



Eucalyptus Tutorial

HPC and Cloud Computing Workshop

<http://portal.nersc.gov/project/magellan/euca-tutorial/abc.html>

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Tutorial Outline - I

- **Eucalyptus Account and Credentials**
- **How to talk to the cloud – the euca2ools**
- **Eucalyptus “candy store” – pre-loaded images**
- **VM access**
 - Firewall control, security groups
 - authentication – private keys
- **VM life cycle**
 - start an instance, instance types
 - Monitor
 - Console access
 - reboot
 - terminate



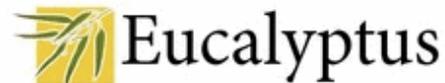
Tutorial Outline - II

- **VM Storage**
 - Volatile Local storage on VM
 - S3 storage - Walrus
 - Elastic Block Storage
- **Hybridfox** – a GUI for the cloud
- **How to customize and save images**
- **Build your own cluster**
 - Why clusters?
 - Look under the hood of a cluster building script
 - Just do it!
- **Where to look for help**
- **Cleanup**



Eucalyptus Account and Credentials

In your browsers go to <https://mageuca.ner.sc.gov:8443/#login>



Version 2.0.1

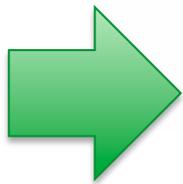
Please, sign in:

Username:

Password:

Remember me on this computer

Sign in



[Apply](#) for account | [Recover](#) the Password

You will be asked for:

Username: **train<n>**

Password: **makeUpYourOwn**

Password, again:

Full Name: **Your Name**

Email address: **for notification**



Credentials

Your Eucalyptus Cloud Logged in as **sakrejda** | [Logout](#)

Credentials Images Users Configuration Extras

User account Information

Login: **sakrejda**
Name: **Iwona Sakrejda**
Email: **ISakrejda@lbl.gov**

Feel free to change the account information (except the login) and the password whenever you want. The cryptographic credentials for the Web services associated with this account, shown below, will not be affected by these changes.

[Edit Account Information](#)
[Change Password](#)

Credentials ZIP-file

Click the button to download a ZIP file with your Eucalyptus credentials. Use the public/private key pair included therein with tools that require X.509 certificates, such as Amazon's EC2 command-line tools.

[Download Credentials](#)

Query interface credentials

Use this pair of strings with tools - such as [euca2ools](#) - that utilize the "query interface" in which requests and parameters are encoded in the URL.

Query ID:
Secret Key:

[Show keys](#)

- Go to <https://mageuca.nersc.gov:8443>
- Select **“Credentials”** from the top bar
- Click on **“Download Credentials”**
- scp** zip file with credentials to **carver.nersc.gov**
`scp euca2-$USER-x509(3).zip carver.nersc.gov:~/.`
- ssh** to **carver.nersc.gov**
`mkdir ~/.euca`
`mv euca2-$USER-x509(3).zip .euca/.`
`cd ~/.euca`
`unzip euca2-$USER-x509(3).zip .euca/.`
`chmod 0700 ~/.euca`
`chmod 0600 ~/.euca/*`
- Set up your environment and look at what's new**
`source ~/.euca/eucarc`
`printenv`
- Create ssh keys to access your VMs**
`cd ~/.euca`
`euca-add-keypair $USER-euca > $USER-euca.private`
`cat $USER-euca.private`



How to talk to the clouds?

- **euca2ools**

- command-line tools for interacting with cloud and compatible with Amazon EC2 and S3 services.
- can be used with both Amazon's services and with installations of the Eucalyptus open-source cloud-computing infrastructure.
- inspired by command-line tools distributed by Amazon (api-tools and ami-tools) and largely accept the same options and environment variables. However, implemented from scratch in Python

- **Summary of features:**

- Query of availability zones (i.e. clusters in Eucalyptus)
- SSH key management (add, list, delete)
- VM management (start, list, stop, reboot, get console output)
- Security group management
- Volume and snapshot management (attach, list, detach, create, bundle, delete)
- Image management (bundle, upload, register, list, deregister)
- IP address management (allocate, associate, list, release)

`ssh carver.nersc.gov`

Source `~/.euca/euca2ools`

module load `tig euca2ools`

ls `-I $EUCA_HOME/bin`



Stored Images

https://mageuca.nersc.gov:8443/



Your Eucalyptus Cloud

Logged in as sakrejda | [Logout](#)

Credentials

Images

Users

Configuration

Extras



Id	Name	Kernel	Ramdisk	State	Actions
emi-40AD0D78	carver-sl5/ltlc3.manifest.xml	eki-A86F17CD	eri-1062190B	available	Disable
eri-19791933	centos32-ramdisk-bucket/initrd.img-2.6.28-11-server.manifest.xml			available	Disable
emi-290411CA	centos-image-nfs-06212010/image.manifest.xml	eki-A86417CA	eri-1095191A	available	Disable
emi-A7391419	Yushu_Atlas/eki-sl55-64-atlas-v3.img.manifest.xml			available	Disable
emi-404912CF	garth-test-images/visit-test3.manifest.xml	eki-51BA1694	eri-96CB1771	available	Disable
emi-F46410F9	admin-images-bucket/bt1.0.1.manifest.xml	eki-A86F17CD	eri-1062190B	available	Disable
emi-A73E1415	Yushu_Atlas/eki-sl55-64-atlas-v2.img.manifest.xml			available	Disable
emi-39FA160F	ubuntu-image-bucket/ubuntu.9-04.x86-64.img.manifest.xml	eki-AEC117E0	eri-175C1933	available	Disable
emi-B2560FA7	canon-sl6-bucket/sl6-0.8.manifest.xml	eki-90B50F4F	eri-A3940FC2	available	Disable
emi-B3331476	jan8-star-vm-SL10c-ubuntu-32bit/image.manifest.xml	eki-B15217F6	eri-19791933	available	Disable
emi-1D380CAC	sl5-pdsf/pdsf3.manifest.xml	eki-A86F17CD	eri-1062190B	available	Disable
emi-3CE20D73	sl5-pdsf-01/image.manifest.xml	eki-A86F17CD	eri-1062190B	available	Disable



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Stored Images

euca-describe-images eki-A86F17CD

IMAGE eki-A86F17CD centos-kernel-bucket/vmlinuz-2.6.28-11-generic.manifest.xml admin available public x86_64 kernel

euca-describe-images eri-1062190B

IMAGE eri-1062190B centos-ramdisk-bucket/initrd.img-2.6.28-11-generic.manifest.xml admin available public x86_64 ramdisk

euca-describe-images emi-5B7B12EE

IMAGE emi-5B7B12EE canon-torque-bucket/torque1.0.1.manifest.xml canon available public x86_64 machine eri-1062190B eki-A86F17CD





Security Groups

- Security groups are sets of networking rules (in effect a firewall) applied to all VM instances associated with a group.
- Security group defines the access rules for all VM instances associated with a group. User can specify ingress rules, such as allowing ping (ICMP) or SSH (TCP, port 22) traffic to reach VMs in a specific security group.
- VM instance, unless otherwise specified at instance run-time, is assigned to a "default" security group that denies incoming network traffic from all sources.
- To allow login and usage of a new VM instance you must authorize network access to the default security group with the **euca-authorize** command.
- Security groups are available in MANAGED and MANAGED-NOVLAN Mode.

`euca-authorize --help`

Add a new rule to a security group.

`euca-authorize [-P, --protocol protocol] [-p, --port-range port_range]`

`[-t, --icmp-type-code type:code] [-o, --source-group source_group]`

`[-u, --source-group-user source_group_user] [-s, --source-subnet source_subnet]`

`[-h, --help] [--version] [--debug] group_name`

`euca-authorize -P tcp -p 22 -s 0.0.0.0/0 default`



Let's run.....

- Decide what image you want to run
- Decide what kind of VM you need

Name	CPUs	Memory (MB)	Disk (GB)
m1.small	<input type="text" value="1"/>	<input type="text" value="256"/>	<input type="text" value="10"/>
c1.medium	<input type="text" value="2"/>	<input type="text" value="256"/>	<input type="text" value="10"/>
m1.large	<input type="text" value="2"/>	<input type="text" value="512"/>	<input type="text" value="10"/>
m1.xlarge	<input type="text" value="4"/>	<input type="text" value="10240"/>	<input type="text" value="20"/>
c1.xlarge	<input type="text" value="8"/>	<input type="text" value="19456"/>	<input type="text" value="140"/>

```
euca-run-instances -k $USER-euca -t m1.small --kernel eki-A86F17CD --ramdisk eri-1062190B emi-5B7B12EE
```



..... and look

- **euca-describe-instances i-3B4D06F3**

RESERVATION r-44040811 sakrejda default

INSTANCE i-3B4D06F3

emi-5B7B12EE image ID

128.55.70.210 public IP

192.168.3.194 private IP

running state

sakrejda-euca key

m1.large image type

2011-06-18T00:11:50.18Z date started

euca cluster name

eki-A86F17CD kernel ID

eri-1062190B RAM ID

- **euca-get-console-output i-3B4D06F3**



Reboot or terminate?

- **Reboot**
 - `euca-reboot-instances <instance id>[,<another instance id>...]`
 - same as if you rebooted “real” system
 - instance does not go away
 - modifications persist
- **Terminate**
 - `euca-terminate-instances <instance id>[,<another instance id>...]`
 - the instance goes away
 - all modifications lost
 - the right thing to do when you are done with your task – Eucalyptus has no time limits and will not clean up after you!



VM Storage

- **Volatile storage on the node**

```
-bash-3.2# df
```

Filesystem	1K-blocks	Used	Available	Use%	Mounted on
/dev/vda1	3144632	1106204	1878684	38%	/
/dev/vda2	6419528	52	6093376	1%	/mnt

- /dev/vda2 partition will be created for you
- You need to mount this partition
- Data will vanish when you terminate the instance

- **Walrus (s3 storage)**

- Images are kept in Walrus
- Any data can be uploaded/downloaded from your client as well as the VM
- Tools exist to communicate with Walrus (3s-curl)
<http://open.eucalyptus.com/wiki/s3curl>



Elastic Block Storage

- **EBS** provides block level storage volumes for use with instances.
- **EBS** volumes are off-instance storage that persists independently from the life of an instance.
- **EBS** can be attached to a running instance and exposed as a device within the instance.
- **EBS** is particularly suited for applications that require a database, file system, or access to raw block level storage.

euca-create-volume -s size -z zone

-s, --size size of the volume (in GiB).

-z, --zone availability zone to create the volume in

euca-describe-volumes <volume id>

euca-attach-volume -i <instance_id> -d /dev/vdb <volume id>



Hybridfox

- Download Hybridfox from <http://code.google.com/p/hybridfox/>
- Configure following instructions <http://yogeshg1987.in/blog/2010/06/using-hybridfox-with-eucalyptus/>
- Add <http://mageuca.nersc.gov:8773/services/Eucalyptus> to regions

Run!



Hybridfox

Regions magellan-nersc Credentials sakrejda Account IDs Tools About

Instances Images KeyPairs Security Groups Elastic IPs Volumes and Snapshots Bundle Tasks Availability Zones Reserved Instances

Your Instances

Reservation ID	Owner	Instanc...	AMI	AKI	ARI	State	Public DNS	Private DNS	...	Groups	Re...	Type	Local Launch Time	Av...	Tag	Pl...
r-341906DD	devarshi	i-3AE4...	emi-5B7B...	eki-A86F17...	eri-1062190B	runn...	128.55.70....	192.168.2.66	d...	default	NO...	0	m1.small	2011-06-20 12:29:...	euca	
r-429D0882	sangalin	i-319F0...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	3	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-377F0...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	0	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-3D1B...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	1	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-3D72...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	9	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-3D84...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	6	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-3FD7...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	4	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-4092...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	7	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-4652...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	2	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-4F4A...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	8	c1.xlarge	2011-06-20 10:32:...	euca	
r-429D0882	sangalin	i-51C1...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.4....	s...	default	NO...	5	c1.xlarge	2011-06-20 10:32:...	euca	
r-3E9107DC	yyao	i-4485...	emi-A830...	eki-A86F17...	eri-1062190B	runn...	192.168.4.2	192.168.4.2	y...	yushu_w...	NO...	0	m1.small	2011-06-19 22:38:...	euca	
r-406007AF	sakrejda	i-46F20...	emi-1CF1...	eki-A86F17...	eri-1062190B	runn...	128.55.70....	192.168.3....	s...	default	NO...	0	m1.small	2011-06-18 10:25:...	euca	
r-33A60788	shiyong	i-3B1C...	emi-E91F...	eki-A86F17...	eri-1062190B	runn...	128.55.70....	192.168.3.3	k...	default	NO...	0	c1.xlarge	2011-06-14 19:56:...	euca	
r-2C3B0556	shiyong	i-4AEA...	emi-E91F...	eki-A86F17...	eri-1062190B	runn...	128.55.70....	192.168.3.2	k...	default	NO...	0	m1.large	2011-06-16 09:25:...	euca	
r-40A00825	yyao	i-3A21...	emi-A830...	eki-A86F17...	eri-1062190B	runn...	192.168.2....	192.168.2....	y...	yushu_g...	NO...	0	m1.large	2011-06-19 22:37:...	euca	
r-407E07DC	yyao	i-4AFD...	emi-A830...	eki-A86F17...	eri-1062190B	runn...	192.168.2....	192.168.2....	y...	yushu_g...	NO...	0	m1.large	2011-06-19 22:37:...	euca	
r-3F6C0833	yyao	i-4981...	emi-A830...	eki-A86F17...	eri-1062190B	runn...	192.168.2....	192.168.2....	y...	yushu_g...	NO...	0	m1.large	2011-06-19 22:37:...	euca	
r-3E950827	devarshi	i-43A7...	emi-5B7B...	eki-A86F17...	eri-1062190B	runn...	128.55.70....	192.168.3.66	d...	dghosha...	NO...	0	c1.xlarge	2011-06-17 15:44:...	euca	
r-3C5B0725	yyao	i-3723...	emi-B5B6...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.2....	y...	yushu_g...	NO...	0	c1.xlarge	2011-06-19 13:26:...	euca	
r-49A709AC	sakrejda	i-3CA3...	emi-1CF1...	eki-A86F17...	eri-1062190B	term...	128.55.70....	192.168.3....	s...	default	USE...	0	m1.small	2011-06-20 13:25:...	euca	
r-2EF20755	shiyong	i-50D0...	emi-1F4A...	eki-B15217...	eri-19791933	runn...	128.55.70....	192.168.3.4	k...	default	NO...	0	m1.xla...	2011-06-16 17:25:...	euca	
r-4324076B	devarshi	i-482E0...	emi-5B7B...	eki-A86F17...	eri-1062190B	runn...	192.168.3.68	192.168.3.68	d...	dghosha...	NO...	1	c1.xlarge	2011-06-17 15:48:...	euca	
r-4324076B	devarshi	i-4F090...	emi-5B7B...	eki-A86F17...	eri-1062190B	runn...	192.168.3.67	192.168.3.67	d...	dghosha...	NO...	0	c1.xlarge	2011-06-17 15:48:...	euca	
r-364D07E6	yyao	i-2FF10...	emi-A830...	eki-A86F17...	eri-1062190B	runn...	192.168.4.66	192.168.4.66	y...	yushu_w...	NO...	0	m1.small	2011-06-19 23:19:...	euca	
r-41D90746	lavanya	i-4A9C...	emi-5B7B...	eki-A86F17...	eri-1062190B	runn...	128.55.70....	192.168.2.2	la...	lavanya-...	NO...	0	c1.xlarge	2011-06-14 10:14:...	euca	
r-443807A0	yyao	i-41A0...	emi-A830...	eki-A86F17...	eri-1062190B	runn...	128.55.70....	192.168.2....	y...	yushu_g...	NO...	0	m1.large	2011-06-19 22:34:...	euca	
r-45C707A8	balewski	i-2581...	emi-6E5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.3....	b...	default	NO...	3	c1.xlarge	2011-06-19 16:45:...	euca	
r-45C707A8	halewski	i-417A...	emi-6F5B...	eki-8BF817...	eri-D5C118...	runn...	128.55.70....	192.168.3....	b...	default	NO...	1	c1.xlarge	2011-06-19 16:45:...	euca	





How to customize and save images

- Get your credentials into a running instance (scp)
- source /root/.euca/eucarc
- Make any modifications you need, install packages, change configuration

• euca-bundle-vol --.....

-s, --size Size for the image in MB (default: 10GB or 10240MB).

-p, --prefix The prefix for the bundle image files. (default: image name); let's you keep several images in one bucket.

--[no-]inherit Add (or do not add) instance metadata to the bundled image. Inherit is set by default (<http://docs.amazonwebservices.com/AWSEC2/latest/UserGuide/index.html?instancedata-data-categories.html>).

-e, --exclude Comma-separated list of directories to exclude (/root/.euca/eucarc)

-r, --arch Target architecture for the image ('x86_64' or 'i386').

-v, --volume Path to mounted volume to create the bundle from (default: "/").



How to save a customized image

- **Make sure time is set properly in your instance**
- **Upload your customized image to the server**

`euca-upload-bundle`

`-b, --bucket` bucket name

`-m, --manifest` manifest_path

You'll get the path to the manifest at the end of the `euca-bundle-vol`

- **Register the uploaded image**

`euca-register` image_location

`image_location` - - path to the uploaded image (bucket/manifest) –
you'll get an image ID when the process works

- **Check that the image is available**

`euca-describe-images` <image id>



/root/mkbundle

```
-bash-3.2# more mkbundle
#!/bin/sh
KERNEL=eki-A86F17CD
RD=eri-1062190B
VERSION=torque1.0.1
EUCA=/root/.euca
. $EUCA/eucarc
# Get the username from the cert
USER=$(openssl x509 -in $EC2_CERT -subject|grep subject|sed 's/.*O=//'|sed 's/\N.*//')
BDIR=/mnt
BUCKET=${USER}-torque-bucket
IMG=$VERSION.manifest.xml
EXCLUDE=$EUCA, /root/.ssh,$BDIR/*, /apps,/global
euca-bundle-vol --kernel $KERNEL --ramdisk $RD -d $BDIR -s 3120 -r x86_64 --no-inherit -e
$EXCLUDE -p $VERSION
euca-upload-bundle -b $BUCKET -m $BDIR/$IMG --debug
euca-register $BUCKET/$IMG
```



Build your own cluster!

- **Why a cluster?**
- **virtualcluster**
 - module load tig virtualcluster
 - module show virtualcluster
 - documentation available in:
`$VIRTUALCLUSTER_HOME/doc/README`
 - vc-launcher options
 - `vc-launcher newCluster <noNodes>`
 - `vc-launcher addNodes <noNodes>`
 - `vc-launcher terminateCluster <noNodes>`
 - `vc-launcher pubCluster <noNodes>`
 - `vc-launcher pubClusterEbs <noNodes> <path to file with ebs info>`



Clean up!

- **Terminate all your running instances**
 - `vc-launcher terminateCluster <noNodes>`
and check
 - `ec2-describe-instances`
 - `ec2-terminate-instances`
- **Delete images**
- **Delete S3 buckets**
- **Delete EBS volumes**

Thank You!