

India's First Microprocessor – The BITSian Connection

Did you know that the Intel Xeon 7400 series has been completely developed in India? Did you know that more than a dozen BITSians were involved? Read on for more...

Sriram V, 1996A3PS080
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Do you remember your Mom complaining that she needed more than just two hands as she prepared your tiffin, combed your hair and polished your shoes, all at the same time? For a few years, microprocessors have been similarly crying out for help. As your YouTube video streams while you check your mail and the anti-virus is running a daily scan in the background, the microprocessor requires as much power as possible. The challenge gets compounded exponentially when you are dealing with the server platforms of today. With more and more people turning to the internet and Web 2.0 resulting in much greater client-server interaction, it is essential for tomorrow's computer chip to have the greatest multitasking abilities ever imagined.

This challenge was thrown to Intel India's Enterprise Microprocessor Group (EMG) and the result is a computer chip with six brains, all packed in a single piece of silicon. Codenamed Dunnington (DUN), the processor is the first fully owned CPU product developed in India. More than a dozen BITSians were involved at various stages of this project which began in 2006. The green-field team, based in Bangalore and led by a BITSian, Mr. Ravishankar (Ravi) Kuppuswamy, put in two years of intense efforts in planning and execution to deliver the final product.

Ravi is a 13-year Intel veteran and had worked on several generations of Intel microprocessors in Portland, Oregon USA. He moved back to Intel-India to work with the green-field Bangalore Design Center, taking up the challenge to design Dunnington (Intel® Xeon™ 7400 processor) for Caneland, the 4-socket server platform. This enterprise server CPU, which is now sold in the market as the Intel Xeon 7400 series brings home a lot of accolades in terms of power and performance. Starting

from scratch, the design and development of this wallflower is based on the latest Intel Core Micro architecture. It is built on Intel's latest 45nm process technology and within it a mammoth 1.9 Billion transistors (Now remember the Pentium III packed about 9 million transistors only!).

This new CPU team delivered key milestones at a blistering pace. Within just 14 months from the start, DUN A0 version was taped-in 6-weeks ahead of commit schedule. Within 24 hours from receipt of parts, a complete 4-socket Caneland platform booted all major Operating Systems. In just a few weeks thereafter, DUN A0 silicon achieved record-breaking 4-socket TPC-C performance – a rock-solid tribute to its high quality design. The top-quality Dunnington design and validation effort enabled launch one quarter ahead of schedule. This combined with Dunnington's ~1.3X performance improvement over the predecessor chip makes it a product par excellence. DUN delivers a record-breaking 1.2 million tpmC result on an 8-socket platform winning praise from around the industry. "It's pretty bone-crushing performance," said Jim Gargan, Vice President of IBM's x86 Server Unit. DUN provides power feature (CC3) and virtualization (CPUID spoofing) leadership – key criteria for server purchases.

It is to be noted here that the debug teams worked in tandem with the design team to isolate the bugs in the design and hence fix it to qualify the product! A state of the art CPU Debug Lab (a clean room in manufacturing parlance) was set up in Bangalore to conduct Component and Physical Debugging of the Silicon, a step that proved critical to ensuring the product qualifies after all. The post silicon efforts duly supported by the Server Development and Manufacturing Team proved to be a

catalyst in the sojourn of making a clear proof point in the history of semiconductor development in India. It was indeed a proud moment for Ravi when the NASSCOM IT Innovation Award 2008 was handed over to him for the category "Market Facing Innovation - New Technology Advancement" for successfully developing India's first Microprocessor.

Praise from the industry

"It's pretty bone-crushing performance," said Jim Gargan, a vice president in International Business Machines Corp.'s (IBM) x86 server unit. [Wall Street Journal: Intel's New Six-Brain Chip Getting Strong Reviews]

"There is a realization that we will be able to bring things to market that weren't feasible four years ago," MySpace vice president of technical operations Richard Buckingham said while discussing the new chip's potential. MySpace is among a growing number of Internet companies using "virtualization" to essentially multiply the usefulness of computing hardware.

Several computer makers are

Journal: Intel's New Six-Brain Chip Getting Strong Reviews]

Dunnington looks like a very solid chip," said Charles King, an analyst at Pund-IT Inc. in Hayward, Calif. "It looks like the products based on Dunnington will offer enterprise customers a lot to smile about. Higher performance is a very good thing, especially among enterprises that have a great deal of money invested in their x86 infrastructures. There's a growing desire to consolidate those servers and workloads on as few a machines as possible." [ComputerWorld: Blowing past quads, Intel launches 6-core chips]

The performance is heads and tails above our previous products and where the competition is," Poulin said. The chip uses less electricity and is as much as 48 percent faster than previous models, he said. [Bloomberg: Intel Debuts First Server Processor With Six Cores (Update1)]

Ravishankar Kuppuswamy, Project Leader for Dunnington

Ravi joined BITS in 1989 and did his dual degree program in Chemistry and EEE.



Figure 3: [BITSian Ravi Kuppuswamy receiving the NASSCOM IT Innovation Award 2008]

reporting test results of machines using the chip that they are calling a milestone for x86 technology, which was originally developed for use in personal computers. [Wall Street

Nicknamed c/2 (as in half chom) at BITS, he was the Swimming Team captain in 1991-92. He later did an MS in Electrical Engineering from Arizona State University in

USA. and then started working for Intel, spending 11 years in Portland, USA working on 5 generations of Intel's Pentium II, III and IV microprocessors.

At Intel, he got the opportunity to work with some of the smartest engineers in the world. "That experience and confidence motivated me to want to do something like this in India". He really wanted to work on and manage the team that built India's first microprocessor." Microprocessor development and development of complex chips in general really thrill me ". He used to really wonder at the sheer complexity of the design and the ability to get all these components working together with great precision to power the world's fastest computers. It still amazes him to this day!

List of BITSians Involved

1. Ravi Kuppuswamy, Engineering Director, Enterprise Microprocessor Group (1989B2A3698)
2. Suresh Kuttuva, Micro-architect and Front End Execution Lead (1984A3PS045)
3. Sreekanth Nallagatla, Engineering Manager Uncore RLS and Speed Path Debug Lead (1992A3PS145)
4. Sriram Vaideeswaran, Optical Probe Engineer with Server Development and Manufacturing Team (1996A3PS080)
5. Shivaram Chandrasekaran, Component Design Engineer with Logic Synthesis Team (1996A3PS040)

6. Karthikeyan Balakrishnan, Component Design Engineer with Logic Synthesis Team (1996B5A3586)
7. Subashini S, Verification Engineer with Full Chip Validation Team (1999A3PS103)
8. Hemant Kumar Sivaraj, Post Silicon Validation Engineer with Multi Processor Test Content Team (1994B4A7PS367)
9. Sanjukta Mitra, BIOS Engineer with System Validation Team (2001B4A7475)
10. Sivashankar Ramamurthi, Component Debug Engineer (1999H105427)
11. Sekhar Vakada, Component Design Engineer with Logic Synthesis Team (2001H081)
12. Virat Sharma, Design Automation Engineer (2004K103416)



Figure 4: [Intel Xeon 7400 Series – BITSians inside!]