

Implementation of Cloud Energy Saving System using Virtual Machine Dynamic Resource Allocation Method

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Abstract - Cloud Computing is one of the most famous and leading technology in the market as per analysis of Gartner Inc. Almost, every internet user uses cloud services. Cloud computing is mixture of virtualization service management and standardized technology to provide flexible computing ability, by using this we can implement new useful cloud services. As per the market analysis cloud computing one of top 10 strategies, but still faces the two problems i.e. energy consumption and waste of ideal resources. To solve these two problems, we propose two methods first is autoscaling and second is live migration of VM's from one host to another. we are going to proposed a system which based on Open nebula. Open nebula is a complete infrastructure as a service platform for a cloud. Autoscaling and live migration methods are designed and implemented in Open nebula. In this project two experiments are carried out to check autoscaling and energy saving performance of Open nebula cloud platform 1. Add VMs from Open nebula cloud platform. 2. Remove VMs from Open nebula cloud platform.

Key Words: Cloud Computing, Open nebula, Status Monitoring, Autoscaling process, Open-source Cloud platform, Performance Evaluation.

1. INTRODUCTION

Now a days, cloud computing becomes one of the popular technologies and almost every internet user uses these services. So, management of cloud computing platform is efficient becomes very much necessary. Power consumptions and waste of ideal resources these two problems are faced by cloud computing platforms. Due to this designing such a system which reduces these two issues considerably becomes very much important. The bill of energy consumption by data centers in cloud computing is so high. So, if it wasting unnecessary then unnecessary cost of project will increase. Even though most of cloud service providers uses virtualization still they have to face above two problems. To solve these problems, we are going to propose two algorithms i.e. Autoscaling method and Energy Saving Method. For reducing power consumption, we perform live migration of VMs from one host to another host

of Open nebula. Live Migration of refers to migrating VM from one host to another. Cloud computing introduces new technology called server virtualization which helps to manage resources efficiently. This technology allows live migration of VMs from one host to another and shutdown the virtual machine on which processes are not running. By this way power consumption and ideal of resources are reduced. We first assign the various processes from controller node to various VMs. These processes are running on different virtual machines. The controller node monitors the status of virtual machines and requirement of processes which are running on them. Machine resizing is done in the respective cases. If processes running on virtual machine utilizes less resources of that VM and that processes able to run on another virtual machine with the unutilized resources of that virtual machine then live migration of that virtual machine from this host to another host of Open nebula takes place. By this way we achieve the goal of power saving. The propose system is totally based on Open nebula cloud platform. Open nebula is open source software and free to use. Open nebula acts infrastructure as a service. The above proposed two methods are used to improve traditional autoscaling and energy saving method. Using above two methods power consumption and wastage of ideal resources reduces significantly.

2. LITERATURE REVIEW

Over a past few years there are many efforts are carried out to reduce energy consumption, but they save energy only up to 7 to 14%, this energy saving is not up to mark. It is required to design and implement such a system which saves energy and reduce wastage of ideal resources considerably.

Autoscaling is a process of reassigning total load to the individual nodes as per the requirement of jobs. Due to this response time of the job is reduced and system gives maximum throughput. Using this method, the goal of energy saving is achieved and wastage of ideal resources gets reduced considerably. [1]

Open nebula cloud platform is open source and freely provides complete infrastructure as a service (IaaS). [2] Open nebula provides flexible and easy access to a large pool of storage, networking and computing resources through various resources and virtual resources management.

These are various techniques emerging in today's world which are used to build more reliable, flexible and high-performance cloud platform for private, public and hybrid cloud. [3]

There is many open-source cloud software which provides us cloud solutions for building private, public and hybrid clouds. Eucalyptus, Cloud Stack, Open Stack, Open nebula etc. are the examples of such open-source cloud platform. [4]

Apache cloud stack is open source cloud software which provides us cloud solutions to build, deploy and manage large networks of virtual machines. [5] Apache cloud stack provides IaaS services.

Open stack is also open-source cloud software which provides us cloud solutions for building private and public cloud. [6] Using open Stack we can manage large pools of storage, compute and network resources through a datacenter. We can check the status of all the VMs which are running on Open stack on the dashboard through the web interface.

Open nebula is a open source software for cloud computing. Open nebula provides cloud computing facilities for managing heterogenous data center infrastructure. [7]

Internet plays an important role in optimizing the way we exchange and process information. [8] Network virtualization is very important and critical task which is done by the open-source cloud software. Due to these various machines which are running on the cloud platform can access the network through the physical base machine. The major challenge in network virtualization is network mapping, these is done by the network components of cloud system platforms.

The term cloud computing is closely related with virtualization. Virtualization support cloud technologies very flexibly. Virtualization provides facility to cloud platform to acquire and release resources as per the requirement. [9]

Hypervisor plays very important role in cloud computing and virtualization technologies. There are two types of hypervisors first is type 1 or bare metal hypervisors this are installed directly on the hardware and various operating systems runs on it and second is type2 hypervisors these are

installed on the top of operating system and then various operating systems runs on it. For example, VMware, VirtualBox and virtual machine monitor these are the type 2 hypervisors and Xen and Citrix these are the examples of type1 hypervisors. [10]

Elasticity is very important and considered as one of the differentiating features of cloud system platform. Elasticity is a property of cloud platforms by using it cloud users quickly deploy or remove resources as per there need. Autoscaling method is based on the elasticity property of cloud computing platform. Due to this energy consumption and wastage of ideal resources gets reduced considerable amount. [11]

3. EXPERIMENTAL METHODOLOGY

In this paper we are going to perform two different set of experiments and their impact on open nebula cloud platform is observed.

3.1 On Open nebula cloud platform add and delete Virtual machine:

In this experiment we add or different virtual machines on open nebula cloud platform and see their impact on open nebula cloud platform. This experiment shows that if we add or delete different virtual machines on open nebula cloud then how open nebula manage this situation.

3.2 Assigning a number of jobs to instances and observe autoscaling service of open nebula that we created:

In this experiment we first create autoscaling service on open nebula cloud platform base on certain parameters i.e. in terms of CPU usage, RAM usage and time period condition. After that we assign various jobs to the instances and check that autoscaling service that we create how works.

4. EXPERIMENTAL SETUP

Open nebula cloud system platform software is installed and configure by using following software and hardware. The network adapter used for this purpose are also mentioned below:

4.1 Software Requirements:

1. Operating system – CentOS 7
2. Hypervisor – VirtualBox
3. Cloud system platform – Open nebula
4. Open nebula sunstone

4.2 Hardware Requirements:

1. 64-bit Processor will install and run 64bit operating system
2. 8 GB RAM
3. 500 GB Hard drive
4. Provide support for broad range of x64 multicore processors.

4.3 Hardware Virtualization Support

For providing support to 64-bit virtual machines and support for hardware virtualization (Intel VT-x or AMD RVI) must be enabled on x64 CPUs.

4.4 Network Adapters:

- 1) First network adaptor which we use here is NAT for taking internet from the physical base machine.
- 2) Second network adaptor which we use here is Host only adaptor. This network adaptor provides connection between host machine and guest machine, by using it we can access guest machine from the host machine.
- 3) Third network adaptor which we used here is Bridge adaptor.

This adaptor is used for connecting directly to the physical network. i.e. Guest machine is connected directly the host machine’s physical network.

5. EXPERIMENTAL SCENARIOS

5.1 Scenario for the normal status checking on dashboard:

The identity service of Open nebula i.e. Open nebula sunstone shows dashboard for open nebula cloud system. This shows status of all the components which are running on open nebula cloud system platform. It shows the number of running instances, pending instances and number of failed instances. It also shows information about images, virtual networks, system and hosts. This is shown in the following screenshot:

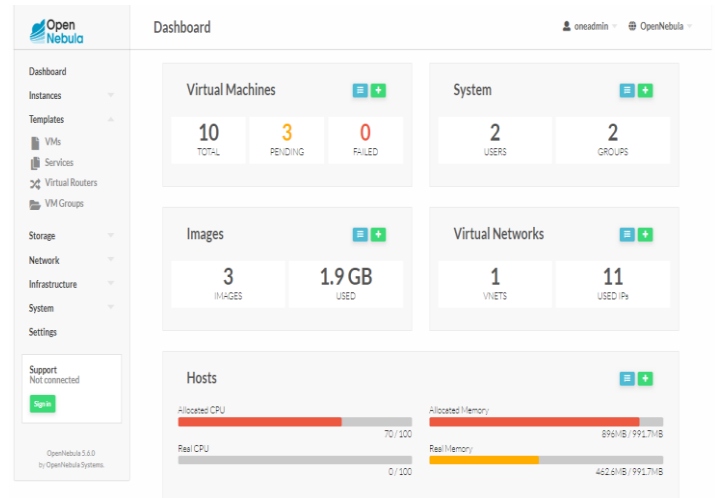


Fig-1: Open nebula sunstone (Identity service)

5.2 Scenario for the host management:

Open nebula cloud system works with different hosts. Users deploy virtual machines, images and create users in the host they want, but it is required that user select the host and perform these operations on it. On a host we can perform different operations like add, delete, disable, enable and monitor the different virtual machines which are running on open nebula cloud platform. In the particular host we deploy number of virtual machines, images and create service templates. The graph for a particular host shows the CPU and memory usage. The following screenshot shows the graph for a host:

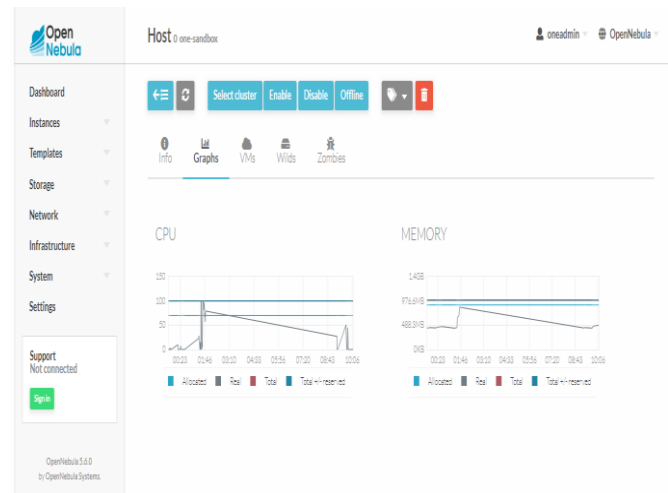


Fig-2: Host graph of Open nebula shows CPU and memory usage

5.3 Scenario of network topology:

On open nebula cloud platform, we launch number of instances. A unique IP address assign to each virtual machine. This IP address which are assign to the virtual machines are given by the network management system of open nebula cloud platform. The different IP addresses which are assigns to the various instances in open nebula cloud platform is as shown below:

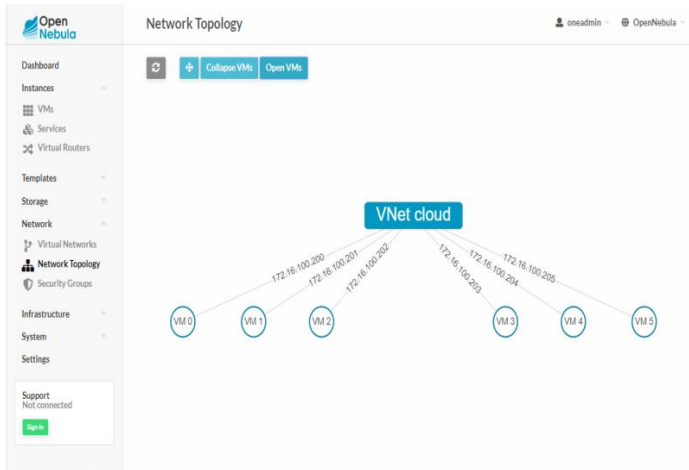


Fig-3: Network topology for a host

5.4 Scenario for Autoscaling service:

Autoscaling service of open nebula cloud platform plays an important role for cloud energy saving and load balancing. We set a particular condition for an autoscaling services. When these situations match then autoscaling of processes takes place. In this paper we set autoscaling condition in terms of CPU usage, RAM usage and time period conditions. This is shown in following Screenshot:

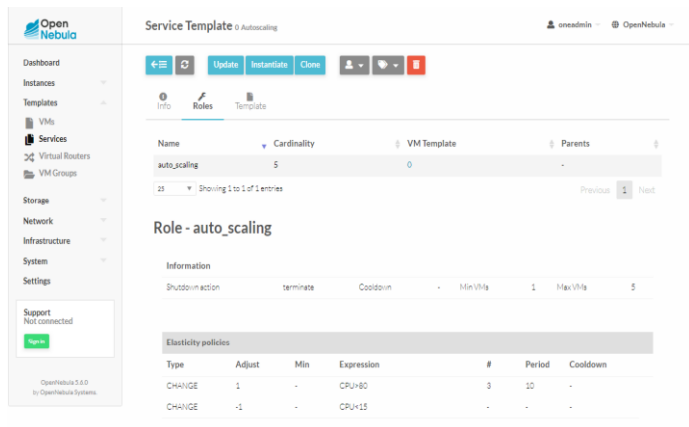


Fig4: Autoscaling service in Open nebula

6. EXPERIMENTAL RESULTS AND ANALYSIS

6.1 Results after autoscaling process is done:

Autoscaling process refers to reassigning the work load as per the requirement of process. Due to this system performance increases and energy consumption also gets reduced. When autoscaling process is performed then its impact on CPU usage and RAM usage is as shown in following screenshot:

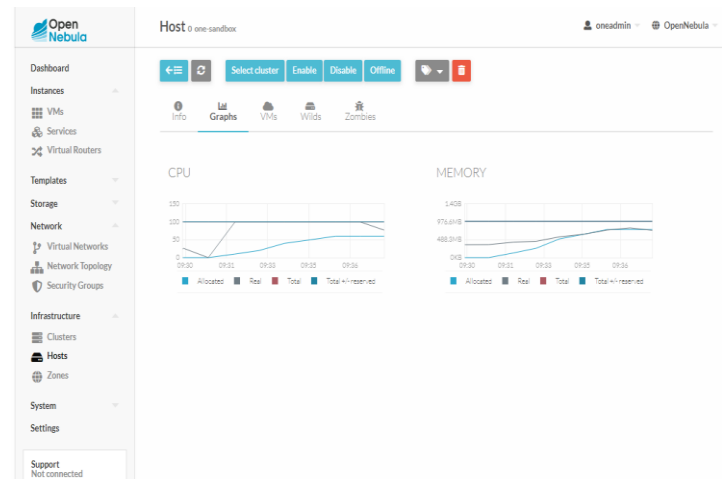


Fig5 : Graph of host after autoscaling performed on open nebula

6.2 Performance of a system:

The response time of jobs gets reduced due to autoscaling process and system throughput gets increased, as compared to previous traditional system. There is no wastage of ideal resources and energy consumption also gets reduced, due to autoscaling process. Due to this cost of electricity gets reduced.

7. CONCLUSION

We are going to propose an infrastructure platform base on cloud software Open nebula. This platform allows us to create multiple virtual machines inside it and all these machines are works under control of Controller node. We are going to improve traditional autoscaling and Energy saving method by this we achieve goal of power saving and wastage of ideal resources gets reduced significantly. The improved autoscaling method not only reduce the waste of ideal resources but also increases allocation of resources to virtual machine having inadequate resources. By this way the overall performance of system increases. From the above experimental analysis, it is clear that energy saving is

not only depends on the characteristics of VM but also the physical environment of machines. For achieving the goal of power saving it is mandatory that to focus on real state of physical machines and virtual machines and accordingly design and implement autoscaling and energy saving methods.

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