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Improving Parameters of Task Scheduling in Cloud Environment Using Multi Objective Function

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Abstract

Cloud Computing is on-demand access of computing resources available via simple internet access on pay per use method. In recent times the demand for system and the resources of Cloud Computing in IT industry has remarkably increased. The increase in number of users is proportional to the increase in quantity of information.

Cloud computing is a demand based service that contains well connected and virtualized resources available on the web. So due to its increasing popularity, the number of cloud users and the quantum of information has increased many folds. Task scheduling plays an important role in fulfilling the user's needs and to utilize the resources at their best.But in reality the resources are not utilized to their fullest.

This paper uses the multi-objective job scheduling algorithm for improving the efficiency of the task scheduling. This algorithm performs non- dominated sorting for ordering of tasks using the concept of multi objective functions.

Keywords: Cloud Computing; Task Scheduling; Priority; Non-Dominating sorting; Quality of Service (QoS); Virtual Machine (VM).

1. Introduction

These days Distributed computing fulfill user demands by coordinating largely distributed resources into a single cohesive system. Over the span of few years, the various types of distributed computing namely grid, cluster and cloud computing have emerged. Out of these, Cloud computing has proved to be a admired platform in making long held dream for utility processing easily available for high end computational applications.

Efficient Cloud computing is focused on generating new business opportunities for administration providers as well as for administration requesters with the help of conveyance

model for providing Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).It is a multi-user concept and makes the processing of huge data easier by sharing different resources like network etc. The best practices in Cloud model offers more scalability as the numerous users shares pooled resources, the quantity of resources continues to differ as per the necessities of clients. Therefore to optimise system throughput and the resource utilization one way out is the cloud task scheduling. Scheduling allocates a task to a specific Vm for making best possible use of resources. An efficient task scheduling algorithm not only improves the system performance but also helps the service provider to provide high quality of service (QoS). Cloud Broker act as intermediate between cloud service provider and the user. They keep the track of Vms and there QoS. Further they take the request from the client and allocates Vm (Virtual Machine) to complete the requirements of user and SLA (Service Level Agreement).

The rest of the paper is organized in following manner. I have discussed previous Work in Section II. In Section III, I have discussed the Present work. In Section IV experiments and results are taken out and finally, Section V arrives at conclusions along with some recommendations about the future investigations.

2. Prior Work

Cloud computing is a growing phenomenon. It becomes important to lessen the preparing cost as well as handling time and finishing time to increase the use of resources in cloud which can be done by arranging the tasks in the cloud. Various writers has seen it NP hard to schedule task issues. Different methods have been used to make scheduling issue efficient and framework have been presented out of which best outputs are: usage of Genetic algorithm which was presented by DAVIS in 1985 in form of Job Shop problem which reduced makespan time. Ghanbari S.methodology was based on Priority based Job Scheduling (PJSC) in which QoS parameters was used to select task to be allotted to VM. This was based on multiple criteria and decision .A method was presented by S.B. Zhan in 2012 to improve Particle Swarm optimization combined with Simulated Annealing Algorithm has demonstrated a method related to combined PSO. To maintain the SLA for a request in SaaS cloud environment by increasing the workrate of the data center and minimizing the expenses Lakra A presented ,aligning tasks to VM's in multi-objective task scheduling algorithm.E.S.Mathukiya presented a method for acceptability of the optimization method. He proposed multi Objective task scheduling algorithm for smooth running of the work rate in a

particular framework and for performing non –dominated sorting for various jobs. Zhao S defined a structure for task scheduling optimization taking into consideration particle swarm optimization heuristic algorithm which depend upon small part of value rule in cloud computing iterative system was used to achieve better makespan and consistency of jobs ,a priority based scheduling algorithm was presented by Patel S.J ,to get the best execution Multi criteria and number of attribute decision making structures are used. A detailed thought about Genetic method has been presented by Singh S.and it's various variations are offered for job scheduling in this environment scheduler based on GA is presented in which loads of assets are adjusted and makespan is lessened thus creating populance by further improving Max-Min.To minimize the execution time and cost execution time ,writers talked about modified ant colony optimization in [9,11].In this framework author has also considered entry timeand QoS parameters to find best VM in the proposed framework. In Structures based on cloud,B.T.Bini has presented Hyper-Heuristic scheduling. Genetic and Simulated Annealing Algorithms are used as a part of the competitor pool as low-level heuristic calculations.Further the Differential development combined with the Genetic algorithm to extend the execution, maximum Lateness, maximum tardiness, makespan and most extreme stream time are the execution estimations, used to make examinations. B.Kanani has inspected a brief survey of Max-Min Task Scheduling Algorithm for Cloud Computing . In this paper the proposed calculation is familiar with Max-Min methodology in order to decrease the makespan and optimize the resource utilization while considering customer need, so that the import job will execute first. To satisfy the needs of the clients , The task with higher priority will first execute than other less job priorities .[19].

3. The Proposed Technique

Cloud service providers like Google, Amazon etc. have set up many data centers with abundant resources to give access to the client . The proposed work is compromising on best possible scheduling of jobs allocated to VM's to achieve good QOS Levels. The datacenter in cloud computing have many servers . Further every server comprises of different VMs with distinctive ability to execute diverse QoS's tasks seek by the client. The broker of Cloud acts as middleware between cloud supplier and SaaS and such arrangement are motivated by QoS prerequisites. Broker assigns resources for Saas that can meet application's QoS prerequisites.

3.1 Problem Statement

With the goal to reduce the execution time, the main problem is to link all the jobs which the broker has received to the list of Vms.The low priority job has to wait for the longer time as compared to high priority jobs which gets the chance to execute first in the task scheduling with priority [22, 23] , however low priority jobs are taken hold of when high priority jobs gets the chance to come in and CPU is distributed to high priority which leads to reduction of throughput of system as it demolishes the execution time of the errand.Moreover, methods perform extraordinarily good in shortest job first task scheduling [22, 23] in the best scenario and bad in the worst case. Hence a successful scheduling method is required which can perform best in two cases.The completion time of whole of the workload therefore depends upon VMs as well as the order of submitting the tasks. The start time,waiting time and the length of task both affect the finishing time of the entire workload. VM describe as

$= \{Vid , Mi\}$, where Vid represents a particular Virtual machine, id is for ID of VM and Mi represents a MIPS of ith VM. Further task is represented as Ti ={IDi , Qi ,CPi } , here IDi represents task ID, Qi means QoS estimation of an task and CPi represents the CPU utilization of a task.

The cloud broker sends the request for QoS of requested job to the cloud service provider.According to the QoS task's priority projected task scheduling methodology is decided.Small QoS value is assigned with high QoS task and the large QoS value is assigned the low QoS task.Later,lower Qos value task has highest priority and the job with high QoS value has the lowest priority.These can be achieved in SLA.Task's QoS value depends upon the time span of its life cycle.For record of VM's that is made in data centers,the cloud broker passes plea to the service providers.Then broker sets QoS to the VMs after getting the details of VM's. For this MIPS of VM is taken into consideration for allocation.VM which has a high MIPS is a high QoS VM and vice versa that is VM with low MIPS is low QoS VM.

3.2 Non-Dominated Sorting

For handling the multi-objective cases a non-dominated sorting [8, 5] is used. Number of targets are observed in this .Here the main objective is to maximize the CPU utilization and minimizing the waiting time of the task.

$$\text{Maximize } f(Cp) = CPk | \forall j \ni i, f(CPi) \leq f(CPj) \qquad (1)$$

$$\text{Minimize } f(Wk) = Wk| \forall j \ni i, f(Wi) \leq f(Wj) \quad (2)$$

Here, $i = \{1, 2, 3.... n\}, j = \{1, 2, 3.... n\}, k = \{1, 2, 3.... n\}$. S represents size of the task and Q is the QoS of every virtual machine. T is the order in which task are arranged so that utilization of CPU is maximized and n is the total number of task. A non-commanded sorting is used to fulfill the multi-target assignment booking algorithm with the above mentioned destinations. Number of goals are applied and parameters are taken to get results in non-commanded sorting.

$$\text{CPU utilzation} = \text{CloudletLength} * n/\text{vmNumberOfPes} \quad (3)$$

$$\text{Cost} = \text{characteristics.getCostPerMem} * \text{vm.getRam} \quad (4)$$

$$\text{Waitingtime} = \text{cloudlet.Entrytime} - \text{cloudlet.starttime} \quad (5)$$

3.4 Virtual Machine Assortment

The record of VM is kept by cloud broker for the VMs .With the vast increase in number of requests, this list is upgraded at the pick time. The records of Vm's is arranged in decreasing order taken into view the MIPS of VM. The VM having highest QoS is at the first place and the last has the lowest QoS. Consequently, non-dominated sorting tasks set to the VM's as per the records of the tasks and VM's. The first VM in the row gets the first task in the task's record ,the second VM in the list gets the second job aligned and this process repeatedly goes on. As soon as the job allocated to the last VM,the next task is once again allocated to the first VM in the VM's queue and this allocation procedure goes on repeating. The following calculation shows the multi-objective scheduling method.

Algorithm: Multi-Objective Scheduling algorithm

1) Set the virtual machine and its list of task

3) Arrange the virtual machines in increasing order according to two QOS parameters (memory,arrival time).

4) Arrange the task list using non
– dominating Sorting (considering cloudlet outputsize and cloudlet filesize as function parameters)

5)Dividing the task among Virtual machines.

6) This process of allocation will be repeated for all tasks.

Non − dominated sorting (task list)

i = 0

Create empty non − dominated list

Initially put task (i) into non − dominated list

For all i = 1 to size of task list

For all j = 0 to size of non − dominated list

If *task (j) dominates task (i) i.e. checking the tasksize and task Output file size*

Then

Put task (j) into non − dominated set

Else if task (i) dominates task (j)

Then

Put task (i) into non − dominated set

Else

Put task (i) and task (j) into non − dominated set

End if

End for

End for.

4. Experiments and Results

4.1 Simulation and Analyses

In this experiment simulation test have been performed on Net Beans IDE and cloud simulator. The comparisons have been performed between three algorithms. The first algorithm is the proposed technique(MO), the second algorithm is Multiple objective algorithm with non-dominated sorting(MO1) and the third algorithm is Simple Multiple objective algorithm to schedule a task

The following diagrams shows shows the CPU utilization and average time of task in Fig.1and Fig.2.

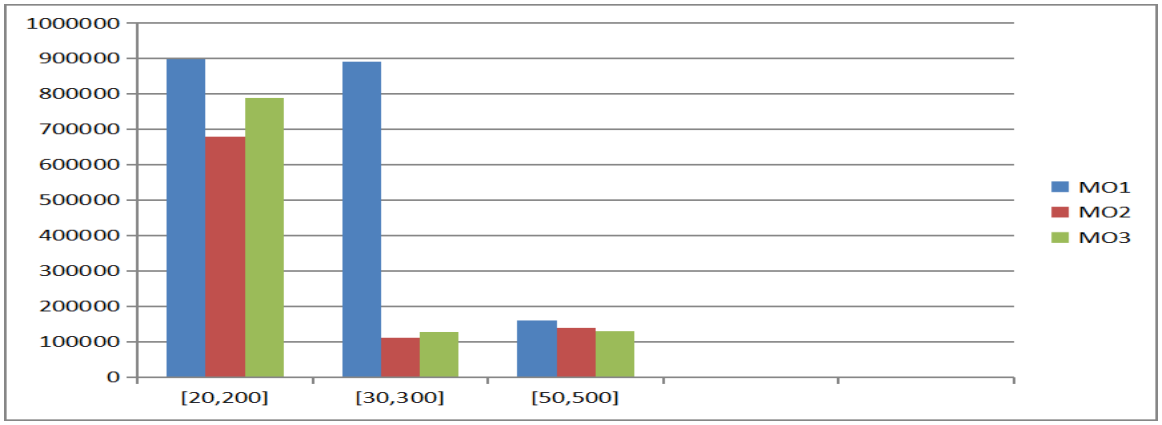

Fig. 1. CPU utilization time for Datasets [20,200] , [30,300], [50,500]

The X-axis shows the machines, no. of tasks and the y-axis shows the CPU utilization by machines. It is clearly depicted from the figure that the proposed technique(MO1) performs much better than the other two algorithms.

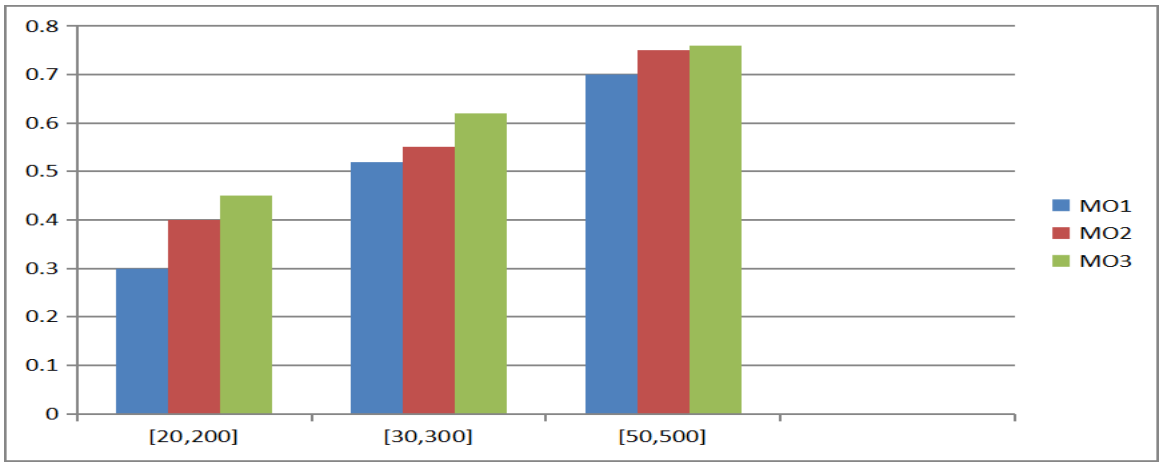

Fig .2. Average waiting time for Datasets [20,200], [30,300],[50,500]

The X-axis shows the machines, no. of tasks and the y-axis shows the average waiting time of machines. It is clearly depicted from the figure that the proposed technique (MO1) performs much better than the other two techniques.

Datasets [Machines ,Tasks]	Proposed Technique(MO)	MO1	MO2
[20,200]	898886	786545	134509
[30,300]	687545	109872	110089
[50,500]	798654	113435	123450

Table 1. CPU Utilization Output of various datasets

Datasets [Machines ,Tasks]	Proposed Technique(MO)	MO1	MO2
[20,200]	0.3	0.52	0.7
[30,300]	0.4	0.54	0.74
[50,500]	0.45	0.61	0.76

Table 2 shows the average waiting time of tasks using three different techniques.The various datasets of machines and tasks i.e. [20,200] , [30,300],[50,500] are used as inputs for solving the Task Scheduling Calculation.

5. Conclusion and Future Scope

So to conclude, It is presented in this paper that maximizing the CPU Utilization and minimizing the average waiting time in a particular arrangement makes Multi-objective task scheduling algorithm most effective. Using Multi Objective algorithm with non- dominated sorting gives much better results than simply performing task scheduling with multi objective. In future non dominated sorting could be performed considering other parameters like average response time ,average execution time etc.

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