

DELL TAKES HOLISTIC APPROACH TO ADDRESS **DATA CENTER POWER AND COOLING ISSUES**

COMPANIES ARE FINDING THAT THEY NEED higher-performance servers to meet increasing demands of new applications. At the same time, server consolidation and the move from stand alone servers to rack-mounted and blade servers is concentrating systems into smaller spaces.

These trends are driving up electricity usage in data centers--to a point of exasperation for many IT managers and corporate executives. Specifically, the power required to run servers has increased on average from 1 kilowatt (kW) per rack in 2000 to 6.8 kW per rack in 2006, according to IDC. The amount of electricity needed to power cooling systems for these servers has shot up in a similar fashion.

As a result, companies are finding that the amount they pay for electricity is skyrocketing. In a July 2006 CIO Insight magazine

Yahoo! location choice noted that electricity in that region cost about half the national average.

Most companies don't have the luxury of moving their data centers to places where electricity is cheaper. Instead, they are trying to find ways to cut their electricity costs.

Accomplishing this requires a strategic approach to dealing with power issues.

CONSEQUENCES OF STAYING THE COURSE

If companies continue to install ever more powerful servers into their equipment racks without making changes, problems can arise.

First, costs are spiraling out of control. A November 2005 Wall Street Journal article about the growing power requirements of today's data centers noted that some medium-sized companies had

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article, Adam Braunstein, a senior research analyst at the Robert Frances Group, noted that up to 40 percent of the operating costs of a building that houses a data center could be power and cooling-related expenses.

Such costs have led Microsoft and Yahoo! to build new server farm data centers in Washington State's Grant County, because of the abundance of relatively cheap hydro-electric power there. A 2006 National Public Radio story discussing the Microsoft and

experienced a seven-fold increase in power requirements from 1998 to 2005. And over that time, the electrical costs to run those data centers had grown from \$10,000 per month to \$40,000 per month. Some larger companies are paying hundreds of thousands of dollars per month for electricity to operate their data centers.

If nothing is changed, the power consumption per system is going to rise, thus increasing the costs for electricity. The consequences of this consumption growth were quantified last year



by Google engineer Luiz André Barroso. In an article in the Association for Computing Machinery's Queue magazine, Barroso noted that if server power consumption grew from 2005 levels by 20 percent per year, the electricity to run a server over its four-year lifetime would exceed the cost of the server.

Second, heating and associated cooling become more serious issues. In general, higher-performance processors consume more electricity. Most of this electricity is converted to heat. As systems are packed closer together

in racks or a blade chassis, equipment fans and forced cold air from floor vents have a harder time removing the heat.

As heat builds up, equipment temperature rises. This leads to increased equipment failure. In fact, the failure rate doubles for every rise of 18 degrees Fahrenheit, according to studies done by the high-performance computing researchers at Los Alamos National Laboratory. This increased failure rate due to heating has also been noted by the Uptime Institute, a group that focuses on improving uptime management in data center facilities.

Standard Performance Evaluation Corp. to develop benchmarks for measuring energy efficiency (see sidebar: New Benchmarks on the Way).

Another problem is that companies have simply not bothered looking at the energy consumption of servers. Last year, 59 percent of the IT managers surveyed by AF-COM, a data center managers' association, said their biggest worry is that computer equipment is purchased without concern for power and cooling.

This behavior obviously must change, given the growing attention being focused on controlling energy costs. Companies now must take energy efficiency into account just as they would server performance, memory, and storage capacity.

Once equipment is purchased and installed, it needs to be monitored constantly. This is also an area where current IT departments are falling behind. A 2006 CIO Insight magazine survey of 195 companies found that only 28 percent measure the energy consumption of their servers at least once per year. Again, this behavior must change.

Additionally companies now need to look at issues like air flow through equipment and racks and spot heat removal. The key is to not look at all of these issues as individual factors, but to adopt a holistic approach to energy efficiency in the data center.

THE DELL VALUE PROPOSITION

This holistic approach to energy efficiency and reduced power consumption must include standards-based technologies that create end-to-end solutions spanning from the desktop to the data center.

NEW BENCHMARKS ON THE WAY

To run data centers as efficiently as possible, companies today are constantly trying to balance server performance with energy consumption. The only problem is that there is no reliable guide to help make energy-wise server purchasing decisions.

To address this issue, Dell, AMD, Intel, and several other manufacturers have joined with the non-profit Standard Performance Evaluation Corp. (SPEC) to develop a benchmark for measuring energy efficiency.

The group is using input from IT managers and a variety of industry and government organizations, such as the EPA's Energy Star Program, to develop useful power-performance benchmarks.

Once completed in 2007, the SPECpower benchmark will give businesses a neutral way to compare the energy efficiency of various vendors and server products. For more information, visit SPEC's web site at www.spec.org/specpower.

NEW THINKING REQUIRED

To deal with growing power and cooling issues, companies must change their approach to data center layout and management.

To start, these issues must be taken into account even before equipment is purchased. Similar to the way one might compare cars based on the EPA's mile-per-gallon fuel economy ratings, companies must compare server power consumption before making a purchase.

However, there are two problems here. There is no equivalent to the EPA's MPG rating for servers, because power consumption depends on performance. Run a server for maximum performance, consumption is high; run a server to be energy-efficient, performance is lower.

But efforts in this area are starting to pick up. The EPA has developed a Server Energy Measurement Protocol that is designed to provide a standard reference for measuring power requirements for servers at different load levels. Companies can use these measurements to evaluate existing systems.

Dell is addressing this problem by working with industry groups such as the Stan-





The servers, announced in December, add to Dell's line of energy-efficient products such as the company's Energy Smart OptiPlex desktop computers, which were announced in September (see sidebar: The energy efficiency of Dell desktop systems).

Energy efficiency is a fundamental design criterion for all Dell PowerEdge servers. With the introduction of Energy Smart servers, Dell is introducing the next step towards reducing server power requirements and the resulting system heat. The

THE ENERGY EFFICIENCY OF DELL DESKTOP SYSTEMS

In September, Dell introduced its new line of OptiPlex Energy Smart Desktop systems. The default OptiPlex Energy Smart configuration offers companies up to \$53 per system power savings annually, according to Dell. If companies want to save more, they can select the most energy-efficient CPU and a flat-panel monitor for an annual power savings of \$69 per system.

At the time of the announcement, Dell noted that if every system shipped to Dell customers in 2005 touted the power efficiency of the OptiPlex, customers worldwide would have realized about \$1 billion in power savings.



Working with customers, Dell helps businesses achieve energy efficiency through the combination of the most relevant energy-efficient technology, partnerships with best-in-class equipment vendors, and energy-optimizing professional services and tools.

Applying the same pragmatic approach that Dell has applied to other high-priority issues in the enterprise, Dell is leading the charge to drive awareness and understanding of energy efficiency in the market.

To that end, Dell is the only vendor focused on providing 100 percent standards-based technology solutions--from end-user PCs to the data center--designed to minimize impact on the environment at every stage of the product lifecycle, from design and manufacturing to recycling.

Dell says it is listening to its customers' input and delivering on an energy-efficiency commitment. Dell aims to lead the industry in environmental responsibility and usher in a new model of standards-based, end-to-end business computing that delivers unmatched

simplicity in customers' IT management strategies, enabling enterprises to centralize and control their data, increased productivity, and lower TCO throughout the operation.

DELL TECHNOLOGY AND SERVICES

The first step to controlling data center power consumption starts with the servers themselves. Dell's new Energy Smart servers offer a 26 percent improvement in performance per watt over the previous version of the same server models.

The Energy Smart servers feature Intel® Xeon® Low Voltage processors that draw only 40 watts of power, which is significantly less than the 65 to 80 watts drawn in a standard server. Energy Smart servers also include high efficiency power supplies and cooling fans, plus software that regulates the processors and memory to power the server up or down as needed. For example, a system can operate at maximum performance when a heavy workload needs to run; when the workload decreases, the software can throttle back for maximum energy efficiency.



new offerings provide additional gains in both power efficiency as well as performance per watt, helping companies maximize server resources.

Besides offering power-conserving servers and systems, Dell offers a num-

A GROUP EFFORT

To ensure customers are able to take advantage of existing energy-efficiency best practices and technology standards, Dell is working with a number industry groups and participating in several global initiatives. They include:

- **ASHRAE:** The American Society of Heating, Refrigeration, and Air-Conditioning Engineers, which advances the arts and sciences of heating, ventilation, air conditioning, and refrigeration to serve humanity and promote a sustainable world.
- **DMTF:** The Desktop Management Task Force's efforts with regard to energy efficiency are to ensure all energy-related and power-consumption components in a system are interoperable and can communicate with management systems.
- **Ecma International:** A group that fosters the development of international IT standards, which includes an effort focused on energy efficiency.
- **Green Grid:** An association of technology vendors chartered to lower the overall consumption of power in data centers around the globe. Its focus is on standards and frameworks to improve overall power efficiency between compute services, power delivery, and cooling systems.

ber of services to help businesses make their data centers more energy efficient. In particular, Dell offers Data Center Environmental Assessment Services that help companies make an existing facility more energy efficient or that can be used to incorporate energy efficiency into new data center acquisitions.

Specifically, the Data Center Environmental Assessment Services optimizes data centers and IT infrastructures. To do this, Dell professional consultants help companies assess and plan data center power and cooling requirements for new deployments.

As part of this service, companies are provided with comprehensive assessments and remediation plans for HVAC, cooling, and power delivery systems.

Another service, called the Data Center Capacity Planner, helps companies select the appropriate systems to meet their computing needs – again, with an eye towards energy efficiency. For example, today many servers run, on average, at 10 to 20 percent utilization rates. Rolling out a new application typically means adding a new server.

But companies are finding the costs for server hardware and software warranties, management and administration, and electricity can be reduced by consolidating individual applications onto fewer, higher-performance blade or rack-mounted servers.

The Data Center Capacity Planner service helps companies “right-size” rack deployments by taking advantage of the latest, high-density technological advancements.

PARTNERSHIP'S THE KEY

Keeping data center energy issues in check also requires control over complex interactions between many

disparate components. As such, the only way larger problems get solved is when vendors work together.

For this reason, Dell is leveraging its own work in energy efficiency by partnering with market-leading data center equipment vendors and design companies like APC, Emerson/Liebert, Rittal, Sanmina SCI, and EYP Mission Critical Facilities. Through these partnerships, Dell is working to address data center inefficiency end-to-end.

Another area of collaboration involves working with virtualization partners Microsoft and VMware. The emphasis here is on enabling customers to deploy virtualization, which significantly reduces the number of physical servers an organization needs. Again, companies can slash data center costs by consolidating to fewer, higher-performance servers running virtual environments. Virtualization strategies help reduce power consumption, reduce cooling requirements, and reduce data center square footage.

Additionally, vendors or businesses that want to validate or develop an energy-efficient solution can work with the Dell Energy Efficient Research Center in Austin. The center is a research facility that can simulate data center environments. At the lab, customers and vendors can try different HVAC, power delivery, and airflows on various server deployments and workloads to find the right solution for a customer.

END-TO-END ENERGY EFFICIENCY

Dell recognizes that energy efficiency is a growing issue for IT managers and is committed to leading the market in helping customers achieve greater levels of energy efficiency. Dell's approach addresses the issue end-to-end, from servers and storage to power distribution and cooling equipment. The result is a reduced TCO for data center operations. ■

