ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

TIK
Technische Informatik und Kommunikationsnetze
Computer Engineering and Networks

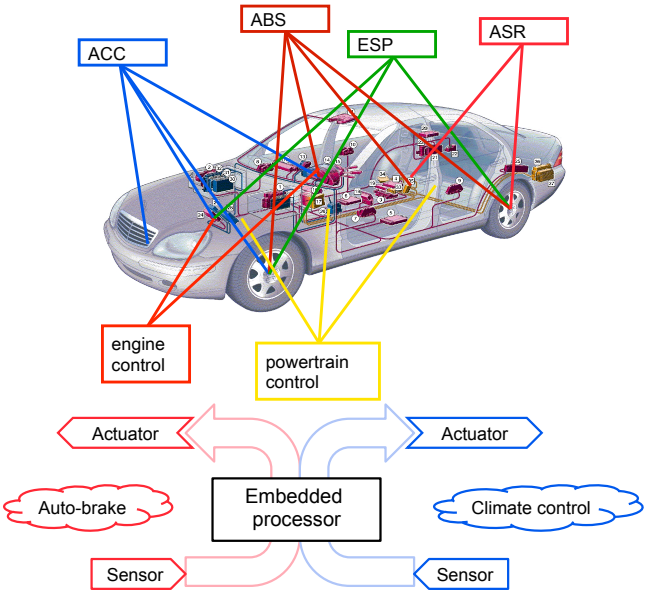
Prof. L. Thiele

Master Thesis:

Crossing the Deadline

The problem: In real-time systems, software tasks must complete within specified deadlines for correct operation. For instance, there are several real-time systems in a modern car. A difficulty in the design of such systems is that several tasks share resources. As an example shown in the figure, two control tasks execute on a shared processor. With such resource sharing, the time taken to complete tasks is highly variable. So, it is plausible that a task often completes within its deadline, but rarely misses its deadline. Such a task would probably meet its design objective, such as engine control. Nevertheless, the task would be certified to fail, according to the current industrial practices, as it misses its deadline.

Proposed solution: We propose to cross the deadline! More specifically, to define a *richer timing guarantee* to specify the correctness of a real-time system. As a an example, one such interface would express that a deadline can be missed, but not more than twice for any 100 consecutive jobs.



The Thesis:
The aim of the thesis is to design an automata-based formalism for expressing a richer timing guarantee. The automaton would bound the sequence of possible deadline misses. To demonstrate such a formalism, a tool-chain is needed to compute it for a given application and architecture. We propose to use the model checker UPPAAL [1] for this purpose.

What you will learn:
The thesis will give an opportunity to study theoretical aspects of real-time systems and automata theory. On the practical side it will provide familiarity with a model checker such as UPPAAL which represents the state-of-the-art tool used in industry and academia.

Existing Infrastructure: As part of the CERTAINTY [2] project, we have developed models for timing verification of several scheduling policies [3] developed on the UPPAAL tool. We have also developed a tool-chain to calibrate real-time software running on a variety of platforms.

Interested? Please have a look at `http://www.tec.ethz.ch/research.html` and contact us for more information!

- Pratyush Kumar: `kumarpr@tik.ee.ethz.ch`, ETZ G76
- Georgia Giannopoulou: `ggeorgia@tik.ee.ethz.ch`, ETZ G77
- Lothar Thiele: `thiele@tik.ee.ethz.ch`, ETZ G87

References

[1] UPPAAL: `http://www.uppaal.org/`
[2] CERTAINTY: CErtification of Real Time Applications desIgNed for mixed criticaliTY, `http://www.certainty-project.eu/`
[3] G. Giannopoulou, *et al*, *Timed Model Checking with Abstractions: Towards Worst-Case Response Time Analysis in Resource-Sharing Manycore Systems* in EMSOFT 2012.