Energy-efficient storage has become an imperative for IT organizations. The tremendous growth of storage, spurred by government mandates and an explosion of data, means that overall IT costs are going up. Energy is a significant part of that increase—the cost of power and cooling has been steadily rising with no downturn in sight. The availability of energy is also a challenge. At the same time that increasing resources are needed to retain and manage data, many data centers are running out of power capacity and sources of supply.

These challenges, along with important environmental initiatives, are pressing IT managers to define a clear strategy for reducing storage power consumption. Dell/EMC CX4 Series storage area network (SAN) arrays offer compelling options designed to reduce power consumption and cooling requirements.

DEVELOPING A MULTIFACETED APPROACH TO ENERGY USE

Today, administrators grapple with a number of approaches that can be used together or as stand-alone measures to address power and cooling problems. IT organizations need a comprehensive array of tools that enable them to implement the most appropriate way to suit their specific storage and energy requirements. For that reason, Dell/EMC CX4 Series SAN arrays offer multiple capabilities and options together in a single system. Energy efficiencies specific to Dell/EMC CX4 Series storage include the following:

- **Disk drive spin-down technology:** Because much of the energy use in a given array goes into keeping mechanical drives spinning, whether they are being used or not, disk drive spin-down can provide the most direct way of reducing energy use at the source.
- **Virtual provisioning:** This flexible, automated approach to capacity utilization can enhance energy efficiency by increasing utilization rates and deferring the use of additional capacity.
- **Enterprise flash drives (EFDs):** The benefits of solid-state technology in EFDs—including no moving mechanical parts and no rotating platters—help to reduce power consumption and increase performance for critical applications.
- **Low-power Serial ATA (SATA) II drives:** These drives, designed for archiving and backup to disk, can help significantly reduce storage power consumption and can therefore be excellent candidates for offline content.
- **Adaptive cooling:** Intelligent automation that adjusts blower and fan speeds based on system activity helps reduce energy use.
- **Virtual logical unit (LUN) migration:** Efficient management of storage tiers and the ability to move between the tiers is transparent to the hosts.

Rising energy costs and growing volumes of information mean that pressure is mounting to increase the efficiency of storage systems and reduce power consumption. Employing capabilities such as disk drive spin-down, virtual provisioning, and tiered storage design in Dell/EMC CX4 Series storage arrays helps IT organizations keep energy costs under control.
Each of these features can play a valuable role in helping organizations conserve power and optimize data center efficiency.

**Disk drive spin-down technology to help reduce energy use**

Integrated functionality in Dell/EMC CX4 Series arrays is designed to enable disk drive spin-down capabilities for applications that require infrequent access to data. The Dell/EMC CX4 Series allows administrators to set policies at the RAID group level to place inactive drives in sleep mode after they have been idle for a set amount of time. The platform is designed to allow the drives to spin down the drive motor to 0 rpm but still keep the electronic capabilities in the drive powered up, enabling it to respond quickly to I/O. IT administrators can also monitor disk drive spin-down states using EMC® Navisphere® Management Suite software.

**Virtual provisioning to enhance utilization rates**

Dell/EMC CX4 Series arrays provide virtual provisioning to enhance energy efficiency by increasing utilization rates and deferring the use of additional capacity. IT managers have traditionally met application performance and availability requirements by pre-allocating enough physical storage capacity to handle anticipated growth, which often means unutilized physical capacity is running and consuming power.

Instead of overprovisioning hardware, organizations can help save operating expenses, including energy costs, by deploying additional storage only as needed (see Figure 1). Virtual provisioning in Dell/EMC CX4 Series arrays offers a thin provisioning-based storage virtualization technology that aggregates thin LUNs into a virtualized thin pool of shared storage capacity. The system then allocates physical capacity on demand, automatically.¹

![Figure 1. Comparing capacity requirements for traditional provisioning and virtual provisioning](Image)

**EFDs to deploy flash technology in storage environments**

Dell/EMC CX4 Series storage provides the option of including EFDs in the arrays. Depending on specific application environments, such as those with high transaction rates, a single EFD can achieve similar performance levels to multiple 15,000 rpm Fibre Channel drives, but require up to 98 percent less energy consumption per I/O per second (IOPS) than traditional disk drives. By avoiding mechanical overhead and data placement latency, EFDs can enhance application performance as well as efficiency.²

**Low-power SATA II drives to help reduce power consumption**

Low-power 5,400 rpm SATA II drives in Dell/EMC CX4 Series arrays are designed to maximize power savings for large, high-capacity deployments such as array-based backup to disk, online tape replacement, data warehousing, and test and development. These drives are designed for applications in which low energy use and cost-to-performance ratio is important and high performance is not a priority. They can use up to 96 percent less energy per terabyte than 73 GB, 15,000 rpm Fibre Channel drives and 32 percent less energy than traditional 1 TB, 7,200 rpm SATA drives.³

**Adaptive cooling to help monitor storage environments**

The Dell/EMC CX4 Series provides adaptive cooling functionality that uses intelligent sensor technology to monitor airflow and temperature within the storage array. Adaptive cooling is designed to adjust blower and fan speeds based on system activity to help reduce power consumption for cooling, because the blower and fans operate only when needed.

**Virtual LUN migration to help efficiently manage tiered storage**

The virtual LUN migration capability available in Dell/EMC CX4 Series arrays allows data migration to take place dynamically and effortlessly, helping to avoid disruption in tiered storage environments where data frequently moves between tiers. Dell/EMC CX4 Series storage also supports the optional EMC MirrorView™ and EMC SAN Copy™ data replication and migration tools, which enable remote mirroring of data from one array to another.

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¹ For more information on virtual provisioning in Dell/EMC CX4 Series storage, see “Allocating Storage with Virtual Provisioning on Dell/EMC CX4 Series Storage Arrays,” by Greg White, Annette Cormier, and Eric Cannell, in Dell Power Solutions, September 2009, DELL.COM/Downloads/Global/Power/psdp09-20090037-Cormier.pdf.

² For more information on EFDs in Dell/EMC CX4 Series storage, see “Boosting Performance with Enterprise Flash Drives in Dell/EMC CX4 Series Storage,” by Bharath Vasudevan, Annette Cormier, and Eric Cannell, in Dell Power Solutions, September 2009, DELL.COM/Downloads/Global/Power/psdp09-20090034-Vasudevan.pdf.

³ Based on drive specifications; actual power consumption will vary based on configuration, usage, and manufacturing variability. For more information and a detailed analysis of performance characteristics and differences between 1 TB, 5,400 rpm SATA II drives and 1 TB, 7,200 rpm SATA II drives, see “An Introduction to Dell/EMC Storage Device Technology,” by Dell Inc., April 2009, available at DELL.COM/EMC.
CREATING A TIERED STORAGE STRATEGY

One answer to the explosion of data in today’s data centers is information life cycle management (ILM), a best-practice approach for utilizing a variety of storage tiers with different performance and energy use characteristics to help reduce costs. As active use of aging data decreases, the data can be moved to an appropriate storage tier where it can remain online and accessible. ILM can lead to measurable cost-efficiency for energy because data can be moved to a least-energy-intensive tier.

Dell/EMC CX4 Series arrays offer the ability to implement multiple tiers of storage using a variety of disk drive technologies and corresponding energy requirements within the same array. Mixing drives involves balances and trade-offs. For example, deploying a SATA drive with a low rotational speed can mean a trade-off in performance but enhanced energy efficiency, which can be appropriate for data that is not used often. The following three types of drives are available in Dell/EMC CX4 Series arrays to help facilitate storage tiers:

- **EFDs**: Designed to use much less energy than other drive types, EFDs can be especially well suited for low-latency applications that require consistently low (under 1 ms) read/write response times. Because performance is typically application dependent, EFDs should be matched to the application to help optimize cost-effectiveness.
  - **Fibre Channel drives**: Available with either 10,000 rpm or 15,000 rpm rotational speeds, Fibre Channel drives can be appropriate for environments running applications that require large capacities and high performance.
  - **SATA drives**: SATA drives can be an energy-efficient choice in modest-performance environments, and can also provide cost-effective, energy-efficient bulk storage capacity. Dell recommends using SATA II drives for single-threaded, large-block streaming applications.

Organizations can apply different capacity and performance drives, RAID types, and enclosures to suit various applications within an operating environment. Disk drives for Dell/EMC CX4 Series arrays are available in a range of capacity points and spindle speeds, which may be factored into the mix. Figure 2 provides one example of how drives may be configured for storage tiers.

**OPTIMIZING ENERGY EFFICIENCY FOR DELL/EMC CX4 SERIES STORAGE**

As organizations look to reduce energy use in their data centers, enterprise storage systems can be a significant focus of the efforts to reduce power consumption. Dell/EMC CX4 Series storage systems can efficiently handle demanding applications while offering multiple options that help reduce energy use. Features such as disk drive spin-down technology and virtual provisioning, as well as capabilities such as tiered storage using Dell/EMC CX4 Series SANs, can help organizations meet their environmental goals and maintain control of energy costs. Organizations using techniques such as tiered storage that incorporate EFDs and low-power disk drives can achieve favorable data center efficiency to help mitigate increases in energy costs and the ongoing challenge of power availability.

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**Figure 2. Configuring Dell/EMC CX4 Series arrays in an example tiered storage configuration**

<table>
<thead>
<tr>
<th>Storage type</th>
<th>Disk drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1a</td>
<td>Logs</td>
</tr>
<tr>
<td></td>
<td>73 GB, 4 Gbps EFD</td>
</tr>
<tr>
<td></td>
<td>200 GB, 4 Gbps EFD</td>
</tr>
<tr>
<td></td>
<td>400 GB, 4 Gbps EFD</td>
</tr>
<tr>
<td>Tier 1b</td>
<td>Hot data, tables</td>
</tr>
<tr>
<td></td>
<td>146 GB, 15,000 rpm, 4 Gbps Fibre Channel</td>
</tr>
<tr>
<td></td>
<td>300 GB, 15,000 rpm, 4 Gbps Fibre Channel</td>
</tr>
<tr>
<td></td>
<td>450 GB, 15,000 rpm, 4 Gbps Fibre Channel</td>
</tr>
<tr>
<td>Tier 2a</td>
<td>Warm data, tables</td>
</tr>
<tr>
<td></td>
<td>450 GB, 10,000 rpm, 4 Gbps Fibre Channel</td>
</tr>
<tr>
<td></td>
<td>600 GB, 10,000 rpm, 4 Gbps Fibre Channel</td>
</tr>
<tr>
<td>Tier 2b</td>
<td>Clones</td>
</tr>
<tr>
<td></td>
<td>450 GB, 10,000 rpm, 4 Gbps Fibre Channel</td>
</tr>
<tr>
<td></td>
<td>600 GB, 10,000 rpm, 4 Gbps Fibre Channel</td>
</tr>
<tr>
<td>Tier 3</td>
<td>Backup to disk, archive</td>
</tr>
<tr>
<td></td>
<td>1 TB, 5,400 rpm, low-power SATA II</td>
</tr>
<tr>
<td></td>
<td>1 TB, 7,200 rpm, low-power SATA II</td>
</tr>
</tbody>
</table>

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**QUICK LINKS**

Dell/EMC storage: [DELL.COM/EMC](http://DELL.COM/EMC)

Register for a Dell/EMC event or Webcast: [www.dellenterprise.com/goto/emc](http://www.dellenterprise.com/goto/emc)