



# HEAD TO HEAD

Power and cooling issues in the data center continue to be at the forefront of concerns for IT and data center management teams. William Dibella, President of AFCOM, the premier industry group for data center professionals, puts forward a series of thought provoking questions to Doug Balog, Chairman of Blade.org and Vice President of IBM BladeCenter; and Sriram Ramakrishnan, Board Member Blade Systems Alliance and the Powerware business unit head for Eaton Corporation.

## Power and cooling in the data center - The Business Imperative

**WD:** To increase efficiency while reducing power consumption and cost, data center business plans must address critical components of energy management and planning. What tools are available today to address these business metrics?

**SR:** There are two key aspects to this issue. First, you must have reliable and meaningful data about present-day power consumption and quality: not just a snapshot, but a performance record. Second, you need the ability to analyze, troubleshoot and assess trends over time.

The good news is that even a small data center can afford the tools to address both these aspects: to proactively manage energy consumption to prevent overload conditions, and to improve capacity planning and optimize power distribution.

With new energy management systems, new or existing electrical

infrastructures can be equipped for 24/7 monitoring all the way to the branch circuit or receptacle level easily. New, high-speed power meters

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**“you must have reliable and meaningful data about present-day power consumption and quality: not just a snapshot”**

*- Sriram Ramakrishnan*

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can accurately detect even the most fleeting anomalies in power quality on critical loads. Compact environmental monitors fit into unused side or rear channels in racks to monitor temperature and humidity. At a central vantage point, or from anywhere,

software systems aggregate this data, present it in easy-to-grasp terms or visuals, and support in-depth analysis.

With these technologies, data center managers can get visibility into their power systems at multiple levels: down to the individual branch circuit or receptacle, or summarized across loads or for the whole data center.

**DB:** One is IBM Active Energy Manager, which provides a view of power usage, so clients know what really is happening in their data center. Active Energy Manager not only measures power usage, but also controls power use by setting caps for improved allocations, or for making power/performance adjustments when the situation allows.

Also, the IBM Energy Efficiency Self Assessment provides clients a free online view of their data center energy efficiency.



Other Blade.org members Eaton and APC provide solutions to help companies manage and assess energy use.

**WD: To reduce power consumption and cut costs, are we seeing an increase in the use of real time automated monitoring systems to analyze power usage and help identify hot spots and cooling problems?**

**SR:** Absolutely, and this has been driven not only by rising energy costs but by recent technology advances. For example, back in the day, if you wanted high-speed sampling of power quality, you'd have to call in a consultant with a \$20,000 portable power meter. Even then, you'd get a snapshot view of power consumption and quality, but could miss fleeting anomalies or seasonal variations.

Now, this kind of high-end monitoring is affordable and practical for data centers to own and use all the time, and you don't have to be a power guru to understand the information it delivers.

These technologies are so readily available, and so easy to use, that we are definitely seeing an increase in interest from data center customers.

**DB:** We're certainly seeing a lot of interest in these solutions, and for very good reason. Some data center managers have already reported that the cost of electricity and cooling in the data center are exceeding the cost of the equipment itself. IDC estimates for every \$1.00 spent on new data center hardware, an additional \$0.50 is spent on power and cooling, more than double the amount of five years ago. So, companies in all industries are looking for a solution.

**WD: The first step in gaining a firm grasp of power usage would be for a company to conduct an energy assessment. What recommendations do you have for a data center manager to begin this process?**

**SR:** Many data center managers don't know the efficiency of their IT equipment or site infrastructure, or have a clear path in mind for maintaining

and improving that efficiency. There are many easy opportunities to reduce energy costs and become "greener" in the process (which can be overlooked). So, a good first step is simply to determine how much of the data center power budget goes to IT systems, and how much goes to support systems, such as power distribution and cooling. For every kilowatt-hour of power being fed to IT systems, how much real IT output do you get, in terms of Web pages served, transactions processed or network traffic handled?

The Uptime Institute has a variant on this metric called the Power Usage Effectiveness (PUE) ratio, which is a ratio of total facility power to the power drawn by all IT equipment. After applying this calculation to several

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- Doug Balog

data centers, the Uptime Institute recommends an ideal PUE of 1.6 and a realistic goal PUE of 2 for a well-designed and operated data center. The Institute estimates that most U.S. data centers have a PUE of 3.0, with an average of 2.4. If PUE is poor, data center managers can investigate operational changes, such as virtualization or consolidation; or configuration changes, such as alternating hot and cool aisles; and new technologies, such as high-efficiency UPSs and power supplies.

In this process, data center managers can turn to outside consultants to conduct an energy audit and make recommendations. If time and manpower are in short supply, this is an attractive option. But with new monitoring and management tools available, data center managers can be more self-sufficient than ever in assessing their power systems.

**DB:** First, data center managers should make a plan. Start with assumptions, if necessary and then fine tune as you acquire more data about your consumption profile.

Next, monitor and analyze your energy consumption, and factor those results back into your plan. Then, develop a timeline and forecast for future data center performance requirements. Datacenter managers should explore available new technologies for virtualization or power management to manage and reduce power consumption. This is where a community organization, like Blade.org, can assist them. It provides a broad view of solutions available across the industry, not just from one company.

Blade.org can also help provide datacenter managers with expert assistance from energy and equipment vendors to map out a realistic program of data center floor planning, cooling planning and power management.

**WD: Virtualization offers many advantages, especially in power and cooling, since technology refreshes are the best time to change to virtualization. Do you foresee a big difference in server replacement cycles? What is the best strategy to plan for this change?**

**SR:** There's no doubt that virtualization can be a good deal. Some analysts

predict that virtualization will improve server utilization for a typical x86 machine from 10 to 20 percent to at least 50 to 60 percent in the next three to five years. One of our customers found the opportunity to reduce its portfolio of 1000 servers to about 200 servers. Even if we assumed a utility rate of only 10 cents a kilowatt-hour, this customer stands to save \$700,000 in the first year alone.

The prospect of such savings will drive more data centers to adopt virtualization strategies to one degree or another, and that will translate into an accelerated pace of server replacement. But, virtualization will not be the salvation for everyone. Many data centers have to be designed to accommodate periodic peak loads far above daily loads, such as seasonal peak volumes for a retailer. In that case, having underutilized or idle hardware is just par for the course, and virtualization wouldn't buy the data center much, if anything.

The best strategy is therefore not a prescription but a process: stay abreast of new technology developments and regularly assess the ROI potential of replacing old technology. The business case will differ for every customer, geography and infrastructure.

**DB:** I think that virtualization has already become very pervasive. According to the Yankee Group, 9 out every 10 large enterprises will have implemented virtualization into their IT infrastructure by end of 2007. IDC predicts 69% of servers purchased in 2006-2007 were virtualized compared to just 7% of the existing worldwide base. So I think the majority of IT managers have likely made and/or implemented their virtualization plans.

Those who haven't should take a look

at their existing server resources, as they are typically highly under utilized. Many computer systems use 5 to 10 percent of their capacity. IT managers should first ensure that their existing assets are leveraged to their fullest capacity.

**WD: With power and heat rising higher in blade server racks — from 1 kW in 2000 to 14kW and even 24kW today — what are your thoughts about refrigerant-based cooling systems that provide up to 30kW cooling per rack?**

**SR:** As much as 30 to 60 percent of the data center utility bill goes to support cooling systems. If that figure seems too high, it is. As data center managers struggle to reduce this burden, they have to weigh several variables. Are they better off paying the higher initial cost of refrigerant-based cooling modules and enjoying lower energy costs over time, or spreading the IT load so average power level is less than 15kW per rack, which can be supported with conventional air cooling and makes new investment unnecessary?

As with so many issues in data center design, the answer is, "It depends." Where existing air-cooling seems to be ineffective, we often find that the cooling system has been inefficiently

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deployed, or racks are set up in a way that produces hot spots. These issues can be minimized by best practices, such as distributing servers across more racks, alternating hot and cool racks or aisles, and carefully regulating air flow across the data center.

However, in areas of the country where energy and real estate costs are high, such as Manhattan or California, a data center could easily cost-justify refrigerant-based cooling. The higher initial investment would be repaid in lower utility bills for cooling systems and lower real estate costs, thanks to the ability to deploy more IT equipment in the same square footage.

**DB:** I think liquid cooling is an incredibly effective solution for addressing heat issues in the datacenter. IBM pioneered the use of water to solve heat issues in the datacenter 40 years ago in its mainframe systems, and now this innovation is being used to address the same issue in today's datacenters.

The technology uses chilled liquid to dissipate heat generated from the back of computer systems. It's effective because it allows users to pack a greater number of systems into the same space, and it generates cold instead of generating heat in the data center. ■

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### Sriram Ramakrishnan

Sriram Ramakrishnan is the Business Unit Manager for Powerware Data Center Solutions with Eaton. He has worked in various business development, marketing and engineering capacities over the last 12 years

within the power quality and mission-critical environment of GE and Eaton. Having earned his graduate degree in Electrical Engineering from the University of Florida and his MBA from Duke, Ramakrishnan's accomplishments include four US patents, with several additional applications pending. He is also a member of Blade.org and the Blade Systems Alliance.

### Douglas Balog

Douglas Balog is Vice President, IBM Modular and Blade Systems Development and also serves as Chairperson of the industry Blade Server solution community – Blade.org.

Prior to this Mr. Balog was Vice President and Business Line Executive for BladeCenter. Previously, he was Vice President, IBM BladeCenter Development.

Until mid-2004, Mr. Balog served as Vice President of IBM TotalStorage Open Software Development in the Systems and Technology Group and was also the Senior Site Executive of the IBM San Jose, California facility.

Mr. Balog has also served as the Technical Executive on IBM's integrated account team for Charles Schwab Corporation from January 2001 to April 2002.

