WORLD WIDE JOURNAL OF
MULTIDISCIPLINARY RESEARCH AND
DEVELOPMENT

Dr. Sunil Kumar
Assistant Professor, P.G.
Department of Computer
Science, Guru Nanak College
for Girls, Sri Makassar Sahib
Punjab, India

Optimization Task Scheduling Techniques for Distributive Environment

Dr. Sunil Kumar

Abstract
Distributed system has become the soul of today's computing world and Distributed system have various forms like Grid computing, Ubiquitous computing, Cloud Computing. In the present competitive environment efficient utilization of resources is important, which is possible by efficient task and resource scheduling. For this purpose various task scheduling algorithms has been proposed by eminent scholars. Meta-Heuristic algorithms are the renowned algorithm to achieve the optimum result in term of execution time, load balancing and cost. These types of problem are known as NP-Hard problem. This paper performs the SWOT Analysis of few of the prominent Meta-Heuristic algorithm optimization techniques. In this paper an extensive comparative study has been performed in terms of their strength, weakness, opportunity and threat to the already proposed algorithm to find out the scope for the further research in these prominent areas

Key-words: Cloud Computing, Heuristic based Task Scheduling, Distributive Environment, Resource Utilization, and Makes pan

1. Introduction

In the era of Internet, Distributed computing achieves extreme reputation due to its feature to share the resource at lowest cost and trustworthiness. In the late 1960, the idea of Distributed computing come into the real shape with development of Main frame IBM System& which come into the shape of Grid computing, Cloud Computing and Ubiquitous computing, which considered as spirit of Distributive Computing. Cloud Computing and Grid computing works for computationally intensive applications. Grid computing is mainly working for non-interactive applications. On the other hand, Cloud computing work for interactive environment. Basically, Virtual Network of Super Computers is loosely knot to perform the length tasks form the Grid, which is one of Avtar of distributed computing. On the other hand, Cloud computing is an emerging tool that offer diverse variance of services [1] software on demand, infrastructure to perform high computation intensive applications and other various applications which are high on cost but required by enterprises to perform their non-routine but important activities. Cloud can also be defined as a distributed computing prototype and it is a compilation of interconnected and virtualized computers that are provisioned and offered enthusiastically [2] as cohesive computing resources, who offer the services on pay-per use basis. The basic aim of all Distributed computing is optimum utilization of available distributed resources and performs the large computational problems to achieve the extensive results from the system. To achieve the optimum result scheduling of available resources and task is important, this process of resource management is known task scheduling and resource scheduling. Mainly two types of scheduling techniques are used for this purpose i.e. Independent task scheduling, workflow task scheduling. Independent task scheduling deals with the task without any precedence means task can be allocated to any of the machine without bothering about flow of any running task. On the other hand, workflow based task scheduling where all tasks are interdependent; they have precedence relations to each other, so while assigning the task to resources it is important to take consideration precedence before allocation. This type of application deals with the real type Situations [3]

Correspondence:
Dr. Sunil Kumar
Assistant Professor, P.G.
Department of Computer
Science, Guru Nanak College
for Girls, Sri Makassar Sahib
Punjab, India

As we further classified, it can be categorized into three categories i.e. Heuristic, Meta- Heuristic and Hybrid task scheduling algorithms [4]. Heuristic task scheduling algorithm perform for particular type of problem and better for simple type applications on the other hand Meta-Heuristic task scheduling algorithms are the practical methods which provide ease to schedule the task and provide the best possible solutions, it lead to the optimal result and these methods can be used to speed up the process of finding a satisfactory results. Hybrid algorithms are emerged with the feature of heuristic and meta-heuristic to achieve the optimum result. There are various prominent researchers who proposed renowned algorithms.

The rest of the paper is organized as follows. Section 2 gives the introduction about the SWOT analysis and section 3 provides the extensive study of various optimization based task scheduling algorithms in term of SWOT Analysis to find out the scope for further research work and section 4 gives the conclusion about the complete study

2. Concept of SWOT Analysis

SWOT analysis is a most renowned tool for audit and analysis of the overall capability of any element. Basically it is considered that it is used only to judge the business or a venture but it gives the basic capability and weakness of elements in terms of internal and external environments in the term of Strength, Weakness, Threat, and Opportunity. So we have chosen the SWOT Analysis to assess the capability of research work till date in the field of task scheduling in distributive environment. As above described above that lot of work has been purposed by various researcher, so there is need of SWOT analysis of these works. In the next section is related to the extensive SWOT Analysis of few prominent Meta-Heuristic Task Scheduling Techniques.

3. Optimization Techniques

As concern to the task scheduling, all the researchers always try to get the optimum results. Various researchers have proposed techniques which take idea from the real world to design the schedule for real situations. In this section, some of the renowned optimization techniques like Ant Colony Optimization (ACO), Artificial Bee Colony Optimization (ABC), Practical Swarm Optimization (PSO) and Cat Swarm Optimization (CSO) techniques are discussed.

Ant colony optimization is based on the behavior of Ants means how they moves in search of food and find the minimum path to achieve their target. ACO is a renowned technique which is used in various fields like vehicle routing, travelling salesman problem and task scheduling for Grid and Cloud computing Environment. Ruay-Shiung Chang et. al. [5] has proposed Balanced Ant Colony Optimization Algorithm for task scheduling for Grid Computing to reduce the makespan and balance the load of system. For this purpose in this algorithm, researcher proposed the concept of local and global pheromone to balance the load of Grid system

Table 1: SWOT Analysis of Optimization based Task Scheduling Algorithms

S. No.	Performance Parameters	Algo Type	Platform Used	Strengths	Weaknesses	Opportunity	Threat
1	Makespan Load Balancing	I	UniGrid GNU Linear Prog. Kit	Balance the system load Minimize the Makespan	It is based on independent task which is far from real applications	Concept of replicas can be added to this techniques to predict which resource have more storage capacity	Some time there is need to improve pheromone update function for better result but It is static in nature.
2	Makespan, Cost	I	CloudSim	Overall makespan time is optimized and cost decreased.	Based on the assumption that task are independent and non-preemptive by nature which is far away from the real life application	There is scope of improvement in algorithm in terms of precedence constraint and load balancing	Jobs are non-preemptive, if higher priority job comes it will not consider that job.
3	Load Balancing and Cost	W	Amazon Cloud Services Jswarm	It gives at least three times cost reduction as compared to BRS algorithm and resource utilization	Implementation perform through collection of data from various platforms makes it time consuming and complex	This technique can be used for workflows applications such as brain imaging analysis with little bit modifications	PSO generate the population randomly at initial level so it can lead more time consumption
4	Load Balancing, Makespan	W	CloudSim	It speedup the evaluation, minimum makespan and load balancing of resources.	It is based on the jumping factor which make it more complex	It is workflow based scheduling so deadline constraint makes it more realistic.	It doesn't consider the QoS Parameters, which is performance metrics to declare it as real life application
5	Minimization of cost, CPU idle Time and make span	W	MATLAB	It gives the reduced cost and minimum CPU idle Time with lowest Make span	It constraint on CPU idle time but ignore the CPU response time which is vital element in task scheduling	More QoS parameters can be considered so that it can easily accessible in more business areas	It is working with more conflicting objective which can design the undesired clash in application.

6	Schedule length	I	Test functions	It give the better schedule length for system	It is only considering the schedule the length, it doesn't consider any parameters.	It is base work of CSO, so there is lot of scope to use this technology for cloud	It randomly pick the point to move for replacement of cat so it can lead to non-improved step which cause to wastage of efforts
7	make span and Total Transfer Time	I	OptorSim	It reduce the make span as basic parameter with reduction in Total transfer time	Some time it can relax one of the objectives from makespan or total transfer time.	Energy efficiency and cost management can set add up to the proposed algorithm as its future scope. And make the application can work for cloud	When we transfer the documents then security is important features which is ignored by this proposed algorithm

Medhat et. al. [6] has proposed the algorithm based on Ant colony optimization for cloud computing environment. This algorithm gives the minimum makespan for the available task set. ACO technology works on the random optimization search to allocate the resource to incoming tasks. In this algorithm, like the ant behavior in search to food, when all the ants traverse to find the food, then ant with best route path is selected and global pheromone is updated. This technique gives the better results as compared to the existing technologies like FCFS and round robin algorithms in terms of makespan and load balancing.

In the decade of 90, one of the prominent optimization techniques has been given by Kennedy and Eberhert [7] named Particle Swarm Optimization. This Algorithms is relies on the social behavior of particles. In every generation a particle adjust its path based on its best position and meet rapidly to universal minima with a rational good solution. Suraj Pandey ET. al. [8] has proposed an algorithm based on PSO for the cloud computing environment. Proposed Algorithm performed dependent application by changing its computation and communication cost. It outperform as compared to BRS algorithm in term of cost (three times better) and resource utilization. Proposed algorithm is dynamic in nature it can be used for any number of task and resources so that it optimizes the cost of computation based on the existing network and resource conditions.

S. Chitra ET. al. [9] has proposed a workflow schedule to optimize the load balancing, makespan and Speedup ration with the concept of particle Swarm Optimization (PSO). It works better with increasing number of tasks. Like the PSO technique in every generation it tries to get the best element named as gbest with addition of one more step based on jumping factor. It set the jumping factor and if the value is less than that factor then it ensures the faster convergence and higher values ensure the local minima value. Its experimental results surpass the performance of existing PSO algorithm and Genetic Algorithm.

Various swarm based optimization techniques has been proposed till date. Saurabh Bilgaiyan et. al. [10] has proposed an multi-objective optimization technique based on the cat Swarm optimization for the cloud environment. MOCSO gives best performance in term of minimization of cost, Makespan and reduction in the idle time of CPU. It has added up a smart mechanism which reduces the unnecessary energy expenditure and lead to optimum solution in each iteration. Researcher has agreed that there is more scope in improvement of proposed algorithm with adds up of QoS parameters, which make it more realistic application.

CSO algorithm is based on the behavior of cats, they are always looks in passive mode but they remain active inside means they remains alerts all the time even when they are resting. On based on this idea, Shu-Chuan Chu et. al. [11] has proposed an algorithm named Cat Swarm Optimization for different domain problems. Its working is proposed in two modules tracing mode and seeking mode. In the seeking mode, it looks around and seeking the next position to move and in the trace mode it follow the target for best solution. It performs better as compare to the PSO algorithm.

In the complex system for the task scheduling it moves through three phases, resource discover, matchmaking and job execution. In improvement to these algorithms for complex system, Javid Taheri ET. al. [12] has proposed an algorithm for simultaneous job scheduling and data replication in grid environments with name Bee Colony based optimization. This algorithm schedules the jobs on computational node and makes the duplicate data files on storage nodes. It minimizes the makespan and total data file transfer time for heterogeneous system. Proposed algorithm has given the different space to data centric job scheduling in Grid Environment.

Conclusion

In this research paper we have perform the extensive survey of various optimization based Algorithms with SWOT Analysis. After the SWOT analysis of these algorithms we find that researcher has given various techniques to get the optimum results but All of these techniques are working for two or three objective but there is need to find any technique which can outperform in terms of Makespan, Load balancing, cost and most important element in field of Distributive Environment is security. Our research work is based on these basic parameters which can propose an optimum Algorithm.

References
1. R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, and I. Brandic, "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility," Future Generation computer systems, vol. 25, no. 6, pp.599-616, 2009.
2. Sunil kumar, Sumit mittal, Manpreet Singh, "Metaheuristic Based Workflow Scheduling in Cloud Environment" in Proc. 5th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO),,IEEE, 2016, pp. 553-559.

3. Barrionuevo JJD, Fard HM, Prodan R, Fahringer T. A multi-objective approach for workflow scheduling in heterogeneous environment: cluster, cloud and grid computing. In: 12th IEEE International conference; 2012. p. 300–309.

4. Sunil kumar, Sumit Mittal, Manpreet Singh, "Fuzzy based Trust Management System for Cloud Environment" Advances in Science and Technology Research Journal, 2016,vol. 10, no. 30, pp.32–37.

5. Ruay-Shiung Chang_, Jih-Sheng Chang, Po-Sheng Lin, "An ant algorithm for balanced job scheduling in grids", Future Generation Computer Systems, Vol. 25, 2009, pp: 20–27.

6. Medhat A. Tawfeek, Ashraf El-Sisi, Arabi E. keshk, Fawzy A. Torkey, "Cloud Task Scheduling Based on Ant Colony Optimization", IEEE, 8th International Conference on Computer Engineering & Systems (ICCES), 2013, pp: 64 - 69

7. J. Kennedy and R. Eberhart, "Particle swarm optimization", In IEEE International Conference on Neural Networks, vol. 4, 1995, pp: 1942–1948.

8. Suraj Pandey, LinlinWu, Siddeswara Mayura Guru, Rajkumar Buyya, "A Particle Swarm Optimization-based Heuristic for Scheduling Workflow Applications in Cloud Computing Environments", 24th IEEE International Conference on Advanced Information Networking and Applications, 2010, pp: 400-407.

9. S. Chitra, B. Madhusudhanan, and G.R. Sakthidharan, and P. Saravanan, "Local Minima Jump PSO for Workflow Scheduling in Cloud Computing Environments"Springer, Advanced in Computer Science and Its Applications, Lecture Notes in Electrical Engineering, 2014, pp: 1225-1234.

10. Saurabh Bilgaiyan, Santwana Sagnika and Madhabananda Das, "A Multi-objective Cat Swarm Optimization Algorithm for Workflow Scheduling in Cloud Computing Environment", Intelligent Computing, Communication and Devices, Vol. 308, 2014, pp 73-84.

11. Shu-Chuan Chu, Pei-wei Tsai, and Jeng-Shyang Pan, "Cat Swarm Optimization", PRICAI 2006: Trends in Artificial Intelligence Volume 4099 of the series Lecture Notes in Computer Science pp 854-858.

12. Javid Taheri, YoungChoonLee, AlbertY.Zomaya, HowardJaySiegel, "A Bee Colony based optimization approach for simultaneous job scheduling and data replication in grid environments", Computers & Operations Research, Vol. 40, 2013, pp: 1564–1578