Keynote
High-Speed Link Design, Then and Now

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Abstract

For the past 13 years, my research has included the design of high-speed chip-to-chip communication links. When this work started, most chip I/O were TTL levels, and ran at tens of MHz. Our initial work focused on understanding the basic problems of chip I/O, creating the needed circuit blocks to solve these problems, and predicting how the performance would scale with technology. Today the situation is quite different. The basic issues are well understood, and there are many variants of the needed circuit blocks. However the speed demands have also grown with time, causing new issues to arise, and forcing the resulting designs to grow dramatically in complexity.

This talk will review the basic issues of a high-speed link, first looking at the problems of link design 10 years ago. After describing how the basic issues of timing and signaling are addressed and how these solution scale, I will look at the issues that designers are facing today, and the techniques being used to cope with these problems. These issues include: circuits limited by the bandwidth of the external wires, worsening transistor matching, and rising bandwidth requirements. The talk will close with some projections about the future, and will look at both electronic and optical links.

Biography

Mark Horowitz is the Yahoo Founder's Professor of Electrical Engineering and Computer Science at Stanford University. He received his BS and MS in Electrical Engineering from MIT in 1978, and his PhD from Stanford in 1984. Dr. Horowitz is the recipient of a 1985 Presidential Young Investigator Award, and an IBM Faculty development award, as well as the 1993 best paper award at the International Solid State Circuits Conference. Dr Horowitz's research area is in digital system design, and he has led a number of processor designs including MIPS-X, one of the first processors to include an on-chip instruction cache, TORCH, a statically-scheduled, superscalar processor that supported speculative execution, and FLASH, a flexible DSM machine.

He has also worked in a number of other chip design areas including high-speed and low-power memory design, high-bandwidth interfaces, and fast floating point. In 1990 he took leave from Stanford to help start Rambus Inc, a company designing high-bandwidth chip interface technology. His current research includes multiprocessor design, low power circuits, memory design, and high-speed links.