"An Effective Virtual Machine Migration Technique for Underutilized VM's"

Vandana Rana[1], Er. Simarjit Virk [2]
[1] *Bhai Gurdas Institute of Engineering and Technology, Sangrur*
[2] *Bhai Gurdas Institute of Engineering and Technology, Sangrur*
(E-mail: Vandanarana94@gmail.com*)*

Abstract— The energy efficiency has become the major demand in the field of information technology. As most of the technologies runs on the basis of the energy allotted to the devices. Thus it becomes mandatory to develop the techniques to reduce the energy consumption and to boost up the performance of the system. The cloud computing is a filed in which the energy consumption plays an important role with the perspective of VMs. The factor such as fault tolerance relies upon the concept of energy consumption. The cloud server with high energy consumption is more liable to the faults. Thus due to higher occurrence of faults the count of VM migration also increases and this manner the overall performance of the cloud server goes down.

In this work, SCD is developed to make the cloud system fault tolerant and to reduce the VM migrations. The QoS is obtained by updating the jobs assignment criteria to the VMs. The SCD allots the cloudlets on the basis of their processing and size requirements. The propose work is implemented in JAVA and the analysis of SCD, IQR-MMT, BEE-MMT, LR-MMT, MAD-MMT and COA-MMT is done. On the basis of the comparison analysis, the PDM, energy consumption and VM migration of the SCD is observed to be lower than the traditional techniques.

Keywords—*Cloud Computing, Virtual Machine Migration, Energy Consumption, Fault Tolerance.*

I. INTRODUCTION

Due to sudden increase in the internet usage within the last few years, the computing resources are universally accessible [1]. This advancement enables the realization of a novel computing concept known as cloud computing. Cloud Computing is a technology that is specifically meant to support distributed structure which works upon the centralized servers on the scalable platforms in order to fulfill the demands of users regarding the computing resources and services [2]. Cloud computing needs traditional service providers (SPs) which facilitate the services to the end users via clouds. These infrastructures and service providers direct the cloud platforms and lend the resources as per the usage [3]. The role of SP in cloud computing is to rent the resources from infrastructure providers and fulfill the requirements of the end users. A large scale companies or firms such as Google, Microsoft and Amazon etc also get indulged to the cloud computing technology [4]. In this era of information technology, where processing is offered as a utility, datacenter plays a key role to uplift the real time applications. Each and every application is linked with a Service Level Agreement (SLA) to organize the application execution levels [5]. Cloud computing is based on virtualization. The term "virtualization" refers to the framework that splits the computer resources to multiple or various execution environments by implementing one or more than one Virtual Machines (VMs) and technologies such as time sharing, hardware and software screening, biased or full machine simulation, QoS and many more [6]. The virtualization empowers the computing resources of a single Physical Machine (PMs) among various VMs ensuring execution detachments and makes it set for productive resource utilization and management. Migration is a major characteristic facilitated by the current VM technologies. It is a process in [7] which the instance of an OS is switched to another physical node without any intervention to the service providers who provides the migration OS services [8]. The objective of the migration is to provide a well organized online system maintenance, load balancing and fault tolerance in data centers. In VM migration, the processes or jobs consume resources from both the ends i.e. from which OS it is migrating and the OS to which it is going to migrate [9]. As consequences, the performance of VM in the migration and VMs existing on both the ends get affected. The process of reallocation of the VMs is known as dynamic server consolidation [10].

II. PROBLEM FORMULATION

Power consumption, Energy and Faults are considered to be crucial factors in study of cloud computing. The increment of power consumption in the infrastructure results in the generation of carbon dioxide. Cuckoo Algorithm is used for Energy awareness [11]. In Cuckoo Algorithm, cloudlet or packet of information or the job is switched from one Virtual Machine to the other VM whereas task is simulated by receiving VM along with their own packets [1]. In this way they show where the energy of sender VM is saved. The existing work is unable to meet the requirements of prioritized or critical work as they do not consider response time etc. Because while switching, if the packet is moved to VM, having low MIPS, job could not complete on time and would be considered as failed.

III. PROPOSED WORK

After having a review to the traditional work, it had come to known that the Cuckoo Search optimization technique was done to detect the over-utilized VMs. In case, if such VM was located then the VM migration had to be performed to reduce the load of the VM. The over-utilization of the host leads to the various worst consequences such as excess energy utilization, increased load onto the VM, occurrence of fault in the system due to excess load of cloudlets to the VM etc. Thus there is a requirement to develop such an approach that should have the caliber to overcome these issues and should have the feature of fault tolerance as well. In this work, such a mechanism is developed and named as Splitted Cloudlet Distribution (SCD). In SCD, the assignment of host machines is done on the basis of requirement of the cloudlets. For this purpose, first of all, the sizes of the cloudlets are measured and then the most compatible host is detected. The compatibility of host machine is evaluated on the bass of its processing capacity. Then some of the cloudlets are assigned to the most suitable host machines in order to perform the load balancing and to reduce the VM migrations. Then the leftover cloudlets are again assigned to those VMs which are allocated with the light weighted jobs or cloudlets. Hence the proposed work reduces the risk of fault unlike in traditional work, due to excess assignments of the cloudlets, the chances of faults were high and thus the cloudlets were lost in between the processing. The methodology of proposed work is as follows:

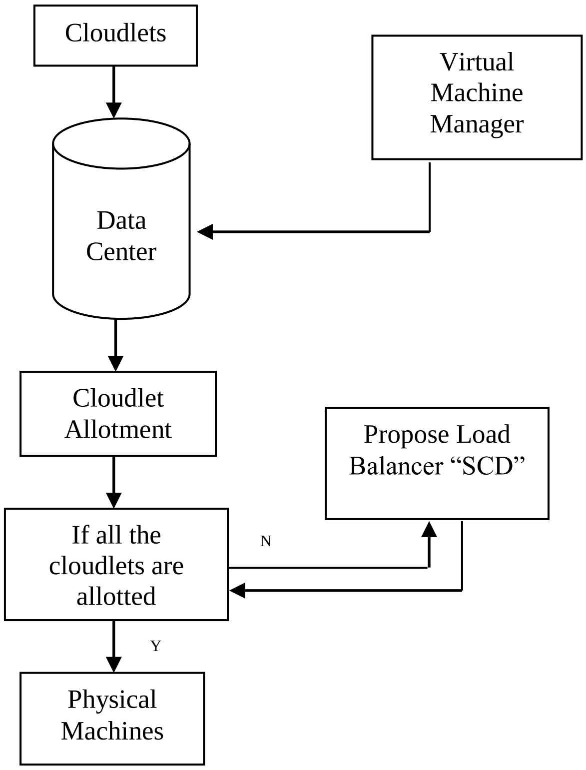

Figure 1 Framework Splitted Cloudlets Distribution

Figure 1 defines the framework of the proposed work. In first step, the cloudlets are received from the users and assigned in a queue. After this the information related to the available VMs is gathered from the VM manager and the cloudlets are entered to the data centers. The data center comprised of the information regarding coming cloudlets and available VMs. On the basis of this information, the allotment of the cloudlets and VM is performed. After assigning all the cloudlets as per the available VMs, it is evaluated whether any of the cloudlet remains unassigned. And if so, then the proposed load balancer "SCD" is applied. Then the control will again evaluate that whether any of cloudlet is left or not and this process will go on until and unless all the cloudlets are processed by the VMs.

IV. RESULTS

The proposed Splitted cloudlet distribution mechanism aims to perform load balancing and fault tolerance in an effective way to reduce the energy consumption and VM migrations. The previous section describes the working of SCD and this section organizes the results that are obtained after implementing it. The performance evaluation of SCD is done in terms of "Energy Consumption", "VM Migration" and "Performance Degradation due to Migration (PDM)". Along with this the performance of the proposed SCD algorithm is compared with the performance of traditional algorithms such as Interquartile Range- Minimum Migration Time (IQR-MMT-1.5), Median Absolute Deviation- Minimum Migration Time (MAD-MMT-2.5), local Regression-Minimum Migration Time (LR-MMT-1.2), Bee colony algorithm-Minimum Migration Time (BEE-MMT) and COA-MMT.

The graph in figure 2 displays the comparison analysis of traditional and proposed techniques in the terms of energy consumption. The energy consumption of IQR-MMT-1.5 is 117.08 KWH, MAD-MMT-2.5 is 114.27 KWH, LR-MMT-1.2 is 116.71 KWH, BEE-MMT is 85.84 KWH, COA-MMT is 19.95 KWH and for Propose-MMT is 9.3 KWH.

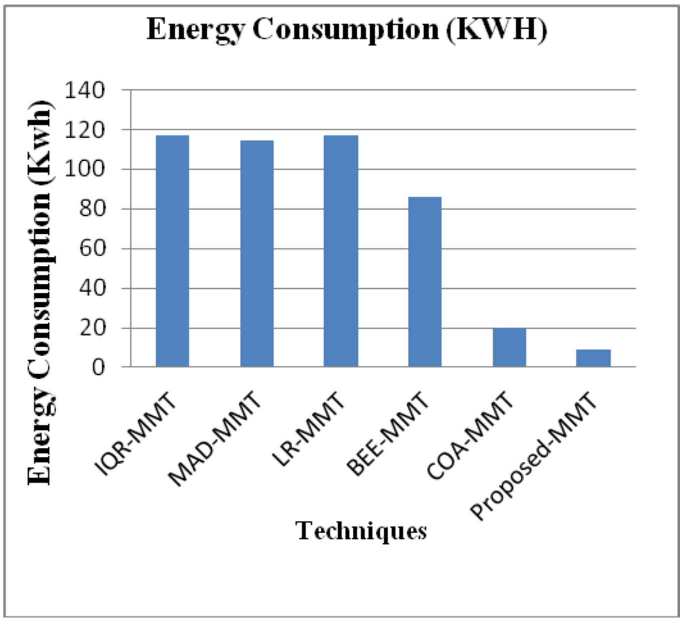

Figure 2 Comparison Analysis of Energy Consumption

Hence on the basis of the observations it is proved that the proposed technique consumes less energy in comparison to the traditional techniques.

The graph in figure 3 delineates the VM migration of traditional and proposes work. The x axis in the graph shows the various techniques and the y axis calibrates the data for count of Migration. The number of VM migration should be low in order to achieve the high QoS. The graph explains that the highest number VM migrations is performed by IQR-MMT technique and the least migrations are performed by propose work i.e. 0.18. Thus from the perspective of VM migration, the propose SCD technique outperforms the traditional techniques.

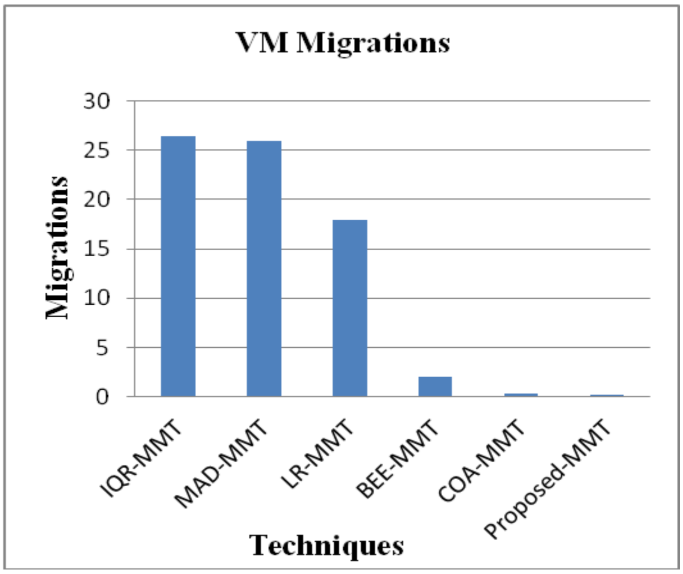

Figure 3 Comparison Analysis of VM migrations

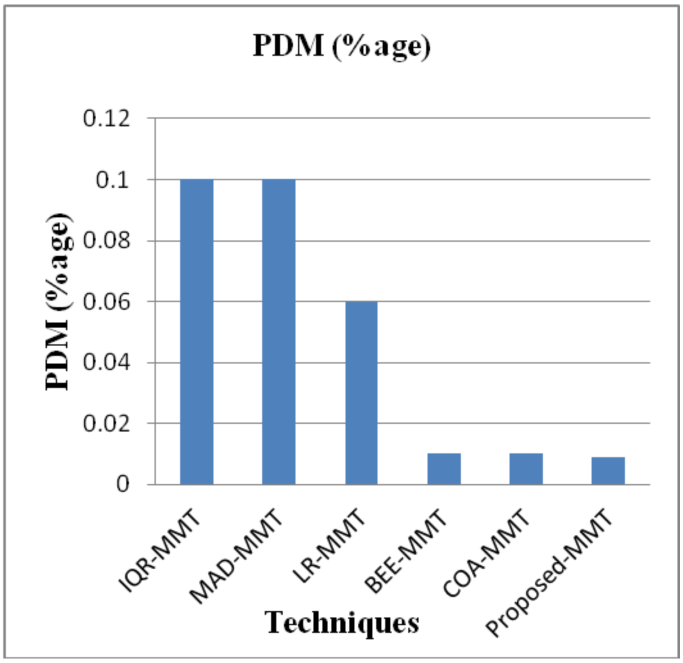

Figure 4 Comparison Analysis of VM migrations

The PDM of proposed work and traditional work is analyzed in graph shown in figure 4. The PDM is a parameter that refers to the Performance Degradation due to Migration. As the name defines, the PDM of a system should be low. If the PDM is high then the system did not considered as an ideal system. The facts that are obtained from the graph describes that the PDM of IQR-MMT, MAD-MMT is 0.1%, LR-MMT is 0.06, BEE-MMT, COA-MMT is 0.1 and for propose work is 0.009. Therefore it can be said that the lowest PDM of proposed work proves it more effective and efficient than the traditional techniques.

V. CONCLUSION

VM migration is a process, in which the VMs are migrated or switched to other idle VM to complete the allotted task. In order to develop an efficient and effective cloud computing architecture it is mandatory that the allotment of jobs should be done in such a way that the overall performance of the system should enhance. The load balancing and fault tolerance mechanism effects the VM migration.

In this study, it is concluded that if the energy consumption, VM migration and Fault Occurrence can be reduced by changing the cloudlet assignment criteria. As in SCD, firstly the cloudlets are assigned to the VMs on the basis of the size and processing cycles of the cloudlets. The most suitable VM to the Cloudlets size and processing requirements is allotted to the respective cloudlets. Then the leftover cloudlets are splitted and allotted to the idle VM. Thus in this manner it is observed that the PDM, Energy Consumption and VM migration of SCD is 0.009%, 9.3 KWH and 0.18.

In future, there is a possibility to improve the present work by increasing the number of VMs in the cloud server. If the number of available VMs is higher, then this can lead to the reduction of time consumed and cycles required to process a job.

REFERENCES

[1]. M.Yakhchi, S.M. Ghafari, S. Yakhchi, M. Fazeli, A. Patooghi, "Proposing a load balancing method based on cuckoo optimization algorithm for energy management in cloud computing infrastructures", IEEE 8th international conference on cloud computing, 2015.

[2]. K. Park, V. S. Pai, "CoMon: a mostly-scalable monitoring system for PlanetLab," ACM SIGOPS Operating Systems Review, vol. 40, pp. 65-74, 2006.

[3]. A. Beloglazov, R. Buyya, "Optimal Online Deterministic Algorithms and Adoptive Heuristics for Energy and Performance Efficient Dynamic Consolidation of Virtual Machines in Cloud Data Centers," Concurrency And Computation: Practice And Experience-Wiley, vol. 24, pp. 1397-1420, 2012.

[4]. R. N. Calheiros, R. Ranjan, A. Beloglazov, C. A. F. De 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-Wiley, vol. 41, pp. 2350, 2011.

[5]. A. Beloglazov, J. Abawajy and R. Buyya, "Energy-aware resource allocation heuristics for efficient management of data

centers for Cloud computing," Future Generation Computer Systems-ELSEVIER, vol. 28, pp. 755768, 2012.

[6]. M. Mesbahi, A.M. Rahmani, A.T. Chronopoulos, "Cloud light weight: A new solution for load balancing in cloud computing," International Conference on Data Science & Engineering (ICDSE), Kochi, 2014.

[7]. S. M. Ghafari, M. Fazeli, A. Patooghi, L. Rikhtechi, "Bee-MMT: A Load Balancing Method For Power Consumption Management in Cloud Computing," in sixth international conferance on contemporary computing (IC3), Noyda, Dehli, 2013.

[8]. Z. Zhang, C.C. Hsu, M. Chang, "CoolCloud: A Practical Dynamic Virtual Machine Placement Framework FFor Energy Aware Data Centers," IEEE 8th international conference on cloud computing, 2015

[9]. R. Rajabioun, "Cuckoo Optimization Algorithm," Applied Soft Computing vol. 11, pp. 5508-5518, 2011

[10]. Y. Sahu, R.K. Pateriya, R.K. Gupta, "Cloud Server Optimization with Load Balancing and Green Computing Techniques Using Dynamic Compare and Balance Algorithm," 5th International Conference on Computational Intelligence and Communication Networks (CICN).

[11]. D. Poola, S.K. Garg, R. Buyya, Y. Yang, K. Ramamohanarao, "Robust Scheduling of Scientific Workflows With Deadline and Budget Constraints in clouds, IEEE 28TH International conference on Advanced Information Networking and Applications, 2014.