Keynote Speech I

CONSUMER DIGITIZATION: ACCELERATING DSP APPLICATIONS, GROWING VLSI DESIGN CHALLENGES

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Dr. Biswadip (Bobby) Mitra has been with Texas Instruments since 1986, and is currently the Managing Director of Texas Instruments (India). During 1996-2000, he was with Texas Instruments Incorporated, Dallas, as the Director of the Worldwide Wireless Communication Digital Baseband Platform. His other responsibilities included the Management of the Americas Wireless Product Development Operations and key Wireless sockets. Dr. Mitra also led the development of Worldwide Texas Instruments' low power DSP cores of the C54x and C55x family since 1996, as well as software and system solutions that drive almost two-thirds of all cellular handsets in the world today. Prior to 1996, Dr. Mitra held several key management responsibilities in Texas Instruments (India) in the ASIC and Memory operations. Dr. Mitra has published and presented over 30 technical and management articles in key International Journals and Conferences. He has been the recipient of several Best Paper Awards, and was the General Chair of the International Conference on VLSI Design in 1996. Dr. Mitra has a B.Tech (1985) in Electronics and Electrical Communication Engineering and a Ph.D in Computer Science and Engineering (both from IIT Kharagpur). He also holds an Executive-MBA degree from the University of Texas, Austin (where he was a recent recipient of the Dean's Award for Excellence).

Abstract

The greatest opportunity for growth in the Internet Age will come from combining broadband and mobility. Bandwidth explosion, personalized bandwidth and multimedia convergence are beginning to change the landscape of how we live, work, connect and entertain. And two new technologies have emerged to lead this Internet Age: Digital Signal Processors (DSPs) and Analog semiconductors. DSPs are doing for communications what the microprocessor did for computing. DSP and Analog technologies bridge the gap between the digital world and analog world. And they do it in real-time. In addition, because one can program the DSPs, manufacturers and network service providers can quickly integrate new features and evolving standards into existing equipment. This reduces long-term infrastructure costs and facilitates rapid service rollouts.

Today, DSP applications range from Cellular handsets, Basestations, Cable Modems and DSLs, IP Telephony to MP3 players, Digital Still Cameras, Digital Motor Control Systems and many more. These applications are all characterized by the need to have a combination of DSP and high performance Analog functions.

Worldwide programmable DSP chip shipments for the year 2000 were over US$ 6.1 Billion according to World Semiconductor Trade Statistics (WSTS). In spite of the cyclical nature of the semiconductor industry, as witnessed in 2001, a compound annual growth rate (CAGR) of 27% is predicted for DSP shipments through 2005. One of the key challenges of this dramatic growth and widespread application of DSPs is in terms of the increasing complexities of VLSI design. The challenge of integrating more transistors, but using less power, has led to a dramatic evolution of semiconductors and CAD methodologies. In 1980, a typical DSP chip had 50,000 transistors

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and could process 5 million instructions per second (MIPS). These chips sold for about $150 each and consumed 250 milliwatts of power per MIPS. Today, it is routine to have more than 10 million transistors on a chip - delivering 5 billion instructions per second at just one-tenth of a milliwatt per MIPS. Such chips sell for about $5 today. That's less than a penny per MIPS compared to $30 per MIPS twenty years ago. And power consumption is a tiny sliver of what it once was. By 2010, we anticipate DSPs can process 3 trillion instructions per second with a chip about the size of a thumbtack.

Functional integration is another new twist. This implies taking analog and digital functions that had been handled earlier by separate chips, and combining these onto a single chip. This analog integration challenge (with minimal cost delta due to additional masks), the need to miniaturize, the need for high performance at the lowest possible power makes it a very interesting challenge for VLSI designers. At the same time, success in these very attributes by VLSI designers worldwide has led to the explosion in DSP applications in the past few years. And indeed, we are sure that there are many more innovations in VLSI design that are yet to come and there are many applications of DSP that have not been invented yet - an area for future developers and entrepreneurs to exploit.