Master Thesis

“Advanced Multi-core Simulation of Real-Time Embedded Systems”

Background
The consequences of different scheduling strategies are often poorly understood. The simulation of different scheduling paradigms and their visualisation can significantly increase the degree of understanding. Therefore, a simulation tool supporting a few scheduling strategies was developed. The tool originally focused on single-core strategies, yet was successfully extended to support several multi-core techniques. There still remain a number of desirable extensions including support of new algorithms, improvements of computation methodologies and enhancements of the graphical interface.

Tasks of the Thesis
The objective of the thesis is to extend the available simulation software to support new multi-core scheduling algorithms for task sets of varying properties, and to enhance the provided computation component while keeping the simulation software suitable for teaching and researching scheduling concepts and consequences.

The thesis is expected to meet at least the following requirements

- A study of the literature to analyse new multi-core real-time scheduling approaches.
- Extension of the simulator and the computation engine written in Java to support several multi-core scheduling mechanisms: PD2 / PD2*, ERfair, BF, BF2, UEDF, P-EDF and PD2 with FMLP.
- Offline performance evaluation based on the number of context switches and core utilisation among predefined processor groups allowing comparison of at least two related multi-core scheduling techniques.
- Introduction of sporadic tasks to the simulation model including direct sporadic task definition in the input.
- Automatic task generation based on user-provided constraints that supports at least one multi-core scheduling technique. It should be possible to extend the engine for other techniques.
- The resulting system is expected to be well documented and easily maintainable so that later extensions are possible. Therefore, high-quality design and documentation are imperative.
- An intermediate presentation is expected to be held 3.5 months after the starting date and the final presentation no later than 1.5 months after the submission of the written report.

The following additional capabilities are optional tasks for this thesis:

- Support of additional paradigms for multi-core and single-core scheduling.
- Provision of the missing Response Time Analysis for scheduling techniques, primarily for EDF using shared resources, for one global multi-core approach, and for one technique using self-suspension or having non-preemptable sections.
- Support for the coordination of access to shared resources.
- Design of a user interface that enables the user to change simulation models by direct input of simulation parameters from within the software.

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