Modeling, Simulating, and Compiling with Timing Semantics

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In Cyber-Physical Systems (CPS) the notion of time is inherent; the dynamics of a physical system (the plant) evolve in real-time and the cyber part (the embedded systems and networks) interacts with the plant using sensors and actuators. In CPS, timing is a correctness property, not only a quality (performance) factor, making design and implementation considerably different compared to other computer systems. An important design problem is how such systems can be modeled and simulated (virtually prototyped) and then automatically realized by compiling models/programs of the cyber part to a target platform. The key challenges lie in expressive extensible modeling capabilities and semantically correct translation, both concerning functional and timing semantics. In this talk, I will discuss two ongoing projects that are addressing these challenges: Modelyze, a host language for embedding different modeling formalisms, and the Precision Timed Infrastructure, an infrastructure where an intermediate language, a compiler, and an ARM-based microprocessor are extended with instructions and semantics for handling real-time.

David Broman is currently a visiting scholar at UC Berkeley, USA, working in the Ptolemy group at the Electrical Engineering & Computer Science department. He is an assistant professor at Linköping University in Sweden, where he also received his PhD in computer science in 2010. David's research interests include programming and modeling language theory, compiler technology, software engineering, and mathematical modeling and simulation of cyber-physical systems. He has worked five years within the software security industry, co-founded the EOOLT workshop series, and is member of the Modelica Association and the Modelica language design group.

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