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THE EDITORIAL VIEW

# AN ELEPHANT DANCED FOR THREE DAYS AT FALL IDF

*By Steve Leibson {8/28/00-ed}*

I spent the week at the fall Intel Developer Forum (IDF) 2000, and I have some advice for you. If you compete with Intel, watch out. There's definitely an elephant on the loose on the Silicon Valley dance floor. Intel now appears solidly and broadly behind four essentially unrelated processor architectures, aimed at four broad market arenas that overlap only marginally. The aggregate footprint of these architectures is huge, and the competition in the targeted markets will be fierce—perhaps fiercer than ever before. The four Intel processor architectures are IA-64, IA-32, XScale, and IXA. IA-64 and IA-32 are no doubt familiar. The others may not be. XScale is Intel's newly minted name for StrongArm 2. IXA is Intel's name for the processor family based on the IXP-1200 network processor the company obtained when it bought Digital.

IA-64 is Intel's 64-bit, parallel-architecture behemoth aimed at servers and high-end workstations. Itanium, the first iteration of IA-64, has received plenty of criticism for projected performance from the pundits. Some of that criticism may even have come from the pages of *Microprocessor Report*. However, as with any new microprocessor architecture, the first try teaches a plethora of lessons that help improve the second and subsequent attempts. We expect the follow-on IA-64 processors (McKinley, Madison, and Deerfield) to bring rapid improvements to IA-64 performance. IA-64 is a processor architecture positioned for the future.

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IA-64 breaks with the past because it has a new 64-bit instruction set. Itanium contains an x86 instruction decoder as the sole architectural link to Intel's past, and Intel has committed to keeping this decoder in future IA-64 implementations. Only a few thousand Itaniums have shipped to developers so far, but IA-64 has already created a duopoly in the future workstation market. Every major workstation vendor (HP, IBM, SGI, etc.) save one has announced that it plans to adopt IA-64 for future workstation designs. Only Sun has declined IA-64. The takeover is more difficult in the more conservative server arena, but IA-64 is doing well there also, as evidenced by the server vendors on the IDF show floor.

Intel is not sitting on its laurels for IA-64, however. The company has already opened 27 Application Solution Centers to help customers of all stripes adopt computers based on both IA-64 and IA-32, and Intel plans to open 10 more centers before the end of the year. Some of these centers are located within large Intel clients, such as Dell. Others belong to Intel alone. According to Intel, the centers' mission is to "enable best-of-class e-solutions on Intel hardware." In other words, the centers help generate demand for Intel's high-end server and networking products.

In addition to spreading the gospel of its processor architectures, Intel's Application Solution Centers stock expertise in the latest technologies, including Linux, Java, and Infiniband. Whether your company is large or small, if you want help configuring big Itanium servers into some

sort of Internet enterprise application, you can now hire Intel to help. Depending on your potential value to Intel as a customer, the help may not even cost you anything. If you're up against Intel in the 64-bit processor arena, take note. Silicon alone cannot compete with Intel's support for IA-64.

Intel rolled out the Pentium 4 at IDF on the first day of the conference. The pipeline in the Pentium 4 is twice as long as the P6 pipeline in the Pentium III. The designers doubled the pipeline depth to allow a large jump in processor clock rate. While a Pentium III fabricated in a 0.18-micron process currently struggles to attain a 1.13GHz clock rate, at IDF Intel debuted the Pentium 4 in a 1.4GHz version and demonstrated it running at 2GHz. (In fact, Intel was forced to recall the 1.13GHz Pentium III a week after IDF due to operating stability problems at full speed.) Make no mistake, plenty of criticism will be directed at the Pentium 4 because of the long-pipeline tax that any processor with a deep pipeline must pay—large, performance-robbing pipeline bubbles caused by branch mispredictions. The symptom of the long-pipeline tax is a drop in the number of instructions per clock that a processor can execute, and Pentium 4 is unlikely to avoid this tax completely. But Intel's 0.13-micron process comes on line in mid 2001, and Intel had to decide if and when to develop a new microarchitecture for executing x86 code that takes advantage of that new fab process. Based on simulations that Intel isn't sharing with the analyst community, the company decided to take the architectural hit now rather than later. By paring down the work required in each pipeline stage, Intel has created a new x86 microarchitecture that is already poised to exploit the company's 0.13-micron process as soon as it's available. Like IA-64, Pentium 4 is an architecture positioned for the future. Competitors to Intel's IA-32 processor family take note. Is your existing microarchitecture ready to fully exploit the clock rates made possible by a 0.13-micron process? Intel's is.

On day two of IDF, Intel launched its new name for StrongArm-2—XScale—and at long last demonstrated working silicon. The new name refers to the processor's "extraordinary ability to scale," which it indeed has. (Unlike the old name, the new name also is one that Intel can trademark.) The early XScale silicon at IDF ran at 50MHz while consuming 10mW and at 1GHz running at 1.5W. The very same piece of silicon operated at both extremes, although the more conservative data sheet will span only 50MHz at 10mW to 800MHz at 900mW. Incidentally, standby power is 0.1mW and XScale jumps from standby to full operation in less than 20µsec.

As impressive as the XScale silicon is, Intel realizes it must provide support for the new system-design possibilities this core creates. The processor itself contains circuitry to monitor 22 parameters internal to the core and eight external inputs. Using this information, a suitably configured operating system can dynamically configure an XScale processor to deliver only the processing power required at any time, based on the tasks at hand. Doing so ensures that no power is wasted on unneeded CPU cycles. No such operating system yet exists, but you can be certain that Intel is busy helping its software partners create the suitable OS extensions. Once Intel changes the playing field for 32-bit embedded processors so that configurable power and performance is easily achieved with XScale, competing embedded processors that lack this feature will hit substantial new barriers to acceptance.

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Intel also devoted a keynote speech to its fourth major architectural initiative on day three of IDF. Intel's IXA (Internet exchange architecture) is the ecosystem that the company is wrapping around the IXP1200 network processor. In 1999, Intel had only the processor, a set of APIs, and some companion physical-layer chips. This year, the company has added more software, some partners, and various bits and pieces developers can use to create systems. Next year, Intel plans to offer what it terms solutions—entire kits of chips, reference designs, driver software, and application code—to permit rapid development and deployment of systems based on IXA. In the span of two years, Intel will have gone from being a chip supplier to being a systems partner in the network processor arena.

The intent of this discussion is not to congratulate Intel for executing well, although clearly the company has its act together in many ways. The point is this: if your business plan involves competing with Intel, the mere creation of better processors with a quick port of the relevant GNU tools may not take you very far these days. Intel has changed the playing field from chips to ecosystems by harnessing its incredible success in PC processors and the financial clout derived from that success. Even IDF, with its 5,000 attendees, packed exhibit floor, and more than 100 technical sessions set a new level of competition for processor vendors that would compete with Intel.

I see an elephant dancing very much like a ballerina. What do you see? ◇