Volume 3, Issue 10, October 2013 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

A Live Migration of Virtual Machine Based on the Dynamic Threshold at Cloud Data Centres

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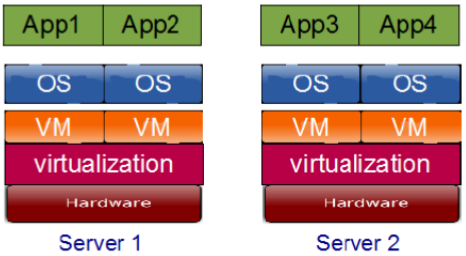
Abstract— ***Cloud computing has changed the whole picture of computing which is presented by the distributed and Grid computing. It's give the new meaning to the distributed and off-premises computing. Virtualization is the key technology behind cloud computing. Virtualization is the technique which divides the one physical machine into the multiple physical machines. Live migration of virtual machine is the key features of the virtualization. By the virtual machine migration administrator can move the virtual machine from one physical to another physical machine. Migration is widely used for the fault tolerance, load balancing, resource consolidation and hot spot mitigation. This technology can also be used to minimize the energy consumption of datacenters. In this paper we are presenting a method which uses a lower and upper level threshold to minimize the number of migration as well as the energy consumption.***

Keywords— Migration , Virtual Machine, Cloud , Data Canter , Cloud Sim , Threshold , MIPS.

I. INTRODUCTION

Cloud Computing technology is made to provide utility-based IT services to its user. To meet this requirement data centre's are established to give facilities like telecommunication and storage system as equal to the house computer. Rapid growth of cloud computing has caused large scale establishment of such virtualized data-centers. Cloud computing [1] is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a metered service over a network. It is a marketing [2] term for technologies that provide computation, software, data access, and storage services that do not require end user knowledge of the physical location and configuration of the system that delivers the services.

Virtualization [3] is the key technology in cloud computing. Virtualization is the powerful tool used in today's computing. Through virtualization multiple operating system can made running on one physical machine. With the help of virtualization number of VM can be created on the server with multiple OS running on it and on single OS one application can run well. Even if a virtual machine goes down, other OS running on other virtual machines running on same host will not be affected and work is continuously done. Virtualizations are implemented through hypervisor, which create the virtual machine for each user. One or more VM are created to one user and numbers of virtual machine are hosted in a single host.



Live migration is the most important feature of the Virtualization. It's enable the cloud provider to balance the system though the migration. Migration is the technology by which administrator can move the virtual machine from one host to the other host without the suspension of the VM. Migration is the powerful tool for the load balancing, server consolidation and hot spot mitigation. Server consolidation is the situation where the load on the host is below the lower threshold, and hot spot mitigation is the situation where the current host in which virtual machine is running is not able to full fill the requirement of the VM.

II. RELATED WORK

Y. Song [4] et al. describes about the allocation policy. The paper has introduced a RAINBOW prototype through which multi tier resource scheduling is done. The allocation of resource based of priority. The evaluation result says that paper is capable of improving resource allocation for both critical and less priority jobs. Problem with method is that it

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does not apply virtual machine migration policy for the optimization. D. Gmach [5] et al. describes about the threshold based approach a threshold based reactive approach to dynamic workload handling. The paper has tired detecting the underutilized and over utilized work load and initiates migration as required. This approach is not much suited for IaaS environment. A. Beloglazov, R. Buyya et al, [6] they are using a single threshold value for the load balance. When the utilization is beyond the upper level threshold system will be consider as an overloaded system. So migration will be performed. Problem with this method is that it is not support to the server consolidation. So when the utilization is above the upper level threshold migration will be done, but what about the when the system is under utilize. Nathuji and Schwan [8] have proposed architecture of an energy management system for virtualized data centers, where resource management is divided into local and global policies. Consolidation of VMs is handled by global policies applying live migration to reallocate the VMs. Kusic et al. [9] have stated the problem of continuous consolidation as a sequential optimization and addressed it using Limited Look ahead Control (LLC). The proposed model requires simulation-based learning, and the execution time reaches 30 minutes even 15 nodes. On the contrary, our approach is heuristic-based allowing a reasonable performance even for large-scale. Song et al. [10] have proposed resource allocation to applications according to their priorities in multi- application virtualized clusters. Unlike our work, it does not apply migration of VMs to optimize the allocation. Verma et al. [11] have applied a heuristic for the bin packing problem to tackle the dynamic placement of applications in virtualized heterogeneous systems. On the contrary to our approach, the proposed algorithms do not ensure QoS fulfillment: SLA can be violated due to the workload variability. Gmach et al. [12] have investigated a threshold-based reactive approach to dynamic workload consolidation. The proposed approach is in line with our preliminary work [13]. However, this approach is not suitable for an IaaS environment serving different kinds of applications, as the threshold values have to be tuned for each workload type to allow the consolidation controller to perform efficiently. VMware Distributed Power Management [14] operates based on the same idea with the lower and upper utilization thresholds set to 45% and 81% respectively. However, as it was justified before, fixed values of the thresholds are not suitable for systems with dynamic and unpredictable workloads. In our current work, we propose an approach to set the threshold values dynamically, depending on a current set of instantiated VMs and historical data of the resource usage by each VM.

III. PROPOSED WORK

Migration is the process to move the VM from one PM to another PM. Migration algorithm consists of three steps.

A. When the migration done
B. Which VM should be migrated?
C. Host where the VM placed

A. WHEN THE MIGRATION DONE?

Threshold value are use to decide the time when the migration is done. In this paper we are using two threshold values i.e. upper and lower threshold. When the load on the host is greater than the upper threshold, system is overload and when the load on the host is below the threshold that means system is under loaded. In both case migration will be done.

Here, firstly calculation of the CPU utilization for all VMs done as,

$$Uvm = \frac{totalRequestedMips}{total\ MIPS\ for\ that\ VM}$$

Beside utilization, allocated ram and bandwidth for both virtual machine and host,

Bw = Σcurrent bandwidth for VMs for host,
Ram = Σcurrent Ram for *VMs for host*
And also Sum = ΣUvm

Upper level and lower level threshold can be calculated as following:

a UPPER THRESHOLD CALCULATION

Here, the upper threshold (Tupper) is calculates this value for each host separately by following equations;

temp= Sum + (Bw / Bw(host)) + (Ram/Ram(host))
*Tupper =1-.05*temp ……(1)*

Where, the variable temp gives the summation of parameter that we have taken into consideration.

b LOWER THRESHOLD CALCULATION

From the studies, it was found that if the CPU utilization is lower than 30%, lower threshold (Tlower) is always 0.3. So, the equations for calculating lower threshold for each node is,

if CPU utilization is < 30%
(Tlower) *= 0.3 ……(2)*

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B. Which VM should be migrated?

It is very difficult to decide which VM should be migrated because if large VM is selected, it will increase the total migration time and if smallest machine is selected then number of machine will be migrated. So we select the VM machine which size equal to the difference between the total host utilization and upper level threshold. Anton Beloglazov and Rajkumar Buyya [7] also use this algorihm to select the VM for the migration.

Algorithm that returns the list of VM that can be migrated

```
1.  Input: hostList, vmList Output: migrationList
2.   vmList.sortDecreasingUtilization()
3.  for each h in hostList do
4.  hUtil ←h.util()
5.  bestFitUtil ←  MAX
6.   while hUtil > h.upThresh() do
7.  for each vm in vmList do
8.   if vm.util() > hUtil ─ h.upThresh() then
9.  t  ← vm.util() ─ (hUtil ─ h.upThresh())
10. if t < bestFitUtil then
11.  bestFitUtil  ← t
12. bestFitVm  ←vm
13.  else
14.  if bestFitUtil = MAX then
15.  bestFitVm ←  vm
16. break
17.  hUtil   hUtil ─ bestFitVm.util()
18.  migrationList.add(bestFitVm)
19.  vmList.remove(vm)
20.  if hUtil < lowThresh() then
21. migrationList.add(h.getVmList())
22.  vmList.remove(h.getVmList())
23.  return migrationList
```

C. Host where the VM placed

After the VM selection next step is to select the host where the selected VM will be placed. Paper [15, 16, 17] using a vector calculus to select the host for placing a vm but it's very difficult to understand it. So we are using array instead of vector. To select the target host we are using 6 arrays; because in this work we are work on the three attribute i.e. cpu, memory, bandwidth. So there will be six combinations.

CBM	H_1	H_2	H_3			H_p
CMB	H_1	H_2	H_3			H_q
MCB	H_1	H_2	H_3			H_r
MBC	H_1	H_2	H_3			H_l
BMC	H_1	H_2	H_3			H_m
BCM	H_1	H_2	H_3			H_n

Where CMB stored all the host where utilization of CPU >Bandwidth>Memory similarly. CMB store all the host where utilization of CPU >Memory>Bandwidth etc.

Array CMB and BMC are the complementary array because array CMB store the host where Cpu>Memory >bandwidth while BMC array store the host where Bandwidth>Memory>Cpu. Host inside the array are stored into the increasing order of their utilization. After selecting the VM for the migration, we find the array where this VM belongs, then select the host from the complementary array that fulfill the VM requirement.

IV. Experimental Results

This study was made on one datacenter. Study was done with 10 hosts and 20 vm. Each node comprises of one CPU core with 10 GB ram/network bandwidth and storage space of 1TB. The host comprises of 250 MIPS accordingly. For each

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virtual machine on host ram size is 128MB and bandwidth size is 2500 MB. MIPS for each Vm generated randomly between 1 to 250. This experience is done with one Datacenter.

VM PLACEMENT POLICY

The experiment was done with 10 hosts running with 20 virtual machines. On x- axis, ids of host are placed and accordingly number of VM are placed on each host. It deals with two policies. The first one is one by one mapping policy i.e. assign VM to host one by one and once the host are over again start from first host and second is our proposed method.

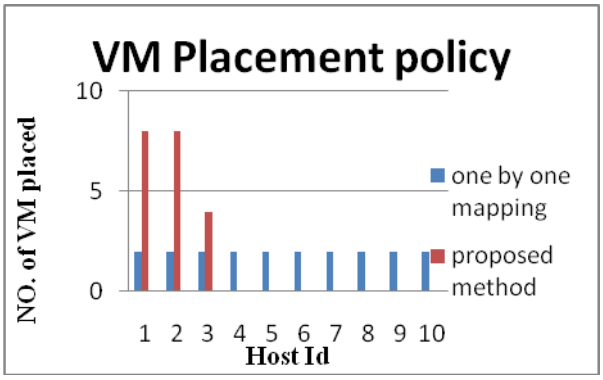

Figure-2 VM placement Results

As shown in the graph in figure 2, in one by one mapping all the hosts are compulsorily utilized to do work, but by our proposed method only 3 hosts are utilized and others are remained off so power can be saved.

VM MIGRATION

In our method we are using random function to generate MIPS, so number of migration change every time. To calculate the average number of migration we are executing our program 20 times for the same upper and lower threshold and then calculating the average. When we increase the number of VM our method gives the best result.

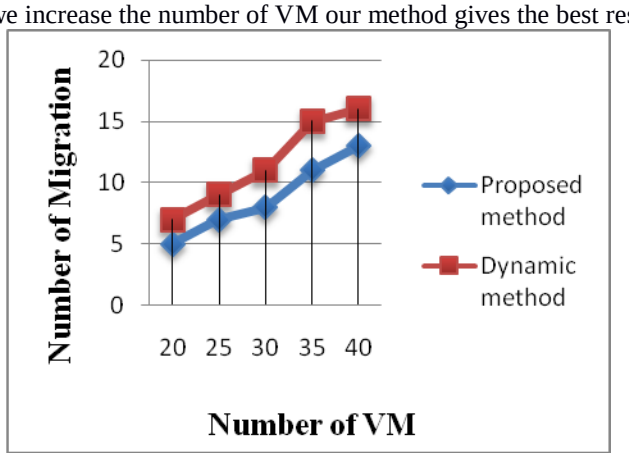

Figure-3 VM Migration

V. CONCLUSION

VM migration is the important feature of the virtualization. It can be used to reduce the energy consumption by the server consolidation and switching off idle servers. In this paper we have proposed threshold-based dynamic consolidation of VMs with auto-adjustment of the threshold values. We have evaluated the proposed algorithms on the CloudSim simulator and compare with the dynamic algorithm. The experimental results show that the proposed technique reduces the number of migration.

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