ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

TIK
Institut für Technische Informatik
und Kommunikationsnetze
Computer Engineering and
Networks Laboratory

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Semester/Master Thesis:

Orchestrate the Mixed-Criticality Melody

Reconcile Temperature with Safety

The Background: Mixed-Criticality is emerging as a significant trend for future computer systems, e.g. automotive, avionics, medical and cloud systems. For such systems, applications of different safety/security criticality levels share a common commercial-off-the-shelf computing platform, to meet increased performance demand and to reduce system cost. The ultimate design goal for mixed-criticality systems is to provide different levels of assurance to applications of different criticality levels, while the main difficulty is that resource sharing could lead to mutual interferences among critical and non-critical applications, jeopardizing safety/security guarantees.

Meanwhile, all modern processing platforms are thermally constrained i.e. their temperature has to be below a threshold to ensure safe operation. With continuously shrinking feature sizes of circuits, power densities of processors have increased rapidly. This increase in power density corelates to increase in temperature; making temperature an increasingly stringent design constraint. In a mixed-criticality setting, temperature could greatly affect system reliability; possibly even lead to system failure due to thermally-triggered shutdown. Therefore, it is imperative to consider thermal constraints while designing mixed-criticality systems.

The Thesis: In our group, we are currently exploring schemes for providing thermal isolation to Hi Criticality applications. The proposed scheme will limit the thermal heat up caused due to execution of Lo Criticality applications, such that the Hi Criticality applications do not experience slowdown.

As part of this thesis, you will develop an evaluation framework for testing the proposed schemes on a hardware testbed. Depending on your interest, you may also work on algorithm development/extension and theoretical analysis. The tasks of this thesis are detailed as follows:

- Understand the basic building blocks of the scheduling framework. These include POSIX threads, PreemptRT Linux kernel patch.
- Build a basic scheduling framework that is able to spawn realtime tasks according to a static schedule
- Build a "thermal isolation" server that is able to regulate execution of Lo Criticality applications to guarantee thermal isolation.
- Perform evaluation experiments on the hardware testbed.

What you will get? You will get yourself familiar with the next generation mixed-criticality systems and important techniques for thermal analysis in electronic systems. You will get a chance to develop both analytical and implementation skills.

Requirements:
Courses: Embedded System Programming: C/C++, Java, Matlab/Mathematica

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

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