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A Novel Cost-Efficient Approach for Deadline-Constrained Workflow Scheduling by Dynamic Provisioning of Resources

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Abstract

Workflow scheduling is a crucial aspect of cloud computing that should be performed in an efficient manner for optimal utilization of resources. The development of a cost-efficient algorithm has always been an important topic of research in this regard. In this paper, we propose a novel approach for dynamic provisioning of resources and present a workflow scheduling algorithm which is cost-efficient and deadline-constrained. The proposed approach is consolidated with the k -means clustering technique and a variant of Subset-Sum problem, for dynamic provisioning of resources. In the algorithm, we consider level based scheduling using the concept of Bag of Tasks (*bots*) and develop a new technique for associating deadlines with each *bot*. Through extensive simulation runs, we show that the proposed algorithm outperforms the existing approaches like Dynamic Provisioning Dynamic Scheduling (DPDS) and Infrastructure as a Service (IaaS) Cloud-Partial Critical Path (IC-PCP). The effectiveness of our approach over these two approaches is also illustrated through the popular statistical test ANOVA and its subsequent post-hoc analysis.

Keywords:

Workflow Scheduling, Dynamic Provisioning, Partition Problem, k -means clustering, Cost, Deadline

1. Introduction

Cloud computing [1, 2] has attained a well-established position in the field of technology due to the reform it has brought about in the area of distributed computing. Nowadays, large data processing, huge storage requirements, reliable information management, etc., are predominantly done using clouds. For this purpose, we have various Cloud Service Providers (CSPs) who furnish resources to their end-users remotely over the Internet. These resources maybe in the form of Virtual Machines (VMs), softwares or even platforms (for uploading user applications), according to the need of the user. Therefore, the necessity of highly efficient and capacious local servers has diminished.

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