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Improved Efficient Multi-Objective Tasks Scheduling Algorithm Considering More QoS (Quality of Service) Parameter for Cloud Computing.

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Abstract: **In cloud computing broker plays an important role. Broker act as a medium between users and cloud service provider. Cloud broker maintains list of virtual machines (VMs) and it's QoS. User sends the request to the cloud broker and cloud broker send the request to the VM server. After selecting the proper VM that meet the user's requirement and Service level agreement (SLA), broker binds the task to that particular VM.**

Scheduling is the process of mapping or assigning task to the available resources after looking the characteristics of task. An efficient scheduling mechanism should meet user's requirement and helps service provider to provide good quality of service, so as to enhance the overall system performance. Many of the task scheduling algorithm in cloud computing uses single criteria, which degrade resource utilization. So to enhance the system performance and increase resource utilization we need to consider multiple criteria. There are many criteria like execution time, cost, bandwidth for communication, deadline, make span etc. An efficient multi-objective task scheduling algorithm based on three criteria (task size, make span, and deadline). This algorithm also integrated with non-dominated sorting for ordering of tasks.

Literature review:

Cloud computing is an emerging technology and still is in the developing stage. There are many tasks scheduling algorithm in cloud computing that are based on QoS. Various QoS parameters are execution time, deadline, cost, bandwidth, make span, reliability and many others. Priority scheduling, FCFS (First Come First Serve), SJF (Shortest Job First) [3,4] are the traditional scheduling methods for selecting a task from a list of tasks. FCFS is a non-pre-emptive algorithm. SJF and Priority algorithm can be pre-emptive or non-pre-emptive. Task's priority can be assigned statically or dynamically using the QoS parameter. Multi-objective optimization methods were studied by many researchers [5, 6, 7-10] for grid workflow scheduling. Basically, there are two methods used. The first is weighted some method which converts all the objectives into single by assigning weights to all objectives. The next method is to search for a non-dominated solution, also called the Pareto optimal front [12]. In [14, 15] authors proposed an algorithm based on multiple criteria and multiple decision model to map a task to a particular VM. Multiple criteria include the various QoS parameters. These algorithm helps to minimize the make span and improve the performance of the system. Optimized task scheduling algorithms using genetic algorithms with greedy approach not only performs task scheduling but also perform load balancing [13].Load balancing algorithm based on NSGA-II is proposed in [16]. Nature inspired algorithm such as ant colony optimization bee colony optimization is also used. In ant colony optimization ant are tasks that move in any direction for the search of food source that are VMs. In [17], author proposed novel, efficient approach of non-dominated sorting (ENS). This algorithm decreases number of comparisons. A modified ant colony optimization algorithm in [18, 19] is used to minimizing the execution time and cost. This algorithm consider various criteria such as execution time , arrival time and other QoS parameter for searching a best VM for the execution of tasks which minimize make span.

In cloud computing broker has to allocate the VM to a task at runtime. In [20] author proposed a scheduling algorithm for real time tasks and also used game theory concept for ensuring the truthfulness of service provider. Some algorithm based on the execution time and arrival time are proposed in [21, 22] which picks a specific task from the group of task for the allocation of VM. Sometimes the tasks from the list is selected linearly and submitted to the VM. This process of allocation is done repeatedly until the all tasks in the list finish its execution. This leads to reduced completion time and minimized make span of the VMs. Generally, in tasks scheduling algorithm our goal is to minimize the execution time, cost, make span. There are some algorithm that also used to increase the scalability [23] and reliability [24] of the system.

Need for study:

To enhance the execution time and system performance an efficient multi-objective task scheduling algorithm developed and it based on 3 criteria (task size, make span, and deadline). As per customer demands and service provider to provide better service we can also improve this algorithm by considering more Qos parameter's currently which are not taken care.

Methodology:

QoS Guided Min-Min Heuristic:

This algorithm was introduced with the concept that some task requires higher network bandwidth to exchange a large amount of data among processors, whereas some can be satisfied with the lower network bandwidth. In this algorithm the matching of the QoS request and services between the tasks and hosts are based on conventional Min-Min. Firstly each task with the high QoS request in the Meta task, the algorithm finds the earliest completion time and the host that obtains it, in the entire QoS Qualified host. Secondly find the task with the minimum earliest completion time and assigns the task to the host that give the earliest completion time to task. In this algorithm they have addressed only one-dimension QoS issue, because they worked only with bandwidth constraint.

QoS Priority Grouping Algorithm:

QoS priority grouping algorithm considers deadline and acceptation rate of the task and the make span as main factor of task scheduling. It achieves better acceptance rate and completion time for the submitted task as compared to Min-Min and QoS Guided Min-Min.

Towards Improving QoS-Guided Scheduling:

It consists of two optimization schemes MOR (Make span Optimization Rescheduling) and ROR (Resource Optimization Rescheduling). MOR focus on improving the make span to pull off the better performance and ROR focus on the re-dispatch tasks from the machine with the minimum number of tasks to other machine, which is helpful to reduce the resource need. Both this technique achieves low complexity, high effectiveness and good performance than Min-Min algorithm.

QoS based predictive Max-min, Min-min switcher:

In this algorithm, scheduling of the next job is based on appropriate selection among QoS based min-min or QoS max-min algorithm. The effect on the execution time grid jobs has been reduced due to non-dedicated resources. It normally uses the history information about the execution jobs to predict the performance of non-dedicated resources. This algorithm merges the efficiency of max-min along with min-min and also considers both QoS and non-dedicated property of grid resources.

RASA:

This algorithm has the advantage of both Min-Min and Max-Min algorithm. In this first estimate the completion time of the tasks on each resource and then applies both the algorithm. It uses the Min-Min strategy to execute the small task first then long task and then apply the Max-Min to avoid the delays in the execution of large task and support concurrency in the execution of the large and small tasks. It achieves the lower make span with good QoS.

Improved Cost-Based Algorithm for Task Scheduling:

This scheduling algorithm makes efficient mapping of tasks to available resources in cloud. The improvisation of traditional activity based costing is proposed by new task scheduling strategy for cloud environment where there may be no relation between the overhead application base and the way that different tasks cause overhead cost of resources in cloud. This scheduling algorithm divides all user tasks depending on priority of each task into three different lists. This scheduling algorithm measures both resource cost and computation performance, it also Improves the computation/communication ratio.

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Job[Task] Scheduling based on Berger Model:

In this algorithm scheduling process establish dual fairness constraint. First constraint is to classify user task by QoS preferences, and establish the general expectation function in accordance with the classification of tasks to restrain the fairness of the resources in the selection process. Second constraint is to define resource fairness justice function to judge the fairness of the resources allocation. According to constraint, the algorithm always assigns tasks on the optimal resources in order to satisfy the QoS requirement of user and it avoid to consider a long task for execution. Experimental result of this algorithm shows effective execution of the user tasks and manifest better performance.

Task scheduling algorithm based on QoS-driven in cloud computing (TS-QoS):

In this TS-QoS algorithm we compute the priority of the task according to the special attributes of the tasks, and then sort tasks based on priority. Then the algorithm calculate the completion time of each task on different services, and schedule each task onto a service which can complete the task as soon as possible according to the sorted task queue. But in this process priority can change dynamically probably an increase continuously which can help to solve the ―starvation problem and follow FCFS principle. Experimental result achieves well performance and load balancing by QoS driving form both priority and completion time.

COMPARISON OF QOS- BASED TASK SCHEDULING ALGORITHM

Scheduling Algorithm	Scheduling Method	Scheduling Parameters	Scheduling Factors	Finding	Environment	Tools
QoS Guided Min-Min Heuristic [3]	Batch Mode	Quality of service, Make span	Bandwidth of tasks	1. Reduce the Makespan then Min-Min 2. Use only bandwidth parameter for QoS	Grid	GridSim
QoS Priority Grouping Algorithm[4]	Batch Mode	Acceptance rate, completion time	Grouped tasks	1.Deadline and acceptance rate of the tasks 2. Makespan	Grid	GridSim
Towards Improving QoS-Guided Scheduling[5]	Batch Mode	Make span		1.Improving makespan to achieve better performance 2. Reduce the Resource Need by Rescheduling	Grid	GridSim

QoS based predictive Max-min, Min-min switcher[6]	Batch Mode	Make span	Heuristic	Better performance with QoS	Grid	GridSim
RASA[7]	Batch Mode	Make span	Grouped tasks	Use to reduce the make span	Grid	GridSim
Improved Cost-Based Algorithm for Task Scheduling[8]	Batch Mode	Cost, Performance	Unscheduled task	1.Measure both resource cost and computation performance. 2. Improve the computation /communication ratio	Cloud	CloudSim
Job[Task] Scheduling based on Berger Model[9]	Batch Mode	QoS, Fairness Constraint , Completion time	Bandwidth of tasks	1. Improving Task execution time and get better performance. 2. Better meet the user expectation	Cloud	CloudSim
Task scheduling algorithm based on QoS-driven in cloud computing (TS-QoS)[10]	Dynamic Batching mode	Priority of Task, Minimum Completion time	Grouped tasks	1.Great performance 2.Load balancing	Cloud	CloudSim

Expected Benefits:

After research on this topic we will expect following benefits.

1. Service provider will provide good quality of service
2. Meets the needs of customer.
3. Improve the execution time helps in the system performance
4. Proper utilization of resource helps in high throughput the system

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