



Enhanced Energy Efficient Virtual Machine Placement Policy for Load Balancing in Cloud Environment

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ABSTRACT

Cloud computing is an emerging computing technology that uses the Internet and central remote services to maintain data and application which are provisioned on-demand and on pay-as-you-go basis. Wide adaptation of Cloud concepts has increased number of data centers worldwide resulting into significant amounts of power consumption by datacenters which affects environment and economical aspects. Through virtualization, multiple virtual machines (VM) can be deployed onto one physical machine (PM). These VMs hold and execute the Cloud workload. Efficient allocation of VMs on PM may lead to better resource utilization and result into saving in energy. In this research, we aim to provide enhanced energy efficient VM placement policy for load balancing in Cloud environment which places the VMs in such a way that hosts' overload and underload situation is addressed and maintain Service Level Agreement (SLA) between the Cloud provider and the user. In addition, we propose power aware algorithm to reduce energy consumption and achieve better load balancing.

Key Words: Cloud computing, VM Placement, Energy consumption

INTRODUCTION

Cloud computing is based on Internet that provides shared computational resources and access data on demand [1]. Cloud computing provide storage, application and services, which are available to customer on acceptance basis between provider and user. User use cloud services on pay per use. Cloud computing has three types of services such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). There are numerous advantage of Cloud's deployment model such as QoS, reliability, ease of utilization, robustness etc [2].

Virtualization technology is a backbone for working of Cloud environment [3]. In virtualization, resources are requested by user in terms of virtual machine and then provisioned on different host based on the requirement of storage, memory, bandwidth etc. [4]. Virtualization helps to increase resource utilization and decrease energy consumption. Through virtualization multiple VM can be deployed onto one physical machine [5]. Virtualization uses file abstraction to provide mapping between virtual resources and physical resources. Virtualization and abstraction applied to disk storage [6].

VM placed in different hosts based on specific criteria, such as Service Level Agreement (SLA) between Cloud provider and users [7]. The placement goal can either be increase the usage of available resources or it can be saving of power by being able to suspend some servers [8]. Allocating virtual machine to physical is NP hard problem and this problem can be solved by first-fit or best-fit method [9].

In this paper, we propose VM placement algorithm for better load balancing and reduce power consumption using power aware placement algorithm. Load balancing is the optimization technique that should be improve the performance of the system by shifting of workload among the virtual resources. So, improve the performance and increase the availability of the physical machine and maintain SLA between Cloud provider and user.

The rest of the paper is organized as follows. Section 2 discusses about related work that has been carried out in the domain over recent years. Section 3 illustrates introduction of various existing scheduling techniques. Section 4 discusses about our proposal based on VM placement. In section 5 we conclude our work subsequently listing the references.

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RELATED WORK

With increase usage of Cloud computing, the issue of energy consumed by Cloud datacenter has attracted attention of research community. Proper usage of available computing resources may assist in addressing the issue. In this section, we discuss various mechanisms which claim to reduce power consumption by various means such as efficient resource allocation, better VM placement, proper load balancing techniques etc. The virtual machine placement problem is being well advised as one of the most research issues in the direction of achieving energy efficiency in Cloud computing. There are two types of placement algorithm. First one is power based approach in which energy conservation is reduced by shutting down some servers. Second one is application QoS based approach which is based on maximizing the resource utilization.

Fu et al[7] claim that which VMs should be migrated from high utilized host and migrated VM should be directly effect on the VM migration time and it raise energy consumption for the datacenter. Authors propose VM selection policy that prefers placing a migratable VM on a host that has the minimum host utilization. For host lower utilization indicates lower performance reduction for other VM on the host due to the migration.

Ranjana et al[8] define problem of mapping of VM to physical machine and problem is solved at two stages viz. Initial placement of VMs and dynamic VM placement. Resource aware energy efficient VM placement algorithm classify the physical machine into classes based on their physical configuration and check for the appropriate class of host for the VM to be placed and select a host with minimum resource usage.

Okada et al[11] identify VM placement problem as a bin packing problem[8] and it is solved by First Fit Decreasing and Best Fit Decreasing algorithms. Authors have used PABFD (power aware best fit decreasing) algorithm based on best fit decreasing algorithm. In PABFD algorithm, authors assume that initially each host is suspended hence, every host needs to wakeup first before allocating virtual resources on it and calculate power that host had the lowest increase in power consumption.

In the proposal given by Kaur et al[12], VM is placed one by one on physical machine and the PM is checked for host stability factor. VM check threshold violation when PM has required resources for VM and if PM is below lower threshold then VM is allocated that PM.

Zheng et al[13] claim that the recent VM placement approaches are not effective for live migrations with dynamic characters. In dynamic VM placement scheme map VM on PM dynamically by calculating probability of VM on PM. Using probability calculate normalized matrix and author

decide which VM should be migrated on PM. Probability matrix is build by considering physical machine characteristics such as storage, virtualization, bandwidth.

OUR PROPOSAL

As mentioned earlier, due to the issue of heavily power consumption and CO₂ emission in Cloud datacenters, in this research, we propose a modified version of power aware best fit decreasing algorithm. The proposed approach enhances energy efficiency by minimizing number of active hosts.

In our algorithm, total number of hosts in a datacenter is bifurcated among two categories (a) Active hosts (b) Inactive hosts. Active hosts are the host which are currently being in use (host utilization is greater than zero) whereas inactive host are the host which are in sleep mode or switched off (host utilization is zero). For any VM to be placed on host, first the policy searches for suitable host from (with required resources) the list of active host having following criterion (i) Does the host have enough resource to serve the incoming VM? (ii) Does the resultant utilization exceed the preset upper threshold value after placing the VM on the host and (iii) for all found hosts, calculate the power consumption by the host after the VM placement, and select the host with least increase in power consumption. In case, the result of exploring suitable host for a VM is empty, we go for an option of making one of the inactive hosts live and add it to the list of active hosts. Above process is repeated till all the requests in terms of VMs are served on active hosts are full and there is not a single inactive host left, which can be turned off. Following algorithm illustrates the process mentioned above.

Algorithm: Modified Power Aware Best Fit Decreasing algorithm for VM placement

```

Input:ActiveHost List,
InactiveHostList, vmList
1.
2. Output: VMPlacementMap
3. sort all vm in decreasing utilization
4. for each vm in vmList do
5.   minPower <- MAX
6.   allocatedHost <- NULL
7.   // (i) Check if the utilization exceeds preset limit after VM
   Placement
8.   // And (ii) Check whether the power consumption is
   minimum
9.   for each host in listActiveHost do
10.  if host has enough resources for vm then
11.  if estimatedUtilizationHost (host, vm) < UpperThreshold
    then
12.    power <- estimateIncreaseInPower (host, vm);
13.  if (Power < minPower) then

```

```

14. minPower <- power
15. allocatedHost <- host
16. endif
17. endif
18. endif
19. endfor
20. if allocated is Null then
21. activate a random suitable host h
   from InactiveHostList
22. VMPlacementMap (vm,h)
23. ActiveHostList.add(h)
24. Else
25. VMPlacementMap(vm, allocated-
   Host)
26. endif
endifor

```

The Flowchart illustrated in Figure 1, summarizes the steps as described in an algorithm.

FLOWCHART

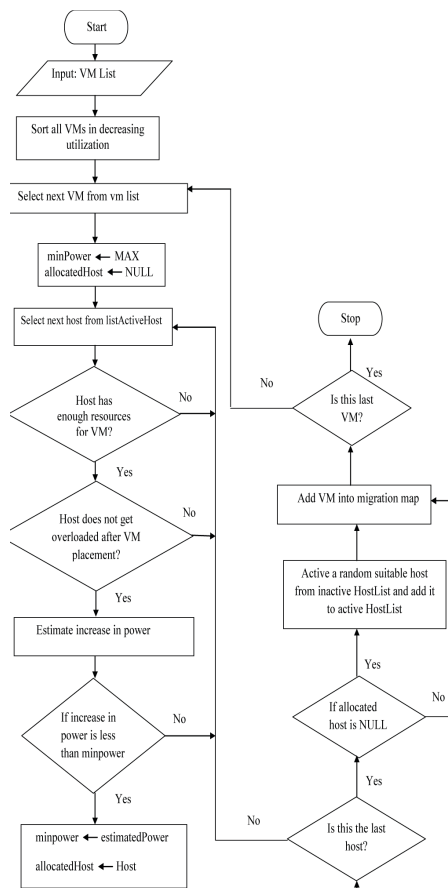


Figure 1: Flowchart of VM Placement algorithm

The proposed algorithm is only theoretically checked. In next phase of our work, we aim to implement our VM se-

lection policy on CloudSim [14] simulator and test it with real dataset provided by PlanetLab [15]. The outcome of experimentation will be compared with that of contemporary policies.

CONCLUSION

Virtual machine placement is the key challenges for service providers, when the Cloud computing growth increases. We propose modified version of power based VM placement algorithm for reduce energy consumption, better load balancing and optimized VM placement. The proposed algorithm is yet to be implemented and tested under various real-time or simulation environment, which is our forthcoming plan of action.

REFERENCES

1. P. Mell and T. Grance, "The NIST Definition of Cloud Computing," National Institute of Standard and Technology, Information Technology Laboratory 800-145, September 2011
2. R. Buyya, S. Pandey, and C. Vecchiola, "Cloudbus toolkit for marketoriented Cloud computing", International Conference on Cloud Computing, pp. 24–44, 2009.
3. C. A. Waldspurger, "Memory resource management in VMware ESX server," SIGOPS Oper. Syst. Rev., vol. 36, pp. 181–194, December 2002.
4. P. Barham, B. Dragovic, K. Fraser, S. Hand, T. Harris, A. Ho, R. Neugebauer, I. Pratt, and A. Warfield, "Xenandtheartofvirtualization," in Proceedings of the nineteenth ACM symposium on Operating systems principles, SOSP '03, (New York, NY, USA), pp. 164–177, ACM, 2003.
5. F. Hermenier, X. Lorca, J.-M. Menaud, G. Muller, and J. Lawall, "Entropy: a consolidation manager for clusters," in Proceedings of the 2009 ACM SIGPLAN/SIGOPS international conference on Virtual execution environments, VEE '09, (New York, NY, USA), pp. 41–50, ACM, 2009.
6. Smith, James; Nair, Ravi (2005). "The Architecture of Virtual Machines". Computer. IEEE Computer Society. 38 (5): 32–38. doi:10.1109/MC.2005.173
7. Xiong FU and Chen ZHOU, "Virtual machine selection and placement for dynamic consolidation in Cloud computing environment" 2015-Springer
8. R. Ranjana, S. Radha, J. Raja, "Performance study of resource aware energy efficient VM Placement Algorithm" 2016-IEEE
9. A. Beloglazov and R. Buyya, "Optimal online deterministic algorithms and adaptive heuristics for energy and performance efficient dynamic consolidation of virtual machines in Cloud data centres," Concurrency and Computation: Practice and Experience, vol. 24, no. 13, pp. 1397–1420, 2012.
10. R. Panigrahy, K. Talwar, L. Uyeda, and U. Wieder, "Heuristics for Vector Bin Packing" Technical report, Microsoft Research, 2011
11. Thiago Kenji Okada, Albert De La Fuente Vigliotti, Daniel Macêdo Batista, Alfredo Goldman vel Lejbman, "Consolidation of VMs to improve energy efficiency in Cloud computing environments" 2015-IEEE
12. Amandeep Kaur and Mala Karla, "Energy Optimized VM Placement in Cloud Environment" 2016-IEEE

13. Xinying Zheng and Yu Cai “Dynamic Virtual Machine Placement for Cloud Computing Environments” 2014-IEEE
14. R. N. Calheiros, R. Ranjan, A. Beloglazov, C. A. F. D. Rose, and R. Buyya, “CloudSim: A toolkit for modeling and simulation of Cloud computing environments and evaluation of resource provisioning algorithms,” *Software: Practice and Experience*, vol. 41, no. 1, pp. 23–50, 2011.
15. K. S. Park and V. S. Pai, “CoMon: a mostly-scalable monitoring system for Planet- Lab,” *ACM SIGOPS Operating Systems Review*, vol. 40, no. 1, pp. 65–74, 2006.