Load Balancing in Cloud Computing Using Dynamic Load Management Algorithm

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Abstract— **Nowadays, Cloud computing has become essential buzzword in the Information Technology and is a next stage in the evolution of Internet, The Load balancing problem of cloud computing is an important problem and critical component for adequate operations in cloud computing system and it can also prevent the rapid development of cloud computing. Many clients from all around the world are demanding the various services at rapid rate in the recent time. Although various load balancing algorithms have been designed that are efficient in request allocation by the selection of correct virtual machines. In the present paper, a dynamic load management algorithm has been proposed for distribution of the entire incoming request among the virtual machines effectively. Further, the performance is simulated by using CloudAnalyst simulator based on various parameters like data processing time and response time etc. and compared the result with previous designed algorithm VM-Assign. Here results after simulation have demonstrated that the present algorithm has distributed the load uniformly among server through efficient usage of resources uniformly.**

Keywords—Cloud Computing; Virtual Machines, Load Balancing; Resource Allocation.

I. INTRODUCTION

In the upcoming years the term Cloud Computing has become an emerging and fastest technology in the world. Cloud Computing is one of the most talked about technologies and due to the various opportunities offered by it has got lots of attention from media and analysts. Cloud computing is an on demand service[1] in which shared resources[1],information services, software and other services[1] are given to specific users according to the need at exact time.

Cloud Computing system are heavily rely on term virtualization that improves the power efficiency of datacenters and enables virtual machines to single physical server All services through the internet are distributed whenever user demands, such as operating system, network, storage, software, hardware and resources. These are three types of services that are divided into these types: Infrastructure as a Service (IaaS) [10], Platform as a Service [1] (PaaS) and Software as a Service (SaaS).

Cloud Computing has become one of the popular technology adopted by both industry academia providing a flexible and efficient way to store and retrieve files [2]. The major problem is scheduling of the incoming request so minimum response time is obtained, efficient resource utilization. Cloud Computing system[3] are heavily rely on term virtualization[2] that improves the power efficiency of data centers and enables virtual machines to single physical server. Many algorithms FCFS, honeybee based load balancing technique, Round Robin, Active Clustering, Active Monitoring Load Balancer[3], Throttled Load Balancer[9], Active Clustering, WCAP, JIO, CLBVM, Random sampling have been designed to carry out the client's request towards the cloud nodes but to ensure effective utilization of resources and response time minimum the term load balancing comes into effect. The paper included some algorithms of load balancing algorithms in cloud computing which is analyzed on a specific environment of virtual machine. In this paper, we proposed a Dynamic Load Management algorithm which will distributes the load uniformly at the servers by considering the current status of all the available virtual machines intelligently and later response time of this algorithm is compared with the existing VM-Assign Algorithm.

The paper is organized as below: existing algorithm and In Section II related work has been discussed, Load balancing classification is in Section III and discussed various algorithm is given, Section IV and V introduces the experimental setup of CloudAnalyst tool results and section VI gives conclusion.

II. RELATED WORK

Load balancing is a new technique that provides high resource time and resource utilization is effective by assigning the load among various servers, side by side it solves the problem of overutilization and underutilization of virtual machines [7]. Load balancing [9] resolve us the problem of critical overloading and focuses on maximum throughput [12], optimization of various resource utilization [6] and minimize response time.

Load balancing has two major tasks, one is resource allocation or provisioning of resources and other is scheduling in distributed environment system. An Efficient provision of different resources and scheduling of resources as well as tasks will ensure:

- Resources are available easily.
- Resources are utilized under condition of low/high load.
- Reduction in cost of using resources.

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- Load balancing helps in increasing throughput to the maximum level and minimum response time.

In cloud computing environment[1] various load balancing algorithm have been facilitated and proposed such as Honeybee-based load balancing technique[4], Active Clustering[9], Random Sampling, Throttled Load Balancer[9], JIQ,WCAP, and Active Monitoring Load Balancer[1] ,and the another one is CLBVM.

Hemant S. Mahalle, Parag R. Kaveri [12] and Vinay Chavan [12] proposed an "Active monitoring load [13] balancer algorithm" which is responsible for maintaining the information related to VM and how many requests are allocated to each VM. When a request is come, it will assigned to the VM which is least loaded, if more than first one is selected. The result of is that Active VM load balancer is able to return id to Data Center Controller[13] and a request is then send by the data center controller to VM identified by that id. Then Data Center sends notification to Active VM Load Balancer for new allocation of request.

Shridhar G. Domanal [9] and G.Ram Mohana Reddy [9], proposed "Modified [9] throttled algorithm" is optimized load balancing technique for distribution of coming jobs request consistently between the servers or virtual machines. The efficiency is evaluated using simulator Cloud Analyst and result is compared with previous algorithm Round Robin and throttled algorithm. Hence response time has been improved related to previous one.

Shridhar G. Domanal [2] and G. Ram Mohana Reddy [2] have proposed an algorithm VM-Assign i.e. responsible for distribution of all the coming requests to all the virtual machines that are available efficiently. Here CloudSim Simulator has been used for result analysis and then compared with existing Active-VM load balance algorithm. Our proposed technique resolves the ineffective utilization of the VMs / resources when relates result to previous algorithm.

B.Wickremasinghe [11], R.N.Calheiros and Rajkumar Buyya [11] states that Throttled Load Balancing Algorithm is fully based on the allocation of request to virtual machine [3]. In this current right virtual machine is checked by load balancer when user request and it can able to approach that load dynamically well and performs the task that had been requested by user. The result [17] is that an index table of available virtual machines has been maintained by the load well and their states i.e. Busy or Available. Firstly then a user requested to the active load balancer [17] to select the applicable Virtual Machine to execute the assigned task.

M. Moradi [18], M.A. Dezfuli, M.H.Safavi [18], proposed algorithm is New Time Optimizing [18] Probabilistic Load Balancing. An algorithm is proposed to for management of load and response time should be less and main purpose is to choose the resources based on least completion time and better past status.

III. PROPOSED WORK

In present we have proposed an efficient algorithm Dynamic Load Management Algorithm has proposed where load is managed by the server by considering the present status of present VMs for request assignment sharply. Therefore reduction in response time when compared to VM-Assign Algorithm.

Algorithm: Dynamic Load Management Algorithm

Input: Number of incoming jobs is i1, i2 . . . . . in
Available VM j1, j2… . . . . . jn
Output: All coming task i1, i2 . . . in are assigned to virtual machines which are having minimum load with the present j1, j2…… jn.

1. VmLoad Balancer manages symbol table of all the present VMs and the status of VM (i.e. BUSY/AVAILABLE). All VM's are free in starting.
2. A new query has been received by the Datacenter Controller.
3. A query is received by VmLoad Balancer through datacenter Controller for the next allotment.
4. Allocation table has been parsed by VmLoad Balancer from top to bottom till the time when first and free available VM is found.
5. Here then to check that present allocation total is less than that of maximum limit of VM list.
6. Active load has been counted for all VM.
7. Then return id of least loaded VM. And then a request is assigned by VM Load Balancer to present VM.
8. A few task will be assigned to VM which is least loaded if sometimes VM i.e. overloaded for equal allotment of load to every VM.
9. If VM not found, VmLoadBalancer returns -1 then DataCenterController queue up the incoming request.
10. When VM end with taking the query and the Datacenter Controller get the response of cloudlet it alerts the VmLoadBalancer of the particular VM deallocation.
11. The Data Center Controller focuses on checking if any requests that are in their waiting queue, it will continue from start of step 3.
12. Continue from step 2.

The VM-Assign [2] load balancer mainly target on the effective usage of the resources VM [2]. In proposed algorithm employs that Dynamic Load Management takes the set of available virtual machines in an available group or block. When a new request comes we check for best suited virtual machine. Once the request is bound with the virtual machine, we remove this VM index from the group of available virtual machines so it will not be considered for any future request until it finish its assigned workload and becomes available again by setting its status to be free. If the next upcoming task is received then it checks for the table of VM if it is overloaded then a request will be assigned to and returns the id of that particular VM to the Data Center, else -1 is obtained. When Vm completes its work, the Data Center Controller receives the reply of Datacenter, it notifies the Modified Throttled Load Balancer of the VM deallocation.Our proposed algorithm gives response time improved when compared to Optimal VM Load balancer because we have a dynamic set of available virtual machine and unlike the previous one we don't considers an overloaded machine again and again for scheduling. It leads to the better response time.

IV. INTRODUCTION TO CLOUD ANALYST

The simulation of problem, result and performance analysis is carried out by using this simulator cloud analyst tool.

A. *Cloud Analyst*

Cloud Analyst is a GUI [5] based tool based on Cloud Sim architecture. It has been developed at University of Melbourne that aims is to support assessment of tools of social networking tools according to the geographic distribution [2] of clients and different data centers. CloudSim is a tool which was developed in the University of Melbourne of GRIDS laboratory which enables modeling[19], simulation [19] and experimenting [5] on designing the infrastructure of Cloud computing.

Cloud Analyst tool detached programming from the simulation [5] experimentation, such as modeler has to focus on the simulation complexities. The Cloud Analyst grants modeler to work into various experiments.

B. *Cloud Analyst Design*

The tool Cloud Analyst has created on topmost of Cloud Sim [19] tool kit [5], by continuing some functionality of Cloud Sim with the internet modelling and behavior of Internet Application by introducing the concepts.

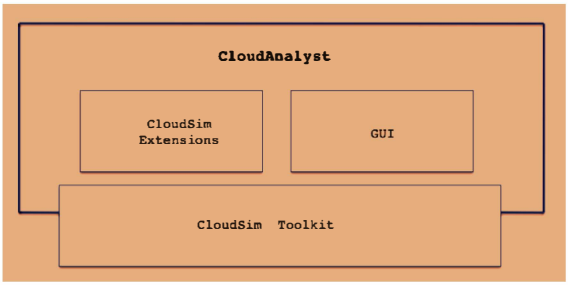

Fig.1. CloudAnalyst Architecture

1) *The basic constituents of the tool cloud analyst [9] are:*

a) *GUI Packages:* It is mainly responsible for the graphical user Interface.

b) *User Base[19]*: It models a different clients who are treated as individual entity in the simulation and generates traffic for the simulation.

c) *Internet-* By introducing delay for transmission and data transfer,It can models routing scheme for Internet traffic .

d) *DataCenterController***:** It generally controls Data center activities.

e) *VmLoadBalancer***:** A VmLoadBalancer is used by Data center controller for determination of which particular VM is to be used for assignment to which datacenter and models load balancing policies.

f) *Simulation***:** Simulation accepts requests and then execute request.

g) *CloudAppServiceBroker:* This component broker handles the traffic routing between data centers and user base.

V. RESULT & ANALYSIS

Now we will analyse the two load balancing policies by setting the configurations of components of the cloud analyst tool [5].The parameters have been set for the application deployment, configuring user base [7], In Fig 2-5 we have shown the Data center configuration and load balancing policy [8]. As shown in the Fig 2, the six regions have been defined for locations of various user bases in the world. We consider the four data centers to serve the requests of users. First data center is located in region 0, second one is in region 1, third one is in region 2 and fourth one is in region 4 and fifth one is in region 5. There are total 25 VMs in each of DC1 to DC5. As shown in Fig 5[7], you can select a load balancing policy; first VM-Assign algorithm is selected. Time for simulation is about 24hrs. Cloud analyst tool permits the users to repeatedly executing the simulation when change of the parameters time to time. Few of user Base configurations are shown below.

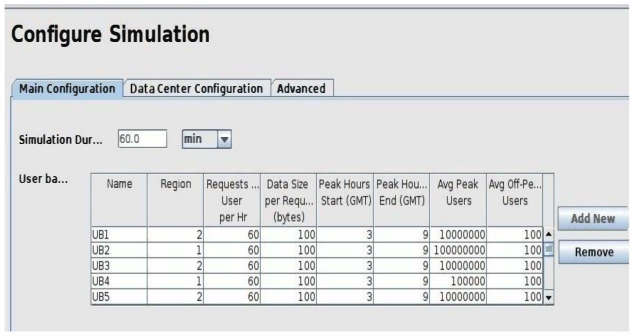

Fig.2. User Base Configuration

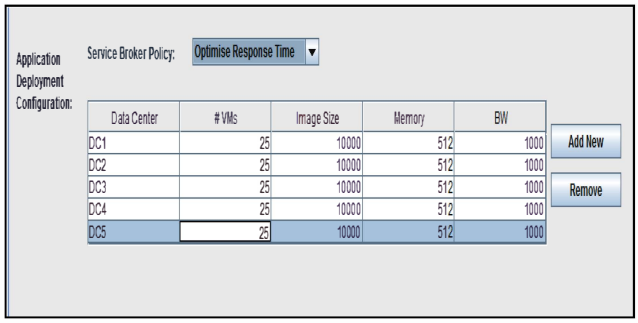

Fig.3. Application Deployment Configuration

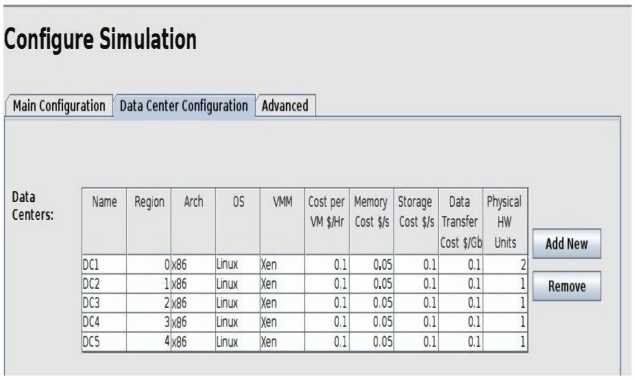

Fig.4. Data Center Configuration

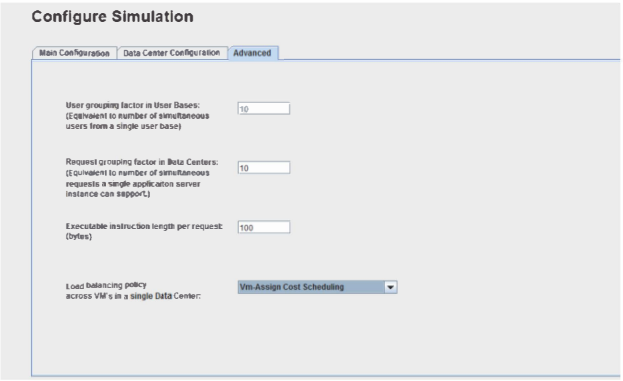

Fig.5. Load Balancing Policy

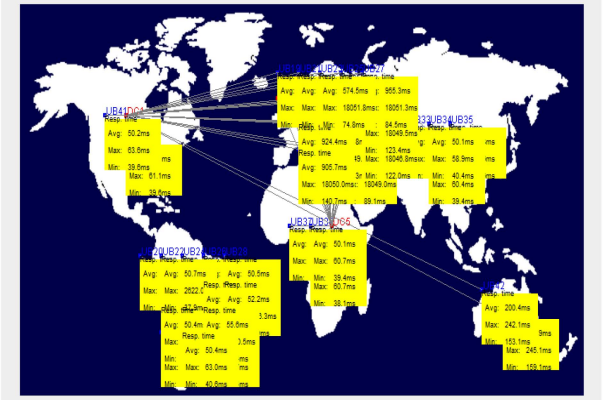

Fig.6. Output Screen of CloudAnalyst

Here after execution simulation result has been shown by cloud analyst has shown in Fig.6. The above defined configuration [7] has been set for individual load balancing policy one after the other and finally the result has been calculated for metrics i.e. request processing time[9], response time and total cost required in achieving the task are shown in Tables I, II, III.

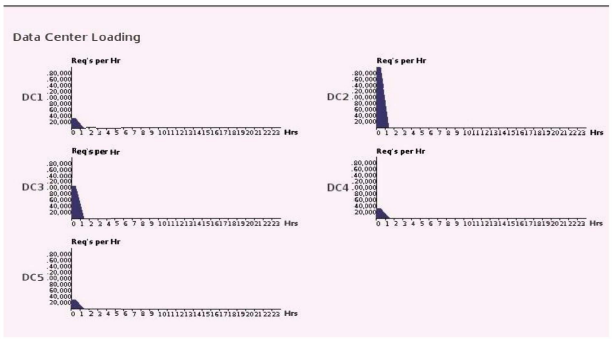

Fig.7. Data Center Hourly Load

A. Response Time By Region

Here the response time of all the user base in various regions has been analysed by the Cloud Analyst tool by selecting loading policy that are shown as in Table I.

TABLE I. Response Time by Region

User Base	VM-Assign(ms)	Dynamic(ms)
UB1	800.38	545.49
UB2	50.34	50.00
UB3	849.93	506.21
UB4	50.32	50.18
UB5	918.64	526.78

B. Datacenter Servicing Times

Data center [7] Request Servicing Time has analysed by the cloud analyst by the selection of loading policy one by one are given in the Table II.

Table II. Data Center Request Servicing Times

Data Center	VM-Assign(ms)	Dynamic(ms)
DC1	.37	.35
DC2	.97	.51
DC3	.97	.30
DC4	.37	.37

C. Cost

In Table III the cost for particular load balancing policies analyzed by the tool cloud analyst are given as:

Table III. Date Transfer Cost

Data Center	VM-Assign($)	Dynamic($)
DC1	.50	.40
DC2	.10	.10
DC3	.10	.10
DC4	.50	.50
DC5	.50	.49

D. Overall Response Time

The overall responding time for each algorithms estimated by the simulation of cloud analyst as shown in Fig 8 and Fig 9.

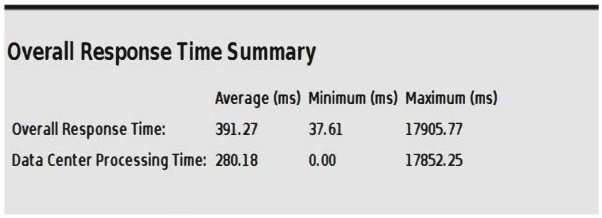

Fig.8. Overall Response Time Summery of VM-Assign Algorithm

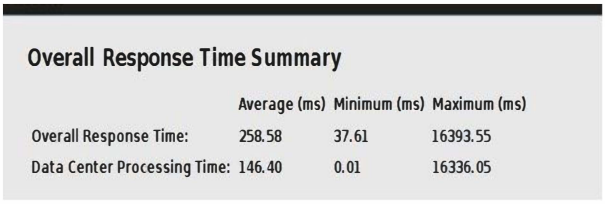

Fig.9. Overall Response Time Summery of Dynamic Load Management Algorithm

VI. CONCLUSION

In present paper, a dynamic algorithm is proposed which will manage the load incoming by focusing on their present status at cloudlet for all free VMs to be used at request assignment and will take more requests that are dynamic in nature. The response time has been improved efficiently. The main problem with the existing algorithm is that every time it considers all the virtual machines to check the availability of assigning new load. So it takes more time in request allocation which in turn leads to increased response time. The simulated algorithm has response time better when relates to Optimal VM-Load balancer because we have a dynamic set of available virtual machine and unlike the previous one we don't considers an overloaded machine again and again for scheduling. It leads to the better response time. Hence our proposed algorithm distributes the load nearly efficiently among VMs with improved time in comparison to the previous algorithms [2] and solves all the issues of ineffective usage of the present VMs. The experimental results has shown that this algorithm have minimum response time and proper resource utilization by using CloudAnalyst tool and checked its performance on various different load distributions. Here Simulation results indicated that the proposed Dynamic Load Management algorithm outperforms the existing virtual machine load balancing algorithms.

In future if both dynamic and static load is to be mixed then the this algorithm can be improved sufficiently and also by incorporating the paradigms of parallel and high performance computing response time and utilization of VMs may be further optimized.

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