

RESEARCH ARTICLE



ISSN: 2321-7758

PERFORMANCE ENHANCEMENT OF HYPER-HEURISTIC SCHEDULING ALGORITHM IN CLOUD COMPUTING FRAMEWORK

Er. GEETINDER KAUR, Er. SARABJIT KAUR
PTU, CTITR
Jalandhar , India

International Journal
of Engineering
Research-online
(IJOER)

ISSN:2321-7758
www.ijoe.in

ABSTRACT

Cloud computing has gained popularity in recent time and has become a great solution for providing a flexible utility oriented, on demand and dynamically scalable computing infrastructure on pay-as-you-go basis for many applications. In which systems are deployed. This technology is an abstraction based on the notion of pooling physical resources and presenting them as a virtual resource. Job scheduling Problem is a fundamental issue. For efficient utilization and managing of resources, services, scheduling plays an important role. This paper dispense the Hyper-Heuristic Scheduling Approach to schedule cloudlets and resources that takes into account both computation time and transmission cost along with two detection operators to generate candidate and optimal solutions for cloud environment. The numerical experiments of HHSA were performed on CloudSim. Experimental results generated via simulation shows that combined heuristic scheduling approach is much better than individual approaches in terms of minimizing makespan time.

Keywords- Cloud Computing; Job Scheduling Problem; Hyper-Heuristic Scheduling Algorithm; Makespan Time.

NOMENCLATURE: Job Scheduling Problem (JSP), Hyper-Heuristic Scheduling Algorithm (HHSA) , Data Center Creation (DCC) , First-In-First-Out (FIFO).

©KY Publications

I. INTRODUCTION

Numerous available arrangements have been anticipated to improve, to enhance the execution of data frameworks; mostly regarding computation, examinations and capacity. Since distributed as well as parallel computing was broadly used to upgrade the execution of a variety of data frameworks for different approaches and hereditary restrictions in different ages. The principle issue is the way to deal with these computer resources effectively, no matter which deliberation it is for. Among them, the most essential one for the successful operation of computer framework is scheduling. Scheduling is basically the allocation of various jobs to given resources in given time period. It is one of the most eminent activities that executes

in the cloud environment, to enlarge the productivity of the workload to get utmost gain.

In recent years, the new advance paradigm has been successfully used for computer and information systems i.e. Cloud Computing. It is highly automated information technology services similar to the way; automobile manufactures adopted the assembly line in the early 20th century. Companies today are adopting cloud computing as more efficient and eligible way of building their information technology platforms. Cloud computing delivers self-service, self-compute, networking, self-service storage, customer relationship management and big data analytics. It is really about hardware and software capability delivered virtually to any device. This technology is overall philosophy and design

concept for enabling revolutionary business models that are dramatically changing the nature of society and commerce. Cloud approach is the convergence of three major trances; Virtualization, Utility Computing and Software-as-a-Service based on pay-as-you-go feature, which is the hallmark of today's computing. It is the mass of infrastructure, applications, services which are floated in data center.

Most of the Traditional scheduling algorithms are standard –based scheduling algorithms generally utilized on today's distributed frameworks. These algorithms are easy and simple to actualize ; because of issue in handling the extensive scale or complex scheduling problems these algorithms are inappropriate in obtaining the optimal results. Heuristics are applied to scheduling on cloud computing frameworks. To solve problem , and reasons of learning and revelation , heuristics refers to several experience based systems in finding a solution which is not ensured to be optimal but it is adequate for the given arrangement of objectives in any case. The most essential goal of Hyper-Heuristic is to select right algorithms for a specific problem on the bases of bunch of existing algorithms and their performance to some degree. The basic plan of the proposed algorithm is to hold the strength of low-level heuristic algorithms such as First-In-First-Out (FIFO) and Max-Min by integrating them into single algorithm.

The remaining paper is coordinated as follows. Section II begins with a brief retrospect of Job Scheduling problem and Hyper-Heuristic . Literature Survey is examined in Section III. In Section IV, The Proposed work has been discussed. In Section V Experiments and Results are computed and Finally, Section VI draws the conclusion remarks together with some conceives about the future research.

II. JOB SCHEDULING PROBLEM

In computer science and operation research, JSP is an optimization problem in which ideal jobs are assigned to resources at particular times. The ideal answer for problem including n jobs must be transformed on m machines, decides the example of landing of jobs on each one machine so as to finish all the jobs on all the machines in the base aggregate

time emulating the same handling operation request when passing through the machines with no priority demands. ^[4] The issue is to discover the ideal jobs groupings, setup times on the machines in least time by utilizing the ACO calculation. A job shop typically consists of a large number of general purpose machines, as opposed to several purpose machines which would typically happen in a assembly line. Each job depending upon its technological requirements, demands processing on machines in a certain order. The JSP should be an extremely perplexing issue. Numerically, the greatest no. of conceivable successions with n jobs and m machines is $(n!)^m$ i.e. greatly substantial. The issue is typically explained by close estimation or heuristic strategies.

The need for job Scheduling in cloud focuses on some parameters such as load balance, throughput, Quality of Service (QOS), running time, efficiency, cost, space etc. And to improve the class of entire cloud computing environment. Scheduling process in cloud is separated into three stages to be specific; Resource finding and sifting, Resource determination, and Task portion. In Resource finding and sifting the datacenter broker finds the resources present in the network framework and gathers status data about the resources. In Resource determination the objective resource is chosen in view of the requirements of tasks and resources. This is a choosing stage. In task portion, the task is allotted to choose resource.

II.1 HYPER-HEURISTIC

Heuristics are the problem solving tools which can be used to solve the challenging and non-routine problems. The chief three key operators ; Transition , Evaluation and Determination (TED) of heuristics has been used to search for the possible solutions on the convergence process. The extended version of heuristic merge two or more high – performance scheduling algorithms which can provide a better scheduling in a reasonable time i.e. Hyper-heuristics . It is designed to expertise their heuristic evaluation process. Hyper-heuristics intend to find some algorithms that are capable of solving a entire range of problems, with little or non-coordinate human control. There may be a countless number of heuristics from which one can choose for solving a problem, and every heuristic has its own

particular advantages and disadvantages. The idea is to consequently devise algorithms by consolidating the quality and adjusting for the shortcoming of known heuristics. A typical framework incorporates a high level methodology and several low level heuristics [1]. When a problem example is given, the high level strategy chooses which low level heuristic should be applied and this relies on the search space of the problem and the current problem state. The problems are solved by discovering a solution from the arrangement of all possible solutions for a given problem, which is regarded as the "search space". The learning point should refine the algorithms, so that the algorithm solutions consequently address the needs of the training set and problems of a certain class can be explained all the more productively. The response mechanism should move towards optimum algorithm solutions in the workspace, as it aids the determination of heuristic. Hyper Heuristic is the coordination of two or more heuristic algorithms and aims to tell what sequence of meta- heuristics are utilized to solve the problem at hand. Additionally it can be utilized to characterize what meta-heuristic fits better to which problem. The fundamental idea of Hyper- heuristic is to utilize "one and only one "heuristic algorithm at every iteration, in order to keep up high search diversity to build the possibility of discovering better solutions at later cycles while not expanding the calculation time.

III. LITRATURE SURVEY

Numerous authors have contemplated the JSP and have been viewed as N-P hard.. With the utilization of Heuristic procedure, a few systems were proposed by authors to tackle this scheduling issue and among those routines that have achieved best results are: In 1985, Davis proposed Job Shop Problem with the application of Genetic Algorithm. There are numerous such works alongside the application of advancement techniques. Shortest Processing Time (SPT) cross breed heuristic strategy has been proposed by Zhon and Feng for taking care of scheduling issue. Viable pheromone adjustment procedure for development of essential ant framework which helps in investigation of the arrangement space is proposed by Zhang.J. [1] Total Make span time of set of jobs is minimizing by using the heuristic technique of SPT (Shortest Processing

Time) and procedure of LMC (Largest Marginal Contribution) by Aftab.M.T. [9] In 2012, S.B.Zhan has proposed an examination concerning the utilization of Improved Particle Swarm Optimization combined with Simulated Annealing Algorithm in resource scheduling strategy of cloud computing to streamline the JSP, by

increasing the convergence speed and utilization ratio of resources. [8] In 2013, R.G.Babukarthik have proposed a Hybrid Algorithm based on Ant Colony Optimization and Cuckoo Search to optimize JSP. [11] In 2014, C.W.Tsai proposed a novel Hyper-Heuristic Scheduling Algorithm to solve JSP to reduce makespan time and to find better scheduling solutions for cloud computing systems. Two detection operators has been used by the proposed algorithm to balance the intensification and diversification in the search of solutions during the convergence process. [14]

IV.THE PROPOSED work

To contract the makesapn time of jobs on cloud computing frameworks, a high-level performance, adaptive Hyper-Heuristic Scheduling algorithm is proposed. This Algorithm combines two low-level scheduling algorithms i.e. FIFO and Max-Min to generate optimal scheduling solutions with reduced calculation time. From the pool of candidate one algorithm is choose as heuristic algorithm. Two operators are used i.e. diversity detection operator that automatically determine which algorithm is chosen and perturbation operator to optimize the solutions generated by each of these algorithms to further improve makespan time. The fundamental idea of Hyper- heuristic is to utilize "one and only one "heuristic algorithm at every iteration, in order to keep up high search diversity to build the possibility of discovering better solutions at later cycles while not expanding the calculation time.

In This exploration work, HHSA calculation is applied to minimize the aggregate make span time in the Job Shop Scheduling.

Pseudo code for basic HHSA procedure:

Setup the parameters over the search space.

Input the job scheduling problem.

Initialize the population of solutions

$x = \{x_1, x_2, \dots, x_n\}$

Random selection of low-level heuristic algorithm

- H_j from the pool of candidate.
5. Until Termination criterion is met.
 6. Update the populations of solutions x by using the selected algorithm H_j .
 7. $E_1 =$ Diversity detection (x).
 8. If $\psi(H_j, E_1)$
 9. Randomly select the new H_j .
 10. $x =$ Perturb (x)
 11. end
 12. end
 13. output the best optimal solution as final solution.

v . EXPERIMENTS AND RESULTS

A. Problem Formulation

The objective of this project is applying the best solution method in the job scheduling problem to find the optimal solution for the NP-hard problems. For too large and complex problems, traditional scheduling techniques are not feasible to perform and to get optimal solutions in a reasonable time. An efficient scheduling algorithm is needed for cloud computing systems called Adaptive Hyper-Heuristic Scheduling algorithm (AHHSA). An integration of two or more heuristic algorithms to maintain high search diversity, reduce makespan time and in order to keep up high search diversity to build the possibility of discovering better solutions at later cycles while not expanding the calculation time.

B. Experimental Results

While going for implementation part, we solve the JSP by creating a Virtual Cloud Environment for the inputs. We take total Makespan time of jobs as the key factors on the basis of which the results are shown. The HHSA Algorithm is coded in the NetBeans IDE Platform and CloudSim in which all the test and experiments are performed. Php My Admin is used for creating database and Wamp Server is used for the server connectivity.

Table 1 containing Output of different algorithms as time

Virtual cloud Environment (No. Of)				Makespan Time (mili sec)		
DCC	Broker	Virtual Machine	Jobs	FIFO	Max-Min	HHSA
7	4	6	9	1541	19004	4735

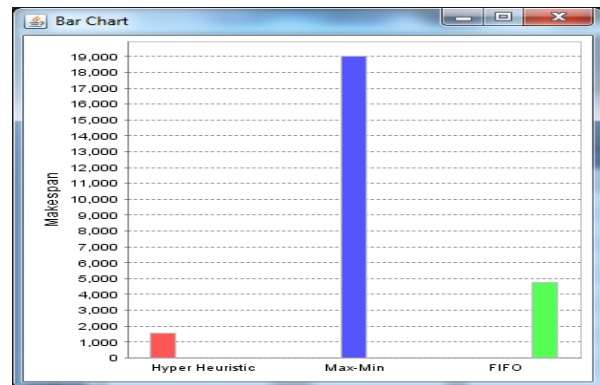


Fig.1. makespan time for HHSA(1541ms) , Max-Min (19004ms) and FIFO(4735ms) of Dataset [7,4,6,9]

VI. CONCLUSION AND FUTURE SCOPE

In this paper an effective adjustment of the high –level heuristic for a JSP to minimize the aggregate make span time of given arrangement is displayed. As conclusion land at concerning the utilization of Adaptive Hyper- Heuristics, a combined Scheduling technique will prove to generate better results than individual heuristic techniques used for solving problem. The proposed algorithm leverages the strength of other two low-level scheduling algorithms i.e. FIFO and Max-Min, while not increasing the calculation time, by running one and only one low-level algorithm at each cycle. The future extension is to comprehend the kind of job failures with the expectation of enhancing the dependability of cloud base from the cloud suppliers view point. Further, the focus is to obtain load balance of virtual machines and to utilize resources efficiently to overcome the wastage of resources by jobs that fail in due course.

REFERENCES

- [1]. Zhang .J, Hu.X,Tan.X ,Zhong J.H and Huang.Q, " Implementation of an Ant Colony Optimization technique for job shop scheduling problem", The Institute of Measurement and Control, 2006.
- [2]. I. Foster , Y.Zhao , I . Raicu , and S.Lu , " Cloud Computing and Grid Computing 360 –degree compared , " In : Proceedings of the Grid Computing Environments Workshop , pp. 1- 10 , 2008.
- [3]. S. Selvarani , G. Sadhasivam , " Improved Cost –based algorithm for task scheduling in cloud computing , " In: Proceedings of IEEE

- International Conference on Computational Intelligence and Computing Research , pp. 1-5 , 2010.
- [4]. Pandey , L. Wu , S.M. Guru and R.Buyya ,” A Particle Swarm Optimization – based Heuristic for scheduling Workflow Applications in cloud computing environments ,” In: Advanced Information Networking and Applications (AINA) ,24 th IEEE International Conference , 2010.
- [5]. G. Ming , and H. Li ,” An Improved Algorithm Based on Max- Min for cloud Task Scheduling,” Tunnam University, China , 2011.
- [6]. N. Kaur , T.S . Aulakh , and R.S . Cheema ,” Comparisons of workflow scheduling algorithms in cloud computing ,” In: International Journal of Advanced Computer Science and Applications , vol.2 , pp. 81-86 , 2011.
- [7]. A.Bala and I. Chana ,” A survey of various workflow scheduling algorithms in cloud environment ,” In : Proceedings of the National conference on Information and Communication Technology , pp. 26-30 , 2011.
- [8]. S.B. Zhan , H.Y.Huo ,” Improved PSO-based Task Scheduling Algorithm in cloud computing ,” In: Journal of Information and Computational Science , vol. 9 ,pp.3821-3829, 2012.
- [9]. Tahir.M,Aftab,Umer.M,Ahmad.R,”Job Scheduling and Worker Assignment Problem to Minimize Make span using Ant Colony Optimization Metaheuristic “,Word Academy of Science Engineering and Technology ,vol :6,2012.
- [10]. L. Huang , H. Chen , T. Hu ,” Survey on Resource Allocation Policy and Job scheduling Algorithms of Cloud Computing 1, “ In: Journal of Software, pp. 480-487 , 2013.
- [11]. R.G. BabuKarthik , R.Raju , and P.Dhavachelvan ,” Hybrid Algorithm for job scheduling : Combining the benefits of ACO and Cuckoo Search” . In: Advances in Computing and Information Technology. Springer Berlin Heidelberg, pp.479-490, 2013.
- [12]. P. Kowsik , K. RajaKumari ,” A Comparative Study on Various Scheduling Algorithms in Cloud Environment , “ In: International Journal of Innovative Research in Computer and Communication Engineering , vol.2 , 2014.
- [13]. K.M .Cho, P.W.Tsai, C.W. Tsai ,” A hybrid meta-heuristic algorithm for VM scheduling with load balancing in cloud computing ,” In: Neural Computing and Applications , 2014.
- [14]. C.W.Tsai,W.C.Huang,,” A Hyper-Heuristic scheduling Algorithm for Cloud,” In: IEEE Transactions on Cloud Computing , vol.2 , pp.236-250,2014.
- [15]. C.W. Tsai and J. Rodrigues , “ Metaheuristic Scheduling for Cloud : A Survey ,” In: IEEE Systems Journal, vol.8 , pp. 279-297, 2014.