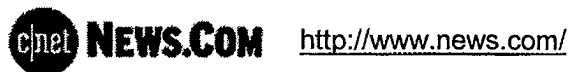


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## Itanium: A cautionary tale

By Stephen Shankland

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### **On June 8, 1994, Hewlett-Packard and Intel announced a bold collaboration to build a next-generation processor called Itanium, intended to remake the computing industry.**

Eleven years and billions of dollars later, Itanium serves instead as a cautionary tale of how complex, long-term development plans can go drastically wrong in a fast-moving industry.

Despite years of marketing and product partnerships, Itanium remains a relative rarity among servers. In the third quarter of this year, 7,845 Itanium servers were sold, according to research by Gartner. That compares with 62,776 machines with Sun Microsystems' UltraSparc, 31,648 with IBM's Power, and 9,147 with HP's PA-RISC.

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#### **What's new:**

The recent delay in the release date for the first dual-core Itanium underlines the shrinking ambitions and scope of the Intel processor, once vaunted as an industry-changing chip.

#### **Bottom line:**

The chip's story serves as a cautionary tale of how complex, long-term development plans can go drastically wrong in a fast-moving industry.



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But perhaps most significant, it compares with 1.7 million servers with x86 chips, based on an architecture Itanium was intended to replace.

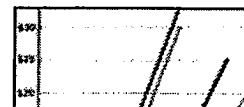
"At the original launch, the claims from HP and Intel were essentially saying, 'If you're not with us, you're going to die. We're going to be the chip that runs everything,'" said Illuminata analyst Jonathan Eunice. "It so happens that promise has largely been achieved, but with x86."

The saga illustrates the risks of such sweeping strategies. While grand plans offer the promise of major rewards, long development cycles mean many more chances to stumble or be overtaken by unanticipated events--such as x86's longevity. Itanium isn't a unique example; Microsoft's ambitious "Longhorn" version of Windows has been delayed and pared back several times, meaning that some technology the company hoped to release in the 1990s won't show up until 2006 or later.

Itanium did vanquish two rival chip families: Compaq's Alpha and Silicon Graphics' MIPS. It also has respectable performance and is gradually replacing the PA-RISC family from HP, which sold 79 percent of all Itanium servers in the third quarter of 2005, according to Gartner figures.

But the processor's long history has more notably been marked by a series of missteps that undermined its heir-apparent status.

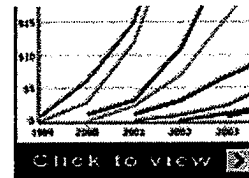
The latest problem cropped up in late October, when Intel announced that the release of the first dual-core Itanium, code-named Montecito, would be delayed from 2005 until mid-2006. Earlier problems included other delays, poor initial performance and software



incompatibility with the processors it was designed to replace.

Moreover, throughout Itanium's inglorious debut, Intel was dramatically improving x86 chips, and IBM, Sun and Advanced Micro Devices poured more resources into their rival chips.

The future looks unlikely to get better, said Kevin Krewell, editor-in-chief of industry newsletter Microprocessor Report. "It's not promising. It has a space that will be there for a number of years, but it's been marginalized," Krewell said. "It's not hard to see that Itanium is not going to go much beyond the niche of replacing Alpha and PA-RISC."



### Billions invested

Intel and HP are mum about how much money has been invested in the project. But some data points are clear. Albert Yu, general manager of Intel's microprocessor products group, was quoted in Electronic Engineering Times in 1994 as saying the joint development effort for Itanium would entail an investment of \$400 million to \$500 million over several years.

But the project grew well beyond that price tag as it slipped and backers had to pump funding into a massive effort to get third parties to revamp software for the new chip family. Several analysts estimate the cost as multiple billions of dollars, and the spending hasn't stopped: In December 2004, HP pledged to spend a further \$3 billion to fund Itanium-related software, hardware and marketing work.

"The fact that they spent so much money to develop Itanium implies to me they expected an equally huge return on that investment," said Linley Group analyst Linley Gwennap, who followed Itanium closely for years for Microprocessor Report.

Intel and HP acknowledge they've had challenges with Itanium but staunchly defend the effort. "I think it's doing very well," said Lisa Graff, general manager of Intel's high-end server group. She points to gains in Itanium's scaled-back mission of replacing Power, UltraSparc and other reduced instruction set computing (RISC) chips and observes that half of the world's 100 biggest companies use Itanium systems.

"I think Itanium is still the architecture for the next 20 years," Graff said. "It's the newest architecture that has come out. It has the headroom. I think the RISC architectures will run out of steam."

Rich Marcello, general manager of HP's Business Critical Server group, adds that more than 90 percent of the company's customers moving off PA-RISC systems are moving to Itanium.

Dividing the market between two chip families is a solid strategy, he added. "The reality is you take \$45 billion server market and break it in two," HP's x86-based ProLiant servers for the bottom \$22.5 billion and Itanium-based Integrity servers for the other half, he said.



But that divide is somewhat artificial. AMD has made a series of server-oriented improvements to its x86 Opteron chip, making it a better competitor both to Itanium and to Xeon, Intel's x86 server chip. AMD beat Intel to market with useful x86 server features such dual-processing cores, lower power consumption and a 64-bit design--the latter once one of the main advantages Itanium held over 32-bit x86 chips.

In a few short years, AMD's features drew IBM, Sun and even HP to offer Opteron servers, and the chip continues to make strides. In third-quarter shipments of x86 servers, AMD accounted for 5 percent in 2004 but 10 percent in 2005, according to Gartner, while revenue jumped from 4 percent to 8 percent.

In addition, some potential customers are put off by Intel's approach. The reason high-end x86 server start-up Fabric7 chose Opteron is that it easily works in systems with eight processor sockets, CEO Sharad Mehrotra said. "Intel doesn't want you to build greater than four-socket topologies of Xeon," he said.

Intel's moves to keep Xeon competitive hurt Itanium. "Once AMD showed Intel what to do with x86--adding 64-bit support--that was the end of Itanium right there. When Intel announced it was going to do (64-bit x86 chips), it was obvious Itanium was irrelevant for anything but the high end of the market," said Peter Glaskowsky, an

Envisioning analyst and chief architect of start-up MemoryLogix.

### Back in the day

The Itanium project began in December 1988 as a secret HP research project to create a successor to the company's own PA-RISC processor family, according to HP Labs' then-chief Dick Lampman.

In 1993, HP approached Intel with the idea of collaborating, said Jerry Huck, HP's technical leader on the project. "Producing our own chips--there was not enough volume, and the economics were not in our favor," he said of the company's decision not to build its own processors. "Intel floated to the top of the list pretty quickly as somebody with the resources that would make this work."

When HP and Intel announced their partnership in 1994, Richard Sevcik, general manager in HP's server group, said in a press release that the companies would create "a unified computing infrastructure that accomplishes three fundamental goals: preserves current customer investments, readies corporate customers for the next century and offers high-volume cost models."

So far, none of those goals has been met.

The chip, initially code-named PA-WideWord, used an architecture called Explicitly Parallel Instruction Computing, or EPIC. HP hoped the design would execute more instructions in parallel by lining them up in advance for maximum speed. Those instructions are ordered by an advanced compiler--the software that translates human-written programs into the code consumed by the actual processors. EPIC's compiler-oriented technique contrasts with RISC chips, which are geared to adapt to whatever software instructions are thrown at them.

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--Peter Glaskowsky, analyst,  
Envisioning

In 1997, Intel and HP revealed more details, saying the Itanium design "is expected to advance the state of the art in processor technologies, specifically addressing the performance limitations found in today's RISC and CISC (complex instruction set computing) technologies." (x86 chips are CISC designs, though their external interfaces now cloak faster RISC-like cores.) Itanium also would provide "full compatibility for IA-32 (x86) applications and operating systems," Intel said in its press release.

The initial Itanium prospects were impressive. All the major server and operating systems companies jumped on board.

**"Originally, Itanium was envisioned as an architecture to replace the entire spectrum, and that turned out to be overly ambitious."**

--Rich Marcello, general manager, HP's Business Critical Server group

Sun created a version of Solaris for Itanium in the 1990s. IBM joined with the Santa Cruz Operation and Sequent to combine their Unix products into an Itanium operating system code-named Monterey. Microsoft offered Windows 2000 for Itanium. Linux allies banded with Intel and server makers in a project called Trillian to adapt the open-source operating system to the chip. Compaq's Tru64 Unix was up and running on an Itanium software. And Silicon Graphics decided to support Itanium and Linux in preference to its own MIPS processor and Irix operating system.

"The momentum was huge," Gwennap said. "There was this incredible anticipation and expectation that this was going to be the next big thing. Intel was on a roll, and with HP backing them, then other companies started jumping

on the bandwagon."

### Itanium derailed

Then big problems hit. The first Itanium, code-named Merced, was delayed from 1999 to mid-2000. When it arrived even later, in May 2001, even lowly x86 chips beat it in important performance tests.

When Intel and HP launched the Itanium project, "they thought they had just laid the golden egg," Eunice said. However, "when Merced arrived, it was a turd."

Even HP called Merced a mere "development environment."

The delays forced SGI to extend its MIPS chip family by two generations and cancel its first-generation Itanium system. "We had a product we designed based on the Merced chip which we elected not to take into the market," said Dave Parry, general manager for SGI's server group.

And Sun--admittedly a lukewarm ally that never planned to sell its own Itanium servers--dropped Solaris support in 2000.

Intel got the Itanium train back on the tracks after Merced, doubling performance with "McKinley" in 2002. In 2003, it launched "Madison" with 6MB of on-board cache memory; the next year, it unveiled "Madison 9M" with 9MB of cache and a plan for the 2005 release of the dual-core "Montecito."

"Montecito is a fundamentally new, true dual-core design. It does get significant performance advantages over the previous single-core parts," Glaskowsky said.

Behind the scenes, there had been another Itanium shift. An ambitious future-generation product code-named Tanglewood had been planned with as many as 16 processing cores, according to a source familiar with the plan and a document about the chip seen by CNET News.com. But in December 2003, Intel announced the model would be called Tukwila instead--quietly moving to a more conventional design that had four or more cores, slated for release in 2007.

### Retreat to the high end

As Intel grappled to produce desirable Itanium products, it gradually reduced its ambitions until the chip's niche was just high-end systems. Itanium is tailored for "the biggest iron," Pat Gelsinger, senior vice president of the Digital Enterprise Group in charge of the servers, said in a March interview.

"I was the one who initiated that, probably two-and-a-half years ago," Marcello said of the high-end shift. "I don't think you can span the entire server market with one architecture. Originally, Itanium was envisioned as an architecture to replace the entire spectrum, and that turned out to be overly ambitious."

The new direction diminished Itanium's potential influence. "Each time, it was whittled to a smaller and smaller niche, trying to make it more successful," Krewell said.

In 2004, Intel acknowledged that Itanium shipments weren't meeting the company's goals--it had hoped to double its chip sales total in 2004, from 100,000 in 2003.

But the problems went beyond hardware. The initial promise that x86 and PA-RISC software would run unchanged on the chip only came true for a tiny fraction of applications, and Intel and HP began working hard to lure software companies, whose revenues are tied strongly to how widely a server family is used.

HP and Intel have made progress on the software front. They now have a list of 5,000 applications that run on Itanium, about half of them for HP-UX. In addition, they launched the Itanium Solutions Alliance this year to help lure more.

Unfortunately, 5,000 applications still isn't enough.

Chris Koppe, CEO of Quebec-based Speedware and a board member of the Encompass HP user group, has seen firsthand the importance of the missing Itanium software as his company helps customers migrate off the HP 3000, an earlier server line that's being phased out. About 70 percent of those customers are moving to HP-UX, and of those about half are still buying PA-RISC servers and half Itanium, Koppe said.

"We've had some Itanium prospects who had to go back to PA-RISC because their (software) tools weren't available on Itanium," Koppe said, adding that the tide is slowly turning.

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Speedware

### Newer troubles

The October news of Montecito's delay isn't the Itanium's only recent trouble. Intel has also lowered the chip's

planned top speed and disabled a 200MHz performance-boosting feature called Foxton. Release dates for future sequels also slipped a year—a Montecito revamp code-named Montvale into 2007, and Tukwila into 2008.

On top of that, some Itanium allies have departed or backed away.

IBM and Dell dropped Itanium servers this year, leaving HP the only one of the top server makers to sell them.

Among the smaller remaining companies that sell Itanium systems—NEC, Unisys, Fujitsu, Silicon Graphics Inc., Groupe Bull and Hitachi—there has been consolidation, as NEC and Unisys announced an October partnership to jointly design Itanium systems.

In January, Microsoft canceled Windows for Itanium workstations and in September said the next Itanium version of Windows for servers would be limited to use with high-end software such as the SQL Server database.

SGI, already struggling financially, has been hit again. "We were aligning our road map and product delivery to have a time-to-market release with the Montecito processor," Parry said. "Fortunately, we got enough advance insight into where things were that we've been able to react and build a product line based on Madison 9M as an interim solution."

SGI still believes it made the right decision, though. "Intel is going onward and upward with additional dual-core and multicore designs. We see them as great engines to our systems," Parry said.

The Montecito delay in October also affected HP, which had planned to release a new high-end Itanium server that uses Montecito and a chipset code-named Arches.

The October change particularly affected Unisys, whose ES7000 line can accommodate both Xeon and Itanium chips. The company now is delaying a feature that Intel had planned to launch in 2007, a "common platform architecture" that would allow Xeon and Itanium chips to plug into the same sockets. That would have simplified Unisys server designs.

Competitors have become increasingly eager to pounce on Itanium.

Software companies "make their money on licensee counts, so for them it's very important for them to achieve volume," said Karl Freund, vice president of marketing for IBM's rival Power-based Unix servers. "It doesn't have that critical mass."

And Sun President Jonathan Schwartz said on his blog in November that Itanium is headed for "a lingering death."

But through it all, Itanium allies maintain their optimism.

"We certainly had our challenges," HP's Huck said. "All in all, we're coming out ahead."

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