



## Visualizing a Cloud using Eucalyptus and Xen

**Kaustav Choudhury**

Dept. of CSE

Heritage Institute of Technology  
West Bengal, India.**Argha Roy**

Dept. of CSE

Netaji Subhash Engineering College  
West Bengal, India.**Diptam Dutta**

Dept. of CSE

Heritage Institute of Technology  
West Bengal, India.

**Abstract -** The clouds are a large pool of virtualized resources which are easy to use and access. As per NIST “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”. There are various ways of setting up clouds in an academic or IT infrastructure. We are proposing a method to setup a cloud infrastructure using Eucalyptus and Xen. Eucalyptus is an open source cloud computing framework that gives users the ability to create, run and manage virtual machine instances across physical machines. Xen is the hypervisor upon which the virtual machines run on the host computer.

**Keywords—** Cloud computing, Eucalyptus, Xen, ubuntu, Open source.

### I. INTRODUCTION

Cloud computing [1],[6] follows a type of parallel and distributed computing architecture where the computational power, storage, network and software resources are dynamically provisioned over the internet through service level agreements between the cloud service provider and the consumer.

Setting up a cloud computing infrastructure has various advantages as huge IT organizations setting up their IT infrastructure can minimize their IT budget as they only have to pay for the services they want to use and save themselves from the harassment of maintaining a huge infrastructure. An organization willing to setup a cloud infrastructure has the flexibility to choose from three types of service models such as Paas, Saas and Iaas. Various deployment models exist to choose from such as private, public and hybrid clouds.

In a private cloud [6] an organization has the ability to use the infrastructure exclusively for its own needs. A public cloud is provisioned for open use by the general public whereas a hybrid cloud is a composition of both private and public clouds. There are various methods to set up cloud computing infrastructures in today’s market but it has to be taken into account that the infrastructure is reliable, secure and less expensive to deploy the various applications an organization wants. So, keeping in mind the above philosophy we have decided to implement such an infrastructure using Eucalyptus and Xen.

### II. LITERATURE REVIEW

#### A. Eucalyptus, Euca2ools and Xen.

These are mainly open source platforms and freely available for download and use.

Eucalyptus (Elastic Utility Computing Architecture for Linking Your Programs to Useful Systems) [2], [5] was released in May 2008. It uses the existing IT infrastructure where it is to be deployed to create a scalable web services layer that performs an abstraction of the computer, network, security and storage to offer Iaas. Through the use of an effective hypervisor it creates elastic VMs. The system allows the user to start, control, and access and terminate entire VMs simulating features equivalent to Amazon EC2’s SOAP and Query interfaces. It supports popular hypervisors such as Xen, KVM/QEMU and VMware.

Euca2ools [5] are command-line tools for interacting with Web services that export a REST/Query-based API compatible with Amazon EC2 and S3 services. The tools can be used with both Amazon’s services and with installations of the Eucalyptus open-source cloud-computing infrastructure. Xen [9], [10] is a hypervisor that provides services to virtualize the computing resources. It enables you to run multiple virtual machines on a single physical computer known as host computer, thereby improving the effective usage and efficiency of the underlying hardware. Each virtual machine may be running a different operating system with a different configuration. The hypervisor provides an isolated execution environment for each virtual machine running on the host computer. It undergoes memory management and CPU scheduling of all VMs and launches “dom 0” the most privileged domain which has default access to the hardware.

### III. PROPOSED WORK AND THE SYSTEM ARCHITECTURE

This paper provides an insight into setting up cloud infrastructures using and Xen. The cloud infrastructure will be setup in minimal conditions using a single physical computing node as it is expensive to rent servers to carry out our work but in optimal conditions it is suggested to use 2 or more physical computing nodes setup such a cloud infrastructure. The

advantage of our setup is that all the software resources we are using are freely available for download with only expenses in the hardware resources. So, this is a cost cutting model to setup a cloud infrastructure.

Hardware resources used: - A laptop with the following configuration:

1. 320 GB Hard disk – 100 GB allotted specifically for Linux OS.
2. 2GB RAM.
3. Intel Core i3 Processor @ 2.10GHz.

Software resources used:-

1. Linux OS – Ubuntu 10.04 LTS Desktop.
2. Cloud Management Software – Eucalyptus 1.6.2.
3. Hypervisor – Xen 4.1.2.
4. Command Line Interface Tool – Euca2ools 1.2.

The proposed System Architecture is that above the underlying operating system lies the hypervisor also known as the virtual machine monitor whose task is to create or simulate the virtual machines (VM) as required which will be managed by the cloud management framework called Eucalyptus and the interaction and communication between the various virtual machines will be performed by a command line interface tool known as Euca2ools. The figure depicting this architecture is as shown below:-

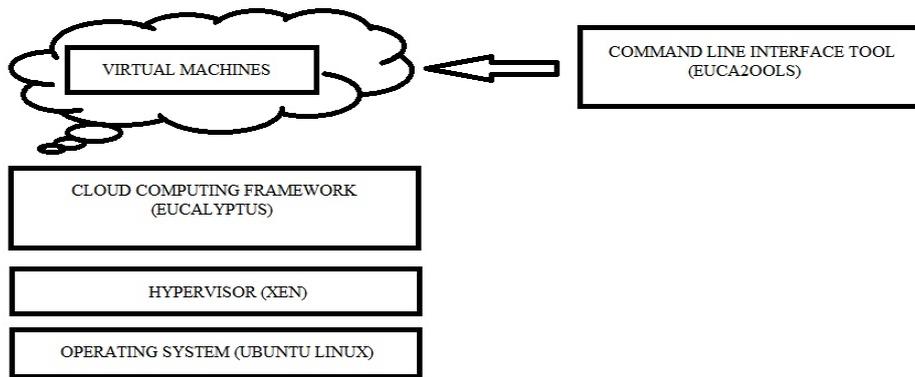


Fig.1: The Cloud System Architecture

#### IV. Setting Up The Cloud Infrastructure

The setup consists of the following steps: - [3], [5], [8]

1. Installing Eucalyptus from the Synaptic package manager which comes as a package with the Ubuntu Linux OS.

Ubuntu 10.04 comes installed with UEC (Ubuntu Enterprise Cloud) which consists of all the packages and dependencies required for the installation of eucalyptus. So, I did not have to install eucalyptus. For, reinstalling eucalyptus you need to go to Administration -> Synaptic Package Manager -> Search for eucalyptus and the results will display several eucalyptus packages. Select the necessary packages such as eucalyptus common, cloud, sc, cc, nc, walrus and select 'Mark for installation'.

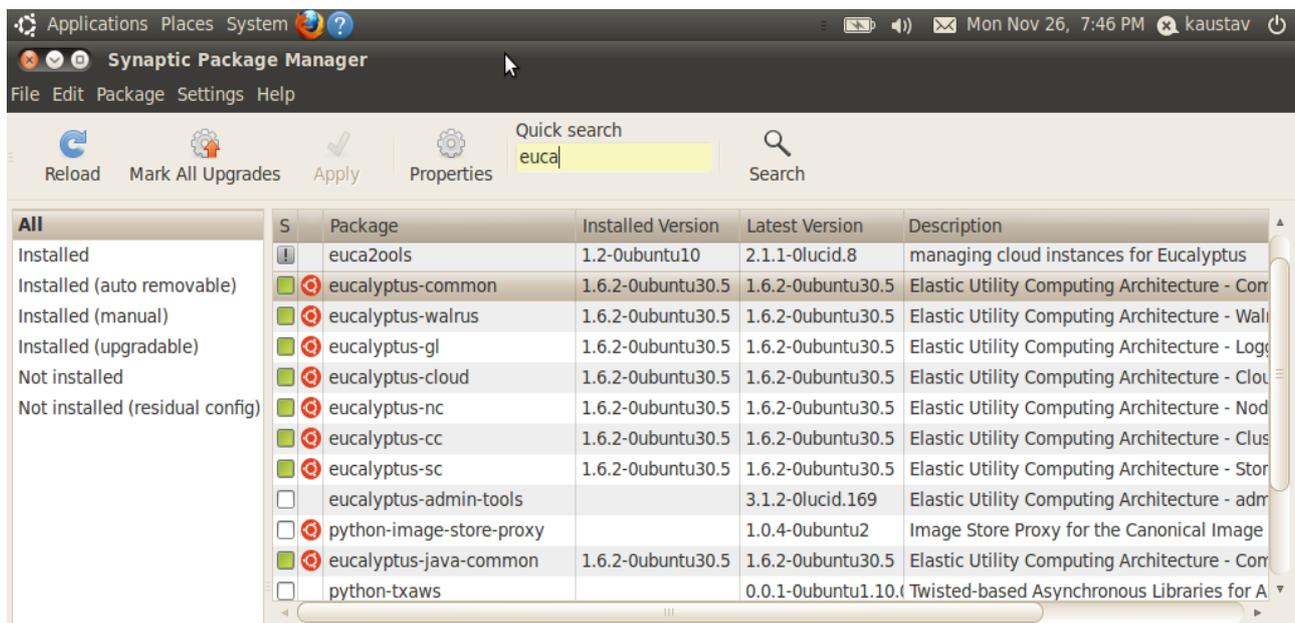


Fig.2: Synaptic Package Manager showing the eucalyptus packages

2. Setting up the Cloud controller (CC), Storage controller (SC), Cluster controller, Node Controller (NC) and Walrus.  
Eucalyptus comes with the euca\_conf script for configuring Eucalyptus.
  - a. Enable services on the front-end  
\$EUCALYPTUS/usr/sbin/euca\_conf --enable cloud --enable walrus --enable sc
  - b. Start enabled front-end services  
\$EUCALYPTUS/etc/init.d/eucalyptus-cloud start
  - c. Start the cluster controller  
\$EUCALYPTUS/etc/init.d/eucalyptus-cc start
  - d. And on each of the compute nodes run:  
\$EUCALYPTUS/etc/init.d/eucalyptus-nc start  
To stop them you call the script with *stop* instead of *start*.
3. Configuring the network in SYSTEM mode in the eucalyptus configuration file.
  - a. Create and configure the bridge for a static IP address by modifying the /etc/network/interfaces file.
  - b. The options in 'eucalyptus.conf' that must be configured correctly in 'SYSTEM' mode are as follows:  
On the front-end: VNET\_MODE="SYSTEM"  
On each node: VNET\_MODE="SYSTEM"  
In each Eucalyptus node controller's (NC) 'eucalyptus.conf' file, VNET\_BRIDGE="xenbr0"(name of the bridge).
  - c. It is necessary to set up a DHCP server that has a dynamic pool of IP addresses to hand out as the VMs boot.
4. Installing Xen as the hypervisor which also involves installing the Xen kernel as it is not available for Ubuntu 10.04 OS. The tasks to be accomplished are building and installing Xen and compiling the Xen Dom0 kernel [4].
5. Configuring the hypervisor.

```
root@kaustav-laptop:~# vim /etc/xen/xend-config.sxp
```

Edit the file as follows:-  
(xend-http-server yes)  
(xend-unix-server yes)  
(xend-unix-path /var/lib/xend/xend-socket)  
(xend-address localhost)  
(network-script 'network-bridge netdev=xenbr0')
6. Registering the eucalyptus components.

```
root@kaustav-laptop:~# euca_conf --register-walrus 172.16.17.121  
root@kaustav-laptop:~# euca_conf --register-sc cluster1 172.16.17.121  
root@kaustav-laptop:~# euca_conf --register-nodes "172.16.17.121"  
root@kaustav-laptop:~# euca_conf --register-cluster cluster1 172.16.17.121
```
7. Installing euca2ools to setup a command line interface to communicate with eucalyptus.  
You need to install the euca2ools\_1.2-0ubuntu10\_all.deb package downloaded from the internet. Also, the system must have the python, boto and M2crypto packages already installed which can be viewed from the Synaptic Package Manager.
8. Creating and managing virtual machine images through the Ubuntu Enterprise Cloud (UEC) interface.

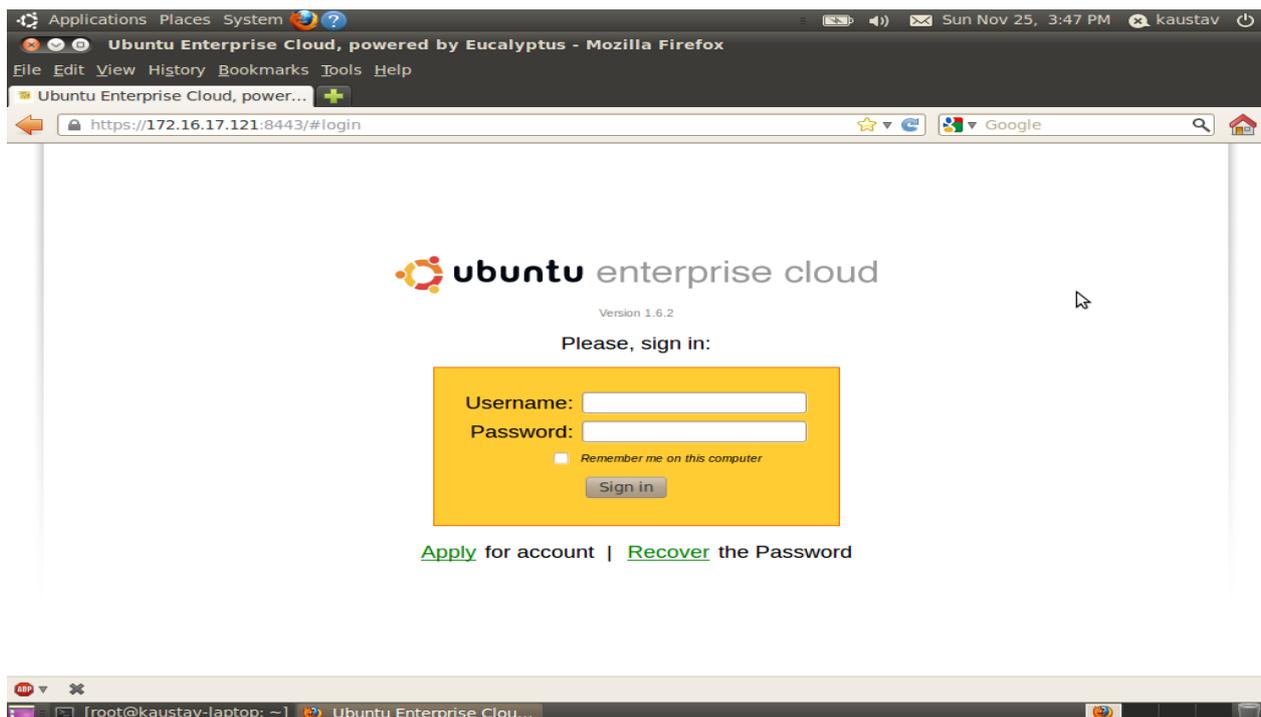


Fig.3: Login Page of UEC Web Console

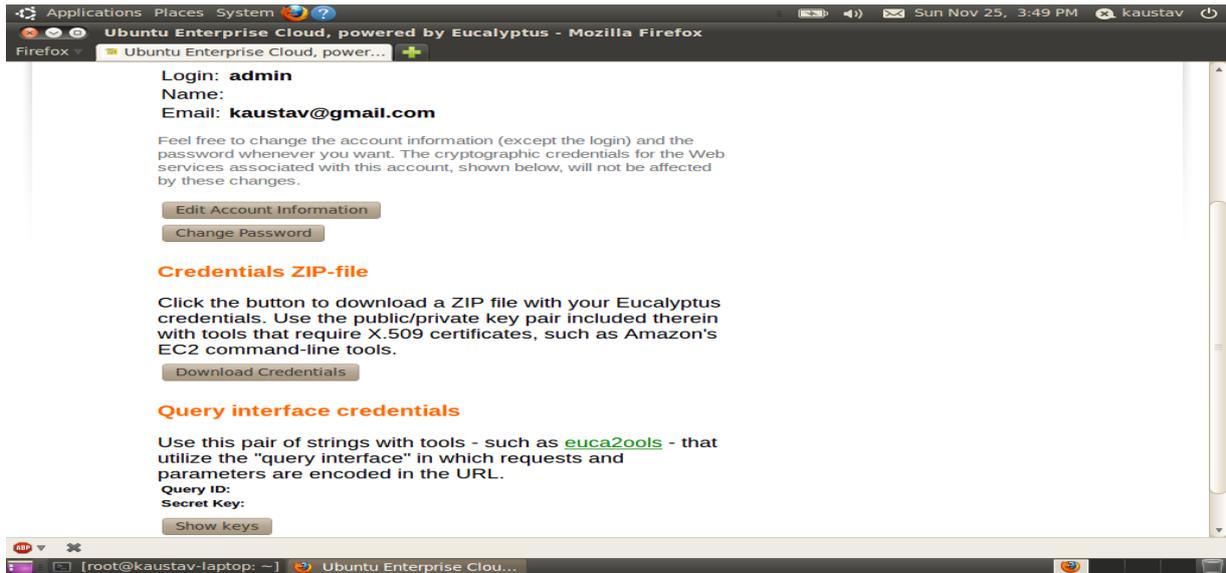


Fig.4: Credentials Page of UEC

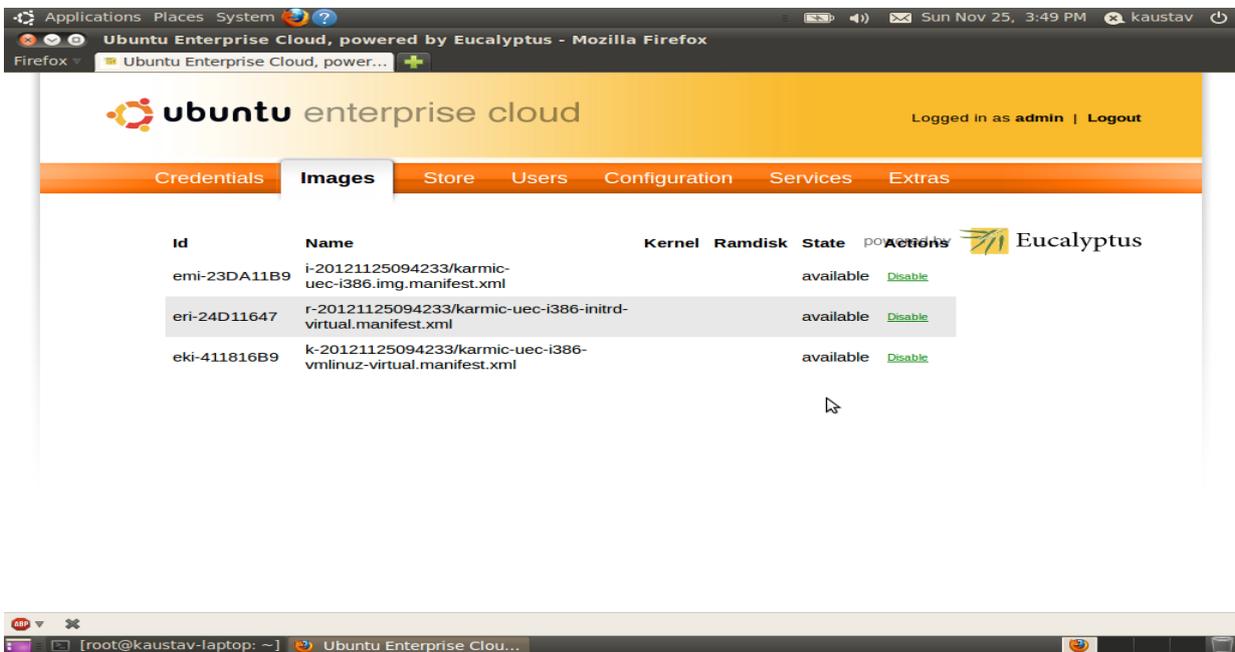


Fig.5: Images Page of UEC

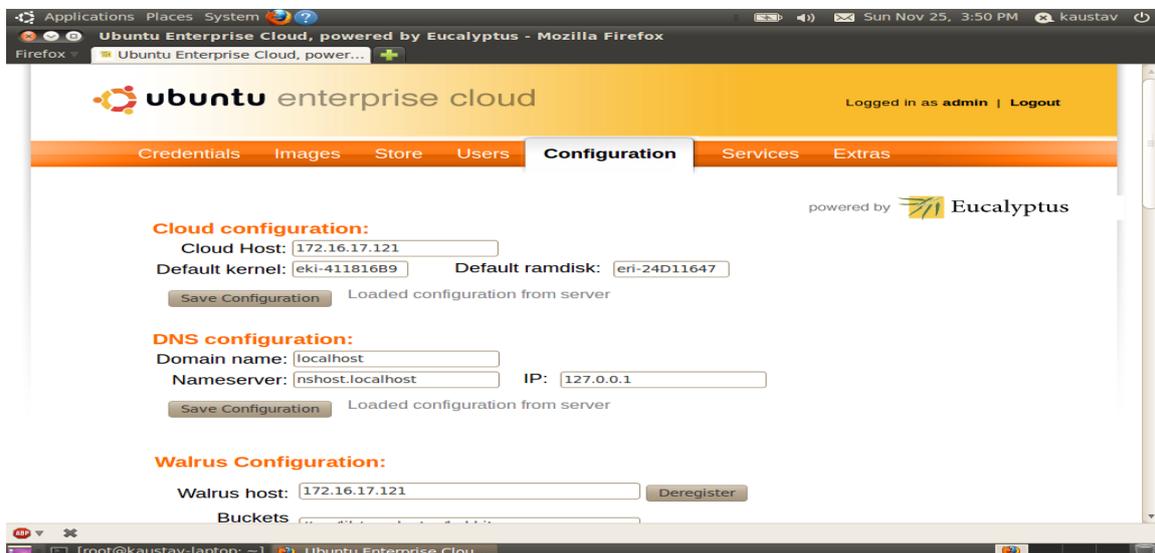


Fig.6: Configuration page of UEC

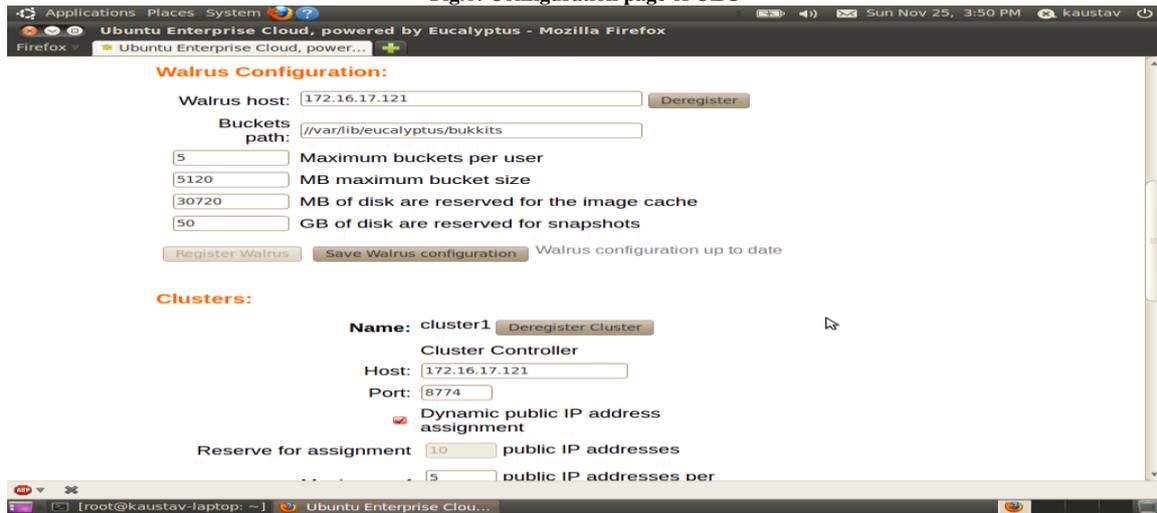


Fig.7: Walrus Configuration page of UEC

9. Retrieving Credentials through command line.

```
$ mkdir -p ~/.euca
$ chmod 700 ~/.euca
$ cd ~/.euca
$ sudo euca_conf --get-credentials mycreds.zip
$ unzip mycreds.zip
```

10. Source *euca* script to make sure that the environmental variables used by *euca2ools* are set properly.

```
$ . ~/.euca/euarc
```

11. Execute following command to register the node.

```
$ sudo euca_conf --no-rsync --discover-nodes
```

12. To verify that *euca2ools* is able to communicate with the UEC, fetch the local cluster availability details as.

```
root@kaustav-laptop:~# euca-describe-availability-zones verbose
```

On executing the above command the result is:-

```
AVAILABILITYZONE cluster1 172.16.17.121
AVAILABILITYZONE|- vm types free / max cpu ram disk
AVAILABILITYZONE|- m1.small 0000 / 0000 1 192 2
AVAILABILITYZONE|- c1.medium 0000 / 0000 1 256 5
AVAILABILITYZONE|- m1.large 0000 / 0000 2 512 10
AVAILABILITYZONE|- m1.xlarge 0000 / 0000 2 1024 20
AVAILABILITYZONE|- c1.xlarge 0000 / 0000 4 2048 20
```

13. Unpacking the downloaded Virtual Image file [7].

```
root@kaustav-laptop:~#tar -S -xzf ubuntu-9.10-rc-uec-i386.tar.gz
```

14. Registering the kernel.

```
root@kaustav-laptop:~/ubuntu-9.10-rc-uec-i386# euca-bundle-image -i karmic-uec-i386-vmlinuz-virtual -r i386 --kernel true
```

15. Registering the image.

```
root@kaustav-laptop:~# euca-bundle-image -i karmic-uec-i386.img
root@kaustav-laptop:~/ubuntu-9.10-rc-uec-i386# BUCKET_IMAGE="i-$TIMESTAMP"
root@kaustav-laptop:~/ubuntu-9.10-rc-uec-i386# euca-upload-bundle -b $BUCKET_IMAGE -m /tmp/karmic-uec-i386.img.manifest.xml
root@kaustav-laptop:~/ubuntu-9.10-rc-uec-i386# euca-register $BUCKET_IMAGE/karmic-uec-i386.img.manifest.xml
```

16. Registering the ramdisk.

```
root@kaustav-laptop:~# euca-bundle-image -i karmic-uec-i386-initrd-virtual --ramdisk true
root@kaustav-laptop:~/ubuntu-9.10-rc-uec-i386# BUCKET_INITRD="r-$TIMESTAMP"
root@kaustav-laptop:~/ubuntu-9.10-rc-uec-i386# euca-upload-bundle -b $BUCKET_INITRD -m /tmp/karmic-uec-i386-initrd-virtual.manifest.xml
root@kaustav-laptop:~/ubuntu-9.10-rc-uec-i386# euca-register $BUCKET_INITRD/karmic-uec-i386-initrd-virtual.manifest.xml
```

17. To view details of the image registered.

```
root@kaustav-laptop:~# euca-describe-images
IMAGE emi-23DA11B9 i-20121125094233/karmic-uec-i386.img.manifest.xml admin available
public x86_64 machine
IMAGE eri-24D11647 r-20121125094233/karmic-uec-i386-initrd-virtual.manifest.xml admin available
public x86_64 ramdisk
```

```
IMAGE eki-411816B9 k-20121125094233/karmic-uec-i386-vmlinuz-virtual.manifest.xml admin available
public i386 kernel
```

18. Create a SSH keypair that can be used to log into the instance.

```
root@kaustav-laptop:~# if [ ! -e ~/.euca/mykey.priv ]; then
> touch ~/.euca/mykey.priv
> chmod 0600 ~/.euca/mykey.priv
> euca-add-keypair mykey > ~/.euca/mykey.priv
> fi
```

19. Configuring default security group to allow SSH access (port 22).

```
root@kaustav-laptop:~# euca-authorize default -P tcp -p 22 -s 0.0.0.0/0
m. Run the instance created:-
root@kaustav-laptop:~# euca-run-instances emi-23DA11B9 -k mykey
```

20. View details of the instance running.

```
root@kaustav-laptop:~# euca-describe-instances
RESERVATION r-4DB0096A admin default
INSTANCE i-39290670 emi-23DA11B9 0.0.0.0 0.0.0.0 terminated mykey 0
m1.small 2012-11-25T05:50:16.176Z cluster1 eki-411816B9 eri-24D11647
```

#### IV. CONCLUSION

This work includes the setup of a private cloud with minimal hardware resources using open source software technologies like Eucalyptus, Xen and Euca2ools. The virtual machine images are also freely available for download and upon the request of the user they can be made to run. The current implementation of this paper provides Infrastructure as a service (IaaS) and Software as a Service (SaaS).

#### REFERENCES

- [1] <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>
- [2] Daniel Nurmi, Rich Wolski, Chris Grzegorzcyk, Graziano Obertelli, Sunil Soman, LamiaYouseff, Dmitrii Zagorodnov - The Eucalyptus Open-source Cloud-computing System.
- [3] <https://cssoss.wordpress.com/2010/03/19/uec-cc-nc-single-machine/>
- [4] <https://garfield001.wordpress.com/2012/02/20/installing-xen-4-1-2-dom0-on-ubuntu-10-04/>
- [5] Eucalyptus Administrator and User Guides.
- [6] Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility - Rajkumar Buyyaa, Chee Shin Yeo, Srikumar Venugopal, James Broberg, Ivona Brandic
- [7] <http://cloud-images-archival.ubuntu.com/releases/karmic/rc/>
- [8] <http://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cad=rja&ved=0CFYQFjAG&url=http%3A%2F%2Fwww.thbs.com%2Fpdfs%2FPrivate-Cloud-Whitepaper-EucOnXen.pdf&ei=4cCxUIwYkOSsB7OegLAI&usg=AFQjCNFRL461eGY-cxLBHRYyFtxMJUyw3g>
- [9] [http://wiki.xen.org/wiki/Main\\_Page](http://wiki.xen.org/wiki/Main_Page)
- [10] <https://en.wikipedia.org/wiki/Xen>