



OpenData

Optimizing Energy Performance In Today's Global Data Center

Modius Helps Enterprises Reduce Costs and Tame Out-of-Control Energy Consumption

EXECUTIVE SUMMARY

MANAGING ENERGY CONSUMPTION IS TODAY'S DATA CENTER CHALLENGE

Managing power in the data center has never been more important, or more complicated. Data center operators are constantly searching for ways to reduce costs. The cost of power continues to be the focus, as managers look to reduce bottom-line expenses, eliminate or optimize underutilized equipment, and provide more modulated cooling. However, data center operators are equally challenged to maintain uptime, ensure business continuity, and expand capacity to accommodate further server growth.

LESSONS LEARNED: CHANGING ENERGY SUPPLY & DEMAND PUTS DATA CENTERS AT RISK

As companies pursue energy efficiency initiatives, they also need to prevent unnecessary negative impacts on resiliency and uptime. In one very public outage, a Texas-based Internet hosting company experienced a one-hour outage due to insufficient power load management. This service disruption brought down several well-known political and entertainment sites and resulted in the operator paying up to \$3.5M in service level refunds for one hour of outage. ¹

¹: "Rackspace to issue as much as \$3.5M in customer credits after outage" (networkworld.com): <http://bit.ly/2kQMC1v>

MODIUS OFFERS NEXT-GENERATION MONITORING AND MEASUREMENT

Modius® meets all of these challenges by actively monitoring and measuring the complete view of the data center, including the power distribution, cooling systems, environmental sensors, and IT assets. Modius helps companies implement energy-efficiency best practice, by offering a new approach to data center energy management. By measuring more performance indicators, in more places, more easily, Modius gives large companies online visibility and insight into energy consumption and capacity utilization across all their critical computing locations.

MODIUS DRIVES ENERGY SAVINGS WHILE IMPROVING RESILIENCY

In one recent case study, the client company leveraged Modius' OpenData® monitoring and measurement system to implement a variety of aggressive efficiency initiatives. According to a recent report by the US Department Energy (DOE) the company has invested a total of \$710k in new capital costs and now saves approximately \$262k in annualized energy cost savings.

To implement these changes, the company used OpenData to:

- 1:** Identify areas of existing inefficiency (hot spots, cold spots, poorly operating equipment, etc.)
- 2:** Monitor the true impact on the environment as incremental changes were made.
- 3:** Measure the energy savings these changes produced over time.
- 4:** Validate the overall costs savings for utility rebates and other reporting requirements.

As a result of OpenData's continuous monitoring and measurement throughout the efficiency initiative, the company not only made better decisions about how and where to invest scarce resources but they also implemented these changes without endangering the facility's resiliency or uptime.

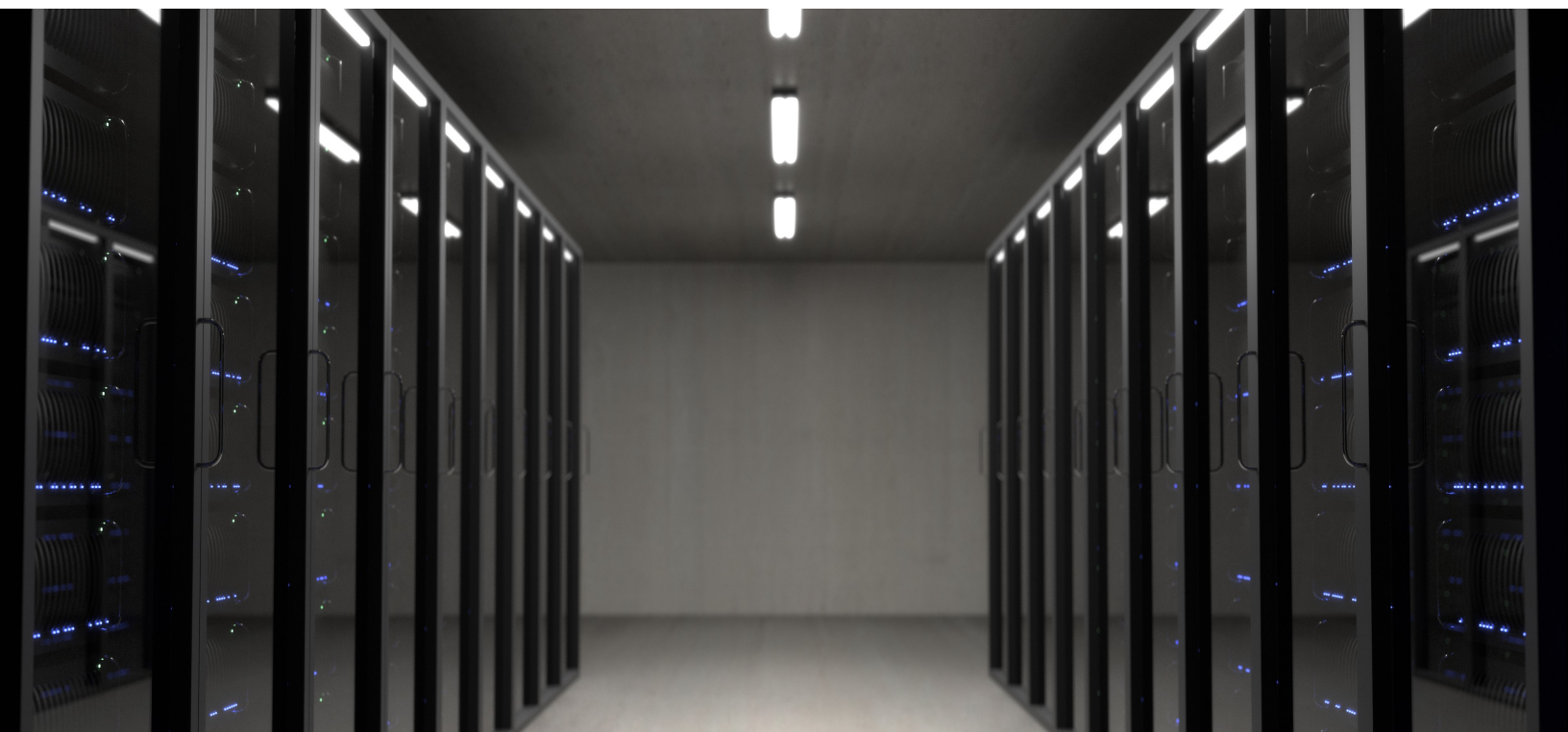


TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
I: FEEDING THE CLOUD - THE NEED TO TAME ENDLESS ENERGY CONSUMPTION	4
THE CHALLENGES OF GROWTH	4
THE RISKS OF TRYING TO DO MORE WITH LESS: NO MARGIN FOR ERROR	5
OPENDATA: THE CONFIDENCE TO LOWER COSTS WHILE IMPROVING PERFORMANCE	6
II: CURRENT MANAGEMENT OPTIONS - INSUFFICIENT, REACTIVE, FRAGMENTED	7
BUSINESS AS USUAL: RELYING ON REACTIVE PROCESSES	7
EXTEND THE BMS: DESIGNED FOR CONTROL, NOT REAL-TIME MANAGEMENT	7
STITCH-TOGETHER, POINT SOLUTIONS, PERPETUATE STOVEPIPE DATA	7
III: THE MODIUS APPROACH: INTEGRATED, HOLISTIC, REAL-TIME	8
POWERFUL TOOLS TO COPE WITH DATA CENTER CAPACITY CONSTRAINTS	8
SOLUTION DIFFERENTIATORS: CORE STRENGTHS OF THE MODIUS PLATFORM	8
IV: SUCCESS SNAPSHOT	11
COMPANY EXTENDS THE LIFE OF ITS DATA CENTER AND REDUCES COSTS	11
V: ENABLING INDUSTRY ALIGNMENT	12
MODIUS SUPPORTS GARTNER RECOMMENDATIONS FOR PRIM	12
VI: SUMMARY	13



I: FEEDING THE CLOUD - THE NEED TO TAME ENDLESS ENERGY CONSUMPTION

“Data centers worldwide now consume more energy annually than Sweden, and the amount of energy required is growing”, says Dr. Jonathan Koomey, a scientist at Lawrence Berkeley National Laboratory. The cloud, he calculates, consumes 1 to 2 percent of the world’s electricity.

“Data Center Overload”, Tom Vanderbilt, The New York Times

Calculations such as Dr. Koomey’s illustrate the obvious: in a world in which increasing amounts of business and leisure time are spent online, data centers have become the new ‘factories’ of the Information Age, churning out electronic products consumed by every computer on earth. But, while today’s data centers are infinitely less pollutive than their Industrial Age counterparts, every executive is concerned about the cost and environmental impact of these facilities’ high levels of energy consumption and their rampant growth.

THE CHALLENGES OF GROWTH

Three interlocking critical concerns are now front-and-center issues for executives.

The spiraling costs of energy and its environmental impact. An extraordinary amount of energy is required to operate and cool the air in data centers. These functions can easily consume more than twice as much energy as that which is required to run the equipment housed within, yielding a PUE of 2.0 or even greater. ²

In the U.S., and abroad, companies and shareholders are increasingly concerned with the environmental impact of high levels of energy consumption. As part of a large and growing trend in corporate environmental responsibility, companies are intensifying their efforts to conform to carbon emissions guidelines such as those set forth by LEED, or the Green Grid.

The high cost of building new capacity. New capacity to sustain continued server growth particularly at ‘five-nines’, (99.999% uptime operational requirements) – which equates to about five and a half minutes of unscheduled downtime per year – is very expensive. To mitigate business risk from data center out-ages, most large enterprises have built global facilities to house rapidly growing amounts of redundant computing and network equipment.

For example, a 10,000 square foot, Tier III/IV data center, carries a price tag of approximately \$50 million ³ - a very large expenditure that can’t easily be accelerated, if data center space prematurely runs short.

A changing IT landscape that packs more computing power - and heat - into an ever-smaller footprint. High density servers, server virtualization, and compact switches and routers, all conspire to generate more heat within the data center. In pursuit of more powerful (and redundant) computing resources, enterprises are generating a geometric increase in the power load on existing data center facilities, thereby straining existing capacity - and capacity-management methodologies.

²: Power usage effectiveness (PUE) is a metric used to determine the energy efficiency of a data center. PUE is determined by dividing the amount of power entering a data center by the power used to run the computer infrastructure within it. PUE is therefore expressed as a ratio with overall efficiency improving as the quotient decreases toward 1. PUE was created by members of the Green Grid, an industry group focused on data center energy efficiency.

³: Source: Gartner.

THE RISKS OF TRYING TO DO MORE WITH LESS: NO MARGIN FOR ERROR

The composite effect of these three issues is that yesterday's Arctic-cooled data center has become a hotbed of risk – risk for the operator, and risk for the business. Inside the data center, the only other noise louder than the hum of computing equipment is the incessant stream of phone calls and message alerts to facilities managers, alerting them to potential danger.

In today's environment, the need to support more growth, while also boosting efficiency, has made the margin for error razor thin. The danger of an outage is always imminent, potentially occurring at any one of multiple points of failure.

Specifically, Figure 1 illustrates the evolution of the challenge of cooling the data center. Less than a decade ago, IT loads were sufficiently low that power and cooling capacity could be over-provisioned without excessive cost concern. This strategy entailed significant waste, but allowed for a high margin of error.

As the data center evolves toward a more modulated strategy, improvements in efficiency and energy performance are possible. However, ad-hoc cooling adjustments based on imperfect information create an operating environment with a much lower margin of error – and, for data center operators, relentless stress.

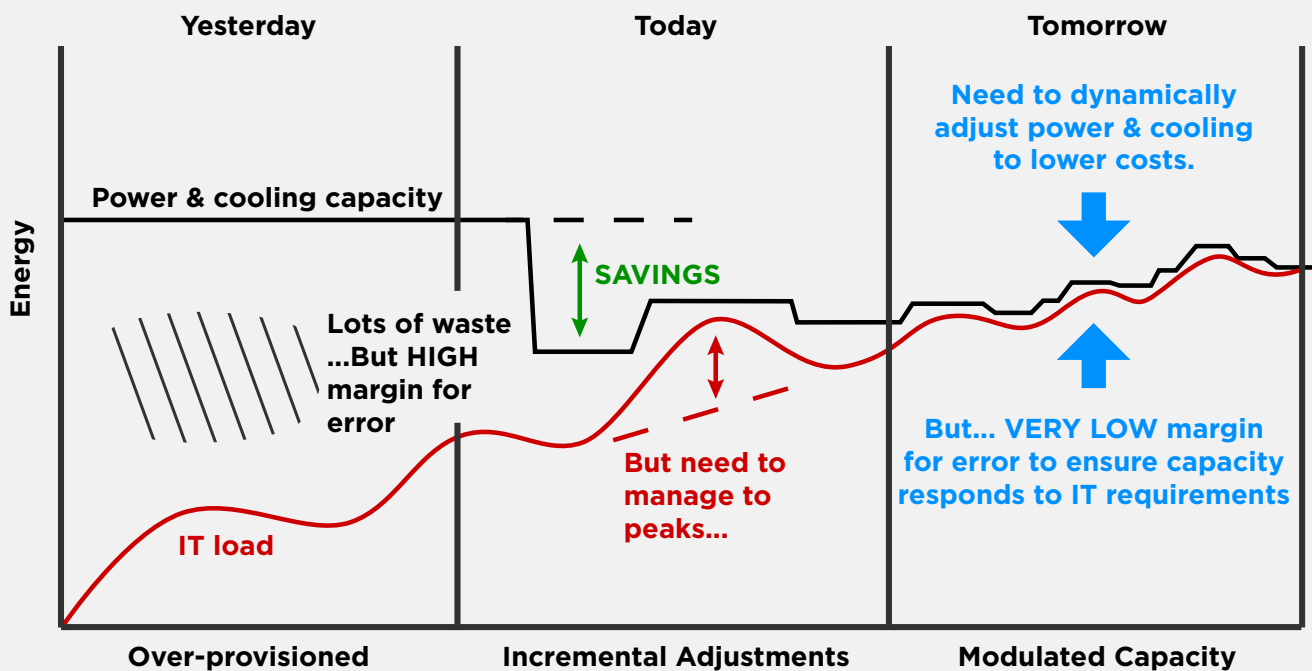


Figure 1: Yesterday's over-cooled data center is evolving into the next-generation data center, in which cooling capacity and power consumption can be dynamically adjusted based on continuous input. OpenData provides intelligent guidance to meet the needs of tomorrow's data center, allowing facilities professionals to dynamically manage power and cooling based on real-time information – while helping to ensure maximum uptime.

OPENDATA: THE CONFIDENCE TO LOWER COSTS WHILE IMPROVING PERFORMANCE

Clearly a 'five-nines' business world cannot be sustained by facilities in which disaster is only moments away. Today, a next generation data center is emerging in which Modius' OpenData provides the comprehensive and holistic data required to aggressively modulate power and cooling, while also ensuring maximum uptime. Based on real-time information, Modius transforms reactive methods into proactive management, giving operators the confidence to aggressively reduce data center costs and energy consumption.

Modius uniquely provides a "single pane of glass" solution that enables real-time holistic management of data center health and energy performance, across the global enterprise. As such, it is the leading provider of scalable data center telemetry and infrastructure management systems, integrating availability monitoring, capacity analysis, and efficiency performance tracking of multiple facilities. Only OpenData can offer intelligent guidance for real-time resource management, allowing companies to:

- Defer or eliminate costly CapEx investments in new data center facilities by maximizing data center efficiency under capacity constraints.
- Improve energy performance to reduce power consumption and environmental impact.
- Provide peace of mind in the data center that can only come from a holistic, proactive approach to data center health management.

With the OpenData data collection system, Modius solves the challenge of integrating performance data from a broad range of site infrastructure devices, with demand data from essential IT equipment. Through this single, comprehensive measurement system, OpenData allows enterprises to extend the useful life of existing data center sites, significantly lower energy consumption costs, and prevent downtime due to device or system failure.

MODIUS DELIVERS INTELLIGENT GUIDANCE FOR SMART MANAGEMENT



OpenData uniquely allows operations personnel to dynamically adjust capacity on all resources based on real-time input. This data ensures that business continuity is not compromised by IT outages or performance degradation. The Modius approach, called "Intelligent Guidance", provides a "just in time" recommendation of the right improvements at the right time, and significant advantage over traditional building management systems or other point solutions.

Modius achieves Intelligent Guidance through the use of computational capabilities not found in other monitoring and measurement products. Called 'computed points', this feature allows operators to combine different data points from different devices into algebraic equations. These equations can then calculate metrics that provide insight to make the right changes, at the right time, or to send alarms based on specific conditions.

II: CURRENT MANAGEMENT OPTIONS - INSUFFICIENT, REACTIVE, FRAGMENTED

As enterprises struggle to manage the performance and energy consumption of their global data centers, current options provide three choices. Ultimately, all of these options are insufficient in managing today's highly fluid, high stakes environment.

BUSINESS AS USUAL: REACTIVE PROCESSES

The first option is to use existing systems to maintain the current reactive management model. Given that these systems already have a slim margin of error, any further taxation will only increase operational and business risk. Moreover, given the accelerating growth trajectory of data centers, maintaining the status quo is simply not a viable option.

EXTEND THE BMS: DESIGNED FOR CONTROL, NOT REAL-TIME MANAGEMENT

In pursuit of better controlled data center environments, some companies are using building management systems to monitor temperature and energy consumption. While providing a "command center" environment that is useful for managing relatively static conditions, these systems were designed for high-level facilities control, not real-time adjustment. BMS tools are reactive systems, giving a backward looking view at data that is often too little, too late, (i.e., after air temperature has risen, a key function has failed, and uptime jeopardized).

In addition, BMS are usually proprietary, vendor-centric systems that are expensive to acquire, install, and hard to customize. BMS solutions also typically require per-point licenses. In fact, their complexity is such that developing and maintaining a customized BMS solution, that will provide acceptable site specific information, often has a total cost of ownership (TCO) greater than the money it saves.

STITCH-TOGETHER POINT SOLUTIONS: PERPETUATE STOVEPIPE DATA

Today, facilities professionals recognize the need for proactive management; they require real-time environmental information that allows problems to be anticipated. To modulate continuously-changing temperature conditions, data center managers must adjust airflow and cooling on a "just in time" basis.

Thus, to achieve a more holistic view, the third management option currently available is to stitch together a patchwork of device management software from different device manufacturers. This is an expensive proposition, requiring manual integration of disparate systems, and high software licensing costs.

Worse, neither the BMS system, nor a stitched-together point solution solves the multi-site problem. None of these systems were architected to easily scale across multiple data centers. This is a critical shortfall in today's global computing environment, in which an "enterprise cloud" of distributed computing resources is allocated in an increasingly dynamic manner.

III: THE MODIUS APPROACH: INTEGRATED, HOLISTIC, REAL-TIME

Modius' OpenData provides a platform for an integrated, holistic view of the three key drivers of data center health and energy performance – Availability, Capacity, and Efficiency (ACE) – from a single pane of glass.

For the first time, operators now have a global perspective of data center resources; only Modius provides “Intelligent Guidance” on how to react to power and cooling events, manage capacity utilization in real time, modulate cooling, and harmonize IT loads in rapidly changing environments.

POWERFUL TOOLS TO COPE WITH DATA CENTER CAPACITY CONSTRAINTS

OpenData is a breakthrough solution that brings to the data center the holistic high level view that numerous IT domains – including networking and business service management – have long enjoyed. This allows enterprises to cope with data center capacity constraints in three important ways.

First, data center space that appears to be maximized is often just poorly configured. OpenData provides critical information on the myriad microclimates within the data center, helping facilities professionals to reorganize equipment to harmonize the IT load. Ongoing and in real-time, OpenData's Intelligence Guidance then allows cooling resources to be modulated without compromising the overall environment. This prolongs the life of existing data centers and allows companies to defer or eliminate CapEx investments in new data center facilities – approximately \$50 million for the average 10,000 square foot enterprise-class center.

Second, energy costs and associated environmental impact can be dramatically reduced via OpenData. OpenData allows adjustments to key data center equipment – CRAC units, HVAC systems, chillers and generators – that can translate into substantial cost savings and rebates. Thus, OpenData allows PUE to be reduced and maintained within acceptable limits, improving energy performance and IT asset reliability. Third, the holistic view OpenData delivers imparts peace of mind that benefits facilities management professionals and executives alike. OpenData allows data center teams to take a proactive approach to managing conditions instead of living in a state of perpetual reaction to emergency situations. The real-time information OpenData provides is essential in managing the highly volatile cooling conditions of a data center, where temperatures can vary by 30 degrees or more from one corner to another at different times of day. By enabling data center operators to spontaneously adjust key cooling resources, OpenData allows enterprises to move toward more efficient “just in time” management. Simply put, OpenData helps to reduce the stress of managing one of an enterprise's most volatile physical assets.

SOLUTION DIFFERENTIATORS: CORE STRENGTHS OF THE OPENDATA PLATFORM

The OpenData DCiM platform provides a number of unique capabilities that enable superior, proactive management of distributed data center environments.

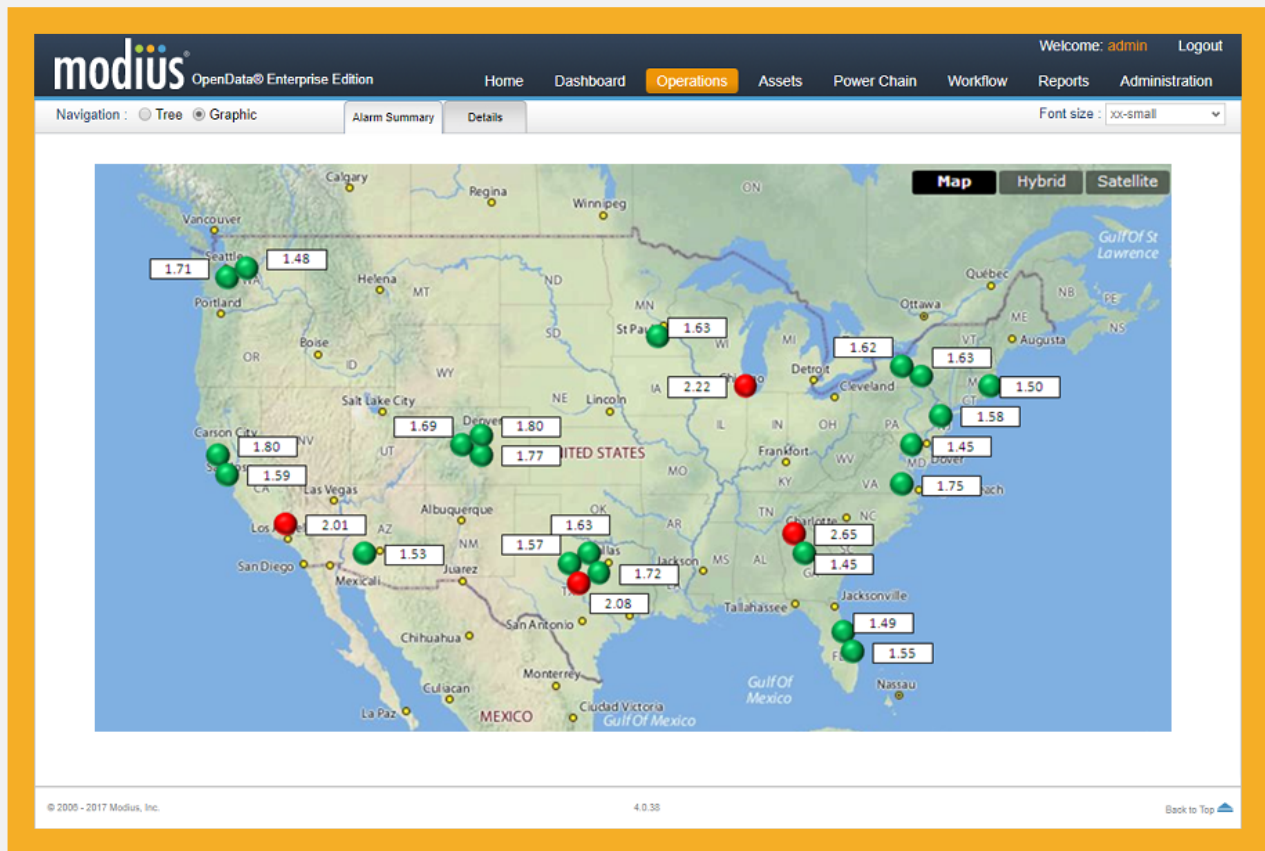


Figure 2: OpenData provides instant status on the energy performance of a national network of data centers. Green dots indicate an acceptable PUE of less than 2.0 while red dots indicate a PUE of 2.0 or greater and thus excessive energy consumption.

Global visibility - The OpenData solution is easily distributed to multiple sites. Easy to deploy and maintain, it is architected and designed to enable dynamic management of distributed, worldwide data center environments. For example, Figure 2 above illustrates how at a glance, OpenData can inform users of PUE performance across an entire network of data centers.

OpenData uses a two-tiered architecture to collect information from multiple categories of devices in the data center; this allows companies to add new sites incrementally, and distributes the platform's computing workload. OpenData then aggregates the data from all sites into a single data warehouse in real-time, and provides centralized dashboard and reporting functions.

The collection software interfaces with a wide array of infrastructure devices (environmental, power, cooling), and IT assets such as servers, switches, and routers. Unlike BMS systems, OpenData collection software is vendor-independent, device-agnostic, and highly scalable; it can be easily deployed at any location by existing staff without special training or requiring programming. Only one software installation is required per site.

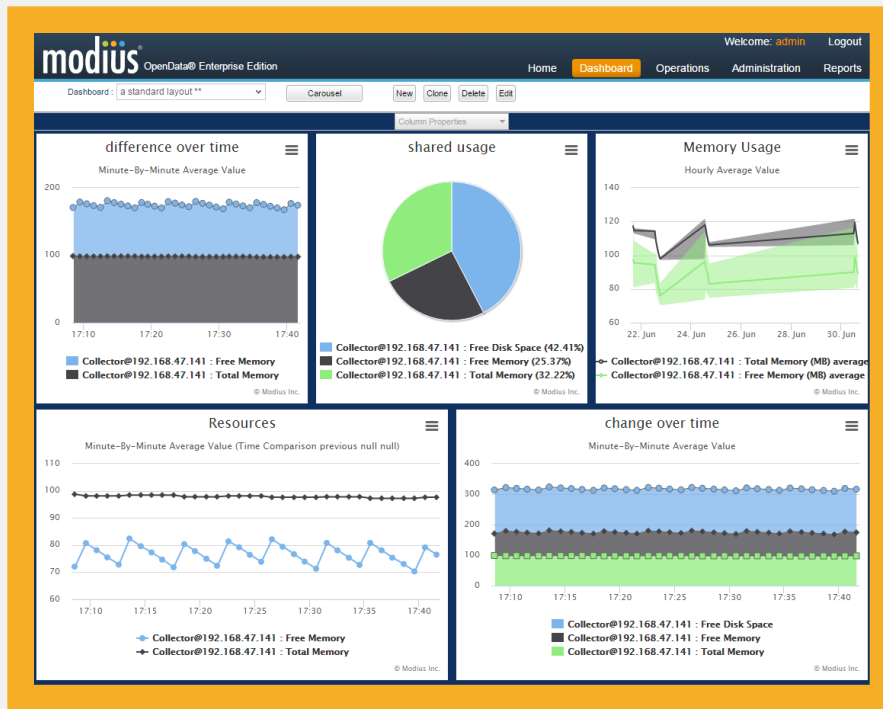


Figure 3: This dashboard shows numerous different data types rolled up into a single console with computations for various operational metrics and Key Performance Indicators (KPIs).

Local guidance - OpenData collects granular information within each data center, providing a cross domain view of power efficiency (PUE), rack level climate, and airflow management. A central dashboard for managing these key performance indicators allows operators and executives to gain insight into granular operational performance, as well as higher level abstractions such as total carbon footprint. Role-based dashboards can be easily created to address different users' needs.

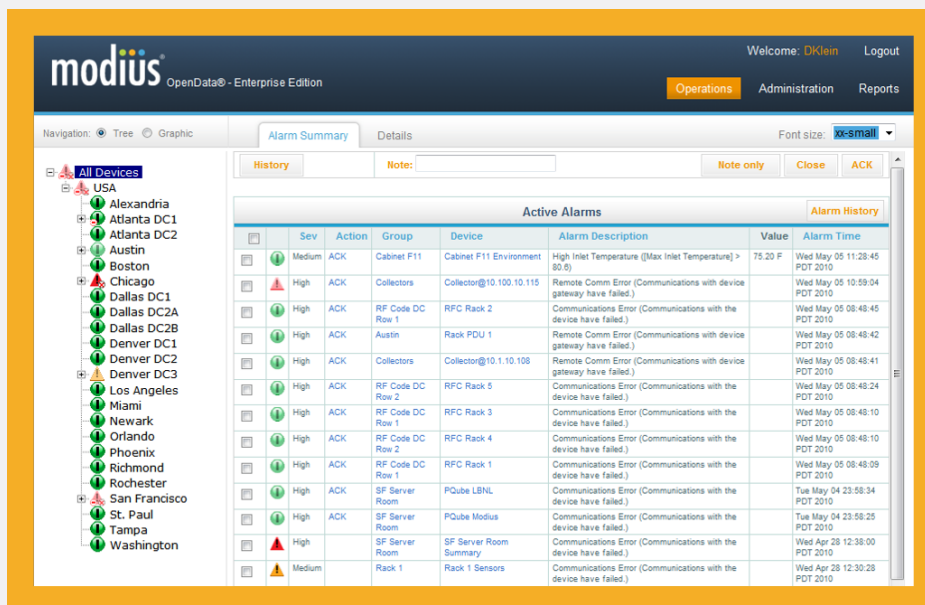


Figure 4: OpenData provides a single console for monitoring all alarms and alerts across the entire data center infrastructure, including power, cooling, environmental, and IT.

Easy configurability - OpenData is a self-service solution; automated alarms, metrics, and dashboards can be easily configured without expensive service calls. One of the platform's most powerful capabilities is that it allows users to create computed points, which are configurable calculations comprising multiple native points built on internal and external sensor data collected by Modius. This lets data center operators easily automate complex measures of data center health and energy performance, such as cooling system performance, for example.

Computed points help users more effectively manage the data center environment in two ways:

- They can create "Intelligent Alarms" that will only be triggered by a specific sequence of events, such as a loss of utility power combined with generator failure. This is a vast improvement over typical alarms that are based on only one variable - such as fuel levels in a generator - that alone may not constitute a 'red alert'. Rather than flood operators with low-level alarms that require interpretation, OpenData provides Intelligent Alarms that can be sent direct to operators or routed to other systems.
- They deliver "Intelligent Guidance". OpenData uniquely allows operations personnel to dynamically adjust capacity on all resources, based on real time input - while ensuring that business is not compromised by IT outages or performance degradation. OpenData's Intelligent Guidance provides a "just in time" recommendation of the right improvements at the right time, and significant advantage over traditional BMS.

IV: SUCCESS SNAPSHOT

COMPANY EXTENDS THE LIFE OF ITS DATA CENTER AND REDUCES COSTS

At this client company - an industry leader in delivering enterprise and mobile software - growth is good; except in its data center, built eight years previously with a planned lifespan of five years. "Who could've planned for today's IT environment five years ago?" Greg, the client's real estate manager for common services, asks rhetorically. "Five years ago servers ran at 120 volts. Now I have entire farms of three-phase servers that generate much more heat."

Greg credits OpenData with allowing him to "reclaim a lot of runway before we hit the wall", e.g., before the data center was incapable of housing any more IT equipment. The company's annual equipment growth rate is 12 percent, but "we've been able to operate for eight years in a data center that was designed for five years," he says proudly.

"When we put in the OpenData system, we were able to stop chasing the hot spots and start chasing the cold spots... That's where the energy's being wasted. Before, for example, we used 120 kilowatts of fanshaft horsepower to run just the computer air handlers. Now I'm using 11.9 kilowatts to move the same heat". OpenData has allowed Greg to maintain a consistent, very impressive PUE of 1.41 at the company's main data center in Pleasanton, CA.

Specifically based on OpenData's Intelligent Guidance and trend reports, the client has been able to deliver:

- **Chiller Optimization** - achieved a 26% reduction in energy consumption for the data center's chiller accomplished by rebalancing airflow. This was executed by monitoring CRAC valve positions and pump output. As a result, the client was able to raise the chilled water temperature, resulting in \$94,500 in annual savings.

- **Outage prevention** - avoided a serious outage by identifying a dangerous temperature rise in the UPS room, which had gone unreported because the BMS was offline.
- **CapEx avoidance** - avoided \$13 million in new CapEx expenditures by identifying unused capacity in existing facility which allowed it to accommodate new servers.
- **Utility incentives** - supported more than \$400,000 in utility rebates from PG&E. OpenData was used to identify inefficiencies and optimize new equipment. The measurements were used in submitting 16 successful PG&E rebate applications.

“OpenData gives us a single pane of glass we can use to see what’s happening in any of our data centers... This is the essential capability OpenData brings to us economically.”

“It’s not just about installing the system, it’s maintaining, calibrating, and replacing it,” Greg continues. “We can install OpenData in any of our worldwide data centers quickly and cost-effectively using existing local resources. The Modius offering costs far less, and delivers more value than anything else we’ve looked at.”

In addition, OpenData has provided a common language that our facilities and IT organizations can use to work together more effectively. “OpenData helps show the IT guys my side of the world,” Greg says before concluding, “And that’s made it much easier for all of us to strategically plan how to maximize the use of our data center space - without hitting the wall.”

V: ENABLING INDUSTRY ALIGNMENT

OPENDATA SUPPORTS GARTNER RECOMMENDATIONS FOR PRIM

Data center health and energy performance are two core tenets of Physical Resource and Infrastructure Management (PRIM, a solution category defined by Gartner and quickly gaining visibility in enterprise circles). PRIM leverages existing relevant tools, such as BMS, overlaying them with holistic management systems like OpenData. OpenData’s ease of integration with existing management systems speeds enterprise adoption of PRIM and associated benefits.

In the PRIM domain, Gartner’s key findings include:

- Monitoring asset performance related to availability is no longer valid by itself. During the next two years, many organizations will require the monitoring of assets relative to productivity vs energy consumption.
- Dynamic resource management - based on energy consumption and asset utilization - will become commonplace.
- Evolving management dashboards will include IT assets, as well as integrated facilities components required by IT.

Furthermore, in terms of achieving effective PRIM, Gartner recommends:

- Include the integral parts of facilities that are required by IT as part of asset-tracking.
- Make energy consumption a primary component of monitoring and reporting.

- Changing IT assets will affect facilities assets, so include them as part of your configuration management database (CMDB).
- When working with monitoring vendors, get a clear understanding of how they plan to integrate energy and facilities categories, and be wary of those that can't define a clear product direction.

VI: SUMMARY

OpenData is at the vanguard of a transformation in the way that increasingly global data center resources are strategically managed. As traditional means of ensuring “five-nines” uptime – massive redundancy and over-provisioning – have become untenable, computation-centric businesses have shifted their focus to a broader view of ensuring data center health as a means to reduce costs and tame out-of-control facilities growth.

A data center operating at optimal health will house more computation power with higher reliability than a poorly-cooled, inefficient facility. This fact allows more utility to be extracted from existing facilities, and CapEx in new data centers to be deferred or eliminated.

As a corollary, the granular visibility and control OpenData provides allows for more strategic management of the data center's energy performance. Enterprises are striving to meet corporate mandates to reduce their environmental impact and carbon footprint spending significantly, to meet building standards set by LEED and similar organizations.

However, through the reduced energy consumption that OpenData makes possible, companies can take a major step in reducing their energy bills and carbon footprints – today! Because Modius' OpenData solution is inherently green, companies deploying OpenData can achieve eco-responsible improvements quickly and cost-effectively.

To learn more about how OpenData can help your organization reduce facilities investments and improve data center health and energy performance, please visit modius.com.

ABOUT MODIUS

Modius is an independent software vendor based in San Francisco, California. Founded in 2004, Modius develops intelligent measurement systems for mission critical facilities that improve business continuity, energy performance, and carbon management. Modius solves the challenge of integrating both IT and facilities management information into a single, comprehensive measurement system. Modius empowers ‘smart’ data center management through:

- 1:** Widespread, practical, low-cost collection of all physical-layer performance data
- 2:** Trustworthy and reliable analysis tools based on comprehensive data and rich analytic capabilities
- 3:** Useful and actionable intelligence through highly-configurable business logic
- 4:** Customized workflows, **delivering the right intelligence to the right people at the right time.**

**CONTACT YOUR MODIUS REPRESENTATIVE FOR MORE
INFORMATION ABOUT HOW OPENDATA CAN FREE UP
TRAPPED CAPACITY IN YOUR DATA CENTER,
SIGNIFICANTLY REDUCING OPERATING COSTS.**



TECHNICAL SPECIFICATIONS

Modius OpenData is a software application that can be installed on-premise or hosted in the cloud. Some customers choose to run the application within VMWare ESX. Software platform requirements are as follows:

- **Windows Server** - 2008, 2008 R2, 2012
- **Database** - Express, Workgroup (Up to 2012) and MS SQL Server 2008 - 2016



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