A Study of the Trade-off Energy Consumption-Performance-Schedulability for DVFS Multicore Systems

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Abstract : Dynamic Voltage and Frequency Scaling (DVFS) multicore platforms are promising execution platforms that enable high computational performance, less energy consumption and flexibility in scheduling the system processes. However, the resulting interleaving and memory interference together with per-core frequency tuning make real-time guarantees hard to be delivered. Besides, energy consumption represents a strong constraint for the deployment of such systems on energy-limited settings. Identifying the system configurations that would achieve a high performance and consume less energy while guaranteeing the system schedulability is a complex task in the design of modern embedded systems. This work studies the trade-off between energy consumption, cores utilization and memory bottleneck and their impact on the schedulability of DVFS multicore time-critical systems with a hierarchy of shared memories. We build a model-based framework using Parametrized Timed Automata of UPPAAL to analyze the mutual impact of performance, energy consumption and schedulability of DVFS multicore systems, and demonstrate the trade-off on an actual case study.

Keywords : time-critical systems, multicore systems, schedulability analysis, energy consumption, performance analysis

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