

Data Center Users' Group Special Report

Growing concerns over data center infrastructure monitoring and management



Executive Summary

The overarching message that can be derived from the results of the spring 2010 Data Center Users' Group (DCUG) member survey is that data center managers are increasingly concerned with infrastructure monitoring and management. The results also point to a focus on maintaining or improving availability, while reducing costs and increasing efficiency. This year's spring survey results report these notable items:

- Data center infrastructure monitoring and management has emerged as a top-of-mind issue for DCUG members. In fact, more than half of the respondents listed it as one of their top facility/network concern.
- Data center power density continues to be an issue. Sixty-three percent of respondents reported rack power densities in their data centers of 8 kW or greater.
- Continuing concern over availability was reflected in the survey, as 47 percent of respondents listed availability as a top facility/network concern and 23 percent reported experiencing at least one power outage in the last 12 months.
- Organizations are deploying new and proven technologies capable of supporting higher densities and improving cooling efficiencies, such as cold aisle containment, economizers and rack-based cooling.

Today's data center managers continue to struggle to balance organizational pressure to deliver both efficiency and availability. The DCUG survey indicates many understand the important role monitoring and management systems can play in ensuring availability, improving efficiency, planning for the future and managing change. As data center densities continue to rise, data center managers also are looking to new and proven cooling technologies to support high-density IT spaces.

Survey Methodology

The Data Center Users' Group (DCUG) is a collection of influential data center, IT and facility managers formed by Emerson Network Power. Founded in 2003, the DCUG includes approximately 2,000 members who participate in a collaborative, focused forum that addresses the issues, trends, challenges and solutions associated with building and maintaining a highly available, flexible and cost-effective facility. The group's membership comprises executives with a wide variety of IT and facilities management expertise from an assortment of companies, including board member companies Vanguard, Cincinnati Bell Technology Solutions and JPMorgan Chase, among others. For more information on the DCUG, including membership and upcoming events, visit www.datacenterug.org.

The DCUG membership is surveyed twice each year to provide members with unique insight into data center trends and to ensure the group's meetings address issues of top concern to the membership. The results

discussed in this report are from the DCUG survey that was completed in April 2010, with a total of 176 DCUG members providing answers to the 24 questions. This report highlights a selection of the questions posed in the survey. Access to the full report is limited to the DCUG membership.

Respondents to the survey primarily represented data center management (39 percent), facilities management (28 percent) and IT management/operations (14 percent). Primary facility size ranged from less than 500 square feet to greater than 50,000 square feet. Figure 1 shows a specific breakdown.

The timing of the survey coincided with the continuing economic recession, although the period of unprecedented turmoil in world financial markets appears to be in the past and the economy is beginning to show signs it is on the mend. During this time there also were a number of well-publicized data center outages resulting in service disruptions, data loss and hundreds of thousands of dollars of losses for affected businesses.

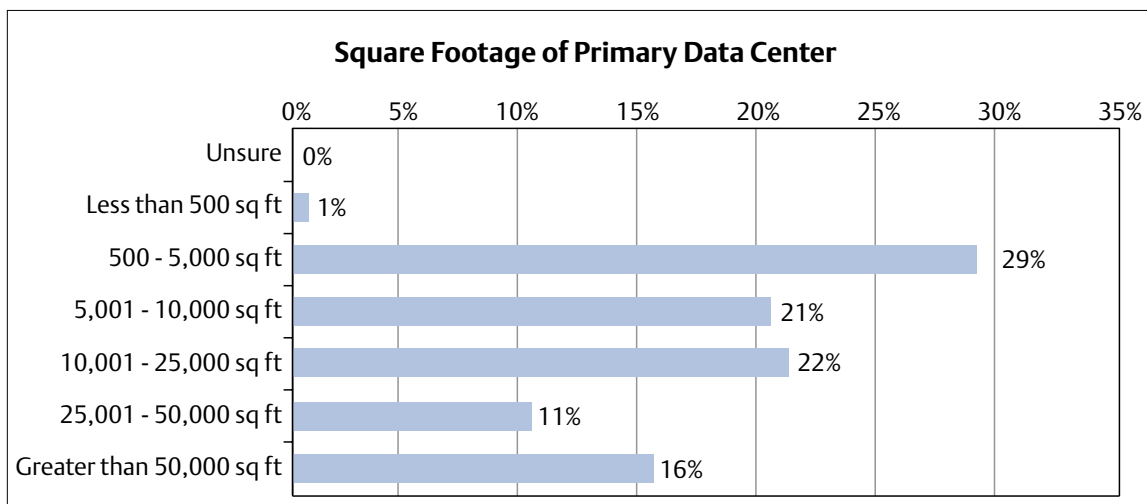


Figure 1. Respondents represented data centers ranging from less than 500 square feet to more than 50,000 square feet.

Emergence of Infrastructure Monitoring and Management

The first decade of the 21st century has been one of rapid growth and change for data centers. For most of this decade, data center managers have been forced to react to rapid, continuous changes dictated by the capacity and availability requirements of their organizations and the density of the equipment being deployed to meet those requirements.

Data centers, with their increasingly complex infrastructures, now are entering a new stage of maturity marked by a more proactive approach to management that moves them beyond simple “sense and respond” monitoring. Creating the ability to predict for performance optimization will enable increased efficiency, better informed planning and higher levels of service. Many organizations are looking to take a more

proactive management approach. To do this, they need a better understanding of equipment operating conditions, as well as the ability to predict how changes to one system will impact mutually dependent systems. Achieving that level of visibility requires the ability to collect, consolidate and analyze data from across the data center.

This growing realization on the part of data center, facility and IT managers is reflected in this year’s DCUG survey results. When asked to identify their top three facility/network concerns, 51 percent of respondents cited adequate monitoring and data center management capabilities, making it the leading response to the question. Heat density (49 percent) and availability (47 percent) were second and third in the list of top concerns, followed by energy efficiency (44 percent) and power density (36 percent). (See Figure 2)

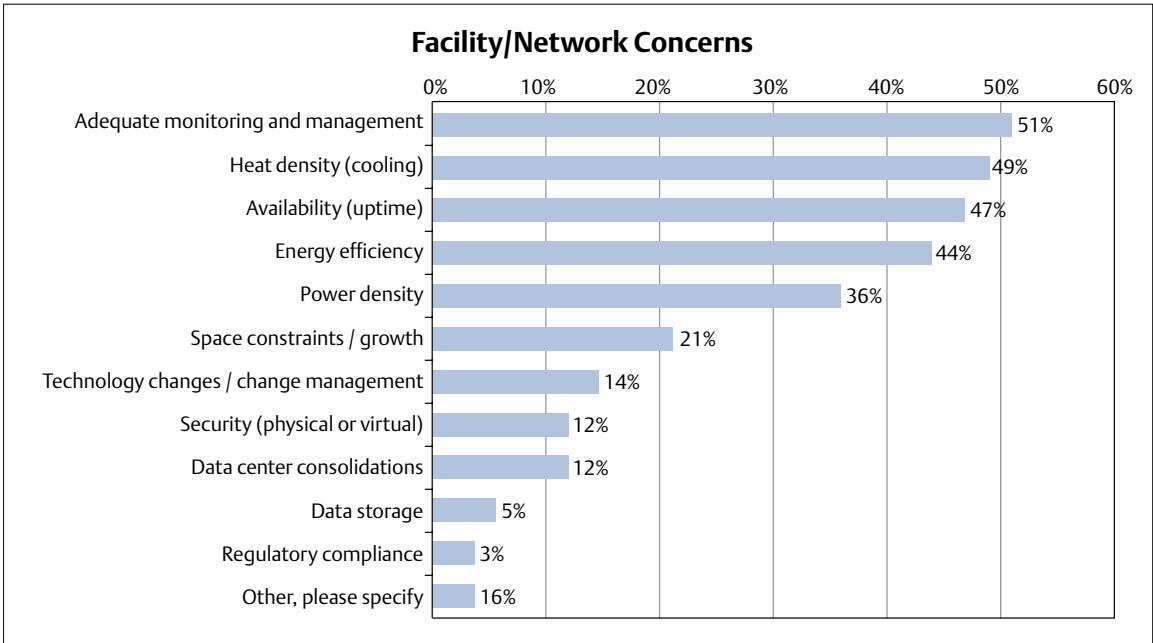


Figure 2. Respondents identified top three facility / network concerns.

This year's DCUG survey marks the culmination of monitoring/management's climb up the list of issues. Three years ago, it ranked sixth among the top issues. It climbed to number four in the 2008 survey and was number three in 2009. Heat density has remained a significant concern throughout the history of the DCUG survey, but was down 6 percent from last year when it occupied the No. 1 spot. Energy efficiency was also down from last year when it occupied the No. 2 spot. (See Figure 3)

Network management systems are essential to IT personnel in monitoring and managing IT equipment but do not address issues such as energy consumption, available rack capacity or ambient air temperatures that are critical to proactive data center management. Building management systems often used by facility personnel to monitor power and cooling in the data center, do not provide the alarm management capabilities required for critical systems and fail to account for the interdependencies between systems.

The increasing complexity of the data center is forcing many organizations to better track the usage and performance of their assets to ensure IT investments align with the enterprise's needs—driving the increased interest in monitoring and management. However, in many cases, organizations still lack the tools to track those factors adequately.

These survey results point to the need for a new breed of infrastructure monitoring technologies that allow data center managers to implement systems that not only support higher availability but also measure the return of energy efficiency initiatives, increase the value of virtualization and consolidation efforts, and improve planning. These tools will be created, deployed and refined as organizations continue to seek to optimize efficiency and density without compromising availability.

	Spring 2010 ranking	Spring 2009 ranking	Spring 2008 ranking	Spring 2007 ranking	Spring 2006 ranking
Adequate monitoring / data center management capabilities	1	3	4	6	4
Heat density (cooling)	2	1	1	1	1
Availability (uptime)	3	4	3	4	5
Energy Efficiency	4	2	5	3	7
Power Density	5	5	2	2	3
Space	6	6	6	5	2

Figure 3. Top six facility/network concerns from the past five years.

Power Density Remains an Issue

One of the key data points businesses need to track is the power density (kW) per rack in a data center. The 2010 DCUG survey reflects the continuing issue of data center power densities, with 63 percent of respondents reporting maximum rack power density in their data center climbing to 8 kW or greater. (See Figure 4) This is an increase over 2008 when it was 59 percent.

The power density per rack in the data center is expected to trend upward in the coming years. Sixty-eight percent expect maximum rack power density to be between 8 kW and 16 kW by 2012, while 32 percent expect it to be 16 kW or greater.

Figure 5 shows the average rack density for respondents was 6.4 kW. It also shows this average is expected to increase to nearly 10 kW by 2012. More than half the respondents

(53 percent) also report having less than 25 percent excess floor space in which to expand.

Concerns Over Availability & Outages

In the second half of 2008, as the U.S. economy entered a deep recession, companies focused more attention on reducing energy consumption as a means to reducing costs. This trend has been illustrated over time in past DCUG surveys. DCUG members surveyed in 2005 did not include energy efficiency in their top five data center concerns. In spring of 2008, efficiency made the list at No. 5. By spring of 2009, efficiency had moved to the second position.

Over the past 18 months, however, a number of companies experienced well-publicized data center outages, which can result in disruptions in services, lost data, and

What is the maximum power density (in kW) per rack in your data center?

	2 kW or less	>2–4 kW	>4–8 kW	>8–12 kW	>12–16 kW	>16–20 kW	>20–24 kW	Greater than 24 kW	Unsure	Approx. Average
Now	1%	5%	20%	23%	16%	9%	8%	7%	11%	12.32
In two years	0%	3%	10%	20%	16%	14%	7%	11%	19%	14.57

Figure 4. Maximum power density (in kW) per rack in the data center.

What is the average power density (in kW) per rack in your data center?

	2 kW or less	>2–4 kW	>4–8 kW	>8–12 kW	>12–16 kW	>16–20 kW	>20–24 kW	Greater than 24 kW	Unsure	Approx. Average
Now	4%	28%	36%	12%	4%	3%	1%	0%	11%	6.36
In two years	0%	9%	30%	21%	15%	4%	3%	3%	15%	9.95

Figure 5. Average power density (in kW) per rack in the data center.

hundreds of thousands of dollars in financial losses. In the wake of those outages, the industry seemed to refocus on availability and realized that energy efficiency gains at the expense of availability were wasted. This is reflected in the survey results. Another look at Figure 3 shows that while availability was in the top three in 2008, it dropped out in 2009 as energy efficiency emerged as a pressing concern. It is back in the top three again in the most recent survey.

throughout the history of the DCUG survey, Figure 6 shows it was down 6 percent from last year when it occupied the top spot in the survey. At the same time, availability increased by 6 percent to come within two percentage points of heat density and secure the number three spot. The likely reason for the rise of availability again is economic: one significant outage can be so costly that it wipes out years of savings achieved through incremental efficiency improvements.

In fact, closer examination shows availability is only slightly behind heat density, which is in the number two position. While heat density has remained a significant concern

Now, the challenge is to increase efficiency while maintaining or improving availability in these increasingly dense computing environments.

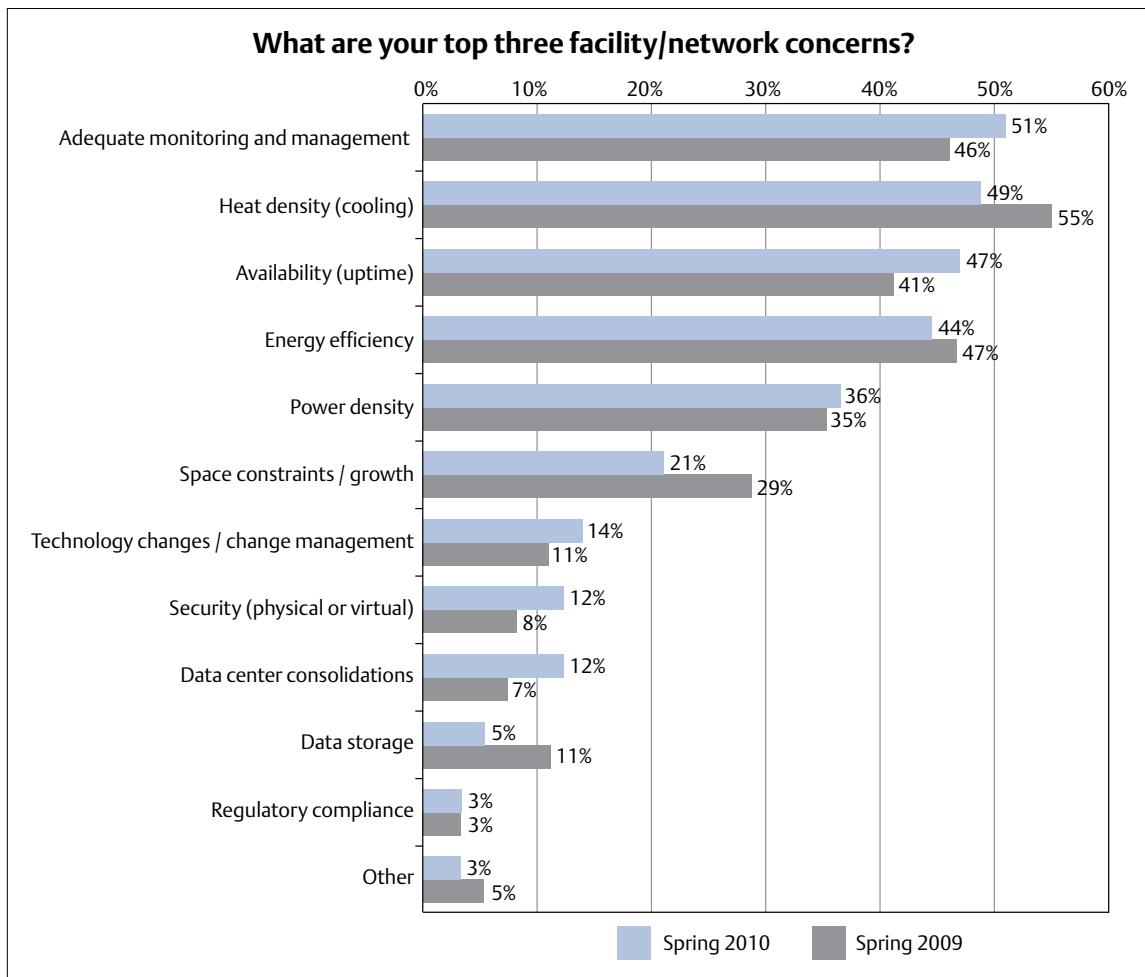


Figure 6. Top three facility/network concerns from the past two years.

Concerns over density and availability were validated when respondents were asked to list the issues they had experienced in the past 12 months (See Figure 7). The No. 1 issue listed was “hot spots,” with 40 percent of respondents saying they had experienced this problem. This actually reflects some progress in the battle with hot spots – 53 percent said they experienced hot spots in 2009 and 45 percent in 2008 – but still is twice as high as the next issue cited, running out of power (26 percent).

Twenty-three percent of respondents also reported experiencing at least one power outage in the last 12 months; with more than 20 respondents saying they have experienced 2 to 4 outages. Reasons cited for the outages included weather, human error, and equipment failure, while costs were as high as \$2 million per incident.

Deployment of Energy Efficient Cooling Technologies

Finally, the survey highlights the evolution in data center cooling as organizations deploy new and proven technologies capable of supporting higher densities and improving cooling efficiency.

When asked to highlight from a provided list the cooling technologies their data centers have implemented or plan to implement, 39 percent of respondents cited cold aisle containment. Thirty-nine percent of respondents also indicated they had implemented or planned to implement fluid economizers and 21 percent named air economizers. While only 17 percent of respondents checked rack-based cooling,

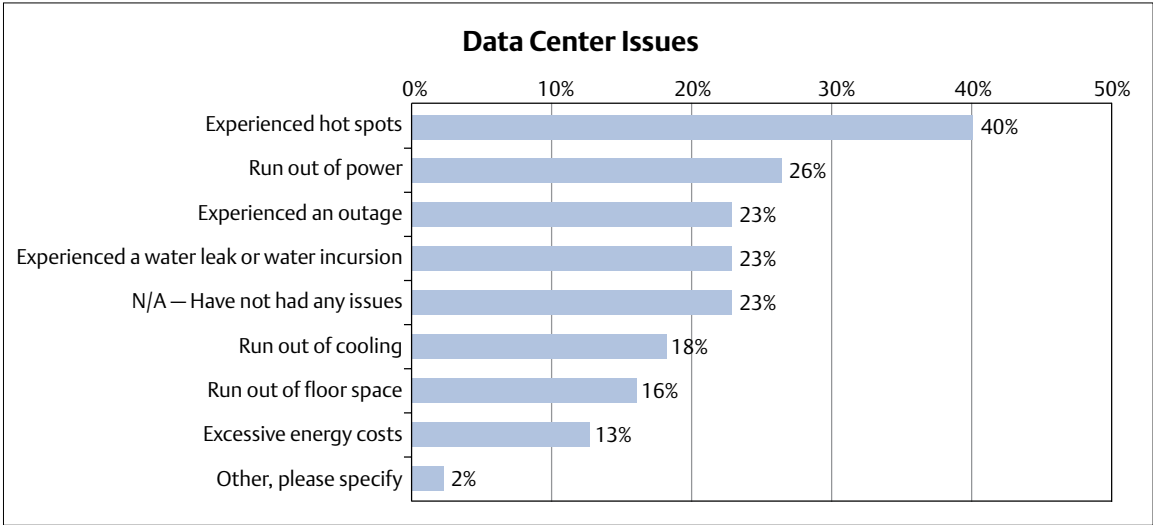


Figure 7. Issues experienced in data centers in the past 12 months.

another 38 percent acknowledged that they still are considering the technology. (See Figure 8)

Considering the advantages of cold aisle containment, it is not surprising it was the most widely adopted technology despite its relative newness. First, it increases the cooling capacity and energy efficiency of the cooling unit in part by ensuring the return air temperature is high. Second, the increased

capacity, together with the separation of hot and cold air, makes it possible to cool higher heat loads per rack. Cold aisle containment systems with internal cooling can cool more than heat loads greater than 30kW per rack. Combined with precise aisle-level control of temperature, humidity and airflow, that enables data centers to realize greater than 30 percent energy savings and a 25 percent cooling capacity increase without compromising availability.

Has your data center implemented, or considered implementing, any of the following technologies?

	Already implemented	Plan to implement	Still considering	Considered, but decided against	Will not consider	Unsure
Fluid economizer on chiller plant	14%	5%	14%	10%	28%	29%
Fluid economizer using dry coolers	14%	5%	14%	10%	28%	29%
Air economizer	14%	5%	14%	10%	28%	29%
Cold aisle containment	28%	11%	38%	14%	6%	3%
Containerized/Modular data center	5%	2%	24%	18%	35%	16%
Wireless monitoring	7%	5%	44%	9%	18%	18%
Solar array	1%	3%	14%	10%	47%	25%
Rack-based cooling	11%	6%	38%	18%	13%	15%
DC Power	6%	3%	18%	18%	35%	20%

Figure 8. Technologies that data centers have implemented or plan to implement.

Eighty-one percent of respondents have implemented some form of virtualized equipment, and 74 percent already have purchased, or plan to purchase, servers with high-efficiency power supplies. Sixty-six percent said they currently meter or plan to meter power consumption at the data center branch level, while 39 percent have

implemented or plan to implement metering of power consumption at the data center receptacle level. Fifty-seven percent of respondents reported they have increased or plan to increase the temperature of the data center, while another 29 percent are considering this practice. (See Figure 9)

Has your data center implemented, or considered implementing, any of the following data center best practices?

	Already implemented	Plan to implement	Still considering	Considered, but decided against	Will not consider	Unsure
Server power capping	7%	6%	30%	10%	18%	30%
Virtualized equipment	81%	9%	2%	1%	1%	6%
Shut down redundant power and/or cooling equipment	23%	7%	25%	11%	24%	9%
Purchase servers with high efficiency power supplies	54%	20%	17%	0%	0%	9%
Purchase Energy Star 4.0 qualifying devices	18%	25%	29%	1%	2%	26%
Power consumption metering at the data center branch level	47%	19%	20%	4%	3%	6%
Power consumption metering at the data center receptacle level	23%	16%	35%	12%	7%	7%
Utilize power management capabilities (i.e. sleep mode)	10%	15%	39%	8%	13%	16%
Increase the temperature of the data center	44%	13%	29%	5%	7%	3%

Figure 9. Best practices data centers have implemented or plan to implement.

Conclusion

Results of the Data Center Users' Group 2010 survey provide a revealing look into the changes occurring throughout data centers.

While each facility is uniquely different, the insights provided by the more than 176 survey participants serve as an accurate representation of what's going on inside the data center, including these notable realities:

- Data center infrastructure monitoring and management has emerged as a top-of-mind issue for DCUG members as they embark on a more proactive approach to precise monitoring and measurement of data center components and performance that enables increased efficiency, better planning and higher levels of service.
- Heat density is an issue, but one that is improving. Power density is expected to continue to increase which will enable greater efficiency if cooling issues are properly addressed through the use of cold aisle containment, rack-based cooling and other high density cooling solutions.
- Organizations once again are focusing on availability. In the wake of a number of high-profile outages, many data center, facility and IT managers realize their top priority is to maintain or improve availability in increasingly dense computing environments. Their challenge is ensuring availability while reducing costs and increasing efficiency.
- DCUG members are deploying new technologies and implementing data center practices capable of supporting higher densities and ensuring efficiency without compromising availability.

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