

Mixed Critical System Design and Analysis

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ABSTRACT

With increasing use of embedded systems in safety critical systems, architectures and design processes for safety have become a primary objective in systems design. Most such systems are also time critical leading to safety and time critical systems. Safety standards impose strong requirements on such systems challenging system performance and cost. Very often, however, only part of the functions is safety and time critical calling for a design approach that both meets the safety requirements and provides efficiency and flexibility for less critical functions. These conflicting requirements have given rise to the new research area of mixed critical system design with enormous practical relevance.

The tutorial addresses key aspects of mixed critical system design. The tutorial starts with a short introduction to the topic summarizing requirements and challenges of mixed critical system design. The first lecture by Alan Burns gives an overview of scheduling issues in mixed critical systems and explains first solutions. The second lecture by Lothar Thiele addresses the lack of multicore timing predictability which challenges mixed critical systems integration and proposes a solution based on reducing timing variation. The third lecture by Rolf Ernst and Jimmy Le Rhun explains integration solutions based on switched networks and presents a scalable manycore architecture for mixed critical systems integration.

Categories and Subject Descriptors

B.8.1 [Performance and Reliability]: Reliability, Testing, and Fault-Tolerance; B.8.2 [Performance and Reliability]: Performance Analysis and Design Aids

Keywords

Performance, Reliability, Design, Verification, Mixed Critical Systems

1. Mixed Critical Systems Design – Overview

Rolf Ernst, TU Braunschweig, Germany

2. Mixed Critical System Scheduling

Alan Burns, Univ. of York, UK

3. Increasing Predictability in Multicore Systems

Lothar Thiele, ETH Zürich, Switzerland

4. Switched Network Systems Integration for Manycore Architectures

Rolf Ernst, TU Braunschweig, Germany, and Jimmy Le Rhun, Thales R&T, France

Speakers Bios

Alan Burns is Professor of Real-Time Systems at the University of York, UK. He has published over 450 papers in the area of real-time systems and is an expert in scheduling theory. In 2009 he was elected a Fellow of the Royal Academy of Engineering and in 2012 he was elected a Fellow of the IEEE for contributions to fixed-priority scheduling for embedded real-time systems.

Jimmy Le Rhun is research engineer at Thales Research & Technology France, within the Embedded System Lab. He was recently in charge of middleware design for embedded multi-core processors on FPGA, and of the integration of a hardware operating system for heterogeneous reconfigurable multicore platform. He is currently involved in the definition and integration of a safety-critical manycore platform on FPGA.

Lothar Thiele joined ETH Zurich, Switzerland, in 1994. His research interests include models, methods and software tools for the design of embedded systems, embedded software and bioinspired optimization techniques.