Implementation of Improvement in Handling Virtual Machine Migration using Multiphase Optimization

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Abstract- Cloud Computing is defined as a term being used for distributing services along with resources hosted over the online network. It is nothing but Infrastructure and then Platform and finally Software as a Service whose abbreviations are IaaS and then PaaS and finally SaaS respectively. Cloud computing permits user to utilize the resources by paying for those resources the user demands for. Due to this Cloud Computing is famous among the IT Industries. The increase in popularity of Cloud Computing in the IT environment leads to a large amount of energy consumption. This results in high level of pollution in the environment. Thus in the proposed system VM scheduling technique are being used by keeping the quality of service as high as possible in order to achieve minimization in energy consumption. This is done by making use of CloudSim tool-kit.

Keywords: Cloud computing, CloudSim tool-kit, VM Placement, VM Migration

I. INTRODUCTION

Cloud Computing provides an environment for users to access a pool of resources such as Applications, Development Environments, Virtual Machines and so on, by using network communication media to access computing resource. The superiority of this model of access lies in the way it is on demanded fashion and “Pay-per-use” model. Due to its resource sharing nature, this model can cause huge savings in resource consumption cost, maintenance cost, resource upgrading cost, etc. Moreover, it is predicted that Cloud Computing will be dominant in whole IT industry, from user application in form of web services or online storages to whole users machine as Virtual Machines that store on remote computer and user can access to that through a terminal whenever and wherever they wish to. On the other hand, increasing demand on computing causes massive energy consumption and consequently causes pollution to the environment.
In a research conducted on more than 5000 production servers over more than six months, they observed that in most of the times, servers worked at 11-50% of machines total utilization capacity and it caused huge loss of investigation money, resource utilization, electricity power and consequently increase in total cost. Therefore, this research aims to solve this problem and reduce costs by exploiting this phenomena in Cloud Computing “Infrastructure as a Service” (IAAS) environment where users are provided with their virtual machines on their demands and configuration of the virtual machines determined by an agreement on specifics of virtual machines such as amount of RAM memory, Storage capacity, amount of Bandwidth and CPU power. This agreement made between user and cloud administrator is known as “Service Level Agreement (SLA)”. So the main idea is to consolidate virtual machines in cloud data center such that virtual machines with under-utilized resources use resources in share mode and turn off extra machines to reduce energy consumption of host machines and save resources.

II. PROBLEM STATEMENT AND SOLUTION

There is a very high necessity for computational power. And because of this the concept of “Cloud Computing” came into existence. Now since there is a drastic growth in computing and communication due to its popularity, a need for greater energy power increases, hence the field of Green Computing try to diminish this procedure by revising early computing techniques or inventing new procedures to have more efficient computing material that would perform more work while consuming less energy and making less pollution.

In this implemented system, there is trial made in order to minimize the energy that is being used in a Cloud computing data centre environment by reconsidering the virtual machines scheduling technique, but the quality of service parameters are kept as highest as possible. This approach is implemented by using the “CloudSim toolkit” and is evaluated by comparing with recent popular methods. The final evaluated result clearly demonstrates the success in achieving aims to reduce energy consumption whilst keeping quality of service in a moderate range by reducing the number of virtual machines migrations.

III. SYSTEM ARCHITECTURE

To overcome the problems of Useless Migration obtained from the existing system which include SLA violation occurring between the user and the cloud service provider who provides the resources for VMs based on the user’s demand, and the unnecessary increase in the energy consumption a 2 phase optimization technique is used. Using this technique it is possible to achieve reduction in energy consumption and also reduction in violation of SLA.
The architectural view of the 2 phase optimization technique involves two major steps which are Virtual Machine Placement and Virtual Machine Migration. The architecture consists of the following models:

- **Physical Machine (PM):** The physical machine consists of 1 or more virtual machines based on the requests sent by the user. It also consists of VM schedulers.

- **The Green Scheduler** is that point of the architecture where steps are being taken to conserve the energy. It consists of:
  - **VM scheduler:** For the VMs to be scheduled effectively and efficiently Resource Usage Collection, VM Placement and VM Migration is being performed.
  - **Resource usage Collector:** In order to have an optimized scheduling process the resource usage collector will keep a track of the resources used by the virtual machines. It will also keep track of all the VMs present in the PMs. It will perform the task of putting all the VMs of an over-utilized host into the VM pool. VM pool will consist of VMs belonging to over as well as under-utilized hosts. Now the VMs from the VM pool can be assigned to a host where it is needed. This is done based on scheduling algorithms.
  - **VM Placement:** This is an important module of the proposed system. Here the VM from the VM pool is being picked and is placed on to an appropriate host according to the VM Placement method. The VM placement method used here is Minimum Best Fit Decreasing (MBFD). In MBFD method the host with the most minimum number of VMs will be opted for placing the VMs that are present in the pool. This is done to achieve best fit. This process of moving the VM from the pool to the host is called as VM Placement. Picking of PM is done based on the resource requirements virtual machine’s hardware that the host will render and finally the utilization of resources. Main aim of performing placement is to ensure that the resources are being conserved by maximizing the resources on individual hosts because of which other hosts can be switched off leading to saving of resources or balancing the load among the hosts again to conserve resources by using it in limitation.
  - **Check VM migration to under-utilized host:** There are certain steps to be performed before migration can occur. Firstly, check if there are any under-utilized hosts present. If they are present then check if the VMs present within the under-utilized hosts can be migrated onto another active host. Here, it should even check if it is going to be compatible in the host onto which it is getting migrated. If all these are possible then perform the migration.
  - **VM Migration:** This also considered as the major module of this system. If the system gets to know that a VM can be successfully migrated, it will migrate that VM onto the decided host. It will then update the information of the host. This process of migration from one host to another host is known as VM Migration and all these activities are unknown to the users.
  - **Virtual Machine(VM):** Instead of creating many different PMs and assigning resources to them which increases the resource utilization drastically and unnecessarily, it is possible to create many different virtual machines on a single physical host. Virtual Machine is nothing but a software running on physical machine. It works exactly like a PM which runs the OS and other applications. The VM will comprise of specification as well as configuration file and important files such as log file, NVRAM setting file and virtual disk files that is being supported by the physical resources of the PM. Since VMs use the resources of the PM there is no need for separately assigning new set of resources to the VMs created. This leads to great savings of the resources. Main feature of a VM is that, its presence inside a PM is not known to the user.

By doing this activity we can observe that there is a reduction in the energy being consumed since there is no useless migration carried out. The energy is being saved because by performing the above method we will be able to reduce at least 1 host thus reducing the energy consumed by it and it’s VMs. And also this leads to a reduction in SLA violation since there is very less or no resource consumed by that host, thus it will enable turning off that particular machine.
IV. IMPLEMENTATION

A. Language used for execution

For the execution of this project the coding language that is undertaken is JAVA and the reason for choosing this as the base language in the expansion of the project is because of its following nature:- (i) Its independent of a platform; (ii) Its oriented towards object; (iii) Its library has high benchmark; (iv) Consists of interface designed using applet’ (v) Has syntax equivalent to C++; (v) Has Swing support

B. Type of Testing

- Unit Testing

Unit test is being performed by verifying even the trivial units of a software design present in each module. In this step of testing all the modules are observed to be doing their activity in a satisfactory manner by observing the required o/p from the subdivided components. In this testing the single separate blocks of code are being tested to see if they are working fine, so that, during functional testing the testing will be working fine for the functionalists that are associated with those units.

<table>
<thead>
<tr>
<th>Functionality to be tested</th>
<th>Tests performed</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working of VM Placement</td>
<td>Tested to check whether the VMs were picked and added at the appropriate hosts according specific methods.</td>
<td>Successful result obtained after testing</td>
</tr>
<tr>
<td>Working of VM Migration</td>
<td>Tested for check whether any underutilized hosts present, if present, pick that host and migrate to other active host.</td>
<td>Successful result obtained after testing</td>
</tr>
<tr>
<td>Working of CloudSim</td>
<td>Tested for check whether the hosts and VM are added and scheduling done.</td>
<td>Successful result obtained after testing</td>
</tr>
</tbody>
</table>

Table:- Unit testing table

- Bottom Top Integration

In bottom-up approach the modules present in the low lying portion of the program is constructed and tested. Processing that is needed for the elements present below a stated point are always made convenient since the elements are being merged from the down to up. Because of this reason there is no need for stubs and hence stubs are being completely removed.
There is an image of an open page of text with tables and text. The tables are in the form of a spreadsheet, showing classes, their functionality, and testing performed. The text is in English and discusses testing performed upon validation. The page includes a table titled "Integration testing table." The table shows classes, their functionality, and the tests performed. The text also mentions validation testing, where the final product is evaluated to meet business desires and is complete and properly assembled as a package. Errors are unearthed and rectified during this phase, ensuring the software meets customer expectations.
<table>
<thead>
<tr>
<th>Testing of a function</th>
<th>Input</th>
<th>Tests performed</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front-End activity</td>
<td>Inter-communication b/w end-user and s/m by using mouse &amp; keyboard</td>
<td>Leads to opening of the correct page upon the click of a button</td>
<td>Successful result obtained after testing</td>
</tr>
<tr>
<td>CloudSim activity</td>
<td>The Virtual m/c and PMs are added by the end-user followed by beginning of scheduling process.</td>
<td>Addition of Virtual M/c and PMs.</td>
<td>Successful result obtained after testing</td>
</tr>
<tr>
<td>Broker activity.</td>
<td>Broker performs the work of scheduling the Virtual m/cs.</td>
<td>Initiation of Scheduling process.</td>
<td>Successful result obtained after testing</td>
</tr>
<tr>
<td>VM Placement activity</td>
<td>End-User performs selection of Virtual M/c which is added to proper PM.</td>
<td>VM placement completed.</td>
<td>Successful result obtained after testing</td>
</tr>
<tr>
<td>VM Migration activity</td>
<td>User has to check the underutilized hosts and start migrating if any.</td>
<td>Migration of virtual m/c completed.</td>
<td>Successful result obtained after testing</td>
</tr>
</tbody>
</table>

**Table:** Validation testing table

V. RESULT

The following snapshot represents the results or outputs which are obtained after step by step execution of all the modules of the system.

- No Consolidation Technique

- Figure 1, shows the 1st performance graph which is the VM Migration for No consolidation technique. Figure 2, shows the 2nd performance graph which is the SLA violation for No consolidation technique
• Figure 3, shows the 3rd performance graph which is the Energy Consumption for No consolidation technique.
Two Phase Consolidation Technique

- Figure 4, shows the 1\textsuperscript{st} performance graph which is the VM Migration for Two phase consolidation technique. Figure 5, shows the 2\textsuperscript{nd} performance graph which is the SLA violation for Two phase consolidation technique

- Figure 6, shows the 3\textsuperscript{rd} performance graph which is the Energy Consumption for Two phase consolidation technique.
- Enhanced Two Phase Consolidation

- Figure 7, shows the 1st performance graph which is the VM Migration for Enhanced Two phase consolidation technique. Figure 8, shows the 2nd performance graph which is the SLA violation for Enhanced Two phase consolidation technique.

- Figure 9, shows the 3rd performance graph which is the Energy Consumption for Enhanced Two phase consolidation technique.
VI. CONCLUSION & FUTURE SCOPE

Another aspect of VM scheduling optimization is “Fairness”. Current scheduling methods migrates VMs to optimize overall parameters, despite user’s behaviour and their SLA Violation history, and sometimes cause starvation for servicing and extreme SLA violations for some users with specific VM configuration. We are now concerning this subject and try to make value of maximum SLA Violation that happens for a user to average SLA Violation value while try to reduce both values.

The future enhancement that is being taken up in this project is occurring in the phase 2 of the proposed Two Phase Optimization Technique.

In the migration phase the following enhancements can be made:- During the process of choosing a VM to be migrated, we firstly going to analyze the primary machines based on how many VMs are pending in them in an ascending order, i.e., from lowest to highest and then we perform the process of migration.

We allocate the migrating VM in the order of lowest to the highest.

REFERENCES


