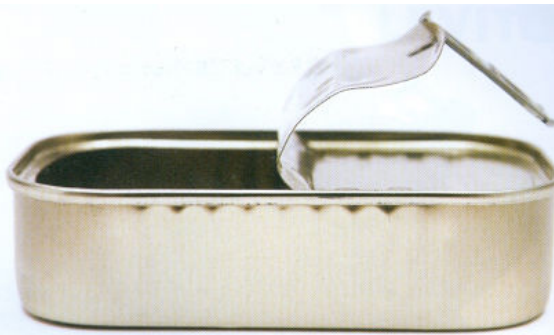


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UNDER PRESSURE

Rising densities

The challenge for data center professionals today is in getting the maximum from the space available by increasing the number of high-density racks. But can airflow alone cope with the cooling challenges of high-density computing?



No standards body has yet offered a universally accepted definition of 'high-density computing'. Despite a slight fuzziness about what it actually is, high density is clearly an important goal for data center professionals, and represents a clear trend towards which the industry is moving.

Victor Avelar, senior research analyst with Schneider Electric, defines it thus: "High-density computing is about packing as many servers, typically blade servers, as you can into a data center rack," he says. "The more power per unit of rack space that goes into the rack to support the increased processing power of modern servers, the denser the rack."

He says that today's typical density of two-to-three kilowatts (kW) per rack is heading for the history books: "Densities are rising to the five to eight kW per rack range as a result of virtualisation and consolidation of servers," he believes. "The higher density racks are already in the 10-20 kW range."

The motivation to squeeze the maximum from the space available in a data center is clear. Data center managers and the enterprises that rely on such facilities are being pushed to achieve more performance at greater value for money, and to reduce energy demands for both environmental and cost reasons.

"Enterprises have moved to consolidate their data centers and to work out how to avoid energy efficiency taxes that will apply in 2010," says Jeremy Young, director for service management and automation solution sales at Computer Associates. "Basically, Defra (the Department for Environment,

HIGH-DENSITY COMPUTING IN THE REAL WORLD – PART 1

Some people believe that high-density computing will lead to a major shift to water cooling in the data center. Despite concerns that water and servers don't mix, densely packing blade servers into racks means the amount of air needed to cool them will make a data center an inhospitable place to work. Doug Neilson of IBM believes the shift will be to water chillers for cooling. For tomorrow's IT infrastructure, only chilled water will be effective enough to remove the heat generated, he says. Others believe that high density can be handled by smarter use of air.

"There's a different definition of high density depending on who you talk to," says Jason Friedler, head of hosting at Telstra International EMEA, operator of a number of data centers in the UK. "But it's really just about maximising the power you get out of a rack, perhaps using a multi-blade chassis. The knock-on effect is that more power and more cooling are needed."

To be described as truly high density, a data center should offer 20-30 kW per rack, he says: "We can do that, but we're mostly offering between five and 10 kW because that's what our customers need for trading systems, for example, but I know that requirement will grow," he explains.

"In our London data center, because of the age of the building, we can demonstrate the evolution of how data centers have been kitted out over the years. Starting with the basic telco facility of 10 years ago, we travel to the present day with the need for minimal power consumption and cooling."

Friedler detects the physical limitations of air cooling fast approaching, with the need for a system of chilled water cooling pipes the most obvious solution.

"A world of hosted applications and internet companies has rapidly changed the demands made of data centers," he says. "We've refitted old data centers, but that's not an ideal scenario. Some of the older data centers you get around Docklands make today's environment a challenge."

In Friedler's view, relatively few data centers have stepped up fully to the high-density challenge: "Maybe two or three in London, and 10 nationally at the outside – fewer than you would expect from all the talk about the subject," he says. "We've made the jump to stay ahead of the market. Customers are driving the need for it – certainly for data centers offering colocation rather than those dedicated to one company's needs. Customers want the flexibility to choose the high-density option when they want it. Vendors such as APC are helping by really sexing up their products. You wouldn't have thought there would be much difference between one rack and another, but there is."

Rackable Systems, now known as SGI, is pushing new rack designs, and the move to putting fans on the actual rack and removing enclosures from server boxes is increasing airflow and making its cooling more effective. Sun also recently brought a cooling door solution to market.





Food and Rural Affairs, will be introducing tax on those consuming more than £500,000 in energy each year. All this is increasing the desired density of an organisation's computing infrastructure."

But good intentions and carefully laid plans aside, are high-density principles actually being adopted in the real world?

"Enterprises are taking virtualisation strategies step by step, as they can result in complex management requirements," says Young. "I don't think enterprises are setting out to organise high-density computing as such; it's more that businesses are changing shape, and they know they can save money by consolidation and so end up with higher density computing almost as a by-product."

But organisations that are tempted to look at computing capacity benefits without considering wider operational costs and constraints should think again, warns Young.

"Companies may consolidate their data centers, but they can't consider components discretely," he advises. "When a company is reducing costs and boosting server utilisation, it is inevitably increasing energy use and cooling needs for the infrastructure, so new heating, ventilation and air-conditioning systems will probably be needed."

He says there are vendors, including CA, that have tools to help manage a virtualised data center infrastructure and that better understand energy consumption in a rounded, end-to-end way.

"We're doing more high-density data centers than traditional ones at the moment, and a lot that are medium density of about 10kW," says Chris Smith, sales and marketing director at data center infrastructure specialist On365.

HIGH-DENSITY COMPUTING IN THE REAL WORLD – PART 2

The move to high density started a few years ago for City-based telco and data center operator Colt, says Derek Ainscough, product specialist for managed services.

"For us it started with the adoption of blade servers, leading to a higher density of rack loads," he says. "What you offer really depends on what applications the customer is running and what technology they are running them on. Whether you take a traditional or high-tech approach depends a lot on what sector you are in."

Financial services companies, says Ainscough, are more traditional in approach, whereas manufacturers and retailers have, for many years, been comfortable operating at the bleeding edge.

"The data center world is moving to a 'just-in-time' model of operations, just as manufacturers did for their supply chains years ago, where you provide exactly what's needed when it's needed," he says.

The world of virtualisation that is being ushered in, hand-in-hand with high-density computing, is allowing companies that use data centers to be increasingly flexible in their choice of technology, says Ainscough.

"With the move to cloud computing, you have properly adaptive technology that can scale more quickly to meet particular needs," he says. "This is driving a new generation of data centers – what Microsoft is calling the fourth generation. The data center itself is becoming as modular and flexible as the equipment it houses. There's really a whole load of developments all happening in parallel, favouring the larger data center operations. Small ones have less space in which to move without needing to write off equipment," he says.

Some centers are at a half-way stage: "You have data centers that are mostly on traditional lines that have a high-density 'room within a room'," says Smith. "Wherever you have high density, you have a challenge with delivering power. But power is the easy challenge – it is the cooling process that's hard.

"When a high-density rack is running hard, a lot of air is being drawn in. We offer hot aisle containers that enclose part of the operation, managing the hot air out and cool air in."

Avelar agrees that cooling – specifically the cost of cooling – is the primary challenge as data centers move to achieve maximum efficiency from available space. "Cooling is the biggest issue when it comes to deploying high density," he believes. "Most traditional data centers have raised floors and use the raised floor as a plenum. Cool air is forced under the floor by air handlers and gets fed to the servers through perforated floor tiles. Given that there are practical limits in achieving per-tile airflow above 300 cubic feet per minute [cfm], there are challenges in properly cooling high-density enclosures.

"With the rack filled with blade servers in a 42U configuration, requiring 20kW of power, the requirements would be 2,100cfm per rack.

"When a company is reducing costs and boosting server utilisation, it is inevitably increasing energy use and cooling needs for the infrastructure, so new heating, ventilation and air-conditioning systems will probably be needed"

This would require seven vented floor tiles per rack, which is eight times more than what would normally be allocated. To achieve this would require substantial increases in both aisle width and spacing between the racks – which can be expensive," Avelar says.

Built into all future thinking on density and data center design must be the ability to take a flexible approach that takes account of particular needs at particular times, says Smith. He cites the example of a data center fitted by On365 that runs the BBC iPlayer service: "It is able to cope with huge demand at particular times of the day," he says.

"It's about data centers offering a flexible approach to maximise levels of efficiency. For the data center itself, it's about maximising the returns you get from the space you have." ■

