Monitoring of Virtual Machines in the Eucalyptus Cloud

Mohan Krishna Varma Nandimandalam, Eunmi Choi*
Department of Information System,
School of Business IT, Kookmin University,
Jeongneung-Dong, Seongbuk-Gu, Seoul, 136-702, Korea
e-mail : mohankvarma@gmail.com, emchoi@kookmin.ac.kr*
*Corresponding Author

Abstract

Cloud computing provides access to big volumes of data and computational resources through various services. Cloud computing also supports to process these volumes of data using set of computers. Cloud computing can satisfy resource requirements through virtualization technology. Eucalyptus is an open source cloud computing environment helps the users to setup their own private cloud based on virtualization. In this paper, monitoring of virtual machines is explained with the eucalyptus cloud setup.

1. Introduction

There are different ways to provide computational power and data storage facilities to the users. They are ranging from a user accessing a single computer to the allocation of thousands of nodes. This node selection can be made based on the hardware architecture, memory and storage capacity. In the current trend Virtual Machines [4] are used as software-based solutions in the enterprise environments for building shared hardware infrastructures via virtualization [6]. Proper utilization of the computer resources is one of the main goals of virtualization. Eucalyptus [2] is used to implement the concept of cloud computing [1] with the help of virtualization. Eucalyptus is used to implement the private cloud computing environment [3] to fulfill the requirement of on-demand scalable resources.

In this paper, we observe the resource management of memory for VM deployment [5] under the cloud environments. This paper is organized as follows: Section 2 deals with the cloud computing infrastructure with Eucalyptus, Sections 3 shows Eucalyptus virtual network infrastructure, Section 4 has the Layered Architecture of Eucalyptus Cloud, Section 5 explains about the Results, and Section 6 concludes the paper.

2. Cloud Computing Infrastructure with Eucalyptus

Eucalyptus is used to setup the cloud computing infrastructure. In the Eucalyptus cloud, cloud controller and Walrus are high level components, which are written in Java. Cloud controller offers EC2-compatible web interfaces and Walrus implements simple storage service compatible bucket-based storage. An illustration of a general cloud computing environment of Eucalyptus cloud [2] is shown in Fig. 1. Cloud controller and walrus nodes can aggregate resources from multiple clusters. Each cluster needs a cluster controller node for scheduling and network control. All the clusters also need storage controller node for block-based storage. The cluster controller is written in C and storage controller is written in Java. On every virtualized node hypervisor is installed with node controller. Node controller is written in C and it controls the hypervisor. XEN [7] or KVM is used as the hypervisor in the Eucalyptus cloud. Virtual network is formed among the virtual machines running on the nodes. Eucalyptus can make hybrid cloud infrastructure by combining computing resources from one or more public clouds and one or more private clouds. Eucalyptus web services are uniquely designed for hybrid clouds using the industry standard Amazon Web Services API. (Fig 1) Eucalyptus cloud overview

3. Eucalyptus Virtual Network Infrastructure

Virtualized node installation and configuring results in creating a virtual network infrastructure. In this process, hypervisor is installed on the top of operating system. After that node controller is installed to control the hypervisor. Cluster controller uses the Virtual network feature of Eucalyptus to make networking among the virtual machines running on the Eucalyptus cloud. Cluster controller has network control subcomponent to make virtual network successful.

Virtual network is done by the Cluster Controller to setup the network be-tween the instances. All network-related options specified in eucalyptus configuration file using the prefix VNET_. Eucalyptus Cloud has four networking modes: Managed mode, Managed-NOVLAN mode, System mode, Static mode. Most Eucalyptus net-working modes require a bridge. The bridge names are both hypervisor and Linux distribution dependents. To configure a network mode
we must know the bridge name of our system. VNET_DNS option is used to specify a name server available on the network. DNS must be specified as an IP address. VNET_SUBNET option is used to specify the network address for the eucalyptus cloud. VNET_BROADCAST option is used to specify the broadcast address on the network, and VNET_NETMASK option is used to specify the subnet mask. These three work together, to define the configuration of a specific network. It is necessary to specify all three options when Eucalyptus requires a virtual subnet for clustering inside the cloud infrastructure.

VNET_ADDRESSPERNET option is used to control how many virtual machine instances may simultaneously be part of an individual network. This option is used only when security groups are available. Typically these numbers are 16, 24, 32, 64, etc., but should never be less than 8. The value specified in this option determines the number of available security groups in the system. VNET_NETMASK determines the size of the address space, while VNET_ADDRESSPERNET determines how the address space is partitioned and how security groups can be created. If VNET_ADDRESSPERNET is too large relative to VNET_NETMASK we may have very few security groups. VNET_PUBLICIPS is the list or range of public IP addresses available for VMs to specify the IP addresses as a list.

In the Managed mode, Eucalyptus manages the local network of VM instances and provides all networking features. Eucalyptus supports VM network isolation, security groups, elastic IPs and metadata service. In this mode each security group requires a separate VLAN which Eucalyptus controls and maintains the underlying physical network. There is an available range of IP addresses to be used for the virtual subnets that do not interfere with the physical network. Typically these IP addresses are selected from the private IP ranges. Network must be VLAN clean, meaning that all switch ports that Eucalyptus components are connected to will allow and forward VLAN tagged packets. A range of IP addresses must be available for use by Eucalyptus Front end must have installed DHCP (Dynamic Host Configuration Protocol) server daemon compatible with ISC (Internet System Consortium's) DHCP Daemon. In Managed-GNOVLAN mode, Eucalyptus fully manages the local VM in-stances and provides all of the networking features. Eucalyptus supports security groups and elastic IPs, but does not provide VM network isolation.

In System mode, there is very little Eucalyptus configuration required. In terms of networking Eucalyptus mostly out of the way in this mode. This mode requirements the Ethernet device on the nodes that communicates with the cluster controller must be bridged and a pre-existing DHCP server must be running and configured. In Static mode, Eucalyptus manages VM IP address assignment by maintaining its own DHCP server with one static entry per VM. This mode requires the Ethernet device on the nodes that communicates with the CC must be bridged, a range of IP addresses must be available for use by Eucalyptus, and pre-existing DHCP server on subnet and existing DHCP server must be configured to not serve instances. Front end must have installed DHCP server daemon compatible with ISC DHCP Daemon, but not configured or running DHCP server daemon compatible with ISC DHCP Daemon.

4. Layered Architecture of Eucalyptus Cloud

The architecture of the Eucalyptus system shows the three layers to integrate the cloud computing as in Figure 2. Cloud layer contains the cloud controller and walrus components of Eucalyptus cloud. Cluster layer contains the cluster controller and storage controller. Node layer contain the resource nodes with Eucalyptus node controller on the top of the XEN hypervisor. This architecture is designed by Eucalyptus open source cloud to process the computational and data-intensive tasks and delivers on-demand scalable resources. Eucalyptus cloud layer’s cloud controller and walrus work together with cluster controller and storage controller of cluster layer. Cloud controller has four subcomponents. They are web interface, query interface, group control and instance control. Web interface interact with the users of Eucalyptus cloud with the help of web GUI provided by the Eucalyptus. Query interface help to execute the command line queries of Eucalyptus cloud. Group control manages the security groups of admin users and non-admin users. Instance control helps to manage the instances of the Eucalyptus cloud. Cloud controller is the administrative interface for the cloud management. It manages authentication, provisioning, scheduling, accounting, quota management and reporting. Only one cloud controller is active per cloud. Walrus contains storage manager subcomponent and provides simple storage service compatibility. It provides persistent storage across the eucalyptus cloud infrastructure. It contains application data, images, volumes and snapshots. Only on walrus is active per cloud.

Cluster controller has network control and resource discovery subcomponents. Network control subcomponent manages the networking functionality of instances. Resource discovery manages the node controllers and instance execution. Each cluster can have only one active cluster controller. It has a specific resource discovery subcomponent, to coordinate the resource of every cluster. Storage controller has volume manager and snapshot manager subcomponents. Volume manager makes persistent volumes or virtual disks available to instances. Snapshot manager sends volume’s snapshots to the walrus. Each cluster can have only one active storage controller.

Each resource node is configured with Eucalyptus Node Controller (NC) on the top of the hypervisor. NC controls the execution, inspection and termination of the VM instances on the host where it runs. To deliver the Virtual Machine (VM) tasks, a set of subcomponents work together with Eucalyptus cloud. Cloud controller makes high level scheduling decision and implements them by making requests to cluster
controllers. Cluster controller allows monitoring of resources for a given time interval in order to see the behavior of the resources. Cluster controller also gathers the information about the VM execution on specific node controller. Eucalyptus nodes are accessed with the help of XEN adapter to run the virtual machines on eucalyptus nodes.

5. Eucalyptus Cloud Results

Results are experimented using the Eucalyptus cloud. Virtualized nodes can be controlled via the Eucalyptus node controller. Eucalyptus enables users to create and control Virtual Machine (VM) instances deployed across different physical resources within cloud environment. Fig. 3 shows the different sizes of virtual machines possible to deploy based on the resource nodes. Small size virtual machine, which is m1.small in the Eucalyptus, contains 128MB of RAM. Medium size VM, which is c1.medium in the Eucalyptus, contains 256MB of RAM. For large, which is m1.large in the Eucalyptus, VM 512MB of RAM is allocated. Extra-large VMs are m1.xlarge and c1.xlarge in the Eucalyptus, where m1.xlarge occupies 1024MB of RAM and c1.xlarge VM contains 2048MB of RAM. X-axis contains the type of the virtual machine and Y-axis shows the possible number of VMs user can deploy. By using these results, we can calculate the number of resource nodes required for the user based on the type of the virtual machine.

6. Conclusions and Future work

The Eucalyptus cloud environment helps the user to execute the jobs remotely with maximum utilization of the resources. The virtual network details help the cloud users to assign the IP addresses to the virtual machine instances in the Eucalyptus cloud. The layered architecture explains components and subcomponents available in the Eucalyptus cloud. Eucalyptus components deliver the required services to the cloud user. The results are shown based on the Eucalyptus cloud environment with different node configurations.

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References


