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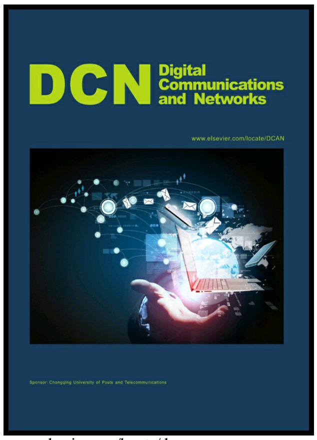

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Dynamic Scheduling and Analysis of Real Time Systems with Multiprocessors

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Abstract

This research work considers a scenario of cloud computing job-shop scheduling problems. We consider *m* realtime jobs with various lengths and *n* machines with different computational speeds and costs. Each job has a deadline to be met, and the profit of processing a packet of a job differs from other jobs. Moreover, considered deadlines are either hard or soft and a penalty is applied if a deadline is missed where the penalty is considered as an exponential function of time. The scheduling problem has been formulated as a mixed integer non-linear programming problem whose objective is to maximize net-profit. The formulated problem is computationally hard and not solvable in deterministic polynomial time. This research work proposes an algorithm named the Tube-tap algorithm as a solution to this scheduling optimization problem. Extensive simulation shows that the proposed algorithm outperforms existing solutions in terms of maximizing net-profit and preserving deadlines.

Keywords: job-shop scheduling problems, JSP, LPT, SPT, LS, EDD, Tube-Tap, MINLP

1. Introduction

The rapid growth of realtime services and complex commercial strategies of cloud computing makes the scheduling problem a crucial challenge. In the literature of computer science the problem of scheduling multiple jobs (or tasks) on multiple machines (or processors) has been found very crucial and challenging. In terms of computer science jargon this type of optimization problems are known as job-shop scheduling problems (JSP) [1][2]. A number of variants of JSP are available in the literature focusing on different objectives and constraints. This research work considers a cloud computing scenario of real-time dynamic job-shop scheduling where multiple jobs need to be scheduled on multiple processors (i.e., machines) to maximize the net profit. The problem scenario assumes that each job has a deadline to be met, each job may have different job lengths in terms of bits, and the profit of processing a packet of one job differs from the other jobs. It is also considers that each machine may have a different processing rate (bit/s) and processing cost. The cost of processing a job on a machine per time unit may differ from one machine to another machine. The goal is to distribute the loads of the jobs to multiple machines in such way that meets all the deadlines and maximizes the net profit i.e., minimizing the overall processing cost.

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