file'>
              <source file='/tmp/centos6.img'/>
              <target dev='hda'/>
          </disk>
       <interface type='bridge'>
           <source bridge='br0'/>
           <model type='virtio'/>
       </interface>
          <graphics type='vnc' port='-1' autoport='yes' listen='0.0.0.0'/>
      </devices>
   </domain>
   ```

6. Connect to the virtual machine using your VNC client of choice and make the following configuration changes:
   a) Modify the `/etc/sysconfig/network-scripts/ifcfg-eth0` file and set the `ONBOOT` option to "yes". For example:

      ```
      DEVICE="eth0"
      BOOTPROTO="dhcp"
      #HWADDR="B8:AC:6F:83:1C:45"
      IPV6INIT="yes"
      MTU="1500"
      NM_CONTROLLED="yes"
      ONBOOT="yes"
      TYPE="Ethernet"
      UUID="499c07cc-4a53-408c-87d2-ce0db991648e"
      PERSISTENT_DHCLIENT=1
      ```

   b) Enable a serial console on the virtual machine by adding the following option to the end of the /boot/grub/menu.lst:

      ```
      console=ttyS0
      ```

   c) Remove the `quiet` option from the kernel parameters and the grub menu splash image in the `/boot/grub/menu.lst` file. For example:

      ```
      # grub.conf generated by anaconda
      #
      # Note that you do not have to rerun grub after making changes to this file
      # NOTICE:  You have a /boot partition.  This means that
      ```

```
#          all kernel and initrd paths are relative to /boot/, eg.
#          root (hd0,0)
#          kernel /vmlinuz-version ro root=/dev/sda2
#          initrd /initrd-[generic-]version.img
#boot=/dev/sda
default=0
timeout=5
#splashimage=(hd0,0)/grub/splash.xpm.gz
hiddenmenu
title Eucalyptus (2.6.32-358.18.1.el6.x86_64)
 root (hd0,0)
 kernel /vmlinuz-2.6.32-358.18.1.el6.x86_64 ro
root=UUID=062b9c31-95f3-424f-8b47-35107cfdfc08 rd_NO_LUKS rd_NO_LVM
LANG=en_US.UTF-8 rd_NO_MD SYSFONT=latarcyrheb-sun16 crashkernel=auto
KEYBOARDTYPE=pc KEYTABLE=us rd_NO_DM rhgb
 initrd /initramfs-2.6.32-358.18.1.el6.x86_64.img
```

d) Add the following line to the `/etc/sysconfig/network` file to disable the zeroconf route, which can interfere with access to the metadata service:

```
NOZEROCONF=yes
```

e) Edit the `/etc/udev/rules.d/70-persistent-net.rules` file and remove all entries for the existing network interface. Make sure that you delete all entries before terminating the virtual machine and registering it with Eucalyptus.

7. Eucalyptus instances use cloud-init to specify actions to run on your instance at boot time, which can be passed using the userdata parameter. To install and configure `cloud-init` on your instance:

a) Install cloud-init:

```
# rpm -Uvh
http://download.fedoraproject.org/pub/epel/6/x86_64/epel-release-6-8.noarch.rpm
# yum install cloud-init
```

b) By default, cloud-init uses ec2-user as the log-in user. Add ec2-user to your instance and give it appropriate sudo permissions:

```
 # adduser ec2-user
 # passwd ec2-user
```

c) Run visudo and add the following entries at the bottom of the sudoers file:

```
## Allow root to run any commands anywhere
    root    ALL=(ALL)       ALL
    ec2-user        ALL=(ALL)       NOPASSWD: ALL
```

d) You can optionally copy Eucalyptus `rc.local` file (available at *https://github.com/eucalyptus/Eucalyptus-Scripts/blob/master/rc.local*) to the `/etc` directory on your virtual machine and modify it as needed.

You now have a raw disk file that can be installed using instructions in the *Install an HVM image* section.

Migrate an Image

This section covers migrating images to and from your Eucalyptus cloud.

Create an Image from an Existing EBS-Backed Instance

A common way to create a new image is to customize an existing instance. This topic describes how to create a new image by modifying an existing EBS-backed instance.

This example shows how to create a new EBS-backed Eucalyptus image based on an existing EBS-backed Eucalyptus instance.

1. Log on to an existing Eucalyptus EBS-backed instance and customize the instance.
2. Prepare the image. See for instructions.
3. Create a new image based on the image you just modified by using the eucalyptus-create-image command, specifying a name, a description, and the instance ID of the Eucalyptus instance you customized in the previous step. For example:

   ```
   euca-create-image -name "mynewimage" -d "This is my new custom recycled image"
   i-1ABCDEFF
   ```

   This command will show the ID of the new machine image and exit immediately. In the background, Eucalyptus will begin the process of creating a new image based on the instance you supplied.

   You can monitor the status of the image using the euca-describe-images command, supplying the ID of the image returned from the euca-create-image command. For example:

   ```
   euca-describe-images i-e12398ab
   ```

Create an Image from an Existing Instance-Store Instance

A common way to create a new image is to customize an existing instance.

This example shows how to create a new instance store Eucalyptus image based on an existing instance store Eucalyptus instance. This topic describes how to create a new image by modifying an existing instance-store instance.

1. Log on to an existing Eucalyptus isntance-store instance and customize the instance. See for instructions.
2. Create a new image based on the image you just modified by using the `euca-bundle-instance` command, specifying a name, a description, and the instance ID of the Eucalyptus instance you customized in the previous step. For example:

   ```
   euca-bundle-instance -b mybundle -p mycentos6 -o $EC2_ACCESS_KEY -w
   $EC2_SECRET_KEY i-96154365
   BUNDLE     bun-96154365     i-96154365     mybundle     mycentos
   62013-11-05T21:37:23.469Z2013-11-05T21:37:23.469Z     pending     0
   ```

   This command will the bundle task ID and exit immediately. In the background, Eucalyptus will begin the bundling process. Depending on the size of the instance, it can take several minutes for the bundling task to complete.

   You can monitor the status of the bundle task using the `euca-describe-bundle-tasks` command, supplying the ID of the image returned from the `eucalyptus-bundle-instance` command. For example:

   ```
   euca-describe-bundle-tasks
   BUNDLE     bun-96154365     i-96154365     mybundle     mycentos6
   2013-11-05T21:37:23.469Z2013-11-05T21:37:58.446Z     storing     0
   ```

3. Once the bundle task is complete, you can register thebundle as an instance-store image using the euca-register command, specifying the path to the bundle manifest in the format `[bucket]/[prefix].manifest.xml`. For example:

   ```
   euca-register mybundle/mycentos6.manifest.xml.
   ```

Your new image is now ready for use in your Eucalyptus cloud.

Install a paravirtual image

Note: As of Eucalyptus version 4.0, it is now required to pass a Eucalyptus Kernel Image (EKI) and a Eucalyptus Ramdisk Image (ERI) when uploading and registering a paravirtual Eucalyptus Machine Image (EMI) using the `euca-bundle-image`, `euca-bundle-and-upload-image`, and `euca-register` command line tools.

Once you've customized or acquired a paravirtual image to use with Eucalyptus, you can enable the image as an executable entity with the following steps:

1. Unless a suitable kernel is already registered, bundle the kernel, upload it to Object Storage, and register it as a new EKI.
2. Unless a suitable ramdisk is already registered, bundle the ramdisk, upload it to Object Storage, and register it as a new ERI
3. Bundle the root disk image, which must be a Linux partition, requesting the kernel and ramdisk that you desire, upload the bundle to Object Storage, and register it as a new EMI.

Important: Note that while all users can bundle, upload and register images, only users under the `administrator` account have the required permissions to upload and register kernels and ramdisks.

Once you have an image that meets your needs, perform the tasks listed in this section to add the image to your cloud.

Remove an Image

When a new image is uploaded to Eucalyptus, Eucalyptus saves the bundle and the image manifest to a bucket in Walrus. This bucket is set in the Eucalyptus property `walrus.storagedir`. The default value for this property is `/var/lib/eucalyptus/bukkits`.

When you register an image, Eucalyptus creates the actual image file. Both the image manifest and the bundle must remain intact to run as an instance.

Eucalyptus stores images in the path set

To delete an image fully, you must deregister the image and delete the bundle. To successfully remove an image and associated bundle files:

1. Find the image you want to remove.

```
euca-describe-images
IMAGE   emi-E533392E    alpha/centos.5-3.x86-64.img.manifest.xml    965590394582
available   public   i386    machine eki-345135C9    eri-C4F135BC
instance-store
IMAGE   emi-623C38B0  alpha/ubuntu.9-04.x86-64.img.manifest.xml   965590394582

available   public   i386    machine eki-E6B13926    eri-94DB3AB9
instance-store
```

2. Note the image file name (for example, emi-623C38B0).
3. Deregister the image.

```
euca-deregister emi-623C38B0
IMAGE   emi-623C38B0
```

4. Delete the bundle.

```
euca-delete-bundle -b alpha -p ubuntu.9-04.x86-64.img
```

Tip: If you accidentally try to delete a bundle for a second time, you might see an error message: `problem parsing: /tmp/centos.5-3.x86-64.img.manifest.xml`. This error only displays if you try to delete a bundle that no longer exists.

When you have finished these steps, display all images to confirm that the image was removed.

```
euca-describe-images
IMAGE   emi-E533392E    alpha/centos.5-3.x86-64.img.manifest.xml    965590394582
available   public   i386    machine eki-345135C9    eri-C4F135BC  instance-store
```

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