Deadline and Suffrage Aware Task Scheduling Approach for Cloud Environment

Poonam Chaudhary[1], Varsha[2]

[1]M. Tech. Research Scholar Shri Krishan Institute of Engineering and Technology, Kurukshetra, India
[2]Assistant Professor Shri Krishan Institute of Engineering and Technology, Kurukshetra, India

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Abstract - *A new way of computing in 21st century is cloud computing. In this computing services are provided through internet. Services are used by user on pay per usage model. Users are offered different level of services based on their requirement. So cost of service also depends upon the type of resources provided to user. To provide the services as per the demand, there is need of efficient task scheduling approach. The basic approaches found in the literature were very easy and effective for small system. The major limitation of those approaches is that they cause unbalancing of system.*

In the present work, authors have proposed a deadline & suffrage aware task scheduling algorithm which not only consider the deadlines but also consider the priorities assigned through suffrage. It has been analyzed and tested critically using Cloudsim simulator on the various relevant parameters. Through simulation results, it has been found that deadline & suffrage aware min-min approach outperforms the basic min-min approach on all the relevant parameters.

*Key Words***: Task scheduling, priority, load balancing, cloud computing, cloudsim, deadline, suffrage.**

1. INTRODUCTION

Cloud computing has emerged as new way of providing computing services. Virtualization, elasticity and scalability are the basis of this technology. Cloud model provide services to the user on demand. User demands different services at different time from different regions. So it is very difficult to predict the demand requirements. So it is very difficult to conclude how many resources will be sufficient to provide the services as per service level agreement [1, 2]. To manage the resources properly and provide services as per service level agreement, there is strong need of task scheduling approach. Task scheduling algorithm is one way to achieve load balancing. It is a way through which it is decided that which tasks will be mapped with which resource [3].

Scheduling of task in a cloud is very hard problem as it involves the multiple tasks and resource combinations. So scheduling problem in cloud environment belongs to NP Hard. Task received at scheduler as well as resources

available with service provider are heterogeneous in nature. So it's very challenging task to map task with resources so that all terms mentioned in service level agreement get satisfied [4, 5].

The prime objective of task scheduling approach in cloud is to minimize the task completion time, task waiting time, makespan, optimize the utilization of resources and provide the quality of services as mentioned in service level agreement. Unfortunately, different technique found in literature does not satisfy all objective collectively. So while doing task scheduling in cloud, all these factors must be considered [6, 7].

In this work, authors have given a deadline &suffrage based task scheduling approach which not only improves the makespan, resource utilization and profit of service provider but also handles the tasks according to their deadline. Proposed approach has been simulated using cloudsim simulator and compared with min-min, max-min. Organization of paper is as follows: Section II contains the detailed discussion of different task scheduling approach. Proposed work has been given in section III. Simulation analysis of proposed work & its comparison with existing has been given in section IV. Section V contains the conclusion of the paper.

2. RELATED WORK

Work done by other researchers in the area of cloud task scheduling has been discussed.

R. Kumar et al. [4] have discussed minimum execution time (MET), join shortest queue (JSQ), minimum completion time (MCT) and join idle queue approach of task scheduling. Among the discussed four approaches, MET, JSQ & MCT are centralized in nature while JIQ is distributed in nature. Authors have tested the approach using cloud analyst simulator and it was found that JIQ has given best performance among the tested four task scheduling approach for cloud computing.

A. Mevada et al. [9] have presented an Enhanced Energy Efficient Virtual Machine Placement Policy for Load Balancing in Cloud Environment. Authors have proposed a modified version of power based VM placement algorithm for reduce energy consumption, better load balancing and

optimized VM placement. The proposed algorithm is yet to be implemented and tested under various real-time or simulation environment.

M. Randle et al. [10] have discussed the three popular distributed task scheduling approach for cloud computing. Authors have discussed the Honey bee based, Biased random walk based and Clustering based task scheduling approach for cloud computing. Authors have tested the approach using cloudsim simulator. It was found that biased random walk outperforms the other on all the relevant parameter.

H. Chen et al. [11] have discussed the load balanced based version of basic min-min approach. In the basic version of min-min approach, there was no provision of balancing the resource. Some resource remains idle and some resources get overloaded. As an improvement of basic min-min version, authors have first implemented the basic min-min approach and then tasks are migrated from overloaded resource to under loaded resource. After this execution of tasks are started.

A. Jain et al. [12] have discussed the basic min-min task scheduling approach for cloud computing. A set of n tasks { T_1, T_2, T_3,.... T_n} and m Resources { R_1, R_2, R_3,....R_m} is generated in the beginning. This approach does not follow the first come first serve sequence of task execution. Initially all arriving tasks are stored in the buffer till buffer get completely filled. As buffer got filled, smallest size task is searched in the buffer and mapped with the resource which will also require minimum completion time. Smallest size task is mapped with the smallest completion time machine. Due to involvement of two minimum criterions, this approach is called min-min approach.

Meenakshi Sharma et al. [13] have discussed active VM load balancing approach. In this approach, information about the load assigned to each node is maintained & whenever a new task arrives, it is mapped with the least loaded machine. Due to the consideration of VM present load during mapping, it is somewhat dynamic in nature.

A. Tumanov et al. [14] discussed the need for and an approach for accommodating diverse tenant needs, based on having resource requests indicate any soft (i.e., when certain resource types would be better, but are not mandatory) and hard constraints in the form of compo sable utility functions. They proposed scheduler that acknowledges such requests that can then maximize overall utility, perhaps weighted by priorities, taking into account application specifics. Done Experiments with a prototype scheduler, called alschsed, reveal that support for soft constraints is important for efficiency in multi-purpose clouds and that compostable utility functions can provide it.

A. Jain et al [15] have proposed a new load balancing approach for cloud computing. Proposed approach has used the concept of biased random walk. Biasing has been achieved through task size, and available capacity of virtual machine. Proposed approach has not only improved the load balancing but also improved the reliability of the system.

Mubarak Haladu et al. [16] Cloud Computing provides the chance to use computing resources over the internet without owning the infrastructure. The main content of Cloud Computing is to manage Software application, data storage and processing capacity which are assigned to other users on demand through the internet and pay only for what they consume. Task arranged in cloud computing is the biggest overcome because many tasks need to be executed by the available resources in order to meet user's requirements. To achieve best performance, minimize total completion time, minimize response time and maximize resources utilization there is need to allocate these challenges.

Elzeki et al [17] a new unique modification of Max-min algorithm is proposed. This algorithm is built based on study of the impact of RASA algorithm in performing tasks and the atom concept of Max-min strategy. An Improved version of Max-min algorithm is proposed to outperform scheduling map atleast similar to RASA map in total complete time for submitted jobs. Improved one is based on the expected
execution time instead of complete time as a selection basis. In turn performing tasks within cloud computing using Improved one demonstrates achieving schedules with comparable lower make span rather than RASA and original Max-min.

S. Devipriy et al [18] in this paper varied rule is mentioned then improved the Max-Min programming rule. Min-Min programming rule is employed resource imbalance drawback has occurred. In max-min programming rule most size allotted to minimum completion time. Make span is best than Min-Min rule. Once resource is even then Max-Min rule is employed and resource is odd then Min-Min rule is employed. The result show that RASA rule has higher make span then Max-Min. Improved max-min rule during which largest most task is allotted to the slowest resources.

Hsu Mon Kyi in [19] Cloud computing is deployed a large set of virtualized computing resources in different infrastructures and various development platforms. One of the significant issues in cloud computing system is the scheduling of virtual resources and virtual machines. To address this issue, this proposed an efficient approach for virtual machines scheduling in VM management also called Efficient Virtual Machines Scheduling Algorithm

that provides the effective and efficient resource allocation.

Mohd Zamri Murah et al. in [20] Cloud computing is a technology that allow the users to access software applications, hardware, storage, computing processes directly from the web. It offers two paradigms in computing; SaaS and PaaS. This paper reviewed the experience of using cloud computing in teaching a graduate level networking course. It had been used to share references, to create collaborative environments, to hold virtual discussions, to manage projects and to deploy web applications. The students were able to learn this latest computing technology without incurring any cost.

Razaque, et al. in [10] an efficient task scheduling algorithm that offer divisible task scheduling in view of network bandwidth and automatically implements the tasks when tasks are scheduled for the execution. Most Efficient Server First (MESF) is a task scheduling scheme that schedules the tasks to maximize the energy aware servers of a data center. MESF decreases average task response time. A Min-min algorithm that takes into consideration both cloud users requirement and resource availability. Proposed algorithm decreases make span of the tasks by analyzed task size.

3. PROPOSED ALGORITHM

Authors have proposed a deadline and suffrage aware task scheduling approach. Criterion for suffrage is minimum completion time of task on a virtual machine. Machine whose completion time is least for a given task will get the highest suffrage. Basic idea of deadline aware suffrage approach is as follows:

- Received task are sorted in the order of deadline time. Task having least deadline is arranged first in the list.
- Suffrage for task on all machine is calculated and task is mapped to machine which gets highest suffrage.

Algorithm Deadline Suffrage ()
{
    Received the task till buffer get filled.
    Sort all the tasks based upon their deadline time in the buffer.
    While (task is there in the buffer)
    {
        Fetch the task ta from the buffer whose deadline is least.
        Calculate the completion time of the task ta on all the machines.
        Select the machine which executes the task ta in the least time.
    }
}

Flowchart of the proposed algorithm is shown below in figure 1
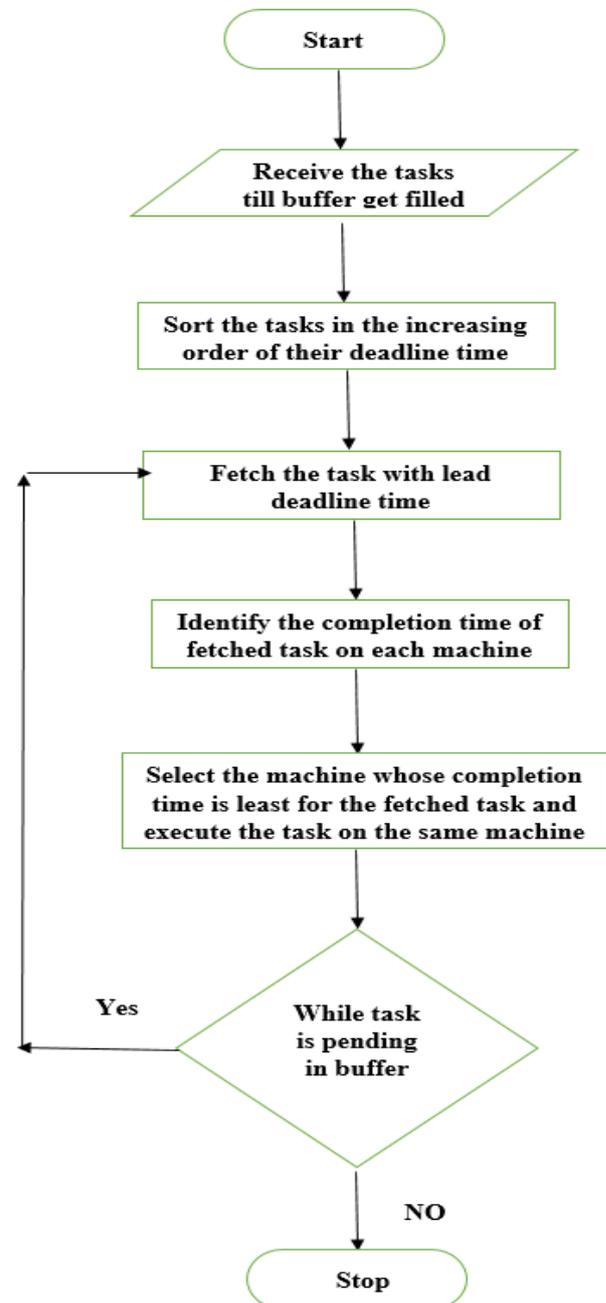
Fig- 1: Flow chart of proposed algorithm

Advantages:

- Give consideration to deadline of all tasks.
- Consider the task size, machine capacity and no of tasks in the queue of machine while calculating the execution time of task.

Disadvantage:

Centralized in nature

4. SIMULATION ENVIRONMENT & RESULTS

In this section, authors have tested the deadline and suffrage aware proposed approach and compare it with min-min and max min approach in the simulation environment developed by cloudsim simulator.

Cloudsim simulator is free and open source software available at http://www.cloudbus.org/CloudSim/. It is a code library based on Java. This library can be directly used by integrating with the JDK to compile and execute the code. For rapid applications development and testing, Cloudsim is integrated with Java-based IDEs (Integrated Development Environment) including Eclipse or NetBeans. Using Eclipse or NetBeans IDE, the Cloudsim library can be accessed and the cloud algorithm can be implemented. Figure 2 shows detailed architecture of layered cloudsim simulator. It shows different classes through which it provides the simulation services.
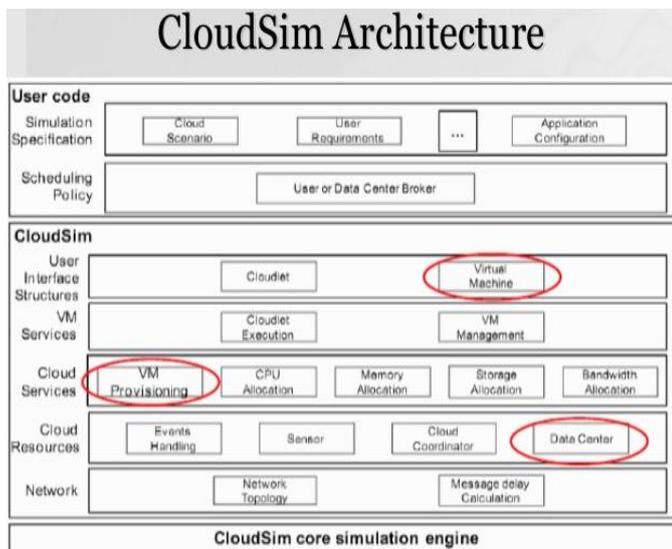
Fig- 2: Cloudsim Architecture [22]

Cloudsim has the following novel features:

1. Support for modeling and instantiation of large scale Cloud computing infrastructure, including data centers on a single physical computing node and java virtual machine
2. Independent platform for modeling data centers, service brokers, scheduling, and allocations policies
3. Accessibility of virtualization engine, which assist in creation and management of multiple, independent, and co-hosted virtualized services on a data center node
4. Flexibility to switch between space-shared and time-shared allocation of processing cores to virtualized services [22].

Different parameters on which performance of the proposed approach has been compared with the existing one are as follows:

- ➤ Make span: It denotes the total schedule length. Lower value of this parameter is desirable.
- ➤ Average Resource Utilization: It denotes upto what extent of make span, resource was in usage. Higher value of this parameter is desirable.
- ➤ Service Provider profit: It indicates the profit earned by the service provider while providing the services. It is estimated on the basis of resource utilization, and time duration for which resources was engaged.

Comparison of proposed deadline and suffrage aware task scheduling approach with the min-min and max min task scheduling approach on the above discussed parameter in the cloudsim based simulation environment are as follows.
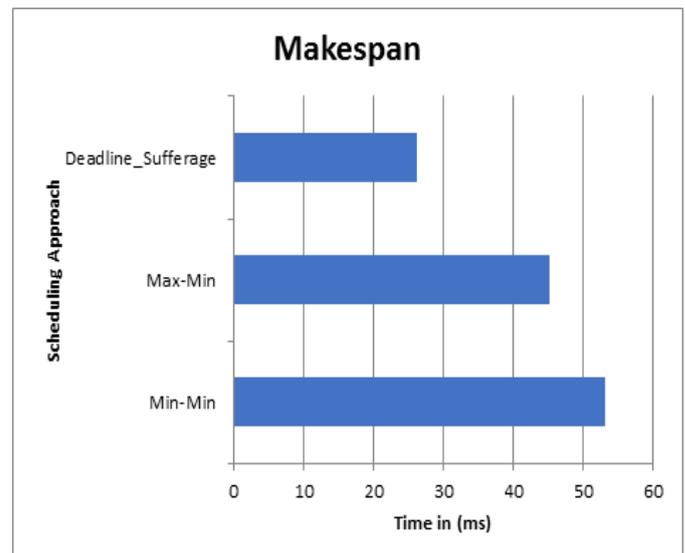
Chart- 1: Comparison of deadline suffrage with other on the scale of makespan

Chart 1 shows the comparison of deadline suffrage with min-min and max min on the scale of makespan. It has been identified that deadline suffrage is showing better makespan relative to min-min and max min.
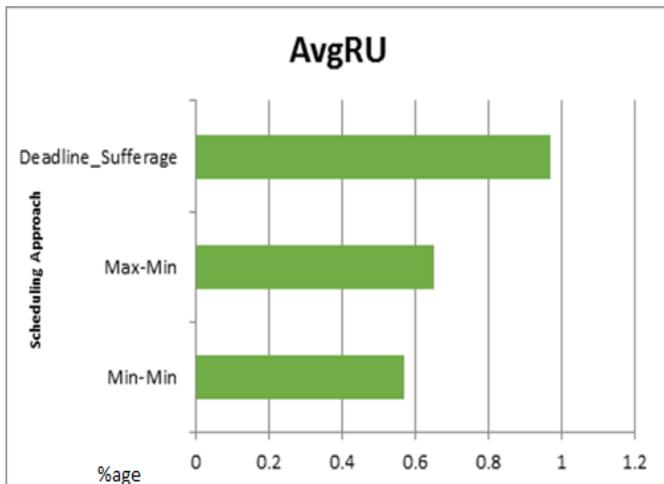
Chart- 2: Comparison of deadline suffrage with other on the scale of resource utilization

Chart 2 shows the comparison of deadline suffrage with min-min and max min on the scale of resource utilization. It has been identified that deadline suffrage is showing better resource utilization relative to min-min and max-min.
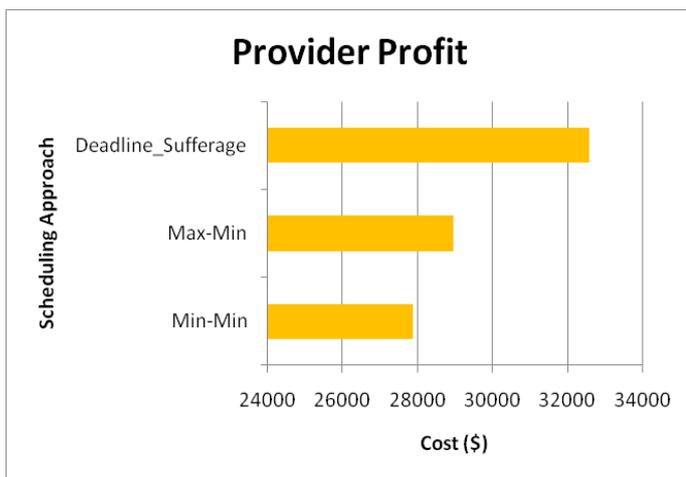
Chart- 3: Comparison of deadline suffrage with other on the scale of service provider profit

Chart 3 shows the comparison of deadline suffrage with min-min and max min on the scale of service provider profit. It has been identified that deadline suffrage is giving better service provider profit relative to other. So it is justifying the result of charts 1 & 2.

5. CONCLUSION

Among the different issues of cloud computing, task scheduling is the key issue. In this work, authors have proposed a deadline and suffrage aware task scheduling approach. Proposed approach has been tested & critically analyzed in the cloudsim simulation environment. It has been found that deadline & suffrage aware task scheduling approach has outperformed the other traditional scheduling approach on almost all parameters. Though complexity in deadline &suffrage aware task scheduling approach has increased but it is suitable for cloud environment. As a future scope, authors have planned to propose a hybrid task scheduling approach by combining this work with other

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