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Multi-Objective Workflow Scheduling in Amazon EC2

P. P. Madulkar, Prof. A. J. Kadam

ME Student, Department of Computer Engineering, All India ShriShivaji Memorial Society's College of Engineering Pune, SavitribaiPhule Pune University, Pune, India

Professor, Department of Computer Engineering, All India ShriShivaji Memorial Society's College of Engineering, Pune, SavitribaiPhule Pune University, Pune, India

ABSTRACT: In a Cloud model, users are charged based on their usage of resources and the required Quality of Service (QoS) specifications. Although there are many existing workflow scheduling algorithms in traditional distributed or heterogeneous computing environments, they have difficulties in being directly applied to the Cloud environments since Cloud differs from traditional heterogeneous environments by its service-based resource managing method and pay-per-use pricing strategies. In this paper, we highlight such difficulties, and model the workflow scheduling problem which optimizes both make span and cost as a Multi-objective Optimization Problem (MOP) for the Cloud environments using more than one pricing schemes, instance type groups or even multi-Clouds in a single schedule.

KEYWORDS: Scientific workflow, Workflow Scheduling, Cloud Computing, Multi-Objective Optimization, Genetic Algorithm.

I. INTRODUCTION

In recent years, Cloud computing has become popular and reached maturity capable of providing the promising platforms for hosting large-scale programs. In a Cloud model, on-demand computational resources, e.g., networks, storage and servers, can be allocated from a shared resource pool with minimal management or interaction. Infrastructure as a Service (IaaS) is one of the most common Cloud service models, which provides customers with the abilities to provision or release pre-configured Virtual Machines (VMs) from a Cloud infrastructure. Using the VMs, which are called instances in IaaS, customers can access to almost unlimited number of computational resources while remarkably lowering the Total Cost of Ownership (TCO) for computing tasks. Usually, these services are provided under a Services Level Agreement (SLA) which defines the Quality of Services (QoS). Hereafter, the IaaS service provider can charge customers by their required QoS and the duration of use. Workflow is a common model to describe scientific applications, formed by a number of tasks and the control or data dependencies between the tasks. There have been consensuses on benefits of using Cloud to run workflows. Some Grid workflow management systems, like Pegasus and ASKALON, are starting to support executingworkflows on Cloud platforms. Juveet found that Cloud ismuch easier to set up and use, more predictable, capable of giving more uniform performance and incurring less failure than Grid. Workflow scheduling problem, which is known to be NP-complete, is to find proper schemes of assigning tasks to processors or services in a multiprocessor environment. There has been much work on the workflow scheduling problem in heterogeneous computing environments. Heterogeneous Earliest-Finish-Time (HEFT) and Critical-Pathon- a-Processor (CPOP) are two best-known list based heuristics addressing the performance-effective workflow scheduling problem, which are widely used in popular workflow management tools. The list-based heuristics schedule tasks to the known-best processors in the order of priority queues. Although the classical algorithms aim to minimize only finish time, recent studies begin to consider both total monetary cost and execution make span since it is common to rent computational resources from commercial infrastructures such as Grid and Cloud nowadays. The multi-objective scheduling algorithms are classified into QoSconstrained algorithms and QoS optimization algorithms. In practice, most algorithms require QoS constraints to convert this problem into a simpler single-objective

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optimization problem. LOSS and GAIN are two budget-constrained algorithms, which start from existing schedules and keep trying reassigning each task to another processor until the cost matches or exceeds the budget. Budget-constrained Heterogeneous Earliest Finish Time (BHEFT) is an extended variant of HEFT, which considers the best budget reservations in each assignment. Recent studies include Heterogeneous Budget Constrained Scheduling (HBCS), which also starts from existing schedules and defines a Cost Coefficient to adjust the ratio between available budget and the cheapest possibility. Also, a workflow execution planning approach using Multi-Objective Differential Evolution (MODE) is proposed in, to generate tradeoff schedules according to two QoS requirements time and cost. Recent studies include Multi- Objective Heterogeneous Earliest Finish Time (MOHEFT), a Pareto based list heuristic that extends HEFT for scheduling workflows in Amazon EC2.

II. OBJECTIVE OF THE WORK

1) Minimizing make span and minimizing monetory costs as a multi-objective optimization problem(MOP)for the cloud environments.
2) Design genetic operations of an evolutionary function,population initialization etc.
3) Design a scheduling algorithm to be directly applied to cloud.

III. LITERATURE SURVEY

Evolutionary Multi-Objective Workflow Scheduling in Cloud Zhaomeng Zhu, Gongxuan Zhang, Senior Member, IEEE, Miqing Li, Xiaohui Liu,2015.[1] We propose an Evolutionary Multi-objective Optimization(EMO)-based algorithm to solve this workflowscheduling problem on an Infrastructure as a Service (IaaS) platform. Novel schemes for problem specific encoding and population initialization, fitness evaluation and genetic operators are proposed in this algorithm.

S. Su, J. Li, Q. Huang, X. Huang, K. Shuang, and J. Wang, Cost-effective errand planning for executing extensive projects in the cloud, Parallel Comput.,vol. 39, no. 4, pp. 177188, 2013.[2] Here DAG can be executed by numerous VMs at the same time vast DAGs produced aimlessly and also on genuine applications.

G. Juve, M. Rynge, E. Deelman, J.- S. Vockler, and G. B. Berriman, Looking at futuregrid, amazon ec2, and open science framework for logical work processes, Computing in Sci. and Eng., vol. 15, no. 4, pp. 2029, 2013.[3] This paper is used to accommodating to utilize provisioning instruments, for example, Wrangler and Glidein WMS to help us in sending our application. utilization of these digital frameworks to execute logical work processes, an imperative class of logical applications.

M. Zhu, Q. Wu, and Y. Zhao, A practical booking calculation for logical work processes in mists, in 31th IEEE Int. Execution Comput. whats more, Commun. Conf. IEEE, 2012, pp. 256265.[4] In this paper enhancement of asset usage for high throughput is done. Work process based on Scientific Application.

W.- N. Chen and J. Zhang, An insect province advancement way to deal with a network work process planning issue with different QoS prerequisites, IEEE Trans. Syst. Man Cybern. A., Syst. People, vol. 39, no. 1, pp. 2943, 2009.[5] This paper is used to timetable expansive scale work processes With different QoSparameters. Lattice advances fulfill the need of countless and business figuring applications.

T. Fahringer, R. Prodan, R. Duan, F. Nerieri, S. Podlipnig, J. Qin, M. Siddiqui, H.- L. Truong,A. Villazon, and M. Wieczorek, Askalon: A matrix application improvement and processing environment, in sixth IEEE/ACM Int. Workshop on Grid Comput. IEEE Computer Society, 2005, pp. 122131.[6] In this paper,We have exhibit huge execution increases through two check guiding techniques for sparing and reestablishing the execution of Grid work processes upon motor and application disappointments. Two certifiable logical applications to show the adequacy of our approach.

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_ E. Deelman, G. Singh, M.- H. Su, J. Blythe, Y. Gil, C. Kesselman, G. Mehta, K. Vahi, G. B. Berriman, J. Great et al., Pegasus: A system for mapping complex logical work processes onto appropriated frameworks, Sci. Programming, vol. 13, no. 3, pp. 219 237, 2005.[7]In this paper the outcome enhancing application executionthrough work process A genuine cosmology application is utilized.

IV. EXISTING SYSTEM APPROACH

Existing booking calculations to be specifically connectedto Cloud, and define the Cloud work process planning issue with genuine Cloud qualities. These difficulties emerge from the contrasts amongst Cloud and the customary heterogeneous situations, for example, Grid, and the way that a large portion of the current calculations still accept that the heterogeneous situations are Grid-like. Because of the particular properties of the issue, the current hereditary operations, for example, two fold encoding, genuineesteemed encoding and the relating variety administrators in view of them in the EMO zone, are difficult to be embraced as arrangements.

Disadvantages Of Existing System:-

1) Real-world Cloud work process planning issue.
2) Size of the asset pool is normally restricted.
3) Make traverse and cost as a Multi-target Optimization
Problem (MOP) for the Cloud situations.

V. PROPOSED SYSTEM APPROACH

An Evolutionary Multi-objective Optimization (EMO)basedalgorithm used. First User Select the virtual machine then choose real world workflows and randomly generated workflows show that the schedules produced by our evolutionary algorithm. Then Calculate Starting time and Finishing Time,Using Genetic Algorithm Fitness evaluation, Crossover Order, Mutate Order etc. Finally calculate the execution time and cost.

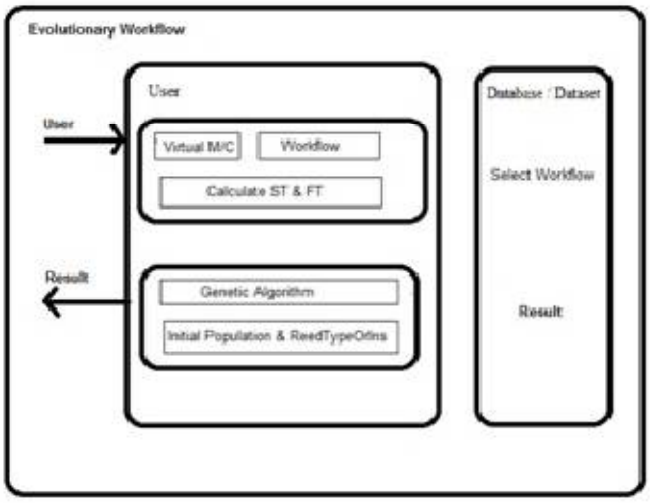

Fig. 1. System Architecture

VII. EXPERIMENTAL RESULT

The random workflow sets consist of totally different workflows;the results are hard to be compared directly. Thus, we also compare the HV ratios between the compared algorithm and EMS-C on each tested workflow. That is, if the ratio is less than 1, EMS-C is shown to perform better than the competitor.The evaluation function and the population

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initialization scheme for this problem. We apply our designs to several popular EMO frameworks, and test the proposed algorithm on both the real-world workflows and two sets of randomly generated workflows. The extensive experiments are based on the actual pricing and resource parameters of Amazon EC2, and results have demonstrated that this algorithm is highly promising with potentially wide applicability.

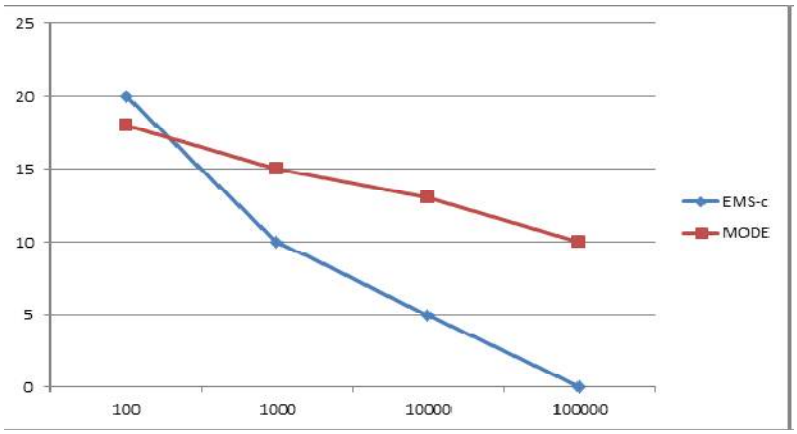

Fig. 2. Trade off selected random workflows

	EMS-c	MODE
100	20	18
1000	10	15
10000	5	13
100000	0	10

Fig. 3. Random Workflow

VIII.CONCLUSION

To comprehend the multi-target Cloud planning issue which minimizes both make traverse and cost all the while, we propose a novel encoding plan which speaks to all the booking orders, undertaking example assignments and occasion particular decisions. In view of this plan, we likewise present an arrangement of new hereditary administrators, the assessment work and the populace instatement plot for this issue. We apply our plans to a few prominent EMO structures, and test the proposed calculation on both this present reality work processes and two arrangements of arbitrarily produced work processes. The broad tests depend on the genuine estimating and asset parameters of Amazon EC2, and results have shownthat this calculation is very encouraging with possibly wide relevance.

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