Scheduling and Certification of Mixed-criticality Systems

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Context and Motivation

This research addresses issues arising from the convergence of two important trends in embedded systems:

1. Many safety-critical applications are subject to **certification requirements**.
2. There in an increasing trend towards **integrated architectures** that support multiple functionalities, often of different **criticalities**, upon a single computing platform.

As such systems become increasingly more complex, obtaining required certifications becomes more challenging. This project investigates the following **thesis**:

> *Scheduling theory in its current form is unsuited to the design of mixed-criticality (MC) systems that are subject to multiple certification requirements; efficient resource use in such systems requires the development of fundamentally new scheduling techniques.*

Methodology

The methodology adopted in investigating this thesis is to first **identify major weaknesses** with current approaches, that render certification cumbersome. Once these weaknesses are understood, **new models are proposed** for representing MC systems, and **metrics derived** for quantifying the effectiveness of techniques for building these systems. A **systematic study of resource allocation and scheduling** issues in certifiable systems is then conducted, aimed at providing quantitatively superior resource allocation methodologies.

Outcomes

We expect that the outcomes of this project will enable embedded safety-critical systems designers to provide systems that make far more efficient use of platform resources than is currently possible, and that pass certification at a significantly lower cost.

Project Members

James Anderson, professor
Sanjoy Baruah, professor
Jeremy Erickson, graduate student
Haohan Li, graduate student
Mac Mollison, graduate student

Collaborators

Vincenzo Bonifaci
Alan Burns
Gianlorenzo D'Angelo
Alberto Marchetti-Spaccamela
Nicole Megow
John Scoredos
Leen Stougie

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Related Publications

Sanjoy Baruah, Haohan Li, and Leen Stougie. "Towards the design of certifiable mixed-criticality systems." *Proc. of the IEEE Real-Time Technology and Applications Symposium* (RTAS), Stockholm, Sweden. April 2010. IEEE Computer Society Press.

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Malcolm Mollison, Jeremy Erickson, James Anderson, Sanjoy Baruah, and John Scoredos. "Mixed-Criticality Real-Time Scheduling for Multicore Systems." *Proc. of the 7th IEEE International Conference on Embedded Systems and Software* (ICESS), Bradford, UK. June, 2010. IEEE Computer Society Press.

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For More Information

Dr. Sanjoy Baruah
Department of Computer Science
University of North Carolina at Chapel Hill
CB#3175, Frederick P. Brooks, Jr. Building
Chapel Hill, NC 27599-3175
Phone: (919) 962-1803
Fax: (919) 962-1799
E-mail: baruah@cs.unc.edu

http://www.cs.unc.edu/~baruah/Research/2010Mixed Criticality/