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Building a power monitoring and management strategy

Selecting the software and services needed to keep critical power systems continuously available

Executive summary

IT and facilities management solutions come in many varieties, most of which include at least some power monitoring and management functionality. Generally speaking, however, no one solution offers all the features data center operators need to keep their uninterruptible power systems (UPSs), power distribution units (PDUs) and other critical power components operating at peak efficiency.

This white paper explains why a complete power monitoring and management strategy should usually include one or more infrastructure management solutions, a virtualization management solution, a specialized power monitoring and management application and remote power monitoring services from a proven third party with deep power quality expertise.

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Powering Business Worldwide

Infrastructure management solutions

Data center operators use infrastructure management solutions to administer applications; hardware; and the facility's mechanical, electrical and plumbing systems. Most data centers require several of these solutions, which typically include at least some power monitoring and management functionality.

There are three main kinds of infrastructure management solutions.

1. Network management systems

Network management systems enable IT managers to view and administer all an organization's servers, storage devices and network resources from a single location.

Strengths and weaknesses: Network management systems excel at managing IT hardware and software, but provide limited visibility into a data center's physical infrastructure, including its power systems.

2. Building management control systems

Building management control (BMC) systems give data center operators centralized control over the facility's safety, comfort and mechanical systems.

Strengths and weaknesses: BMC solutions are essentially a mirror opposite of network management systems in that they provide comprehensive control over physical resources but little to no control over IT assets. In addition, while most BMC offerings include power and cooling management capabilities, that functionality rarely extends all the way down the power chain to a company's UPSs, batteries, PDUs and server racks.

3. Data center infrastructure management solutions

Unlike network management and BMC systems, data center infrastructure management (DCIM) solutions provide unified control over both IT and mechanical resources, enabling administrators to manage everything from physical and virtual servers to power and cooling systems through a single console. The most sophisticated DCIM solutions also provide:

- Ticketing systems for scheduling and tracking maintenance procedures to servers, storage and the network
- Three-dimensional rack enclosures and device maps
- Three-dimensional rack-level power and cooling maps
- Capacity planning features, including tools for determining where best to install new servers and other IT equipment
- Inventory management functionality, including the ability to track central processing unit (CPU), memory and storage requirements on a per-application basis

Strengths and weaknesses:

The same end-to-end functionality that makes DCIM solutions so powerful also makes them complex. As a result, deploying, integrating and maintaining them can be an expensive, time-consuming process.

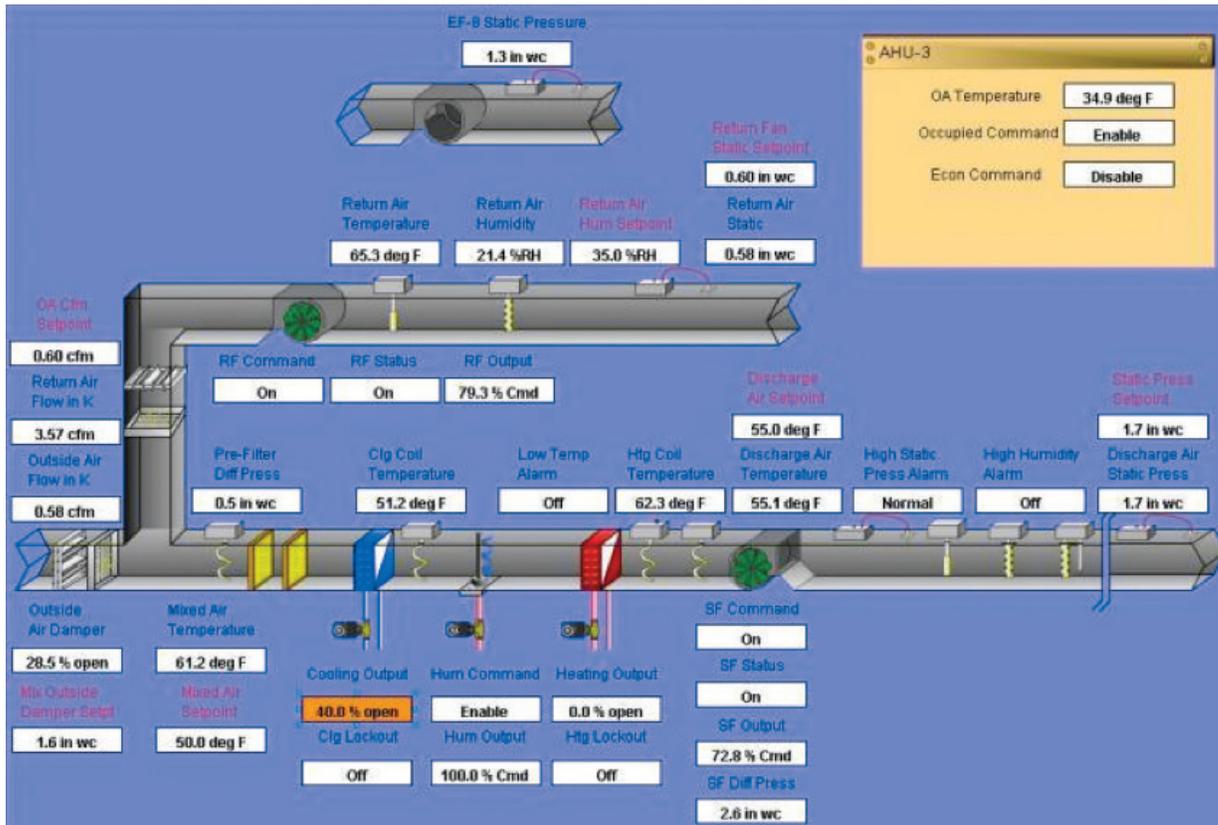


Figure 1. Building management control systems give data center managers centralized control over safety, comfort and mechanical systems.

Virtualization management solutions

Solutions such as VMware vCenter Server, Microsoft System Center Operations Manager and Citrix XenCenter enable today's highly virtualized data centers to view and control their many physical and virtual machines.

They also assist with power management. Specifically, virtualization management solutions allow technicians to extend UPS battery life during utility outages by shutting down virtual machines and consolidating them onto fewer host devices. Solutions equipped with "live migration" programs such as VMware vMotion also let data centers move virtual machines from host servers running on battery power to unaffected servers elsewhere on the network or in a colocation data center in the cloud.

No other type of IT and facilities management solution can perform these critical functions, so every virtualized data center should include a virtualization management solution in its power management and monitoring arsenal.

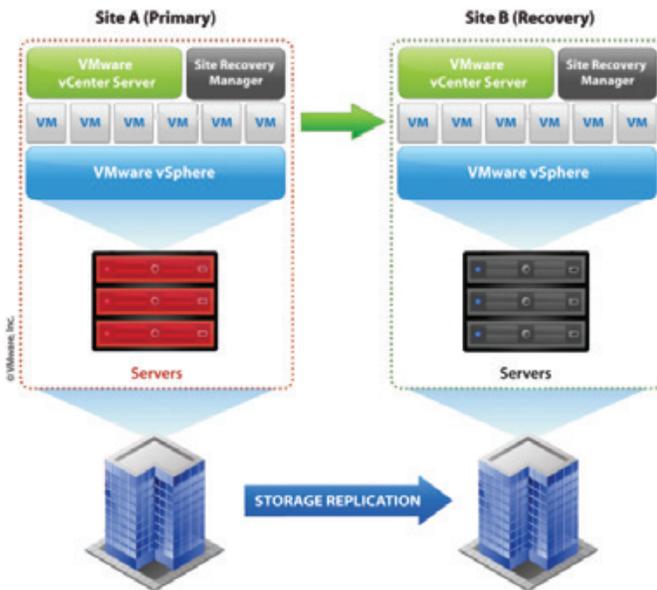


Figure 2. Virtualization management systems equipped with live migration capabilities can automatically move virtual machines to backup data centers during power outages.

Power monitoring and management solutions

Infrastructure and virtualization management solutions assist with a wide range of administrative tasks. Power monitoring and management solutions, by contrast, offer more specialized assistance with one particularly critical task: keeping a data center's power systems running efficiently and continuously. There are two basic kinds of power monitoring and management solutions.

1. Entry-level power management solutions

These equip data centers with an extensive array of capabilities that infrastructure and virtualization management solutions typically lack, including the ability to:

- Automatically discover UPSs, PDUs and other network-enabled power devices across the enterprise
- Group and display these power devices in logically arranged tree structures that make managing them easier
- View and manage power assets through a single control panel that's accessible from any web browser

- Display real-time status information for power equipment from multiple vendors
- Shut down servers automatically and gracefully during utility failures
- Divide receptacles on UPS hardware into separately managed load segments to conserve battery capacity during extended power outages by shutting down the least important systems first
- Collect and archive facility-wide UPS performance data that can help administrators prevent downtime by proactively identifying and addressing impending failures, overloaded UPSs or UPSs in need of rebalancing
- Set power consumption limits for servers during extended power outages (Though not yet widely available in entry-level power management solutions and generally only usable in conjunction with hardware from specific manufacturers, "power capping" features of this sort help increase UPS battery runtime during utility failures while preserving uptime by slowing rather than stopping mission-critical servers.)

State-of-the-art entry-level power management solutions also integrate closely with leading virtualization management systems, enabling data center managers to:

- View, monitor and administer not only physical and virtual servers, but UPSs, PDUs and other power devices through one console
- Receive network- and power-related alerts through their virtualization management application, so they don't have to watch for alarms in two or more different systems
- Shut down virtual servers as well as physical ones automatically and gracefully during power failures, or use live migration software to relocate virtual machines onto host servers in a backup facility or co-located cloud data center
- Automatically suspend non-critical virtual machines, consolidate critical loads on fewer host servers and shut down unused host servers (Such "load shedding" operations dramatically extend UPS battery runtime by minimizing unnecessary power consumption. In fact, reducing data center power usage by 50 percent via load shedding can increase battery runtime by some 150 percent.)

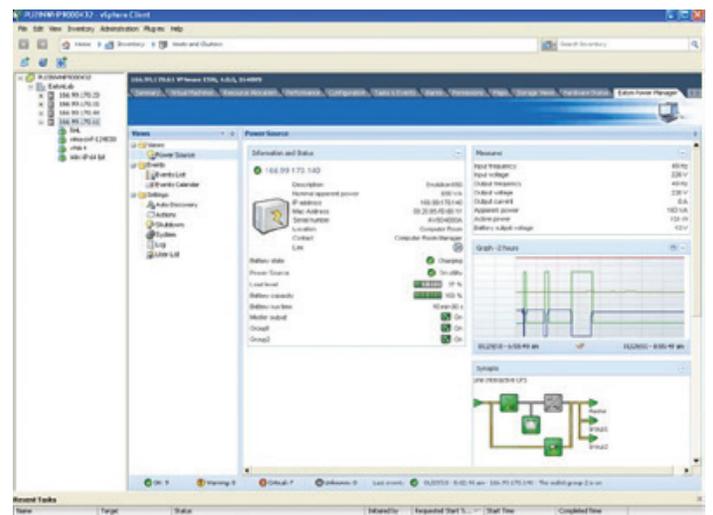


Figure 3. The best entry-level power management solutions integrate closely with leading virtualization management applications.

2. Enterprise-grade power management solutions

Designed for use in larger data centers with more complex requirements, enterprise-grade power management solutions come with more extensive and advanced capabilities than entry-level systems. Specifically, the best enterprise-grade power management solutions give IT and facilities managers the ability to:

- Generate detailed energy-efficiency reports and calculate key energy-efficiency metrics such as Power Usage Effectiveness (PUE) and Data Center Infrastructure Efficiency (DCiE)
- Balance electrical loads to minimize peak demand and maximize energy cost savings
- Identify inefficient data center hot spots that can put wasteful strains on a facility's cooling systems
- Measure power consumption on a per-workload basis to support energy chargeback initiatives
- Provide capacity planning data



Figure 4. Enterprise-grade power management systems offer more extensive and advanced capabilities than entry-level systems.

The most sophisticated enterprise-grade power management systems also come with:

- Manager of Managers (MOM) software that enables administrators to view and control up to 500 separate deployments anywhere on the network through a single dashboard
- A full range of complementary project management, systems design, device integration, testing and custom application development services

Remote power monitoring services

Together, infrastructure management solutions, virtualization management solutions and power monitoring and management solutions arm data center operators with a broad assortment of capabilities for keeping power systems and mission-critical workloads continuously available. However, no power monitoring and management strategy that relies exclusively on such systems is truly complete.

To maximize application uptime and power system reliability, data center operators should supplement their onsite management solutions with a remote power monitoring service. Such offerings ensure that IT and facilities managers receive prompt notification of power-related problems no matter when they occur by providing round-the-clock, worldwide monitoring of data center power systems. They're also staffed by trained experts with deep

knowledge of power systems who can help data center managers interpret power system alarms and more accurately distinguish those requiring immediate action from those that can wait.

When evaluating remote power monitoring services, be sure to look for these capabilities:

- 24/7 real-time monitoring of battery discharge, humidity, temperature and other critical variables to detect and prevent failures
- Immediate email notification of alarms to certified technicians who understand their meaning and can recommend the most appropriate response
- Prompt dispatch of experienced service personnel equipped with the right parts
- In-depth knowledge of the specific make and model of UPS and PDU hardware your data center uses

More advanced services include these capabilities as well:

- Graphical, color-coded reporting tools that distill large volumes of information into actionable, meaningful overviews so administrators can quickly identify which systems are within acceptable tolerances and which aren't
- Monthly reports on longer-term UPS and battery trends
- A web-based dashboard that provides fast anytime, anywhere access to data on availability, power capacity, energy-efficiency and other critical topics
- Mobile apps for iOS and Android devices that let IT and facilities managers see detailed device, site and alarm information from their smartphones and tablets

The most sophisticated remote power monitoring services also come with predictive analytics functionality capable of preventing downtime by detecting power system failures days or even weeks before they occur, allowing data center operators to take corrective action in advance.

Conclusion

Power monitoring and management are complex tasks, but they are critical to maintaining nonstop uptime. To perform those tasks effectively, most data centers need one or more infrastructure management solutions, a virtualization management solution and a specialized power monitoring and management solution. They also, however, require the deep expertise and continuous protection offered only by remote power monitoring services. Data center operators who wish to stop utility outages and power system malfunctions from disabling mission-critical IT solutions should ensure they have the right set of onsite solutions and remote services for their specific environment.

About Eaton

Eaton's electrical business is a global leader with expertise in power distribution and circuit protection; backup power protection; control and automation; lighting and security; structural solutions and wiring devices; solutions for harsh and hazardous environments; and engineering services. Eaton® is positioned through its global solutions to answer today's most critical electrical power management challenges.

Eaton is a power management company with 2013 sales of \$22.0 billion. Eaton provides energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power more efficiently, safely and sustainably. Eaton has approximately 103,000 employees and sells products to customers in more than 175 countries. For more information, visit www.eaton.com.

About the author

Arthur Mulligan is a Raleigh-based product line manager for Eaton's U.S. power quality service organization and has celebrated more than 15 years with Eaton. He has a varied background of marketing, advertising and sales experience in telecom, software and professional services.

Jim Tessier is an experienced product manager for IT hardware and software products, and has been with Eaton for six years. He introduced and grew the Intelligent Power Manger (IPM) software product from a simple power management platform to a powerful, award-winning data center power management software that integrates within the IT environment and offers controls to optimize data center power solutions

For the basics on power management, visit
Eaton.com/intelligentpower

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