Computer Systems, Inc.
MERCURY

CUSTOMER REFERENCE STORY

Mercury Solution Provides TFLOPS of Processing to Weed Out Semiconductor Flaws

Four Times the Performance Levels of Previous Generation System at Almost Half the Cost

Situation: Powerful Real-Time Image Processing to Drive Inspection Systems

No matter what semiconductors are designed for – personal computers, cell phones, robotics, or gaming consoles – their power and complexity continues to follow Moore's Law by doubling every 18 months. To stay competitive, semiconductor manufacturers are driven to invest billions of dollars to constantly upgrade their production facilities and materials, leaving little financial margin for error.

The key metric for semiconductor manufacturers is yield, the number of quality chips produced in a manufacturing run. An entire industry has sprung up to provide testing and verification equipment to identify defects early, particularly in the pre-production phase, where prevention can save a manufacturer millions of dollars. A leading semiconductor test-equipment maker is collaborating with Mercury Computer Systems to provide the high-performance image processing technologies necessary to drive its acclaimed wafer and reticle defect detection solutions.

Critical Issue: Better, Faster Testing for Reticle Defects

Today's most advanced semiconductor manufacturers compress GFLOPs of processing power into microscopic spaces. Some manufacturing processes create circuits that are only 65 nanometers thick – mere molecules of thickness.

Manufacturers use reticles to make the chips. Semiconductor reticles are carefully etched glass panels through which light passes to print millions of circuits onto as many as 16 different layers of a single wafer. Not surprisingly, these incredibly precise reticles are very expensive to make, costing up to $2 million each. If one flaw in a reticle should slip through undetected, it could reproduce that error in millions of chips, creating a huge problem for the chip manufacturer.

To prevent this potential nightmare scenario, semiconductor test-equipment makers use lasers, sophisticated sensors, and powerful back-end computers to capture images and perform automated visual inspections of the reticles. The sensors review a reticle in tiny sections, capture massive volumes of data, and send the data to an image-processing computer that uses hundreds of algorithms to determine if the reticle has any flaws. A single reticle could have thousands of sections that must be reviewed.

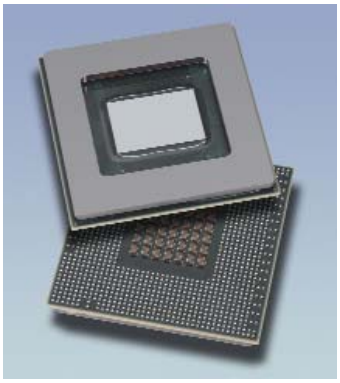
Reason: Staying Ahead of Moore's Law

Mercury's customer was facing a massive compute challenge relating to its reticle inspection systems. Previously, for this customer's largest version of its former generation of reticle inspection systems, Mercury had deployed hundreds of PowerPC® processors in a single system and distributed the data and processing tasks among them. The multicomputer compared the sensor data with a reference database representing valid circuitry and analyzed the results.

However, because chip capacities and processing power follow Moore's Law, the density and complexity of the new generation of reticles have created data volumes that outstrip the ability of the previous generation's inspection systems to perform valid comparisons in useful timeframes. For Mercury's customer, this massive compute challenge required four times the processing speed of its previous-generation system to verify the quality of the new Cell Broadband Engine™ (BE) processor, jointly developed by Sony, Toshiba, and IBM.

What Mercury Provided

To meet this challenge, Mercury designed an entirely new back-end image processing system for this customer's reticle inspection solution – one that actually uses Cell BE processors to test and validate reticles for producing future versions of the Cell BE processor. The customer appreciated Mercury's exceptional engineering expertise, outstanding software architecture, and unique skill in optimizing the hundreds of algorithms that are required to analyze the sensor data. But over and above these essential requirements, Mercury was able to make those algorithms run orders-of-magnitude faster.



Cell BE Processor

Capabilities of the Mercury Solution

Through years of experience, Mercury has assembled and refined an extensive Scientific Algorithm Library (SAL). Using these algorithms, along with the Mercury MultiCore Framework (MCF) software and Parallel Acceleration System (PAS™) middleware, Mercury engineers have allowed the semiconductor test-equipment maker to maximize the performance of its back-end image processing system.

Results

Optimized Architecture for Real-Time Image Processing

The resulting reticle testing system delivers teraFLOPS of real-time image processing and achieves four times the performance levels of the previous generation system at almost half the cost. The sophisticated test systems offered by Mercury's customer now enable semiconductor manufacturers to scan, capture, process, and display gigabytes of imaging data in real time.

Thanks to Mercury, these images of wafers and reticles can be evaluated and classified immediately to identify defects faster, improve manufacturing yields, and save semiconductor manufacturers millions of dollars.

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