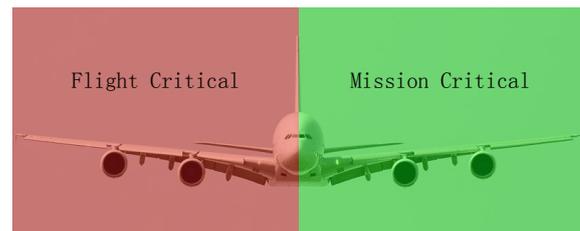


Semester / Master Thesis:

Towards the Design of Real-Time Mixed-Safety-Critical Systems on Multicores

The Problem: Complex embedded systems typically have functionalities of different importances (criticality levels). As an example, the airplane software applications can be usually categorized as flight critical or mission critical, where for flight critical applications like the autopilot, failures (e.g. pilot commands not being transmitted in time) could result in an airplane crash, while for mission critical applications like the radio communication or the passengers' video entertainment, the consequences of failures (e.g. loss of communication or wrongly decoded videos) are not severe. On the other hand, various unexpected situations may happen during the operation of an airplane, since neither the hardware nor the software we build for airplanes are perfect. How should the system react to such unexpected situations? And which properties should/can we guarantee in such dynamic and mixed-criticality environments? To answer those questions, smart online scheduling algorithms that can react to unexpected scenarios need to be developed.

The Thesis: In this thesis, we consider hardware/software transient errors as the source of uncertainty, and task re-execution as the hardening technique. We aim at delivering safety guarantees explicitly according to safety standards, and real-time guarantees for timely operations of mixed-criticality systems. To further enhance resource efficiency, system wide operations e.g. degrading less critical tasks are assumed when errors are frequent in the system. However, the impacts of such operations on system safety and schedulability need to be analyzed and bounded.



Specifically, based on our knowledge about single-core solutions, the student will scale the design and analysis to multicores. Throughout this thesis,

- you will get to know the challenges that are faced by the automotive and avionics industry;
- you will learn and master the safety analysis for complex mixed-criticality systems;
- you will design and master multicore solutions for mixed-criticality systems where both safety and schedulability need to be satisfied .

Requirements:

Courses: Embedded Systems, Hardware/Software Co-Design

Programming: Familiarity with C/C++/Java, Matlab/Mathematica

Interested? Please have a look at <http://www.tec.ethz.ch/research.html> and drop by for more details!

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