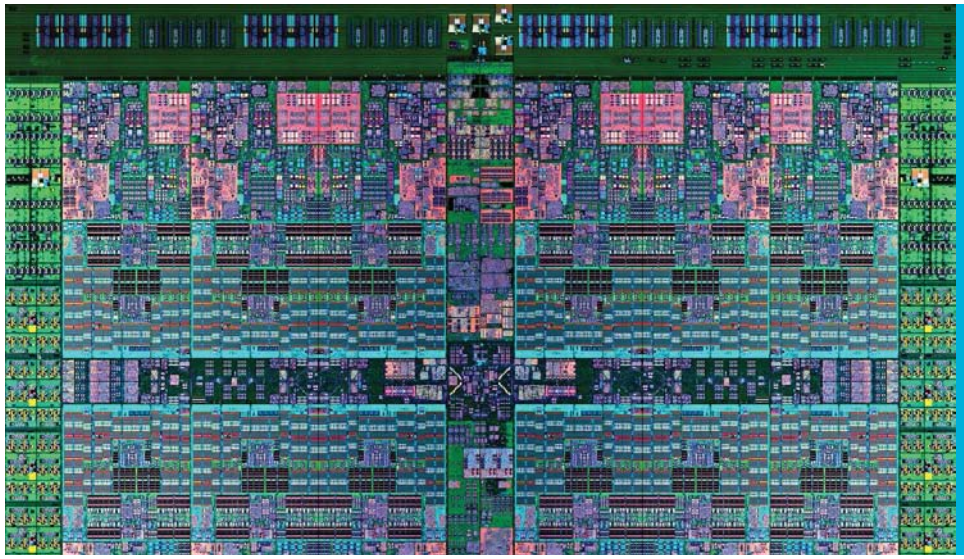

## Business challenge

To create advanced IBM POWER processors, IBM EDA virtually tests designs to find and fix bugs before fabrication. How could it test complex chips more rigorously without adding compute resources?

## Transformation

IT resource constraints limited the volume and intensity of pre-fabrication testing at IBM EDA. Today, with an IBM Spectrum LSF solution that enables more detailed tests to run faster on the same infrastructure, the company can detect issues sooner, helping it meet tight deadlines for designing increasingly complex processors.

Leon Stok
Vice President, IBM EDA

## Business benefits

**Saved**

millions of dollars by finding and fixing bugs prior to fabrication stage

**10%**

higher utilization enables more thorough testing without extra IT investment

**10x**

faster scheduling saves staff time and cuts time-to-market

# IBM EDA

## Accelerating time-to-market and trimming millions of dollars from chip design costs

IBM Systems designs state-of-the-art IBM® POWER® processors for use in IBM Power Systems™ and IBM z Systems™ servers. The latest IBM POWER8® processors, fabricated on a 22nm process, offer unprecedented performance for enterprises as they tackle the challenges of the waitless world.

***"IBM Spectrum LSF handles the scheduling intelligently, boosting overall performance and utilization."***

—Michael Kazda, Senior Software Engineer, IBM EDA

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## Hotbed of innovation

When it comes to advanced technology, time-to-market is a critical factor. Processor manufacturers are under immense pressure to deliver new generations of chips that offer faster processing and greater reliability with higher efficiency, which means that each new generation is more complex, and has more (and smaller) components, with four times the number of internal connections.

To keep the IBM POWER family at the forefront of the market for enterprise computing, while maintaining control over costs, IBM EDA wanted to boost the efficiency and effectiveness of its design and testing processes.

Leon Stok, Vice President of IBM EDA, explains: "We run more than 100 IBM and third-party tools to enable our inventors and designers to design, test and refine their designs virtually. The goal is to refine our designs and fix as many bugs as we can before our designs reach the physical prototyping and fabrication stages with our manufacturing partners—where it is much more costly to address flaws. In short, the more comprehensive and reliable we can make our tests during the design phase, the faster and more cost-effectively we can bring powerful new chips to market with our partners."

As design complexity rises with each new chip generation—for example, the POWER8 processor features more than four billion transistors across 12 cores each with eight hardware threads—IBM EDA must perform more tests in increasing detail. At the same time, it is constrained by modest annual increases in the compute power available for testing, so the organization is constantly seeking new efficiencies in its use of the existing infrastructure.

Michael Kazda
Senior Software Engineer, IBM EDA

The internal cloud on which IBM EDA runs its chip design and testing jobs spans more than 40,000 processors across seven sites, and handles more than 150 million grid jobs annually, generating hundreds of terabytes of data. These jobs vary enormously in terms of size, urgency and resource consumption. IBM EDA also uses the grid to refine the testing software itself, based on the output from home-grown analysis tools that monitor resource usage while design and testing jobs are running.

Michael Kazda, Senior Software Engineer at IBM EDA, says: "Jobs were taking a long time to start, and to avoid missing their deadlines, designers and developers often overbooked IT resources. This caused underutilization of our infrastructure and sparked a hike in waiting times for other teams. With design complexity always rising, we needed a better way to schedule and monitor jobs, so that we could maximize overall performance on our existing compute grid."

## Driving efficient resource consumption

IBM EDA deployed IBM Spectrum LSF workload management software to optimize job scheduling, and IBM Spectrum LSF RTM operational dashboard software to monitor resource usage in real time for each job.

"We had considered building a load-level scheduling solution in-house, but saw that IBM Spectrum LSF did a far superior job of managing all the different classes of computations and prioritizations," recalls Kazda. "Critically, we were able to migrate to the new solution seamlessly and incrementally while in full production—avoiding disruption to the business. We handled each migration on a site-by-site basis with no interruption to existing processing jobs, and we enabled users to choose when they switched from the old solution to the new one; everything ran really smoothly as a result."

He continues: "IBM Spectrum LSF handles the scheduling intelligently, boosting overall performance and utilization, while IBM Spectrum LSF RTM offers us a macro-level view into the lifetime of our tools and flows memory, runtime, process and thread counts, enabling us to triage any pain points and optimize software integration."

IBM EDA also launched a virtual desktop offering, which offers employees a persistent, user-friendly environment running on the compute grid. Team members based in different locations can share desktops to collaborate more effectively—an extremely useful feature given that chip engineers in India, Germany and the United States often work on the same projects. Staff logging in from any machine (and running any operating system with a standard web browser) can access their remote virtual desktop, either running jobs directly on it or using it to command a larger set of virtual resources on the grid.

## Multi-million dollar savings

Using IBM Spectrum LSF to schedule jobs enables IBM EDA to greater performance and complete more work using the same compute resources as before.

"Small but important or urgent jobs are no longer sidelined by larger jobs that occupy more resources on the grid," explains Stok. "Additionally, we can assign higher priorities to urgent tasks, for example if we have a deadline approaching. Now that computations are organized efficiently to maximize utilization of the available resources, average run-times are lower and resources are shared more effectively. Utilization has risen up by ten percent, and scheduling runs are completed ten percent faster than with our previous solution. Team members now wait seconds rather than minutes for their computations to start, cutting the time they spend waiting for results and enabling them to work more productively."

***"The technologies deployed from IBM Spectrum Computing play a pivotal role in enabling us to perform more rigorous design and testing within the constraints of our existing resources."***

By maximizing utilization and cutting the time to complete compute jobs, the new IBM Spectrum LSF solution enables chip designers at IBM EDA to complete more tests within the same deadlines and on the same compute resources as before. This helps ensure that—in spite of the massive increase in the size and sophistication of the POWER8 processor versus previous generations—processors can be released to the market faster than before and with fewer costly errors needing to be resolved post "tape-out" (that is, after the chip is sent to IBM's manufacturing partner for fabrication).

Prior to tape-out, IBM EDA secured the use of the IBM Hydra Cloud—a 36,000-core supercomputer based on IBM POWER7® processors—to augment its testing capacity during the verification simulation stages. This effectively enabled the team to simulate an entire functioning POWER 8 processor in software.

"Performing highly detailed testing enables us spot hardware bugs of a type that show up extremely rarely during normal operations," comments Stok. "Using the Hydra Cloud, we spotted 70 hardware bugs and 12 millicode bugs during virtual testing. Some of these bugs only showed up once during our virtual tests, which means they would previously have gone unnoticed until the fabrication stage, after which each fault might have cost several million dollars to fix. Being able to avoid costly mistakes contributes to our competitiveness in the market and helps ensure that IBM can deliver reliable products on schedule to enterprise clients."

Software tool developers at IBM EDA are using IBM Spectrum LSF RTM to examine the resource consumption of their testing software in real time, identifying and removing bottlenecks. Their efforts help to cut computation runtimes and boost efficiency further, enabling designers to run more tests on the same infrastructure and within the same timeframes.

"The technologies deployed from IBM Spectrum Computing play a pivotal role in enabling us to perform more rigorous design and testing within the constraints of our existing resources," concludes Stok. "This in turn helps us continue to bring powerful, enterprise-class processors to market rapidly and cost-effectively—even as complexity skyrockets."

## Solution components

- IBM® Power® 775
- IBM Spectrum LSF
- IBM Spectrum LSF RTM

### Connect with us

### Take the next step

To learn more about IBM Spectrum Computing, please contact your IBM representative or IBM Business Partner, or visit the following website: **ibm.com**/systems/spectrum-computing



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