Case Study

Neal Tisdale, vice president of software development at NewEnergy, gets the results of complex simulations in minutes, not hours, thanks to Sun Fire servers with AMD Opteron™ processors.

TOMMY CROW

NewEnergy Powers Up with Sun Servers

NEW ENERGY ASSOCIATES BUILDS A GRID COMPUTING PLATFORM WITH SUN FIRE SERVERS RUNNING AMD OPTERON™ PROCESSORS.

By David Morrison

In late 2002, Neal Tisdale and his colleagues at NewEnergy Associates, a wholly owned subsidiary of Siemens Westinghouse Power that provides software and consulting services to energy companies, gathered around a white board in their Atlanta headquarters. They were plotting out the kind of computing power their customers would need for the sophisticated mathematical modeling that would become more routine in the coming years.

When they totaled up the numbers for the types of calculations most customers should already be doing on their current technology platforms, the results were shocking. "We calculated that it would take 72 days [to run these calculations], and that was not acceptable," recalls Tisdale, vice president of software development for the 30-year-old company.

A HISTORY OF GROWTH

NewEnergy Associates was founded in Atlanta in 1975 by two utility industry experts. The company, which was then called Energy Management Associates, released its first product, PROMOD production costing software, the same year.

Over the next decade and a half, as federal and state regulators put more pressure on utilities to project their costs more accurately—especially when justifying the rates their customers were asked to pay—the company's client base expanded rapidly.

In 1992, Electronic Data Systems acquired the company and built it into a strategic business unit to address utility industry needs with an electric, natural gas and financial planning practice. Five years later, the Planning Solutions and Power Systems Operations groups of EDS Utilities spun off to become an independent company, New Energy Associates LLC. The company continued to expand its offerings, adding products that would help utility companies manage business operations and that would assist the retail and commercial sectors of the blossoming deregulated natural gas industry.

In 2002, in response to an increase in demand for information technology solutions in the worldwide energy industry, Siemens Westinghouse Power acquired NewEnergy Associates. Operating as part of Siemens Power IT Solutions, the company provides energy IT and consulting for decision support and energy operations to decision-makers at all levels of electric and gas companies. Its products and consulting services assist more than 250 customers in about 500 locations around the globe with strategic and financial planning, fleet management, energy trading, risk management and retail/wholesale energy market operations.

PROMOD IV, the offspring of the first software product, remains the flagship of the NewEnergy strategy and planning offerings. Customers rely on it for risk management, profitability assessment and cost controls.

NewEnergy's recently introduced VectorGas product provides a detailed evaluation of a supplier's entire supply portfolio and determines how that portfolio will perform in today's volatile natural gas market, given an array of potential weather and price conditions. Monaco, the company's energy trading and risk management solution, accommodates the consolidation of the global energy industry by providing real-time information about an entire operation—from deals on the commodities trading floor to signing up homeowners as customers.

Existing affordable systems would not accommodate such extensive calculations. Nor would the users of the company's decision support systems tolerate weeks-long delays in getting the information required to support day-to-day decision-making in the global electricity, natural gas and energy markets.

What emerged from that low-tech simulation exercise was NewEnergy's very high-tech approach to solving the problem: Create a computing grid that would pool available central processing unit (CPU) cycles from dozens of high-performance servers, "borrow" data from a variety of software sources, create data cubes of enormous sizes, crunch the numbers and put information back in its proper place—all in a short enough time span to support business decisions.

Choosing the Cornerstone

In 2005, NewEnergy selected as the cornerstone of its computing grid Sun Microsystems' Sun Fire V20z and Sun Fire V40z rack-mounted servers using AMD Opteron™ processors, the industry's first x86 Dual-Core processor that is both 32- and 64-bit capable. "Calculations that previously were taking 50 minutes to two hours," Tisdale says, "are now down to the sub-minute [seconds]."

That's good news for NewEnergy's internal operations and its consulting services, because as Tisdale puts it, "we eat our own dog food" by running NewEnergy software to solve customer problems. But it's even better news for the company's customers who buy and install the software in their own environments.

Understandably, they could be reluctant to shell out hundreds of thousands of dollars for software that will not run efficiently on their existing computer systems.

"I have a real problem telling customers that they need to spend $200,000 for a machine [to run NewEnergy software]," Tisdale says, "but I have no problem telling them to

buy the AMD Opteron processor-powered Sun Fire boxes. I was absolutely floored by the cost. Now the Sun Fire servers are all I'm recommending."

The AMD Opteron processor with Direct Connect Architecture is available in single-core and Dual-Core models. Both are the same physical size and require the same amount of power to run efficiently. A four-processor server, like the Sun Fire V40z, can effectively be converted into an eight-way server by replacing single-core AMD Opteron processors with the Dual-Core AMD Opteron processor. And, because of the way the Sun Fire server was built to allow easy front-panel access, customers don't have to tear up their data center to make such an upgrade.

Cool Performance

Tisdale says that before acquiring the Sun Fire servers, he'd learned enough about the AMD Opteron processor and Sun server engineering that he wasn't surprised by the outstanding performance the servers provided. He thought his biggest problem would be finding enough real estate to accommodate servers that were powerful

KEEPING IT COOL

NewEnergy Associates serves the industry that helps heat our homes, but it doesn't want to turn its data center into a generating plant.

That's why the company finds Sun Fire servers powered by the AMD Opteron™ processor such an attractive option for its computing grid, which runs software for constructing massive mathematical simulations for electric and natural gas utilities. "They run faster and deliver higher performance than the equivalent [competitive] machine, but they consume less power and generate less heat," says Graham Lovell, senior director of x64 servers for Sun Microsystems' Network Systems Group.

The "heat envelope" is a big consideration in today's data centers—especially those like NewEnergy's, which build computing grids using networks of rack-mounted servers with multiple and multi-core CPUs. With previous servers, NewEnergy noticed an appreciable increase in computer-generated heat in the data center and a commensurate increase in cooling costs.

When it started using the AMD Opteron processor-powered Sun Fire servers, however, the company was able to turn down the air-conditioning. In addition to the cooler-running AMD Opteron processors, the boxes themselves are built to stay cool and reduce energy consumption.

"The most unreliable system on a server is the cooling system," Lovell says. And those tiny fans are essential in keeping the server running. The Sun Fire servers have enough redundancy that, if one fan breaks, the others speed up to keep cool air flowing through the system. And the failure triggers a software alert to tell the network manager that there's a broken fan that has to be replaced. The replacement is easy: Pop the top, take out the old one and put in a new one—while the server is still running.

While other 64-bit processors stoke up the heat, especially when running compute-intensive calculations, the AMD Opteron processor runs cooler. Even the Dual-Core versions generate the same low heat levels as the single-core version.

"We saw less heat," confirms Neal Tisdale, NewEnergy's vice president of software development. And that translates into lower operating costs.

Such savings can add up, says Sun's Lovell. An organization running Sun Fire servers configured with 1,000 AMD Opteron processors, he says, will shell out about $200,000 a year less in electrical power costs than an organization running 1,000 of the competitor's CPU-based servers.

"These Sun Fire servers provide an organization with tremendous savings on space, performance, power costs and heat," Lovell says.

enough to deploy in the grid computing schema. However, after planning began, Tisdale and his team quickly realized that "heat would be the boundary consideration."

NewEnergy runs about 50 servers in its data center. (See "IT Blueprint" on page 24.) About half of them are used to run the two grids the organization has deployed. "Each of the CPUs is like a little blow dryer," Tisdale says. "They generate enormous amounts of heat."

In contrast, the Sun Fire systems are surprisingly cool. In a single rack, for example, NewEnergy can install up to 32 of the 1.69-inch-high Sun Fire V20z units with the Dual-Core AMD Opteron processor and up to 16 of the 5.3-inch-high Sun Fire V40z boxes with four single-core or Dual-Core AMD Opteron processors.

Each server requires considerably less power to run than other servers and, even at full tilt, generates considerably less heat. That will reduce the company's energy bills over the long term.

Sun estimates that a typical data center with Sun Fire servers configured with 1,000 AMD Opteron processors will save about $200,000 annually on power consumption and cooling costs. NewEnergy anticipates significant savings in its environment once it replaces other servers with the Sun Fire machines with AMD Opteron processors.

And NewEnergy is all about saving on energy bills.

Staying Ahead

Based on the nature of its business, NewEnergy must stay ahead of its customers—determining what customers' computing needs will be five and 10 years into the future. Indeed, as Tisdale explains, many customers still rely heavily on Microsoft® Windows®.

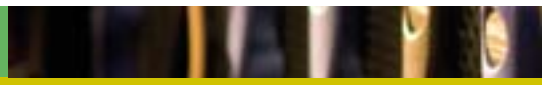
"But we are also pulled into Linux because many of our customers are Oracle users, and [the Windows platform] can't support the amounts of data generated by a large Oracle application," he says.

In addition, some NewEnergy customers are going beyond Linux to other open systems solutions, Tisdale notes, relying on less-costly technology like MySQL. NewEnergy itself, already a believer in Sun's Java software development technology, plans to move many of its products to Sun's Solaris 10 operating system.

"We're not just going to free and open [systems], but to agnostic ones as well," Tisdale says. "We're not there yet, but that's our next step."

Sun Fire servers powered by the AMD Opteron processor enable NewEnergy to do exactly that. Not only will one server run Windows, Linux and Solaris, but it will also run any other operating system the company wants to install. Likewise, the true 64-bit technology will also run 32-bit applications as if they were native—

A PERFECT FIT



It's not surprising that the enterprises with the greatest computational needs want the fastest, latest, greatest computers. It's because they simply have to have them. "They'll buy the newest computer with the fastest performance, and six to nine months later when something faster comes along, they'll want to change the old one for the new," says Graham Lovell, senior director of x64 servers in Sun Microsystems' Network Systems Group.

With the forward and backward compatibility that is offered by the AMD Opteron™ processor-based Sun Fire servers, these demanding users don't have to completely replace their machines. Instead, they can keep their "ancient" six-month-old servers and replace components that will make the machines perform faster and better.

For example, those who buy single-core processor configurations of the Sun Fire server can easily switch the processors out for newer, faster Dual-Core processors. It uses the same socket, but has more than twice the computation power. And, if a still-faster chip comes along in the future, these power uses can take out the old chips and put in the new ones.

Although some cynical observers of the technology industry might say that the model for hardware manufacturers has been to ensure that customers have to buy all new systems to take advantage of improved features and functionality, AMD and Sun are breaking the mold.

The philosophy of the AMD Opteron processor is that each new generation still has a relationship with its ancestors and doesn't abruptly branch off to create a whole new race. As a result of that adherence to a well-established standard, the AMD Opteron processor's Direct Connect Architecture incorporates ways to make it better: Memory can be addressed directly from the processor, instead of through a single bottleneck.

Lovell says, "The way the AMD Opteron processor is architected, directly connecting to the memory and the I/O system, you're able to have a much higher bandwidth and throughput." The Sun Fire V40z four-processor server out-performed comparable servers by 76 percent in a SPECweb99_SSL benchmark test, Sun reports.

"Most software in use today has been written as 32-bit applications," he explains. "Other 64-

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only faster, Tisdale points out.

The AMD Opteron processor's Direct Connect Architecture provides a very significant performance boost. Memory is directly connected to the CPU, optimizing access; input/output (I/O) is directly connected to the CPU for more balanced throughput and I/O; and CPUs are connected directly to CPUs, allowing for more linear symmetrical multiprocessing (SMP).

"By eliminating all the bottlenecks that usually slow things down, you're getting close to two or three times the performance that you get with other processors," Tisdale says.

That's particularly important for NewEnergy applications. Many of the quantitative analytical features use Monte Carlo mathematical modeling for financial and demand simulations—an essential tool for today's global energy industry.

The Monte Carlo technique for simulations came into its own during the World War II research leading to the development of the atomic bomb. There were so many variables—and the potential for unknown reactions—that scientists had no way of predicting with any degree of confidence what might happen. But they had to try nonetheless. The Monte Carlo modeling method, developed by mathematicians at the Los Alamos National Laboratory, ironically takes its name from the home of casinos in which patrons can get costly lessons in the vicissitudes of probability.

After the war, as computers became more powerful, the Monte Carlo method found its way into other arenas that required the construction of models

bit processors require those 32-bit applications to run in emulation mode, and the result is that they would run slower on 64-bit machines than on 32-bit processors. The AMD Opteron processor does not require emulation for 32-bit applications. The 32-bit applications run natively and, as a result, they can take advantage of some of the other performance enhancements on the processor and actually run faster."

The 64-bit processor is critical in running large Oracle-type applications. Memory addressing must scale to much larger data sets. NewEnergy's vice president of software development, Neal Tisdale, says his company's mathematical modeling applications routinely create "massive data cubes" of 10 gigabytes to 16 GB.

"It's like you're taking a mainframe batch analysis operation that used to churn away for hours and turning it into a real-time operation," he says. "That puts a high performance requirement on your CPU."

All the existing and upcoming 64-bit applications, Lovell says, also will require high performance from peripherals, such as high-speed mass storage devices, faster backup and data redundancy operations—all of which can also create significant bottlenecks if I/O devices feed through a single point. But the AMD Opteron processor architecture in the Sun Fire servers wires I/O directly to the processor, eliminating bottlenecks and improving throughput.

The key to it all, says Roger Wheatly, an AMD business development executive, is that there's no degradation of performance, no matter what the computing task. He adds that the AMD Opteron processor was built to ensure high availability of system resources, and says the Sun Fire servers were built on the same high-availability principle, down to every detail, including redundant fans, redundant power supplies, and even dual-power cords so the server can be plugged simultaneously into both regular and back-up power sources.

"The kind of performance NewEnergy reports from its Sun Fire servers is exactly what we're trying to achieve with the AMD Opteron processor," Wheatly points out. "NewEnergy proves that it is a perfect fit for high-computational grid technology."

dependent on both known and unknown variables, including global finance and energy exploration and consumption.

It would be relatively easy to construct a model to predict the financial impact on an electricity-generating company if, for example, one of its two nuclear reactors had to shut down for unexpected repairs, forcing the company to increase production at a plant that depended on other sources of fuel, and if that shutdown occurred at the same time global oil prices increased to $100 a barrel. But such predictions become much more difficult when you're trying to build a model that addresses thousands of such scenarios simultaneously and also factors in contingencies for horrific events like Sept. 11.

Creating Elaborate Models

NewEnergy's customers can't do the 5,000-point models they need for day-to-day business with "if … then" mathematical scenarios done on a Microsoft Excel spreadsheet. They need elaborate models. A NewEnergy model, for example, simulates the entire U.S. power grid to determine how electricity would be rerouted under certain conditions, plugs in historical data about consumption at certain times of the year, inserts lots of "What if" weather scenarios and even tries to incorporate unthinkable events—all weighted by degrees of probability.

That kind of modeling is critical because it enables the utility company to predict energy demand among its customers in order to ensure that it can supply the power and avoid making expensive last-minute purchases during unexpected periods of peak demand and reduced supply.

Modeling is also important in the rate-making process. State and federal regulators who decide how much power companies can charge must balance a desire to ensure that consumers and businesses pay fair rates with the need to keep the public utility company earning enough to stay in business.

Although the models never catch all contingencies with exact certainty, Tisdale says they do catch enough "outlying effects that are rare but will have some effect."

Tisdale says NewEnergy is so pleased with the addition of the Sun Fire servers with the AMD Opteron processor to its computing grid that it plans to replace some existing servers with AMD Opteron processor-based Sun Fire servers in the future. AMD

A WINNING COMBINATION

Sun Microsystems and AMD formalized their technology-sharing and joint marketing relationship with a public announcement in November 2003. From Sun's perspective, the relationship is a success because AMD has constantly delivered on its promise to provide reasonably priced, high-performance 64-bit processors with maximum flexibility.

From AMD's point of view, Sun is delivering servers that showcase the capabilities of the AMD Opteron™ processor in any computing environment. And from the perspective of companies like NewEnergy Associates, that's a winning combination because it enables them to serve their customers more effectively.

NewEnergy plunged with vigor into grid computing more than two years ago and, as a result, the company may have gained a two- or three-year edge on its competitors, says Neal Tisdale, vice president of software development. But that edge won't last—and it won't be easy to maintain—if the systems don't provide the company with the flexibility to adapt to the ever-changing needs of the energy industry. And that includes the ability to serve customers that are operating multiple platforms or migrating from one platform to another. It also includes the ability to add computing power when and where it's needed, easily and inexpensively.

Roger Wheatly, an AMD business development executive, says Sun Fire Servers with the AMD Opteron processor provide flexibility that will accommodate almost any organization's needs as it prepares to migrate to a 64-bit environment. The enterprise can enjoy much-improved performance on existing 32-bit systems now and won't have to make massive investments in new hardware when it makes the transition to 64-bit systems.

As enterprises grow or evolve, they often have to add computing capacity quickly—sometimes to accommodate multiple operating systems. "We have many, many customers now who are running Windows® platforms," Tisdale says, "but they know that they'll be moving to Linux eventually. With the Sun Fire server, they're hedged."

Sun Fire servers with the AMD Opteron processor can run Microsoft® Windows in native 32-bit mode with desktop applications, 64-bit Oracle applications on Linux, VMWare on Linux for emulation to accommodate Windows applications or high-level scientific number-crunching applications on Sun Solaris 10. Companies like NewEnergy see a great advantage in the ability to run multiple operating systems. They can keep what they already have and migrate applications to different platforms as needed.