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An Enhanced Cost Effective Virtual Machine Scheduling Approach 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. 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: Cloud Computing, Virtualization, CloudSim, Scheduling, Load balancing

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 provides three types of services and can be deployed in three different ways [2]. Virtualization [3-5] 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.

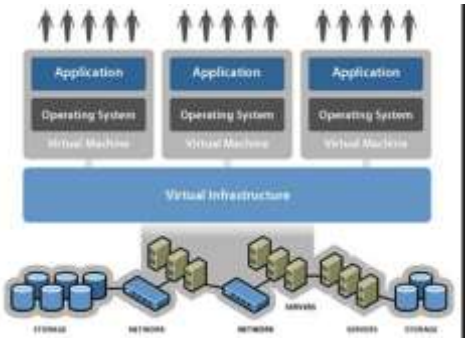

Figure 1: Virtualization

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

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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], proposed a load balancing approach for the cloud computing environment. This approach used the genetic approach for scheduling the virtual machine. In the genetic approach first they find the value of a variable known as fitness value then take the scheduling decision based on this fitness value. 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 = weighting coefficient,
NIC = size of the process,
MIPS = MIPS of the VM and
L = 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

$$T_1 = \frac{\text{Size of Task}}{\text{MIPS of VM}}$$

Where, MIPs are 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

$$T_2 = \frac{\text{Size of Task}}{\text{MIPS of VM} * 0.6}$$

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.

$\zeta = w_1 * x\ T_2 + w_2 * y$

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) Arrange all PM into the descending order of their capacity
4) Find the cost X for each VM
5) Assign priority to each VM according to the cost value
6) Arrange all VM in to the decreasing order of their priority
7) while (vmList != Null) do
8) for each pm in the pmList do
9) if ((PM_{CPU}>VM_{CPU} && PM_{RAM}>VM_{RAM})&& PM_{BW}>VM_{BW})
10) Add PM to the pmList-
11) end if

```
            end for
          if pmList-1 = Null
            Start new PM
          else
            for all PM in the pmList-1
                PM^1_CPU ← pm.getUtill().
                Assign VM to the PM
                PM^2_CPU ← pm.getUtill().
                diff ← PM^2_CPU - PM^1_CPU
                Add diff into the diffList
          end if
            end for
      Arrange all PM into the PMList-1 in ascending order according to their diff value
      Assign VM to the first PM
      PM_CPU ← PM_CPU + VM_CPU
      PM_RAM ← PM_RAM + VM_RAM
      PM_BW ← PM_BW + VM_BW
```

IV. Result analysis

To check the performance of the proposed VM scheduling approach CloudSim simulator [10] 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.

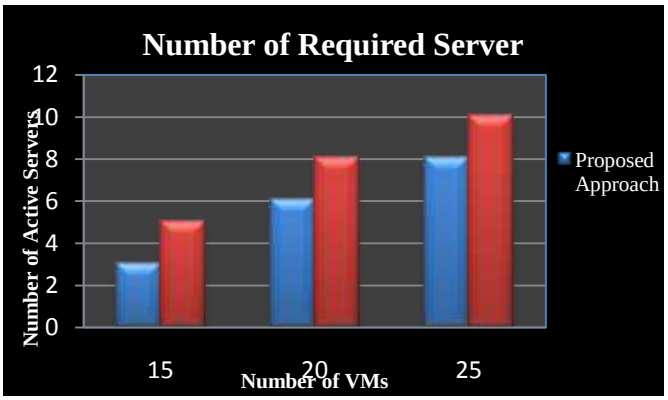

Figure 2: Number of Server required to placed VM

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.

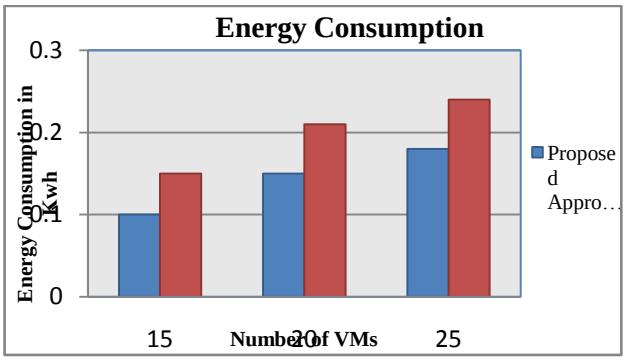

Figure 3: Energy Consumed by the Datacenter

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.

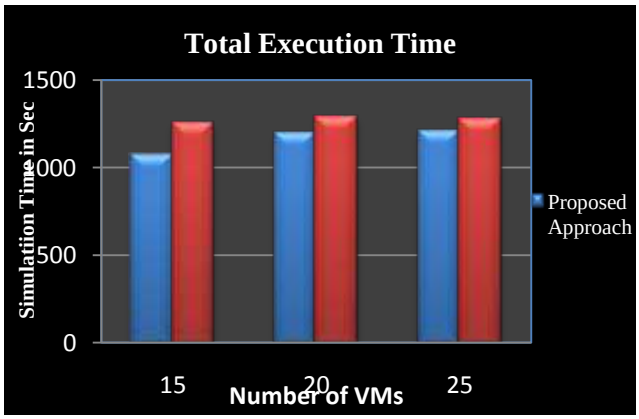

Figure 5. 1: Total Execution Time

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