

Efficient Embedded System Models Using Result Oriented Modeling

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Embedded Systems are omnipresent in our environment for example as digital media devices, mobile phones, or control systems. Their increase in complexity poses great challenges to the design process, and an exploding number of architecture alternatives have to be evaluated to derive an efficient implementation. Additionally, today's embedded systems become more software centric, and software development clearly dominates the design cost. System-Level Design addresses these challenges by using a unified approach for hardware and software design. Raising the level of abstraction, system-level design uses abstract HW/SW models, Transaction Level Models (TLM), for system analysis, exploration, simulation, and synthesis. Well-defined and efficient models are crucial for a reliable design space exploration. In particular, fast yet accurate models are needed to improve the end product and reduce the design time.

We contribute in three aspects. First, we systematically analyze communication models and quantify the speed/accuracy trade-off in TLM. Each abstraction level improves the simulation speed by several orders of magnitude, however at a significant loss of accuracy. Second, we propose a novel technique, Result Oriented Modeling (ROM), which removes the inaccuracy drawback of TLM, yet yields nearly the same speed. Third, we propose a fast alternative to traditional instruction set simulation that shows speed gains of three orders of magnitude with only a few percent error in timing accuracy. Overall, our work guides the system developer in choosing proper model features and provides efficient techniques to model them. It supports the designer in model selection, analysis and implementation. As a result, our system modeling research will influence the design of digital embedded systems, resulting in better and less expensive end products while reducing the time-to-market.

About the Speaker

Gunar Schirner is an Assistant Project Scientist at the Center for Embedded Computer Systems at the University of California Irvine. He earned a Ph.D. and a M.S. in EECS from UC Irvine in 2008 and 2005 respectively, as well as a Diploma in Berlin, Germany in 1998. Gunar Schirner has 5 years of industry experience, designing distributed embedded real-time software for telecommunication products. His research interests include modeling for system-level design focusing on communication, and the modeling and synthesis of embedded software.