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BEST POWER PRACTICES IN ENSURING BUSINESS RESILIENCE

WHAT TO PROTECT AGAINST?

DISASTER AVOIDANCE VERSUS DISASTER RECOVERY

7x24 Exchange International

Best Power Practices in Ensuring Business Resilience

by Jim Neumann

ABSTRACT: According to headlines in leading IT periodicals, the list of IT-savvy companies whose business operations have been adversely impacted by electrical power-rooted problems reads like a "Who's Who" of the leading e-commerce, transaction processing, networking, software, financial services, and IT services business leaders.

Because electrical power and IT operations are so tightly interwoven, power problems cut directly into a company's ability to keep its mission-critical computing on-line... and prevent them from maintaining a high degree of insight into power-related problems.

This article examines the symbiotic relationship between electrical power and IT systems, including new "Power Analytics" strategies that give facilities owners and operators unprecedented insight into the health of these two interdependent infrastructures.

If you Google the terms "power outage" and "data center" together, you'll find 98,400 reasons why the most important element in data center design – and the most unpredictable wildcard in getting it right – is electrical power infrastructure. Reading through the search results, chances are good that you'll see your ISP… your cellular phone carrier… your bank… your credit card company… and other very familiar names.

The economic impact of electrical power problems in data centers has grown in correlation with the digital economy itself, with staggering implications for data center operators:

- 40% of all business downtime now stems from power quality problems[1] and fully 80% of those electrical disturbances originate inside the company's own facilities… most caused by the day-to-day operation of ordinary equipment[2] like computer and networking gear.
- More than 500,000 businesses and consumers experience electrical power problems every day, with the average power outage lasting two hours[4]. The annual cost to the U.S. economy due to these power disruptions is estimated as high as $164 billion... not including up to another $24 billion due to power quality phenomena that falls short of full-blown power outages.
- The seriousness of an unplanned power outage to an individual company varies by industry and application – ranging from "costly and disruptive" to "costly and life-threatening" – with some industries losing as much as *$6.45 million per hour* of business downtime[3].
- Even the daily cost per for planned mission-critical application downtime ranges from $167,200[5] to $800,000[6] depending on the size of the company.
- For large companies, a gain of just one percentage point of availability is worth $7,358,400 per year. Even at an average size company, one hour of downtime translates to $10,000 off the bottom line; with a 5% power availability gap, such companies risk $3,679,000 per year.[7]

Companies slammed by power problems, even as technology-savvy as they may be about IT, have learned the hard way that failing to understand the symbiotics between their IT systems and their electrical power infrastructure can create operational and financial havoc. Because electrical power and data center operations are so interdependent, power problems greatly jeopardize companies' ability to ensure business continuity… or even just maintain a sufficient level of insight into power-related problems.

CRITICAL BENEFITS OF POWER ANALYTICS SOLUTIONS FOR DATA CENTERS

1. Adaptive, real-time situational awareness
2. Predictive diagnostics based upon actual operating conditions (not just extrapolations of historical data)
3. Intelligent alarm management that filters irrelevant alarms
4. Global consolidation and management of assets
5. Energy, capacity, and resources management
6. Reliability-centered maintenance
7. "What if" simulation environment to drive design and maintenance considerations
8. "Black Box" data restoration and analysis in the event of anomalies

A Costly Pound of Cure

Despite the overwhelming financial incentives and imperatives, many companies still are still flying blind when it comes to their power systems infrastructure. They frequently **overestimate** the capabilities of their internal preparedness (UPS, generators, etc.) and at the same time **underestimate** the severity and the speed with which power problems strike: for example, the 2003 Northeast Blackout surged across the Great Lakes and northeast regions like a tsunami, knocking out 250 power plants across a million square miles in only eight minutes.

Knowing that advance warning isn't always possible, businesses have made continuity their highest priority, at whatever costs. The first-generation approach to mitigating – short of preempting – the effects of data center power problems are monitoring and SCADA technologies… coupled with banks of fault-tolerant systems, UPS, generators, battery rooms, etc.

For organizations concerned about maintaining business continuity, these technologies were a wise investment for reducing post-outage business disruptions. Many modern-day facilities still rely solely on these approaches… knowingly operating in reactionary mode, and responding to alarms as they arise. In times of trouble, these alarms deluge users with thousands of lines of information per second, making it nearly impossible for data center operators to gain an accurate understanding of the precarious health of their power system operations. So, like the car alarm that has become more of an annoyance than an alert that a car is being stolen, operators often ignore – or even just turn off – these systems.

"The biggest challenge in data center design is striking a balance between continuity versus costs," explained Mark A. Ascolese, co-founder of the Critical Power Coalition, a national organization whose mission is to develop common public policy and establish a unified industry voice to ensure the quality, reliability, and continuity of electrical power within critical industries, businesses and public services.

"Too frequently, organizations over-invest in standby and recovery equipment, when all that is really needed is greater visibility into how power infrastructure will respond to changes in the operating environment under varying conditions," Ascolese added. "It's like paying to install airbags throughout the interior of your car, when collision avoidance alternatives are readily available, less expensive, and offer safety benefits far beyond what airbag can. In the past year, Power Analytics has emerged as a proven, cost-effective, and forward-looking methodology for providing the insight required to identify, isolate, and prevent electrical power problems long before they can jeopardize data center operations."

An Ounce of Prevention

The term "Power Analytics" is the electrical power counterpart to "Business Analytics," those sophisticated mathematical models that help financial institutions to assess a consumer's real-time financial health, determine FICO scores, prevent fraud and predict lending risks.

Power Analytics enable data center operators to assess the real-time integrity of their electrical power infrastructure, prevent anomalies, and predict the nature and location of electrical power problems the instant they become theoretically possible. Over the past year, since its introduction at the **Spring 2006 7x24 Exchange Conference**, Power Analytics technology has emerged as the "collision avoidance" solution data center operators sought to successfully predict and prevent electrical power problems from occurring.

With successful installations nationwide with the Federal Aviation Administration (FAA) and several undisclosed corporate data centers, the technology has proven successful in helping companies gain an unprecedented understanding into the innermost workings of the power systems supporting their IT infrastructure, ushering in a new era in data center management and planning; one executive compares it to the revolution that occurred in the medical field when CT scanners and other diagnostics technologies were introduced.

How Power Analytics Work

The comparison to medical technologies is an apt one: Power Analytics systems allow unprecedented insight into power systems infrastructure for a simple reason: every element of power systems design – from the largest piece equipment to the smallest circuit breaker – is codified with the operating specifications, system parameters, and all other pertinent data for every component that comprises the overall system.

Just as all components of the human body have normal and abnormal "vital signs" – and irregular signs like high temperature, elevated blood pressure, heart rate, or respiration rate are indicators of potential longer-term health problems – so does electrical power infrastructure.

So, just as physicians rely on a full range of patient monitoring systems to observe vital signs – right down to the real-time respiration and cardiac output of a patient – data center owners now have the means to understand systems-level reliability and capacity, right down to the smallest power cable or circuit.

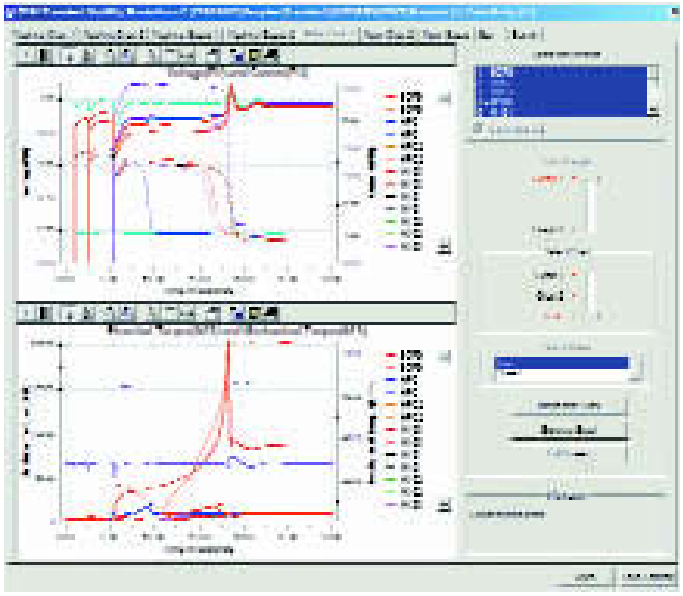

Image One: Once a Power Analytics model is created, it serves as a "flight simulator" that not only detects potential design miscues, but allows data center managers to conduct important "what if" scenario testing of their operational environment.

Model-Driven Design, Diagnostic, & Deployment

The principal benefit of the "model-driven" Design/Diagnostics/Deployment approach for data center operators is that it removes all major variables, unknowns, and uncertainties from the entire project. Because specifications for every component – and the interrelation of all components to one another and the surrounding infrastructure – are known early in the design stage, they can also serve as the basis for downstream diagnostics and deployment.

Thus, operators know precisely how their infrastructure is going to perform during the three crucial phases:

- **Design Phase:** A Power Analytics platform creates more than a typical CAD blueprint or one-line diagram of a facility: it creates a dynamic, "virtual model" of the power distribution system and its components and controls logic. Within this virtual model, detailed manufacturers' specifications for all equipment and components are stored; by recognizing "normal" power system readings on a component-by-component basis, data center operators are assured of the system-level integrity on a sum-of-the-parts basis…

  Armed with this information, potential electrical infrastructure problems can be easily designed out of a facility before it is constructed or modernized; safety considerations (arc flash, protection coordination, etc.) are addressed; and a detailed understanding of systems-level capacity and reliability are attained in order to ensure that the data center design is "perfect on paper" before proceeding.

- **Diagnostics Phase:** Once completed, this Power Analytics virtual model is used as the basis for simulating and validating the operational parameters of the overall electrical distribution system, to ensure system-wide integrity before it is constructed.

  Reusing the data in the virtual model, important "what if" problems, even ones that are beyond the scope of operational probability, can be quickly and easily addressed. Better still, these diagnostics can identify design modifications that will further improve the operational performance and resilience – power flow, power quality, component sizing, etc. – of the finished facility.

- **Deployment Phase:** The true value of Power Analytics becomes apparent in the deployment phase. Unlike traditional one-line diagrams, the virtual model can be switched from "design mode" to "surveillance mode" once the facility is constructed. In this mode, a facility's target operating specifications as encoded in the virtual model, are compared to actual online data from the facility's physical equipment, to ascertain when and where anomalies have the potential to occur.

  Power Analytics systems know how to check, interpret, and cross-reference "symptoms" deep within data center infrastructure… whether locally, or in remote locations managed by a central operator. In comparing the "actual" and "virtual" performances of the electrical infrastructure, Power Analytics software is able to detect the most negligible variations, even those involving seemingly unrelated components. This actual-to-virtual methodology accurately predicts yet-to-fail components or operating conditions that, left undetected, could result in a power outage.

  Over time, "normal" power system readings consist of more than just the original manufacturer's equipment specifications used to launch the facility: historical operating measurements, including day-to-day readings of equipment in routine operation, are also factored in. Negligible deviations in measurements from any component – combined with other readings in a seemingly unrelated area – can be probed to determine if they could be an indication of the early stages of power anomalies.

Image Two: After a Power Analytics system is deployed, thousands of arcane electrical components making up a data center's power systems infrastructure can be presented in easily understood charts, graphs, and diagrams depicting only relevant information for specified users.. including the economic impact of operational decisions.

The Big Picture: Millions of Smaller Ones

But these millions of micro-details are pointless unless they can be translated into actionable measures by data center operators. Like Business Intelligence (BI) visualization tools – which companies use to consolidate, analyze, and present information about their operations – Power Analytics systems have advanced, customizable data reporting tools that can generate individualized real-time status reports; these reports can be tailored for the informational needs (technical, operational, financial) and technological knowledge of appropriate people within the organization.

This flexible visualization capability prevents one of the most frequently-cited problems resulting in data center power outages: information overload. In case after case, human error – specifically, incorrect human action caused by misinterpretation of systems readings – has been shown to worsen, if not directly cause, the severity of power outages.

Acting as both an on-board electrical power system expert and translator, Power Analytics systems intelligently filter the power system sensory data, help data center operators understand the real-time health of their electrical power infrastructure, as well as diagnose whether that health is improving, stable, or deteriorating.

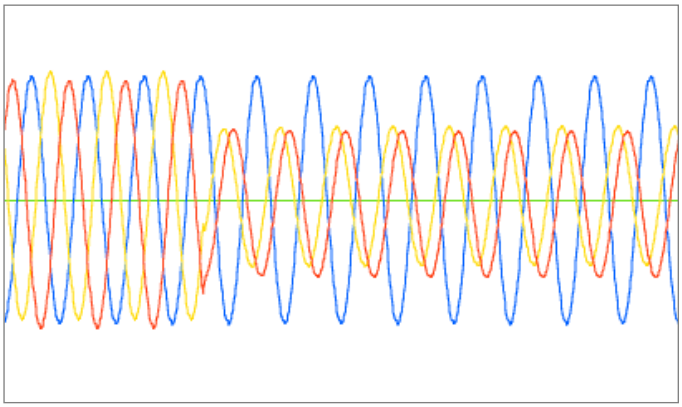

Image Three: Thin-client Internet Explorer Viewer, with an actual Square D CM4000T waveform displayed. This waveform capture – taken from a live, non-disclosable client application – displays the effect of a power anomaly on all three voltage phases, time-stamped to the millisecond.

When a reading that warrants further investigation is detected, Power Analytics systems help operators understand the impact of surrounding components to scrutinize and determine when and where problems could be in the formative stages. As a result, Power Analytics provide a far more detailed assessment of potential electrical power problems... in most cases, long before they actually occur and can have a devastating effect on a company's bottom line.

Thus – like the difference between a checkup and an autopsy – business-impacting questions rooted in the health and reliability of electrical power can be answered immediately, not after a problem occurs. As examples:

- How much more capacity can our existing facilities accommodate, before it becomes necessary to make arrangements for new facilities?
- What would be the operational impact of adding new equipment, changing configurations or adopting new technology?
- If we were to outsource our manufacturing – or we needed to monitor our suppliers' facilities to ensure the integrity of their systems – how could we do so?

Summary: Implications for Data Center Owners

Forward-thinking data center operators are recognizing that Power Analytics presents a dramatically new best practices paradigm over traditional IT/power systems methodologies.

For the first time, companies are now able to comprehensively and confidently view power systems infrastructure synergistically with their IT planning and facilities management.

Armed with these capabilities, facilities across America are now operating at peak levels of uptime… and more importantly, unprecedented insight into the health, reliability, and capacity of their facilities for the long term.

For businesses for which electrical power serves as the central nervous system for their global operations, Power Analytics is emerging as one of the most promising new business continuity technologies of the e-business era.

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