Implementation of Improved Throttled Load Balancing Algorithm Using Cloud Analyst

C. R. Durga Devi and Dr. R. Manicka Chezian

***Abstract*—**Big Data Applications are handled using Cloud. Cloud computing contains an important area of resource management. The resources are of two types as physical resources and logical resources. Resource management refers to the operations used to control how capabilities provided by Cloud resources and services can be made available to other entities, whether users, applications, services in an efficient manner. Scheduling of Virtual Machines to Data Centers should conserve energy. Task scheduling to Virtual machine also focuses on reducing the time delay and cost. Load balancing plays a vital role in making the usage of resources in an efficient manner. There are many algorithms used for load balancing. In this paper, comparative study is performed for existing Round robin algorithm, Throttle algorithm and proposed Dynamic load balancing algorithm in cloud computing. Proposed algorithm is implemented and tested. All of these algorithms are compared in terms of Response time Datacenter Request Servicing time and Cost in Cloud Analyst and Results prove the performance of proposed algorithm.

***Keywords*---**Big Data, Cloud Computing, Virtual Machine, Dynamic Load Balancing, Response Time.

I. Introduction

CLOUD computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing. Resources (e.g networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

A. Esential Characteristics

1) On-Demand Self-Service

A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

Manuscript received on December 12, 2019, review completed on December 13, 2019 and revised on December 20, 2019.

C. R. Durga Devi is with the Department of Computer Science, NGM College, Pollachi, India .E-Mail: deviswe@gmail.com.

Dr. R. Manicka Chezian is with the Department of Computer Science, NGM College, Pollachi, India. E-Mail: chezian_r@yahoo.co.in.

Digital Object Identifier: PDCS122019002.

2) Broad Network Access

Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

3) Resource Pooling

The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.

4) Measured Service

Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

5) Rapid Elasticity

Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

B. Cloud Services Models

1) Software as a Service (SaaS)

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings. e.g: Google Spread Sheet

2) Infrastructure as a Service (IaaS)

The capability provided to provision processing, storage, networks, and other fundamental computing resources. Consumer can deploy and run arbitrary software

3) Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider.

The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

II. Related Work

A Dynamical Load-Balanced Scheduling (DLBS) technique was introduced in [1] for achieving the higher throughput while handling the large number of tasks. The designed DLBS technique significantly minimizes the transmission delay but it failed to consider the makespan minimization.Distributed service broker policy was used in [2] and it was compared with other existing Load balancing algorithms in terms of response time and cost. Improved Throttled algorithms was implemented in [3] and compared with existing Throttled algorithm in terms of response time. Resource Optimized Traffic Aware Gradient Boosting Classification (ROTAGBC) technique in [4] reduces the traffic occurrence level with minimal energy consumption for geo-data distribution over multiple data centre. Multivariate Logistic Regression based Gradient Descent firefly optimized Round Robin Scheduling (MLR-GDFORRS) technique is introduced in [5] for scheduling the number of task (i.e. user request) to optimal virtual machine with minimum time.

Task scheduling was done by using Logistic regression for clustering of jobs in [6] for cloud environment. Based on job size, priority is given for jobs but other important parameters like job arrival time, job completion time are not taken into consideration. Energy-Aware Tasks Scheduling with Deadline-constrained in Cloud Computing was introduced in [7] to schedule the task by minimizing the make span and energy consumption. Based on the simulation, threshold value is set and tasks are classified as Low, medium, high priority tasks by comparing with threshold value. The proposed algorithm was better in performance when compared with other algorithms like Earliest Deadline First and First Come First Served (FCFS) algorithms in terms of Makespan, Resources Utilization and Energy consumption. Priority Task Scheduling Strategy was used in [8] for allocating the tasks to Virtual machine. The parameters used are task deadline, the task length, and the task age. Prioritizing the task helps to perform scheduling in an efficient way. But migration of tasks was not identified. Energy Aware VM Available Time (EAVMAT) scheduling algorithm was introduced in [9] to reduce the energy consumption by making less number of hosts in the active state and increase the utilization of active host. It deals with problem of job to VM mapping in cloud providers' datacenter. The performance is measured in terms of CPU utilization, throughput.

Task grouping concept is used in [10]. Tasks are classified as computational tasks and storage tasks before grouping. This algorithm outperformed with compared algorithm in terms of cost

III. Methodology

Load balancing is used in cloud mainly to reduce the Turnaround time, waiting time and Response time along with cost incurred. There are many Load balancing algorithms available in cloud computing. In this paper, Round robin and Throttled algorithms were taken into consideration.

A. Round Robin Algorithm

Round Robin Algorithm simply maintains a queue of incoming requests and allocates them VM in Time scheduling manner. Thus each request is allowed to be executed for specific time quantum only then after if it is still incomplete, it has to wait for its next round and if the request is complete it allows other process to take charge of that VM based on the algorithm

B. Throttled Algorithm

This algorithm checks for suitable and available VM in the list of VMs along with state (BUSY/ AVAILBLE). When a request arrives at load balancer, it scans VM list available with it. If suitable VM is found free it is allocated for request execution otherwise the request is queued. Here the VM searching process is speed up with help of introducing indexing at each row of the VM list. Thus Throttled algorithm is good as it does not introduce any implementation complexity and though performs significantly

C. Proposed Algorithm

Our proposed algorithm is Improved Throttled algorithm. In existing Throttled algorithm, there are no selection criteria for the Virtual Machine (VM).But in proposed method the resource status of the vm is evaluated and according to that allocation is done. In existing Throttled algorithm only the allocation table is maintained, but in proposed algorithm an Index table is also maintained. Migration of tasks is done using the Index table.

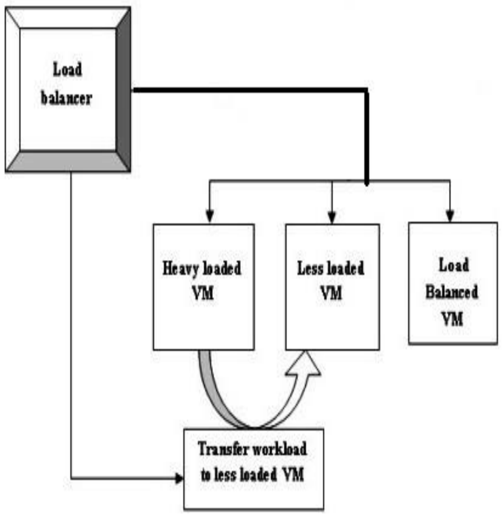

Fig 1 Load Balancer Architecture

Fig 1 shows the working of a Load Balancer. For each incoming tasks, the load balancer calculates the resource status of the virtual machine. The VM are classified as less loaded, overloaded and balanced loaded

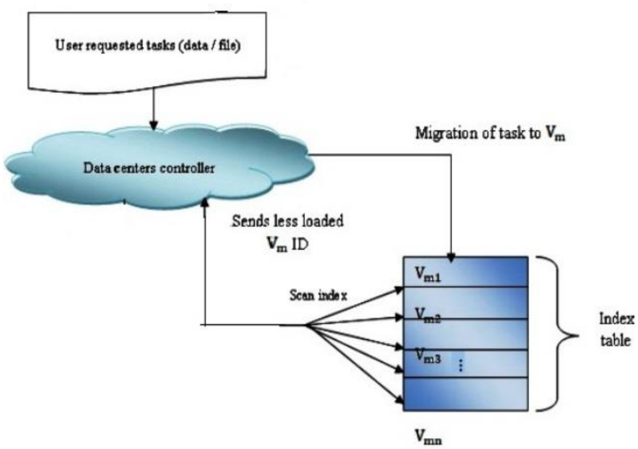

Fig. 2 Flow Process of Load Balancing

Fig. 2 shows Flow process of load balancing. The load balancer sends the ID of the less loaded virtual machine and makes the decision to decide the migration of task from an overloaded VM to a less loaded VM at a run time. Based on the decision of the load balancer, the data center controller migrates the workload to the less loaded virtual machine with minimum time. As a result, minimizes the workload across the data centers.

IV. Experimental Setup

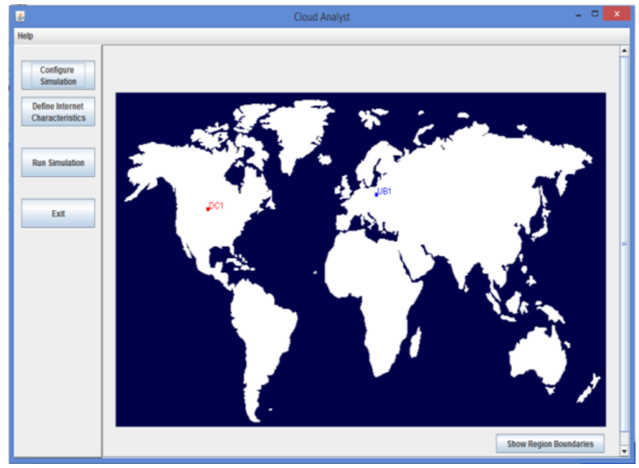

Fig. 3: Cloud Analyst Home Screen

In fig 3, the home screen shows sample user base and data center. The whole area is divided into six regions. There are three main tabs which represents setting simulation configuration, setting Internet characteristics and run simulation.

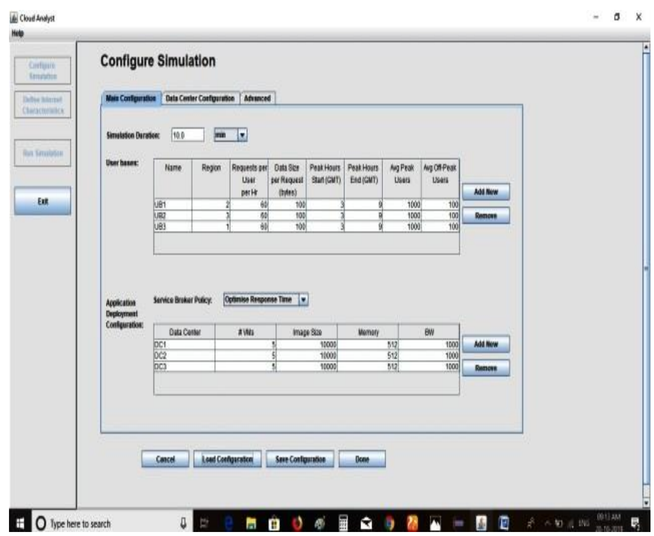

Fig. 4: Main Configuration Cloud Analyst

In fig 4, main configuration shows that the simulation contain three user bases and three data centers. Each Data centers contain five Virtual Machines. The memory, Bandwidth also set was every Data centers.

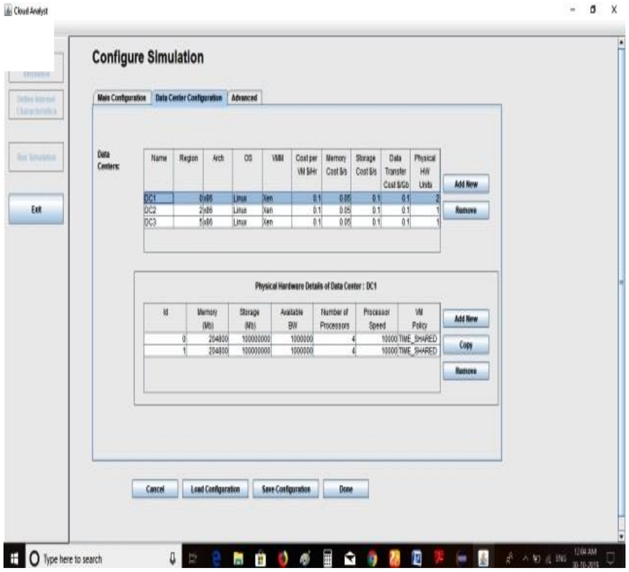

Fig. 5: Data Center Configuration

In Fig.5, our experimental setup shows each datacenter's parameter values such as processing architecture is set to X86, operating system is Linux, Virtual Machine Manager is set to Xen, cost and no of physical hardware unit. For each datacenter Physical Hardware properties section where we have set the VM memory 204800 MB, Storage 1TB, No of Processor 4 and VM policy TIME_SHARED.

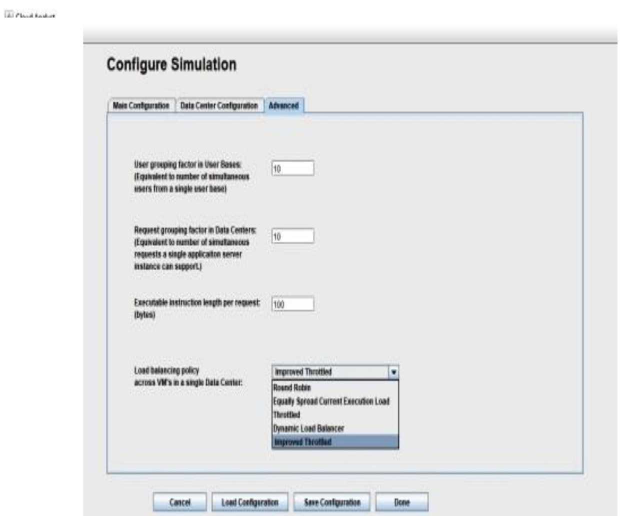

Fig. 6: Advance Configurations

In Fig.6, Advanced configuration parameters such as User Grouping Factor (UGF), Request Grouping Factor (RGF), Executable Instruction Length (EIL) and load balancing policy for VM can be selected. For our experiment we can select different load balancing policy from the drop-down. As we have created new policy for Improved Throttle Algorithm, we can select it from propped system simulation. We have set UGF to 10, RGF to 10 and EIL to 100 bytes.

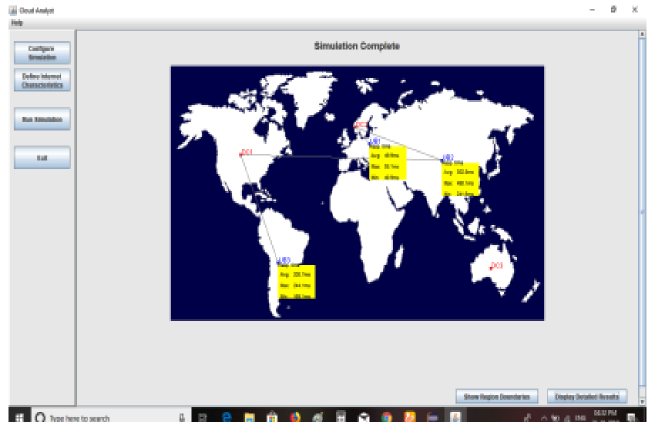

Fig. 7: Allocation of User Base to Data Centers

Fig 7 shows the allocation of user base to data enters using the Improve Throttled load balancing algorithm.

V. Result And Discussion

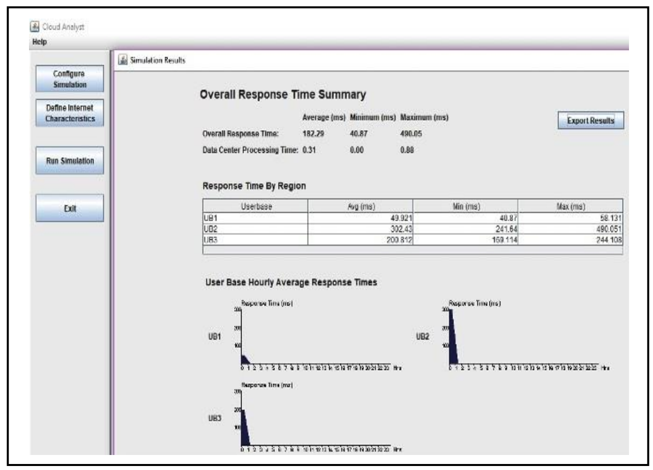

Fig. 8: Response Time Summary

Response Time by Region

	User base	Avg (ms)	Min (ms)	Max (ms)
ROUND ROBIN ALGORITHM				
	UB1	49.93	40.87	58.13
	UB2	302.54	241.64	490.05
	UB3	200.67	169.11	244.11
THROTTLED ALGORITHM				
	UB1	49.88	39.87	56.13
	UB2	302.82	240.64	488.05
	UB3	200.70	167.10	242.10
IMPROVED THROTTLED ALGORITHM				
	UB1	48.15	37.87	55.13
	UB2	301.43	238.64	486.05
	UB3	199.81	165.11	240.10

Fig. 9: Response Time by Region

Fig 8 shows the response time summary. Fig 9 shows the response time for each user base. The Improved Throttle Algorithm takes 48.15 ms, 301.43ms, 199.8 ms for user bases 1,2 and 3 respectively.

TABLE.1
DC PROCESSING TIME AND COST

ALGORITHMS	ROUND ROBIN			THROTTLED			IMPROVED THROTTLED		
FACTORS	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN
Data Center processing time (ms)	0.31	0.88	0.02	0.28	0.75	0.01	0.25	0.70	0.00
Cost ($)	VM	DATA TRANSFER	TOTAL	VM	DATA TRANSFER	TOTAL	VM	DATA TRANSFER	TOTAL
	0.23	0.03	0.27	0.22	0.02	0.24	0.21	0.01	0.22

Table 1 shows the Data Center processing time and cost for Round robin, Throttled and Improved Throttled algorithms. It shows that the cost and processing time for Improved Throttled algorithm is lesser than Round robin and Throttled algorithm

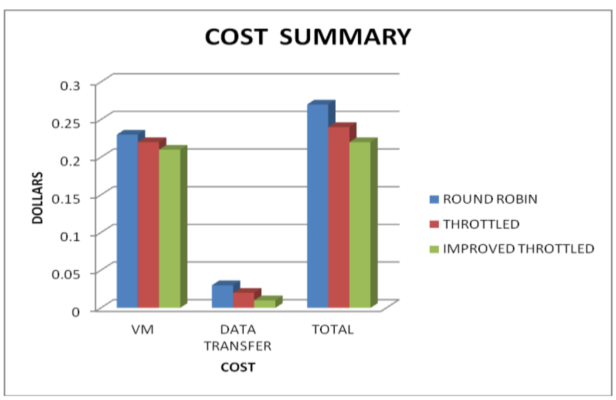

Fig. 10: Cost Summary

Fig. 10 shows cost incurred in terms of the Virtual Machine, Data Transfer. The total cost for Improved Throttled algorithm is 0.22 ($), which is comparatively lesser than Round robin and Throttled algorithms

Our proposed Improved Throttled algorithm is performing better than Round robin and Throttled algorithms in terms of Response time, processing time and cost.

REFERENCES

[1] Feilong Tang , Laurence T. Yang , Can Tang , Jie Li ; Minyi Guo, "A Dynamical and Load-Balanced Flow Scheduling Approach for Big Data Centers in Clouds", IEEE Transactions on Cloud Computing, Volume 6 , Issue 4 , 2018, Pages 915 – 928

[2] Shivani Dubey, Mamta Dahiya, Sunaya Jain "Implementation of Load Balancing Algorithm with Cloud Coloboration for Logistics", Journal of Engineering and Applied Science, 2019, pp. 507–515.

[3] Slesha Nayak,Pragnesh Patel," Analytical Study for Throttled and Proposed Throttled Algorithm of Load Balancing in Cloud Computing using Cloud Analyst", International Journal of Science Technology & Engineering, Volume 1, Issue 12,June 2015,, pp. 90–100.

[4] C.R.Durga Devi and R.Manicka Chezian, "Resource optimized ensemble gradient boosting classifier for traffic aware big data analytics", Journal of Advanced Research in Dynamical & Control Systems , Volume 10 , Issue 3, 2018, Pages 839-852

[5] C.R.Durga Devi and R.Manicka Chezian, "Multivariate Logistic Regression based Gradient Descent Firefly Optimized Round Robin Scheduling with Big Data", Journal of Advanced Research in Dynamical & Control Systems , Volume 11 , Issue 1, 2019, Pages 179-192

[6] M. Vaidehi, T.R. Gopalakrishnan Nair and V. Suma, An Efficient Job Classification Technique to Enhance Scheduling in Cloud to Accelerate the Performance. ICT and Critical Infrastructure: Proceedings of the 48th Annual Convention of Computer Society of India- Vol I: Chapter (pp.593-603)

[7] Said Ben Alla, Hicham Ben Alla, Abdellah Touhafi and Abdellah Ezzati, An Efficient Energy-Aware Tasks Scheduling With Deadline-Constrained In Cloud Computing, Computers, Vol 8, issue 2,2019

[8] Naoufal Er-raji , Faouzia Benabbou Priority Task Scheduling Strategy for Heterogeneous Multi-Datacenters in Cloud Computing, International Journal of Advanced Computer Science and Applications, Vol. 8, No. 2, 2017

[9] Shyamala Loganathan1, Renuka Devi Saravanan1, Saswati Mukherjee, Energy Aware Resource Management and Job Scheduling in Cloud Datacenter, International Journal of Intelligent Engineering and Systems, Vol.10, No.4, 2017

[10] Lailah M.Mustafa, Mohamed K. Elmahy, Mohamed H.Haggag Improve Scheduling Task based Task Grouping in Cloud Computing System, International Journal of Computer Applications (0975 – 8887), Volume 93 – No.8, May 2014

C. R. Durga Devi received her Bsc.Computer Technology from Coimbatore Institute of Technology,Coimbatore,India. she had her Master of Computer Applications from Bharathiar University,Coimbatore, India. she holds Mphil in Computer Science from Bharathiar University, Coimbatore, India. She has 11 years of experience in teaching. She is presently working as an Assistant Professor in NGM college, pollachi. Her research interest includes Data Mining,Big Data Analytics. Now she is pursuing her ph.d Computer Science in Dr.Mahalingam center for research and Development at NGM college, Pollachi.

Dr.R.Manickachezian received his M.Sc., Degree in Applied Science from P.S.G College of Technology, Coimbatore, India in 1987. He completed his M.S. Degree in Software Systems from Birla Institute of Technology and Science, Pilani, Rajasthan, India andPh.d degree in Computer Science from school of Computer Science and Engineering, Bharathiar University, Coimbatore, India. He served as a faculty of maths and Computer Applications at P.S.G College Of Technology, Coimbatore from 1987 to 1989. presently, he has been working as an Associate Professor of Computer Science in NGM college (autonomous), pollachi under Bharathiar University, Coimbatore, India since 1989. He has published 150 papers in International/National Journal and Conferences. He is a recipient of many awards like best Computer Science Faculty of the year 2015, Best Research Supervisor award, Life Time Achievement award, Desha Mithra Award and best paper award. His research focuses on Network Databases, Data Mining, Distributed Computing, Data Compression, Mobile Computing, Real Time Systems and Bio-Informatics