



FIRST INTERNATIONAL NANOTECHNOLOGY CONFERENCE ON COMMUNICATION AND COOPERATION

Abstract

Bridging the Gaps between Giga-Complexity and Nano-Scale Integration

Ambient Intelligent (AmI) applications are evolving to connected wearable and low cost consumer products driven by software from the top, and enabled and constrained alike by Nano-Scale physics at the atomic level. On the one hand scaling delivers the Giga-ops compute- and GHz communication capability needed for AmI. On the other hand, scaling to the decananometer level creates an architectural and a physical gap between technology and design. We focus on the major challenges to bridge these gaps. First, there is the power and memory wall. AmI devices are memory intensive and need a power efficiency 10...100 fold better than today's microprocessors for one twentieth of the cost. Yet embedded programmability and reconfigurability must be provided for customer personalization and adaptation to new emerging standards and services. This requires novel power efficient parallel heterogeneous architectures as well as Electronic System Level (ESL) tools, methods and skills to reduce the huge NRE costs associated with such systems. We will focus on emerging techniques to bridge this architectural gap between systems and platform design based on reuse of optimized software and hardware IP blocks.

At the same time scaling to the nano-meter level confronts the silicon architect with a physical gap. A plethora of nano-scale physical phenomena such as leakage power, variability of transistors and interconnect, poor signal integrity, lithography uncertainty move from second order to the first order seat. They disturb the digital abstraction necessary for design productivity. This requires new device architectures concurrently with new system design techniques to cope with uncertainty, non-determinism and better than worst case design and five years to develop yielding processes, libraries, design methods and programming environments. These challenges exceed all previous ones in the days of happy scaling. Worldwide R&D sharing is needed if we want to keep Moore happy!