

Linux Cloud Lab: Establishing A Private Cloud

Bijoy Chhetri^{1, #}, Abhimanyu Sharma², Neha Thapa³, Bhuwan Mukhia⁴

¹Centre for Computers and Communication Technology, Chisopani, South Sikkim

²Sikkim Manipal Institute of Technology, Majhitar, East Sikkim

³Shivalik College of Engineering, Dehradun, India

⁴Camillia Institute of Technology, Kolkata, West Bengal

#Corresponding Author, Email: bijoychhetri@gmail.com

Abstract— Cloud Computing and storage is the topic that is in the heart of every arena of Information storage, computing and processing, on demand resource utilisation and many other. Cloud computing is a computing environment, where there is an abstraction level on software, network devices, utilities, computing power, storage space and location which is readily accessible to the user for its appropriate uses. Linux Cloud Lab provides services on one platform that provides the user with shared resources, software products, operating systems and other devices on-demand. The proposed concept is about providing cloud storage to store and upload binary files, operating system that are provided virtually regardless of the client-side operating system and the computation within the intranet service of the prescribed LAN structure. The users are facilitated with an abstracted and controlled memory space to store and use operating system (like Ubuntu and Windows Server) with their own credentials. CentOS 7 is used for implementation of the proposed framework. Therefore, this is a novel work for establishing a private cloud network for Institute as case study using open source cloud platform.

Keywords — Cent OS 7, OpenStack, Cloud Computing, resource utilization, resource sharing.

1. INTRODUCTION

In the era of ubiquitous computing, the cloud has been advanced with the new concept of computing and storage system to cater the ubiquitous nature of Information processing. In this methodology of Cloud eco system, the available and unavailable resources are dynamically made to extend, virtualize, and provide it as various service to the intended user over the cost of Internet and pay on request and demand basis. This cloud utility enables the approved and registered user through various authentication procedure [1] to access a virtual system of an unlimited number of resources using a methodology called Resource Outsourcing [2]. The outsourcing is done in terms of various Cloud Services like infrastructure as a service (IaaS), network as a service (NaaS), platform as a service (PaaS), software as a service (SaaS) etc. Cloud computing also amalgamates the technologies Web Enabled services, Resource virtualization, variable architecture, grid

computing, distributed computing, analytics, data mining, etc. [3].

While providing service models, business models are also provided by them while delivering the Information Technology in terms of application, Software, Developmental Platforms, Hardware resources which are bundled with highly scalable technology and elastic with on demand dynamic service-oriented technologies. User can easily access the services and use for any kind of cloud supported applications using app based or browsers-based interface, in any devices with minimal computation like mobile. While transaction takes place for any processing, a remote server stores and coordinates the data and required software units at a remote location. It could be a simple to heavy processing tasks that requires multiple platforms.

2. OPEN SOURCE CLOUD PLATFORM

Current software licensing limits the computer and the user to which it can be installed and payment is done at once for annual maintenance charge. Whereas, Cloud service providers have made use of open source software with free and open GNU license. This method of development further challenges the commercial vendors to release smoother and viable licensing model for the Cloud implementation. Well known players in the market of Cloud like Microsoft AZURE, Amazon EC2 etc. are doing well being big proprietor of services in the market but that apart the following section introduces few of open source cloud platform which can also considered as competitor in the field of cloud hosting and configuration.

2.1 OpenStack

OpenStack [4-7] is also considered as the free and open source software which was initially introduced in July 2010. It was contributed by NASA and Rackspace in the beginning but with Rackspace brought in their "Cloud Files" code and NASA with an invent of "Nebula" code. The variants of

OpenStack as a bundled package is an initiative from global developers and cloud computing researchers that produced an operating system used for either of both private and public cloud. It is one of the most used and standard Cloud Operating System with its inbuilt, scalable, elastic, and robust technologies delivering quality services to the intended users. The different modules of OpenStack consist of Compute, Object Storage and Image Service. The ninth release of OpenStack ninth release “Icehouse” is the latest release that enables a built of public, private, and hybrid clouds and added with various other features of configuration, development, and maintenance.

2.2 *OpenNebula*

Back in 2005, OpenNebula [8-10] was initiated as the baseline for the research-based project by Ignacio M. Liorente and Ruben S. Montero. This system is used by many organisations, enterprises and individuals as an open source, more flexible, and compatible with VMware based data centres. OpenNebula is a tool which is gradually increasing its grip in the market by providing a tool for virtualization that manages infrastructure in a virtual machine within the data centre, sometimes referred as Private Cloud. It also has features to support hybrid cloud and other cloud-based infrastructure. It enables a powerful and scalable hosting platform for the various services provided by the cloud environments. This architecture of Cloud computing provides the user with a scalable and elastic platform [11] for the delivery of services by its exposure to virtual machine, storage and network management.

2.3 *Eucalyptus*

EUCALYPTUS [12] which stands for Elastic Utility Computing Architecture for Linking Your Program to Useful Systems. This open source cloud architecture enables organisation and individuals for private cloud hosting and configuration platforms. This architecture, which is used with very little knowledge on the technologies to host resources for computing, networking, storage, etc. It is also compatible with Amazon Web Service (AWS) APIs in modulating, migrating and function orientation. EUCALYPTUS is developed by the University of California for Cloud

Computing to implement various services like Infrastructure as a Service (IaaS) [13]. It also provides the user with Elastic Compute Cloud (EC2), Computing Platform and Simple Storage Service (S3) Cloud Storage, which is compatible with other proprietary cloud service technologies. Eucalyptus mainly has Cloud Controller (CLC), Cluster Controller (CC), Storage Controller (SC), and Node Controller (NC). This open source software is mostly used to generate private clouds and other cloud supportive platforms as well, which is treated as highly efficient, scalable, and organised with agility.

3. LITERATURE REVIEW

Cloud computing has been escalated to a greater height such that every application from smart computer, devices to high computing are in some or the other way using cloud infrastructure either for storage or processing or computation. Cloud can handle miniature data to an extent of big data [14] which is challenging to manage in commodity machine. There are various vendor and open cloud providers providing computing infrastructure which can be used for educational purpose featuring Microsoft, Google and Amazon Web Service [15] which increases the effectiveness of students as well as teachers. There is requirement of ICT based training and learning which would be enabled by rapid setup of such kind of cloud infrastructure where teaching and learning fraternity can explore the flexibility of e-contents for sharing knowledge and other tools [16]. However, various issues are to be addressed before cloud can take up the education sector completely [17]. The review of such complete strategy has been drawn by the researcher to augment universities where intensive computing are primary for teachers and students. An institutional cloud Edu: Cloud [18] exceptionally made a difference in the perspective of usage in terms of scheduling, learning management, software access, time and space as well as providing additional resources to the organization in low cost, effective payment and usage. The cloud framework benefits the education sectors implementation but with few limitations as to security [19] and attacks like Denial of Services being on top. However, an extra milage has gain in terms of cloud-

based e learning [20]. The cloud e learning under public or private platform is feasible. There are several such tools successful because of its service types, scale-ability, share-able contents etc. It has been tested and proven that education system implemented online has been fundamental to effectively upload, manage, download the content within pedagogical and technological aspects [21] as well as setting up of an entire virtual laboratory in the cloud [22].

4. PROPOSED SYSTEM

The idea and concept of cloud storage and computing is an interesting concept in the present era of Information usage and its capability as it allows the remote resources to be provisioned according to the user's need in terms of on demand cost scheme. The proposed system of Linux Cloud Lab as shown in fig-1, provides multiple services on virtual machines where in the intended and registered user can share resources, software, operating systems and other devices on-demand. The concept is about providing cloud storage to store and upload binary files. It also runs operating system virtually regardless of the client-side operating system. The cloud storage and computation are mainly designed to be used within Intranet by using LAN connections or by using wireless connections. The users are facilitated with a separate and limited space to store and use an operating system (like Ubuntu and Windows Server) with their own credentials. The platform used to implement the idea is Centos 7. Therefore, an attempt has been made by us for implementing a private cloud network in an academic institution campus. It supports the Academic operations of institution that includes general purpose academic computing labs which accommodate a large variety of software and hardware requirements for different courses and programs which can be conducted even in software and hardware incompatibility issues. Furthermore, when incorporating new technologies, the Linux Cloud Lab also has experienced some challenges and issues that has been examined & further proposed strategies to successfully employ cloud technology in building and enhancing academic computing labs infrastructure. The main aim of having a setup cloud

computing environment in the academic setup is to provide services in terms of SaaS, PaaS, and IaaS [23].

A. Software as a service (SaaS): This model deploys software as per the demand of the user by providing a license version of the authentic software on demand in the form of application that are in the cloud infrastructure. These services are used in specified time and on demand billings are generated.

B. Platform as a service (PaaS): In performance-based web enabled application, the entire infrastructure required to develop, model and deploy complete software cycle is provided in this type of service. These are available on demand over the internet without having to download it on the local commodity machine.

C. Infrastructure as a Service (IaaS): High computing power servers and storage with connection are primary to computation of high processing transactions, these services are provided by IaaS through cloud making it viable for easy and quick delivery of the product by the developers.

The system has been planned to serve web platform [24] in such a way that the staffs can upload data to the containers storage that are useful to the students. The staffs can remove, view, and download the data, whereas the guests can only download and view the learning materials like: syllabus, assignments, projects, and many more. The users can also use the Operating system without downloading it. While performance can also be measured using the clustering [25,26] methods on the various activities-based cloud platform.

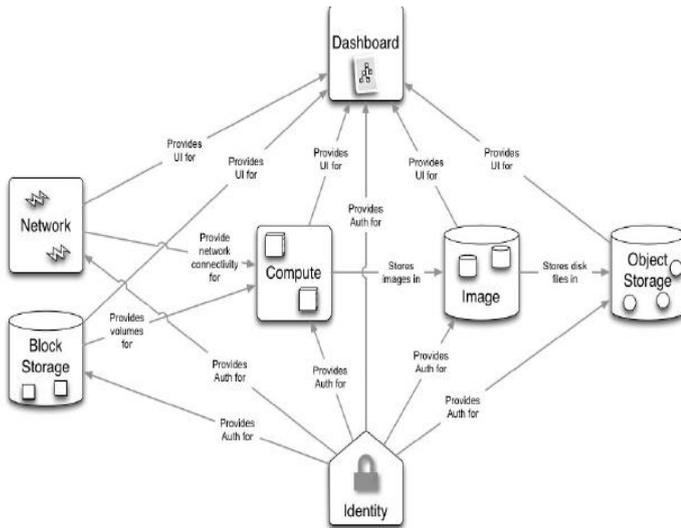


Fig 1- Overview of System Model

5. METHODOLOGY USED

Observing within campus computer labs running Microsoft Windows OS (Operating System), since everyone is very much familiar to windows OS and most of the work is based on windows environment. In case a trainee is willing to work on Linux environment she/he need to either fresh install Linux OS or run virtualization, thereby hampering the performance on client side as in fig 2.

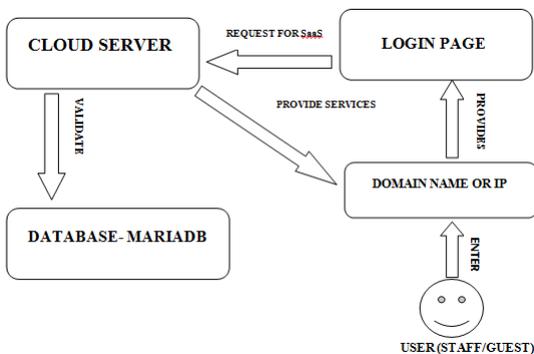


Fig-2 Communication Among Nodes

The academic institution having various department requires different software, platforms which are either purchased license or free and open source. These packages are installed in each and every node in the network performing their own computation based on need and availability. This moreover makes tedious task of setting up of entire cloud infrastructure is lessen to greater extent. Local

LAN, internet can be used to design a cloud storage sometimes it's called as Drive. In the proposed model, a administrator user can perform all the activities that can be performed by other users like staff members and the administrator will know guests.

Each of the user like staff member are assigned with ID and password in order to login as a matter of security. Whenever user "student" has to request for any file, software or platform, login ha to be done through valid ID & password allotted. The login request will be forwarded to the server in the Cloud. The server with its available database server validates and services requested will be provided to the user. The Software/ Hardware requirement for the setting up of proposed system is as shown in the TABLE I below.

TABLE I
SOFTWARE AND HARDWARE REQUIREMENTS

Items	Specs	Types
Server	Fedora Core	Windows/Linux/UNIX
Client	OpenStack RDO	HTTP/HTTPS Web Browser
CPU	Xenon 3.2 GHz	Min Pentium Processor
Memory	8 GB	512 MB (min)
Disk	78+78 GB	Min. 20 GB
Networking Support	1 Gbps Ethernet	Ethernet / Wi-Fi

OpenStack is the platform used for deploying of the underlying Cloud functionalities. It has function like Computing and storage, which is mostly efficient to the user. Compute feature that runs on OpenStack is run by its service NOVA. it helps in running VNC over browser from Server to client. Storage: Storage function in OpenStack is run by the service SWIFT. The storage gives a particular space to the user. The user can keep his files and application in the storage, which are important to them. Network: Network may not be thought as an application but in OpenStack it is an application. The network is used by the service

NEUTRON. The OpenStack creates its own network and routers for a particular user allocating the users a particular IP for their VNC.

A. OpenStack Installation

The following algorithmic procedure are followed in order to install open stack framework and services -Hostname in the form of IP address is filed, take an instance, here in case study, server name is OpenStack.ccct.com

-(IP Address) OpenStack OpenStack.ccct.com, where 127.0.0.1 acts as localhost i.e. (localhost). (localdomain)

Install the packages needed:

- sudo yum install _____.rpm
- sudo yum install Openstack
- sudo yum update
- sudo reboot

Install and setup OpenStack RDO:

-packstack with all in one provisioning

B. While setting up of network, the following configuration details are used

-At file location /etc/sysconfig/network-scripts/ifcfg-br-ex

- In order to add the IP Hosts
Set device as br-ex
- set device type as OVS with OVSBridge and static BOOTPROTO
- Set IPADDR=(IP address of Host in the same subnet) OR set it as DHCP for range of addresses
- Set NETMASK=255.255.255.0
- Set GATEWAY= (IP of Gateway)
- Set DNS with ONBOOT option

C. In order to Fix up ethernet interface to eth0

- Set no BOOTPROTO for IP version 4
- Set no IPV4_FAILURE_FATAL if any
- Use IP initialization as IPV6INIT="yes"
- use IPV6_AUTOCONF with default routing
- Repeat for IP version 6 also
- Set name of ethernet as Eth0
- with set ID="ID" with Onboot option

- Fix its hardware address and DNS with peer routing service ON
- Set TYPE as OVSPort for OVS devices and br-ex bridge option with on boot option ON

Under the note pad editor, locate an initialization file under VxLAN and open .ini file

- set a range as physical network range;
 - restart the entire network with service option
- Now it is also mandatory to setup OpenStack to the specific requirement. After this setup, find password in /root in order to get a access. Once access of network is granted perform the following
- setup /keystonerc_admin
 - Clear the configuration saved
 - Use neutron to clear the router router-gateway-clear router1
 - Set up subnet after deleting Public subnet.

The public subnet id made as part of existing network at (IP/Range)

- Add neutron for the subnet and enable it with NO DHCP option. for instance, pool=192.1.6.160(Start), 192.1.6.220(end), 192.1.6.12(Gateway) and 192.1.6.12

The addition of router and private network using neutron is done using

- set router(device) as public
- Create a network of hosts
- enable subnetting with DHCP enabled, for instance pool allocation of 192.1.6.1 to 192.1.6.199 with range (IP/24)
- set hostnet as router_gateways

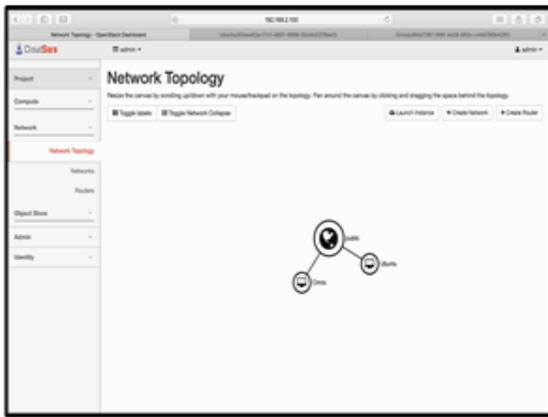
After committing all the above, network topology diagram is as in the figure 3.

D. Floating IP

The following procedure is required to add the floating IP in the network

- Goto dashboard and find compute module
- Set floating IP under Access & security
- generate a Key Pairs using PEM file in compute module

While setting up of Access server as shown in figure 3 -with ssh rule and ICMP rules from rule manager under project, compute



E. For Installing Instance

- Get to the Host settings using dashboard and create instances
- set name: "Name"
- Set the flavor: "Flavour type"
- If Boot set from the Image as source
- Set image: "Name of Image"
- set Network: "physical network created in the beginning". Associate a floating IP that are created before to the host. Ping network by testing i.e. 8.8.8.8 and 192.0.0.1.

Fig-3 Network topology setup

While testing restart the services with the following procedure

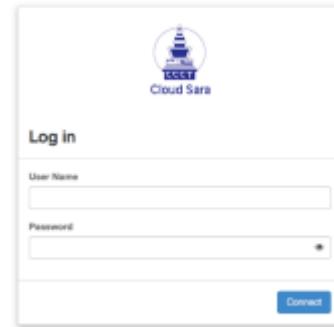
- restart service, restart OpenStack-swift-proxy.service, restart OpenStack-swift-object.service, OpenStack-swift-container.service, OpenStack-swift-

- account.service, OpenStack-ceilometer-api.service, OpenStack-ceilometer-api.service
- also restart neutron services and DB services

6. EXPERIMENTS AND RESULTS

At the end of the system implementation, the proposed system of private cloud called Cloud Linux Lab is made successful in launching images with its

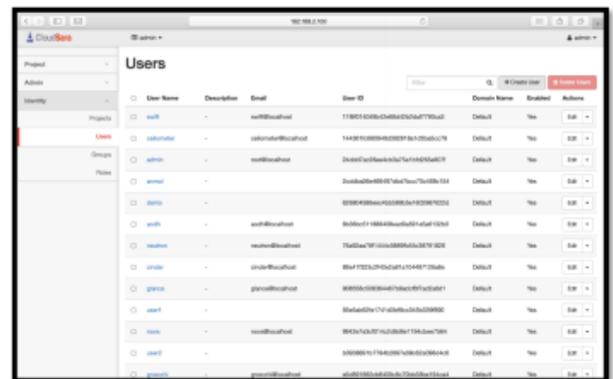
to user and with of



flavours, instances every and projects other services the help

OpenStack dash board.

- A. Login with the known credentials
- B. Different groups of users that can have various access permission and respective privileges.



- C. Openstack is loaded with the Images of the Operating flavours which can be easily made available to the user where one can install, explore and make use of it for various processing and computation.

system medium of communication. The cloud infrastructure used are based on the open source application, however existing standard platform of Microsoft, Google or Amazon can be hybridized for support and more reliable storage.

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