An Implementation and Performance Monitoring of Virtual Machines using Ganglia in Eucalyptus Private Cloud

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***Abstract* — Cloud computing is the emerging technology that offers hosted services based on the demand of the user (*i.e.* Pay as Use model) with scale up and down of the resources such as RAM, CPU and Storage etc. With the help of virtualization technology, a virtual IT infrastructure can be built to provide a private cloud for creating virtual machine instances. This paper discusses how the resources have been allocated and deploy an application into the cloud instances. Furthermore the Eucalyptus is integrated with open source Ganglia tool to analyze the performance of a virtual machine.**

***Keywords* -** Cloud Computing; Pay as Use; Virtualization; Virtual Machine; Ganglia and Eucalyptus

I. INTRODUCTION

Cloud computing is a model for enabling 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 provided by National Institute of Standards and Technology, Information Technology Laboratory [1]. Cloud computing is classified based upon three service delivery models to the customer namely Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as Service (IaaS). These services offer software, platform and infrastructure to the customer on demand. Based upon cloud deployment it can be further divided into private cloud, public cloud, community cloud and hybrid cloud.

Cloud computing is based on the virtualization technology in which the data centre resources are allocated dynamically based on the demand of the application. Virtualization is divided into three types viz para-virtualization, host-based and full virtualization. In para-virtualization, enhancement of virtualization technology in which a guest OS is recompiled prior to installation inside a virtual machine and in full virtualization, a VM environment that enables guest operating systems to run without modifications of the source code. Virtualization technology is used to convert the physical resources available in a cluster zone to virtualized resources, in order to utilize the hardware resources efficiently and to dynamically allocate these resources to the virtual machine instances and rapidly provisioned the resources based on the application demands. Live VM migration provide high availability and fault tolerance of VMs. Migrating the live VM from one physical machine to another physical machine with less down time is major challenges in cloud era. Eucalyptus uses hypervisor as XEN or KVM to virtualize the IT infrastructure to provisioning the virtual resources to the cloud user on demand [2, 3].

Open source Ganglia Monitoring tool monitors the active nodes presence and measure the performance of VMs to meet the QoS objectives to the end user [4]. The rest of the paper is discussed about the implementation of private cloud using eucalyptus in section 3 and integrate with Ganglia monitoring tool presented in Section 4. Section 5 concludes the results and discussions for future enhancement.

II. RELATED WORK

Eucalyptus is an open source software tool acquired by HP used to build a private cloud or Hybrid cloud that offers Infrastructure as a service (IaaS) and Software as a Service (SaaS) [5-11]. Ericsion et al [17] stated that provisioning of virtual machine for processing real time streaming data rather than provisioning of direct physical machines to process the data for minimizing the cost spending towards physical infrastructure. Rodriguez et al [18] proposed an algorithm based on meta-heuristic optimization technique, particle swarm optimization (PSO) is to minimize the overall cost of virtual machine and also stated in his paper, though performance is less in virtual machine but still focused on cost constraints only that should be fit in. Rafiullah Khan et al [19] have been implemented nagios tool in their paper for continuous monitoring of network measurements and active nodes in the cluster and Nagios tool and their work report the errors and log as email to the administrator.

III.DESIGN AND IMPLEMENTATION OF EUCALYPTUS CLOUD

Each Eucalyptus components has own functionality described below:

A. Cloud Controller

Cloud Controller (CLC) is the entry point for managing the cloud and administrator can access the underlying resources into the node controller via cluster controller (CC).

B. Cluster Controller

Cluster controller manages the Virtual Machines (VM) into the node controller and schedules the which VM has to be allocated to run the instances based upon the scheduling polices such as round robin and greedy algorithm opted into the CC. By default round robin algorithm is opted in CC. Main function of CC is to create virtual instances on node controller.

C. Storage Controller

Storage Controller (SC) provides block storage for Elastic Block Storage (EBS) images for persistent storage and is capable of interfacing external storage system (NFS, iSCSI, etc.). An EBS provides to take snapshot of a volume.

D. Walrus

Walrus is a big storage system to store virtual machine images and data in it as file level system to manage these files to store/register/delete them from Walrus using Euca tools.

E. Node Controller

Node Controller (NC) is placed on every node to virtualize the physical resources to hardware resources for deploying the virtual machine instances. Eucalyptus uses XEN or KVM as hypervisor to virtualize the physical resources on NC. These hypervisor supports only on VT enabled CPUs. Eucalyptus private cloud model is shown in the Fig. 1 representing the components. CC, CLC, SC and Walrus act as a front end and NCs Act as a back end in eucalyptus cloud. Front end components can be deployed in single node or multi node.

IV.SYSTEM REQUIREMENTS

TABLE I. SYSTEM REQUIREMENTS

Front end requirements	***Back end requirements***
Cent Os 6.X	Cent Os 6.X
8 core CPU.	8 core CPU.
8 GB ram.	8 GB ram.
1 TB hard disk	1 TB hard disk
x86 64 bit architecture	x86 64 bit architecture VT-X Enabled

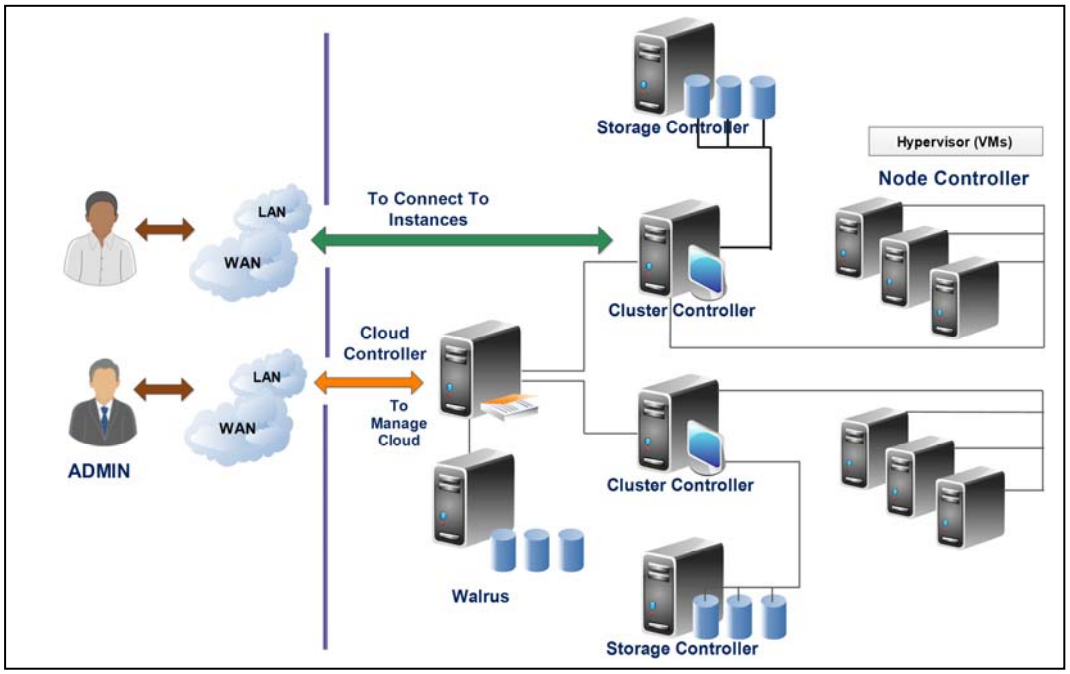

Figure 1. Eucalyptus Components

V. GANGLIA MONITORING TOOL

Ganglia is an open source powerful tool for monitoring the distributed system such as grid and cluster to analyze the performance of CPU, memory and load etc., trending with graph properties. Ganglia monitoring system is shown in the Fig. 2.

Components of the ganglia monitoring tool:

- *Gmond* stands for ganglia monitoring daemon is a small service run on each node that to be monitored the metric information send as XML message over TCP.
- *Gmetad* is the daemon that collects data from other *gmetad* daemons and all the *gmond* daemons in the form of an *rrd* (round robin data base).
- RRD tool stores the data in time series RRD tool will store all values of CPU load at a certain time interval and then graph these data according to time.

VI. EUCALYPTUS INTEGRATED WITH GANGLIA

Ganglia components are installed on cloud components to monitor the nodes to analyze the performance. *gmond* services are run on the nodes controller and *Gmetad*, RRD tool and Apache web server are installed on cloud controller. Metric information received from node controllers to controllers as XML message over TCP according to the time interval that can be displayed as graph [12-14].

VII. PERFORMANCE EVALUATION

Using ganglia tool performance of a cluster can be as showed in a graph. The performance metrics of a node are load of CPU, network, memory and node disk performance are shown in the Figs. 3 - 6 Elastic is one of the main characteristic in cloud, based upon the utilization and Service Level agreement between the user and Cloud Service Provider, resource can be scale up and scale down on user demand.

VIII. CONCLUSION AND FUTURE WORK

In this paper, we implemented private cloud integrated with ganglia tool in Linux to monitoring the utilization of Virtual Machines for providing an instance with better performance based upon user demand and this will help to minimize the cost of VMs. Our Future work is to provide a good scheduling algorithm for resource allocation to create virtual machine in the cluster.

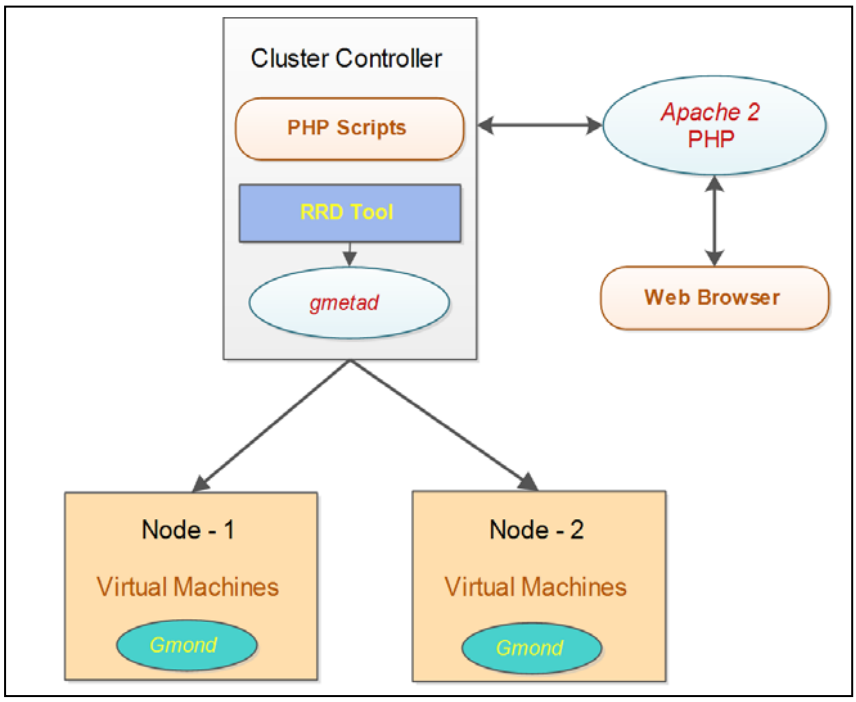

Figure 2. Ganglia Monitoring System.

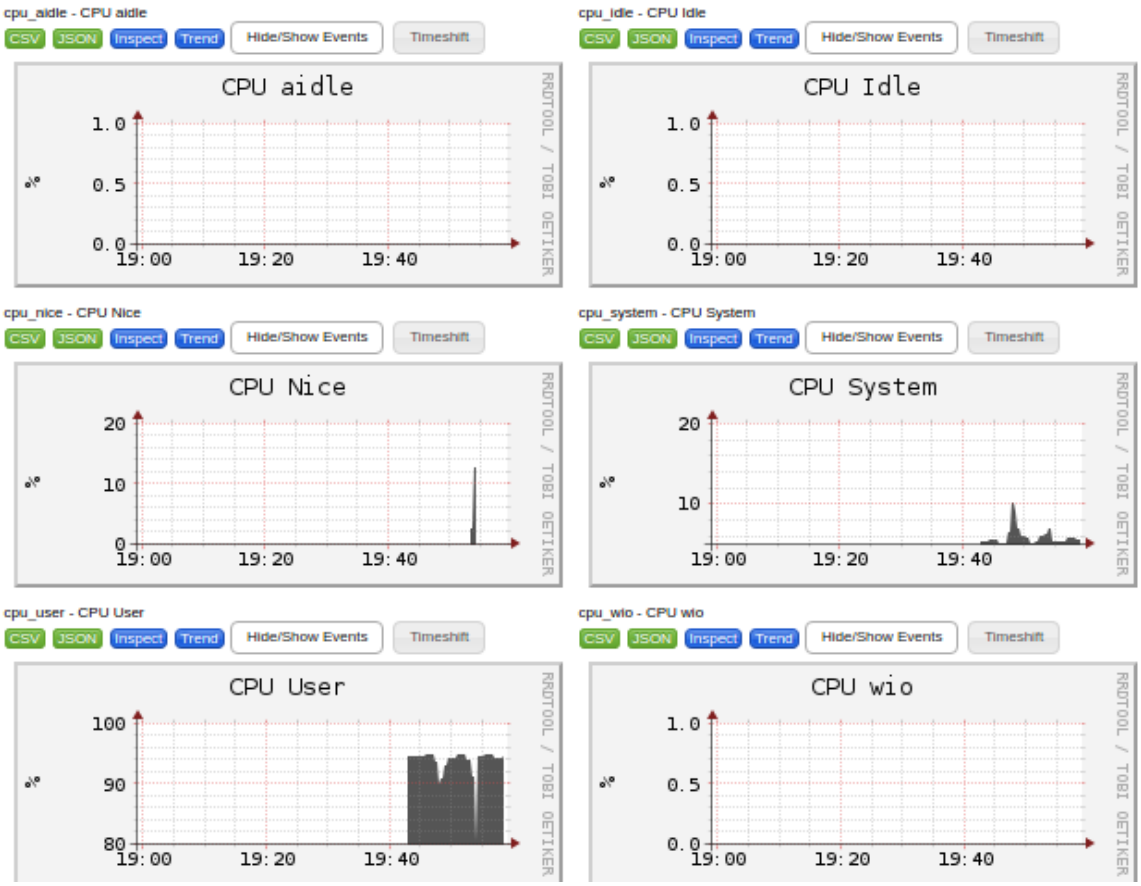

Figure 3. Performance measure chart for various Virtual Machines Top row shows the ideal state of CPU, Middle row shows the system performance, bottom row shows the user performance.

Figure 4. Performance measure for the various memory modules in Virtual Machines.

Figure 5. Performance measure for the number of process allocated to Virtual Machines.

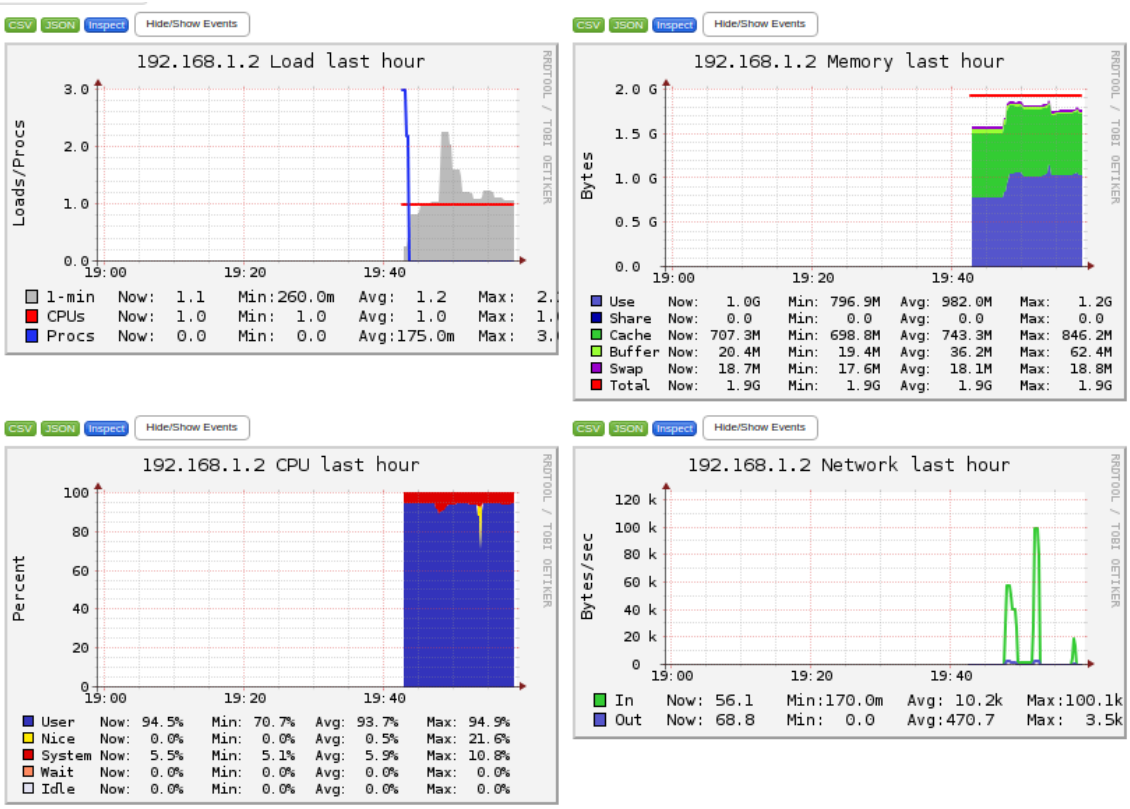

Figure 6. Performance measure for the various network modules in Virtual Machines.

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