



Data Center Professionals Turn to High-Density Computing as Major Boom Continues

Research reveals a trend towards the rapid deployment of high-density devices, but will this technology solve the capacity demand or create new unforeseen challenges for data centers?

Introduction

Modern businesses are running more sophisticated applications and handling larger volumes of mission critical information every day. It's an accelerating trend that industry observers believe shows no sign of slowing in the near future. As a direct result, demand for data center facilities capable of housing systems and components that can relieve much of this burden in controlled, highly redundant environments has never been higher.

In order to meet this enormous demand head-on, it's no surprise that a high number of innovative high-density data centers are being rolled out worldwide as quickly as possible, while existing data centers are being upgraded rapidly to cope with higher volumes. This advancement is possible thanks to the deployment of higher-density blade servers capable of throwing more computing power at the problem.

Initially, high-density devices and blade servers offer an attractive solution to such a dramatic explosion in demand, because they were designed specifically to pack greater processing power into a rack than traditional servers. Unfortunately, a fresh proliferation of high density servers in an older facility, or housed within a new data center designed with traditional energy and cooling thresholds, brings its own considerable problems in terms of heat and power management issues. It is vital these issues are addressed quickly to guarantee business continuity.

Survey

In this latest in a series of incisive research notes, Aperture Research Institute™ analyzes current trends in the use of high-density devices in data centers. This research is based on interviews with more than 100 data center professionals across a broad spectrum of industries who, between them, manage several hundred data centers.

An overview of the Institute's survey results indicates that although many data center managers are introducing blade servers and increasing the density of power, many facilities are not able to handle the associated demand for power and cooling.

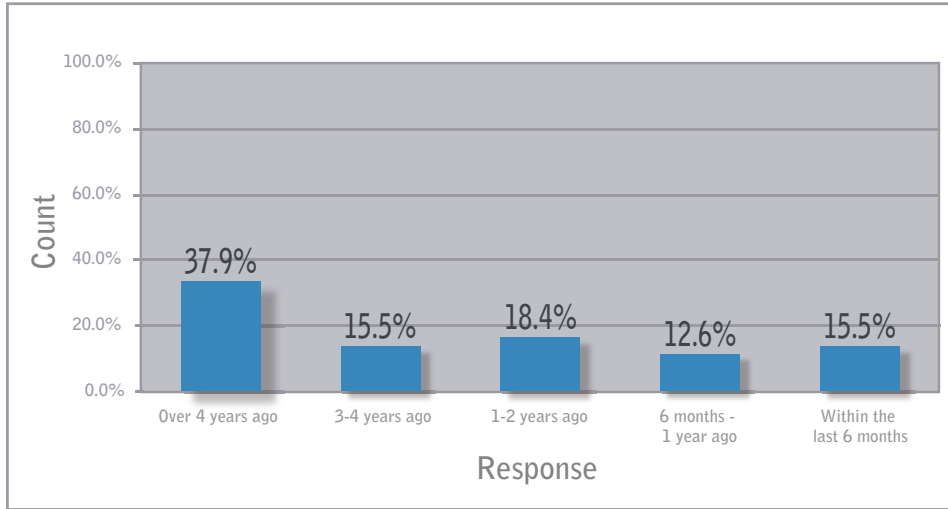


Continuing Growth

Data centers are undergoing a period of growth and expansion, both within existing facilities and in the creation of new ones. This research reveals that 36% of all respondents were currently building or planning to build new data centers within the next three years, while 23% are expecting to open new facilities by the summer of 2008.

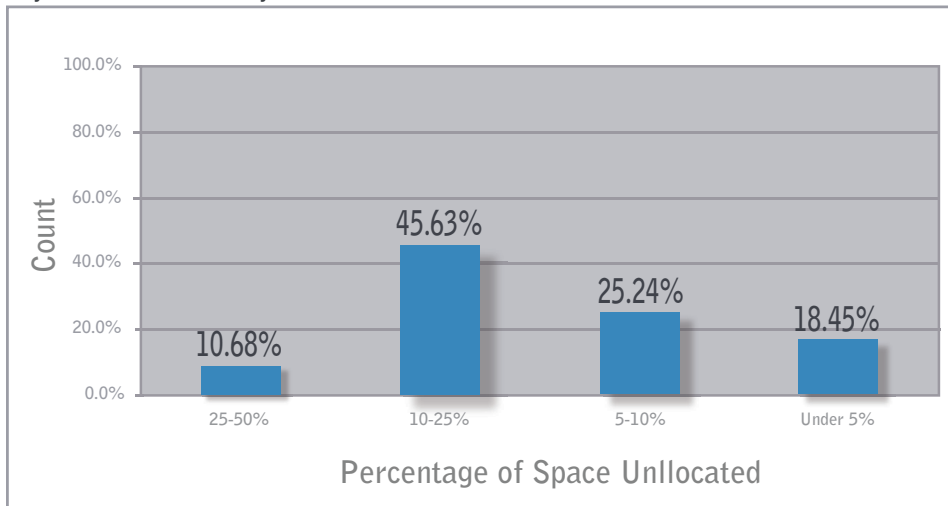
This trend is continuing an already fervent period of growth in data center construction. A significant 56.5% of respondents revealed that their firm had built a new data center in the past two years, while 28.1% had done so in the last year alone.

When did you build your most recent data center?



Despite this acceleration in data center construction, capacity and power is still running out fast. As shown in Table 2, almost 90% of respondents reported that at least three-quarters of the space in their data centers was already occupied by IT equipment, while nearly 44% of respondents reported that their data centers were operating at over 90% capacity.

Do you have blade servers in your data centers?

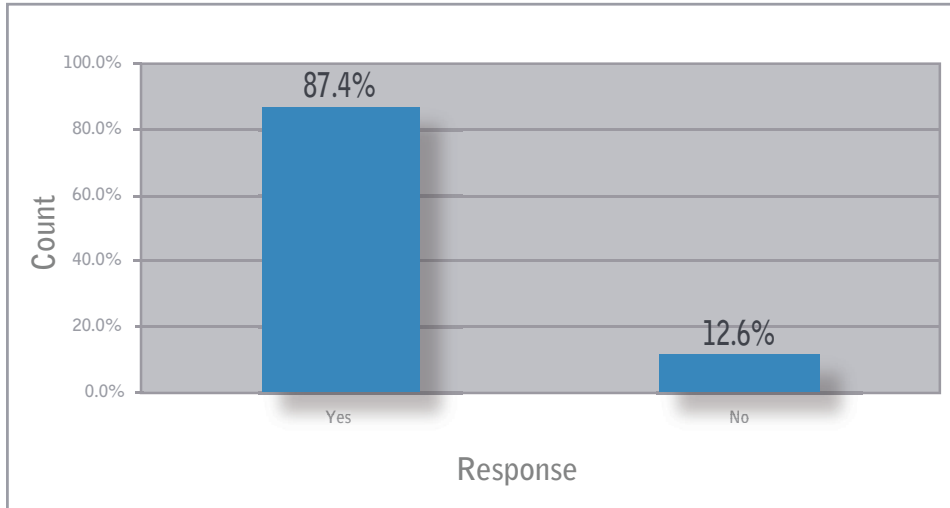




High-Density Computing

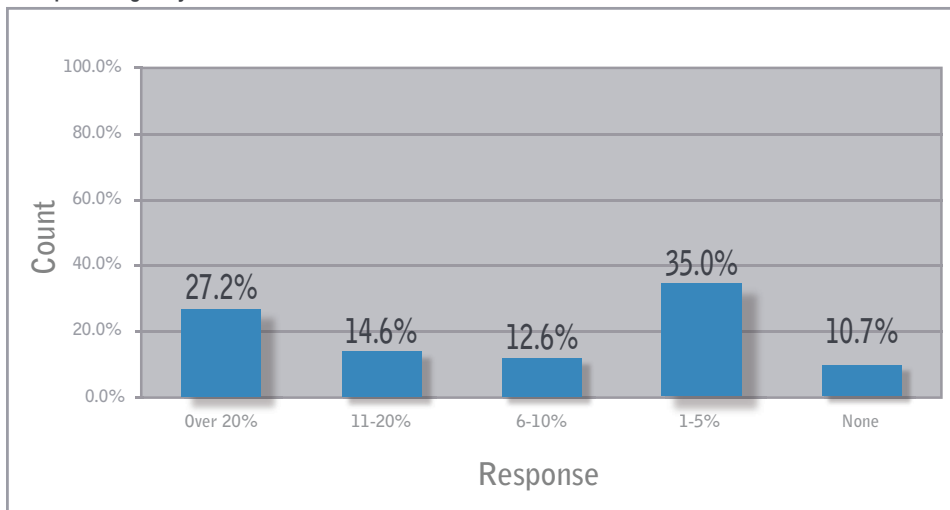
The majority of data centers are already utilizing blade servers, which can provide superior levels of performance to traditional servers within a much smaller footprint. Over 87% of respondents confirmed that they were currently operating blade servers within their data centers.

Do you have blade servers in your data centers?



While deployment of blade servers has been widespread, many data centers remain conservative in their purchasing plans, with conventional non-blade servers continuing to dominate purchase orders. Nearly 11% of respondents said that none of their new servers were blades and 35% said that fewer than 5% of their new servers were blades. However, 27% are starting to make a significant commitment to blades by buying them for over 20% of their new server deployments, while a further 27% will buy blades for between 6% and 20% of their new servers.

What percentage of your new servers are blades?



These survey results clearly demonstrate the pressures that exist regarding space within data centers, together with a precedent for adopting high-density equipment. Given the choice between using traditional servers or more compact blade servers, the answer may at first seem obvious, but high-density equipment does have associated problems of its own.

Because blade server technology is still relatively new, there remains a lack of interoperability between vendors, as well as issues in compatibility between blade servers and traditional servers. For these reasons,



maintaining heterogeneous environments or a mix of traditional and blade server equipment can still prove a struggle for data center managers.

Part of this struggle arises because 35% of administrators are making less than 5% of their purchases blade servers. Adopting new technology in such small quantities can create unnecessary increases in complexity within data centers, resulting in much more difficult maintenance and an increased likelihood of downtime. A heterogeneous environment quickly becomes much more difficult to maintain than a homogeneous one.

However, perhaps the most prevalent concern is that the power demands of blade servers far outweigh those of traditional servers. This makes them expensive to operate and manage. A total of \$7.3 billion was spent on electricity for servers worldwide in 2005¹, and some estimates say anywhere from 1.2% to 4% of all power generated in the United States is used by data centers².

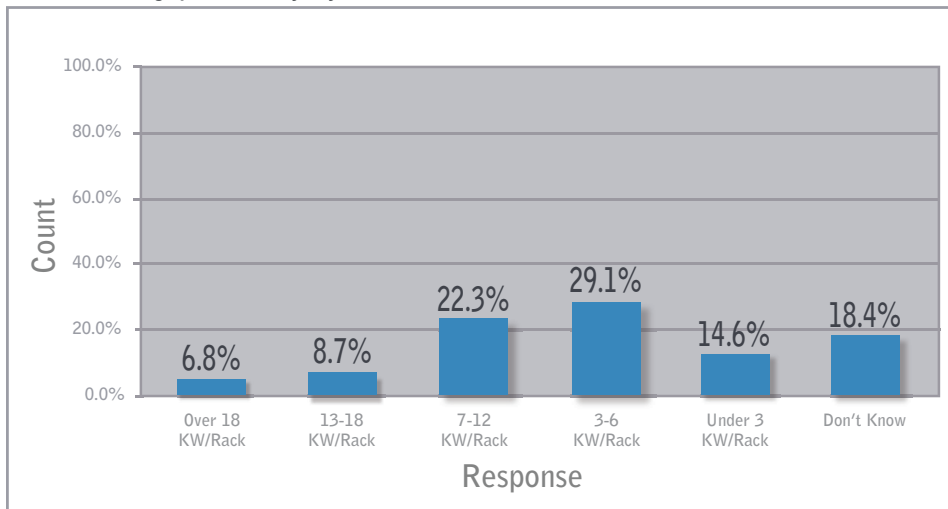
Cooling Power

These greater power demands from high-density equipment are reflected in the rising power density of racks, often making them difficult to cool. An ideal configuration for a data center would be to alternate hot and cold racks to maximize ambient cooling. However, some respondents reported that their rack which required the most power was up to ten times as demanding as their average rack. This kind of situation would certainly be more complex to cool than simply re-arranging racks to disperse heat more evenly throughout the data center. Even with an optimal arrangement, conventional wisdom holds that once these unusually hot aisles begin averaging around 8KW per rack, cooling problems and eventual downtime are likely to follow.

Worrying then, that 29% of respondents said their average power density per rack was 3-6KW - significantly higher than what would have been expected 3-5 years ago – while more than 37% of administrators noted that their racks averaged over 7 KW, pushing them firmly into the danger zone previously mentioned.

Furthermore, while the maximum power density for a rack in each of these data centers was on average a reasonable 1.6 times the density of the average rack, some data centers offered far more dramatic differences. One respondent for example, admitted that while its average racks required 3-6 KW/Rack, it's most powerful rack demanded more than 30 KW to run. Such a dramatic difference will inevitably lead to cooling issues and potential business continuity issues.

What is the average power density of your racks?

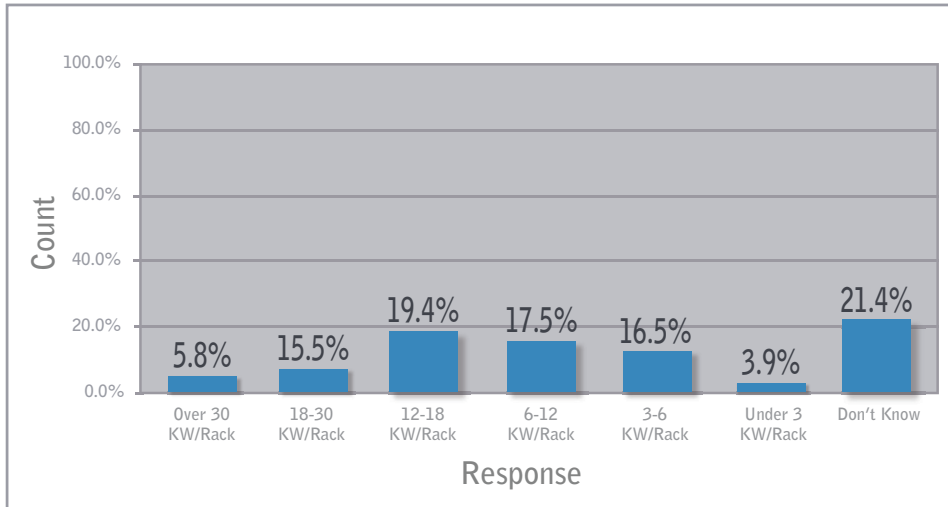


¹ http://www.amd.com/us-en/Corporate/VirtualPressRoom/0,,51_104_543~115850,00.html

² http://www.cfo.com/article.cfm/8792620/c_8796367?f=home_todayinfinance&x=1



What is the maximum power density per rack?

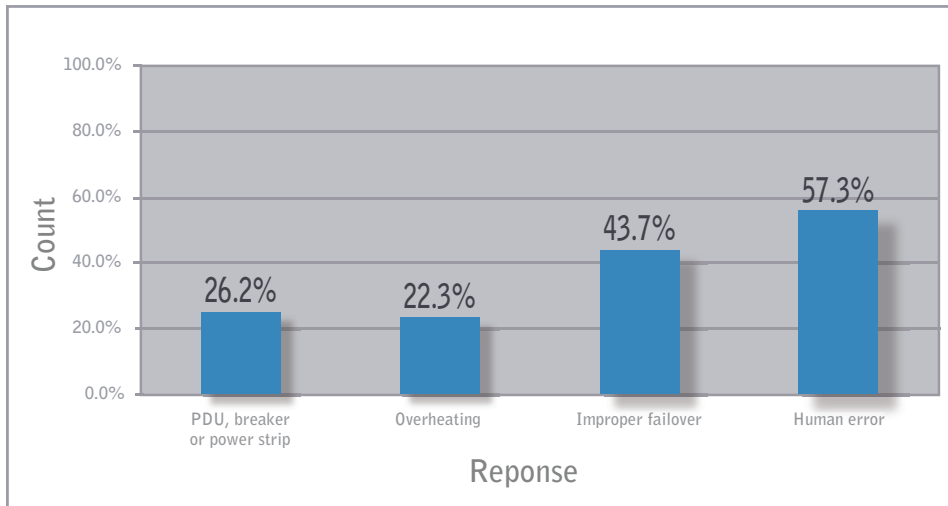


Perhaps the most alarming statistic was that 21% of those surveyed did not know the maximum power density of their racks. Over 8% of respondents are therefore using high-density devices without tracking power density in a rack, dramatically increasing the potential for outages.

The increased weight, heat, and stress placed on these racks by the use of blade servers, when combined with the increase in power density per rack, causes the margin of error for data centers to be dangerously diminished. The improper configuration or maintenance of just a single blade server, or poor airflow to a particularly dense rack could result in critical downtime.

Respondents noted (as seen below) that over 57% of outages were caused by human error, and nearly 44% were due to improper failover. Over a fifth of outages were caused by overheating and over a quarter were due to overloading a PDU, breaker or power strip. All these problems are likely to be magnified by the use of high-density equipment in environments in which the power density of racks is not suitably managed.

Which causes of outage have you experienced?

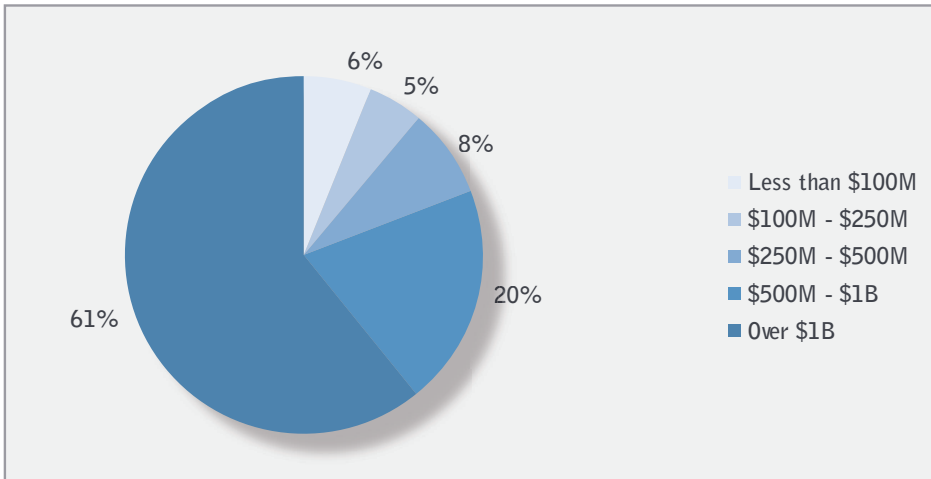




Survey Methodology

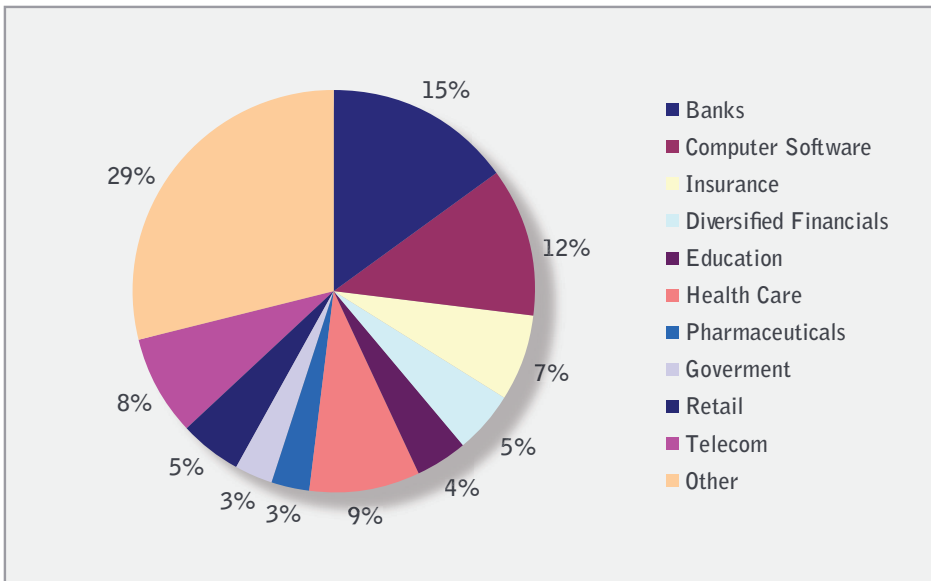
More than 100 data center professionals and executives from a variety of industries participated in this online survey. Survey participants were solicited from an industry database of Aperture customers and prospects.

Annual Revenue of Participating Companies



The below chart shows the cross section of types of businesses that participated in the survey. It includes companies across various vertical industries and ranges from smaller businesses to Fortune 100 companies.

Primary Industry of Participating Organizations





Conclusions

Even though most professionals surveyed had built a new data center in the last four years, almost 90% of them said their racks were already three-quarters full. The vast majority of data centers (over 91%) have deployed high-density equipment to fully exploit the space available, but a worrying percentage are not adequately managing the power density of their racks, with an alarming 21% unaware of their maximum power density per rack. Data centers need to ensure that their rush to install high-density equipment is matched by a genuine ability to manage power and cooling. High-density equipment helps the data center to keep up with the demands of business, but if organizations continue to operate close to thresholds, they can also dramatically increase the risk of outage. In many cases the widespread use of high-density equipment is putting a strain on data center infrastructure, massively reducing any margin for error, with human error remaining the number one cause of outage.

About The Aperture Research Institute

The Aperture Research Institute is dedicated to providing the market with current information and trends on enterprise data centers. The Institute plans to publish new research notes on a quarterly basis. To read the latest research findings, visit: www.aperture.com.



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