Computer Systems, Inc.
MERCURY

CASE STUDY

Mentor Graphics

Achieving Mission-Critical Breakthrough Performance on Cell-Based EDA Platform

IBM 2007 PartnerWorld Beacon Award Winner

Best IBM Embedded Power Architecture™ Solution
Mercury Computer Systems

Customer: Mentor Graphics
Business: Electronic Design Automation (EDA)
Challenge: Accelerate OPC computation of 45-nm process designs

Mentor Calibre® nmOPC Solution Uses Mercury's Cell-Based Co-Processor Acceleration System to Enable Computational Lithography for Next-Generation 45-nm Process Chips – in Hours, not Weeks

Mentor Graphics® is a world leader in electronic design automation (EDA), providing software and hardware design solutions that enable the world's most successful electronics and semiconductor companies to create better products faster and more cost-effectively. The company has long been acclaimed for its innovative products and solutions that help engineers overcome the design challenges they face in the increasingly complex worlds of board and chip design. Mentor Graphics has the broadest industry portfolio of best-in-class products and is the only EDA company with an embedded software solution. Established in 1981, the $800 million company employs more than 4,250 people worldwide.

Meeting the 45-nm Challenge

Circuits are made using a photolithographic process in which light is passed through patterns drawn on a mask to etch circuits onto silicon. With recent technology advancements, the dimensions of the circuit patterns have grown smaller than the wavelength of the light sources used to create them. This causes distortion that destroys the fidelity of the pattern. Optical proximity correction (OPC), an extremely compute-intensive task, modifies the circuit pattern to pre-compensate for these distortions and restore circuit fidelity.

In 2006, Mentor Graphics and its largest customers had reached a crossroads. Mentor's customers were facing critical time-to-market constraints for chip designs to be used in personal computers, HDTVs, mobile phones, video and digital cameras, and other consumer applications. As these customers pursued the new 45-nm process designs – where minimum feature sizes are literally the size of a few atoms – the amount of computation required to complete and verify designs was growing exponentially. More complex designs, new optical effects necessary for modeling, the need to simulate across the process window, and more complex optical proximity correction were pushing computation requirements from 5 to 10 times higher than the previous-generation 65-nm process.

Mentor's industry-leading Calibre® OPC product was relying on scaling general-purpose processors to maintain acceptable turnaround times (TAT). But even if Mentor's customers could complete their design processing and simulation on standard compute farms, the TAT would still be too long and the cost would be unacceptable. For critical layers, 1,000 CPUs or more might be needed to keep turnaround times to less than three days.

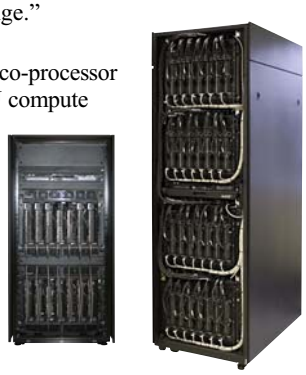
According to Charlie Albertalli, marketing director for Mentor Graphics, leading-edge customers needed faster, less-expensive solutions to accommodate the growing computation volumes resulting from the increased chip densities. "Mercury's broad expertise in hardware acceleration enabled us to evaluate a variety of co-processor accelerator alternatives quickly," he said. "We considered FPGAs, graphics processing units, and DSPs, before selecting the Cell Broadband Engine™ (BE) processor as the optimal acceleration solution for our computational lithography applications.

"Mercury Computer Systems was the perfect choice as a development partner. They have a strategic relationship with IBM, the producer of the Cell processor chips, and are an aggressive, capable, and proven company with a 20-year track record in applying hardware acceleration to computationally intensive tasks. This was a good technology match and a good organizational match. We shared very similar working styles and attitudes. Our engineering skills matched up well, and our strategy and company cultures lined up nicely."

Dramatic Improvements through a Co-Processing Accelerator

Mentor Graphics was being pressed by its customers to deliver a solution to the computation-processing challenge within a seven-month timeframe. "This ended up being the most accelerated development effort I've been involved in during my entire 30-year career," said Tom Kingsley, director of product marketing, RET products. "It was a huge undertaking – but going into the project, we had every confidence that Mercury could help us meet this challenge."

The hardware portion of the solution is a co-processor accelerator (CPA) based on a 25U or 42U compute cluster of Mercury Dual Cell-Based Blades. These Dual Cell-Based Blade Systems offer Mentor customers the advantages of the Cell BE processor in a form factor designed for high-performance data-center environments, significantly improving performance for the Mentor Calibre® nmOPC optical proximity correction tool.



25U/42U Dual Cell-Based Blade System

On the software side, Mercury engineers adapted Mentor's core algorithms and optimized them for the Cell BE processors. "When we started, production hardware was still not available," Albertalli noted. "Mercury's experience in programming for the Cell processor and multi-core framework API helped shorten the development time for porting our simulation algorithms onto the Cell processor. Our algorithms mathematically replicate the photolithographic manufacturing process and reproduce simulated wafer-level image contours. We model the physics of the optic system and the physical chemistry of the resist system to predict images on the wafer."

"Our software performs multiple simulations of billions of mask shapes to create a corrected mask layer that will produce acceptable image fidelity on silicon," Albertalli explained. "Mercury's support for hardware acceleration for our software has dramatically reduced the cost of the hardware and software we need to process leading-edge IC designs. We can now reduce hardware and software costs by 3x compared to conventional computing hardware alone. In addition to direct cost savings on hardware and software, we have also reduced the power and cooling costs attributable to the massive compute farms that would otherwise be needed. Power savings from using the Cell co-processor for acceleration can easily offset the cost of the acceleration hardware. With the Cell processor, we use far fewer processors, saving our customers time and money."

The combination of the Mercury Dual Cell-Based Blade System and MultiCore Plus™ optimized software accelerates fundamental simulation tasks – which comprise 70-90 percent of the computational burden – by as much as 30 to 60 times compared to conventional hardware. "Mercury helped us solve an absolutely mission-critical challenge for our company in multiple dimensions," said Albertalli. "First, Mercury solved the crisis in turnaround time by rapidly enabling co-processor acceleration of our image-processing algorithms on the Cell processor. That speed-up also provides our customers with dramatic reductions in hardware, software, and operating costs. Finally, speeding up the simulation also enables us to implement new yield-enhancing functions that ensure image fidelity across multiple process conditions, providing additional value for our customers."

An Unprecedented Partnership

"This has been a uniformly outstanding partnership for Mentor Graphics," said Albertalli. "The quality and speed of Mercury's engineering deliverables were the key reason we were able to provide a next-generation software system with co-processor acceleration on the Cell BE platform. There's also been an excellent partnership with Mercury on the sales and marketing level as well. Our mutual customers will depend on Mercury for the Cell hardware and support. Coordination and cooperation with the Mercury business unit managers has been excellent. In my 35-year career in engineering management, Mercury has been one of the best vendors I've worked with. We intend to continue to take advantage of their engineering expertise in hardware acceleration over the long term to extend the leadership of our software solutions."

About Mentor Graphics

Mentor Graphics Corporation (Nasdaq: MENT) is a world leader in electronic hardware and software design solutions, providing products, consulting services and award-winning support for the world's most successful electronics and semiconductor companies. Established in 1981, the company reported revenues over the last 12 months of about $750 million and employs approximately 4,100 people worldwide. Corporate headquarters are located at 8005 S.W. Boeckman Road, Wilsonville, Oregon 97070-7777. World Wide Web site: http://www.mentor.com/.

About Mercury Computer Systems, Inc.

Mercury Computer Systems (www.mc.com) is the leading provider of computing systems and software for data-intensive applications that include image processing, signal processing, and visualization. We work closely with customers to architect comprehensive, purpose-built solutions that capture, process, and present data that have a meaningful impact on everyday life – from detecting aneurysms, designing safer, more fuel-efficient aircraft, identifying security threats, and discovering oil; to developing new drugs, and visualizing virtually every aspect of scientific investigation.

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