Defying Dark Silicon with Idempotent Processors

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Karu Sankaralingam is an assistant professor in the computer sciences department at the University of Wisconsin-Madison, where he also leads the Vertical Research Group. His research interests include microprocessor design and VLSI. He is a recipient of the NSF CAREER award. He earned a PhD from The University of Texas at Austin in December 2006.

Abstract

Technology constraints are radically changing as we scale to the end of silicon technology. In this talk, I will first describe how "dark silicon" may bring Moore's law to an end. Unless we embrace radical microprocessor designs, performance improvements in next 10 years will be a meager 8X, more than half the transistors on chips must remain turned off, and the decreasing reliability of transistors further exacerbates these problems. Transistor innovations, architecture innovations, or application innovations, alone are insufficient to deliver the ``expected'' Moore's law speedup of 32X. While these predictions are dire, synergistically exploiting the changing application trends can help overcome these challenges. My research fundamentally rethinks microprocessor designs with energy and reliability as primary constraints. In this talk, I will describe formal concepts and practical systems we have built in my group, spanning FPGA prototypes to full-fledged compilers.

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