Server Technology®
A brand of legrand®

stay powered. be supported. get ahead.

The top 10 things every data center manager should know about power

WHITE PAPER April 2016

Executive Summary

Today's data center has come a long way from being the home of a single mainframe computer. It is a complicated mix of servers, storage, networking, load balancers, and other hardware, all running multiple layers of software. This paper identifies some key considerations for the data center planner and operator regarding how to simply and reliably power all of the IT hardware in the modern data center.

Overview

The Data Center industry has been a primary focus of energy consumption for many years due to increasing power demands and the need to continuously provision for more power. This need for more power capacity, augmented by the increasing cost of electricity, has created a new found urgency to effectively manage the power resources and energy usage. It is more prevalent than ever before for the Data Center Manager to ascertain the capability to determine, drive and report on energy efficiency while overseeing capacity planning management.

The data center facility contains racks of Information Technology (IT) equipment that consists of Server Racks, Network Racks, and Storage Racks. The methodology chosen for power delivery to IT equipment within these racks is a key factor for operational best practices that will allow power delivery improvements and drive up energy efficiency. Comprehensive power management and control is required to understand how power is being used and what can be done for improvements. You cannot improve something that is not being measured!

The following items outline points of interest for data center power management and define ten things every data center manager should know about power.

Power Density and Voltage

One way that many data center managers have coped with the growing demands on their infrastructure is to increase the density of the IT loads within their racks. With the rack equipment and power density requirements getting bigger, it is important to choose a power delivery and monitoring solution that maximizes energy efficiency.

1 **Whenever possible, deliver 3-phase power to the IT rack instead of single-phase power. This will accommodate 1.7 times greater power density within the rack versus single-phase power of a similar amperage. Maximum energy efficiency for 3-phase power can be achieved through power monitoring of the individual phases and working to maintain phase load balancing.**

1-800-835-1515
sales@servertech.com
www.servertech.com

The top 10 things every data center manager should know about power

WHITE PAPER April 2016

Higher voltage AC power delivery to the rack and IT equipment

There is a push in the North American datacenters for higher voltage power delivery all the way to the rack and ultimately the end IT equipment. Nearly all information technology (IT) equipment today is designed with auto-ranging power supply modules that can operate over a broad AC voltage range. It is common today for most AC to DC power supplies (PS) to have an operating range of 100-to-250 Volts AC in order to provide worldwide power compatibility.

Some typical North American rack based power distribution options include:

120V 30A, 1-Phase = 2.8 kW (NEC Continuous Current Rating)

208V, 30A, 1-Phase = 4.9 kW (NEC Continuous Current Rating)

208V, 30A, 3-Phase = 8.6 kW (NEC Continuous Current Rating)

208V, 60A, 3-Phase = 17.3 kW (NEC Continuous Current Rating)

415V, 30A, 3-Phase = 17.3 kW (NEC Continuous Current Rating)

15V, 60A, 3-Phase = 34.6 kW(NEC Continuous Current Rating)

[NOTE: 240 VAC to the IT device]

Historical power delivery within the datacenter has taken one of the following architectures:

North American 120/208V

Japan 100/200V

230V for most of the remaining world

Beginning around 2010, data centers within North America began implementing high voltage power delivery to the end IT equipment within the rack. Instead of delivering 120VAC or even 208VAC to the power distribution unit (PDU) within the rack, many began using 3-phase Wye power from 415VAC to provide 240VAC to their servers, networking and storage equipment. Some data center operators even investigated delivering 480VAC/277V to the end loads. Seeking to reduce power conversion losses, Facebook and other members of the Datacenter Pulse group led the efforts to eliminate the stepdown transformers within their data centers that take 480VAC down to 208VAC.

Higher voltage AC power delivery to the rack and IT equipment (continued)

The drivers for the adoption of higher voltages are:

Increased capacity

- The need to support greater equipment rack densities – reduced space requirements.

Reduced energy losses throughout the power distribution chain increase efficiency

- Transformer losses are reduced and in some cases eliminated with the delivery of higher voltages to the rack and ultimately to the end IT equipment. Typical power service within North America is 480 VAC, 3-Phase at the building entrance. It is then stepped down with transformers, delivered to the Remote Power Panel (RPP), from there to the racks, and from within the racks it is typical that power strips will further distribute the power to the IT equipment.
- The IT equipment (servers, storage, and network devices) AC Power supplies are able to more efficiently convert the AC power to DC power for the device components at the higher supported voltages. Typical IT equipment Power Supplies will transform from AC to 3.3, 5, and 12 VDC. These DC voltages are used to operate the device Printed Circuit Board (PCB) components within the IT equipment such as Servers, Storage, and Network devices.
- I^2R losses are reduced within the rack when using higher voltage and lower amperage to deliver an equivalent amount of power.

Decreased infrastructure and equipment expenses

- Fewer breakers at the Remote Power Panel (RPP)
- Fewer cable runs – reduced copper wire requirement

2 Provide increased voltage to the equipment. Select a power distribution system to supply the maximum rated voltage on each device within the IT rack. Equipment will operate more efficiently using the highest supported voltage.

Power & Environmental Monitoring in the IT equipment Racks

Data centers today are frequently dealing with a greater number of devices within individual racks than they were in 2005 or even 2010. Equipment density driven by the widespread adoption of blade servers and other compute-dense form factors requires more energy per unit volume than ever before. This increased power within the rack, along with higher data center operating temperatures, requires careful consideration to maintain uptime and ensure minimal interruptions in service. A roughly 4% energy savings is realized for each upward degree C change in the data center thermostat set point. This has driven up the typical data center operating temperature to 78 degrees F and higher. In this environment, increased equipment density along with

The top 10 things every data center manager should know about power

Power & Environmental Monitoring in the IT equipment Racks (continued)

increased operating temperatures means there is less time to react to a cooling system failure, thus necessitating the adoption of rack-level power and environmental monitoring systems.

Power and environmental monitoring are "MUST HAVES" to ensure staff is doing what needs to be done to effectively manage power in the data center. Managers that can see temperature and power readings in a variety of different ways will have the information required to understand how the IT equipment and applications are being used.

3 **A quality rack-level power monitoring solution such as those found in a PDU will enable immediate/automated response in order to avoid bigger problems affecting additional equipment and applications. Any solution being considered should offer:**

- Remote power measurement
- Remote power management (switching)
- Automated alerts and alarms for both power and environmental measurements

Power Use & Measuring Energy Efficiency

Measuring data center energy efficiency requires being able to monitor power usage to determine what can be done to make improvements on electricity use, reduce wasted energy and ultimately provide cost savings. Since 2008, PUE (Power Usage Effectiveness) and DCiE (Data Center infrastructure Efficiency) have been the most prevalent metrics for measuring efficiency. This was a good start, but PUE and DCiE measured only energy efficiency without consideration of workload performance. Early in 2012 DCeP or Data Center energy Productivity was introduced to go beyond PUE and include measurement for the useful work being performed by the IT equipment. DCeP is not easily measured and still requires a measured PUE. The goal of these metrics is to provide a common standard for comparing power usage within data centers, as well as provide a means for establishing baselines for comparisons and enabling measured improvement. Choosing the method to measure a facility's power requires careful consideration.

Having the ability to monitor device-level energy usage, plus the ability to monitor rate of consumption, increases the data center manager's insight as to what's happening within the data center and provides characterization for changes to enable power efficiency improvements. A key point to remember is that the application service level usage is what drives DCeP.

With enterprise level monitoring and power control down to the device level, or rack PDU outlet level, this can provide key features that enable capabilities identifying areas for energy efficiency improvements:

The top 10 things every data center manager should know about power

WHITE PAPER April 2016

4 Power control to the rack PDU's individual outlets will assist with security, capacity and savings by scheduling outlets to be turned off when not needed.

- Management tools can help an administrator protect the IT infrastructure against unauthorized usage by defaulting all unused outlets to the off state.
- If a rack PDU is functioning at its rated limits, simply turning off any unused outlets to prevent anyone from powering additional IT equipment and tripping any power circuit protection such as breakers or fuses. This ensures the rack does not exceed the available power.
- Similar to turning off a light when no one is in the room, if IT equipment is only used for a particular time period, or if workload diminishes at particular times, it is possible to power off the underutilized gear as a way to maximize energy conservation.

5 Using kWh information with low power threshold triggers can identify underutilized or idle (Zombie) IT equipment for consolidation or virtualization candidacy.

- What servers are pulling how much power?
- Are the servers in a steady state of power consumption, implying that the workloads never vary, and the servers may not be in use but simply "idling?"

6 Cost allocation can be achieved with kWh consumption numbers and can be useful for determining individual department usage within an enterprise data center or at off site colocation facilities. Actual power usage can be compared to fee-based colocation models.

- Charge backs help address the question for most IT users of "Why conserve energy if I am not being billed for it?"
- Remote power measurement helps the IT manager determine whether or not they are making full use of the power being paid for at the colocation facility.

7 Outlet level monitoring capability that includes quality of power measurements such as Power Factor and Crest Factor can provide an indication of an impending IT device power supply failure before complete failure actually occurs.

- Having the ability to monitor consumption at the IT device will help keep potential problems at bay.

The top 10 things every data center manager should know about power

WHITE PAPER April 2016

8 Having the ability to monitor loading at the rack PDU input provides information to prevent overloading the circuit and tripping any Remote Power Panel (RPP) circuit protection.

- With accurate circuit load monitoring and alarming, circuits close to overload can be identified before they become problematic.

9 Outlet level monitoring capability that includes quality of power measurements such as Power Factor and Crest Factor can provide an indication of an IT device power supply failure before complete failure.

- Having the ability to monitor consumption at the IT device will help keep potential problems at bay.

10 You cannot knowingly improve something that is not being measured! Power and environmental monitoring is a "MUST HAVE" to ensure staff is doing what needs to be done to effectively manage Power in the Data Center. Managers that can see temperature and power readings in a variety of different ways will have the information required to understand how the IT equipment and applications are being used.

- Power Reporting and Trending capability in power consumption for devices, applications or departments based upon finite time periods or seasonality.

About Server Technology®

Server Technology, a brand of Legrand, is leading the engineering and manufacturing of customer-driven, innovative and exceptionally reliable power, access and control solutions for monitoring and managing critical IT assets for continual availability.

Server Technology's power strategy experts are trusted to provide Rack PDU solutions for data centers worldwide ranging from small technology startups to Fortune 100 powerhouses. Because power is all we do, Server Technology can be found in the best cloud and colocation providers, forward thinking labs, and telecommunications operations.

Server Technology customers consistently rank us as providing the highest quality PDUs, the best customer support, and most valuable innovation. We have over 12,000 PDU configurations to fit every data center need and most of our PDUs are shipped within 10 days.

Rack PDU Buying Guide
Find the best PDU for your data center
servertech.com/rack-pdu-buying-guide

Rack PDU Selector
Over 2000 standard configurations
servertech.com/product-selector

Build Your Own PDU
Build an HDOT or HDOT Cx PDU in 4 easy steps
byopdu.servertech.com

Speak to a Power Expert
Get free technical support
servertech.com/support

How to Buy
Tools to simplify the PDU buying process
servertech.com/how-to-buy

About Us
Stay Powered, Be Supported, Get Ahead
servertech.com/about-us

1-800-835-1515
sales@servertech.com
www.servertech.com

Server Technology®
A brand of legrand®

©2019 Server Technology, Inc. All rights reserved. Information is subject to change without notice. Printed in USA. Server Technology offers a wide range of products for North America and Global markets. For more information on global products visit our website at servertech.com