Universität Bamberg

Fakultät Wirtschaftsinformatik und Angewandte Informatik

Kolloquiumsvortrag

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Dealing with Time in software development processes for embedded control systems

Dr. Stefan Resmerita, University of Salzburg

This talk describes research directions, results and tools where time is regarded as a first-class citizen in the software development process. This consideration is particularly relevant for real-time control systems such as automotive engine controllers. A central concept is the Logical Execution Time (LET), where task execution times are specified statically and dedicated system components ensure their realization at run-time. Usually, a logical execution time (LET) is associated to every periodic software task, representing the time interval in which the task is executed within every period. Inputs are read only at the start of the LET, while outputs are only made available at the end. The physical execution of the task within a LET interval may suffer delays and preemptions depending on the underlying execution platform and on runtime conditions. Under the condition that every physical execution fits within its LET interval, the LET model achieves a pre-specified, platform-independent observable temporal behavior of a set of software functions, leading to both time and value determinism. In this area, we provide some answers to questions such as: How can the basic LET programming model be extended in order to deal with realistic embedded software containing also critical event-driven computations? How to reconcile LET-induced delays with the traditional control requirement of minimum response times? How to use LET as a vehicle for migrating legacy single-core software to multi-core platforms? How can the LET programming model be embedded in Model-Based-Design processes?

We also deal with Physical Execution Time (PET), particularly in testing phases based on Software-in-the-Loop (SiL) and Hardware-in-the-Loop simulations (HiL). We are interested in shifting the workload from HiL to SiL by providing more realistic SiL testing, where execution times of software are simulated at various granularities, down to the source code line. We propose a level of abstraction in systems modeling that leads to fast simulations capturing the most significant real-time behaviors of an embedded software application.

Stefan Resmerita is an Associate Professor at the Department of Computer Science, University of Salzburg. He received his B.Sc. and M.Sc. degrees in Control Engineering from the Technical University of Iasi, Romania, and obtained his Ph.D. in Computer Science from the Technion-Israel Institute of Technology. Since then, he was a research associate at the Institute for Pervasive Computing, University of Linz, Austria, a visiting researcher at NASA Ames Research Center, USA, a research fellow at the Department of Electrical Engineering and Computer Science, UC Berkeley, USA, and a visiting researcher at the Toyota Technical Center, USA.
S.Resmerita is also co-founder and CTO of chrona.com, applying advanced methods in real-time embedded software development to industrial systems.

Kontakt: Dr. Eugene Yip: eugene.yip@uni-bamberg.de