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Review on Priority Based Task Scheduling In Cloud Computing

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Abstract: **- With the help of cloud computing users need not worry about the required data storage, infrastructure and platform as it helps users to remotely store the data and access the required hardware and platforms for their applications to run. In cloud computing user has to pay the charges as per service pricing model. With the help of cloud services can be available and used anywhere, anytime by the user. This makes cloud computing more popular and efficient. But still cloud computing faces the problems of task scheduling and resource management / allocation. So optimum scheduling of tasks must be there which allocates the resources efficiently and returns maximum benefits to the cloud service provider in terms of QoS(Quality of service). In this paper we have reviewed different priority based task scheduling algorithms and performed their comparison so that we can conclude which algorithm is more beneficial.**

***Index Terms*— ETC (Expected time to compute), PPIA(Priority based performance improved algorithm), ABC(Activity based costing), PA-LBIMM(Priority aware load balance improved min min algorithm).**

I. INTRODUCTION

With the help of cloud user can remotely store their data, use the required infrastructure and stop worrying about the platform on which their application will run.

1.1 Cloud Services

Cloud service provider provides, three basic services. [1] They are as follows:

1.1.1 Infrastructure As A Service(IAAS)

It provides hardware and software components to the users as per their requirement. Here hardware components include server and storage etc.

1.1.2 Platform As A Service (PAAS)

It provides the platform to the cloud users so that they can execute their application without installing extra internal hardware and software.

1.1.3 Software As A Service(SAAS)

It provides the software to the users through internet. So user doesn't invest in buying and maintaining the software. Cloud computing provides four types of infrastructures. They are as follows:

1.2 Cloud Infrastructures

1.2.1 Private Cloud

This type of cloud is used by private organization. They provide services such as security, availability of resources. They also provide authentication and privileges to specific private organization. This type of cloud provides high security than the other clouds.

1.2.2 Public Cloud

These type of clouds provides specific services that can be used by public group. These services will be used by all. So less security is provided to users.

1.2.3 Hybrid Cloud

This type of cloud uses the features of both public and private cloud. It has the internal control using private cloud and transfer the application from public cloud to private cloud as per requirement. In this cloud security access is open to all.

1.2.4 Community Cloud

It provides the services to only specific group of members. So these clouds are rarely used.

II. TASK SCHEDULING

In general scheduling of tasks is NP Complete problem. There are different types of scheduling techniques in cloud computing which accomplish high performance computing and maximum system throughput. A good scheduling technique gives maximum utilization of resources. Cloud computing faces the difficulty in scheduling the tasks. Task scheduling becomes challenge due to following features of cloud computing. [1]

2.1 The Heterogeneity of Resources

In cloud computing cloud may have different types of resources like mobile, supercomputer. So it becomes difficult to schedule tasks on such incongruent resources, as every resource has different features and requirements.

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2.2 The Heterogeneity of Tasks
Different user performs different tasks as per their requirement. So tasks submitted to cloud are assorted and heterogeneity of tasks is dependent on user's requirement.

2.3 User Priority
In cloud computing the user who pays more enjoys better service. High priority is given to the tasks of the user who pays more.

III. PERFORMANCE OF TASK SCHEDULING ALGORITHMS

Based on the following parameters the performance of task scheduling algorithms is analyzed. [1][2]

3.1 Execution time
The exact time taken by the resource to execute task is known as execution time. It is necessary for a good scheduling algorithm to minimize the execution time of the tasks.

3.2 Completion time
The entire time taken by the task to complete its execution is known as completion time. A good scheduling algorithm should reduce the completion time of the task.

3.3 Makespan
It is the total time from the start of the task execution to the completion of the task execution. A good task scheduling algorithm should have less makespan.

3.4 Bandwidth
It is the amount of data that can transfer from one point to another point in a given time slot.

3.5 Resource utilization
The resources of the cloud should be fully used. A good scheduling algorithm should maximize the resource utilization.

3.6 Load balancing
It is the process of distributing the workload of the cloud among the cloud resources. A good scheduling algorithm should balance the load of the resources efficiently which reduces the cost and increases the availability of the resources.

3.7 Scalability
It is the ability of the cloud to manage and work in increasing workload.

IV. TASK SCHEDULING TECHNIQUES

There are four main task scheduling techniques. They are as follows: [1]

4.1 Heuristic
Heuristic algorithm provides final solution among all available possible solutions, but they do not guarantee that the given solution is best one. So these algorithms are not accurate but approximate algorithms. These algorithms get the solution which is near to best one solution very quickly and easily.

4.2 Deadline
Deadline is a time limit given for execution of particular task. The output of the task must be produced to the cloud user before the deadline of the task because the output produced after the deadline is of no use. The concept of deadline increases the efficiency and makespan of the algorithm.

4.3 Priority
Here the priority means higher priority is given to tasks of user who pays more. It simply states that user who pays more should enjoy better services.

4.4 Optimization
It finds the optimal solution among all the possible solutions. Here optimal solution means the solution which maximizes or minimizes the objective function as per user's requirement. An optimization technique uses genetic algorithm, fuzzy logic and neural network to find the optimal solution.

V. PRIORITY BASED TASK SCHEDULING ALGORITHMS IN CLOUD COMPUTING

Following are some priority based task scheduling algorithms.

5.1 Multi Objective Task Scheduling Algorithm
In this algorithm first preprocessing of ETC matrix using Min-Max normalization is performed to normalize the values of ETC matrix. The new values of ETC matrix will lie between 0 and 1. Then in second step difference between latest finishing time and earliest finishing time for each task on available resources is calculated. [3] The task which has maximum time difference is selected and scheduled on optimal resource. Then this selected task is removed from the queue and completion time of other tasks is updated in ETC Matrix. This algorithm reduces the cost and makespan and increases average utilization of the resources.

5.2 Priority Based Performance Improved Algorithm For Meta Task Scheduling
This algorithm considers user's priority which means user who regularly uses cloud services, enjoys better services. In this algorithm regular user's task is having high priority and rest other user's task is having normal priority. This algorithm is used for Meta task scheduling here Meta task means the task which cannot be divided into sub tasks. [4]These Meta task set is stored in two groups one is high priority group and other is normal priority group. Here high priority tasks are scheduled by using min-min algorithm whereas normal priority tasks

are scheduled by using max-min algorithm. This algorithm decreases the makespan and increases the resource utilization.

5.3 Dynamically Optimized Cost based task scheduling

This algorithm is based on both costs and task groupings. It groups the user tasks according to cloud resource's processing capability and sends these grouped jobs to the resources which make improvement in computation / communication ratio. [5]As the utilization of resource's processing capability is increased the overhead time and cost for task execution is reduced. This algorithm is based on greedy approach as it finds the locally optimal solution and doesn't care about whether this solution is globally optimal or not. First in this algorithm the cost based tasks are prioritized on the basis of task profit in descending order. Then according to this order the high profit tasks are executed on the minimum cost based resource. This reduces the processing time and cost.

5.4 Improved Priority Based Job Scheduling Algorithm Using Iterative Method

This algorithm is based on multiple criteria and multiple attribute decision making models. There are three levels of priorities in this algorithm scheduling level, resources level and jobs level. Here every task requests for a resource with determined priority then priority of each job is compared with the priority of every other job. [6] For creating comparison matrices first priority vector is calculated using iterative method. Then according to the resource accessibilities the comparison matrices of tasks is created. This states which resource is having the highest priority than the resources according to the decision maker. Then maximum element of priority vector is selected and scheduled for execution on highest priority resource. This algorithm increases the makespan and complexity.

5.5 Improved Cost Based Algorithm

In this algorithm we measure resource cost and computation performance. [7] This algorithm improves computation/communication ratio. In this algorithm scheduler groups the user tasks according to the cloud resource's processing capability.

5.5.1 Activity Based Costing (ABC) Algorithm

In this algorithm scheduler measures direct cost of applications by measuring every individual use of resources.

5.5.2 Improved ABC

In this algorithm Scheduler accepts no. of tasks, average MI (no. of machine instructions) of tasks, deviation percentage of MI granularity size and processing overhead of all tasks. Then resources are selected and priority levels of tasks are calculated. There are 3 lists of task priorities (High, Medium, and Low). Then sorting of tasks is done according to their priority and placed in lists based on priority. After this Job grouping algorithm is applied to allocate the task-groups to different available resources. But the drawback of this algorithm is that dynamically changing cloud environment and other QoS attributes are not considered while scheduling the tasks.

5.6 User Priority Guided Min-min algorithm

Here we consider the matching of the user priority aware between tasks and resources based on Load balance improved min-min algorithm. [8] First scheduler makes two groups of all tasks G1 and G2 respectively. Where G1 is for higher priority tasks of VIP users and G2 is for lower priority tasks of normal users. Then scheduler schedules the tasks in G1 first and then G2 by using min-min algorithm. Then load balancing operation is performed to optimize the load of all available resources. But this algorithm doesn't consider the high heterogeneity of networks, deadline of each task and geography location of tasks and resources.

5.7 Novel Hybrid Cost-Priority Based Scheduling

This algorithm uses Multi queue and multi-priority levels. [9] First scheduler calculates the priority of each task. Then these tasks are sorted according to their priorities in the scheduler's queue. After that completion time is calculated for every task on every resource. Then the task having highest priority is selected and assigned to the resource which has the minimum completion time if it is free otherwise scheduler selects the next resource. Then this selected task is removed from the queue and all ready times and completion times for all the resources are updated. When the higher priority tasks finishes its execution lower priority tasks are moved from low priority queue to high priority queue. Now if new task arrives the scheduler calculates its priority and process is repeated where all the calculations are performed again and all the queues are updated. This algorithm reduces the makespan by reducing the completion time of each task and also optimizes the resource utilization.

VI. COMPARISON OF ALGORITHMS

Sr. No.	Name of the Algorithm	Advantages	Disadvantages
1	Multi objective task scheduling algorithm	1) Requires minimum execution time 2) Increased throughput	1) Deadline, Priority cost and other QoS parameters are not considered.

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2	Priority based performance improved algorithm	1) Reduces makespan 2) Increases resource utilization	1) Scheduling process is performed statically. 2) No. of meta tasks, no of resources @ expected execution time of tasks on each resource is known.
3	Dynamically optimized cost based task scheduling	1) Improves Computation / Communication ratio and utilization of available resources 2) Reduces processing time and cost	1) Makespan can be further improved
4	Improved priority based job scheduling using iterative method	1) Enhances makespan and complexity than other priority based algorithms	1) Makespan can be considered further for improvement.
5	Improved cost based algorithm	1) Low processing cost 2) Less makespan	1) Deadline, Priority cost and other QoS parameters are not considered.
6	User priority guided Min-min scheduling algorithm	1) Improves load balancing of resources 2) Minimizes makespan	1) Time and complexity increased due to rescheduling of tasks to achieve load balancing.
7	Novel Hybrid cost priority based scheduling	1) Optimizes resource utilization 2) Minimizes makespan by reducing completion time of each task.	1) Doesn't provide optimal fairness 2) Other QoS factors are not considered

VII. CONCLUSION

In the dynamic cloud environment where various jobs are submitted at anytime from anywhere, the management and scheduling of such tasks becomes complex, so there is a requirement of redefined mechanism to investigate algorithm before applying to the actual environment. In this paper priority based task scheduling algorithms are reviewed in comparative form stating their advantages and disadvantages. The performance of the cloud computing depends on the algorithm used for job scheduling. From the above all priority based algorithms, PA_LBIMM is superior as it considers load balancing with user priority which maximizes the performance of the algorithm.

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