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An Efficient Hybrid Load Balancing Method (HLBM), Based on Data Correlation and Dynamic Resource Allocation for Cloud Computing

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***Abstract:** In this current scenario computer technologies are getting change day by day. The cost computing resources are extremely higher and it is quite difficult to upgrade hardware's over software's. It user are demanding for a more innovative technology, which provides optimum utilization of computing resources and cloud computing is one of them. Cloud computing technology mainly focuses on "sharing of computing resources", among companies, industries, organizations and individuals. Cloud computing reduce cost of ownership, it serves computing resources such as software, data, platform and infrastructure as a service. It serves computing resources to all the available members on "Pay per uses" basis. This idea makes cloud computing more popular and reliable among computing users. A cloud user can use a dedicate service without warring about infrastructure. This new logic increases higher number of cloud users. On cloud day by day computing resources are getting increases. So it is challenging task for cloud service providers so serve computing resources to each of the cloud user (private, public and hybrid) without any failure. Load balancing methods play an important role in resource allocation among various cloud users. Load balancing is a process of reallocating a task from overloaded machine to an under loaded VMs. An efficient load balancing method is always challenging and demanding for cloud computing researchers.*

In this paper an efficient hybrid load balancing method (HLBM) is proposed. Proposed HLBM method works in two phases. In phase one a data correlation strategy is created between virtual machines and data. This correlation strategy helps in migration of data or task on resources and solves the problem of correlation of the data disposed. First phase uses time shared strategy. Second phase of the HLBM method focused on dynamic resources (VMs) allocation to user request according to their need. Second phase mainly focused space shared strategy. In this phase VMs and are arranged based on their respective capacity and processing speeds and it allocates the cloud-lets to resources as per their need and data correlation on Proposed HLBM method and existing load balancing method Throttled, Round Robin are implemented over Cloud-Sim and Cloud Analyst simulator and various performance measuring parameters are calculated. An experimental study clearly shows that proposed HLBM performs outstanding in terms of load distribution, total execution time, waiting time and response time.

Key words: Cloud Computing, Load balancing, Data correlation, HLBM, Efficient resource allocation, and Cloud performance

I. INTRODUCTION

In recent years cloud computing emerge as a new model for constructing, manipulating, and accessing big scale distributed computing applications over the internet. Remarkable usage of internet has made vast data on the network, without compromising on the routine of network; the Cloud users must get finest services. Load Balancing is necessary for competent operations in distributed environments. Since Cloud Computing is growing quickly and clients require further services and improved results, Cloud load balancing has turn out to be a very interesting and essential research area [7]. Numerous algorithms were proposed to give proficient mechanisms and algorithms for allocating the client's requests to existing Cloud nodes. These kinds of methods intend to improve the overall performance of the Cloud and give extra satisfying and effective services to the user. Through this chapter, we explore the various algorithms proposed to determine the load balancing and task scheduling issues of Cloud Computing. We investigated these algorithms, to provide an outline of the recent approaches in this field.

Cloud computing is one of the best technology in the decade. Several companies are seeking to implement and establish clouds, because of its easy and flexible design. These end result in the growing number of Cloud users getting cloud. Even though clouds are divided in public private and hybrid models but still reliability issue may arise in these clouds. Cloud models utilize virtualization technology; this technology facilitate in slicing a single DC (data centre) or high power server to perform as several machines [11].

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A. Load Balancing In Cloud Computing

Load balancing able to be either centralized or decentralized. Load Balancing algorithms are used for implementing. Nowadays cloud computing is a set of numerous data centers which are sliced into virtual servers and located at different geographical location for providing services to clients. The current system does have these polices of load balancing , but still the effectiveness of these algorithms are considered and presented to discover the best suited algorithm for load balancing of virtual servers. Following challenges and opportunities are available in field on cloud computing.

CHALLENGES	OPPORTUNITY
Information sharing	Data and information shares insecurely over the network.
Interoperability	Lack of standards for service portability between Cloud providers.
Security and Privacy	Lack of improved techniques in authorization and authentication for accessing the Cloud users information
Resiliency	The ability of the system to provide Cloud users with standard level of services while experiencing faults and challenges in the system.
Reliability	The chance of failure in standard period of time.
Energy saving	Defining a standard metric for effective power usage and an efficient standard of infrastructure usage.
Resource Monitoring	Lack of accurate monitoring mechanism using sensors to collect the data from CPU load, memory load and etc.
Load Balancing	Lack of standard way of load monitoring and load management for different Cloud applications.

Load balancing works in the way to decide which virtual machine is in stable state while which virtual machine will go on hold. Load balancing facilitate in reducing the bandwidth usage which results in decreasing the rate of machine and to get the most out of the services offered by the service providers. The arrival of load can affect some server to be overloaded while other servers possibly idle or under loaded. Uniformly distributing the load improves the performance of the cloud by transferring load from the overloaded server. Well-organized scheduling and efficient resource allotment is a characteristic of cloud model based on which the system's performance is considered. These characteristics have resulted on cost optimization, which can be then achieved by improving the response time and processing time.

II. PROBLEM STATEMENT

Cloud computing reduce cost of ownership, it serves computing resources such as software, data, platform and infrastructure as a service. It serves computing resources to all the available members on "Pay per uses" basis. This idea makes cloud computing more popular and reliable among computing users. A cloud user can use a dedicate service without warring about infrastructure. This new logic increases higher number of cloud users. On cloud day by day computing resources are getting increases. So it is challenging task for cloud service providers so serve computing resources to each of the cloud user (private, public and hybrid) without any failure. Load balancing methods play an important role in resource allocation among various cloud users. Load balancing is a process of reallocating a task from overloaded machine to an under loaded VMs. An efficient load balancing method is always challenging and demanding for cloud computing researchers. Existing load balancing methods have following issues-

A. Higher response time
B. Higher Migration time
C. Poor throughput
D. Poor performance
E. Poor resource utilization

III. PROPOSED EHLBM ALGORITHM

In this paper an efficient hybrid load balancing method (EHLBM) is proposed. Proposed EHLBM method works in two phases. In phase one a data correlation strategy is created between virtual machines and data. This correlation strategy helps in migration of data or task on resources and solves the problem of correlation of the data disposed. Second phase of the EHLBM method focused on dynamic resources (VMs) allocation to user request according to their need. In this phase VMs and are arranged based on their respective capacity and processing speeds and it allocates the cloud lets to resources as per their need and data correlation.

PROPOSESD EHLBM	Phase-1 Data Co relation • Helps in Migration of data • Creates Correlation between VMs and Cloud lets
	Phae-2 Dynamic Resource Allocation • Allocates user request as per their need and VMs capacity

A. Algorithm for Proposed EHLBM-

1) *Input*- Virtual Machines (VM1……VMn), Cloudlets, server, storage, Queue
2) *Output*-Higher throughput, less waiting time, better resource allocation and performance
3) *Phase-1:* Data Correlation Phase-
4) *Step-1* Calculates data correlation factor-

a) *Correlation factor is* calculated by-

$$DC\ (VMi, DGi) = (\ C^{DI}_{VMi,\ DGi} - C^{DO}_{VMi,,\ DGi}\ )$$

Where- DC (VMi, DGi) - Data correlation between machine and data group

$C^{DI}_{VMi,\ DGi}$ - The Overhead of communication between VMs and the inner group of data

$C^{DO}_{VMi,,\ DGi}$ - The overhead of communication between the virtual machines and the data Out of the group.

b) *Calculates the data load-*

$$L^{w}\ (Di) = \sum^{n}_{i=1} L^{w}_{1} \text{------------------------} L^{w}_{n}$$

c) *Calculates threshold task-*

$$Task\_th = \sum^{n}_{i=1} L^{w}\ (Di)\ \ / n$$

d) *Call data_Corealtion( )*

e) *Repeat steps 1.2 to 1.4*

B. Step-2 Dynamic resource allocation phase-

1) Sort virtual machines in descending order according to MIPS (million instructions per Second
2) Sort cloudlets in descending order according to length (million instruction
3) 3 Take the mid-point of sorted cloudlets list and sorted virtual machines list.Midc = (Number of cloudlets) / 2 Midv = (Number of VM's) / 2
4) Divide the Vm list in two equal parts as:
5) [VM1 VM2…VMmidv] [VMmidv + 1 …VMnDivide the Cloudlet list in two equal parts as:
   [C1 C2…Cmidc] [Cmidc + 1 …Cn
6) Repeat the step-3 to step-6 till we have at most one virtual machine or cloudlet in the list.
7) Map first group of cloudlets to first virtual machine & other group of cloudlets to corresponding group of virtual machines.
8) Call data Call data_Corealtion( )
9) Step 3:- Repeat Steps 1 and 2 till queue having data
10) Step 4:- End

IV. SIMULATION RESULTS

Implementation of proposed method and existing method is done by using Cloud-Sim3.1 simulator, cloud analyst and Java language is used as a programming language.

A. Performance comparison parameter

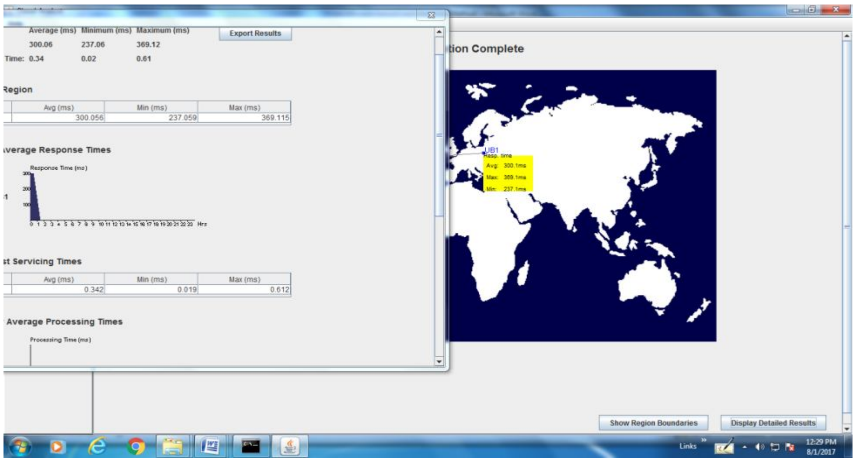
For performance comparison in between proposed and existing method following parameters are used. Each parameter are calculated secretly for both methods (proposed and existing)Performance metrics for the cloud scheduling algorithms are based on following factors-

1) *Average waiting time*- Waiting time is defined as how long each process has to wait before it gets it's time slice.
2) *Average response time*- It is the amount of time taken from when a process is submitted until the first response is produced [15]. Average response times for each algorithm have decreased by increasing the number of CPUs.

3) *Make span*- Make span can be defined as the overall task completion time. We denote completion time of task Ti on VMj asCTij

Make span=max {CTij | i ∈ T, i = 1, 2 . . . n and j ∈VM, j ∈1, 2 . . . m}

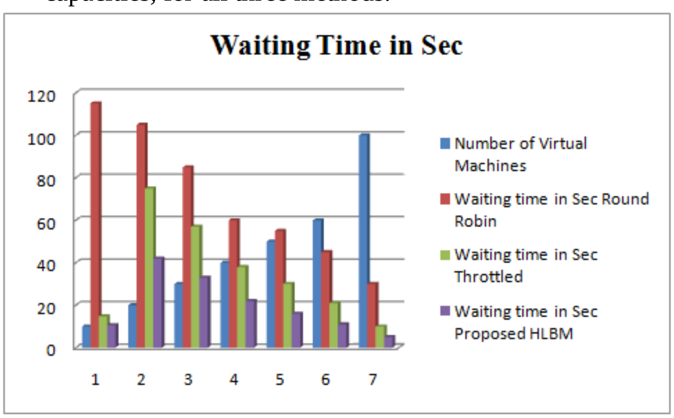
4) *Performance*- It is the overall efficiency of the system. If all the parameters are improved then the overall system, performance can be improved.



B. Result Comparison and analysis-

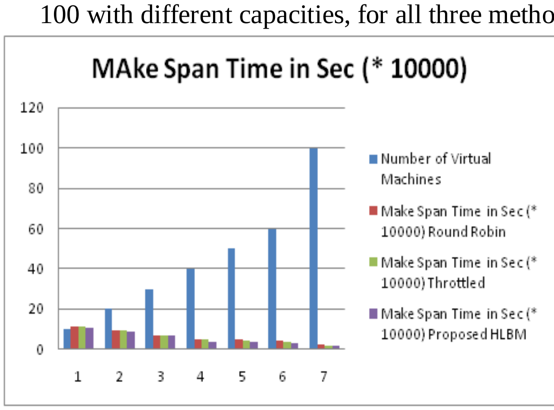
For comparison of proposed HLBM and existing Round Robin method, Throttled method following parameters are calculated-

1) *Average Waiting Time*- Task completion time is calculated for various virtual machines from 10 to 100 with different capacities, for all three methods.



Number of Virtual Machines	Waiting time in Sec		
	Round Robin	Throttled	Proposed HLBM
10	115	14.78	10.65
20	105	75	42
30	85	57	33
40	60	38	22
50	55	30	16
60	45	21	11
100	30	10	5

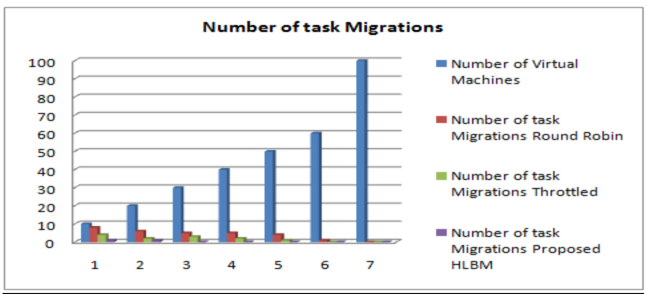
2) *Task overall Completion time or Make Span time*- Task completion time is calculated for various virtual machines from 10 to 100 with different capacities, for all three methods.



Number of Virtual Machines	Make Span Time in Sec (* 10000)		
	Round Robin	Throttled	Proposed HLBM
10	11.5	11.2	10.8
20	9.8	9.4	9.2
30	7.2	7.1	6.8
40	5.15	4.98	4.1
50	4.78	4.25	3.85
60	4.4	4.1	3.1
100	2.5	2.2	1.98

3) *Number of task migration*- The task migrations is very minimal in the HLBM algorithm due to extensive static and dynamic scheduler algorithm in identifying the most appropriate VM to each of the jobs.

Number of Virtual Machines	Number of task Migrations		
	Round Robin	Throttled	Proposed HLBM
10	8	4	1
20	6	2	1
30	5	3	0
40	5	2	0
50	4	1	0
60	1	0	0
100	0	0	0



4) *Performance Comparison*-Performance of any load balancing method is depending on its results. In this experiment proposed HLBM and existing methods. Table 5.2.4 clearly shows that proposed method performs outstanding in terms of make span time, migration of task and waiting time over existing methods.

Performance Measuring parameter	Algorithm		
	Round Robin	Throttled	Proposed HLBM
Make Span Time	Poor	Average	Better
Migration of Task	Average	Good	Better
Waiting Time	Average	Good	Better

V. CONCLUSIONS & FUTURE WORK

In cloud computing load balancing plays an important role in performance improvement of the entire system. In this research paper a hybrid load balancing method (HLBM) is suggested. Proposed method uses time and space strategy in different two phases. It also shows data correlation in between data and VMs and also shows assignment of task based on VMs capacity and task requirement. Result comparisons clearly shows that proposed method performs outstanding over existing round robin and throttled method in terms of make span time, task migration status and waiting time.

In future work proposed HLBM method can be improve by applying new improved policies in task selection and migration based on flow, queue length and time parameters. More load balancing methods can be used for comparisons in real time environments, in place of simulation.

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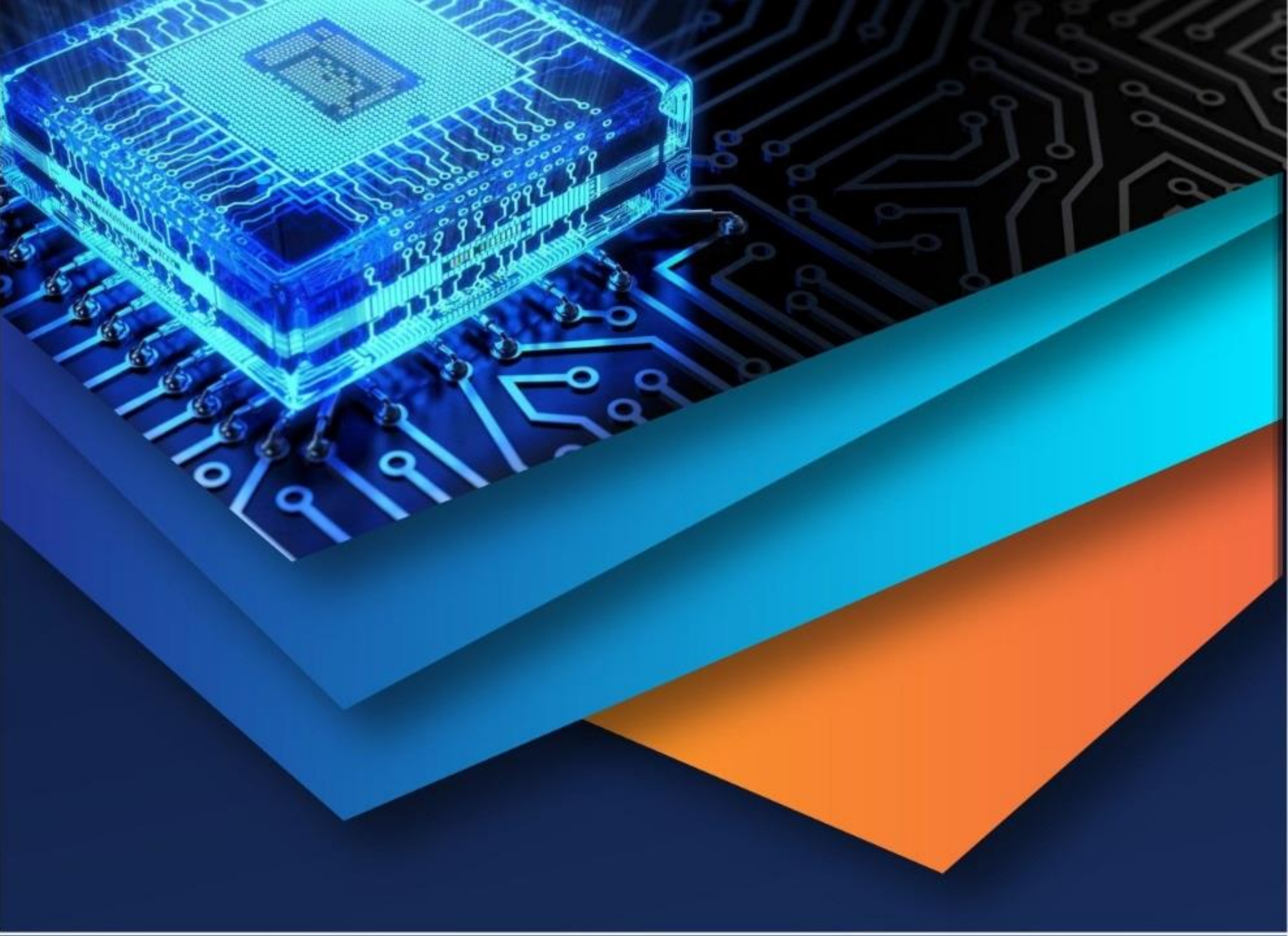

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