GREEN VIRTUALIZATION

CONTROLLING POWER AND COOLING COSTS IN THE DATA CENTER

The big picture is easy to see: It's the whole earth from space, stitched together from hundreds of satellite photographs by computer so that there's no cloud cover. There's no sign of human beings either and no national borders. Just blue, green, and brown, with white at the poles where there is ice.

BY ALAN DRUMMER

PHOTO COURTESY OF EARTHOBSERVATORY.NASA.GOV

The picture is not static:

Human beings are changing it every moment. Over the past 50 years, the evidence of a global warming trend is "unequivocal" concludes a February, 2007 report of a United Nations scientific panel. The release of carbon dioxide and other heat-trapping gases from smokestacks, tailpipes, and burning forests has played a central role in raising the average surface temperature of the earth by more than one degree Fahrenheit since 1900. Human activity, the report states, has "very likely" been the driving force.[1]

Evidence of this change is in the news almost every week: Weather patterns are more extreme; violent storms are more frequent. There is unusual flooding in some areas and extended drought in others.[1]

Slowly, the white, the green, and the portion of the blue that represents drinkable water are shrinking. The brown is growing.

A major contributor to global warming is humanity's thirst for electrical power. The U.S. alone consumes 26 percent of the world's electricity, according to Solar Energy International, and the U.S. Environmental Protection Agency reports that roughly 1.5 percent of total U.S. electricity, or about 60 billion kilowatt-hours in 2006, is consumed by data centers.[2] With a growing appetite for IT services and more powerful chips, this has doubled in the past five years, according to the EPA, and it's expected to almost double again in the next five years.

Existing technologies and strategies could reduce typical data center energy use by an estimated 25 percent, resulting in savings of over one billion dollars a year. And even greater energy savings are possible with advanced technologies. A number of companies are already achieving such savings and doing their bit to help slow the changes occurring in the global environment.

How much can be saved?

Evan Jafa, chief technology officer for The First American Corporation, based in Santa Ana, California, needs a large mainframe environment and 4,300 servers to support the company's mission. First American is the nation's largest provider of business information in areas such as title insurance and services, specialty insurance, and mortgage and property information.

Jafa and his IT team have set out to reduce data center power consumption at First American by 25 percent, based on virtualization and efficient data center design.

Just down the road in San Diego, QUALCOMM, a leading developer of wireless communications products and services, realized that its data centers were consuming one megawatt-hour a year and would require 4 megawatt-hours annually within two years. There just wasn't enough power available in the San Diego area to fill that need.

The company now requires only 2 megawatt-hours. "We've saved $4 million in power costs for the past two years and another $13 million in hardware, software, and labor cost avoidance from virtualization," says Matt Clark, IT director at QUALCOMM. "We were going to have to build another data center, for instance, and now we don't have to. On the conservative side, that alone saves us about $3 million."

Symantec Corporation, based up north in Sunnyvale, California with more than 17,000 employees, is using several strategies to achieve "an 18 to 20 percent power reduction within three years," says CIO David Thompson. Savings are projected to be in the tens of millions of dollars and payback time is 20 months.

David Thompson, CIO, Symantec Corporation

In Atlanta, Georgia, The Weather Channel CIO Brian Shields and his team are plotting a substantial power reduction. "We'd like to become the poster child of virtualization," he says.

So how are these companies going about saving power and cooling costs in the data center? Here are their top strategies:

Consolidate

When Symantec's Thompson joined the company he began a review of its global data center capacity. "We looked at every facility, from large data centers to small server rooms, and factored in maintenance and power costs—including the regional cost of power," he says. "We

MICHAEL BRUNETTO

Matt Clark (left), IT Director, and Paul Ferraro (right), Staff Manager, IT, QUALCOMM

looked at moving the facilities to where power was cheaper and from a renewable source, wherever possible. We ended up consolidating 13 computing centers to four, and 10,300 production servers to 6,000. The result is a seven percent reduction in overall power utilization, delivering savings in the low millions."

Virtualize

"Virtualization is our number one approach to saving power," notes First American's Jafa. "We plan 60 to 70 percent virtualization of our 4,300 servers. Already about 1,100 of them are virtualized. Once the servers are in a pool, we plan to dynamically monitor their usage, and down the line we'll be able to power them on or off depending on whether they have a load."

QUALCOMM reports success in consolidating as many as 10 to 18 physical servers on one physical host. "Virtualization is our key strategy," says Paul Ferraro, staff manager of IT. "Our main challenge is now political. You have to work with the project requestors who say 'I just want my CPU. I don't care about power savings.' You have to show those customers that virtualization does not result in performance degradation. It takes time."

The Weather Channel is moving into virtualization carefully. "We run many mission-critical processing systems, so we're evaluating and reviewing all the solutions as they develop," says Senthil Kumar, director of system and database administration. "We've taken 100 servers and reduced them to 20 virtual servers on a quad core machine. We just need to demonstrate that service levels will remain the same."

As a choice of virtualization solution, VMware seems to be getting the most use at these companies. Other choices, such as XenSource from Citrix and Microsoft's virtualization technologies in the upcoming "Longhorn" server release, are being closely monitored.

Push back on equipment demands

"Five or six years ago, if someone said they needed 30 servers for their new application, we bought them," says QUALCOMM's Clark. "Now we push back. We show them they can share development/test environments and don't need their own boxes. We carry a much bigger stick within IT to help reduce these costs. Much of that stems from QUALCOMM's commitment to the environment."

The Weather Channel's Shields agrees. "There's such low utilization in the development/test area. Internal teams launching the next small application will say it requires one or more separate boxes for development, QA, and production. Virtualization is a way to reclaim some territory."

Cool more efficiently

Gartner reports that 60 cents of every dollar spent for data center energy is used to cool equipment rather than power it.

Evan Jafa, CTO, The First American Corporation

First American and QUALCOMM each designed and built new data centers within the past few years with cooling and power efficiency in mind. Each data center has a floor recessed several feet to trap cool air. High ceilings allow hot air to escape. At QUALCOMM, cables are routed above the racks instead of being placed under the floor where the coolest air is.

"We don't have hot and cold aisles in our latest data center, which is about 12,000 square feet," explains QUALCOMM's Clark. "We use a direct vent strategy. We duct AC into the bottom of a rack and vent the heat out the top, taking it straight out of the building. This totally reduces costs. We'll see payback on the incremental cost of direct venting in about one and a half years."

First American has broken its data center down into zones, which it can monitor for temperature. "We can throttle cooling up and down as necessary in the different zones, adjusting to cool and hot spots as they occur to gain the most efficiency."

Symantec has been able to divide its main data center into three parts and, after its major server consolidation, needs to use only two of them. Cooling demands are minimized. "We

PHOTOS BY MICHAEL BRUNETTO

also gain by using adjustable tiles to direct cool air from computer room air conditioning (CRAC) units to wherever it's needed most, on demand," says Thompson.

Focus on your power provider

At First American, Jafa asked his team to reach out to power companies and get green certification for the company's two data centers. "Both power companies we deal with, in California and Texas, have suggested they're willing to talk to us about this, and they do have some plans for this type of certification. If we qualify, the cost per unit of power will decrease."

Symantec's Thompson asked his team to find locations where at least a third of data center power requirements could be filled from renewable energy sources. "Locations like this are hard to find," he says. "Some of our peer companies are already saturating these areas with data centers." (Microsoft, Yahoo, and Google are developing data centers near the inexpensive hydro power of Washington State's Columbia River, for example. Microsoft and Cisco are exploring putting data centers in Iceland where they can tap geothermal energy.)

Get granular in measuring power

Over the lifetime of a piece of hardware, it's likely to consume power that will cost more than its purchase price. But IT departments have tended to focus only on the hardware bill, and the power bill has gone to a facilities department.

Now, IT departments evaluate power consumption carefully. "We always test servers for how much power they use during an evaluation," says QUALCOMM's Ferraro. "The results are usually widely off from what the vendors tell us." The Weather Channel also runs its own power tests on servers. And power strips in First American's data center each have their own power meters.

De-duplicate your data

QUALCOMM works with Data Domain and NetApp de-duplication technologies. "We use them for Microsoft Exchange environments and some database environments," Ferraro explains. "We're getting about a 10- or 12-to-1 reduction, and in some cases have been able to reduce a 300 to 400 terabyte volume to the 10 terabyte range."

QUALCOMM is also using Veritas NetBackup PureDisk technology to reduce an 8 terabyte data store in remote offices to 2 terabytes, for a 4-to-1 reduction. "Because we can back up remotely and centrally with NetBackup PureDisk, and don't need to pay for or operate backup equipment in remote offices, that's an additional power savings," Ferraro says.

Symantec's Thompson reports that "initial indications are that Veritas NetBackup 6.5, with its de-duplication feature, will give us a 30 to 35 percent reduction in backup volume. We'll get much better utilization of our storage hardware, lowering power costs."

Numbers Tell a Story

ENERGY COSTS ARE RISING

50 cents: Cost of energy at a data center for every dollar spent on hardware

71 cents: Cost of energy in four years for every dollar spent on hardware

Source: IDC Technical Brief : Enabling Technologies for Power and Cooling, Jed Scaramella, September 2006

MORE THAN HALF OF ENERGY IS WASTED

60%: Portion of energy used to cool data center equipment instead of powering it

Source: Gartner Says Look Beyond Power Issue As Pressure Mounts for 'Greener' IT; 2006 press release.

NOT ENOUGH IS AVAILABLE

50%: Share of today's data centers likely to have insufficient power and cooling by the end of 2008

Source: Gartner Says 50 Percent of Data Centers Will Have Insufficient Power and Cooling Capacity by 2008; 2006 Press Release.

UNDERUTILIZATION IS EXPENSIVE

65% to 70%: Estimated power use by a server even when it has only 20 percent utilization

Source: Report to Congress on Server and Data Center Energy Efficiency [as per] Public Law 109-431, U.S. Environmental Protection Agency, ENERGY STAR Program, August 2, 2007

How Symantec Solutions Can Help

Symantec invites enterprises to request a free ROI analysis of the projected power and cooling-related savings that Symantec solutions can provide their data centers. Talk to your Symantec representative.

> **Veritas CommandCentral Storage** identifies wasted space across heterogeneous enterprise storage environments and helps improve utilization. It provides centralized visibility, control, and provisioning from a single console.

> **Veritas NetBackup 6.5** offers data protection for UNIX, Windows, Linux, and NetWare environments that includes data de-duplication and new support for snapshot capabilities and VMware environments, improving utilization.

> **Veritas Storage Foundation** provides online storage management across heterogeneous operating systems (Solaris, Linux, HP-UX, and AIX), enabling dynamic storage tiering to control costs and improve utilization.

> **Veritas Cluster Server** enables proactive management of application availability with clustering across multiple sites and platforms, including VMware, reducing hardware and administrative costs.

> **Symantec Enterprise Vault** provides a software-based intelligent archiving platform that stores, manages, and enables discovery of corporate data, while de-duplicating and compressing it and transparently migrating it to lower-tier storage, reducing storage costs.

Deploy thin clients

QUALCOMM is deploying 3,000 thin clients instead of desktops and forecasts second-year savings of $6 million from the project, much of which is savings in power. "Getting desktops off employee's desks is very important," Clark says. "Thin clients don't break for 10 years. And there's nothing spinning in them, so power consumption is low, and you get desktop performance."

Put pressure on hardware vendors

"We need to ensure that data centers don't start consuming 20 or 25 percent of the power in this country," First American's Jafa says. "We're looking to our technology partners for help in controlling the growth of power consumption."

Symantec's Thompson agrees. "CIOs as buyers of technology can have tremendous influence if we exert pressure on vendors to make products that use less power, and require fewer toxic chemicals during manufacturing," he says. "During the due diligence stage of a proposal, we ask vendors to give us a briefing on their green strategy and power optimization strategy. We can drive them to make products that help us better protect the environment."

Study LEED Certification

The U.S. Green Building Council has put forward Leadership in Energy and Environmental Design (LEED)[3] specifications, a nationally accepted benchmark for the design, construction, and operation of high-performance green buildings.

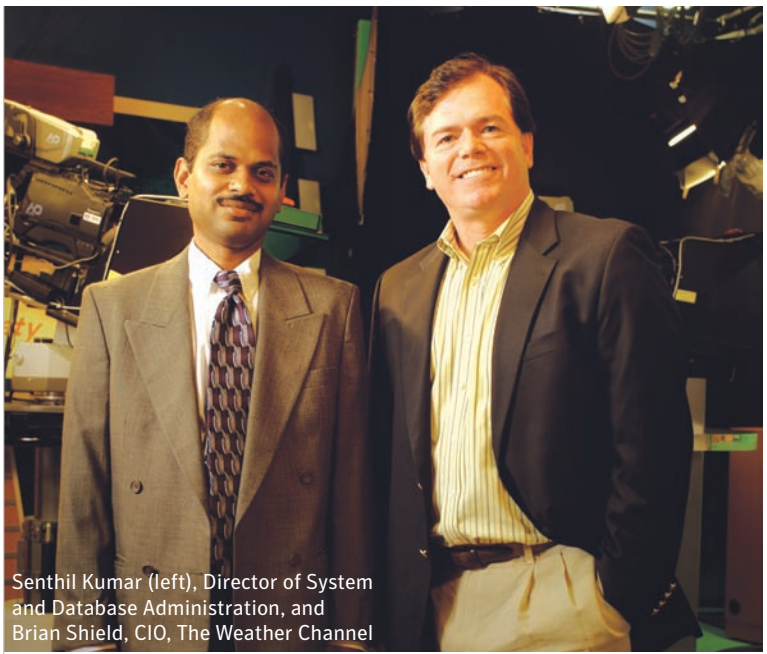
"We're building a 12,500 square foot technical center for HD production, and we're planning that it be LEED-certified," says The Weather Channel's Shields. "There's no LEED certification yet specifically for data centers, but anyone upgrading or building a data center will get a number of insights from LEED requirements on how to conserve water within the facility, prevent air contamination, use environmentally-friendly materials, and reduce lighting and energy demands."

Other Sources of Information

www.thegreengrid.org is home to The Green Grid, an industry consortium seeking to improve data center energy efficiency around the globe. Includes best practices and metrics for improving data center efficiency.

Green Data Center Storage is a Symantec whitepaper recommending proven ways to minimize the power, space, and cooling demands of storage. www.symantec.com/enterprise/stn/articles.

EPA Report on Server and Data Center Energy Efficiency includes not only the report itself, but also links to workshop materials as industry stakeholders brainstormed issues such as IT equipment efficiency, power and cooling infrastructure, facility operation and management, and voluntary measures.



Senthil Kumar (left), Director of System and Database Administration, and Brian Shield, CIO, The Weather Channel

Go solar

Symantec is studying how to put solar panels on the roof of its primary data center in Arizona in order to run the office portion on solar power. "Our data center is 100,000 square feet, and the office portion represents only 12,000 square feet," Thompson says. "But we're learning about solar power options and vendors, and when the project's complete, we won't have to get power off the grid for the office section of our data center."

Online Exclusive:
Going Tapeless. Learn more about proven, stable technology to implement cost-effective, secure data protection with no tape in the system anywhere. www.symantec.com/ciodigest/tapeless

Podcast: Hear more from the author. Listen to a podcast on this feature at www.symantec.com/ciodigest/greenpodcast

Read Online:
www.symantec.com/ciodigest/greenvirtualization

You're in the picture

There's another image of the whole earth. This one is taken at night, stitched together by computers from hundreds of satellite shots, and visible on *National Geographic* magazine's site. It shows the lights of major cities across the globe. By 2025, experts predict, cities will be home to over half of humanity.

What the image doesn't capture is a realization lighting up in the heads of more and more people that we need to make choices that lessen the damage we're doing to the earth's ecosystem.

Technology executives are in a unique position to help turn the tide. ■

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1) Science Panel Calls Global Warming 'Unequivocal'—The New York Times, February 3, 2007 2) U.S. consumes 26 percent of the world's electricity—www.solarenergy.org; EPA Report to Congress on Server and Data Center Energy Efficiency—ww.energystar.gov 3) LEED specifications—www.usgbc.org.