Master Thesis / Diplomarbeit

“Analysis and Simulation of Scheduling Techniques for Real-Time Embedded Multi-core Architectures“
“Analyse und Simulation von Scheduling-Verfahren für eingebettete Mehrkern-Echtzeitarchitekturen”

Background
With the advent of multi-core architectures into the world of real-time embedded systems, the demand for efficient yet predictable scheduling techniques is on the rise. While conventional systems are sufficiently well served with commonly used scheduling mechanisms delivering a satisfactory degree of efficiency on average, real-time embedded systems often have deadline constraints that must be met even in the worst case scenarios. Though the area of single-core real-time scheduling is quite mature, many of the well-researched solutions are either not applicable or not optimal on multi-core architectures. Multi-core scheduling is an area of active research offering some remarkable opportunities. An overview of the currently available multi-core scheduling techniques along with a detailed comparison of their advantages and limitations would therefore be highly desirable.

Tasks of the Thesis
The objective of the thesis is to conduct an in-depth research of static and dynamic scheduling techniques for multi-core architectures along with their comparison and simulation. Particularly important is predictability and usability on real-time systems with hard deadline constraints. Theoretical research should be complemented with practical examples.

The thesis is expected to meet at least the following requirements

- In-depth analysis of currently available literature on multi-core scheduling in real-time contexts.
- Comparison of multi-core scheduling techniques emphasising the degree of their usability on hard real-time embedded systems.
- The focus should be on techniques offering better processor affinity and lower number of context switches.
- The following scheduling techniques must be included in the analysis: Partitioned-EDF, Global-EDF, Pfair Scheduling.
- Analysis and comparison of the existing real-time test-beds aiming at finding a suitable one for the selected scheduling techniques.
- Selection of a test-bed for the evaluation of the identified scheduling techniques.
- Simulation of the analysed techniques on the chosen real-time test-bed.

Decisions regarding the choice of the scheduling techniques and the test-bed should be coordinated with the Consultant. The following work items are optional tasks for this thesis:

- Identification of approximation heuristics that can be used by the analysed techniques to prevent deadline violations.
- Analysis and simulation of scheduling techniques allowing for bounded tardiness.
- Improvements of the analysed techniques making them more predictable and efficient.

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Starting Date: now