

Tivoli software

Manage energy and reduce risk in the data center with IBM Tivoli software and Eaton Power Xpert.



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Introduction

In the next decade, enterprise data centers anticipate substantial growth to support their organization's objectives. Potential results from this growth include data centers with higher power and cooling densities. This ever-increasing density of computing power can drive up energy costs, limit data center organizational growth and place critical businesses at risk.

Many organizations are seeking to reduce energy consumption to combat rising costs and carbon emissions considerations. The data center is an integral part of this initiative. Currently, however, many IT and facility systems operate independently of each other and are not set up to optimize energy consumption holistically. If data center energy consumption is not optimized, companies can have higher energy expenses, increased carbon footprint and unnecessary construction of data center capacity. Enabling IT and facilities to work collaboratively can help position organizations to operate more efficiently and effectively while still meeting their business objectives.

Through an integrated approach to managing energy that links IT assets, the data center infrastructure and facilities assets, IBM Tivoli® software offers a holistic view of data center energy consumption in the context of risk. Combined with the facilities and environmental capabilities of Eaton Power Xpert, IBM and Eaton can give organizations increased visibility into power consumption to help make more efficient use of existing resources.

This white paper describes the benefits of an integrated energy management offering and discusses the role of Tivoli software and Eaton Power Xpert. Specifically, it describes how configuration and implementation of this combined offering can help organizations better manage power infrastructure issues in the data center through increased visibility into the capacity and health of the infrastructure.

Highlights

Increased visibility within a management system shared by the IT infrastructure can enable greater control of power usage for data center assets

An end-to-end view of IT, facilities and business objectives

In most organizations, IT procures the hardware and software, while facilities or corporate real estate is responsible for the energy bills. Historically, facilities have charged back expenses based on square footage, not for actual energy consumption. As a consequence, line-of-business (LOB) or IT managers are not able to see actual energy consumption, while facilities managers are frustrated by the opaqueness of energy usage in data centers.

In order to optimize data center power usage, IT, LOB and facilities managers need to know how much power the data center is consuming and where. Increased visibility within a management system shared by the IT infrastructure can enable greater control of power usage for data center assets.

An end-to-end view of business objectives as well as IT and facilities resources, services and assets can enable organizations to:

- Dynamically provision servers to respond to energy situations, such as unexpected data center equipment usage spikes, which could affect the load on the underlying infrastructure, including power and cooling systems.
- Give the IT department visibility into its energy consumption and the status and capacity of the power chain devices that provide this energy. By having this information, including important energy pricing considerations, IT can more intelligently balance workloads to optimize energy usage and control costs.
- Provide chargebacks to users, including energy consumption. With this data, organizations may be more likely to remove unnecessary items from the data center, reducing power and cooling loads.

A joint solution

When applied to energy consumption, Tivoli software – and its broad range of monitoring, event health, performance and automation capabilities – can help data centers adapt application usage to power constraints while maintaining service levels and workload throughput. Implementing IBM Tivoli Monitoring for Energy Management and Eaton Power Xpert Gateway for Eaton Power Distribution Units (PDUs) and Uninterruptible Power Supplies (UPSs) can bring greater precision in data center and facilities management by combining power consumption of IT computing resources, such as servers and storage devices, with energy-related events, power quality, historical trending and forecasting information.

The joint Tivoli and Eaton Power Xpert solution consists of the following components:

IBM Tivoli Monitoring for Energy Management

Tivoli Monitoring for Energy Management is a powerful energy management tool for the data center. It provides a key link between the domains of energy management and service management, to help customers reduce energy use while maintaining IT service levels.

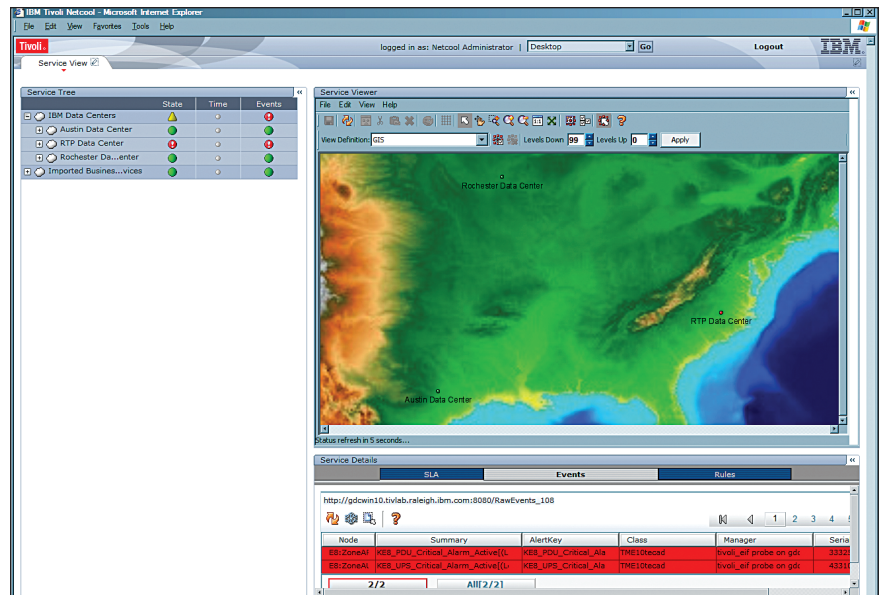
The Eaton Power Xpert Agent for Tivoli Monitoring for Energy Management collects Simple Network Management Protocol (SNMP) data from Eaton Power Xpert Gateway Series 1000 and 2000 cards. This data is displayed in various workspaces for graphical viewing, which provides basic visibility for IT operations personnel into the PDU breaker and UPS operational parameters.

Along with the Eaton Power Xpert agent, Tivoli Monitoring for Energy Management produces out-of-the-box reports to identify ways to improve energy efficiency along with data center infrastructure efficiency (DCiE) and power usage effectiveness (PUE) metrics.

IBM Tivoli Monitoring Discovery Library Adapter (DLA) can be used to generate a DLA book (an XML output file), which contains UPS and PDU resources that are being monitored by Tivoli Monitoring for Energy Management. When imported to IBM Tivoli Business Service Manager, the UPS and PDU resources from the DLA book are available for inclusion in business services as dependents, in addition to other applications and computer systems. This enables correlation to and visibility of the effects of power chain components on business services.

IBM Tivoli Business Service Manager

Tivoli Business Service Manager supports the creation of executive dashboards to monitor energy infrastructure and critical situations that could threaten business services.



IBM Tivoli Usage and Accounting Manager

Tivoli Usage and Accounting Manager can utilize the power data, provided by Eaton Power Xpert Meter (PXM), from Tivoli Monitoring for Energy Management to allocate or charge back energy cost to the business units or cost centers that are using the power. Energy usage can be combined with other data center resource usage to provide complete financial management cost accounting across the enterprise. Tivoli Usage and Accounting Manager can help customers gain new insights into how their shared resource budgets are being consumed.

Eaton PDUs or RPPs with Power Xpert Gateway Series 1000 card

The Eaton Power Xpert Gateway Series 1000 card is compatible with Eaton Remote Power Panels (RPPs), PDUs, Rack Power Modules and the Eaton Energy Management System. Data from this card can be accessed three different ways: through Tivoli software, standard onboard Web pages or Power Xpert software. The information presented through this easy-to-use interface helps simplify interpretation of complex power data by viewing panel, subfeed breaker and branch circuit breaker names and settings. These cards also support Modbus TCP/IP and SNMP support for building automation systems.

Eaton UPSs with Power Xpert Gateway Series 2000 card

The Eaton Power Xpert Gateway Series 2000 card is compatible with Eaton UPS systems with X-slot compatibility, including Eaton models 5115 RM, 5125, 9125, 9140, 9155, 9315, 9355, 9390, 9395 and BladeUPS. Data available from these devices through Tivoli software or a standard Web browser can include power quality data, time stamping, Eaton environment probes and dry contact information. These cards also support Modbus TCP/IP and SNMP support for building automation systems.

Getting started: an implementation

A recent implementation of the solution sought to bring power metrics into the IT systems management domain, such as:

- Rated capacity for a branch circuit breaker.
- Present load on a branch circuit breaker.
- Accumulated energy usage.
- UPS status.

Highlights

With applications becoming more mission-critical, it is essential to take adequate measures to ensure the performance of business services to the promised SLAs

One goal for these metrics includes the ability to send notifications to IT and facilities when abnormal power conditions threaten the IT infrastructure. More importantly, the metrics could offer increased knowledge of what business services are at risk as a result of a power system issue, such as a loss of N+1 redundancy in the data center. With applications becoming more mission-critical, it is essential to take adequate measures to ensure the performance of these business services to the promised service level agreements (SLAs).

In order to alert exceeding PDU breaker capacity, the electrical current needs to be monitored in each branch circuit breaker and mapped to the business processes, or applications, being run on the equipment connected to that PDU. If unforeseen usage spikes occur, it is possible to dynamically re-provision such loads to run on other systems. From there, a database of load characteristics of all the PDU breakers in the entire data center could be built to provide information for future planning.

With blade servers continuing to increase in power density and cooling capacity, ensuring that adequate utility provisions are available on both the “A” and “B” systems in a dual-corded server data center is critical. By giving IT and facilities visibility into power consumption – with circuits correlated to business services – the implementation allows strategic planning based on infrastructure usage information, such as kilowatt-hours (KWH) of energy consumption.

A closer look at an actual implementation

The implementation environment consisted of Eaton UPSs and PDUs, IBM BladeCenter® and IBM System x™ stand-alone Microsoft® Windows® servers configured with virtual machines. The following steps were taken during the implementation process:

- Install the 1000 and 2000 cards in the Eaton equipment as outlined in the installation manuals located at www.eaton.com/powerxpert.
- Install IBM Tivoli Monitoring, Version 6.2 Fixpack 1 on the IBM BladeCenter server.
- Install Tivoli Monitoring for Energy Management, Version 6.2 on the same IBM BladeCenter server.
- Configure the Eaton Power Xpert agent to add UPSs and PDUs with SNMP details, such as SNMP version, IP address, port number and community names.
- Install Tivoli Business Service Manager, Version 4.1.1 with Interim Fix IF0001, IF0003 and IF0007 on a Windows 2003 server, on a virtual machine running on an x3950 server.

The configuration of Tivoli Business Service Manager and Tivoli Monitoring for Energy Management integration included:

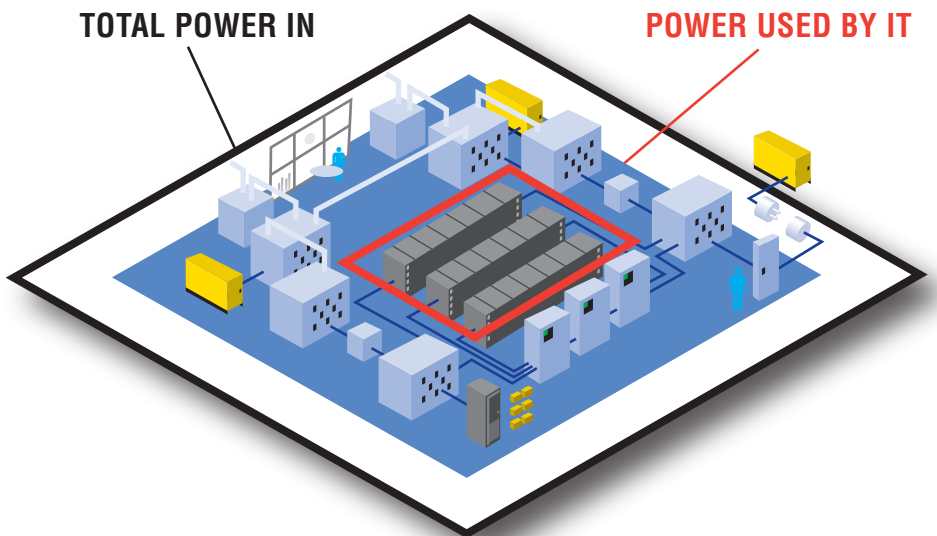
- Configuring Tivoli Monitoring for Energy Management to communicate with Tivoli Business Service Manager.
- Customizing rules and templates files in Tivoli Business Service Manager to enable import of the resources being monitored by Tivoli Monitoring for Energy Management.
- Running the Tivoli Monitoring Services DLA to generate a DLA book, which contains Eaton PDU and UPS resources.
- Importing the DLA book into Tivoli Business Service Manager. When the DLA book is imported to Tivoli Business Service Manager, the UPS and PDU resources are available for inclusion in business services as dependents along with other applications and computer systems. This enables correlation to and visibility of the effects of power chain components on business services.
- Creating the business service within Tivoli Business Service Manager, adding the imported resources as dependent children and configuring the template with incoming status and aggregation rules to enable status propagation from resource level to service level.
- Configuring the event integration facility (EIF) on the Tivoli Monitoring for Energy Management machine to send events to Tivoli Business Service Manager.

Implementation results

As a result of the implementation, the combined Tivoli software and Eaton Power Xpert solution offered the following benefits:

- Reduced risk of downtime through increased visibility into the affected business service, power quality, UPS capacity status and PDU breaker capacity margins.
- Greater visibility into power consumption, allowing proactive decision making to take energy-saving actions.
- Insight into ways to save energy and manage growth.
- The ability to protect critical equipment through visibility into the location and capacity of loads.

When a PDU breaker load is exceeded or a UPS failure occurs, Tivoli Monitoring situations are forwarded to Tivoli Business Service Manager, and the status of the business service on the dashboard changes according to incoming status and aggregation rules.



Highlights

The combination of Tivoli software and Eaton Power Xpert can also provide the unique ability to capture energy efficiency metrics

The combination of Tivoli software and Eaton Power Xpert can also provide the unique ability to capture energy efficiency metrics as defined by The Green Grid, a nonprofit industry consortium addressing data center efficiencies.*

As illustrated below, two key metrics include DCiE and PUE. DCiE expresses the efficiency of the data center while PUE, its reciprocal, expresses the amount of overhead power consumed to run the UPS, cooling, lighting and other loads.

Data center efficiency metrics

The PUE is defined as the total facility power divided by the IT equipment power.

Power utilization effectiveness

$PUE = \text{Total facility power} / \text{power consumed by IT equipment}$

For example, a PUE of 3.0 means that your data center consumes three units of power for each single unit of power used by the IT equipment. Smaller values are better than larger values.

Data center infrastructure efficiency

$DCiE = 1 / PUE$

For example, DCiE is represented as a fraction or as a percent. So a PUE of 3.0 would be a DCiE of 1/3, or 33 percent. A DCiE of 1/3 or 33 percent represents the fraction of the total power consumed by the IT equipment. Larger values are better than smaller values.

Ideal PUE	1.6
Target PUE	2.0
Typical PUE	2.4 to 3.0
Many PUE	3.0 and higher

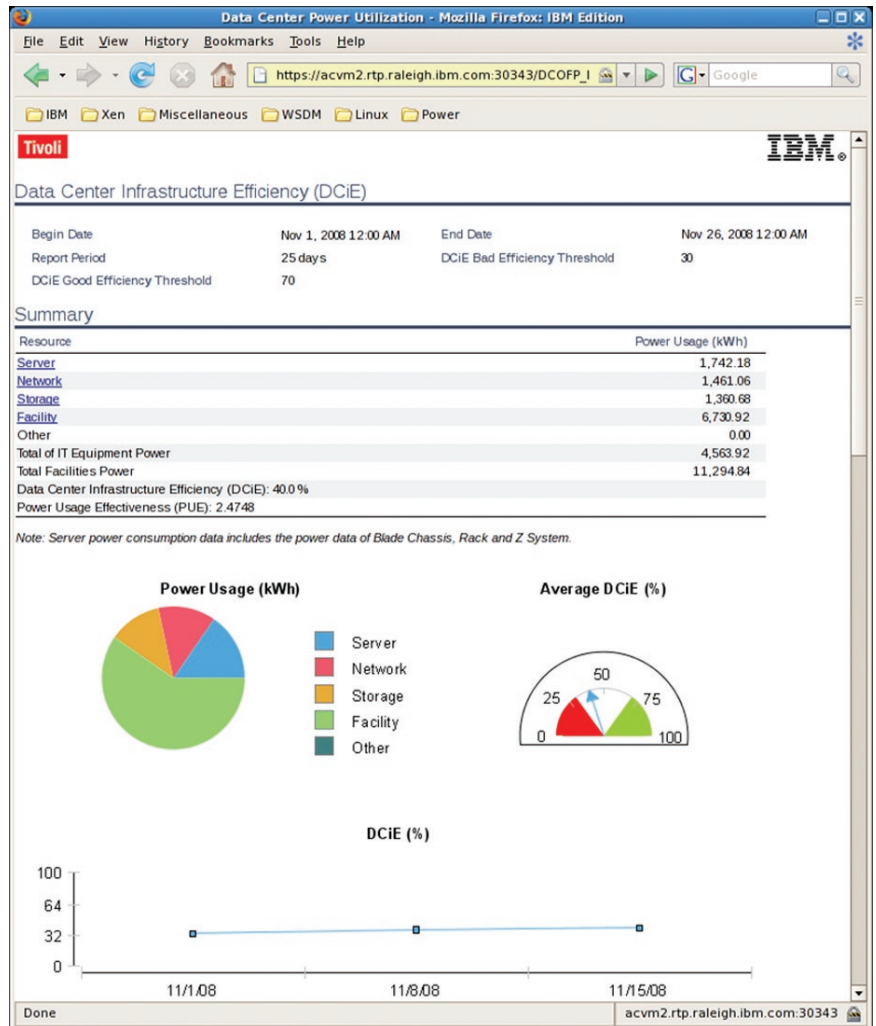
Identify, model and act on power-saving opportunities

IBM and Eaton continue to innovate with offerings that can help organizations successfully address the challenges of managing energy consumption. Tivoli Monitoring for Energy Management now provides a new capability to examine power consumption in a data center, in order to identify, model and immediately act on power-saving opportunities. Also, the data can be incorporated into the policy-based behavior of other Tivoli products.

This new reporting and modeling feature can help create reports for energy management costs. These reports can be itemized by resource (such as servers, storage, network devices and facilities in the data center). Through results generated by a modeling and recommendation engine, organizations can perform “what if” calculations to help determine power savings alternatives and associated costs.

Organizations can take power measurements for elements in the power chain by implementing the Eaton PXM 4000/6000/8000 series of meters. The meter information is fed, per the outlined configuration, into Tivoli Monitoring for Energy Management, in which the new reporting and modeling feature runs as a component.

The following diagram provides an example of a reporting and modeling workspace generated from Tivoli Monitoring for Energy Management:



Data center efficiency dashboard

Summary

Organizations today continue to be challenged to do more with less. Having an enterprise-wide IT and facilities collaborative strategy enables clients to review their processes and better understand how they can operate more efficiently to reduce energy expenses and their carbon footprint – and still meet business objectives.

The power of Tivoli software, coupled with the open architecture of Eaton Power Xpert, can provide cost-effective implementations to meet the business challenges of today and tomorrow.

For more information

To learn more about how Tivoli solutions can help you manage energy more efficiently – or to find the entry point that is right for your organization – contact your IBM representative or IBM Business Partner, or visit ibm.com/tivoli/products/monitor-green-energy. For additional information on Eaton, contact Eaton Corporation at www.eaton.com/datacenter or www.eaton.com/powerxpert

About Tivoli software from IBM

Tivoli software offers a service management platform for organizations to deliver quality service by providing visibility, control and automation – visibility to see and understand the workings of their business; control to effectively manage their business, minimize risk and protect their brand; and automation to optimize their business, reduce the cost of operations and deliver new services more rapidly. Unlike IT-centric service management, Tivoli software delivers a common foundation for managing, integrating and aligning both business and technology requirements. Tivoli software is designed to quickly address an organization’s most pressing service management needs and help proactively respond to changing business demands. The Tivoli portfolio is backed by world-class IBM Services, IBM Support and an active ecosystem of IBM Business Partners. Tivoli clients and Business Partners can also leverage each other’s best practices by participating in independently run IBM Tivoli User Groups around the world – visit www.tivoli-ug.org



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Produced in the United States of America
December 2008
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*www.thegreengrid.org



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