



BEST PRACTICES FOR UNLOCKING YOUR HIDDEN DATA CENTER

Dr. Albert Esser, vice president of data center infrastructure at Dell, shares his perspective on the momentum that is building behind green data center design. Plus: How IT organizations can put unused capacity to work and leverage tactics for fast, flexible growth that helps maximize the bottom line.

Get ready for a major shift in the way data centers operate: according to Gartner, “By 2008, 50 percent of current data centers will have insufficient power and cooling capacity to meet the demands of high-density equipment.”¹ Many companies may respond to this challenge by performing a major data center facility upgrade in the next several years.

Concerns about power consumption are behind much of this momentum to upgrade. Operating high-density equipment such as blade servers demands an enormous amount of energy. For example, rack enclosures that accommodate the equivalent of 60–70 1U servers typically require 20–25 kW of power per rack.

Many data centers do not have the power or cooling capacity to extend this level of rack density across the raised-floor area to help meet growing performance demands. Traditional data centers have been provisioned to supply 40–60 W per square foot, but densities of 20–25 kW per rack would require power and cooling capacity of up to 600 W per square foot—a level that typically exceeds acceptable efficiency or cost levels.

In addition to imminent power and cooling problems, growing awareness about the environmental impact of excessive energy usage is driving business

leaders to explore ways to make IT infrastructures more efficient than they are now. Today, compute servers typically account for 26 percent of total energy consumption in a typical data center, while a whopping 59 percent of total energy is consumed by power distribution and cooling equipment.²

Dr. Albert Esser, vice president of data center infrastructure at Dell, recently spoke with *Dell Power Solutions* about the connections between green IT, data center performance, and Dell’s flexible approach to creating an environmentally friendly infrastructure.

WHAT DOES GOING GREEN ENTAIL ON A TACTICAL LEVEL?

There’s a common misconception that going green means buying lots of new, more energy-efficient equipment. In fact, in many cases, the easiest way to be more environmentally friendly is to consolidate your infrastructure onto fewer servers.

Most data centers are not even near capacity, and there is an enormous potential savings there—a whole “hidden data center.” A lot of data centers run at maybe 15 to 30 percent CPU utilization without realizing it. But there is so much more capacity in those servers. Even running at 60 percent, those servers are often not fully loaded.

¹ “The Data Center Power and Cooling Challenge,” by Michael Bell, Gartner, Gartner Symposium/ITxpo 2007, San Francisco, CA, April 22–26, 2007.

² Dell data center study, fall 2006. Data is based on one example data center. While energy consumption in typical data centers will likely be close to these estimates, the percentages could be significantly higher or lower in other cases.

HOW DOES VIRTUALIZATION HELP MAKE DATA CENTERS GREENER?

For many companies, the current mentality is to buy servers. Your data center is planned around servers and infrastructure for servers, the number of servers, what kind of servers you have in there. One application per server used to be the norm—and once a system was commissioned, you didn't mess with it. These guidelines served us well in the past. But now it's clear that, in both cases, some efficiencies and productivity are left on the table. Requiring one application per server frequently leads to equipment running at low utilization rates—wasting processor power. Leaving legacy systems in place results in server populations that are not leveraging the best that today's technology has to offer.

What you really need is *application space*. So, say you have a facility that needs to support your enterprise resource planning implementation, your document management applications, and your customer relationship management database. If you deploy each of those workloads on virtual machines (VMs), you don't have to worry about buying servers every time you add something new. You basically just look at how fully your servers are loaded, and if you're running out of space, you just buy capacity.

Dell has a virtualization assessment service that helps organizations consolidate servers and storage with excess capacity, which also lets them turn off outdated equipment or replace aging systems with new ones. You don't have to buy all-new Dell hardware to make your data center greener. It's not a rip-and-replace model. Virtualization features are built into Dell servers. For example, iSCSI storage systems such as the Dell PowerVault MD3000i modular disk array enable seamless VM mobility across physical servers by allowing VMs to be mapped directly to shared storage.

Organizations can typically fit anywhere from 5 to 20 VMs on a single physical platform, depending on the

application, user demand, system configuration, and the configuration of the old or replaced servers. A typical ratio is 8:1. Our customers frequently report 10:1 or 12:1 ratios as well.

HOW DO GREEN INITIATIVES AFFECT DATA CENTER PERFORMANCE?

Sometimes people get fooled by the idea that you have to choose between being green and being effective. You don't. The two concepts are related—more effective data centers tend to be greener, and greener data centers tend to be more effective.

It's common sense, really. The best hardware in the industry is the most cost-effective and energy efficient, and that makes for the greenest data center you can have. And it goes the other way too—if your data center is not green, it isn't as efficient or effective as it could be.

City buses are a great analogy. If you're in the bus business, you buy big buses because they are an efficient way to transport lots of people. But the bus isn't efficient if you have only two or three people on it all the time. That is what we do right now with our data centers. Businesses have servers with lots of capacity, but they may use only a fraction

HOW EFFICIENT SERVER UTILIZATION HELPS SAVE ENERGY

When a server is underutilized, it uses a disproportionate amount of power and cooling. But as utilization increases, the additional power and cooling required to meet computational needs is relatively lower.

Two tactics can help improve this situation. First, companies may increase utilization rates, either through consolidation or virtualization. Power throttling and putting servers in sleep mode or turning them off when they are idle also can help conserve energy, cut costs, and boost the bottom line.

Consider this example: at 20 percent utilization, a Dell™ PowerEdge™ 2950 server requires 293 W. At 80 percent utilization, the same server requires just 358 W—only a 22 percent increase, despite the 60 percent jump in utilization (see Figure A).*

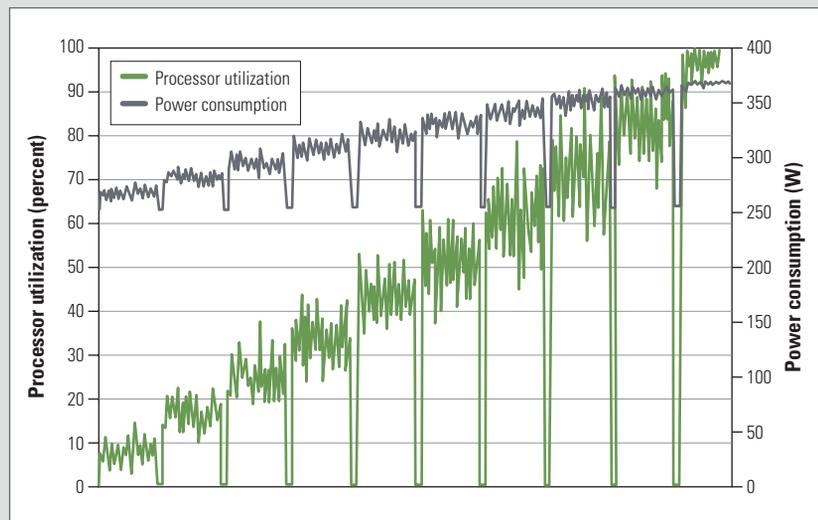


Figure A. As server utilization increases, the additional power and cooling required to meet computational needs becomes relatively lower

*Dell Server Performance Analysis lab study, November 2, 2007.

“The key thing for CIOs to remember is that they can make their company’s IT greener on their own schedule and with their own IT people. Dell’s approach is not to come in and take everything over—you choose what you can afford.”

of it. This situation leads to inefficiencies that can make workload consolidation a big deal for green initiatives.

HOW DOES COOLING IMPACT EFFICIENCY IN THE DATA CENTER?

One of the biggest misconceptions about data centers is that colder is better. You don’t have to cool your data center like a meat locker. You can actually gain efficiencies in your facility if you allow a higher set point for air and water temperatures.

For example, we’ve found we can improve airflow efficiency in servers by lowering the flow with variable-frequency drive blowers and allowing a hotter exhaust. That’s because any kind of energy that goes into moving air is wasted energy. Pushing air through the system only moves the heat—so fan power is wasted power.

On the air-conditioning side, chiller cooling efficiency improves with increased water temperature. It’s almost a linear curve, where for every degree you can raise the temperature of the cooling coil, the more effective and efficient your air-conditioning will be. In many data centers, you can just crank up the temperature on your thermostat five degrees and see up to a 5 percent increase in efficiency. The magnitude of these easy savings is absolutely astounding.

Recently we told a customer that these types of changes would allow four

times more servers into a data center than they had anticipated. Not four more servers—but four *times* more servers. And it was a big data center.

WHAT IS DELL’S APPROACH TO GOING GREEN?

Dell can give companies a lot of help on the path to being green, from helping with buying decisions to providing the hardware to making recommendations for improving efficiency. We also have, for one server line, an in-depth study that shows up to 10 to 15 percent better efficiency for Dell servers than for comparable systems from competitors.³ So just using Dell equipment can help businesses make their data centers greener.

On the operations side, Dell has online resources to help customers with infrastructure questions. We have “Plant a Tree for Me” and “Plant a Forest for Me” programs that give companies a way to offset their data center carbon emissions. We offer consolidated delivery options that can help reduce packaging by shipping multiple products in a single box, and we have an asset recovery program that helps make sure that retired IT equipment is disposed of properly.

At Dell, we believe in simplifying IT—including power and cooling. While the industry has witnessed steadily increasing complexity and cost associated with energy management, we offer simple, cost-effective solutions.

If you want to take your power consumption levels back to what they were five years ago without making drastic changes, Energy Smart Dell PowerEdge 1950, PowerEdge 2950, or PowerEdge 2970 servers are an excellent option. They have about the same power draw as servers used five years ago, but they are designed to be significantly more energy efficient than legacy systems and applications. For example, Dell studies show that a PowerEdge Energy Smart system configuration can deliver up to 21 percent greater performance per watt over a similarly configured server.⁴

Or, in a more comprehensive approach, you can buy the latest and greatest cooling technology. We can hook you up with Liebert and other partners to design a new infrastructure and the tools and services to support it. One way or another, Dell can help make your IT infrastructure as efficient as possible in terms of application utilization—which also translates to low cost of ownership and simplified operations.

The key thing for CIOs to remember is that they can make their company’s IT greener on their own schedule and with their own IT people. Dell’s approach is not to come in and take everything over—you choose what you can afford. But virtually anything you do with Dell can help reduce the environmental impact of your data center. 

Albert Esser, Ph.D., serves as vice president for data center infrastructure at Dell, where he is responsible for enhancing Dell’s enterprise-class IT solutions by sharing insights gained from customers with the company’s Server, Storage, Data Center Solutions (DCS), and Services teams. Albert has an M.S. and a Ph.D. in Electrical Engineering from the University of Aachen. He holds 12 U.S. patents.

³ Based on testing conducted by Principled Technologies in December 2006 on comparable configurations of servers from Dell, Hewlett-Packard, and IBM. For detailed results, see “SPECjbb2005 Performance/Watt on Three Servers with Dual-Core Processors,” by Principled Technologies, December 2006, DELL.COM/Downloads/Global/Products/Pedge/En/enrg_smrt_perf_brief.pdf.

⁴ Dell Datacenter Capacity Planner 2.0 online calculator tool, available at DELL.COM/Energy. For more information, see “The Energy Smart Data Center,” by John Pflueger, Ph.D., and Albert Esser, Ph.D., in *Dell Power Solutions*, February 2008, DELL.COM/Downloads/Global/Power/ps1q08-20080179-CoverStory.pdf.