Erratum to
“Suspension-Aware Analysis for Hard Real-Time Multiprocessor Scheduling”

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Abstract

In [3], we derived hard real-time multiprocessor schedulability analysis for self-suspending task systems, under both global fixed-priority and global EDF scheduling. For global fixed-priority scheduling, we derived an upper bound on the workload for a task that does not have a carry-in job. It has come to our attention that this derivation suffers from an error. In this note, we point out the error and offer a correction.

I. Counterexample

Lemma 1 in [3] shows that the workload bound for any task $\tau_i$ in an interval of length $L$ that does not have a carry-in job is at most:

$$\left(\left\lfloor \frac{L - e_i}{p_i} \right\rfloor + 1\right) \cdot e_i.$$  \hspace{1cm} (1)

Consider a task $\tau_i$ with $e_i = p_i = 4$ and an interval $[0, 10]$ with $L = 10$. Suppose $\tau_i$ does not have a carry-in job in this interval and releases three jobs in this interval at time one, five, and nine, respectively. For this example, Eq. (1) computes a workload bound of $\tau_i$ of eight time units. However, the actual workload of $\tau_i$ is nine time units, as its first two jobs contribute four time units each and its third job contributes one time unit to the workload.

II. Correction

We now state the corrected Lemma 1.

Lemma 1.

$$\omega^{nc}(\tau_i, L) = \left\lfloor \frac{L}{p_i} \right\rfloor \cdot e_i + \min(e_i, L \mod p_i).$$  \hspace{1cm} (2)

Proof: The proof is similar to reasoning in [1], [2], as illustrated in Fig. 1. Since $\tau_i$ does not have a carry-in job, only jobs that are released within $[t_o, t_f)$ can contribute to $\omega^{nc}(\tau_i, L)$. Note that suspensions do not contribute to the workload. According to our task model, suspensions of $\tau_{i,k}$, which is the last job of $\tau_i$ that is released before $t_f$, may be of length 0 within $[r_{i,k}, t_f)$.

We also note that Sec. 3 as well as the rest of the paper [3] remain correct if the above corrected Lemma 1 is used in later derivations.

References


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