

A migration aware scheduling technique for real-time aperiodic tasks over multiprocessor systems

ABSTRACT

Multi-processor systems consist of more than one processor and are mostly used for computationally intensive applications. Real-time systems are those systems that require completing execution of tasks within a pre-defined deadline. Traditionally, multiprocessor systems are given attention in periodic models, where tasks are executed at regular intervals of time. Gradually, as maturity in a multiprocessor design had increased; their usage has become very common for real-time systems to execute both periodic and aperiodic tasks. As the priority of an aperiodic task is usually but not essentially greater than the priority of a periodic task, they must be completed within the deadline. There is a lot of research works on multiprocessor systems with scheduling of periodic tasks, but the task scheduling is relatively remained unexplored for a mixed workload of both periodic and aperiodic tasks. Moreover, higher energy consumption is another main issue in multiprocessor systems. Although it could be reduced by using the energy-aware scheduling technique, the response time of aperiodic tasks still increases. In the literature, various techniques were suggested to decrease the energy consumption of these systems. However, the study on reducing the response time of aperiodic tasks is limited. In this paper, we propose a scheduling technique that: 1) executes aperiodic tasks at full speed and migrates periodic tasks to other processors if their deadline is earlier than aperiodic tasks-reduces the response time and 2) executes aperiodic tasks with lower speed by identifying appropriate processor speed without affecting the response time-reduces energy consumption. Through simulations, we demonstrate the efficiency of the proposed algorithm and we show that our algorithm also outperforms the well-known total bandwidth server algorithm.

Keyword: Real-time systems; Multi-processor scheduling; Energy consumption; Performance; Dynamic voltage and frequency scaling