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Dynamic Rebalancing Technique for QOS Provisioning in Cloud Storage Service

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Abstract: Cloud is huge collection of different servers and number of virtual machines and it will provide access to different resources for various users. So there will be a problem of balancing the load. Load balancing is the mechanism of dividing workload among different servers of distributed systems to improve utilization of processor & also improve response time. It will help to increase the performance of the whole system. As there is an increase in users of web, there is automatically increase in the request of services. By this the load will be increased automatically. When load increases, the performance of the system will decreases. To overcome from this problem we are using the mechanism called Load balancing. In this paper we are proposing an algorithm called Load rebalancing algorithm. We have compared our proposed system with the existing algorithms such as round robin and throttled. Simulation result shows that, by using this rebalancing we improve the resource utilization, performance & we get less response time and cost of data centre. Performance is analyzed using cloudsim.

Keywords— "Cloud sim", "Cloud computing"," Data centres", "Virtual machine"," Resource utilization".

I. INTRODUCTION

This A cloud is the cluster of data centers and virtual machines. Basically it contains many types of hardware and software which work together to offer the online services to the clients. The cloud computing is the method of using hardware & software to deliver or provide the files, resources & use application from any device which is capable of accessing internet. Mainly we have three types of cloud deployment modules public, private and another one is hybrid cloud. Public cloud is one which is accessed by any user, private cloud can be used within an organization and hybrid cloud is the mixture of both public and private cloud to provide variety of operations in the same organization.

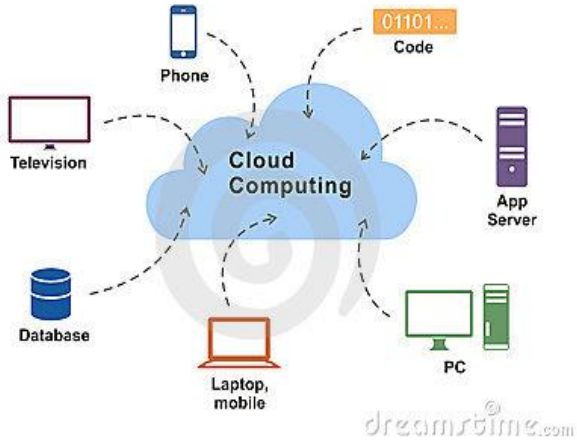


Fig1.1: cloud computing

A web server is basically a computer with high configuration and it works with http protocol. A client like browser, senses http data server, and processes it. There is a mechanism by which system has to ensure that data is same across all data centre. So, clusters of server cluster of data centre, content distribution network, load balancing and data integrity all together will form an Infrastructure. The best thing is we can offer part of this infrastructure as a service. Anybody who requires a small part can take it & pay a small amount, as his business grows he pays more & take more services. This is known as IAAS (Infrastructure as a service).

Infrastructure as a service is a software that connects a huge cloud hardware infrastructure to the customer based on some APIs and helps to run software's. These we known as SAAS (Software as a service).

Once we profile this IAAS on this we can run SAAS, based on this software as a service we can combine several SAAS running on clouds to create another service.

So, this is our whole cloud infrastructure where multiple servers, datacenter & content distribution network at the hardware level infrastructure as the service.

As increase of users in cloud there will be increase in request of servers. By this there will be a problem of load in the cloud. To overcome from the problem of load we introduce the load balancing-rebalancing concept

Load balancing is the procedure of dividing the load from heavily loaded servers to the different cloud servers. For this we are proposing the algorithm called load-rebalancing. This proposed algorithm will distribute the work load twice, so that we can get the quick response time and improved performance. We are simulating this by using cloudsim2.0.

Load balancing can be classified as static or dynamic

a) Static load balancing: In this, load is distributed evenly across all the nodes. This algorithm must know about the system resources before.
b) Dynamic load balancing: It depends on the current state of the system. If any node is overloaded then its load is shifted to the under loaded node. So real time communication is performed here.

The rest of the paper is organized as follows: The related work is discussed in section2, in section 3 the proposed system is explained, section 4 gives the details about experimental setup, section 5 gives result and analysis; finally the conclusion is given in section 6.

II. RELATED WORK

Literature is the study of existing systems here we have studied the different techniques for load balancing published by many authors by using different methods, algorithms, techniques.

In[1] the author Nidhi jain et.al discussed methodologies like decentralized content aware load balancing, server based load balancing & scheduling strategy of virtual machine and discussed their results by using various parameters, such as performance and scalability overheads. They proposed techniques of energy consumption & carbon emission perspective. They have improved performance of cloud by maximum resource utilization and reduced energy consumption & carbon emission.

Soumya ray et.al [2] discussed token ring, round robin, randomized central queuing connection mechanism. They have compared response time using different algorithms like round robin, central queuing algorithm. They have given a way to know which algorithm is better for load balancing and reduced response time.

In [3] author Suriya begum et.al discussed methods of event driven, server based LB for internet distribution service, vector dot, fuzzy logic & swarm optimization tasks scheduling. They have solved problem domain of cloud computing, generic issue & issues related to load balancing. And they are using review of load balancing to achieve the great performance & good resource allocation & less energy consumption. We can get the available resource to perform tasks by using some methods.

Pratik s et.al [4] proposed partitioning concept with switch case game theory to improve efficiency, and used mathematical process. Existing Load balancing algorithms focuses on reducing overheads, migrations time & improve efficiency. In the proposed system they have introduced different concepts of load balancing.

Asha et.al [5] discussed the problem of overloading or under loading of virtual machines, and distributing load among all virtual machines. They are balancing load as well as virtual machine, and for this using algorithms and dynamic resource management in cloud virtualization technology. We can use this for improving power efficiency of data centers. By allowing assignment of the multiple virtual machines to single data center. It is efficient to be used for balancing power with load from server.

In [6] author Karll smith et.al proposed PALB power aware load balancing algorithm. Discussed Load balance approach to IAAS cloud architecture that is power aware. Here introducing new algorithms to load the power. They discussed we can do the load balancing using the networks protocols.

Zehua Zhang et.al [7] proposed methodology Ant colony cloud computing, complex network federation cloud balancing. To improve aspects related to anti colony algorithms

III. PROPOSED WORK

Load-Rebalancing algorithm:

In this algorithm we have a node as I of each chunks, I is used to check weather node is overloaded or under loaded, without knowing the global data. It will look at the memory, if the load is said to be light it means that, the number of chunks are smaller than the capacity. For ex: if it has capacity of storing 10 GB resource, it has stored only 4GB is called as lightly loaded. If it has 10GB storage and it already stored 8GB resource means, it is heavily loaded. For checking these we are using the parameters L, vl. Here L indicates load, L should be less than capacity, v indicates virtual machine and vl should be less than capacity. We have two nodes J & K, if J fails, it will joins to another node J+1. It is heavily loaded, it distributes load among all nodes. To distribute load data will be divided equally with the global knowledge. Nodes do not know is it heavily loaded or not. Starting it will be lightly loaded, when it starts loading heavily rebalancing is done.

Cloud sim: Provides support for modelling and simulation. And it is the resource provider in cloud. And it provides library of java classes of cloud computing.

Cloud Sim is basically a toolkit or library of java classes for modelling of cloud computing, and it provides basic classes for relating and defining data centres, virtual machines. And it will help us to use different scheduling algorithms.

Cloud Sim is a flexible, extendable or replaced, new policies can be added and new scenarios for utilization can be coded. Cloud Sim is a software framework for modelling Cloud computing environments and provides application services for testing the performance.

IV. SIMULATION SETUP

We are using cloud analyst. It is tool developed using cloud sim architecture for analysing load balancing policies and configuration of various parameters. We have parameters like user base configuration, data centres configuration and setting of internet characteristics as shown in below figures. We have taken six regions, many user bases, three data centres and 50 virtual machines for each data centres. These are located in different regions for simulation. DC1 is in region 0, DC2 is in region1 and DC3 is in region2. Different user bases in different regions and the duration of simulation is set to 60 mins.

Cloud analyst enables to execute the simulation repeatedly and easily. The output of simulation is shown graphically. It will be easy to analyse efficiently.

The figure below shows architecture of cloud sim:

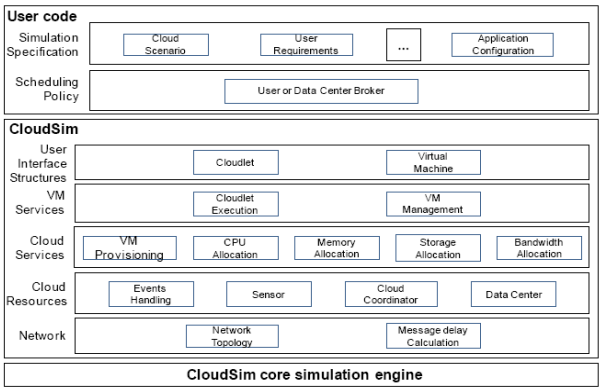


Fig4.1: Architecture of cloud Sim

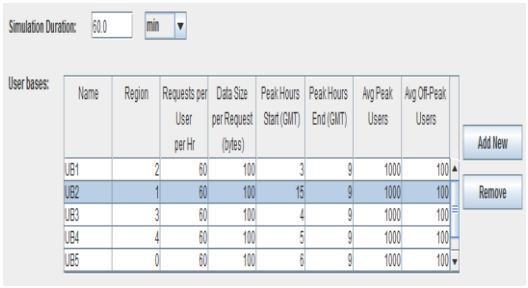


Fig1: User base configuration

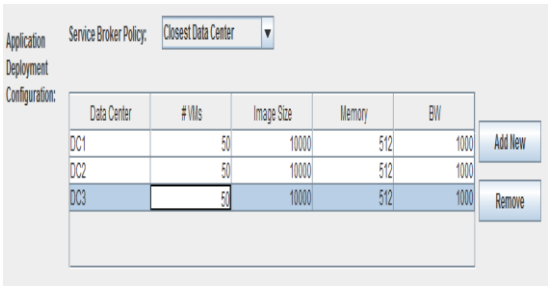


Fig2: Datacenter configuration

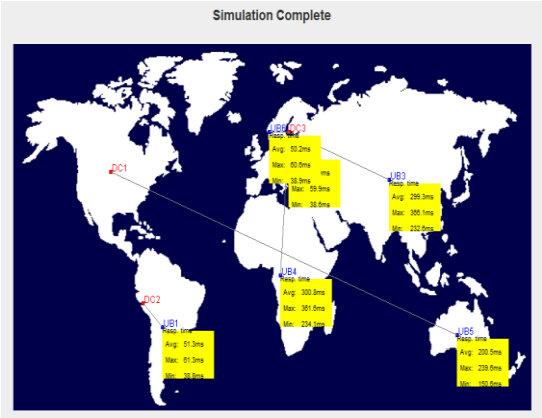


Fig3: Shows output screen of cloud analyst

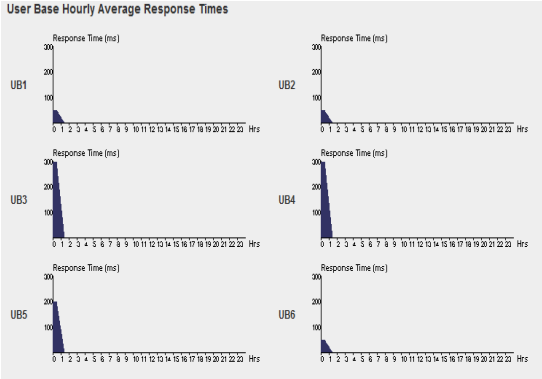
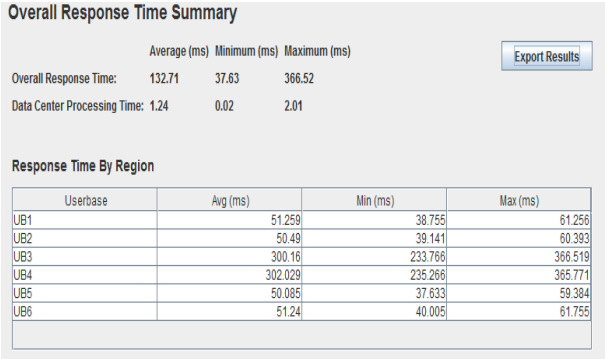


Fig4: User hourly response time using round robin



Overall Response Time Summary

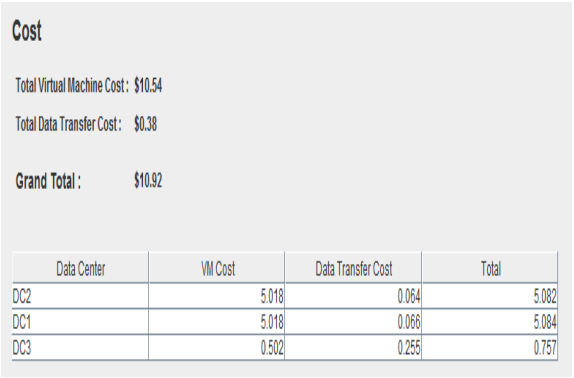
	Average (ms)	Minimum (ms)	Maximum (ms)
Overall Response Time:	132.71	37.63	366.52
Data Center Processing Time:	1.24	0.02	2.01

Export Results

Response Time By Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	51.259	38.755	61.256
UB2	50.49	39.141	60.393
UB3	300.16	233.766	366.519
UB4	302.029	235.266	365.771
UB5	50.085	37.633	59.384
UB6	51.24	40.005	61.755

Fig6: Response time using rebalancing



Cost

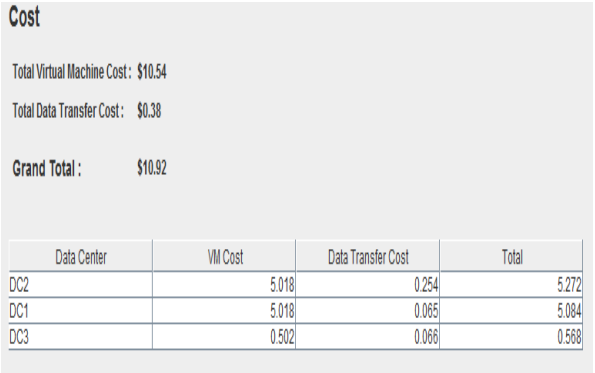
Total Virtual Machine Cost: $10.54

Total Data Transfer Cost: $0.38

Grand Total: $10.92

Data Center	VM Cost	Data Transfer Cost	Total
DC2	5.018	0.064	5.082
DC1	5.018	0.066	5.084
DC3	0.502	0.255	0.757

Fig5: Total cost of Data centers using round robin



Cost

Total Virtual Machine Cost: $10.54

Total Data Transfer Cost: $0.38

Grand Total: $10.92

Data Center	VM Cost	Data Transfer Cost	Total
DC2	5.018	0.254	5.272
DC1	5.018	0.065	5.084
DC3	0.502	0.066	0.568

Fig7: Cost of datacenters using rebalancing

Parameters	Round Robin	Equally spread load balancing	Throttled
Data Centres	2	2	2
UB	5	5	5
H/W Unit	2	2	2
V.M	50	50	50

Table1: Simulation configuration with input values

V. RESULTS AND ANALYSIS

The simulation results shows that, comparing to previous methods of balancing load the proposed rebalancing method results less response time, and it requires less cost.

Parameters	Round Robin	Equally spread load balancing	Throttled
Data Centers	2	2	2
User Base	5	5	5
H/W Unit	2	2	2
V.M	50	50	50
Response Time (ms)	300.12	251.09	200.09
Total $ (Cost)	0.571	0.571	0.571

Table2: Simulation configuration with result

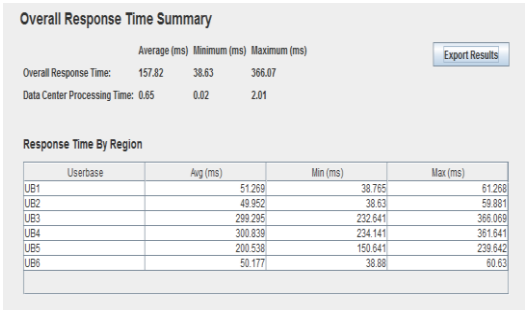


Fig8: Response time using round robin

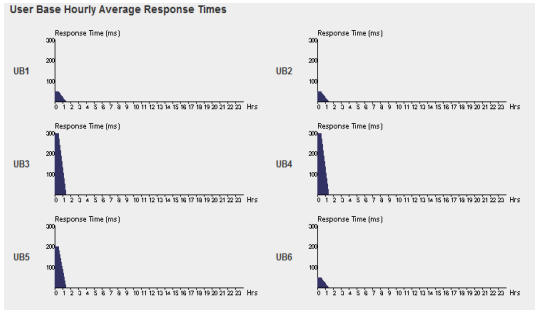


Fig9: User hourly response time using round robin

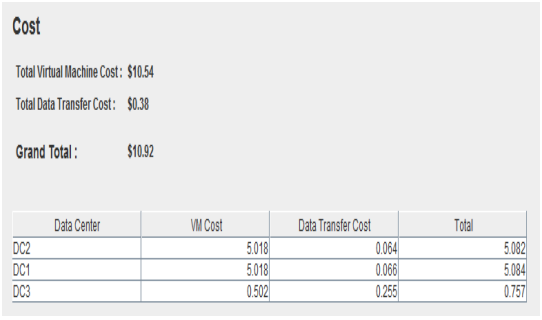


Fig10: Total cost of Data centres using round robin

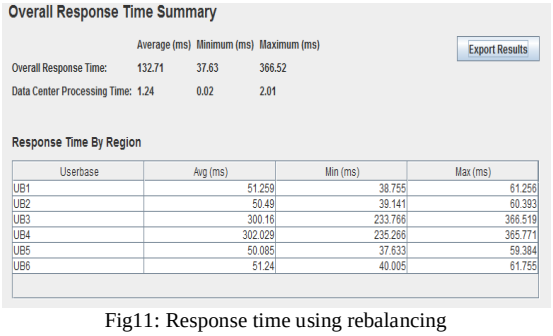


Fig11: Response time using rebalancing

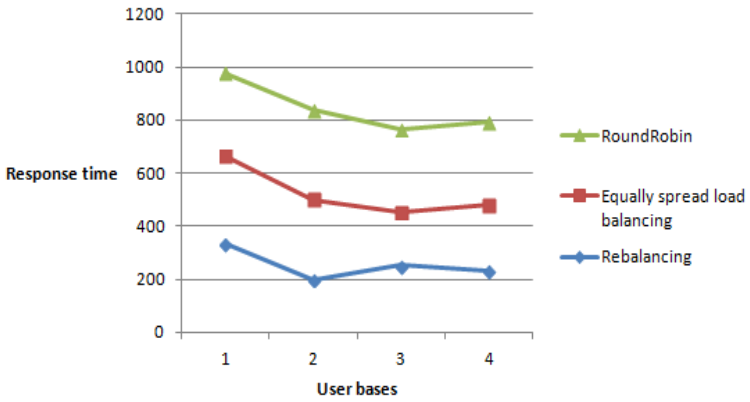


Fig12: Graph showing response time vs user base

Here in this above graph we are comparing the current load balancing with the proposed rebalancing. Comparing to current load balancing we get less response time in rebalancing because, in proposed system we are balancing load twice. In current load balancing only once the load is balanced but in proposed system we will balance the load twice. Hence the proposed system is improved in performance.

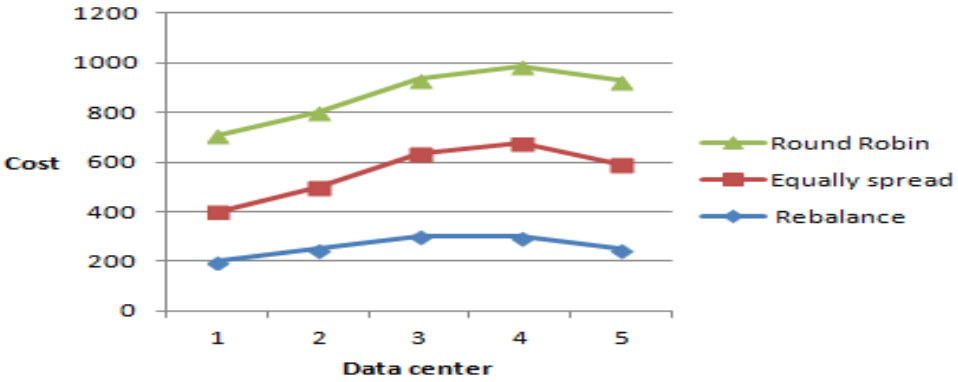


Fig13: Shows cost of data centres

In the above graph we are considering the data centre and cost. Each data centre has many virtual machines and for each virtual machine we will have separate cost. The graph shows that cost of data centre is reducing in rebalancing case, comparing to current load balancing rebalancing takes less cost.

VI. CONCLUSION

Cloud computing is the most popular way of storing, distributing, managing data & business logic. However due to theoretically very high number of virtual machines, brokers & data centres, it is almost impossible to test and verify the algorithm that needs to be implemented over the cloud. Therefore we propose a novel simulation based technique to simulate the entire global content distribution cloud on a local machine. It is mainly based on a novel load distribution technique called rebalancing to balance the load as the data arrives for storage & then redistribute it as & when new virtual machine joins. Result shows that proposed technique provides much lesser response time, and causes less cost usage in comparison to existing here load balancing technique.

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