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Differences and Problems Task Scheduling Algorithm -A Survey

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Abstract

Cloud computing is a computing paradigm where applications, resources and services are provided over the internet. Software and hardware can be used to pay as service basis, without buying them. The key role of scheduling is to manage different tasks in different cloud environment. Cloud computing service providers use the available resources efficiently to achieve maximum profit. This makes task scheduling as a challenging issue for cloud service providers. This paper gives an introduction about cloud computing, various existing scheduling algorithms in different task scheduling environments, existing problem and the future suggestions in existing algorithms.

Keywords: cloud computing, user level scheduling, dynamic level scheduling, real time scheduling, workflow level scheduling component, IVQ, SLA, LBIMM, PA-LBIMM, CPROVISIONTQS, DGS, OFDT, HEFT, CSO

1. Introduction

Cloud computing provides services, shared resources or common infrastructure on demand through the internet. Service provider provides the facilities to pay per use policy [1]. Customer can use storage space, processing capabilities, servers, operating system and application development environments. The user can scale up and down the resources in an instant (timely) and on-demand manner in the cloud [2]. Service providers schedule tasks by taking care of the different needs of users. Due to the increase in popularity of cloud model, cloud, environment gives access to computing with the appearance of having unlimited resources. Cloud service providers serve the users by giving the permission to use their resources like memory, bandwidth, disk, etc. According to the available resources in cloud environment different tasks with different QoS requirements are scheduled in different environments.

Task scheduling in different cloud environment is of many types- static and dynamic scheduling, workflow, scheduling, user level scheduling, and real time scheduling, heuristic scheduling. In this paper, section I give a brief introduction about cloud computing, section II contains various user level scheduling algorithms, section III contain various dynamic level scheduling algorithms, section IV contain various workflow level scheduling algorithms, section V contain various real time scheduling algorithms and section VI concludes the paper.

2. User Level Scheduling Algorithms

Cloud consist of many things like User Requirement, Load Balance and other constraints that affects user consumption rate of resource [3]. In this section, various user scheduling algorithms are reviewed. In the table, the existing problems in user level scheduling algorithms, tool used, Parameters considered and future suggestions are summarized.

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2.1 IVQ (Intelligent Approach for VM and QoS Provisioning) [4]

Amit Kumar Das, Tamal Adhikary and Md. Abdur Razzaque, Choong Seon Hong proposed an adaptive QoS aware VM provisioning approach which gives the efficient utilization of system resources by recycling the virtual machines in proper way. A lot amount of time is required to create and destroy Virtual machines again and again to serve user's request. By taking into account that virtual machine is not necessary to be created for all jobs, IVQ proves better in term of rejection rate. The goal of this model is achieved by serving more users at same time and ensuring QoS parameters.

2.2 Novel Scheduling Heuristic based on SLA [5]

Vincent C. Emeakaroha, Ivona Brandic, Michael Maurer, Ivan Breskovi proposed an approach related to service level agreement(SLA) which is a contract between service provider and user. Many previous algorithms worked on the single SLA parameter but the proposed approach works on multiple SLA parameters like load balancing and resource utilization. In this, author proposed a novel scheduling heuristic approach to schedule user requests on VM's based on agreed SLA terms and allocate VM's with available physical resources. Algorithm works on cloudsim simulation tool with custom extension layer. Proposed algorithm is two times better than traditional task scheduler.

2.3 LBIMM (Load Balance Improved Min-Min Scheduling), Pa-Lbimm(User Priority Aware Load Balance Improved Min-Min Scheduling) [6]

The proposed algorithm is based on min-min algorithm [7]. The biggest drawback of traditional min-min algorithm that is load unbalancing is improved in the proposed scheme. Two algorithms are proposed in this. First algorithm named LBIMM is proposed to optimize the load balancing by considering min-min algorithm. Second algorithm named PA-LBIMM is proposed by considering user priority to serve users with better services. Proposed algorithm performs better in case of completion time, load balancing and average resource utilization.

2.4 CPROVISION [8]

Sharrukh Zaman, Daniel Grosu proposed an auction based mechanism for dynamic VM provisioning. Proposed algorithm takes user demand into account when taking VM's allocation decision. Algorithm includes a reserve price concept which is the operating cost of resources. Reserve price means users has to pay some minimum amount to the cloud service provider. When compare with CGREEDY [9] it performs better in case of resource utilization and percentage of served users. In high demands, CPROVISION proves better in term of profit.

Table 1. Various User Level Scheduling Algorithms And Future Suggestions

Problem find	Proposed scheme	Tool used	Findings	Parameters	Future suggestions
Large amount of time required to create and deploy VM's	IVQ[4]	Cloudsim	Minimizes the rejection rate	Simulation time, rejection rate	Resource allocation policy will be included with VM's. Energy memory mechanism

					will also be included.
Previous proposed algorithm works on only single SLA parameter.	Novel scheduling heuristic based on SLA [5]	Cloudsim	Achieve load balancing and higher resource utilization.	Resource utilization, load balancing	To investigate this approach by considering energy efficiency objectives in utilizing resources.
Load imbalances of traditional Min-min	LBIMM, PA-LBIMM [6]	MATLAB	1.LBIMM is better in case of load balancing 2. PA-LBIMM proves better in term of completion time.	Completion time, load balancing and resource utilization	To study PA-LBIMM by considering tasks as dependent entity.
Dynamically provisioning VM instances for higher profit	CPROVISION [8]	Real workload tracers	It performs better in case of resource utilization and in term of profit	Cost, resource utilization	To combine both CPROVISION and CGREEDY and to set a private cloud for implementation

3. Dynamic Level Scheduling Algorithms

An internet-based large-scale distributed computing provides dynamically-scalable, efficient and optimized services, platforms and resources , according to the demands of users.[10]. In this section, various dynamic level scheduling algorithms are reviewed. In table, the existing problems in dynamic level scheduling algorithms, tool used, Parameters considered and future suggestions are summarized.

3.1 TQS (Tri Queue Job Scheduling Algorithm) [11]

Liang Ma, Yueming Lu, Fangwei Zhang, and Songlin Sun. proposed an algorithm to avoid the fragmentation at time of scheduling. This algorithm gives equal opportunity to small, medium and long job using dynamic quantum time to make efficient use of resources. Starvation problem is removed by TQS. Algorithm divides the jobs into three different queues small, medium and large using queue forming technique and make efficient use of available resources.

3.2 DGS (Dynamically Allocating VMs and Distributing Tasks by Greed strategy)[12]

AV.Karthick, Dr.E.Ramaraj, R.Kannan proposed a DGS [12] algorithm which is feasible and flexible dynamic task scheduling scheme. This scheme dynamically allocates virtual resources to execute tasks by using improved greedy strategy. DGS evaluates the amount of resources required by user's application and then dynamically adjust the virtual resources for load balancing and to increase resource utilization rate. Greedy strategy is used later to dynamically allocate tasks to computing node to get fastest response time.

3.3 OFDT's (An Optimally Fair Dynamic Task Scheduling Algorithm) [13]

In this, Shilpi Saxena, Satyendra Singh Chouhan proposed a dynamic task scheduling technique OFDT's because traditional methods tends to overpricing and slow processing rate. This algorithm works on the requirement of each individual task and then allocates the task to most appropriate resource. OFDT's performs better in term of cost and execution time when compared with other traditional algorithms

Table 2. Various Dynamic Level Scheduling Algorithms And Future Suggestion

Problem find	Proposed scheme	Tool used	Findings	Parameters	Future suggestions
Fragmentation problem at time of scheduling	TQS[11]	Cloudsim	Better resource utilization	Processing time, resource utilization	TQS algorithm with reservation category of scheduling.
Dynamically allocation of VM's to achieve load balancing and resources utilization	DGS[12]	Cloudsim	Achieve high load balancing and resource utilization	Resource utilization, load balancing	Cost of virtual resources will also be included
Due to overpricing and slower processing time in bulk of tasks	OFDT's[13]	Cloudsim 2.1.1	Performs better in term of cost and execution time	Cost, execution time	By taking more parameters like bandwidth, energy and latency,algorithm will be enhanced.

4. Workflow Level Scheduling Algorithms

It schedules interdependent tasks of workflow application on a available virtual machines to achieve the overall objective of workflow application. In workflow scheduling, various sub tasks of the main task should be executed in particular manner. In this section, various workflow scheduling algorithms are reviewed. In table, the existing problem in workflow level scheduling environment proposed schemes, tool used, Parameters considered and future suggestions are summarized.

4.1 HEFT (Heterogeneous Earlier Finish Time) [14]

Nitish Chopra, Sarbjeet Singh proposed an algorithm which works on the deadline and monetary problems of user's tasks. HEFT use a new concept of subdeadline for rescheduling and allocate the best resource from public cloud to user. HEFT works on a concept of deadline which is compared with makespan to set the best schedule. At the starting, all tasks are assigned to private cloud. If the allocated resourcees in private cloud meets the deadline than it is a best schedule otherwise some of them are send to public cloud. When HEFT is compared with min-min and greedy approach, it proves better in term of cost and always meets deadlines.

4.2 CSO(Cat Swarm Optimization) [15]

Saurabh Bilgaiyan, Santwana Sagnika, Madhabananda Das proposed an heuristic scheduling algorithm with hypothetical workflow. CSO algorithm optimizes the transfer cost between two dependent resources. CSO considers two costs; data transfer cost and other is execution cost. CSO algorithm is inspired by two social behavior of cat, seeking mode and tracing mode. CSO proves better in term of total cost, load balancing and in number of iterations to achieve best solution.

4.3 Critical Greedy Algorithm [16]

Xiangyu Lin, Chase Qishi Wu proposed an algorithm to reduce the cost and meet the other performance goals. Author find that an analytical problem called MED-CC(minimum end to end delay under cost constraints) which is NP-complete as well as non-approximable.Then to find a solution of heuristic workflow, end-to-end delay critical greedy algorithm is proposed. When compare with GAIN3, it proves better in case of cost under large budget.

Table 3. Various Workflow Level Scheduling Algorithms And Future Suggestions

Problem find	Proposed scheme	Tool used	Findings	Parameters	Future suggestions
Resource allocation in hybrid cloud which is a difficult task	HEFT[14]	Cloudsim	Better in term of cost and always meet deadlines.	Cost, deadline, makespan.	On full workflow application and measure the cost in real time.
Data produced by complex problems is always large and the cost to transfer that data is also large	CSO[15]	Benchmarks	Better in term of total cost, load balancing and in number of iterations to achieve best solution.	Energy consumption, cost , load balancing	To include multiple parameters in CSO like execution time, energy efficiency etc.

MED-CC which is NP complete and non-approximable	Critical greedy algorithm [16]	Cloudsim	Proves better in case of cost under large budget	Cost and end to end delay	To achieve higher accuracy in real world cloud environment.

5. Real Time Scheduling Algorithms

Real time tasks have to be complete before deadline. There are some real time scheduling algorithms presented in this section. In Table, the existing problem in real time scheduling environment proposed schemes, tool used, Parameters considered and future suggestions are summarized.

5.1 Multiobjective Particle Swarm Optimization [17]

Pengju He, Yan Liang, Xingxing Chou proposed an algorithm to achieve real-time task scheduling and to make embedded cloud computing resources. In this resource load balancing degree and task completion time are objective functions. Multiobjective particle swarm optimization is used to achieve task scheduling. Algorithm proves better in case of task processing time and in load balancing degree.

5.2 ECMM(Max-Min Task Scheduling Algorithm For Elastic Cloud) [18]

Xiaofang Li1, Yingchi Mao, Xianjian Xiao, Yanbin Zhuang1 proposed an algorithm for load balancing and maintain a real time load status table. It maintains two tables, task status table and virtual machine status Table. By estimating the total execution time and number of tasks in virtual machine, a task is scheduled to virtual machine. ECMM proves better in case of average task pending time when compared with round robin algorithm.

Table 4. Various Real Time Scheduling Algorithms and Future Suggestions

Problem find	Proposed scheme	Tool used	Findings	Parameters	Future suggestions
To solve multiobjective optimization problem	Multiobjective particle swarm optim ization[17]	MATLAB R2009a	Better in case of task processing time and in load balancing degree.	Completion time, processing time,load balancing	To achieve more real time requirements and practically implement them should be done in future.
Elasticity in cloud computing	ECMM(Max-Min task scheduling algorithm for elastic cloud)[18]	Cloudsim	Better in case of average task pending time	Task pending time, response time, load balancing	To estimate load balancing in more real environment can be the future task

6. Conclusion

Cloud computing is an emerging technology. Lot of work is going on the task scheduling in different cloud environment. Some algorithms are good in terms of cost and some are in processing time etc. This paper helps in good understanding of task scheduling options in different environments according to user needs. This paper gives a review on various task scheduling algorithms in different environment, problems existing in different environment, findings of algorithms by taking different parameters and future suggestions in existing algorithms.

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