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AN ENHANCED ENERGY EFFICIENT VIRTUAL MACHINE MIGRATION APPROACH FOR THE CLOUD ENVIRONMENT

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Abstract:Cloud is one of the fastest emerging technologies in the field of IT industries as well as from the research perspective. It received much attention in the last few years due to the attractive features like on-demand services, easy to use, measured services etc. Virtualization is the driving technology in the cloud which allows application isolation and enables the service provider to transfer the VM from one physical Device to additional physical machine knows as virtual machine (VM) migration. VM migration is the key features of the virtualization. It facilitates load balancing, hot spot mitigation, server consolidation, fault management, and power saving. Several steps are involved in the migration process i.e. source physical selection, virtual machine selection, target virtual machine selection and the last step is transferred VM data. Previous study says that in the migration process VM selection and VM placement are the two most difficult tasks due to the dynamic change in VM request. This work proposed a priority based load balancing approach that migrate and schedule the VM according to the priority which is assign on the basic of profit. VM which paid more to the provider will have more priority and schedule first. Main idea of this approach is that gives better service to those users who provides additional advantage to the contributor. Experiment result shows that suggested method provides enhance result..

Key Words: *Cloud computing, VM migration, Load Balancing, Saas, Paas, Iaas*

1. INTRODUCTION

Cloud is one of the fastest emerging technologies in the field of IT industries as well as from the research perspective [1]. It received much attention in the last few years due to the attractive features like on-demand services, easy to use, measured services etc [2].It can be deploy in three different way i.e. private, public and hybrid and support for the three different type of services names SaaS (Software as a service), PaaS (platform as a service) and IaaS (infrastructure as a service) [3].

Virtualization [4, 5] is the driving technology in the cloud which allows application isolation and enables the service provider to transfer the virtual machine from one physical device to an additional physical machine knows as virtual machine migration. Hypervisor is the software which is use to implement the concept of the virtualization that create the VM and assign to the user for performing the user task. Figure 1 show the virtualization stack of the PM

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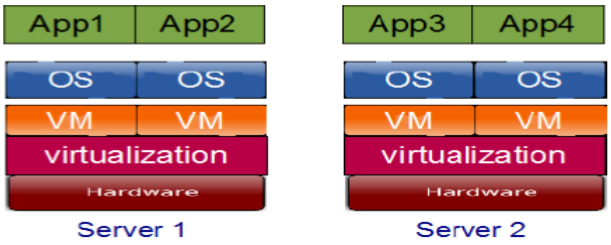

Fig. 1: Virtualization stack

In cloud number of user can use the single PM due to the virtualization, which may overload the PM. Load on the VM can change dynamically [6], so some resources are left for the future use. To avoid the overloaded and under loaded situation upper and lower threshold are used respectively. Based on the threshold VM scheduling approach can be static or dynamic. In the static approach fixed lower and upper threshold are used, that can't be changed with time, while in the dynamic approach an dynamic lower and upper threshold are used, that can be changed with

VM migration [6, 7] is the key features of the virtualization. It facilitates load balancing, hot spot mitigation, server consolidation, fault management, and power saving. When the PM is overloaded or under loaded the overall performance of the PM is degrades. To mitigate the overloaded or under loaded situation VM migration is use. Since overload and under load situation may decrease the performance of the PM, so every cloud provider want to resolve them. Due to this reason it received much attention in the last few years. Numerous load balancing algorithm have been proposed in the past. These approaches are mainly focus to increase the increase the resource utilization by placing the VM in such a way that all VM place to the minimum number of servers. This is the one way by which provider can increase their profit by reducing the number of active server. Other way to increase the provider profit is to is to place the VM in such a manner where higher profit VM will place first. This approach uses this concept and place the VM first which is more important to the user.

2. RELATED WORK

B. Sotomayor et al. [8], proposed a Round Robin approach for the VM placement. This approach used the static threshold. In this approach VM are placed on the first come first serve (FCFS). In this approach all process are treated equally and VM scheduler assign the resources to the process that comes first. Most of the cloud provider used this approach.

Y. Fang et al., [9] proposed three layer architecture of cloud computing i.e. application layer, platform layer and infrastructure layer. The application layer is oriented to users, it implements the interaction mechanism between user and service provider with the support of platform layer. Users can submit tasks and receive the results through the application layer in the task scheduling process. The infrastructure layer is a set of virtual hardware resources and related management function. Furthermore, the platform layer is a set of software resources with versatility and reusability, which can provide an environment for cloud application to develop, run, manage and monitor.

A. Rabiatul et al. [10], introduced a load balancing approach based on the VM migration. This approach set the value of lower and upper limit for the resource utilization of the PM are 10 and 90 respectively. When the load is above the upper limit larger VM is selected from the overloaded PM and place to the PM where the resource utilization of the PM is less than50. This approach seems good but may increases the number of migration due to setting higher value of the upper threshold.

Mohammad H et al. [11], present a migration based VM migration approach for the cloud. In this approach they set lower and upper threshold for the host and monitor the utilization of each PM. Now filter all PM where the utilization is below the lower threshold or higher than the upper threshold. Now migrates all VM from the underloaded PM and switch OFF the underloaded PM to save the energy. If the PM is overloaded then arrange all VM in the ascending order of their utilization and select the first VM for the migration. First fit approach is use to place the migrated VM. This approach seems good but selects the small VM for the migration that can increase the number of migrations. another problem with approach is that first fit approach is use to place the VM that can increase the number of running server which result in increasing the energy consumption.

M. S. Pilavare and A. Desai [12], proposed VM placement approach based on the genetic algorithm. Genetic approach is suffered by the starvation, so to avoid the starvation problem they prioritize the VM and then use the genetic approach to place the VM. To prioritize the VM they are using Logarithmic Least Squares Method which first find the comparison matrix of all VM then multiply each row to find the value of fitness function. Then assign the priority of each VM according to the fitness value. VM with higher fitness value will have higher priority. Following equation is use to find the fitness value for each VM.

$$\zeta = w1 * \alpha(NIC \div MIPS) + w2 * L$$

Where,
W1 and w2 are the weighting coefficient
NIC is the number of instruction in cloudlet
MIPS Million instruction per second requested by the VM
α is the cost of instruction execution
L is the delay cost
After assigning the priority to each VM, they use genetic algorithm for placing the VM, which randomly select the PM for placing the VM. Main problem with approach is that, they are not focusing on the energy consumption. VM placement play an important role in managing the energy consumption, hence energy consumption will be increase.

3. PROPOSED METHODOLOGY AND EXPERIMENT RESULT

Energy consumption and VM migration are to major issue for the cloud provider. These issues can be handled effectively by the proper load balancing approach. Most of the existing approach uses lower and upper threshold to balance the PM. After the assessment of cloud theory it is found that VM scheduling is the way by which user can minimize the number of migration and energy consumption and increase the provider profit. Most of the existing work in the load balancing field increases the cloud provider profit by minimizing the energy consumption and number of migrations. But these approaches can be improved to increase the provider profit by giving more preference to the VM which gives more profit to the provider. M. S. Pilavare and A. Desai [12] proposed an load balancing approach that is based on idea where VM which gives more profit are place first. This approach can be optimized more by placing the VM properly. The proposed load balancing enhanced the idea of the existing load balancing approach by implementing the VM migration concept. Main objective of our approach is to increase the provider

profit. To achieve this we assign the priority to each VM according to the cost which is depends on the time for which the VM is use and the size of the VM.

VM migration process is use when the performance of the PM is not good or to minimize the number of running server known as server consolidation. Most of the existing load balancing approaches used the lower and upper threshold to identify the overloaded and underloaded situation. Static threshold is more suitable for the cloud environment due the dynamic nature of the VM demands. Our proposed approach also used the static threshold and set the value of lower and upper threshold are 20 and 80 respectively. Lower threshold is used for the server consolidation i.e., when the load on the PM is less than 20 then all VM running on the PM is migrate to the other PM whereas upper threshold are used for the load balancing purpose to optimize the system performance. Hence, to deal with both the situation VM migration process is required. Three steps are involved in the migration process

3.1 Source PM Selection
3.2 VM selection
3.3 Target PM Selection

3.1 Source PM Selection

To select the source PM lower and upper threshold are used. A PM is a candidate of the source PM when it is either overloaded or underloaded. In both situation, PM is considered as a source PM and some VM have to be migrated to balance the PM.

3.2 VM Selection for the Migration

Main objective of our proposed approach is to increase the provider profit and enhanced the system performance. After identifying the source PM next step is to find the VM which has to be migrated. If the PM is underloaded the all the VM running on that PM or host have to migrate and PM is switch to the power saving mode know as server consolidation. Where in the case of overloaded, VM with lower priority is migrates to the other PM.
In our proposed method to allot the priority cost or profit is used. So first we discover the cost of the VM. If size of the cloudlet running on the VM x and T1 is the time required to execute the VM then.

$$T_1 = \frac{x}{MIPSoft\ heVM}$$

Typically it is seen that VM utilizing only 70% of their full capacity. So now if the T_2 is the time required to execute the VM then

$$T_2 = \frac{x}{MIPSoft\ heVM * 0.7}$$

If x, y and z are the cost of CPU, memory and bandwidth then cost of the VM is calculated as follow given in table 1.

Table 1: Comparison Matrix to Measure VM Cost

VM_1	CPU Cost	CPU Cost	CPU Cost	Cost (X)
VM_2	$L_1 = T_1 * x_1$	$M_1 = T_1 * y_1$	$N_1 = T_1 * z_1$	$X_1 = L_1 * M_1 * N_1$
VM_3	$L_2 = T_2 * x_2$	$M_1 = T_2 * y_2$	$N_2 = T_2 * z_2$	$X_2 = L_2 * M_2 * N_2$
VM_4	$L_3 = T_3 * x_3$	$M_3 = T_3 * y_3$	$N_3 = T_3 * z_3$	$X_3 = L_3 * M_3 * N_3$

Now after find the cost of the VM assign the priority to the VM based on their cost value x. Higher priority is assign to the VM which has higher value of x and vice versa.

Following algorithm is use to select the VM for the migration.
Step-1: Assign priority to each VM
Step-2: for each PM in the PMList do
Step-3: if load <lower_threshold
Step-4: Migrate all VM
Step-5: end if
Step-5: if load >upper_threshold
Step-7: Select the lower priority VM for the migration
Step- 8: end if
Step-9: end for

3.3 Target PM Selection for Placing the VM

Main concern of our proposed work is increase the provider profit. This can be achieved by minimizing the number of active server. To achieve this we place the VM to the largest PM. The concept for selecting the larger PM is to pack maximum number of VM in a minimum number of active servers. Algorithm for the proposed VM placement approach is
Step-1: For all VM in VMList do

Seep-2: Select VM with higher priority
Step-3: for all PM in PMList
Step-4: PM_{load} Load of the PM
Step-5: if PM_{load}>lower_threshold&&PM_{load}<upper_threshold
Step-6: Add PM into the newPMList
Step-7: end if
Step- 8: for all PM in the newPMList do
Step-9: Select the largest PM
Step-10: end for
Step-11: end for

4. RESULT ANALYSIS

CloudSim simulation [13] tool is use to evaluate the performance of the proposed approach. To efficiency of the proposed approach it is compare with the existing load balancing approach [12]. Efficiency of the proposed and competitive approach is measured in term of number of migrations, energy consumption and number of active server To create the cloud environment 10 number of PM is create with MIPS of 1000, 2000 and 3000 and size of RAM and bandwidth is 10000 MB and 100000 bit/sec respectively.

.Numbers of created VM during the experiment are 10, 15 and 20. Some cost is also assumed for the each resources based on this cost priority to the VM is assigned.

Figure 2, 3 and figure 4 shows the number of active server, energy consumption and number of migration respectively

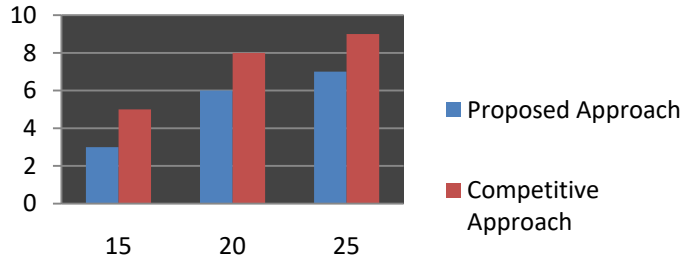

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Fig. 2: Number of Active Servers

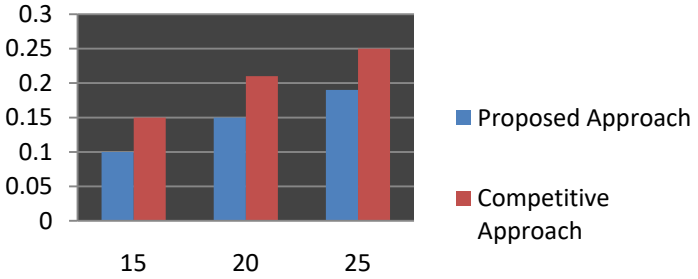

Fig. 3: Energy Consume by the Datacenter

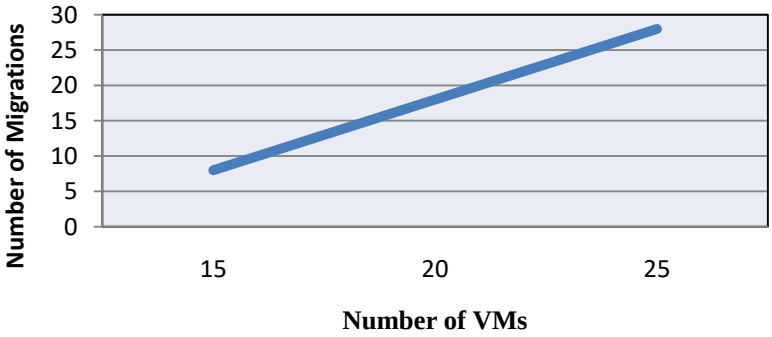

Figure 4: Number of Migrations in Proposed Approach

CONCLUSION

VM migration is the key features of the virtualization. It facilitates load balancing, hot spot mitigation, server consolidation, fault management, and power saving. Several steps are involved in the migration process i.e. source physical selection, virtual machine selection, target virtual machine selection and the last step is transferred VM data. Previous study says that within the migration process VM selection and VM placement are the two most difficult tasks due to the dynamic change in VM request. This work proposed a priority based load balancing Method that migrate and schedule the VM according to the priority which is assign on the basic of profit. VM which paid more to the Supplier will have more priority and schedule first. Key Proposal of this Method is that gives better service to those users who provides extra benefit to the contributor. Experiment result shows that suggested method provides improved outcome in term of number of lively server, migration and energy consumption.

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