A Profitable Resource Scheduling Virtual Machine Placement Scheme for the Cloud Computing Environment

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Abstract— Cloud computing is one of the fastest growing technology in the field of computer era. It delivered the computing resources on user request and charge to the user according to the resource usage. It is a business model where cloud provider gives the resources to the user. Main target of the cloud provider is how to increase their revenue with minimum investment. One way to increase revenue by serving more and more user with their existing infrastructure. To achieve this they use the virtualization technology. Virtualization technology increased the provider profit by increasing the utilization of the resources. Typically, cloud provider has the list of VM for the scheduling so other way to increase the profit by give service to the higher margin virtual machine first. In our approach we are using the second idea for increasing the profit. In our proposed we place the VM in such a way that VM with higher cost will be placed first. Energy consumption is also one of the important factor on which the profit is depends. So proposed approach place virtual machine in such a way that minimum number of PM is required to place the VM. CloudSim simulation tool is used as a simulation tool.

Keywords— Virtual Machine, Physical Machine, Energy Efficient

I.   INTRODUCTION

Cloud computing [1] provides a "computing-as a-service" model in which compute resources are made available as a utility service — an illusion of availability of as much resources (e.g., CPU, memory, and I/O) as demanded by the user. Cloud computing is efficient and scalable but maintaining the stability of processing so many jobs in the cloud computing environment is a very complex problem with load balancing receiving much attention for researchers. It provide three types of services and can be deployed in three different way [2]. It supports various types of services like software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS). Since cloud used for the various purpose, so it can be implemented as public, private and hybrid. Virtualization [3, 4, 5] is a popular solution that acts as a backbone for provisioning requirements of a cloud-based solution. Virtualization provides a "virtualized" view of resources used to instantiate virtual machines (VMs). A VM monitor (VMM) or hypervisor manages and multiplexes access to the physical resources, maintaining isolation between VMs at all times.
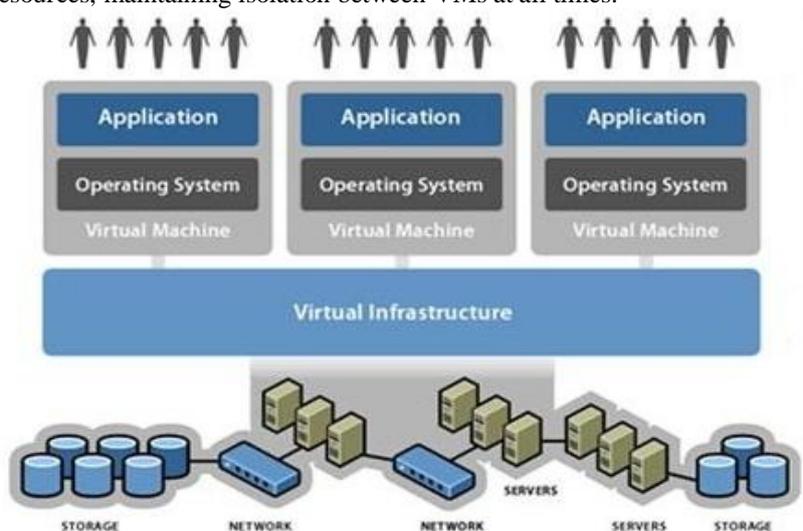

Figure 1: Virtualization

Task scheduling is an important part of cloud computing, which is a mechanism that maps users' tasks to appropriate resources to execute, its efficiency will directly affect the performance of the whole cloud computing environment. Compared with grid computing, there are many unique properties and the mainly include virtualization and flexibility for cloud computing.

In this paper, we focus on problems related to VM Placement. In the next section, we present a detailed description of some of the well known approaches used to address these problems.

II. RELATED WORK

Li Jiaxin et al. [6], proposed a VM scheduling approach for assigning the resources to the multi-tenant in the cloud environment. In this approach first they design the formula for allocating the VM to the multi-tenant. This formula considered the requirement of multi-tenant. After this they proposed approach an algorithm for placing the VM which uses the Multiple Knapsack Problem (LP-MKP). this approach successfully reduced the resource fragmentation in cloud.

S. Joshi et al. [7], proposed cuckoo search approach for the virtual machine consolidation. Main objective of this approach is to reduce the energy consumption and resource wastage. Main concept of this approach is the life cycle of Cuckoo bird which keeps their eggs to the other bird nest. In order to reduce the resource wastages vector projection method is used which the PM to the PM where resource utilization of the VM is opposite to the resource used by the PM. This approach reduced the resource wastage.

A. Alahmadi et al. [8], present energy aware VM scheduling approach called EATS-FFD. In this paper they consider FFD as a base approach and make some modification to improve the VM scheduling policies. Local and global manager are used for the scheduling purpose. All user tasks are submitted to the global manager then global manager find the resource requirement of the task and send to the appropriate local manger.

Berral et al.[8], proposed a threshold based VM scheduling approach for the cloud. In this paper they proposed two scheduling approach for turn on and turn of the PM to save the energy. VM is place based on the energy consumption. This approach is based on the future prediction of the power. For this purpose machine learning is used.

Lawazaski et al. [9] proposed an energy efficient VM scheduling approach for placing the VM to the PM. DVFS technology is used for placing the VM which place the VM without affecting QoS. For placing the VM, scheduler first sort all VMs into the ascending order of their resource requirement and place first VM to the PM with the minimum frequency and having enough resources to host the PM. this approach say that their approach reduce the energy consumption but they didn't proposed any approach for scheduling approach.

M. S. Pilavare et al. [10], introduced a cost based load balancing concept for the cloud computing environment. The genetic strategy is used for scheduling the VM in cloud environment. Fitness value is used to place the VM to the PM. In this approach first they calculate the fitness value for each VM and then use this fitness value to place the VM to the most efficient PM available in the data center. Main perception of this approach is to maximize the profit of the cloud owner. Following equation is used to find the cost of the VM:

$\zeta = w_1 * \alpha(NIC \div MIPS) + w_2 * L$

where w_1 and w_2 are the weighting coefficient, NIC is the size of the process, MIPS is the MIPS of the VM and L is the delay cost. After finding the value of ζ for each VM first fit approach is used to schedule the VM. Main problem in this approach is the use of first fit approach for placing the VM which can increase the number of active server.

III. PROPOSED APPROACH

Cloud computing is the technology which deliver the computing resources to the client on the demand basic and charge for the user according to the uses. Hence it is a business model. Here, main target of the providers is to increase the margin or profit for the providers. Due to the utility model user has to pay only for the used resources. So provider can increase their margin only by placing the more and more number of VM in the existing server. For this intention they used the virtualization. M. S. Pilavare et al. [] proposed a new idea for increasing the provider margin. This approach serves the user first which pay more. In our approach we also use the same concept for increasing the provider earnings. In our approach if we have the list of VM for the placement then first we place the VM which gives more profit to the provider. So if number of VM need to be placed first we estimate the cost for each VM.

Since in cloud user pay only for the used resources so total amount paid by the user is proportional to the time and size of the VM. Time taken by the VM for completing the user job is depends on the CPU capacity which is measured by the MIPS. Time required by the VM to complete the task

$$T_1 = \frac{No.of\ Instruction\ in\ Task}{MIPS\ of\ VM}$$

Where MIPs is the actual MIPS requested by the VM but most the time VM use only 60% o their MIPS. So VM takes some more time for completing user task which can be define as

$$T_2 = \frac{No.of\ Instruction\ in\ Task}{MIPS\ of\ VM * 100} * 60$$

T_2 is the time which is taken by the CPU to complete the user task. Hence VM uses the resources for the T_2 time. If the cost of the MIPS is x and cost introduced due to the delay is y the following equation is used for calculate the cost of the VM.

$\zeta = w_1 * x\ T_2 + w_2 * y$ --- (1)

where w_1 and w_1 is the weighting coefficient.

Now after finding the cost for each VM we sort the VM in to the decreasing order based on the value of ζ. To make our approach power efficient we schedule the VM in such a way that it will minimize the total number of running server. Due to the minimizing the number of running server it will also consume less amount of power. Following algorithm is used for the placemat.

Algorithm for the VM scheduling

1) vmList ← {List of all VM need to be placed}
2) pmList ← {List of all available PM }
3) for each vm in the vmList
4) Find the cost X for each VM according to the equation 1
5) End for
6) Assign priority to each VM according to the cost value
7) Arrange all VM in to the decreasing order of their priority
8) while (vmList != Null) do
9)   for each pm in the pmList do
10)   if ((PM$_{CPU}$>VM$_{CPU}$ && PM$_{RAM}$>VM$_{RAM}$)&& PM$_{BW}$>VM$_{BW}$)
11)   Add PM to the pmList-
12)   end if
13)   end for
14)   if pmList-1 = Null
15)   Start new PM
16)   else
17)   for all PM in the pmList-1
18) P_1 ← pm.getPow().
19)   Assign VM to the PM
20) P_2 ← pm.getPow().
21)   diff ← P_2 - P_1
22)   Add diff into the diffList
23)   end if
24)   end for
25)   Arrange all PM into the PMList-1 in ascending order according to their diff value
26)   Assign VM to the first PM
27) PM$_{CPU}$ ← PM$_{CPU}$ + VM$_{CPU}$
28) PM$_{RAM}$ ← PM$_{RAM}$ + VM$_{RAM}$
29) PM$_{BW}$ ← PM$_{BW}$ + VM$_{BW}$

IV. RESULT ANALYSIS

To check the performance of the proposed VM scheduling approach CloudSim simulator [11] is used to design the cloud environment. CloudSim is a JAVA based simulation tool which have several classes to create the cloud entity like virtual machine, physical machine, broker etc. It also some scheduling polices which is used tom place the VM to the PM. To chest the accuracy of the proposed VM scheduling approach, it is compare with already existing VM scheduling approach [10]. Performance of the both approach is measured in term of number of running server, total execution time and energy consumption. To setup the cloud environment 10 PM is created with 1000, 2000, 3000 MIPS, 10000 MB of RAM and 100000 bit/sec of bandwidth. Then 15, 20 and 20 VM is created during the experiment. MIPS of these VM are 250, 500, 750 and 1000 and use the 128 MB RAM and 2500 bits/sec of bandwidth.

Now we check the number of running server, total execution time and energy consumption in both approaches.

Experiment result declared that our proposed VM scheduling approach gives better result. It used less number of PM to host the 15, 20 and 25 VM. Since it needs less numbers of PM, so it also consumed less amount of power as contrast to the existing scheduling approach.
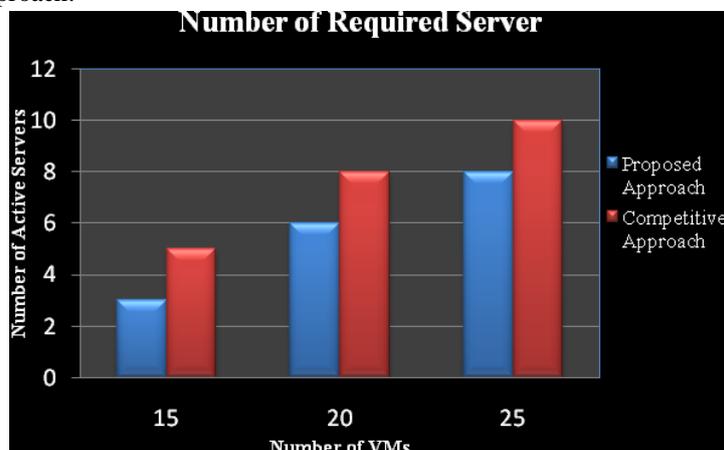

Figure 2: Number of Server required to placed VM

Figure 2 shows the result for the number of server required to place the 15, 20 and 25 VM on the 10 PMs. It is clear our proposed approach needs lees server compare to the base approach.
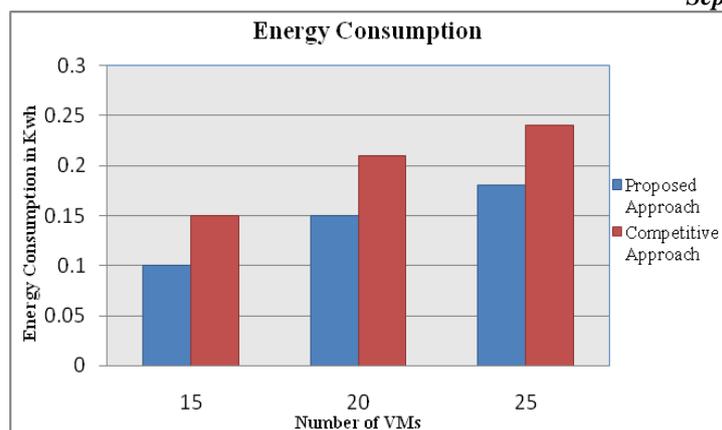
Figure 3: Energy Consumed by the Datacenter

Figure 3 shows the result for the energy consumed by the datacenter required to place the 15, 20 and 25 VM on the 10 PMs. It is clear our proposed approach needs lees amount of energy compare to the base approach. This is because our strategy placed all VMs into the less number of PM. Since energy devour by the datacenter is depend on the running server hence less number of running server will minimize the devour energy.
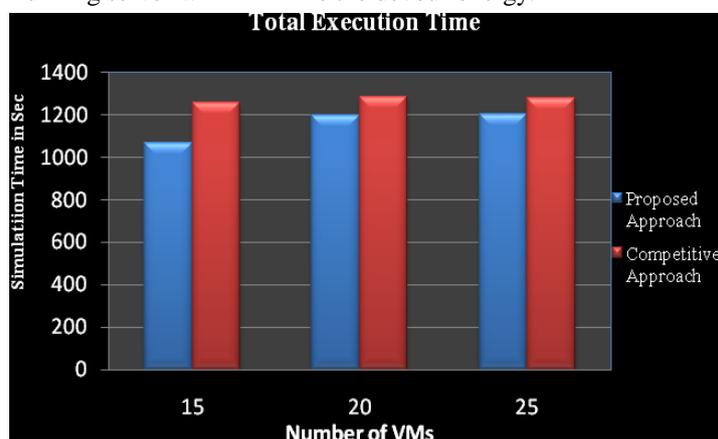

Figure 4: Total Execution Time

Figure 4 shows the result for the total execution time required to execute 15, 20 and 25 VM on the 10 PMs. It is clear our proposed approach complete task in less time compare to the base approach.

V. CONCLUSION

The cloud is the technology which is design to provide the computer resources to the client. It is a business oriented technology where main aim of the provider is to get profit from the existing infrastructure. The resource management and energy saving in cloud is the way by which an provider can increase their profit. This paper introduced an cost based approach for the resource scheduling to increase the cloud owner profit. In our proposed we place the VM in such a way that VM with higher cost will be placed first. Energy consumption is also one of the important factor on which the profit is depends. So proposed approach place virtual machine in such a way that minimum number of PM is required to place the VM. CloudSim simulation tool is used as a simulation tool. Experiment results shows that this approach uses minimum number of server to serve the VM which result in increasing the profit.

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