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AN INVESTIGATION OF LOAD BALANCING ALGORITHMS IN CLOUD COMPUTING THROUGH CLOUD ANALYST TOOL

Mrs. Anjali Sharma School of Computer Science and Applications, IIMT University, Meerut,
Dr.Prof. K.K.Sharma School of Computer Science and Applications, IIMT University, Meerut,
anjali.shail@gmail.com ; Drkks57@gmail.com

Abstract — Cloud computing is the evolution of distributed computing, parallel computing, and grid computing in the digital era. Cloud computing makes use of resource pooling to improve cooperation efficiency and lower system upgrading costs. Cloud computing is a new technology that still has to be refined. Load balancing is the technique of dispersing a node's total load to increase efficiency and response time. There are several known methods that are used in cloud computing to optimize work scheduling. In this study, a comparison of three selected Load Balancing Algorithms in cloud computing will be focused on, which are priority algorithm, Equally Spread Current Execution, and Throttled, and their respective performance will be simulated and documented using Cloud analyst tool.

Keywords *— cloud computing, cloud analyst, load balancing algorithms.*

I. INTRODUCTION

A. BACKGROUND

Cloud computing is a trending computing with internet based has adopted many fields which provide a better and efficient solution to store and access files. Cloud computing key aim is to provide high efficiency, scalability and quality on-demand computing resources in a distributed environment [1]. Cloud providers deliver flexible cloud services across large data centers. Hierarchical network design is the model most widely seen in data center networks [2]. By using the concept of distributed and parallel computing which use combining and sharing computing resources have been an industry game changer in businesses and information technology communities because enable the decreasing of hardware resource costs. This transforms the traditional data center to a boundary less data center which means no hub. Cloud allows users to access information at anytime from anywhere with an internet
Connection. In distributed computing, a job or a problem can be divided into many tasks, each of which is solved by one or more computers. Hence, it is essential to research some of the areas in cloud computing to improve the processing time and response time of the user associated with load balancing.

Load balancing is the process to assign load to every node of a distributed system to work faster and efficiently. It is a parallel system strategy that is used to achieve optimal system condition, in which workloads are spread uniformly among computers, which as its effect would decrease the execution time of the programs [3]. It executes load balancing tasks before execution of programs. In a cloud environment, load balancing is ensuring all nodes in the network are given an equal amount of work [4]. The importance of load balancing in cloud computing is distributing the load to reach maximum resource utilization. Load balancing algorithms will help in dividing resources efficiently by ensuring no node will be overloaded. The goals of load balancing are optimum resource utilization, maximum throughput, preventing overload and maximum response time. There is a general downside to static load balancing algorithms is that when the process is established, the final selection of a host for task allocation is done and can not be modified during process execution to adjust the system load [5].

B. PROBLEM STATEMENTS

Cloud computing allows users to access data from any location at any time. Load balancing is used in cloud computing to avoid load bottlenecks. There are several methods in use to optimize cloud

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computing. The performance information of algorithms is restricted. People are interested with the processing time of static load balancing algorithms since it finishes the completion of jobs as well as the system's utilization. Furthermore, some static load balancing algorithms outperform others.. Load balancing algorithms should notice that resource migration time is an important factor which significantly affects system

Efficiency [6]. Cloud service provider efficiency is strongly affected by load balancing which is a very critical problem [7]. Therefore, researchers have created many load balancing algorithms to overcome the bottleneck of cloud computing, and there is a range of load balancing algorithms to accomplish better load balancing [8].

C. OBJECTIVE

This paper's three goals are as follows:

1. To provide selected static load balancing techniques
2. To evaluate the performance of selected static load balancing techniques.
3. To compare the response times of various static load balancing strategies.

D. SCOPE

In this project, we will conduct research about the response time on 3 load balancing algorithms which are Round Robin, Equally Spread Current Execution and Throttled. We will use clouds analyst to record their response time and do a comparison between them.

II. RELATED WORKS

A. LOAD BALANCING ALGORITHM

The load balancing technique is used to distribute requests from bigger processing nodes to smaller processing nodes, which improves system performance. Load balancing is used in cloud computing to divide computational resources across all nodes. Because of its equitable distribution of computer resources, it can maximize resource utilization and satisfy consumers. As a result, optimizing resource utilization may assist in lowering resource usage and avoiding bottlenecks.

1. Priority Load Balancing Algorithm

Round robin is the most common and easy scheduling algorithm. It works based on time quantum and process in round form. In this load balancing, the datacenter controller assigns the request to VMs on a rotational basis. The process will wait for the last process to proceed. The major problem is that the new process will take a lot of time to complete if previous processes are huge and need a large amount of time. The Round Robin technique does not take resource abilities, priority, and assignment duration into account. The

Higher priority and the lengthy jobs, however, end up with the higher response times [9].

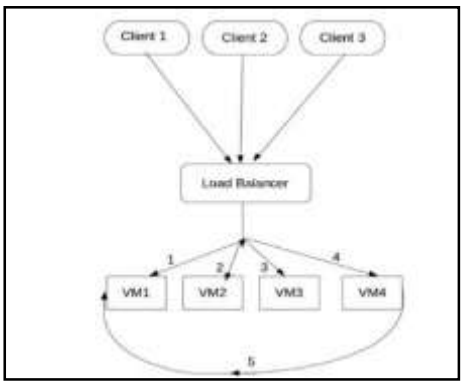

Figure 2.1.1: Priority load balancing

2. Equally Spread Current Execution

Equally spread current execution algorithm functions on a continuous basis on the queue and

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randomly passesit to another virtual machine and distributes it by measuring the size of the coming load, then distributesit to a virtual machine that has light work [10].

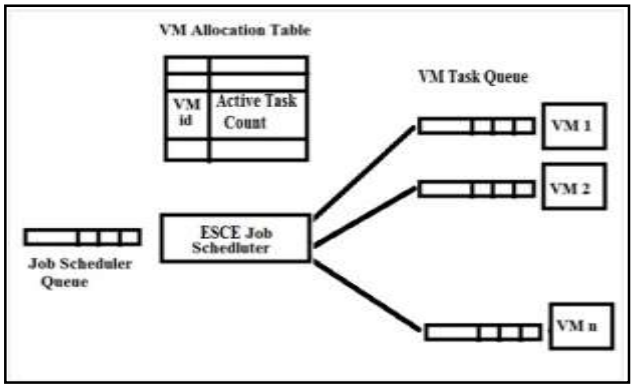
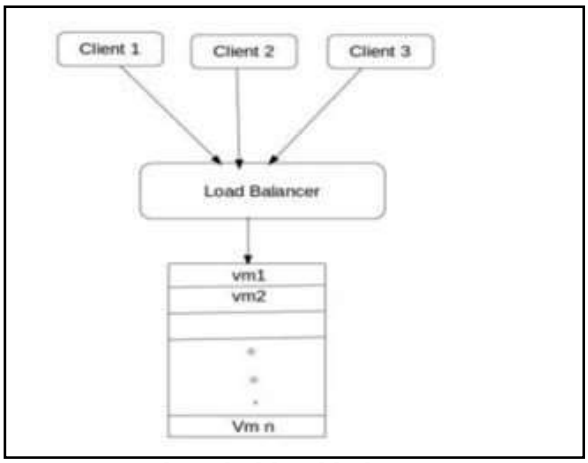


Figure 2.1.2: Equally spread current execution

3. Throttled Load Balancing Algorithm

Throttled load balancing algorithm contains an index of virtual machines and the states, which is available or busy. The load balancer has the list of VMs. When a new request comes in, the load balancer will assign the request to the first available VMs .If no VMs are available, then the request needs to wait in queue for fast processing ,and it returns -1 to the datacenter and this will reduce the cost of usage.



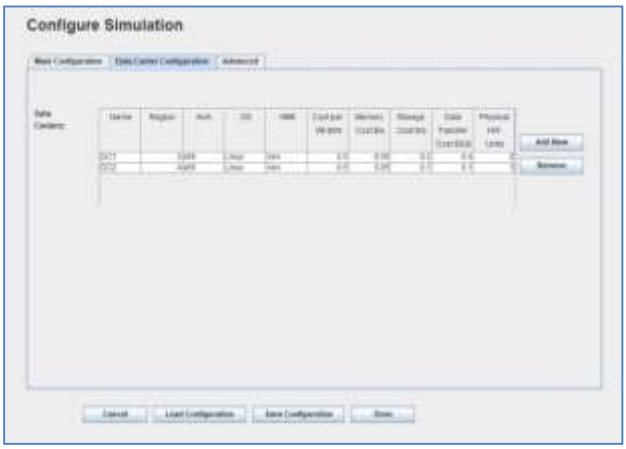


Figure 2.1.3: Throttled load balancing

B. RESULTS OF SIMULATION

Key setup is set as shown in the figure 3.1, 3.2, 3.3 andfigure 3.4 reliant on which we have found the result forthe three figuring that is RR, ESCE, and TLB. The parameters secluded are response time. The response time was tested in 2 cases, which is 3 hour case and 6 hour case[11][12].

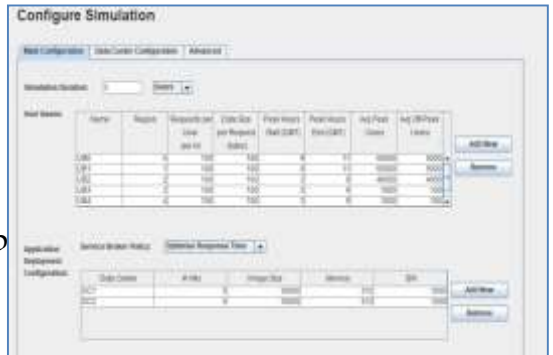


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Fig.2.2.1: 3 Hours Main Configuration

Fig.2.2.2: 3 Hour Data Centre Configuration

Fig.2.2.3: 6 Hour Main Configuration

Fig.2.2.4: 6 Hour Main Configuration

A) Case 1:
• Simulation run 3 hours
• Six customer bases UB0, UB1, UB2, UB3, UB4, UB5in territory 0, 1, 2, 3, 4 and 5 correspondingly.
• Application sending setup data centers DC1 in area 3,DC2 in locale 4[13].

B) Case 2:
• Simulation length 6 hours
• Six customer bases UB0, UB1, UB2, UB3, UB4, UB5in zone 0, 1, 2, 3, 4 and 5 correspondingly.
• Application sending setup data centers DC1 in zone 3,DC2 in locale 4.

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C) Comparison of response time for the load balancingalgorithm that is Round Robin, Equally Spread Current Execution, Throttled Load Balancing [14].

Case 1: Response Time in Simulation 3 Hours

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	174.65	34.37	466.13
Data Center processing time:	1.87	0.02	11.59

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB0	54.33	34.37	70.83
UB1	200.90	141.71	264.00
UB2	300.56	205.94	466.13
UB3	50.16	38.86	61.36
UB4	50.06	38.65	62.91
UB5	50.11	37.55	62.38

Fig.2.3.1: Round Robin Algorithm Overall ResponseTime

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	174.60	34.37	466.13
Data Center processing time:	1.81	0.02	10.87

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB0	54.20	34.37	70.24
UB1	200.87	141.71	264.00
UB2	300.56	205.71	466.13
UB3	50.13	38.86	61.36
UB4	50.08	38.65	63.90
UB5	50.09	37.55	62.38

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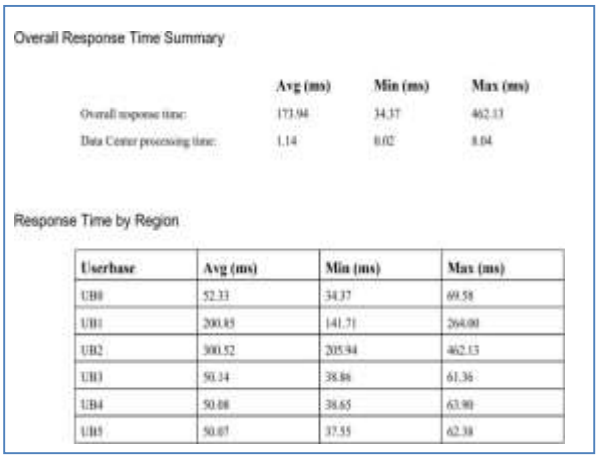
Fig.2.3.2: Equally Spread Current Execution Algorithm Overall Response Time



Overall Response Time Summary

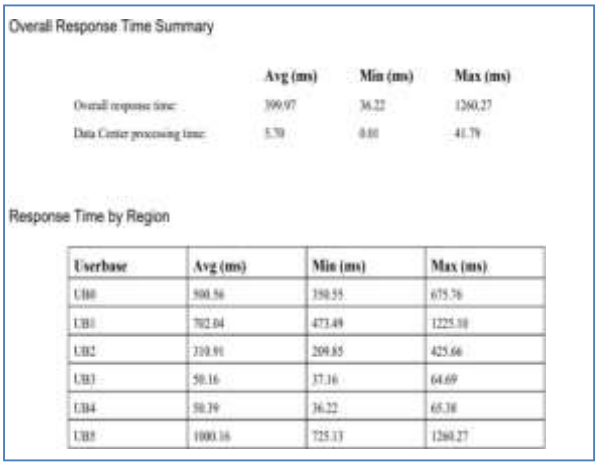
	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	173.94	34.37	462.13
Data Center processing time:	1.14	0.02	8.04

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB0	52.33	34.37	69.58
UB1	200.85	141.71	264.00
UB2	300.52	205.94	462.13
UB3	50.14	38.86	61.36
UB4	50.08	38.65	63.90
UB5	50.07	37.55	62.38

Fig.2.3.3: Throttled Algorithm Overall ResponseTime

Case 2: Response Time in Simulation 6 Hours



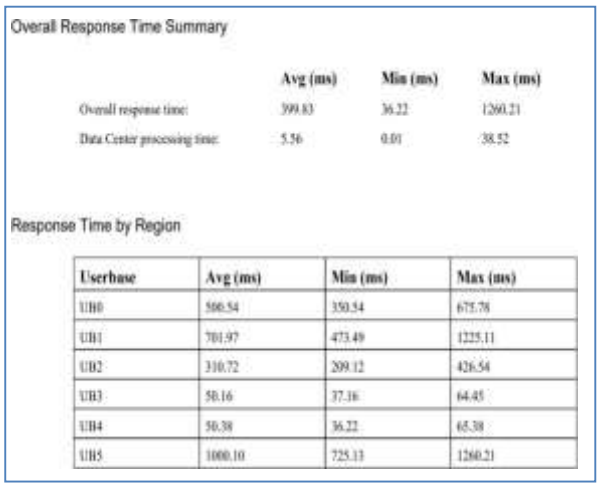
Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	399.97	36.22	1260.27
Data Center processing time:	5.70	0.01	41.79

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB0	500.56	350.55	675.76
UB1	702.04	473.49	1225.10
UB2	310.91	209.85	425.66
UB3	50.16	37.16	64.69
UB4	50.39	36.22	65.38
UB5	1000.16	725.13	1260.27

Fig.2.3.4: Round Robin Algorithm Overall ResponseTime



Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	399.83	36.22	1260.21
Data Center processing time:	5.56	0.01	38.52

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB0	500.54	350.54	675.78
UB1	701.97	473.49	1225.11
UB2	310.72	209.12	426.54
UB3	50.16	37.16	64.45
UB4	50.38	36.22	65.38
UB5	1000.10	725.13	1260.21

Fig.2.3.5: Equally Spread Current Execution Algorithm Overall Response Time

Table 2: Overall Response Time in Simulation 6Hours

Load Balancing Algorithm	Overall Response Time(ms)		
	Avg	Min	Max
RR	399.97	36.22	1260.27
ESCE	399.83	36.22	1260.21
TLB	397.44	36.22	1260.19

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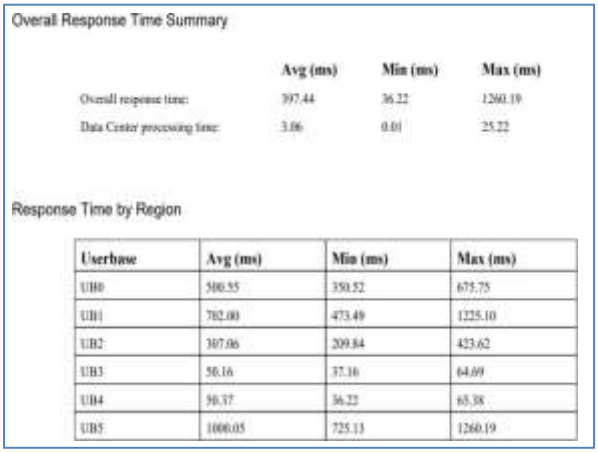

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	397.44	36.22	1260.19
Data Center processing time:	3.06	0.01	25.22

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB0	500.55	350.52	675.75
UB1	782.00	473.49	1225.10
UB2	307.06	209.84	423.62
UB3	50.16	37.16	64.69
UB4	50.37	36.22	65.38
UB5	1000.05	725.13	1260.19

Fig.2.3.6 Throttled Algorithm Overall Response Time

C. RESULTS ANALYSIS AND SUMMARY

Table 1: Overall Response Time in Simulation 3Hours

Load Balancing Algorithm	Overall Response Time(ms)		
	Avg	Min	Max
RR	174.65	34.37	466.13
ESCE	174.60	34.37	466.13
TLB	173.94	34.37	462.13

In summary, we can see that in table 1 which Throttled load balancing algorithm has the best average response time in case 1. In table 2, Throttled load balancing algorithm also has the best average response in case 2.So we can conclude that the throttled load balancing algorithm has the best overall response time among these 3 load balancing algorithms.

III. OPEN RESEARCH ISSUES

However, the paper only consists of the comparison of performance between limited load balancing algorithms and based on the two scenarios. Many of the scopes beyond this report can be discussed in the future, namely:

I. Analyzing the performance of load balancing algorithm affect by user base usage pattern
II. Discussing the performance of the centralized and distributed data center at each scenario.
III. Also we can take the joint approach any of two load balancing algorithms.

IV. CONCLUSION

Load balancing helps distribute the total request to individual nodes to enhance resource consumption and response time. It also helps avoid heavy loads on individual nodes because it has fair allocation .To compare the response time of each load balancing algorithm, we choose cloud analysts to conduct our research. The result showed joint load balancing algorithms have the better response time in cloud analysts.However, other algorithms [15].

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