AFCOM
The Communique
August 2009
AFCOM's monthly e-newsletter

Predict Power Problems Before They Occur

By Jim Neumann

While vital power systems such as UPSs and generators stand at the ready to mitigate power glitches, they act in a reactive mode and only provide power after there has been a power event. What if there was a way to know before impending power faults of key systems? What if there was a crystal ball inside the walls of the facility that show exactly what is going on with the power infrastructure? What if by a click of the mouse a data center manager could be assured that it is safe to add a new rack of blade severs without compromising the internal power grid? There is. It is called power analytics. Managers can now take control of power availability, minimize consumption and increase efficiencies.

Through power analytics, managers have the tools to simulate, understand and reengineer their power infrastructure based on how it will respond to unanticipated faults. This provides time to iron out potential design issues prior to any problems. What's more, power analytics detect variations between as-designed specifications and actual system performance; it predicts potential failure points and energy inefficiencies.

Think about power analytics as the collision avoidance solution that predicts and prevents electrical power problems from occurring to begin with. Just as business analytics–those complex mathematical models developed by risk analysis companies like Experian and Fair Isaac–help financial institutions predict lending risks and prevent fraud, power analytics enable organizations to predict electrical power problems before they occur by continually assessing the real-time health of their electrical power infrastructure.

This clever analytical system helps to demystify the power infrastructure and gives data center and facility managers a set of easy-to-understand tools to minimize energy consumption and protect the

AFCOM News

Deadlines for Fall 2009 Data Center World Show:
Early-bird rate ends Aug.14
Regular rate ends Sept. 11
register now...

Members Post Resumes, Vendors List Updates On Message Board
read more...

Chapters

Chapter Meeting Dates
read more...

facility against costly downtime.

Traditionally, once a data center is built, modifications are tested by trial and error. A company's computing services are far from being a static environment. Data center managers are called upon to implement new application loading schemes including server consolidations and virtualization. The error part of testing is risky and potentially costly. Moreover, all changes have to be audited for energy efficiency, risk of system instability and cost impact. One way or another, minimizing the power demands (cost of operation) while maximizing reliability and availability is the goal.

Knowledge Is Power

The issue is how to cost-effectively ensure system reliability and uptime while managing power usage. The application of power usage effectiveness (PUE) and data center efficiency (DCE) power ratios (See Figure 1) gives managers a keen understanding of their facilities' power and cooling performance from an energy demand perspective. By partitioning the IT equipment load demands (servers, storage, network management, communications, etc.) from total facility power (switchgear, UPS/power backup systems, chillers, CRAC units, etc.), the data center manager gains a much clearer picture of the facilities' performance dynamics.

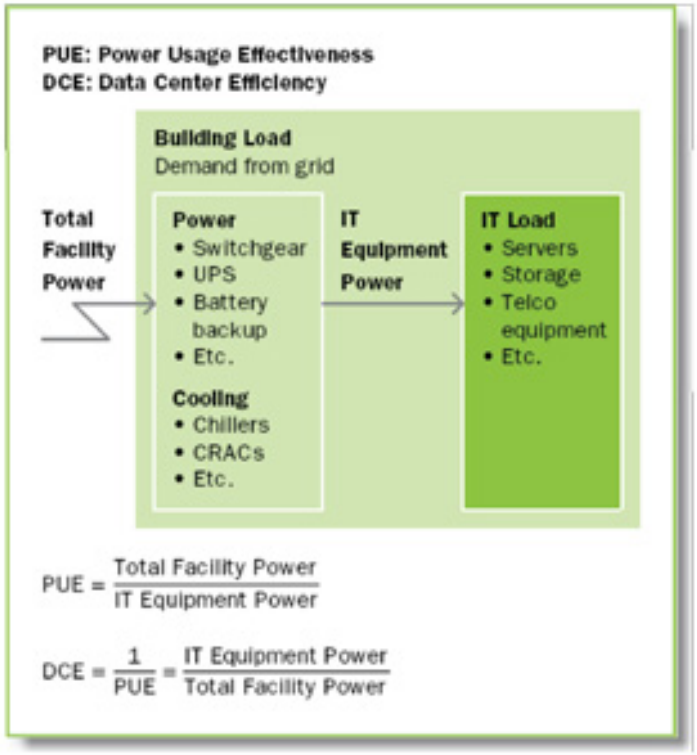


Figure 1. PUE/DCE enable data center managers to quickly estimate the energy efficiency of their data centers, compare the results against other data centers, and determine if any energy efficiency improvements need to be made.

Insight into a data center's electrical infrastructure and the ability to simulate the entire power distribution system in a virtual environment will reduce costs. While commissioning costs are high, the ROI is significant. Data center commissioning can deliver an unbiased evaluation of whether a newly constructed data center will be an operational success or a failure. Proper execution of the commissioning process is a critical step in determining how the data center operates as an integrated system.

According to an EYP report, the data center manager should plan to spend one percent to two percent of the overall data center project cost on commissioning. In most cases, the manager will see a five percent to 10 percent ROI benefit in terms of overall data center performance as a result of commissioning. With today's cost of data center construction approaching $2,500 per square foot, the commissioning of a 50,000-square-foot Tier IV facility will cost approximately $2.5 million. Power analytics has the potential to save 10 percent to 25 percent of the overall commissioning process costs.

Mitigating Risk

Depending on industry sectors, the value of one hour of downtime can range from about $100,000 to more than $6 million. Real-time power analytics can intelligently predict the timing and location of potential system upsets, and, in the case of a downtime episode, can quickly apprise the right people as to the cause and solution. Since time is money, reducing overall downtime by as little as six minutes per year can mean a potential savings of approximately $100,000, if downtime is worth $1 million per hour. Intelligent analytics can formulate truly predictive diagnostics based on system design boundaries and the implications of variable operating conditions from system aging. Wisely scheduled system maintenance or repair based on a reliability assessment rather than a simple periodic basis can be significantly less upsetting and costly.

Key to an effective energy management program is accurate information regarding the consumption of energy. Based on the amount of IT equipment in racks, the power distribution and cooling equipment infrastructure, and the variations in application loading, power analytics can report accurate, real-time energy usage. This data can be compared to the as-designed energy usage calculated to give insight into system unbalances, capacity restraints or overloads. The results of virtualization and other energy efficiency measures can be followed and assimilated. Scenarios can be suggested for improved energy utilization based on predictive diagnostics and by what-if simulation. At current energy costs (approximately $0.089 kWh), savings of $100,000 or more can be realized even for a relatively small, lightly loaded data center.

Facility engineers are generally focused on the reliability and capacity of the data center's power distribution system while the data center manager is concerned with server availability and service level agreements. While they may be preoccupied with different aspects of data center operation, they both

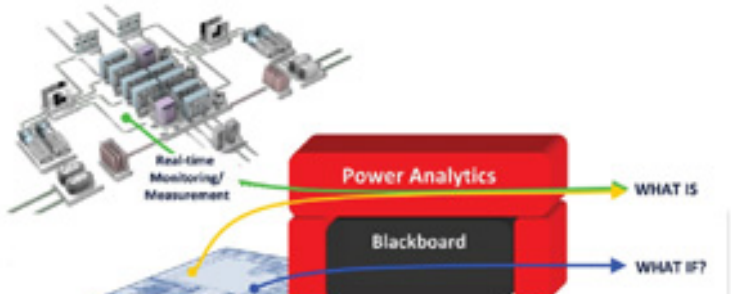
are in agreement regarding taking risks. They do not want them. The adage no pain no gain is not part of their conversation. The fact is energy conservation schemes, thermal efficiency advances, capacity improvements, server loading rearrangements, new technology applications and other energy management measures involve the risk of unintended consequences. The simulation of a system's performance in a virtual environment is the safest way to test a system modification and assess risk.

According to The Green Grid, to gain real insight and to successfully manage a data center's energy efficiency, continuous real-time monitoring should be employed to do the historical trending and statistical analysis. The Green Grid states in a white paper published last year: "The initial design of the data center is obsolete the day after the installation and commissioning is complete. Often, energy efficiency calculations are based on a static design instead of the dynamic data center configuration. The designed (static) versus actual (dynamic) nature of a data center must be considered. Improvements will come through incremental step changes in infrastructure over time. Also, it is important to keep in mind that as the load changes in the data center, the operating point of the subcomponents on their efficiency curves will change."

Power analytics makes it possible to have true insight into the operational variations between the designed versus the actual data center. Power analytics is driven by sophisticated mathematical modeling, which synthesizes the performance specifications of all the electrical interconnections and equipment of the electrical design model. The power and uniqueness of the platform is derived from this complete encoding of the design specifications from the original as-built power infrastructure into the model designbase.

Energy Management and the What-Ifs Scenario

Advanced power analytics can provide sophisticated, yet easy-to-understand what-if scenarios by capturing a snapshot of the current facility's input power parameter settings. By altering selected model specifications (circuit breaker settings), the impact of real-time, what-if system changes (server loading, power distribution, cooling, capacity shifts, equipment substitution, etc.) can be projected and analyzed. The facility's current performance and costs, or what is, can be compared to performance and costs based on what-if.



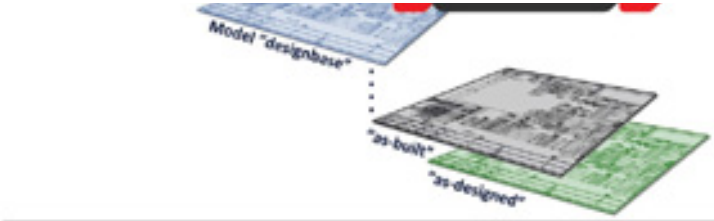


Figure 2. What-if simulation using model parameters.

Virtualization, server consolidation, decommissioning, improved airflow, cooling efficiency, more efficient power distribution, rationalized capacity and other energy management measures involve the risk of unintended consequences. The simulation of a system's performance in a virtual environment can safely investigate the effects of changes that might have an impact on the live system without the risk of actually doing live testing. Moreover, during the what-if simulation of an energy reduction scheme, the data center's performance can be watched to make sure the IT equipment is supported and system availability and reliability are maintained.

Energy efficiency metrics are valuable in revealing the efficacy and ranking of measures taken to reduce energy use. How can cost benefits be estimated? If real-time utility costs (energy and power demand rates) are recorded while power analytics technology scrutinizes data center performance, costs at a measured performance state can be assessed. The utility costs verified by local rate table calculation can be correlated with what-if performance simulations.

Figure 3. A real-time energy management advisor allows managers to isolate and reduce energy inefficiencies in their mission-critical facilities so they can assess and reduce energy costs.

Furthermore, if simulations are run with equipment costs correlated with power measurements taken at the individual equipment level, then the cost impact of energy efficiency measures can be determined.

The economic benefit of virtualization, server consolidation, eliminating unproductive IT assets, reduced cooling load, more efficient power distribution, and other changes can be assessed before actually implementing the change.

Armed with advanced power analytics, the energy efficiency and environmental friendliness of new data center system designs can be explored. Now, equipment delivering the most efficient performance can be selected and cost justified, and as productivity metrics are refined, the total cost of operating the data center can be fully understood and verified.

Jim Neumann is vice president of EDSA, San Diego, www.edsa.com.