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Analytical Study on Load Balancing Techniques in the Environment of Cloud Computing

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Abstract: *In today's word the cloud computing paradigm, load balancing is one of the big challenges due to the increase in the users and their demand for different services on the cloud computing platform. Now fruitful or efficient use of resources in the cloud environment became a critical concern while using cloud Platform. Load balancing is playing an important role in maintaining the balance of Cloud computing. The metrics of load balancing performance algorithms in the cloud are depend on response time and waiting time. In this research paper we primarily focus on two load balancing algorithms techniques, first is the Max-Min Algorithm and second is the Min-Max Algorithm.*

Keywords: *Min-Min, Max-Min, Response time, Load Balancing, Batch mode scheduling, Immediate mode scheduling, Makespan, Minimum completion time, Minimum executiontime*

I. Introduction

In Load balancing [1] is the best method that distributes full workload between the diverse nodes in the available environment. so that it ensures not a single node in the system is overloaded or web sits remains idle for any part of the time. In load balancing, any efficient load balancing algorithm always takes care of the same distribution of workload, it will make sure that every available node in the system does more or less the same volume of work. The main responsibility of the load balancing algorithm is to do job mapping.

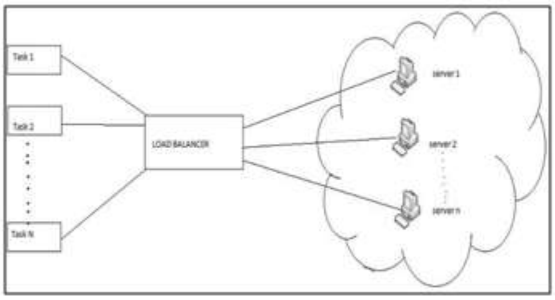

Figure 1: Diagram for load balancing

The jobs which are allocated to the cloud domain to the unoccupied resources so that the total response time is improved and it provides efficient utilization of the resource. In today's world Balancing the load became a crucial concern in cloud computing, as we cannot predict the total number of requests per second in the cloud environment.

This unpredictability is because of the always changing behavior of the cloud. the load balancing mainly focuses on the allocation of load dynamically among the available nodes so that it should satisfy the user requirements and also provide maximum utilization of resources.

II. Demand Of Load Balancing In Cloud Environment

In Load balancing [1] method the overall working is such that it can assign the equal workload among all the available nodes in the system. The motto behind this load balancing is the higher user satisfaction. As day by day, the number of the user is increasing its mandatory clouds should provide better service to the customer with their at most satisfaction.

An efficient or an ideal load balancing algorithm always help in making use of the available resources most in an optimizing way, it's always ensure that no single node is overloaded or under loaded. The Load balancing gives scalability and also avoids bottlenecks and reduces the response time it was taken before. We can see many load balancing algorithm [2] have been available today to schedule the load among various machines. But there is no such ideal load balancing algorithm has been developed which will allocate the load neutrally across the system. It has been proved that allocating the tasks equally across the system is considered to be an NP-complete problem [7].

III. Load Balancing In A Cloud Computing Environment

Load balancing algorithms in the cloud environment are mainly classified into two categories which are:-

1. Immediate mode scheduling

2. Batch mode scheduling

In immediate mode scheduling, the task is provided to the resources on its arrival. In immediate mode scheduling, the MET algorithms are used, which is helps to expand and gives minimum execution time and minimum completion time which is abbreviated to MCT. In MCT algorithm first, the minimum completion time task will get allocated in analogous mode.

In Batch mode scheduling all the tasks are collected based upon their arrival in a Meta task and then set them so that they are mapped at prescheduled times to their corresponding machines. Max- Min and Min-Min belong to the Batch mode scheduling category.

3.1Min-Min load balancingalgorithm

The Algorithm take up with a task set which are initially not assigned to any of the nodes. Initially the minimum completion time is calculated for all the available nodes. Once this calculation gets completed the task having the completion time minimum is chosen and assigned to the respective node. The execution time of all other taskswhich are currently available in that machine is updated and the task gets discarded from the available task set. The routine is done time after time until all the tasks have been assigned to the equivalent machines. The algorithm works better when the situation is like where the small tasks are greater in number of than the large tasks. The algorithm has a disadvantage that it leads tostarvation.

Min-Min is a simple and fast algorithm capable of providing improved performance. Min-Min schedules the ideal tasks at first which results in best schedules and improve the overall make span. Assigning small task first is its drawback. Thus, smaller tasks will get executed first, while the larger tasks keeps on in the waiting stage ,which will finally results in poor machine use. Min-Min exhibits minimum completion time for jobs which are unassigned (similar to MCT), and later allocating the jobs with minimum completion time (hence min-min) to a node that is capable of handling it. Architectural description of Min-Min algorithm is shown below in Fig.2

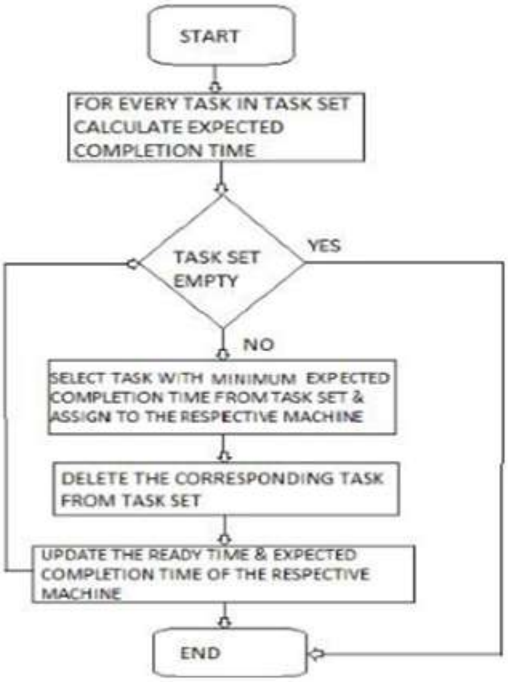
START
FOR EVERY TASK IN TASK SET CALCULATE EXPECTED COMPLETION TIME
TASK SET EMPTY
YES
NO
SELECT TASK WITH MINIMUM EXPECTED COMPLETION TIME FROM TASK SET & ASSIGN TO THE RESPECTIVE MACHINE
DELETE THE CORRESPONDING TASK FROM TASK SET
UPDATE THE READY TIME & EXPECTED COMPLETION TIME OF THE RESPECTIVE MACHINE
END

Figure 2 - Architectural description of min-min algorithm.

3.2Max Min load balancingalgorithm

The max-min algorithm is much the same as to min-min algorithm. At first for all the available tasks are submitted to the system and minimum completion time for all of them are calculated, then among these tasks the one which is having the completion time, maximum is chosen and that is allocated to the corresponding machine. This algorithm outperform than Min-Min algorithm where when short tasks are in high numbers when compared to that of long ones.

For e.g., if there is a single long task presented then, Max-Min algorithm first runs short tasks concurrently along with the long task. The makespan focus on how much small tasks will get executed concurrently with the large ones. Max-Min is almost identical to Min-Min, but the difference is first, it selects the task with the maximum completion time and allocates to the corresponding machine. The algorithm suffers from a resource where task having the minimum completion time leaving behind and the tasks having the maximum completion time will get executed first. Architectural description of Max-Min algorithm is presented below in Fig. 3

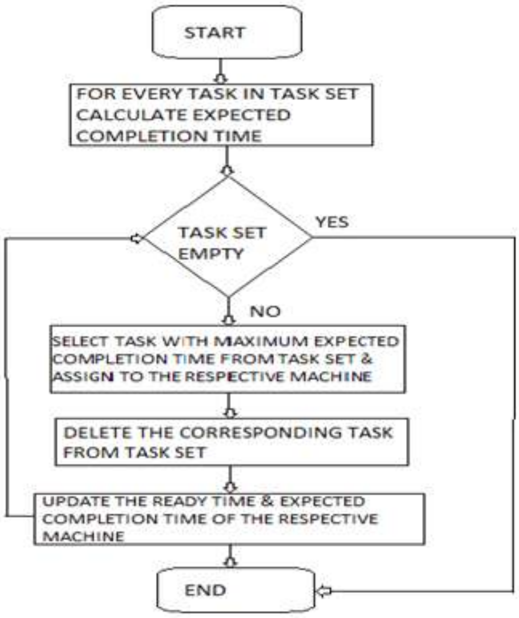
START
FOR EVERY TASK IN TASK SET CALCULATE EXPECTED COMPLETION TIME
TASK SET EMPTY
YES
NO
SELECT TASK WITH MAXIMUM EXPECTED COMPLETION TIME FROM TASK SET & ASSIGN TO THE RESPECTIVE MACHINE
DELETE THE CORRESPONDING TASK FROM TASK SET
UPDATE THE READY TIME & EXPECTED COMPLETION TIME OF THE RESPECTIVE MACHINE
END

Figure.3 Architectural description of max-min algorithm.

IV. Simulation Overview

In this portion, we are giving an experimental result for the comparison between the Min-Min and Max-Min algorithms. For the implementation of both the algorithms, we have used Cloud-Sim [8], it is a simulator which checks the performance of the two algorithms. "Cloud-Sim [9] is an extensible toolkit for simulation, which enables modeling and simulation of Cloud computing systems and application provisioning environments". In cloud-sim all the tasks are treated as the cloudlets and nodes are taken into account as virtual machines.

We can observe the performance of this algorithm using cloud-sim in three cases: in the first case, we set five number of content nodes for all the cases and change the number of task to 25. For the second case, we increase the task to 50 and then the third case it is changed to 100. Experiments conducted with 25, 50 and 100 tasks are assigned to Cloud with 5 resources. The resources are located at one data center.

Table 1 shows the results for simulation of both the algorithms. It shows the make span of Min-Min and Max-Min algorithm for three cases

Table 1: Make span of two algorithms

Number of tasks	Min Min	Max Min
25 tasks	159	120
50 tasks	230	200
100 tasks	510	450

From the above table it is noted that make span get reduced for Max-Min compared with that of Min-Min, Max-Min outperforms than the other and in the later run the assignment of tasks to the resources ge changed. i.e. if we are using these two techniques the allocation of tasks to the machine will not be the same it will get changed. Depending upon the type of load balancing algorithm we choose the tasks are allocatedto the respective nodes.

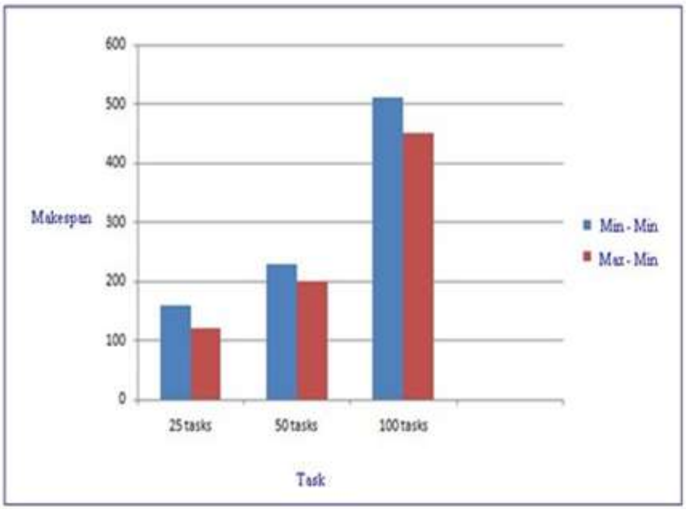

Figure 4 Results of comparison of Max-Min & Min-Min

The performance of the three cases in accordance with the computed values are shown in chart above as shown in Fig.4, in which y-axis shows the makes pan and x-axis shows the two algorithms. From the above simulation results. We came into a conclusion that Max-Min achieves better performance than Min-Min with respect to the make span. For an efficient load balancing algorithm it always tries to reduce the makespan

V. Conclusion

We have done an extensive study through the implementation of the two load balancing algorithms namely Max-Min and Min-Min based on our selected cloud environment. The result of our evaluation shows that the Max-Min performs better than Min-Min in terms of make span. But there are other works of load balancing in cloud environment which shows that Min-Min outperform the Max-Min algorithm. Both algorithms have got their own pros and cons, where depending upon the cloud environment one outperforms the other. If the number of lighter tasks outnumbers the heavier tasks then Max-Min performs well better than the Min-Min in terms of resource utilization and make span on the contrary if there are many heavier tasks it results in Min-Min to perform better than Max-Min. So we came in to a conclusion that the performance of load balancing in cloud doesn’t depend upon any algorithms but it is purely based on the cloud environment wechoose.

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