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A Comparitive Analysis on Load Balancing Algorithms in Cloud Computing

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ABSTRACT

Cloud computing is one of device technology now a days for providing everything as a services to the cloud users. Cloud computing is a specific style of computing where everything from computing power to infrastructure, business apps are provided as a service. It mainly refers to applications and services that run on distributed network using virtualized resources and accessed by common internet standards. The basic principle of cloud computing is that user data is not stored locally but is stored in the data center of internet. The allocation of the group of resources may start a problem of availability of these resources and distributing the workload of all the VMs among themselves called as load balancing. As the numbers of users are increasing on the cloud, the load balancing has become the challenge for the cloud provider. Load balancing is a main issue in cloud environment. It helps in proper utilization of resources .It also improves the performance of the system. This paper is a brief discussion on the existing load balancing algorithms in cloud computing and further compares them based on various parameters like maximum completion time that is Makespan and resources utilization. This paper analyses the result based on existing load balancing algorithms like virtual machine random load balancing VMARLB, Priority based virtual machine load balancing algorithm PBVMLBA and EVMLBA algorithms.

Keywords: Cloud Computing, Load Balancing, Virtual Machine, Makespan, Analysis

I. INTRODUCTION

Cloud computing is the best ever developed technology in the IT industry and a new delivery technique for the services on pay per use basis. [1] Cloud Computing has become one of the current technologies adopted by both industry and academic. It provides a flexible and efficient way to store and retrieve the data. The main problem is to schedule the incoming request in a way that it should take least response time, efficient resource utilization and at the same time resources should not be underutilized. Cloud Computing system are heavily rely on term virtualization that improves the power efficiency of datacenters and enables virtual machines to single physical server. It delivers all services through the internet dynamically when user demands, such as operating system, network, storage, software, hardware and resources. These services are classified into these types: [2] Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS), and Everything as a Service (Xaas). The Cloud computing domain is divided into three categories such as Public, Private and Hybrid cloud. [3]

This paper has been orchestrated as follows. Section I gives introduction on cloud computing. Section II

specifies the load balancing in cloud computing. Section III describes literature study on relevant load balancing algorithms. Section IV tells the performance analysis of load balancing algorithms. Section V specifies the conclusion.

II. LOAD BALANCING IN CLOUD COMPUTING

Load balancing is a new technique that provides high resource time and effective resource utilization [3] by assigning the total load among the various cloud nodes, side by side it solves the problem of overutilization and underutilization of virtual machines. Load balancing resolves the problem of overloading and focuses on maximum throughput, [4] optimizing resource utilization and minimize response time. It is the pre requirements for maximizing the cloud performance and utilizing the resources efficiently. The utilization of clouds has been improved by a resource allocation method, which has pre-emptible task execution.

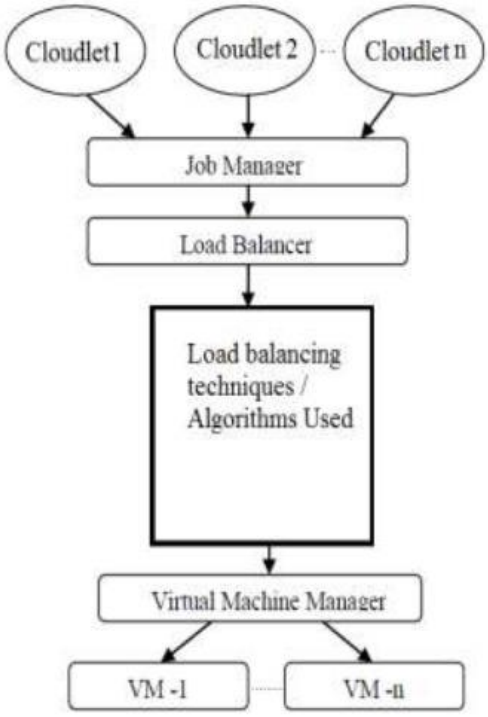

Fig 1. Load Balancer

The load balancing is an efficient and critical concept in cloud computing and it helps to utilize the resources optimally, thereby minimizing the consumption of resources. Thus, load needs to be distributed over the nodes in cloud-based architecture, so that each resource does the equal amount of work at any point of time that is allocated by a load balancer. The load balancer determines the various request allocation to different servers. The load balancer uses various algorithm to determine the server which has to handle the request .[5]

Figure.1 shows a framework of under which load balancing algorithms work in a cloud computing environment. Cloudlet submits tasks to Job Manager and then Job Manager gives all jobs to Load Balancer. Load Balancer applies Load Balancing Algorithm for Submitted Tasks and schedules all tasks in such way that each Virtual Machine will get equal number of task for execution. [6]

In cloud computing, different load balancing algorithms have been proposed. The ultimate aim of all these proposals is to achieve high throughput and minimizing the response time.

III. RELATED WORK

Virtual Machine Algorithm Random Load Balancing

The load-balancing algorithm VMARLB is a load-balancing algorithm in which all the distribution and decision of arrangement are completed by a special node called as Load Balancer (LB). This node is responsible for storing knowledge base of entire cloud network. The Data Center Controller (DCC) receives all the requests from the users from all around the world, which is one of the major components of Cloud. Data Center Controller forwards the request to the Load Balancer to assign the request to the available virtual machines. It handles a table, which contains the job id of the user request, shortest completion time of the virtual machine and the state of the virtual machine. Initially, jobs are allocated randomly to the available VMs. To handle further request, this algorithm will search the table to find the virtual machine with

shortest time and which is available at that moment. If found, the algorithm will reply back to the Data Center Controller with the id of that machine (Vm id) and the Data Center Controller assign the job of that Vm otherwise waits for the signal which is to be forwarded to DCC. This algorithm produces the minimum Makespan. This algorithm compared with MIN MIN algorithm and produces improved results. [7]

Priority Based Virtual Machine Load Balancing Algorithm

The load balancer is play the important role in this PBVMLBA algorithm. Here a special node called as Load Balancer (LB) completes the allocation and decision. This node is responsible for storing knowledge base of entire cloud network. The Data Center Controller (DCC) receives all the requests from the users from all around the world, which is one of the major components of Cloud. Data Center Controller forwards the request to the Load Balancer to assign the request to the available virtual machines. It handles a table, which contains the job id of the user request (priority or no priority), completion time of the virtual machine and the state of the virtual machine. Initially, checks the jobs priority, if any priority, allocate the VM and update the status or allocate the VM based on the condition of the completion time of that task is less than to makespan of RPA_LBIMM. To handle further request, this algorithm will search the table and repeat the above procedure until all the tasks are completed. This algorithm deals with priority request. When priority request occurs. This algorithm executed it produces the best result for resource utilization and minimum makespan. [8]

Enhanced Virtual Machine Load Balancing Algorithm

This algorithm is one of the improved algorithm it is mainly used for to find the minimum makespan from all available virtual machines. The proposed EVMLBA is a load-balancing algorithm in which all the allocation and decision of scheduling are completed by a special node called as Load Balancer (LB). This node is responsible for storing knowledge base of entire cloud network. The Data Center Controller (DCC) receives all the requests from the users from all around the world, which is one of the major components of Cloud. Data Center Controller forwards the request to the Load Balancer. It handles a table, which contains the job id of the user request, completion time of all the virtual machines and the state of the virtual machine. Based on the information available on the table.LB compute the minimum makespan VM, allocate the job to that VM, and update the status. The algorithm will reply to the Data Center Controller with the id of that machine (Vm id). Otherwise waits for the signal. This algorithm produces the minimum makespan and resource utilization. This algorithm compared with VMARLB and Min Min algorithm and the performance of the EVMLBA is better than the other algorithm. [9]

IV. PERFORMANCE ANALYSIS OF LOAD BALANCING ALGORITHMS

The forthcoming part discusses various load-balancing algorithms and shows the results comparatively. Now we will analyse the various load balancing algorithms by setting the configurations of the various components of the cloud environment using Microsoft azure real time cloud, which runs on ASP, SQL database and Microsoft azure as a deploying tool. Assume we have a setup of three available resources (VM) to which various users can submit their tasks. Suppose users have submitted five tasks. Table1 represents the id, size and the user group of each task. Table 2 represents the id, processing speed and service type of each resource, data present in Table3 is the completion time for all task for all VMs.

Table1: Task Parameter

Task ID	Task Size (MB)	User Group
T1	100	Ordinary
T2	150	Ordinary
T3	200	Ordinary
T4	250	Priority
T5	500	Ordinary

Table2: Resource Speed

Resource (VM) Id	Resource (VM) Speed(Mbps)	Type
VM 1	20	Priority
VM 2	16	Ordinary
VM 3	10	Ordinary

Table3: Computed Completion time(CT)

Task	Resource		
	Priority VM 1	VM 2	VM 3
T1	5	6.25	10
T2	7.5	9.375	15
T3	10	12.5	20
T4	12.5	15.625	25
T5	25	31.25	50

Table4: Execution time of VMARLB algorithm

Task	Resource		
	VM 1	VM 2	VM 3
T3			20
T1		6.25	
T5	10		
T4		31.25	
T2	7.5		

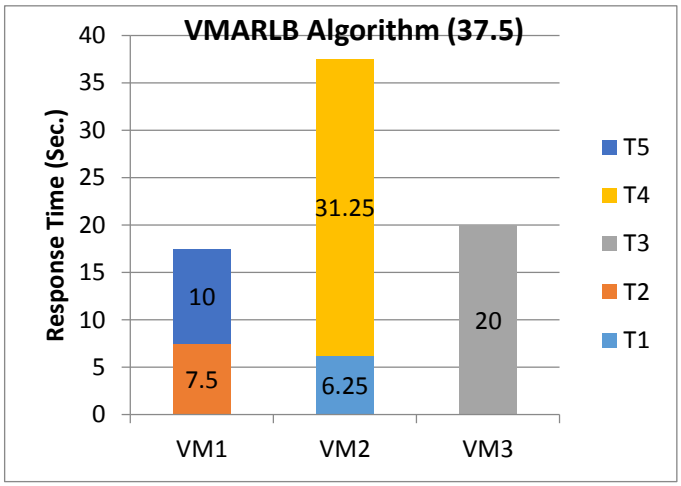

Fig 2. VMARLB

The results of above table 4 and the fig. 2 represents (VMARLB) the virtual machine based random load balancing algorithm produces the makespan 37.5s.

Table 5: Completion time of PBVMLBA algorithm

Task	Resource		
	Priority (VM1)	VM(2)	VM(3)
T4 (P)	12.5		
T5		31.25	
T3			20
T2	7.5		
T1			10

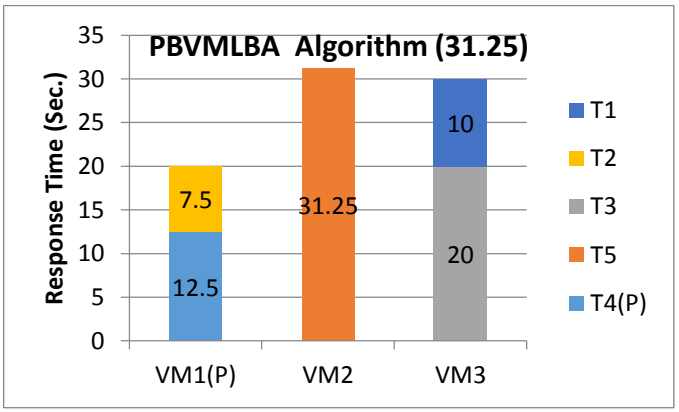

Fig 3 PBVMLBA

The results of above table 5 and the fig. 3 represents (PBVMLBA) the Priority Based virtual machine load balancing algorithm produces the makespan 31.25s.

Table6: Completion time of EVMLBA algorithm

Task	Resource		
	VM1	VM2	VM3
T5	25		
T3			20
T4		15.625	
T1			10
T2		9.375	

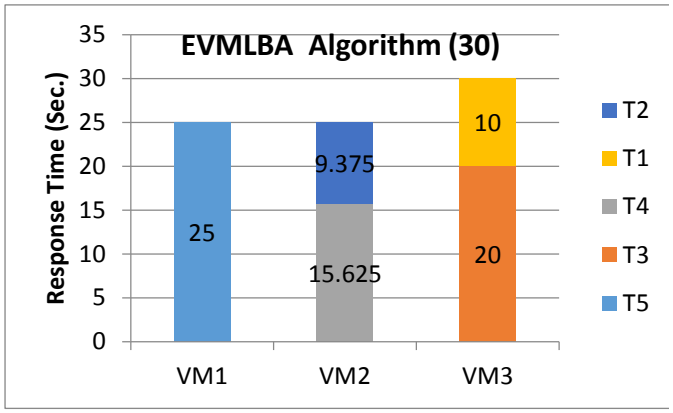

Fig 4. EVMLBA

The results of above table 6 and the fig. 4 represents (EVMLBA) the Enhanced virtual machine load balancing algorithm produces the makespan 30s.

The EVMLBA algorithm shows a reduction in execution time of tasks. The above algorithms execute 5 tasks on three virtual machines. The VMARLB algorithm execute the same tasks with time utilization is 37.5 , the PBVMLBA algorithm executes 5 tasks with time utilization is 31.25 seconds the EVMLBA algorithm executes the same tasks 30 seconds. This shows that the EVMLBA algorithm used minimum time for execution of the task. This is due to the use of enhanced approach, which reduces the waiting time and increases the utilization time of the resources.

In the random approach, compare the results with three set of values. Priority approach the task, which has the priority that is assigned to the priority virtual machine. In the Enhanced approach, Initially It calculated completion time for all tasks which one have the minimum execution time that is selected and allocated the request to that virtual machines.

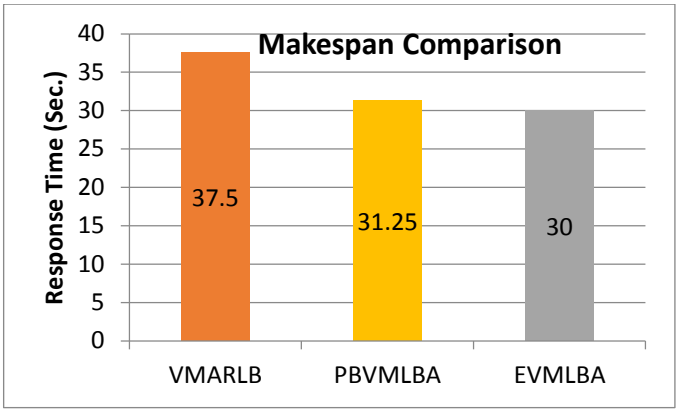

Fig 5. Makespan Comparison

Based on the above results the following points are concluded.

(i) The resources utilization of PBVMLBA is increased compared with other algorithms.

(ii) Makespan = max (rtj), Maximum execution time in a node(VM)

Table 7: Makespan

Method	Makespan
VMARLB	37.5
PBVMLBA	31.25
EVMLBA	30

Average resource utilization (Ua)

$$Ua = \frac{\sum_{i=1}^{N} Ci * 100}{Nm} \quad [1]$$

N = Number of nodes, m= makespan, Ci = Completion Time

Table8 Resource Utilization

Algorithmas	Resource Utilization (%)
VMARLB	66.66
PBVMLBA	86.66
EVMLBA	88.88

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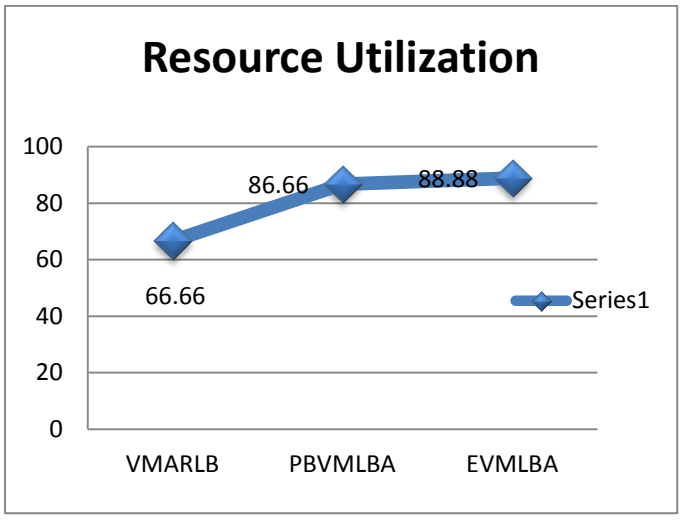

Fig 6. Resource Utilization

The above result says that the EVMLBA algorithm is better than other two algorithms VMRLBA and PBVMLBA. It produce the best result for resource utilization.

V. CONCLUSION

Load balancing is a main task in cloud computing for efficient utilization of resources and minimizing and makespan. The study deals with various load-balancing algorithms like VMRLBA, PBVMLBA and EVMLBA. The ultimate purpose of those algorithms is to reduce the response time and maximize the resource utilization. The results of the existing algorithms are confined to give better result. The performances of three algorithms VMRLBA, PBVMLBA and EVMLBA discussed in this paper. Here Enhanced Virtual Machine Load balancing algorithm reduces the task completion time and increases the resource utilization, therefore EVMLBA algorithm is more efficient in terms of utilization of resource and Makespan for load balancing on cloud data centers.

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