



THE INFORMATION SOURCE FOR THE DATA CENTER INDUSTRY

Data Center Knowledge Guide to
**Optimizing the Energy Efficiency of the
Modern Data Center**

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Summary

The modern data center has changed. There are new demands around cloud computing, big data and infrastructure power efficiency. Furthermore, this change in the data center is being driven by more users, more data and a lot more reliance on the data center itself. With cloud technologies and the rapid growth in data leading the way within many technological categories — working with the right data center optimization technologies has become more important than ever. Administrators must understand where their current energy demands are allocated and how they can best optimize those resources. In this white paper, we look at the key considerations data center optimization, management, and how to better utilize energy resource.

Introduction

There is a revolution happening within the data center environment. Administrators are being tasked with delivering much more while still retaining optimal efficiency levels. Globally, data center power consumption has been growing. In fact, IDC reports that energy consumption per server is growing by 9% per year globally as growth in performance pushes demand for energy. As more organizations place their environments into the data center, energy efficiency and data center management have become extremely important for multiple reasons. Not only are data center administrators working hard to cut costs — they're also working hard to minimize management overhead and improve infrastructure agility.

Rising energy costs, needs around energy efficiencies, increased compute densities, and big data demands are driving data center managers to conserve electricity and make the most of what they expend. Remember, many organizations are actively looking at hybrid or public cloud platforms to help them with increased density requirements and new big data demands. In creating optimizations for your data center, it's important to utilize technologies that are able to meet the needs of your environment. Not only are there tools which enhance the data center infrastructure management (DCIM) process — these same platforms work to further optimize valuable data center resources. By using intelligent and scalable platforms, your organization can improve floor plan layouts, airflow, energy utilization, and much more. Solid data center management platforms help empower your business and data center to consume less energy and trim infrastructure costs.

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The future of the IT landscape clearly points to the continued evolution of the data center infrastructure. These vital environments have become an integral part of any organization. Because of this, data center administrators will strive to create designs around efficiency and scale. Today's modern data center is tasked with creating intelligent solutions around both cloud computing and big data. This is why having the right data center management tools in place is crucial for success. This means deploying management and efficiency tools which are capable of pinpointing sources of energy waste and cooling inefficiency. Furthermore, the use of these intelligent solutions will help integrate approaches to create measurable improvements and maintain them throughout the data center lifecycle.

SECTION 1 – Modern data center demands

Over the past decade, the data center infrastructure has become a vital part of many different organizations. As the push to stay ahead of the competition continues, organizations are working hard to meet the demands of both the market and the end-user. With more devices connecting into a data center — there is the need to manage larger amounts of data and workloads. All of these new demands require the use of more resources. Since this can become expensive, administrators must adapt and utilize intelligent data center solutions to help them optimize what they have now as well as what will be deployed in the future.

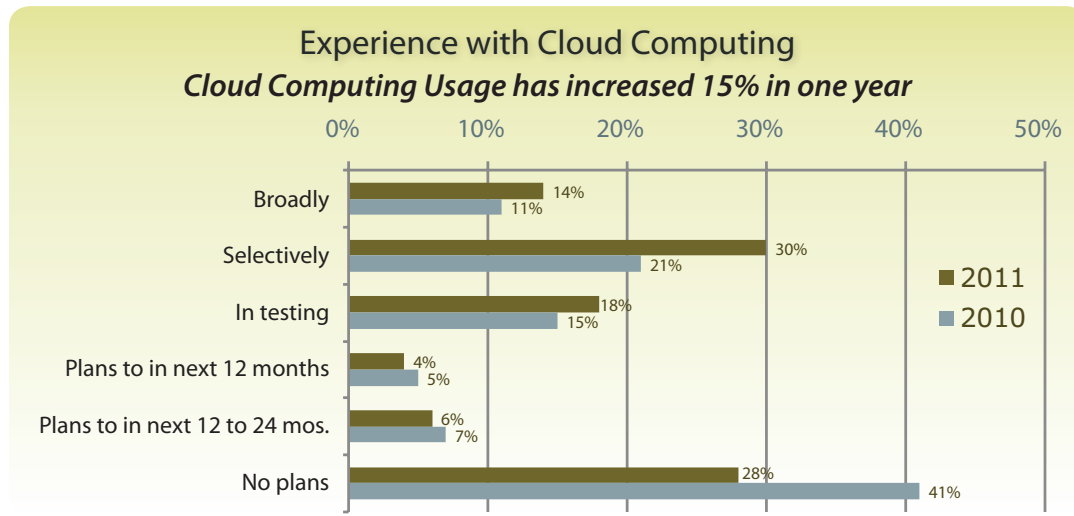
There are several growing trends which have resulted in the higher usage of data center resources. This means more requirements around power, cooling, and overall efficiency improvements.

Power of the cloud

IT executives are continuously looking at new types of technologies to help their organizations become more agile and flexible. The reality is simple: The data center has become the heart of any organization. In fact, spending continues to increase around various data center technologies.

The *2012 Uptime Institute Symposium report*¹ indicates that 32% of managers interviewed said that they will be increasing their budget for data center spending year over year. Now, with cloud computing in the mix, it's more important than ever to have the right data center optimization technologies deployed. As the graph below indicates, since 2010, the data center community has seen steady double-digit growth in the cloud and virtualization space. Furthermore, a recent *2012 Data Center Market Insights report*² indicates that 65% of data center managers were looking at cloud computing and another 62% were interested in deploying even higher levels of virtualization.

Cloud computing can help organizations expand their infrastructure into a truly distributed system. There has been distinct growth within the private cloud area. As more organizations work with big data – administrators are looking for ways to outsource their environment into a public or hybrid cloud environment to better control resources. However, with new technologies like cloud, there is a need to deploy smart technologies to create efficiency around modern platforms. Without these optimizations — new solutions will have only limited success.



Source: Data Center Knowledge Audience Survey, 2011/2012

¹ <http://www.uptimeinstitute.com/2012-survey-results>

² <http://www.datacenterknowledge.com/archives/2011/09/28/2012-data-center-market-insights-report/>

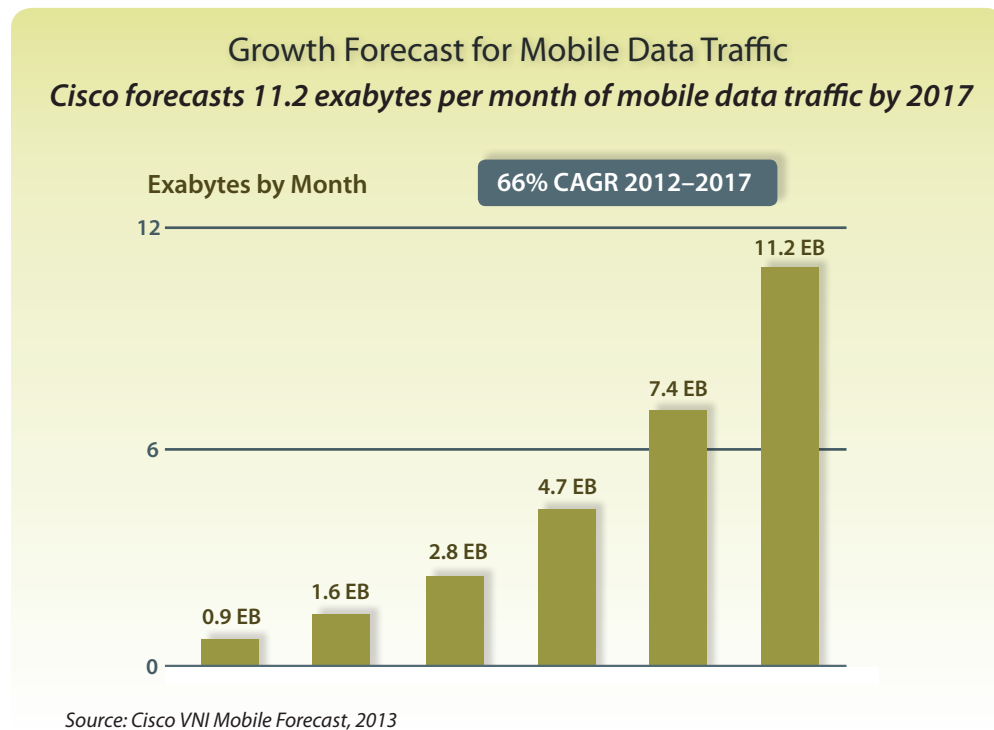
Growth in big data

Causes of increasing data center power consumption include the growing processing demands of big data. In conjunction with cloud computing, big data is forcing data centers to process increasingly massive amounts of data and information. Furthermore, the direct increase in cloud usage and cloud computing platforms are driving demands for big data control and management. For example, the *2011 IDC Digital Universe report*³ demonstrates just how much information can be created in one year alone. The report indicates that more than 1.8 zettabytes of data were created that year alone.

Business and consumer demand for mobile data is helping to fuel big data expansion. As the Cisco image below demonstrates, mobile data is creating increasing exabytes of data traffic.

The direct increase in cloud usage and cloud computing platforms are driving demands for big data control and management.

Overall mobile data traffic is expected to grow to 11.2 exabytes per month by 2017, a 13-fold increase over 2012. Mobile data traffic will grow at a CAGR of 66 percent from 2012 to 2017," according to Cisco. "The growth in Big Data is driving data centers to react by adding more IT capacity to meet demand. It is critical to understand what the actual space, power, and cooling requirements are to avoid overprovisioning" says Andy Chaloupka, Solution Marketing Manager, Panduit.



³ <http://www.datacenterknowledge.com/archives/2011/06/28/digital-universe-to-add-1-8-zettabytes-in-2011/>

Enterprises built data centers to last 20 years, not knowing what the future held. Today, older data centers are less than 50-percent occupied and the footprint is much smaller than anticipated.

Understanding the new reliance on the data center

With all of these new technologies — the data center environment has been tasked with keeping up. Organizations don't want to continuously spend on resources and inefficient technologies. This means a focus on power, cooling and a good data center design. The other side of the energy crunch coin—energy inefficiency—proceeds largely from overprovisioning of power and cooling and low IT utilization. Enterprises built data centers to last 20 years, not knowing what the future held. Today, older data centers are less than 50-percent occupied and the footprint is much smaller than anticipated. Enterprises overprovisioned power and cooling but compute densities have increased only within a small area of the whole facility. Data centers use all that power and cooling capacity to support a much smaller square footage of equipment. With an inefficient energy and power topology, your organizations could very well be losing valuable energy dollars.

New technologies and new ways to optimize

As new technologies move into the data center, organizations will need to create better solutions to combat inefficient data center components. To accomplish this, your organization may need to adopt a simple new formula: Consume Less Power + Optimize Power Used = Increased Efficiencies. To reduce energy costs, data centers should increase energy efficiency by optimizing cooling airflow, layout and cabinet densities to realize greater energy savings. Furthermore, industry trends have shifted how and where power is deployed. It's important to document your data center's compliance with industry standards and best practices and understand where there are recommendations for remediating thermal as well as power issues. For example, using computational fluid dynamics (CFD) helps identify and eliminate stranded

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power or cooling. CFD, a branch of fluid mechanics, uses algorithms to analyze problems that involve fluid flows such as hot and cold airflows and how they interact with surfaces and boundaries. This creates the ability to identify potential hot spots where equipment is receiving too little airflow. Furthermore, administrators are able to review areas where power resources are being improperly utilized.

Without a doubt, the data center will only continue to grow as the core component of any organization. Staying agile in the IT space can mean the difference between staying ahead or, falling behind the competition. In working with these new technologies — your organization should understand the new types of data center needs that may emerge.

Mini-Section – Growing data center needs

As technologies surrounding big data and cloud computing continues to push forward — the data center environment will be tasked with supporting these platforms. Because of this, there will be a direct impact on data center resource utilization. Instead of continuously having to purchase new systems, administrators must work to identify where their resources are currently allocated and how they can be optimized.

Growing energy utilization

Big data and cloud computing require a lot of processing power. This means more resources, more space, and more power consumption. A recent report from *DatacenterDynamics*⁴ indicates that the world's data centers are expected to consume 19% more energy in the next 12 months than they have in the past year. According to *the report*⁴, data centers currently consume about 31GW, a report on energy consumption data included in the census concludes. The average total power to rack is about 4.05kW, with 58% of racks consuming 5kW per rack, 28% consuming from 5kW to 10kW per rack and the rest consuming more than 10kW per rack.

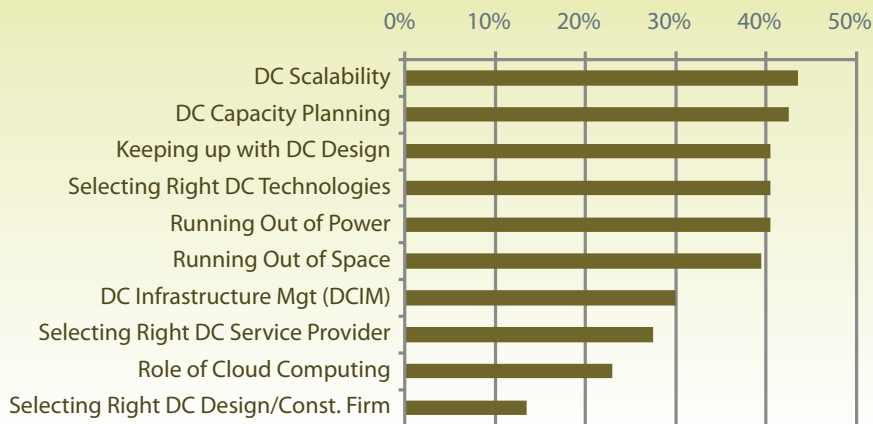
Furthermore, the latest *Data Center Market Insights report*⁵ indicates that data center power usage, space, and the right data center design are still major concerns for data center operators. In each case, roughly 40% responded that they're trying to improve everything from data center capacity to better utilization of infrastructure resources.

The need for better data center design

As indicated above, power and energy usage is on the rise. Because of this trend, data center owners and operators need to be concerned about energy cost and availability. The above report concluded that energy cost and availability was the number-one concern for a large portion of data center executives and operators. In fact, more than 40% of participants believe increasing energy costs will have a strong impact on their data center operations in the next 12 months.

Optimizing the data center not only helps your organization regain control over valuable resources — it helps your administrators plan for the future.

Top 10 Concerns/Challenges of Data Center Operators



Source: Data Center Knowledge Audience Survey, 2012

⁴ <http://www.datacenterdynamics.com/focus/archive/2011/09/global-data-center-energy-use-grow-19-2012>

⁵ <http://www.datacenterknowledge.com/archives/2011/09/28/2012-data-center-market-insights-report/>

Section 2 – Using intelligent tools to manage and optimize

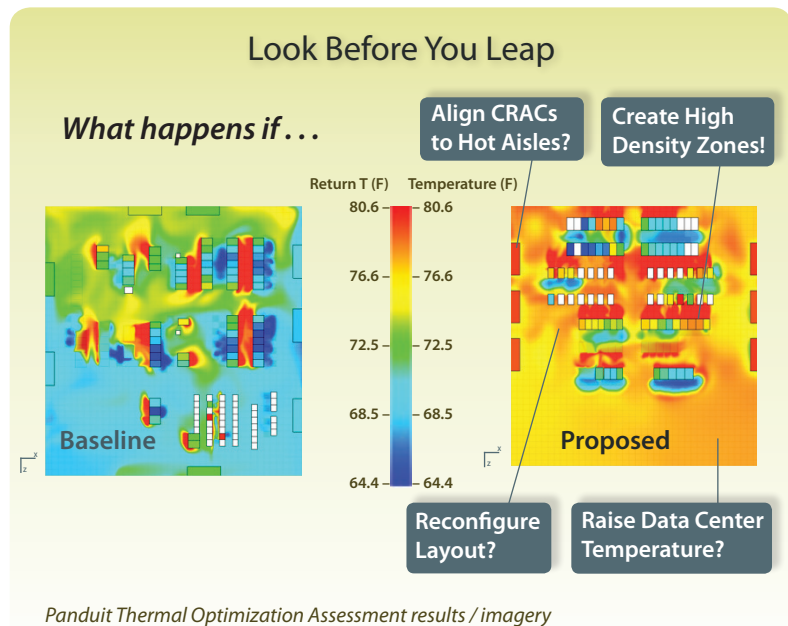
Now that you have your data center deployed and it's hosting some of the latest technologies — how do you create long-lasting optimizations and efficiency? Resource optimization revolves around numerous aspects within the data center environment. This can range from air flow control to power distribution management. For example — solutions, like those from a Panduit Thermal Optimization Assessment, use CFD to color image airflow patterns and point up the hot spots and inefficient computer room layouts that increase cooling costs (see image below). From there, Panduit documents the data center's compliance with industry standards and best practices in a subsequent report, providing detailed recommendations for remediating thermal issues.

To create truly efficient data centers — organizations should partner with physical infrastructure solution providers like Panduit to help deliver long-lasting, powerful solutions.

Utilizing efficient technologies

The idea is simple: "Measure, improve and maintain. This means using continuously proactive tools that maintain clear visibility into data center efficiency. Data center efficiency scales far beyond power alone. As mentioned earlier, holistic optimization partners, like Panduit, are able to offer approaches such as containment technologies, cabinets with enhanced sealing features, and energy efficient computer room layouts. Cooling energy inefficiencies expose the data center to:

- (A) **Poor separation** of hot and cold air causing loss of cooling effectiveness
- (B) **Air leaking** through cabinets allowing hot air circulation back into equipment inlets instead of into the CRAC units
- (C) **Airflow obstructions** that constrict cooling airflow



To combat these challenges, the Panduit Net-Contain Cold Aisle Containment system and Net-Access Cabinets ensure optimal separation of hot and cold air improving data center operational efficiency and reclaiming lost power. Cold aisle containment can improve air flow and cooling efficiency by as much as 10%, according to Gartner Analyst Dave Cappuccio. Cold aisle containment can reduce fan energy by 20% to 25% and deliver 20% energy savings from the chiller, all while paying for itself in about two years, according to PG&E. Panduit's Cold Aisle Containment (CAC) provides physical separation of cold air and hot exhaust air by enclosing the cold aisle and facilitating a cool air supply to equipment air intakes at the desired, uniform temperature.

Infrastructure management and maintenance

It's time to take DCIM to a new level. We're no longer just looking at general data center management. Now, we're taking a proactive approach to management, efficiency and optimization. Panduit SmartZone™ solutions utilize software and intelligent devices to monitor data center power consumption/environmentals in real-time, enabling the data center to maintain energy efficiency gains

The Panduit SmartZone™ software suite monitors data center infrastructure metrics for power, space, connectivity, and asset tracking, as well as ensuring that users and user access is in compliance with regulatory requirements.

on an ongoing basis. Once Panduit has measured the data center's PUE, isolated causes of energy inefficiency, and remedied those causes by applying a range of service expertise and product breadth and depth, the DCIM overlay maintains those energy efficiency improvements by monitoring the data center infrastructure for variations. This type of platform monitors data center infrastructure assets including the number of devices, their states, asset age and type, status, adds-moves-changes, and connectivity so the data center can manage those assets. The Panduit SmartZone™ software suite monitors data center infrastructure metrics for power, space, connectivity, and asset tracking, as well as ensuring that users and user access is in compliance with regulatory requirements.

Optimizing energy usage for today and the future

It's important to leverage a holistic solution that will help manage and optimize energy utilization. The power utilization efficiency (PUE) metric has become a widely accepted industry metric of data center green efficiency. By using intelligent monitoring tools, your organization will save money in electricity costs and create even more optimization around power usage. As part of the SmartZone™ software suite, Panduit's Physical Infrastructure Manager™ (PIM™) Software Platform uses data center mapping to model the data center by asset name and location. This kind of mapping aids colocation facilities and cloud computing service providers.

- **PIM™ utilization mapping** groups the resources consumed by each asset and prioritizes power and thermal characteristics, which are useful for facilities managers who must undertake resource provisioning activities. PIM™ performs operational process mapping of big asset processes used for asset acquisition and management across an organization, enabling efficient management of invoices, leases, chargeback schemes, licensing, renewals and dispositions.

- **PIM™ reporting module** summarizes data collected by the DCIM software. The module enables the data center to generate reports for enterprise stakeholders. PIM™ software creates visual representations of operational metrics using dials, charts, and gauges. This capability provides immediate insight into the vital signs of the facility including asset data, connectivity, space, and power.

This type of modular approach to delivering DCIM functionality enables you to customize the solution to meet the needs of your organization both now and in the future. Process-driven integration with your current network management and service desk platforms delivers a streamlined interface to support management of IT assets with related attributes and physical infrastructure components of your data center and extended enterprise.

Conclusion

The data center will always continue to evolve and expand. As more organizations see the benefits of utilizing an efficient platform, the use of intelligent management tools will grow. Remember, by identifying the causes of data center energy inefficiencies, enterprises can formulate a cure with lasting effect.

It's more important than ever to stay proactive when it comes to data center efficiency and optimization. Reactive instances are not only costly — they're also time consuming. In using technologies like the Panduit SmartZone™ solutions portfolio your organization can have complete visibility of the data center and extended enterprise through software-based automation, predefined dashboards and reports, change management, and related documentation and combines with intelligent devices for increased functionality. This means direct visibility into:

- **Process documentation** of IT assets, moves, adds, and changes (MACs)
- **Power consumption, temperature, and humidity measurement** of active equipment
- **Precise location and utilization data** for assets and connections
- **Centralized monitoring** of IT assets through a single platform
- **Underutilized assets and resources**
- **Unauthorized patch field changes**
- **Potential physical network security breaches**
- **Root cause analysis** of physical network problems
- **Capacity limits**

To have an optimally running data center which can support technologies like big data and cloud computing, your organization will have to take data center management to a new level. In using technologies like those from Panduit, your data center can use the next level DCIM tools to help meet the needs of your business both today and in the future.

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