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A Review on ACO based Scheduling Algorithm in Cloud Computing

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ABSTRACT

Task scheduling plays a key role in cloud computing systems. Scheduling of tasks cannot be done on thebasis of single criteria but under a lot of rules and regulations that we can term as an agreement between users and providers of cloud. This agreement is nothing but the quality of servicethat the user wants from the providers. Providing good qualityof services to the users according to the agreement is a decisivetask for the providers as at the same time there are a largenumber of tasks running at the provider's side.In this paper we are performingcomparative study of the different algorithms for theirsuitability, feasibility, adaptability in the context of cloud scenario.

Keywords—*Cloud Computing, Cloud Architecture, Task Scheduling, Scheduling Types, GA, PSO*.

INTRODUCTION

The cloud computing is a kind of new computation method that works for solving the new problem which combines the different computers to constitute a big computing system to execute some large tasks. The core technology of cloud computing is task scheduling, but the task scheduling problem of cloud computing is NP-hard, and it is very difficult to attain an optimal solution due to the isomerism and complexity of cloud resources. When the cloud resources are requested for by a big number of tasks, an efficient task scheduling algorithm is especially important. The characteristics of cloud computing resources such as heterogeneous, dynamic and self-Governing, make the task scheduling for grid computing to be extraordinary complex. The robustness and self-adaptability of ant colony optimization (ACO) can just match the characteristics of cloud computing, which makes the ant colony optimization to have a good effect on the task scheduling for cloud computing.There is no exact definition of cloud but we can define cloud in various ways and by considering various means. Cloud computing is Internet-connected mode of supercomputing. It is a type of shared infrastructure, which simply puts the huge system pools together by using various means; distributed virtualization etc. It gives users a variety of storage, networking and

computing resources in the cloud computing environment via Internet, users put a lot of information and accesses a lot of computing power with the help of its own computer.

Task scheduling plays a key role to improve flexibility and reliability of systems in cloud. The main reason behind scheduling tasks to the resources in accordance with the given time bound, which involves finding out a complete and best sequence in which various tasks can be executed to give the best and satisfactory result to the user.

Task Scheduling in Cloud Computing

Task scheduling plays a key role in cloud computing systems. Scheduling of tasks cannot be done on the basis of single criteria but under a lot of rules and regulations that we can term as an agreement between users and providers of cloud. This agreement is nothing but the quality of service that the user wants from the providers. Providing good quality of services to the users according to the agreement is a decisive task for the providers as at the same time there are a large number of tasks running at the provider's side. The task scheduling problem can be viewed as the finding or searching an optimal mapping/assignment of set of subtasks of different tasks over the available set of resources (processors/computer machines) so that we can achieve the desired goals for tasks. In this paper we are performing comparative study of the different algorithms for their suitability, feasibility, adaptability in the context of cloud scenario, after that we try to propose the hybrid approach that can be adopted to enhance the existing platform further. So that it can facilitate cloud-providers to provide better quality of services.

1. ACO(Ant Colony Optimization)

The basic idea of ACO is to simulate the foraging behavior of ant colonies. When an ants group tries to search for the food, they use a special kind of chemical to communicate with each other. That chemical is referred to as pheromone. Initially, ants start searches their foods randomly. Once the ants find a path to food source, they leave pheromone on the path. An ant can follow the trails of the other ants to the food source by sensing pheromone on the ground. As this process continues, most of the ants attract to choose the shortest path as there have been a huge amount of pheromones accumulated on this path. The advantages of the algorithm are the use of the positive feedback mechanism, inner parallelism and extensible. The disadvantages are overhead and the stagnation phenomenon, or searching for to a certain extent, all individuals found the same solution exactly, can't further search for the solution space, making the algorithm converge to local optimal solution. Applications of ACO algorithm are:

1. It must visit each city exactly once;
2. A distant city has less chance of being chosen (the visibility);
3. The more intense the pheromone trail laid out on an edge between two cities, the greater the probability that that edge will be chosen;
4. Having completed its journey, the ant deposits more pheromones on all edges it traversed, if the journey is short;
5. After each iteration, trails of pheromones evaporate.

2. PACO (Period ACO)

PACO uses ant colony optimization algorithm in cloud computing, with the first proposed scheduling period strategy and the improvement of pheromone intensity update strategy. PACO has a good performance both in makespan and load balance of the whole cloud cluster. A Period ACO (PACO) based scheduling algorithm, to solve task scheduling problems in cloud computing was proposed by Sun et al.. PACO used ACO algorithm in cloud computing, with first proposed scheduling period strategy and improvement of pheromone intensity updated strategy. Experiment showed that PACO ensured good performance in makespan and load balance of the total cloud cluster.Applications of PACO algorithm are:

1. PACO uses ant colony optimization algorithm in cloud computing, with the first proposed scheduling period strategy and the improvement of pheromone intensity update strategy.
2. PACO has a good performance both in makespan and load balance of the whole cloud cluster**.**

3. Min-Min Based Scheduling Algorithm

It selects the smaller task first and occupies the resource which has high computation power. This algorithm sorts the tasks based on ETCs (Estimated Time to Complete) The tasks are sorted on the basis of sorting key using an ordered list by the trade-off factor N in average ETC, minimum ETC and maximum ETC. After this segments with the equal size using a trade-off factor N are created using the task list partitioning scheme. The larger task segments get scheduled and executed first followed by the smaller tasks i.e., in decreasing order. Min-min is applied to assign tasks to machines for each and every segment. The task sorting is done before scheduling here so that the larger tasks are scheduled earlier.

Cloud computing is emerging as a new paradigm of large-scale distributed computing. In order to utilize the power of cloud computing completely, we need an efficient task scheduling algorithm. The traditional Min-Min algorithm is a simple, efficient algorithm that produces a better schedule that minimizes the total completion time of tasks than other algorithms in the literature [7]. However the biggest drawback of it is load imbalanced, which is one of the central issues for cloud providers. In this paper, an improved load balanced algorithm is introduced on the ground of Min-Min algorithm in order to reduce the makespan and increase the resource utilization (LBIMM). At the same time, Cloud providers offer computer resources to users on a pay-per-use base. In order to accommodate the demands of different users, they may offer different levels of quality for services. Then the cost per resource unit depends on the services selected by the user. In return, the user receives guarantees regarding the provided resources. To observe the promised guarantees, user-priority was considered in our proposed PA-LBIMM so that user's demand could be satisfied more completely. At last, the introduced algorithm is simulated using Matlab toolbox. The simulation results show that the improved algorithm can lead to significant performance gain and achieve over 20% improvement on both VIP user satisfaction and resource utilization ratio.

Disadvantages of Min-Min Algorithm:

1. It selects the smaller task first and occupies the resource which has high computation power.
2. Task which has larger completion time has to wait so it increases the make span.
3. So Min-Min does not produce optimal scheduling.

LITERATURE REVIEW

Weifeng Sun & et al. [1] defines that tasks scheduling problem in cloud computing is NP-hard, and it is difficult to attain an optimal solution, so we can use intelligent optimization algorithms to approximate the optimal solution, such as ant colony optimization algorithm. In order to solve the task scheduling problem in cloud computing, a period ACO_based scheduling algorithm (PACO) has been proposed in this paper. PACO uses ant colony optimization algorithm in cloud computing, with the first proposed scheduling strategy and the improvement of pheromone intensity update strategy.

T-Kokilavani [2] defines that Min-Min algorithm selects the task with the minimum execution time among all the tasks and assigns that task on the resource.

LipsaTripathy & et al. [3] designed a Protocol to minimize the switching time improve the resource utilization and also improve the server performance and through put. It is used to minimize the whole switching time and increase the utilization which helps to improve the cloud computing cluster. In this way improve the task scheduling in cloud computing and the types of tasks. In this paper, a cloud task scheduling policy based on Ant Colony Optimization (ACO) algorithm compared with different scheduling algorithms First Come First Served (FCFS). The main goal of these algorithms is minimizing the make span of a given tasks set.

M. A. Elsoud & et al. [4] defined an improved version of Max-min algorithm is proposed to outperform scheduling map at least similar to RASA map in total complete time for submitted jobs. Improved Max-min is based on the expected execution time instead of complete time as a selection basis. Experimental results show availability of load balance in small cloud computing environment and total small make span in large-scale distributed system; cloud computing. In turn scheduling tasks within cloud computing using Improved Max-min demonstrates achieving schedules with comparable lowermake span rather than RASA and original Max-min.

Manish Singh & et al. [5] The task scheduling problem can be viewed as the finding or searching an optimal mapping/assignment of set of subtasks of different tasks over the available set of resources (processors/computer machines) so that we can achieve the desired goals for tasks. In this paper we are performing comparative study of the different algorithms for their suitability, feasibility, adaptability in the context of cloud scenario, after that we try to propose the hybrid approach that can be adopted to enhance the existing platform further. So that it can facilitate cloud-providers to provide better quality of services.

Medhat Tawfeek & et al. [6] defines that one of the fundamental issues in this environment is related to task scheduling. Cloud task scheduling is an NP-hard optimization problem and many meta-heuristic algorithms have been proposed to solve it. A good task scheduler should adapt its scheduling strategy to the changing environment and the types of tasks. In this paper, a cloud task scheduling policy based on Ant Colony Optimization (ACO) algorithm compared with different scheduling algorithms First Come First Served (FCFS) and Round-Robin (RR), has been presented. The main goal of these algorithms is minimizing the makespan of a given tasks set.

S. Selvarani & et al. [7**]** present a particle swarm optimization (PSO) based heuristic to schedule applications to cloud resources that takes into account both computation cost and data transmission cost. They experiment with a workflow application by varying its computation and communication costs. We compare the cost savings when using PSO and existing 'Best Resource Selection' (BRS) algorithm. Our results show that PSO can achieve: a) as much as 3 times cost savings as compared to BRS, and b) good distribution of workload onto resources.

S. Pandey & et al. [8]formulates a model for the multi-objective task assignment and describes a particle swarm optimization algorithm in cloud computing environment. The algorithm not only optimizes the time, but also optimizes the cost. The experimental result manifest that the proposed method is more effective and efficient in time and cost.

COMPARISON

AUTHOR	TECHIQUE	ADVANTAGES
T-Kokilavani	Load Balanced Min-Min (LBMM) algorithm	Reduces the make span and increases the resource utilization.
LipsaTripathy& et al	proposed a scheduling mechanism or method to schedule the jobs in the cloud	Minimize the switching time, improve the resource utilization and also improve the server performance and throughput
M. A. Elsoud& et al.	Proposed a improved version of Max-min algorithm	Results show availability of load balance in small cloud computing environment and total small makespan in large-scale distributed system; cloud computing. In turn scheduling tasks within cloud computing using Improved Max-min demonstrates achieving schedules with comparable lower makespan rather than RASA and original Max-min.
MedhatTawfeek& et al.	cloud task scheduling policy based on Ant Colony Optimization (ACO) algorithm compared with different scheduling algorithms First Come First Served (FCFS) and Round-Robin (RR), has been presented	Cloud task scheduling based on ACO outperformed FCFS and RR algorithms.
S. Selvarani& et al.	Improved Cost-Based Task Scheduling Algorithm	It measures resource cost as well as computational performance also improves (computation /communication) ratio.
S. Pandey & et al.	A PSO-based Heuristic for Scheduling Workflow Applications	It gives three times cost saving as compare to BRS and also balances the load on resources by distributing tasks to available resources.

RESULTS

To test the performance of the proposed algorithm is designed BPSO, we will BPSO algorithms and other classical task scheduling algorithm for comparison testing. Figure 9 shows the response time of three task scheduling algorithms. Figure 8 shows the execution time of three task scheduling algorithms. PSO and BPSO are often applied to task scheduling in cloud computing, and achieved more satisfactory results. From the experimental results of Figs. 8 and 9, it can be seen that BPSO algorithm has evident advantages, effectively contributing to solving the genetic algorithm which is prone to premature convergence phenomenon. When increasing the number of tasks cloud computing system, the advantages of the proposed algorithm are shown even more clearly.

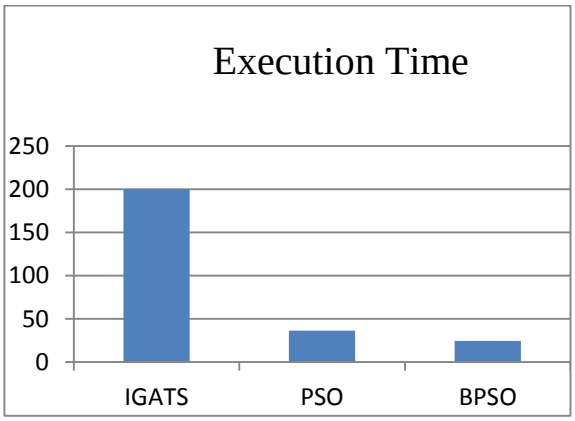

Fig.8 Execution Time

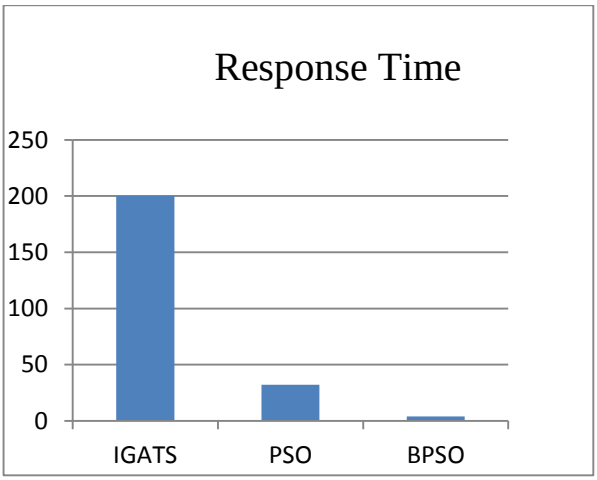

Fig.9 Response Time

Experimental results show that the proposed algorithm can effectively improve the throughput of cloud computing systems, and can significantly reduce the execution time of task scheduling. It can apply to the task schedule optimization for cloud computing problems in the research.

CONCLUSION

Task scheduling in cloud computing is highly challenging in cloud computing. To meet the needs of thousands requests by making best possible use of cloud resources is a challenge for task manager. Traditional methods of scheduling lead to high response time and low throughput. Many algorithms make use of priority scheduling and

suffer from long waiting queues. In this paper we compare the different algorithms which are used to schedule the tasks in cloud computing.

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