A comparison of heuristics algorithm for load balancing in cloud environment

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Abstract— Cloud computing, has boomed technology in new era. The main reason for its growth is its capacity to store large amount of data. We store data in digital and to store their data we require large number of storage and computer resources. Its provides a solution of this problem, as it store all software, platform and infrastructure in the data center and these all are easily accessible through internet, through the service provider at anytime and anywhere. The main objective of the work is to find an enhanced algorithm through compression various cloud load balancing algorithms since in cloud job arrivals pattern is not predictable. This paper shows the comparison of various load balancing algorithms like round robin, equally spread current execution load and throttled in cloud environment with different metric like Response time, Data processing time, cost. The considered uniqueness has an impact on cost, which can be obtained by enhanced response time and processing time. We use CloudAnalist simulation tool to show the table and results.

Keywords: cloud computing, Load balancing, cloud load balancing, Round Robin Algorithm, Equally Spread Current Execution Algorithm, Throttled Load Balancing Algorithm, Cloud-Analyst.

I. INTRODUCTION

Cloud Computing is growing up like a rapid fire. It takes in all fields: IT industries, research, students, government sector, non IT etc. In traditional computing, we install each and every software which we have required and update hardware time to time. The works we have done and stored in our computer they are accessible only in our network we cannot be access all these matter or documentation outside the network. Cloud computing provide services according to your wish, if you want to take service you can start and when you want to stop you can. You pay for what you have used. It is very easy to use a cloud we need only a thin client or a laptop to access the internet. It is like electricity used at home.
Cloud computing provides all the features of grid computing like software as a service and utility computing. It also use the concept of virtualization. Cloud computing architectures are basically parallel, distributed and serve the desires of various clients in different scenarios.

Load balancing algorithm

Load Balancing is a method in which work is distributed among all the servers, network interfaces and computing resources. Load balancing in the cloud is completely different from the classical perception on load balancing implementation by using commodity servers to perform the load balancing. It is a process in which data is distributed to various servers through different algorithms and methods to improve the performance and resource utilization. It makes sure that our all the servers are being utilized and none is idle. Load balancing is used to distribute a larger processing load to smaller processing server for increasing the overall performance.

Load balancing algorithm is divided into static algorithm and dynamic algorithm [1]. The static algorithm is easily carried into execution and takes less time, which doesn't refer to the states of the load nodes, but it can be only used in certain specific conditions. The common static algorithms are Round-Robin Scheduling Algorithm, Weighted Round-Robin Scheduling Algorithm, and Least-Connection Scheduling Algorithm etc.

The dynamic algorithm like first come first serve is self-adaptive algorithm, which is better than static algorithm, and suitable for a great deal of requests which procreate different workloads, which would be unable to be forecasted [2].
. At the same time, assigning the load carries on synchronous operation according to the load information from all nodes, that is, redistributing the load that needs to be done.

These are some existing load balancing algorithm in Cloud computing

1. Honey bee foraging algorithm[3]:

It is a natural inspired algorithm for self organization. It is based on the behavior of honeybee. In this algorithm servers are grouped under virtual servers, and they have own queue for each. Each server sends a request from the queue and checks the availability. If the availability is high than the bees perform their waggle dance. It increases the system diversity but it does not increase the throughput.

2. Biased Random Sampling[3]:

It is a distributed and scalable load balancing approach that uses random sampling of system domain to achieve self organization. In this algorithm firstly virtual graph is

constructed with the connectivity of each server representing the load of server. Load balancing scheme used fully decentralize and it makes a large network system like Cloud. Performance is degraded with an increase in population Diversity.

3. Active Clustering[3] :

It works on the principle of grouping similar nodes together and working of groups. Performance degrades with an increase in system diversity.

4. Round Robin Algorithm[3]:

In this algorithm load is transferred randomly and it can cause some server to be heavily loaded and other to be idle or lightly loaded. In this algorithm, processes are scheduled in a FIFO manner but are given a limit time-slice or a quantum. If a process is not completed in its time slot the CPU preempts that process and gives to the next process which is in queue. The preempted process is then placed at the last of queue. The response time and processing time can be improved in the respect of cost optimization considered.

5. Equally Spread Current Execution Algorithm[3]:

Equally spread current execution algorithm processes handle the priorities. It distributes the load randomly by checking the size and transfer of the load to that virtual machine which is lightly loaded or handles that task easy and take less time , and give maximum throughput. It is spread spectrum technique in which the load balancer spreads the load into multiple virtual machines.

***6.* Throttled Load Balancing Algorithm[3]:**

Throttled algorithm is completely based on virtual machine. In this algorithm end user first request the load balancer to check the availability of virtual machine which access that load easily and performs the job. In this algorithm the client first requests the load balancer to find a suitable Virtual Machine to perform the required operation.

II Literature review

A literature survey means that we read and report on what the literature in the field has to say about a topic or subject. It is a systematic way of the relevant research which has focused on a research

Khanna, Beaty and Kar (2006) [4], According to author they want to deploy applications rapidly as businesses have grown. Many times a new application was needed to new server with the application software were deployed. Author introduced the concept of server consolidation using virtualization that arise performance in the area of application. They try to solve the problem using data to trigger migration of VM and key performance metrics.

Jackson, Keith's (2010) [5], in this paper author introduces Cloud computing and compare the two platform HPC and Amazon EC2. It has seen fastest growth in cloud, mainly for commercial web applications. The implementation and performance of clouds are very different. It is very hard to evaluate the performance of HPC applications in cloud environments. In this work author represents the most evaluation of comparing HPC platforms to Amazon EC2, using real applications. It represents the workload in cloud datacenter. The result of comparison indicates that a mid-range Linux cluster is six times faster than EC2, and twenty times faster than HPC system.

Padhy and Rao(2011) [6], In their thesis have given the basic concepts of Cloud computing , load balancing and some existing load balancing algorithms. They develop an effective load balancing algorithm using divisible scheduling theorem. They proposed a complete task within time and process is very high. For this they divide all number of tasks in sub-tasks and each and every task is given one job at least. They introduce an algorithm divisible load scheduling (DLT). In cloud it is used as an optimal division of load in master computer and communication links. The main objective of this algorithm is to obtain a minimal partition of the load by different communication links so that load can be distributed in minimum time. These strategies related to performance with respect to the timing.

Ren et al. (2012) [1], they discussed about load balancing algorithms. The load balancing algorithm is an important tool to achieve maximum utilization of resources and performance. This paper presents a load balancing algorithm in cloud environment based on virtual machine. This algorithm proposes the trigger strategy based on the fractal methods. They determine the time of the virtual machine to migration through forecasting, which can avoid the problem of load trigger. They compare result with another algorithm like, ant colony optimization and honey bee and results is they can achieve more resource utilization. They proposed test the system and experiment results show that the algorithm can achieve load balancing and improve system performance.

Sidhu and Kinger (2013)[2], has discussed about cloud computing, load balancing and its challenges related to the cloud environment .This paper presents a concept of load balancing as a key issue in cloud, and discusses about some existing load balancing algorithm which are already used in cloud and their challenges like security, data availability and network level migration etc. Load balancing enhances the performance and also helps in utilization of resources. The comparative study of algorithms in cloud computing with respect to scalability, resource utilization, performance, response time and overhead associated.

N.Sran and Naveep Kaur(2013) [7], they have developed a Load Balancer Algorithm that controls the flow of payload based on thresholds, which may be static or dynamic in nature. The author have analyzed the existing algorithms of load balancing such as round robin, throttled, equally spread and biased random sampling and have proposed new algorithm which increase the performance of the will make better the existing Load Balancing Algorithms, by decreasing the overall requesting and processing time .The proposed algorithm will also provide security to the data in cloud during Load Balancing process by using Zero Proof Algorithm. In the proposed work they worked on VM migration policy on the basis of resources available. Firstly it checks the CPU utilization is equal, greater or less than 80%. Through this method it becomes clear that this is able to balance the load to a greater extent than analyzed algorithm.

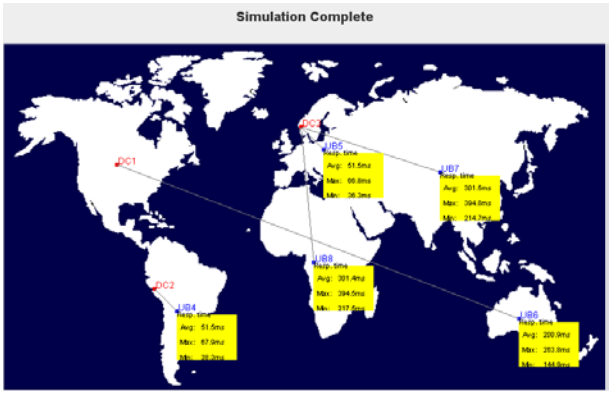
Pritam Fulsoundar, Rajesh Ingle [8], in this paper author has discussed about cloud computing, QoS, SLA. QoS is one of the big issues in cloud resources. Service Level Agreement (SLA) between cloud provider and customer is generated. SLA consists of information about requirement specification of resources, duration for it required and its parameters are throughput, latency, availability is mentioned in SLA document. They propose novel approach for predicting performance degradation due to insufficient CPU cycles. Proposed system consists of cloud manager in which they integrated prediction system so that they can predict performance degradation. They used monitoring tool to collect data about CPU usage and they analysis easily apply Pareto distribution model for performance degradation using CPU usage values. They focused on techniques and algorithms for prediction of performance degradation. They will develop an algorithm for VM placement which will use output produced by proposed model.

III PROBLEM DEFINATION

The random arrival of load in cloud atmosphere causes some servers are heavily loaded in comparison to others. Due to this problem client cannot be ignored since access is denied to their request or requirement. It mostly seems the reason for degradation of performance in cloud. The considered uniqueness has an impact on cost, which can be obtained by enhanced response time and processing time.

IV Simulation CloudAnalyst

CloudAnalyst is a simulation package that has an easy to use GUI. CloudAnalyst provides performance analysis. It was derived from CloudSim and extends some of its capabilities and features propose. It enables to repeatedly perform simulations experiments with parameters variations in a quick and easy way. CloudAnalyst can be used for examining the behavior of large internet application in a cloud environment [9]. It is a tool in which we can do testing and perform simulation with different matrices. In CloudSim we need to do core Programming. Perform analysis of different different load balancing policies, with different parameters. The study includes compression of various algorithm with different service polices.



Through CloudAnalyst in this paper we analyze various load balancing policies configuration of the various components. We have set the parameter for the user bases configuration, data center configuration and advanced configuration. Through this we can get output screen of CloudAnalyst. The location of the UB has been defined 0-5 different region which covers the world. In all reason we have taken four or more than data center to handle the requests of users.VM machine allocated are 60 each. The Time of duration simulation is 60hrs. The GUI of the simulation results can be analysis easily after performing the simulation the result compared by cloud analyst for RR with different services polices and then results is calculated for the metrics response time, request processing time and cost after this we simulate and get all there load algorithm result as compare in the table. Using table it is inferred that throttled load balancing provides best responses time, data center processing time with small processing cost as compare with both algorithm. And among different service broker policies, closet data center is the best as it forwards request to the closet data center in lesser time. Through CloudAnalyst Simulation we are showing the comparison between RR, Equally spread Current execution algorithm and Throttled algorithm with different parameters like Response time, data transfer processing time and cost. When we compare both algorithms we are taking same data for the algorithms 3 data center, and 5 user base. These data we set five user base identifiers as UB4,UB5,UB6,UB7,UB8 each user bases belong to different

region and we set 3 different data centers DC1,DC2,DC3 having 60VM each.

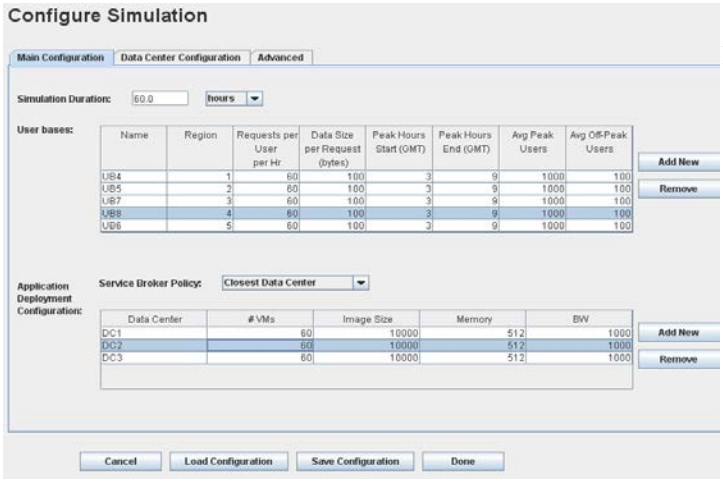


Fig1 : Main Configure

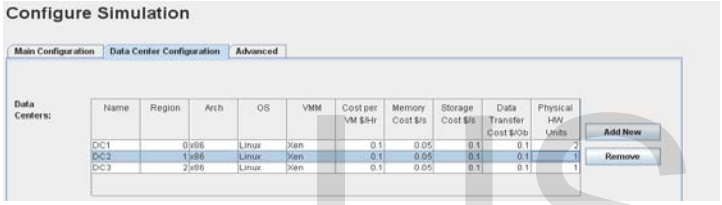


Fig2: Data Center Configure

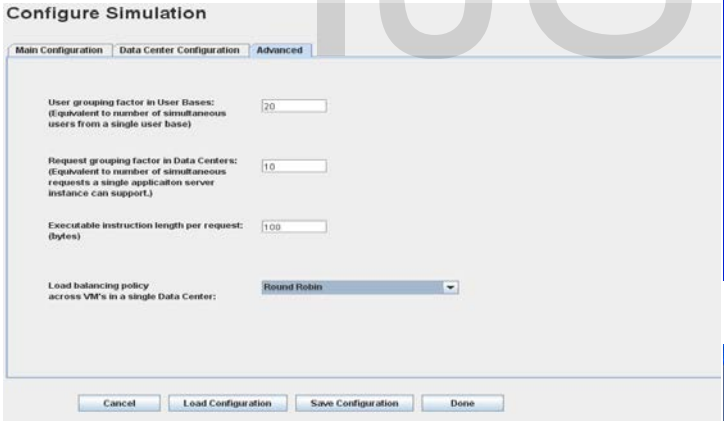


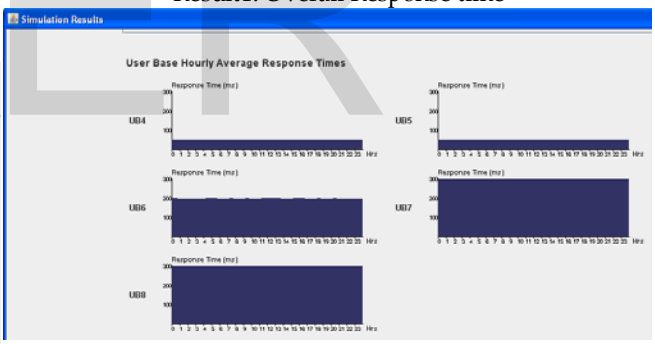
Fig3: Advanced Configure

V Results:

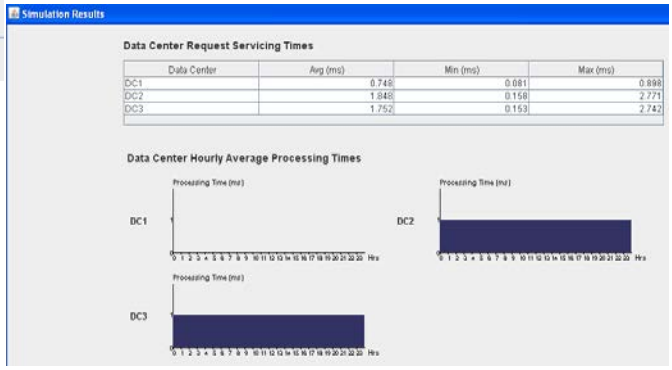
After performing the simulation the result computed by CloudAnalyst is as shown in the figures and graphs. The defined configuration has been used for each policy one by one and depending on that the consequence calculated for the metrics with response time, request processing time and cost in gratifying the request has been shown. Response time is defined as time taken by any internet function and is defined as interval time between sending and getting of a response. Request processing time refers to time period the data centre takes to confirm the request. The estimated cost is sum total of total virtual machine cost and total data transfer cost. Parameters like average response time, data center service time and total cost of different data centers have taken for analysis. After performing simulation in case of round robin, there is grow of response time and datacenter processing time while in case of throttled, there is intense reduction in response time and data center request processing time.

Through CloudAnalyst simulation we analyzed with table and graph and show the overall response time and DataCenter processing time is enhanced/improve. It is also proved that throttled and ESCE algorithm is greatly superior than we compare Round robin algorithm. Results are strongly shows that both algorithms are 50-60 % appx grow compared to Round Robin algorithm.

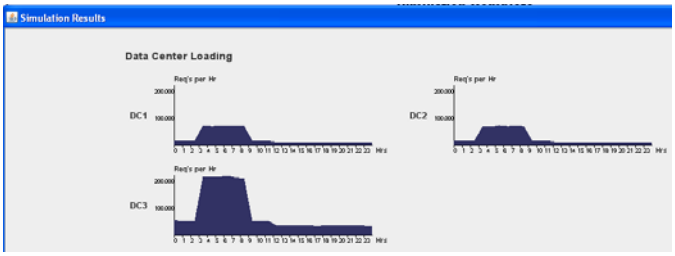
Result1: Overall Response time



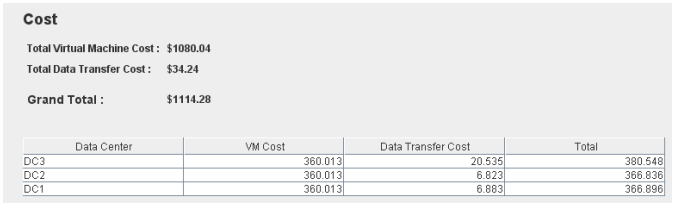
Result2: Average Response time



Result3: Data center request servicing time



Result4: Data center Loading



Cost

Total Virtual Machine Cost : $1080.04
Total Data Transfer Cost : $34.24
Grand Total : $1114.28

Data Center	VM Cost	Data Transfer Cost	Total
DC3	360.013	20.535	380.548
DC2	360.013	6.823	366.836
DC1	360.013	6.883	366.896

Result5: Cost

Overall Response time

Load balancing algorithm	Service policy	Avg(ms)	Min(ms)	Max(ms)
Round Robin algorithm	Closest Data center	181.48	36.26	394.82
Equally Spread Current Execution	Closest Data center	171.38	35.75	526.76
Throttled Load balancing	Closest Data center	171.38	35.75	526.76
Round robin	Optimize response time	171.44	34.81	542.11
Equally Spread Current Execution	Optimize response time	171.40	35.46	542.76
Throttled Load balancing	Optimize response time	171.40	35.46	542.77
Round robin	Reconfigure Dynamically	241.88	37.28	71448.26
Equally Spread Current Execution	Reconfigure Dynamically	188.40	37.28	62446.01
Throttled Load balancing	Reconfigure Dynamically	188.32	37.28	62446.01

Data Center Processing Time

Load balancing algorithm	Service policy	Avg(ms)	Min(ms)	Max(ms)
Round Robin algorithm	Closest Data center	1.57	0.08	2.77
Equally Spread Current Execution	Closest Data center	1.83	0.00	3.79
Throttled Load balancing	Closest Data center	1.19	0.02	2.31
Round robin	Optimize response time	1.26	0.00	2.81
Equally Spread Current Execution	Optimize response time	1.22	0.02	2.31
Throttled Load balancing	Optimize response time	1.22	0.02	2.31
Round robin	Reconfigure Dynamically	34.17	0.00	38400.25
Equally Spread Current Execution	Reconfigure Dynamically	18.22	0.08	62395.51
Throttled Load balancing	Reconfigure Dynamically	18.13	0.08	62395.51

Table 1and2: Show overall response time data and Data center data

Cost in Dollar ($)

Load balancing algorithm	Service policy	TVM($)	TDT ($)	Grand Total ($)
Round Robin algorithm	Closest Data center	1080.04	34.24	1114.28
Equally Spread Current Execution	Closest Data center	738.03	34.24	772.27
Throttled Load balancing	Closest Data center	750.03	34.24	784.27
Round robin	Optimize response time	750.03	34.24	784.27
Equally Spread Current Execution	Optimize response time	750.03	34.24	784.27
Throttled Load balancing	Optimize response time	750.03	34.24	784.27
Round robin	Reconfigure Dynamically	982.43	4.31	986.75
Equally Spread Current Execution	Reconfigure Dynamically	1806.94	34.24	1841.18
Throttled Load balancing	Reconfigure Dynamically	1806.84	34.24	1841.08

Table 3: Show overall Cost

Above Table 1, Table 2 and Table 3 go over the Simulation settings and experimental results. It shows that bring the service closer to the users enhanced the value of service (in response time case). It is a predictable effect, because user's experiments have less effect from internet issues when they are geographically closer to the computing server. From above results it is reasonably apparent that high quality of service is achieved when we follow the throttled as a service policy across virtual machine in each cloud resource. It is relatively clear from above result that when we increase the no of cloud resources near to the user base then response time is improved. Overall average response time and Overall average time spent for processing request by a datacenter is minimum in case of cloud configuration 5 with 3 data center and 60 virtual machine each because we use throttled for load balancing policies . The service closer to the users improves the quality of service. Service quality can be further improved by applying different service policies.

VI CONCLUSIONS:

The response time and data transfer cost is a key challenge issue in cloud environment it affects the performance in the cloud based sectors. The paper aims to compare the Load balancing algorithm in cloud environment. The simulation results show overall time and cost results and comparison of two loads balancing algorithms round robin and throttled.

Throttled algorithm dynamically allocates the resource to the job in a queue leading reduced cost in data transfer and Virtual machine formation. The simulation result shows the reduction up to 50-60%in the cost and time. This improves the business performance.

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