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Modified Max-Min Algorithm for Resource Allocation in Cloud Computing

Pandaba Pradhan* Jashmin Swain
Asst. Professor & H.O.D, Department of Comp. Sc. BJB (Auto) College, BBSR, Odisha, India.
Student, BJB Autonomous College

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ABSTRACT: Cloud computing is the current emerging technology that aims to provide the hardware and the software residing in the data centers with pay as per need policy to the users in the form of services. Computing resources are flexible or elastic means the number of resources and their computing power can be adapted dynamically to match the changing workload. The mainobjective of cloud computing is to provide multiple services to multiple users simultaneously. To achieve this goal, many cloud service providers face lot of challenges to facilitate all the required resources to the users according to their demand. Max-Min is an existing resource allocation algorithm that help service providers to cater the varying need of the users for resources. The drawback of the Max-Min algorithm is that it attains high waiting time and completion time. To overcome this, here in this paper, we focus mainly on modifying the existing algorithmto achieve minimum completion time as well as waiting time as compared to the existing Max-Min (MM) algorithm.The Modified Max-Min (MMM) algorithm will be helpful in allocating resources in cloud environment along with reducing the average waiting time and total completion time thereby improving the overall system productivity.

Keywords:cloud computing, resource allocation, resource management, task scheduling, MM, MMM.

I. INTRODUCTION

Cloud computing is gaining popularity among users by offering a variety of resources at the cost of its usage and also eliminates the cost of maintenance by the users. It is the recent evolving technology that leads to provide the hardware and the software present in the data centerswith "pay as you use" policy to the users in the form of services. Basically, according to definition, **Cloud**is nothing but large pool of easily accessible and usable virtual resources. It is generallyproviding various kinds of agile and effective services to the consumers and hence effectively could be termed as a service provision model that enables the mentioned mechanism[1,3]. The National Institute of Standards and Technology (NIST) has definedthe cloud computing as "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, software platforms and applications) that can be rapidly acquired and released without the intervention of service provider and with minimal management efforts." The various characteristics of cloud computing are [3]: (i)On-demand self-services(ii) Broad Network Access (iii) Resource Pooling (iv)Rapid Elasticity and (v) Measured Services [9,10]**.** Cloud computing has major role in applications that include storing data, data analytics and IoT applications. Initially in traditional computing services were deployed by enterprises, organization and individuals but cloud computing being the revolutionary step in computing has changed the concept of computation by allowing computing over cloud. There are several services that are provided by Cloud computing such as IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS(Software as a Service). The internet plays a vital role in Cloud Computing where users are expected to submit the requests to the service provider through the medium of internet. The request generated by the user is managed by the service provider. There are various scheduling algorithms that are employed by service provider to schedule the incoming request so that they could manage their computing resources efficiently[11,13].

II. REVIEW OF LITERATURE

The main objective of Resource Management is allocation of resources to resource user from resource provider so that the users can use it to the optimum capacity[3, 4]. Virtualization enablesavailing the users with the requested

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resources by enablingmaking instances of the resources to serve increasing demands called the virtual machine that further helps making an efficient utilization of resources. There are 4 types of resources, such as compute resources, networking resources, storage resources and power resources[5].Resource allocation being a part of resource management deals with assignment of available resources in an efficient and economical way. The difficulty faced to achieve accurate resource allocation is the one users demand vary dynamically and the second is the heterogenous environment in which the demands needed to be catered.There are algorithms that are developed to attain the resource allocation effectively[6]. Task scheduling is the process where one or more resources are allocated for one or more time period. Completion time is one of the parameters that helps to determine the efficiency of the algorithm. Scheduling tasks basically concentrate on how efficiently computing resources can be allocated to the submitted tasks so as to minimize the completion time of a specific task[7]. Task scheduling basically focusses on two factors that are first and foremost is how to attain high computing performance and next is best system throughput. Scheduling is responsible to manage availability of CPU memory and good scheduling policy ensures maximum utilization of resources[6].Resource Allocation Strategy (RAS)[12] is the strategy that incorporates the all activities of the cloud provider so as to utilize and allocate scare resources in the limits of the cloud environment so as to fulfill the demands of the cloud users.

III. EXISTING MM ALGORITHM

The MM algorithm works by choosing tasks with large execution time first then executes small once subsequently. The algorithm after selecting the task with largest execution time, selects a resource so that it obtains minimum completion time to execute completely. The ready time is the time when the resource is available to be allocated is updated by adding the execution time of the task to it[8]. Finally, the tasks executed recently is removed from the meta-tasks set, and the completion time is updated.This process repeat until all the tasks in the meta-tasks set is executed and the meta- task set is empty[7].

ALGORITHM:

For all submitted tasks in meta-task Ti
1. **For** all resources Rj
2. Compute Cij=Eij+Rtj
3. **While** meta-task is not empty
4. Find the task Tm consumes maximum completion time
5. Assign task Tm to the resource Rj with minimum execution time
6. Remove the task Tm from meta-tasks set
7. Update Rtj for selected Rj
8. Update Cij for all Ti

Cij: the expected completion time
Eij: the execution time
Rtj: the ready time of the resource

This algorithm is suitable in situation when the number of short tasks is more than the longer tasks[7] because it will obtain minimum completion time. But it generates maximum completion time in situation when the number of longer tasks is more than the number of smaller tasks because longer tasks will take maximum time to execute completely that will simultaneously increase the total completion time.

IV. MMM ALGORITHM

We can use MMM algorithm in order to reduce the completion time. Initially the task with maximum burst time is executed first then tasks with minimum burst time is selected for execution till the summation of their burst time is less than or equal to the burst time of task that has been executed recently,and this procedure continues till every task in the meta- task set is executed completely. The MMM algorithm is defined as below:

ALGORITHM:

1. Sort the tasks in the meta-task set T in descending order
2. i= 1, j= T.length ,k=0
3. **While**i<=j do
4. Select resource R with minimum ready time Rt
5. Ck = Ei+ Rt
6. k = k+1
7. Update Rt for select R
8. Sum= Ej
9. **While** sum<=Ei do
10. Select resource R with minimum ready time Rt
11. Ck = Ej + Rt
12. K = k+1
13. Update Rt for select R
14. j=j-1
15. Sum= Sum+ Ej
16. **EndWhile**
17. i = i+1
18. **EndWhile**

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V. SIMULATION AND RESULT

We simulated the existing MM algorithm as well as the MMM algorithm taking four, Six, Eight, Ten and Twelve Tasks with different burst times respectively. For different inputs, total completion time & average waiting time are calculated as in below tables:

Number of tasks executed	MMAlgorithm	MMM Algorithm
4	49	44
6	112	90
8	222	192
10	310	249
12	345	291

Table 1: Total completion time produced by two algorithms

Number of Tasks executed	MM Algorithm	MMMAlgorithm
4	21.75	17.5
6	51.33	34.83
8	95.87	75.12
10	135.10	92.80
12	146.58	109.41

Table 2: Average waiting time attained by two algorithms

The outputs are graphically shown as in below figures:

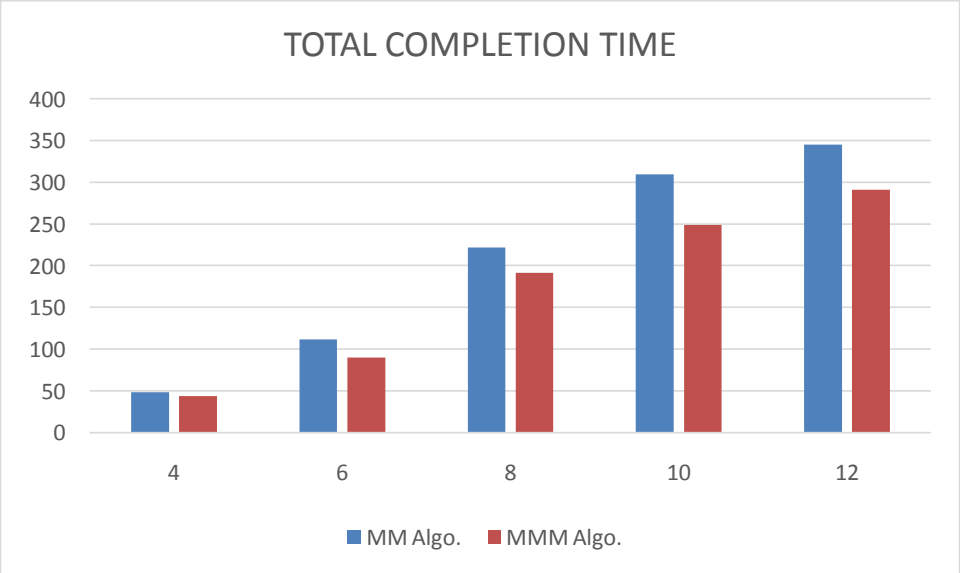

Figure 1: Total completion time compared between two algorithms

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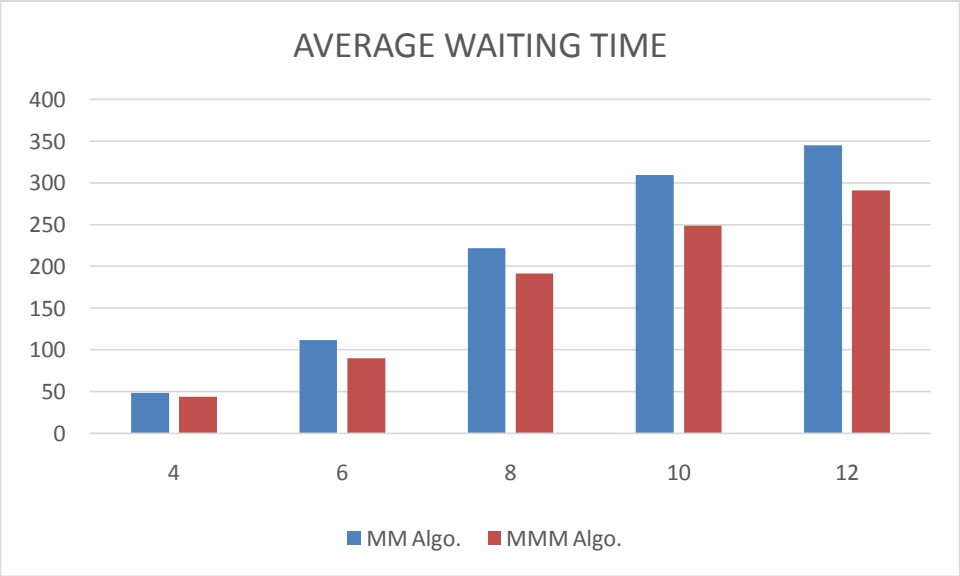

Figure 2: Average waiting time compared between two algorithms

VI. CONCLUSION

To conclude in a nutshell, cloud computing is the most recent and advance technology in the arena of computing that provides its user a flexible and wide platform for computation. Eventually we could understand that the most challenging field of cloud computing is Resource Allocation. While allocating resources to the requesting users the service provider follows certain techniques to devise various resource allocation algorithms so as to attain efficient and effective resource allocation. The efficiency and effectiveness of the algorithms can be judged by two parameters that is total completion time and average waiting time. In MM algorithm, the execution of the tasks with highest burst time is executed first then subsequently the lower ones.As a result, the execution of task having the lowest burst time is delayed and the completion time for the lowest task is maximum though it requires less CPU time to get executed. That is the tasks with lowest burst time will starve till the tasks with higher burst time have not completed their execution and hence leads to delayed execution of the lowest burst time tasks. As the algorithm is a non-preemptive one we need to focus on an approach that completely execute the task once allocated the CPU and instead of following the usual approach of selecting tasks with higher burst time (as in case of Max-Min algorithm) we could keep on alternating among the tasks to execute completely ,that is executing tasks with highest burst time first then lowest.In this way we can achieve the reduction in average waiting time and total completion time. Hence MMM algorithm makes it possible to reduce the total completion time and average waiting time by not letting the task with lowest burst time to starve for long. Hence MMM algorithm is more efficient as compared to MM algorithm.

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