

# power solutions

Your guide to maximizing IT efficiency

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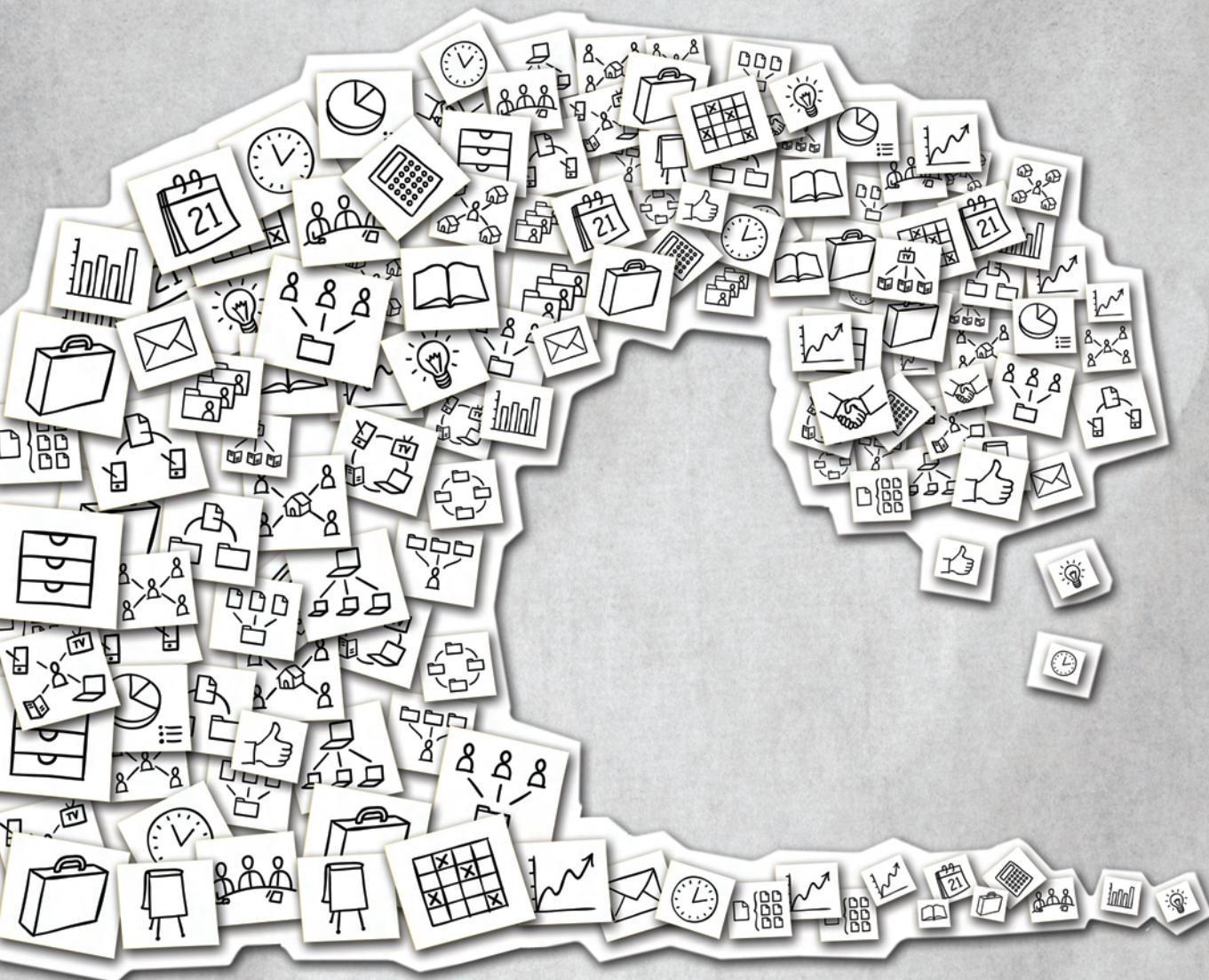
## Solutions for the virtual era

*How advanced data center technologies  
drive sustainable growth*

- The smart money's on IT
- Designing for hyperscale computing
- Storage deduplication technology advances
- Dell KACE appliances for Windows 7 migration
- Enhancing iSCSI SAN self-management
- Pervasive business intelligence on Oracle



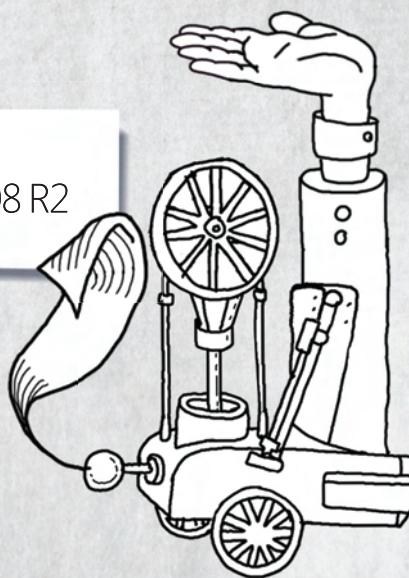
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# The smart money's on IT

### How the Efficient Data Center drives sustainable growth

By Bryan Jones and Bill Goins

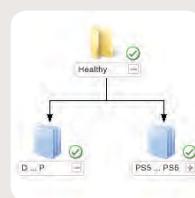
**I**magine a data center where pooled servers, networking, and storage can be rapidly redeployed to meet changing needs; where business application developers can self-provision their workload deployments; and where optimized storage and intelligent infrastructure are the norm. Dell is helping organizations to unlock data center efficiency and work toward the goal of returning as much as 50 percent of the IT budget to drive business innovation.



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## online exclusive

### Streamlining systems management with Dell Management Console 1.1

By Todd Rodgers and Tad Walsh

Dell Management Console powered by Altiris™ from Symantec™ consolidates multiple systems management tasks into a unified, easy-to-use console. Dell Management Console 1.1 enhances this functionality with features including power monitoring, out-of-band update capabilities for server BIOS and firmware, and automated warranty reporting.

Dell Power Solutions Magazine and special edition articles are also available online at [dell.com/powersolutions](http://dell.com/powersolutions). Check the

Dell Power Solutions Web site for early-release articles, how-to's, case studies, best practices, and expert tips you won't find anywhere else.

## Power Solutions Digital Edition

Dell Power Solutions Digital Edition offers a comprehensive IT library at your fingertips—featuring powerful searches across archived issues and direct links to related resources. For instant accessibility, visit [powersolutionsdigital.dell.com](http://powersolutionsdigital.dell.com).

The screenshot shows a search results page for 'Solutions for the virtual era'. The left sidebar has a 'Feature section' tab selected, showing 'Solutions for the virtual era'. The main content area displays several articles with titles like 'Dell Advanced Infrastructure Manager software allows IT departments to manage networking, storage, and servers—both physical and virtual—as a single resource pool.' and 'Intelligent infrastructure management: Dell's Data Center Fabric'. The right sidebar is titled 'Four pillars: Building the Efficient Data Center' and lists four categories: Intelligent Infrastructure, Simplified Infrastructure Management, Streamlined Application and Workload Management, and Dell Intelligent Data Management.

The screenshot shows the Dell Efficient Enterprise website. The top navigation bar includes 'Shop', 'Support', 'Community', 'solutions', 'Services', 'Systems', 'Printer', 'Software', 'Accessories', 'TechCenter', 'View All', 'PRINT', and 'SHARE'. The main headline reads 'Invest in innovation. Not in the status quo.' with a sub-headline 'The Efficient Enterprise'. Below the headline is a call to action 'Free up 50% of your IT budget for innovation' and a sub-call to action 'Have Dell contact you by email or phone'. There is also a 'Learn the Inside Scoop on Green IT' button and a 'Cloud IT services market overview – real enterprise value or just vapor?' button. The bottom of the page has a section for 'The Efficient Enterprise challenges the status quo of proprietary technology, limited openness, limited choice, and solutions that enable complexity rather than reduce it. Delivered as open, capable and affordable solutions, the Efficient Enterprise includes:'



Join the Dell TechCenter community at [delltechcenter.com](http://delltechcenter.com) to share your experiences, voice your concerns, and pick the brain of your favorite Dell expert—or be the expert by signing up for the Dell Masters program. And you won't want to miss TechTuesday chats, community forums, discussion groups, blogs, white papers, video demos, and much more.

## Efficient Enterprise framework

Take control of your data center with open, capable, and affordable solutions that help you focus on driving business innovation rather than just "keeping the lights on." For the full story, visit [efficiententerprise.com](http://efficiententerprise.com).

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BCM5709, BCM57710, and BCM57711 provide the best performing, most economical, and most power efficient iSCSI host bus adapter (HBA) solution on Dell™ PowerEdge™ LOMs, Mezz and Standard NICs.



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# Designs on efficiency



**W**hat began life as, quite literally, a bulleted list of core publishing design tenets and the clean slate of a digital sketch pad has metamorphosed into the redesigned IT magazine you are holding in your hands, viewing online, or scanning from the frames of our Digital Edition.

Once we began designing, no pixel in our page layouts was left unscathed. The result is an end-to-end transformation of *Dell Power Solutions*, into what we hope you will find to be a **bold new visual design that is at the same time information-rich yet more open and accessible—so you can more efficiently zero in on the information you need both within and outside the borders of the magazine.**

Beyond the contemporary, Dell-standard Museo for Dell and Museo Sans for Dell typography throughout; fresh color palette; and rethought artwork accents layered upon the framework of a fresh editorial design system, we've also redesigned the logo on the front cover and included a tagline to reflect our core editorial mission: "Your guide to maximizing IT efficiency."

**"Once we began designing, no pixel in our page layouts was left unscathed."**

In addition, the margins of our pages have been architected to be eminently scannable for links to online content and communities: **look for the gray iconographic signposts to instantly engage with related technology demos, videos, blogs, chats, peer-to-peer discussions, and more.** Of course, we think this is most efficiently accomplished from our Digital Edition at **powersolutionsdigital.dell.com**, accessible from any Web browser and from many mobile devices.

While our look has decidedly changed, the team behind the scenes has not: special thanks to managing editor Debra McDonald and art director David Chan for their tireless dedication to editorial and creative excellence while keeping us on a frenzied production schedule throughout the redesign process, aided by a gold-class supporting cast including Kathryn White, Jim Duncan, Dawn Davidson, Terrence O'Donnell, James Hurd, Amy J. Parker, Cissy Walker, Lalaine Gagni, Margie Preston, and Cynthia Webb.

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2010 Issue 2



# 4P Performance at 2P Economics<sup>1</sup>

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The AMD Opteron™ 6000 Series platform helps Dell™ PowerEdge™ R815 servers pack a whole lot of punch into a slim 2U form factor, with unprecedented price per processor core.<sup>2</sup>

The AMD Opteron 6000 Series platform delivers as many as 48 total cores in up to a 4-processor configuration at significantly lower prices per core.<sup>2</sup> Featuring the industry's first 12-core x86 processor, these processors enable up to twice the performance of our previous generation<sup>3</sup> and up to double the cores at the same price.<sup>4</sup>

Dell PowerEdge R815 servers deliver real world performance for virtualization, databases, and HPC—with up to 48 cores and high memory capacities. They're designed on a consistent architecture that enables scalability for today and tomorrow, plus energy efficiency that can help you conserve precious resources and reduce operating costs. More than a server, it's an investment in your future.

Learn more at [www.dell.com/poweredge/amd](http://www.dell.com/poweredge/amd).



1 Based on standard power Six-Core AMD Opteron™ processor model 2435 lku pricing of \$989 as of 10/19/09 vs. standard power AMD Opteron™ processor model 6172 (Magny-Cours) lku planned pricing of \$989 as of 3/29/2010.

2 Based on lku pricing for AMD Opteron™ processor Model 6128 as of 3/29/2010 (\$2996 + 8 cores = \$350/core).

3 Intel® Xeon® Processor Model 5400 series of 5/10/08 showed a 2.16x performance gain for 2x AMD Opteron processor Model 874 ("Magny-Cours") over 2x Six-Core AMD Opteron processor Model 8635 ("Tetbury") running SPECjbb®-rate2006 Configuration: 2x Six-Core AMD Opteron™ processors Model 8745 in SuperMicro® 4x-Socket 1024M4-8x8 server, 32GB (6x4GB DDR2-667) memory, SuSE Linux® Enterprise Server 10 SP1 64-bit and 2x AMD Opteron™ processors Model 874 in HP ProLiant DL165 G7 server, 64GB (8x 4GB DDR3-1333) memory, Red Hat Enterprise Linux® Server release 5 Update 4 64-bit.

4 Based on comparison of Six-Core AMD Opteron processor Model 2435 (6 cores; \$989 suggested lku price) vs. AMD Opteron processor Model 6172 (12 cores; \$989 lku price as of 3/29/2010).

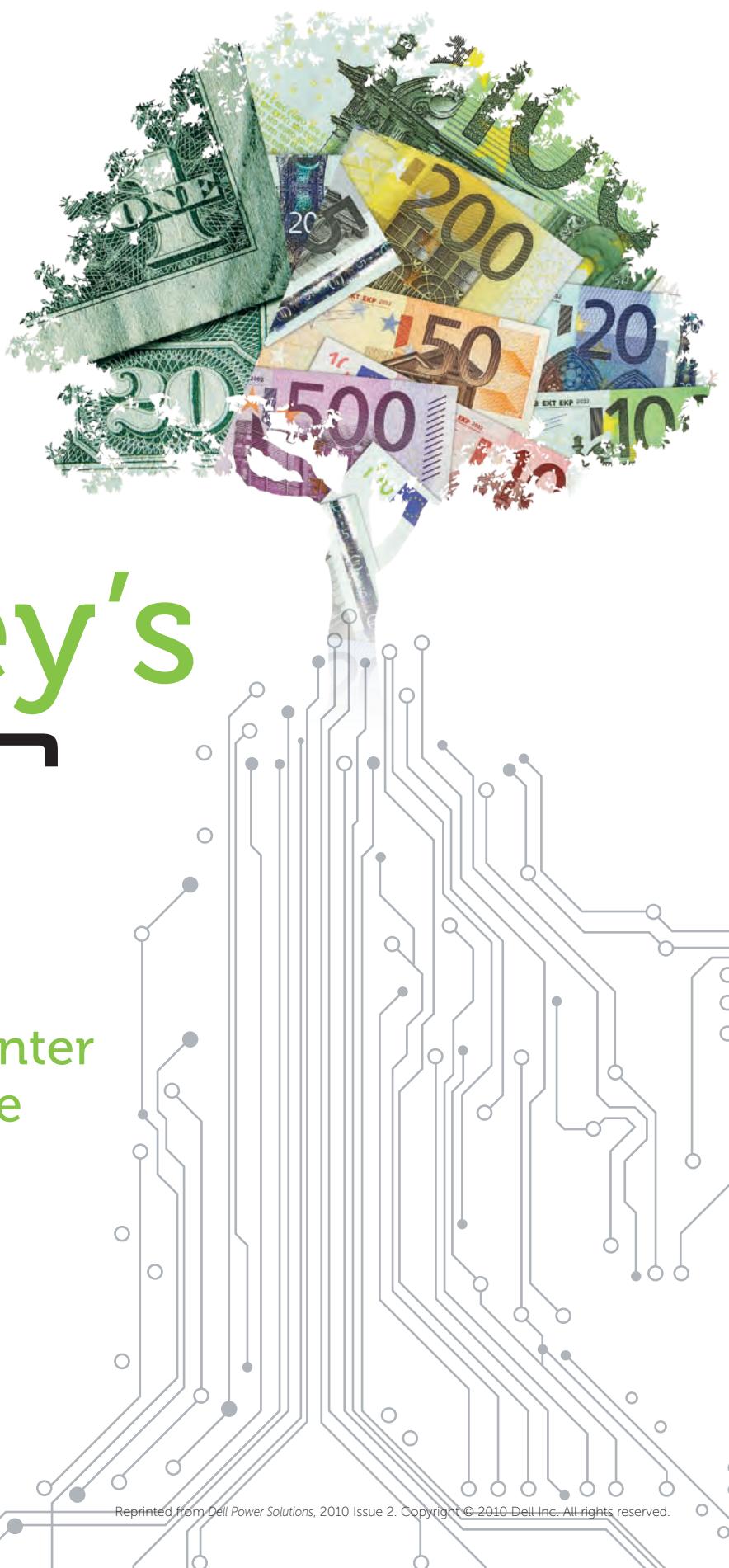
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# The smart money's on IT

How the  
Efficient Data Center  
drives sustainable  
growth

By Bryan Jones and Bill Goins



Imagine a data center where **pooled** servers, networking, and storage can be rapidly redeployed to meet changing needs; where business application developers can **self-provision** their workload deployments; and where optimized storage and intelligent infrastructure are the norm. Dell is helping organizations to unlock data center efficiency and work toward the goal of returning as much as **50 percent of the IT budget to drive business innovation.**

**T**oday, efficiency is a basic tenet of business survival. The boardroom IT conversation is no longer restricted to cutting costs—it's about investing in technology to efficiently drive business and organizational success.

Although IT supports virtually every business process, and tough economic times have led to intensified competition, many organizations are hard-pressed to take advantage of technology advances when they are trapped into spending most of a spartan IT budget on maintenance instead of innovation. As a result, nonstrategic tasks are occupying an increasing proportion of the workday in many data centers.

Virtualization and consolidation can go a long way toward driving data center efficiency, but they are just the beginning. Technologies for flexible data management, self-service workload creation and deployment, resource pooling, and smart, self-aware infrastructure help to simplify data center management and significantly lower total cost of ownership (TCO). In an environment where IT leaders are looking to partner with business units in a way that increases automation and productivity across the organization, advanced data center technologies can make these goals a reality.

Most technology vendors are focused on tackling the simplest of these challenges by virtualizing, consolidating, and automating the data center. These vendors typically propose a collection of proprietary offerings designed to lock organizations into vertically integrated, premium-priced infrastructures.

Dell offers a model for tackling these challenges and building a solid foundation for enterprise efficiency that does not lock organizations into proprietary solutions—a model that can optimize the existing data center, maintain choice in vendors and technology, and allow incremental implementation as time and budget allow. The Efficient Data Center is a key component of Dell's Efficient Enterprise model, purpose-built to lower costs and increase IT efficiency.



# “Dell Advanced Infrastructure Manager software allows IT departments to manage networking, storage, and servers—both physical and virtual—as a single resource pool.”

## Best practices: Envisioning the Efficient Data Center

In the Dell Efficient Enterprise vision, technology infrastructures are open, capable, and affordable. Products and services for the data center are flexible and avoid locking organizations into using a single vendor or proprietary technologies that contribute to increased TCO and limit future choice; products and services have innovative functionality that meets existing requirements and provides the flexibility to adapt to future requirements. In addition, Dell's vision blends new technology with existing infrastructure, existing expertise, and industry-standard approaches designed to drive down TCO and complexity.

Dell begins with a three-step approach to help organizations unlock enterprise efficiency and achieve significant returns on their IT investment. The first step on the journey is to optimize the existing data center infrastructure, with the goal of achieving uniformity and cutting costs. Common platforms, standards-based tools, and unified fabrics can contribute to these efforts. The goal: to eliminate proprietary legacy architectures, like RISC- and SPARC-based UNIX® systems, and replace them with a scaled x86 architecture running Microsoft® Windows® or Linux® operating systems to help lower costs and reduce management oversight.

The next step is to simplify the technology infrastructure. Using pragmatic approaches such as virtualization and storage consolidation, organizations can consolidate or unify redundancies to help ensure that they are getting the most out of their data center resources. Rationalizing and reducing the number of applications also enhances the flexibility to easily remove and repurpose servers.

After the data center has been standardized and simplified, enhanced levels of automation become possible. The third step is to implement best practices that help reduce manual intervention and boost productivity, together with cloud-based delivery models (where appropriate) that help reduce administrative burdens on IT staff and enhance application availability. Managed service options also allow organizations to combine 24/7 monitoring, alerts, and reporting with expert analysis and advice.

In the Dell model, the Efficient Data Center is built on four key pillars (see Figure 1).

## Intelligent infrastructure

Dell's Efficient Data Center approach can help organizations optimize their existing data centers, virtualize on their own schedule, take advantage of cloud technologies as they make business sense—and prepare their data centers for the future.

Achieving these goals requires advanced servers, networking equipment, and storage. Intelligent infrastructure is designed to automate frequent tasks to drive down TCO, rapidly respond to change requests, and help administrators anticipate issues and proactively respond. Dell offers a range of infrastructure products to help meet these needs. Purpose-built hardware, like Dell™ PowerEdge™ C-Series servers optimized for cloud applications, can help administrators accomplish specific tasks. An efficient fabric helps lower costs and allows administrators to rack and cable only once. Cloud services enable applications to be cloud optimized. Intelligent infrastructure helps optimize the data center today and build the foundation for advanced Efficient Data Center services.



## 10GbE data center fabric

In this Webinar, learn how innovative technologies such as virtualization and 10GbE enable organizations to converge storage traffic onto a common unified data center fabric. The recorded presentation explores how integrating IT management, server, storage, and networking solutions can help accelerate 10GbE deployments—enhancing flexibility and performance while reducing cost and complexity.

[eseminarslive.com/c/a/IT-Infrastructure/Dell041610](http://eseminarslive.com/c/a/IT-Infrastructure/Dell041610)

Dell gears its approach to enterprise efficiency toward taking advantage of the hardware and software already in the data center while also incorporating purpose-built hardware. With the right mix of blade servers, rack servers, towers, and custom form factors, IT departments can achieve optimum levels of compute density, memory, and I/O to help meet specific enterprise needs.

Dell PowerEdge servers are designed to support generalized workloads, hardware-based availability, and a traditional break/fix service model.

PowerEdge C-Series servers are standardized and purpose-built for cloud applications.<sup>1</sup> And Dell Data Center Solutions (DCS) are designed to support the largest public cloud providers in the industry with specialized workloads, application-based availability, and custom service models.

10 Gigabit Ethernet (10GbE) connectivity is rapidly becoming the industry standard for

networking in the data center. Enterprises can leverage this convergence to help reduce operating costs and avoid complexity while continuing to extract value from existing investments. Because the 10GbE standard allows organizations to continue using their existing platforms and networking tools, they can extend capital investments and IT staff training to the updated infrastructure. 10GbE bandwidth also allows the reduction of port count to help reduce cost, while a multi-vendor approach helps preserve choice in adopting new technologies as they become available.

Key Dell connectivity offerings include Dell PowerConnect™ switches, which provide Gigabit Ethernet (GbE) and 10GbE rack and blade switches that can deliver extreme price/performance targeted for edge network applications. Dell PowerConnect B-Series switches offer GbE and 10GbE rack and chassis switches for price-sensitive aggregation, core, and storage area network

# Four pillars: Building the Efficient Data Center

**Intelligent infrastructure:** Deploys servers, networking, and fabrics that are designed and purpose-built to help reduce acquisition and operating costs, with the goals of reducing the number and types of devices to manage, racking and cabling once, taking advantage of the 10GbE convergence, and maintaining the flexibility of a multi-vendor approach

**Simplified infrastructure management:** Leverages technologies that enable IT staff to consolidate tools and pool resources, helping them to increase the operating efficiency of both new and existing infrastructures and to dynamically redeploy assets as conditions change

**Streamlined application and workload management:** Includes tools that allow rapid delivery of strategic IT services with the goals of enabling application developers to easily create images and self-provision their workload deployments, automating approval and deployment processes, and providing self-service cataloged services and chargebacks

**Dell Intelligent Data Management:** Optimizes content storage throughout its life cycle by automatically placing it on the appropriate tier and storage type while optimizing storage for virtualized environments

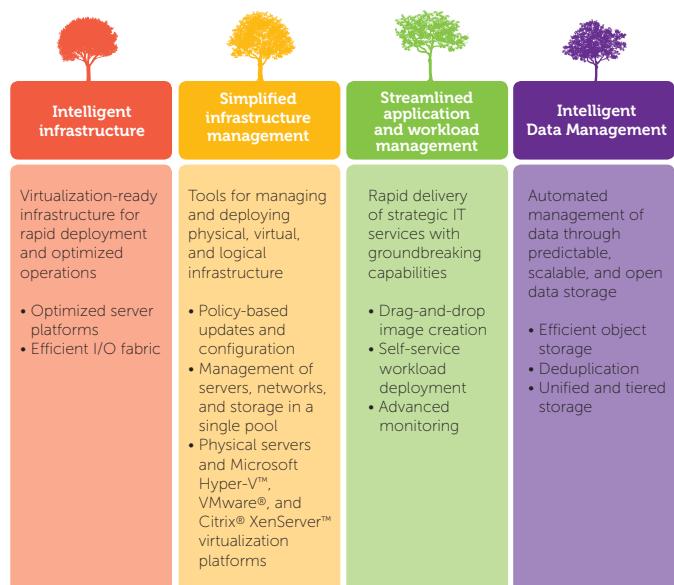


Figure 1. Four key pillars support the Dell model for building the Efficient Data Center

<sup>1</sup> For more information, see "Designing for Hyperscale Computing," by Steven Croce, Brandon Draeger, and Buck Avey, in *Dell Power Solutions*, 2010 Issue 2, [dell.com/downloads/global/power/ps2q10-20100360-cloud.pdf](http://dell.com/downloads/global/power/ps2q10-20100360-cloud.pdf).



(SAN) applications, while other upcoming Dell PowerConnect switches are expected to facilitate performance-oriented switching for wide area networking and networking security applications.

The Dell Lifecycle Controller, delivered as part of the Integrated Dell Remote Access Controller (iDRAC) Express in 11th-generation Dell PowerEdge servers, embeds systems management features directly in the server—helping avoid media-based delivery of systems management tools and utilities. This delivery model helps simplify provisioning, deployment, patching and updates, servicing, and user customization. It also helps to reduce the time required to accomplish common tasks, reduce the potential for error, enhance security, and contribute to increasingly efficient management.

#### Simplified infrastructure management

Managing servers, networks, and storage as a common pool enables these resources to be rapidly redeployed to help meet dynamically changing needs. Dell's Efficient Data Center approach consolidates, streamlines, and automates the management of data center resources to bring virtual-like functionality to physical servers, help eliminate unnecessary management consoles, and dynamically reprovision servers. Advanced Dell systems can help administrators to efficiently

operate heterogeneous data centers—enabling them to rack and cable once, and then redeploy when needed.

Instead of replacing heterogeneous technology infrastructures with single-vendor platforms, Dell focuses on providing comprehensive, streamlined support for the range of platforms already at work in enterprise data centers (see Figure 2). This approach—which accommodates dynamic management of mixed technology environments, including platforms from Microsoft, VMware, Citrix, IBM, Hewlett-Packard, and Sun, in addition to Dell hardware—helps to deliver dynamic workload flexibility, enable automated deployment, and support highly efficient operations management.

Dell offers a range of technologies designed to simplify systems management. Dell Advanced Infrastructure

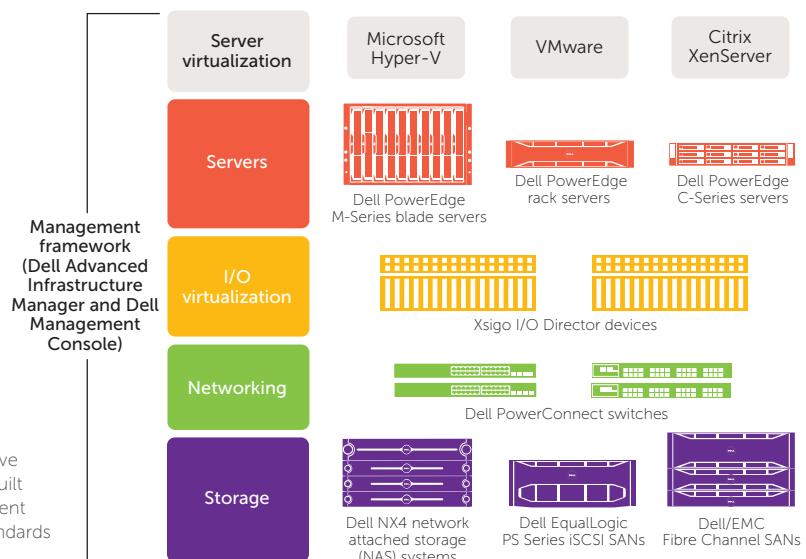
Manager software allows IT departments to manage networking, storage, and servers—both physical and virtual—as a single resource pool. This approach helps avoid resource silos, allowing organizations to allocate resources dynamically to meet changing workload demands. In addition, IT managers can seamlessly migrate workloads between physical and virtual environments to help organizations meet virtualization goals and extend the use of virtualization technology in the enterprise while also avoiding duplicate tools and processes.

Dell Management Console powered by Altiris™ from Symantec™ provides a single comprehensive view into an organization's IT infrastructure to help reduce the management complexity traditionally associated with data center infrastructure. IT managers can use this tool to monitor the

health of key systems or system subcomponents, and perform basic provisioning, discovery, inventory, power control, and alerting tasks.

#### Streamlined application and workload management

Advanced, application-aware workload and service monitoring as well as on-demand monitoring of underlying physical and virtual platforms can help dramatically reduce administrative burdens on IT staff—freeing them to focus on strategic projects that add value by advancing business goals and organizational objectives. In addition, by automating and standardizing the way IT resources are deployed, organizations can reduce the time and manual intervention required to allocate resources to applications. Tiered infrastructure offerings further help to create uniformity and facilitate cost containment and chargebacks.



**Figure 2.** A comprehensive framework of purpose-built hardware and management tools based on open standards avoids vendor lock-in

“Automatically deduplicating and storing content on the appropriate tier and storage type can help control data storage costs while providing almost limitless storage capacity scaling.”

In the Dell vision of the Efficient Data Center, enterprises can rapidly deliver strategic IT services with new capabilities. The Dell road map includes a range of application and workload management functionality—including drag-and-drop image creation, self-service workload deployment, and advanced monitoring capabilities.

#### Intelligent Data Management

By automating management of data through predictable, scalable, and open data storage, enterprises can move toward maximizing the value of their data. Automatically deduplicating and storing content on the appropriate tier and storage type can help control data storage costs while providing almost limitless storage capacity scaling.

Strategies for Intelligent Data Management can include the following:

- **Storage tiers:** Enterprises reduce storage costs by using tiered storage infrastructures—matching data value with storage platform cost. Intelligent tiering alone can cut storage costs by 50 percent.
- **Object storage:** Policy-based deduplication, archiving, and search of structured and unstructured data help reduce storage costs by automating time-consuming manual tasks.
- **Virtualization optimization:** Storage arrays that are optimized for virtual environments help reduce costs and complexity.
- **Open standards:** Leveraging Fibre Channel and Internet SCSI (iSCSI) over 10GbE helps reduce fabric complexity, streamline maintenance, and simplify cabling configurations.

Dell offers support for Intelligent Data Management through Dell EqualLogic™ PS Series iSCSI SAN arrays, which are optimized for virtualized environments. Dell PowerVault™ tape

drives offer simplified storage solutions for branch office or cost-sensitive applications. And Dell/EMC SAN arrays offer highly scalable, flexible networked storage aimed at Fibre Channel-based storage applications. Dell has also recently announced new object-based storage systems with the Dell DX Object Storage Platform, which uses a self-managing peer-scaling architecture to enable organizations to access, store, and distribute billions of files or other digital content, from archiving all the way to the cloud.

#### A broader focus: Reinvesting IT efficiency gains to competitive advantage

Efficiency has become a basic tenet of business survival, and the relentless drive to increase efficiency is leading to a widespread transformation of the IT infrastructure. While executives are searching for the best way to increase efficiency and, in turn, competitive advantage, the largest share of many technology budgets is still going to fixed expenses that maintain the status quo. Technologies like virtualization offer many benefits, but they also create complexity when the proposed solution is a collection of proprietary offerings that restrict organizations with vertically integrated, premium-priced toolkits.

The Dell Efficient Data Center model goes beyond the efficiency basics of standardization, simplification, and automation to unlock the business value of enterprise IT investments. By implementing the four key pillars of the Efficient Data Center—intelligent infrastructure, simplified infrastructure management, streamlined application and workload management, and Intelligent Data Management—organizations can create an open and affordable approach to infrastructure that increases flexibility, reduces costs, and shifts the focus to how IT can help meet strategic enterprise goals. 



#### Lessons learned

After Dell reengineered its own IT architecture and infrastructure, it went public with best practices the company learned along the way. Watch this in-depth exploration of how a global enterprise boosted its own IT efficiency and reinvested the savings into innovation.

[talktodell.com/go/transition-it/webcasts](http://talktodell.com/go/transition-it/webcasts)



**The Efficient Enterprise:**  
[dell.com/efficiententerprise](http://dell.com/efficiententerprise)



**The Efficient Data Center:**  
[dell.com/efficientdatacenter](http://dell.com/efficientdatacenter)



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**Bill Goins** focuses on large enterprise differentiation and sales enablement. He joined Dell through its acquisition of MessageOne, where he was vice president of product marketing.



# Designing for hyperscale computing

By Steven Croce, Brandon Draeger, and Buck Avey

Created for hyperscale environments such as private and public clouds, Web 2.0 and online gaming infrastructures, and high-performance computing, Dell™ PowerEdge™ C-Series servers provide outstanding performance in a dense, streamlined, eco-efficient design.

**F**or many organizations building hyperscale IT infrastructures, their data centers are their factories in Web 2.0, online gaming, search engine, and high-performance computing (HPC) environments. Running hundreds or thousands of servers, these organizations need to maximize data center efficiency at every turn. With each infrastructure decision, these organizations are keenly aware of the implications for their bottom line.

To help maximize efficiency and reduce the cost of these hyperscale environments, organizations often require something different than traditional general-purpose servers. They need streamlined systems without the extensive management tools, enterprise storage options, or same-day support contracts typically included with standard servers. At the same time, they need high-performance hardware with a dense, energy-efficient design that can help them save on power, cooling, and space. Dell PowerEdge C-Series servers can address these requirements—helping to decrease total cost of ownership with a dense, streamlined design that was purpose-built for scale-out environments.

## Understanding hyperscale computing requirements

Hyperscale environments have hardware requirements that are distinct from traditional data centers. Because these environments have focused uses, organizations do not want to pay for capabilities they do not need. For example, because high availability in hyperscale environments is typically achieved primarily through software, organizations do not need many of the redundant hardware components or availability tools included with other servers. In addition, these organizations do not typically use same-day parts replacement services; instead, they typically have on-site parts kiosks they can use to service multiple systems during regularly scheduled maintenance windows.

At the same time, organizations with hyperscale environments want to accelerate access to the latest technology. They do not want to wait for software components to be updated or hardware components to be validated to gain access to the latest processing architecture. Because the environment has a single focused use, they do not need broad support for a range of operating systems or support for legacy software.



## Fast access to high performance

In designing the Dell PowerEdge C-Series, Dell has built on the knowledge gained by producing custom servers for large organizations running hyperscale environments. For example, the PowerEdge C6100 shares several attributes with a customized server that the Dell Data Center Solutions (DCS) team created for R Systems, a high-performance computing (HPC) resource provider.

When a new customer requested a particular large-scale HPC cluster for a rapidly approaching product launch, R Systems needed to find a way to accommodate both the new customer and the company already using that cluster. The R Systems team decided to upgrade a second cluster and migrate the existing customer to that upgraded cluster. R Systems needed dense, energy-efficient servers equipped with the latest Intel® architecture, but without the redundant hardware components and software features supplied with existing PowerEdge models.

Dell PowerEdge C6100: 2U design housing four two-socket server nodes with shared infrastructure



“The Dell DCS group was able to produce the servers more quickly without having to integrate some of the typical software components. By eliminating redundant power supplies and other components that are unnecessary in our particular deployment model, Dell DCS created a server with an extremely compact form factor.”

—Brian Kucic

Vice president of business development at R Systems  
October 2009

R Systems worked with the Dell DCS team to design and produce a streamlined server that would deliver the required performance, energy efficiency, and density. The servers feature four nodes in a 2U rack space—a shared infrastructure design that was subsequently adopted for the PowerEdge C6100 server. Each node includes two processors from the Intel Xeon® processor 5500 series.

Because R Systems did not need many of the software components included with general-purpose servers, Dell was able to produce compact servers quickly, without requiring R Systems to wait for software validation on the Intel processors. R Systems was able to accommodate both customers by the launch deadline. The upgraded cluster provided the existing customer with a 200 percent aggregate performance increase using half as many nodes as the other cluster, and the dense, energy-efficient servers helped R Systems control operational costs while conserving data center space for continued expansion.



## Up close with the PowerEdge C-Series

In this video walk-through, Dell solutions architect Rafael Zamora gives an up-close look at the first three systems in the PowerEdge C-Series line.

[youtube.com/watch?v=EcIXX7vj-8s](http://youtube.com/watch?v=EcIXX7vj-8s)

	PowerEdge C1100	PowerEdge C2100	PowerEdge C6100
<b>Form factor</b>	1U	2U	2U
<b>Sockets</b>	Two	Two	Two per node
<b>Memory</b>	Up to 18 Double Data Rate 3 (DDR3) modules	Up to 18 DDR3 modules	Up to 12 DDR3 modules per node
<b>Hard drives</b>	Up to four 3.5-inch or ten 2.5-inch disks	Up to twelve 3.5-inch disks plus two internal SSDs (with support for up to twenty-four 2.5-inch disks expected in the near future)	Up to twelve 3.5-inch or twenty-four 2.5-inch disks
<b>PCIe 2.0 expansion slots</b>	Three (one x16 slot and two custom daughtercard slots providing SAS and 10 Gigabit Ethernet support)	Four (two x8 slots and two daughtercard slots providing SAS and 10 Gigabit Ethernet support)	Two per node (one x16 slot and one x8 mezzanine slot providing internal SAS, internal RAID, 10 Gigabit Ethernet, and InfiniBand support)

Figure 1. Key features of Dell PowerEdge C-Series servers

These organizations also want to maximize hardware density: IT professionals who are building hyperscale environments are thinking large, but they do not have endless supplies of power, cooling, or space. They need to maximize the number of nodes within the limitations of the physical infrastructure. (For examples, see the "Fast access to high performance" and "Greener cloud computing" sidebars in this article.)

### Introducing Dell PowerEdge C-Series servers

Dell PowerEdge C-Series servers were created as the result of experience gained by the Dell Data Center Solutions (DCS) team. DCS works with large organizations that need customized servers and support for their hyperscale environments. Through these engagements, DCS has learned firsthand what types of features and characteristics enterprises find essential—and which are unnecessary—in a hyperscale infrastructure. PowerEdge C-Series servers help organizations address the requirements of hyperscale environments without customized designs.

PowerEdge C-Series servers offer a streamlined approach for targeted hyperscale environments. For these servers, Dell has removed the redundant hardware, broad OS support, and same-day parts replacement that these organizations do not need, helping provide the requisite performance levels in dense, energy-efficient configurations.

These servers also allow organizations to gain fast access to emerging technology, instead of waiting for customized solutions or traditional general-purpose servers (with their additional features and extensive OS support). IT groups can deploy focused hardware, capitalize on robust Dell services and support, and even select targeted solutions that help further simplify deployment.

The PowerEdge C-Series comprises three models: the PowerEdge C1100, the PowerEdge C2100, and the PowerEdge C6100. Each can be equipped with processors from the Intel Xeon processor 5500 series or Intel Xeon processor 5600 series; a variety of hard drive types, speeds, and capacities, including Serial Attached SCSI (SAS) drives, Serial ATA (SATA)



## Greener cloud computing

By working with software-as-a-service (SaaS) providers worldwide, Dell has had firsthand experience providing these businesses with compact, energy-efficient servers that facilitate simplified management. When Swedish SaaS provider NAB Solutions needed to refresh its cloud environment, its administrators decided to implement a virtualized infrastructure. For this midsize business, it was imperative to use a hardware platform that could conserve data center space for future growth, minimize administrative complexity, and reduce the costs and environmental impact of IT.

NAB Solutions switched to a Dell hardware platform and adopted Dell PowerEdge blade servers for the cloud environment. Each blade includes four multi-core AMD Opteron™ processors and supports the large memory capacity needed for running multiple virtualized servers on each physical host.

“Our new Dell environment has cut power consumption by half. Increasingly, companies will only work with suppliers who can prove they are truly committed to sustainability. Besides the cost savings, green IT is important in helping drive new business.”

—Jörg Wiesemann

Project manager and infrastructure specialist  
at NAB Solutions  
June 2009

By creating a virtualized environment with a dense hardware platform, NAB Solutions was able to reduce the size of its cloud infrastructure by nearly 87 percent, leaving data center space for future growth. The virtualized environment has also helped simplify key administrative tasks, such as provisioning new servers or moving applications from one physical server to another during maintenance. By using a reduced number of highly energy-efficient servers, NAB Solutions has lowered its power consumption and created an environmentally friendly IT environment.

drives, and solid-state drives (SSDs); and flexible PCI Express (PCIe) 2.0 I/O options (see Figure 1). A standard baseboard management controller with Intelligent Platform Management Interface (IPMI) 2.0 support helps simplify and streamline ongoing systems management.

Each model is suited for different types of environments. The PowerEdge C1100 is designed to deliver outstanding performance and a large memory footprint in a 1U form factor, and can be especially useful for applications that cache massive quantities of data in memory, including search engine, Web analytics, and Web 2.0 applications. The PowerEdge C2100 builds on the PowerEdge

C1100 with a 2U design that supports increased storage capacity, and is geared toward search engine, Web analytics, distributed database, and private or public cloud computing environments.

For maximum density, the PowerEdge C6100 offers a shared infrastructure design with four independent server nodes in a 2U form factor. Optimized for focused environments with hyperscale application workloads, the PowerEdge C6100 provides exceptional compute performance, a large memory capacity, and an eco-friendly shared chassis that helps to reduce the overall weight, power, and cooling requirements for the four nodes. This model is designed to provide twice the density



## Explore cloud computing with Dell IT Consulting services

The Dell IT Consulting team can work with organizations that are considering a move to cloud computing, helping them to understand the potential advantages of building a cloud infrastructure and establishing a road map for change.

- **Cloud Workshop:** In a one-to-one format, IT Consulting introduces organizations to private clouds, public clouds, hybrid models, and related concepts such as software as a service (SaaS), explaining the advantages of adopting a cloud approach.
- **Cloud Assessment:** IT Consulting examines current applications and workloads, reviews the current state of the infrastructure, and provides an assessment for cloud computing approaches. The consultants then produce a road map with customized recommendations and strategies that include integrated cloud hardware and software.
- **Cloud Design and Implementation:** IT Consulting streamlines the path to cloud computing and helps reduce costs by recommending, procuring, and deploying a suitable combination of technologies for a tailored cloud implementation.



### Compelling clouds

Performance and reliability are essential for the successful delivery of cloud computing services. In this case study, read how Swedish company City Network Hosting deployed virtualized Dell PowerEdge blade servers and Dell EqualLogic storage to create an efficient, reliable, scalable platform for its new cloud offering.

[dell.com/downloads/global/casestudies/2010-city-network-10008302.pdf](http://dell.com/downloads/global/casestudies/2010-city-network-10008302.pdf)

of traditional 1U servers and is well suited for many hyperscale environments, including HPC clusters. In addition, the PowerEdge C6100 helps simplify service: unlike some comparable shared infrastructure servers from other vendors, all nodes in the PowerEdge C6100 are hot-serviceable, enabling administrators to power down any one node without affecting the availability of the other nodes in the system.

### Tailoring support with Dell Services

Organizations can capitalize on services developed specifically for PowerEdge C-Series servers as well as many of the same support options available for standard PowerEdge servers. For example, the Dell Configuration and Deployment Rack Integration Services

program was designed for organizations using PowerEdge C-Series servers, and helps accelerate deployment of hyperscale infrastructures by racking, stacking, and cabling servers before shipping them. Organizations receive fully assembled racks that are ready to be powered up. This service also provides rack configuration documents with configuration details that help significantly reduce implementation time.

Organizations can also select from a wide range of Dell Support Services options to help standardize the maintenance of their Dell infrastructures. The Basic Support option provides entry-level hardware support and includes call-in assistance during business hours only. Dell ProSupport for IT is available for 24/7 professional-level hardware and software support

that includes the ability to fast-track dispatch parts and labor, bypassing basic troubleshooting.

Enterprise-Wide Contract is an enterprise-level support service that provides a designated services delivery manager who facilitates proactive planning and reporting to help organizations maximize the uptime and performance of their Dell infrastructures. Organizations can also select self-maintenance options geared toward large-scale enterprises, including on-site parts kiosks for immediate access to replacement parts, periodic on-site maintenance service, and the Dell Online Self Dispatch program. As part of the Online Self Dispatch program, IT administrators can earn a certification to order warranty replacement parts directly from Dell. Dell IT Consulting also offers a comprehensive set of services

to help organizations understand and implement cloud computing in their own environments (see the "Explore cloud computing with Dell IT Consulting services" sidebar in this article).

## Accelerating deployment with Dell Cloud Computing Solutions

The upcoming Dell Cloud Solution for Web Applications is expected to be the first turnkey cloud offering that combines software with an optimized architecture powered by Dell PowerEdge servers and a broad range of support services. This solution is designed for organizations deploying Web applications on a private, on-premise cloud as well as telecommunications and hosting organizations looking to build infrastructures for a public cloud. When available, it is expected to deliver the following:

- **Enhanced volatile Web traffic management:**

Load balancing and processor-bursting capabilities allow applications to scale as user demand fluctuates, helping maintain rapid response times.

- **Purpose-built support for Web applications:**

Built-in support for applications written in Java, PHP, Python, Ruby on Rails, and other programming languages helps rapidly deliver virtualized instances that are ready to run Web applications such as Apache HTTP Server or Apache Tomcat.

- **Support for lab to hyperscale deployments:**

Organizations can deploy simple lab clouds for developer workgroups as well as hyperscale production clouds that can scale to hundreds or thousands of virtualized compute instances.

- **Self-service portal:** End users can use a self-service portal to help simplify the process of acquiring compute resources to begin new projects or launch new applications. The portal provides access to compute resources and helps IT departments respond to the needs of the organization as a whole.

- **Physical infrastructure:** Supported hardware platforms include PowerEdge C2100 servers or PowerEdge R710 servers plus Dell PowerConnect™ switches and Dell PowerVault™ storage.

- **Services:** Dell IT Consulting, Configuration and Deployment, and Support Services options have been developed to help organizations plan, implement, and maintain the Dell Cloud Solution for Web Applications.

By combining Joyent cloud software with Dell hardware and services plus an optimal blueprint for creating a private cloud, this solution helps organizations get started rapidly and operate the infrastructure efficiently with highly responsive, on-demand scaling.

## Reducing total cost of ownership

Used as a building block for hyperscale server environments, Dell PowerEdge C-Series servers help organizations reduce their total cost of ownership. These servers avoid hardware, software, and support components that are unnecessary in hyperscale deployments, providing a dense, energy-efficient design that packs a tremendous amount of processing performance and memory capacity while helping to reduce power, cooling, and space requirements along with their associated costs. The cloud infrastructure itself is designed to keep costs down by maximizing the utilization of hardware resources. A wide range of service options help organizations simplify deployment and ongoing maintenance so that they can begin to realize the benefits of cloud computing quickly and easily. 



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**Buck Avey** is the services product planning manager for Dell PowerEdge C-Series servers and the Dell Cloud Solution for Web Applications.

## Learn more



**Dell PowerEdge C-Series servers:**  
[dell.com/poweredgec](http://dell.com/poweredgec)



**Dell cloud computing:**  
[dell.com/cloud](http://dell.com/cloud)



# Advancing scalability and performance with four-socket Dell PowerEdge servers

By Armando Acosta and Robert Bradfield

Four-socket Dell™ PowerEdge™ R810 and PowerEdge R910 rack servers and PowerEdge M910 blade servers offer highly scalable processing power and memory capacity to help cost-effectively boost performance and expand virtualized environments, while other features help increase reliability and simplify administration.

Enterprises running large-scale databases or virtualized environments need servers that let them scale processing power and memory capacity flexibly and cost-effectively. Because servers in these types of environments run everything from enterprise productivity tools to mission-critical business applications, they must provide outstanding reliability. And to help optimize worker productivity and enhance business agility, servers must also be quick to deploy, simple to manage, and easy to maintain. The Dell PowerEdge R810 and PowerEdge R910 rack servers and PowerEdge M910 blade servers are designed to meet these requirements, combining scalable processing performance and tremendous memory capacity with a dense server design, reliability features, and streamlined management.

## Achieving scalable compute performance

Dell PowerEdge R810 and PowerEdge R910 rack servers and PowerEdge M910 blade servers are designed to provide exceptional scalability within each server, helping organizations to quickly and cost-effectively expand database environments or add virtual machines to each physical host. In the past, scaling processor performance frequently meant adding servers. With the PowerEdge R810 rack server and PowerEdge M910 blade server, however, organizations can begin with a two-socket configuration and then scale to four sockets when they need to increase application performance or extend a virtualized environment (see Figure 1). Organizations can therefore double the processing performance within a server without needing to provide



## Maximum performance

Forrest Norrod, vice president of the Dell Server Group, answers questions on the latest Intel Xeon processor-based Dell servers and how they can help IT organizations increase performance, reliability, and efficiency for mission-critical applications.

[youtube.com/watch?v=Y7OCYT9WSms](http://youtube.com/watch?v=Y7OCYT9WSms)

	Dell PowerEdge R810 rack server	Dell PowerEdge M910 blade server	Dell PowerEdge R910 rack server
<b>Sockets</b>	Two or four	Two or four	Four
<b>Form factor</b>	2U rack server	Full-height blade server	4U rack server
<b>Processors</b>	Intel Xeon processor 7500 or 6500 series	Intel Xeon processor 7500 or 6500 series	Intel Xeon processor 7500 series
<b>Memory slots</b>	32	32	64
<b>Maximum memory capacity</b>	512 GB	512 GB	1 TB
<b>PCI Express (PCIe) slots</b>	6 PCIe slots	Up to 4 mezzanine card slots	Up to 10 PCIe slots

Figure 1. Four-socket Dell PowerEdge rack and blade server configurations

the extra power, cooling, or data center space associated with additional servers.

Each of the four sockets in these PowerEdge servers can be filled with powerful multi-core Intel® Xeon® processors that offer significant performance enhancements compared with previous-generation PowerEdge servers. The PowerEdge R810 rack server and PowerEdge M910 blade server can be equipped with the Intel Xeon processor 7500 or Intel Xeon processor 6500 series; the

PowerEdge R910 rack server can be equipped with the Intel Xeon processor 7500 series. Using this generation of Intel Xeon processors, the PowerEdge R910 rack server has achieved up to 219 percent higher performance compared with the previous-generation PowerEdge R900 rack server, and the PowerEdge M910 blade server has achieved up to 76 percent higher performance compared with the PowerEdge M710 blade server in a four-socket configuration.<sup>1</sup>

By using the latest multi-core Intel Xeon processors, these servers can dramatically increase the number of processor cores per rack compared with previous-generation PowerEdge servers. In its four-socket configuration, the PowerEdge R810 server can be equipped with 32 processor cores in a single 2U enclosure—up from a maximum of 12 cores in previous-generation 2U PowerEdge servers. Both the PowerEdge R910 4U rack server and the

<sup>1</sup>Based on SPECjbb2005 performance testing by Dell Labs in March 2010; actual performance will vary based on configuration, usage, and manufacturing variability. For the latest SPECjbb2005 benchmark results, visit [spec.org](http://spec.org).



# 219%

The Dell PowerEdge R910 rack server has achieved up to 219 percent higher performance than the PowerEdge R900.

# 76%

The Dell PowerEdge M910 blade server has achieved up to 76 percent higher performance than the PowerEdge M710.

# 1/3

The Dell PowerEdge M910 blade server provides double the memory capacity of previous-generation 4U Dell servers in one-third the space.

PowerEdge M910 full-height blade server also support up to 32 cores per server, compared with a maximum of 24 cores in the PowerEdge R900 rack server and 12 cores in the PowerEdge M710 blade server. In addition, the thread-level parallelism provided by Intel Hyper-Threading Technology enables highly efficient use of these processing cores—providing a substantial performance boost for multi-threaded software compared with the same number of cores without this technology.

Packing additional cores into each server enables organizations to support large databases and large-scale virtualized infrastructures while helping to keep power, cooling, and space requirements under control. For example, the PowerEdge M910 server enables the deployment of up to eight four-socket blade servers in just 10U of rack space. Compared with previous-generation 4U Dell servers, the PowerEdge M910 server is designed to

provide double the memory capacity in one-third the space.

The powerful processing capabilities and compact designs of these servers contributes to exceptional price/performance ratios. At the same time, supporting additional processors in a reduced amount of space helps organizations minimize power consumption. In four-socket configurations, these PowerEdge servers also deliver outstanding performance per watt compared with previous-generation PowerEdge servers.

### Breaking the server memory capacity barrier

Many organizations running large enterprise applications and virtualized environments find that server memory capacity is a primary limitation for scaling. These four-socket Dell PowerEdge servers accommodate significantly greater memory capacity than previous-generation PowerEdge servers, enabling organizations to break through those limitations. The PowerEdge R810 and

PowerEdge M910 servers both offer 32 memory slots for up to 512 GB of memory in each server; for the PowerEdge M910 server, that is more than twice the maximum memory capacity of previous PowerEdge blade servers. The PowerEdge R910 server provides 64 memory slots for up to 1 TB of memory.

These large memory capacities enable organizations to increase the number of virtual machines per server or enhance the performance of memory-bound database applications. They can also capitalize on the large number of memory slots to help reduce costs: populating these slots with smaller, less-expensive memory modules enables organizations to provision sufficient memory without incurring the cost of larger-capacity modules.

In addition, Dell FlexMem Bridge technology allows organizations to take advantage of large memory capacities without having to scale the number of processors. This innovative, patent-pending

technology in PowerEdge R810 and PowerEdge M910 servers enables organizations to access the capacity of all 32 memory slots while using only two of the four available processor sockets. While other servers typically require populating all four sockets to gain access to this type of large-scale memory capacity, Dell FlexMem Bridge technology enables organizations to achieve a suitable mix of memory and processing performance for their particular environments without incurring the expense of purchasing and running large servers. And because virtualization software licensing costs are often calculated per socket, this technology can help organizations avoid the fees associated with those extra processors—enabling them to increase virtual machine density while controlling licensing costs.

### Boosting reliability and simplifying management

These four-socket Dell PowerEdge servers also incorporate a range of features designed to enhance reliability for mission-critical workloads. For example, they include dual internal Secure Digital (SD) modules for embedded hypervisor redundancy. The embedded hypervisors can accelerate virtualization deployment, and including two modules enables failover to help minimize downtime even if there is a hardware problem with one SD module.

Using advanced reliability, availability, and serviceability

(RAS) technology features, processors from the Intel Xeon processor 7500 and Intel Xeon processor 6500 series are designed to automatically monitor, report, and recover from hardware errors to maintain data integrity and keep mission-critical applications online. In addition, the physical design and production of these servers help ensure reliability and increase uptime. PowerEdge M910 blade servers, for example, capitalize on the multiple power, cooling, and networking infrastructure redundancies provided by the PowerEdge M1000e modular blade enclosure to help avoid unplanned outages.

Simplifying server management is also critical to enhancing IT efficiency. These PowerEdge servers incorporate key management capabilities introduced in 11th-generation PowerEdge servers to help reduce the time and effort required for a range of administrative tasks. The Dell Lifecycle Controller in each of these servers is an integrated chip that helps simplify tasks by enabling administrators to access a comprehensive set of management functions—including driver installation, firmware updates, hardware configuration, and diagnostics—in a pre-OS environment. Using a single intuitive interface called the Unified Server Configurator, administrators can get to work as soon as the server is powered up, without needing additional media or even requiring an OS to be installed—helping

speed up server deployment, save time on maintenance, and minimize downtime.

### Enhancing resiliency and performance

Dell PowerEdge R810 and PowerEdge R910 rack servers and PowerEdge M910 blade servers are designed to increase the performance of large database-intensive applications and scale virtualized server environments rapidly and cost-effectively. From the integration of Dell FlexMem Bridge technology to the inclusion of dual SD modules for embedded hypervisor redundancy, many of the advances included in these PowerEdge servers resulted from discussions with IT professionals who sought ways to enhance scalability, increase reliability, and simplify management while controlling costs. These PowerEdge servers are designed to boost the performance of core business applications, expand database environments, and ultimately increase the overall efficiency of the enterprise. 



**Armando Acosta** is a senior product line consultant at Dell and has more than 12 years of experience in the IT industry.

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### Learn more



**Dell PowerEdge servers:**  
[dell.com/poweredge](http://dell.com/poweredge)



### PowerEdge R810

Armando Acosta gives a peek inside Dell FlexMem Bridge and other key features of the PowerEdge R810 rack server.

[youtube.com/watch?v=KoMixtDvK68](http://youtube.com/watch?v=KoMixtDvK68)



### PowerEdge M910

Robert Bradfield provides a rundown of the design features of the PowerEdge M910 blade server, including the network fabrics and dual internal SD modules.

[youtube.com/watch?v=iUnc1o0xLXE](http://youtube.com/watch?v=iUnc1o0xLXE)



### PowerEdge R910

A Dell team discusses the architecture of the PowerEdge R910 rack server and the advantages it offers—including manageability, ease of access, and efficient power and cooling.

[youtube.com/watch?v=ouIHU7hGRDM](http://youtube.com/watch?v=ouIHU7hGRDM)



# Introducing the Dell PowerEdge R815: **High performance in a compact design**

Maximizing performance while making efficient use of available power and space can be critical in data center environments. The Dell™ PowerEdge™ R815 rack server with the AMD Opteron™ 6000 Series platform delivers four-processor performance in a compact, cost-effective 2U design.

**E**nterprise IT departments are constantly looking for ways to increase performance, memory capacity, and I/O bandwidth while extracting maximum value from the available space. For these environments, the powerful Dell PowerEdge R815 rack server offers an innovative combination of high performance, compact size, and cost-effective value. Enabled by the high core count and substantial memory capacity of the AMD Opteron 6000 Series platform, the PowerEdge R815 is a powerful x86-based four-processor server in a 2U form factor—helping organizations to achieve high levels of processing density, flexibility, and energy efficiency at a price typically associated with two-processor servers.

## Increased density and flexibility

Traditionally, x86-based four-processor rack servers have been available primarily in a 4U

form factor, meaning that organizations that needed these levels of processing and memory resources could fit no more than 10 such servers in a typical 42U rack. Thanks in part to the ample core count and memory footprint of the AMD Opteron 6000 Series platform, however, the PowerEdge R815 can deliver four-processor performance in a 2U design—allowing organizations to install up to 21 of these servers in a 42U rack, and enabling them to implement the capacity of a four-processor system while more than doubling their rack density. When taking into account the costs of data center space, the savings from consolidating servers onto a reduced number of racks can be considerable.

In terms of compute density, a rack holding 10 four-processor, 4U servers with 6 cores per processor would contain just 240 total cores. Because each four-processor server based on the AMD Opteron 6000 Series platform can include

“Like other 11th-generation PowerEdge servers, the PowerEdge R815 is designed for long-term value.”



The Dell PowerEdge R815 with the AMD Opteron 6000 Series platform packs four-processor performance into a 2U rack server design

up to 48 cores, a 42U rack holding 21 PowerEdge R815 servers could contain up to 1,008 total cores—a 320 percent increase over legacy 4U servers. This compute density even rivals that of blade servers, enabling organizations to choose among highly flexible deployment options to help meet their specific needs.

The flexibility of the PowerEdge R815 also extends to virtualized environments. PowerEdge servers and the AMD Opteron 6000 Series platform both support a wide range of hypervisors, including Microsoft®, VMware®, and Citrix® platforms. As a result,

organizations using the PowerEdge R815 as a virtualized host server can select the appropriate hypervisor for their specific needs.

#### Enhanced energy efficiency

In addition to rack and floor space, the PowerEdge R815 is designed to conserve power as well. First, the AMD-P suite of power management technologies built into AMD Opteron processors enables the AMD Opteron 6000 Series platform to deliver 12-core performance within the same general power and thermal envelopes as previous-generation 6-core

processors. And second, because the PowerEdge R815 is a 2U server, it contains just two power supplies instead of the four that are typical of some 4U four-processor servers, helping reduce power draw.

The PowerEdge R815 also incorporates key Dell Energy Smart technologies to enhance efficiency. The careful positioning of system components and internal shrouding, along with programmable voltage regulators, efficient fan designs, and system thermal management, is designed to provide the right level of cooling to help reduce energy use.



#### Highlighting the PowerEdge R815

In this video, Dell senior product line consultant Armando Acosta outlines some of the key features of the PowerEdge R815 rack server and the advantages it can provide in enterprise IT environments.

[youtube.com/watch?v=qO188iZTu2g](http://youtube.com/watch?v=qO188iZTu2g)



# 1,008

A 42U rack filled with Dell PowerEdge R815 servers can house up to 1,008 total processor cores—a 320 percent increase in compute density over legacy 4U servers.

Sensors also help decrease power consumption by automatically tracking and regulating internal thermal activity. And Energy Smart management features such as power capping, power scheduling, and device disablement further help PowerEdge R815 servers to limit energy use.

#### Intelligent management capabilities

Like other 11th-generation PowerEdge servers, the PowerEdge R815 incorporates a variety of sophisticated management features designed to simplify administration and reduce operating costs, including the following:

- **Lifecycle Controller:** The Lifecycle Controller is an embedded chip installed directly on the motherboard that makes common provisioning functions such as deployment, configuration, and updating available to administrators without requiring media such as a CD or DVD. By enabling administrators to perform these tasks without the hassle of tracking and using separate media, this chip helps to streamline server configuration and reduce downtime.
- **Interactive LCD screen:** Positioned on the front of each server, this miniature monitor enables technicians to see error messages, execute selected boot options, view power consumption information, and more.
- **Dell Management Console:** A standard feature on Dell servers, Dell Management

Console powered by Altiris™ from Symantec™ offers IT staff a consolidated view of their infrastructures, including deployment, inventory, monitoring, and updates.

Also like other 11th-generation PowerEdge servers, the PowerEdge R815 is designed for long-term value. Dell incorporates durable materials, emphasizes component redundancy and ease of servicing, and performs rigorous testing and validation to help minimize downtime and ensure reliability.

#### High-performance, highly efficient rack server

Balancing performance against power, space, and cost requirements can be a challenge for enterprise IT departments. Designed to support highly threaded workloads such as virtualization and high-performance computing, the PowerEdge R815 server with the AMD Opteron 6000 Series platform provides a highly efficient way for organizations to gain the performance advantages of a four-processor server while still maintaining the space and cost efficiencies of a 2U design. 

#### Learn more



**Dell PowerEdge servers with AMD Opteron processors:**  
[dell.com/poweredge/amd](http://dell.com/poweredge/amd)

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# How deduplication helps reduce the cost of backup and **disaster recovery**

By Kay Benaroch and Shane Jackson

Dell and EMC have teamed up to deliver efficient disk-based backup and recovery with integrated deduplication technology designed to make disk-based backups as cost-effective as tape-based backups.

## Deduplication pays off



Dell/EMC DD Series appliances incorporate deduplication and other key technologies to help meet storage and backup challenges.

- **Up to 99 percent** bandwidth reduction for replication
- **90–97 percent** data reduction for backups
- **Leading defense** against data integrity issues with the Data Domain Data Invulnerability Architecture

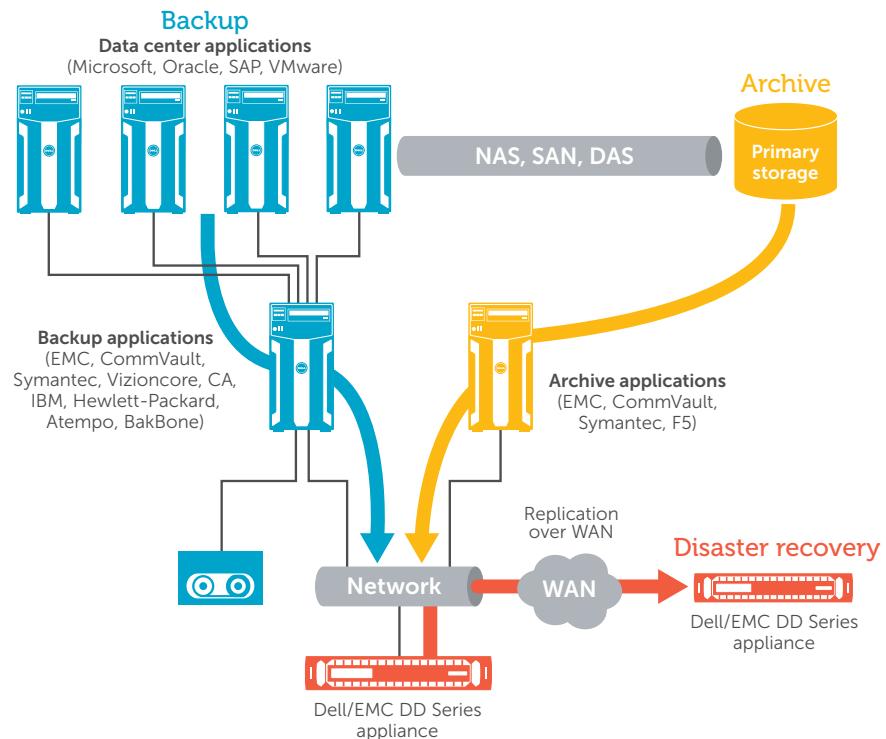
**T**oday's explosive data growth is prompting many organizations to look for ways to increase the efficiency of their storage, backup, and disaster recovery processes. The growth of data is straining capacity, but at the same time, cost and complexity frustrate many IT managers seeking to make improvements. For example, tape-based approaches that worked well when originally implemented can prove to be slow, expensive, and unreliable as the organization grows and as tapes must be physically transported from remote sites to a central storage location. Disk-based backup is inherently faster and more reliable than tape, but has traditionally been more costly, and large disk arrays can be difficult to manage.

Dell and EMC are addressing these challenges by leveraging the data reduction and cost-saving advantages of deduplication storage systems from Data Domain, which was purchased by EMC in 2009. Rather than adding deduplication to an existing storage platform, Dell and EMC have introduced the Dell/EMC DD Series—purpose-built appliances that incorporate disk-based storage and deduplication. These appliances are designed to tame data growth as effectively as possible, helping organizations to reduce complexity and costs.

### Overcoming challenges to effective data protection

Cost pressures can keep many organizations from making needed storage and backup improvements to cover the variety of operating systems, applications, and geographic locations that produce critical

Figure 1. Dell/EMC DD Series infrastructure and ecosystem



information. IT managers may be forced to deploy systems piecemeal, requiring additional management by IT departments that are already stretched, or they may have resources for headquarters or central sites but lack the budget to create a comprehensive plan that encompasses all types of servers and applications at local and remote sites.

Organizations may also be exposed to risk by doing without essential protection such as off-site disaster recovery. Off-site processes for disaster recovery have historically induced latency, prompting many organizations to simply create local copies to speed local recovery—an approach that exposes the organization to data loss in the event of accidental deletion or site disasters. In addition, the cost of bandwidth to replicate the growing volume of critical information over a wide area network (WAN) is often prohibitive, especially for remote or branch offices.

Complexity in the backup environment is another factor that can delay storage and

backup improvements. Many organizations have multiple backup software instances or heterogeneous environments. This complexity can increase operational and procedural errors, leading to unprotected, corrupted, or lost backup data. As a result, IT managers may not be able to meet business needs for data restoration and recovery.

To address these challenges without requiring a costly redesign of backup procedures, IT managers are exploring ways to remove duplicate data from the backup process, reducing data volume to the point that they can use fewer hard drives than they had been. Finding an approach that works with a flexible range of backup and archive software is also desirable. Dell and EMC are working collaboratively to create storage and backup systems that include integrated deduplication functionality.

### Examining technical requirements

Building a storage system that delivers the full potential of deduplication requires a flexible approach that addresses variable-length

duplicates, multiple formats and protocols, and other technical considerations.

**Variable-length duplicates.** Conventional storage systems, whether network attached storage (NAS) or storage area networks (SANs), store data in fixed-size blocks. Some deduplication systems simply look for identical fixed-size data blocks, an approach that is inadequate for maximizing deduplication results; to be effective, a system must be able to identify variable-length segments as well. This capability is necessary to maximize the amount of redundant data that can be found in incoming data blocks, regardless of small changes in those blocks compared with previous backups.

**Format parsing.** Data comes in many formats generated by many different applications, and the same duplicate data is often embedded in those different formats. The sheer number of these formats and the speed at which they change make it impractical for a storage vendor to support them all. Parsing the formats requires substantial overhead. A



## Enhancing logical capacity

Comparing physical capacity to logical capacity illustrates the value of integrated deduplication in Dell/EMC DD Series appliances. The physical capacity is the amount of raw storage provided by the disks in a particular system. Some of this storage is consumed by appliance operations such as RAID and spares; subtracting this amount from the physical capacity yields the usable capacity, to which the expected deduplication ratio is then applied. Multiplying usable capacity by the deduplication ratio yields the expected logical capacity—the amount of backup data an administrator can keep on the system after deduplication, depending on change rate, retention policies, and other factors.

For example, 1.5 TB of physical capacity in the Dell/EMC DD140 appliance ultimately provides up to 17.0 TB of logical capacity with a typical 20:1 deduplication ratio (see Figure A). That increase can help deliver substantial additional terabytes of logical backup capacity to the organization, allowing administrators to increase the scope of information backed up for replication and disaster recovery purposes.

	Physical capacity	Logical capacity	Maximum throughput
Dell/EMC DD140	1.5 TB	Up to 17.0 TB	Up to 450 GB/hour
Dell/EMC DD610	Up to 6.0 TB	Up to 75.0 TB	Up to 675 GB/hour
Dell/EMC DD630	Up to 12.0 TB	Up to 165.0 TB	Up to 1.1 TB/hour

Figure A. Capacities and throughputs for Dell/EMC DD Series appliances



### Calculating the benefits

Based on a few simple questions, the Data Domain Deduplication Calculator can help organizations evaluate how deduplication could help reduce storage and bandwidth requirements in their specific environments.

[dedupcalculator.com](http://dedupcalculator.com)

storage-based deduplication engine should be data agnostic, and find and remove duplicates in data no matter how it is packaged or stored in the system.

**Multiple protocols.** Many standard access protocols are used in storage systems today, from Common Internet File System (CIFS) and Network File System (NFS) to block-based and virtual tape library (VTL) access methods. For example, user directories may be in NFS, the Microsoft® Exchange server may need to run in data blocks, and backups may require VTL. To be efficient, a backup storage system should support all of these protocols, and the deduplication approach should be able to remove redundant data no matter how it is stored.

#### Processor-centric versus disk-intensive

**algorithms.** Over the last two decades, processor performance has increased dramatically compared with disk performance. Today, processor performance takes another leap with every doubling of the number of cores in a chip. Algorithms

developed today for deduplication should take advantage of the growth in processor performance instead of being tied to disk performance.

**Deduplicated replication.** When it comes to disaster recovery, true data protection requires storing a copy of the data safely at a remote location. Replication has long been used for the relatively small volume of mission-critical or high-value data in an organization, but many organizations find that the cost of replication can be too high for the remainder of their information.

Backup storage systems designed with integrated deduplication and replication can help reduce the bandwidth required to replicate large quantities of data from one site to another, thus enhancing the cost-effectiveness of the replication process. However, not all deduplication systems can replicate, and even those that can have wide gaps in capabilities. The system must be implemented in a way that runs fast enough for deduplication and replication with low overhead across a

comprehensive range of topologies and infrastructure typically found in the distributed enterprise.

### Combining disk-based backup with integrated deduplication

In an effort to bring the cost of disk-based backup close to that of tape-based backup, Dell has been incorporating deduplication into an increasing number of storage technologies. The Dell/EMC DD Series of storage appliances increases the breadth of options for disk-based backup with deduplication.

The Dell/EMC DD Series consists of three models: the Dell/EMC DD140, the Dell/EMC DD610, and the Dell/EMC DD630. Each offers different levels of capacity, throughput, and scalability. (For capacity and throughput details, see the "Enhancing logical capacity" sidebar in this article.) Each self-contained appliance has its own connectivity and power cable, so it can simply plug into an existing data center environment.

Dell/EMC DD Series storage appliances incorporate leading Data Domain disk-based deduplication storage systems. Data Domain systems are "CPU-centric" and therefore are not dependent on disk drive performance advances or an increase in the number of disk drives to speed throughput over time. They are also designed to identify duplicate data regardless of how the data is packaged and regardless of changes in block size.

Because these appliances are built for deduplication from the ground up, they can run fast enough to apply the benefits of deduplication to replicated data streams in real time, so that the lag until data is safely off-site can be as small as possible. Systems that have add-on deduplication can impose unnecessary delays on the replication process.

### Assessing Dell/EMC DD Series backup and recovery features

Deploying disk-based backup using Dell/EMC DD Series appliances with integrated deduplication can provide benefits that address many IT concerns regarding backup and recovery and help provide favorable return on investment.

**Complexity reduction.** Dell/EMC DD Series appliances provide a deduplication approach that can be implemented easily in heterogeneous environments (see Figure 1).

They can connect to storage using CIFS and NFS over Ethernet, Symantec™ OpenStorage over Ethernet, and VTL over Fibre Channel, and can work with many common backup and archive software applications—enabling organizations to consolidate backups but maintain current data management schemes. By simplifying backup and recovery processes, organizations can save time and money while freeing staff resources to pursue other tasks that help increase productivity and profitability.

**Data reduction.** Dell/EMC DD Series appliances with integrated deduplication are designed to avoid the storage of redundant data, helping reduce the disk capacity required for backup. Reducing the number of hard drives needed to store data then helps reduce the costs of power, cooling, space, and management in the data center. Space that was allocated to the physical footprint for extra drives can be available for other uses. Using Dell/EMC DD Series deduplication technology, organizations can realize up to a 99 percent bandwidth reduction for replication in a typical backup environment with a 5–10 percent incremental change rate, and can achieve 90–97 percent backup data reduction with a typical 10:1–30:1 deduplication ratio.

**Low overhead and high speed.** Because Dell/EMC DD Series appliances use in-line deduplication, they do not require the overhead of extra disk capacity found in post-processing applications of deduplication. Performance is not dependent on adding disk drives, and equipment, management, and operating costs can be reduced compared with other approaches to storage backup. Deploying Dell/EMC DD Series appliances also helps speed recovery times beyond what tape-based backup can deliver, helping reduce the impact to an organization if something goes wrong.

**Cost-effective disaster recovery.** Replication to a remote disaster recovery site can be highly cost-effective with Dell/EMC DD Series appliances, because deduplication reduces the amount of data that needs to be transmitted and the required bandwidth. Bandwidth is one of the major expenses involved in replication, and by helping reduce bandwidth requirements, deduplication can make replication a viable



### Taming the unstructured data beast

This blog post outlines three primary ways that organizations can address out-of-control data growth, including deduplication with Dell/EMC DD Series storage appliances.

[en.community.dell.com/dell-blogs/b/direct2dell/archive/2010/03/24/taming-the-unstructured-data-beast.aspx](http://en.community.dell.com/dell-blogs/b/direct2dell/archive/2010/03/24/taming-the-unstructured-data-beast.aspx)



# 99%

Dell/EMC DD Series deduplication technology can help organizations reduce bandwidth for replication by up to 99 percent.

disaster recovery method for a wide range of data sets and applications, and for many organizations that may have previously ruled out robust protection as a cost-prohibitive option.

**Data integrity and protection.** The Data Domain Data Invulnerability Architecture in Dell/EMC DD Series appliances is designed to ensure data integrity and protection through continuous fault detection and healing, end-to-end verification of data recoverability at time of backup, redundant system components, and other data safety techniques. Unlike some other deduplication systems or file-based backup systems, Dell/EMC DD Series appliances help ensure that recoverability is verified and then continuously re-verified.

**Tape avoidance.** By enabling organizations to avoid redundant data, Dell/EMC DD Series appliances with integrated deduplication help to eliminate space-consuming tape libraries. These appliances are designed to deliver all the benefits of backup to disk, including accelerated backup and restore times and enhanced reliability and data integrity compared with tape. More data can be stored with reduced media resources

compared with tape, helping to speed the recovery process.

### Optimizing the storage infrastructure

Deduplication has the potential to reduce data backup volume, enhance data protection, and, in general, simplify data management across the storage infrastructure. Dell/EMC DD Series appliances offer a cost-effective deduplication and storage backup option that enhances data protection and accelerates recovery time. The appliances implement deduplication in a way that combines performance and low overhead across a comprehensive range of backup environments. IT managers can easily deploy mature, flexible, high-throughput deduplication without needing to change current backup processes.

Dell/EMC DD Series appliances offer organizations a cost-effective storage, backup, and recovery approach designed to reduce complexity through a single point of contact at Dell. In addition, Dell has a suite of fixed-duration professional services that help organizations identify the optimal approach to archiving, backup, and deduplication to meet their specific needs. 



**Kay Benaroch** is a senior marketing consultant at Dell focused on data protection, deduplication, and object-oriented storage, and has more than 30 years of experience in marketing technology products.

**Shane Jackson** is senior director of product marketing for the EMC Backup Recovery Systems division, and has more than 17 years of experience in the storage industry.

### Learn more



**Dell/EMC DD Series:**  
[dell.com/emc](http://dell.com/emc)



**Dell™ storage solutions:**  
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# Optimizing management efficiency with Dell/EMC NS storage

By Annette Cormier, Eric Cannell, and Brad Bunce

The Dell/EMC NS family of unified storage enables organizations to easily and cost-effectively consolidate both unstructured file-system data and structured application data into a single shared storage system—helping organizations control costs, streamline management, and enhance storage availability and performance.

**E**xplosive growth in content, especially unstructured file-system content, can place a heavy burden on storage administrators in many organizations. Often, they deploy multiple storage systems to handle file-system-level and block-level storage, including network attached storage (NAS) as well as Internet SCSI (iSCSI) and Fibre Channel storage area network (SAN) arrays.

However, deploying and managing multiple systems can be expensive and complicated. Provisioning these systems can be costly, and managing them can require significant time and expertise—increasing the risk of data loss, poor performance, and downtime. Additionally, organizations often overprovision storage to meet service-level agreements, which can further increase storage costs.

An emerging approach to the challenge of managing multiple, disparate storage platforms is unified storage. Using a unified storage approach, both structured and unstructured data can be stored on a single shared system, helping avoid the need to purchase, deploy, and manage multiple storage platforms. However, for a unified

storage system to be effective, it must deliver the performance, availability, and flexibility that organizations have come to expect from purpose-built storage such as Fibre Channel SANs.

To help organizations enhance the efficiency and manageability of their enterprise storage environments, Dell recently introduced the Dell/EMC NS family of unified storage systems. Dell/EMC NS storage arrays support integrated Common Internet File System (CIFS), Network File System (NFS), iSCSI, and Fibre Channel connectivity, and are designed for high levels of performance, flexibility, and availability. These arrays are also available with a wide range of features designed to streamline management, protect data, and optimize efficiency, capacity, and cost across mixed Microsoft® Windows®, Linux®, and UNIX® environments.

## Consolidating data and file systems and scaling storage capacity

The Dell/EMC NS family of unified storage systems enables organizations to consolidate file-system and application data into a single shared storage environment. In particular, Dell/EMC NS

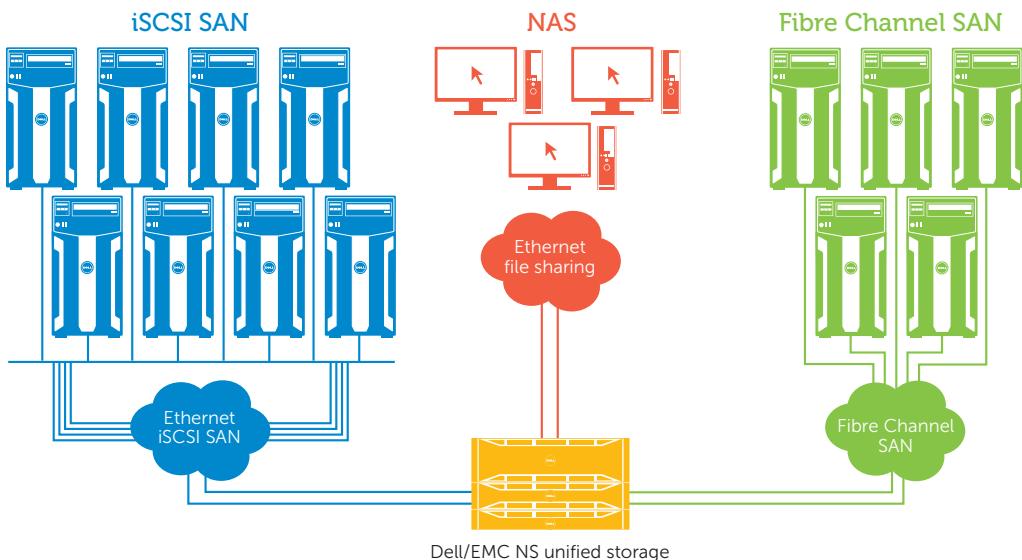


Figure 1. Integrated protocol support in Dell/EMC NS storage

storage combines support for a range of industry-standard protocols—including CIFS in Microsoft Windows environments and NFS in Linux and UNIX environments, as well as iSCSI and Fibre Channel SAN connectivity protocols—that enable integration of both NAS file-based storage and SAN block-based storage (see Figure 1).

By supporting multiple file-system protocols, Dell/EMC NS storage can enable consolidation and file sharing across heterogeneous Windows, Linux, and UNIX environments. Dell/EMC NS storage also takes advantage of native file-system protocol features. For example, the CIFS protocol leverages storage-based file-locking capabilities required in enterprise database environments, and the NFS protocol delegates file and volume management to the NAS server to optimize host cycles for mission-critical operations. Dell/EMC NS storage can also be well suited for organizations that need to support Windows, Linux, or UNIX file-system storage as well as application storage for VMware® virtualization, Oracle® database, Microsoft SQL Server® database, Microsoft Exchange messaging, and other software.

In addition to supporting multiple connectivity protocols, Dell/EMC NS storage arrays also support a wide range of drive types to help provide targeted, cost-effective performance, including enterprise flash drives (EFDs), Fibre Channel drives, and Serial ATA (SATA) drives. EFDs offer extremely high-performance, low-latency storage that is well suited to highly performance-sensitive applications; Fibre Channel drives can offer reliable, high-performance storage; and energy-efficient, low-power SATA II drives can offer cost-effective, high-capacity storage for applications that are not performance intensive, such as archiving or historical data storage.

Dell/EMC NS storage arrays are also scalable, and can be easily expanded to support growth in capacity and throughput requirements (see Figure 2). The Dell/EMC NS-120 array supports a maximum of 120 drives, while the Dell/EMC NS-480 array supports a maximum of 480 drives. The Dell/EMC NS-960 array, expected to be available later this year, is designed to support up to 960 drives. These drive counts can be utilized for block storage, file storage, or both simultaneously based on specific requirements.

	X-Blades (data movers)	Control stations	Storage processors	Maximum number of drives	Maximum file storage capacity
Dell/EMC NS-120	1 or 2	1	2	120 across 8 enclosures	64 TB (32 TB per X-Blade)
Dell/EMC NS-480	2 or 4	1	2	480 across 32 enclosures	192 TB (64 TB per X-Blade)
Dell/EMC NS-960	2 to 8	1 or 2	2	960 across 64 enclosures	896 TB (128 TB per X-Blade)

Figure 2. Scalability specifications for Dell/EMC NS storage



## Exploring information life cycle management efficiencies

Using multi-protocol, multi-tier Dell/EMC storage systems together with advanced features in Oracle Database 11g can help increase efficiency while maintaining high-performance operations and access. In this Webcast, Annette Cormier and Eric Cannell examine ways to align infrastructure costs with the value of information throughout its life cycle.

[dellenterprise.com/  
goto/encoracle](http://dellenterprise.com/goto/encoracle)

Both block- and file-performance throughput can also be easily scaled. For block scaling, Dell/EMC NS storage arrays come with flexible, multi-protocol I/O ports that utilize the Dell/EMC UltraFlex™ architecture. With UltraFlex, I/O ports can support protocols such as iSCSI and Fibre Channel as well as expected technologies such as Fibre Channel over Ethernet (FCoE), and can be upgraded or expanded online for increased throughput without application disruption—for example, when moving from 4 Gbps to 8 Gbps Fibre Channel or from 1 Gbps to 10 Gbps iSCSI. File-system (NAS) access throughput can be increased as well, by adding additional X-Blades (data movers) to the storage array.

### Optimizing for efficiency and extending cost-effective storage

In addition to providing scalable, high-performance unified storage for sharing file-system-level and block-level storage, Dell/EMC NS unified storage systems are designed to deliver additional efficiencies such as reduced capacity requirements, minimal power usage, and increased performance. Key features include the following:

- **Virtual provisioning:** To help ensure that end users do not run out of capacity, organizations often overprovision storage, which can

result in substantial underutilization of disk resources. Virtual provisioning, available on all Dell/EMC NS unified storage systems, enables storage capacity to be allocated simply and automatically on an as-needed basis as opposed to all at once, which can help dramatically increase disk utilization and lead to reduced power consumption costs.

- **Data deduplication and compression:** Duplicate and infrequently used files can consume extra capacity and network bandwidth during both storage operations and backup and recovery operations over a local area network (LAN) or wide area network (WAN). Data deduplication and compression features available with Dell/EMC NS storage can reduce data capacity requirements by up to 50 percent, helping to further reduce costs and optimize performance (see Figure 3).

- **Efficient drives:** Low-power SATA II drives and power-efficient EFDs help minimize energy costs in both high-capacity and high-performance situations. Low-power SATA II drives require up to 32 percent less energy than traditional 1 TB, 7,200 rpm SATA drives for efficient, high-capacity storage; EFDs require up to 98 percent less energy per I/O per second (IOPS) than Fibre Channel drives for efficient, extremely high-performance storage.

- **Tiered storage:** By enabling organizations to mix drive types within a single scalable storage system, Dell/EMC NS storage arrays help simplify the deployment and management of tiered storage and archiving infrastructures.

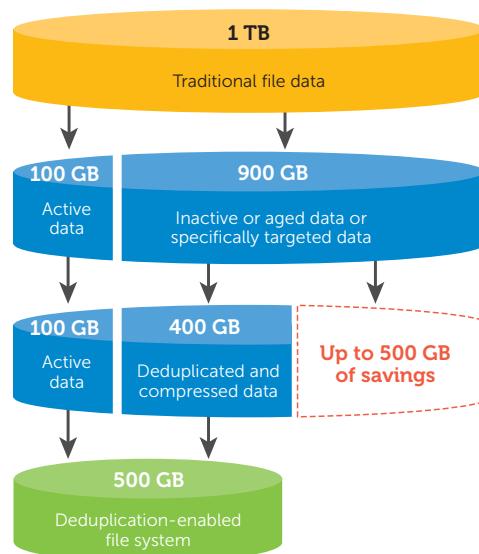


Figure 3. Reduced capacity requirements using data deduplication and compression features available in Dell/EMC NS storage

### Deploying built-in capabilities and delivering high availability

The Dell/EMC NS family of unified storage systems incorporates an extensive range of built-in features designed to streamline management, protect data, and ensure availability. For example, the Celerra® Manager software included with all Dell/EMC NS storage systems is a Web browser-based tool that enables administrators to easily deploy, configure, and manage file-system and application-based storage.

The Celerra Provisioning Wizard, an integral part of Celerra Manager, enables storage to be

Figure 4. Automated replication and recovery available with Celerra Manager

deployed in just a few clicks. The Automated Volume Management feature in Celerra Manager enables easy provisioning and optimization of file systems based on workload; storage can be automatically provisioned and tiered across disk types based on workload type and policies.

The Celerra File-Level Retention (FLR) feature, available in FLR-Enterprise (FLR-E) and FLR-Compliance (FLR-C) versions, supports simple management of compliance and regulatory policies. For example, FLR is designed to protect files from deletion or modification until a specified retention date, enabling organizations to create a permanent, unalterable set of files and directories and help ensure data integrity. FLR also enables write-once, read-many (WORM) functionality on file systems for information governance, and meets the requirement of U.S. Securities and Exchange Commission (SEC) Rule 17a-4(f) regarding electronic storage of broker-deal records.<sup>1</sup> This requirement means that an FLR-C file system that has files in the locked state cannot be deleted.

Celerra Manager also offers robust integration with third-party backup, antivirus, and quota management tools. For example, the Celerra Event Publishing Agent (CEPA) provides integration with leading quota management software (such as

Northern Parklife's Northern Storage Suite) that enables event notification following Celerra file and directory actions.

### Comprehensive integration with VMware virtualization

Dell/EMC NS unified storage systems support comprehensive integration with the VMware vCenter™ platform for simplified management and protection of VMware virtualized environments. Using the VMware platform enables IT administrators to choose among the NFS, iSCSI, Fibre Channel, and FCoE storage protocols, and Dell/EMC NS unified storage enables them to support all of these within a single storage infrastructure. IT departments would typically begin a virtualization project with the protocol that most comfortably matches their skill sets—for example, companies that have Fibre Channel SAN infrastructures might carry out their initial deployments on Fibre Channel, while those that do not have Fibre Channel experience might opt for IP networking through either NFS or iSCSI. The Dell/EMC NS unified storage infrastructure would enable these organizations to deploy whichever of these protocols they prefer. Using VMware Storage vMotion™ technology or array



### Enabling next-generation tiered storage

Bob Laliberte, senior analyst at the Enterprise Strategy Group, discusses how the EMC® Fully Automated Storage Tiering (FAST) technology available in some Dell/EMC arrays enables highly automated, dynamic, cost-efficient use of storage resources.

[bitpipe.com/detail/RES/1272658016\\_706.html](http://bitpipe.com/detail/RES/1272658016_706.html)

<sup>1</sup> For more information on SEC Rule 17a-4(f), visit [sec.gov/rules/interp/34-47806.htm](http://sec.gov/rules/interp/34-47806.htm).



## 5 clicks

Dell/EMC NS storage arrays help organizations to cost-effectively meet demanding service-level agreements and simplify management with easy-to-use unified storage that supports CIFS, NFS, iSCSI, and Fibre Channel protocols. The Dell/EMC NS family is not only easy to configure and use, but also enables organizations to provision file shares in less than five mouse clicks.



**Annette Cormier** is a solutions marketing manager for Dell/EMC storage solutions with 20 years of experience in developing and bringing to market enterprise storage, network management, and security products.

**Eric Cannell** is a product marketing manager for Dell/EMC storage systems with many years of experience developing enterprise technology products.

**Brad Bunce** is the technical marketing director for EMC midrange storage solutions. He has 17 years of IT experience in technical presales, IT management, and marketing.

### Learn more



**Dell/EMC storage:**  
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**Dell/EMC events and Webcasts:**  
[dellenterprise.com/goto/emc](http://dellenterprise.com/goto/emc)

functionality enables administrators to move virtual machine deployments between protocols. Celerra Manager enables end-to-end virtual-to-physical mapping of virtual machines to storage resources in a Web browser-based tool that helps streamline management of virtualized environments.

The VMware Site Recovery Manager Automated Failback feature enables end-to-end disaster recovery of VMware virtualized environments through a VMware vCenter plug-in, and the VMware View Storage Integration feature enables rapid provisioning of virtual desktops through an additional vCenter plug-in. VMware-aware data deduplication and compression features are also available with Dell/EMC NS storage arrays and provide comprehensive integration with VMware View, enabling data deduplication and compression of VMware virtualized storage.

### Advanced data protection and high availability

To help maximize file-system and application uptime, Dell/EMC NS unified storage systems are designed for enterprise-level availability, and include advanced reliability capabilities such as RAID technology for drive-level data protection, redundant storage processors for continued operation in the event of a failure, and active/passive failover. Dell/EMC NS storage arrays also support the Data Access in Real Time (DART) OS, which offers dynamic failover to a hot standby X-Blade (data mover) to help ensure that data remains highly available and protected.

Dell/EMC NS unified storage systems also come with robust data protection software, including automated snapshot, replication, and recovery capabilities. Celerra SnapSure™ software can create application-consistent point-in-time

snapshots, including writable snapshots for test and development (see Figure 4). Celerra SnapSure also supports built-in automated recovery and utilizes pointer-based copy technology to help minimize disk space and enhance performance.

Celerra Replicator™ software supports automated, multisite replication. Replicator creates point-in-time read-only and read/write copies of production file systems or logical units (LUNs) on local or remote storage systems, and uses standard IP-based networks for maintaining consistent replicas between sites. Replicator is designed for simple administration using easy-to-define business policies, and includes features such as application-level recovery point objectives and customizable bandwidth usage schedules. Bandwidth throttling is also supported for situations when it is important to share network bandwidth with other applications. Acting as a synchronizing or orchestration tool, Replication Manager resides at the host and leverages integration with Microsoft and Oracle software to provide application-consistent replicas of Microsoft Exchange, Microsoft SQL Server, and Oracle Database data to help ensure that snapshots and replicas remain consistent for recovery operations.

### Benefiting from consolidation on unified storage

Consolidating block- and file-level storage into a unified storage system has many potential benefits. The Dell/EMC NS family of unified storage combines scalable, flexible, high-performing storage with advanced efficiency, data protection, and management features that can help reduce total cost of ownership, enhance availability, and streamline the manageability of enterprise storage deployments. **PS**



# Racking up data center efficiency

By Joyce Ruff

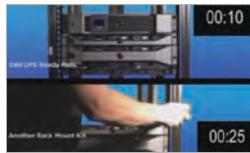
Designed to meet the needs of high-density data center environments, the Dell™ PowerEdge™ 4820 rack enclosure can hold and protect a wide range of IT equipment while supporting enhanced power management, efficient cooling, and simplified component storage and mounting.

When organizations deploy or expand their data centers, they often struggle with finding the right balance between server capacity and power management. Many choices depend on the space available in the room being used for equipment storage, and IT managers must also account for weight, power, cooling, and data management requirements to help ensure that the data center is both functional and efficient. One key decision is the selection of a rack infrastructure: racks have become far more than simple cabinets, and the inclusion of features that help organizations store, power, cool, manage, and secure their hardware makes them a key part of the overall data center design.

Dell PowerEdge racks include an array of features to address the critical power, cooling, and cabling issues that many organizations face in their data centers. The Dell PowerEdge 4820 rack enclosure is the latest addition to the PowerEdge rack family, which now includes three models to help meet different needs: the 24U PowerEdge 2420 rack, the 42U PowerEdge 4220 rack, and the 48U PowerEdge 4820 rack. Each rack is 600 mm wide and 1,070 mm deep to fit within a two-tile floor plan. Designed to hold and protect server, storage, and networking equipment, the PowerEdge 4820 provides a high-density option for organizations with high-performance computing centers and similar environments that need to support additional servers while still maintaining the existing footprint.



The Dell PowerEdge rack family includes three models to help meet a variety of data center needs



## The 10-second challenge

The Dell ReadyRails mounting interface is designed for easy installation—with no tools required. In this video, see just how quickly this design can be fitted onto a Dell rack.

[youtube.com/watch?v=7GCPOKSNuC4](http://youtube.com/watch?v=7GCPOKSNuC4)

### Designing for flexibility, strength, and security

Built with adjustable vertical mounting rails within the rack, Dell PowerEdge rack enclosures are designed to accommodate multiple types of IT equipment. Because they adhere to the EIA-310-E standard for rack mounting of electronics, the racks can fit not only Dell PowerEdge servers, but also Dell EqualLogic™, Dell PowerVault™, and Dell/EMC storage; Dell PowerConnect™ switches along with other networking equipment such as routers, switches, and hubs; and even telephony equipment.

The PowerEdge 4820 has a static load rating of 2,500 pounds (1.13 metric tons), enabling it to hold a typical complement of equipment without the need for special infrastructure. To help increase rigidity, IT departments can take advantage of accessories such as side stabilizer bars to secure the rack to the floor, as well as interconnect kits to bolt adjacent racks to each other. Rotating rear casters and accessible leveling feet on Dell racks enable easy maneuvering and positioning. And because they incorporate lockable doors at the front and rear of the rack as well as lockable side panels that use the same key, these racks can be used in almost any environment—including data centers, remote offices, wiring closets, and even factory floors.

### Incorporating key accessories

Although rack enclosures provide the necessary capacity for holding key data center components, it takes more than just a rack to create an efficient data center. To help organizations implement best practices for efficiency, Dell racks support a range of complementary accessories to enhance power management, airflow, and component storage and mounting.

To enable IT staff to mount Dell half-height and full-height managed power distribution units (PDUs) without cables impeding airflow and equipment access, the Dell PowerEdge 4820 rack provides a large distance between the back panel of the server and the PDU outlets. This rack also supports a wide range of options for PDU types and form factors, and includes a tray for mounting PDUs at the rear of the rack as well as support for installing them in the U-spaces. The PDU tray has been enhanced with additional mounting locations for PDUs and cable management accessories.

Rack fan kits and blanking panels can help ensure proper airflow in the rack and enhance cooling efficiency. Plastic blanking panels in 1U and 2U sizes are now available in addition to steel blanking panels in 1U, 2U, 3U, and 6U sizes. The plastic blanking panels have a tool-less snap-in design that enables quick, easy installation and removal in the unused U-spaces in a square-hole rack. The screw-in design of the steel panels provides support for a wider range of racks, including threaded and unthreaded round-hole racks as well as square-hole racks.

IT staff can quickly and easily mount latest-generation PowerEdge servers in PowerEdge rack enclosures using the Dell ReadyRails™ tool-less mounting interface, which includes spring-loaded latches designed to engage automatically. This efficient design makes the release latch visible and accessible from the front of the rack, without requiring special tools or empty U-spaces above or below to disengage them.

These rail kits are available in sliding or static styles to accommodate the needs of different server specifications and the environment as a whole. Sliding rails allow the system to be fully extended out of the rack for service,

and additionally support an optional cable management arm (CMA) that attaches without the use of tools and provides a guide for component cable routing to the rear of the rack. Because static rails are less complex than sliding rails and do not need CMA support, they offer a smaller footprint. Both types of ReadyRails mounting kits can be installed in EIA-310-E-compliant four-post square-hole and unthreaded round-hole racks; the static rail kits can also be mounted into four-post threaded-hole racks and two-post racks.

For components that do not come with rails for rack installation, IT staff can take advantage of the 1U fixed equipment shelf, which is designed for tool-less installation into square-hole or unthreaded round-hole racks using the ReadyRails mounting interface. The rail design for the shelf also supports tool-less installation in four-post and two-post threaded-hole racks for added versatility. This steel shelf is designed to hold up to 200 pounds of

weight, and comes with a pair of hook-and-loop straps to secure cables to the shelf.

### Enabling efficient, high-density environments

Server racks are an important part of effective data center design. In conjunction with key accessories, the Dell PowerEdge 4820 rack enclosure provides a flexible way for organizations to create efficient, high-density environments without increasing floor-space requirements. 



**Joyce Ruff** is a product marketing manager for the Data Center Infrastructure team within the Dell Enterprise Product Group.

### Learn more



**Dell racks and accessories:**  
[dell.com/poweredge/rack](http://dell.com/poweredge/rack)

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BEST PRACTICES FOR REDUCING  
NETWORKING COMPLEXITY  
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Tsumura & Company

## Solving IT problems with server consolidation

By consolidating its infrastructure on virtualized Dell™ PowerEdge™ servers, Japanese herbal medicine leader Tsumura & Company has laid the groundwork for a dramatic reduction in ongoing server costs while ensuring that legacy applications can continue running years into the future.



With its motto of "The Best of Nature and Science," Tsumura & Company aspires to contribute to human health and well-being by fusing Western medicine with a scientifically grounded understanding of *kampo*, Japan's traditional herbal medicines. In addition to its 129 *kampo* products, Tsumura provides 136 varieties of healing medicines and makes significant on-site contributions at a wide variety of medical facilities.

Tsumura has long been committed to advanced technology initiatives, but its relentless focus on IT had led to a problem: an explosion in the number of in-house systems, particularly servers. "Even as we continue to introduce more and more servers," says Hideo Sato, head of the Tsumura IT department, "one by one our existing servers are approaching the end of their lives, and the effort and cost needed to update our in-house systems keeps on growing. In this environment I find myself constantly wishing I could bite down and put a stop to things."

### Reducing fixed operating costs

With an eye toward reducing costs, Tsumura went in search of a game-changing solution—and found one in virtualization-based server consolidation. Tsumura had first implemented VMware® server virtualization around 2005, but at that time, the hardware and software had not yet matured enough to support true consolidation.

## Innovative savings

Advanced IT initiatives have been a focus at Tsumura & Company for years. Now, server virtualization and consolidation on Dell PowerEdge servers are paving the way for future growth.

# 137:12

Following a Dell Virtualization Assessment, Tsumura found that it could consolidate 137 of its Web and application servers down to just 12 virtualized Dell servers.

# 68.2%

The company's preliminary estimates indicate that the consolidation project could reduce its annualized server costs by 68.2 percent.

# 224 tons

In addition to the cost advantages, Tsumura reports that the project has contributed to environmentally friendly IT practices—reducing its power consumption by an amount equivalent to 224 tons of CO<sub>2</sub> emissions.

Big changes were in store in 2008. Dell and Mitsubishi Research Institute DCS, the two outsourcing partners in charge of Tsumura's system operations, proposed that the company deploy the latest version of the VMware platform. Two features that particularly impressed Sato were the VMware vMotion™ and VMware High Availability technologies. "Previously, our primary server machines had never gotten beyond a redundancy of about 50 percent," he says. "If the server consolidation we get from the latest version of VMware enables us to reach an effective redundancy of near 100 percent, then I would say that was definitely something worth trying!"

The targets for this round of consolidation were 137 Web and application servers. After an initial Dell Virtualization Assessment service, Tsumura saw that it could concentrate its resources on just 12 Dell PowerEdge servers. Preliminary estimates suggested that the consolidation could reduce the combined annualized costs for servers and server farms by 68.2 percent—a huge savings for the company.

The Dell team was able to get the new environment up and running quickly. "At Tsumura, once we made the decision, we wanted to execute it immediately," says Takuo Yamaguchi, leader of the information management group within Tsumura's IT department. "Dell was there to meet our

**"Dell was there to meet our needs—in less than six months, an incredibly short interval, they had implemented our server consolidation project."**

—Takuo Yamaguchi

Leader of the information management group at Tsumura & Company  
September 2009

needs—in less than six months, an incredibly short interval, they had implemented our server consolidation project."

In addition to helping significantly reduce costs, virtualization is also helping preserve system continuity well into the future. "Previously, we had been pretty much redoing our whole system every five years or so," says Sato. "The truth is, once you replace the hardware, you wind up having to upgrade to newer versions of the OS and the middleware, and in order to maintain compatibility you then wind up with no choice but to redo the entire system." The virtualized infrastructure enables Tsumura to maintain compatibility across all of its operating environments—a reassurance that means a lot to the company.

Consolidation has also brought major advantages in another area: environmentally friendly IT. "By significantly concentrating our servers and other hardware resources, we have reduced our electric power consumption by an amount equivalent to around 224 tons of CO<sub>2</sub> emissions," says Sato.

## Moving toward database server consolidation

"Above all else," says Sato, "the point on which I really want to commend Dell is the driving force they provided for this project. In collaboration with the technical staff at Mitsubishi Research Institute DCS, they proceeded in an extremely short time from proposal to design, architecture, and full transition."

Yamaguchi agrees. "I'm looking forward to two or three years from now, when we'll be able to assess how the cost reductions we achieved through this round of server consolidation took shape and stimulated our management and our business."

As a next step, Tsumura plans to consolidate its database servers. In contrast to the relatively compact Web and application servers, these servers are large-scale systems that demand high levels of scalability, and several hurdles remain to be cleared. But with the experience and knowledge gained thus far, the firm is optimistic that it can meet the challenge. **PS**



## State of Delaware

## Taming the e-mail beast with blades

Centralizing its e-mail systems on Dell™ PowerEdge™ blade servers and Dell EqualLogic™ storage helps the state of Delaware reduce total cost of ownership, streamline management, and cut downtime from days to minutes.

**T**he second-smallest U.S. state after Rhode Island, Delaware is a 30-by-96-mile wedge of land on the Delmarva Peninsula. The state government maintains a central data center in the capital of Dover and a disaster recovery facility in New Castle, and its e-mail system processes more than a million messages a day.

A decade ago, the state began consolidating its systems as part of a move to the Microsoft® Exchange and Active Directory® platforms. The government initially chose HP blade servers, but recently switched to Dell PowerEdge M-Series blade servers with Intel® Xeon® processors. "When we migrated to Microsoft Exchange Server 2007, Dell presented us an

outstanding value for a consolidation solution," says Douglas Lilly, lead telecomm technologist for Delaware's Department of Technology and Information. "When we first started out with Microsoft Exchange, we had 16 clusters, which we reduced to 12 clusters of HP server blades. Now we've reduced those to 4 clusters of Dell PowerEdge M610 blade servers."

The Dell blades have brought a variety of benefits, including reducing downtime each year from days to minutes, reducing rack space requirements by 66 percent, simplifying remote deployment and management, lowering energy costs, and significantly increasing capacity. Lilly estimates that matching the current capacity on the previous systems would raise total cost of ownership by about 20 percent.

Dell EqualLogic PS5000E storage arrays help meet the state's large e-mail volume and retention requirements while streamlining storage management. "Compared to other storage, the ease of administration is fabulous," he says. "With EqualLogic, it takes 50 percent less time to administer LUNs and set up the servers with the storage." He estimates that the simplified connectivity saves US\$1,000 per server port.

Lilly also praises Dell support services. "We really like Dell services and products, which is why we are running our entire state Active Directory, e-mail infrastructure, Microsoft Office Communications Server deployment, and Microsoft SQL Server® databases on Dell PowerEdge blade servers with Intel processors," he concludes. **PS**



### Cutting costs

The state of Delaware is already seeing results from its consolidation on Dell PowerEdge blades and Dell EqualLogic storage.

**16:4**

The state initially required 16 clusters to run Microsoft Exchange; now 4 clusters of PowerEdge M610 blade servers get the job done.

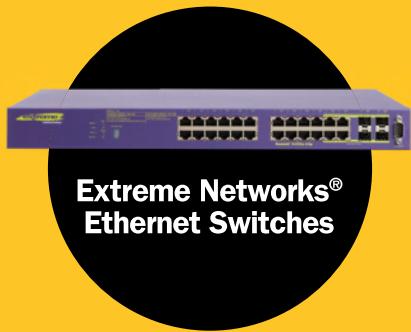
**50%**

The easy-to-use EqualLogic arrays have cut storage management time by 50 percent.

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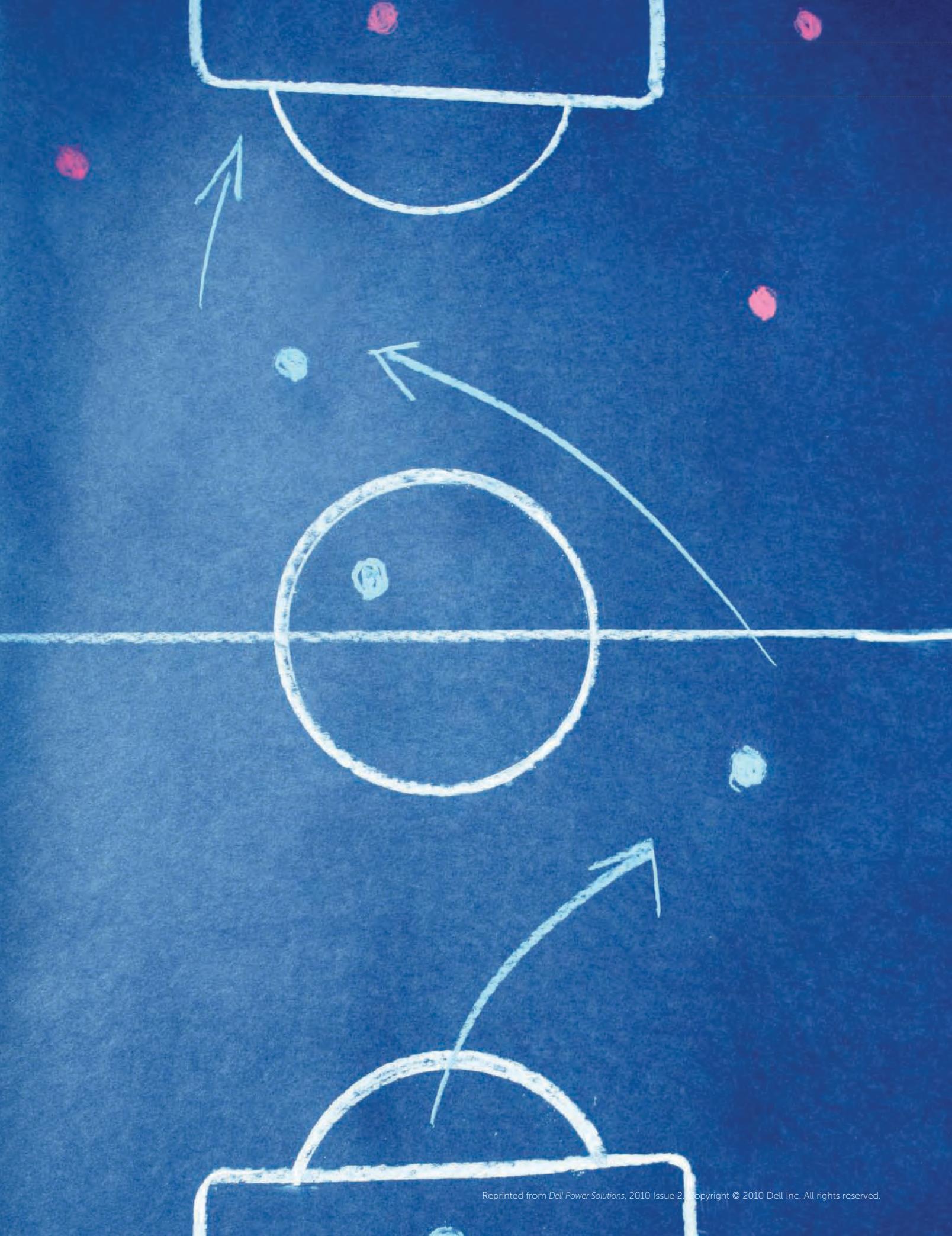
have changed the economics of iSCSI to  
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# Dell KACE appliances: Simplifying Windows 7 migrations

By Sendhil Jayachandran



For midsize organizations working with a diverse range of hardware and limited resources, making the move to the Microsoft® Windows® 7 OS can be a daunting challenge. The innovative Dell KACE™ family of appliances provides a simplified, automated, cost-effective way to design and carry out an end-to-end migration.

Enterprise IT departments are quickly embracing the Microsoft Windows 7 OS: in a recent survey, 87 percent of organizations said that they plan to deploy Windows 7, and almost half do not plan to wait for Service Pack 1 before rolling it out.<sup>1</sup> Because Microsoft does not support in-place upgrades of Windows XP to Windows 7, however, the migration can pose a daunting challenge for organizations that bypassed the Windows Vista® OS and continued running Windows XP, but still need a means to execute clean installations of Windows 7 while retaining critical data.

The migration can pose an even larger challenge for midsize organizations, which may need to carry it out with limited staff and financial resources. These organizations may also be highly flexible about the types of hardware and operating systems allowed on their networks, requiring IT administrators to account for a diversity of systems and OS platforms during the rollout. When planning a Windows 7 migration strategy, these organizations should follow best practices that align with their specific environment and use tools that can help them to optimize the migration process. Designed specifically with the needs of midsize organizations in mind, the Dell KACE family of appliances offers a way for administrators to create a simplified, automated, cost-effective approach to Windows 7 migration.

<sup>1</sup>"Windows 7 Adoption: A Survey of Technology Professionals," by Dimensional Research, January 2010, available at [kace.com/resources/windows-7-adoption-survey-2010](http://kace.com/resources/windows-7-adoption-survey-2010).



**Figure 1.** Scripted installation details in the Dell KACE management interface



## Success stories

Dell KACE appliances have enabled a wide range of organizations to dramatically simplify ongoing systems management. In this series of videos, customers explain how these appliances have changed the way they run their IT operations.

[dell.com/kacecustomers](http://dell.com/kacecustomers)

## Assessing hardware and software compatibility

One of the first steps to executing a successful Windows 7 migration is to assess the hardware and software in the environment to determine readiness and potential upgrade needs. IT departments should start by determining the mix of systems running Windows, Linux®, or other operating systems. The release of Windows 7 presents an opportunity to increase standardization: administrators might decide that they want to remove an OS from their network, or at a minimum ensure that all users are on the same version of each OS. Taking the time to standardize platforms can be a worthwhile investment for midsize organizations, resulting in simplified systems management.

In the same survey referenced earlier, software compatibility was identified as the single greatest concern organizations had regarding Windows 7. Automated tools do exist that can assist with verifying Windows 7 software compatibility, and these tools work with centralized clearinghouse databases of already-tested applications. Just as they can standardize their OS platforms as part of the migration process, midsize organizations can also take this opportunity to consolidate their software applications. Critical applications that can't be consolidated and aren't compatible with Windows 7 can be run using Windows XP Mode, a feature available in the Windows 7 Professional and Ultimate editions that uses an updated version of Windows Virtual PC to maintain a virtualized Windows XP environment within Windows 7. The process is hidden from end users: applications appear as if they are running on Windows 7, while in fact they are running in the background on the Windows XP virtual machine. Because the use of Windows Virtual PC requires special hardware capabilities, administrators should be sure to inventory their systems to ensure that they are compatible with Windows XP Mode.

## Optimizing OS deployment

Midsize organizations need a way to streamline the Windows 7 deployment process as much as possible to minimize manual work. An optimal deployment should incorporate gold master

automation, hardware-independent deployment, user state migration, and cross-platform support.

To deploy Windows 7 throughout an organization, administrators typically build a gold master reference system from which to capture a disk image—a process that can consume precious time and resources if executed manually.

Automating the process can help to both simplify image captures and increase reliability, avoiding the need to rely on manually inserting the appropriate installation media into the reference system. For midsize organizations that may not have the time, personnel, or capital to dedicate staff toward building and maintaining these reference systems, gold master automation can be a necessity.

An optimized Windows 7 migration should also allow for a driver repository of known hardware, to enable the creation of a hardware-independent installation process that can automatically customize itself at the point of installation for each hardware class. For midsize organizations that need to accommodate a wide range of systems, hardware-independent installations become particularly useful over time—enabling repeated use of the same installation as new hardware is purchased. After the initial setup, administrators should need to concern themselves only with ensuring that new drivers are contained in or added to the database as needed for each deployment.

User state migration allows user-specific files and settings to be deployed along with the OS and applications, helping reduce the risk of losing critical information and helping minimize end-user downtime. This step applies to both clean installations on existing systems and migrations to new systems; a successful migration means that when users turn on their new system or OS for the first time, the information they want to retain from their old system or OS is already there. For midsize organizations that may back up end-user data inconsistently, it is particularly important to migrate user states to help ensure that critical data is not lost. By collecting user states on a regular basis after a Windows 7 migration, administrators can potentially refresh systems at any time, rather than just during the migration project. Users in such

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## **Easy-to-Use**

- Intuitive tabbed web-based console
- Integrate with LDAP, Active Directory and email
- One-click updates simplify upgrades and patches

## **Comprehensive**

- Full PC and server lifecycle management
- Dell KACE supports Windows, Mac and Linux operating systems

## **Affordable**

- Deploy in one day
- No hardware or software prerequisites
- No professional services required
- Remote site support without dedicated hardware or staff

## **System requirements**

### VMware™ ESX 4 or later / vSphere

- Intel-VT or AMD-V 64 bit processors
- 4 GB RAM
- 250 GB minimum disk space

### VMware™ ESX 3 or later / viClient

- Intel-VT or AMD-V 64 bit platforms
- 4 GB RAM
- 250 GB minimum disk space

### VMware™ Player 2.5.3 or later

(Trial Dell KACE appliances only. Not supported by production Dell KACE virtual appliances.)

- Windows-based system with Intel-VT or AMD-V capable processor(s)
- Windows XP or later, either 32- or 64-bit
- 2 GB RAM
- 7 GB disk space minimum (additional space required to test backup features; approximately 50 GB to test the patching feature)



Dell KACE appliances are designed for exceptional performance, reliability, ease of use, and scalability

an environment may choose to have their systems seamlessly rebuilt when a problem cannot be solved. The same holds true after a crash, helping administrators to quickly provision a new system with little or no loss of user data.

Finally, administrators in midsize organizations should utilize a tool that provides cross-platform support for Windows, Linux, and other operating systems. In heterogeneous environments, using tools that can manage only a single platform would require deploying separate tools for each supported OS—which can result in increased infrastructure and training costs that the organization may not be able to afford.

### Taking an appliance-based approach to migration

The Dell KACE family of physical and virtual appliances offers an innovative approach to Windows 7 migration specifically designed for midsize organizations—providing an easy-to-use, comprehensive, and cost-effective way to carry out Windows 7 migrations. KACE physical appliances are based on 1U Dell™ PowerEdge™ rack servers, while KACE virtual appliances can run in the VMware® ESX and ESXi virtualization platforms. Both physical and virtual appliances are designed to seamlessly integrate OS, database, file server, Web server, and systems management software to provide a true plug-and-play solution that supports Windows, Linux, and Apple Mac OS X operating systems (see Figure 1).

Windows 7 migrations can entail much more than just the OS deployment itself, including inventory readiness analysis, user state migration, software and patch distribution, and ongoing asset management. By providing comprehensive support for the process as a whole, these appliances can help eliminate the need for midsize organizations to task IT personnel with tactical work, allowing them to focus instead on strategic initiatives.

Midsize organizations also may not have the luxury of investing in consulting services and extended training. KACE appliances can be plugged into an existing network and immediately begin functioning, helping support rapid, simplified deployments. The appliance-based architecture helps eliminate many of the costs of traditional systems management software packages—there are no professional services fees to incur, no additional hardware or software requirements, no custom integration costs, and only minimal training requirements. At the same time, KACE appliances can provide exceptional performance, reliability, ease of use, and scalability in a purpose-built appliance that is pre-tuned, hardened, and self-monitoring.

### Enabling simplified, automated, cost-effective migrations

Steve Brasen, a senior analyst with IT research firm Enterprise Management Associates, offers this perspective on the Windows 7 migration challenge: "In the history of Windows, we've never seen the

kind of rapid adoption of a new OS version as we have with Windows 7. The move to Windows 7, however, is not a process that can be effectively performed through manual processes. Automated migration solutions such as Dell KACE deployment appliances are essential for ensuring consistency, reliability, and cost-effectiveness in a migration strategy."

This perspective can resonate strongly with midsize organizations in particular, which are often contending with diverse hardware, limited IT budgets, and personnel constraints that make ease of use and cost-effectiveness essential. Through their innovative approach to Windows 7 migration, Dell KACE appliances can help these organizations simplify, automate, and optimize the move to Windows 7 as part of an end-to-end migration strategy. 



**Sendhil Jayachandran** is a senior product manager at Dell KACE, where he is responsible for product management activities related to the Dell KACE K2000 deployment appliance.

### Learn more



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**Dell KACE and Windows 7 migration:**  
[dell.com/kacewindows7](http://dell.com/kacewindows7)



# Enhancing SAN self-management with Dell EqualLogic storage

By Tony Ansley and Mansour Karam

Dell™ EqualLogic™ arrays offer built-in intelligence to help simplify configuration—but operators may still miss important settings. Together, Arista and Dell have created a storage architecture that can automate configuration through switches running the Arista® Extensible Operating System (EOS®) platform.

Ever-increasing growth in the volume of stored data, coupled with applications that demand large computational power, are driving the need for scalable, high-capacity storage area networks (SANs). At the same time, a constant push to simplify IT infrastructure and reduce operating costs is driving a move to virtualize operations in the storage segment.

These factors put a premium on interconnect bandwidth and manageability. Scaling to hundreds of terabytes or petabytes of storage capacity requires switches that can cost-effectively provide high bandwidth and low latency. To help simplify IT management and minimize operating costs, tight integration is necessary between the management capabilities of storage platforms and those of the switches. Successful operation requires a high degree of automation and integration into an organization's IT environment.

The combination of Dell EqualLogic PS Series Internet SCSI (iSCSI) SAN arrays and the Arista 7000 Family of Gigabit Ethernet (GbE) and 10 Gigabit Ethernet (10GbE) switches helps meet these requirements. Now available with 10GbE controllers, the EqualLogic PS6000 series of

arrays can be deployed in conjunction with Arista switches to provide a cost-effective 10GbE-based cloud storage platform that is well suited to bandwidth-intensive software such as database, analytics, search, high-performance computing (HPC), and media applications.

## Simplifying management through automatic configuration

Dell EqualLogic PS Series iSCSI SAN arrays offer high levels of built-in intelligence and self-management. They are designed to automatically load balance data across network connections, disk drives, and arrays to help optimize performance, and can automate storage configuration, management, pooling, storage tiers, and data distribution to help save time and increase productivity.

Switches from Arista Networks offer a customizable, extensible switch OS that provides a platform for automation in support of EqualLogic storage—and combining the two enhances the self-management capabilities of both platforms. The Arista switch software has distinct properties that make this high level of self-management possible.

Many of today's network switches present a fundamental design limitation: a single defect anywhere in the OS can potentially expose the entire system to disruption. At the same time, with no isolation between multiple tasks, it is difficult to add functionality. In fact, making any significant changes to a code base that is measured in millions of lines of code is likely to reduce product stability and reliability.

The fragile nature of this monolithic approach makes it inherently difficult to extend the network OS to implement new switch features or provide integration with other systems. The Arista Extensible Operating System (EOS) software available across the Arista 7000 Family of switches is designed to avoid this limitation.

Built on a Linux® kernel, EOS can be easily extended to implement new features such as integration with storage-array-specific management processes. Tight integration between the EqualLogic management firmware and EOS allows Arista switches to automatically detect when an EqualLogic SAN is connected and optimize the switch configuration accordingly. The process requires minimal manual intervention, which helps dramatically reduce the risk of human error and associated costs.

### Understanding the modular Arista EOS architecture

The key to EOS extensibility is its state-sharing architecture (see Figure 1). This architecture consists of multiple processes interacting with a central shared-state repository called Sysdb (short for system database), a design that separates the networking state from the actual processing.

Each switch function is in a separate address space, including command-line interface (CLI) sessions, hardware device drivers, and individual protocols such as the Open Shortest Path First (OSPF) routing protocol, Spanning Tree Protocol (STP), and Link Aggregation Control Protocol (LACP). Sysdb holds the state information, while agents implement the logic and perform the processing. Sysdb delivers state updates from one agent to another, and state information is recoverable from Sysdb when needed. Like a traditional database engine,

## Arista EOS: Open to extension

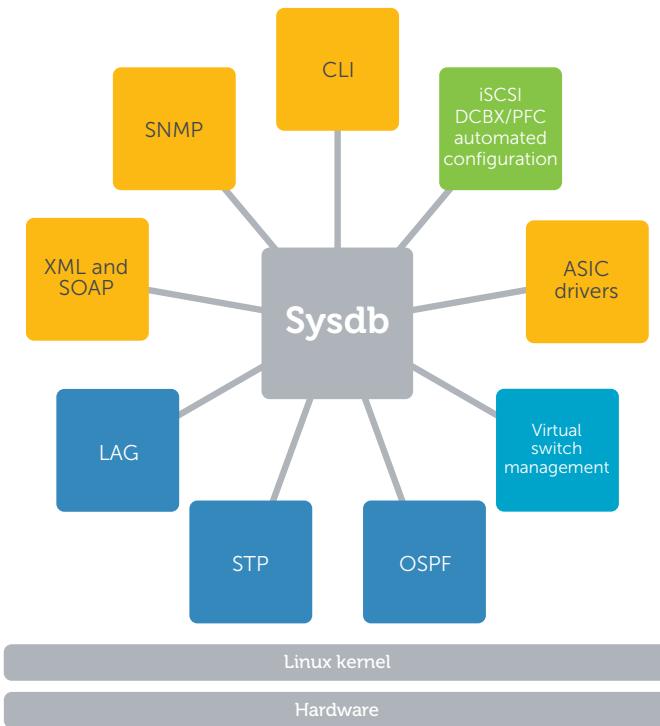
Adding functionality to network switches can be difficult for IT organizations or third parties. In the spirit of openness, the Sysdb programming model and application programming interface (API) set in the Arista Extensible Operating System (EOS) software is visible and available through a standard shell. This approach offers a number of advantages:

- The Sysdb API set is not a "walled garden" that includes only a limited subset of features; all APIs that Arista software developers use between address spaces within EOS are available to third-party developers and organizations using Arista switches.
- Developers can create third-party agents to customize switch behavior and automate common tasks such as deployment, monitoring, maintenance, and upgrades within specific IT environments.
- EOS has Linux shell access for root-level administrators, and makes a broad suite of Linux-based tools available (such as tcpdump and fping).
- The extensible EOS architecture enables enhanced capabilities with Dell EqualLogic PS Series storage arrays.

Sysdb is designed to be reliable because it contains no application code.

All interprocess communication in EOS is implemented as writes to Sysdb objects. These writes propagate to the appropriate agents, triggering events in those agents. For example, if a user-level application-specific integrated circuit (ASIC) driver detects a link-down state, it writes this to Sysdb. An LED driver would then receive an update from Sysdb and adjust the LED status to reflect the link-down state.

EOS helps provide reliable interprocess communication services while preserving the Linux heritage of openness and extensibility (see



**Figure 1.** Arista EOS architecture consisting of multiple processes interacting with the central Sysdb shared-state repository

the “Arista EOS: Open to extension” sidebar in this article). Protocol operation, management function, and device management—including hardware device drivers—run in user address spaces rather than in the kernel. Keeping the vast majority of processing out of the kernel helps to increase system stability and simplify extensibility. Adding a user process to a Linux-based platform can be simpler and safer than adding kernel-level code.

EOS implements Link Layer Discovery Protocol (LLDP) and the Data Center Bridging Capability Exchange (DCBX) protocol to help automate the configuration of Data Center Bridging (DCB) parameters, including the upcoming Priority-Based Flow Control (PFC) standard, which is expected to allow an end-to-end flow-control feature. DCBX is an extension of LLDP that allows storage arrays and switches to exchange capability parameters—coded in a type-length-value (TLV) format—and automatically negotiate common PFC parameters.

This feature enables a switch to recognize when it is connected to a Dell EqualLogic iSCSI SAN array and automatically configure the switch link parameters (such as priority flow control) to provide

optimal support for that array. DCBX can be used to prioritize the handling of iSCSI traffic to help ensure that packets are not dropped or delayed.

Using Arista’s application programming interface (API) set for Sysdb, administrators can create their own separate agents that can communicate with, read from, and write to Sysdb to implement additional functionality. These extensions are designed to be safe and reliable because the switch state is protected within Sysdb, and faults within the extensions are contained. Simple agents can be implemented to extend automation of the network configuration to include LACP groups or STP parameters.

## Deploying Arista EOS with Dell EqualLogic storage

Dell has developed best practices for infrastructure configuration that are designed to optimize Dell EqualLogic PS Series iSCSI SAN deployments. In particular, these best practices revolve around how the individual switches that make up that SAN are connected.

An Arista switch can configure an optimized storage infrastructure based on Dell best practices and organizational requirements. The switch software performs discovery and configuration in a three-step process:

### 1. Peer switch discovery and configuration:

Using DCBX/LLDP, the Arista fabric automatically discovers peer switches (see Figure 2). For typical SANs, an administrator must create a construct in the switch fabric called a link aggregation group (LAG), which is a group of individual ports on the switch that act as a single virtual link or port. Creating a LAG for these ports can be automated by implementing a simple EOS agent.

### 2. Storage array discovery and configuration:

Again using DCBX/LLDP, the Arista fabric automatically discovers the ports on the EqualLogic arrays. EqualLogic arrays and Arista switches both implement DCBX/LLDP, which allows the arrays to give the switches information about their capabilities. The configuration of appropriate settings for these ports is automated through DCBX, which

## [TOUGH QUESTION #3]

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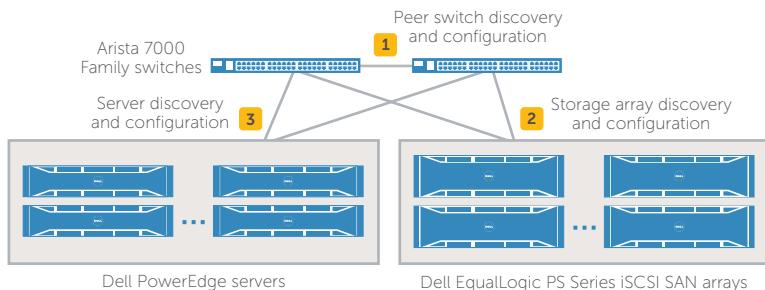
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**Figure 2.** Arista EOS three-step discovery and auto-configuration process for peer switches, storage arrays, and servers



automatically configures the appropriate settings for the PFC standard and gives priority to iSCSI traffic.

3. **Server discovery and configuration:** Ports with attached servers are discovered automatically. Based on the information obtained through DCBX/LLDP, some settings for the server links can be automatically changed by implementing a simple EOS agent.



## Enabling flexible networking for virtualization

Virtualization has introduced its own networking challenges for IT administrators. This video presents an extended overview of the Arista vEOS™ platform, an EOS implementation that integrates with the VMware vNetwork Distributed Switch feature to help maintain consistent operational models and policies across the environment.

[aristanetworks.com/  
media/system/video/  
AristavEOS\\_Detail.mov](http://aristanetworks.com/media/system/video/AristavEOS_Detail.mov)

## Assessing performance and scalability benefits

With up to 48 non-blocking 10GbE ports in just 1U of space, and 384 ports in an 11U form factor, the Arista 7000 Family of switches provides a high-performance, low-latency, space-efficient interconnect for 10GbE Dell EqualLogic PS Series iSCSI SAN arrays. Performance from the EqualLogic platform is optimized based on the switching architecture that suits the needs of the specific IT environment.

The combined EqualLogic and Arista architecture helps eliminate errors introduced during traditional network configurations, potentially saving many hours of troubleshooting and remediation time for IT staff while also helping to minimize downtime for end users. The savings in time and labor because of simplified management and automated optimization can help reduce the total cost of ownership of the SAN infrastructure.

This architecture also enables simplified scaling to petabytes of capacity. For example, the EqualLogic PS6000 series of arrays is designed to scale up to 24 TB of storage per unit of rack space, and the Arista 7000 Family of switches is designed to scale up to 1 Tbps of capacity per unit of rack space. This high density along with the automation features in the EqualLogic arrays and Arista switches

make it nearly as easy to deploy petabytes of storage as it is to deploy a single terabyte.

Finally, EqualLogic arrays and Arista switches can be combined in a power- and space-efficient way that helps reduce operating expenditures. Arista switches are designed to minimize power consumption, and the power supplies are designed for highly efficient operation. IT organizations can achieve high densities by taking advantage of the scalable capacity of the EqualLogic PS6000 arrays and the high port counts of the Arista switches.

## Optimizing the architecture for virtual environments

The combined Dell EqualLogic and Arista architecture provides a unified management framework for virtualized compute, networking, and storage resources. EqualLogic data management is optimized for virtualization, and the Arista Virtualized Extensible Operating System (vEOS) platform binds network policy configurations to storage and server links to help keep policies consistent.

Arista vEOS is an implementation of EOS that is designed to work with the VMware® vNetwork Distributed Switch feature. Working together with the VMware vSphere™ 4 platform, vEOS helps to increase workload mobility. It preserves the networking state and policy as virtual machines move around the data center and into the cloud, providing visibility and consistency between physical, virtual, and cloud networks. Using vEOS, administrators can treat virtual distributed switches as an extension of the physical network and can manage them using a CLI and Simple Network Management Protocol (SNMP).

Together, EqualLogic arrays and Arista 10GbE connectivity are well suited to high-bandwidth,

low-latency networking in today's increasingly virtualized data centers. The architecture supports efficient migration and replication to enhance the utilization, scalability, and flexibility of storage and server resources.

### Minimizing fixed overhead for infrastructure management

With its ability to scale storage capacity and bandwidth requirements, and to help simplify management across both physical and virtualized environments, the joint Dell EqualLogic and Arista platform offers organizations an automated, self-managing storage infrastructure. EqualLogic PS Series iSCSI SAN arrays can automate much of the day-to-day management of logical units (LUNs), volumes, and disks where data is physically located. This built-in intelligence helps reduce the amount of knowledge and time required to manage performance and monitoring, while

helping to ensure that the SAN is operating optimally for the application.

Integration with Arista EOS adds value to this design by further helping minimize the knowledge and time required for setup and helping ensure that the configuration is resilient and can automatically adjust to changes in the infrastructure. Just as EqualLogic arrays are designed to reduce the time and effort involved in storage management, an architecture that combines EqualLogic storage and Arista switches can reduce overall infrastructure management demands. 

### Learn more



#### Dell EqualLogic PS Series:

[dell.com/psseries](http://dell.com/psseries)  
[dell.com/equallogic](http://dell.com/equallogic)



#### Arista EOS:

[aristanetworks.com/en/products/eos](http://aristanetworks.com/en/products/eos)

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# Simplified monitoring of Dell EqualLogic storage with **Microsoft System Center**

By Viswanathan Balakrishnan, Stanley L. Stevens, Sekhar Duggirala, and Tom George

The Dell OpenManage™ Integration Suite for Microsoft® System Center offers a simplified way to incorporate Dell™ hardware into the System Center management framework. As part of this software portfolio, the Dell EqualLogic™ Storage Management Pack Suite extends this functionality to help administrators efficiently monitor EqualLogic storage.



## Dell EqualLogic Management Pack in action

Visit this Dell TechCenter page for a demonstration of monitoring Dell EqualLogic storage with Microsoft System Center Operations Manager.

[delltechcenter.com/page/system+center+operations+manager+demonstrations](http://delltechcenter.com/page/system+center+operations+manager+demonstrations)

**A**s enterprise data centers migrate toward increasingly consolidated infrastructures based on virtualization and cloud networks, monitoring and managing all data center components—including servers, storage, and switches—can become increasingly complex, time-consuming, and costly. When these considerations are placed alongside the goals of maximizing productivity, providing flexible access to IT resources, and maintaining 24/7 operations, the need for a comprehensive, integrated approach to systems management becomes clear.

The Microsoft System Center suite includes a range of management tools that enable IT professionals to plan, deploy, manage, and optimize physical and virtualized environments across data centers, desktops, and other devices. In environments using this systems management suite, administrators can take advantage of the Dell OpenManage Integration Suite for Microsoft System Center to incorporate Dell hardware

monitoring and management functionality into System Center.

The Dell OpenManage Integration Suite encompasses a comprehensive set of Dell Management Packs (MPs) and other tools designed to simplify and automate essential IT tasks, including the Dell Server MP Suite for Dell PowerEdge™ and PowerVault™ servers, Dell Remote Access Controllers (iDRACs) and Integrated DRACs (iDRACs), and Dell Chassis Management Controllers (CMCs); the Dell Client MP for Dell business client systems; the Dell Printer MP for Dell printers; the Dell PowerVault MD Storage Arrays MP Suite for Dell PowerVault MD Series storage arrays; and the Dell EqualLogic Storage MP Suite for Dell EqualLogic PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays.<sup>1</sup> Available as software downloads at no additional cost, these tools integrate directly with System Center applications to deliver end-to-end management and monitoring functionality for supported Dell hardware. Through the Dell OpenManage

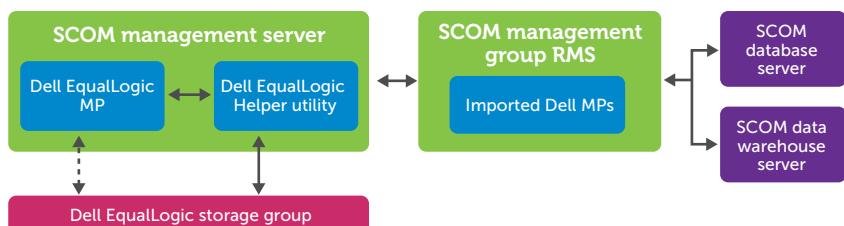
<sup>1</sup>For more information, see "Unified Monitoring and Proactive Management of Dell Hardware with Microsoft System Center," by Viswanathan Balakrishnan, Saravan Kumar, Mahendran P., and Vignesh Pandian, in *Dell Power Solutions*, 2010 Issue 1, [dell.com/downloads/global/power/ps1q10-20100177-balakrishnan.pdf](http://dell.com/downloads/global/power/ps1q10-20100177-balakrishnan.pdf).

Integration Suite, administrators can select and download individual tools as needed, without having to purchase a prescribed package of tools that may not be necessary in their specific environment.

As part of the Dell OpenManage Integration Suite for Microsoft System Center, the Dell EqualLogic Storage MP Suite enables IT administrators to discover, classify, inventory, and monitor Dell EqualLogic PS Series arrays—including the latest 10 Gigabit Ethernet EqualLogic PS6010 and EqualLogic PS6510 arrays—using System Center Operations Manager (SCOM) or System Center Essentials (SCE). SCOM is typically suitable for use in large, enterprise-class environments, while SCE 2010 is designed for midsize organizations with up to 50 servers and 500 client systems and provides a unified console for managing physical and virtual servers, clients, network devices, software, and IT services; in this article, *Operations Manager* is used to refer generically to both SCOM and SCE. In conjunction with System Center and the other tools in the Dell OpenManage Integration Suite, the EqualLogic Storage MP Suite offers a way for administrators to incorporate their EqualLogic arrays into a comprehensive framework for efficient IT management.<sup>2</sup>

### Dell EqualLogic Storage MP Suite installation and architecture

The Dell EqualLogic MP installer is designed to perform all necessary installation tasks other than importing the MP into the Operations Manager management server, helping simplify initial deployment for IT administrators. This process includes installing the internal Dell EqualLogic Helper utility, which the MP uses to discover and monitor EqualLogic PS Series arrays. The EqualLogic Helper files are not installed on Microsoft Windows® client operating systems. After the installation is complete, administrators can customize the MP using overrides available for various unit monitors for EqualLogic group discovery and component-level monitoring to help meet their specific needs and data center policies.



**Figure 1.** Example Dell EqualLogic Storage MP Suite architecture in a large-scale data center

Figure 1 shows an example EqualLogic Storage MP Suite architecture in a large-scale data center. This infrastructure would comprise a SCOM root management server (RMS); device-specific SCOM management servers that monitor various Dell devices, including a dedicated, device-specific management server for monitoring the EqualLogic arrays; a SCOM database server; and a SCOM data warehouse server.

After the EqualLogic MP has been imported into Operations Manager, administrators can discover the EqualLogic arrays by performing an out-of-band Simple Network Management Protocol (SNMP) v2c-based discovery using the EqualLogic management port IP address (which may be either the group IP address or the dedicated management port IP address). Operations Manager can then monitor the SNMP-based hardware traps of the discovered EqualLogic group and classify the arrays in the Operations Manager alert view, enabling administrators to proactively view and manage the resulting hardware alerts. The MP provides a separate view in the Operations Manager console showing alerts related to possible impending failures, including cause and resolution information to help administrators troubleshoot the arrays by launching the EqualLogic console and/or physically accessing the array. The MP also verifies that discovered arrays have firmware versions of 4.x.x or higher, and generates alerts listing the IP addresses of groups with members that do not meet this requirement.

As part of the MP monitoring functionality, monitored arrays are represented with various

<sup>2</sup>The Dell EqualLogic Storage MP Suite is available for download at support.us.dell.com/support/downloads/format.aspx?releaseid=R266477. For a list of supported EqualLogic arrays and detailed functionality provided by the EqualLogic MP, see the documentation available at support.dell.com/support/edocs/software/smconnect/msscom/40eqlmp.



# Simplifying storage monitoring and management

Dell EqualLogic PS Series arrays provide the advantages of consolidated networked storage in a self-managing Internet SCSI (iSCSI) storage area network (SAN) designed for simplicity and cost-effectiveness even in large-scale deployments. By helping to eliminate complex tasks and enabling fast, flexible storage provisioning, these arrays can help dramatically reduce the costs of storage acquisition and ongoing operations. These fault-tolerant, fully redundant arrays include software features enabling administrators to virtualize, optimize, and protect their data, while avoiding the management hassles that can come with multiple software licenses or support contracts. Organizations can also add a yearly support contract that enables them to implement new software features and enhancements as they become available, extending the value of their hardware investment.

In environments that include EqualLogic arrays, administrators can take advantage of a comprehensive suite of software options to help simplify storage management, enable advanced functions, and support virtualized storage and best-practice data protection, including the following tools:

- **EqualLogic PS Group Manager:** This simple, intuitive, unified storage management and provisioning tool allows administrators to remotely manage virtually any aspect of their EqualLogic SANs using a Web browser-based interface, helping eliminate the need for a dedicated management workstation or server. In addition to using this graphical interface, administrators can manage arrays using a scriptable command-line interface over Secure Shell (SSH) and Telnet. Standard features include built-in monitoring and notifications through e-mail, syslog support, and comprehensive Simple Network Management Protocol (SNMP) monitoring and traps.
- **Enclosure Monitoring System (EMS):** EMS provides the real-time status of EqualLogic array components such as power supplies, controllers, fan trays, disk drives, and network interface ports. It allows administrators to quickly recognize, report, and address component faults and failures without downtime, helping maintain system availability.
- **SAN HeadQuarters (SAN HQ):** Administrators can use SAN HQ to monitor EqualLogic arrays, pools, and groups from a single location. This centralized tool supports performance, alarm, and health monitoring as well as historical reporting to assist with operational planning, trend analysis, and troubleshooting. Flexible viewing options range from high-level group summaries to sophisticated analyses, including detailed statistics on performance, latency, capacity, volumes, and network activity. Predefined and customized views enable administrators to select their preferred method of accessing information.

components, including a Controllers group for controllers, a Physical Disks group for hard disks, a Network Interfaces group for Ethernet interfaces, a Power Supply group for power supplies, and a Sensors group for temperatures and fans. This feature enables administrators to monitor an assortment of EqualLogic array components as individual field replaceable units (FRUs). In addition, the diagram view shows a Volumes group that includes the volume information associated with the arrays, enabling administrators to narrow down specific impending hardware failures and take appropriate action. Components in the diagram view are represented hierarchically for specific EqualLogic groups under the common Dell Hardware group, which includes the global health status of all Dell hardware presented by the base Dell MP. By default, the MP's component-level discovery cycle is set to one day and the health monitoring cycle is set to approximately one hour; administrators can customize these periods using configuration overrides.

The EqualLogic PS Group Manager tool is a natural extension of the EqualLogic MP, in that it enables storage administrators to easily provision storage, schedule replication, and carry out comprehensive array management, including critical hardware components of the EqualLogic arrays. A key feature within Group Manager is the Enclosure Monitoring System (EMS), which tracks the health of redundant components such as power supplies, controllers, fan trays, disk drives, and network interface ports. Leveraging SNMP-based hardware alerts, EMS through Group Manager can notify administrators that a component has reached a "warning" or "critical" level, thus enabling a proactive approach to managing component failures. (For more information on EMS and other EqualLogic management tools, see the "Simplifying storage monitoring and management" sidebar in this article.)

## Flexible views for storage monitoring

Different Dell MPs categorize Dell hardware into Dell-specific groups, which could include Dell EqualLogic PS Series storage arrays, Dell PowerVault MD Series storage arrays, Microsoft Windows-based Dell servers and clients, DRACs, CMCs, and Dell printers. Status monitoring for

Dell systems includes Dell-specific alerts and pre-failure alerts. Administrators can also launch specific Dell instrumentation consoles from the Operations Manager console to perform granular problem-solving analysis and enable effective systems management.

The Dell EqualLogic MP presents the following views in Operations Manager:

- Alert views:** Alert views present specific alerts generated by Dell hardware. In the case of the EqualLogic MP, alerts are displayed for SNMP hardware events received from the monitored arrays, along with cause and resolution information to assist with troubleshooting (see Figures 2 and 3). Administrators can also add custom fields for group- and member-related information to help them track down alerts that have come from a specific array.
- Diagram views:** Diagram views provide a holistic, graphical representation of hardware devices and logical device groups (see Figure 4). Administrators can further drill down the hierarchy to monitor arrays and other hardware at a granular level. This view includes realistic, component-specific icons for various FRU components in the EqualLogic arrays. In a data center environment where administrators are using both the EqualLogic MP and the MD Series Storage Array MP, this view can also visually classify EqualLogic and PowerVault MD Series storage arrays using distinctive icons to help administrators easily identify these arrays.
- State views:** State views display health status based on the event and status poll information reported by the hardware (see Figure 5). The EqualLogic MP provides a list of severity-level indicators along with detailed inventory information to help administrators monitor and manage their arrays. By default, the Operations Manager alert mapping is "OK," "warning," and "critical"; the various states of the hardware alerts from the EqualLogic array, like "unknown" and "warning," are modeled as "warning" because of the Operations Manager state representation.
- Detail views:** Within the alert, diagram, and state views, administrators can select an individual EqualLogic group to view specific information

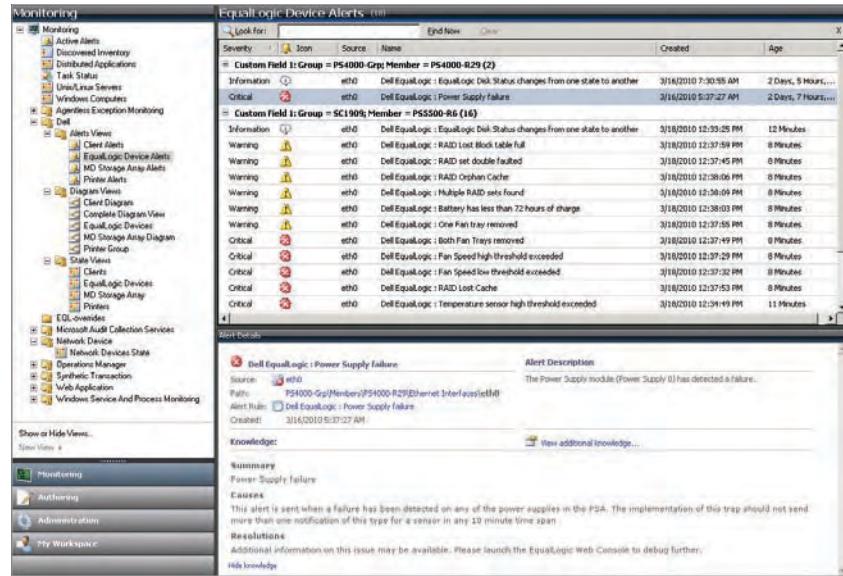


Figure 2. Alert view for Dell EqualLogic arrays in Microsoft System Center Operations Manager 2007 R2

Dell EqualLogic alert name	Dell EqualLogic MP severity definition in Operations Manager
1 RAID set double faulted	Warning
2 One fan tray removed	Warning
3 RAID lost block table full	Warning
4 Battery has less than 72 hours of charge	Warning
5 RAID orphan cache	Warning
6 Multiple RAID sets found	Warning
7 Incorrect controller module inserted	Warning
8 Low ambient temperature	Warning
9 Ops panel missing or broken	Warning
10 Enclosure is open for a long time	Warning
11 EqualLogic disk status changes from one state to another	Informational
12 Temperature sensor high threshold exceeded	Critical
13 Temperature sensor low threshold exceeded	Critical
14 Fan speed high threshold exceeded	Critical
15 Fan speed low threshold exceeded	Critical
16 Power supply fan failure	Critical
17 Power supply failure	Critical
18 Both fan trays removed	Critical
19 RAID lost cache	Critical
20 NVRAM battery failed	Critical
21 Critical hardware component failed	Critical
22 EMM link failure	Critical
23 High battery temperature	Critical
24 Both the Sumo channel cards missing	Critical
25 EIP failed in Sumo	Critical
26 Both the Sumo channel cards failed	Critical

Figure 3. SNMP-based Dell EqualLogic hardware alerts and severity definitions

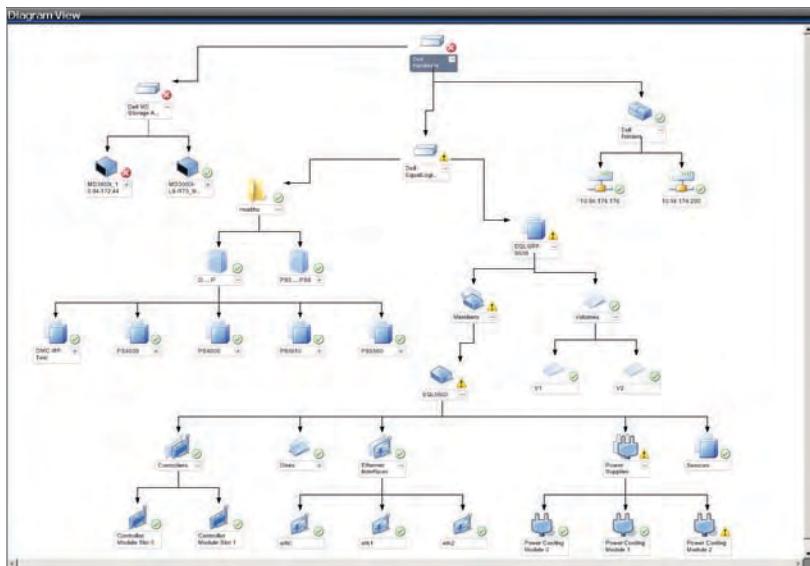


Figure 4. Diagram view of Dell EqualLogic arrays and other hardware in Microsoft System Center Operations Manager 2007 R2

The screenshot shows the Microsoft System Center Operations Manager 2007 R2 interface. On the left, the 'Monitoring' pane is open, showing various alert categories like Agentless Exception Monitoring, Dell Alerts, and EqualLogic Devices. The main area displays a table titled 'EqualLogic Devices' with 19 rows. The table includes columns for State, Name, Path, Volumes Group, and Members Group. The 'Name' column lists devices such as 'DMC-MP-Test', 'EQLGRP-5500', 'EQLGRP-5500', 'P54000', 'P54000', 'P54000-Grp', 'P55010', 'P5500', 'P56000', 'P56010', 'P56510', 'P56510', 'SC1909', 'SC1910', 'SC1911', 'SC1913', 'SC1914', and 'SC1915'. The 'State' column indicates the health status of each device. The bottom pane shows a 'Detail View' for the 'Dell EqualLogic Member Group properties of P55010'.

Figure 5. State view of Dell EqualLogic arrays in Microsoft System Center Operations Manager 2007 R2

on that group and its members. The component attributes in these detail views have been selected to provide information that would be useful to administrators from a hardware management perspective.

To provide comprehensive details on monitored arrays and enable administrators to troubleshoot their arrays, the EqualLogic MP also includes a Launch EqualLogic Console task within Operations Manager that administrators can use to launch the Web browser-based EqualLogic PS Group Manager console.

### Unified monitoring and management infrastructure

Microsoft System Center is designed to support a comprehensive hardware monitoring and management infrastructure. As part of the Dell OpenManage Integration Suite for Microsoft System Center, the Dell EqualLogic Storage MP Suite enables administrators to incorporate their EqualLogic PS Series iSCSI SAN arrays into a SCOM or SCE management server console alongside other Dell hardware. Taking advantage of this unified approach can help IT departments respond quickly to hardware alerts while simplifying management of the environment as a whole. 

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**Tom George** is a software development engineer analyst on the Dell Partner Engineering Team involved in integration development for Microsoft System Center.

### Learn more



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# Boost storage consolidation

## with Blue Coat WAN Optimization and Dell PowerVault appliances

By George Sadler and Suresh Jasarasaria

Deduplication, compression, and bandwidth enhancement technologies available in Dell™ PowerVault™ DL2100 backup and Blue Coat® ProxySG® WAN Optimization appliances can alleviate stress on networks—helping organizations enhance data protection and application recovery at remote or branch offices.

**D**emand for increased storage, fueled by exponential data growth, can result in storage sprawl that can be difficult to manage at both remote or branch office (ROBO) and central data center locations. ROBO locations, in particular, often do not have full-time IT personnel, and the staff may not have expertise in managing storage and performing backup and recovery operations. These constraints can put ROBO data particularly at risk of loss or noncompliance with regulatory requirements.

Storage consolidation can be a key strategy for overcoming data protection and management challenges at ROBO locations. Consolidation enables administrators to store data at ROBOs on a single system, and storage can then be replicated to a centralized repository for data protection, retention, and analysis—helping alleviate the need for ROBO IT personnel to perform complicated data protection and management tasks.

Although storage consolidation at ROBO locations can offer many benefits, the cost and

availability of high-bandwidth lines coupled with high latency in wide area network (WAN) connectivity can present serious challenges to a storage consolidation strategy for ROBOs. Deploying limited bandwidth between a ROBO and a central data center can constrain storage consolidation at the ROBO—for example, the amount of time it takes to replicate consolidated data from the ROBO to the central location can be larger than the recovery point objective (RPO) of the organization, and the amount of time it takes to restore consolidated ROBO data from the central data center may be larger than the recovery time objective (RTO) of the organization, thus jeopardizing application recoverability at the ROBO. Such WAN constraints can be especially pronounced in ROBOs with a large number of users or high data change rates. Fortunately, emerging technologies such as data deduplication, data compression, and bandwidth optimization can alleviate stress on WANs, enabling organizations to boost ROBO storage consolidation with reduced WAN traffic.

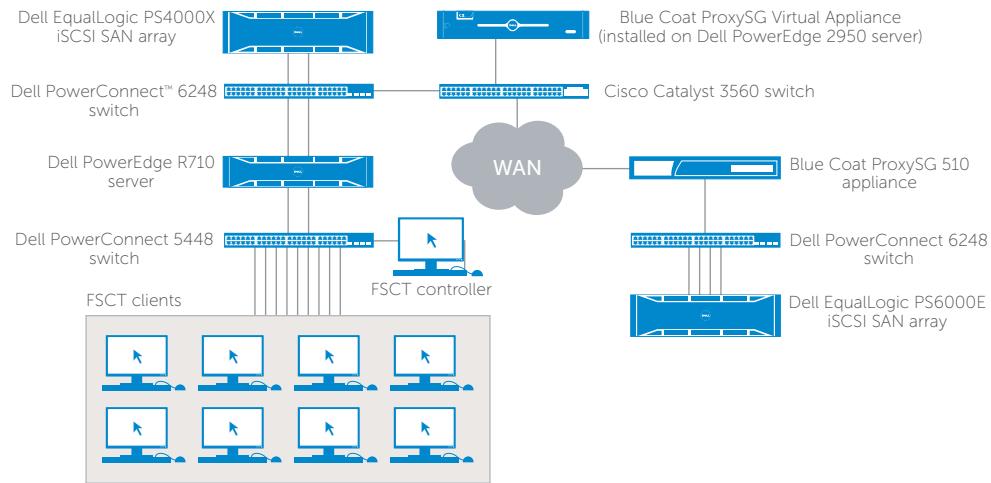


Figure 1. Test configuration for the low-change-rate environment

To help organizations implement a successful, scalable ROBO storage consolidation strategy, Dell and its partners offer a range of storage arrays and appliances—including Dell EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays, Dell PowerVault DL2100 backup appliances, and Blue Coat ProxySG WAN Optimization appliances. EqualLogic arrays enable storage consolidation at remote sites and support automated replication to a centralized location, providing an excellent foundation for implementing a storage consolidation strategy. PowerVault DL2100 backup appliances offer built-in data deduplication and compression features that help to significantly reduce WAN traffic and provide reliable, fast local recovery at remote sites. And Blue Coat ProxySG appliances offer advanced features for optimizing WAN connectivity, including data deduplication, data compression, and network protocol enhancements designed to further reduce WAN traffic to meet an organization's RPO and RTO objectives with minimum network bandwidth. In fact, benchmark testing has shown that adding a Blue Coat ProxySG WAN Optimization appliance in an existing configuration can enable ROBOs to support up to five times more users (see the "Benchmarking replication and backup performance" section in this article).

Organizations can take advantage of these appliances to both enhance data protection and application recovery through storage consolidation, and overcome WAN constraints

because of limited-bandwidth deployments between a ROBO and a central office. By implementing a storage consolidation strategy based on EqualLogic PS Series storage arrays, PowerVault DL2100 backup appliances, and Blue Coat ProxySG WAN Optimization appliances, they can create reliable, scalable storage consolidation and data protection and recovery for their ROBOs—enabling them to streamline data management, ensure regulatory compliance, and meet organizational RPO and RTO requirements.

### Designing a consolidated storage infrastructure

A storage consolidation strategy based on Dell EqualLogic PS Series iSCSI SAN arrays helps remove the burden of data protection and regulatory compliance from ROBOs. Implementing an appropriate configuration, however, depends on factors such as number of remote users or data change rates, and available WAN bandwidth and latency.

ROBOs with a low data change rate or a small number of users as well as a connection to the central data center with adequate bandwidth and latency may be able to use a storage consolidation strategy based on EqualLogic arrays alone, using the built-in remote replication functionality included at no additional cost. A typical deployment might include EqualLogic PS4000 series arrays for storage consolidation at ROBO locations connected to a central data

center approximately 2,000 miles away (40 ms round-trip latency) over a 5 Mbps connection. In such a deployment, the ROBO EqualLogic PS4000 array would replicate the changed data every hour, a typical RPO objective, to an EqualLogic PS6000 series array at the central data center for data protection, retention, and analysis.

ROBOs with a high data change rate or a large number of users with a limited-bandwidth connection to a central data center—or organizations that require extremely fast, local disaster recovery (very small RTO)—have the option of using a storage consolidation strategy that combines EqualLogic PS Series arrays with Dell PowerVault DL2100 backup appliances. PowerVault DL2100 backup appliances include built-in compression and data deduplication features designed to avoid backup of redundant files, attachments, and documents and help reduce backup storage requirements—which in turn can dramatically reduce WAN traffic associated with remote data protection and recovery. A typical deployment for such ROBO locations might include EqualLogic PS4000 series arrays for storage consolidation with PowerVault DL2100 backup appliances for local backup and quick recovery. In such a deployment, the ROBO PowerVault DL2100 backup appliance would deduplicate, compress, and replicate the changed data every hour, a typical RPO objective, to an additional PowerVault DL2100 backup appliance at the central site over a limited-bandwidth connection (for example, a 5 Mbps connection with a 40 ms round-trip latency) for data protection using CommVault® Simpana® backup software.

## Optimizing WAN performance

To further enhance the effectiveness of WAN connections associated with data protection and recovery, or to help scale ROBO data growth and consolidation, organizations can add Blue Coat WAN Optimization. Blue Coat ProxySG appliances—available as either physical (hardware) or virtual (software running in a dedicated server or virtual machine) implementations—use a specific combination of the following technologies to enhance WAN effectiveness:

- **Byte caching:** Helps reduce network traffic by observing repetitive patterns in network traffic,

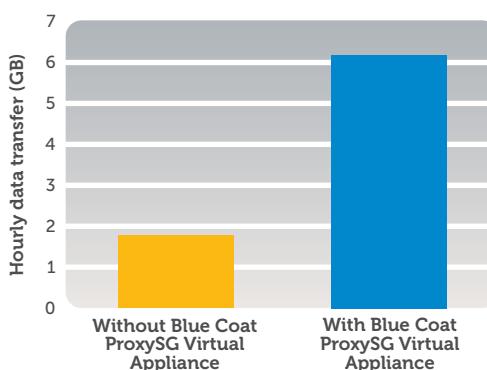
symbolizing those patterns as tokens and then sending tokens in lieu of bulky traffic

- **Object caching:** Can lighten network traffic even further by caching entire application-specific objects
- **In-line compression:** Complements caching by helping to reduce data over the wire
- **Protocol optimization:** Can utilize a variety of optimization techniques to enhance the efficiency of WAN network protocols such as TCP, iSCSI, HTTP, HTTP over Secure Sockets Layer (HTTPS), and Common Internet File System (CIFS)
- **Bandwidth management:** Helps partition application traffic and allocate bandwidth to applications based on priority

Adding a Blue Coat ProxySG appliance to a storage consolidation configuration based on Dell EqualLogic arrays alone or on Dell EqualLogic arrays combined with Dell PowerVault DL2100 backup appliances can help dramatically increase backup and recovery performance over existing WAN connections. Enhanced WAN effectiveness, in turn, enables organizations to scale ROBOs without necessarily having to purchase additional WAN bandwidth. In addition, when ROBOs do not use local storage and run critical business applications like e-mail or enterprise resource planning (ERP) software over a WAN using remote desktops, a Blue Coat ProxySG appliance can help increase application performance while reducing WAN costs.

## Benchmarking replication and backup performance

To illustrate the benefits of adding Blue Coat WAN Optimization to a storage consolidation



## Blue Coat acceleration demo

This video overview of Blue Coat WAN Optimization includes a detailed discussion of specific use cases as well as demonstrations of the Blue Coat dashboard interface.

[dc.bluecoat.com/?elqPURLPage=510](http://dc.bluecoat.com/?elqPURLPage=510)

Figure 2. Replication results for the low-change-rate environment with and without Blue Coat ProxySG WAN Optimization



deployment, in April 2010 Principled Technologies conducted Dell-commissioned benchmark tests on various ROBO configurations.<sup>1</sup> In particular, these tests were designed to determine the advantages of various remote replication and backup technologies for ROBO data protection to a central office across a WAN. Configurations with and without a Blue Coat ProxySG physical appliance and a Blue Coat ProxySG Virtual Appliance were tested.

These tests used the Microsoft® File Server Capacity Tool (FSCT) with the HomeFolders workload to simulate typical ROBO data change rates in two example configurations—one based on a low data change rate and the other based on a high data change rate. FSCT simulates file server activity, and includes typical operations such as deleting, navigating, and moving files using Windows® Explorer and editing, saving, closing, and opening files with Microsoft Office software such as the Word, Excel®, and PowerPoint® applications. A typical WAN bandwidth of 5 Mbps and a ROBO at a distance of approximately 2,000 miles (round-trip delay of 40 ms) were used in all tests.

### Low data change rate

The test configuration illustrated in Figure 1 simulated a ROBO with a low data change rate. This ROBO configuration consisted of one Dell PowerEdge™ R710 rack server for file sharing, one Dell EqualLogic PS4000X iSCSI SAN array for primary storage and local backup, and one Blue Coat ProxySG Virtual Appliance installed on a PowerEdge 2950 server for WAN optimization. A Cisco Layer 3 switch was used for redirecting traffic to the Blue Coat ProxySG Virtual Appliance using Web Cache Communication Protocol (WCCP). The central office configuration consisted of one Blue Coat ProxySG 510 hardware appliance for WAN optimization and one Dell EqualLogic PS6000E array for off-site data protection.

The test first ran the FSCT benchmark at the ROBO with 150 users for four hours to create a baseline data set on the EqualLogic PS4000X array. This baseline data set was then replicated to the EqualLogic PS6000E array using EqualLogic replication. To evaluate ROBO data protection performance for a range of users, the test then restarted and ran FSCT with user counts ranging from 10 to 150,

increasing the user count progressively every other hour.

Backups were performed every hour, a typical RPO for ROBOs, where the amount of data replicated to the central location each hour was equal to the amount of data that changed in the hour preceding the backup and replication. The tests were performed both with and without the Blue Coat ProxySG Virtual Appliance.

Figure 2 shows the results. The configuration without the Blue Coat ProxySG Virtual Appliance was able to support up to 1.85 GB of user changes in less than one hour, while the configuration with the Blue Coat ProxySG Virtual Appliance was able to support up to 6.07 GB of user changes in less than one hour—a more than threefold increase in effective network bandwidth due to Blue Coat WAN Optimization.

### High data change rate

This test was designed to illustrate WAN optimization in a ROBO with a high data change rate when using a Blue Coat ProxySG 510 hardware appliance (see Figure 3). The ROBO configuration consisted of one Dell PowerEdge R710 rack server for file sharing, one Dell EqualLogic PS4000X array for primary storage, one Dell PowerVault DL2100 backup appliance for local backup, and one Blue Coat ProxySG 510 hardware appliance for WAN optimization. The central office configuration consisted of one Dell PowerVault DL2100 backup appliance for off-site data protection and one Blue Coat ProxySG 510 hardware appliance for WAN optimization.

The test first ran the FSCT benchmark at the ROBO with 500 users for four hours to create a baseline data set on the EqualLogic PS4000X array. This baseline data set was backed up to the remote PowerVault DL2100 appliance and then replicated to the centralized PowerVault DL2100 appliance using CommVault Simpana backup software with continuous data replication. To evaluate

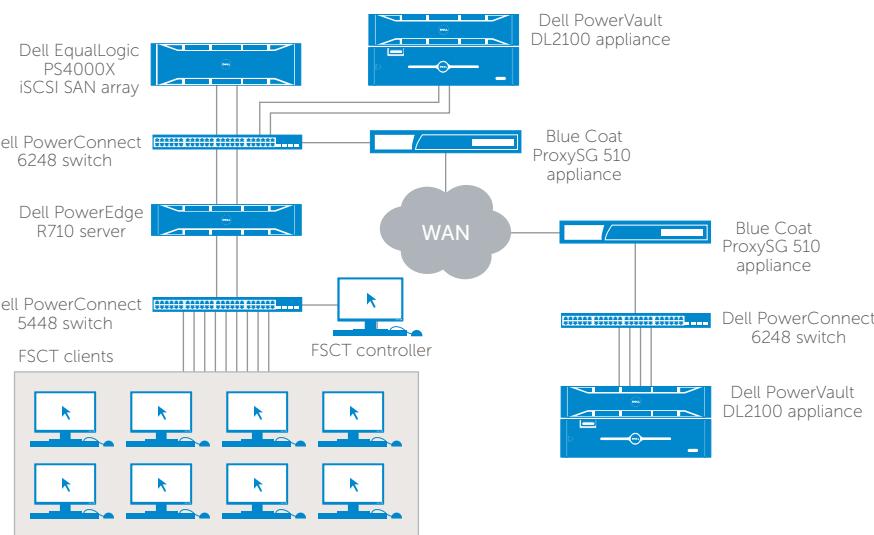


Figure 3. Test configuration for the high-change-rate environment

<sup>1</sup>For the complete report, including detailed information on the test environment, benchmark workloads, methodology, and results, see "Dell PowerVault DL2100 and Dell EqualLogic PS Series Remote Office/Branch Office Data Replication with Blue Coat ProxySG WAN Optimization," by Principled Technologies, April 2010, [principledtechnologies.com/clients/reports/dell/dl2100robowithbluecoat.pdf](http://principledtechnologies.com/clients/reports/dell/dl2100robowithbluecoat.pdf).

ROBO data protection performance for a range of users, the test then restarted and ran FSCT with user counts ranging from 30 to 500, increasing the user count progressively every other hour.

As in the low-change-rate test, backups were performed every hour, and the amount of data replicated to the central location each hour was equal to the amount of data that changed in the hour preceding the backup and replication. The tests were performed both with and without the Blue Coat ProxySG 510 appliances.

Figure 4 shows the results. The configuration without the Blue Coat ProxySG 510 appliances was able to support up to 1.75 GB of user changes in less than one hour, while the configuration with the Blue Coat ProxySG 510 appliances was able to support up to 9.19 GB of user changes in less than one hour—a more than fivefold increase in effective network bandwidth due to Blue Coat WAN Optimization.

### Boosting storage consolidation and scalability for remote or branch offices

A storage consolidation strategy based on Dell EqualLogic PS Series iSCSI SAN arrays helps organizations to streamline data management and ensure reliable data protection and recovery. The powerful deduplication, compression, and network optimization technologies available with Dell PowerVault DL2100 backup appliances and Blue Coat ProxySG WAN Optimization appliances help

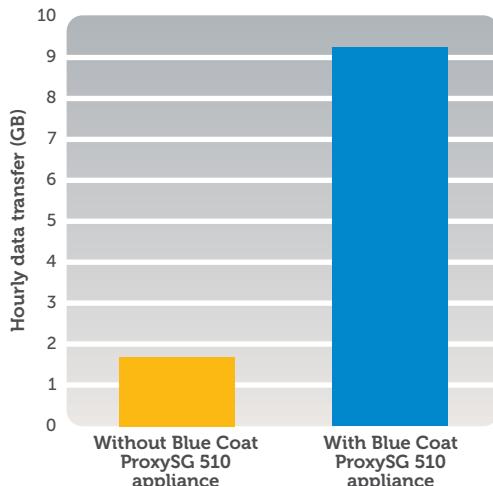


Figure 4. Replication results for the high-change-rate environment with and without Blue Coat ProxySG WAN Optimization



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**Suresh Jasrasaria** is a product marketing senior consultant in the Dell Enterprise Storage Product Group, and has worked in the data storage industry for more than 20 years.

organizations overcome WAN bandwidth limitations to enhance data protection and application recovery. By boosting storage consolidation scalability in this manner, organizations can enhance the performance of their data protection and recovery at ROBOs to help facilitate regulatory compliance, streamline IT management, and meet RPO and RTO service-level agreements. 

#### Learn more



##### Dell EqualLogic PS Series:

[dell.com/psseries](http://dell.com/psseries)  
[dell.com/equallogic](http://dell.com/equallogic)



##### Blue Coat ProxySG:

[bluecoat.com/products/sg](http://bluecoat.com/products/sg)

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# F5 ARX file virtualization and Dell storage

By Renny Shen

F5® ARX® Series intelligent file virtualization devices and Dell™ storage help simplify management by enabling flexible data mobility, while automated data management policies help to reduce costs, lower IT overhead, and enhance productivity.



## File virtualization at the Dell TechCenter

This post from the Dell TechCenter wiki gives a quick rundown on the advantages of F5 ARX file virtualization in enterprise IT environments—including reduced storage costs, optimized backups, and nondisruptive data migrations.

[delltechcenter.com/page/file+virtualization+with+f5](http://delltechcenter.com/page/file+virtualization+with+f5)

**T**he torrid rate of growth in file data is elevating the strategic importance of smart data management in the eyes of IT professionals. Businesses and other organizations are generating data faster and retaining it for longer than ever—but in many environments, the traditional strategy of constantly adding capacity no longer scales well enough to handle this accelerated growth. Bridging the gap between rapid data growth and constrained IT budgets, Dell and F5 Networks have partnered to help organizations build dynamic storage infrastructures that can simplify management and offer breakthrough storage economics.

File virtualization using F5 ARX Series devices provides the foundation for flexible data mobility, while automated management policies intelligently move files based on data value. This combination of nondisruptive file movement and automation can help organizations make the most of their investment in—and leverage the cost and management advantages of—Dell file storage systems.

### Understanding the impact of data growth on storage

Data growth stresses the storage infrastructure in many ways, but the capacity cost required to

sustain that growth is generally paid the greatest attention. Storage is often the largest line item in the IT budget, and the rate of data growth can exceed that of budget growth, often dramatically. But behind the balance sheet, the lack of data mobility can contribute as much to rising storage costs as data growth. Moving data is a disruptive task, making it difficult to match data to the most cost-effective or efficient location.

One common attribute of many high-growth environments is the high ratio of inactive data to active data. As organizations retain data for extended periods, a growing percentage of it is no longer actively accessed or modified. The logical next step would be to move that inactive data to lower-cost storage, but the operational cost of doing so can be prohibitive. Aside from the IT resources needed to continually identify which files are inactive, the act of physically moving those files can be disruptive: when users and applications are statically mapped to specific storage resources, moving data to a different resource can break those mappings and cause downtime.

Another critical, yet often overlooked, aspect of data growth is its inconsistent nature. Because data sets grow at different rates and those rates typically change over time, it is extremely difficult

**“F5 ARX Series devices provide a rich set of automated policies that govern the movement of individual files customized to how specific organizations intend to deploy and optimize their available storage capacity.”**

to predict which storage resources will need additional capacity and which will have excess capacity. Here, once again, a lack of data mobility hampers effective growth management by making it hard to share capacity across storage resources or to migrate data between resources to balance utilization levels. As a result, organizations are often forced to deploy more capacity than they really need, while existing capacity goes unclaimed.

#### Enabling data mobility

F5 ARX Series intelligent file virtualization devices can play a crucial role in addressing these data mobility challenges. File virtualization is designed to abstract the physical storage layer and decouple the physical relationship between clients and storage resources. The key feature that facilitates this decoupling is the global namespace—essentially a collection of virtual Common Internet File System (CIFS) shares and Network File System (NFS) exports presented by the ARX device. With file virtualization, clients mount these logical or virtual shares and exports to access their data, instead of mapping to the physical storage devices directly.

Because user and application clients mount virtual shares and exports, they are no longer exposed to the physical location of their data. This approach enables ARX devices to move data between different physical locations without changing how clients logically access data. In a sense, the device acts like a file router, keeping track of the current location of each file and routing logical access through virtual shares to the appropriate physical location.

The in-line placement of ARX devices between client systems and storage also makes

them well suited for providing and enforcing data management policies. The devices provide a rich set of automated policies that govern the movement of individual files customized to how specific organizations intend to deploy and optimize their available storage capacity, including the following:

- **Data migrations:** Migrations occur for a variety of reasons, and can include planned events such as consolidations, upgrades, and technology refreshes as well as unplanned events such as re-provisioning capacity. Virtualized file storage enables organizations to flexibly move data as needed without affecting user or application access. Data migration policies help reduce the amount of up-front

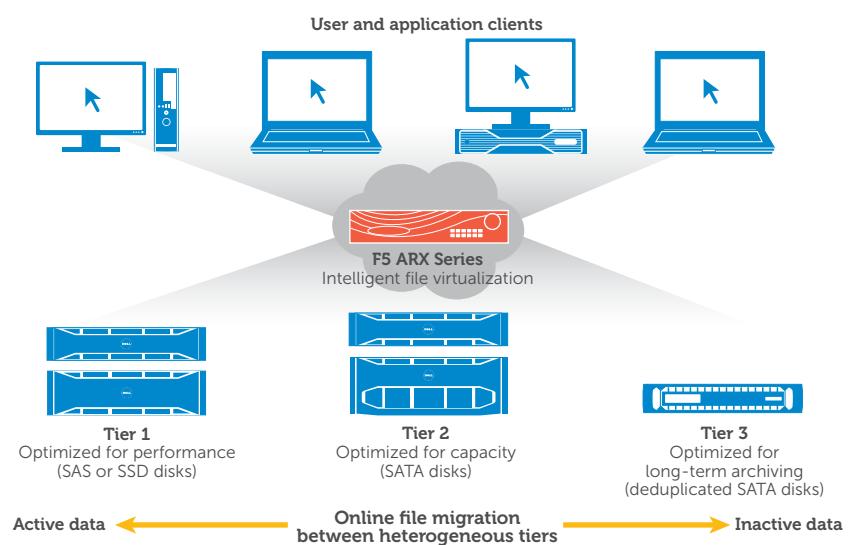


Figure 1. Automated storage tiering with F5 ARX Series intelligent file virtualization and Dell storage



## “F5 ARX Series devices and F5 Data Manager software can help organizations realize the cost and management advantages of Dell file storage systems.”

planning, time, and IT overhead required, even when performing complex migrations and restructuring file system layouts.

- **Storage tiering:** Storage tiering helps organizations align the cost of storing data with their limited IT budgets. The basic premise is to match different classes of data with the most appropriate type of storage. Many organizations have already implemented tiering at the block level using storage such as Dell EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays, or on a per-application basis. ARX devices provide automated storage tiering policies that take advantage of the inherent business context of each file to help determine the most appropriate place to store it—active or high-value data on high-performance storage, and inactive or low-value files on lower-cost storage. When inactive data represents a large percentage of all data under management, storage tiering can be a huge source of cost savings. In addition, organizations can now apply different backup policies to tiers with active and inactive data to help reduce backup windows and media consumption.
- **Capacity balancing:** Capacity balancing combines multiple file storage resources into a virtual storage pool. Similar to the capabilities of Dell EqualLogic PS Series storage between different arrays at the block level, virtual file systems presented through ARX devices can utilize storage capacity from different back-end file storage resources—allowing organizations to reclaim stranded capacity from underutilized storage and redeploy it where data is growing.

Automated policies can balance file placement across multiple storage resources for consistent aggregate utilization.

Although the lack of data mobility hampers the ability of organizations to respond to data growth, enabling data mobility by itself is not enough to do so effectively. Effective data management must be a repetitive process of optimizing how and where storage capacity is most efficiently and cost-effectively deployed.

F5 Data Manager software can help organizations understand their changing data storage requirements by providing customized reporting on file storage and data characteristics. Detailed analysis of scanned data provides crucial information for planning and refining data management policies.

### Taking advantage of Dell file storage

F5 ARX Series devices and F5 Data Manager software can help organizations realize the cost and management advantages of Dell file storage systems. Organizations looking to migrate their storage infrastructure to Dell systems can do so without disruption or downtime, while those looking to augment their existing environment can take advantage of ARX automated tiering and load balancing policies to seamlessly integrate these systems:

- **Seamless integration of Dell storage:** ARX devices are designed to simplify management of heterogeneous file storage environments and allow organizations to deploy Dell file storage systems seamlessly alongside existing systems. File virtualization masks the physical differences between different storage types from user and application clients, enabling organizations to utilize available storage capacity efficiently and effectively regardless of type, platform, or vendor.
- **Simplified migration to Dell storage:** ARX devices help simplify and accelerate data migration projects from legacy infrastructures to Dell file storage systems. One of the biggest hurdles when replacing legacy file storage is the potential disruption from migrating data.

ARX devices support online migration without downtime or client reconfiguration, helping to reduce planning, migration time, and IT overhead requirements.

- **Consolidation with Dell NX4 systems:**

ARX devices can perform nondisruptive consolidation of legacy file servers onto Dell NX4 systems for mixed Microsoft® Windows®, Linux®, and UNIX® environments. File virtualization allows nondisruptive file migration, enabling even complex consolidations with reduced planning, migration time, and IT overhead requirements.

- **Storage tiering with Dell EqualLogic and Dell PowerVault™ systems:**

Storage tiering with ARX devices can provide performance and cost-savings benefits for file data similar to those provided by EqualLogic arrays for block data. Within a virtual file system, ARX devices can migrate individual files between physical CIFS shares or NFS exports presented by multiple PowerVault systems and provisioned from Serial ATA (SATA), Serial Attached SCSI (SAS), and solid-state drive (SSD) capacity on EqualLogic arrays. File-level tiering complements block-level tiering by adding dimensions or criteria used to determine what data to move and when to move it. Organizations can configure automated policies based on the inherent context of each file, using a combination of file attributes such as the latest modification or access date, type, name, location, and size.

- **Storage tiering with Dell/EMC DD Series**

**systems:** ARX devices can also be used to take advantage of the data deduplication capabilities of Dell/EMC DD Series systems in a long-term file archive tier. Because of the performance impact that can be associated with accessing deduplicated data, organizations may choose to deploy deduplicated storage capacity only for data that is rarely accessed or modified. Automated tiering policies can move individual files as they age to a deduplicated storage tier, allowing organizations to seamlessly combine primary storage capacity from Dell NX4 or EqualLogic systems for active data with deduplicated storage capacity from

Dell/EMC DD Series systems for inactive data (see Figure 1).

- **Load balancing across Dell storage:** ARX devices can combine Dell file storage systems—including Dell NX4, Dell EqualLogic, Dell PowerVault, and Dell/EMC DD Series systems—into a single virtual storage pool. Organizations with applications needing large workspaces can create virtual file systems that exceed the physical limitations of individual devices while automated policies distribute files across multiple heterogeneous storage resources for consistent and predictable utilization.
- **Simplified provisioning of Dell storage:** ARX devices help make it easy to add capacity from Dell file storage devices into existing virtual shares, on demand and transparently to clients. By avoiding the disruption of reprovisioning storage, ARX devices provide organizations with the operational flexibility to run highly efficient storage environments that are responsive to unpredictable growth.

### Building a dynamic storage infrastructure

F5 ARX Series intelligent file virtualization devices and Dell file storage systems can help organizations build dynamic storage infrastructures that can respond to unpredictable and inconsistent data growth. With F5 ARX Series devices, the combination of data mobility and automated policies helps dramatically simplify the processes of deploying and managing a comprehensive range of Dell file storage systems while helping maximize operational and cost savings. 



**Renny Shen** is a product marketing manager with F5 Networks.

### Learn more

	<b>Dell storage:</b> <a href="http://dell.com/storage">dell.com/storage</a>
	<b>F5 ARX Series:</b> <a href="http://f5.com/products/ark-series">f5.com/products/ark-series</a>
	<b>F5 Data Manager:</b> <a href="http://f5.com/products/data-manager">f5.com/products/data-manager</a>



# Accelerate and secure data replication with **F5 WAN optimization**

By Fred Johnson, Ujjwal Rajbhandari, and Puneet Dhawan

Combining Dell™ EqualLogic™ PS Series storage with F5® BIG-IP® application delivery systems and WAN Optimization Module™ technology can have significant performance and security benefits for data replication over wide area networks (WANs), helping reduce WAN-related costs.

**A**pplication availability, data center capacity, and business continuity can all depend on the timely movement of applications and data between remote sites. The low throughput and long data transfer completion times typical of wide area networks (WANs) can make remote WAN replication difficult or even impossible. Additionally, the need to meet regulatory and compliance standards—including controlled access to and encryption of replicated data—is often a paramount consideration for enterprise storage administrators.

With these challenges in mind, Dell and F5 have completed proof-of-concept (POC) lab testing to demonstrate how organizations can help accelerate and secure Dell EqualLogic PS Series Internet SCSI (iSCSI) storage area network (SAN) replication over WANs using version 10.1 of the F5 BIG-IP WAN Optimization Module (WOM). By overcoming the effects of limited bandwidth, high latency, and packet loss, WOM technology helps to dramatically increase throughput, reduce replication completion times, and enhance bandwidth utilization and efficiency. When taking into account the costs of WAN bandwidth,

equipment, and administration, these performance advantages can quickly lead to bottom-line savings.

## F5 BIG-IP WAN optimization features

F5 BIG-IP application delivery controllers provide the flexibility to support multiple feature sets on a single platform. For example, a BIG-IP device providing high availability, traditional load balancing, and Secure Sockets Layer (SSL) offload can also incorporate WAN optimization, Web acceleration, application security, and other features without the need for additional dedicated appliances—helping to simplify management and save on hardware, rack space, and power consumption.

F5 BIG-IP WOM technology is designed to accelerate TCP traffic for data center applications, with the ability to scale to meet high bandwidth requirements. The module includes special acceleration profiles for Common Internet File System (CIFS) and Messaging Application Programming Interface (MAPI), and supports Web Cache Communication Protocol version 2 (WCCPv2); because it must be deployed symmetrically, it requires two or more BIG-IP devices.

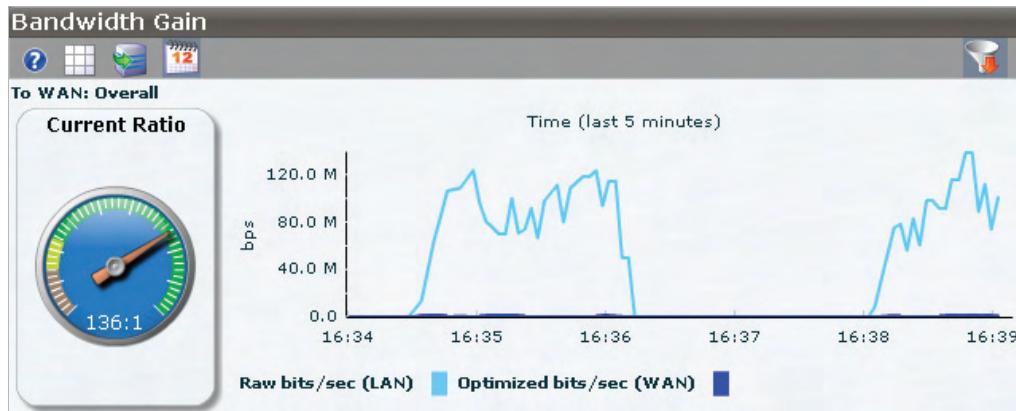


Figure 1. F5 BIG-IP WOM performance dashboard

A variety of features help to boost performance, secure communications, and manage traffic, including the following:

- **iSessions:** The F5 iSessions network tunneling feature integrates security, acceleration, and traffic management. This feature is designed to work through firewalls: for example, iSCSI requires only TCP port 443 for the secure control channel and TCP port 3260 for iSCSI, and iSessions encryption can be enabled without changes to the port assignments.

- **Symmetric encryption:** iSessions can be secured by controlling access, encrypting the control channel, and optionally encrypting the iSCSI replication traffic; the SSL encryption is designed to operate with only minimal impact on performance. Administrators can easily enable encryption by modifying the iSCSI virtual server using the Web browser-based BIG-IP management interface.
- **Symmetric data deduplication:** In the WOM context, deduplication means

preventing redundant data patterns from crossing the WAN. A cache is built on the device at each end, and when a duplicate pattern in the network traffic is found, a small reference to the cache is transmitted instead of the entire pattern—an important way to help reduce the amount of WAN traffic. The Dell and F5 POC testing used a memory deduplication data store, an approach well suited for replication traffic. The deduplication cache can also be stored on disk to support increased cache sizes.

**“The goal of WAN optimization is to increase performance by minimizing latency—helping to increase the perceived bandwidth, seamlessly recover from packet loss, and enable WANs to provide performance characteristics similar to LANs.”**



- **Symmetric adaptive compression:** As with symmetric deduplication, compression helps to reduce the amount of WAN traffic and increase bandwidth usage efficiency. *Adaptive* means that BIG-IP devices can intelligently select compression based on the type of data. Compression can also be offloaded to hardware compression cards on high-end F5 platforms to help reduce processor usage and increase throughput. The Dell and F5 POC testing used adaptive compression, yielding a combination of Lempel-Ziv-Oberhumer (LZO) and Deflate (level 1) compression. Volume data set characteristics such as compressibility influence the performance gains associated with WOM technology.
- **TCP Express:** The BIG-IP network stack implements a variety of TCP optimization techniques and performance-related IETF Request for Comments (RFC) enhancements designed to offload and optimize TCP network traffic, helping

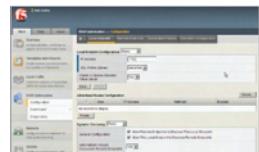
to reduce TCP overhead and increase network performance and reliability.

- **Layer 7 (L7) quality-of-service (QoS) rate shaping:** L7 QoS rate shaping allows for the enforcement of bandwidth minimums and maximums per application, including burst control, and supports terms-of-service and differentiated services code point (DSCP) features. For example, the bandwidth associated with an iSCSI BIG-IP virtual server can be limited, helping prevent iSCSI replication from affecting other critical applications that share the same WAN link.

The WOM performance dashboard offers integrated monitoring and reporting tools, providing administrators with a quick look at real-time data, performance, and bandwidth gains for WOM-optimized traffic (see Figure 1).

### Proof-of-concept test environment

The goal of the Dell and F5 POC testing was to demonstrate Dell



### F5 BIG-IP configuration

In this Dell TechCenter video, Fred Johnson demonstrates how to configure the F5 BIG-IP WAN Optimization Module for a central office.

[delltechcenter.com/video/9320147/f5+big+ip+configuration](http://delltechcenter.com/video/9320147/f5+big+ip+configuration)

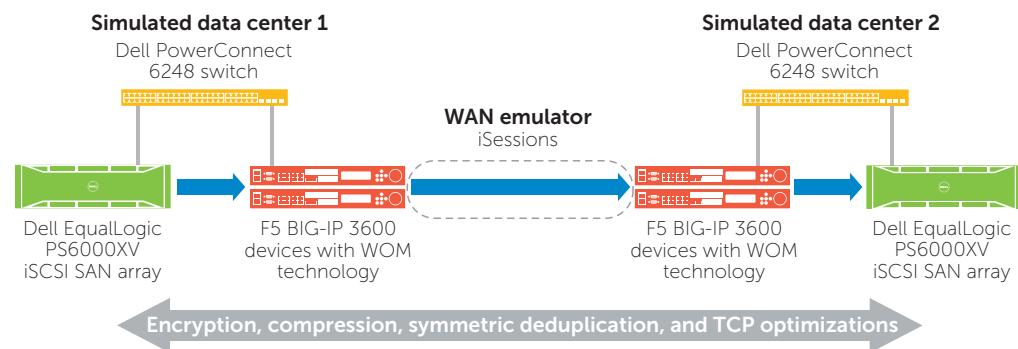
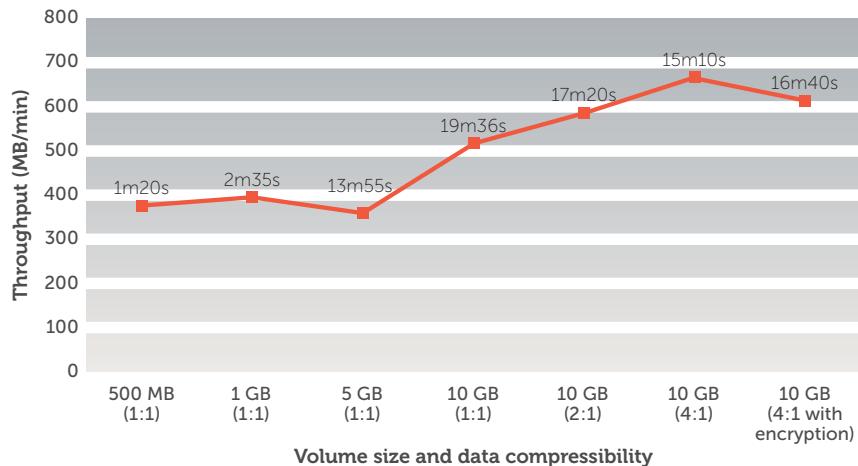


Figure 2. Proof-of-concept test environment incorporating F5 BIG-IP WOM technology



**Figure 3.** Dell EqualLogic replication throughput and completion times with F5 BIG-IP WOM acceleration over a 45 Mbps WAN with 100 ms of latency and 1 percent packet loss

EqualLogic iSCSI SAN replication throughput and completion times when using F5 BIG-IP WOM technology to accelerate and encrypt iSCSI traffic as it crossed a WAN. The tests were performed in November 2009 at the Dell Interoperability Lab in Round Rock, Texas.

As shown in Figure 2, the lab configuration included two EqualLogic PS6000XV iSCSI SAN arrays with sixteen 420 GB, 15,000 rpm Serial Attached SCSI (SAS) hard drives in a RAID-50 configuration connected by two Dell PowerConnect™ 6248 L3 switches. F5 BIG-IP 3600 appliances with WOM technology were connected to the switches at each simulated site. A WAN emulator interconnected the switches; the emulator functions included limiting bandwidth, injecting latency, and dropping packets to simulate two remote data centers connected over a WAN. The two arrays then replicated volumes over the emulated WAN, benefiting from WOM acceleration and encryption.

The test team used the Web browser-based EqualLogic Group Manager user interface to configure the volumes, manage the replication jobs, and report throughput and completion times. The test runs included asynchronous full-volume replication jobs, with no incremental replications, and each run was limited to single-volume replications.

Similarly, the Web browser-based BIG-IP management interface was used for WOM configuration, including endpoints, virtual servers, encryption profiles, and acceleration profiles and routing, as well as an iSCSI acceleration policy. The performance dashboard was monitored to observe WAN optimization statistics, network throughput, and processor and memory utilization during the test runs.

increase the perceived bandwidth, seamlessly recover from packet loss, and enable WANs to provide performance characteristics similar to LANs. Figure 3 shows Dell EqualLogic iSCSI replication throughput and completion times with F5 BIG-IP WOM acceleration over a 45 Mbps WAN with 100 ms of latency and 1 percent packet loss (10,000 packets per million) across a variety of volume sizes. The WOM-accelerated tests for the 10 GB volume additionally show the throughput and completion times for 2:1 and 4:1 volume data compressibility as well as 4:1 compressibility with encryption.

To put these results in context, using WOM technology enabled the WAN link at 45 Mbps with 100 ms of latency and 1 percent packet loss to provide results roughly comparable to what could be expected of a 100 Mbps LAN with no latency or packet loss, even when using encryption—helping make remote replication of large data volumes possible in a much shorter period of time than it would otherwise require. As an

### F5 BIG-IP WOM acceleration test results

The goal of WAN optimization is to increase performance by minimizing latency—helping to



**“F5 BIG-IP WOM technology can help organizations reduce administration costs and avoid the need to purchase additional bandwidth while continuing to meet overall organizational and compliance requirements.”**

	Typical latency range	Typical average latency
Regional within the United States or Europe	10-40 ms	30 ms
U.S. East Coast to West Coast	80-120 ms	100 ms
South America to North America	90-170 ms	150 ms
Asia Pacific to Europe	250-400 ms	300 ms

Figure 4. Typical latencies that might be expected across a variety of WAN link distances

additional point of reference when evaluating the results, Figure 4 shows typical latencies that might be expected across a variety of WAN link distances.

Organizations can further increase iSCSI WAN data transfer throughput by configuring concurrent replication of more than one volume at a time, helping maximize overall bandwidth utilization. They can also enhance network efficiency by using remote point-in-time replication, which helps minimize the amount of data crossing the WAN by transferring only the changed volume data to the replication partner.

#### Reduced costs through WAN acceleration

Because bandwidth, equipment, and administration for WAN operations can represent significant costs over time, the performance advantages of F5 BIG-IP WOM technology with Dell EqualLogic storage demonstrated by the Dell and F5 POC tests can lead to bottom-line savings. By accelerating data transfer times over WANs, enabling encryption with minimal performance overhead, and providing an easy-to-use management interface, F5 BIG-IP WOM

technology can help organizations reduce administration costs and avoid the need to purchase additional bandwidth while continuing to meet overall organizational and compliance requirements. Combining WOM technology with Dell EqualLogic iSCSI SAN arrays enables organizations to create a shared storage solution supporting accelerated and encrypted site-to-site data transfers over WANs. 



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#### Learn more



**F5 and Dell:**  
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**Dell EqualLogic PS Series:**  
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[dell.com/equallogic](http://dell.com/equallogic)



# A unified networking approach to iSCSI storage with **Broadcom controllers**

By Dhiraj Sehgal, Abhijit Aswath, and Srinivas Thodati

In environments based on Internet SCSI (iSCSI) and 10 Gigabit Ethernet, deploying Dell™ PowerEdge™ servers with Broadcom® NetXtreme II® converged network controllers can help IT departments to eliminate network bottlenecks, reduce power consumption, and maximize data center efficiency.

**U**se of the Internet SCSI (iSCSI) protocol has been growing significantly in enterprise data centers, largely because it offers a variety of advantages over traditional Fibre Channel storage technologies. Because iSCSI provides a simple method for transporting SCSI commands, data, and status messages over standard TCP/IP networks, it lets organizations take advantage of existing infrastructure and knowledge bases while using cost-effective, familiar components. It is also standards based, which facilitates industry adoption and helps ensure interoperability. And its performance can scale up along a common technology path—Ethernet.

But the widespread use of iSCSI has also created challenges as network usage has grown and evolved. For example, many organizations are running an increasing number of rich-content and data-intensive applications or virtualized environments on their servers, which can significantly increase the iSCSI-based network traffic in a data center. To help keep up with this growth, many IT departments have begun moving from Gigabit Ethernet (GbE) network controllers

to 10 Gigabit Ethernet (10GbE) controllers. Under heavy workloads, however, traditional controllers can consume significant amounts of server processing power, reducing the amount available for critical applications. In addition, the traditional approach typically requires using separate network controllers to handle different types of tasks (such as high-speed networking, storage, and clustering), which leads to a burgeoning number of devices, which drives up cost and complexity—and limits the ability of IT departments to take advantage of 10GbE controllers.

The Broadcom NetXtreme II family of 10GbE converged network interface controllers (C-NICs) is designed to address these problems. Available in Dell PowerEdge servers as LAN on Motherboards (LOMs), mezzanine cards, and stand-up network interface cards (NICs), these controllers provide the speed and efficiency to support heavy network traffic workloads—enabling IT departments to simplify their systems and provide network, storage, and clustering capabilities over existing TCP/IP and Ethernet infrastructures, while also helping reduce power consumption and enabling highly efficient use of processing resources.



**“As converged controllers, Broadcom NetXtreme II C-NICs can handle multiple types of networking tasks simultaneously.”**

#### Easing the network processing load

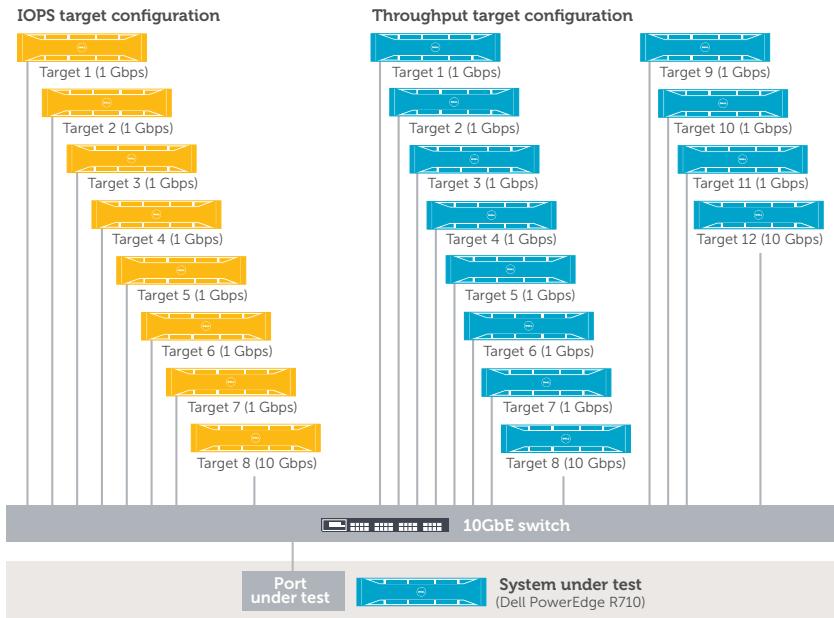
As converged controllers, Broadcom NetXtreme II C-NICs can handle multiple types of networking tasks simultaneously. A traditional server is typically equipped with four GbE controllers, along with other storage adapters in some cases. Simultaneously running network, storage, and clustering traffic at high rates typically requires multiple adapters and a large number of CPU cycles. The Broadcom C-NIC approach, in contrast, enables administrators to use a single 10GbE port for multiple traffic types. Alternatively, if administrators choose to run just one traffic type, they can do so without having to deploy custom hardware and software, which helps simplify IT deployment and management. In addition, NetXtreme II C-NICs available in Dell PowerEdge servers can support Microsoft® Windows®, Linux®, VMware®, and other platforms, helping maximize deployment flexibility.

To help reduce the burden of packet header processing on the host server, NetXtreme II C-NICs provide iSCSI host bus adapter (HBA) functionality with iSCSI Offload Engine (iSOE) technology (see Figure 1). By offloading iSCSI header processing from host processors to HBAs, these controllers can help optimize server processor utilization while helping increase both performance and throughput for file-oriented storage, block-oriented storage, backups, database transactions, and tightly coupled distributed applications such as high-performance computing workloads. The iSOE technology is designed to free up host processor cores and memory resources and increase I/Os per second (IOPS)—including, in the Broadcom test environment detailed in the next section of this article, enabling up to 400,000 IOPS at 10GbE line rates over a single Ethernet port while substantially reducing processor utilization.

iSOE enables NetXtreme II C-NICs to effectively handle both TCP/IP and iSCSI processing. By offloading the TCP/IP and iSCSI stacks, the controller does not need to compete with upper-layer software such as e-mail or Web applications for CPU cycles: iSCSI performance is unaffected by application workload. The convergence of block storage and network processing over a standard TCP infrastructure helps eliminate the need for a separate storage adapter and additional cabling, while providing performance and reliability comparable to Fibre Channel at a significantly reduced cost.

Broadcom controller model	Ports	Broadcom part number	Dell part number	Card type	I/O bus	Physical interface	iSCSI features
BCM5709	Two GbE	BCM95709A0907G	430-3254	Standard PCIe	PCIe 1.0	1000Base-T	iSCSI boot
BCM5709	Two GbE	BCM95709A0916G	430-3263	Mezzanine	PCIe 1.0	1000Base-T	iSCSI boot and HBA
BCM5709	Two GbE	BCM95709SA0908G	430-3310	Blade mezzanine	PCIe 1.0	SerDes	iSCSI boot and HBA
BCM5709	Two GbE	BCM95709A0907G	430-3261	Standard PCIe	PCIe 1.0	1000Base-T	iSCSI boot and HBA
BCM5709	Four GbE	BCM95709A0906G	430-0800	Standard PCIe	PCIe 1.0	1000Base-T	iSCSI boot and HBA
BCM57710	One 10GbE	BCM957710A1022G	430-2834	Standard PCIe	PCIe 1.0	10GBase-T	—
BCM57710	Two 10GbE	BCM957710A1021G	430-2836	Mezzanine	PCIe 1.0	10GBase-T	iSCSI boot and HBA
BCM57711	Two 10GbE	BCM957711A1123G	430-0674	Blade mezzanine	PCIe 2.0	10GBase-KX4	iSCSI boot and HBA
BCM57711	Two 10GbE	BCM957711A1113G	430-0710	Standard PCIe	PCIe 2.0	SFP+	iSCSI boot and HBA

Figure 1. iSOE-enabled Broadcom NetXtreme II C-NICs available in Dell PowerEdge servers



**Figure 2.** High-level configuration used in the test environment

Easing management and reducing costs are ongoing goals in the data center—and to that end, the NetXtreme II family helps to simplify administration of controllers across the environment through the Broadcom Advanced Control Suite (BACS) 3 management application, which provides a single platform for network and iSCSI HBA I/O management. BACS 3 includes at-a-glance status reports of LAN adapters and controllers in a system, network testing to confirm connectivity to a remote station, and detailed performance statistics on adapters and controllers.

### Evaluating the converged approach

To help IT departments understand the enhancements and benefits of the converged approach, in October 2009 Broadcom's performance laboratories ran a series of tests to analyze the power consumption, processor utilization, throughput, and processor effectiveness (IOPS per CPU cycle) of a Broadcom NetXtreme II C-NIC and a third-party NIC with an iSCSI software initiator.

Figure 2 shows the test environment, which was designed to evaluate the maximum performance value organizations could expect in this type of deployment. The system under test was a Dell PowerEdge R710 server with two quad-core

Intel® Xeon® X5570 processors at 2.93 GHz, 12 GB of RAM, and the Microsoft Windows Server® 2008 Enterprise Edition OS. The setup included one NetXtreme II BCM57711 dual-port 10GbE C-NIC with iSCSI HBA functionality enabled, along with a third-party NIC using an iSCSI software initiator. The tests used 8 targets for IOPS measurement and 12 targets for throughput measurement; the target systems were PowerEdge R710 servers with two quad-core Intel Xeon X5570 processors at 2.93 GHz, 2 GB of RAM, the Red Hat® Enterprise Linux 5.2 OS, and iSCSI Enterprise Target (IET) 0.4.16 software.

The tests utilized the lometer I/O subsystem measurement and characterization tool, which is designed to evaluate the performance of storage and networked applications, perform stress tests on storage and network devices, and predict storage and networked application performance. The test environment used version 2006.07.27 of this tool, configured for 128 outstanding I/Os. Power consumption was measured as the average of three one-second samples taken at the power inlet.

As these tests showed, using NetXtreme II C-NICs as iSCSI HBAs can provide a variety of advantages in data center environments, including helping to reduce power consumption and increase processing efficiency. In the test environment, the NetXtreme II C-NIC in iSCSI HBA



## Storage optimization

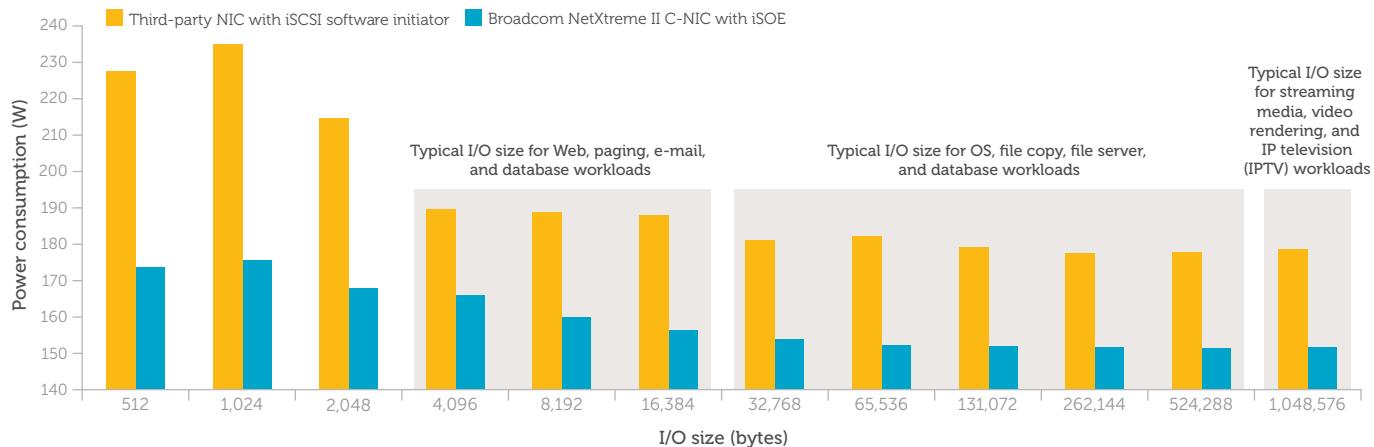


Figure 3. Power consumption at different I/O sizes for the third-party NIC and the Broadcom NetXtreme II C-NIC

mode provided a system-level savings of approximately 60 W per port compared with the third-party NIC (see Figure 3)—a difference that can lead to dramatic cost savings. For example, consider a data center with 2,500 servers containing four 10GbE ports each. Assuming the same load characteristics over the same period as the test environment, using this NetXtreme II C-NIC

in place of the third-party NIC could reduce power consumption by 600 kW at the port level alone; when factoring in an example Power Usage Effectiveness (PUE) value of 1.8 and assuming matching savings in power consumption across the supporting infrastructure, the total reduction would reach 1,080 kW. At an energy cost of US\$0.088/kWh, then, the cost savings over the course of a year

would amount to US\$832,550. IT departments could also take advantage of these enormous power savings to help them rightsize the data center's supporting infrastructure, helping to reduce total cost of ownership and improve PUE efficiency.

In addition to reducing power consumption, the NetXtreme II C-NIC reduced processor utilization by

approximately 30 percent at large I/O sizes (2–64 KB) and delivered three times the IOPS per CPU cycle of the third-party NIC, enabling highly efficient processing of storage workloads (see Figure 4). This efficient operation in turn can provide increased IOPS performance to end users for storage workloads while also freeing up processing power to support additional applications

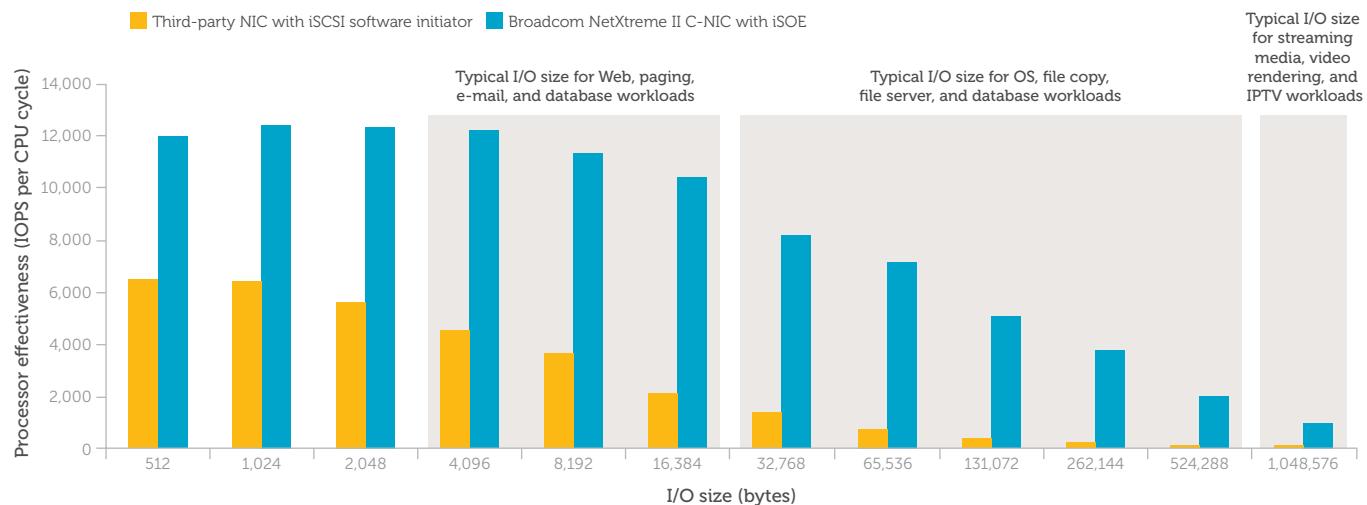
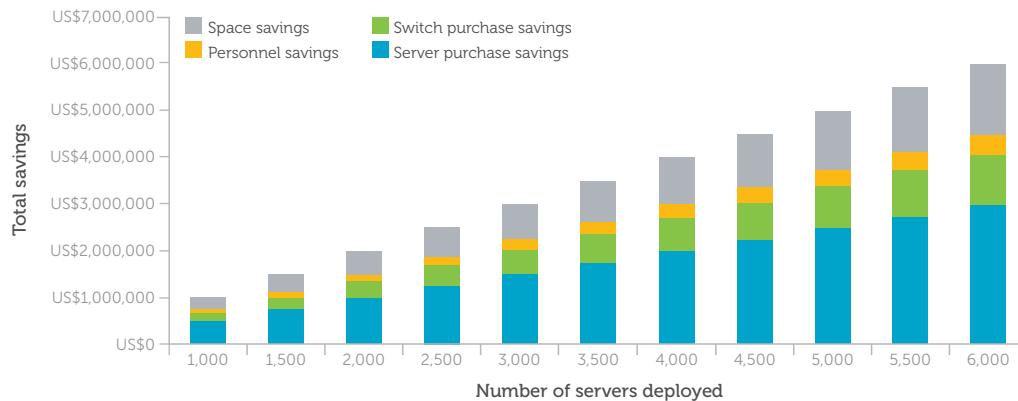


Figure 4. Processor effectiveness at different I/O sizes for the third-party NIC and the Broadcom NetXtreme II C-NIC



**Figure 5.** Example onetime savings possible from proper planning and efficient processor utilization with Broadcom NetXtreme II C-NICs

or increased usage of high-performance applications—all without increasing the total cost of operations.

This efficient operation can also help IT departments during installation, allowing them to plan for increased load capacity. In a data center with 5,000 servers, for example, the onetime savings from proper planning and improved utilization could reach US\$5 million (see Figure 5).<sup>1</sup>

**Reducing costs through converged networking**  
Converging multiple functions over one wire using Dell PowerEdge servers with Broadcom NetXtreme II C-NICs can help simplify networking, increase processor effectiveness, and reduce total cost of ownership. In addition, by enabling IT departments to take advantage of existing Ethernet infrastructure and avoid the need for stand-alone HBA cards, these converged controllers help lower the cost of iSCSI acquisition, deployment, and management—avoiding the need to maintain a separate storage infrastructure and the need for specialized training.

The Broadcom NetXtreme II family can also enable organizations to take advantage of 10GbE iSCSI networking while providing the flexibility to either converge data and storage

traffic onto a single network or use a dedicated network for each. This approach holds the promise of accelerating iSCSI networking adoption and helping IT departments pursue a variety of critical initiatives, from environmentally friendly computing to virtualization and consolidation—and the constant need to keep costs down while maximizing data center efficiency. **PS**



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**Srinivas Thodati** is a senior product marketing manager for PowerEdge M-Series servers at Dell.

#### Learn more



**Broadcom Ethernet controllers:**  
[broadcom.com/products/Ethernet-Controllers](http://broadcom.com/products/Ethernet-Controllers)



**Dell PowerEdge servers:**  
[dell.com/poweredge](http://dell.com/poweredge)

<sup>1</sup>Based on a 30 percent reduction in server count from an average 30 percent reduction in processor utilization. Calculations assume an average server cost of US\$5,000, a server lifetime of 3 years, 1 switch for every 2.5 servers, an average switch cost of US\$1,500, 12 servers per rack, 10 square feet of rack floor space at a commercial cost of US\$1,000 per square foot, 1 administrator for every 250 servers, and an average administrator salary of US\$60,000.



# Addressing data growth challenges with Symantec deduplication software

By Charles Butler

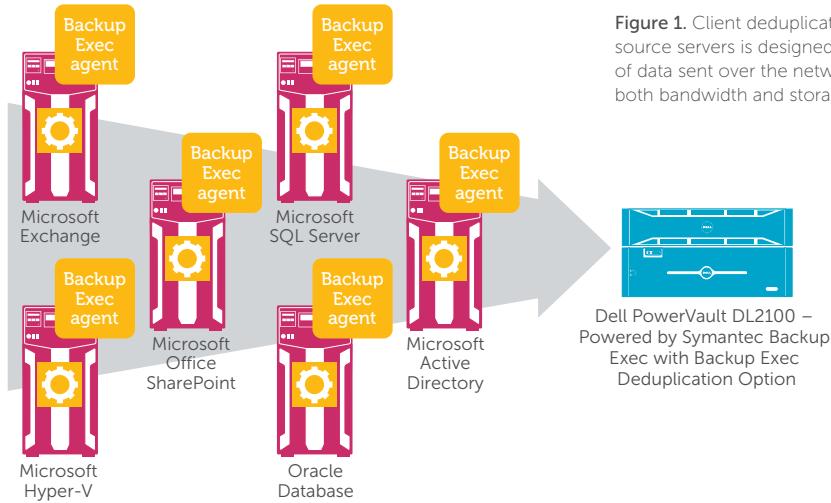
Combining the Symantec™ Backup Exec™ 2010 Deduplication Option with the Dell™ PowerVault™ DL2100 – Powered by Symantec Backup Exec can help dramatically reduce bandwidth and storage requirements for backup infrastructures while providing versatile, enterprise-class data protection.

**A**lthough data growth is not new, the pace of that growth has become more rapid, the locations of data more dispersed, and the links between data sets more complex than ever—leaving enterprises constantly seeking ways to overcome their data protection challenges. Data deduplication offers the opportunity to dramatically reduce the amount of bandwidth and storage required for backups and to centralize backup data in support of disaster recovery strategies. Although this technology has existed for several years, many organizations have yet to take advantage of the enhanced efficiencies it can provide.

Dell and Symantec have worked together to address the explosion of enterprise data by creating the Dell PowerVault DL2100 – Powered by Symantec Backup Exec. The combination of this integrated backup-to-disk solution and the Backup Exec 2010 Deduplication Option enables organizations to flexibly deduplicate data across their backup environments through either client deduplication (also called *source deduplication*,

which occurs at the remote client servers using Backup Exec agents) or media server deduplication (also called *target deduplication*, which occurs in-line when a Backup Exec media server writes data to disk).

To help simplify deployment and scalability, the Backup Exec Deduplication Option does not use capacity-based licensing; instead, it is delivered through a single license key that enables all deduplication functions within Backup Exec, including client deduplication, media server deduplication, and appliance deduplication through integration with Symantec OpenStorage-enabled intelligent disk devices (see the “Intelligent backups through Symantec OpenStorage” sidebar in this article). Incorporating deduplication into the Backup Exec platform can provide a variety of advantages in enterprise backup environments, including helping organizations to dramatically reduce bandwidth and storage capacity requirements, centralize and manage backup operations, and reduce rotations and use of tape for disaster recovery.



**Figure 1.** Client deduplication performed on the source servers is designed to reduce the amount of data sent over the network, helping optimize both bandwidth and storage usage

### Deduplication and compression

Deduplication and compression technologies can both help reduce the size of a backup, but the two approaches differ in key ways. Compression can be applied to files, directories, or even volumes, but typically lacks awareness of the underlying data and therefore cannot recognize that identical files exist in different directories. In addition, a typical compression algorithm—unlike the deduplication process—can neither recognize changed data nor capture these unique blocks at a subfile level.

When administrators back up data on a remote server and choose to compress that data before backing it up, the compression would generally result in reduced sizes for files sent to the local backup application or across the network to a centralized backup application. When using Symantec Backup Exec deduplication, in contrast, files on the remote server might

be recognized as identical to files already stored, before compression occurs—in which case only a very small amount of data would need to be transmitted and stored. Other systems sending data to the same Backup Exec media server would also be aware of similar data that may have already been transmitted and stored, helping reduce backup sizes across the environment.

### Bandwidth and storage optimization

Administrators can deploy Symantec Backup Exec 2010 deduplication to help optimize both bandwidth and storage using client deduplication, or to help optimize only storage using media server deduplication. The degree of storage optimization can depend on factors such as the type of data, data change rate, and retention period.



The Dell PowerVault DL2100 – Powered by Symantec Backup Exec provides an integrated backup-to-disk solution that supports flexible deduplication



## Setting up Backup Exec 2010 deduplication

This Dell TechCenter video walks through how to set up and configure a deduplication storage folder in Backup Exec 2010, as well as how to configure backup jobs to utilize deduplication.

[delltechcenter.com/video/8866943/backup+exec+2010+set+up+de-duplication](http://delltechcenter.com/video/8866943/backup+exec+2010+set+up+de-duplication)

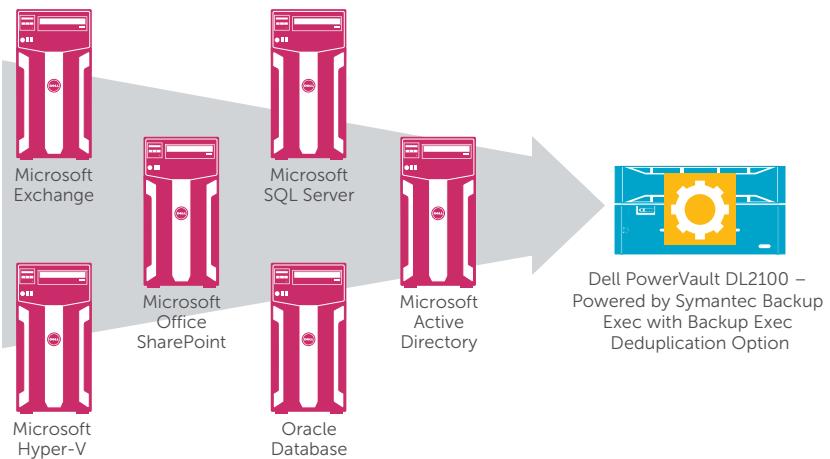
Backup Exec client deduplication is supported on Microsoft® Windows® OS-based systems, and requires a Backup Exec client agent on the system to be protected (see Figure 1). This agent enables the data to be deduplicated at this source client before it is transmitted to the backup target, helping significantly reduce the amount of data that must be sent over the network. In addition, Backup Exec agents are designed to leverage the deduplication of data across all systems under protection in the environment, helping achieve higher levels of deduplication than would otherwise typically be possible.

The bandwidth reductions possible when using Backup Exec client deduplication make this approach well suited for protecting distributed servers or virtual machines with bandwidth (and I/O) constraints. Traditional full backups send all of the data across the network to the backup application, which then directs the data to a

media source where it can be compressed or deduplicated; traditional incremental backups, similarly, transmit entire files during the backup process even though only a small portion of a given file may have changed. Deduplicating this data at the source enables Backup Exec to perform full backups that transmit only data that does not already exist on the backup target, and to perform incremental backups that send only changed segments of each modified file rather than the entire file.

In many data centers, bandwidth constraints may not be a concern. In this type of environment, administrators may prefer to use Backup Exec media server deduplication, which performs the deduplication at the storage target after the data has already been sent over the network (see Figure 2). This approach is typically easier to incorporate into existing backup architectures than client deduplication.<sup>1</sup>

**Figure 2.** Media server deduplication performed on the Dell PowerVault DL2100 helps optimize storage while simplifying deployment in existing backup infrastructures



<sup>1</sup>For more information on types of deduplication and the advantages and disadvantages of different approaches, see "Demystifying Deduplication," by Joe Colucci and Kay Benaroch, in *Dell Power Solutions*, 2010 Issue 1, [dell.com/downloads/global/power/ps1q10-20100235-colucci.pdf](http://dell.com/downloads/global/power/ps1q10-20100235-colucci.pdf).

### **Versatile platform and application protection**

The Backup Exec 2010 Deduplication Option supports data protection for a variety of platforms and applications. Administrators can enable either client or media server deduplication to help protect Microsoft platforms and applications such as Hyper-V™, Exchange, SQL Server®, SharePoint®, and Active Directory® software; VMware® virtual machines (with an agent installed in the guest OS); Symantec Enterprise Vault™, SAP®, IBM® Lotus® Domino, and IBM DB2 software; and Oracle® databases on Microsoft Windows operating systems. It additionally supports media server deduplication for VMware virtual machines using vStorage application programming interfaces (APIs); Linux®, UNIX®, and Novell® NetWare® operating systems; and Oracle databases on Linux operating systems.

### **Efficient backups and data protection**

For IT environments where bandwidth is at a premium, combining the Dell PowerVault DL2100 – Powered by Symantec Backup Exec with client deduplication through the Backup Exec 2010 Deduplication Option enables bandwidth-efficient, storage-optimized data protection for remote systems and virtualized environments. For environments where bandwidth is not a concern, Backup Exec media server deduplication enables efficient use of storage resources and can help simplify deployment in existing backup infrastructures. Although specific results can vary depending on type of data, change rate, retention period, and other factors, Symantec Backup Exec 2010 deduplication technology in the Dell PowerVault DL2100 can help organizations create a flexible backup infrastructure to help maximize management and storage cost efficiencies. 



**Charles Butler** is a technical director in the Information Management Group at Symantec.

### **Learn more**



**Symantec Backup Exec:**  
[backupexec.com](http://backupexec.com)



**Dell PowerVault DL2100:**  
[dell.com/dl2100](http://dell.com/dl2100)



**Dell and Symantec:**  
[dell.com/symantec](http://dell.com/symantec)  
[symantec.com/dell](http://symantec.com/dell)

## **Intelligent backups through Symantec OpenStorage**

The Symantec OpenStorage initiative is a disk-based innovation that allows Symantec Backup Exec to take advantage of the advances of intelligent disk storage devices—including storage reduction, backup image duplication, synthetic backups, replication, and energy efficiency. The tight integration with third-party intelligent disk storage devices provides enhanced management of backup images and additional functionality while helping avoid the limitations of tape emulation.

Intelligent disk storage vendors write plug-ins for the OpenStorage application programming interface (API) that integrate with Backup Exec. These plug-ins provide Backup Exec with visibility into the properties and capabilities of the storage devices as well as control over the backup images stored on them. Backup Exec can then treat them as disk devices rather than tape devices, as in the case of virtual tape libraries.

Using OpenStorage plug-ins and the OpenStorage API, Backup Exec can control when backup images are created, duplicated, and deleted, while the intelligent disk storage devices control how the images are actually stored in and replicated between devices. In addition, intelligent disk storage manufacturers in the OpenStorage program can add value to an overall solution through specialized innovations such as backup image deduplication, wide area network (WAN)-optimized backup image replication for disaster recovery, power management, and more.



# End-to-end, snapshot-aware data protection with **CommVault SnapProtect**

By Darin Camp

In conjunction with Dell™ EqualLogic™ PS Series snapshot capabilities and CommVault® Simpana® SnapProtect™ technology, the Dell PowerVault™ DL2100 – Powered by CommVault enables end-to-end data protection that supports fast, flexible recovery and aggressive service-level agreements.

**T**oday's IT departments are facing explosive data growth along with service-level agreements (SLAs) for data availability and recovery that can often seem unobtainable. Because traditional tape-based protection typically captures data only from the previous backup event, a recovery request may mean a gap of up to 24 hours from the most recent recovery point—often unacceptable for business-critical data.

Moving the primary recovery location of critical data to a readily available storage area network (SAN)-based snapshot can significantly mitigate the risk of data loss. In conjunction with Dell EqualLogic PS Series Internet SCSI (iSCSI) SAN arrays and CommVault Simpana SnapProtect technology, the Dell PowerVault DL2100 – Powered by CommVault can help organizations create an end-to-end environment that leverages native EqualLogic snapshots to enable fast, flexible data protection and recovery. As an integrated, full-featured backup appliance, the PowerVault DL2100 is designed to significantly simplify storage and backup administration and help create an advanced, highly scalable storage solution. By incorporating

EqualLogic snapshot copies, the PowerVault DL2100 with SnapProtect, and multiple copy tiers into the environment as part of a comprehensive recovery strategy, IT administrators can meet the challenges of data growth while supporting aggressive SLAs and data protection requirements for critical systems.

## **Enabling end-to-end, snapshot-aware data protection**

The separation of recovery-copy, protection-copy, and archive-copy tiers provides the availability and speed required for today's critical applications, and helps reduce costs by using the appropriate storage types and technologies such as deduplication to meet long-term retention requirements (see Figure 1). Forming the foundation of the local recovery-copy tier, snapshots capture the disk layout at the exact point the snapshot is initiated, providing a point-in-time (PIT) copy that can then serve as a reference for the other tiers. These PIT copies can be easily mounted to the Dell PowerVault DL2100 for nightly backups—thus enabling IT staff to use the same consistent snapshot for off-site recovery and retention copies on cost-effective disk and tape.

With the SnapProtect Enabler (SPE) introduced in CommVault Simpana 8.0, SAN snapshot management controls are coded directly into the data protection agents—delivering combined protection and recovery capabilities within a single operation from beginning to end. The SPE is the core piece of intelligence creating the CommVault open snapshot management framework. Enabling it is a simple check box option within the Simpana Intelligent Data Agent (iDA) that effectively takes the backup process and enhances it with the ability to integrate native SAN array snapshots.

The SPE integrates natively into host systems, applications, and SAN arrays to blend the speed and efficiency of hardware snapshots with robust Simpana data access capabilities. Instead of scheduling multiple processes with different solutions or scripts, Simpana software is designed to control the entire progression of data

within a single protection policy (see Figure 2). This single-step process enables administrators to create, retain, and catalog the data within snapshots without the need to compile a script or take on unnecessary management overhead.

From a single protection policy, administrators can leverage snapshots on the SAN by adding SnapProtect to the backup client and then configuring it for the appropriate snapshot application programming interface (API). These snapshots are mounted, cataloged, checked for data integrity, and retained as a highly available recovery copy (see Figure 3). By using this same copy, the software moves the data to the appropriate protection copy or archive copy based on the original protection policy. Data accessibility remains the same regardless of the data location. The simple browse and recovery from a traditional backup extends to the snapshot copies, providing IT teams with

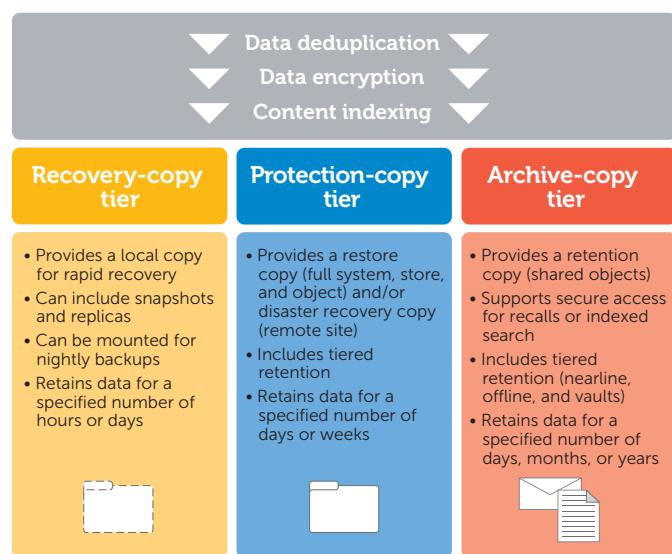
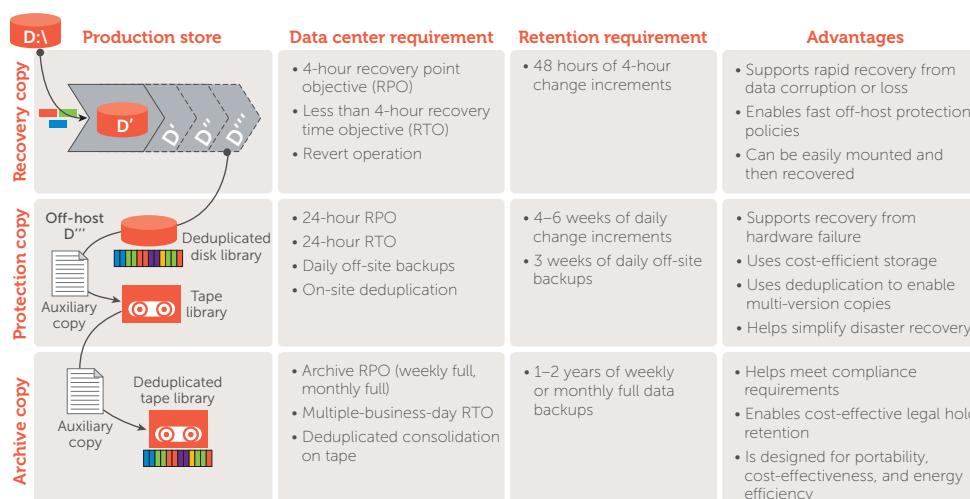


Figure 1. Data management copy tiers optimized for different scenarios

a simplified, cost-effective way to incorporate snapshots into a tiered strategy to help meet recoverability requirements.

Implementing a protection-copy tier with deduplication on disk and tape provides a long-term, versioned retention strategy to help meet organizational and regulatory compliance requirements while

Figure 2. Recovery-copy, protection-copy, and archive-copy tiers as part of a comprehensive data protection and recovery strategy



## Simplifying array-based snapshots

Array-based snapshots can have significant advantages in enterprise IT environments, but can also increase operational complexity. This video from the CommVault Simpana Whiteboard Series explores how SnapProtect technology helps overcome these challenges by enabling administrators to control array-based snapshots through a single management console.

[download.commvault.com/unsecure/media/video/whiteboards/snapprotect/](http://download.commvault.com/unsecure/media/video/whiteboards/snapprotect/)

**“Layering deduplication with cost-effective storage can help drastically reduce costs for long-term retention.”**

also helping protect critical applications from a production disk failure. Recoveries from this tier typically take longer than SAN-volume revert operations, but the disaster recovery copies and off-site replication can enable additional data availability options for the longer SLAs at a much lower cost compared with a recovery-copy tier.

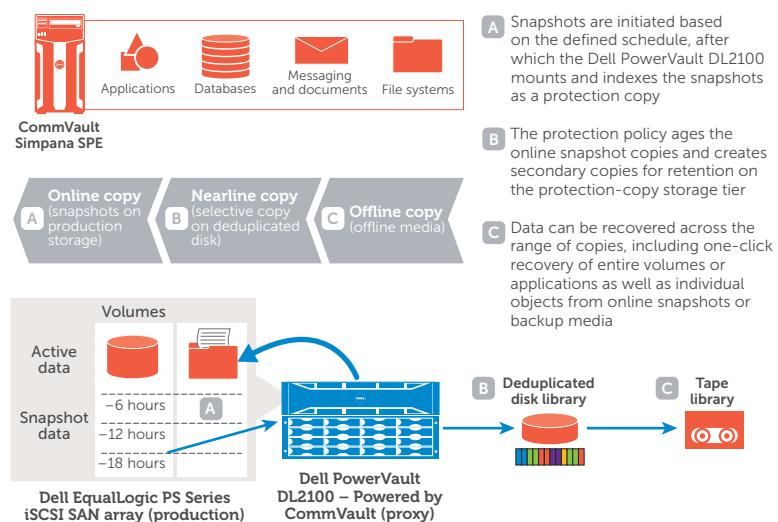
Further extending the data protection methodologies to an archive-copy tier provides a long-term, removable data copy to support retention policies and regulatory compliance. Layering deduplication with

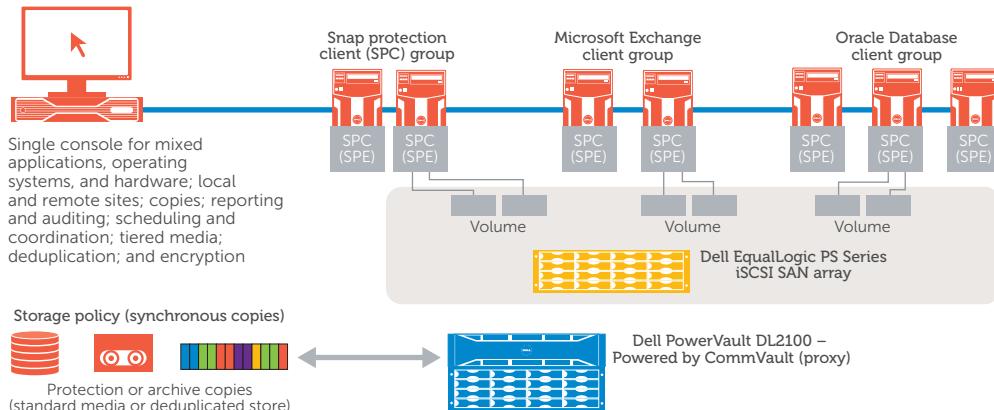
cost-effective storage can help drastically reduce costs for long-term retention. Allowing a single protection policy to initiate the progression of data through the recovery-copy, protection-copy, and archive-copy tiers without sacrificing data availability helps optimize current and future storage hardware implementations.

SnapProtect blends the intelligence of Simpana application iDAs with native snapshot capabilities to create application-consistent PIT data copies. Application awareness enables SnapProtect

to incorporate a PIT recovery copy with the cataloging of a standard backup routine from a script-free snapshot protection operation. Recovering data to a PIT is a single operation through a volume revert operation, a recovery from deduplicated data on disk or tape, or a blend of the two, depending on the specific recovery point. The process of sequencing and scripting application quiescence, initiating the snapshot, mounting the snapshot, and running protection and/or recovery procedures is managed through the CommVault CommCell®

**Figure 3.** Hardware snapshot process using Dell EqualLogic PS Series storage with the Dell PowerVault DL2100 – Powered by CommVault





**Figure 4.** Comprehensive management through a single CommVault Simpana console

interface without requiring scripting. Simpana can access the copy or copies (recovery copy, protection copy, or mixed access) necessary in a one-pass routine with minimal IT staff intervention.

### Spotlighting Microsoft Windows applications

CommVault Simpana supports software including Microsoft® SQL Server®, Microsoft Exchange, Oracle®, and SAP® applications as well as file systems on Microsoft Windows®, Linux®, and UNIX® operating systems. In particular, Microsoft Volume Shadow Copy Service (VSS) integration with the CommVault snapshot management framework helps ensure tight application control for a snapshot routine on Windows operating systems. Taking advantage of VSS creates a simplified adoption path for organizations seeking to

eliminate scripted snapshot operations or implement highly available recovery copies for the first time. By simply enabling SnapProtect, administrators can enable applications to become snapshot aware with the backend storage array.

**Supporting comprehensive data protection and recovery**  
 Organizations seeking to meet stringent SLAs while enhancing data protection and application uptime no longer need solutions from multiple vendors, dedicated hardware, and custom scripting to make everything work together. With SnapProtect, the Dell PowerVault DL2100 – Powered by CommVault enables IT administrators to incorporate comprehensive snapshot awareness into traditional backup and recovery routines while still retaining

the advantages of application data file consistency and log management. Leveraging Dell EqualLogic iSCSI SAN arrays with the CommVault open snapshot management framework provides a single protection policy that creates highly available local recovery copies, protection copies for off-site storage and disaster recovery, and archive copies for long-term retention (see Figure 4). The integration with the PowerVault DL2100 – Powered by CommVault provides a simplified, integrated way to implement script-free data management (including deduplication) and control processes throughout the data life cycle—with the added advantages of reduced backup media costs, shortened backup windows, and reduced bandwidth replication requirements. **PS**



**Darin Camp** is a senior technical alliance manager at CommVault, and has spent the past 12 years in the storage networking and data protection industries.

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# Overcoming data protection challenges in **virtualized environments**

By Scott Herold

Relying on traditional backup approaches in virtualized environments can be complex and time-consuming. By adopting image-based data protection technologies, IT staff can create a simplified, streamlined, reliable system for efficiently protecting and recovering virtual machines.

**V**hen virtualization was first moving into the mainstream, IT groups were largely concerned with "Step 1" problems—determining how to plan and deploy virtualized servers to consolidate physical infrastructure and reduce costs. These problems were generally straightforward to solve, and many organizations were able to achieve the types of consolidation benefits that they expected.

Now, however, these IT groups are deep into the challenges of "Step 2"—operating those environments efficiently. And the problems that have come up are not so simple to solve. Virtual machine (VM) sprawl, for example, took many IT teams by surprise. Setting up a new VM is significantly faster, easier, and more cost-effective than requisitioning an entire physical system, which is the analogous process in a traditional non-virtualized environment. Application owners can therefore obtain the necessary development, quality assurance, and production application servers relatively easily, which can quickly lead to an explosion of VMs. In a data center that has consolidated 50 physical servers to 4 virtualized servers, IT staff might expect a corresponding

reduction in their administrative burden. But because the operating systems themselves don't go away, the workload actually continues to grow as these additional VMs are created. Six months in, this environment might have 100 VMs—or what amounts to double the workload.

Another Step 2 problem—and the one that is the focus of this article—is data protection. It's no surprise that many organizations still protect data in VMs as if they were working with physical systems, by deploying backup agents into the VMs and then using those agents to back up and recover files while often doing nothing to protect the VM image itself. But by instead taking advantage of image-based backup technologies, these organizations can overcome the numerous problems with these traditional backup approaches and create a simplified, streamlined, reliable approach to data protection in virtualized environments based on Dell™ systems.

## Challenges of traditional backups

Traditional backup approaches are less than ideal in virtualized environments. Performing a complete system recovery using file agents in a disaster recovery scenario, for example, can be



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difficult and extremely time-consuming. In addition, because of the shared resource model of virtualization, scheduling backup jobs can be tedious or, in some cases, impossible. Backup administrators must identify the servers hosting each VM—which may change in real time in environments using live migration technologies—and ensure that only a certain number of backup jobs run at one time on a given server. When backup agents are individually deployed in every guest OS, the backup job is consuming underlying system resources the entire time it is running—slowing down not only the VM being protected, but also other VMs on the same server. Running simultaneous backup jobs on different VMs on the same server is generally out of the question.

Then there is the question of how backup data is moved from the virtualized server to storage. In a physical environment, a separate backup server is typically attached to each client to move that data. This approach can still work for virtualized servers—but all backup data must be sent over the LAN, which can disrupt use of that network for other users. To combat this, some organizations may use a separate backup network, which increases the cost and complexity of the infrastructure. Another option has been to use VMware® Consolidated Backup (VCB), but this feature requires a storage area network and has been superseded by the VMware vStorage application

programming interfaces (APIs) introduced with the VMware vSphere™ release.

vStorage offers an enhanced way for backup software to capture VM data, by working with the VM image through a published VMware API (see Figure 1). Image-based backup software, such as the Vizioncore® vRanger™ Pro Data Protection Platform (DPP) solution for image-based backup and recovery, can offer major advantages in virtualized environments. It can accelerate the process of capturing data, helping reduce the impact on the system and the organization as a whole. It can fill a critical gap by helping protect the full VM image as well as the individual files within that image. It can help speed recovery and increase recovery reliability for individual files as well as for the entire image. And it can help increase data transmission speed—it's generally far faster to transmit the whole image instead of the many individual files that comprise the image.

### **Advantages of image-based data protection**

When designed well, image-based backup can provide a more reliable method for handling data than traditional methods. What IT teams worry about is the integrity of the backup data copies held in the archive, and creating those copies depends on a continuous, uninterrupted write of the backup data copy. Another concern is the integrity of the application data captured,

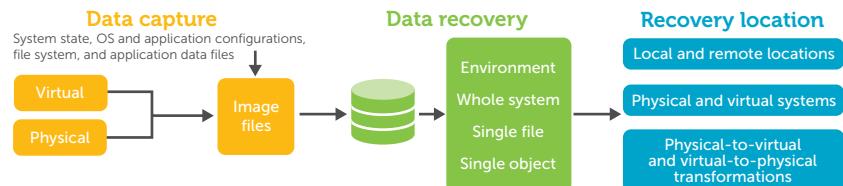
## **Putting image-based data protection to work**

Image-based data protection can provide significant advantages over traditional backups in a wide range of typical IT scenarios.

- Rapid, efficient backup and recovery of large VM images, such as those that exceed 10 GB in size
- Support for local high availability of VMs by preserving them and then restarting them on alternate virtualized servers in the environment
- Disaster recovery through the transmission of VM images to an off-site recovery location, in which case recovering both the data and applications occurs in the single step of launching the replica VMs on different servers
- Rapid recovery of entire servers, especially those hosting business-critical applications such as customer relationship management, payroll, and accounting systems, in which case the ease of recovery—without requiring separate steps for operating systems and applications—can make image-based approaches invaluable
- Rollback of database systems to a point in time just before drive resizing and other optimization tasks—just in case
- Protection for end users and customers against disk problems, data corruption, and the troubleshooting steps required for repairs, replacements, and bringing storage environments back to operational readiness
- Rapid recovery from human errors such as storage provisioning and reallocation by mistakenly deleting logical units (LUNs) that contain critical data—a situation that can occur frequently when virtualized servers are underprovisioned and inexperienced administrators attempt to find space for backups, or when the steps of an infrastructure upgrade or cutover are performed out of sequence



**Figure 1.** Enhanced data capture, transmission, and recovery processes using image-based data protection in virtualized environments



which must be consistent at a given point in time to be recoverable and usable from that point.

Both problems can be alleviated with a well-designed image-based data protection system. First of all, this type of system can be extremely fast—incurring minimal overhead by bypassing the file system to directly read a disk, in addition to skipping empty blocks in the image. This approach also creates a smaller backup copy—in a single file—than would be created by the traditional method of creating a backup copy of the thousands or millions of individual files that make up the image. Faster means that there is less time for something to go wrong, while smaller means that the backup copy can be transmitted more quickly and stored using fewer blocks than it could otherwise—again helping reduce the risk of something going wrong.

In terms of application data consistency, because capturing an image that includes all of an application's data from a single point in time is the definition of an image-based backup, this approach helps significantly reduce the odds of backing up data at inconsistent points. Even in the unlikely event that the data is not consistent, administrators could still recover and restart the application by rolling back to the nearest previous consistency point, which is captured in the backup image.

When asked to comment on image-based data protection, Lauren Whitehouse, a senior analyst from the Enterprise Strategy Group (ESG), agreed that this technology is the one most likely to help improve backup and recovery in virtualized environments. Citing ESG's 2010 IT spending survey, in which over 500 respondents reported on their budgets for investing in virtualization technology this year, she said, "ESG research found that implementing data protection processes for server virtualization environments is a big pain

point for many end-user respondents. These organizations have committed to fixing the issue this year with increased investments in solutions that improve backup and recovery of virtual machines, improving disaster recovery processes, and improving application backup and recovery." She continued, "For x86 server virtualization environments, rapid image-level backup with flexible image- or item-level restore can address all of these challenges. It can provide nondisruptive and optimized backup, enable efficient disaster recovery strategies, and facilitate improvements in application-specific backup and recovery." (For more examples of the benefits of image-based data protection in real-world scenarios, see the "Putting image-based data protection to work" sidebar in this article.)

### Streamlined data protection for virtualized environments

Vizioncore has introduced its Backup 2.0 campaign to help organizations understand how image-based data protection can simplify their operations. The sooner that IT teams begin to adopt image-based methods for VM backups, the sooner they can overcome the Step 2 challenges of protecting their virtualized Dell servers—a critical step toward gaining the full benefits of virtualization. **PS**



**Scott Herold** leads product design and architecture for Vizioncore and has more than a decade of industry experience in OS, network, security, and storage design.

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# Simplifying networks in virtualized environments with Intel technology

By Srinivas Thodati and Brian Johnson

Advances in Intel® 10 Gigabit Ethernet technology and VMware® vSphere™ virtualization can help create a flexible, simplified, highly efficient networking environment without compromising areas such as security and traffic segmentation.

The success of virtualization, while substantial, has been limited by the complexity that has arisen from networking with Gigabit Ethernet (GbE) technology. Networking virtualized hosts with GbE is typically based on relatively large numbers of dedicated physical connections, which are used to segregate different types of traffic because of networking infrastructure and bandwidth limitations from 1 Gbps connectivity. Organizations pay for this complexity in increased management and equipment costs, as well as increased power usage.

As 10 Gigabit Ethernet (10GbE) technology enters the mainstream, IT organizations are considering how they can use it to help simplify their virtualized environments. Consolidating multiple GbE traffic flows onto a reduced number of 10GbE connections helps reduce complexity and cost. However, many IT administrators have expressed concerns that quality of service (QoS), security, or performance may suffer as a result of this traffic convergence. These concerns have

prevented some organizations from taking full advantage of 10GbE technology.

Cumulative experience among Dell, Intel, and VMware together with advances in Dell™ PowerEdge™ servers, Intel 10GbE server adapters, and VMware vSphere 4 virtualization software can alleviate these concerns and help organizations realize further efficiency and cost savings.<sup>1</sup>

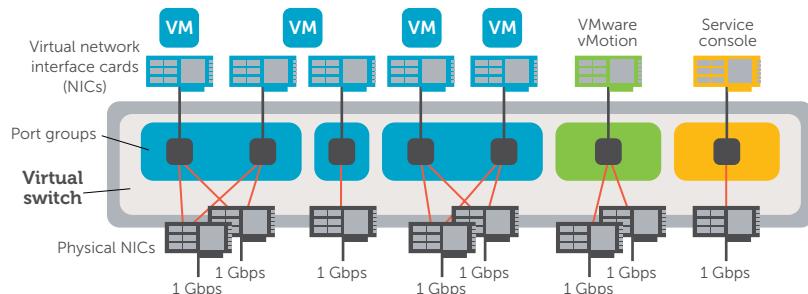
## Transitioning to a virtualization mind-set

The common practice when deploying virtualized hosts in a physical environment has been to segregate network functions onto dedicated GbE ports, adding additional ports as demand or bandwidth increases. These ports are often installed in pairs to provide network failover, doubling the number of ports required per host. As a result, the number of network ports has a tendency to become bloated, leading to excessive complexity and associated high costs of hardware and power.

<sup>1</sup>To learn more about optimizing performance in virtualized environments with 10GbE connectivity, see "Intel Ethernet Server Adapters Maximize Throughput Performance for iSCSI Connectivity," by Sunil Ahluwalia and Gary Gumanow, in *Dell Power Solutions*, 2010 Issue 1, [dell.com/downloads/global/power/ps1q10-20100322-Intel.pdf](http://dell.com/downloads/global/power/ps1q10-20100322-Intel.pdf).



**Figure 1.** Virtual switch with multiple physical GbE server adapters



This approach is largely a carryover from physical configurations. Pre-virtualization best practices guided initial implementations of virtualization technology, and physical server network paradigms were often extended to virtual infrastructures. This extension led to the use of separate physical connections for segmenting traffic and providing the required bandwidth.

In addition, previous versions of the VMware platform required dedicated connections for virtual machines (VMs) and for each of multiple traffic types, such as VM traffic, service console connections, IP storage, and VMware vMotion™ technology. Security procedures also led network administrators to physically segregate traffic onto separate ports, because the IEEE 802.1Q standard for trunking to the host was not implemented as a standard practice and was limited to switch-to-switch connections.

Segregating a 10GbE port into multiple dedicated bandwidth channels, however, can significantly reduce the advantages of moving to a 10GbE environment. For example, dividing a connection into four channels with

dedicated bandwidths of 4 Gbps, 2 Gbps, 1 Gbps, and 1 Gbps means that no single connection can use more than those limits, because the channels cannot share unused bandwidth. Unlike using one open connection in which unused bandwidth can be used by other traffic types, segregating the bandwidth of a 10GbE connection does not provide significantly more headroom than using multiple GbE connections, and leads to a significant increase in management overhead. If a maximum of 4 Gbps of throughput is all an organization needs on the largest connection, then a single open 10GbE connection can handle any of the traffic with plenty of bandwidth to spare, especially in a typical implementation using 10GbE ports in a redundant active/active configuration.

### Comparing GbE and 10GbE topologies

Using GbE, host servers may need as many as eight or more network ports to satisfy the requirements of virtualization (see Figure 1). In this topology, several port groups are configured to support the various networking functions

and application groupings. In turn, each port group is supplied with one or more physical connections. Virtual LAN (VLAN) tags may be implemented on these port groups as well. This GbE topology raises several issues, including the following:

- **Inefficiency:** The large number of physical ports and server adapters contributes to increased administrative overhead and power consumption.
- **Difficult network management:** The increase to 8–12 network ports on each server can increase the likelihood of misconfiguration.
- **Numerous points of potential failure:** Multiple physical devices and cable connections contribute to the likelihood of hardware failures.
- **Bandwidth limitations:** Static allocation and physical reconnections are required to add bandwidth to the network.

Moving from multiple GbE connections to fewer 10GbE connections enables a flexible, scalable network infrastructure that helps reduce complexity and management overhead while providing high availability and redundancy. The 10GbE installation shown in Figure 2 is analogous to the GbE topology shown in Figure 1 but uses 10GbE connectivity for most ports (limiting GbE to the service console) and capitalizes on the VMware vNetwork Distributed Switch feature in VMware

vSphere 4. This feature provides the same basic functions as standard virtual switches, but the switches exist across two or more clustered VMware ESX or ESXi hosts. (For an overview of performance-enhancing technologies for flexible infrastructures, see the "Enabling near-native 10 Gigabit Ethernet performance" sidebar in this article.)

### Addressing security, segmentation, and bandwidth concerns

Even though 10GbE networking enables the consolidation of multiple functions onto a single network connection, the practice of using large numbers of GbE connections has persisted because of several administrator concerns—including segregating traffic for security, meeting QoS requirements, and providing dedicated bandwidth for critical networking functions. When GbE server connections are consolidated onto 10GbE connections, isolating connections in the absence of dedicated physical connections is still necessary. This requirement reflects the need for security between different types of traffic. Isolating connections is also necessary to help ensure adequate bandwidth for specific applications within the shared connection.

Employing 10GbE with VMware vSphere 4, as in the infrastructure shown in Figure 2, helps meet these requirements using updated approaches

rather than discrete physical connections. VLANs provide the basic security features needed, and VLAN traffic segmentation provides dedicated bandwidth for each type of network traffic. The IEEE 802.1Q standard for VLAN trunking enables administrators to group multiple VLANs onto a single wire, helping reduce complexity. The grouping can be managed as a unit over one physical wire and broken into dedicated networks at the switch level instead of at each host.

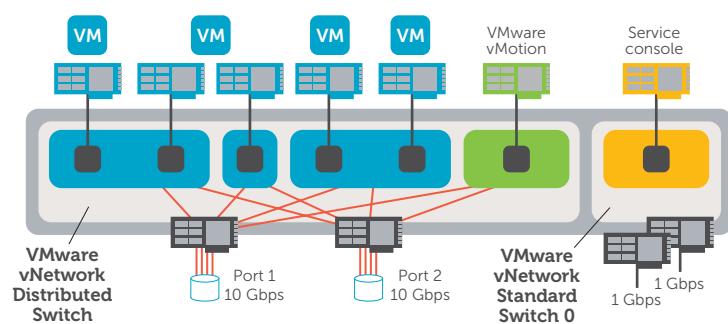
### Using traffic segmentation to isolate data

VLANs allow network traffic segmentation without dedicating physical ports to each segment. This method has the obvious benefit of reducing the number of physical ports needed to isolate traffic types. Dell and Intel have developed best practices for the 10GbE model to address questions of performance, security, and bandwidth allocation. These best practices are based on extensive experience in the organizations' own IT environments as well as advances in server adapter and virtualization technologies.

### Optimum performance through VLAN segmentation

In a virtualized environment, the switch that previously was the first connection out of the server is now part of the hypervisor, and therefore part of the server. In the past, VLAN trunking from physical servers was not typically necessary; with 10GbE and virtualization, however, it can help significantly with port consolidation while still providing traffic segmentation. The key is to segment the traffic to various VLANs and use VLAN trunking to connect the host server to the top-of-rack or end-of-row switch, or to the blade switch for a blade host server.

To help maximize performance, the service console should be on a dedicated port group with its own dedicated VLAN ID, and should use port 2 in a two-port configuration or a dedicated GbE redundant team. VMware vMotion should also be on its own dedicated port group with its own dedicated VLAN ID, and should also use port 2. IP-based storage traffic—Internet SCSI (iSCSI) and Network File System (NFS)—should be on its own port group in the vNetwork



**Figure 2.** VMware vNetwork Distributed Switch with 10GbE server adapters for network traffic and GbE server adapters for service console traffic



Distributed Switch, using port 2. VM traffic can use one or more VLANs, depending on the level of separation needed between the VMs. In a non-failed state, the VMs should not share the service console, vMotion, or IP-based storage traffic VLAN IDs, and should use port 1 in a two-port configuration.

#### VLANs for traffic isolation

When VLANs are separated in this manner, logical partitioning isolates individual traffic flows. VMware vSphere can control the effects of individual VMs on the traffic flows of other VMs that share the same physical connection. Demilitarized zones (DMZs) can be configured on different network adapters to isolate internal traffic from external traffic.

Administrative traffic and other back-end services are handled by a separate networking stack managed by the VMkernel, providing further isolation from VM traffic even on the same physical connection.<sup>2</sup>

#### Enterprise-level reliability

Many IT organizations are concerned about the need to ensure enterprise-level reliability for critical applications and workloads. To enhance reliability, administrators can install 10GbE ports in pairs to support a redundant configuration. If two 10GbE ports are used, a best practice is to run VM traffic primarily on port 1 and all other traffic on port 2. This design uses the bandwidth of both 10GbE ports and can be configured for network failover.

In the event of a hardware failure, the host and management software should migrate all VMs off the host using vMotion to retain redundancy and help ensure reliability. To enhance redundancy further, a second option is to move to a configuration of four 10GbE ports, with two primary ports and backup ports on separate adapters.

#### Meeting the bandwidth requirements of converged data streams

Another concern among many administrators is that 10GbE connections can become saturated with one traffic type, negatively affecting other traffic classes. In particular, live migration of VMs using VMware vMotion can be bandwidth intensive. However, reaching saturation on 10GbE is unlikely, given that the converged traffic streams previously used only GbE connections.

Using Dell PowerEdge servers with powerful multi-core processors and Intel 10GbE server adapters can provide the overall bandwidth to support this aggregation. 10GbE adapters provide the bandwidth necessary for multiple traffic types to coexist on a single port. In many cases, QoS requirements can be met simply by the availability of large amounts of bandwidth. The presence of sufficient bandwidth can also increase the speed of live VM migration using vMotion, removing potential bottlenecks for enhanced performance.

## Enabling near-native 10 Gigabit Ethernet performance

Realizing the performance benefits of 10 Gigabit Ethernet (10GbE) in virtualized environments requires minimizing software overhead. Several technologies can enhance networking performance in these environments.

- **Intel Virtual Machine Device Queues (Intel VMDq):** Offloads data-packet sorting from a virtual switch onto a physical network adapter, helping to reduce processor overhead and enhance overall efficiency\*
- **Single Root I/O Virtualization (SR-IOV):** Allows administrators to partition a physical port into multiple virtual I/O ports, and use each as a single dedicated port directly assigned to a virtual machine
- **Intel Virtualization Technology for Directed I/O (Intel VT-d):** Enables an I/O resource to be assigned to a specific virtual machine, giving its OS direct access to that resource\*\*
- **Data Center Bridging (DCB):** Provides enhanced traffic prioritization over a single interface and, in conjunction with 10GbE, can help cost-effectively meet latency requirements\*\*\*

\*To learn more about Intel VMDq, see "Intel Ethernet Server Adapters Maximize Throughput Performance for iSCSI Connectivity," by Sunit Ahluwalia and Gary Guamanow, in *Dell Power Solutions*, 2010 Issue 1, [dell.com/downloads/global/power/ps1q10-20100322-intel.pdf](http://dell.com/downloads/global/power/ps1q10-20100322-intel.pdf).

\*\*To learn more about Intel VT-d, see "Building the Efficient Enterprise with Dell, Intel, and VMware vSphere 4," by Andrew Gilman, Mike Monthei, and Andrew I. Fields, in *Dell Power Solutions*, September 2009, [dell.com/downloads/global/power/ps3q09-20090301-vmware.pdf](http://dell.com/downloads/global/power/ps3q09-20090301-vmware.pdf).

\*\*\*To learn more about DCB, see "Mixing Gigabit Ethernet and 10 Gigabit Ethernet in a Dedicated SAN Infrastructure," by Tony Ansley, in *Dell Power Solutions*, September 2009, [dell.com/downloads/global/power/ps3q09-20090416-ansley.pdf](http://dell.com/downloads/global/power/ps3q09-20090416-ansley.pdf); and "10 Gigabit Ethernet: Unifying iSCSI and Fibre Channel in a Single Network Fabric," by Ahmad Chadran, Gaurav Chawla, and Ujjwal Rajbhandari, in *Dell Power Solutions*, September 2009, [dell.com/downloads/global/power/ps3q09-20090392-chadran.pdf](http://dell.com/downloads/global/power/ps3q09-20090392-chadran.pdf).

<sup>2</sup>To learn more about using VLANs to protect data, see "vSphere 4.0 Security Hardening Guide," by VMware, Inc., April 2010, available at [communities.vmware.com/docs/DOC-12306](http://communities.vmware.com/docs/DOC-12306).

In addition to generally available bandwidth, traffic segmentation helps ensure dedicated bandwidth for specific traffic types and QoS. Shared 10GbE server adapters are more advantageous than separate GbE connections for this purpose. The 10GbE connections make more efficient use of available bandwidth than GbE connections for demanding applications and heavy-use portions of the workday.<sup>3</sup>

#### **GbE limitations with traffic spike management**

Although separating traffic flows onto discrete GbE connections is a viable means of providing dedicated bandwidth, doing so has distinct shortcomings. For example, allocating two GbE connections to a VM traffic port group provides a potential of 2 Gbps of dedicated bandwidth. However, if additional bandwidth is needed for sporadic traffic spikes from that port group, additional server adapters must be added—assuming additional PCI slots are even available. Another shortcoming is that the bandwidth allocated in this example cannot be used by any other traffic, so it simply goes to waste.

#### **10GbE and seamless management of traffic spikes**

Providing bandwidth to the port group from a shared 10GbE server adapter allows additional bandwidth to be allocated seamlessly for traffic spikes. Multiple port groups can share the bandwidth headroom provided by the server adapter. The resource can be automatically and dynamically reallocated as various port groups are accessed by their associated VMs. Dedicated bandwidth is not necessary for any one port group as long as the host network connection does not reach saturation.

#### **Deploying 10GbE to help reduce complexity and cost**

Using Dell PowerEdge servers with Intel 10GbE server adapters in VMware vSphere 4 virtualized environments enables organizations to reduce

the complexity and cost of their network infrastructure. These hardware and software technologies are designed to work together to ensure that security and performance requirements can be met without the large numbers of physical server connections required in legacy GbE networks. As a result, administrators can replace methods that depend on physical separation with updated approaches that use logical separation.

The key for IT organizations is to resist trying to mimic a traditional setup of physical servers in a virtualized server environment. Rather than segregating a 10GbE port into multiple dedicated channels, they can take advantage of open 10GbE connections and VMware virtualization to enable flexible, dynamic bandwidth allocation and increased headroom while also dramatically reducing the number of physical server adapters needed for a given configuration—which, in turn, helps them to reduce capital and support costs. Ultimately, 10GbE connectivity enables organizations to obtain maximum value from their virtualized server environment. 



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**Brian Johnson** is a product marketing engineer at Intel for 10 Gigabit Ethernet products and virtualization technologies, and has more than 12 years of experience in server product planning and marketing.

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##### **Dell PowerEdge servers:**

[dell.com/poweredge](http://dell.com/poweredge)

<sup>3</sup>For more information on how 10GbE connectivity handles the demands of bandwidth-intensive applications, see "New Technologies Speed the Move to 10 Gigabit Ethernet Data Center Connectivity," by Sunil Ahluwalia, in *Dell Power Solutions*, June 2009, [dell.com/downloads/global/power/ps2q09-20090230-intel.pdf](http://dell.com/downloads/global/power/ps2q09-20090230-intel.pdf).



# Productivity at the touch of a button: **Dell Latitude ON | FLASH**

By Roberto Ayala and Steve Rokov

The Dell™ Latitude ON™ | FLASH module was designed for on-the-move workers. By avoiding a full system boot, Latitude ON | FLASH is available within seconds, providing near-instant access to the Internet, Microsoft® Office documents, virtual remote desktops, and more.

## Dell Latitude ON | FLASH module



Supported Latitude ON Ready laptops include Dell Latitude™ E4200, Latitude E4300, Latitude E4310, Latitude E6410 (shown here), Latitude E6510, and Dell Precision™ M4500 models

**B**ooting up a laptop just to check e-mail or access the Internet can be a slow process—and a definite drain on productivity. On-the-move workers can reclaim that lost time by using Dell Latitude ON | FLASH, the latest member of the Latitude ON family.

### Access in seconds

Installed as a separate, alternative workspace designed to launch in under 10 seconds, Latitude ON | FLASH offers a full-featured, secure, high-performance Web browsing experience together with Citrix®, VMware®, and Remote Desktop Protocol (RDP) remote desktop support. Users can also check e-mail, access chat and voice-over-IP (VoIP) services, and read and edit Microsoft Office-compatible documents.

Because it is designed to launch in seconds at the touch of a button, Latitude ON | FLASH helps reduce the need to leave laptops turned on or in sleep mode overnight—helping to lower power consumption and reduce boot problems with the Microsoft Windows® OS. And unlike a conventional mobile thin client, laptops equipped with Latitude ON | FLASH transform into mobile hybrid computing devices that provide the flexibility to work in a traditional thick-client mode, a thin-client mode, or a combination of the two.

Latitude ON | FLASH can be preinstalled on supported models at the time of purchase or field installed as a module kit that includes the necessary hardware, drivers, and application software. After configuring the software using a Windows utility, end users can

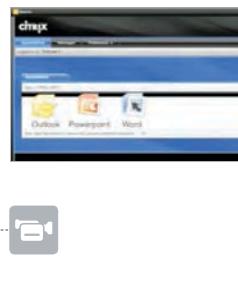


**Figure 1.** Dell Latitude ON | FLASH start screen, designed to launch within 10 seconds

launch Latitude ON | FLASH by pressing the Latitude ON button, entering their login information, and choosing an application from the start screen, without waiting for a full Windows boot (see Figure 1). Users can switch easily between the Latitude ON | FLASH and Windows environments. And because the module utilizes the system power, processor, memory, LAN, and wireless networking resources, users can continue to leverage their existing investments. Latitude ON | FLASH works with supported Latitude ON Ready laptops, easily identifiable by the separate Latitude ON button; these models include Dell Latitude E4200 and Latitude E4300 laptops in addition to the recently announced Latitude E4310, Latitude E6410, Latitude E6510, and Dell Precision M4500 models.

### Rock-solid reliability

Laptops are in frequent motion and subject to regular bumps and drops. Latitude ON | FLASH is designed to operate independently of the laptop's primary OS and hard drive so that users can still get online even following an OS or hard drive failure. Its alternative workspace remains active even if the hard drive has been encrypted or has been removed for replacement. And if the laptop must be sent in for repair, the Latitude ON | FLASH module can be easily transferred to another Latitude ON Ready system while retaining the existing configuration and user information.



### Dell Latitude ON | FLASH overview

This video demonstrates the key features of the Latitude ON | FLASH environment, including multiuser authentication, the full-featured Web browser, and comprehensive Virtual Remote Desktop support.

[youtube.com/watch?v=zvda-cT69ek](http://youtube.com/watch?v=zvda-cT69ek)



# “Latitude ON | FLASH provides a highly flexible, cost-effective way to maximize productivity on the road.”

## Secure business workspace

Latitude ON | FLASH was designed with security in mind. Because it provides a separate workspace, application changes to the Microsoft Windows environment do not affect it, helping to reduce support and security issues. IT staff can configure multiple user accounts and passwords to help ensure that only authorized users gain access. Strong passwords are required for login.

Latitude ON | FLASH uses a hardware firewall and is electrically isolated from the system hard drive and from the Windows OS, helping to prevent users and applications from accessing the drive or the Windows partition. The locked-down Linux® OS-based environment is designed to ensure that applications cannot be installed or removed. Local user preferences are stored for each configured user, but browser plug-ins are not—helping reduce virus and malware threats by preventing their payloads from executing and installing themselves into the permanent file system. The result is a clean, secure session each time the system boots into Latitude ON | FLASH.

## Flexible remote desktop client

With the Dell Virtual Remote Desktop (VRD) solution, the storage and processor functionality—the client “desktop”—is offloaded to a server and virtualized, with the client device performing only

graphics processing and user interface functions. Latitude ON | FLASH is well suited for this type of client virtualization, because it has pre-integrated Citrix and VMware remote desktop clients within a locked-down, secure OS along with an RDP client for Windows Terminal Services.

The Citrix client supports Citrix XenDesktop™ and Citrix XenApp™ services using the Program Neighborhood and Web interfaces, including smooth roaming, client drive mapping, cut and paste, and audio mapping functionality. The VMware View client supports VMware virtual desktop infrastructure software such as ThinApp, including USB redirection, Secure Sockets Layer (SSL), and direct mode functionality. The open source rdesktop client is available to provide access to Windows Terminal Services using RDP. These options enable mobile and remote workers to turn their existing laptops into cost-effective thin clients that can provide more flexibility than dedicated mobile thin-client hardware.

## Maximum efficiency and productivity

The Dell Latitude ON | FLASH module was designed with the specific needs of mobile and remote workers in mind. By providing secure, near-instant access to the Internet, Microsoft Office documents, virtual remote desktops, and more, it provides a highly flexible, cost-effective way to maximize productivity on the road. 

## Learn more



**Dell Latitude ON | FLASH:**  
[latitude-on-flash.com](http://latitude-on-flash.com)

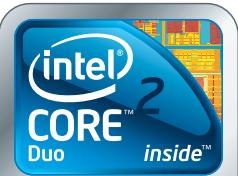


**Dell Latitude laptops:**  
[dell.com/latitude](http://dell.com/latitude)



**Dell virtual clients:**  
[dell.com/virtualclients](http://dell.com/virtualclients)

Windows®. Life Without Walls™.  
Dell recommends Windows 7.



Look for  
Intel  
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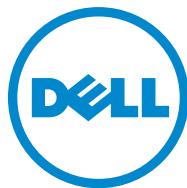
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T3 magazine called it one of the toughest gadgets on Earth and it'll work in some of the toughest conditions on the planet. Whether that's Alaska, Afghanistan, or anywhere in-between. If you need a computer that goes above and beyond the call of duty, [visit Dell.com/ruggedE6400xfr](http://Dell.com/ruggedE6400xfr) or call 1-866-810-8610.

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# Securing the mobile workforce with SonicWALL appliances

By Patrick Sweeney and Matthew Dieckman

The mobile workforce presents significant security challenges to IT departments. SonicWALL® Aventail® E-Class Secure Remote Access (SRA) appliances are designed to support a comprehensive, policy-based approach to remote access that helps streamline management while enhancing security and flexibility.

**M**obile technology is changing the face of business, enabling employees to be productive from virtually anywhere, cutting time and costs out of operations, and helping companies reach their customers effectively. But this technology is also presenting a significant challenge to IT departments—especially when it comes to security. With a growing range of devices and points of entry on the network, the “workplace” is no longer restricted to a protected area behind a hardened perimeter.

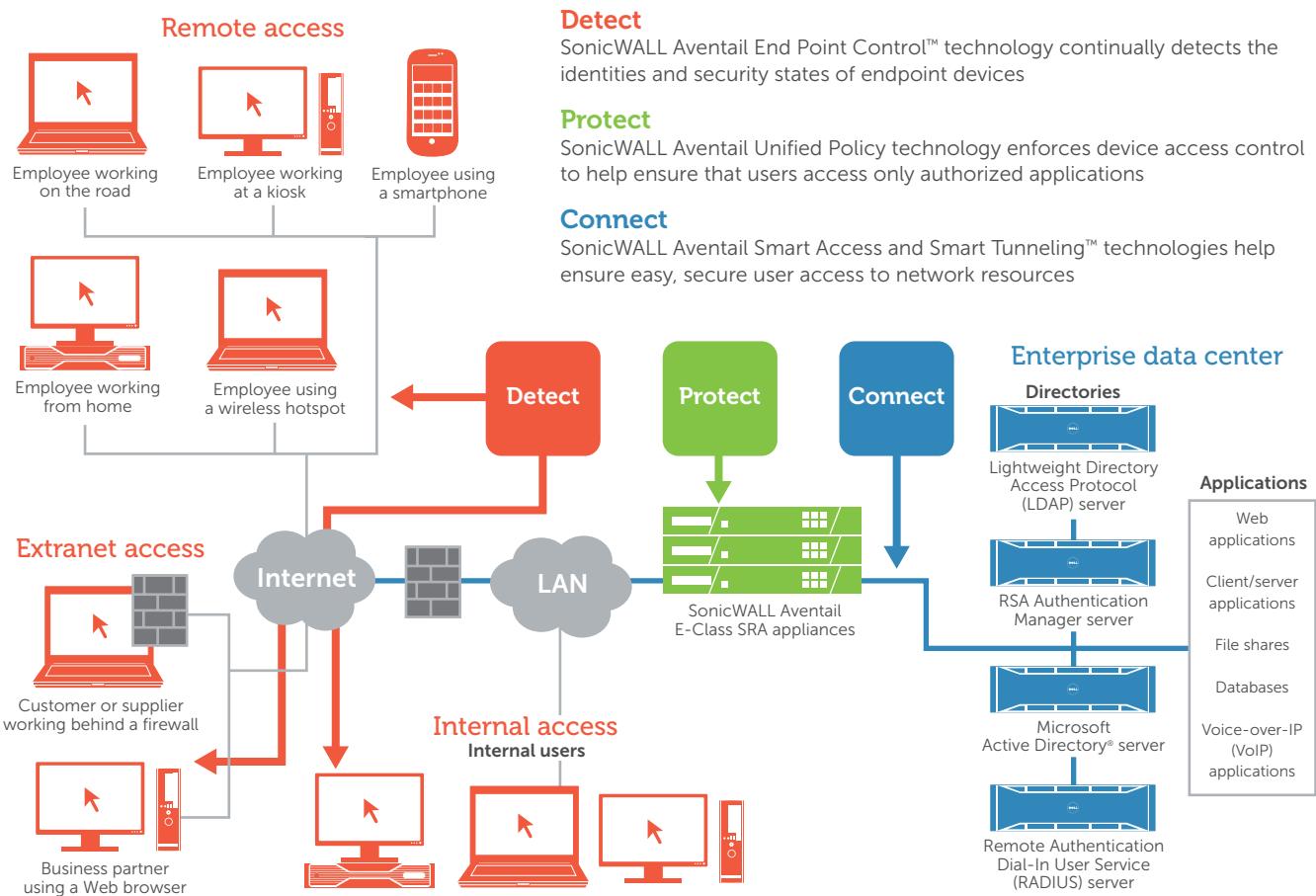
In response, IT departments often find themselves having to adopt a one-size-fits-all approach to authenticating end users and providing remote access, which often is not enough in a multifaceted mobile world. Alternatively, they may create a thicket of individual rules to try to meet the different enterprise and security needs presented by the wide range of users and devices, which can be complex, time-consuming, and expensive.

The growing emphasis on mobility requires a sophisticated, nuanced view of security. SonicWALL Aventail E-Class Secure Remote Access (SRA) appliances are designed to support a

comprehensive, policy-based approach to security in Dell™ hardware-based IT environments—enabling access to mission-critical resources from virtually any endpoint device, streamlining policy management, and helping IT groups effectively provide the security and flexibility to support the increasingly mobile workforce.

## Blurring the network perimeter

The expansion of mobile technology means that IT departments must contend with a wide range of data and voice devices, a growing number of which are personal devices used by employees. Mark Bouchard, founder of the AimPoint Group research and analysis firm, calls this the “consumerization” of IT. IT groups, he writes, are “being given no option other than to support the ongoing cross-over and melding of equipment, services, and activities of a personal nature with those historically identified as being ‘business-oriented.’” As a result, “the IT department, along with its network security infrastructure, must be able to account for a mixed bag. Not all devices will have a robust security model, not all devices will be corporate-owned and managed, and neither will there be clear relationships between a



**Figure 1.** SonicWALL Aventail E-Class SRA appliances help provide secure access across a comprehensive range of users, devices, and applications

device's location (e.g., inside the network) and its type, security state, or category of user.<sup>1</sup>

Beyond the use of mobile technology, other enterprise practices are also blurring the traditional network perimeter. Increased collaboration and the rise of extended enterprises mean that a rising number of external partners may need to access internal applications. And the use of teleworking is growing—a trend that is likely to continue, as rising transportation costs and environmental concerns

encourage flexibility regarding working from home.

Many organizations are also looking at the role that a remote workforce can play in business continuity. This interest increased sharply with the recent focus on the H1N1 virus, which had the potential to keep large numbers of people away from offices. But disruptions such as snowstorms, earthquakes, and terrorist acts could also require an increased reliance on remote employees, and on the variety of managed and unmanaged devices they need to use.

Perhaps most significantly, as the importance of remote workers grows, many companies find that the complexity of providing security in this type of environment can actually stifle growth and productivity. According to a report from Nemertes Research, "new applications and services can, increasingly, transform operations or customer interactions, but 67% of enterprises in Nemertes Security and Information Protection benchmark have rejected attractive and useful

<sup>1</sup> "Network Security for 2010 and Beyond – The Impact of the Consumerization, Webification, Virtualization, and Consolidation of IT," by Mark Bouchard, AimPoint Group, February 2010, [www.sonicwall.com/downloads/wp-eng-049\\_apg-network-security-2010-beyond.pdf](http://www.sonicwall.com/downloads/wp-eng-049_apg-network-security-2010-beyond.pdf).



technologies because of security concerns around them.<sup>2</sup> In essence, secure mobile access is not just an IT concern, but a fundamental issue for the enterprise as a whole.

### Designing an effective mobile security policy

SonicWALL Aventail E-Class SRA appliances are designed to support an increasingly mobile workforce securely and cost-effectively. By using Secure Sockets Layer (SSL) virtual private network (VPN) technology

element, user authentication, is based on authentication realms, which administrators set up to establish how end users are identified. Organizations can create multiple authentication realms to accommodate different requirements for different users. For example, some users may be required to provide only a username and password, whereas others may be required to use token authentication or stacked authentication. E-Class SRA appliances support a variety of authentication

hard drive serial number and Windows domain membership; and device type. These profiles are then used to scan and verify device attributes before access is granted. Based on the results of the scan, the device is placed into a security category, or "policy zone"; depending on the zone the device falls into, access may be granted or denied, or the device may be quarantined until some action is taken, such as installing a required antivirus update. Policy zones make it possible to provide

example, the policy may specify that employees working from home on unmanaged devices would be given just enough application access to carry out the basics of their work, while those same employees would have greater access to more sensitive content when using a highly secured, IT-managed device. A business partner using an external corporate system, an IT technician working from a home PC, and a traveling executive with a company laptop can all be given different yet appropriate access with relative ease—providing far more flexibility than a typical one-size-fits-all approach.

The policy-based approach is not only effective; it also helps reduce the complexity of managing access. This simplicity is further enhanced with the advanced, object-based SonicWALL Aventail Unified Policy™ model, which enables administrators to view and manage the entire organization's remote access policy structure using a single integrated view in an intuitive management console. The centralized administration is designed to consolidate control of Web resources, file shares, and client/server applications in a single location.

Unified Policy also enables administrators to quickly and easily create a single rule set covering a comprehensive range of resources and access methods—avoiding the need to create separate access-control

## "SonicWALL Aventail E-Class SRA appliances are designed to support an increasingly mobile workforce securely and cost-effectively."

rather than traditional IP Security (IPsec) VPN technology, these appliances enable security at the application level rather than the network level and can allow secure access even from unmanaged devices. They also provide a layered approach that enables increased granularity of policy and access control, which is key when dealing with a variety of locations and remote devices (see Figure 1).

The SonicWALL Aventail E-Class SRA policy-based approach encompasses three fundamental elements of mobile security: user authentication, endpoint device identification, and application access. The first

methods, including server-side digital certificates, usernames and passwords, client-side digital certificates, RSA SecurID and other onetime password tokens, and dual or stacked authentication.

For endpoint device identification, E-Class SRA appliances let organizations enforce granular access control rules for Microsoft® Windows®, Microsoft Windows Mobile®, Linux®, and Apple Mac OS X endpoints. Administrators can create device profiles that include attributes such as the presence of specific files, directories, registry settings, and antivirus programs; Windows

differentiated access based on the type of device being used and the overall security state of the device—a significant enhancement over a typical approach that grants access to many potential resources regardless of the safety of the endpoint device.

Finally, for application access, E-Class SRA appliances look at the information gathered about users and devices—that is, the degree of trust established for those factors—and then matches it to a customized authorization policy that determines which applications and resources the user and device can access. For

<sup>2</sup> "The Center Is Everywhere," by Andreas Antonopoulos and John Burke, Nemertes Research, February 2008, [www.sonicwall.com/downloads/wp\\_nemertes\\_center-is-everywhere.pdf](http://www.sonicwall.com/downloads/wp_nemertes_center-is-everywhere.pdf).

rules for each user based on the type of resource he or she wants to access and the access method being used, all spread across separate pages in the management interface. A single rule can define access for an entire group of users across multiple resources using multiple access methods. For example, from one console page, administrators can define a single rule granting every user in a sales group access to sales-specific Web resources, file shares, and client/server applications from their workstations or their managed smartphones.

### Taking advantage of the layered approach

The comprehensive, layered approach to mobile access provided by SonicWALL Aventail E-Class SRA appliances can provide a wide range of benefits, including the following:

- Effective remote access security:** Effective remote access security includes comprehensive access management policies based not only on users, but also on the level of risk presented by the users' environments. Granular access enables organizations to customize secure access for diverse endpoints rather than relying on a single approach that may or may not be appropriate for a given device.
- Streamlined IT management:** Unified Policy helps to simplify use and administration, ease the burden on IT resources,

and reduce systems management costs. The object-based model is also highly scalable—for example, E-Class SRA appliances have been successfully deployed in global organizations with more than 85,000 users. This scalability helps to reduce repetition for administrators and simplify network changes.

- Low total cost of ownership:**

In addition to helping reduce management costs, E-Class SRA appliances help lower IT costs by enabling network managers to easily deploy and manage a single secure access gateway to network resources for both internal and external users—including Web browser-based, host-based, and client/server applications. The appliances can be clientless or use lightweight Web-delivered clients, which helps reduce management overhead and support calls. They can also deliver high availability, with integrated load balancing and active/active failover on some models, helping eliminate the need for a third-party load balancer.

- Business continuity:** In the event of a business disruption, organizations can quickly establish secure, appropriate access to an expanded remote workforce. E-Class SRA appliances can provide a secure application access gateway at primary data centers and serve as a gateway to hot, warm, or cold disaster recovery facilities. An optional SonicWALL Aventail Spike License Pack

lets organizations temporarily and cost-effectively increase their remote user count to the maximum capacity of their E-Class SRA appliance, whether this capacity is a few dozen or a few thousand additional users.

- Increased productivity:**

Employees and partners can have appropriate yet controlled access to enterprise applications from a wide variety of devices and locations, helping to deliver the right information to users when and where they need it. E-Class SRA appliances also provide session persistence, which lets mobile users retain a current session when they switch between networks—for example, as they move between offices, cars, homes, and hotels—without needing to re-authenticate.

### Supporting the mobile workforce

A mobile workforce brings with it specific security challenges that call for comprehensive, policy-based control of remote access. Using this type of approach in conjunction with SonicWALL Aventail E-Class SRA appliances and Dell hardware, IT departments can simplify the management of remote access without sacrificing sophistication or driving up costs. And they can meet the dual demands of providing high levels of security while supporting the flexible delivery of vital information—and help the enterprise thrive in the era of the mobile workforce. 



**Patrick Sweeney** is vice president of the product management team at SonicWALL, where he oversees its network security, content security, business continuity, and policy and management product lines.

**Matthew Dieckman** is the product manager for SRA solutions at SonicWALL, where he drives the development road map for SonicWALL SSL VPN products and services.

### Learn more



**SonicWALL Aventail E-Class SRA appliances:**  
[www.sonicwall.com](http://www.sonicwall.com)



# Enabling pervasive business intelligence using an **integrated Oracle platform**

By Mark Conway, Dan Blankenship, and Jaime Delgado

An integrated, standards-based platform offers an efficient way to move beyond the traditional, fragmented approach to business intelligence. Taking advantage of Oracle® BI software and Dell™ servers and storage can help weave cost-effective, analytics-driven decision making deep into the organization.

**T**oday, organizations are constantly contending with increased volatility, complexity, and demands for transparency and performance—and to keep up, they must be armed with timely, accurate information. That reality has put the spotlight on business intelligence (BI) and the analysis of data to support decision making.

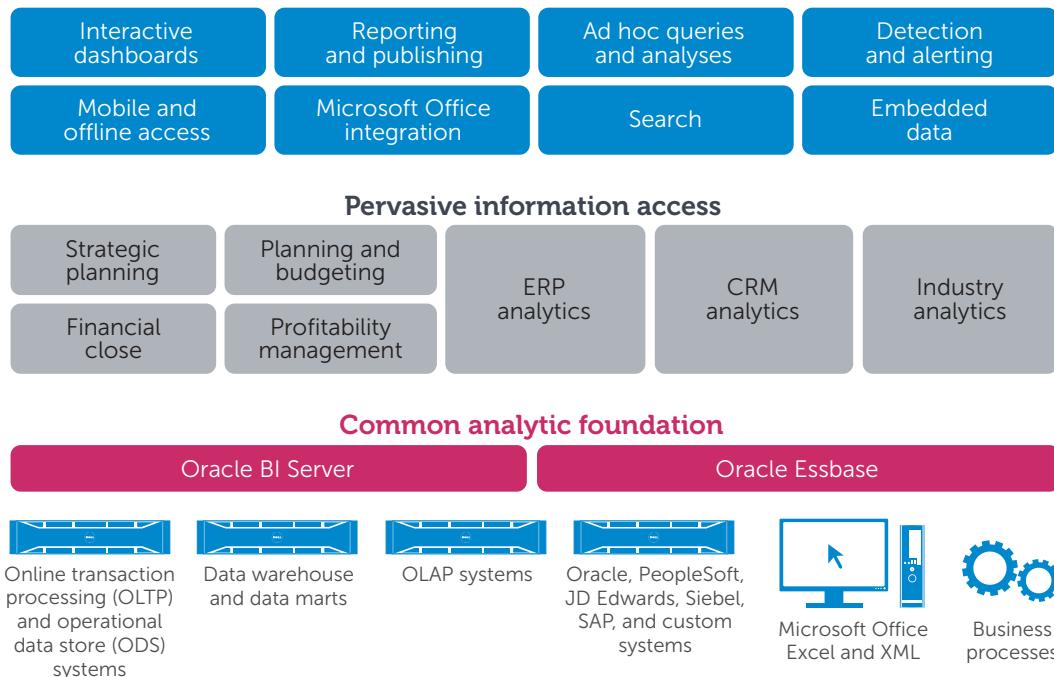
BI has been a top priority at many companies for years, offering a key way for senior executives to gain fast, high-quality insights into performance and operations. But the need for such analytics-driven insights has been growing at other levels of the enterprise as well. As a result, there has been a growing interest in “pervasive BI”—the use of BI tools to share and analyze information throughout an organization. The idea is to glean insights from the vast amounts of data flowing through the organization, and then use them to drive predictions, decisions, and actions from the executive suite to the front line.

Pervasive BI is clearly an appealing concept, but adoption has been relatively slow. As a recent

survey report on “the intelligent enterprise” from the Economist Intelligence Unit pointed out, “the ability to make rapid, high-quality decisions based on the most timely, relevant and accurate information available is critical and a common characteristic of the world’s leading companies. Yet as this survey shows, few have developed the necessary processes for sharing and analysing critical operational information across the enterprise.”<sup>1</sup> To a large extent, this situation is due to the traditional fragmented approach to BI. Organizations often have multiple BI and analytical tools and architectures deployed in various departments. This fragmentation leads to siloed views, making it difficult to share data and insights across the organization, and often creating inconsistencies in reporting. It also leads to inefficiencies in reconciling various data points and reports, or, worse yet, key decisions being made based on inconsistent data.

The solution is a comprehensive approach that embeds standardized enterprise BI platforms and analytics across the organization. Such an approach offers the advantages that typically come with

<sup>1</sup>“The Intelligent Enterprise: Creating a Culture of Speedy and Efficient Decision-Making,” by the Economist Intelligence Unit, December 2009, available at [eiu.com/site\\_info.asp?info\\_name=oracle\\_decision\\_making](http://eiu.com/site_info.asp?info_name=oracle_decision_making).



**Figure 1.** Integrated Oracle platform for pervasive business intelligence

standardization, including increased efficiency and consistency as well as reduced complexity.

That perspective is at the heart of Oracle's approach to BI. The Oracle enterprise BI platform encompasses a comprehensive range of BI tools and technologies. But, more important, it integrates these tools and technologies to create a platform that is more than the sum of its parts. Organizations can take advantage of this BI platform as well as Dell servers and storage to create a scalable, enterprise-class approach to BI and ultimately drive fact-based decision making and increased business agility.

### Oracle business intelligence platform components

To help meet the BI needs of organizations of all sizes, Oracle has made significant investments in this area—including the

acquisition of Hyperion and its financial-analytics and performance-management tools, and the acquisition of Siebel and its extensive suite of analytical technologies. Oracle has focused on the integration and standardization of BI tools using open technologies to create a true enterprise BI platform that supports all three of the fundamental types of BI—giving organizations the query and reporting tools needed to understand their business, the analytic tools needed to pose a range of questions, and the modeling tools needed to look ahead, manage risk and uncertainty, and exploit opportunities. With this platform, Oracle was recently recognized by IDC as the largest vendor in business analytics in 2008.<sup>2</sup> In January, Oracle was positioned as a "leader" in Gartner's BI Platform Magic Quadrant.<sup>3</sup>

The Oracle platform is designed to support pervasive BI with a unified foundation

that includes three fundamental components (see Figure 1):

- **Oracle BI Server:** Oracle BI Server is a scalable, sophisticated data access, aggregation, and calculation engine for creating real-time intelligence from heterogeneous data sources—including Oracle, Microsoft® SQL Server®, IBM® DB2, and Teradata software—and delivering it efficiently across even large-scale enterprise environments. It can semantically integrate information and, through a combination of a distributed query engine and a logical, semantic representation of the data, can enable organizations to represent multiple physical data sources as a single, simplified data structure to end-user tools. This simplified view can then be accessed

<sup>2</sup> "Worldwide Business Analytics Software 2009–2013 Forecast and 2008 Vendor Shares," by IDC, Doc #219383, August 2009.

<sup>3</sup> "Magic Quadrant for Business Intelligence Platforms," by Rita L. Sallam, Bill Hostmann, James Richardson, and Andreas Bitterer, Gartner, Inc., January 29, 2010. The Magic Quadrant is copyrighted 2010 by Gartner, Inc. and is reused with permission. The Magic Quadrant is a graphical representation of a marketplace at and for a specific time period. It depicts Gartner's analysis of how certain vendors measure against criteria for that marketplace, as defined by Gartner. Gartner does not endorse any vendor, product, or service depicted in the Magic Quadrant, and does not advise technology users to select only those vendors placed in the "Leaders" quadrant. The Magic Quadrant is intended solely as a research tool, and is not meant to be a specific guide to action. Gartner disclaims all warranties, express or implied, with respect to this research, including any warranties of merchantability or fitness for a particular purpose.



“For IT departments, an enterprise BI platform helps to streamline BI modeling, reduce the need for support, and simplify changes and upgrades.”

by the end-user tools through a standard SQL-based interface.

- **Oracle Essbase:** This online analytical processing (OLAP) server software provides an environment for the rapid development of custom analytic and enterprise performance-management applications. Based on a high-performance calculation engine, it provides rapid response times and an intuitive interface, enabling users to interact with the data quickly without requiring support from technical experts—helping them to analyze the metrics that influence performance and enhance their decision making. (For more information, see the “Thinking ahead with Oracle Essbase” sidebar in this article.)
- **Oracle Real Time Decisions (RTD):** Oracle RTD is a high-performance transactional server platform and a predictive analytics engine that lets organizations “embed” analytics and BI into operational processes. Using a service-oriented Java 2 Platform, Enterprise Edition (J2EE) architecture, it is designed to provide real-time decisions and recommendations to help organizations align frontline actions with performance goals. Oracle RTD can support decision logic based on user-defined rules or provide automatically managed self-learning predictive models, enabling organizations to learn from each interaction and adjust their processes in real time.

A key element in the Oracle BI approach is its common enterprise information model, a unified

metadata model that consists of three tiers: a physical layer that allows organizations to import the table structures of their existing data sources, a semantic object layer that lets them create a simplified semantic representation of multiple data sources and a model of the business that reflects the end user’s perspective, and a presentation layer that exposes this business model to end users.

This common enterprise information model is accessed by Oracle analytics applications and end-user BI tools, giving each user and department the same consistent view of information, customized to their needs. Unlike the traditional approach, which typically requires organizations to use different metadata for their ad hoc tools, reporting tools, and dashboard tools, the Oracle approach avoids the need to maintain multiple metadata environments for different types of users. Organizations can instead “model once, deploy everywhere”—that is, they can define key metrics and calculations in one place, and then use that base to deliver a consistent view of information across the organization to support efficient, effective decision making.

### Comprehensive tools

Running the Oracle BI foundation on Dell servers and storage provides a unified enterprise infrastructure for a comprehensive suite of BI and analytics tools. These tools provide organizations with a variety of key capabilities, including the following:

- **Production reporting:** The Oracle BI Publisher integrated reporting component enables the creation of highly formatted templates, reports, and documents, such as checks and government forms, in complex and distributed environments. The Oracle architecture enables organizations to generate and deliver information to employees, customers, and partners securely and in the appropriate format. End users can work with familiar tools such as Microsoft Office Word or Adobe® Acrobat for report layouts.
- **Interactive dashboards:** A thin client solution provides interactive collections of analytic



### Deploying pervasive BI

Implementing true pervasive BI can present significant difficulties for organizations contending with complex business processes, data silos, and other challenges. In this podcast, BI experts from Dell and Oracle share insights on trends and best practices that organizations can begin taking advantage of today.

[oracle.com/goto/bipodcast](http://oracle.com/goto/bipodcast)

## Thinking ahead with Oracle Essbase

Decision makers are constantly trying to determine what is likely to happen in the future—and pervasive business intelligence (BI) can help users across the organization do just that.

Oracle Essbase puts powerful analytical tools directly into the hands of end users. Among other features, it enables these users to perform forward-looking analyses that model complex scenarios and create forecasts. They can use these tools to identify patterns, such as determining which customers spend the most, and to explore questions such as "What if demand falls short of forecast?" or "What if we rolled out this product nationwide?" The ability to interact quickly and easily with the data—as opposed to reading through static reports—helps increase user adoption of the system and supports rapid, focused decision making.

At its core, Oracle Essbase contains a high-performance calculation engine with more than 350 prebuilt functions. Oracle Essbase also provides a rapid application development environment that is managed by the business, enabling users to quickly create applications for querying and reporting, analytics, and forward-looking modeling. It also enables pervasive BI by supporting extremely fast query response times for vast numbers of simultaneous users, large data sets, and complex models.

Oracle Essbase also helps simplify enterprise BI support for IT departments. It can be configured, deployed, and maintained by the business organization, and its *n*-tier architecture provides connection pooling, load balancing, and automatic failover to help meet service-level requirements. Because it works with both 32- and 64-bit computing, it is capable of massive scalability for enterprise-wide deployments. Its support for 64-bit architectures also enables larger analytical models with shorter calculation times than would be possible in 32-bit environments, helping increase the potential size of analytic applications and the number of concurrent users.

Meanwhile, user scalability features such as caching, multi-threading, partitioning, and cross-platform support enable IT professionals to use a reduced number of servers to support many analytic applications and large user communities. Oracle Essbase also includes a number of manageability features, such as Microsoft .NET development tools, certified enterprise resource planning (ERP) and customer relationship management (CRM) application integration adapters, administrative wizards, and automated maintenance scripts—all of which help reduce the deployment and maintenance costs of pervasive BI.

content with a rich variety of visualization tools. Running on a Web-based architecture, these dashboards provide end users with information filtered and personalized for their specific identity, function, or role based on predefined security rules. The interactive interface helps make the presentation of data intuitive, relevant, and easy to understand, while guided navigation and alerts help users gain insight and take action. Making information personalized and providing it in the appropriate context is one of the keys to encouraging user adoption and moving organizations along the pervasive BI maturity curve.

- **Ad hoc queries and analyses:** End users can create new analyses or modify existing analyses in dashboard pages. To help free users from data structure complexity, the metadata layer of Oracle BI offers a logical view of metrics, hierarchies, and calculations expressed in

understandable concepts. End users do not need to understand physical data storage to combine data from multiple enterprise information sources.

To further drive pervasive BI, Oracle BI Applications provide prebuilt applications that deliver intuitive, role-based intelligence throughout the organization—from frontline employees to senior management. Broadly speaking, these applications fall into two categories: customer relationship management (CRM) applications such as sales or customer analytics software, and enterprise resource planning (ERP) applications such as financial, supply chain, or human resources analytics software. They each include four key components: a prebuilt warehouse; pre-mapped metadata embedding best practices for metrics and key performance indicators; prebuilt extract, transform, and load (ETL) capabilities to



## Accelerating business intelligence with Dell Services

Dell Services uses a holistic, collaborative approach to business intelligence (BI) analytics that incorporates information from multiple sources to give management comprehensive reporting on financial and operational performance. The Dell Services approach is integrated across the enterprise to deliver broad-based insight into overall enterprise efficiency, with deep-dive analytics that enhance perspective and decision making.

The Dell Optimized Business Intelligence Analytics program integrates key financial and operational informational analytics throughout the organization—with a focus on using best practices to standardize processes and drive profitability. The program is an accelerated enterprise BI process that blends technology and business processes using the Oracle BI framework as an accelerator to help consolidate

and deliver financial, human capital, supply chain, and other operational performance measures. The program is designed to take full advantage of Oracle BI Applications to extract and consolidate data from enterprise resource planning (ERP) systems in a single process framework, enabling enterprise-wide organizational intelligence.

Using Dell servers and storage along with Oracle BI tools—and drawing on prebuilt configurations and solutions, including installing the Informatica PowerCenter data load tool, Oracle BI Server, and Oracle analytics applications, offered through the partnership of Dell and Oracle—Dell Services can help organizations quickly build solutions and configurations customized to meet their needs and enable them to transform information into actionable knowledge.

extract data from Oracle and non-Oracle sources; and a best-practice library of dashboards and reports. They also include guided analytics that walk users through analyses using straightforward, natural questions. These BI applications help organizations shorten time to value while extending BI throughout the organization, using a single common foundation. Organizations can also take advantage of Dell Services to help optimize deployments of the Oracle platform and Oracle BI Applications in their own environments (see the "Accelerating business intelligence with Dell Services" sidebar in this article).

### Simplified integration

To be effective, a BI platform naturally needs to integrate easily with other systems. To that end, the Oracle BI platform helps reduce the integration burden on IT groups in several ways. For example, Oracle BI tools are pre-integrated with one another and with Oracle transactional applications such as Oracle E-Business Suite, PeopleSoft® Enterprise, JD Edwards® EnterpriseOne, Siebel CRM, and Oracle CRM On Demand software.

As an open platform, Oracle BI also uses a "hot-pluggable" strategy to help integrate with non-Oracle technologies and applications. The Oracle platform is designed to easily integrate

with existing IT infrastructures and data sources, including ETL tools, application servers, security infrastructures, and other front-end and analytical tools. The Oracle BI platform can access data from multiple heterogeneous sources—including relational databases such as Oracle Database, Microsoft SQL Server, IBM DB2, and Teradata software; multidimensional sources such as Oracle Essbase, SAP® NetWeaver® BI, and Microsoft Analysis Services software; flat files; XML data; and unstructured data. It also integrates with standard portals, Web services, and authentication technologies.

End users are, of course, a key part of pervasive BI, so this focus on integration also extends to the desktop. An Oracle BI plug-in can integrate BI information from Oracle BI Server and Oracle reporting tools into the Microsoft Office environment, enabling users to embed up-to-the-minute data in Microsoft Office Word, Excel®, and PowerPoint® documents.

### Business intelligence across the organization

The Oracle approach adds up to having one platform and one information model supporting multiple delivery channels, helping to enhance decision making and increase agility throughout

“Unlike the traditional approach, which typically requires organizations to use different metadata for their ad hoc tools, reporting tools, and dashboard tools, the Oracle approach avoids the need to maintain multiple metadata environments for different types of users.”

the organization. Today, the need for that kind of capability is not restricted to large enterprises—organizations of all sizes can benefit from an enterprise approach to BI.

To support the needs of both large and small organizations, the Oracle platform is available in two versions. Oracle BI Suite Enterprise Edition is designed for large organizations; in addition to core capabilities such as interactive dashboards and ad hoc queries and analyses, this suite incorporates features such as proactive intelligence and alerts as well as disconnected analytics, which allow mobile users to use BI tools offline. It also bundles a number of key Oracle Hyperion financial and Web analysis tools.

Oracle Business Intelligence Standard Edition One, meanwhile, is based on Oracle BI Suite Enterprise Edition technology but is

packaged and preconfigured for deployments of 5–50 users. Designed to run on one server, it provides a comprehensive and integrated BI system, and includes Oracle BI Server as well as interactive dashboards and support for highly formatted reporting and ad hoc reports and analyses. It also includes Oracle Database and powerful ETL tools for building data warehouses.

Both versions offer similar advantages. For IT departments, an enterprise BI platform helps to streamline BI modeling, reduce the need for support, and simplify changes and upgrades. For the organization as a whole, this platform provides a simplified way to provide consistent, accurate information to drive decisions; deploy a variety of front-end BI tools without creating BI silos; and move toward pervasive BI. Because both versions are

built on the same technology, organizations can easily expand their BI capabilities as needed. By taking advantage of this seamless scalability along with the wide range of available Dell servers and storage, organizations can start small and then scale their deployments later as their requirements increase.

Many organizations still have a ways to go in achieving pervasive BI, and the field continues to evolve. Ongoing enhancements are likely to further improve the ability to link insight to business actions, and to give end users access to advanced visualization and other tools to support effective decision making. Having an open, integrated, standard BI platform that can be used across the organization is key to pervasive BI, and continues to be key to the continued evolution of BI. 



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# Enabling eco-friendly deployments with NEI platforms

By Richard Gruber

For organizations planning to build a new data center or expand a suitable existing facility, implementing a DC-based power infrastructure can offer significant advantages. Based on the Dell™ PowerEdge™ R710 server, NEI's E-2710 provides a cost-effective, purpose-built application platform designed to maximize efficiency in these environments.

## Gauging data center efficiency

$$\text{PUE} = \frac{\text{Total facility power}}{\text{IT equipment power}}$$

$$\text{DCiE} = \frac{1}{\text{PUE}} = \frac{\text{IT equipment power}}{\text{Total facility power}}$$

Power consumption has become an increasingly important topic for enterprise data centers, particularly as the economy has forced organizations to focus on ways to maximize energy, performance, and cost efficiencies. Rising power and cooling costs, meanwhile, have resulted in IT departments investigating ways to take advantage of eco-friendly technologies that can help increase resource utilization, availability, and compute density while also helping lower the costs associated with power, cooling, and maintenance. Servers are one of the biggest power users in data centers today, which explains why virtualizing x86-based servers is among the most popular energy-saving strategies.

Globally, governments are also putting their weight behind eco-friendly technologies. Data centers typically require vastly more energy per square foot than a typical office building, and while data center consolidation has remained a primary focus, some administrative bodies have also turned their attention to energy conservation and power management in operating systems and computing hardware. In May 2009, for example, the U.S. Environmental Protection Agency (EPA) put new ENERGY STAR requirements for enterprise-class servers into effect; other U.S. agencies like the Department of Energy (DOE) are also working with industry associations to prepare standards and create tools to help measure and enhance data center efficiency. This efficiency is commonly defined by the Power Usage Effectiveness (PUE) and Data Center Infrastructure Efficiency (DCiE) metrics shown on the left.



### NEI's E-2710

The E-2710 provides a highly efficient, power-optimized, standards-based platform for eco-friendly deployments



Hot-swappable hard drives and redundant power supplies help maximize E-2710 reliability and uptime

A data center having a PUE value of 2.0, for example, would draw a total of 2 W of power for every 1 W consumed by IT equipment. This same data center would have a DCiE value of 0.5—an inverse way of presenting the same measure. A perfectly efficient data center, in which 100 percent of the power was used directly by IT equipment, would have PUE and DCiE values of exactly 1.0.

Among the many technologies that can help improve data center PUE and DCiE is a smart, end-to-end power architecture. In some data centers, one option that can help maximize efficiency is an infrastructure that converts AC power from the utility to DC power inside the data center itself. In the short term, this type of design is not likely to replace existing structures, particularly in recently constructed facilities that have not yet reached payback on their initial investments and in facilities being retrofitted or upgraded. For organizations planning to build a new facility or to significantly expand a suitable existing facility, however, moving to a DC-powered infrastructure can potentially offer significant advantages. This article examines the requirements of an end-to-end DC-based data center and introduces an advanced, highly efficient DC-powered platform from Dell and NEI that is designed to fit seamlessly into these infrastructures—the E-2710.

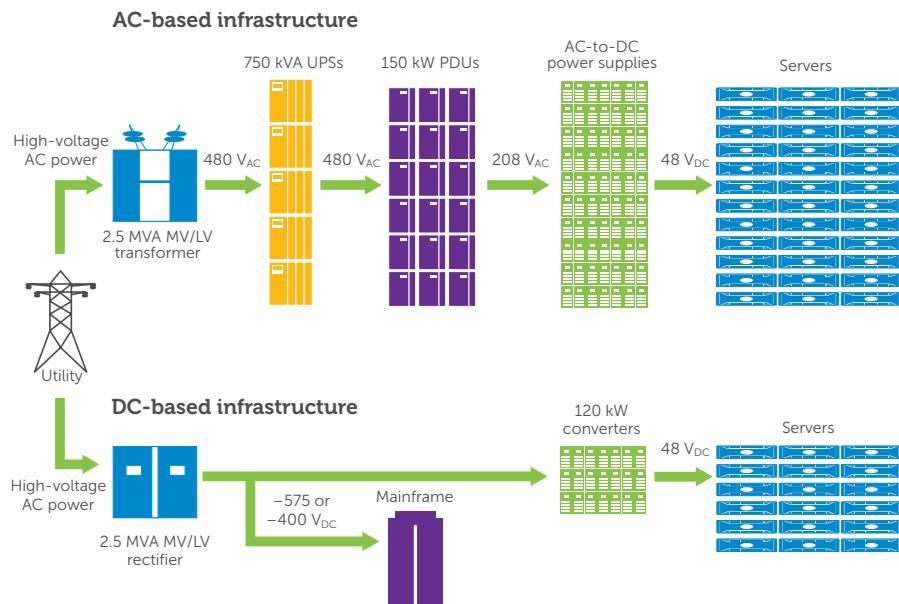
### Evolution of DC-powered data centers

The evolution toward DC-powered data centers has been proceeding for some time. DC is already the resident power used by data center subsystems, primarily at the microchip and board level, and virtually all active and passive semiconductor integrated circuits operate from low-level DC voltages. High-speed processors, memory and storage devices, and I/O circuitry all consume DC power, which is readily regulated and distributed in x86-based servers.

Lower and lower DC voltages are also being used to power microcircuits, and data processing performance has become increasingly efficient with every successive generation of processors. The Intel® Xeon® processor 5500 series in 11th-generation Dell PowerEdge servers, for example, incorporates power-throttling technologies designed to significantly increase memory bandwidth and performance per watt over previous-generation processors. The trend has been to expand native DC efficiencies beyond the subsystem level and eliminate multiple (and often redundant) power conversion steps to help increase overall efficiency within the IT infrastructure. In terms of adopting DC power in the data center, the servers and data center appliances themselves are generally no longer the conversion break point.



**Figure 1.** Equipping a data center with high-voltage DC power can eliminate inefficient power conversion steps



### Efficient design and the power conversion process

A typical data center includes numerous conversions from high-voltage AC power to multilevel DC power. The power converters that perform these conversions and regulate downstream components are more efficient than they used to be, but are still typically expensive to purchase, service, and maintain over their life spans. Supplying the data center with high-voltage DC power rather than AC power can help minimize or eliminate these conversion steps (see Figure 1). Reducing the number of components can also translate to increased efficiency and reduced heat dissipation—helping reduce costs and water usage associated with server room cooling—as well as a simplified overall design.

The energy efficiency of DC systems is a measurement of the end-to-end system efficiency, not merely a single component within the system, which is how organizations pay for power. Using -575, -380, and -48 V<sub>DC</sub> power distribution

can provide substantial advantages in some data centers—including increased energy efficiency, reliability, scalability, and safety; reduced space requirements, installation costs, and maintenance costs; simplified integration of renewable energy; and eligibility for utility rebates and credits in some areas. In the United States, Energy Efficiency Certificates (EECs) and Renewable Energy Certificates (RECs) may also be available, helping make DC power a viable long-term choice for the organization as a whole.

Because many renewable energy sources generate DC power, using these energy sources helps avoid the need to add multiple conversions to accommodate an AC power path—helping to eliminate inverters and save significant amounts of power. And because DC-based data centers typically require fewer power components than comparable AC-based data centers, such facilities can potentially be more reliable, simply because there are fewer pieces to fail. DC systems also do not need to synchronize sine waves or frequencies across multiple

sources, which can help to further eliminate points of failure and simplify the system.

With fewer components to install and maintain and less heat to dissipate, a DC-based data center's density per square foot can also potentially be greater than a traditional AC-based data center design. Bulk rectifiers can be sized up to 2.5 MW in a single unit, enabling denser power factors compared with AC topologies, and the resulting savings on space alone can be substantial over the life of a typical system. DC distribution systems are also more readily designed to accommodate modularity compared with typical AC systems, helping support a scalable infrastructure and growth strategy.

In addition, in conjunction with simple power electronics and appropriate DC circuit breaker technology, DC systems can be safer than AC systems from 380 V to 600 V. When using 48 V<sub>DC</sub> power, for example, the system is considered safer from a handling perspective than 110 V<sub>AC</sub> or 220 V<sub>AC</sub> systems.

## Server platform for the DC-powered data center

One of the difficulties with moving from high-voltage AC power to DC power is the general lack of IT equipment designed to handle DC power. To help address this gap, Dell and NEI have introduced the E-2710—a highly efficient, power-optimized platform based on the Dell PowerEdge R710 server. Available as an AC- or DC-powered platform, the E-2710 is purpose-built to help meet the needs of enterprise and telecommunications application developers and original equipment manufacturers (OEMs) worldwide, as part of eco-friendly deployments in data centers and carrier-class central offices that do not require Network Equipment-Building System (NEBS) Level 3 certification.

This highly available, standards-based platform features up to two quad-core processors from the Intel Xeon processor 5500 series to help

dynamically scale power usage to specific workloads and help increase energy efficiency. It can also host NEI Smart Services to deliver network-ready, life-cycle-managed applications; OS and patch management; streamlined support processes; and accelerated deployments. NEI offers support and deployment services as well as reverse logistics for this platform.

The E-2710 is also designed to be highly flexible and customizable while providing cost-effective, scalable, and reliable performance. In a 2U rack-mount design, it supports up to four high-end telephony PCI Express (PCIe) cards and up to eight Serial Attached SCSI (SAS) or Serial ATA (SATA) hard drives—enabling OEMs to customize the system for specific storage and I/O requirements. Integrated hardware RAID, hot-swappable hard drives, and redundant hot-swappable power supplies help maximize reliability and uptime. The E-2710 is also

compatible with the Integrated Dell Remote Access Controller (iDRAC) for remote power management, virtual media access, and other console-driven capabilities, all available through a supported Web browser.



**Richard Gruber** is senior vice president of engineering and operations at NEI.

## Optimized, eco-friendly data center design

For some data centers, implementing a DC-based power infrastructure can bring substantial benefits—ranging from reduced cooling costs to simplified maintenance to increased safety and reliability. Designed to fit seamlessly within these types of environments, the E-2710 provides a flexible, purpose-built platform for enterprise data centers and OEMs that can help maximize efficiency while supporting comprehensive eco-friendly strategies. 

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## Custom fit:

# The Dell PowerEdge R310 appliance server platform

By Franklin Flint

The Dell™ PowerEdge™ R310 server offers enterprise-class features in a high-performance, one-socket, 1U rack server that is well suited for original equipment manufacturers (OEMs). Its small form factor and wide range of options provide a versatile, OEM-ready platform for custom-built appliances.

### Dell PowerEdge R310 appliance server



By offering flexibility, uptime, connectivity, and robust management features, the Dell PowerEdge R310 can help meet a breadth of OEM appliance requirements.

When original equipment manufacturers (OEMs) develop custom appliances, they often have specific requirements for the server they use as a platform. For example, appliances for certain medical applications might require extremely high availability to avoid downtime or the need for IT intervention. Other appliances, such as those for networking and digital media applications, may require more connectivity options and bandwidth than many standard server applications. Still others—such as those that reside in shallow and legacy racks, mobile server enclosures, and other nonstandard locations—may require a compact form factor.

The 11th-generation Dell PowerEdge R310 is a single-socket, 1U rack server designed specifically with OEMs in mind. Available as either a standard Dell-branded server or an unbranded, OEM-ready appliance platform that can be re-branded by OEMs, this highly flexible system combines cost-effective, high-performance computing power and a small form factor with a range of configurable uptime, connectivity, and management features designed to meet a breadth of custom appliance requirements. Additionally, Dell offers a range of services designed to supply OEMs with cost-effective, reliable appliance server platforms that can easily be custom configured and custom branded.

## Combining cost-effectiveness with performance and reliability

OEMs have a range of specific requirements, so to help meet these needs, the Dell PowerEdge R310 platform offers a broad range of performance and functionality options, and can scale from basic, nonredundant configurations with limited manageability to highly redundant configurations with enterprise-class systems management capabilities (see the "Ease of management" sidebar in this article). Processor options range from the entry-level Intel® Celeron® processor to the high-end Intel Xeon® X3400 series processor, while the six dual in-line memory module (DIMM) sockets can provide up to 32 GB of memory capacity.

Four hard drive bays are available for either 2.5- or 3.5-inch cabled or hot-swappable hard drives, and include support for Serial Attached SCSI (SAS) drives, Serial ATA (SATA) II drives, and solid-state drives (SSDs), for a total raw capacity of up to 8 TB.

The PowerEdge R310 also offers full-height and half-length PCI Express (PCIe) expansion slots with x8 and x16 connectivity, a dedicated storage controller PCIe slot, and an embedded dual-port Gigabit Ethernet network interface card (NIC). The system supports the Microsoft® Windows®, Red Hat® Enterprise Linux®, Novell® SUSE® Linux Enterprise Server, and Sun Solaris operating systems; custom services can provide compatibility with less common operating systems.

## Ease of management

The Dell PowerEdge R310 incorporates multiple features designed to simplify and streamline management.

- **Embedded Dell Lifecycle Controller:** This optional feature performs provisioning functions such as systems deployment, updates, hardware configuration, and diagnostics from a single intuitive interface. The Lifecycle Controller is OS independent, helping avoid the need for patches and updates to be compatible with the OS.
- **Dell Management Console powered by Altiris™ from Symantec™:** This unified console software helps simplify systems management by providing IT administrators with a consolidated view of their IT infrastructure. Dell Management Console is included at no additional cost with all Dell servers.
- **Interactive LCD:** This optional feature enables state-of-the-art serviceability and diagnostic capabilities.
- **Integrated Dell Remote Access Controller 6 (iDRAC 6) Enterprise:** This optional out-of-band management controller enables remote control, event diagnosis, updates, and other management features.

### High uptime and extensive connectivity

Many of the features available in the PowerEdge R310 are designed specifically for uptime and connectivity—factors that are often paramount for OEM custom appliances. For example, appliances that have high-availability requirements can leverage the fact that the PowerEdge R310 can be configured with options that include redundant power supplies; hot-swappable hard drives, including hot-pluggable SAS and SATA II drives and SSDs; a range of RAID storage controllers from low-end, software-based chipset RAID up to high-performance RAID with advanced battery-backed cache; and front-mounted status LCD

panels. Comprehensive remote management capabilities and remote access capabilities are also available through the Integrated Dell Remote Access Controller (iDRAC).

For appliances with high connectivity requirements, the connectivity features included with the PowerEdge R310 offer easily expandable I/O bandwidth through two PCIe expansion slots, a dedicated storage controller PCIe slot, and two Gigabit Ethernet NICs. [This combination of expansion slots and embedded NICs is designed for dramatically enhanced connectivity within a 1U rack server, making the PowerEdge R310 well suited for I/O-heavy appliance software such as video, networking, and voice-over-IP \(VoIP\) applications.](#)



**“Many of the features available in the PowerEdge R310 are designed specifically for uptime and connectivity—[factors that are often](#) paramount for OEM custom appliances.”**



Generic bezels and faceplates enable fast, simple custom branding for OEM-ready Dell PowerEdge R310 appliances

In addition, to support custom appliances that may be deployed in space-limited areas, the PowerEdge R310 has a chassis depth of only 24 inches—enabling it to fit in nonstandard locations such as shallow and legacy racks and mobile server enclosures.

#### Flexibility

The PowerEdge R310 is designed for extensive flexibility, enabling OEMs to offer platforms with custom configurations to help precisely meet performance, uptime, connectivity, and management requirements. OEMs can select from several configurations for different use cases—for example, production appliances might be configured for maximum performance and availability, while test and development appliances may use cost-effective configurations. With this flexibility, OEMs pay for only the features they need while maintaining room for growth.

#### Delivering an OEM-ready platform

To facilitate development of custom appliances, the Dell OEM Solutions team offers a range of services designed to deliver OEM-ready appliances. These appliances are based on standard Dell hardware platforms—including the Dell PowerEdge R310 appliance server platform—that have been de-branded

to allow fast, simple customization. OEM-ready platforms incorporate a range of features, including the following:

- **Generic bezels and faceplates:** Generic bezels allow for custom OEM branding. Bezel design templates such as the Bezel Design Kit are available at no additional cost and allow OEMs to easily engineer their own bezels for a custom look and feel. Dell OEM Solutions offers custom bezel design services as well.
- **Unbranded BIOS splash screen:** OEM-ready servers ship with a generic splash screen.
- **Generic packaging:** OEM-ready servers are delivered with unbranded packaging, including no logos; unbranded regulatory, safety, and environmental literature; and plain packing tape.
- **Unbranded Unified Server Configurator (USC):** The USC performs provisioning functions through the Dell Lifecycle Controller, and is available unbranded on OEM-ready platforms. The platform update feature built into the Lifecycle Controller has been removed to help prevent Dell-sanctioned product updates that may not be approved by the OEM, and that could otherwise potentially cause issues with the applications running on the server platform.

Dell also offers a range of optional OEM-ready services to further facilitate the rapid, easy development of OEM appliances, including custom integrations, custom shipping, and custom inventory services.

#### Powering custom appliances

The Dell PowerEdge R310 appliance server platform can deliver outstanding performance, reliability, and connectivity in a compact, cost-efficient, single-socket rack server. This versatile system is well suited for custom OEM appliances designed for a wide range of applications, including digital media, networking, and applications in medical and health care, retail, and other specific environments. [OEM-ready services](#) from Dell OEM Solutions allow standard PowerEdge R310 servers to be quickly and easily customized to help OEMs streamline development of applications on custom appliance server platform configurations. 



**Franklin Flint** is a global enterprise technology evangelist for OEM Solutions at Dell.

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