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Dynamic Resource Allocation on Virtual Machines

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Abstract: Resource allocation is one of the main issue in cloud computing (rare resources will be distributed). Although having sufficient resources sometimes we cannot make use those properly. So we use resource allocation method for the sufficient usage of resources available. In resource allocation method user neither need to install hardware nor software for to access applications. In this paper the aim is to implement a virtual machine (VM) resource monitor in OpenNebula platform with web based interface, and to integrate a Dynamic Resource Allocation (DRA) method in virtual machine (which is useful when overload occurs) and to show the experimental results of before DRA and after DRA in virtual machine.

Keywords*: VR, DRA, OpenNebula*

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I. INTRODUCTION:

In earlier days computer machines were designed in such a way that, they could only used to have the capability to run on a single application on single OS at a time. After inventing virtualization technology now people are running no of virtual machines on top of a physical machine. Here each virtual machine shares the resources of the physical machine (host machine). Now we are capable to achieve the virtualization on multiple platforms and migration of multiple virtual machines across the host machine (without disturbing the host machine). And here we need to take care of load balancing between the virtual machines.

Clustering the virtual machines on a physical machine can also provide a stable and comfortable environment but not efficient. Here the clustering environment cannot balance the unpredictable workloads occurred at the time of working. But most of the virtual machines uses statistical load balancing methods only, but it will not be efficient at the time of higher loads occurrence (throughput and response time of the machine will get increases).

So in this paper we are using the DRA (Dynamic Resource Allocation) method for the resource allocation between the virtual machines on physical (host) machine. And we used OpenNebula platform for the experiment. In the experiment we increases the load on the virtual machines (too highly), and make them to get migrate automatically form one VM (Virtual machine) to another VM which is having the less workload.

Why we are using DRA?? Suppose let assume that a server is running at less utilization (wastage of resources), even the CPU utilization is 20% only it takes the power consumption more than 75%. So we need to use the method (DRA) for the efficient usage of resources available with less power consumption.

II. RELATED WORK:

1. Virtualization: it is the process of allocating available resources to the virtual machines for to run applications efficiently. By using virtualization process we can improve the server's utilization and reduce the no of physical machines required for to run the applications. Virtualization process is similar like abstraction. Virtualization mainly focus on the logical environment of the operating system (OS) but not on the physical environment of the OS. Virtualization provides the details of the complete individual unit to the each and every virtual machine (VM).

In virtualization process we have mainly two type's mechanisms

- Full virtualization
- Para virtualization

Full virtualization: it is also called as native virtualization process, which is similar like emulation process. Here we cannot modify the OS (operating system) and applications which are running inside the VM (virtual machine). The advantage of full virtualization is operating system and applications can run on the same physical architecture (physical machine)

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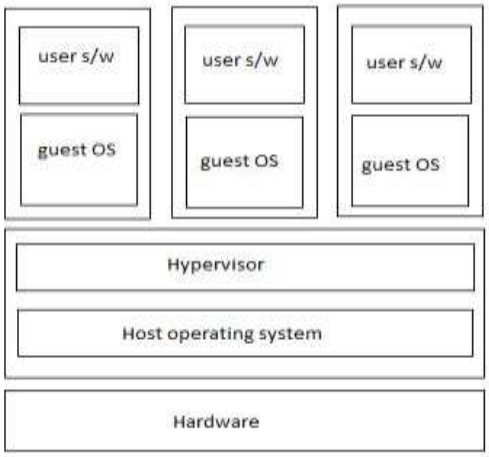

Fig 1. Full virtualization

Para virtualization: it is similar like full virtualization but the only difference is to change or modify the OS (operating system), in this method it processes the VM's to coordinate with hypervisors and to reduce the usage of the instructions which are privileged. The gist to use para virtualization responsible to increase the performance of the virtual machines. But the disadvantage is usage of the hypervisors will be differs from one machine to other machine, so we need to do changes for every hypervisor when we are using that.

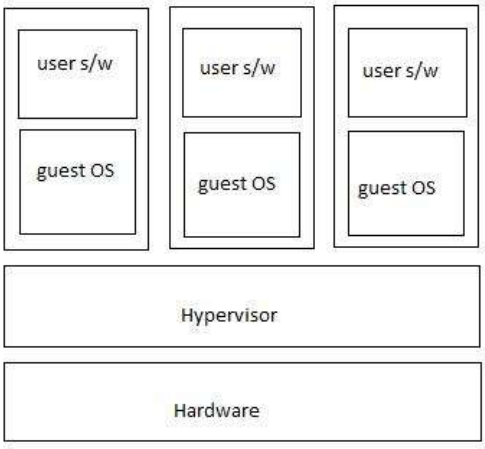

Fig 2.para virtualization

OpenNebula: it is a type of virtual infrastructure engine, it helps to enable the reallocation of vm's. OpenNebula contains multiple back ends and one front end. Live migration is one of the main advantage in OpenNebula (migrating the virtual machine from one physical host to the other physical host).

In live migration it provides proactive maintenance, if any failure occurs the problem can be resolved before it is going to disrupt the service. It uses for load balancing where we can share the workload among the computers for to utilize the available services.

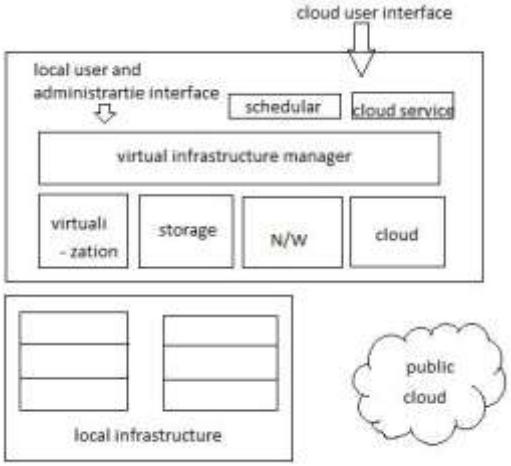

Fig 3. OpenNebula architecture

Main components of OpenNebula:

1. OpenNebula core is one of the component acts as centralized, which manages the vm's life cycle..
2. It consists one capacity manager which adjusts the placements of the vm's based on policies.
3. Virtualized access drivers which provides the basic functionalities of the hypervisor when the OpenNebula is unplugged.

Eucalyptus: it is also one of the type of platform of virtual management. It acts as an open source software, this system is flexible, simple and modular. Here, the users of the eucalyptus uses the same interface and tools to interact with Amazon EC2.

Eucalyptus components:

- Node controller : it is responsible to the execution and termination of virtual instances
- Cluster controller : manages virtual machines instances on network
- Storage controller : provides storing and accessing mechanisms of the vm

Cloud controller: it acts as entry point of the users and administrators of cloud platform. This uses to do high level scheduling decisions and implementations. The overall function of OpenNebula and eucalyptus is to manage the virtual machines.

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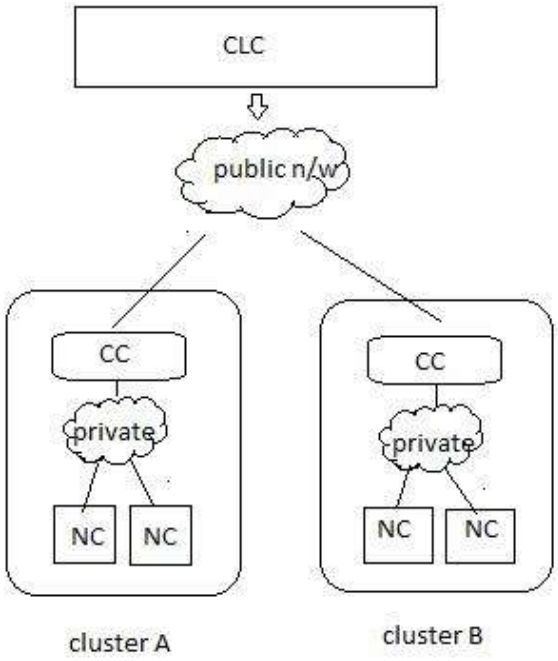

Fig 4. Eucalyptus hierarchical structure

III. SYSTEM DESIGN (ARCHITECTURE)

Dynamic resource allocation: The allocation of the resources among the physical computers is a major issue. For to get the maximum efficiency we need distribute the resources among the physical computers properly. DRA manages a cluster of the physical computer hosts (computers which made as a group) and serves the resource based service level agreement and maintain load balancing across the cluster whenever workloads changes. Load balancing is mainly uses for to improve the performance of virtual machines across the distributed or centralized systems.

SLA: SLA (Service Level Agreement) is one of the type of agreement between the service providers and customers, it is the part of the contract. It consists what services that the service provider needs to provide. SLA agreement contains SLO's (Service Level Objectives) .SLO's are the properties of QOS (Quality of Services) that should have to maintain by the service provider. These properties be in measurable formant which helps to find out the penalties for the respective provider's or customers who failed in performing the pre-agreed service. The SLA contains set of penalty clauses which are used for to allocate the violation costs to the respective parties.

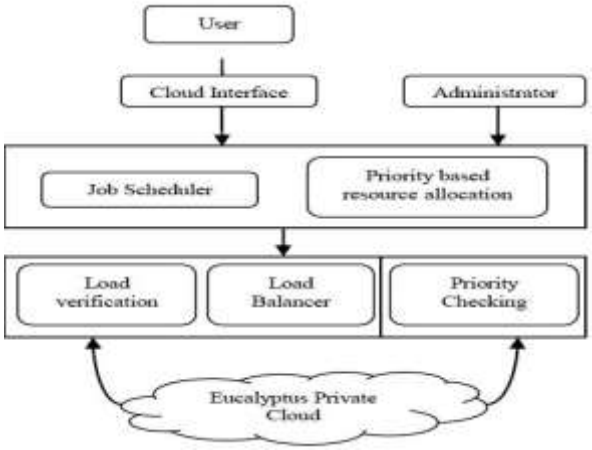

Fig 5.

Eucalyptus mechanisms in virtual machines

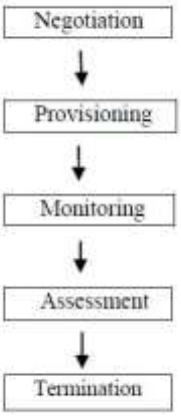

Fig 6. SLA life cycle

System architecture :

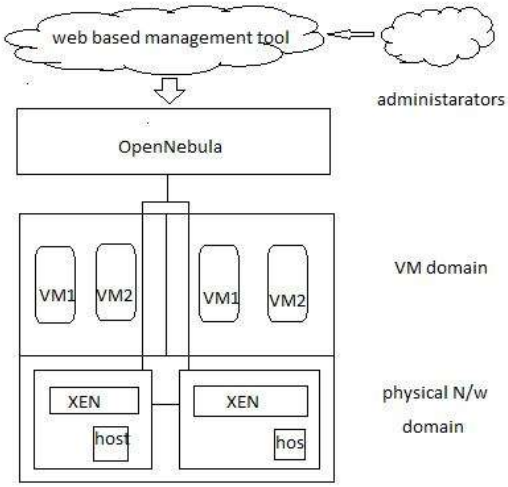

Fig 7. System architecture

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In the above figure we prepared one cluster system with OpenNebula and web interface to manage both physical and virtual machines. We created a cluster of computers having homogeneous nature like with same memory, storage and other resources.

IV . IMPLEMENTATION

To calculate the resource allocation of DRA model we using HPCC defines High Performance Computing Challenge. And HPCC is the software application which consists set of benchmarks targeting to test multiple attributes.

Step 1: We are installing OpenNebula in two machines for to act like hosts with same configurations.

Fig 8. Installing OpenNebula

Step 2: Installing vSphere client which acts like interface for vCenter Server and ESXi.

Fig 9. Installing vSphere

Step 3: We are creating two VM's (ManageIQ, VOneCloud) with different configurations for to check the working of DRA in vSphere client.

Fig 10. Installation of vOneCloud

Step 4: In the VM's of first host we are increasing the load by downloading the applications which needs more memory, n/w and disk configurations.

Step 5: Experimental results of first host after increasing the load (the utilization of disk, n/w and CPU are getting increases (shown in the figure)).

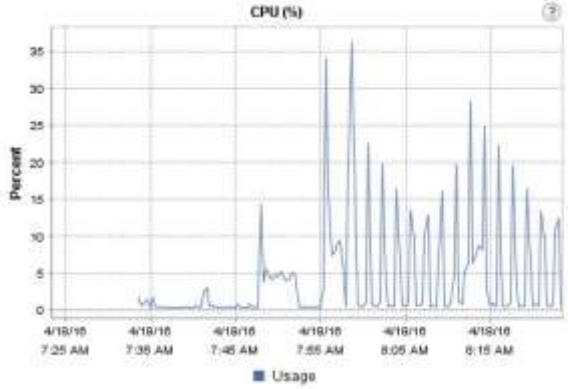

Fig 11. CPU utilization before DRA

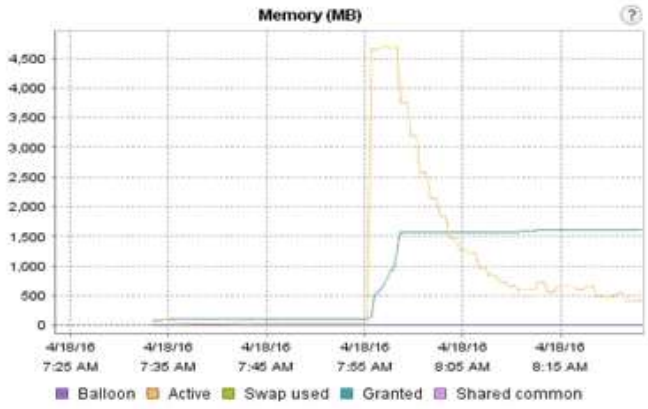

Fig 12. Memory utilization before DRA

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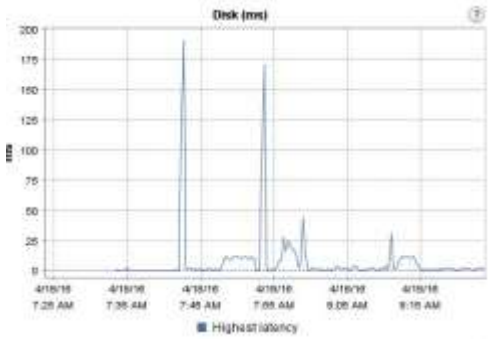

Fig 13. Disk utilization before DRA

Step 6: The efficiency of the VM's are getting reduces. The time needs for to complete operation is getting increases because of the load.

Step 7: We are applying DRA (Dynamic Resource Allocation) on the VM's of first host. When the VM's cannot handle the increasing load the host of the VM's checks for the host which is having less load of operations and sends one of its VM to the other host. Which is called as live migration.

Fig 14. Enabling DRA

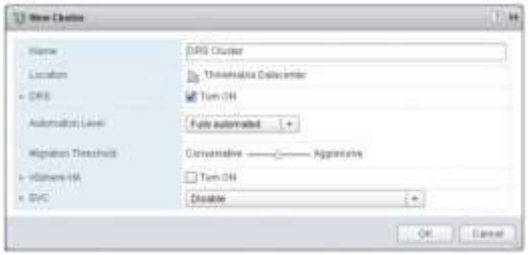

Fig 15. Enabling DRA

Step 8: After applying the DRA method the utilization of disk, n/w and CPU gets reduces as shown in the figures. So DRA is one of the best method which helps for the effective utilization of VM's by distributing the workloads between them. We can perform the same operations for the VM's of the same cluster (different hosts) and between different clusters also.

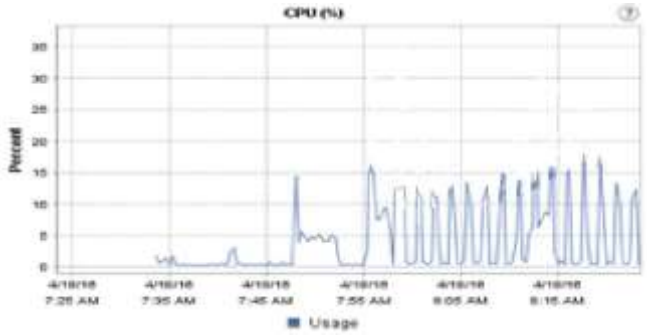

Fig 16. CPU utilization after enabling DRA

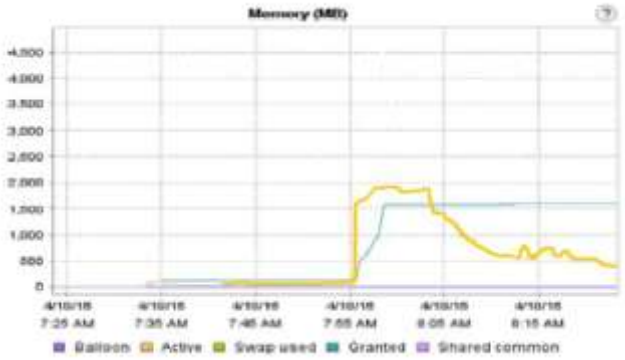

Fig 17. Memory utilization after enabling DRA

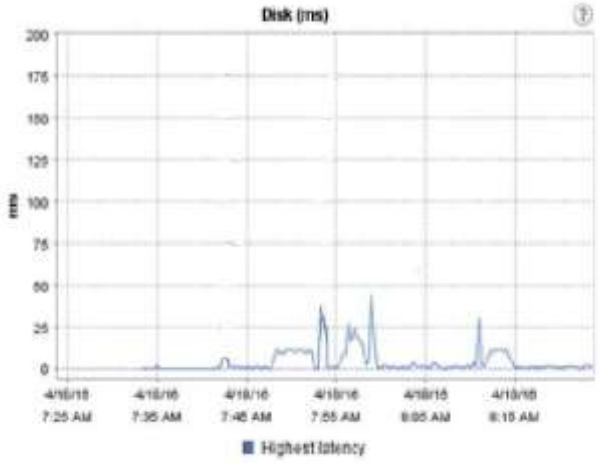

Fig 18. Disk utilization after enabling DRA

V. RESULTS:

The utilization of CPU, disk and network before and after applying DRA

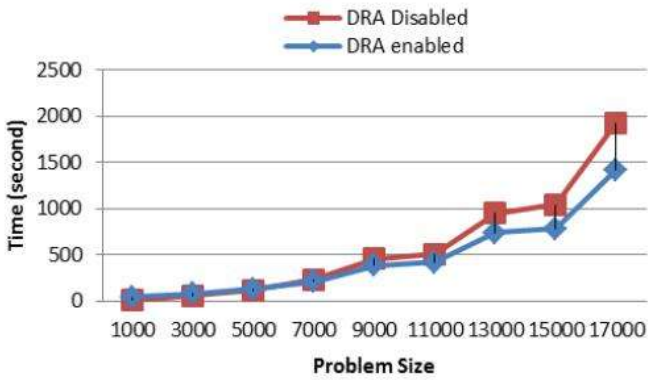

Fig 19. Utilization of resources before and after enabling DRA

VI. CONCLUSION:

For the efficient usage of resources DRA (Dynamic Resource Allocation) be the one of the best method. After applying the DRA mechanism it reached the gist of energy saving model than traditional approach. Not only energy but also the time required for the performance of the operation is reduced.

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