7th International Conference on Recent Development in Engineering Science, Humanities and Management
National Institute of Technical Teachers Training & Research, Chandigarh, India (ESHM-17)
3rd June 2017, www.conferenceworld.in ISBN: 978-93-86171-26-9

PERFORMANCE ANALYSIS ON LOAD BALANCING BY ROUNDROBIN, THROTTLED & ACTIVE MONITORING ALGORITHMS USING CLOUDANALYST

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ABSTRACT

Load balancing is the process of distributing the total load to the individual node to improve resource utilization and response time. This avoids the circumstances that some nodes are heavily loaded, some are less work and idle. Here, the concepts of load balancing is used in Cloud Computing, for migrate the loads to underloaded nodes or Vms(Virtual Machine) for effectively sharing the resources. Various types of load are possible in cloud computing like CPU, memory, network load etc. By load balancing, it prevents the bottlenecks of the system which may occur due to load imbalance. There are many load balancing algorithms studied using simulation techniques enquire into the behaviour of large scale distributed systems and therefore introduces a new simulation tool called CloudAnalyst used for simulating large scale applications in cloud computing. Here, propose to implement existing algorithms like roundrobin, throttled load balancing and active monitoring load balancer algorithms and are simulated in CloudAnalyst. Comparing these algorithms based on their response time for their better performance and found that active monitoring load balancer algorithm have better response time.

Keywords: Active Monitoring Algorithm, CloudAnalyst, Cloud Computing, Load Balancing, RoundRobin Algorithm, Throttled Load Balancing Algorithm.

I. INTRODUCTION

Load balancing [1] helps to distribute the load from heavily loaded nodes to less loaded nodes. Therefore, no single node is overloaded or underloaded. It ensures that all nodes in the system approximately equal amount of work. So it can achieve optimal resource utilization, maximize throughput, minimum response time and avoid overload. The concepts of load balancing applied in cloud computing to migrate the loads to underloaded nodes or VMs for effectively sharing the resources.

The load balancing concept in cloud computing [2] [7] allows enterprise to manage application and workloads demands from user by allocating resources among multiple servers. The heterogeneous environment is considered [16], because of heterogeneous resource. So it behaves different and has different attribute and different response time for any process. Although load balancing in cloud computing [11] is different from parallel computing. The

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architecture and implementation of load balancing process in cloud computing is different from others and performs load balancing by the use of commodity servers. It provides for new opportunities and economies of scale. Also, load balancing is the major issue in cloud computing paradigm due to elastic nature of cloud computing and unpredictable behavior of user.

In load balancing[3], the ability to allocate the incoming load from user bases among the virtual machines, the researchers proposed several load balancing algorithms such as RoundRobin, Throttled Load Balancing, Active Monitoring Load Balancing etc. Here, propose to implement the existing algorithms and compare with each other on the basis of response time and will find which algorithm is better. To assess the performance of load balancing in cloud environment, cloud simulators play an important role as it is a challenging task to perform experiments on the real cloud. The algorithms are implemented and simulate in CloudAnalyst, which is used for analysis of the large scale applications which are running on cloud and it provided GUI to the users for easy understanding.

This paper is organized as follows: Section II focuses on the related work of existing load balancing algorithms, Section III, about the CloudSimulator, Section IV, presents the Proposed Methodology, Section V, Implementation Details is discussed, Section VI, presents the Result and Performance Analysis and Section VII, Conclusion and Future work done in this paper.

II. RELATED WORK

LOAD BALANCING BASICS

Load balancing is used to distributing the load across multiple nodes for enhancing the overall performance of a system. The current load balancing algorithms in cloud computing environment is not highly efficient. Load balancing is very complex task today, because the users request arrival on server is not possible ie, we cannot predict it. Each Vms [4] [8] has different specifications. So it is difficult to schedule the job and balance the nodes. Recently, many research work done on load balancing. Load balancing mainly classified into two categories, static load balancing and dynamic load balancing algorithms. Static load balancing algorithms mainly defined in the design or implementation of the system. Dynamic load balancing algorithm considered only current state of the system during load balancing. The existing algorithms are following:

Round Robin Load Balancing Algorithm: Round robin [12][14] is the most basic and least complex scheduling algorithm. It works based on time quantum and each processor takes time quantum for sometime. It processes in round form. In this, the datacenter controller assigns the requests to Vms on a rotational basis. The process does notcomplete in given time, it waites for the last process and placed at the end of queue. The major issue is that it cannot complete the processes, because sometimes some process are overloaded and it should be waited in the waiting queue.

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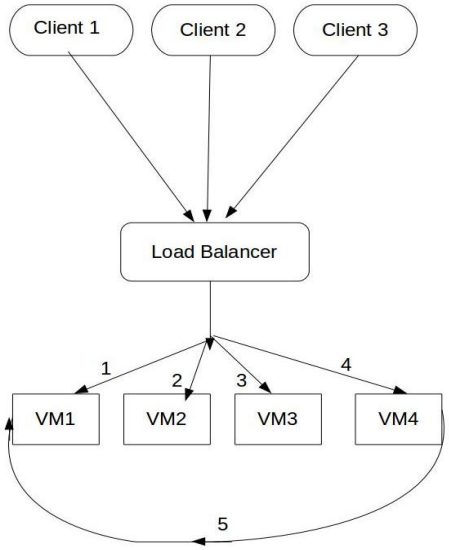

Fig.1 RoundRobin Load Balancer

Throttled Load Balancing Algorithm: Throttled load balancing algorithm [5] contains index of virtual machines and the states, which is available or busy. It finds the suitable VM for assigning a particular job. The load balancer has a list of Vms. When a new request arrives, the load balancer assigned the request to first available Vms for their allocation. If no Vms are available when the request comes, then all request are waiting in queue for fast processing, and it returns -1 to the datacenter and this algorithm reduces the cost of usage.

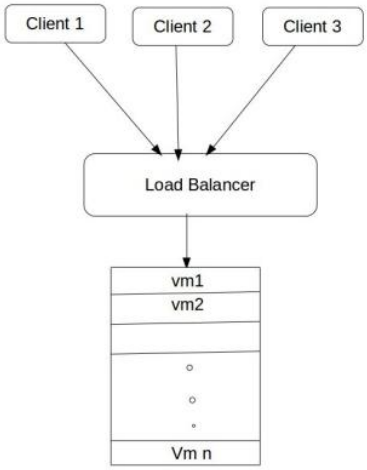

Fig 2. Throttled Load Balancer

Active Monitoring Load Balancing Algorithm: In Active Monitoring Load Balancing Algorithm [15], information about each VM is maintained along with the number of requests currently allocated to it. When a new request arrives the least loaded VM is searched out from the available information. If there are more than one then the first identified VM is selected. After the selection of VM, its id is send back to the DataCenter controller to forward the request to the VM whose id has been identified. At times, multiple tasks are assigned to a single VM which increases the complexity of the algorithm.

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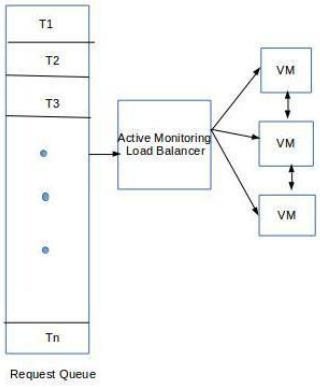

Fig.3 Active Monitoring Load Balancer

III. CLOUD SIMULATOR

Cloud simulators [10] play an important role for performing large scale applications which are running on cloud. This is a toolkit that supports both modeling and simulation of cloud computing based system and application provisioning.

CloudSim: Cloudsim [13] is a simulation tool that allows developers to test the performance of their provisioning policies [9] with free of cost. And it is a library for the simulation of cloud scenarios. The primary objective of cloudsim is to provide a generalized, extensible simulation framework that enables modeling, simulation and experimentation of cloud computing infrastructures and application services. It is designed for the researchers who are working on different set of problems to improve cloud computing technology.

CloudAnalyst: CloudAnalyst [6] is the extended version of CloudSim having the features of original framework and also visualization capability. It is used for the analysis of the large scale applications that running on cloud. It provides a GUI for the user to easy understanding of the simulation experiments. It is the ability to define a simulation with a high degree of configurability and flexibility, and also also enables a modeler to repeatedly execute simulations and to conduct a series of simulation experiments with slight parameters variations in a quick and easy manner.

CloudAnalyst is the cloud simulator used for simulation for easy understanding.

IV. METHODOLOGY

Load balancing is used to distribute load from a larger processing nodes to smaller processing nodes for improving the overall performance of system. In cloud computing environment, load balancing is required to distribute the dynamic local workload evenly between all the nodes. It helps in fair allocation of computing resource to achieve a high user satisfaction and proper resource utilization. High resource utilization and proper load balancing helps in minimizing resource consumption. It helps in implementing fail over, scalability, and avoiding bottlenecks. These all are performed by using load balancing algorithms in CloudAnalyst.

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Implemented Algorithms:

The existing load balancing algorithms used in this paper are:

RoundRobin Algorithm

a) Round RobinVmload Balancer maintains an index of VMs and state of the VMs(busy/available). At start all VMs have zero allocation.

b) The datacentercontroller receives the user requests/cloudlets. It stores the arrival time and burst time of the user requests. The requests are allocated to VMs on the basis of their states known from the VM queue. The roundrobin vmloadbalancer will allocate the time quantum for user request execution.

c) The roundrobin vmloadbalancer will calculate the turn around time of each process. It also calculates the response time and average waiting time of user requests. It decides the scheduling order.

d) After the execution of cloudlets, the VMs are de-allocated by the RoundRobinVmLoadBalancer

e) The datacentercontroller checks for new/pending/waiting requests in queue.

f) Continue from step 2.

Throttled Load Balancing Algorithm

a) Throttled VmLoad Balancer maintains an index table of VMs and the state of the VM(BUSY/AVAILABLE). At start all VMs are available.

b) Data Center Controller receives a new request.

c) Data Center Controller queries the Throttled VmLoadBalancer for the next allocation.

d) ThrottledVmLoad Balancer parses the allocation table from top until the first available VM is found or the table is parsed completely.

If found:

- *The ThrottledVmLoadBalancer parses the VM id to the DataCenterController.*
- *The DataCenterController sends the request to the VM identified by that id.*
- *DataCenterController notifies the Throttled VmLoadBalancer of the new allocation.*
- *ThrottledVmLoadBalancer updates the allocation table accordingly.*

If not found:

- *The ThrottledVmLoadBalancer returns -1.*
- *The DataCenterController queues the request.*

e) When the Vm finishes processing the request, and the DataCenterController receives the response cloudlet, it notifies the ThrottledVmLoadBalancer of the VM de-allocation.

f) The DataCenterController checks if there are any waiting requests in the queue. If there are, it continues from step 3.Continue from step 2.

Active Monitoring Load Balancing Algorithm

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a) Active Monitoring Load Balancer contains table of virtual machine parameters ie, id of VM, state ie, busy or available and the no: of requests in the Vms. First, all Vms are in available state.

b) DataCenterController receives a new request.

c) DataCenterController queries the Active Monitoring LoadBalancer for the next allocation.

d) Applying Modified Active Monitoring Algorithm. This load balancer finds the available VM with least node.

e) If the available Vms with least node, that contain more than one, then it checks for thehighest priority of VM and return that VM id to DCC and it updates the table.

f) DCC sends the request to the chosen available VM.

II. IMPLEMENTATION DETAILS

The implemented algorithms of load balancing are tested in a CloudAnalyst. CloudAnalyst include the cloudsim library. Cloudsim is a code library based on Java. This library can be directly used by integrating with the JDK to compile and execute the code.

Steps for implementation :

- Download and Install Eclipse, import CloudAnalyst into Eclipse.
- Run CloudAnalyst, automatically open the GUI for CloudAnalyst.
- Implement the algorithms into CloudAnalyst and run simulation.
- Setting all conditions for running simulation.

Fig. 1. **GUI of CloudAnalyst**

Fig. 2. **Adding algorithm in CloudAnalyst**

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III. RESULT

The main focus of this algorithm is on propose to implement load balancing algorithms like roundrobin, throttled and active monitoring load balancer algorithms helps to provide high resource utilization and better response time. These algorithms works in CloudAnalyst and comparing these algorithms based on their response time. The experiments shows that Active Monitoring Load Balancer have the better response time than other algorithms. When these algorithms simulates, only point variations produce in these algorithms. One of the variation results of these 3 algorithms are shown below:

Overall Response Time Summary

	Average (ms)	Minimum (ms)	Maximum (ms)
Overall Response Time:	116.27	38.13	355.64
Data Center Processing Time:	0.41	0.02	0.90

Fig3 Simulation results of RoundRobin Algorithm

Overall Response Time Summary

	Average (ms)	Minimum (ms)	Maximum (ms)
Overall Response Time:	116.26	38.13	355.64
Data Center Processing Time:	0.41	0.02	0.90

Fig 4. Simulation results of Throttled load balancing

Overall Response Time Summary

	Average (ms)	Minimum (ms)	Maximum (ms)
Overall Response Time:	116.24	38.13	355.64
Data Center Processing Time:	0.41	0.02	0.90

Fig 5. Simulation results of Active Monitoring load balancing

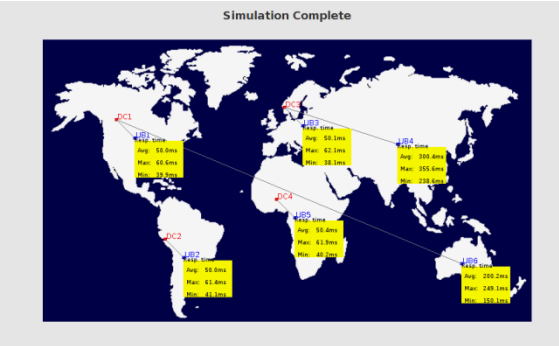

Fig. 3. **Output screen of simulation**

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V. CONCLUSION

Load balancing helps to distributing the total load to the individual nodes to enhance resource utilization and response time. It also avoids a situation where some of the nodes are heavily loaded while other nodes are idle or doing very little work. Here, implemented the existing algorithms and compared the performance using the simulator CloudAnalyst. The performance was compared based on Response time. Better response time was shown for Active Monitoring Load Balancing algorithm in CloudAnalyst. However, these algorithms is efficient for user requests load distribution among the virtual machines but it does not consider the virtual machines reliability and energy awareness therefore the future work focuses on load distribution of users request along with VM Reliability and VM energy awareness.

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