

# Elastic Utility Computing Architecture for linking Your Programs to Useful Systems – Cloud Computing Implementation

Kaushik Sanganabhatla

*Abstract: Cloud computing is one of the hottest buzzword in the academia and as well as industry with services such as Infrastructure as a service, Platform as a service, Software as a service. Since, last decades open-source technology help people who do not wish to use commercial infrastructure for cloud. In the paper I shall discuss Overview of Elastic Utility Computing Architecture for Linking Programs to Useful Systems (Eucalyptus) –a private cloud computing implementation, Advantages and Over-view of various components of Eucalyptus cloud, Installation and configuration of Eucalyptus cloud. So, that it can be easily implemented by the students in the technical universities for their research project works.*

**Keywords:** Eucalyptus, Linux, Cloud, Walrus, Open source software.

## I. INTRODUCTION

In recent years, cloud computing has rapidly emerged as a widely accepted paradigm in computing systems, in which an end-user can request some computing capabilities and services when he need it, and he can reach these resources across networks anytime, anywhere. Pew Research Institute published a research about “the future of cloud computing”, and depicted that about 71% of technology stakeholders and critics believe that by the year 2020, most people will work in Internet-based applications, which can also be run from smartphones<sup>[2]</sup>. Therefore, it can be seen that the future of cloud computing technology is bright and will be widely used in the World.

### ➤ Types of Clouds:

The following list identifies the main types of clouds (currently in use):

(Cloud) **Infrastructure as a Service (IaaS)** also referred to as Resource Clouds, provide (managed and scalable) resources as services to the user – in other words,

- o Compute as a service
- o Storage as a service
- o Network as a service
- o Disaster recovery as a service
- o Backup as a service
- o Virtual desktop solutions

All of the above resources are made available to end user via **server virtualization**. Accordingly, different resources may be provided via a service interface. Examples: Amazon S3, SQL Azure.

Moreover, these resources are accessed by the customers as if they own them. IaaS (Infrastructure as a Service) offers additional capabilities over a simple compute service.

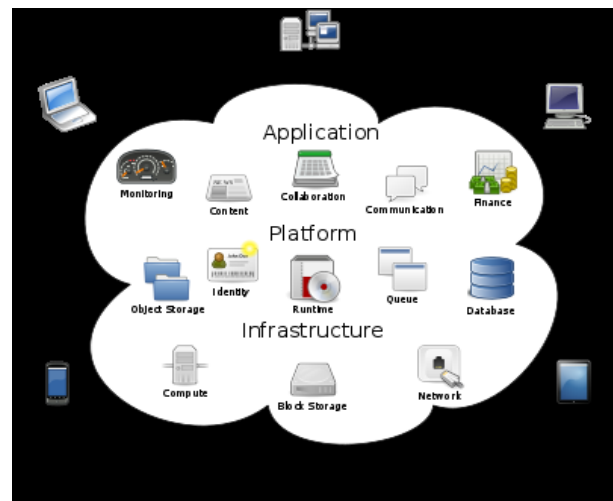
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**Kaushik Sanganabhatla**, Technical Officer, Hyderabad (Telangana), India, E-mail: [skaushik4u@gmail.com](mailto:skaushik4u@gmail.com)

Examples: Amazon EC2, Zimory, Elastichosts.

(Cloud) **Platform as a Service (PaaS)**, provide computational resources like Platform for application, portal development and testing, platform for application or portal hosting, Database as a service, Collaboration platforms.

Examples: Force.com, Google App Engine, Windows Azure (Platform).



**Fig 1. Cloud Platforms diagram**

(Clouds) **Software-as-a-Service (SaaS)** model allows to provide software application as a service to the end users. It refers to a software that is deployed on a host service and is accessible via Internet. There are several SaaS applications listed below:

- Billing and invoicing system
- Customer Relationship Management (CRM) applications
- Help desk applications
- Human Resource (HR) solutions

The characteristics of SaaS service model:

The license to the software may be subscription based or usage based. And it is billed on recurring basis.

SaaS offers shared data model. Therefore, multiple users can share single instance of infrastructure. It is not required to hard code the functionality for individual users.

Examples: Google Docs, Salesforce CRM, SAP Business by Design, Email as service by Meghraj<sup>[5]</sup> (Indian Govt. cloud).

In future, universities can provide on-demand service for using software's by providing unique cloud for students to access the software as a service. The affiliated academic institutions are freed from purchasing and maintaining all software's.

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The Universities can levy pay per use charge for the usage to the affiliated academic institutions [6]. Many schools in abroad implemented this concept.

### II. DESCRIPTION / METHODOLOGY:

**Eucalyptus** stands for **Elastic Utility Computing Architecture for linking Your Programs to Useful Systems**. Eucalyptus is Linux-based software. Eucalyptus is open source software used to create and manage a private or public cloud. Eucalyptus has a self-service interface that allows you to manage various resources like hardware, storage and network in effective way. Eucalyptus is a research project of Prof. Rich Wolski, Computer Science Department at the University of California, USA.

Eucalyptus is written in Java and C programming language. Eucalyptus allows you to create a pool of IT resources (computer power, network and storage) that can be rapidly provisioned and released with minimal management.

### III. EUCALYPTUS COMPONENTS

Eucalyptus components [1] are explained below:

- **Cloud Controller [CLC]:** Cloud controller is written in java. CLC is the entry point. When you try to access cloud resources from outside world, first request goes to CLC, if it approves the request then only access is given. Suppose an unauthorized person tries to access cloud resources, CLC immediately terminates the session. It is the place where decision is taken whether allowed to access the resources or not. As the interface to the management platform, the CLC is responsible for exposing and managing the underlying virtualized resources (servers, network, and storage).

- **Walrus:** Walrus is written in java, it is equivalent to AWS S3 (Simple Storage Service). Walrus is for storage of files, objects, buckets, snapshots, images. Walrus is to put, get, create data objects and access control policies or privileges. There can be only one walrus and CLC active per cloud. Walrus can be accessed by the end user, whether user is running a client from inside the cloud by virtual instance or outside the cloud.

- **Cluster Controller:** The Cluster Controller (CC) runs on the machine that has network connectivity to both the machines running Node Controller (NC) and to the machine running the CLC, machine that has these two features is the front-end machine. CCs gather information about a set of NCs and schedules virtual machine (VM) execution on specific NCs.

- **Node Controller:** The Node Controller (NC) runs on every machine that hosts VM instances. NC manages the execution, termination and inspection of VM running on hosts. It also fetches and maintains a local cache of instance images, and it queries and controls the system software (host OS and the hypervisor) in response to queries and control requests from the CC. NC manages life cycle of VM instances. It maintains data related to resource utilization and availability.

- **Storage Controller:** The Storage Controller (SC) provides functionality that is equivalent to Amazon Elastic Block Store (Amazon EBS). SC can interface with various storage systems like NFS, SAN devices etc. Elastic block storage

exports storage volumes that can be attached by a VM and mounted or accessed as a raw block device.

- **VMware Broker:** VMware Broker (VB) is optional component in Eucalyptus. It is available when you are a Eucalyptus Subscriber. VMware Broker mediates all interactions between the CC and VMware hypervisors (ESX/ESXi) either directly or through VMware vCenter.

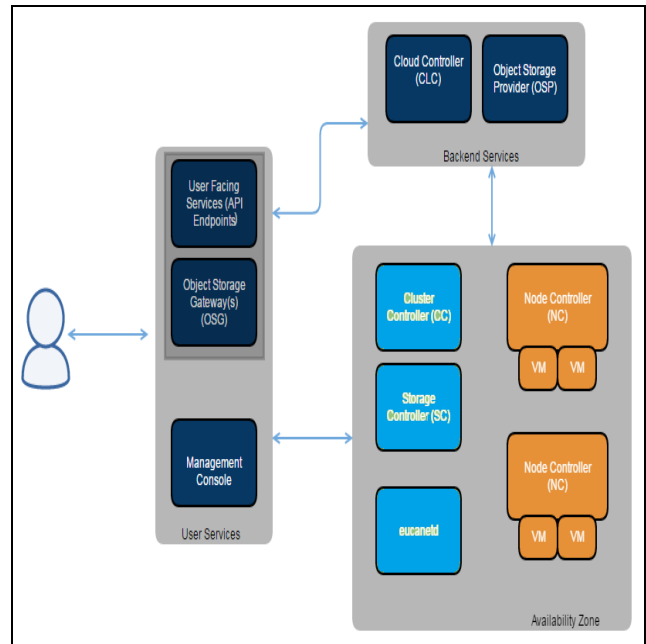


Fig 2. Eucalyptus Architecture

- **Management Console:** The Eucalyptus Management Console provides web-based interface through which you can manage cloud activities.

- **Eucanetd:** The eucanetd service implements artifacts to manage and define Eucalyptus cloud networking. Eucanetd runs alongside the CLC or NC services, depending on the configured networking mode.

### IV. DESIGN AND IMPLEMENTATION

Here we set up a simple Eucalyptus cloud on a set of two machines, one machine acts as management server containing the cloud controller, Walrus, the cluster controller and the storage controller, and the other machine acts as the node controller running a KVM hypervisor. Figure 2 shows the set-up diagram.

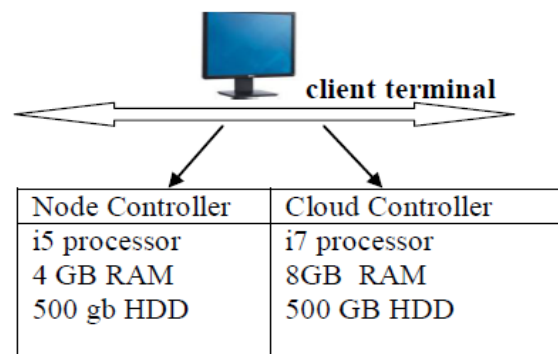


Fig 3. Implementation block diagram

There are two ways by which you can install Eucalyptus. First, one can download the required RPMs onto your machine, install each of them and then manually configure cloud as per your needs.

We shall explain the second way it called Eucalyptus Faststart. It is Cent OS-based ISO that has all the Eucalyptus components embedded in it. Just burn ISO to a DVD and run it on your machine. Installation is wizard based and this wizard guides you for installation process and finally set up your Eucalyptus cloud. It is advised to install the node controller first so that it is easier to add them to cloud controller. Once machine boots from the Eucalyptus Faststart DVD, then select 'Install CentOS 6 with Eucalyptus Node Controller' option from the boot screen.

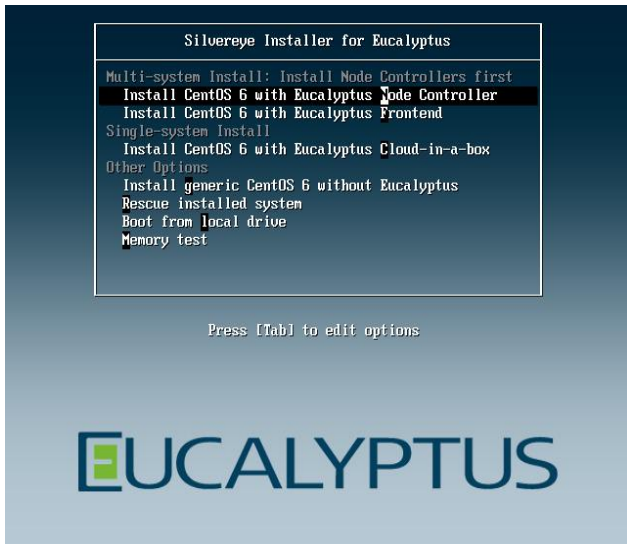


Fig 4. Screenshot of Eucalyptus

Next, select the appropriate 'Language' and 'Keyboard settings' according to your locale. Provide a 'Static IP' and a suitable 'Host Name' to your node controller in the 'Network Configuration' wizard. You must provide a strong 'Root Password' for node controller. After this node controller with base OS is ready. Once installation is complete you have to reboot your system.

Next step is Log in to the node controller using root username and password. At this moment few scripts run in background automatically during node controller's networking configuration. Once completed, node controller can be added to cloud controller.

**Note:** Follow the above mentioned steps for each of the node controllers that you wish to use for your cloud.

## V. CLOUD CONTROLLER INSTALLATION

Cloud controller Installation<sup>[3]</sup> is very much same as the nodes, with a few exception. Once machine should boot from Eucalyptus Faststart DVD, choose 'Install CentOS 6 with Eucalyptus Frontend' from boot screen.

Next select the 'Language and Keyboard settings' from wizard. In the 'Network Configuration' wizard provide 'Static IP' and 'Host Name' to cloud controller.

After this, you need to give 'Public IP Range/ List' for Eucalyptus cloud (see Figure 4). These public IPs will be mapped to individual Eucalyptus instances<sup>[2]</sup> (virtual machines) once they are launched in the cloud.

The rest of the installation process remains the same. After the cloud controller reboots, it will execute a number of configuration scripts that helps to set up Walrus, the cluster controller and storage controller with default parameters. These scripts will also create a CentOS 6 EMI (Eucalyptus Machine Image). With help of EMI we can launch multiple CentOS 6 instances in our cloud.

**Note:** If we want to implement only in a Single system then we have to select cloud in a box, the rest instructions are as usual. Then we need not select the front end and node controller.

Now we need to check whether installation process was successful. For this you need to open web browser type following command, it will open Eucalyptus user console: [http://<Cloud\\_Controller\\_IP>:8888](http://<Cloud_Controller_IP>:8888)

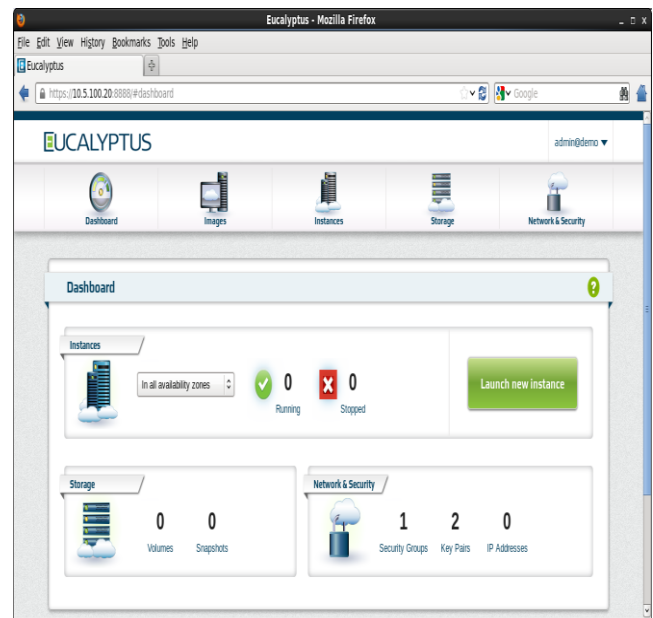


Fig 5: Screenshot of Eucalyptus dashboard

## VI. A. HOW TO LAUNCH THE FIRST AND FOREMOST INSTANCE?

In order to start the first instance, follow the below steps:

i) We need to create a security group<sup>[2]</sup>: A security group is same as firewall that protects all our instances against network-related attacks. All inbound traffic is blocked by default. Use the following command to create a security group:

```
# euca-create-group 'd 'Description of the group' Group_Name
```

```
# euca-create-group 'd 'My First Security Group' TestSecurityGroup
```

After this step you need to open some ports like SSH port 22 to gain access to instance. Use following command to open port for your security:

```
# euca-authorize 'P 'Protocol' p 'Port_No' 's ' IP_Source'Group_Name
```

```
# euca-authorize 'P 'tcp' p '22' 's '0.0.0.0/0' TestSecurityGroup
```

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ii) Next step is to create a key pair. This key pair helps in authentication between users and the instances.

To create a key pair, use the following syntax:

```
# euca-create-keypair Key_Pair_Name' >>
'Key_Pair_Name'.private
# euca-create-keypair TestKeypair >>
TestKeypair.private
```

iii) Last step is to launch the instance: An instance is launched from a machine image (in this case, EMI). You will require an EMI ID to launch your first instance. You can get this from Eucalyptus cloud user-console<sup>[4]</sup>.

To launch an instance, use the following syntax:

```
#euca-run-instances'EMI_ID' 'g 'Group_Name' 'k
'Key_Pair_Name'
# euca-run-instances 'EMI-E90A38DA' 'g
'TestSecurityGroup' 'k ' TestKeypair'
```

The instance will take few seconds to launch. Note down the the instance IP address either from the terminal or by using the Eucalyptus cloud user console.

SSH into the instance using the earlier created key pair by using the following syntax: # ssh -i

```
<Key_Pair_Name> ec2-user@<Instance_IP>
# ssh -i TestKeypair ec2-user@192.168.2.100
```

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**Kaushik Sanganabhatla**, is Presently working as a Technical officer in RGUKT IIT Basar. He pursued M.Tech in Computer Science & Engineering from University College of Engineering Osmania University Campus, Hyderabad, India & B.Tech in Computer science & Engineering from Jawaharlal Nehru Technological University, Hyderabad. His Area of Interest includes Cloud Computing, ATM Machines, Network Security, Grid Computing, and Java. He secured all India GATE Rank/Score: 373 with 93.70%.

### VII. ADVANTAGES:

❖ Eucalyptus is open source software used to create and manage a private or public cloud. Users add new functionality to the software as per their needs. The Eucalyptus open source software core is available for free download at [www.eucalyptus.com](http://www.eucalyptus.com).

❖ Eucalyptus supports scalable data center infrastructure. So enterprise can scale up or down their data center resources as per their needs. Eucalyptus is not so costlier to implement and even is can be used to implement as research projects for the student projects in universities.

❖ Eucalyptus provides Elastic resource configuration. This feature allows user to flexibly reconfigure computing resources as requirements change. It helps enterprise workforce remain adaptable to sudden changes in business needs.

### VIII. CONCLUSION AND FUTURE WORK

The EUCALYPTUS system provides the ability to deploy an infrastructure for user-controlled virtual machine creation and control atop existing resources. Administrators and researchers can take advantage of this. EUCALYPTUS private cloud hierarchical design targets resources that are commonly found in academic and laboratory settings for the Research work, Student and Teacher communities in the Universities or Higher Educational Institutions with low cost just by taking just two systems for implementation of the basic private cloud. There are various security issues in the cloud computing that are to be overcome in the future work.

### REFERENCES

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2. <https://docs.eucalyptus.com/eucalyptus/4.3/euca2ools-guide/euca-create-group.html>