

A **bnp** PUBLICATION
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Data center and emergency backup solutions

November/December 2011

Industry Manufacturer

REALIGNS IT STRUCTURE

to Build New Data Center



Eaton Takes Own Advice for New LEED Certified DATA CENTERS

Company is justifiably proud of its new facilities

BY BILL BLAUSEY AND LENNART JONSSON

Helping companies plan, design, operate, and eventually refresh or repurpose their data centers more efficiently and effectively is a core part of Eaton Corporation's mission. So, too, is doing business in ecologically sustainable ways. Not surprisingly then, when Eaton embarked on Project BlueGrass, a strategic effort to construct next-generation data centers, it took its own advice, employing today's most sophisticated tools, techniques, and design

methods in a manner that carefully balanced business priorities with environmental responsibility. The result is a set of state-of-the-art computing facilities that will reliably support Eaton's IT needs for the next two decades while delivering a projected \$23 million in energy savings along the way.

ORGANIZATIONAL ALIGNMENT

The first piece of advice is less about the technology itself and more about increasing ROI through the efficient and effective use of organizational alignment. At most companies, two departments split responsibility for the data center: IT, which typically reports up to the CIO; and facilities, which typically reports to the COO or vice president of corporate real estate.

Changing the organizational structure so that both the IT and facilities departments report to the same executive helps to align everyone in the data center around common goals, metrics, and objectives. That, in turn, can drive greater efficiencies by ensuring that IT and facilities managers are equally motivated to improve performance and lower power bills.

In order to maximize efficiencies and ensure the successful operation of Project BlueGrass facilities, Eaton created a new extension of the IT Enterprise Infrastructure Services Team, called the Mission Critical Facilities Team (MCF), consisting of resident engineers whose specialty consists of more than 10 years of electrical and mechanical experience in the data center space.



William W. Blausey Jr. is senior vice president and chief information officer for Eaton Corporation, a \$13.7 billion global diversified power management company. Blausey is responsible for the enterprise information technology strategy and execution. Blausey assumed his current position in January

2006 after serving as vice president, information technology, for Eaton's Fluid Power Group since 2001.



Born and raised in Sweden, **Lennart Jonsson** completed his MS degree in electrical engineering from Chalmers University of Technology in 1974. In 2004 he was appointed as director of engineering at Eaton Power Quality Corporation, with the responsibility to develop and grow all power quality products globally. With a diverse and rich experience of 35 years in the power industry, Jonsson currently holds the title of executive vice president and chief technology officer for Eaton Corporation.

“We recognize that a specialized set of skills is required for our team to successfully operate, support, and manage the power and cooling infrastructure that is required by the IT equipment within our data center halls,” said Rob Agar, vice president of enterprise infrastructure services at Eaton Corporation. “By aligning the Mission Critical Facilities Team within the Enterprise Infrastructure Services Team, we feel the collaboration, direction, and integration of their activities is important to our success moving forward.”

As a result of this organizational structural change made three years ago at Eaton, these teams together own the facilities design and operation in Project BlueGrass, with decisions by one team directly affecting the responsibilities of the other group.

INVESTING IN TECHNOLOGY

New electrical power management components are so much more efficient than their predecessors that they can quickly pay for themselves. Agar used only energy-efficient servers and switches, as well as the latest and more efficient power quality and distribution systems in the design and implementation of Project BlueGrass. “Though such components will cost us a little more up front,” said Agar, “they will significantly reduce our energy bills and carbon footprint over the long term.”

“In addition to upgrading uninterruptible power supply (UPS) hardware, you can also save money by modernizing your data center hardware. Deploying state-of-the-art, energy-efficient power distribution units (PDUs), such as the Eaton 400V ePDU, can measurably lower your exposure to costly server outages as can upgrading to newer, more energy-efficient servers,” said Agar.

MODULAR DESIGN PRINCIPLES

Experts increasingly recommend taking a modular approach to power system design, in which capacity is deployed as it is needed and meets only the initial requirements at the outset.

A modular power system offers both improved reliability, by building around multiple modular components instead of a single big one, and increases redundancy and greater flexibility due to smaller size and easier installation. These features make modular systems ideal for today’s fast-paced data centers.

To allow for future growth in Eaton’s new data centers, Agar used modular power design principles in Project BlueGrass to support Eaton’s needs for at least the next 10 to 15 years.

“While we initially will use only 30 percent of that capacity, we don’t have to buy 15 years’ worth of anticipated power resources in advance,” said Agar. “This means that on day one, each site will contain two data halls of 10,000 square



Figure 1. The Eaton 400V RPP works alongside Eaton 9395 UPS with Energy Saver System to extend the capabilities of its UPS technology, allowing users to run servers at 230V, while operating the UPS at 99 percent efficiency.



Figure 2. The lobby of Eaton's new facility

feet at a power density of 90 watts per square foot. The ultimate build out of these two sites, however, is projected to be six data halls of 10,000 square feet each at a power density of 180 watts per square feet.”

ENTERPRISE MONITORING

With web-based convergence solutions, organizations can use a “single pane of glass” to monitor their entire enterprise. Utilizing this secure holistic view, IT and facilities can increase server availability and optimize power usage.

Convergence solutions correlate specific power circuits to



Figure 3. Eaton's Foresee Enterprise Monitoring software works in conjunction with building management systems (BMS) to provide comprehensive and "real time" view of the electrical, mechanical, life safety and security systems.

specific servers and applications, enabling data center managers to spot potentially dangerous electrical conditions in real time, see exactly which business services they jeopardize and take prompt preventive action.

"Enterprise monitoring was implemented in both of our new data centers," said Agar. "Our IT and facilities departments will both enjoy access to the same enterprise-wide monitoring technology, enabling our technicians to identify and address power issues as quickly and effectively as they do network and storage problems."

Additionally, most enterprise monitoring solutions collect historical data on power usage patterns that can allow facilities managers to levy precise charge backs to business managers based on the actual amount of energy they consume, or perform "what if" analyses to find the most efficient data center configuration for their environment.

The new data centers will be equipped with an electrical power management system (EPMS) and a third-party building management system (BMS).

"These systems will provide a high level of monitoring and management and, in the case of the BMS system, will also allow the facility operations staff to control the mechanical portions of the facility from a command console," said Agar. "They have also been integrated in our new data centers to allow critical data to flow from the BMS platform to the EPMS platform."

The BMS system will pass 515 measurements per second to the EPMS, including computer room air handler (CRAH) and chiller status, water temperature, water tank status, generator status, and outside air temperature.

"The EPMS for our project will incorporate that data into its dashboards and reports, giving it and the facility operations staff a comprehensive view of both power-and-

building-related status information in one place," said Agar. "In the event of an alarm, managers will be able to view alarms on a mobile device and have access to a complete, three-dimensional map of the data center that will provide real-time information about what the problem is and in what piece of equipment it is located."

Additionally, the EPMS will provide access to an executive dashboard that will allow decision-makers to monitor key metrics—including PUE—in real time.

The system will also archive power-monitoring data for future reference, enabling data center managers to generate a variety of informative reports on topics such as energy consumption, load capacity, and power quality. That, in turn, will allow data center managers to identify and proactively address areas of energy inefficiency.

SUSTAINABLE PRACTICES

Lastly, organizations can further reduce carbon footprint and energy spending by implementing environmentally responsible "green IT" practices such as consolidating servers through virtualization, creating hot-and-cold aisles, and deploying modern UPSs. Coupling ideas like these with deployment of more efficient power and cooling technologies can enable a midsize data center with 1,500 servers to save millions of dollars while dramatically shrinking its contribution to global warming.

In keeping with a company-wide commitment to "doing business right" that has the complete support of the company's chairman and CEO, Eaton's new data centers employ a variety of technologies and practices aimed at conserving power and shrinking our impact on the environment.

In designing Project BlueGrass, the project team focused on a design that would be flexible, modular, and scalable enough to stay in front of rapid business/IT change and demand. "On day one, the electrical cooling infrastructure will support power densities of 90 watts per square foot with upgrade steps at 120 watts per square foot and 180 watts per square foot," said Agar. "The rack-level electrical loads are projected to be 4 kilowatt per rack on day one, and to scale up to 8 kilowatt as the IT technology footprint grows within the facilities."

Over the data center lifetime, server, and storage virtualization will dramatically limit total power consumption, and save footprint as well.

HOT-AND-COLD AISLES

The Project BlueGrass data halls are designed to be maintained at a temperature of 74°F by conditioning and recirculating the air within the room using a CRAH.

"Heat from the data hall is exchanged by the warm air passing over the coil, which has cool water inside it, resulting in cold air being distributed back into the room and warm water being transported from the coil via closed chilled-water loop to a chiller," said Agar. "There, after another

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exchange, heat is passed to the cooling towers via condenser loop, where it is discharged into the atmosphere.”

Eaton enclosures and thermal management systems are used to create complete isolation between cool inlet air and hot return air. This hot or cold aisle approach eliminates inefficient mixing of hot and cold air.

MODERN UPS

Eaton modular 9395 UPSs in Energy Saver System mode provide scalable power protection and 99 percent efficiency in a dual-bus architecture. Further, the UPS system is backed by two 3,300 horsepower generators (2 megawatts) capable of delivering 12,470 volts in the event that the site loses utility power are also included in the design. This is consistent with Eaton’s N+1 redundancy requirements for these facilities.

“On day one, one generator is required to provide the power requirements for the site during an outage,” said Agar. “The generators are supported by a 30,000-gallon diesel tank in the service yard which is projected to allow the facility to operate for 10 days without supplemental fuel in the case of an extended utility outage.”

Project BlueGrass vividly demonstrates how companies that take a disciplined approach to designing, building and equipping new data centers can deliver IT services not only reliably and cost-effectively but with sustainability as well. Thanks to the rigor with which the team selected vendors and locations, as well as the leading-edge infrastructure resources, power quality equipment and monitoring systems it chose, Eaton will soon be equipped to support at least 20 more years of IT growth while conserving water, energy, and natural resources in ways that will generate tens of millions of dollars in savings. The good news for other companies is that they can achieve similar results by employing the same best practices. ■



Figure 4. Eaton’s Heat Containment System (HCS) technology, featuring the scalable Paramount Enclosure System, protects mission-critical electronics and servers while lowering air handling-related power usage by up to 30 percent.



Hot exhaust air is removed from the server enclosures via HCS chimneys located on the top rear of the racks and is then directed back to precision cooling units (the CRACs) by way of a ceiling plenum.

UNITED STATES
8609 Six Forks Road
Raleigh, NC 27615 U.S.A.
Toll Free: 1.800.356.5794

powerquality.eaton.com



Powering Business Worldwide

CANADA
Ontario: 416.798.0112
Toll free: 1.800.461.9166

LATIN AMERICA
Aruba: 001 866 898 8812
Argentina (South Cone):
+5411 4124 4000
Bahamas: 1 800 389 0368
Brazil: +55 113616 8500
Colombia: 01 800 518 1490
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Mexico: + 52 (55) 9000-5252 or 01 800
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