A Load Balancing and Management Approach with Effective Resource Utilization in Cloud Computing

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Abstract— The cloud computing is a field in which the resource constrained VMs are utilized for processing the upcoming cloudlets. There are various factors that influence the job allocation process. This study introduces a novel approach E-VM-FT and E-VMG-FT for scheduling the process of the job assignment to the available cloudlets at the cost of minimum energy consumption and VM migration. For achieving the purpose, the job assignment to the VM is done by matching the processing requirements of the job to the processing capability of the VMs. For initializing the job allocation, firstly, the VMs are arranged in a sorted order and E-VM-FT is applied. In case if any cloudlet is found to be leftover due to its processing requirements, then the particular cloudlet is divided into modules and allotted to the VMs on the basis of the availability of the VMs. But in case if there is no availability of VM then the request for creating new VM is generated to the server and the new will be generated if and only if there is an availability of the space on cloud server for handling the new VM. After implementing the proposal it is observed that the "E-VM-FT" and "E-VMG-FT" consumes less energy consumption and perform minimum VM migrations in comparison to the other traditional techniques.

Keywords—Cloud Computing, Virtual Machine Migration, Energy Consumption, Resource Utilization.

I. INTRODUCTION

The Cloud computing may be described as technique of computing that depends on sharing of different resources instead of having the personal devices in order to operate various applications [1]. In grid computing technique the unprocessed cycles of different computers in the network are utilized in order to resolve the issues of any individual operating device. The word 'cloud' in cloud computing process is compared to the 'internet'. Therefore cloud computing is expressed as internet oriented computing process. In this, different services like memory unit, servers and various applications are provided to computer and multiple devices of an institute with the help of internet service [2]. The main objective behind the cloud computing process is to implement the ordinary supercomputing so that optimum performance of computer can be achieved. This process is mostly used in military purpose or in research field so that trillions of operations can be executed in one second especially in end user based applications like in financial portfolios, to transfer the personal data, to provide memory unit for storing the information, etc [3].

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 [4] consumption and to boost up the performance of the system. The cloud computing is a field 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 [5]. 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 [6].

II. PROBLEM FORMULATION

In the domain of cloud computing, consumption of power, energy and fault are the primary parameters which require consideration. With the increment in power consumption, infrastructure generates carbon dioxide. In order to reduce this consumption, cuckoo optimization algorithm has been introduced for energy awareness. In this algorithm, cloudlet or particular job is switched from one Virtual Machine to other Virtual Machine where task is simulating by receiving VM along with their own packets. Considering this way, energy of the sender Virtual Machine is saved. The existing work is unable to meet with the requirement of critical work as response time is not considered etc. Moreover, if a particular task switch to a VM with low MIPS then job cannot be completed on time and termed as failed.

III. PROPOSED WORK

The primary focus of the proposed work is to present much effective method in view of managing under load hosts. After having a review to the existing techniques of VM migration in cloud computing, it has been evaluated that the classical mechanism perform job allocation on the random basis due to which the resources were not utilized efficiently. Thus in order to perform efficient resource utilization with the lesser count of VM migration; a novel approach has been performed under this work. The proposed technique works on the basis of two different criteria as follows:

a. E-VM-FT (Enhanced Virtual Machine based Fault Tolerance): In this mechanism the job allocation is done on the basis of the size of the cloudlet and VM. The cloudlet of heavy size is allotted to the VM which has the capability to process the heavier job and so on. For this purpose the available VMs are sorted in an increasing order. The ordering of the VMs is done on the basis of the available resources of the VMs. Then the job assignment is performed.

b. E-VMG-FT (Enhanced Virtual Machine Generation based Fault Tolerance): Under this mechanism, the initial job assignment is done in the similar manner as in E-VM-FT. but this mechanism is specifically designed to handle the exceptional case. The case such as suppose

all the VMs are occupied with the cloudlets for processing and some of the cloudlets remains un-allotted due to unavailability of the VMs. Then the leftover cloudlet is divided into categories. The cloudlet with high processing requirement is allotted to the VM having short or light weight jobs and so on. But in case if after portioning the cloudlet, the size of divided cloudlet becomes heavier and no suitable VM is located for processing the corresponding, then the user have an access to file a request to the cloud server to create a new VM. A new VM will be created If and only if there is an availability of the st5orage on the cloud. After creating a new VM as per the higher requirement of the cloudlet, the job is assigned to it.

Thus in this manner, the reduction in count of VM migration, delay for job processing is reduced by using the proposed mechanism. The methodology for proposed work is as follows:

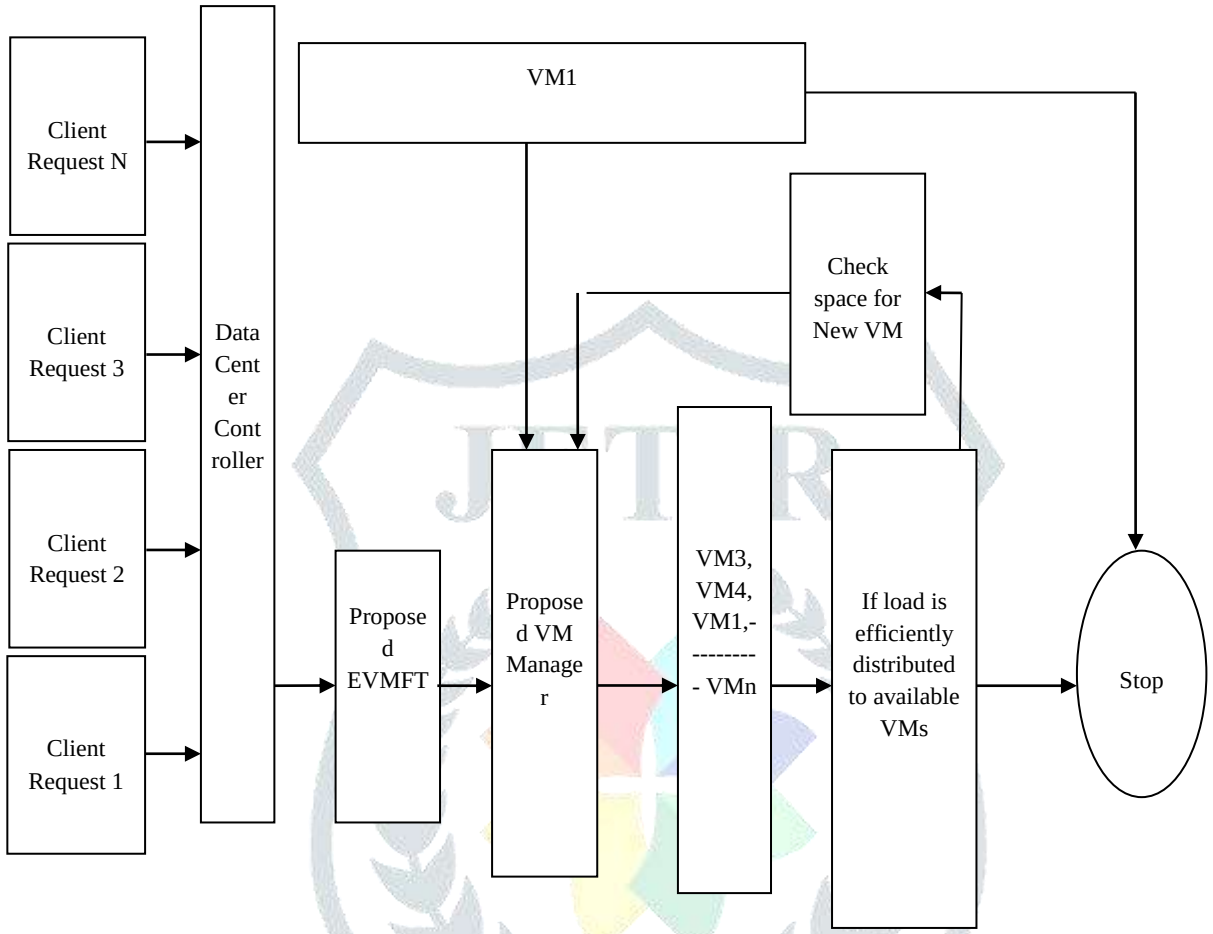

Figure 1 Framework of Propose Work

1. Initial step is to collect client requests in form of cloudlets to process.
2. Next to request there is data center controller which get requests, the data center work as the distribution of the requests or cloudlets to the VMs.
3. Data center is connected to the proposed model developed for the load management and fault tolerance.
4. The proposed model block have 3 major sections
    a. Proposed EVMFT
    b. Proposed VM manager
    c. Proposed EVMGFT
5. The working of the EVMFT is to check that available Vms and their processing of the cloudlet according to the capability of individual machine the effective allotment is done
6. If any cloudlet is large in size and not able to process as it is the proposed model break the cloudlet into sections
7. Once cloudlet is split into sub sections second module start working in which the VM manager is there
8. The VM manager analysis the real time load of the VMs and sort them according to capacity to handle new load
9. Then allot the load to the sorted list of VM
10. Again the rechecking of the load and allotment list is done, is still cloudlet is not allotted to any VM the 3rd section starts working
11. EVMGT is VM generation module, it send request to the VM manager to check the space availability for new VM, if it is available a new VM is generated and the pending cloudlet is processed by the new VM.
12. Else if no space is available this is an exception and cloudlet need to wait and processed once machine get free.
13. The proposed model finalize the VM allotment list effectively to avoid fault in real time processing of the cloudlets.

IV. RESULTS

This study develops a novel approach for processing the cloudlets by using available VMs. The objective of this work is to reduce the VM migration, delay in job processing and to utilize the available resources in an efficient manner. The performance of the proposed work is evaluated in the terms of energy consumption, time consumed for processing and VM migration.

The graph in figure 2 depicts the time consumed by E-VM-FT mechanism for processing the 5 cloudlets. The x axis in the graph mentions the cloudlets and y axis depicts the time consumed by VMs to process the cloudlets.

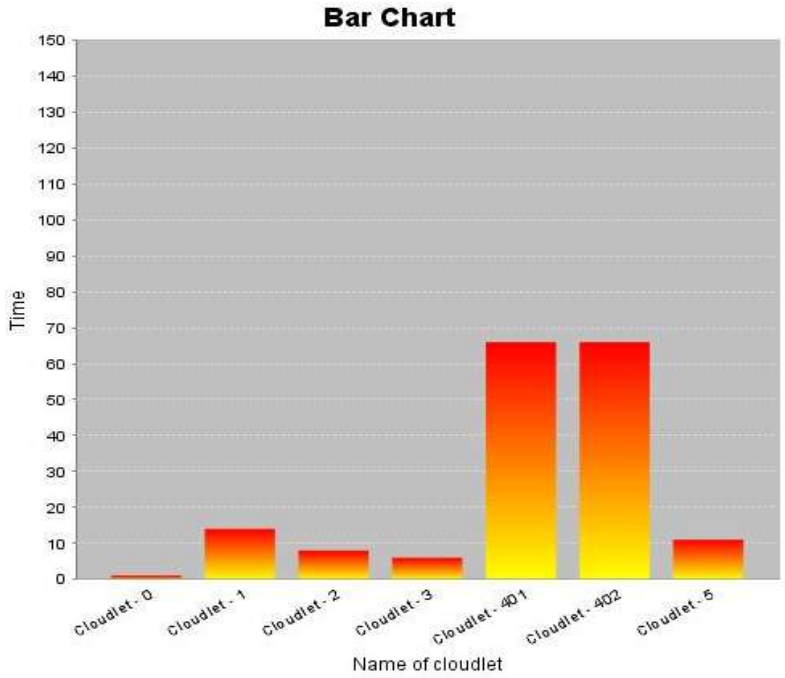

Figure 2 Time consumed for cloudlet processing by using "E-VM-FT"

On the basis of the graph below, it is observe that there are total 5 cloudlets in the system. Out of the 5 cloudlets, cloudlet 0, cloudlet 1, cloud 2, cloudlet 3 and cloudlet 5 is processed individually by different VMs respectively. Only the cloudlet 4 is divided into two cloudlets as cloudlet 401 and cloudlet 402.These cloudlets are allotted to two different VMs. The graph defines that cloudlet 0 consumes less time for processing and cloudlet 401 and cloudlet 402 consume higher amount of time for processing.

Similarly, the graph in figure 3 defines the time consumed for job processing by "E-VMG-FT". In this graph it is delineated that there are total 5 cloudlets out of which the cloudlet0, 1, 2 and 3 is processed normally without subdividing them but the cloudlet 4 and 5 needs to process with highly efficient and capable VM. As the cloudlet4 and cloudlet 5 is heavier in size. Thus the new VM is created to process the cloudlet 5 i.e. cloudlet 501 and cloudlet 502. The graph proves that the cloudlet 501 and 502 consumes the higher amount of time.

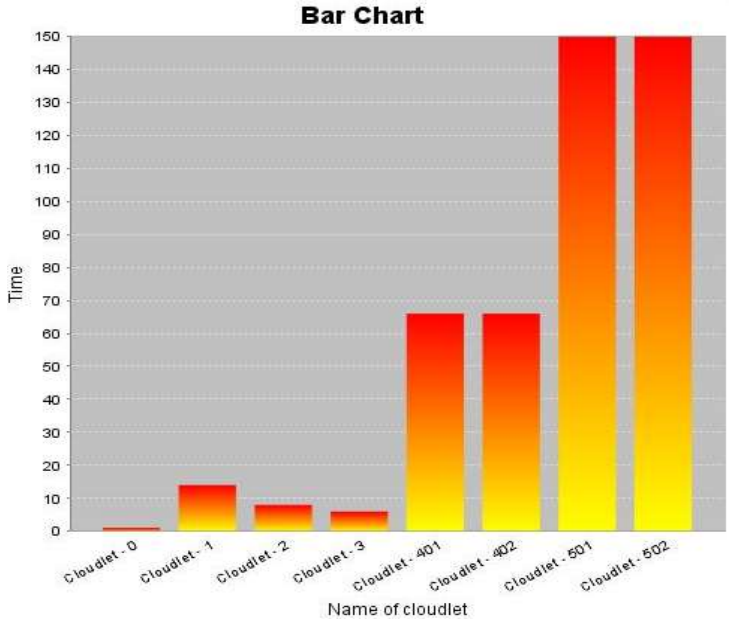

Figure 3 Time consumed for cloudlet processing by using "E-VMG-FT"

The energy consumption has become the major concern for each and every field today. Therefore, in cloud computing it also plays an important role from the perspective of available resources and data transmission. The graph in figure 4 is derived for evaluating the energy consumption of traditional techniques and proposed techniques. For this purpose, the traditional IQR-MMT, MAD-MMT, LR-MMT, BEE-MMT and COA-MMT are considered.

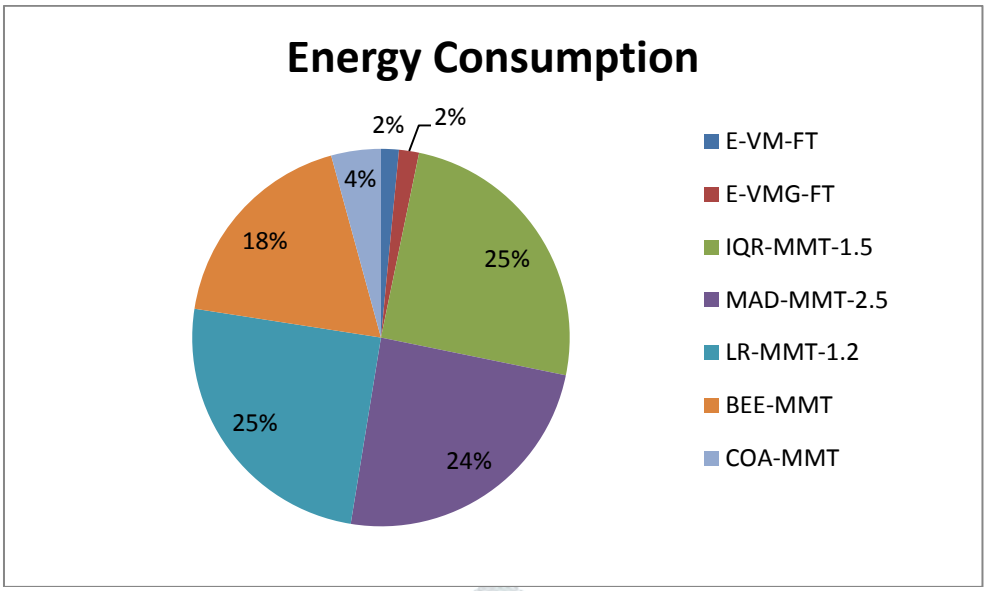

Figure 4 Comparison Analysis in terms of "Energy Consumption"

The graph makes it sure that the energy consumption of proposed work i.e. "E-VM-FT" and "E-VMG-FT" is lower i.e. 2% in both of the cases in contrast to other traditional techniques. The highest amount of energy is consumed by the IQR-MMT mechanism i.e. 25%.
The graph in figure 5 defines the comparison of proposed work and traditional work in the terms of VM migration. The VM migration refers to the switching of VMs for completing the execution of a job. The highest values of VM migration in the cloud lead to the lower performance of system. On the basis of the graph it is obtained that the traditional IQR-MMT mechanism has highest VM migrations whereas the proposed work has 0% VM migrations.

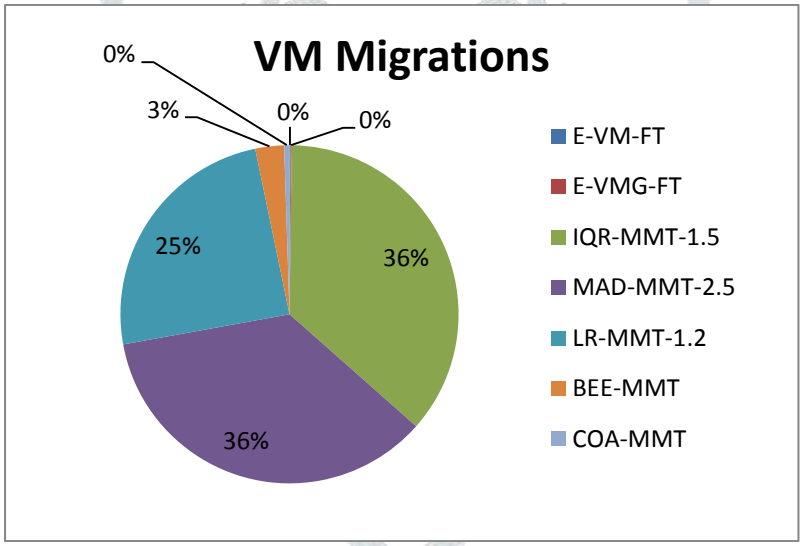

Figure 5 Comparison Analysis in terms of "VM Migrations"

The facts and figures observed from above graphs are defined in the following tables for proving the efficiency of proposed work over traditional techniques. Table 1 shows the comparison of "E-VM-FT" and E-VMG-FT in the terms of Energy Consumed, VM migration, SLATAH, PDM and SLAV. The facts in the table 1 prove that the E-VMG-FT has better results than E-VM-FT technique. Similarly, table 2 and 3 delineate the comparison of proposed and traditional techniques.

Table 1 Comparisons of "E-VM-FT" and "E-VMG-FT"

Parameters	E-VM-FT	E-VMG-FT
Energy Consumed	7.16	8.055
VM Migrations	0.072	0.081
SLATAH	17	99
PDM	0	0
SLAV	0	0

Table 2 Comparisons of "E-VM-FT" and traditional techniques

Parameters	E-VM-FT	IQR-MMT-1.5	MAD-MMT-2.5	LR-MMT-1.2	BEE-MMT	COA-MMT
Energy Consumed	7.16	117.08	114.27	116.71	85.84	19.95
VM Migrations	0.072	26.42	25.92	17.9	2	0.368
SLATAH	17	5.08	5.25	4.03	80.85	55.28
PDM	0	0.1	0.1	0.06	0.01	0.01
SLAV	0	5.14	5.18	2.52	6.45	5.22

Table 3 Comparisons of "E-VMG-FT" and traditional techniques

Parameters	E-VMG-FT	IQR-MMT-1.5	MAD-MMT-2.5	LR-MMT-1.2	BEE-MMT	COA-MMT
Energy Consumed	8.055	117.08	114.27	116.71	85.84	19.95
VM Migrations	0.081	26.42	25.92	17.9	2	0.368
SLATAH	99	5.08	5.25	4.03	80.85	55.28
PDM	0	0.1	0.1	0.06	0.01	0.01
SLAV	0	5.14	5.18	2.52	6.45	5.22

V. CONCLUSION

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 proposed work, firstly the cloudlets are assigned to the VMs on the basis of the size and processing requirements of the cloudlets as well as VMs. The most suitable VM to the Cloudlets size and processing requirements is allotted to the respective cloudlets and so on. Then the leftover cloudlets are splitted and allotted to the idle VMs. Another criteria that is considered in this mechanism is that what to do when the size of the remaining cloudlet is bigger in comparison to the available VMs then the cloud let is divided and a new request is created to the server for the formation of new VM. The VM will be created if and only if the enough storage space is available on the server for creating a new VM. The obtained results defined that the VM migration and energy consumption is lower in proposed work in contrast to the traditional techniques. In future the proposed work can be enhanced by implementing the cloud data pre-processing methods. Along with this the speed of processing the jobs by the VMs can also be considered as a factor for improvement.

REFERENCES

[1] Vig A, Kushwaha S.R, 2016. An Efficient Distributed Approach for Load Balancing in Cloud Computing, Computational Intelligence and Communication Networks (CICN), 2015 International Conference.

[2] Sidra A, Shah. Ali.M.2016.Load balancing algorithms in cloud computing: A survey of modern techniques, Software Engineering Conference (NSEC), 2015 National.

[3] Panwar R, Mallick B.2016. Load balancing in cloud computing using dynamic load management algorithm, Green Computing and Internet of Things (ICGCIoT), 2015 International Conference.

[4] Sharma A, Poduju. K.S.2014. Response time based load balancing in cloud computing, Control, Instrumentation, Communication and Computational Technologies (ICCICCT), 2014 International Conference.

[5] Sreenivas V.2014. Load balancing techniques: Major challenge in Cloud Computing - a systematic review, Electronics and Communication Systems (ICECS), 2014 International Conference.

[6] Dhakad V.K., Sahram L.2012. Performance Analysis Of Round Robin Scheduling Using Adaptive Approach Based On Smart Time Slice And Comparison With SRR, International Journal of Advances in Engineering & Technology, 2, Pp. 333-339.

[7] Shoaib M, Farooqui M.Z.2014. A Comparative Review of CPU Scheduling Algorithms, Proceedings of National Conference on Recent Trends in Parallel Computing.

[8] Maniyar B J. 2015. Review On Round Robin Algorithm For Task Scheduling In Cloud Computing, International Journal of Emerging Technologies and Innovative Research, 2(3), Pp. 788-793.

[9] Saranya D.2015. Load Balancing Algorithms in Cloud Computing: A Review, International Journal of Advanced Research in Computer Science and Software Engineering, 5(7), Pp. 1107-1111.

[10] Kashyap D.2014. A Survey of Various Load Balancing Algorithms in Cloud Computing, International Journal Of Scientific & Technology Research, 3(11).

[11] Katyal M. 2013. A Comparative Study of Load Balancing Algorithms in Cloud Computing Environment, International Journal of Distributed and Cloud Computing , 1(2), Pp. 5-14.

[12] Kumar S.2015. Various Dynamic Load Balancing Algorithms in Cloud Environment: A Survey, International Journal of Computer Applications, 129(6), Pp. 14-19.