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Genetic-based algorithms applied to a workflow scheduling algorithm with security and deadline constraints in clouds☆

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ABSTRACT

There have been a number of metaheuristic scheduling techniques for cloud described in the literature, as well as their applications. The efficiency of metaheuristic techniques has been established in a wide range of workflow scheduling algorithms for cloud environments. However, it is still unknown whether the metaheuristic that is chosen, is suitable for solving the problem of optimization. This paper examines the effect of both Particle Swarm Optimization (PSO) and Genetic-based algorithms (GA) on attempts to optimize workflow scheduling. A security and cost-aware workflow scheduling algorithm was selected to evaluate the performance of the metaheuristics. Three algorithms were evaluated in three real-world workflows with a risk rate constraint that ranged between 0 and 1 with a 0.1 step. The findings indicate that GA-based algorithms significantly outperformed the PSO both in term of cost-effectiveness and response time.

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1. Introduction

scientific workflow is a recent paradigm for distributed programming that is deployed in computational experiments in scientific A areas such as physics, astronomy, and biology. A workflow can be defined as a procedure involving a series of steps designed to simplify the complexity of executing and managing applications [1]. It is commonly represented as a Directed Acyclic Graph (DAG), where each node carries out a task, and each edge denotes a precedence or flow constraints between the tasks. Previously, workflows were deployed in computational grids. However, owing to the increase in the complexity of the scientific applications for handling big data, more powerful and scalable infrastructures are needed to run complex workflows within a reasonable amount of time [2].

Cloud computing is an infrastructure which can be rapidly and elastically provisioned on demand [3]. It can offer different virtual machine configurations that are capable of executing workflows. Clouds can be classified as private, community-based, public or hybrid clouds. Private cloud is owned and used by a single organization, and it does not charge the services it offers. Community-based clouds are designed for a specific community that has shared concerns. Public cloud shares services with multiple-tenants and these are charged on the basis of their use. Finally, hybrid cloud consists of a mix of public,

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