Keynote Addresses

Supercomputing on a Chip: Evolution and Challenges

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Abstract

The last decade saw the emergence of the parallel supercomputer. Based on large array of up to 10,000 high volume microprocessors, these were the first machines to sustain more than one teraFLOPS on scientifically important computations. In a remarkable demonstration of Moore's Law, the new decade should see the advent of the first single-chip parallel microprocessors whose performance will be comparable to the large-scale machines of the mid-1990s. Not surprisingly, the designers of these future single chip multiprocessors will face many of the same concerns as their predecessors such as the need for high bandwidth, low latency, interconnection networks and very-lightweight interprocessor communication protocols. Unlike the earlier supercomputing designs, which were intended for large-scale engineering and scientific computing, these next-generation, single chip parallel machines will be used to deliver "high-value" MIPS that enhance the user's total computing experience.

Applications likely to appear on these micro-scale supercomputers of tomorrow will include the rendering of real-time, 3D graphics, encoding/decoding multiple, HD video streams, and processing real-time voice and video input. This talk will describe several solution strategies, at the architectural, interconnect, and circuit levels, that are suitable for single-chip supercomputers in sub-100nm technology generations.

Biography

Justin Rattner is an Intel Fellow, Enterprise Platforms Group and Director, Microprocessor Research, Intel Labs. His current responsibilities include advanced circuit, microarchitecture, architecture, and programming systems research, as well as the prototyping and deep analysis of future computer applications and workloads. In 1989, Rattner was named Scientist of the Year by *R&D Magazine* for his leadership in parallel and distributed computer architecture. In December 1996, Rattner was featured as Person of the Week by ABC World News for his visionary work on the Department of Energy ASCI Red System, the first computer to sustain one trillion operations per second (one teraFLOPS) and the fastest computer in the world between 1996 and 2000.

In 1997, Rattner was honored as one of the Computer 200, the 200 individuals having the greatest impact on the U.S. computer industry today, and subsequently profiled in the book *Wizards and Their Wonders* from ACM Press. Rattner has received two Intel Achievement Awards for his work in high performance computing and advanced cluster communication architecture. He is a longstanding member of Intel's Research Council and Academic Advisory Council. He currently serves as the Intel executive sponsor for Cornel University where he serves on the External Advisory Board for the School of Engineering. Rattner joined Intel in 1973. He was names its first Principal Engineer in 1979 and its fourth Intel Fellow in 1988. Prior to joining Intel, Rattner held positions with Hewlett-Packard Company and Xerox Corporation.

He received the Bachelor's and Master's Degrees from Cornell University in Electrical Engineering and Computer Science in 1970 and 1972, respectively.