Cool Under Pressure

Storage strategies to improve power
and cooling efficiency and reduce costs.

"There's a shift happening," says Sriram Ramakrishnan, business unit manager for data center solutions at Eaton Powerware. IT power consumption in a data center used to be roughly 60 percent servers, 20 percent storage and 20 percent networking.

Now, says Ramakrishnan, "the amount of equipment has gone up, but storage has gone up faster proportionally. Storage is going to 30 – 40 percent of what's in the data center in terms of power consumption."

"Some storage devices are becoming very scalable," notes Troy Turner, power and cooling specialist at CDW. "If you expand storage to seven or eight racks, the Uninterruptable Power Supply (UPS) may not be big enough if you didn't size to where you will be or pick one that can grow."

Hard drive capacity continues to double roughly every three years. But, according to Mark Greenlaw, senior director of Celerra Marketing at EMC, the amount of storage that companies need is growing faster — an average of 70 percent per year.

"Most storage administrators will have six times their current storage needs in three years," says Patrick Eitenbichler, director of marketing for the StorageWorks Division at Hewlett-Packard. "Most aren't ready for that. Not only will storage cost a lot in terms of administration, but it also consumes space, power and cooling in the data center."

Turning to ILM

Information Lifecycle Management (ILM) tools and procedures can help IT minimize data storage requirements and the costs of storing data. For example, de-duplicators can significantly reduce storage by looking for duplicate blocks, rather than for duplicate files, according to Greenlaw.

ILM tools such as Symantec Enterprise Vault can automate the process of moving data to the most cost-effective storage type available. This approach involves moving older transactions and other files from high-performance (but more expensive to purchase, power and cool) tier-1 hard drives to high-capacity, more cost-effective tier-2 hard drives. Or even to tier-3 storage, such as tape libraries and optical-disk jukeboxes.

Expecting to accommodate growth is an important part of data center planning. But it's no longer sufficient. Today's planners have to also look for ways to improve the efficiency of their power and cooling, along with looking for storage, servers and network IT gear that are cooler and more energy efficient. In a 2006 report, analyst firm Gartner reports, "It is estimated that most enterprise data centers waste more than 60 percent of the energy used to cool the equipment."

Reducing Storage Power

"As sites exceed a rack density of 6kW, they exceed the capacity of traditional underfloor cooling, and traditional computer room air conditioning (CRAC) becomes ineffective," says Michael Bell, research vice president of the server group at Gartner. "You have to go in-rack or in-row cooling."

Power, cooling and infrastructure companies such as APC and Eaton Powerware, along with system vendors such as HP, IBM and Sun, are actively working on more energy-efficient power and cooling approaches to handle storage, servers and network gear.

APC's cooling products, for example, include air distribution/fans; modular and high-density air conditioning, including chilled water distribution; room air conditioning; heat removal; and self-contained rack enclosures with up to 18kW cooling capacity.

"Self-contained air-cooled devices can be in the vicinity of the storage," says John Bean, director of R&D, cooling solutions at APC. "Some of the in-row products were designed for dense server environments, but can also handle lower density storage or combination server/storage areas."

In-row racks are also useful when companies need to put IT gear in rooms that don't have precision air conditioning, says Tom Nester, power specialist at CDW. "You can convert a closet into a mini data center with cooling and the proper temperature and humidity controls, like APC's In Row Cooling, HP's Modular Cooling System (MCS) or Liebert's XDF Air Cooled enclosure."

"We recommend right-sizing — adding cooling as necessary to address increased loads, rather than install it all up-front and then run at an inefficient level," says APC's Bean. "Our InfraStruXure lets you build as you grow, so you don't pay for maintenance on equipment you aren't using." But, Bean cautions: "The backbone, like pipe and chiller power, needs to be done with expansion in mind."

One way that power and cooling infrastructure vendors are working to improve data center efficiency is by looking to increase the amount of power that actually gets to the data center, to cooling and to IT gear.

"We see about 30 percent of the power coming into a building making it to the computer," says Russell Senesac, director of InfraStruXure Systems at APC. "After losses, heat sinks. Only about 3 percent does work. The rest is parasitic load — necessary waste in order for systems to perform their work."

Some of the ways that APC and other vendors are working to improve energy efficiency, according to Senesac, include:

• UPSs that are also efficient at lower loads

New UPSs, "are running at 95 – 96 percent efficiency at full loads and in the low 90s for lower loads." "Our BladeUPS Power System drops only a few percent at lower loads," adds Eaton's Ramakrishnan.

• Scalable UPS

"If you have 50kW of load, instead of installing enough UPS for 200kW to allow for growth, we let you put in enough for your current load, and you can add capacity later."

• Better power distribution

The United States and Japan use 408/230 voltage distribution. By shifting to the 400/230 voltage approach used in Europe done outside the data center, data centers can eliminate a lot of heavy, heat-generating transformers.

• Improving how cold air is distributed

"In-row cooling can save about 30 percent in costs compared to »

traditional perimeter cooling, particularly by reducing the fan horsepower needed in the data center to blow the air under the floor."

In-row cooling also lets IT provide cooling scalably, adds Senesac. "You can add cooling as you need it, which you can't do with the big-fan approach."

Making these and other changes, estimates Senesac, "can make up to roughly a 50 percent improvement in the watts making it through to your storage and servers."

Other products to help keep your data center appropriately cool include HP's Dynamic Smart Cooling (DSC) technology. "Once DSC heat sensors are deployed and a heat map is created, we can adjust the fan speeds that are pushing air. This takes cool air away from areas that are cool enough, and more to where it's too hot," says HP's Eitenbichler. "This can save 25 — 40 percent of the cooling required in the data center, depending on the cooling plant."

Remote sites as well as corporate data centers face the same supporting growth concerns of running out of available power or cooling. Many remote sites, notes APC's Senesac, "are becoming mini data centers." Here, many of the same products and techniques can improve the delivery efficiency of power and cooling, and ILM products and procedures can make the most efficient use of these resources.

Today's power and cooling vendors also offer video and environmental monitoring, which can save staff time (and speed up management and service activities, since fewer remote sites have local IT staff), and many remote sites are running "lights out" with nobody there.

IP video cameras such as APC's NetBotz Webcams, and related environmental monitoring for heat, smoke, water or humidity, help central IT monitor conditions, says Senesac. "If you have to send somebody out, IT can watch and talk them through installing, rebooting and working on gear."

Energy-efficient Approach

ILM tools can move data around to the most cost-effective storage type in your environment — but this still requires having the right amount of each storage available, which in turn requires having sufficient power and cooling without over-provisioning.

One step is to identify the appropriate amount and mix of storage for your data, and understand the power and cooling this storage will need. For example, EMC's Power Calculator lets EMC provide companies with accurate energy consumption data and cooling requirements for EMC Symmetrix DMX-3, EMC CLARiiON CX3 UltraScale and EMC Celerra networked storage systems, based on their specific configuration and workload requirements.

Storage consolidation can also improve utilization, reducing the total amount of equipment needed — and the less storage equipment you have, the less power and cooling you need. "With well-managed direct-attached storage (DAS), you may get 50 percent utilization," says HP's Eitenbichler. "Our new EVA Enterprise Virtual Array File Services combines application and file storage in one array by using a single EVA for block and file storage. A well-managed storage area network (SAN) can get up to 85 percent utilization."

By letting users combine application storage, such as Microsoft Exchange and Structured Query Language (SQL) along with file serving/printing, data protection and other tasks, HP's StorageWorks All-in-One Storage Systems let a company "have one box for storage instead of three, which is more efficient," says Eitenbichler.

And EMC's Symmetrix DMX-3 950, according to EMC, reduces energy use in consolidated and tiered storage environments by as much as 70 percent compared to alternatives.

Other companies with lower power storage products include Infrant Technologies, Iomega and PowerFile. Infrant Technologies' ReadyNAS 1100, which holds up to four 750GB SATA drives in a half-U space, "consumes only 75 watts of power, while doing a read or write, compared to about 200 watts for typical Intel-based devices," says Sam Feng, president of Infrant Technologies. "You can set disk spin down and scheduled power on and off."

Iomega's REV Loader uses a library of removable disk-drive cartridges, which can be idle when not in use, but quickly loaded. For data you want to read but not write, other options include automated tape libraries or optical-disk jukeboxes, such as PowerFile's Active Archive Appliance.

"We were able to bring our power consumption down to about 5 percent of disk-oriented systems, including the cooling overhead on a terabyte-to-terabyte basis," says Jonathan W. Buckley, vice president of marketing at PowerFile.

If you do not do a good job of planning and managing the power allocations in the data center, cautions APC's Senesac, "You'll end up with stranded or unusable power/cooling. So even though you may have 100kW of traditional perimeter cooling installed, you may not be able to use it because you can't get the cooling to where it needs to go. If you plan carefully, you can avoid or delay having to build a new data center."

"Along with the power provision and environmental factors that touch virtually every resource in an IT infrastructure, information storage incorporates a separate set of power consumption issues and requirements that we believe deserve attention," notes Charles King, principal analyst at Pund-IT Research in his December 2006 report, "Power Conservation Inside and Outside the Box: A Systemic Approach to Energy Efficient Information Management."

To succeed, energy efficient storage must be approached systemically, incorporating a combination of physical factors, software strategies, optimization and process management. ◊