Communication-Based, Embedded System Design

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Integration is the next big challenge in Embedded System Design (ESD). The complexity of electronics, from chips to building automation systems, increases at each product generation, while time-to-market shrinks. To overcome the possible barriers coming from a linear increase of productivity, it has become common to assemble systems out of off-the shelf components. This approach to ESD brings up many issues that are not related to the components themselves but rather to the way in which they interact. The problem of interconnecting components correctly appears at all levels of abstraction. At the design entry level, each piece of the system is usually described with the model of computation that most naturally captures its behavior. When the entire system is put together, the interaction between different parts required the definition of the interaction among heterogeneous models. At lower levels of abstraction, the problem reduces to the design of the actual communication architecture that allows the components to communicate. Correctness at this level is defined also with respect to performance metrics like latency, bandwidth and reliability.

Thus, given a collection of agents and the way in which they communicate (usually specified by a set of point-to-point communication requirements) the embedded system designer faces the problem of defining a communication structure such that the communication requirements are satisfied and the cost is minimized. This problem is not trivial considering the number of different ways in which the abstract point-to-point specification can be refined into a concrete communication structure. However, the flexibility provided by the plethora of communication technologies available today, is a great opportunity to “guarantee performance at minimum cost”: a motto for the embedded system community.

I will present our on-going research effort toward the development of an infrastructure for networked embedded systems. I will motivate our work using two design drivers: on-chip communication and building automation systems and I will argue that the same theory can be applied independently from the specific application. Then, I will show how the theory has been used to develop a tool for the automatic design of communication structures and I will present some preliminary results. I will conclude with a list of research directions.

Bio
Alessandro Pinto received the Laura Degree summa cum laude from the University of Rome “La Sapienza” in 1999. From 1999 to 2000 he worked in the R&D group at Ericsson S.p.A. in Rome, where he contributed to the design of a programmable ASIC for GSM applications. From 2000 to 2001 he worked in the System-Level Design group at Ericsson Lab Italy in Rome where he applied Platform-Based Design to the optimization of a wireless access network. He is a PhD candidate at the University of California, Berkeley. His research interests are in the fields of Embedded Systems, heterogeneous and concurrent systems and networked embedded systems. In particular, he defined the syntax and abstract semantics of HyInfo, an interchange format for hybrid systems, and he is currently developing COSI, a communication synthesis infrastructure.

The seminar will take place on Monday, November 12, 2007 at 2 p.m. - 3:30 p.m. in ACES 6.304.