Setting up of an Open Source based Private Cloud

Dr.G.R.Karpagam[1], J.Parkavi[2]

[1]Professor, Department of Computer Science and Engineering,
PSG College of Technology, Coimbatore-641 004, India

[2]ME, Software Engineering,
Department of Computer Science and Engineering,
PSG College of Technology, Coimbatore-641 004, India

Abstract

Cloud Computing is an attractive concept in IT field, since it allows the resources to be provisioned according to the user needs[11]. It provides services on virtual machines whereby the user can share resources, software and other devices on demand. Cloud services are supported both by Proprietary and Open Source Systems. As Proprietary products are very expensive, customers are not allowed to experiment on their product and security is a major issue in it, Open source systems helps in solving out these problems. Cloud Computing motivated many academic and non academic members to develop Open Source Cloud Setup, here the users are allowed to study the source code and experiment it. This paper describes the configuration of a private cloud using Eucalyptus. Eucalyptus an open source system has been used to implement a private cloud using the hardware and software without making any modification to it and provide various types of services to the cloud computing environment.

Keywords: Cloud Computing, Open Source, Private Cloud.

1. Introduction

Cloud computing is a computing environment, where resources such as computing power, storage, network and software are abstracted and provided as services on the internet in a remotely accessible fashion. Billing models for these services are generally similar to the ones adopted for public utilities. On-demand availability, ease of provisioning, dynamic and virtually infinite scalability is some of the key attributes of cloud computing [6].

The main concept behind cloud computing is providing services. It provides various types of services, some of the important services are SaaS, PaaS and IaaS. Software as a service is a model of software deployment whereby a provider licenses an application to customers for use as a service on demand. Platform as a service generates all facilities required to support the complete cycle of construction and delivery of web-based applications wholly available in Internet without the need of downloading software or special installations by developers and finally Infrastructure as a service provides informatics resources, such as servers, connections, storage and other necessary tools to construct an application design prepared to meet different needs of multiple organizations, making it quick, easy and economically viable [4].

Cloud computing is mainly classified into three types based on the deployment model; Public cloud, Private cloud and Hybrid cloud. If the services are provided over the internet then it is public cloud or external cloud and if it is provided with in an organization through intranet then it is named as private cloud or internal cloud and Hybrid cloud is an internal/external cloud which allows a public cloud to interact with the clients but keep their data secured within a private cloud [7].

This paper explains about EUCALYPTUS: an open-source system that enables the organization to establish its own cloud computing environment. Eucalyptus is structured by various components which interact with each other through well-defined interfaces. It is used for implementing on-premise private and hybrid clouds using the hardware and software infrastructure that is in place, without modification.

2. Eucalyptus

Eucalyptus (Elastic Utility Computing Architecture for Linking Your Programs To Useful Systems) was released in May 2008, creator of the leading Open-Source Private Cloud platform. They were incorporated as an organization in January 2009 Headquartered in Santa Barbara, California.

Eucalyptus software is available under GPL (General Public License) that helps in creating and managing a private or even a publicly accessible cloud. It provides an EC2 (Elastic Compute Cloud)-compatible cloud computing platform and S3 (Simple Storage Service)-compatible cloud storage platform.

Eucalyptus is one of the key for open source cloud platforms which makes it much popular. The client tools used for Eucalyptus is same as that of AWS, because Eucalyptus services are available through EC2/S3 compatible APIs [6].

2.1 Amazon AWS Compatibility

API compatibility layer is build on top of Eucalyptus that explores the functionality in terms of Amazon's API. Amazon tools, infrastructure and other work that someone put into building for Amazon would also be compatible with Eucalyptus inside the datacenter. In Fig.1 we can see various components of Amazon and Eucalyptus. The EC2 (Elastic Compute) component of Amazon which handles the provisioning of virtual machine and its resources are replaced here with cloud controller similarly Amazon provides storage mechanism EBS (Elastic Block Storage) which provides block storage devices to virtual machines are replaced by Storage Controller and S3 (Simple Storage System) simple object based get put mechanism, here it is implemented as walrus.
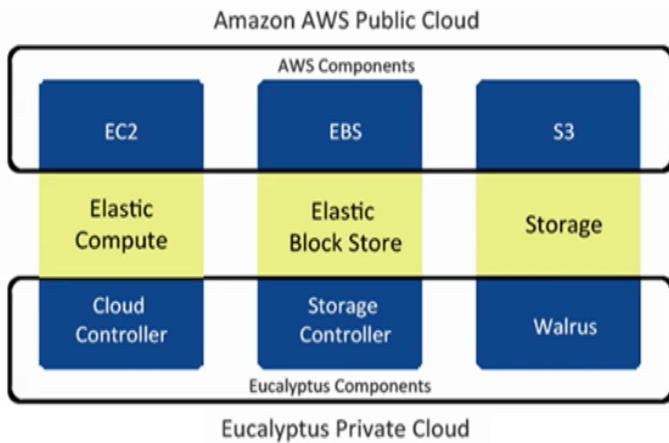

Fig.1. Services from AWS and Eucalyptus [2].

3. UEC Architecture

Ubuntu Enterprise Cloud UEC, is a private cloud set up for developing its our own IT infrastructure. UEC comes up with many open source software and Eucalyptus is one among them and it makes the installation and configuration of the cloud easier. Canonical also provides commercial technical support for UEC.The basic architecture of UEC consists of A front end which runs one or more Cloud Controller (CLC),Cluster Controller (CC),Walrus (WS3), Storage Controller (SC) and One or more nodes[6]. The architecture of UEC is shown in Fig 2. A CLC manages the whole cloud and includes multiple CC's. There will be a WS3 attached to a CLC.A CC can contain multiple NC's and SC's. Ultimately the VM's will be running in the NC making use of its physical resources [5].
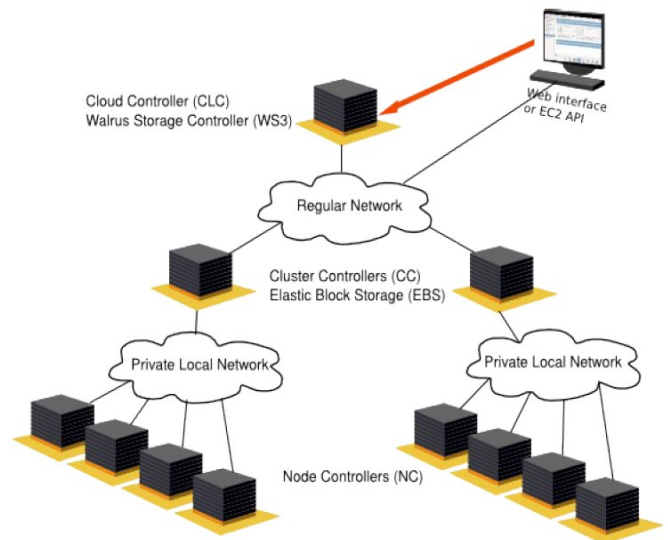

Fig.2. Architecture of Ubuntu Enterprise Cloud [13].

4. Building a private cloud

Private Cloud is also called an internal cloud which is mainly designed to control the data of an organization, than by getting the resources from other hosted services [12].

This section describes about the basic installation and configuration of Ubuntu Enterprise Cloud as well as the steps for creating a virtual machine image and uploading the image to the private cloud.

4.1 Installation and Configuration

The UEC setup in Fig.3. Includes two servers (Server 1 and Server 2) which will run a Lucid 64-bit server version and the third system which will run a Lucid Desktop 64-bit version (Client 1) [6] [8].
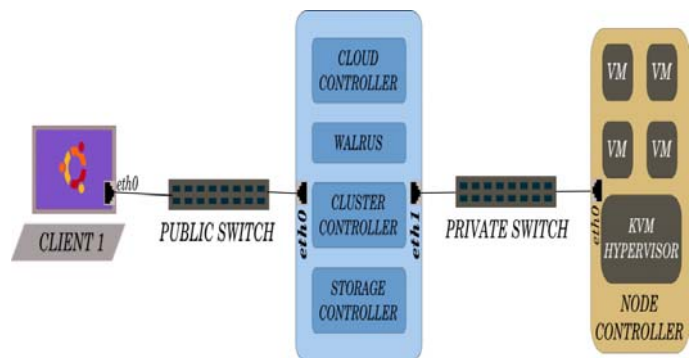

Fig.3.UEC basic setup with Three Machines [6].

5. Steps in Configuring an Open Source Private Cloud

Steps	Description/commands
Installation Procedure for Server 1	
Install Ubuntu Server 10.04 CD in Server 1	**Boot the Server off for installation**
Setup the IP address details.	**192.168.4.145. (Please do that for eth0)**
Cloud Controller Address	**Leave this blank as Server1 is the Cloud Controller in this setup**
Cloud Installation Mode	**Select "Cloud controller", "Walrus storage service", "Cluster controller" and "Storage controller".**
Network interface for communication	**Select eth1 node**
Eucalyptus cluster name	**Cluster 1**
Eucalyptus IP range	**192.168.4.155-192.168.4.165**
Installation Procedure for Server 2	
Install Ubuntu Server 10.04 CD in Server 2	**Boot the Server off for installation**
Setup the IP address for one interface	**Please do that for eth0 by setting up the private IP - 192.168.4.146**
Cloud Controller Address	**192.168.4.145**
Cloud Installation Mode	**Select "Node Controller"**
Gateway	**192.168.4.145 (IP of the CC)**
Installation Procedure for Client 1	
Install Ubuntu Desktop 10.04 CD in Client	**Boot the Desktop off for installation**
IP Address	**The Desktop will be on the enterprise network and will obtain an IP address through DHCP**
Install KVM	**To help us to install images on KVM platform and bundle them**

Invoke the Web Interface	
Login to the web interface of CLC	**https://192.168.4.145:8443/** **The default username is "admin" and the default password is "admin".**
Download the credentials	**From https://192.168.4.145:8443/ #credentials and save it in the ~/.euca directory**
Extract the credentials archive	**$ cd .euca** **$ unzip mycreds.zip**
Source eucarc	**$. ~/.euca/eucarc**
Verify euca2ools communication with UEC	**$euca-describe-availability-zones verbose**
Running Instances	
Installing Images	**From Canonical over the internet (no proxy), check Store tab.**
Checking the available Images	**$ euca-describe-images**
Installing a Keypair	**$ euca-add-keypair mykey > ~/.euca/ mykey.priv** **$ chmod 0600 ~/.euca/mykey.priv**
Running an Instance (using terminals)	**$ euca-run-instances -g Ubuntu 9.10 -k mykey -t c1.medium emi-E08810 7E**
Hybridfox	**Used to run the instances using GUI**
Life cycle of an Instance	**Pending - Running - Shutting down – Terminated – Reboot.** **$euca-run-instances** **$euca-terminate-instances** **$euca-reboot-instances**

Table.1. Configuration Steps

6. ALGORITHM

6.1 Installing server1

1. Boot the server off the Ubuntu Server 10.04 CD. At the graphical boot menu, select "Install Ubuntu Enterprise Cloud" and proceed with the basic installation steps.

2. Installation only lets you set up the IP address details for one interface. Please do that for eth0.

3. We need to choose certain configuration options for UEC, during the course of the install.

4. Cloud Controller Address - Leave this blank as Server1 is the Cloud Controller in this setup.

5. Cloud Installation Mode - Select "Cloud controller", "Walrus storage service", "Cluster controller" and "Storage controller".

6. Network interface for communication with nodes - eth1

7. Eucalyptus cluster name – cluster1

8. Eucalyptus IP range - 192.168.4.155-192.168.4.165   [6].

6.2 Installing server 2

1. Boot the server off the Ubuntu Server 10.04 CD. At the graphical boot menu, select "Install Ubuntu Enterprise Cloud" and proceed with the basic installation steps.

2. Installation only lets us to set up the IP address for one interface. Please do that for eth0 by setting up the private IP - 192.168.4.146.

3. Then choose certain configuration options for UEC, during the course of the install. Ignore all the settings, except the following:

4. Cloud Controller Address - 192.168.4.145

5. Cloud Installation Mode - Select "Node Controller"

6. Gateway - 192.168.4.145 (IP of the CC)   [6].

6.3 Installing Client 1

The purpose of Client1 machine is to interact with the cloud setup, for bundling and registering new Eucalyptus Machine Images (EMI).

1. Boot the Desktop off the Ubuntu Desktop 10.04 CD and install. The Desktop will be on the enterprise network and will obtain an IP address through DHCP.

2. Install KVM to help us to install images on KVM platform and bundle them:

$apt_get install qemu_kvm   [6].

6.4 Algorithm for Invoking the Web Interface

1. Login to the web interface of CLC by using the following link https://192.168.4.145:8443. The default username is "admin" and the default password is "admin".

2. Note that the installation of UEC installs a self signed certificate for the web server. The browser will warn us about the certificate not having been signed by a trusted certifying authority. Authorize the browser to access the server with the self signed certificate.

3. When you login for the first time, the web interface prompts to change the password and provide the email ID of the admin. After completing this mandatory step, download the credentials archive from https://192.168.4.145:8443/ #credentials and save it in the ~/.euca directory.

4. Extract the credentials archive:

$ cd .euca

$ unzip mycreds.zip

5. Source eucarc script to make sure that the environmental variables used by euca2ools are set properly.

$. ~/.euca/eucarc

6. To verify that euca2ools are able to communicate with the UEC, try fetching the local cluster availability details shown in Fig.4.

$ euca-describe-availability-zones verbose

Fig .4 Snapshot for list of Available Resources

7. If the free/max VCPUs are set as 0 in the above list, it means that the node did not get registered automatically. Use the following on Server1 and approve when prompted to add 192.168.4.146 as the Node Controller:

$sudo euca_conf --discover-nodes   [6].

7. Running Instances

7.1 Installing Cloud Images

No images exist by default in the Store (web Interface). Running an instance or VM in the cloud is only based on image. Images can be installed directly from Canonical online cloud image store or we can also build custom image, bundle it, upload and register them with the cloud. The "Store" tab in the web interface will show the list of images that are available from Canonical over the internet [6].
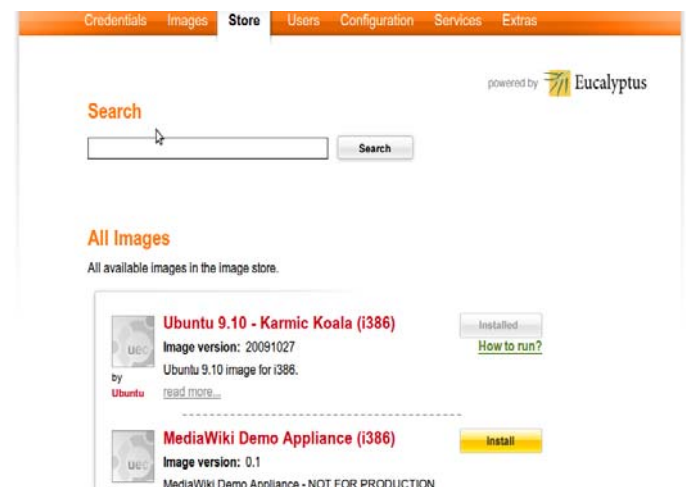

Fig.5. List of Images from Store

7.2 Checking Images

"euca-describe-images" is the command-line equivalent of clicking the "Images" tab in the Eucalyptus administrative web interface. This shows the emi-xxxxxx identifier for each image/bundle that will be used to run an instance.

$ euca-describe-images

IMAGE emi-E088107E image-store-1276733586/ image.manifest.xml admin
available public x86_64machine eki-F6DD1103 eri-0B3E1166
IMAGE eri-0B3E1166 image-store-1276733586/ ramdisk.manifest.xml admin
available public x86_64ramdisk
IMAGE eki-F6DD1103 image-store- 1276733586/ kernel.manifest.xml admin
available public x86_64kernel

7.3 Installing a Keypair

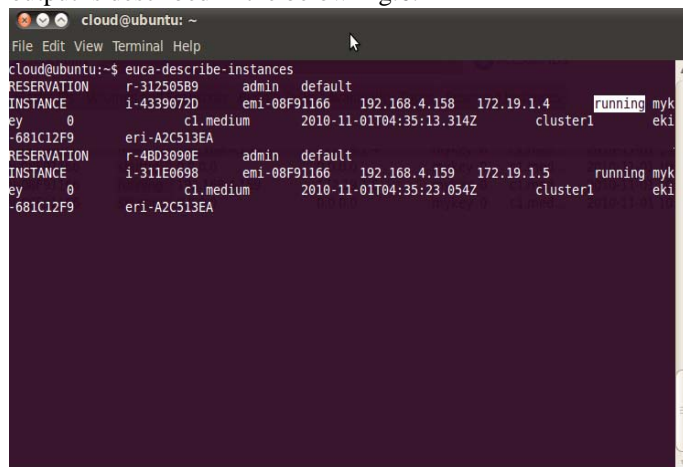Build a keypair that will be injected into the instance allowing us to access it via ssh:
$ euca-add-keypair mykey > ~/.euca/mykey.priv
$ chmod 0600 ~/.euca/mykey.priv   [6]

7.4 Running the Instances

1. Now we are finally ready to begin running instances. We'll start by creating an instance of our image and connections will be allowed on ports ssh and http:
$ euca-run-instances -g Ubuntu 9.10 -k mykey -t c1.medium emi-E088107E
2. After issuing the "euca-run-instances" command to run an instance, we can track its progress from pending to running state by using the euca-describe-instances command and the output is described in the below Fig.6.

Fig.6. Snapshot of Running Instances

7.5 Hybridfox

Hybridfox provide compatibility between Amazon Public cloud and Eucalyptus Private Cloud [9]. Hybridfox tool is a modified or extended elasticfox that enables us to switch seamless between different cloud clusters in order to manage the overall cloud computing environment. Hybridfox can perform all the functions that can be done by elasticfox, on the Eucalyptus Computing environment like Manage Images, Raise and Stop Instances, Manage Instances, Manage Elastic IPs, Manage Security Groups, Manage Key pairs and Manage Elastic Block Storage[3].Running a different instance by using Hybridfox is shown below in the Fig.6.
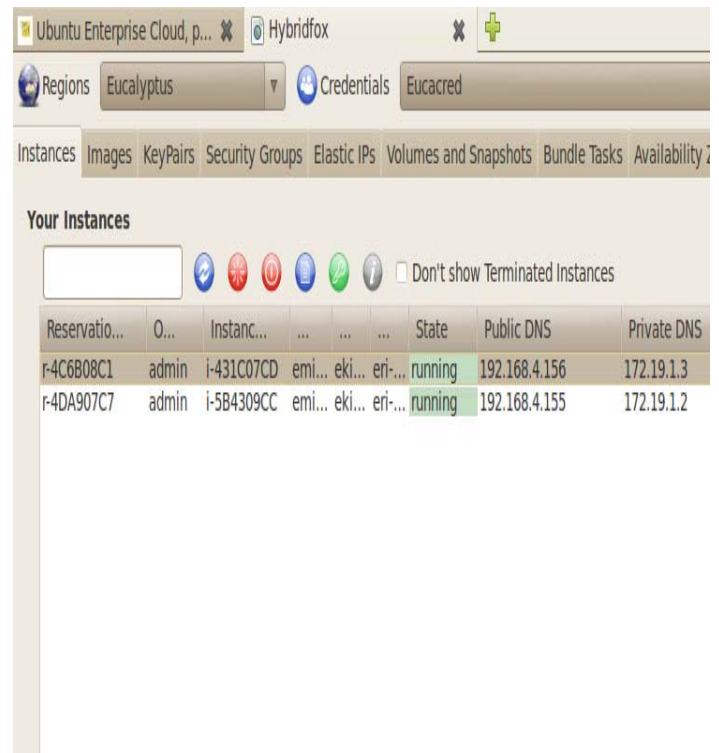

Fig.7. Running the Instance by Hybridfox

7.6 Life cycle of an Instance

When "euca-run-instances" command is invoked (or when run instance is chosen from Hybridfox/Elasticfox), the running process will be in a sequential manner as shown in Fig.7.Here are some few things that happen on various components of UEC:
1. Authentication/Authorization of the user request to ensure that we have permission to launch the instance
2. Identification of CC to take responsibility for deploying the instance and identification of the NC for running the instance.
3. Downloading the image from WS3 to NC (images are cached so that starting multiple instances of the same machine image downloads that image only once) [6]
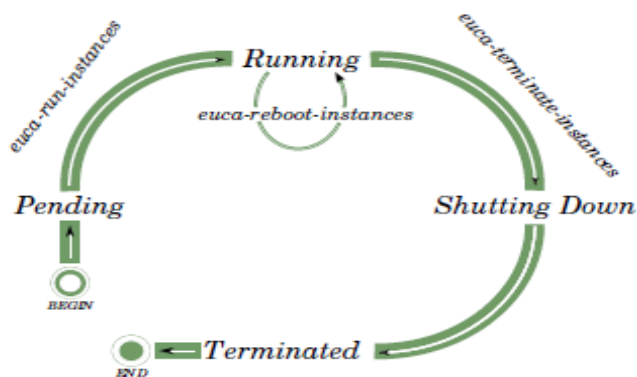
Fig.7. Life Cycle of an Instance [6].

8. Future Scope

Types of Services

A cloud can provide service either to private or public cloud. In public cloud, based on demand the services are provided to the client and in a private cloud the service is provided to a single client [10]. The combination of both public and private cloud is called hybrid private cloud, here the private cloud is hosted in a public cloud. Services that are included to the cloud setup are listed in Table.2.

Apache Service	Software as a Service
GNU C++ Service	Compiler as a Service
IDE as a Service	Software as a Service
Search Engine	Search Engine as a Service

Table.2. List of Services

8.1 Web Service

A user can access a web page from any computer connected to the cloud by using Apache web server. Install the Apache web server in the instance and get accessed to the service.
$sudo apt-get install apache2

8.2 Compiler as a Service

This service is provided to compile the c++file. Even if the client doesn't have the compiler, it can be compiled with the compiler available from cloud. The user is ssh'ed to the instance with certain privileges and allowed to compile and see the result.
$ssh cloud@<IP Address>
Installing gnu c++ compiler in an instance:
$sudo apt-get install build-essential

8.3 Other Services

IDE as a service can be obtained by installing Apache Tomcat6 and Search Engine as a service can be achieved by accessing through the Web Service.

9. Conclusion

Cloud computing is an everlasting computing environment where data are delivered on-demand to authenticated devices in a secured manner and users utilize a shared and elastic Infrastructure. This paper briefly explains the set up of a private cloud in a cluster based environment using open source technologies like Eucalyptus, KVM, and euca2ools. The virtual machine images are available in the cloud and upon user request; its instances are created and run. Services were included successfully and made available to the user. The current implementation of this paper provides Infrastructure as a service (IaaS) and Software as a Service (SaaS).

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