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MOBILITY REDEFINED

SPECIAL MOBILITY SECTION

Freedom from Business as Usual: Introducing the New Dell Latitude Laptops

Designing for the Road Ahead: Inside the Dell Industrial Design and Usability Labs

Mobility and Dynamic Graphics: New Dell Precision Mobile Workstations

Connect and Protect Workers on the Go: Dell ProSupport Mobility Services

PLUS:

BLADE SERVER ADOPTION SUCCESSES AT SOHO VFX AND YCH GROUP

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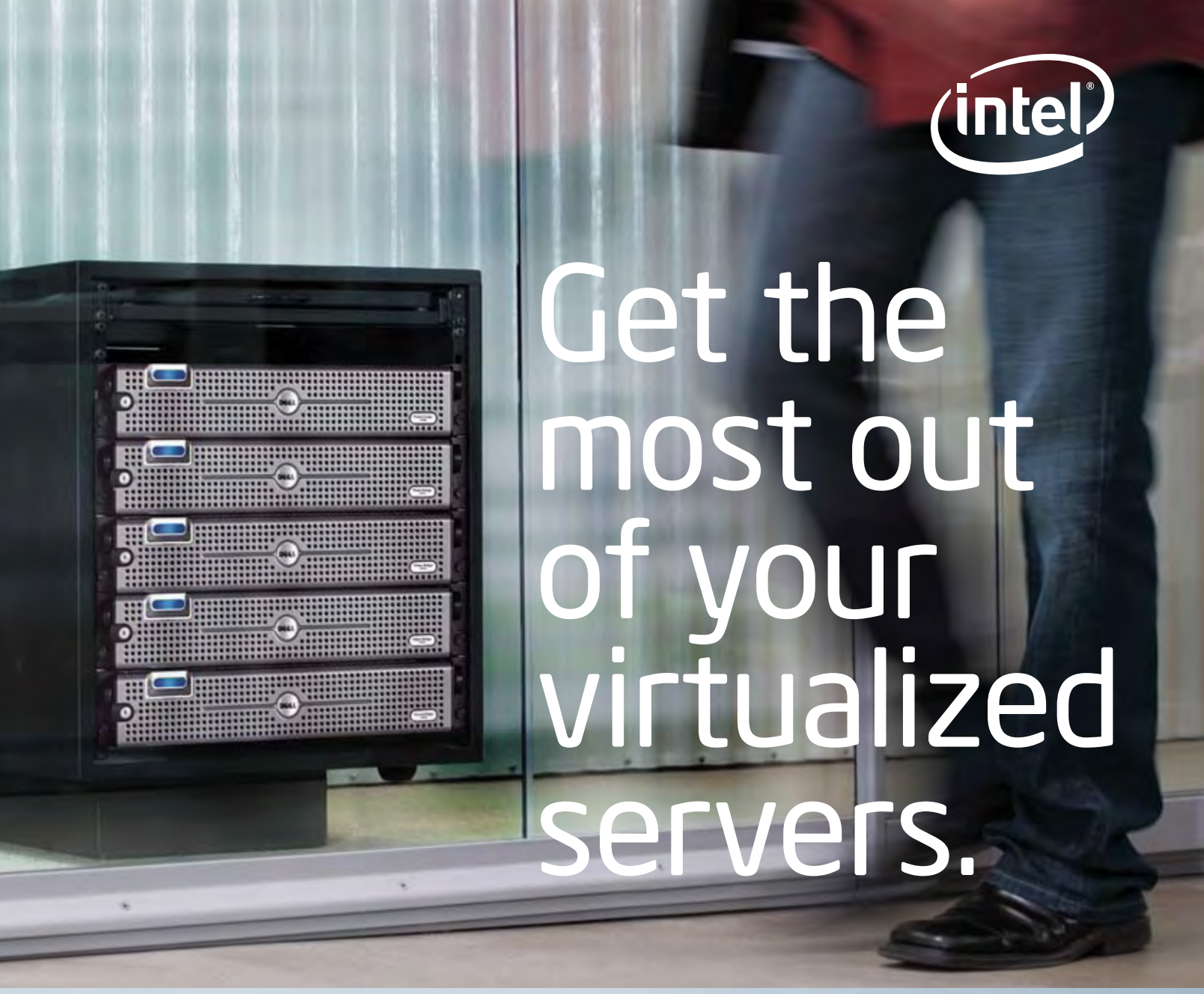

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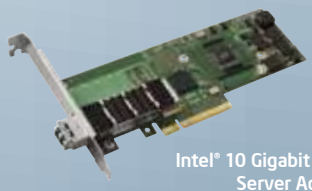
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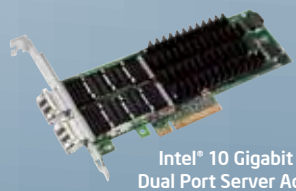
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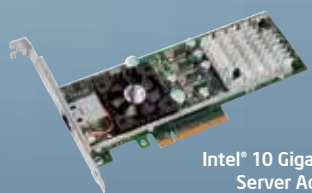
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CONNECT AND PROTECT WORKERS ON THE GO

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DESIGNING FOR THE ROAD AHEAD

When done right, industrial design is invisible. But inspiring a sense of delight and lust from a business laptop that is effortless to use—that takes a lot of work. Ken Musgrave, director of industrial design and usability at Dell, reveals what happened behind the scenes when Dell went to the drawing board to design the new family of Dell Latitude laptops.

Bringing Latitude to life: Extensive usability and engineering innovations are designed into the new Dell Latitude laptops with exceptional sophistication and simplicity

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AUTOMATED DISASTER RECOVERY WITH VMWARE SRM AND DELL EQUALLOGIC iSCSI SANs

By Andrew Gilman and Jon Bock

Virtualized IT infrastructures can simplify management and facilitate business continuity while helping minimize power consumption and procurement costs. Virtualization also helps organizations automate disaster recovery plans. Dell EqualLogic™ PS Series arrays and VMware® Site Recovery Manager (SRM) software provide integrated, cost-effective, automated site recovery and testing for enterprise data centers.

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Best Practices for Networking in a VMware Environment

By Alberto Ramos

By following the networking best practices used by Dell engineers in their own IT environment, organizations can create an efficient, resilient virtualized infrastructure.

Enhanced Power Monitoring for Dell PowerEdge Servers

By Santosh Bhadri G. V., Ramakrishna M. S., and Surendra Bhat

The enhanced power monitoring and management features available in supported Dell PowerEdge servers enable IT administrators to easily track and manage energy use through tools such as the Dell OpenManage™ suite.

Deploying Flexible Brocade 5000 and 4900 SAN Switches

By Nivetha Balakrishnan and Aditya G.

Brocade® storage area network (SAN) switches are designed to meet the needs of rapidly growing enterprise IT environments, offering flexible interoperability, scalability, and cost-effective consolidation.

Maintaining Dell Platforms with Dell Technical Updates

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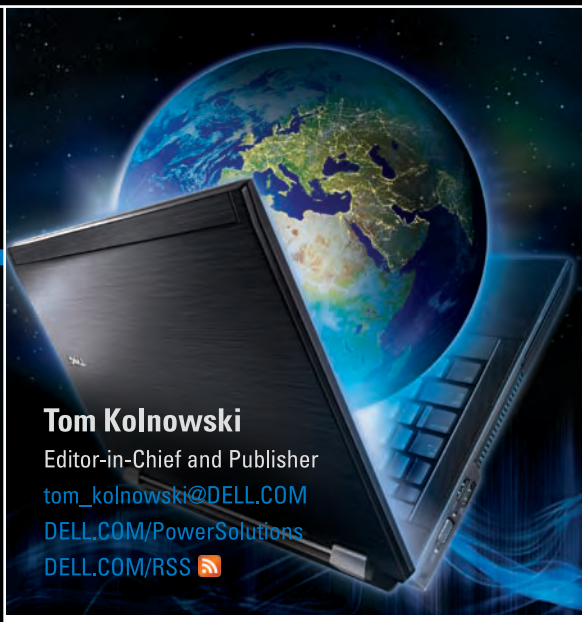

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As I penned this on the eve of our press date, from a jet plane at some 28,000 feet, an image of what it meant to be eminently mobile snapped into sharp focus. It was here—with a bird's-eye view of Hurricane Dolly churning in the Gulf of Mexico, my favorite jazz tunes softly playing through a set of noise-canceling stereo headphones, and my Dell™ Latitude™ laptop in Microsoft® Windows Vista® Power Save mode for the long flight—that it occurred to me that the production process for *Dell Power Solutions* is a neatly framed case study for a mobility-enabled workforce, and that we would have it no other way.

The geographical diversity posed by the editorial lineup for this issue, our first ever on mobility, presented a unique logistical puzzle. Our editorial team chased content and creative contributions across three continents, and orchestrated interviews for customer case studies worldwide: Media General and Merrill Lynch in the United States, Soho VFX in Canada, University College Plymouth St Mark and St John (Marjon) in the United Kingdom, and YCH Group in the Asia Pacific region.

As deadlines loomed, editorial and creative workflow streamed through various time zones nearly 24/7, enabled by a technology suite that includes standard-issue Dell Latitude laptops with mobile networking and purpose-built applications that facilitate iterative workflow. But it is a mosaic of technologies and a high level of global collaboration that gel to make us a truly mobile medium.

In this issue, our special feature section on enabling the mobile workforce starts on page 10. The cover story, "Mobility Redefined," addresses the strategic business imperative for IT departments to manage the diverse needs of an increasingly mobile and global workforce. "Freedom from Business as Usual: Introducing the New Dell Latitude" (page 18) begins with a guided tour of the just-released Dell Latitude laptop family, which has been completely reengineered with the core values of both IT managers and end users in mind. And "Designing for the Road Ahead" (page 24) goes behind the scenes to describe the industrial design and usability processes that helped shape the sleek look of these powerful new Dell Latitude laptops.

Lastly, with this issue we have launched *Dell Power Solutions* Digital Edition as an eco-friendly alternative to our customary print publication. Visit powersolutionsdigital.dell.com/subscribe and enter the code GoGreen to preview the new Digital Edition. You may also convert your current print subscription or begin a new subscription to the Digital Edition.

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STAYING CONNECTED WITH DELL LATITUDE ON

Booting up a laptop just to check e-mail or surf the Web can be slow and tedious—and a drain on worker productivity as well as battery life. To help provide mobile workers with fast and easy access to key laptop functionality, Dell has announced the innovative new Dell™ Latitude ON™ connectivity technology, designed to function as a system within a system that can provide near-instant access to business tools such as e-mail and the Internet without having to wait for a full OS boot, while simultaneously helping provide enhanced battery life.

Users can launch Dell Latitude ON simply by pushing a dedicated Latitude ON button on Dell Latitude™ E4200 and Latitude E4300 ultra-portable laptops. Latitude ON is designed to utilize a dedicated low-voltage sub-processor and mini-OS to give mobile workers comprehensive access to their e-mail, calendars, contacts, and the Internet. To connect to enterprise networks or the Internet,[1] Latitude ON provides support for standard Wi-Fi® or mobile broadband connectivity.[2]

Latitude ON enables comprehensive use of the laptop keyboard and LCD monitor, and can use a strong password separate from the main system. The low-voltage sub-processor allows nearly instant connectivity and is designed to operate at significantly lower power than the standard system processor, helping provide enhanced battery life. Latitude ON integrates Microsoft® Exchange and Post Office Protocol (POP) access, enabling mobile workers to read and respond to e-mail messages, view e-mail attachments, receive alerts, and view and modify appointments and contact information. In addition, users can view Microsoft Office and Adobe® Acrobat PDF attachments (read only) and surf the Web—all without booting up the system OS. In addition, Latitude ON is flash upgradable, enabling future updates to be easily loaded to help ensure users have access to the latest features and enhancements.

Dell Latitude ON Reader is a scaled-back version of Latitude ON that can allow users to view cached e-mails, appointments, and contact information. Latitude ON Reader is integrated with Microsoft Exchange and utilizes the on-board Intel® processor to enable connectivity without performing a full system boot. However, Latitude ON Reader does not support Web access, and e-mail views do not allow editing, forwarding, or re-saving messages. Also, e-mail attachments are not accessible using Latitude ON Reader.

Latitude ON Reader is available now, with Latitude ON planned to be available soon. Organizations that purchase Latitude ON Reader with Latitude E4200 or Latitude E4300 laptops can upgrade to Latitude ON once it is available.

[1] Where wireless access is available. Additional access charges apply in some locations.

[2] Availability may vary by region. Subject to wireless provider's broadband subscription and coverage area; additional charges apply.

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MOBILITY REDEFINED

As legions of employees take their work outside the office and to the far reaches of the globe, supporting the diverse needs of a highly mobile workforce has become a strategic business priority. To encompass this new world order, organizations must implement strong security technologies, intuitive remote management tools, streamlined backup solutions, and a plan for smooth product transitions.

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By Jeanne Feldkamp
Daniel Bounds
Terry Myers
Tom Kolnowski

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Dell Latitude laptops
Dell Precision workstations
Dell ProSupport Services
Laptops
Mobility
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Security
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Across industries and in organizations of all sizes, mobile technology is breaking down the borders of business as usual. Employees are taking their work with them wherever they go and expecting ubiquitous network access—from the conference room down the hall to customer and vendor sites around the world. At the same time, the rapid adoption of mobile devices (such as broadband-enabled handhelds, tablet PCs, and other portable Internet endpoints) in emerging markets such as China and India is contributing to a global explosion in network size.

Organizations are embracing these trends with enthusiasm, encouraging employees to take advantage of the flexibility inherent in mobile computing to work in their own style and on their own schedules. But all this means it is no longer enough simply to equip employees with laptops and BlackBerry devices. Mobile workers need the support of an IT department with a strong, cohesive security strategy. They must be able to access enterprise networks whenever and wherever they need to work. When they have questions, they need immediate IT support that can diagnose and fix problems without delay. And when the organization transitions to new mobile devices, they need the switch to be fast, smooth, and trouble free.

BE IN THE OFFICE—ANYWHERE

An increasing number of employees use their laptops outside their home or office. And virtually everyone is getting in on the trend: organizations of all sizes are planning to retire their desktop infrastructure in favor of laptops that are easy to manage and maintain. Laptops are being mounted in service trucks and patrol cars. Doctors are making notes and writing prescriptions using handheld PDAs instead of clipboards. Students are abandoning their binders in favor of tablet computing, while soldiers and workers in harsh environments such as oil and gas rigs are taking ruggedized laptops along so they can stay informed and productive when they are in the field.

Employee productivity depends on the mobile device's connectivity, battery life, and durability. And as mobility facilitates growing levels of collaboration, users need enhanced tools and features such as video conferencing to fully engage with coworkers and partners. As a result, workers in untraditional environments also need self-support capabilities to stem the rising tide of mobile support requests.

Part of the IT team's job is to support maximum productivity by choosing appropriate laptops and other devices to meet the individualized needs of mobile employees. But IT leaders also must support the mobile infrastructure in a way that is designed to minimize costs, simplify administration efforts, protect against mobile-specific threats, and ensure security. Key enablers of the mobile workforce include the following:

- Outstanding security and network accessibility
- Simple, intuitive systems and data management tools
- A streamlined process for backing up critical data
- Smooth transitions when changing hardware or software

Dell offers a comprehensive range of solutions to help organizations meet these requirements (for a real-world example, see the "Mobility at Merrill Lynch" sidebar in this article). Models from the new Dell™ Latitude™ laptop and Dell Precision™ mobile workstation families are designed not only to meet the evolving needs

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MOBILITY AT MERRILL LYNCH

For Merrill Lynch—a leading wealth management, capital markets, and advisory organization that operates in 40 countries and manages client assets of more than US$1.6 trillion—enabling the mobile workforce is a critical factor in continuing the company's success and maintaining market leadership.

A large percentage of the personal computing devices used at the company are made by Dell—including virtually 100 percent of the laptops.

"We strive to give our employees and business partners the technology that gives them an edge over our competitors," says Joe Martella, director of client-facing infrastructure in the Architecture and Engineering Group at Merrill Lynch. "That means we need to give end users the right devices and tools to help them do business and generate revenue, wherever they are physically located."

Merrill Lynch chose Dell platforms for innovation and ease of maintenance. "We're excited about what's happening with the new E-Family Latitude laptops," says Martella. "We appreciate the quality and the innovation that Dell is putting into the platform."

According to Martella, size and weight are major considerations when it comes to working from the road. "The compact form factors are what our users are asking for," he says. "Until now, the majority of our purchasing has been in the 3.5- to 4-pound range. Our users have been demanding something smaller and lighter. The new E-Family Latitude laptops certainly will meet those requirements. We've seen preproduction units and are looking forward to evaluating them as soon as they become available.

"We're a particularly demanding organization, and Dell has been responsive to our needs," Martella continues. "It's been a great partnership."

of the mobile workforce, but also to provide the IT tools that help simplify the deployment, management, and security of mobile devices (see the "Sleek, powerful offerings support a highly mobile workforce" and "Mobile networking—simplified" sidebars in this article). In addition, these offerings reflect the Dell philosophy of commonality and long product life cycles to help keep costs in check.

SAFEGUARD SECURITY AND NETWORK ACCESS

IT support teams face a variety of security-related challenges. Laptops are particularly vulnerable to physical threats such as theft and accidental damage. Improperly secured mobile networks can allow data leaks and put proprietary enterprise knowledge in the wrong hands. Security breaches can also make organizations susceptible to notification costs, lost productivity, and potential fines that subtract directly from the bottom line. Perhaps even worse, security problems expose organizations to bad press and—most significantly—potential loss of shareholder value, customer confidence, and loyalty.

In the past, laptop security practices have not taken a balanced approach to the challenges inherent in securing mobile devices. The complexity of implementing consistent security across a range of remote devices often means that a few systems fall through the cracks—leaving gaps where the network is vulnerable to attack. Security practices and backup procedures can be confusing to end users, which puts sensitive enterprise data at risk if a laptop, smartphone, or PDA is lost or damaged. Inconsistent data management can also expose organizations to serious compliance violations.

Because complex security policies can be difficult for employees to follow, it is unrealistic to leave security in the hands of mobile employees. An effective enterprise security plan should provide for simple, automated, scalable, and comprehensive ways to protect IT investments and maintain worker productivity. Organizations must approach security from a comprehensive perspective that ranges from the desktop to the data center, following best practices to help ensure that the plan protects both physical assets and data.

The Dell strategy for mobile security is based on four imperatives:

1. **Protect systems:** Asset tags can help simplify asset management by identifying individual devices. When used in conjunction with server-side asset management tools such as Altiris® Dell Client Manager™ software, these tags can give IT organizations the ability to monitor internal system components. In addition, dedicated security locks can help prevent theft. Visual deterrent labels and company logos offer an additional layer of protection against common theft because they can prevent an easy resale.
2. **Protect data:** When physical protection fails and a mobile device is lost, stolen, or damaged, it is critical that organizations retain the ability to protect sensitive enterprise data on the system. Data protection is linked to efficient access management. If authentication is not well managed, data protection can be difficult—especially if it is not centrally controlled.

   With a central security management solution such as Wave Systems EMBASSY Trust Suite—a server-side application that

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interacts with the client-side software for central management linked to the Microsoft® Active Directory® directory service—IT departments can maintain control over key client security features and link them back to Active Directory. This capability helps simplify security management and smooths the deployment process for full-disk-encryption hard drives. Hardware full disk encryption enables transparent data protection to minimize impact on end-user efficiency. Dell Remote Data Delete services also enable organizations to delete data remotely from stolen laptops, as well as trace the systems for recovery through law enforcement organizations.

3. **Prevent unauthorized access:** Security policies must strike the correct balance between providing the right people with access to the right level of information and blocking access for improper users. Organizations typically have an Active Directory implementation with systems and user references. However, attempting to enforce and strengthen rules and policies often adds unwelcome complexity for end users.

Authentication is key to enabling secure data access because it focuses on identifying the user. Authentication methods can include smart cards with PIN access, contactless cards, or unique biometric verifiers such as Federal Information Processing Standards (FIPS)–certified embedded fingerprint readers. Such technologies are available in a variety of Dell products in the new Dell Latitude laptop and Dell Precision mobile workstation families. Trusted Platform Modules also enable enhanced security (as a repository for security credentials) as well as multiple authentications to local components and applications or networks. Multi-factor authentication is the combination of these technologies into one strong authentication process, whereby any end user may be asked for more than one form of authentication.

Dell ControlPoint software offers a unified application framework that allows organizations to customize laptop security settings according to individual needs and usage styles. Dell ControlVault™ software complements these capabilities by providing a single firmware location for end-user credentials such as passwords and biometric templates, which enables Dell laptops to perform security processing and matching outside the scope of malicious applications.

4. **Prevent malicious attacks:** The Dell approach to network security focuses on antivirus deployment and security appliances, targeting three lines of defense: endpoint protection, which relies on software designed to safeguard mobile devices; network traffic monitoring, which uses appliances to watch for unusual data traffic patterns on enterprise networks; and Internet gateway appliances, which serve as filters and firewalls that selectively identify and block potentially dangerous data.

In addition, factory-installed antivirus software is standard on Dell Latitude laptops and Dell Precision mobile workstations and offers a first level of defense against malware. This software can be updated with full versions for enhanced protection or replaced by other enterprise software.

The modular Dell Solution-Based Security Framework (see Figure 1) is based on the preceding four tenets. The goals: remove complexity from mobile security by enabling integrated manageability, make the mobile infrastructure easy to deploy and maintain, and ensure that data is as safe on a laptop as it is on a desktop behind an enterprise firewall.

Hardware, software, and manageability tools—along with security appliances, storage, and services—constitute the basic building blocks of the framework. Dell technologies include encrypting hard drives and the associated manageability software, which helps streamline security by providing a comprehensive yet simple solution. Furthermore, mobile security services such as Remote Data Delete can help prevent potential leakage of valuable data if a laptop is stolen.

Security is also designed directly into many Latitude hardware and software components.[1] New Dell Latitude laptops and Dell Precision mobile workstations use a single, safe hardware location to store encryption keys, which avoids the security risk of storing credentials using software. The new laptops also use discrete processing power for credentials processing, so users do not have to access the OS or software to perform authentication.

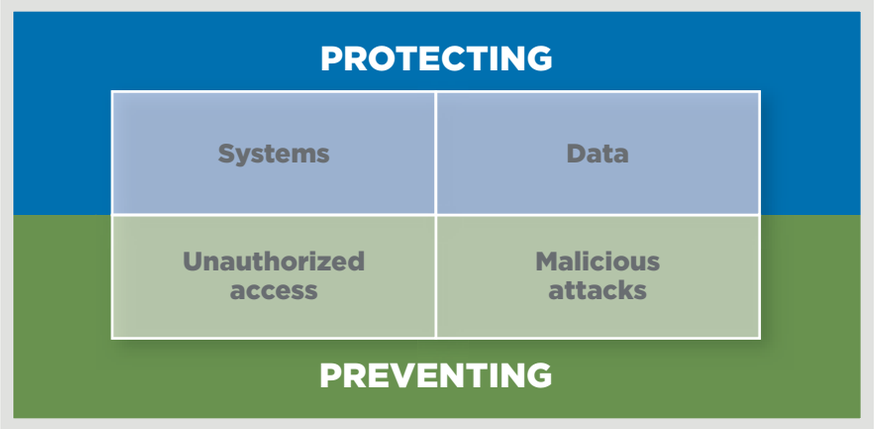

Figure 1. *Structuring a mobile security strategy from the desktop to the data center*

[1] For more information about security features, see "Freedom from Business as Usual: Introducing the New Dell Latitude," by Daniel Bounds, in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080380-Bounds.pdf.

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SLEEK, POWERFUL OFFERINGS SUPPORT A HIGHLY MOBILE WORKFORCE

The new Dell Latitude product line offers a comprehensive range of laptops to meet the diverse, individualized needs of an increasingly mobile workforce and the IT staff that supports it. At the same time, new Dell Precision mobile workstations are designed to run high-performance, graphics-intensive applications in a lightweight, durable chassis.

Anytime, anywhere computing: Dell Latitude laptops. The new Dell Latitude E4200, E4300, E5400, E5500, E6400, and E6500 laptops are designed for outstanding control and manageability, simplified security, comprehensive mobile services, rock-solid durability, and top-notch usability. For employees who travel frequently and want light, convenient devices that can last as long as they do, Latitude laptops help maximize productivity by offering up to 19 hours of battery life in select mainstream models. For those seeking a desktop replacement on the go, Latitude laptops are designed for seamless transitions between desktop and mobile work modes—supporting hot docking with small docks, stands, and peripherals across the new Latitude family. For true road warriors and power users, the ruggedized, lightweight Latitude E6400 ATG has been built and tested to meet MIL-STD 810F standards for dust, vibration, humidity, and altitude to help withstand even the most demanding field use.

Meeting diverse needs: (from left) Dell Latitude E6500, E6400 ATG, and E4300 laptops

SIMPLIFY ADMINISTRATION AND CUT COSTS

When users experienced hardware issues in the past, a member of the IT support staff could simply walk down the hall to fix the computer or handheld device on the spot. Today, mobile users are everywhere and are increasingly dependent on the technology practices provided by the IT department, which may reside in a different location. To truly enable the mobile workforce, organizations must help remote users to be as self-sufficient as possible by providing systems that perform as expected and allow people to individualize configurations without sacrificing security. In the data center, organizations need single, intuitive graphical management interfaces designed to simplify and automate routine tasks—freeing the IT staff to focus on strategic projects.

Dell offers a range of solutions, partner products, and managed service options to help organizations simplify management of their mobile infrastructure. For example, Dell Client Manager software from Altiris takes advantage of the capabilities of the Intel® Centrino® 2 processors with Intel vPro™ technology available in new Latitude laptops to provide basic hardware and software management capabilities as well as advanced client management. It also provides policy-based tools to help simplify management of remote systems by performing automated monitoring. For example, the software can check to make sure configurations for a particular employee are correct when that user logs in to the laptop. If the individual settings are incorrect, Dell Client Manager can automatically deny access, fix the settings, or schedule service.

Dell Client Manager helps reduce the need for IT support teams to arrive in person to troubleshoot or perform system maintenance and migration. Remote provisioning tools enable remote laptop configuration, helping minimize maintenance costs and user downtime. In addition, partner solutions are available for

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Supporting flexible peripherals: Dell E-Flat Panel Stand integrated with Dell E-Port docking station

New Latitude laptops are designed not only to keep mobile users productive, but also to help simplify deployment and management for IT staff. Features such as Dell ControlVault, contactless smart card readers, and integrated fingerprint readers help create a secure platform that is easy to deploy, use, and manage, while a range of Dell ProSupport Services help IT staff protect valuable resources and data against theft or loss.

High-performance mobility: Dell Precision workstations. New Dell Precision M2400 and M4400 mobile workstations feature independent software vendor (ISV)–certified, workstation-class performance and enhanced graphics rendering in compact, lightweight form factors. Next-generation DisplayPort technology supports a wide variety of large external display hardware. In addition, these mobile workstations can share peripherals with Latitude laptops—helping simplify device management and support for IT departments.

Providing high-end performance in a durable, lightweight chassis: Dell Precision M4400 mobile workstation

organizations that already have management solutions in place but are looking to extend them or add new capabilities.

Dell ProSupport Mobility Services also offers solutions designed to free IT professionals from worry, helping minimize downtime and protect key enterprise data. Available most anywhere in the world, Dell ProSupport provides a globally consistent range of simple and flexible support options for mobile workers.[2] And through the Dell CompleteCare™ Accidental Damage Service,[3] Dell can repair or replace laptops that are affected by most accidental drops, liquid spills, electrical surges, extreme temperatures, or collisions.

PROTECT CRITICAL DATA

When mobile users are on the road, their backup practices can be inconsistent at best. Many mobile workers know they should be backing up their systems, but the hassle associated with the process can often sidetrack the best of intentions.

Inconsistent mobile backup processes can put enterprises at risk of losing critical data. They may even expose organizations to compliance violations if regulated data is lost. By enabling consistent, centralized backups through Dell Online Backup and Restore—which facilitates safe, secure, and automated backups of mobile systems over the Internet at redundant offsite facilities—Dell enhances data security and helps ensure that important information is centralized in enterprise data repositories.

SMOOTH TRANSITION MANAGEMENT

Even when enterprise IT executives fully understand the scope of what is required to truly enable the mobile workforce, unplanned image changes, product transitions, and other fire drills can make it difficult to focus on strategic objectives. By proactively managing product transitions, organizations can minimize costs and headaches—helping support mobile workers by making transitions as smooth as possible. Automated deployments can help organizations significantly reduce desk-side visits from technicians as well as network traffic associated with deployment.

Dell helps with transition management in several ways. For example, Dell readiness assessments, tools, and Client Migration services can help guide IT teams making the transition from the Microsoft Windows® XP Professional OS to the Microsoft Windows Vista® OS on their mobile devices. In addition, the Dell Latitude laptop and Dell Precision mobile workstation families offer dedicated hardware configuration options that are available worldwide—which means that a common image can be used in multiple countries, allowing enterprise-wide standardization that helps reduce the cost and complexity of managing hardware in a global economy.

Common peripherals—including power adapters, docking solutions, and monitor stands—are available for new Dell Latitude laptops and Dell Precision

[2] For more information on Dell ProSupport, see "Connect and Protect Workers on the Go with Dell ProSupport Mobility Services," in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080374-Dell-ProSupport.pdf.

[3] CompleteCare service excludes theft, loss, and damage due to fire, flood or other acts of nature, or intentional damage. Customer may be required to return unit to Dell. For complete details, visit DELL.COM/ServiceContracts.

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MOBILE NETWORKING—SIMPLIFIED

In a fast-moving business world, employees need constant access to the Internet and enterprise networks. However, multiple connection options and separate software clients for each network can complicate accessibility—and for many users, the amount of time required to access networks and the Internet is simply too much.

Dell ControlPoint software helps make wireless connectivity fast and easy by using information in preselected profiles to connect to different networks. A mobile broadband card, available in all Dell Latitude laptops and Dell Precision mobile workstations, supports Global Positioning System (GPS) and WiMAX to enable blazing fast Internet access once the WiMAX network infrastructure is completed.

Dell laptops support the IEEE draft 802.11n Wi-Fi® protocol with 3 × 3 antenna design in the laptop for maximum speed and throughput. Users also can utilize Bluetooth® 2.1 technology to connect to peripherals and devices such as smartphones, PDAs, mice, and keyboards. Included ultra-wideband (UWB) technology helps provide an increased range for use with wireless docking, printers, and scanners. In addition, Dell Wi-Fi Catcher™ features allow users to easily find out if a connection is available even when the system is off. Wi-Fi Catcher also has a switch that allows users to turn off antennae when not in use to help save battery life.

Dell Latitude laptops and Dell Precision mobile workstations help safeguard sensitive data by supporting various security protocols for wireless communication, including Wi-Fi Protected Access (WPA), which is designed to prevent other mobile users from capturing sensitive communications. Wave Systems EMBASSY Trust Suite helps reinforce virtual private network authentication and communication to help improve remote computing security. And for large-scale security needs, Dell offers managed client solutions or enterprise solutions such as server-based endpoint protection suites, firewall and security gateways, and detection systems.

mobile workstations, and Dell plans to continue this family commonality for years to come. As a result, transitioning from the new Dell Latitude and Dell Precision models to future releases is designed to be simpler and less costly than the transition from previous product families because it helps eliminate the requirement to purchase new docking peripherals and test or qualify new hardware.

Web-based Dell ImageWatch™ tools give IT professionals visibility into upcoming changes that could potentially impact system images. This capability helps reduce surprises, which can streamline budgeting and planning. In addition, Dell ImageDirect helps IT managers build a single image and use it on any Dell Latitude laptop or Dell Precision mobile workstation—allowing an image built on a currently shipping system to be transitioned almost immediately to a new Dell Latitude or Dell Precision system when it launches. Avoiding the need to build an individual image for each new laptop they deploy helps free organizations to develop value-added system options.

CREATE A FLEXIBLE MOBILE INFRASTRUCTURE

Given the extent to which workers around the world have adopted mobile computing, it is no surprise that enterprises in virtually every industry are redefining their policies and practices surrounding the mobile workforce. But enabling mobile computing can go well beyond just choosing which laptops to give to employees. IT support teams must develop and implement solid security plans and procedures. They must make it easy for workers to gain secure access to enterprise networks virtually anywhere, anytime. They need mobile infrastructures that facilitate simplified, centralized administration—while also making it easy for end users to back up key data. And when the time comes to upgrade to new systems, dedicated transition services can help smooth the way. New-generation Dell Latitude laptops and Dell Precision mobile workstations not only help meet the evolving needs of highly mobile workers, but also offer the requisite IT tools to help simplify deployment, management, and security of wide-ranging mobile devices.

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Tom Kolnowski is the editor-in-chief and publisher of *Dell Power Solutions* magazine.

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Dell Latitude laptops:
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Dell Precision workstations:
DELL.COM/Precision

Dell ProSupport:
DELL.COM/ProSupport

Dell ImageWatch:
DELL.COM/ImageWatch

Join the discussion on the new Dell Latitude family at the Dell TechCenter wiki:
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FREEDOM FROM BUSINESS AS USUAL: INTRODUCING THE NEW DELL LATITUDE

By Daniel Bounds

Dell™ Latitude™ laptops have been completely reengineered to take on the demands of an increasingly mobile workforce. Designed with the core values of both IT managers and end users in mind, the new Latitude laptops make remote management and endpoint security a breeze—while providing a user experience mobile workers will want to write home about.

A myriad of computing devices will be connected to the Internet in the next five years—and most of these devices are expected to be mobile. Because a significant portion of mobile computing devices will travel well beyond the boundaries of the office, it is critical that enterprise IT departments address the concerns of mobile workforces.

As IT administrators are painfully aware, giving mobile employees the technology and support they need is not as easy as handing out laptops. Mobile users come in all shapes and sizes. Some mobile employees travel to the far reaches of the world, while others are working just around the corner in their neighborhood coffee shops. Some are willing to sacrifice features such as large screen size for a thin, light form factor, while others require a heavy-duty feature set that has traditionally been available only to desktop users. But several common threads unite them all—including simplified security, outstanding control and manageability, comprehensive mobile services, rock-solid durability, and top-notch usability to help meet the needs of both mobile users and the IT staff that supports them.[1]

SUITABILITY TO TASK

During the process of developing its new line of Latitude laptops, Dell conducted over 3,900 interviews with enterprise IT managers and end users. These interviews revealed that while both groups ultimately share the same goal—to maximize productivity in the most cost-effective way possible—each has very different requirements in mind to achieve this objective. For end users, maximizing productivity means having an easy-to-use laptop with excellent battery life and dependable network connections wherever they go. For IT staff, it is more about provisioning and managing systems that are secure, reliable, and robust, requiring a minimum of service and maintenance.

As a result of this extensive research, the new Latitude models offer a personalized design that is outfitted with advanced technologies that help keep busy mobile workers productive, including batteries that last up to 19 hours in select mainstream models and enhanced IT control (see the "Guided tour: Anytime, anywhere computing" sidebar in this article). The Latitude line offers a comprehensive range of devices, from ultra-portables to full-featured mainstream and rugged laptops (see the "Dell Latitude E6400 ATG: Semi-rugged, fully featured, and enterprise ready" sidebar in this article). Each model—the Latitude E4200, E4300, E5400, E5500, E6400, E6500, and E6400 ATG—is designed to deliver key benefits for enterprise IT staff as well as highly mobile end users.

Related Categories:
Dell Latitude laptops
Dell ProSupport Services
Laptops
Mobility
Remote management
Security
Visit DELL.COM/PowerSolutions for the complete category index.

[1] For more information, see "Mobility Redefined," by Jeanne Feldkamp, Daniel Bounds, Terry Myers, and Tom Kolnowski, in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080388-CoverStory.pdf.

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GUIDED TOUR: ANYTIME, ANYWHERE COMPUTING

Beneath their sleek exterior, new Dell Latitude laptops offer enhanced thermal design for optimal power and cooling efficiency and long battery life. Support for wireless broadband, Global Positioning System (GPS), Bluetooth® 2.1, ultra-wideband (UWB), high-performance IEEE draft 802.11n, and WiMAX technologies enables cable-free operation with flexible connectivity options. In addition, the keyboard features increased surface area compared with previous-generation Latitude laptops, with comfort enhancements such as key curvature, tactile indicators, and backlighting for low-light environments. Which all goes to show that beauty is truly more than skin deep.

Integrated Webcam and microphone options facilitate video conferencing

Outstanding antenna design and extensive wireless support enable far-reaching connectivity

Magnesium alloy construction helps protect laptop without excess weight

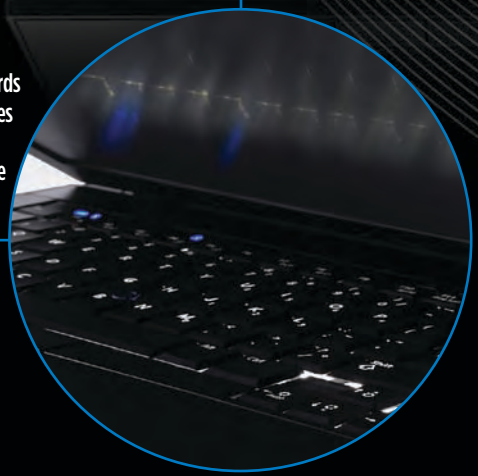
Hot key launches Dell ControlPoint console

Multiple battery configurations include an optional high-capacity battery slice

Integrated fingerprint reader streamlines data security

Contactless smart card reader helps safeguard against unauthorized access

StrikeZone shock absorbers help prevent accidental damage



Redesigned keyboards with comfort features and backlighting designed to enhance productivity

The new Dell Latitude family is designed with an eye to both enterprise IT and mobile worker requirements (shown: Latitude E6400)

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SIMPLIFIED SECURITY

Worries about mobile security cause many sleepless nights for IT executives. In addition to constantly evolving and increasingly sophisticated threats to network security, administrators must contend with the stress of potential loss, theft, or damage.

Dell aims to simplify mobile security by offering secure platforms that are easy to deploy, use, and manage. The Latitude family offers a comprehensive suite of security options that enable administrators to deploy secure systems direct from the factory. For example, Dell ControlVault™ software provides a single firmware location for storing, processing, and managing end-user credentials such as passwords and biometric templates—thereby enabling Latitude products to perform security processing and matching outside the scope of malicious applications. A contactless smart card reader can also help control laptop access using multi-technology cards that enterprises may already have invested in. And the integrated fingerprint reader in the Latitude E6500 is Federal Information Processing Standards (FIPS) 201 certified and designed to be less cumbersome than a peripheral fingerprint device. A standard fingerprint reader is available on the Latitude E6500 as well as all other new Latitude laptops.

OUTSTANDING CONTROL AND MANAGEABILITY

At the heart of the Latitude line, Intel® Centrino® 2 processors with Intel vPro™ technology are designed for enhanced wireless connectivity, energy efficiency, and processor performance. Together with additional support features from Intel, vPro technology helps organizations manage, maintain, and secure mobile workforces by allowing IT administrators to remotely shut down, diagnose, repair, update, and deploy hardware-level security features wirelessly—even when laptops are outside the enterprise firewall.

In addition, Latitude products are designed to minimize total cost of ownership and protect investments while supporting future technologies. Through remote provisioning features, for example, IT administrators can deploy and configure laptops regardless of their physical location. Leading-edge connectivity options such as ultra-wideband (UWB) and WiMAX will allow users to connect from virtually anywhere and help organizations keep pace with technology advances.

Image and systems management tools also play a key role in helping simplify IT administration for a rapidly evolving

THE DELL LATITUDE E6400 ATG: SEMI-RUGGED, FULLY FEATURED, AND ENTERPRISE READY

Most mobile employees take their laptops only as far afield as a client's office in a distant city. But some users (such as manufacturing floor managers, field scientists, and military or emergency medical personnel) need mobile devices that will stand up to extreme conditions—particularly environments of heavy vibration, dust, humidity, potential drops, bright daylight, and liquid spills onto the keyboard. Designed to provide added protection and usability in environments that push the limits of typical laptop users, the semi-rugged Dell Latitude E6400 ATG is designed to meet key military specifications (MIL-STD 810F) and enhanced Dell specifications.

Featuring a completely new design with high-durability textured paint, the Latitude E6400 ATG is designed to provide serious protection from scratches and physical wear. Available hard drive choices include removable shock-mounted hard drives and solid-state disk drives to help protect critical data. An Extreme Environment Port Cover for the rear, bottom, and side ports helps protect against dust, while a spill-resistant keyboard helps protect against liquid damage in a variety of field environments.

The Latitude E6400 ATG also offers a choice of two new shock-mounted Wide XGA (WXGA) LED backlit displays. A high brightness option makes it easy to use in sunlight with an unprecedented 750 nits, or a resistive touch display option can be used with gloves while offering a bright 650 nits.

Because the Latitude E6400 ATG shares its BIOS and hard drive images—including drivers, applications, and utilities—with the Latitude E6400, it is easy to manage from an enterprise standpoint. The Latitude E6400 ATG also uses peripherals and accessories common to other Latitude models, helping simplify deployment of multiple form factors within the client user base.

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mobile workforce. For example, the Dell ImageDirect tool streamlines the creation, updating, management, and deployment of hardware images, while advanced systems management functions available through Altiris® Dell Client Manager™ software can provide significant improvement in first-call resolution. New Dell ControlPoint software lets IT staff customize user settings and profiles for batteries, wireless access, and security. Moreover, common management across the Dell Latitude laptop and Dell Precision mobile workstation families further enhances productivity and streamlines infrastructure support.

Small docks, stands, and peripherals allow true hot docking to promote fast movement between desktop and mobile modes. Commonality across the product family extends to peripherals, so compatible peripheral devices, adapters, and docking connections enable organizations to distribute the same accessories to employees using any system within the new Dell Latitude or Dell Precision families. In addition, global deployment and image update planning can help smooth transition management.

COMPREHENSIVE MOBILE SERVICES

In the past, IT administrators have constantly worried about downtime and loss of data. As organizations continue to push the envelope way past business as usual, Dell is committed to taking the complexity out of securing the infrastructure that supports the mobile workforce.

To that end, Dell offers a comprehensive range of recovery services.[2] Mobile data protection services such as Remote Data Delete and Hard Drive Data Recovery can help prevent loss of valuable data (in the case of theft) and help recover data (if a hard drive fails). Certified Data Destruction Services help preserve peace of mind by allowing administrators to destroy the data on a hard drive if the disk fails, while Hard Drive Data Recovery Services can help prevent the loss of valuable data by recovering information from failed hard drives.

> **"Dell aims to simplify mobile security by offering secure platforms that are easy to deploy, use, and manage. The Latitude family offers a comprehensive suite of security options that enable administrators to deploy secure systems direct from the factory."**

ROCK-SOLID DURABILITY

Because laptops are frequently in motion, they are more prone to damage than desktops. They get bumped. They get dropped. They may get soaked by the occasional cup of coffee. These events are daily realities for mobile workers—so Dell designed the new Latitude family with a robust feature set and impeccable durability, investing thousands of hours in durability testing. Robust metal hinges and latches are designed to stand up to the toughest conditions, while StrikeZone shock absorbers help prevent accidental damage and optional free-fall sensor hard drives and solid-state disks help improve data protection (see the "Flash memory storage enhances reliability on solid-state disks" sidebar in this article).

FLASH MEMORY STORAGE ENHANCES RELIABILITY ON SOLID-STATE DISKS

To help increase reliability and protect enterprise data, the Dell Latitude line offers leading-edge solid-state disk (SSD) technology. Because SSDs are based entirely on semiconductors and have no mechanical parts, they are designed to be more durable and less sensitive to shock and vibration than mechanical disks. This durability helps avoid downtime and speed data access for mobile workers—while helping reduce maintenance costs and service calls for IT personnel. In addition, SSDs characteristically consume less power than mechanical disks. Multiplied across thousands of mobile users, reduced power consumption can add up to significant energy savings.

The SSDs available in new Latitude laptops also enhance reliability and durability through advanced flash memory storage. Flash management controllers map flash memory to specific usage models and wear leveling that spreads write/erase cycles across physical addresses to help maximize chip life cycles and match performance with applications. As flash storage continues to evolve, the near-zero latency, nonvolatility, and durability of SSDs can provide flexible, durable alternatives to mechanical disks.

[2] Availability may vary by country. For more information, see "Connect and Protect Workers on the Go with Dell ProSupport Mobility Services," in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080374-Dell-ProSupport.pdf.

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New Dell Latitude laptops provide outstanding control and manageability in a sleek, durable design (from left: Latitude E4300 and Latitude E6400)

TOP-NOTCH USABILITY

Usability glitches in laptops are not just an issue for mobile workers. Because the IT department is responsible for fixing (and paying for) the problems caused by design gotchas, the Holy Grail of mobile computing is a family of hassle-free devices that let users work self-sufficiently—without compromising security or productivity. With the new generation of Latitude laptops, Dell invested heavily in design to create easy-to-use laptops that are bold, sleek, and durable.[3]

By offering a choice of standard and backlit LED LCD screen sizes in different models, Dell provides a range of options to suit virtually any mobile employee. Latitude E5500 and E6500 models provide the most screen area, with a 15.4-inch display. Latitude E5400 and E6400 models (including the Latitude E6400 ATG) have a 14.1-inch screen. The Latitude E4300 offers a 13-inch display, while the Latitude E4200 comes in at a compact 12.1 inches for users who are after a sleek, light laptop.

Dell ControlPoint software facilitates usability by providing a unified application framework that allows users to customize their laptop according to their needs and usage style, helping to make them self-sufficient and to minimize IT support calls. This software is easy to install, use, and maintain, and offers a consolidated user interface. ControlPoint includes Dell Connection Manager, Digital ID Security Manager, and power management tools to help give end users control over their systems without sacrificing security or serviceability for the IT department.

In addition, one of the most common complaints IT professionals hear from mobile workers is that laptop batteries do not last long enough. Users need batteries that last as long as they do. The new optional nine-cell battery in the mainstream Latitude line is designed to support a full 8-hour workday—or even last up to 19 hours on mainstream systems with the addition of a new battery slice and Dell ControlPoint software. LED backlit displays and customized battery settings can also help users achieve a full-day charge.

INSPIRED DESIGN FOR SECURITY, MANAGEABILITY, AND INNOVATION ON THE MOVE

As their employees become increasingly mobile, organizations require increasingly powerful, flexible tools that can meet the needs of both IT departments and mobile users—whether they are inside the office, in a neighborhood coffee shop, or halfway around the world. Mobile users need easy-to-use laptops with long battery life and the durability to withstand tough conditions on the road. IT departments, meanwhile, must be able to deploy and configure mobile systems regardless of their physical location and ensure the security of critical data against theft or loss.

New Dell Latitude laptops have been designed with these needs in mind. By combining the simplified security and manageability necessary for IT staff with the outstanding usability and durability demanded by end users, new Dell Latitude laptops help maximize productivity and offer a flexible platform for the anywhere, anytime computing of a truly global workforce.

Daniel Bounds is a marketing professional for the Dell Global Relationship Marketing Group focused on commercial laptops. Daniel has previously held positions with the Dell Enterprise Product Group and Hewlett-Packard. He has a B.A. and an M.B.A. from the University of Texas at Austin.

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Join the discussion on the new Dell Latitude family at the Dell TechCenter wiki:
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[3] For more information on design factors, see "Designing for the Road Ahead," in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080410-Musgrave.pdf.

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DELL #1 IN STORAGE

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Source: Gartner, Inc. "Quarterly Statistics: Disk Array Storage, All Regions, All Countries" by Robin Burke et al., June 6, 2008. In the first quarter of calendar year 2008, Dell captured a leading 20.4 percent of the open systems (Windows/Linux) external worldwide disk array storage market as measured in revenue.

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DESIGNING FOR THE ROAD AHEAD

When done right, industrial design is invisible. But inspiring a sense of delight and lust from a business laptop that is effortless to use—that takes a lot of work. Ken Musgrave, director of industrial design and usability at Dell, reveals what happened behind the scenes when Dell went to the drawing board to design the new family of Dell™ Latitude™ laptops.

The launch of the new family of Dell Latitude laptops represents a major turning point for Dell. Long considered a technological leader but not a design star, Dell is now unleashing a double threat with its new business laptop line. And at Dell, design is about a lot more than simply making things look good. The way a product is designed is the key to the whole user experience, from the way the keyboard feels under your fingers to what your laptop says about you. That is why Dell has a specialized team dedicated to designing mobile products that are not only attractive, but intuitive and user-friendly.

Ken Musgrave, who leads the Dell worldwide industrial design and usability team, recently spoke with *Dell Power Solutions* about the process of giving the new Latitude laptops—and Dell Precision™ mobile workstations—a sleek look to match the power under the hood.

HOW WOULD YOU DESCRIBE DELL'S DESIGN PHILOSOPHY FOR THE NEW LATITUDE FAMILY?

We wanted to take our design ideals up a notch with this generation of Latitude laptops. We wanted to land a one-two punch—to convey a level of sophistication and simplicity while also delivering an overt impression of high quality. But mostly, we wanted to make the Latitude laptops exciting. We wanted this to be a product that made people feel both delight and lust.

We knew we had to get an emotional response from users. You don't usually think of business products as emotional items—that response has generally been reserved for gaming systems or the premium product in each category. But it's amazing how important the emotional reaction is when people are forming their impressions of a product, or a brand. And a lot of times, that impression is based on little things. When I push on the palm rest, does it deflect? When I push on the back of the laptop, does it deflect? When I lay my hands on the palm rest, are the keys in the right spot? All those little things are difficult to get right, but they make a huge difference. So that is where we put most of our effort.

Also, because getting an emotional reaction from the user has a lot to do with that first-glance impression, we put a lot of effort into revamping the look of the Latitude line.

WHO WORKED ON THE DESIGN FOR THE NEW LATITUDE LAPTOPS?

We have roughly 100 people working on a variety of products, compared with just 7 in 2001. Industrial design, usability, color design and finishes, packaging, some user interface design, comfort—we have a wide range of specialists working in-house. Our average designer has about 13 years of experience, and we have about 15 Ph.D.'s in cognitive sciences and psychology working on usability.

With psychologists and designers working side by side, we can study things that were considered unconventional in computer design until now. For example, we spend time looking at how people perceive products and how they prioritize their expectations. All of our experts collaborate to bring top appeal to Dell consumer- and business-class products—to help improve the aspects of the products that the customer sees and touches.

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HOW DO YOU CHOOSE COLORS AND FINISHES FOR THE PRODUCTS? IS IT GUESSWORK, OR IS THERE A SCIENCE TO IT?

We have a whole team that focuses on colors, finishes, and trims. You'll notice that every technology vendor tends to come out with the same colors at the same time—that's because we're all working with one of three cross-industry consortiums that do color forecasting. Furniture, apparel, automotive—they're all working with the same forecasts. They're all chasing the same color trends, and the consortiums tend to get most of them right.

For example, in early 2000, blood orange was predicted to be a hot color for late in the decade. Everyone thought there was no way this would be a popular shade—but now it is the hottest color around. Any company that is introducing a new car (starting with the 2003 Honda Element and the 2004 Range Rover Sport) now automatically shows it in that color. Dodge just released the Charger in that color as well.

When you come out with a palette of colors, you try to come up with a range that has global appeal. Sometimes a color that sells really well in Europe won't have much appeal in, say, China. And vice versa. But that's the beauty of having the palette—there are options, and people can choose what they like.

ARE FINISHES JUST LIMITED TO SOLID COLORS?

No. We have a technology in our manufacturing process that lets us turn images into one-offs or small runs. It's the same process we use to apply color on the outside of the laptop. We can also apply the image onto a three-dimensional surface, or add soft-touch paint on top to give it a really nice finish that feels good in your hands.

Another exciting thing we did recently was produce a limited run of special-edition consumer laptops with artist Mike Ming. We've actually done small runs with several artists who have a pop following—so, we might do 2,000 of one design. They sell like mad. They're a long way from gray!

Once we establish our colors, we have to standardize them. We have a facility on-site where we have color analyzers and we create color standards and archive them in the freezer. Our suppliers will submit their matches, and then we test them out to see whether they actually correspond to our specifications.

HOW DO YOU PINPOINT THE FEATURES THAT YOU CAN IMPROVE THROUGH BETTER DESIGN?

When you show something to a focus group, all they can bring to the table is their historical perspective. So we don't just show it to them and ask what they like. We'll describe some of the product attributes and behaviors to make sure they see and understand that. If you design for what consumers want now, you'll be behind their expectations two years down the line, when the product comes out. Their expectations will have shifted. So we aim ahead of their expectations, then lead people to where we think they'll end up. That's why we put so much effort into our forecasting and trends, our advance design work.

Dell engages with about 1,000 users per year in our worldwide usability labs. We test everything extensively—from

BRINGING LATITUDE TO LIFE

Step 1: *Dell designers create rough sketches to define multiple laptop concepts, based on the Onyx design language.*

Step 2: *Designers refine key structural details through iterative sketching processes.*

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> **"If you design for what consumers want now, you'll be behind their expectations two years down the line, when the product comes out. Their expectations will have shifted. So we aim ahead of their expectations."**

keyboard performance and server maintenance processes to wireless connectivity and systems management. We have four full-time, in-house labs. The intelligence that we gain from our usability studies is what gets translated into the design of the product. But it's not as simple as asking users what features they want added to the laptop. Often customers don't even realize they are doing something that makes up for a deficiency in a product. So when our usability experts see subtle compensating behaviors over and over again in different users, that's where we find opportunities to improve the product design. The trick is to pay attention to the right cues so we can identify needs that users have, but can't necessarily articulate.

The point stick—that eraser head that sits in the keyboard and lets you move the pointer on-screen—is a great example. Over the course of two product redesigns, we changed its shape from being an "outie" to an "innie." The button has gone from being a rigid, hard eraser material that amplified all your finger movements to something that helps buffer finger movements. Softening the pointer movement helps make for a dramatically better experience.

ONCE YOU KNOW WHAT USERS NEED FROM THE LAPTOP, HOW DO YOU TRANSLATE THAT INTO THE PRODUCT'S LOOK AND FEEL?

When we start thinking about the look of a product family, we use what we call design languages. These are like visual style guides. They bring together visual elements that tie together products of similar design and similar value propositions.

Car companies are a good illustration of how a design language works—when you see a BMW 3 Series or 5 Series sedan, or a BMW X3 or X5 SUV, they're obviously different cars, but you always know that they're part of the BMW family. Design languages also help continue the heritage from previous product generations.

When you develop a design language, you need to think about what characteristics you want to convey. We recognized that the Latitude line has a masculine kind of persona. And from a design perspective, power is something that has always been conveyed through very muscular forms. The Latitude laptops from two generations ago were designed to evoke overlapping muscle and tendons using organic shapes. The most recent ones evolved into something a little more restrained, with more flat

Step 3: *Concepts edge closer to reality and photo-like quality through the use of high-resolution software rendering.*

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planes. And the new Latitude laptops convey a crisp, precise sense of masculinity. It is a refined version of the aesthetic from two generations ago.

We created a design language called Onyx for this generation of Latitude laptops. Onyx uses a lot of primary, rectangular shapes to create a simple yet capable feel, and we put a lot of emphasis on grouped information and control elements. We tried to make innovation more apparent through tactile and visual features like flush screens, touch controls, and hardware such as latches and hinges. Onyx uses subtle contrasts in color, material, and textures to convey sophistication. We also kept our detailing very precise—almost militaristic—to communicate no-nonsense professionalism.

Latitude is the first glimpse into the new direction we're taking for the industrial design of our upcoming enterprise products. Our new blade servers also have a similar look and some of the same detailing, both on the exterior and under the hood. For example, we spent as much time on the detailing and latches on the back of the blade server chassis as we did on the front.

WHAT DESIGN CHANGES CAN WE LOOK FORWARD TO IN THIS GENERATION OF LAPTOPS?

On the new Latitude laptops, we've gone to a much cleaner, tighter geometry. We moved the battery to the back to help make expansion easier. We have ports in the back and the side. And the 13-inch model, the Latitude E4300, is a really nice form factor—it's the smallest display you can get with a full-sized keyboard, but it's big enough to have the thermals to support a full-sized processor. And it's significantly thinner and shallower than our previous-generation 13-inch models.

We put a lot of effort into building on the features that already worked and revamping the ones that didn't reflect the qualities we want Latitude to project. For example, our keyboard was already viewed as the gold standard. Customers thought it was a really solid component. So in our usability studies, we tried to build a clear, comprehensive list of every attribute that should be part of a best-in-class business keyboard—then we zeroed in on how to deliver those qualities for the future product. We approached every feature within the laptops as if it were its own complete product. We paid attention to how things work individually, as well as together.

One of the coolest things we created is a special trackpad for Dell Precision mobile workstations. When you toggle it on, it'll actually have a scroll wheel in it, for people who do linear editing. There will be some programmable function keys, and you'll be able to do high-speed or low-speed linear movements. It's a small, specialized feature, but it makes a huge difference for the user experience.

We also redesigned the accessories. The docks, for example—in the past, you would dock your laptop and use this big platform with a huge monitor on top of it. But flat-panel monitors are light and dynamic and airy, so we got rid of the bulky platform and monitor. The new dock integrates a flat-panel stand on it.

We've taken some steps to add consumer appeal to business-class products. For example, instead of wrapping metal hinges in plastic, as we have in the past, we actually made the hinges a

Step 4: *Foam models are carved to show the general size and shape of the selected concepts.*

Step 5: *Various hard models of subcomponents are crafted to demonstrate key design attributes. In this case, hinge models show the design progression from previous-generation Latitude D-Family laptops (background) to the new Latitude E-Family laptops (foreground).*

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design element. We gave them a brushed metal finish that shows off the quality of the hardware. We aren't hiding them anymore—we are bringing them out and making them very overt, very apparent.

We expect that these types of design changes will make Latitude laptops appealing for college students, young professionals—anyone who cares about their equipment looking cool. We want to make it look less like a corporate-issued system so people can have some personal expression in a professional work environment.

We're even going beyond the product line itself. We've redesigned the whole Latitude bag line. We realized that we had put all this effort into making our laptops as light as possible, but the bags were adding extra weight—so now they're designed to be lighter and thinner, with sleeker lines than our previous laptop bags.

"Dell's long product cycles can be good for the planet—there's a tremendous amount of ecological benefit in reducing the amount of waste from discarded laptops. We're also using recyclable materials wherever possible, from sustainable plastics to natural compounds."

HOW ENVIRONMENTALLY FRIENDLY IS THIS GENERATION OF LATITUDE LAPTOPS?

We're working on making our systems smaller while delivering the same power and capabilities that are available in bigger systems. And our long product cycles can be good for the planet—there's a tremendous amount of ecological benefit in reducing the amount of waste from discarded laptops. We're also using recyclable materials wherever possible, from sustainable plastics to natural compounds.

WHY DID DELL CHOOSE NOW AS THE TIME TO GIVE LATITUDE LAPTOPS A WHOLE NEW LOOK?

Enterprise users are starting to take more of a consumer attitude toward the technologies they use to do their jobs. They are drawing on their own knowledge of devices they have either personally experienced or have heard about through family and friends. This means that people are approaching workplace technology with a completely different set of values and expectations than in the past.

Our team recognized that user experience wasn't exactly Dell's strong suit in previous years. Customers saw the Latitude product line as competent, but completely free of any emotion. Our product design didn't reflect our world-class engineering. They didn't get people jazzed. So when we sat down to redesign the Latitude laptops, our fundamental goal was to create products that not only incorporated Dell technology innovations, but also delivered an exceptional, exciting user experience.

Step 6: *Full-scale hard models are built to guide selection of the final designs, clearing the way for the Dell engineering teams to finalize the internal components.*

Step 7: *Production Latitude laptops roll out of Dell manufacturing facilities and into the hands of customers.*

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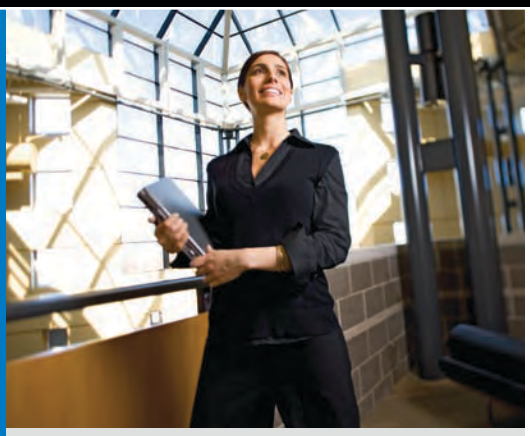

MOBILITY AND DYNAMIC GRAPHICS: NEW DELL PRECISION WORKSTATIONS SHINE

By Richard Thwaites

Dell Precision™ M2400 and M4400 mobile workstations enable engineers, computer-aided design (CAD) designers, video editors, animators, and other creative and business professionals to run high-performance, graphics-intensive applications in a lightweight, durable chassis—and share docking stations and peripherals with the new Dell™ Latitude™ laptop family.

Related Categories:

Dell Precision workstations

Mobility

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Delivering high-performance workstation functionality in a mobile computing environment is no easy task. In particular, the trade-offs that have historically enabled mobile computing have often required sacrifices in performance and graphics capability. Now, the new Dell Precision M2400 and M4400 mobile workstations offer certified workstation-class performance in a choice of lightweight, durable, highly mobile chassis—enabling engineers, computer-aided design (CAD) designers, video editors, animators, and other creative and business professionals to run high-performance, graphics-intensive applications reliably and securely most anywhere in the world. In addition, Dell Precision M2400 and M4400 workstations share the same docking stations, peripherals, and systems management tools as the new Dell Latitude laptops,[1] which can help simplify deployment and lower the cost of management, especially in enterprise environments with a heterogeneous mix of mobile computing platforms. Energy-efficient Intel® Centrino® 2 multi-core processors with Intel vPro™ technology allow administrators to perform hardware-assisted remote isolation, diagnostics, and repair, as well as remotely shut down and update Dell Precision M2400 and M4400 workstations.

POWERING WORKSTATION-CLASS PERFORMANCE

Historically, specialized graphics processors and other high-performance processing hardware generated too much heat to fit safely within the confines of a mobile workstation. As a result, users often had to endure long rendering times and unacceptably slow performance when running graphics-intensive, workstation-class applications on mobile computers. And because of the high power usage of most graphics-intensive applications, mobile users running such applications were often constrained by limited battery life.

Recent innovations in chip design, however, have resulted in chipsets with dramatically enhanced power efficiency and heat dissipation capabilities. By taking advantage of these innovations, Dell Precision M2400 and M4400 systems offer a high level of processing power in a lightweight form factor (see the "Mobile workstations ready to go the distance" sidebar in this article). For example, Dell Precision M4400 workstations include next-generation Intel Core™2 Extreme processors and NVIDIA OpenGL graphics engines with dedicated graphics memory to deliver certified workstation-class performance and enhanced graphics rendering.

[1] For more information, see "Freedom from Business as Usual: Introducing the New Dell Latitude," by Daniel Bounds, in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080380-Bounds.pdf.

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To help improve performance and durability, Dell Precision M2400 and M4400 workstations also take advantage of the latest solid-state disk (SSD) technology. Dell Flash Ultra Performance SSDs are designed to deliver up to 22 percent faster read/write performance over previous-generation laptop hard drives.[2] In addition, Dell Precision M2400 and M4400 mobile workstations take advantage of innovations in battery technology to help lengthen battery life and enhance mobility—including options for six- and nine-cell batteries plus an optional high-capacity battery slice rated at 84 WH.

Although Dell Precision M2400 and M4400 workstations come equipped with 14.1-inch and 15.4-inch LCD monitors, respectively, they can also connect to external monitors up to 30 inches in size. In particular, Dell Precision M2400 and M4400 workstations utilize next-generation DisplayPort technology, which enables them to connect to external display hardware that is compatible with Digital Visual Interface (DVI), dual-link DVI, video graphics array, and high-definition multimedia interfaces. DisplayPort also supports long-length projector cords, and can provide expandability for connections to CRTs, LCDs, flat-panel televisions, and other media devices.

Of course, mobile workstations are at especially high risk for damage in transit. To help IT organizations protect their investment and maximize user uptime, Dell Precision M2400 and M4400 workstations have been carefully designed to withstand the wear and tear that comes from taking a laptop on the road. For example, the chassis itself shares the same innovative design as the new Dell Latitude family of laptops, and is constructed of a strong magnesium alloy with StrikeZone shock absorbers to help withstand drops and blows. Additionally, the hinges, latches, back covers, and keyboards have been designed specifically for the Dell Precision M2400 and M4400 workstations to facilitate ease of use and minimize damage.

MOBILE WORKSTATIONS READY TO GO THE DISTANCE

Two new Dell Precision mobile workstations complement the new Dell Latitude laptop family, creating a comprehensive range of mobile computing platforms that share peripherals and systems management tools to help simplify deployment and lower cost of ownership.

The Dell Precision M4400 is a midsize mobile workstation designed to be a true replacement system for workers who need a mobile system but require excellent workstation performance. In particular, it is designed to deliver leading-edge graphics performance for applications such as video editing, mechanical assembly design, animation, digital content creation, and any others that require extensive manipulation of OpenGL models. The Dell Precision M4400 offers independent software vendor (ISV)–certified application performance in a midsize, durable 15.4-inch LCD form factor with a target entry weight of 5.92 pounds (see Figure A).* The Dell Precision M4400 utilizes the NVIDIA Quadro FX 770M graphics engine and 512 MB of dedicated graphics memory, along with upcoming quad-core Intel mobile processors.

Figure A. *The Dell Precision M4400: Powerful and feature-rich graphics*

The Dell Precision M2400 is a lightweight mobile workstation designed for workers who need certified workstation-class performance but require excellent mobility as well. In particular, it is designed for highly mobile users such as executives, creative designers, and other mobile professionals who need to view, manipulate, and edit design documents, OpenGL models, and other graphical documents while on the go. The Dell Precision M2400 delivers ISV-certified application performance in a lightweight, durable 14.1-inch LCD form factor with a target entry weight of 4.77 pounds (see Figure B).* The Dell Precision M2400 utilizes the NVIDIA Quadro FX 770M graphics engine and 256 MB of dedicated graphics memory, along with next-generation Intel Core 2 Duo processors.

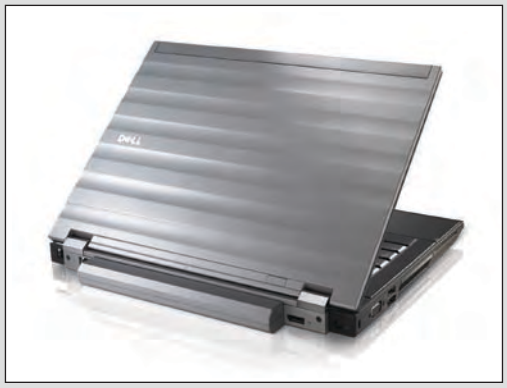

Figure B. *The Dell Precision M2400: Enhanced mobility for workstation performance*

* Weights vary depending on configuration and manufacturing variability.

ENSURING CONNECTIVITY AND SECURITY

To stay productive, mobile workers must have consistent access to the Internet and enterprise networks. Dell Precision M2400 and M4400 mobile workstations combine advanced antenna design and connectivity hardware with specialized connectivity and security software designed to deliver exceptional network access and security.

In particular, Dell Precision M2400 and M4400 workstations support the IEEE

[2] Based on SysMark 2007 benchmark tests performed by Dell Labs in January 2008. Actual performance will vary based on configuration, usage, and manufacturing variability.

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802.11n Wi-Fi® protocol with 3 × 3 antenna design to help maximize speed and throughput. Users can also utilize Bluetooth® 2.1 technology to connect to peripherals and devices such as smartphones, PDAs, mice, and keyboards. Included ultra-wideband (UWB) technology provides extensive range for use with wireless docking stations, printers, and scanners. A mobile broadband card, included in Dell Precision M2400 and M4400 workstations, supports Global Positioning System (GPS) and WiMAX technology to enable lightning-fast Internet access when the WiMAX network infrastructure is completed.

Additionally, to help simplify the task of managing connectivity across a wide range of user communities and network types, Dell ControlPoint software utilizes information in preselected profiles to streamline and automate connectivity to a variety of networks. Dell Wi-Fi Catcher™ features allow users to easily find out if a connection is available even when the system is off. Wi-Fi Catcher also has a switch that allows users to turn off antennae when not in use to help save battery life.

To help ensure the safety and security of sensitive data, Dell Precision M2400 and M4400 mobile workstations support a variety of security protocols for wireless communication, including Wi-Fi Protected Access (WPA), which is designed to prevent other mobile users from capturing sensitive business communications. Wave Systems EMBASSY Trust Suite software helps reinforce virtual private network authentication and communication to help improve remote computing security. Additional security features include contactless smart card readers, fingerprint readers, and Trusted Platform Modules designed to enhance security for credentials repositories.[3]

SHARING COMMON DOCKING STATIONS AND PERIPHERALS

In addition to delivering outstanding performance and durability, Dell Precision M2400 and M4400 mobile workstations share peripherals with the new Dell Latitude laptops, including next-generation docking stations and display options. Sharing a common pool of peripherals not only offers productivity benefits, but also helps IT departments simplify device management and lower the overall cost of supporting a mobile fleet.

Key shared peripherals include next-generation docking stations such as the Advanced E-Port, which supports dual monitors for advanced display functionality, and the E-Port, which features an extremely small footprint. Dell Precision M2400 and M4400 workstations also share the same laptop and monitor stands, cameras, and microphones.

STREAMLINING DEPLOYMENT AND MANAGEMENT

Of course, transitioning to a new hardware platform can be a challenge. To help ease the process, Dell offers a range of products and services designed to simplify provisioning, deployment, overall management, and support. To begin with, Dell Custom Factory Integration services build Dell Precision M2400 and M4400 mobile workstations and other Dell systems to order, including custom hardware and software configurations and factory installation of organization-specific software images.

To help IT organizations simplify management of hardware images, Dell offers ImageDirect, an image management tool that enables administrators to create, update, manage, and deploy hardware images. ImageDirect supports a wide range of legacy, current, and future platforms—including Dell OptiPlex™, Dell Latitude, and Dell Precision systems. In addition, to streamline client migration and deployment, the Dell Client Migration Solution provides end-to-end deployment services ranging from readiness assessments to automated imaging and deployment to user data migration, helping minimize disruption to productivity and local technician visits.

Moreover, to help organizations simplify the challenge of supporting mobile workers around the world, Dell ProSupport Mobility Services offers a comprehensive suite of professional asset and data protection solutions geared to securely and flexibly enhance mobile worker productivity, safeguard organizational data, and protect valuable mobile assets.[4]

ENABLING HIGH-PERFORMANCE GRAPHICS PROCESSING—ANYWHERE

With the enhanced graphics acceleration and processing power now available in Dell Precision M2400 and M4400 workstations, mobile professionals can finally get certified workstation-class performance in a reliable, durable mobile form factor. And because Dell Precision M2400 and M4400 workstations share the same peripherals as Dell Latitude laptops, they can help IT departments simplify deployment and lower the overall cost of managing an enterprise-wide mobile fleet.

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Dell Precision workstations:
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[3] For more information on security technologies, intuitive remote management tools, streamlined backup solutions, and product transition planning for the mobile workforce, see "Mobility Redefined," by Jeanne Feldkamp, Daniel Bounds, Terry Myers, and Tom Kolnowski, in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080388-CoverStory.pdf.

[4] For more information, see "Connect and Protect Workers on the Go with Dell ProSupport Mobility Services," in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080374-Dell-ProSupport.pdf.

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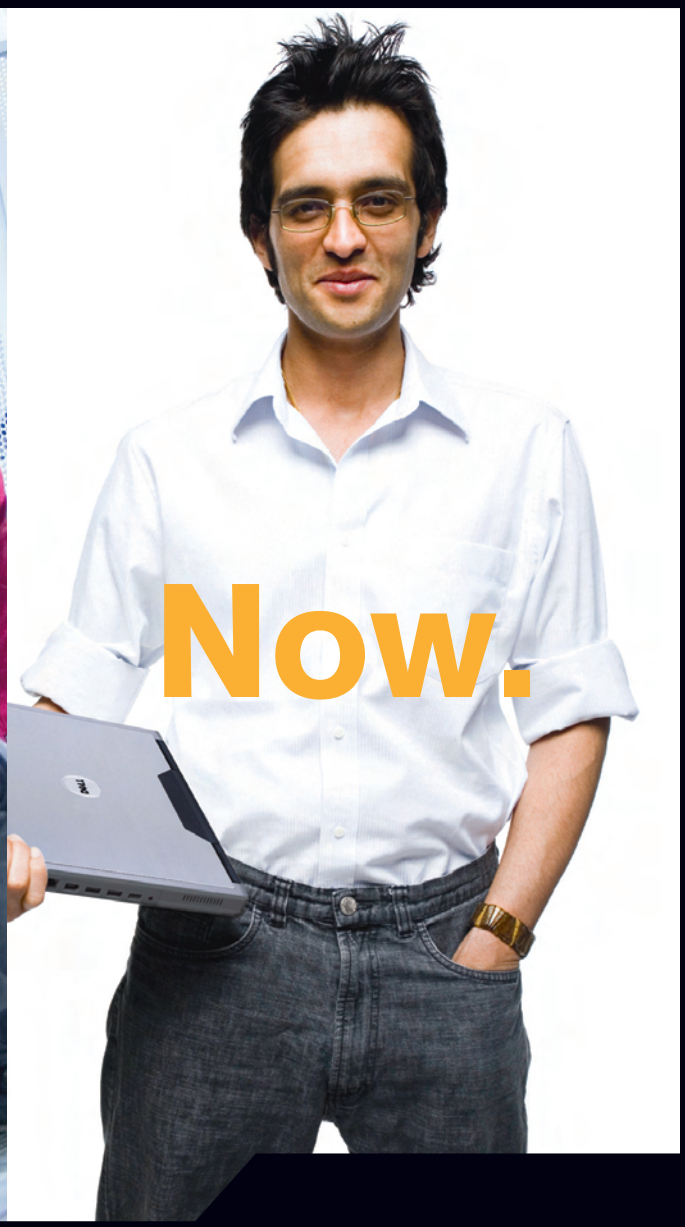

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ENHANCED REMOTE CLIENT CONTROL USING LANDESK MANAGEMENT SUITE

By Travis Zhao
Brett Twiggs

The combination of LANDesk® Management Suite with the Intel® vPro™ technology in Dell™ OptiPlex™ desktops and Dell Latitude™ laptops can provide a powerful, flexible way for administrators to remotely manage, troubleshoot, and secure client systems throughout their life cycle.

Related Categories:
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Desk-side visits from IT administrators can be both costly and time-consuming for many enterprises, making powerful, flexible tools for remote management a key way to both simplify IT and reduce ongoing costs. On their own, the remote management capabilities in LANDesk Management Suite can help significantly reduce the need for these visits—but that need is reduced even further when coupled with the out-of-band management features of Dell OptiPlex desktops and Latitude laptops with Intel vPro technology. LANDesk, Dell, and Intel have worked together to create a powerful vPro implementation that enables administrators to manage client systems at virtually anytime from virtually anywhere—even if the system's hard drive has failed, its OS does not respond, its software agents have been disabled, or the system is powered down.

LANDesk Management Suite 8.8 and Dell desktops and laptops with Intel vPro technology work together to not only help reduce the need for desk-side visits from IT administrators, but also to help automate system discovery and deployment; increase the flexibility of patch management processes to support green IT practices; enhance remote troubleshooting, including seamless transitions from out-of-band to in-band remote management; simplify hardware diagnostics; provide monitoring and alerting of critical management agents while extending the ability to block unwanted traffic at the client system; and enhance overall life cycle management and remote decommissioning for client systems.

AUTOMATED SYSTEM DISCOVERY AND DEPLOYMENT

Intel vPro technology is supported in Dell OptiPlex 755, OptiPlex 760, and OptiPlex 960 desktops and in some models of new Dell Latitude E-Family laptops. When administrators first deploy these systems at a branch office or other remote location, they can take advantage of the internal vPro chipsets in conjunction with LANDesk Management Suite to remotely power up the systems, provision them with operating systems and applications, and configure them without having to use a Preboot Execution Environment (PXE) server or other technologies.

The vPro processor technology has its own management engine (ME) that runs independently of the OS and works in conjunction with Dell client systems' network interface cards to communicate over the network even if the systems are not powered up. As soon as these systems are connected to a power source and network, the vPro technology can immediately send out hello packets over the network. The LANDesk Management Suite core server then receives those packets, establishes an encrypted communication channel, automatically discovers and identifies each system, and lists them as unmanaged devices in the LANDesk management console.

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Once LANDesk Management Suite has discovered the systems, administrators can begin the provisioning process, taking advantage of prebuilt LANDesk templates that can automatically perform tasks such as deleting existing hard drive partitions, creating new partitions, and provisioning those partitions by pushing out a standard enterprise image to the appropriate systems. Although LANDesk Management Suite has its own image creation solution, it can also push out images created with most major imaging applications.

Administrators can also add another level of automation to the provisioning process if they know the Media Access Control (MAC) addresses of the Dell systems before deployment. They can then assign specific provisioning tasks and templates to these MAC addresses in LANDesk Management Suite, so that when the software first discovers those systems, it can initiate the provisioning process automatically without requiring administrator intervention.

To facilitate remote out-of-band management tasks using vPro technology, one of these provisioning tasks should include creating a diagnostics partition and provisioning it with the Windows Preinstallation Environment (WinPE), diagnostic tools, and the LANDesk Management Suite remote control agent. The prebuilt templates in LANDesk Management Suite include ones for creating and provisioning this diagnostic partition, but administrators can also create their own customized provisioning templates as needed.

FLEXIBLE PATCH MANAGEMENT TO SUPPORT GREEN IT

As organizations look for additional ways to go green, many have begun shutting down noncritical PCs after normal business hours—a practice that, by helping reduce power consumption, is typically both favorable to the environment and financially beneficial. However, this approach can interfere with standard patch management processes, creating difficulties for IT departments that want to push out patches after normal business hours, but cannot do so because most of the systems have been powered down.

To help solve this problem, some organizations use Wake-on-LAN to power up systems that are not turned on. However, because Wake-on-LAN can have issues with security and reliability, many organizations refrain from using it to address this specific patching problem. Dell OptiPlex desktops and Latitude laptops with Intel vPro technology can offer a secure, reliable alternative when deployed in conjunction with the patch management capabilities of LANDesk Management Suite by using Wake-on-ME.

Wake-on-ME enables administrators to remotely power up Dell client systems by issuing a wake-up command to the vPro management engine. For example, if administrators schedule a patch to be deployed on affected computers at 2 A.M. through LANDesk Management Suite (see Figure 1), the software automatically checks the power status of the client systems, and if they are powered down, uses Wake-on-ME by default as the preferred method to power them up. If Wake-on-ME is not available, it can also automatically fall back to using Wake-on-LAN. Once the patch has successfully deployed, LANDesk Management Suite can then issue a command to power down the systems.

ENHANCED REMOTE TROUBLESHOOTING

When a desktop or laptop has a fatal error, becomes unresponsive, or will not boot, an administrator typically must make a desk-side visit to fix the problem. The out-of-band communication capabilities and IDE redirection (IDE-R) supported by Dell OptiPlex desktops and Latitude laptops with Intel vPro technology help minimize the need for such visits even in those circumstances.

IDE-R enables administrators to remotely change the boot device location of a client system and then reboot the system. From within the LANDesk console, administrators can right-click on the target device, bring up the Intel vPro AMT Boot Manager window, select "IDE-R boot" as the boot option, and then set the system to boot from a diagnostic CD or boot image (see Figure 2). Using console redirection in conjunction with IDE-R boot allows administrators to view the client system's boot progress from within the console as the system loads the BIOS, drivers, and OS, helping them remotely identify problems or errors that occur during the boot process. From within the console, administrators can also scan for viruses, update BIOSs, clean up temporary files, restore user data, replace corrupted dynamic-link library (DLL) files, and

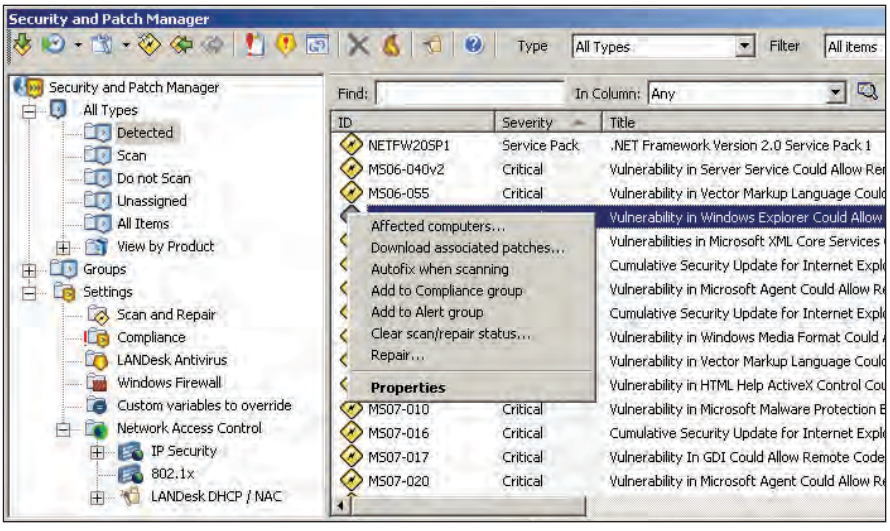

Figure 1. *Wake-on-ME for Dell OptiPlex desktops and Latitude laptops in LANDesk Management Suite*

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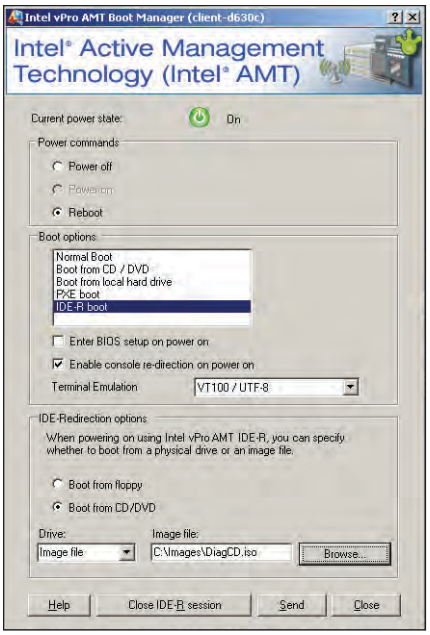

Figure 2. *IDE redirection for Dell OptiPlex desktops and Latitude laptops in LANDesk Management Suite*

perform a variety of other management tasks to help bring the system back to a working state.

One potential problem with IDE-R is that vPro uses Serial Over LAN for its out-of-band communication—meaning not only that pushing out the boot image and diagnostic tools from the console to the remote client system can be time-consuming, but also that the slow speeds typically limit administrators' remote management abilities to command-line functions. However, administrators can help speed up communications by using LANDesk Management Suite to transition from Intel out-of-band vPro communication to LANDesk in-band remote control, which is typically much faster than out-of-band communication.

This acceleration is the rationale behind provisioning Dell OptiPlex desktops or Latitude laptops with diagnostic partitions during the initial deployment. Administrators can launch the remote diagnostic process using Wake-on-ME and IDE-R and then, rather than booting from a diagnostic CD or boot image, boot from the local diagnostic partition provisioned with WinPE, diagnostic tools, and the LANDesk Management Suite remote control agent. Not only does this approach help accelerate the boot process, but the increased network speeds enable administrators to use the full graphical user interface in the LANDesk Management Suite console. In most cases, they can then quickly control, troubleshoot, and fix the client system remotely, then return local control to the user without the need for costly, time-consuming desk-side visits.

SIMPLIFIED HARDWARE DIAGNOSTICS

Of course, when a hardware problem such as a drive failure causes a client system to become nonresponsive, desk-side visits are necessary to resolve the problem. Dell OptiPlex desktops and Latitude laptops with Intel vPro technology can work together with LANDesk Management Suite to help eliminate multiple trips, cut down on visit times, and allow low-level technicians or contractors to make the visit to replace the hard drive.

From within the LANDesk Management Suite console, administrators can take advantage of the vPro ME to perform a basic inventory scan of the remote client system, which provides information such as the device name, IP address, globally unique identifier (GUID), product name, manufacturer, serial number, BIOS version, memory size, and hard drives. If the system has a LANDesk Management Suite agent installed on it, administrators can also view additional detailed inventory information in the LANDesk console that would typically have already been collected during routine LANDesk inventory scans—for example, the exact manufacturer, model number, and size of each hard drive in the system.

The ability to remotely view this inventory information enables administrators to send out an IT staff member or local technician with the appropriate replacement hard drive for that system. Once the failed drive has been replaced, administrators can launch an automated provisioning task from within the LANDesk console to remotely reprovision the new drive.

POWERFUL AGENT MONITORING AND SYSTEM DEFENSES

Dell OptiPlex desktops and Latitude laptops with Intel vPro technology can also work with LANDesk Management Suite to let administrators monitor client systems and help ensure that the security agents on these systems remain present and operational. Many organizations use serial polling to verify the presence of agents or other critical applications. However, polling client systems from a central server can consume valuable network bandwidth. In contrast, the agent presence monitoring in Dell client systems with vPro technology uses regular, programmable heartbeat checks to detect agents.

These heartbeat checks occur between the local vPro ME and the local agent or application, with the agent or application regularly checking in with the ME to verify that it is still active. (The local LANDesk Management Suite agent can also act as a "heartbeat proxy" for agents or applications that lack the ability to provide a heartbeat to the vPro ME.) Agent presence monitoring occurs at the hardware level rather than the OS level, which

> **"From within the LANDesk Management Suite console, administrators can take advantage of the vPro ME to perform a basic inventory scan of the remote client system."**

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> **"By taking advantage of the key features of Intel vPro technology and LANDesk Management Suite, administrators can extend their management capabilities and help increase flexibility and mobility when managing Dell client systems throughout their life cycle."**

helps prevent users or malware from stopping or killing the monitoring program itself to try to get around restrictions or avoid detection.

If a heartbeat is missed, the vPro ME can immediately and automatically log an alert and notify the LANDesk console of the missed heartbeat. Based on the policies set by administrators, LANDesk Management Suite can automatically execute a variety of actions, including sending an e-mail to an administrator, restarting the agent or application, reinstalling the agent or application, isolating the client system from the network, or simply logging an alert at the core server.

In addition to its agent presence capabilities, the vPro ME has 32 inbound and 32 outbound programmable hardware filters that examine the behavior of network traffic at the client system to provide low-level defense capabilities. These filters examine packets before they are passed from the hardware to the OS, or before packets are passed from the software stack to the network. Because the filters are programmable, administrators can define policies in the LANDesk console to automatically trigger specific actions when certain packet behavior occurs.

For example, when the filters detect User Datagram Protocol (UDP) packets that exceed the packet rate of flow, indicating a denial-of-service attack, they can trigger a system defense alert. When the LANDesk core server receives that alert, it can follow an administrator-configured policy to issue a command quarantining the client system from the network, stopping all traffic to and from the system except for vPro and LANDesk traffic necessary to resolve the problem.

EASY REMOTE DECOMMISSIONING

Even when client systems reach the end of their life cycle, they can require desk-side visits to verify that their hard drives have been wiped before the system is decommissioned. Once again, LANDesk Management Suite works in concert with the Intel vPro technology in Dell OptiPlex desktops and Latitude laptops to help eliminate the need for these visits. Using IDE-R and the remote boot manager from the LANDesk console, administrators can remotely boot a client system with a third-party ISO image or application designed to wipe hard drives according to enterprise standards. From the remote LANDesk console, administrators can manage and watch the process until it completes. When the process has finished, they can then remotely reboot the system to verify that it has been properly wiped.

EFFICIENT REMOTE CLIENT MANAGEMENT

The combination of Dell OptiPlex desktops and Latitude laptops, Intel vPro technology, and LANDesk Management Suite can help significantly simplify and enhance remote client management in enterprise environments—reducing the need for desk-side visits from administrators and their associated costs while increasing defenses to help keep the systems secure and protected. By taking advantage of the key features and capabilities of Intel vPro technology and LANDesk Management Suite, administrators can extend their management capabilities and help increase flexibility and mobility when managing Dell client systems throughout their life cycle.

Travis Zhao is a senior product manager in the Dell Product Group, where he is responsible for client systems management software. He has more than 20 years of experience in software engineering, consulting, and marketing, and before joining Dell was a product manager for Trilogy Software and BMC Software. Travis has a master's degree in Electrical Engineering from the University of Houston.

Brett Twiggs is the manager of strategic alliances at LANDesk, where he is responsible for the Intel relationship. He has more than 20 years of experience in IT engineering, consulting, and training. Brett has a bachelor's degree from Brigham Young University and is currently finishing an M.B.A. from the David Eccles School of Business at the University of Utah.

MORE ONLINE
DELL.COM/PowerSolutions

QUICK LINKS

LANDesk Management Suite:
www.landesk.com/solutionservices/product.aspx?id=716

Dell OptiPlex desktops:
DELL.COM/OptiPlex

Dell Latitude laptops:
DELL.COM/Latitude

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MAKING THE NEWS

Dell Precision™ mobile workstations and Dell™ PowerEdge™ servers help a media company maintain its competitiveness in the evolving news business, reducing the time needed to publish breaking stories by 50 percent.

CHALLENGE

Media General's reporters and photographers needed a way to send stories immediately to the newsroom, while the company wanted to improve its ability to compete with cable TV and Internet-only news sources.

SOLUTION

Dell Precision mobile workstations with built-in mobile broadband enable the field news staff to quickly post news stories, including photography and video, without having to go into the office.

BENEFITS

- Dell Precision mobile workstations can eliminate the need to travel to the office to file stories, so field reporters and photographers can now deliver content in half the previous time.
- Dell Precision mobile workstations help reduce travel costs for the news staff by 10 percent.
- Consolidating news applications onto Dell PowerEdge servers helps cut IT support costs by 25 percent.

Related Categories:
Case study, Dell PowerEdge servers, Dell Precision workstations, Media General, mobility

Visit DELL.COM/PowerSolutions for the complete category index.

Media General, founded in 1969 as a publicly traded company, originated 150 years ago as a local newspaper business. Today it is a regional communications company with over four dozen TV stations and newspapers plus an extensive online service. In the past, the company operated separate news organizations for print and broadcast delivery. But with the Internet, customers now want fast access to news in the form they most prefer. Media General needed to react quickly to this changing consumer environment or risk its market position.

ASSESSING FIELD REQUIREMENTS

To feed its news source with up-to-the-minute content, field reporters and photographers submit their stories directly into a centralized publishing system. In 2007, the Media General IT department decided to deploy new digital "field kits"—including a mobile workstation, a digital camera, and wireless communications—to connect the field staff to the central news applications. "Our photographers and reporters used to spend much of their time inputting stories at their desks," says Mark Holt, IT services manager at Media General. "The idea behind the field kits is to enable them to send content back to our newsroom and news Web sites immediately, so consumers can count on our varied news media and Web sites to deliver the most current news."

The Media General IT group had previously standardized on Dell servers and PCs, so there was no question they would turn to Dell for help. "We've been very happy with the performance and reliability of Dell products. The company has also provided great service and advice," says Holt. "When we're considering new technology, we look to Dell first."

Dell consultants began by helping the IT staff assess its requirements. The kits needed to provide continuous two-way communications, and the mobile workstations had to be powerful enough to run demanding news and graphics applications. "Reporters do much more with their computers than just write the story on them," Holt explains. "They use them to research topics in online databases. Then they submit their story for editing, receive comments back, and make final changes." Photographers

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make even greater demands—editing digital photos and videos using powerful graphics applications.

HELPING REPORTERS AND PHOTOGRAPHERS RESPOND QUICKLY

To make the news collection process as efficient as possible, everything about the mobile workstation needed to be high performance. The Dell consultants recommended the Dell Precision M4300 mobile workstation: with a dual-core Intel® Core™2 Duo processor running Microsoft® Windows® XP Professional x64 Edition software, this workstation can provide performance and reliability for high-end and graphics-intensive applications. Starting at less than six pounds, it is also light enough for reporters to easily carry. Media General selected the Dell Precision M4300 with a 15-inch screen for reporters and the Dell Precision M6300 with a 17-inch screen for photographers.

Dell engineers worked with Verizon Wireless, Media General's communications provider, to deliver the anytime, anywhere connectivity required by news staffs. About 300 Evolution-Data Only (EV-DO)–equipped laptops—a mix of Dell Latitude™ and Dell Precision mobile workstations—are now in use at Media General. These laptops have already helped the company transform to compete in the Internet age, reducing the time it took for editors to see photos or videos from a nearby breaking story from 2–3 hours to less than 45 minutes. "With the Dell Precision mobile workstations in the hands of our news staff, we can have a breaking story on TV or online practically in real time," says Holt.

He estimates that reporters and photographers are traveling up to 10 percent less than they were before the kits were introduced, helping them respond quickly to developing stories and cutting travel costs by an estimated 10 percent. They also enable reporters to write more thorough and compelling stories, accompanied by more photos and video, which helps attract and retain readers and drives improved ad sales. "Our online division is reporting 25 percent growth in page views and ad dollars since this initiative began," says Holt. "Combined with other online advertising partnerships, we are seeing regional online-classified ads grow by 40 percent or more on a quarterly basis." The ad sales team is also beginning to use Dell mobile workstations with built-in mobile broadband for instant access to rate quotes, schedules, and proofs right from a customer's office, helping boost ad revenue.

> **"With the Dell Precision mobile workstations in the hands of our news staff, we can have a breaking story on TV or online practically in real time."**
>
> —Mark Holt
> IT services manager at Media General
> February 2008

REDUCING ONGOING DATA CENTER COSTS

In addition to deploying the Dell mobile workstations, Media General also uses back-end Dell servers, including Dell PowerEdge 2950 servers with dual-core Intel Xeon® processors, to host the centralized production applications at the company's Richmond, Virginia, data center. "By consolidating our production IT environment onto Dell servers at one location, we've lowered IT operating costs by an estimated US$250,000 per year—a 25 percent reduction," Holt says. "Our users also benefit because we now provide higher availability from that central site."

The Media General IT team chose Dell Platinum four-hour hardware response on each server, partly to lessen the number of redundant systems needed and gain the benefits of a Dell Platinum account manager to track and escalate calls. "By freeing our administrators to manage their systems instead of their repair orders, we have less overall downtime and higher productivity," Holt says. The IT team, meanwhile, likes the configuration flexibility of Dell products and Dell's ability to respond rapidly to their needs—including, in one case, getting all of their customized Dell server systems for several newly acquired TV stations racked, delivered, and installed in less than two weeks.

TRANSFORMING MEDIA GENERAL'S NEWS OPERATION

With Dell servers and mobile workstations in place, Media General employees are working faster and better. "Dell helped us simplify and mobilize our IT infrastructure so that we could revolutionize the news collection process at our company," says Holt. "Dell's custom factory integration people configure our systems the way we want them during the initial build, so we don't have to go through extra steps. Thanks to them, we were able to get our new process up and running quickly, helping us to maintain and enhance our competitive edge."

MORE ONLINE
DELL.COM/PowerSolutions

QUICK LINK

Dell Precision workstations:
DELL.COM/Precision

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STUDENTS THRIVE IN A WIRELESS ENVIRONMENT

Preconfigured Dell™ Latitude™ D531 laptops running the Microsoft® Windows Vista® Business Edition OS and Microsoft Office 2007 help provide a flexible learning environment and efficient administration and support for university students.

CHALLENGE

The University College Plymouth St Mark and St John (Marjon), in the UK, needs to sustain a competitive edge for attracting new students. As a result, the college wanted to supply a laptop to each student when they enrolled in an undergraduate or postgraduate certificate of education (PGCE) program.

SOLUTION

In September 2007, Marjon worked with Dell to supply Dell Latitude D531 laptops running Microsoft Windows Vista Business Edition and Microsoft Office 2007 to new students. Dell managed the logistics of delivery and made sure the laptops were preconfigured, thanks to its Custom Factory Integration services. Each laptop comes with Dell CompleteCare™ Accidental Damage Service[1] and three-year Next Business Day On-Site Service.[2]

BENEFITS

- The deployment helps create equal opportunity for students.
- Students have access virtually anywhere, anytime with wireless-enabled Dell Latitude laptops.
- Enhanced power management in Microsoft Windows Vista helps ensure maximum uptime.

Related Categories:
2007 Microsoft Office, case study, Dell Latitude laptops, Marjon, Microsoft Windows Vista, mobility

Visit DELL.COM/PowerSolutions for the complete category index.

Today's universities expect their students to be proficient in IT, and many require them to have a PC. However, financial pressures mean that some students find it hard to obtain affordable hardware, which puts them at an immediate disadvantage. In addition, as universities have become increasingly competitive, the schools must deliver top-level courses and provide supportive learning environments to help maintain student numbers.

The University College Plymouth St Mark and St John (Marjon) in Plymouth, UK, has 3,000 students. It offers a variety of courses that include management, public relations, tourism, hospitality, philosophy, and sociology. And its policies on student services are responsive to local, regional, national, and international needs.

In 2006, students in the UK faced an annual tuition hike of up to £3,000. This fee increase caused Marjon to find an innovative way to promote effective learning while appealing to new students. As a result, Marjon began a close working relationship with Dell, rolling out Dell Latitude D531 laptops to undergraduates beginning a three-year course of study and students pursuing a postgraduate certificate of education (PGCE). David Riggs, IT manager at Marjon, explains, "We regard ourselves as a good quality university college. New notebooks would have to complement our reputation, so we needed a top-tier provider like Dell."

Students who previously could not afford a PC had had to rely on older computers in shared computer libraries, so the Latitude laptops helped bolster student satisfaction. And because all assignments must be typed rather than handwritten, students found it easier to produce coursework and access online reading materials using their own laptops rather than using shared computers.

Riggs says, "We want to continue making it easier for students coming here, so we decided to carry out the same deployment for our September 2007 enrollments. Although getting a new computer for free was not a deciding factor when a student chooses to attend Marjon, it does help us become a more desirable choice in a competitive market."

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LAPTOP DEPLOYMENT MEETS STUDENT NEEDS

In June 2007, Riggs liaised with Dell to reassess student needs and finalize specifications before the beginning of the school year. Dell sent the IT department test systems, and Riggs provided feedback before the planned deployment date.

As a small university, Marjon did not have the resources for a swift deployment, but Dell helped keep the deployment of 900 Dell Latitude D531 laptops quick and easy for both staff and students. Each Latitude D531 laptop comes with Dell CompleteCare Accidental Damage Service[3] and three-year Next Business Day On-Site Service.[4] Thanks to Dell Custom Factory Integration services, these laptops are also preconfigured with Microsoft Windows Vista Business Edition, Microsoft Office 2007, and 1 GB of RAM. "Dell arrived at our school gym and delivered the notebooks on both registration mornings, which prevented us from having to keep stock on-site overnight. A team of 11 Dell employees helped us with the rollout and answered any student questions," says Riggs. "We distributed one notebook every 25 seconds. Thanks to Dell, the process went extremely smoothly. And this meant that teachers and students spent minimum time completing registration processes."

As part of the process, students checked that they had all components before signing a Microsoft licensing agreement—after which the laptop was officially theirs. Now, these Marjon students have valuable access to the full professional versions of the latest Microsoft software both in and out of the classroom.

Students can use their wireless-enabled laptops to access the secure Internet connection at the school and spend less time linking to the Internet than they did previously. Students now also have additional time for learning virtually anywhere on campus, and do not need to procure their own Internet service provider. In the long term, teachers and students can take advantage of online tools to help increase learning efficiencies.

> **"We regard ourselves as a good quality university college. New notebooks would have to complement our reputation, so we needed a top-tier provider like Dell."**
>
> —David Riggs
> IT manager at Marjon
> July 2008

RELIABLE SUPPORT CREATES MORE TIME FOR LEARNING

If Marjon had not put this program in place, students would have come with various types of PCs, making it difficult and expensive for the college to provide appropriate support. Access to up-to-date technology also helps eliminate time wasted to wait in computer labs or for older systems to run. "Now students all have exactly the same, standardized model, and it is very easy for our IT employees to swiftly respond to inquiries. We also load written instructions on our Web site and also provide one-to-one help," Riggs says.

The college Web site also has online support links—such as a short video clip showing how to upgrade RAM on a Dell laptop—and includes a page of frequently asked questions showing where to look for help on security advice, how-to guides on software, free software for download, and a link to Dell support. Riggs explains, "Dell provided us with a total package, including hardware, software, and services. In addition, students can access the Dell Premier Pages online ordering service to access additional notebook accessories at preferential rates.

"We also have a very strong working relationship with Dell's sales team. They are very responsive and resolve our problems promptly. If students have an issue, they just call Dell, drop their machine at our office, and a Dell engineer repairs it and returns it to the student by the next working day."

FUTURE DEPLOYMENT MEANS ADDITIONAL LAPTOPS

Marjon expects significant IT cost savings from the changing role of its IT support personnel that will help create a better balance between work and life for students. They can have one secure, centralized system to produce work on, whenever and virtually wherever they are—and even do homework between classes.

Students at Marjon will continue to receive Dell laptops in the near future. Says Riggs, "Knowing our students have effective learning tools will only improve our education delivery. It will also help our students to be more confident with the latest technology when they graduate."

MORE ONLINE
DELL.COM/PowerSolutions

QUICK LINK

Dell Latitude laptops:
DELL.COM/Latitude

[1,3] CompleteCare service excludes theft, loss, and damage due to fire, flood or other acts of nature, or intentional damage. Customer may be required to return unit to Dell. For complete details, visit DELL.COM/ServiceContracts.
[2,4] May be provided by third party. Technician dispatched, if necessary, following phone-based troubleshooting. Availability varies. For complete details, visit DELL.COM/ServiceContracts.

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CONNECT AND PROTECT WORKERS ON THE GO WITH DELL PROSUPPORT MOBILITY SERVICES

Unleashing the workforce to conduct business anytime, anywhere, is a complex undertaking. Dell™ ProSupport Mobility Services offers a comprehensive suite of professional support services designed to improve worker productivity with flexible, comprehensive asset and data protection services and global data recovery and destruction services.

Enterprise workforces are getting the job done in more places than ever before—and highly mobile workers need the attendant support in increasingly remote and untraditional locations. However, helping to ensure mobile worker uptime and safeguard the organizational data they rely on is no easy feat. For example, lost or stolen laptops impede productivity and can compromise data security, as can laptops that are disabled because of system failure or physical damage. But tracking and recovering lost or stolen laptops that may be anywhere in the world and securing sensitive data that resides on them significantly broadens the scope of traditional IT support. Diagnosing, fixing, or replacing a broken laptop and recovering or safely destroying resident data is also a major challenge.

To help simplify support for mobile workers, Dell has launched Dell ProSupport Mobility Services, a comprehensive suite of professional asset and data protection solutions that can help organizations ranging from small businesses to public institutions and large global enterprises securely and flexibly improve mobile worker productivity, safeguard organizational data, and protect valuable mobile assets. Dell ProSupport Mobility Services are available on select Dell commercial laptops, and are part of the Dell ProSupport portfolio of flexible, customizable professional support services (see the "Dell ProSupport: Professional-grade IT" sidebar in this article).[1]

Related Categories:

Dell Latitude laptops

Dell ProSupport Services

Dell Services

Mobility

Visit DELL.COM/PowerSolutions for the complete category index.

PROTECTING WORKFORCE ASSETS

When laptops are lost or stolen, all too often the result is lost productivity, lost resource investment, and compromised data security. Dead laptop batteries, meanwhile, can be expensive to replace and a hassle to dispose of safely. The Dell ProSupport Laptop Tracking and Recovery Service is designed to help organizations recover lost or stolen laptops wherever they may be, while the Extended Battery Service offers the ability to extend the terms of laptop battery coverage for the remainder of the laptop's limited hardware warranty,[2] up to three years

Laptop Tracking and Recovery. If a laptop is lost or stolen, the Dell Recovery team galvanizes to identify its location and then partner with local law enforcement to help recover it. For example, once a missing laptop connects to the Internet, the Dell Recovery team can be automatically notified of its location. If a laptop is equipped with Global Positioning System (GPS) technology, the system just needs to be powered up for the Dell Recovery team to further pinpoint its location and then share specific coordinates to aid recovery efforts.

Extended Battery Service. The Extended Battery Service is an option available at time of purchase on Dell Precision™, Latitude™, and Vostro™ laptops with the purchase of a limited hardware warranty period greater than one year. This service extends the term of coverage for laptop computer batteries, not to

[1] Availability and terms for Dell Services vary by region. For more information, visit DELL.COM/ServiceDescriptions.

[2] For more information, visit DELL.COM/Warranty.

[3] For more information and terms of service, visit DELL.COM/ServiceDescriptions.

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exceed the length of the customer's laptop limited hardware warranty and service contract, or three years, whichever is less.[3] With the Extended Battery Service, Dell both sends out a replacement battery and recovers and safely disposes of the old battery.

PROTECTING WORKFORCE DATA

Mobile workers often rely on valuable organizational data to perform their duties, but having sensitive data on mobile systems puts that data at risk of being lost, compromised, or stolen. Dell ProSupport Mobility Services offers a range of data protection services that can help organizations protect valuable data in the event of laptop loss, theft, or failure.

Remote Data Delete. Data residing on a lost or stolen laptop is at risk of being compromised. The Dell ProSupport Remote Data Delete Service works in conjunction with the Laptop Tracking and Recovery Service and is designed to remotely delete sensitive data from a laptop to help prevent it from getting into the wrong hands.

Hard Drive Data Recovery. When a hard drive fails anytime during the limited hardware warranty period—whether from system errors, physical injury, or an unexpected event—the resident data is at risk of being lost. Despite best-practices guidelines to back up hard drives frequently, mobile users seldom comply with that procedure. To help fill that gap, the Dell ProSupport Hard Drive Data Recovery Service is designed to recover data from Dell Precision, Latitude, and Vostro laptops most anywhere in the world.

Certified Data Destruction. A failed hard drive may contain sensitive information that needs to be permanently removed. However, destroying data on a hard drive can be complex and time-consuming, and strict legal and regulatory compliance requirements often govern data destruction. The Dell ProSupport Certified Data Destruction Service is designed to wipe a hard drive clean and help organizations meet data destruction compliance requirements. In particular, this service destroys data on a failed hard drive, provides a certificate of destruction, and safely disposes of the drive.

DELL PROSUPPORT: PROFESSIONAL-GRADE IT

Traditional IT support offerings can be rigid—shoehorning organizations into service models that may not match their individual requirements. Dell ProSupport offers two flexible support models that organizations can customize with configurable levels of service including speed of response, levels of asset and data protection, and proactive support options (see Figure A):

- **Dell ProSupport for IT:** Provides tech-to-tech support for organizations with an IT staff
- **Dell ProSupport for End-Users:** Supports small businesses and organizations that do not have an internal IT staff

By spanning a wide range of service offerings, Dell ProSupport is designed to support an organization's entire IT environment from the desktop to the data center and beyond. Key features of Dell ProSupport include Fast-Track Dispatch for streamlined access to parts and technicians, collaborative support with third-party hardware and software vendors, and step-by-step support for end users. For more information on Dell ProSupport, visit DELL.COM/ProSupport.

Dell ProSupport also operates Global Command Centers that are available around the clock. Based in several locations throughout the world, Dell Global Command Centers manage cases from end to end, including routing parts and dispatching expert technicians to help organizations speed problem resolution and minimize business disruption—all through a single point of contact. For more information on Dell Global Command Centers, visit DELL.COM/GCC.

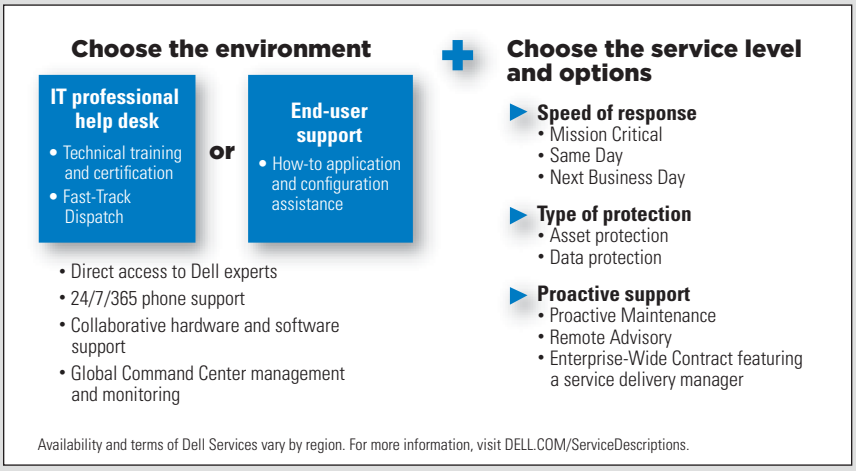

Figure A. *Dell ProSupport Services offers flexible and configurable asset and data protection*

ENHANCING PRODUCTIVITY

By enhancing support for mobile workers and their assets, Dell ProSupport Mobility Services can help organizations improve workforce productivity and ensure business continuity virtually anywhere in the world. Also, with advanced asset and data protection options, Dell ProSupport Mobility Services can help organizations increase security as well as protect their investments. And because Dell ProSupport Mobility Services are part of the flexible, configurable Dell ProSupport portfolio, organizations can easily and flexibly identify the services that are just right for them. For more information about Dell ProSupport Mobility Services, visit DELL.COM/ProSupport/Mobility.

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STEP BY STEP: SIMPLIFYING MIGRATIONS FROM NOVELL TO MICROSOFT

By Ray Weinstein

Planning and performing a migration to a new IT platform can be difficult and time-consuming for enterprise administrators. The tools and best practices offered by Dell Infrastructure Consulting, including powerful migration applications from Quest Software, provide comprehensive solutions to help organizations migrate smoothly from a Novell® platform to a Microsoft® platform.

Related Categories:

Dell Services
Microsoft
Microsoft Active Directory
Microsoft Exchange
Microsoft Windows
Novell
Novell eDirectory
Novell NetWare
Operating system (OS)
Quest Software

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Choosing an appropriate IT platform can depend on many factors. As organizations grow and their needs change, the most suitable platform for their environment may change as well. Based on detailed assessments and testing, these organizations may ultimately decide that a different platform would best serve their needs—leaving IT administrators to work out the best way to carry out the difficult and time-consuming task of actually performing the migration.

As part of the Dell Infrastructure Consulting Microsoft Practice, Dell has worked extensively with Microsoft and Quest Software to help simplify migrations to Microsoft technologies, including environments comprising Active Directory® Domain Services, Windows® and Windows Server® operating systems (including Windows Server 2008), and Exchange messaging platforms (including Exchange Server 2007 with Service Pack 1). Organizations may decide to standardize on a Microsoft platform running on industry-standard Dell™ hardware for many reasons: for example, they may want to implement a more intuitive, familiar, and easy-to-use infrastructure than they have now; consolidate redundant platforms to help reduce support costs; or standardize OS and application platforms throughout the enterprise. For organizations currently using a Novell platform that want to migrate to a Microsoft platform, the tools and best practices offered by Dell Infrastructure Consulting can help them plan and carry out an efficient, cost-effective migration.

DEVELOPING A COMPREHENSIVE MIGRATION PROCESS

When migrating from Novell to Microsoft, developing a comprehensive migration process—one that allows the migration of each Novell component to its Microsoft counterpart while minimizing impact on day-to-day operations—is critical to success. Key components of a Novell platform typically include the eDirectory™ or Novell Directory Services® (NDS®) directory service, NetWare® OS, ZENworks® systems management suite, and GroupWise® messaging platform, as well as end-user desktop environments and other supporting or dependent technologies, such as Domain Name System (DNS) software. The key corresponding components of a Microsoft platform typically include Active Directory Domain Services, Windows client and Windows Server–based operating systems, System Center Configuration Manager management software (formerly Systems Management Server), and Exchange messaging platforms. The tools and coexistence capabilities available in each platform and in tools from Quest Software help avoid the need to migrate every component simultaneously; depending on the size or complexity of the specific environment, administrators may opt to migrate everything together or to spread

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the process out by migrating one component at a time.

The following is a typical high-level process that a midsize organization might use to perform a migration:

1. Begin educating support professionals to help ensure that they are well prepared to make prudent decisions.
2. Develop a design for the Microsoft platform that fits the organization's requirements and support capabilities.
3. Develop and implement a test plan for critical Novell software.
4. Install and configure Active Directory and its dependent technologies.
5. Install and configure Quest NDS Migrator, migrate users and groups from eDirectory or NDS to Active Directory, and configure the account management strategy for the Active Directory service.
6. Install and configure Windows Server–based file and print services.
7. Install and configure Exchange and its dependent technologies.
8. Install and configure Quest GroupWise Migrator for Exchange, then configure the environments for coexistent e-mail flow, address lists, and calendars throughout the migration.
9. Install and configure a desktop management solution such as Active Directory Group Policy, System Center Configuration Manager, or Altiris® software, then migrate any ZENworks images and application packages to the Microsoft Windows Installer (MSI) format.
10. Install and configure tools for backup, monitoring, and management.
11. Begin training end users early to expose them to the new platform and help avoid last-minute adoption problems and increased support calls.
12. Update client desktops and laptops to become Active Directory members. First, install the Microsoft client software, create the user account, and update the user profiles to match the new domain-based user accounts. Next, configure the system for coexistence to allow access to data in both environments throughout the migration; common tools include the Novell Client software (preferred by Dell Infrastructure Consulting), the Novell Native File Access Pack (NFAP), and Microsoft Gateway Services for NetWare (GSNW). Finally, install and configure the Microsoft Office Outlook® client on the system for e-mail and calendar functions.
13. Migrate home directory and group directory data to the new file servers, then update shortcuts, mappings, and object linking and embedding (OLE) objects on each affected client system after each file data migration.
14. Migrate GroupWise mailboxes and archives to Exchange.
15. Remove the Novell Client software.

Administrators could perform these steps sequentially or in parallel, assuming all dependencies have been met.

USING QUEST TOOLS TO SIMPLIFY MIGRATION

The Dell Infrastructure Consulting team relies on several tools and best practices when migrating IT environments from Novell to Microsoft, including Quest Reporter, Quest NDS Migrator, and Quest GroupWise Migrator for Exchange.

Quest Reporter

Quest Reporter enables administrators to collect and store data about environments based on Novell eDirectory or NDS and NetWare or on Microsoft Active Directory and Windows, as well as to receive activity reports and resolve problems (see Figure 1). These functions are essential for change auditing, security assessments, and pre- and post-migration analyses.

Quest Reporter can be a valuable tool throughout the migration process, enabling administrators to perform key tasks such as assessing the environment to identify and clean up unwanted accounts and data; exporting object lists to Quest NDS Migrator for use during later migrations; checking for other important elements such as duplicate user accounts and groups, invalid common name (CN) attributes, and other intelligence and compliance items; and using baseline information during and after a migration for project management, operations, and auditing.

Quest NDS Migrator

Quest NDS Migrator is a robust tool that helps accelerate and simplify migrations from Novell eDirectory or NDS and Novell Bindery environments to Microsoft Active Directory. Its central console enables access to available options both before and after the migration, provides scheduling features, and shows an environment's Novell eDirectory or NDS tree and its Active Directory tree to facilitate planning (see Figure 2). Dell Infrastructure Consulting uses this tool to migrate objects ranging

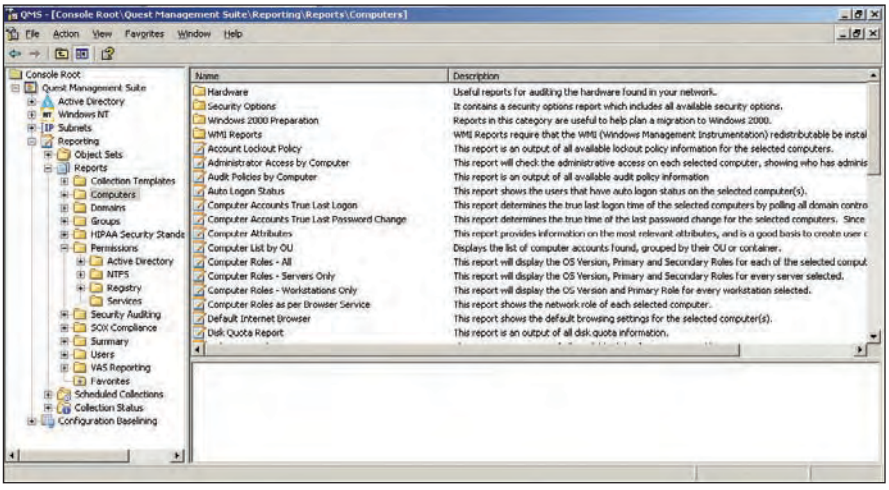

Figure 1. *Quest Reporter can collect, store, and report on configuration items for Novell and Microsoft platforms*

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from user accounts, groups, and organizational units (OUs) to file data, directory synchronization, and even desktop resources such as user profiles, computer accounts, and shortcuts.

Quest NDS Migrator is typically used in the validation and implementation phases of a migration, and can help perform several key tasks. After configuring the tool for elevated permissions (or rights) in both directories, administrators can model the Active Directory migration as defined in the design phase of a migration and set up a password updating strategy. Using the Novell Client for co-authentication is the preferred approach for password updating, and Quest NDS Migrator also provides a self-service password management function. Administrators can then perform validated migration actions—called projects—and use rollback features to undo errors. Typically, administrators should not delete accounts or data—they should only copy them. Best practices recommend migrating all users or groups simultaneously rather than in small batches to help minimize risk and impact on end users.

Administrators can then use Quest NDS Migrator to set up a coexistence strategy for client desktops and laptops as well. First, they install the Microsoft client software on these systems and add the accounts to Active Directory in the appropriate OU. Next, they set up access to both the Novell and Microsoft environments to provide secure data access for both migrated and un-migrated users using Novell Client, NFAP, or GSNW. Finally, they can migrate only the user profiles they want to retain to the new Active Directory user account. Administrators should keep in mind that this process can be time-consuming; cleaning up user profiles before the migration can help minimize the number of unwanted profiles and related data such as temporary Internet files.

After setting up the coexistence strategy, administrators can use Quest NDS Migrator to migrate file data according to a defined schedule. The typical approach is to migrate home directories, then group directories. Administrators can take advantage of the mirror function in Quest NDS Migrator to pre-stage data migrations before the cutover to help reduce file data migration time, which can help significantly reduce the project's complexity and duration. Finally, they can update each affected client desktop or laptop to refresh the OLE paths, mappings, and shortcuts, then provision the appropriate printers to each user.

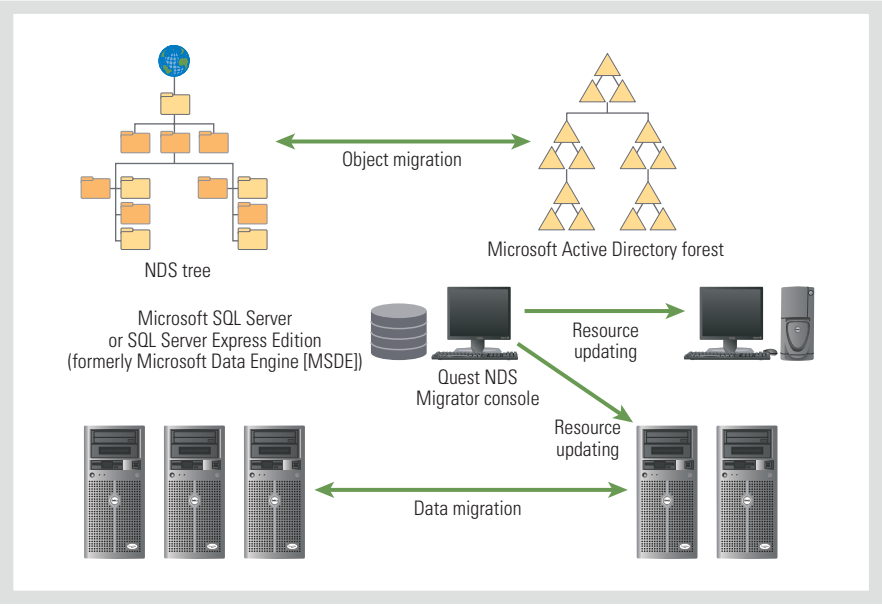

Figure 2. *Quest NDS Migrator helps accelerate and simplify migrations from Novell to Microsoft*

After administrators have migrated all Novell NetWare data and applications to the Microsoft environment, they can use Quest NDS Migrator to remove the Novell Client software, then gradually decommission the Novell environment to help ensure that they have not overlooked any critical services. Some Novell-related services may remain in the IT environment indefinitely.

When migrating from Novell eDirectory or NDS to Microsoft Active Directory, adhering to common best practices such as the following can help prevent errors:

- **Avoid migrating too many client desktops and laptops simultaneously:** Primarily because of challenges associated with migrating user profiles, the practical limit on the number of client systems that organizations can migrate is typically around 20 per team per day, with up to three teams operating simultaneously. Organizations can determine the actual maximum number of migrations for a specific environment during the pilot phase.
- **Allow sufficient time to configure and provision printers:** Many organizations underestimate the amount of time necessary to configure and provision printers, which may require dedicated resources to complete. The challenge in this process relates to the logistics of configuring the printers for appropriate usage scenarios; organizations should identify these scenarios during the assessment phase and test them during the validation phase.
- **Locate, assess, and test Novell applications as soon as possible:** Locating, assessing, and testing Novell applications in a short period of time can be challenging. Organizations should perform this process as soon as possible to help avoid unplanned delays.

Quest GroupWise Migrator for Exchange

Quest GroupWise Migrator for Exchange helps provide direct, secure, and reliable

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migrations from Novell GroupWise to Microsoft Exchange, including Exchange Server 2007. It can convert user e-mail, calendars, tasks, personal address books, and frequent contacts and store them in the new mailboxes on the Exchange server to help preserve critical information, and can migrate GroupWise archives to Outlook personal stores (.pst files).

Quest GroupWise Migrator for Exchange is typically used in the validation and implementation phases of a migration. After configuring the tool with the appropriate permissions (or rights) in both e-mail platforms, administrators can configure the environment for coexistence to help ensure e-mail and calendar access regardless of a given user's migration state or platform. The coexistence configuration would include access to the global address list (GAL) and Simple Mail Transfer Protocol (SMTP) services as well as access to calendars, contacts, resources, and tasks.

They can then use Quest GroupWise Migrator for Exchange to perform Outlook client deployment and configuration on client desktops and laptops, migrate mailboxes to Exchange Mailbox servers, migrate archives to Outlook personal stores, and remove GroupWise e-mail clients after they have successfully migrated the mailboxes. After the migration, administrators should gradually decommission the GroupWise environment to help ensure that they have not overlooked any critical services. They may need to leave some GroupWise servers in place to comply with retention requirements imposed by regulations or enterprise practices.

When migrating from Novell GroupWise to Microsoft Exchange, adhering to common best practices such as the following can help prevent errors:

- **Choose an appropriate coexistence strategy:** Different coexistence strategies have their own advantages and disadvantages. Two of the most common solutions are using iCalendar forwarding and using Exchange Server 2003 with the Exchange GroupWise and calendar connectors. iCalendar forwarding is typically easy to configure and manage and supports sending, receiving, and responding to calendar invitations and tasks from either platform, but provides no Free/Busy service for calendars; for organizations that do not need these services, this approach is typically preferred. Using Exchange Server 2003 with the GroupWise and calendar connectors does support the Free/Busy service, but can be difficult to configure and manage—primarily because of the challenge of implementing and administering the Novell GroupWise API Gateway, which is necessary for the connectors. Organizations migrating directly to Exchange Server 2007 face an additional challenge: because the connectors are not compliant with Exchange Server 2007, they must run on Exchange Server 2003 servers within the Exchange Server 2007 organization (or forest), and these servers must remain in production as long as the coexistence is needed. This mixed-mode option may be unacceptable for many organizations, even for a relatively short time. Organizations already using Exchange Server 2007 cannot use this option without a pristine installation.
- **Reduce the volume of e-mail:** Organizations should reduce the amount of e-mail before migration to help complete the project as quickly as possible. Administrators may also archive e-mail in advance to help reduce volume.
- **Migrate archives using high-speed file servers:** Migrating GroupWise personal archives can present one of the largest challenges of a migration: locating the user archives may be difficult, and the archives themselves may be large. Depending on computer and network resources, archive migrations may take up to three times longer to process than mailbox migrations. Administrators can typically reduce this migration time by processing the archives on a high-speed Windows-based file server instead of a remote desktop.
- **Notify stakeholders that custom interface settings from the GroupWise client will not be migrated:** Proxies, custom views, and other user interface settings are not typically migrated from the GroupWise client to the Outlook client. The project team should communicate this to technology stakeholders, including end users, early in the process and ensure it is covered in end-user training.

SIMPLIFYING MIGRATIONS FROM NOVELL TO MICROSOFT

Dell Infrastructure Consulting experts know how to effectively assess, design, and implement new technology, and have successfully addressed the challenges presented by complex infrastructures in environments at Dell and at enterprises worldwide. This experience enables the organization to implement services that help enterprises take advantage of industry standards to utilize emerging technologies, enhance performance and scalability, and help maximize the value of IT investments. By working extensively with Microsoft and Quest Software, Dell Infrastructure Consulting can provide comprehensive support before, during, and after migrations from a Novell platform to a Microsoft platform. The tools and best practices described in this article are designed to ensure an efficient, cost-effective migration that can ultimately provide organizations with an IT infrastructure that meets their specific needs.

Ray Weinstein is a global practice lead for the Dell Infrastructure Consulting Microsoft Practice.

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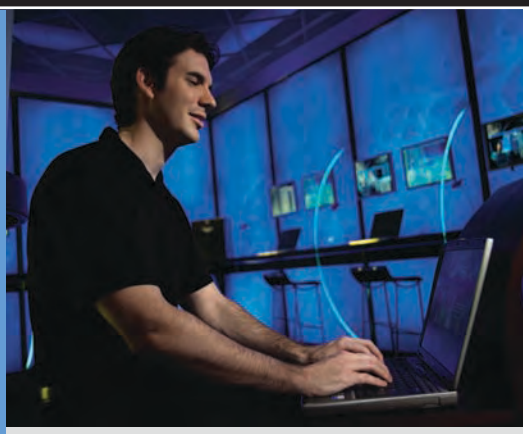

BOX OFFICE GOLD

Dell™ PowerEdge™ M1000e modular blade enclosures helped Soho VFX deliver a Hollywood blockbuster on deadline—more than doubling the company's processing capacity while helping reduce power consumption by 20 percent.

CHALLENGE

Artists at visual effects studio Soho VFX work under intense pressure to meet tight deadlines—requiring highly reliable and dependable systems that allow them to focus on their creativity.

SOLUTION

Soho VFX deployed a new server farm based on Dell PowerEdge M1000e modular blade enclosures, which more than doubled the company's processing capacity while helping reduce power consumption by 20 percent.

BENEFITS

- Quick deployment of Dell PowerEdge blade servers got Soho VFX running in days instead of weeks.
- Dell PowerEdge blade server farm more than doubled existing processing capacity while helping reduce power consumption by 20 percent.
- Dell PowerEdge modular blade enclosure helped simplify IT maintenance and reduce administration time.
- Dell PowerEdge blade server reliability helped minimize downtime during critical projects.

Related Categories:
Blade servers, case study, Dell PowerEdge blade servers, Dell Precision workstations, power management, Soho VFX

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In the film industry, timing is everything—and for film effects production businesses like Toronto-based Soho VFX, release dates are do-or-die deadlines. Soho VFX makes the impossible happen for Hollywood blockbusters. "Audiences expect to see stunts that can't be performed without harming somebody, and camera angles that can't be shot in the real world," says Allan Magled, a Soho VFX partner. To help ensure that it meets its demanding film industry deadlines, Soho VFX relies exclusively on Dell servers and workstations. "Dell suits our needs best," says Magled. "The company understands how its technology fits in with our business."

Soho VFX constantly differentiates itself with high-quality, on-time output. "Each new project brings new challenges, because it's usually bigger and more complicated than anything we've done before," says Magled. The company faced just such a challenge when working on two movies scheduled for release on successive weeks in 2008: *The Incredible Hulk* on June 13 and *The Love Guru* on June 20. It quickly became clear that the technical demands of *The Incredible Hulk*, combined with the tight schedule, would swamp the company's existing systems. "Everybody wants to see their stuff rendered right away, so it's nonstop processing," explains Magled.

Magled and the Soho VFX IT team estimated that they must at least double their processing capacity without overwhelming the company's limited physical and power resources. "There was no way that we could get where we needed to be by just adding more 1U servers to our racks," says Berj Bannayan, a Soho VFX partner. "The new equipment had to fit in our server room and run on our existing power and cooling systems."

DEPLOYING HIGH-PERFORMANCE BLADE SERVERS

The Soho VFX team had previously considered but not adopted blade servers, and Magled was wary of committing to a new technology in the middle of an important project. However, his past experiences with Dell gave him confidence that the deployment would be a success: Soho VFX had previously standardized

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on Dell Precision™ workstations, which delivered the processing power necessary to build the models that would eventually be rendered on the company's server farm. "We've been using Dell Precision workstations for years. As we grow, we just keep purchasing more because they provide fantastic power and value," says Magled. "It's because of products such as the Dell Precision workstations that we have complete confidence in Dell as our technology partner."

Dell responded by exceeding Magled's expectations immediately after he placed the order. "The Dell team initially said that we would have the equipment in two weeks," says Magled. "I asked them to work as fast as they could because we were under such time pressure. Dell had the new enclosure and blade servers in our office in four days. I was shocked. I'd never seen a company do that before."

The Soho VFX IT team deployed 128 Dell PowerEdge M600 server blades housed in 8 Dell PowerEdge M1000e modular blade enclosures. The PowerEdge M600 blades use Intel® Xeon® processors and Gigabit Ethernet network interface cards for fast throughput and flexibility, while the PowerEdge M1000e enclosure is designed to provide the kind of high-performance scalability and power efficiency that Soho VFX requires. The artists use a mix of Dell Precision 380, Dell Precision 390, and Dell Precision T3400 workstations with dual Intel Core™2 Duo processors running the Linux® OS, each equipped with two Dell UltraSharp™ 2407WFP 24-inch widescreen flat-panel monitors that deliver the fast refresh time and color fidelity necessary for world-class animation work.

INCREASING CAPACITY WHILE REDUCING ENERGY USE

The simplicity and design of the Dell PowerEdge blade servers enabled the Soho VFX IT team to take advantage of the increased processing capabilities in days instead of waiting several weeks as they would with a standard server deployment. "I could set up a rack of 16 PowerEdge blades faster than I could set up a single 1U server, which usually took a full day," says Michael Todd Smith, system administrator at Soho VFX.

The Dell PowerEdge blade servers also enabled the Soho VFX IT team to exceed its goal for increasing processing capacity. Where there had been three racks and 500 processors, Soho VFX now had 8 enclosures with 128 server blades for a total of 1,024 processors. At the same time, Soho VFX was able to cut its physical and power requirements because the Dell PowerEdge M1000e enclosures take up less space, emit less heat, and use 20 percent less electricity than the rack servers they replaced. "For the floor space they use, the Dell blades are the best thing I've ever seen," says Bannayan. "We didn't have to expand any of our power or cooling requirements, and our power consumption dropped by 20 percent."

Smith estimates that because the company standardized on Dell servers and workstations, he saves four hours in maintenance time every week. "By using Dell solutions, we can focus on creativity that allows us to push the envelope on the work we do for the studios, rather than worrying about IT," says Smith.

> **"By using Dell solutions, we can focus on creativity that allows us to push the envelope on the work we do for the studios, rather than worrying about IT."**
>
> —Michael Todd Smith
> System administrator at Soho VFX
> July 2008

MEETING DEMANDING DEADLINES

The Soho VFX team used their new Dell PowerEdge server farm 24 hours a day for weeks on *The Incredible Hulk,* bringing the project in on deadline. "Without this new technology, we wouldn't have been able to complete the work on the movie," says Bannayan. The Dell systems worked well even in Soho VFX's demanding environment. "I'm surprised those Dell blades are still alive after what we put them through, but they never missed a beat," says Magled.

Because studios insist on keeping the details of new films under wraps, Magled can't talk about the company's next project. But whatever challenges his clients throw at him—whether in terms of timing or artistic rendering—he knows that he can rely on Dell to deliver the latest and greatest in technology in record time so Soho VFX can meet deadlines and create breathtaking work.

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HIGH-PERFORMANCE SUPPLY CHAIN

Dell™ PowerEdge™ M1000e modular blade enclosures connected to a Dell/EMC CX3-20 storage area network helped supply chain provider YCH Group reduce data center floor space by 70 percent and power consumption by up to 45 percent compared with the previous solution.

CHALLENGE

Facing an expanding data center, YCH Group looked toward new technologies to streamline its IT environment, help reduce its eco-footprint, and provide a scalable and flexible solution.

SOLUTION

To streamline its IT infrastructure, YCH migrated much of its environment onto a standardized platform of Dell PowerEdge M1000e modular blade enclosures containing PowerEdge M600 server blades, which connect to a Dell/EMC CX3-20 storage area network (SAN) to deliver a consolidated, unified storage foundation.

BENEFITS

- Compact Dell PowerEdge blade servers can deploy in half the time required for tower or rack-mounted servers, and helped reduce the hardware footprint by 70 percent, power consumption by up to 45 percent, and total cost of ownership by 40 percent compared with the previous solution.
- Integrated Dell/EMC CX3-20 storage helps consolidate several independently running storage systems into a SAN.
- Dell Global Infrastructure Consulting Services helps deploy the server environment 60 percent faster than the previous process.

Related Categories:
Blade servers, case study, Dell PowerEdge blade servers, Dell/EMC storage, power management, YCH Group

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YCH Group, an integrated logistic services and end-to-end supply chain management provider, supports up to 3,000 partners in more than 20 supplier hubs across the Asia Pacific region. Since the mid-1990s, the company has provided warehousing, freight forwarding, and transportation to manufacturers, suppliers, and retailers. YCH thrives on a flexible technology environment that can respond quickly to customer needs and accelerate supply chain operations by connecting its technology platform to customer systems.

Previously, YCH deployed servers with extra processing capacity to keep pace with growth and handle unexpected increases in activity, which led to servers being underutilized. Additionally, because the company deployed servers from multiple vendors, the server environment was difficult to monitor and manage. Faced with a rapidly expanding business, YCH reviewed how it could simplify its IT environment to meet customer demands and provide new services quickly. James Loo Wai Kheong, CIO at YCH, says, "Compared to the previous deployment, Dell blade servers were chosen because the solution streamlines our IT environment and reduces floor space by 70 percent. Plus, it supports our green initiative of reducing carbon emissions through a smaller energy footprint."

BLADE SERVERS HELP CONSOLIDATE IT ENVIRONMENT

With a close working relationship of over 10 years, YCH chose Dell to help consolidate its IT environment. "We have come to trust and rely on Dell because our companies have a long history of working together," Loo says. "Dell understands our needs. As an actual customer of our end-to-end supply chain solutions, it knows how fast we need to scale our infrastructure to meet customer requirements."

YCH migrated much of its heterogeneous environment of over 400 servers onto Dell PowerEdge M1000e modular blade enclosures and PowerEdge M600 server blades. Explains Loo, "With a product road map, Dell gives us the assurance that our deployed blade servers will be compatible with future products."

Dell Global Infrastructure Consulting Services assisted YCH in rolling out hardware at its data center, helping accelerate deployment of the consolidated server

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environment by 60 percent compared with the previous process and providing training and comprehensive technical support. In addition, YCH integrated several independently running storage systems into a consolidated Dell/EMC CX3-20 storage area network (SAN). "The close partnership between Dell and EMC provided a seamless experience and eliminated the hassle of us coordinating delivery between the two vendors," says Loo.

> **"The Dell blade server system effectively decreases our energy consumption by up to 45 percent compared to the previous solution with its dynamic cooling technology that directs air to areas where the most heat is generated."**
>
> —James Loo Wai Kheong
> CIO at YCH Group
> July 2008

SCALABILITY AND FLEXIBILITY HELP ACCELERATE PROVISIONING

YCH can now use Dell PowerEdge blade servers to help provision capacity for its needs. "We can now respond to different customer requirements, from supporting the smallest customer needing very little computing power to major hubs requiring all the MIPS [million instructions per second] we can muster," says Loo.

Previously, YCH spread its customer data across seven separate databases, which the integrated switching technology in PowerEdge blade servers helped consolidate into one database. "We have a lot of data to grind, so the flexible support for Gigabit Ethernet, Fibre Channel, or InfiniBand protocol enables the Dell blade servers to support all our needs from a single location," says Loo.

With nine evenly distributed, high-efficiency fans, PowerEdge M1000e blade servers can generate less heat than traditional rack-mounted servers and help reduce energy consumption for cooling the system. "The Dell blade server system effectively decreases our energy consumption by up to 45 percent compared to the previous solution with its dynamic cooling technology that directs air to areas where the most heat is generated," says Loo.

HIGH AVAILABILITY HELPS SUPPORT OPERATIONS

YCH can also count on Dell PowerEdge blade servers to help provide maximum availability in support of critical logistics operations. "We know we can rely on Dell hardware to run customer-facing applications that support the continuous flow of information and goods," says Loo. Applications for moving raw materials, distributing consumer goods, and returning defective goods will be delivered to approximately 3,000 YCH customers and suppliers. In addition, up to 3,000 employees can use internal applications such as Microsoft® Office 2007 and internal finance and human resource applications running on PowerEdge blade servers.

To help maximize uptime, PowerEdge blade servers offer dual Chassis Management Controllers (CMCs). The densely packed configuration of PowerEdge blade servers also helped YCH reduce the physical footprint of its data center by 70 percent compared with the previous deployment: up to 64 server blades can fit into a 40U rack space, which is 60 percent more space efficient than traditional 1U rack servers.

The centralized system and reduced footprint resulted in 50 percent faster provisioning of new processing and storage capacity compared with the previous solution. Altiris® Deployment Solution™ software accelerates new service provisioning with its visual drag-and-drop capability and rule-based RAID provisioning. "In the supply chain logistics business, we don't have large data volumes in the beginning of our business transactions, but requirements have a tendency to grow uncontrollably as relationships with customers progress. With the Dell PowerEdge blade server system, we know we can efficiently transfer storage resources and processing power to the customers and supply hubs that need it most," says Loo.

Consolidating its IT environment onto PowerEdge blade servers—which allow server blades to be added to the enclosure with little effort—and decreasing energy consumption helped reduce YCH's total cost of ownership by 40 percent compared with the previous solution. "We do not have to deploy extra resources with Dell blade servers," says Loo. "Other vendors might provide a buffer, but Dell helps us maximize our current hardware without adopting extra capacity."

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BUILDING ONE OF THE WORLD'S LARGEST WINDOWS-BASED HPC CLUSTERS

By Scot A. Schultz
Charles Rubin

When the University of Nebraska at Omaha's Holland Computing Center teamed up with Dell to build a high-performance computing (HPC) cluster, the result was a flexible dual-boot system of Dell™ PowerEdge™ servers with dual-core AMD Opteron™ processors—and one of the world's largest and most powerful Microsoft® Windows® OS–based clusters.

Related Categories:

AMD

AMD Opteron processors

Case study

Dell PowerEdge servers

High-performance computing (HPC)

Microsoft

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Over a year ago, Dell engineers set out to design and build one of the world's largest Microsoft Windows–based high-performance computing (HPC) clusters at the University of Nebraska at Omaha (UNO). Funded with a budget of US$20 million and located in a 2,000-square-foot glass-walled enclosure in the Holland Computing Center (HCC) at the Peter Kiewit Institute, the cluster represents a major milestone in establishing the stature of UNO as a leading U.S. research center. The HCC has already attracted cluster users from the U.S. Department of Defense, Gallup, Microsoft, and the Milliman actuarial firm, and provides a major IT resource for UNO faculty and students as well as research scientists from around the United States. The HCC cluster was ranked 43rd on the TOP500 list of the world's most powerful supercomputers in November 2007.[1]

DESIGNING THE CLUSTER

The three-person HCC staff began by selecting Dell as the master project manager. As part of the design phase, the team looked at other major HPC centers in the United States and received input from local and national business organizations with previous supercomputing experience, and determined that the proposed cluster must be both collaborative and able to scale to meet several general requirements:

- It had to support both Microsoft Windows and Linux® operating systems to accommodate enterprise users, university and government researchers, and students.
- It had to be one of the most powerful clusters in the world.
- It had to fit inside a 2,000-square-foot facility in a region where outside temperatures can range from –20°F to over 100°F.
- It had to include an access and management system that could provision dedicated nodes for several simultaneous users with minimal staff intervention.
- It had to be able to run TOP500 benchmark tests.

American Power Conversion (APC), Cisco, Dell, Force10 Networks, Microsoft, and other vendors were eager to provide equipment and support for this ambitious project to help ensure that the installation went seamlessly. Dell specified 1,150 PowerEdge

[1] For more information on the TOP500 list, visit www.top500.org.

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SC1435 1U servers as the compute nodes, with a PowerEdge 6950 server as the master node (see Figures 1 and 2). The cluster connects to two dedicated networks: a 10 Gigabit Ethernet management network that uses a Force10 TeraScale switching fabric, and a Cisco-based InfiniBand network to deliver high bandwidth and low latency for server-to-server interconnects.

Each compute node was initially configured with dual-core AMD Opteron 2220 SE processors at 2.8 GHz, 8 GB of RAM, and 80 GB of local storage. The HCC selected these AMD Opteron processors because of the server motherboards' plug compatibility with the new generation of quad-core AMD Opteron processors, which enables the HCC to upgrade to quad-core processors in the future simply by installing them in place of the dual-core processors and then updating the server BIOSs—without needing to change power and cooling requirements. While the dual-core processors could deliver 21.5 TFLOPS of performance, the HCC estimates that an upgrade to quad-core processors could provide up to a 320 percent performance increase, in addition to raising the cluster's teraflop rating to more than 60 TFLOPS.

Figure 2. *The HCC cluster is based on 1,150 Dell PowerEdge SC1435 server nodes and a PowerEdge 6950 master node*

For data storage, the cluster links to a Panasas storage and high-speed file system with 150 TB of space over Fibre Channel links designed to provide throughput of 3.5 Gbps (see Figure 3). The system supports both a Microsoft Windows Compute Cluster Server 2003 environment and a Linux environment. The HCC can automatically provision OS images to specific nodes, and can dedicate specific nodes to specific users as needed.

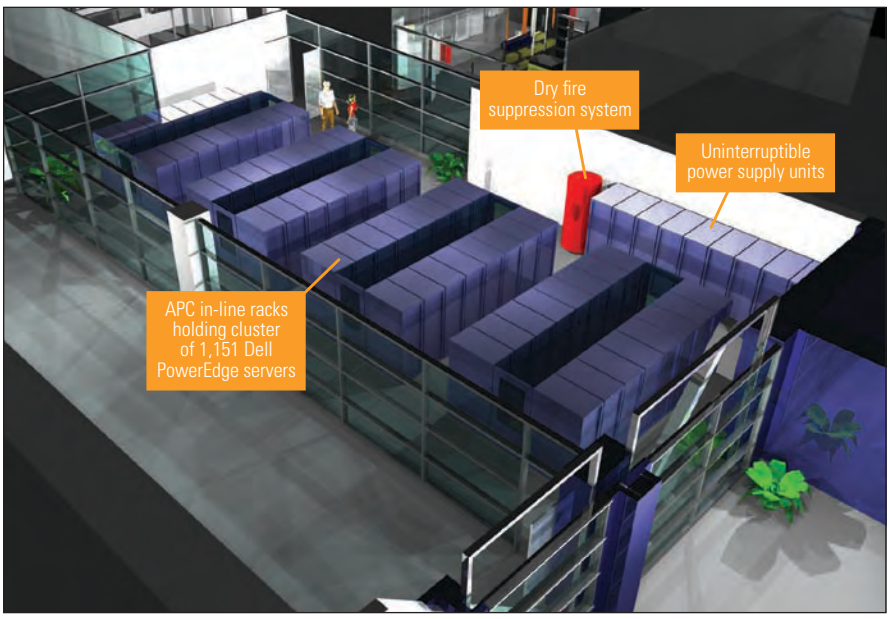

Figure 1. *The powerful dual-boot HCC cluster is housed in a 2,000-square-foot glass-walled enclosure*

To help meet the physical demands of the installation in terms of footprint, space, and power and cooling, the team configured the cluster in four modular pods. The design uses a hot aisle/cold aisle configuration, where the pods hood the hot aisles and recycle the warm exhaust air through an in-row self-contained water-cooled system designed and provided by APC. The system uses two redundant chillers that can provide more than 200 tons of cooling. When outside temperatures drop below 20°F, a dry air cooler turns on and shuts down the chillers to help reduce energy use.

MEETING DIVERSE DEMANDS

The HCC debuted on the TOP500 list in November 2007, placing within the top 50 of the world's largest supercomputing-class systems at number 43. The configuration and testing processes have been ongoing since the initial installation. One of the most important discoveries related to daily operations has been the demand for Microsoft Windows applications; because the HCC team's experience had been primarily with Linux-based clusters, they had not anticipated the level of demand for Windows applications that the cluster has received.

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Initially, the HCC had planned a zero-touch automated deployment of the Windows Compute Cluster Server 2003 OS. However, the Remote Installation Services (RIS) tool used by this OS did not support zero-touch deployment on systems that had already been partitioned using Linux. To work around this limitation, the HCC employed a light-touch deployment, which consisted of an attended network service boot on each node that polled the RIS server for the preconfigured Windows image and allowed the side-by-side deployment.

Microsoft played an active role in the success of the cluster, which is one of the largest Windows-based clusters in the world. The company provided on-site assistance and training, helping the HCC staff overcome early challenges. The collaboration on a project of this large scale not only helped the HCC provide Windows users with comprehensive access to the facility and its available resources, but also enabled Microsoft to refine many of its own best practices and product features.

PLANNING FOR THE FUTURE

As a result of the cluster's success, the HCC plans to move forward with further planning and development, and to increase its internal staffing to help accommodate the large demand from the business community as well as university and research requirements. In addition to the Department of Defense, Gallup, Microsoft, and Milliman, the cluster supports genetics researchers at the Henry Doorly Zoo, researchers studying protein strands at the University of Nebraska Medical Center, and both undergraduate and graduate students at UNO and the University of Nebraska at Lincoln.

> **"The HCC and its collaborators plan to continue pushing the boundaries of HPC performance based on the Dell focus on best-of-breed standards and cost-effective components."**

The HCC, Dell, AMD, Microsoft, and a range of collaborative partners have continued working together since the cluster's original implementation. In December, the team performed an initial upgrade of 250 nodes to quad-core AMD Opteron 2356 processors at 2.3 GHz, anticipating an upgrade of the entire system in time for the next TOP500 test period. For the Dell consulting team, the experience continues to advance the state of computing performance while making that performance available to a worldwide community. The HCC and its collaborators plan to continue pushing the boundaries of HPC performance based on the Dell focus on best-of-breed standards and cost-effective components—helping expand the reach of HPC and deliver it to a growing set of users including enterprises, university and government researchers, and students.

Figure 3. *Panasas storage provides the HCC cluster with over 150 TB of space over Fibre Channel links*

Scot A. Schultz is a senior strategic alliances manager for HPC at AMD, where his responsibilities include understanding computational and operational requirements from commercial vertical markets as diverse as bioinformatics, manufacturing, and oil and gas, as well as managing partnerships with key technology partners to create solutions based on those requirements. He also works with numerous software and hardware partners to optimize their technologies, software, and drivers to deliver superior performance on AMD-based architectures, and serves in various industry organizations including the HyperTransport Technology Consortium and the OpenFabrics Alliance.

Charles Rubin is a freelance technology writer focused on network systems. He is the author of 15 books about computer hardware and software, and has B.A. and M.A. degrees in English from San Francisco State University.

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SCALING SUNGARD HIGHER EDUCATION BANNER SOFTWARE ON DELL HARDWARE

By Dave Jaffe, Ph.D.
Kai Yu
Dan Brint

For institutions of higher education, a scalable IT infrastructure can be critical. To demonstrate the scalability and performance of SunGard Higher Education's Banner® software on Dell™ hardware, Dell collaborated with the State University of New York to build and test a proof-of-concept architecture designed to handle up to 175,000 students with sub-second response times.

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In November 2007, SunGard Higher Education announced that Dell was a partner in its new Unified Digital Campus (UDC) Test Center, and that Dell servers and storage would make up the hardware reference platform for SunGard Higher Education's Banner UDC solutions using Microsoft® Windows® and Linux® operating systems. Banner UDC, an enterprise resource planning solution for higher education that integrates with Oracle® databases, is in use at over 900 institutions worldwide and is designed to work seamlessly with other SunGard Higher Education, third-party, and organization-developed applications to meet the basic information processing needs of higher-education institutions. The partnership between SunGard Higher Education and Dell in the UDC Test Center is intended to facilitate interoperability and performance testing of SunGard Higher Education software and Dell hardware as well as the development of tested and validated reference architectures for Banner software on Dell hardware, helping simplify adoption of Banner at institutions of higher education.

To demonstrate the scalability and performance of Banner software on Dell servers and storage, the Dell Reference Architecture team partnered with the State University of New York (SUNY) Information Technology Exchange Center (ITEC) to perform a proof-of-concept (POC) test in the Dell Austin lab in late 2007 and early 2008. ITEC, a central IT resource for the 64 separate institutions of higher education and research that make up SUNY, manages servers and hosts applications at multiple university campuses. ITEC currently supports Banner for 24 campuses, and manages more than 140 Oracle databases and more than 50 Oracle application servers that provide a variety of applications in addition to Banner.

The Dell-SUNY POC tests extend previous testing performed by Dell and SunGard Higher Education for Texas Tech University.[1] Whereas this previous testing resulted in an architecture designed to meet the needs of the 28,000 students at Texas Tech by running Banner software on Dell hardware, the Dell-SUNY testing was designed to demonstrate that Banner running on Dell PowerEdge™ servers and Dell/EMC storage could scale to handle more than six times that load to help meet the needs of ITEC.

Through the use of VMware® virtualization software to help manage the application servers, Oracle Real Application Clusters (RAC) with Oracle Enterprise Manager Grid Control to manage the large databases, an F5® Networks BIG-IP® load balancer to send the requests to the application servers, and Spotlight from Quest Software to help manage the Oracle RAC databases, the Dell-SUNY POC architecture successfully

[1] For more information, see "Unity and Freedom in One Seamless Solution," by Dell Inc., January 2007, DELL.COM/Content/Topics/Global.aspx/CaseStudies/fy2008_q3_id706?c=us&cs=RC956904&l=en&s=hied.

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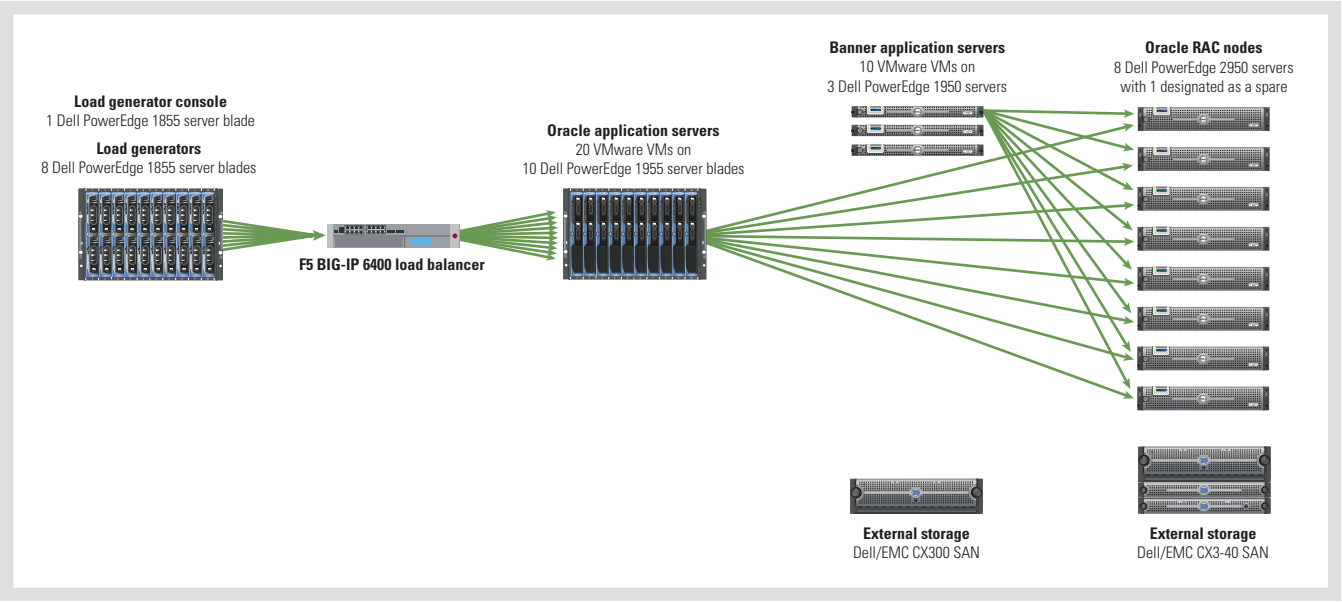

Figure 1. *Hardware configuration in the test environment*

handled a workload representing 175,000 students while providing sub-second response times. In the largest configuration tested, more than 11,000 students simultaneously registered for courses and performed other tasks, with nearly 70,000 courses selected in one hour—37 times the actual number seen at a SUNY school of 11,000 students during a peak one-hour enrollment period.

TEST ENVIRONMENT

Banner UDC from SunGard Higher Education is a tightly integrated suite of higher-education applications that runs on a single database. The Banner components provide universities with tools to manage students, financial aid, finances, human resources, enrollment, and other constituents such as alumni, partners, and the community. Additional elements like the Luminis® and Banner XtenderSolutions components provide portal and document imaging and management features.[2]

To model the large Banner configuration required by ITEC, the test team built the configuration in the Dell Reference Architecture lab along with a sufficient number of load generator servers to model the workload generated by 175,000 students. Figures 1 and 2 detail the hardware configuration used in the Dell-SUNY POC test environment:

- **Load generators:** During the Texas Tech POC tests, SunGard Higher Education and Dell captured the input keystrokes and Web clicks for many of the key Banner user actions using the HP LoadRunner tool. This data was then sanitized to remove real names and other data and used as the workload for the Dell-SUNY POC tests, with 1 Dell PowerEdge 1855 server blade functioning as the load generator console and 8 PowerEdge 1855 server blades functioning as load generators.
- **F5 BIG-IP load balancer:** The F5 BIG-IP 6400 load balancer steered the

	Servers	Processors	Memory	Platform
Load generator console	1 Dell PowerEdge 1855 server blade	Two single-core Intel® Xeon® processors at 2.8 GHz	4 GB	Microsoft Windows Server® 2003 OS (32-bit)
Load generators	8 Dell PowerEdge 1855 server blades	Two single-core Intel Xeon processors at 3.6 GHz	2 GB	Microsoft Windows Server 2003 (32-bit)
Hosts for virtualized Oracle application servers	10 Dell PowerEdge 1955 server blades	Two dual-core Intel Xeon processors at 3.0 GHz	8 GB	VMware ESX 3.02
Hosts for virtualized Banner application servers	3 Dell PowerEdge 1950 servers	Two dual-core Intel Xeon processors at 3.0 GHz	8 GB	VMware ESX 3.02
Oracle RAC nodes	8 Dell PowerEdge 2950 servers	Two quad-core Intel Xeon processors at 2.6 GHz	32 GB	Red Hat Enterprise Linux 4 Update 5 (64-bit)

Figure 2. *Servers used for each role in the test environment*

[2] For more information, visit www.sungardhe.com/products/product.aspx?id=832.

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> **"To demonstrate the scalability and performance of Banner software on Dell servers and storage, the Dell Reference Architecture team partnered with SUNY ITEC to perform a POC test in the Dell Austin lab."**

simulated user requests to the application servers in a balanced way.

- **Oracle and Banner application servers:** The key Self-Service Banner (SSB) and Internet Native Banner (INB) components ran on the Oracle Application Server platform. Other Banner functions such as batch processing and compiling ran on the Banner application servers. To help maximize server utilization and flexibility, the test team installed VMware ESX virtualization software on 10 PowerEdge 1955 server blades and 3 PowerEdge 1950 rack servers to create a virtual machine (VM) farm. The test team created 20 VMs running the 32-bit Red Hat® Enterprise Linux 4 Update 5 OS on the 10 PowerEdge 1955 server blades to function as Oracle application servers, and 10 VMs running the 32-bit Red Hat Enterprise Linux 4 Update 5 OS on the 3 PowerEdge 1950 servers to function as Banner application servers.
- **Oracle RAC nodes:** The Banner components stored their data in an 8-node Oracle RAC database running as an Oracle grid. Each node was a PowerEdge 2950 server running the 64-bit Red Hat Enterprise Linux 4 Update 5 OS. The database was managed by Oracle Enterprise Manager and the Spotlight tool from Quest Software.
- **External storage:** The application server VMs were stored on a Dell/EMC CX300 storage area network (SAN) with ten 73 GB disks. The Oracle RAC database was stored on a Dell/EMC CX3-40 SAN with three DAE4P disk pods of fifteen 146 GB disks each.

The Oracle RAC database was a key component in the test environment. Unlike in the traditional database model, where each database resides on its own set of servers and storage, in the Oracle grid computing model multiple databases share a single infrastructure of servers and storage and provide database services to applications. This model allows an Oracle grid to provide dynamic resource sharing and allocation as well as continuous high availability for the databases in the grid.

The Oracle grid computing model was well suited for the multiple-campus Dell-SUNY infrastructure. In this infrastructure, 10 application databases were consolidated in an eight-node Oracle RAC 10*g* Release 2 (R2) cluster to provide database services for the corresponding 10 Banner applications, each of which was designed to serve one campus.

In addition to Oracle RAC and database services, Oracle Database 10*g* includes features to implement the grid computing model, including Oracle Automatic Storage Management (ASM), Oracle Enterprise Manager Grid Control, and load balancing. The grid configuration used in the Dell-SUNY POC tests included the following hardware:

- Eight Dell PowerEdge 2950 database servers
- Two private interconnect network switches connecting the database servers, forming a fully redundant interconnect heartbeat between the database nodes
- Fibre Channel storage connections with dual host bus adapters in each database server as well as dual Fibre Channel switches connecting the servers to the SAN, providing full redundancy for high availability and I/O workload balance
- A Dell/EMC CX3-40 SAN with 37 spindles, providing shared storage and I/O bandwidth for the 10 databases

Each Oracle RAC node ran the 64-bit Red Hat Enterprise Linux 4 Update 5 OS, Oracle Clusterware 10*g* R2, Oracle RAC 10*g* R2, and an Oracle ASM instance. Based on these software stacks, the test team created 10 database instances on the Oracle RAC cluster: 5 large databases designed to handle a load equivalent to that of the Texas Tech tests (28,000 students) and

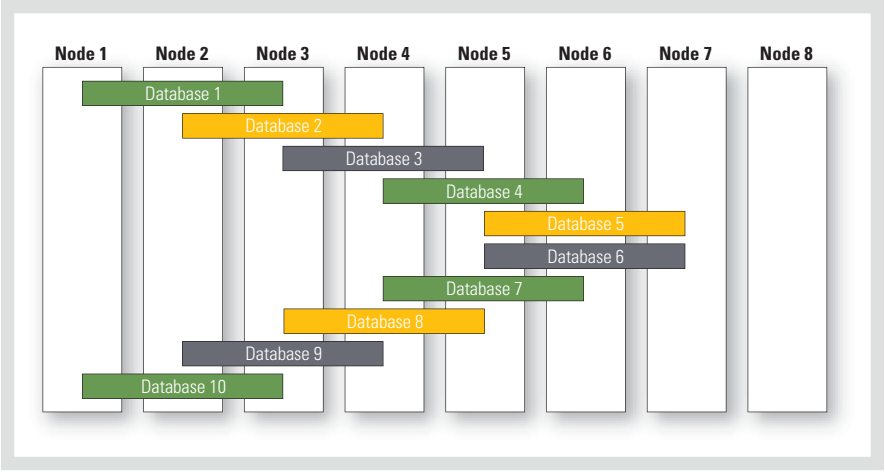

Figure 3. *Database instances on the Oracle RAC nodes in the test environment*

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Function	Users (large database)	Users (small database)
Performing a traditional course registration	320	80
Performing a shopping-cart course registration	320	80
Viewing course lists	200	50
Adding or dropping courses	160	40
Viewing grades	800	200
Total	1,800	450

Figure 4. *Number of simulated users performing different functions in each database during the tests*

Databases used	Total simulated student enrollment	Simultaneous simulated users
1 large and 1 small	35,000	2,250
3 large and 3 small	105,000	6,750
5 large and 5 small	175,000	11,250

Figure 5. *Simulated student enrollments and simultaneous users during the tests*

5 small databases one-fourth that size (7,000 students).

To distribute the workloads across the cluster nodes, the test team initially configured each of the 10 databases instances to run on three of the eight Oracle RAC nodes, as illustrated in Figure 3. An instance could be added or dropped from a node by defining which database services ran on which nodes. Node 8 was reserved for future expansion.

TEST METHODOLOGY AND RESULTS

The Dell-SUNY POC tests focused on five of the most common Banner UDC student requests: performing a traditional course registration (one course at a time), performing a shopping-cart course registration (multiple courses at a time), viewing course lists, adding or dropping courses, and viewing grades. To model a typical student workload, the test team configured the load generators to simulate a particular number of users performing the various functions for each database size (see Figure 4). To demonstrate the infrastructure's scalability from the previous Texas Tech POC tests, the test team combined the large databases (representing 28,000 students) and small databases (representing 7,000 students) to model different university sizes (see Figure 5).

Using LoadRunner, the test team ran the workloads simulating the five Banner student functions shown in Figure 4 against the three database configurations shown in Figure 5. Each run lasted 90 minutes, including 10 minutes of ramp-up time. The test team measured three key metrics: response time, processor utilization on the database servers, and total registrations in a given time.

To help model actual behavior, the load generators inserted pauses of several seconds between the actions of the simulated users to represent think time. The response time to an action was defined as the time from when the simulated user submitted a request to the Banner Web page to the time that the Banner software sent a response back to the simulated user session. Figure 6 shows the average response times for each step during traditional course registrations for each of the three workloads, which were all well below 1 second—significantly lower than the requirements specified originally for the Texas Tech tests of 5 seconds for logging in and registering for classes and 2 seconds for the other steps.

Figure 7 shows the average total response time and processor utilization on the database servers during traditional course registration for each of the three

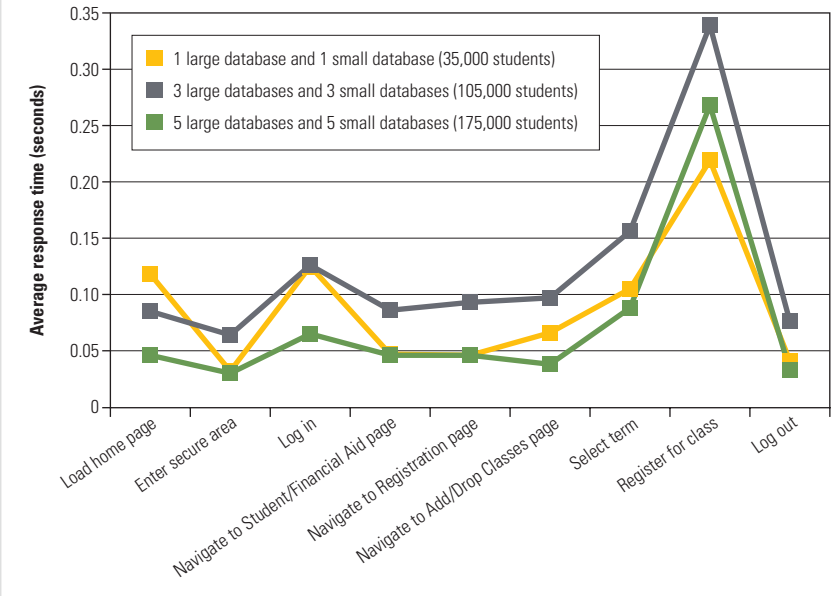

Figure 6. *Average response times for each step during traditional course registration*

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Databases used	Number of database servers	Average total response time	Average processor utilization on the database servers
1 large and 1 small	3	0.7 seconds	25%
3 large and 3 small	5	1.1 seconds	31%
5 large and 5 small	6	0.8 seconds	30%

Figure 7. *Average total response time and processor utilization for each workload during traditional course registration*

	Dell-SUNY POC tests	Buffalo State enrollment period
Maximum number of course registrations in a single 15-minute period	20,267	1,172
Maximum number of course registrations in a single one-hour period	67,807	1,820

Figure 8. *Maximum number of course registrations in the largest test configuration compared with the Buffalo State enrollment period*

workloads. The total time an average simulated user waited for the system to respond was about 1 second for the entire set of registration actions. The average processor utilization on the database servers ranged between 25 percent and 31 percent, which left plenty of room for workload spikes.

One way to evaluate the throughput of the largest configuration tested—5 large databases and 5 small databases, for a total of 175,000 students—in real-world terms is to compare the maximum number of course registrations for a single 15-minute period and for a one-hour period with actual data measured during the November 14, 2007, enrollment period at Buffalo State, a SUNY member school with 11,000 students. As Figure 8 shows, the total number of registrations achieved by the Dell-SUNY POC configuration at its peak was about 17 times higher than the peak 15-minute period and 37 times higher than the peak one-hour period during the Buffalo State enrollment.

SCALABLE ARCHITECTURE FOR HIGHER EDUCATION

The results of the Dell-SUNY POC tests demonstrated that SunGard Higher Education Banner UDC software running on Dell PowerEdge servers and Dell/EMC storage along with an Oracle RAC database could scale to handle the needs of multiple large campuses. The test configuration handled a user load representing 175,000 students, with 11,250 simultaneously registering for courses and performing other typical tasks, while providing sub-second response times and supporting nearly 70,000 course selections in one hour—37 times the actual number seen at a SUNY school of 11,000 students. These results indicate the considerable scalability provided by the Banner software and Dell servers and storage that formed the basis of the Dell-SUNY architecture used in the test environment.

"The results of the Dell-SUNY POC tests demonstrated that SunGard Higher Education Banner UDC software running on Dell PowerEdge servers and Dell/EMC storage along with an Oracle RAC database could scale to handle the needs of multiple large campuses."

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HOW THE GUARDIUM PLATFORM HELPED DELL IT SIMPLIFY ENTERPRISE SECURITY

By Phil Neray
Addison Lawrence
David McMaster
Venugopal Nonavinakere

Safeguarding data is critical for many organizations, but auditing data access activity to comply with regulatory standards can be a complex undertaking. As part of its initiative to simplify IT, the Dell IT group implemented the Guardium platform and database activity monitoring technology to help protect its globally distributed database servers and streamline compliance processes.

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Securely maintaining sensitive financial and customer information in enterprise data centers can be complex and challenging, and the heterogeneous global environment that stores enterprise data for Dell is no exception. The Dell IT infrastructure includes thousands of servers worldwide that run a diverse mix of enterprise applications such as Oracle® E-Business Suite, Oracle JD Edwards®, and Oracle Hyperion software as well as the Oracle Database and Microsoft® SQL Server® database platforms on both Microsoft Windows® and Linux® operating systems.

To add to this complexity, organizations typically must report and audit data access activity to comply with regulatory standards such as the Sarbanes-Oxley Act (SOX), the Payment Card Industry Data Security Standard (PCI-DSS), and Statement on Auditing Standards Number 70 (SAS 70). These detailed reports usually involve documenting the activities of everyone accessing these systems, including help-desk personnel, outsourcers, and privileged users such as database administrators (DBAs) and system administrators. In addition, an oversight team to review and approve these reports on a regular basis—instead of simply generating and stacking them on someone's desk—helps to ensure that a formal process is in place for tracking and addressing exceptions such as failed logins and unauthorized changes to database structures (schema modifications) through Data Definition Language (DDL) operations.[1]

Dell IT administrators are continually looking for new and innovative ways to safeguard critical data in these systems from both external and internal threats, including inadvertent or accidental changes that can affect the integrity of financial data governed by standards. The Dell IT group wanted to replace its manual, internally developed approaches—one for Oracle Database and one for Microsoft SQL Server—with an automated, cross-platform, appliance-based solution that could not only secure the privacy and integrity of critical data, but also streamline the process of reporting and auditing data access activity to comply with regulatory standards.

To help accomplish these goals, the Dell IT group implemented the Guardium platform and its database activity monitoring (DAM) solution, a real-time monitoring technology for safeguarding database data and automating compliance reporting and oversight processes. Dell deployed this automated, cross-platform solution for securing its enterprise

[1] These materials reflect Dell's view of compliance with the statutes and standards as of July 11, 2008, and may be superceded by changes in the statutes/standards. This information is not intended as legal advice and may not be used as such, nor does this information reflect a full and exhaustive explanation of all relevant statutes and standards. You should seek the advice of your own legal counsel on any legal compliance questions.

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data centers to help establish a structured monitoring process for tracking changes and documenting database activity; monitoring all database activity—including privileged user activities—independently from native database logging and auditing features; and simplifying reporting for compliance with regulatory standards in its globally distributed systems.

UNDERSTANDING DATABASE SECURITY TECHNOLOGIES

Although traditional security technologies such as firewalls can be essential building blocks for a layered defense against security threats to enterprise data, they lack embedded knowledge about database protocols and structures and are therefore limited in key ways:

- **Perimeter defenses, intrusion detection systems (IDSs), and intrusion prevention systems (IPSs):** Lack specific awareness of database protocols and activity patterns
- **Database encryption:** Does not protect against access to back-end databases by privileged users with access to keys or against hackers who hijack application servers; it can also require significant architectural changes to existing applications and databases
- **Data leak prevention:** Catches sensitive data leaving endpoints through e-mail or instant messages, but does not protect sensitive data at the source, in the data center
- **Native database management system (DBMS) logging utilities:** Do not provide real-time protection such as alerting or blocking, can create performance overhead, and do not support the separation of duties required by auditors because they are controlled by the same teams that need to be monitored
- **Security Information and Event Management (SIEM) systems:** Rely on imported DBMS log data, cannot detect unauthorized activities in real time, and lack database-focused analytics

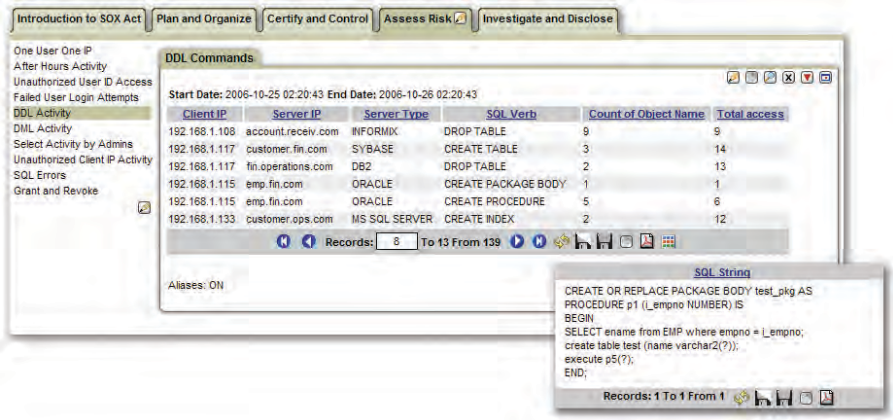

Figure 1. *The Guardium platform provides over 100 preconfigured reports for regulatory standards compliance*

DAM technology—designed to monitor, analyze, and log transactions to a DBMS—provides an alternative to these traditional approaches to help provide increased security for databases. To help minimize performance overhead on production systems—which may process millions of transactions per day—DAM systems typically operate independently of native DBMS logging and auditing functions. Using an independent system for DAM is also important because of the formidable challenge of storing, analyzing, and archiving large volumes of captured audit information. DAM systems typically capture highly granular information about each transaction, including SQL command, database and OS account, date and time, originating IP address and server, source application, database name, network protocol, application account, and bind variable data (see Figures 1 and 2).

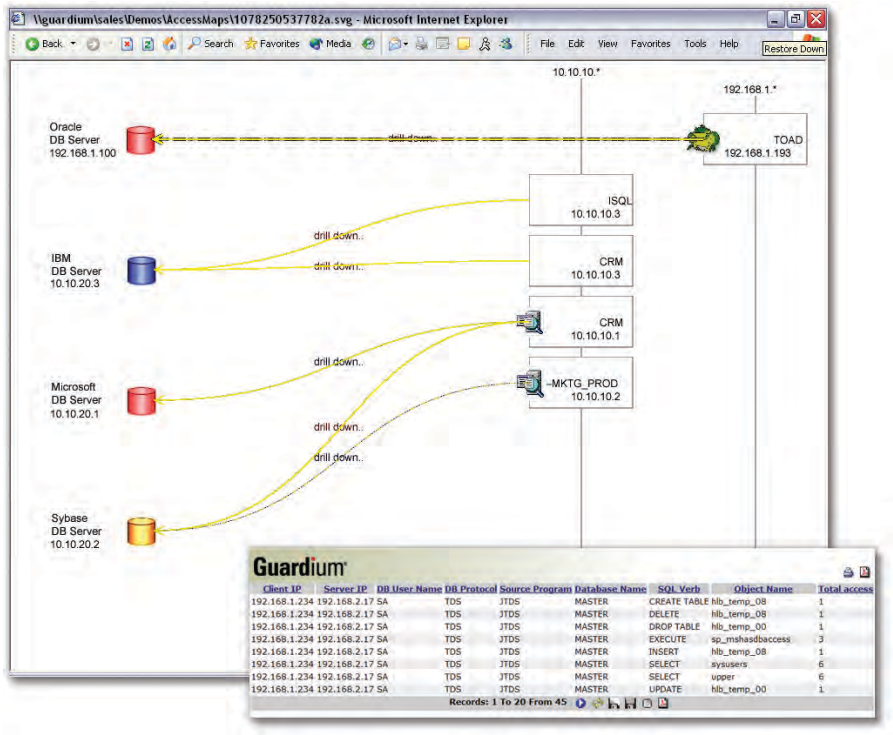

Figure 2. *The Guardium platform monitors all database transactions at a granular level and provides a visual access map showing databases, clients and applications*

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In addition, keeping DAM separate from native DBMS logging functions helps demonstrate *separation of duties*—sometimes called segregation of duties—which can be crucial for internal control. In this context, separation of duties means that the DAM system creates and stores an audit trail without relying on components in the DBMS infrastructure, which could be subject to tampering by privileged users. To help ensure independent accountability, DAM administrators should be security professionals or auditors rather than members of the privileged user group being monitored.

EVALUATING THE GUARDIUM ARCHITECTURE

The Guardium architecture offers a noninvasive, network-based, database-independent platform for continuously monitoring and analyzing database traffic in real time to help immediately identify unauthorized or suspicious activities, both at the network level and on database servers. Built on 2U Dell™ PowerEdge™ 2950 servers, each system runs a suite of real-time monitoring, security, and compliance applications on a hardened Linux kernel. Multiple appliances can be combined in a multi-tier topology to handle high-transaction volumes and/or distributed environments.

Transactions are stored securely in the appliance in an embedded high-performance database for regulatory standards compliance reporting, auditing, correlation analysis, and forensics. To support separation of duties and provide a verifiable audit trail, audit information cannot be modified by anyone—even privileged users. The Guardium platform provides additional security measures, including real-time security alerts through Simple Network Management Protocol (SNMP) and Simple Mail Transfer Protocol (SMTP), custom actions such as automated account lockouts, and blocking. IT organizations can monitor database traffic by using one or a combination of noninvasive methods:

- **Software taps (S-TAPs):** S-TAPs are lightweight software probes installed on each database server to monitor database traffic at the OS level. Because S-TAPs do not rely on the database to collect or process the log data, impact on database performance is generally minimal (typically 2–4 percent). Instead, they simply relay database traffic to separate Guardium appliances in the network for analysis and storage. S-TAPs can also collect traffic from database servers in remote locations to help eliminate the need for dedicated appliances in isolated locations. S-TAPs are important because they also monitor local backdoor access to databases by privileged users through non-TCP protocols such as shared memory, named pipes, and Bequeath, an Oracle Net Services protocol. Finally, a specialized version of S-TAP, called S-GATE, can be used to selectively block unauthorized transactions by privileged users, such as viewing of sensitive data—thereby helping enforce separation of duties and adding a new layer of preventive controls without the risk of blocking legitimate access from authorized users and applications.
- **Switched Port Analyzer (SPAN) port or hardware tap:** In this configuration, the Guardium appliance is deployed as a non-in-line, passive network monitor that captures a mirrored copy of the network stream by connecting to a standard SPAN port in a network switch, or to an in-line network tap, with zero performance impact on database servers.

To help maximize flexibility, organizations can use a combination of host-based and network-based collection, depending on their network topology and relative ease of access to database servers and/or network switches.

DEFINING DELL REQUIREMENTS FOR DATABASE ACTIVITY MONITORING

In early 2007, a cross-organizational team from Dell Global Data Services and Dell Global Information Security Services defined its requirements for a DAM solution. The Dell team needed a scalable, secure, and reliable way to audit sensitive, highly restricted data such as credit card and social security numbers. At the time, Dell was using internally developed scripts with native database auditing for Oracle databases, and a combination of scripts and a third-party tool for Microsoft SQL Server databases.

Although the existing approaches met immediate auditing needs, keeping the scripts properly deployed and the jobs running resulted in supportability issues and added complexity to the environment. Databases that were reporting correctly one day would stop reporting audit data on another day, causing frustration for project teams because the DBAs were in strong demand for delivering business projects—and were instead required to perform repeated maintenance to correct auditing problems. In one case, the Oracle SYSTEM tablespace filled with log files,

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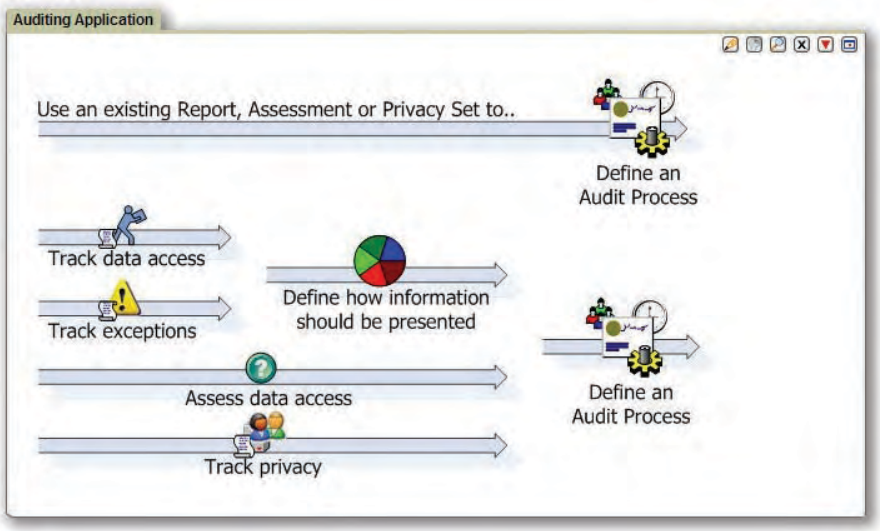

Figure 3. *The Guardium platform helps security professionals and auditors automate regulatory standards compliance, including sign-offs and escalations*

causing a database outage and increasing frustration even further.

Administrators reviewing audit logs also struggled to keep up with the volume of data generated because no data filtering was available, and they labored to document closure to every action item they found when reviewing the audit log. Additional problems were found in the controls for the audit logs because the DBAs were responsible for both installing and maintaining the audit processes.

To help meet its growing business needs, the Dell project team looked for a solution that could provide out-of-the-box auditing for multiple database platforms, including Oracle Database and Microsoft SQL Server. The solution needed to make minimal overhead demands on the database server, provide automated evidence for passing audit requirements (see Figure 3), and be deployable without DBA expertise and without changes to the databases. The audit data reporting needed to be able to compare the audit data to change tickets that were approved in the Dell change-management system and to provide filtering to suppress logging of database changes that were made through authorized applications. Showing that DDL commands such as `DROP TABLE` are logged and checked to ensure appropriate management approval is important for SOX regulations, and reviewing inquiries on credit card and social security numbers—for example, through ad hoc `SELECT` commands—is critical to the requirements of PCI-DSS and privacy standards.

Dell also required real-time alerting for critical security events, such as brute-force password attacks (flagged by repeated failed logins) and SQL injection (flagged by repeated references to nonexistent table names). Finally, the data in the audit log needed to be protected from manipulation by privileged users such as the DBAs.

The team needed to meet all of these requirements within three months on some of the critical databases in the Dell IT environment, including databases supporting 24/7 manufacturing and the DELL.COM Web site. These databases include complex configurations for high availability using Oracle Real Application Clusters (RAC) and Microsoft SQL Server clusters, and complex configurations for disaster recovery using Oracle Data Guard and Microsoft SQL Server database mirroring.

IMPLEMENTING GUARDIUM IN THE GLOBAL DELL ENVIRONMENT

In late 2007, Dell deployed the Guardium platform to approximately 300 database servers in 10 data centers around the world during a 12-week period. In enterprise environments like the Dell implementation, multiple appliances can be deployed in a federated system with a scalable, multi-tier topology consisting of the following components (see Figure 4):

- **Centralized management server:** Automatically aggregates and normalizes audit information from multiple systems and locations into a single

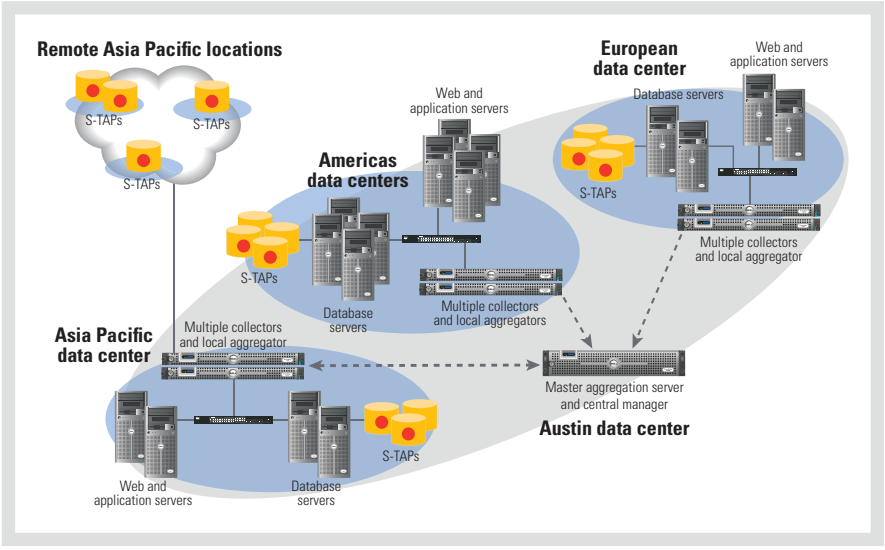

Figure 4. *The scalable Guardium architecture supports a multi-tier topology for centralized aggregation of audit data and management of security policies*

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repository for enterprise-wide regulatory standards compliance reporting, correlation, and forensics

- **Graphical Web console:** Provides centralized management of policies, report definitions, compliance workflow processes, and server settings
- **Role-based administration:** Restricts access to specific appliances, modules, policies, and audit data based on organizational roles
- **Efficient architecture for storing audit data:** Uses patent-pending, intelligent storage algorithms that provide significantly better storage efficiency than traditional flat file–based approaches
- **Lightweight Directory Access Protocol (LDAP) integration:** Supports auto-population and maintenance of groups based on existing enterprise-wide directory services

Because of its highly distributed environment, Dell implemented the Guardium architecture using a four-tier topology in which S-TAPs gather database traffic from each database server, collector appliances receive audit data from multiple S-TAPs, central aggregators in the major geographical areas receive data from multiple collectors, and a Web-based central management console in Austin provides enterprise-wide, centralized policy and appliance management.

The deployment of the Guardium platform successfully met the requirements established by Dell without causing an outage to any of its databases, and produced a significant reduction in auditing overhead in databases. The project team configured Guardium to automatically retrieve a list of table names containing highly restricted data from the Dell Data Classification tool. The Guardium architecture allows DBAs to identify and analyze previously unknown activity on the databases, such as application errors, database time-outs, and legacy scripts causing login failures. The team also implemented closed-loop change control by integrating the Guardium platform with Dell's BMC Remedy change-management system; this integration enables Dell personnel to review reports and alerts comparing all observed database changes from the Guardium system with approved change requests from the change-management system.

In the next phase of the implementation, Dell plans to deploy the Guardium platform to 725 additional database servers. Dell anticipates that this expansion will enable auditing on all databases classified as critical to essential business functions. Dell also plans functionality expansion, including the deployment of additional Guardium modules such as the Change Auditing System (CAS) module, which monitors changes to external database configuration files and environment variables that can impact security posture. Dell also plans to deploy Guardium's Vulnerability Assessment module, which provides security vulnerability and configuration assessment reporting for databases. Finally, Dell plans to deploy specialized Guardium modules for monitoring end users that interact with the database through enterprise applications such as the Oracle e-Business Suite, which use shared "service accounts" to access the database.

SECURING SENSITIVE ENTERPRISE DATA

For many enterprises, practical solutions that address the complexity and challenges of securing databases and complying with regulatory standards are critical to success. Like other organizations with globally distributed IT infrastructures, Dell needed a more scalable, secure, and reliable system than traditional security technologies and manual approaches could provide to help secure and audit access to sensitive, highly restricted data. The Guardium platform provides a comprehensive DAM system that enabled Dell to rapidly deploy and integrate it with its existing infrastructure to help enforce change controls, restrict access to sensitive data, provide automated and centralized controls for regulatory standards compliance, mitigate the risk of Web-based attacks, detect fraud, and automatically locate and classify sensitive data.

Phil Neray is vice president of marketing for Guardium and has more than 20 years of technology experience. He was previously senior director of worldwide strategic marketing for the Symantec Application and Infrastructure Management business unit, and started his career as a field operations engineer with Schlumberger working on remote oil rigs in South America. He has a Bachelor of Electrical Engineering (Honors) degree from McGill University, where he graduated with distinction.

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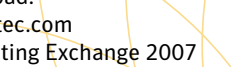

APPLICATION-AWARE DATA PROTECTION WITH DELL EQUALLOGIC AUTO-SNAPSHOT MANAGER

By Sarah Doherty

Creating application-consistent point-in-time data snapshots at the storage area network level can work well in traditional environments, but can also be a complex, manual process. Dell EqualLogic™ Auto-Snapshot Manager allows IT administrators to quickly and easily create and restore snapshots, clones, and replicas at the application level—helping simplify data management, reduce business disruption, and improve data integrity.

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Data consolidation and management

Dell EqualLogic storage

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As the demand for enterprise-class storage continues to rise, storage area network (SAN) technology has emerged as an excellent way to provide scalable, high-capacity storage for business applications. SANs—and in particular virtualized SANs such as Dell EqualLogic PS Series arrays—allow organizations to decouple applications from the physical direct attach or physically oriented networked storage systems that support them to help deliver improved efficiency and scalability in a cost-effective, high-capacity storage environment.

Although SAN deployments offer organizations significant benefits, they create challenges as well. For example, in a SAN environment, application management and storage management are generally performed separately, and organizations often employ different personnel for managing applications and managing storage. However, some management tasks—such as creating application-consistent point-in-time data snapshots—require significant coordination between applications and storage systems to help prevent inconsistencies in data. Coordinating these and other data management and protection tasks can be cumbersome and disrupt productivity.

An emerging direction in data management integrates storage management tasks into the host, enabling application managers to protect and manage data at the application level. Dell EqualLogic PS Series storage arrays provide a comprehensive SAN platform that includes Dell EqualLogic Auto-Snapshot Manager, a data management tool that integrates with Microsoft® Volume Shadow Copy Service (VSS) software to enable application-aware data protection and management. Auto-Snapshot Manager helps IT administrators create and restore snapshots, clones, and replicas of Microsoft SQL Server®, Microsoft Exchange, and NT File System (NTFS) data at the application level, enabling simplified data management and enhanced business continuity and data integrity. Auto-Snapshot Manager is included at no additional cost with all Dell EqualLogic PS Series SAN arrays.

COORDINATING DATA MANAGEMENT AT THE SAN LEVEL

Protecting and recovering data only at the SAN level can create the risk of inconsistencies in copies of application data. For example, if a snapshot is initiated while an application, such as Microsoft SQL Server, is in the middle of a write operation, the resulting point-in-time copy may be inconsistent with the production environment. To avoid such discrepancies,

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snapshot, clone, replica, and restore operations must be coordinated at both the storage and application levels.

Executing such tasks manually, however, can be complex and time-consuming. For example, creating an application-consistent snapshot can require several coordinated manual steps. First, the application manager must pause the appropriate application and ensure that all outstanding writes have been written. Then, the application manager must notify the storage manager, who can then initiate a snapshot. After the snapshot is completed successfully, the storage manager must notify the application manager, who can then safely restart the application.

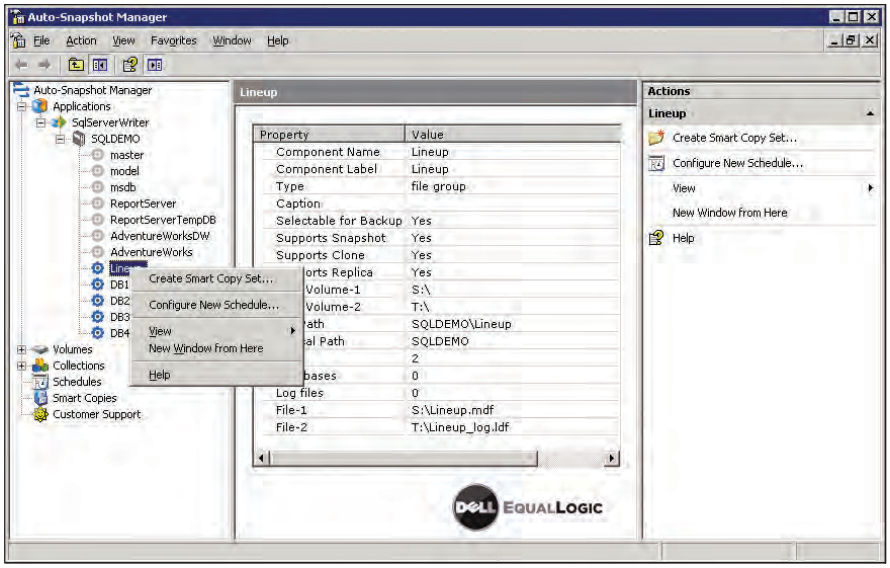

Figure 1. *The Dell EqualLogic Auto-Snapshot Manager GUI helps simplify application data management tasks*

The time and effort required to coordinate and execute such tasks can create significant business disruptions, which in turn may compromise data integrity and recoverability. When applications must be paused for a significant amount of time, application performance may be degraded, availability may be disrupted, and certain operations may fail altogether. The many steps necessary to coordinate data management at the SAN level may increase the chance of error and may compromise data integrity. Furthermore, the extensive time required to perform data protection operations often leads organizations to increase the interval between backups. And difficult data copying processes can complicate other tasks, such as data mining, application test and development, and data validation and maintenance.

Dell EqualLogic Auto-Snapshot Manager allows operations to execute on the application server with no disruption of online applications and with little or no impact on application performance. Operations can be performed by the application manager alone and require no manual coordination with the underlying storage layer. In addition to being initiated manually, data management operations can also be scheduled for convenience, and advanced scripting capabilities for further customization of operations are available as well.

Besides supporting comprehensive data protection and recovery, the functionality available in Auto-Snapshot Manager can support many common data center management tasks. For example, by making it easy to create duplicate or "cloned" environments, Auto-Snapshot Manager can help simplify and streamline data mining, application test and development, and data maintenance and validation operations. Also, Auto-Snapshot Manager offers application-aware replication capabilities, which allow application-aware copies of data to be sent from one Dell EqualLogic PS Series SAN to another at a remote site for disaster recovery purposes.

MANAGING DATA FOR WINDOWS-BASED APPLICATIONS

Dell EqualLogic Auto-Snapshot Manager utilizes Microsoft VSS capabilities for delivering application-level data management of Microsoft Windows® OS–based applications on Dell EqualLogic PS Series SAN arrays. Tight integration of Auto-Snapshot Manager with VSS can provide comprehensive support for managing SQL Server, Exchange, and NTFS data. The VSS broker service can integrate, coordinate, and automate data protection and recovery tasks among Windows-based applications to help facilitate storage management tasks. Unlike many third-party application-level data management tools, which can be costly, Auto-Snapshot Manager is available with PS Series SANs at no additional cost. In addition, the tool can be enhanced with features and support for future applications: updated versions of the tool are available for download at no additional cost for PS Series SANs covered by warranty or other service agreements.

> **"Dell EqualLogic Auto-Snapshot Manager allows operations to execute on the application server with no disruption of online applications and with little or no impact on application performance."**

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Storage and application management software packages that integrate with VSS can initiate VSS operations such as creating, importing, or deleting snapshots from the application level, helping eliminate the need to coordinate data management among applications and storage. This type of integration allows administrators to schedule operations such as data protection and recovery and data mining to take place without affecting the performance, availability, or integrity of online applications such as Microsoft SQL Server, Exchange, and NTFS.

Through a simple graphical user interface (GUI), Auto-Snapshot Manager allows administrators to easily create and manage application-consistent snapshots, clones, or replicas that can be restored (see Figure 1). In particular, administrators can create and restore full or differential copies of Windows application data, including SQL Server databases, Exchange storage groups, and NTFS.

PROTECTING AND MANAGING APPLICATION-AWARE DATA

By automating the coordination among Microsoft Windows–based applications and the underlying storage systems that support them, Dell EqualLogic Auto-Snapshot Manager is designed to dramatically simplify application data management. Because applications remain online during data management operations and application data can be quickly recovered in the event of a failure, Auto-Snapshot Manager can also help minimize the disruption to business processes that is often associated with data protection and recovery. And by avoiding the need for manual coordination, Auto-Snapshot Manager helps reduce the potential for human error and ensure the integrity, safety, and recoverability of critical data.

Sarah Doherty recently joined Dell as a senior product marketing consultant. She has over 20 years of experience in services marketing, sales, and product marketing, and has a B.A. in Economics from Brown University.

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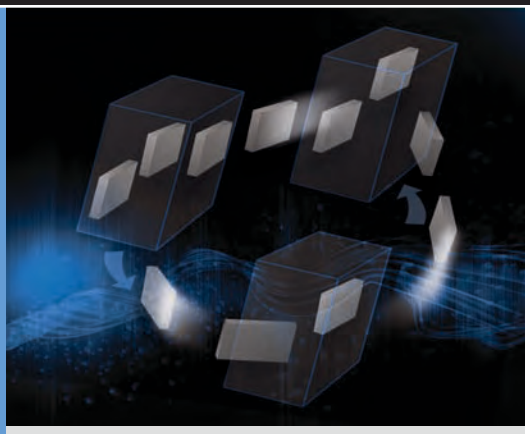

AUTOMATED DISASTER RECOVERY WITH VMWARE SRM AND DELL EQUALLOGIC iSCSI SANs

By Andrew Gilman
Jon Bock

Virtualized IT infrastructures can simplify management and facilitate business continuity while helping minimize power consumption and procurement costs. Virtualization also helps organizations automate disaster recovery plans. Dell EqualLogic™ PS Series arrays and VMware® Site Recovery Manager (SRM) software provide integrated, cost-effective, automated site recovery and testing for enterprise data centers.

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Organizations of all sizes have embraced virtualization as a key technology for consolidating server and storage infrastructure, helping reduce management costs and increase availability. Now IT managers are looking to use virtualization to help them overcome the challenges of traditional disaster recovery as well as tools to automate the recovery process. Deploying Dell EqualLogic PS Series Internet SCSI (iSCSI) arrays in conjunction with VMware Site Recovery Manager (SRM) software can help organizations implement simple, cost-effective, highly automated disaster recovery for virtualized environments.

ADDRESSING TRADITIONAL DISASTER RECOVERY DILEMMAS

Traditional disaster recovery is challenging in part because it relies on specialized hardware that is expensive and complex. Few IT staffs have the expertise to manage and maintain specialized systems for disaster recovery, which usually require costly outside service and support. IT managers also face significant costs for licensing replication software and leasing the required networked bandwidth between sites. In the face of these costs and management complexity, organizations often can provide disaster recovery only for application-level or departmental implementations. But over time, this approach can leave organizations with disparate, incompatible implementations that are inefficient to manage and provide only partial protection.

Apart from the infrastructure investment for disaster recovery, organizations often lack the internal expertise to manually coordinate site failover for what may be hundreds or thousands of servers. Although small organizations typically have fewer servers to manage than large organizations, they also may lack the resources or expertise available to manually develop recovery plans on their own. A typical recovery plan can include hundreds of detailed steps, from changing cable configurations to bringing recovery site servers online in the proper order, all of which must be fully documented. If an event occurs that requires travel to a remote site, where the recovery documentation must be followed exactly and the primary IT administrator may be out of reach, then additional complications can delay the site recovery.

Plan testing can also be a significant challenge for IT organizations. Testing is essential to help ensure a plan works properly, and may also be required by regulatory agencies or insurance companies as proof that an effective disaster recovery plan is in place.

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> **"Apart from the infrastructure investment for disaster recovery, organizations often lack the internal expertise to manually coordinate site failover for what may be hundreds or thousands of servers."**

However, the test process can cause unacceptable disruption to organizations and their customers. Typically, it takes a day or more to repeatedly adjust and retest a plan manually—and because the process involves both the production and recovery sites, the production environment must be shut down. Many companies simply cannot afford to have their services unavailable to internal or external customers for long periods.

CHANGING THE ECONOMICS OF DISASTER RECOVERY WITH iSCSI

Today, the economics of disaster recovery are changing for the better. Remote replication is available for iSCSI storage area networks (SANs). These SANs do not depend on the specialized equipment required by traditional Fibre Channel SANs, and enable organizations to leverage Ethernet infrastructure and IP networking skills already in place—helping reduce training and ongoing management costs.

The iSCSI protocol enables virtual storage implementations that complement and extend the server virtualization made possible by solutions such as VMware Infrastructure. Server virtualization consolidates enterprise application environments, while the virtualized SAN consolidates data assets to create flexible pools of networked resources. Together, server and storage virtualization enable greater scalability, flexibility, and performance compared with traditional all-physical architectures.

Organizations can realize other advantages with iSCSI SANs. The IT environment can be simplified by standardizing on IP networking for server communications, storage access, and off-site replication, further helping reduce complexity and costs. In addition, the lack of distance limitations with IP networking means that a remote recovery site can be located almost anywhere for increased disaster tolerance.

As in physical environments, IT organizations can face formidable challenges when manually developing, testing, and implementing recovery plans for virtualized environments. Tools from VMware and Dell help address these challenges by building on virtualized iSCSI storage to help simplify management and deployment of automated disaster recovery plans.

INTEGRATING REPLICATION OVER IP INTO VMWARE SRM

Dell EqualLogic PS Series arrays and VMware SRM offer an approach to disaster recovery designed to be quick, automated, and economical. PS Series arrays help reduce the complexity and cost barriers of traditional SANs by providing a cost-effective iSCSI SAN infrastructure that can be maintained efficiently by IT staff. They come with Auto-Replication software included, avoiding a major licensing expense and significant recurring software support subscription costs. Dell-engineered SRM Storage Adapter software, available as a download at no additional cost, integrates the PS Series Auto-Replication feature directly into VMware SRM.

The integration of Dell EqualLogic PS Series arrays and VMware SRM through the SRM Storage Adapter software combines the positive economics of replication over IP with automated disaster recovery made possible through virtualization, helping

STEP BY STEP: SETTING UP A DISASTER RECOVERY PLAN

IT administrators can single-handedly configure a disaster recovery implementation in a matter of minutes using Dell EqualLogic PS Series arrays and VMware Site Recovery Manager (SRM) software by following a few simple steps:

1. Initialize a PS Series array at the production site and another at the replication site.
2. Configure the built-in Auto-Replication feature to connect the two arrays.
3. Create a virtual volume at the production site to be replicated to the disaster recovery site.
4. Schedule the replication frequency—how often information is sent to the disaster recovery site (for example, every five minutes, each hour, or each day).
5. Access the VMware SRM feature in the VMware VirtualCenter application.
6. Configure VMware SRM to connect the two arrays.
7. Create a protection group of virtual machines for SRM to recover.
8. Set the order in which the virtual machines should be brought online during recovery, and configure any customized alerts.
9. Bring up the recovery site in VMware VirtualCenter and create a recovery plan.
10. Test the customized disaster recovery setup with the touch of a button.

Should a failover become necessary, VMware SRM automatically runs the recovery plan by starting virtual machines in the proper order with updated networking configurations.

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> **"Dell EqualLogic PS Series arrays help reduce the complexity and cost barriers of traditional SANs by providing a cost-effective iSCSI SAN infrastructure that can be maintained efficiently by IT staff."**

save time and enhance ease of use. This approach enables automated remote recovery and testing for large enterprises as well as automated recovery plan development that helps small organizations overcome the challenges imposed by limited staff and resources. It also advances enterprise reliability, using the redundant, hot-pluggable storage architecture of PS Series arrays and advanced system and disk monitoring capabilities to enhance system availability.

VMware SRM is a new VMware Infrastructure–based solution that provides disaster recovery management and automation for virtualized data centers—integrating tightly with VMware VirtualCenter and Dell EqualLogic PS Series array replication for recovery designed to be rapid, reliable, manageable, and cost-effective. It provides centralized management of recovery plans that not only automates the recovery process but enables enhanced testing of recovery plans. Using VMware SRM, a single IT administrator can configure a disaster recovery implementation quickly and easily (see the "Step by step: Setting up a disaster recovery plan" sidebar in this article).

AUTOMATING DISASTER RECOVERY FOR DATA CENTERS

The native Auto-Replication feature of Dell EqualLogic PS Series arrays helps perform the key disaster recovery function—making copies of data and sending the copies to a remote location at a safe distance from the primary data center. This feature integrates directly into the IP network to help overcome distance limitations. The arrays support one-to-one, bidirectional, or many-to-one replication, and the time interval for replication can be adjusted to meet the needs of the organization.

Requirements for disaster recovery include having a PS Series array and VMware VirtualCenter server at each site. Through the PS Series Auto-Replication software, the arrays are connected to a switched Ethernet fabric and the IP network. The VirtualCenter servers with SRM software can also communicate over the network. The customized Dell SRM Storage Adapter software helps tie the integrated solution together and enables comprehensive, automated site failover.

MINIMIZING MANUAL PROCESSES WHILE RETAINING CONTROL

If the primary site goes down, the volumes are already at the recovery site, and VMware SRM can automatically coordinate the process of bringing the environment online (see Figure 1). SRM runs the entire recovery plan, starting virtual machines in the intended order with updated networking configurations. Many manual procedures associated with traditional disaster recovery are eliminated, but administrators have comprehensive visibility into the execution of the recovery plan through VMware VirtualCenter, and can pause or stop execution as needed.

Another advantage of integrating Dell EqualLogic PS Series arrays and VMware SRM is the Fast-Failback capability included in the PS Series Auto-Replication feature. Fast-Failback helps eliminate the need to retransmit complete volumes when the production site is ready to come back online; instead, the system sends back only the changes that have occurred since the SRM failover operation, helping save time, bandwidth, and expense.

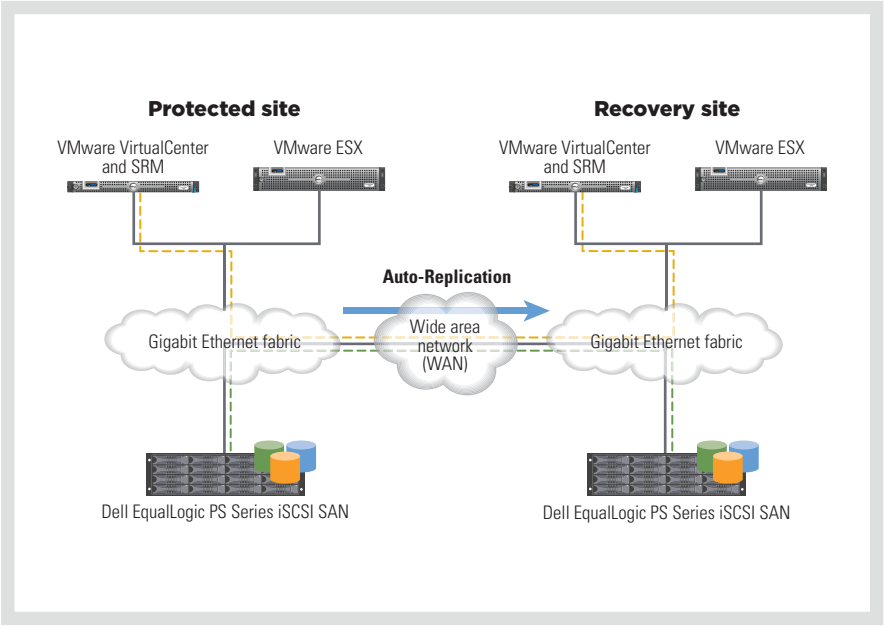

Figure 1. *The Auto-Replication feature in Dell EqualLogic PS Series iSCSI SAN arrays sends volumes to the recovery site according to a user-defined schedule*

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HOW NAVICURE STREAMLINES DISASTER RECOVERY

Virtualized infrastructure and storage helped a health care technology company set up a disaster recovery plan 75 percent faster than anticipated.

"We especially liked the fact that VMware SRM would work with the Auto-Replication feature in our Dell EqualLogic PS Series arrays, letting us build on our iSCSI investment."

—Donald Wilkins
IT director at Navicure
July 2008

Navicure handles claims transactions between physicians and insurers to help doctors speed claims processing, improve cash flow, and drive down the cost of billing. A Navicure-developed online application and outstanding customer service helped propel Navicure to the 2007 Deloitte Technology Fast 500 list of rapidly growing companies.

At Navicure, rapid growth revealed the need for flexible architecture and storage design. The company's entire IT infrastructure is standardized on Dell EqualLogic virtualized Internet SCSI (iSCSI) storage area network (SAN) technology, managing more than 75 TB of storage across 15 Dell EqualLogic PS Series arrays, including their core Oracle® database serving over 500,000 transactions each day as well as their front-end infrastructure and other services based wholly on VMware Infrastructure 3.

The company needed to find and implement a disaster recovery solution to protect its production environment, to both facilitate Health Insurance Portability and Accountability Act (HIPAA) compliance and earn key health care industry certifications. The Oracle environment is protected by Oracle Data Guard writing transactions to a standby database instance at the disaster recovery site that can quickly become the production database in the event of a site failure. The virtualized infrastructure was easy to replicate using the built-in Auto-Replication feature of the Dell EqualLogic PS Series SAN, but recovery of the virtualized infrastructure was not automated. This vulnerability made it difficult to ensure regulatory compliance.

AUTOMATED PLANNING, TESTING, AND DEPLOYMENT

The Dell team recommended that Navicure use VMware Site Recovery Manager (SRM) software with the Dell EqualLogic PS Series arrays as a simple, affordable way to automate disaster recovery of the virtualized environment. In addition, SRM storage adapters developed by Dell enabled Navicure to integrate SRM with the Auto-Replication feature in the PS Series arrays to enhance disaster recovery and provide other advantages:

- Integrated Dell and VMware solution enabled Navicure to set up a disaster recovery plan 75 percent faster than anticipated.
- Built-in automation helps reduce data recovery plan testing time from one day to 20 minutes.
- VMware SRM software can enable disaster recovery testing with no downtime for Navicure customers.
- Dell EqualLogic PS Series arrays and VMware SRM help simplify HIPAA compliance by automatically documenting successful disaster recovery test runs.
- Dell EqualLogic iSCSI-based SAN infrastructure helps simplify deployment and ongoing management.
- Automatic load balancing across all SAN resources helps optimize storage performance and resource utilization.
- Virtualized storage makes it simple to add capacity as needed to accommodate business growth.

Working with Dell, Navicure implemented a scalable, iSCSI-based infrastructure using Dell EqualLogic PS Series arrays and deployed remote disaster recovery using VMware SRM software. Not only did replication and recovery of its virtualized data center environment help Navicure comply with industry certification regulations, but the combined solution helped Navicure keep up with business growth to support its health care industry customers.

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TAKING THE COMPLEXITY OUT OF DISASTER RECOVERY

In keeping with the mission of simplifying IT with standards-based, integrated, end-to-end solutions, the integration of Dell EqualLogic PS Series arrays and VMware SRM software helps simplify the complexity of disaster recovery. PS Series arrays can help dramatically minimize the time and labor associated with setting up and virtualizing data center storage and deploying a disaster recovery plan.

For example, the need to train staff may be significantly reduced. Traditional storage may require IT staff members to attend several days of classes to set up and use their systems for disaster recovery plans, or may require costly professional service engagements. In contrast, IT staff members can quickly familiarize themselves with the PS Series arrays, and the arrays themselves can go from the box to serving data in under an hour. By using PS Series arrays together with Dell™ PowerEdge™ servers, IT organizations can deliver a comprehensive virtualized infrastructure designed to enable and protect the entire enterprise.

In addition, IT organizations can implement replication between additional sites without buying additional software and licenses for various systems—helping simplify the process of scaling their infrastructure as the organization grows. Dell EqualLogic PS Series arrays include expanded functionality at no additional cost and come with a comprehensive suite of data protection tools. IT administrators can also update or modify a recovery plan at any time through the VMware VirtualCenter management console and VMware SRM.

"PS Series arrays can help dramatically minimize the time and labor associated with setting up and virtualizing data center storage and deploying a disaster recovery plan."

SETTING UP AND TESTING AUTOMATED DISASTER RECOVERY

After the virtualized environment is in place, Dell EqualLogic PS Series arrays and VMware SRM enable rapid disaster recovery setup. PS Series arrays provide tools that help simplify the configuration of replication partners and protection groups for rapid deployment (see Figure 2). The SRM software guides IT administrators through the setup process. Using the VMware VirtualCenter management interface, administrators can quickly set plan parameters such as the order in which virtual machines are powered up, and specify the virtual machines that can be suspended to free resources for recovery.

VMware SRM also helps save IT organizations days of work by automating the recovery documentation that contains the step-by-step directions for orchestrating site recovery. Traditional disaster recovery methods use complex paper documentation that is difficult to compile and manage. VMware SRM enables administrators to readily capture the recovery steps in electronic form, which becomes an integrated element of virtual infrastructure management.

This approach also enhances the efficiency of testing disaster recovery plans. In this case, failover executes in an isolated environment, and the environment is quickly and automatically cleaned up following the testing to help avoid disrupting operations. As a result, the IT team can minimize impact on the production environment and avoid downtime for customers. VMware SRM allows administrators to initiate the test at the touch of a button, watch it run automatically, and then make changes (see Figure 3).

In addition, the automated testing capability helps simplify compliance with regulatory specifications[1]—for example, helping streamline Health Insurance Portability and Accountability Act (HIPAA) compliance for organizations in the health care industry (see the "How Navicure streamlines disaster recovery" sidebar in

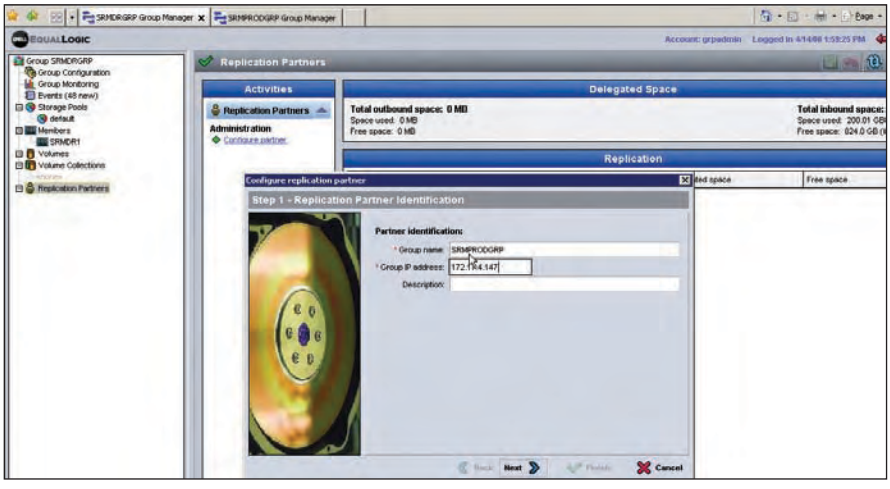

Figure 2. *Group Manager software included with Dell EqualLogic PS Series arrays helps simplify the configuration of replication partners and protection groups*

[1] These materials reflect Dell's view of compliance with the statutes and standards as of July 2008 and may be superseded by changes in the statutes/standards. This information is not intended as legal advice and may not be used as such, nor does this information reflect a full and exhaustive explanation of all relevant statutes and standards. You should seek the advice of your own legal counsel on any legal compliance questions.

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this article). Instead of running multiple demonstrations, administrators can provide a report to management documenting that a complete test of the organization's disaster recovery plan has been conducted successfully. Because failover is automated, regulatory bodies presented with a copy of the report may be assured that the process will run successfully in the future.

USING VIRTUALIZED iSCSI STORAGE TO DEPLOY DISASTER RECOVERY

When hurricanes hit the Gulf Coast, tornadoes strike the Midwest, or wildfires threaten western states, organizations are reminded that almost any location can be susceptible to disaster. The potential for disaster adds urgency to the importance of implementing a business continuity plan that includes remote disaster recovery.

The good news is that disaster recovery no longer must be a complex, manual process or an afterthought put off because of cost considerations. Instead, it can be part of the initial IT discussion for utilizing virtualization in the data center. By implementing Dell EqualLogic PS Series arrays and VMware SRM software, organizations can deploy flexible disaster recovery using virtualized iSCSI storage in the data center. And because integrated Dell EqualLogic PS Series arrays and VMware SRM help free IT administrators from time-consuming SAN management tasks, organizations can use valuable staff resources for application development and strategic planning that advances bottom-line business goals.

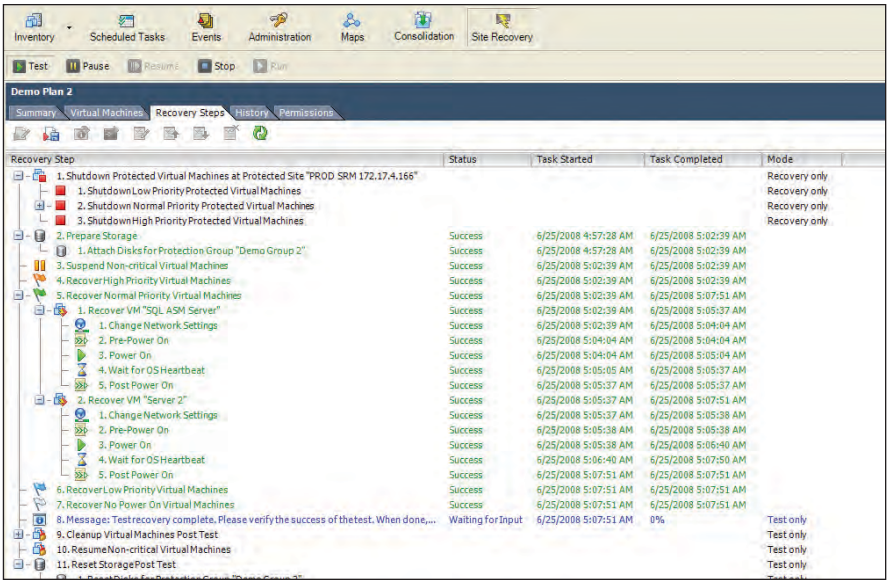

Figure 3. *Recovery plan testing with VMware SRM helps administrators start and stop trial runs and pause them to make changes*

Organizations of all sizes are embracing iSCSI SANs and the next-generation disaster recovery enabled by server and storage virtualization. Using Dell EqualLogic PS Series SANs and VMware SRM, organizations worldwide can achieve simple, cost-effective, and highly automated disaster recovery for their virtualized data centers.

Andrew Gilman is a solutions marketing manager at Dell responsible for virtualization marketing activities for the Dell EqualLogic product family. Before coming to Dell, he held a variety of product marketing roles at EMC and worked in both technical and marketing capacities at several successful startups in the telecommunications industry. Andrew has a B.S. in Business Administration from the Boston University School of Management.

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THE DELL AX4-5: COST-EFFECTIVE, SIMPLIFIED STORAGE FOR SMBs

By Greg White
Eric Cannell

Small and medium businesses (SMBs) often contend with the same storage growth challenges as large enterprises, but with limited IT staff and resources. The Dell™ AX4-5 storage array is designed to help SMBs consolidate their data to a streamlined, scalable, high-performance storage environment in a cost-effective, easy-to-manage way.

Related Categories:

Dell/EMC storage
Direct attach storage (DAS)
Storage
Storage area network (SAN)
Storage consolidation

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Storage needs are estimated to be growing at an average of 50 percent per year, which is causing many organizations to face increasingly complex challenges related to managing and protecting their rapidly increasing data. Although many high-end solutions are available for large enterprises, they typically have a correspondingly high cost and require expertise that can be beyond the reach of small and medium businesses (SMBs) with fewer than 500 employees. These SMBs may have several servers and rely on a combination of internal storage and direct attach storage (DAS) systems, and although they may have considered consolidating to a storage area network (SAN), concerns about the potential costs and risks of performing such a consolidation may have led them to reject this option.

The Dell AX4-5 storage array is designed to help meet the needs of SMBs struggling with data growth, inefficient storage environments, and difficult, time-consuming IT management—placing storage consolidation within the reach of organizations with limited IT staff and resources. Designed for flexible Internet SCSI (iSCSI) or Fibre Channel connectivity and providing streamlined management tools, enhanced scalability, high performance, and powerful backup and recovery options, the Dell AX4-5 provides a flexible, cost-effective way for SMBs to implement a SAN in their IT environments.

UNDERSTANDING THE NEEDS OF SMALL AND MEDIUM BUSINESSES

SMBs are a major part of the global economy, but their limited resources often prevent them from realizing the benefits of the consolidated storage systems used by large enterprises. Like those large enterprises, SMBs face increasing storage needs, but typically do not have the luxury of a large, dedicated IT staff that can design, install, and administer an effective storage management system. They also typically lack large budgets for storage.

Because of these challenges, many SMBs rely on adding DAS to their servers rather than implementing network attached storage (NAS) or a SAN. Figure 1 illustrates typical stages of storage growth for SMBs as they shift from internal storage to DAS, NAS, and a SAN. For organizations with only one server, internal storage or DAS may provide sufficient capacity while still being manageable. As these environments grow to four servers or more, however, deploying and managing multiple DAS systems can bring rapidly diminishing returns—the systems may be cost-effective and easy to deploy in the short term, but in the long term result in higher costs, lower utilization

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rates, and more difficult management than NAS or a SAN. For example, DAS systems are notorious for underutilization, often running significantly below capacity. In addition, as administrators add devices over time, they often end up deploying different models or systems from different vendors, which can make maintenance, upgrade, patching, and backup processes difficult and inefficient.

SMBs need storage that is simple and cost-effective while offering robust management, reliability, and scalability. An ideal system would be one that provides enterprise-class functionality while supporting easy deployment and the ability to add capacity and functionality that aligns with business growth. For many SMBs, DAS systems cannot meet all of these requirements.

INTRODUCING THE DELL AX4-5 STORAGE ARRAY

The Dell AX4-5 can help SMBs meet the challenges of increasing storage needs in their environments, integrating enterprise-class features in a simplified, cost-effective storage array. Designed for flexibility, the Dell AX4-5 storage array offers tiered storage that supports mixing high-performance Serial Attached SCSI (SAS) drives typically suited for demanding applications with cost-effective, high-capacity Serial ATA (SATA) drives typically suited for backup and archiving. The array supports up to 64 servers and can provide up to 60 TB of capacity when configured with the maximum of 60 hard drives, while optional dual controllers help increase availability, reliability, and performance for critical applications.

Integrated EMC® Navisphere® Express and Navisphere Manager software help simplify array installation and provisioning, while EMC SnapView™, MirrorView™, and SAN Copy™ software provide advanced data protection, replication, and migration features. Key features like snapshots and full-volume copies can provide multiple advantages as part of an overall backup and recovery strategy:

- Nondisruptive disk-to-disk-to-tape backups allow applications to access data during the backup and provide off-site copies.
- Multiple servers or users have read/write access to copies of the production data, helping increase efficiency.
- IT staff can rapidly restore data and applications following a hardware failure, disaster, or other disruption.
- Application development can be accelerated, because applications can be tested with the latest data without affecting production systems.
- Backup data can be stored on cost-effective, high-capacity SATA drives, helping control costs.

Dell AX4-5 arrays can support either 1 Gbps iSCSI or 4 Gbps Fibre Channel, providing organizations with the flexibility to choose a network interconnect that suits their requirements. When deciding between the two, SMBs should typically consider their existing network and storage environment, the type of applications they use and their performance demands, backup and recovery policies, IT staff expertise and experience, and budget. Fibre Channel generally provides high levels of performance and availability, and is well suited for backup and recovery operations as well as streaming video; however, it can also be expensive to implement and require special skills to deploy and maintain. Because iSCSI uses standard Ethernet technology, it is typically easier and more cost-effective to deploy than Fibre Channel, and can offer performance comparable to Fibre Channel for many applications, including e-mail and database software.

In general, Fibre Channel is suitable when maximum performance is critical, IT administrators have the expertise to manage a Fibre Channel deployment, the cost of Fibre Channel host bus adapters and switches is justified by business requirements, and/or compatibility with other data centers is critical. iSCSI is generally suitable when organizations are implementing their first SAN, controlling costs is more important than sheer performance, IT administrators are unfamiliar with Fibre Channel or prefer working with Ethernet, and/or the environment does

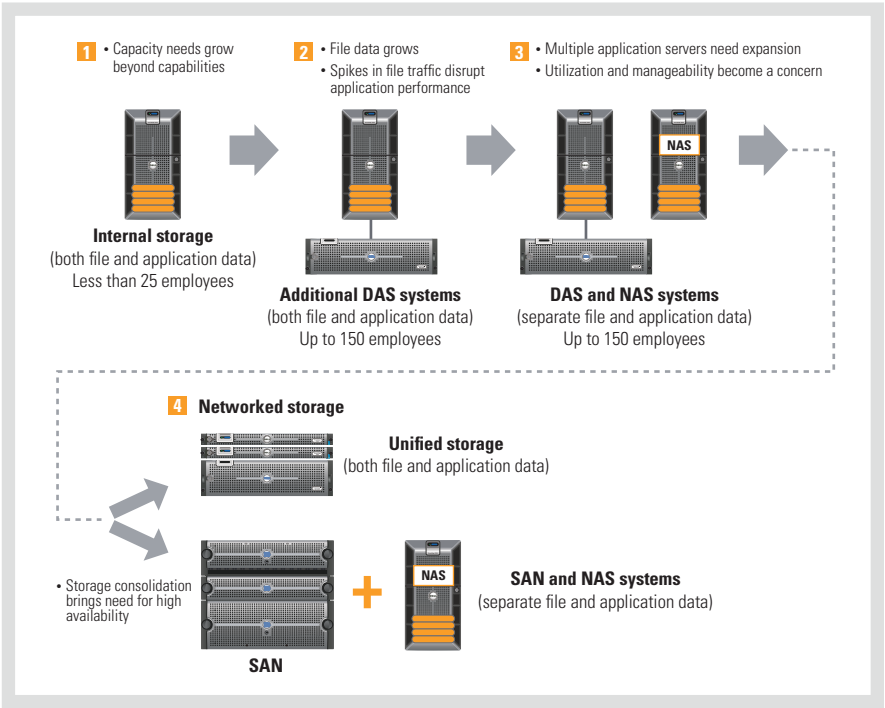

Figure 1. *Typical stages of storage growth for small and medium businesses*

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"The Dell AX4-5 is designed to provide the alternative SMBs are looking for—a cost-effective, simplified, flexible storage array for organizations that want to consolidate their storage to a SAN for the first time or to deploy a SAN at a remote office."

not require advanced replication or data migration options that would typically require Fibre Channel.[1]

DEPLOYING COST-EFFECTIVE, SIMPLIFIED STORAGE

For SMBs that have been limited by the complicated management and expense of multiple DAS systems, the Dell AX4-5 provides a simple and cost-effective way to deploy a flexible, scalable, easy-to-manage SAN. For example, at an organization looking to move beyond DAS, the in-house IT staff might solicit feedback from each department to help them determine the company's needs and then design and plan the Dell AX4-5 storage deployment accordingly. They might choose the iSCSI-based model because the IT staff is thoroughly familiar with the technology and because the required hardware is cost-effective and easy to install.

When the IT staff is ready to deploy the system, the integrated EMC Navisphere Express management software can guide them through the installation and configuration process. They can choose only the number and type of drives they need to meet their short-term demands, knowing that they can expand the system quickly and easily as their data needs grow. Features like snapshots and full-volume copies of critical data can help them implement a comprehensive backup and recovery plan.

In this type of example scenario, the Dell AX4-5 SAN would typically result in fewer physical devices with higher utilization rates than the previous DAS-based storage environment, while providing increased performance levels to help keep key applications responsive to end users. The simplified storage environment and management help free IT staff from mundane administrative tasks and enable them to implement security policies and deploy updates quickly and easily, without disrupting production systems.

MEETING THE CHALLENGES OF DATA GROWTH

SMBs are often concerned that attempting to consolidate their storage may result in spending too much on a system that their in-house IT staff cannot manage. Feeling that they have no viable alternative to a DAS-based environment, they continue to live with the inefficiencies, potential security issues, and management difficulties that often accompany these systems.

The Dell AX4-5 is designed to provide the alternative SMBs are looking for—a cost-effective, simplified, flexible storage array for organizations that want to consolidate their storage to a SAN for the first time or to deploy a SAN at a remote office. Dell support and services can also help address the ever-growing storage needs of SMBs, including storage assessment services that can help organizations understand their existing storage environments and how to meet their specific requirements for data archiving, capacity management, data retention, and other aspects of storage. By taking advantage of these services and the Dell AX4-5 array, SMBs can gain the benefits of storage consolidation previously available only to large enterprises—including streamlined management, enhanced scalability, and high performance.

Greg White is a storage marketing manager in the Dell Global Commercial Marketing organization. He has worked for and with SMBs for 14 years, and for the last several years has focused on helping businesses find solutions for their data growth, data management, and data protection problems.

Eric Cannell is a product marketing manager for Dell/EMC storage systems. He has 16 years of experience developing enterprise technology products, before which he spent 6 years as a software engineer at the NASA Jet Propulsion Laboratory. Eric has B.S. degrees in Astronomy and Computer Science from the University of Illinois, an M.S. in Computer Science from the University of Southern California, and an M.B.A. from the Tuck School of Business at Dartmouth College.

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[1] For more information on iSCSI and Fibre Channel, see "iSCSI: Changing the Economics of Storage; Part 1—Understanding iSCSI in Enterprise Environments," by Travis Vigil, in *Dell Power Solutions*, May 2007, DELL.COM/Downloads/Global/Power/ps2q07-20070335-Vigil.pdf; and "iSCSI: Changing the Economics of Storage; Part 3—Using iSCSI in Small and Medium Businesses," by Travis Vigil, in *Dell Power Solutions*, November 2007, DELL.COM/Downloads/Global/Power/ps4q07-20070402-Vigil.pdf.

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THE DELL POWERVAULT MD1120: HIGH-PERFORMANCE DIRECT ATTACH STORAGE

By Rohit Bhat
Vishal Kadam

The new Dell™ PowerVault™ MD1120 storage enclosure is designed to provide high-performance direct attach storage for ninth-generation and later Dell PowerEdge™ servers. Taking advantage of energy-efficient, rack-dense 2.5-inch Serial Attached SCSI (SAS) drive technology, this enclosure is well suited for applications requiring high I/O or throughput rates.

Related Categories:

Data consolidation and management

Dell PowerVault storage

Serial Attached SCSI (SAS)

Storage

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The new Dell PowerVault MD1120 direct attach storage (DAS) enclosure takes advantage of energy-efficient 2.5-inch Serial Attached SCSI (SAS) drives to provide exceptional I/O performance coupled with optimized rack density. As a high-performance JBOD (Just a Bunch of Disks), this 2U enclosure supports up to 24 drives, and can be daisy-chained with up to two other enclosures for up to 72 total drives. Its modular design utilizes the same type of drive as Dell PowerEdge servers and a common set of hardware and software components used across PowerVault MD Series storage, allowing it to integrate easily into existing infrastructures and scale to help meet future requirements.

The PowerVault MD1120 can connect to ninth-generation and later Dell PowerEdge servers through a PowerEdge Expandable RAID Controller (PERC) 6/E. It can function in both unified and split modes, and can be managed using Dell OpenManage™ Server Administrator, Dell OpenManage Storage Services, and Dell PowerEdge Diagnostics software. While the comparable PowerVault MD1000 enclosure is designed for general-purpose storage and supports both SAS drives and cost-effective, high-capacity Serial ATA (SATA) II drives, the PowerVault MD1120 is primarily suited for applications that require high I/O-per-second performance or high megabyte-per-second throughput rates (see Figure 1).

KEY ENCLOSURE FEATURES

The PowerVault MD1120 is designed for high performance and efficiency, and is based on a modular architecture utilizing upgradable components and designed to integrate seamlessly into existing environments. The 2.5-inch drives used in the PowerVault MD1120 offer several advantages over the standard 3.5-inch drives commonly used in storage enclosures. By offering higher random I/O performance and higher drive densities per shelf than comparable 3.5-inch drives, 2.5-inch drives can help meet the dual objectives of high performance and efficient use of space. Because they typically use less power than comparable 3.5-inch drives, they can help reduce operational costs and total cost of ownership. And their small form factor also allows increased airflow, helping provide efficient system cooling.

The PowerVault MD1120 enclosure offers several advantages in enterprise data centers:

- **High performance:** The PowerVault MD1120 supports 2.5-inch, 3 Gbps SAS hard drives (10,000 rpm and 15,000 rpm) well suited for applications requiring high I/O or throughput rates. Its external

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	PowerVault MD1000	PowerVault MD1120
Rack space	3U (rack only)	2U (rack only)
Drive bays	15 (3.5-inch drives)	24 (2.5-inch drives)
Supported drive types	3 Gbps SAS and 3 Gbps SATA II	3 Gbps SAS (designed for future support for SATA)
Expandability	Three shelves for a total of 45 drives per host port (unified mode only)	Three shelves for a total of 72 drives per host port (unified mode only)
Management	In-band, using Dell OpenManage Server Administrator	In-band, using Dell OpenManage Server Administrator
Backplane options	Unified or split JBOD	Unified or split JBOD
Supported RAID controllers	PERC 5/E and PERC 6/E	PERC 6/E only
Cluster support	No	No
Hot-pluggable drives	Yes	Yes
Hot-pluggable fans and power supplies	Yes (combined fan and power supply modules)	Yes (combined fan and power supply modules)
Enclosure management configurations	Redundant and nonredundant	Redundant and nonredundant
Fan and power supply configuration	Redundant	Redundant
Primary use	General-purpose storage utilizing cost-effective, high-capacity drives	High-performance storage for applications requiring high I/O or throughput rates

Figure 1. *Comparison of Dell PowerVault MD1000 and PowerVault MD1120 storage enclosures*

cable supports a SAS x4 wide lane for a total interface bandwidth to the host controller of up to 12 Gbps.

- **High availability:** The PowerVault MD1120 supports RAID-0, RAID-1, RAID-5, RAID-6, RAID-10, RAID-50, and RAID-60. It is designed with redundant, hot-pluggable physical disks and combined fan and power supply modules, as well as redundant enclosure management modules (EMMs) for managing internal enclosure functions such as temperature regulation, LED control, and alarm control even following the failure of one EMM.
- **Scalability:** Administrators can daisy-chain up to three PowerVault MD1120 enclosures per PERC 6/E connection, allowing them to scale their storage to up to 72 SAS drives in 36 GB, 73 GB, or 146 GB sizes, for a potential total capacity of over 10 TB per PERC 6/E connection. Organizations can also deploy it alongside PowerVault MD1000 enclosures to help build a tiered environment, using PowerVault MD1120 enclosures with high-performance applications and PowerVault MD1000 enclosures for general-purpose storage based on cost-effective, high-capacity SATA II drives.
- **Ease of use:** The PowerVault MD1120 utilizes a set of hardware and software components common across Dell MD Series storage, helping increase flexibility and allowing the system to integrate easily into existing infrastructures. Administrators can use standard Dell OpenManage Server Administrator software for monitoring and management functions.

FLEXIBLE ENCLOSURE MODES

Administrators can set the PowerVault MD1120 enclosure to either unified or split mode using a switch located on the front panel. Changing modes only takes effect when the enclosure is powered up, meaning that administrators should be sure to power down and then power up the enclosure after changing its configuration. Administrators should also ensure that the mode switch is in the appropriate position each time they power up the enclosure; if the position of the switch changes inadvertently, data loss could occur if the controller then recognizes an incorrect number of attached physical disks. When power cycling a PowerVault MD1120, all attached servers must be powered down.

Unified mode

In unified mode, a single server has access to all 24 physical disks in the enclosure through a single SAS cable. This mode can also provide a single server with access to the maximum of 72 physical disks per PERC 6/E connection when three enclosures are daisy-chained from a single host port. The primary advantage of unified mode is its high degree of physical disk scalability. Administrators should note that when using this mode, they can connect only a single host to the primary EMM (EMM 0) controller.

Figure 2 shows a fully scaled unified-mode deployment in which two sets of

"The Dell PowerVault MD1120 is designed for high performance and efficiency, and is based on a modular architecture utilizing upgradable components."

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three daisy-chained PowerVault MD1120 enclosures are attached to a single host server, providing up to 144 physical disks of storage for that server.

Split mode

In split mode, the enclosure is divided into two logical enclosures, with each host connection accessing its own set of physical disks. The primary EMM—located on the left side of the enclosure when viewed from the rear—accesses physical disk slots 12–23, while the secondary EMM accesses physical disk slots 0–11. Each host server sees only its own physical disks.

To connect a server to an enclosure in split mode, administrators should attach the "in" port of each EMM to a connector of a PERC 6/E controller. Because this mode does not support daisy-chaining additional enclosures, the "out" port of each EMM is disabled in this mode. A system with a single EMM can function properly in this mode, but the server sees only the physical disks connected to that EMM. Split mode is primarily useful in deployments where a single PowerVault MD1120 enclosure provides limited amounts of storage for two different servers.

Figure 3 illustrates a split-mode deployment in which two host servers are connected to a single PowerVault MD1120 enclosure, with each server accessing its own set of physical disks in the enclosure.

HIGH-PERFORMANCE DIRECT ATTACH STORAGE

The new Dell PowerVault MD1120 is designed to provide an efficient, high-performance DAS enclosure for ninth-generation and later Dell PowerEdge servers that can be deployed on its own or as a complement to the cost-effective, high-capacity general-purpose storage of the PowerVault MD1000. Based on rack-dense, energy-efficient 2.5-inch SAS drives, the PowerVault MD1120 is well suited for enterprises relying on performance-oriented applications in their data center environments.

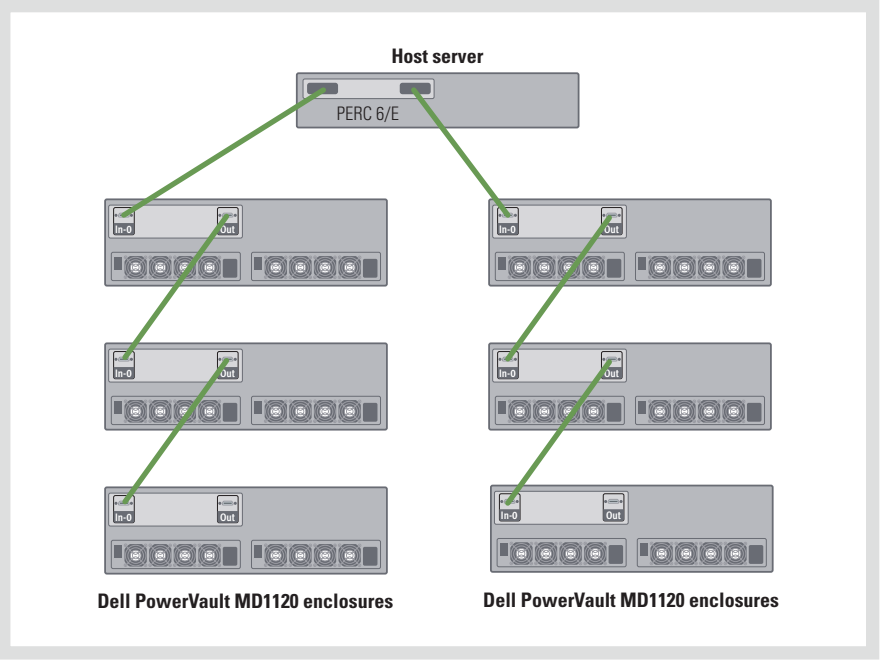

Figure 2. *Fully scaled unified-mode deployment of Dell PowerVault MD1120 storage enclosures*

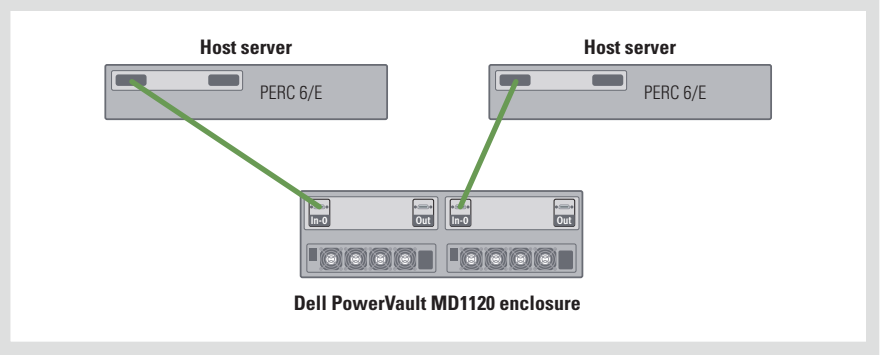

Figure 3. *Split-mode deployment of a Dell PowerVault MD1120 storage enclosure*

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USING DOUBLE-TAKE SOFTWARE TO MIGRATE, CONSOLIDATE, AND PROTECT HETEROGENEOUS STORAGE

By Ward Wolfram
Michael Hickey
Nicholas Schoonover

In heterogeneous storage environments, a lack of interoperability can be a critical barrier to effective data management. Double-Take® software helps overcome this challenge by providing a cost-effective, simplified way to migrate, consolidate, and protect data in these environments, including those using multiple types of Dell™ servers and storage.

Related Categories:

Data consolidation and management
Dell EqualLogic storage
Dell PowerVault storage
Disaster recovery
Double-Take Software
Replication
Storage
Storage software

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Enterprise data centers often include multiple types of storage hardware from different vendors, which can introduce several challenges for IT organizations. For example, administrators typically must become experts on each type of storage, understanding the management intricacies and capabilities of each model. Because each storage vendor has typically implemented its own technologies and methods for handling data, different arrays are often incompatible with one another, resulting in isolated storage islands across the data center. And finally, migrating, consolidating, and protecting data on different storage arrays is often difficult, time-consuming, and expensive, and may even require costly consulting services to carry out.

The key to seamlessly migrating or consolidating data across dissimilar storage hardware is to use a storage-independent replication engine, one that administrators can place on a host server and use with any type of storage that the server can mount. The comprehensive Double-Take suite provides a simplified, cost-effective solution for storage-independent data migration in enterprise data centers, one that can help administrators easily migrate, consolidate, and protect data across different types of storage hardware while including cost-effective high-availability and disaster recovery capabilities. Administrators can take advantage of these powerful, flexible tools to carry out common migration, consolidation, and data protection tasks across multiple types of Dell servers and storage and in other heterogeneous environments, helping seamlessly interconnect hardware that might be otherwise incompatible.

SIMPLE STORAGE MIGRATION

Migrating data between storage systems using Double-Take software is typically a simple process—administrators mount the new storage to a Double-Take software–enabled host server and create a replication set between the two systems. Figure 1 shows an example environment in which administrators have configured a Microsoft® Exchange server with a Dell PowerVault™ 220 direct attach storage (DAS) system, and are now migrating their data to a PowerVault MD3000i Internet SCSI (iSCSI) storage area network (SAN).

Host-based replication is well suited for migration because of its ability to bridge dissimilar storage technologies as well as its ease of use and cost-effectiveness. In the example environment shown in Figure 1, Double-Take software can replicate the real-time data changes of the live Exchange server from the PowerVault 220 to the PowerVault MD3000i iSCSI SAN. After the data has been fully synchronized, administrators can un-mount the Exchange server from the

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PowerVault 220 and mount the replicated stores from the PowerVault MD3000i SAN. The robust, simplified tools provided by Double-Take software are designed to support migration of any Microsoft Windows® OS–based or Red Hat® Enterprise Linux® OS–based application data.

SERVER AND STORAGE MIGRATION

Migrating data to a new storage array often provides a good opportunity to migrate or upgrade to the latest Dell PowerEdge™ server platforms as well (see Figure 2). Double-Take software includes tools such as Full-Server Failover (FFO) for server migrations that remove Windows hardware driver dependencies, enabling administrators to migrate entire systems—including the system identifier (SID), registry, system files, and applications—through an easy-to-use graphical interface while those systems are still running (see Figure 3). Once the synchronization is complete, administrators can shift the new server and storage platforms into production. This solution helps IT organizations optimize time and resources without the complex, time-consuming process of taking servers offline to perform a backup, then restoring, reconfiguring, and testing the new servers—ultimately enabling comprehensive server migrations without the downtime and risks associated with traditional approaches to migration.

In addition, the FFO technology in Double-Take software enables uninterrupted physical-to-physical, physical-to-virtual, and virtual-to-physical migration of production servers, providing IT organizations with a high degree of flexibility in their environments and avoiding limiting them to a single storage vendor or storage array.

Double-Take software includes a virtual appliance that allows IT administrators to perform large-scale physical-to-virtual migrations using the Double-Take Virtual Recovery Assistant. The Virtual Recovery Assistant helps reduce the complex, often

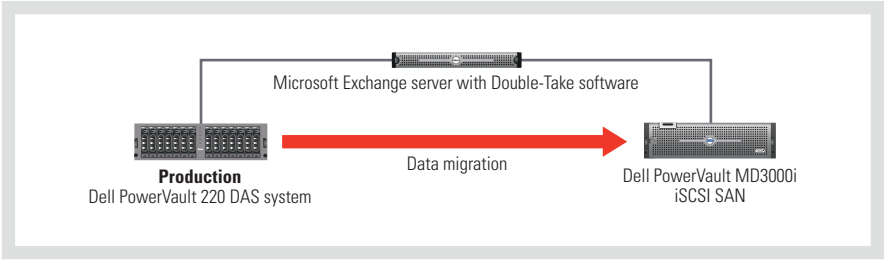

Figure 1. *Migration between two Dell storage arrays using Double-Take software*

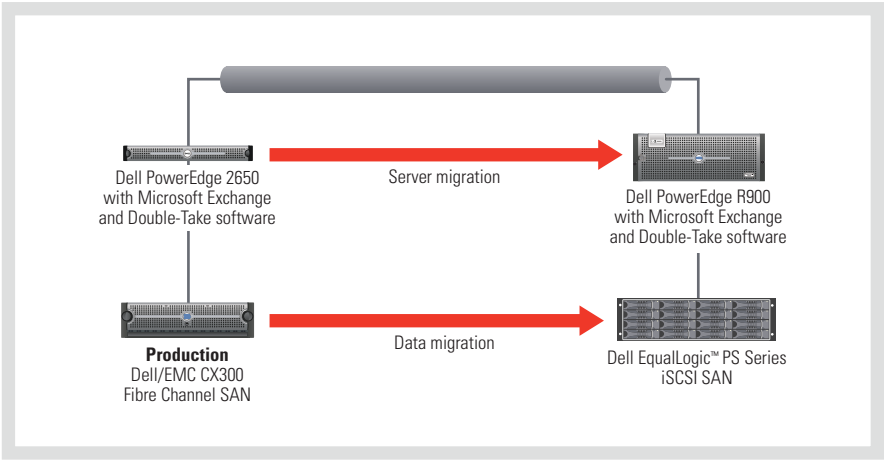

Figure 2. *Migration between Dell servers and storage using Double-Take software*

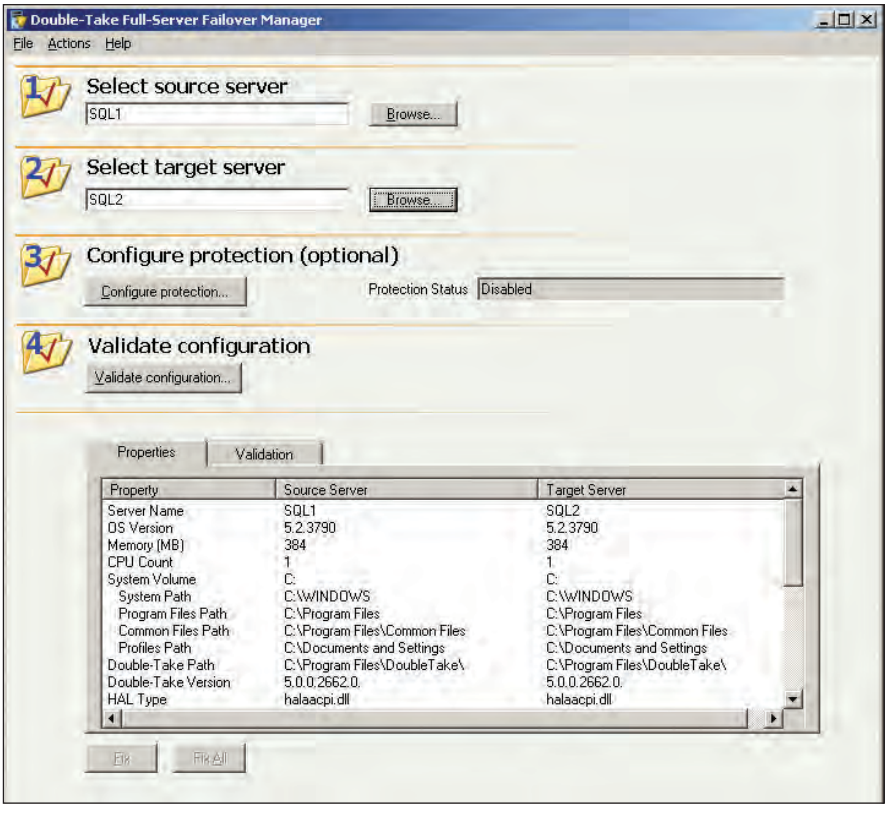

Figure 3. *Double-Take graphical interface designed for ease of use*

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manual steps required to ready a new virtualized environment for migration. It does the work of provisioning the target virtual machine for the user—helping eliminate the need to set up the new virtual machine and install an OS, patches, or applications. Because Double-Take software can replicate changes to data in real time, end users can continue to access production applications right up until the workload is migrated.

SERVER AND STORAGE CONSOLIDATION

IT organizations often struggle to manage islands of data in remote or branch offices and departmental work groups, as well as data created by mergers and acquisitions that may create vulnerabilities. Consolidating applications and data to a single site can help ease management of this type of data, but can be difficult to carry out in heterogeneous environments. Because Double-Take software is designed to work over long-distance wide area network (WAN) topologies, including the Internet and IP networks, it can help administrators consolidate data to a central location regardless of differences in hardware platforms (see Figure 4).

SERVER AND STORAGE DATA PROTECTION

Because some application servers and storage systems need to be physically close to end users at remote sites, IT organizations often still need a way to reliably protect those systems. Double-Take software enables them to continue protecting applications and data in real time with minimal bandwidth requirements, using patented transaction-aware data integrity algorithms to help eliminate concerns about database corruption or reduced performance for production applications.

Double-Take software can also provide continuous data protection in heterogeneous storage environments. The Double-Take TimeData™ product helps extend server and storage data protection by providing granular data recovery for Microsoft Exchange, Microsoft SQL Server®, and other Microsoft Windows–based applications—enabling administrators to quickly recover from common problems such as viruses, data corruption, deleted files, and human error. Coupled with Double-Take software, TimeData helps extend enterprise recovery capabilities to include operational recovery in addition to disaster recovery.

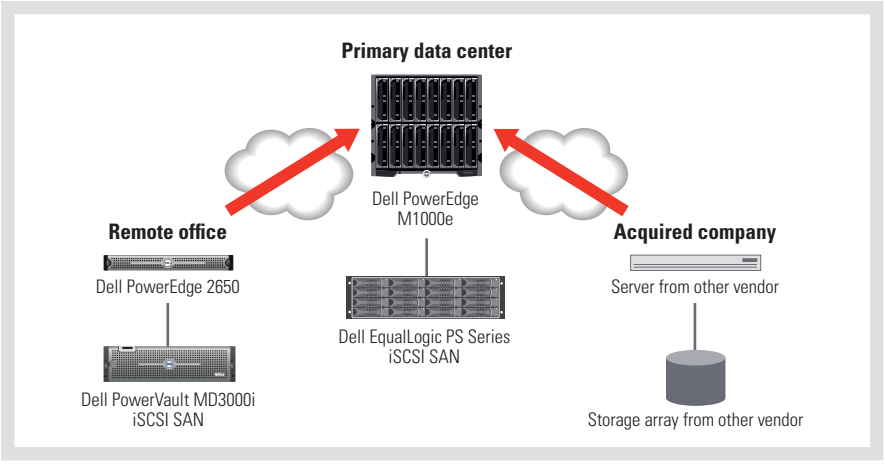

Figure 4. *Consolidation to a single site using Double-Take software*

SIMPLIFIED MIGRATION, CONSOLIDATION, AND DATA PROTECTION

Double-Take software is designed to provide a flexible, cost-effective way to migrate, consolidate, and protect data in heterogeneous environments while avoiding interruptions in service when administrators perform these key tasks. IT organizations can help further reduce total cost of ownership by combining Double-Take software with virtualization software from VMware, Microsoft, or Citrix, including the VMware® ESX, VMware ESXi, and Microsoft Hyper-V™ platforms. Implementing Double-Take software in environments based on Dell servers and storage helps provide a simplified, cost-effective way to manage data for large global IT organizations as well as the IT departments of international emerging-market organizations and small and medium businesses.

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Michael Hickey is the director of strategic alliances and manages the Dell Sales and Marketing Alliance for Double-Take Software. He has a B.A. in Economics from the University of Rhode Island.

Nicholas Schoonover is a senior solutions architect at Double-Take Software and works with enterprise customers and strategic alliances to design data protection solutions. He attended the Ohio State University and majored in Computer Science.

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HOW ARCHIVEIQ DATA DE-DUPLICATION SIMPLIFIES BURA

By helping eliminate redundant backup data, de-duplication provides a key way to streamline backup, recovery, and archiving (BURA) for organizations of all sizes. Combining Data Storage Group ArchiveIQ™ software with Dell EqualLogic™ PS Series storage arrays can help overcome common BURA challenges and enable cost-effective, scalable, and simplified disk-based data protection.

By Pete Caviness

Related Categories:

Backup, recovery, and archiving (BURA)

Data consolidation and management

Data Storage Group

Dell EqualLogic storage

Storage

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Data backup, recovery, and archiving (BURA) systems can be among the most time-consuming and costly aspects of systems management in enterprise IT environments. Protecting and retaining data is a critical function, but the tape-based processes that many organizations use today—copying and storing the same data over and over again, week after week—is difficult to scale, and can become increasingly costly and complex as organizations contend with exponential data growth.

Disk-based backup has been available for years, but many organizations have either viewed it as too costly to implement or restricted its use to a temporary step in a disk-to-disk-to-tape process. Legacy BURA systems, meanwhile, often treat disk as sequential access tape, wasting much of their capacity by storing redundant data. For a disk-based BURA system to be viable, it must address disk capacity costs, storage scalability, management overhead, and efficient off-site protection.

Data de-duplication provides a key way for organizations to overcome the problems of traditional BURA systems and create cost-effective, scalable, and simplified disk-based data protection. By combining Data Storage Group ArchiveIQ software with flexible storage platforms such as Dell EqualLogic PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays, organizations can help streamline data management while controlling costs and enabling their BURA systems to scale to meet their needs.

COMMON BURA CHALLENGES

As organizational data growth continues to accelerate, legacy processes of copying and storing the same data every week become an increasingly inefficient way to protect and archive data. Administrators must contend with a variety of challenges related to BURA as their data needs increase:

- **Growing backup windows:** As data grows, the server and network impact of backup can no longer be isolated to nights and weekends. The amount of time between backup images may also grow, increasing the chances of data loss.
- **Time-consuming recovery:** Data recovery from tape media is notoriously time-consuming and complex compared with recovery from disk-based systems. Organizations are trying to keep an increasing number of recovery points on disk and readily available to enhance service to both internal and external users.
- **Need for remote office data:** Remote office data that is located across low-bandwidth connections typically requires dedicated backup systems and administration. Creating consistent, reliable backups of remote data can be expensive and difficult—and

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keeping these backups at a centralized location can be even more challenging.

- **Large, active files:** Large files that are constantly changing—such as Microsoft® Office Outlook® .pst files, databases, and virtual machine disk files—are a significant problem for many BURA systems. Protecting these files can require a significant amount of storage capacity.
- **Unreliable backup validation:** Legacy backup images are typically validated only once, when they are first created. If an image later develops problems, administrators are typically unaware of those problems until they try to recover data—by which point the original data is gone, and it is too late to correct the problems.
- **Need for regulatory compliance:** Retaining backup images for several years to meet regulatory requirements can be inefficient and expensive. Amendments to the Federal Rules of Civil Procedure now require organizations that operate within the United States to manage their electronic data so that it can be retrieved in a timely and complete manner, and significant penalties may be levied against organizations that cannot comply.
- **Compatibility with hardware upgrades:** Backup images created on tape media are useless without the corresponding tape drive to read them. Should existing tape drive technology become obsolete, administrators could be faced with huge media conversion problems.

As data growth continues to accelerate, these common problems will likely become increasingly difficult to handle using traditional BURA technology alone—requiring organizations to pursue ways of streamlining and simplifying their processes.

BASICS OF DATA DE-DUPLICATION

Data de-duplication has become a popular approach to BURA, one that can help organizations overcome many typical BURA problems in enterprise IT environments while helping reduce the related management time and costs. It can provide immediate and substantial savings compared with legacy BURA systems. Understanding the basics of de-duplication can help organizations understand what to expect from de-duplication software and evaluate how it can help solve both common problems and problems specific to particular environments.

The concept of de-duplication is simple: identifying and removing redundant data helps dramatically reduce the size of a backup image, enabling organizations to use existing storage capacity more efficiently than they can with legacy BURA systems. For example, when a presentation file is distributed within an organization, many people may save a personal copy in their home directory. One key de-duplication technique, single-instance storage (SIS), is designed to identify, transfer, and store only a single copy of this file. From that point on, when the same file data is found, it does not need to be transferred or stored again.

The amount of data reduction that de-duplication can provide depends on the techniques used to locate redundancies. SIS is a standard method in many de-duplication applications, but it should not be the only one used.

Additional de-duplication techniques

ArchiveIQ includes two additional techniques in its de-duplication process: *advanced data compression* and *sub-file data reduction* (see Figure 1). Advanced file compression helps further reduce capacity requirements for backup data, while sub-file data reduction helps efficiently store large, active files. For example, SIS-level data reduction typically provides no benefits for Outlook .pst files, because the very act of reading one of these files modifies its content and forces a full version of the entire file to be copied and stored. In this situation, the de-duplication software needs to look at the sub-file level to identify redundant data and store only unique or changed information.

A fourth technique, *data chunking*, breaks data into small chunks and identifies redundancy at the chunk level. This technique is designed to identify the most redundancies, but it can come at the cost

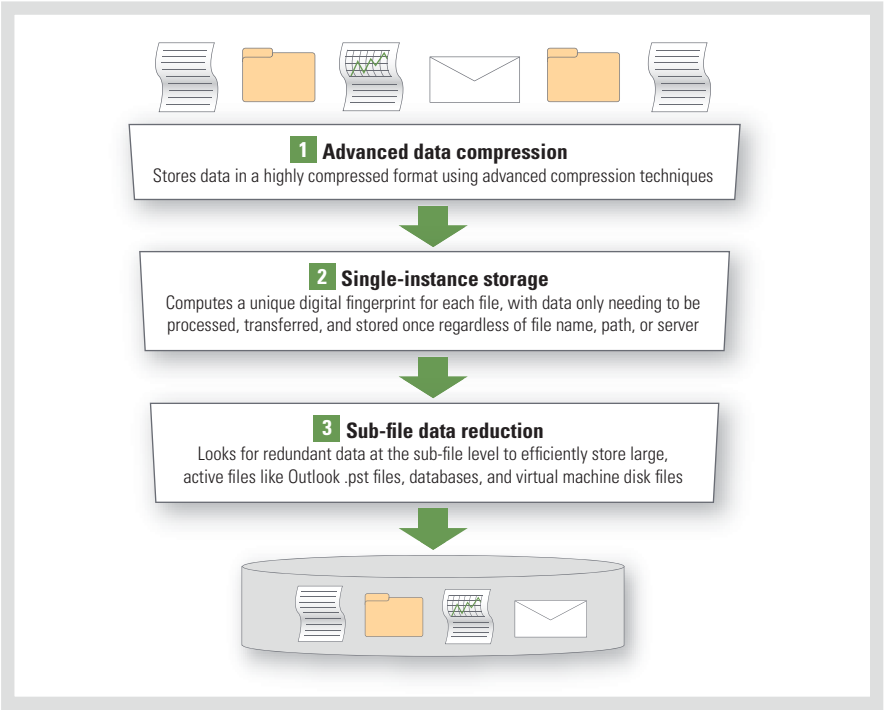

Figure 1. *Using multiple de-duplication techniques helps efficiently identify and eliminate redundant data*

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of significant processing and recovery time to reassemble the de-duplicated data. In addition, the master index that maps the chunks together can become very large over time. For most organizations, the overall data reduction from this technique is not worth the system and recovery impact.

De-duplication as part of the backup process

Another major difference between data de-duplication applications is when and where the de-duplication takes place: different applications may use *post-process*, *in-line*, or *source-based* de-duplication (see Figure 2).

Post-process de-duplication typically requires third-party backup software to perform a full backup to a disk cache and then process the data after it has been stored. This method can accelerate backups when the cache is not full, but usually requires additional disk space to cache the backup jobs.

In-line de-duplication processes full backup jobs as the data arrives at the de-duplication system. This method is generally slower than post-process de-duplication, but also typically uses less disk capacity because it does not require a cache.

Source-based de-duplication equally distributes the de-duplication process among the production servers being protected. Compared with the post-process and in-line methods, source-based de-duplication can help solve more of the problems described in the "Common BURA challenges" section in this article. Once the unique data has been processed, validated, transferred, and stored, it should never require processing again—with the result that large, active files can be efficiently processed at the source, where only changed parts of the files are identified and stored. This method can help dramatically reduce the backup window, increase backup reliability, and enable remote office data protection without requiring a dedicated backup system or an administrator at that location.

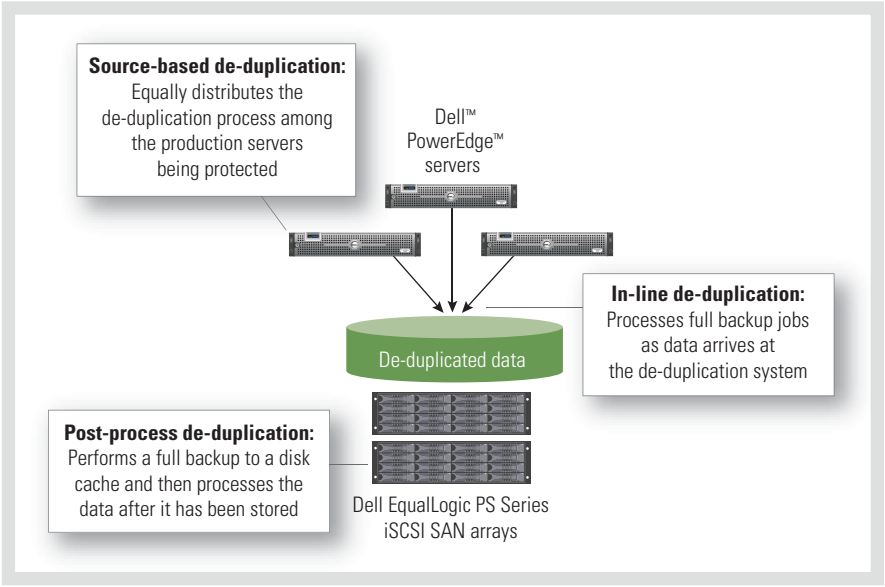

Figure 2. *De-duplication may occur at different stages of the backup process*

Other features

Several other features are also integral to a comprehensive de-duplication system:

- **Reliable data validation:** Compared with legacy BURA approaches, de-duplication has a major advantage in terms of data validation. De-duplication creates and validates a digital "fingerprint" of backup data when the backup is first stored—meaning that a backup image can be validated without accessing the production data. The most reliable data validation process performs a virtual recovery of the content to help ensure the data can be reconstructed exactly to its original state.
- **Flexible data retention policies:** Data retention periods are not the same for all organizations, but one common concern is that this time frame will unexpectedly increase. A comprehensive de-duplication system should support retention policies that allow administrators to manage specific parts of the de-duplicated data independently to service potential litigation requests.
- **Simplified data recovery:** Efficiently storing data is only part of the problem; comprehensive de-duplication should also offer quick and innovative ways to recover data. De-duplicated data is typically on disk and readily available, helping simplify recovery of individual files and folders.
- **Hardware independence:** De-duplicated data depends on the techniques used by specific software, but should not be dependent on specific hardware.

ARCHIVEIQ AND DELL EQUALLOGIC PS SERIES SAN ARRAYS

The advanced de-duplication technology in ArchiveIQ and the flexibility and features available in Dell EqualLogic PS Series iSCSI SAN arrays serve complementary purposes in enterprise IT environments. Deploying these products together can help organizations create a cost-effective, scalable, simplified BURA system to help efficiently protect data.

Key features of ArchiveIQ

ArchiveIQ is an innovative software application that runs on the Microsoft Windows Server® OS and helps eliminate the high costs associated with using disk media for BURA. By removing redundant data and only storing truly unique data over time, it enables organizations to cost-effectively protect and archive many years' worth of data using only a fraction of the storage capacity typically required by traditional BURA approaches. For example, although

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disk capacity may cost 10 times as much per gigabyte as tape capacity, ArchiveIQ is designed to keep significantly more backup data on disk than legacy BURA tape-based products—effectively enabling a lower cost per gigabyte for disk compared to tape.

ArchiveIQ uses multiple de-duplication techniques to achieve high levels of data reduction, including SIS, advanced data compression, and sub-file data reduction. Its source-based de-duplication approach enables it to identify and remove redundant data at the source, before it is transferred across the network—helping protect remote office data and dramatically reduce backup windows and recovery point objectives. Administrators can configure ArchiveIQ to use post-process de-duplication if the source server is not running a Microsoft Windows® OS.

ArchiveIQ is designed to simplify and accelerate file recovery. Its file name index can support wild card searches across several months of de-duplicated data, and administrators can quickly explore each recovery point like a normal file share. Full folder recovery is designed to be a simple drag-and-drop process. Finally, because ArchiveIQ does not chunk data into small pieces, recovery jobs can be carried out at full disk speeds.

Several other key features also help organizations implement powerful, flexible BURA systems:

- **Automated data validation:** Recovery points are continuously validated based on administrative policies—helping the system identify unexpected problems with the storage media early and automatically repair itself from the source data.
- **Automated data retention:** Administrators can specify how long recovery points should be retained, and the system can automatically identify and remove de-duplicated data that does not meet the defined retention policy. This process helps make efficient use of available storage capacity and helps limit litigation and compliance liability.
- **Flexible capacity management:** Administrators can optionally increase available storage capacity on Windows Server–based file servers that are running out of space. ArchiveIQ transparently "stubs" inactive file data and frees the associated storage capacity for new files and active data. If a user or application needs to access the stubbed data, this data can be transparently cached back from the ArchiveIQ server.
- **Hardware independence:** Administrators can use existing server and storage capacity or purchase new capacity based on considerations such as replication, expansion, migration, and price. As long as the storage platform supports NT File System (NTFS) volumes, ArchiveIQ can use it to store de-duplicated data.

On installation, ArchiveIQ allows a fully functional 30-day evaluation period. Using the software in their specific environment is the best way for organizations to understand data de-duplication and measure its benefits.

Key features of Dell EqualLogic PS Series SAN arrays

Dell EqualLogic PS Series iSCSI SAN arrays provide a scalable storage platform for ArchiveIQ de-duplication. The virtualized iSCSI storage helps simplify scaling and upgrading storage capacity over time by enabling the transparent distribution of data across one or more arrays. When administrators add a PS Series array to the storage pool, data can be automatically redistributed to take advantage of the additional storage and processing capacity. The same automatic process can take place when administrators need to repurpose or retire a legacy PS Series array. This simplicity and flexibility helps avoid the need for time-consuming management of data expansion or migration.

PS Series arrays are also designed for reliability and avoiding single points of failure. Critical hardware components have a redundant partner to help eliminate unexpected downtime caused by a hardware failure—one of the most common causes of downtime and data loss. In addition, the advanced data replication features included with PS Series arrays at no additional cost can efficiently replicate data off-site, enhancing disaster recovery systems and helping protect data against local events such as fire or flooding.

The thin provisioning feature of PS Series arrays can help increase storage utilization and reduce administrative overhead across an organization—two key ways that shared storage can help reduce costs. This innovative feature is designed to make storage capacity available, but not truly allocate that capacity until it is used. By allocating capacity on demand, administrators can help avoid over-allocating storage and reduce the time required to recapture capacity from production servers.

SCALABLE, COST-EFFECTIVE, SIMPLIFIED DATA PROTECTION

Accelerating data growth exacerbates common problems with traditional tape-based BURA approaches. By taking advantage of the complementary features of ArchiveIQ data de-duplication software and Dell EqualLogic PS Series arrays, organizations can consolidate resources and implement cost-effective, scalable, simplified data protection.

Pete Caviness is director of marketing at Data Storage Group, Inc.

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Data Storage Group ArchiveIQ:
www.archiveiq.com

Dell EqualLogic PS Series:
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USING QLOGIC 2500 SERIES ADAPTERS TO OPTIMIZE AND SECURE IT INFRASTRUCTURES

By David P. Clark

QLogic® 2500 Series 8 Gbps Fibre Channel host bus adapters are optimized for next-generation data centers built on multiprocessor, multi-core Dell™ PowerEdge™ servers, including support for virtualization; dynamic power management; high levels of reliability, availability, and serviceability; flexible, powerful security; and simplified deployment.

Related Categories:

Data center technology

Host bus adapter (HBA)

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Multi-core processors, high-density servers, increased server I/O performance, and OS virtualization have become key elements of enterprise data centers in recent years. Critical data center applications such as disk-to-disk replication, streaming video, and Web 2.0 technologies not only require high-bandwidth networks, but also the ability to scale storage networking along with the overall IT infrastructure.

To plan for and help meet the ever-growing demands on enterprise data centers, IT managers must deploy a scalable architecture that addresses concerns such as cost, performance, and backward compatibility. They also must meet the key requirements of next-generation data centers, including consolidation and density (through virtualization and blade server deployment); power and cooling; reliability, availability, and serviceability (RAS); security; and simplified deployment and management. The QLogic 2500 Series family of 8 Gbps Fibre Channel–to–PCI Express 2.0 host bus adapters (HBAs) are designed to help organizations meet these requirements in environments based on Dell PowerEdge servers by providing support for virtualization; dynamic power management; high levels of RAS; flexible, powerful security; and simplified deployment.

IDENTIFYING ENTERPRISE REQUIREMENTS

Advanced data storage practices and technologies—including disk-to-disk replication, remote mirroring, de-duplication, and high-density, high-efficiency infrastructures using multi-core processors, blade architectures, and virtualization—are important tools to help enterprises meet evolving needs and scale to support new critical applications. Next-generation 8 Gbps Fibre Channel technology can play a key role in developing a successful infrastructure that meets these needs (see Figure 1):

- **Consolidation and high density:** Consolidating multiple applications on a single physical server can help increase density. Effective deployment requires scalable, reliable, high-capacity I/O interconnects as well as end-to-end isolation and security.
- **Optimized power and cooling:** Green IT initiatives and budget constraints require that IT managers strive to optimize energy use for every component in the data center. Dynamic power and performance throttling can help ensure an optimal and power and cooling infrastructure.
- **RAS:** Demanding service level agreements (SLAs) often require IT managers to plan for remote, long-distance, real-time data backup and rapid failover. These SLAs drive the need for increased RAS, reduced time windows to complete tasks, and proliferation of critical applications. The core of 8 Gbps Fibre Channel technology helps address these issues by doubling the potential performance and bandwidth over previous-generation 4 Gbps Fibre Channel technology.

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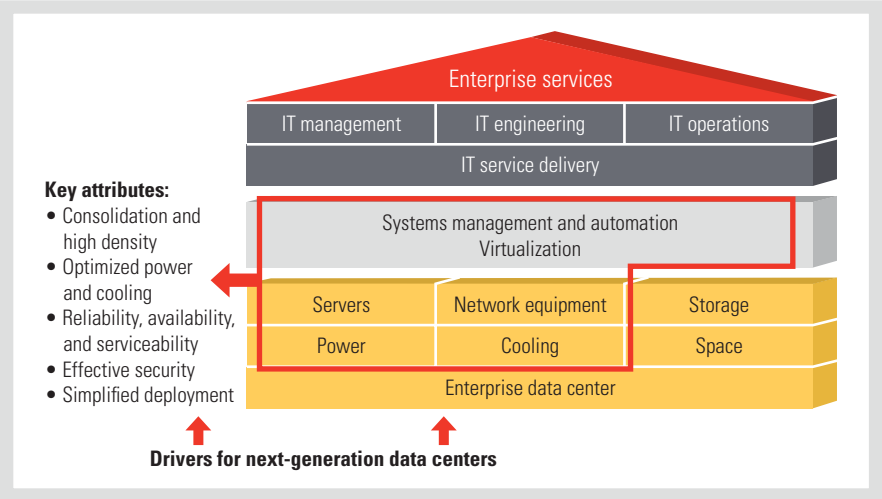

Figure 1. *Key components and attributes of an enterprise-class data center*

- **Effective security:** As data centers adopt virtualization, enhancing security to help prevent privacy loss, data theft, impersonation attacks, and data integrity compromises becomes increasingly important. Effective security strategies and authentication infrastructures enable IT managers to deploy advanced security protocols and extend access control solutions to help meet these needs.
- **Simplified deployment:** As IT infrastructures have grown increasingly complex, simplified deployment of both hardware and software has become critical for efficient operations.

MEETING DATA CENTER CHALLENGES WITH QLOGIC 2500 SERIES ADAPTERS

Next-generation 8 Gbps Fibre Channel technology can provide a migration path that supports current infrastructures and helps overcome ongoing data center challenges. QLogic 2500 Series 8 Gbps Fibre Channel HBAs are designed for virtualized data centers built on powerful multiprocessor, multi-core Dell PowerEdge servers, and are optimized for the key requirements of enterprise-class data centers:

- **Virtualization support:** QLogic 2500 Series HBAs are designed for enhanced security, quality of service, and dynamic provisioning during live migration of virtual servers. They also allow multiple logical (virtual) connections to share the same physical port, with each logical connection having its own resources, priorities, and the ability to be managed independently.
- **Dynamic power management:** QLogic 2500 Series HBAs take advantage of QLogic StarPower™ technology. Dynamic power management technology senses different types of PCI Express buses and consumes only the amount of power necessary to run at full speed. QLogic Cool HBA™ technology enables the HBAs to operate without airflow.
- **High levels of RAS:** QLogic 2500 Series HBAs are designed for high levels of RAS. Overlapping Protection Domains (OPDs) provide overlapping parity and cyclic redundancy checking and generation, helping provide continuous data protection. In addition, the unified driver model helps free storage area network (SAN) administrators from managing driver and firmware version matching.
- **Flexible, powerful security:** QLogic 2500 Series HBAs support SAN-level authentication through Fibre Channel Security Protocol (FC-SP), fabric-level isolation through N_Port ID Virtualization (NPIV), and end-to-end data integrity through T10 standards.
- **Simplified deployment:** QLogic 2500 Series HBAs are backward compatible with 4 Gbps and 2 Gbps Fibre Channel technologies, using a single common driver for each OS across Fibre Channel generations to help simplify deployment. QLogic 2500 Series HBAs provide nondisruptive migration to a next-generation infrastructure, providing immediate advantages and helping address the needs of enterprise-class data centers.

OPTIMIZING AND SECURING IT INFRASTRUCTURES

Enterprise data centers are constantly evolving. The need to consolidate servers, storage, and floor space has led to the adoption of virtualization; infrastructure and economic dynamics have led to energy-efficient infrastructures; and regulations for data security and data loss have created challenges related to authentication, integrity, and encryption. Critical, high-bandwidth applications have created expectations for continuously improving efficiency, response times, and the end-user experience. By deploying QLogic 2500 Series 8 Gbps Fibre Channel HBAs with Dell PowerEdge servers in conjunction with an overall plan to take advantage of new and emerging technologies, enterprise IT managers can help ensure a robust infrastructure that can help meet their needs now and in the future.

David P. Clark is a senior staff product marketing manager for QLogic 2500 Series adapters. He has more than 25 years of storage industry experience in product management and development.

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HOW DISKEEPER 2008 DEFRAGMENTS TRANSPARENTLY AND AUTOMATICALLY

By Howard Butler

Defragmentation software has long been a standard tool for enterprise servers. Now, an increasingly mobile workforce is demanding top performance and reliability from systems on the go. Diskeeper® 2008 software provides transparent, automatic disk defragmentation designed to boost productivity across the entire system spectrum, from the smallest laptop to the largest server.

Related Categories:

Diskeeper

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Storage

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The number of files stored on mobile laptops, workstations, servers, storage area network devices, and RAID arrays in enterprise IT environments is greater than ever. This growth not only necessitates ever-increasing storage capabilities, but also places a burden on file systems to keep files stored contiguously for fast user access. File fragmentation can seriously degrade performance—and is a growing concern for IT teams supporting busy mobile workers who may not have the time or the inclination to perform regular system maintenance.

Hard drives store files in chunks called clusters. Ideally, all of a file's clusters would be located adjacent to one other in a long, unbroken chain. Contiguous clusters enhance hard drive performance—the drive can read files quickly when the read/write heads do not need to move very far. In actuality, however, files are often stored in many thousands of clusters scattered across the drive. Such fragmentation is a natural occurrence—but can lead to a degradation in system performance that continues to erode as a disk becomes increasingly fragmented through ordinary file creation, deletion, and modification. Fragmentation cannot be avoided, but it can be controlled. Diskeeper 2008 software is designed to provide transparent, automatic disk defragmentation as it arises across the system spectrum—including on Dell™ Latitude™ laptops, Dell OptiPlex™ desktops, and Dell PowerEdge™ servers—without affecting performance or requiring scheduling by end users or IT administrators.

CONTROLLING FILE FRAGMENTATION

Common symptoms of fragmentation are well known to IT administrators, and include random disk failures, sluggish system boots, slow load times for documents, and excessively long backups and antivirus scans—the list goes on. But simply put, system performance can slow to a crawl if fragmentation continues unchecked. Defragmentation is essential to help reverse this performance degradation.

Defragmentation software has traditionally been mandatory on servers. But with the increase in laptops and docking bays in enterprise workplaces, information is also being stored locally by mobile users who demand top performance from their systems. Consequently, many large companies have begun equipping virtually every laptop, desktop, and server with defragmentation software to help ensure optimum performance and reliability. Defragmentation has even gained equal footing with antivirus software as a vital best practice. In a March 2008 research survey by Diskeeper Corporation, 179 system administrators were asked, "What software do you consider vital to have on your servers?" Of the respondents, 48 percent responded with "Antivirus/Symantec" and 45 percent responded with "Defrag/Diskeeper." Viruses and file fragmentation

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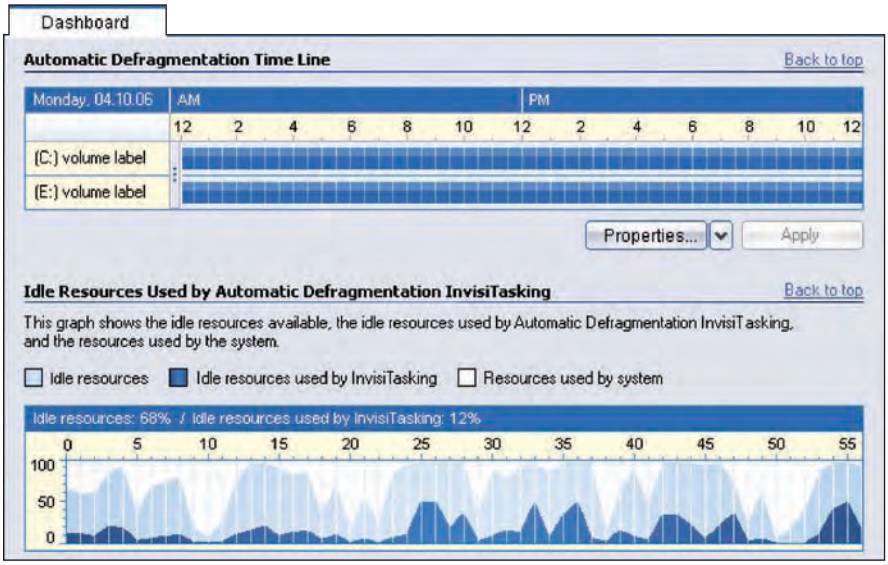

Figure 1. *Diskeeper 2008 with InvisiTasking monitors system resources to enable transparent defragmentation*

are now on par as key degradation problems for administrators.

COMPARING MANUAL AND AUTOMATIC DEFRAGMENTATION

In these environments of spiraling drive capacity and enormous file sizes, frequent defragmentation can be crucial to maintaining disk health and high performance levels. Infrequent manual defragmentation is typically both time-consuming and resource-intensive. Worse, many mobile users are unlikely to bother with it—incurring performance and reliability penalties from the daily increase in file fragmentation until the disk is defragmented.

Automatic defragmentation—enabled by default in Diskeeper 2008—helps avoid performance degradation by handling file fragmentation as it occurs. This approach minimizes defragmentation times and helps ensure maximum performance and reliability by avoiding fragmentation buildup.

UNDERSTANDING DISKEEPER INVISITASKING

Diskeeper InvisiTasking™ technology enables Diskeeper 2008 to run on the fly, with no intrusion on system resources. Because processor and I/O resources are almost never fully utilized, InvisiTasking can work transparently by tapping undetectably into unused system resources. It monitors resource consumption on a Microsoft® Windows® OS–based system—including processor, disk, memory, and network usage—and injects Diskeeper processing only into the unused portions (see Figure 1).

Software engineers sometimes attempt to share resources by choosing low processor priorities to run under, and some past efforts have been based on throttling disk and network I/O. Windows allocates processor resources using a hybrid of round-robin and priority-based preemptive scheduling. This approach can cause low-priority processes to unnecessarily preempt higher-priority processes, reducing their access to processor resources. InvisiTasking utilizes a technique designed to avoid using a processor time slice when higher-priority processes need to run.

InvisiTasking proactively tracks resource usage and network traffic while carefully managing memory usage and maintaining granular control over its own I/O. This approach represents an advance beyond low-priority I/O throttling because it is designed to address all system resource usage. For example, a low-priority I/O approach may still create contention for resources at the disk, and does not address other system resources. InvisiTasking checks resource usage to avoid contention before it begins processing. This proactive (rather than reactive) approach helps ensure that Diskeeper never preempts users or services and enables it to run imperceptibly in the background.

InvisiTasking is essentially a resource delegation framework that allows the OS to operate at high efficiency. It is designed to achieve comprehensive compatibility by allowing applications and services to operate under an additional layer of resource allocation. When operating in the InvisiTasking framework, even I/O-intensive processes can achieve transparency.

TRANSPARENT, AUTOMATIC DEFRAGMENTATION

Fragmentation affects all Windows-based systems. Organizations can opt to ignore the problem until a system crashes; suffer through time-consuming, resource-intensive manual defragmentation; or deploy automated defragmentation software that can handle fragmentation as it arises. Diskeeper 2008 with InvisiTasking technology is designed to work both transparently and automatically, working in real time when needed without intruding on system resources or requiring scheduling by end users or IT administrators. By helping prevent performance degradation buildup altogether, Diskeeper can help maintain a constant level of system performance and reliability.

Howard Butler is a senior technical engineer and the vice president of technical support for Diskeeper Corporation.

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Diskeeper trialware and fragmentation analysis tools:
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AUTOMATING DEPLOYMENT WITH MICROSOFT CONFIGURATION MANAGER AND THE DELL DEPLOYMENT TOOLKIT

By Robert Hearn

Configuring servers in enterprise environments can be complex and time-consuming, often requiring complicated scripts. The integration of Microsoft® System Center Configuration Manager 2007 and the Dell OpenManage™ Deployment Toolkit helps simplify this process by providing easy-to-use graphical tools for the deployment of Dell™ PowerEdge™ servers.

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Dell OpenManage

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IT administrators face many challenges that can increase the complexity of server deployment, including proliferation of disparate operating systems and applications. Many organizations have strict guidelines governing the operating systems and applications they deploy as well as the features or nonessential options, such as games, that are prohibited on their networks. IT departments need automated methods of deploying standard configurations that meet organization guidelines and expedite server rollout across their infrastructures—whether those servers are in their own data centers or halfway across the globe.

In addition, the need for business continuity often drives the need for upgrades to operating systems or hardware installed on existing servers and for rapid replacement of failed servers. Using standardized images and automated processes can help reduce the time required to restore access to enterprise resources for end users and help minimize loss of productivity. Administrators also must be able to track the status of deployed operating systems, applications, and updates to help determine which deployments were successful, which failed, and which are still in progress—information that can be critical for determining compliance with enterprise standards and software license requirements.

Microsoft System Center Configuration Manager 2007 with the certified integration of the Dell OpenManage Deployment Toolkit (DTK) helps address these requirements by providing a centralized, scalable, and customizable approach for quickly and cost-effectively deploying Microsoft Windows® operating systems and applications from a central location to Dell PowerEdge servers across enterprise networks. By removing time-consuming and potentially error-prone manual processes, Configuration Manager 2007 helps reduce administrative overhead and the cost of deploying operating systems.

DEPLOYING AND CONFIGURING BARE-METAL SERVERS

Unlike when requisitioning preconfigured desktop and laptops, administrators often requisition servers without a specific configuration because they have a standard enterprise configuration they must deploy, and reconfiguring servers that have been preconfigured adds a step to what can be an extended deployment process. These bare-metal servers present their own set of challenges: even before installing an OS, administrators must configure the BIOS, array controller, remote access controller, baseboard management controller, and other hardware components, which for Dell PowerEdge servers is typically done using command-line utilities available in the DTK.

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Until recently, using the DTK for server configuration often required going through script files to modify environment variables. An expanding list of scripts and configuration files can create a difficult and complex process for IT administrators, especially because administrators are often generalists with many different types of responsibilities and may lack the time to learn a complicated deployment process.

The integration between Microsoft System Center Configuration Manager 2007 and the DTK helps reduce the complexity of using these command-line tools, scripts, and environment variables by presenting a graphical user interface (GUI) with drop-down lists and check boxes that include the appropriate commands and options—enabling easy point-and-click definition of server deployment and helping provide an easy method to rapidly configure bare-metal servers. By helping simplify the processes of determining the appropriate utility to use, which command-line parameters to supply, and what format the configuration file should be, PowerEdge server deployment using Configuration Manager 2007 and the DTK can become an efficient, automated task instead of a complex scripting procedure.

CREATING RULE-BASED DEPLOYMENTS FOR ARRAY CONTROLLERS

The Microsoft Dynamic Systems Initiative (DSI) strategy is an approach to technology that can help move enterprise IT departments toward model-based management, meaning administrators can create models (or rules) that help minimize concerns with implementation details. The integration of Microsoft System Center Configuration Manager 2007 and the DTK applies the DSI approach to tasks such as configuring array controllers. Configuring an array controller usually involves supplying a static configuration file or command-line parameters, which usually requires knowing what the target server's hardware configuration is before performing the configuration. In enterprise IT environments, however, multiple standard configurations may be in use, and administrators may not always know the exact configuration of a particular server before trying to deploy it. Applying a rules-based deployment in this type of variable environment can help ensure successful configuration.

For example, an IT department might need to deploy a rack of Dell PowerEdge 2970 servers, each of which may have three, four, or five disk drives installed and attached to the array controller. Because the administrators may not know which configuration any single server has before deployment, they cannot apply the same static configuration file to all the servers, or some would likely fail. Instead, they can define a set of rules such as the following:

- If the server has three disk drives, configure the first two drives as a RAID-1 set and configure the third drive as a hot spare.
- If the server has four disk drives, configure the drives as two RAID-1 sets of two drives each.
- If the server has five disk drives, configure the first four drives as two RAID-1 sets of two drives each and configure the fifth drive as a hot spare.

Administrators could define this logic within the DTK; however, doing so would require writing a complicated script, and any changes to the rules would typically require rewriting the script. Instead, the integration of Configuration Manager 2007 and the DTK enables them to solve this type of problem by using the Array Builder wizard.

The Array Builder wizard provides a graphical configuration utility that helps simplify the creation of rule-based configurations for array controllers (see Figure 1). Administrators can use this utility to visually design the desired configuration for target systems by defining matching characteristics of controllers, RAID levels, logical drives, physical disk drives, local and global hot spares, and so on. The wizard even allows administrators to define different configurations based on the presence or setting of a variable on the target system.

For example, if administrators have two servers with identical hardware configurations but different logical array-controller configurations—such as a Microsoft Exchange system and a Microsoft SQL Server® system—defining a variable for each allows the Array Builder wizard to create the rules to configure both appropriately. The complexity remains hidden. Administrators can create virtually any

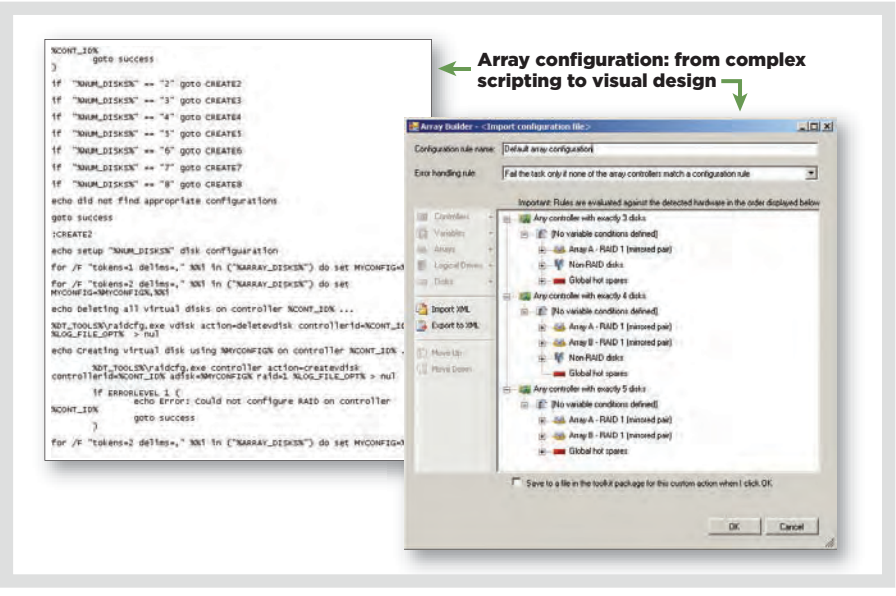

Figure 1. *Complex array controller configuration scripting versus the simplified, graphical Array Builder wizard*

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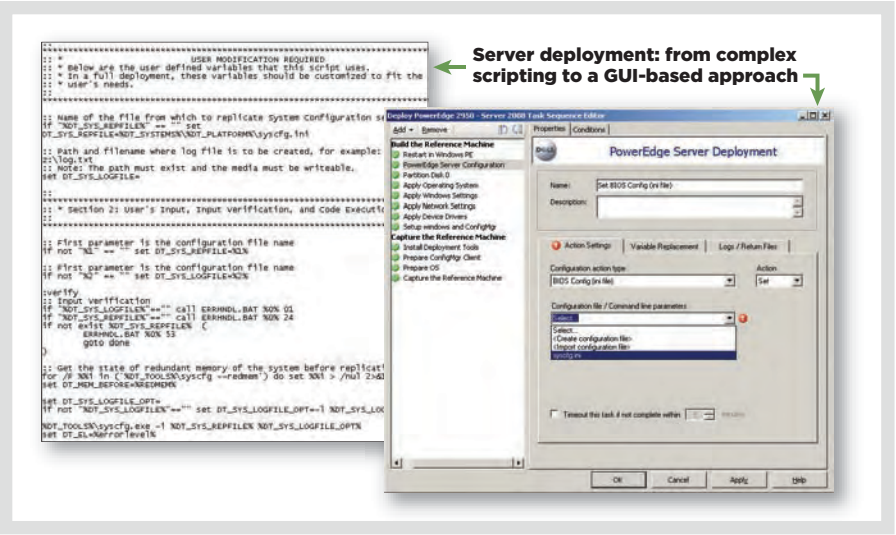

Figure 2. *Complex scripting versus the simplified, graphical Task Sequence Editor*

number of rules in a single configuration and use them in their deployment, or export them to XML and use them in other deployment tasks in Configuration Manager 2007. This approach helps administrators define standard best practices for configuring Dell PowerEdge servers and use those standards across the enterprise.

SEQUENCING CONFIGURATION TASKS

Microsoft System Center Configuration Manager 2007 accomplishes these rule-based standard configurations through the extensibility of its administrator console and Task Sequence Editor (see Figure 2). The Task Sequence Editor is an integral part of the OS deployment functionality in Configuration Manager 2007, including the task sequence engine and functionality on both the management server and the client (or server) being managed.

The task sequence engine allows administrators to deploy an OS through scripted or image-based methods; provide overlays of software packages, including software updates from Microsoft and Dell; and adjust other configuration settings to create a final deployment on a particular Dell PowerEdge server. Overlaying several software components—such as a base Microsoft Windows Server® 2008 OS, hardware-specific driver packages, and application suites—offers many combinations of deployments while helping reduce the number of system images necessary for comprehensive hardware coverage.

Minimizing the number of OS images that an IT organization must create and maintain helps reduce overall costs. The Task Sequence Editor allows administrators to combine a small number of base images into any number of deployment permutations. A change to one aspect of the task sequence such as a driver update does not invalidate the entire deployment, which may occur in a single image file deployment.

The Task Sequence Editor works by evaluating the reported status—succeeded, failed, or skipped—of each step within a task sequence as it executes. Groups of task sequences can also send status messages. Configuration Manager 2007 can take various actions depending on the status of a particular step within a sequence. In addition, auditing steps after completion or taking actions based on the result of certain steps within a task sequence during execution allows administrators to automate much of the decision-making process that they would otherwise handle manually.

MANAGING DEVICE DRIVERS

In addition to helping simplify an array of deployment tasks, Microsoft System Center Configuration Manager 2007 also helps simplify device driver management. Supporting the multitude of device drivers—video, LAN, disk, and so on—required across many hardware types has been a key reason that organizations have maintained large numbers of disk images to support their IT environments. Configuration Manager 2007 helps eliminate the need to host all device drivers in a single OS image. Instead, administrators can deploy a single OS image across a variety of systems, and Configuration Manager 2007 can add the appropriate drivers as part of the deployment process.

AUTOMATING DEPLOYMENT ON DELL POWEREDGE SERVERS

The integration of Microsoft System Center Configuration Manager 2007 and the Dell OpenManage Deployment Toolkit provides a comprehensive, automated, end-to-end deployment solution based on easy-to-use graphical tools. By hiding the complexity associated with manual processes and avoiding the need for complicated scripting, Configuration Manager 2007 and the DTK help reduce overhead and cost through a centralized, scalable, and customizable approach designed to significantly simplify the deployment of Dell PowerEdge servers in enterprise environments.

Robert Hearn is the senior program manager for System Center Partner Integration Programs at Microsoft.

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DEPLOYING MICROSOFT SQL SERVER 2008 ON DELL POWEREDGE SERVERS

By Eric Hale
Corey Bunch
Laura White

Tuning database servers can be key to simplifying operations and enhancing performance. Best practices based on real-world experience can help administrators successfully deploy and optimize the 64-bit version of the Microsoft® SQL Server® 2008 database platform on Dell™ PowerEdge™ servers running the Microsoft Windows Server® 2008 Enterprise x64 Edition OS.

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The 64-bit versions of Microsoft SQL Server 2008 and Microsoft Windows Server 2008 introduce a wide variety of powerful, flexible features and management tools. By following best practices from Dell and Principled Technologies, administrators can create high-performance, highly available databases using the 64-bit version of SQL Server 2008 on Dell PowerEdge servers running Windows Server 2008 Enterprise x64 Edition. The practices described in this article are based on hands-on testing and research performed by Principled Technologies as well as real-world experience, and can help systems administrators and database administrators simplify operations, enhance performance and reliability, and take advantage of features introduced in the 64-bit version of SQL Server 2008.[1]

INSTALLING AND SETTING UP SQL SERVER 2008

The process of installing and setting up the 64-bit versions of SQL Server 2008 and Windows Server 2008 on a Dell PowerEdge server is typically straightforward. When carrying out this process, administrators should be sure they are using the latest tested and validated software, firmware, and driver versions for network interface cards, storage arrays, and other components.[2] They should also deploy the software in a Microsoft Active Directory® domain and use Microsoft Windows® authentication, which allows them to take advantage of the integrated security and centralized management features of Active Directory.

Installing Windows Server 2008

The first step is to install Windows Server 2008, a process that usually takes at least one hour. In general, administrators should configure all database servers with static IP addresses, which helps increase stability and ensure that SQL Server 2008 remains available even after a Dynamic Host Configuration Protocol (DHCP) server failure. In addition, they should typically use canonical name (CNAME) records to assign aliases to database servers, enabling them to isolate users and applications from changes to the underlying server infrastructure, which helps simplify deployments and migrations.

After performing the initial installation, administrators should next configure the remaining drives on the server, formatting all SQL Server volumes—including those for data, logs, and temporary database (tempdb) files—as NT File System (NTFS) volumes. Microsoft recommends a 64 KB allocation unit size for these volumes. Administrators should avoid values

[1] For the full version of this deployment guide, including step-by-step instructions on installing and setting up SQL Server 2008 on a Dell PowerEdge 2950 server, see "SQL Server 2008 x64 on Windows Server 2008 Enterprise x64 on Dell PowerEdge 2950," by Principled Technologies, March 2008, DELL.COM/Downloads/Global/Solutions/Public/White_Papers/sql2008_ws2008.pdf.

[2] For more detailed information on SQL Server 2008, visit DELL.COM/SQL2008.

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less than 8 KB, which can increase the risk of torn pages whose contents are split across disk allocation units.

Because Windows Server 2008 Enterprise x64 Edition does not support compressing drives when the allocation unit size is 64 KB, and the 64-bit version of SQL Server only creates read-only databases on compressed drives, compressed drives should not be used. SQL Server 2008 does include built-in compression features that administrators can use when appropriate to their performance and capacity requirements.

Best practices recommend separating tempdb and transaction log files onto their own disks on separate disk groups when possible; doing so can help increase I/O performance by helping ensure that these files do not share physical disks. Likewise, administrators should create full-text catalogs on their own physical disks. Administrators should also group files with similar I/O characteristics, such as log files; because heterogeneous workloads may have different and possibly competing I/O characteristics, combining them can reduce overall performance.

To help achieve optimal performance that scales with heavy workloads, Microsoft recommends having from 0.25 to 1 data file (per file group) for each server processor core. If these files share spindles, however, the server can experience contention when multiple database processes access them simultaneously. In this case, administrators should consider breaking the data files into a number of files equal to half the number of cores. With tempdb files, they should use one data file per core.

Installing SQL Server 2008

Administrators should typically allow at least 30 minutes for installing SQL Server 2008. In general, they should not deploy it on an Active Directory controller because Active Directory processes add overhead that could reduce SQL Server performance. They should, however, deploy it on a member server in an Active Directory domain. They should also grant the SQL Server service account only necessary rights on the local server, and should not make SQL Server service accounts members of the Domain Administrators group.[3]

After completing the installation, administrators should give the SQL Server service account the right to prevent the OS from paging its memory to disk by enabling the "lock pages in memory" setting (see Figure 1). SQL Server can dynamically allocate and deallocate memory to help relieve memory pressure and swapping; however, another process can request a substantial amount of memory and cause the OS to swap SQL Server memory to disk before SQL Server can react. The "lock pages in memory" setting helps prevent this problem.

When possible, administrators should leave the minimum and maximum server memory at their default settings of 0 and 2,147,483,647, respectively, enabling SQL Server to use as much memory as the system makes available. If changing these settings is necessary, they should ensure that the sum of the maximum memory settings across all processes is less than the amount of physical RAM available.

Finally, administrators should also enable instant file initialization. The default behavior is to initialize the storage with zeros when SQL Server creates a data file or allocates an extent to grow a data file, which can be time-consuming. Instant file initialization stops the system from initializing storage it allocates; instead, the storage remains un-initialized until SQL Server writes data to it. Microsoft testing shows a significant performance improvement when using instant file initialization.

ADMINISTERING AND MONITORING SQL SERVER 2008

Optimizing database server performance depends on more than a successful installation: the run parameters and database layout, for example, require careful thought and advance planning. When administering and monitoring the 64-bit version of SQL Server 2008, following best practices for configuring key settings and tracking performance data can help create an optimized, reliable deployment.

Administering SQL Server 2008

Key settings such as autogrowth, autoclose, tempdb data file creation, and processor and memory parameters can help administrators optimize SQL Server 2008 performance and avoid problems related to inappropriate settings.

Autogrowth. Administrators should be sure to size data, log, and tempdb files appropriately. Because autogrowth can create file fragmentation and reduce performance, they should plan file growth and manually expand files when the server is relatively idle rather than relying on autogrowth to size files for them.

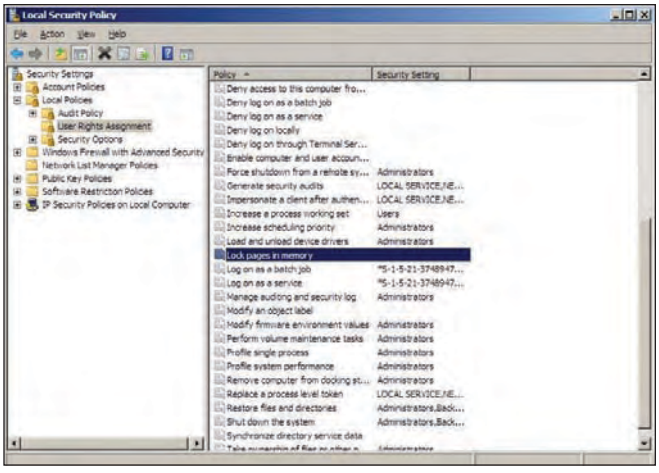

Figure 1. *"Lock pages in memory" setting in the 64-bit version of Microsoft SQL Server 2008*

[3] For more information on domain accounts for SQL Server service accounts, see "Setting Up Windows Service Accounts," by Microsoft Corporation, SQL Server 2008 Books Online, May 2008, msdn.microsoft.com/en-us/library/ms143504(SQL.100).aspx#Review_NT_rights.

Although instant file initialization can mitigate this performance impact, it does not eliminate the problem and does not help reduce file fragmentation. Administrators should typically use autogrowth only as a precaution to help prevent data files from filling up and forcing the database to a read-only state.

The autogrowth increment should be small enough to limit the performance impact of unplanned file growth and large enough to help prevent excessive file fragmentation. In general, best practices recommend setting this increment using fixed sizes—in megabytes or gigabytes—rather than percentages, which can lead to uncontrolled file growth. In addition, administrators must take into account the virtual log files within each physical log file. Because these virtual log files cannot span file extents, the autogrowth increment also limits the maximum size of virtual logs, which can make certain large transactions impossible to complete. Even when administrators have selected an appropriate increment, however, manually sizing files during periods of low activity is still preferred.

Autoclose. Administrators should typically leave the autoclose option at its default value of false. For a frequently used database, autoclose can cause many unnecessary opens and closes, which can reduce system performance.

Tempdb data file creation. The SQL Server installation process creates a single tempdb primary data file. Using a single tempdb data file, however, can create unacceptable latch contention and I/O performance bottlenecks. To mitigate these problems, administrators should allocate one tempdb data file per processor core.

Autogrowth is enabled for tempdb files by default. As with data files, however, expanding tempdb files too frequently can reduce performance. Therefore, administrators should allocate enough initial space to the tempdb files to accommodate the expected workload. As a precaution, they should also set the file growth increment large enough to minimize tempdb expansions. By default, the file growth increment for tempdb files is 10 percent, with an unrestricted growth increment of 10 percent. Although a fixed increment for data files has several advantages, Microsoft recommends the 10 percent increment; the most suitable approach depends on the specific environment.

Administrators should also make all tempdb files equal in size. Because SQL Server uses a proportional fill algorithm, differently sized files do not distribute the I/O load evenly.

Processor and memory parameters. In general, administrators should leave the SQL Server processor and memory parameters at their default settings unless they need to accommodate special requirements. These settings run SQL Server at a standard priority, which lets it use all processors in the server and makes as much RAM available as SQL Server needs. Similarly, administrators should generally leave the network packet size at the default value of 4,096 bytes unless increasing it can enhance efficiency—which may be the case, for example, when processing bulk copy operations or using large image files.

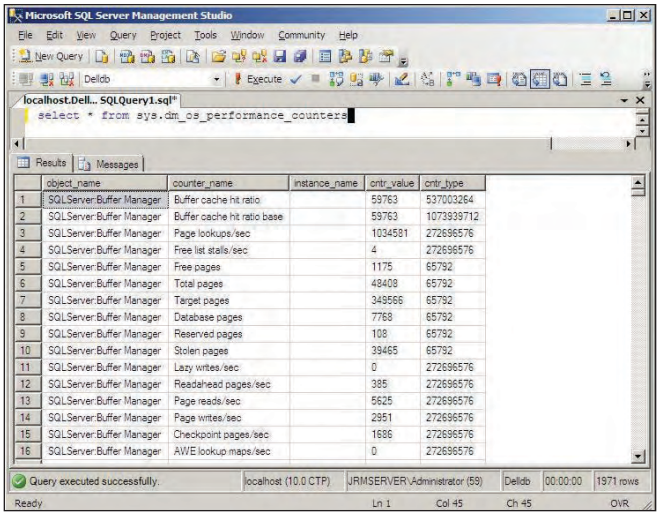

Figure 2. *Example results from the sys.dm_os_performance_counters statistic*

Best practices also recommend running SQL Server 2008 on dedicated servers when possible. Other applications running on the same server can reduce performance by competing with SQL Server for resources, and each additional application makes it increasingly difficult to tune the server for optimal database performance or to troubleshoot problems.

Monitoring SQL Server 2008

Once the server is running, administrators should monitor its performance to help them tune it for their specific workload. The 64-bit versions of Windows Server 2008 and SQL Server 2008 provide many monitoring tools and statistics, including the Windows Server 2008 Reliability and Performance Monitor, SQL Server 2008 dynamic management views and functions (DMVs/DMFs), and the SQL Server 2008 Performance Data Collector.

Reliability and Performance Monitor. The Windows Server 2008 Reliability and Performance Monitor includes multiple performance statistics. For example, the PhysicalDisk/% Idle Time counter tracks the percentage of idle time, which can indicate I/O performance; the Processor/% Processor Time counter tracks the percentage of processor time; and the SQLServer:BufferManager/Buffer Cache Hit Ratio counter tracks the buffer cache hit ratio, which indicates how often SQL Server is using physical memory to retrieve data. In general, best practices recommend that the PhysicalDisk/% Idle Time counter be greater than 20 percent, the Processor/% Processor Time counter be less than 70 percent, and the SQLServer:BufferManager/Buffer Cache Hit Ratio counter be greater than 95 percent.

Dynamic management views and functions. SQL Server 2008 offers over 100 DMVs/DMFs, which expose the current state of a SQL Server system. Administrators can use statistics collected from a DMV/DMF query to analyze server health and diagnose potential problems. Some of these statistics apply to the entire server, while others apply to specific databases. The sys.dm_os_performance_counters statistic, for example, returns the current

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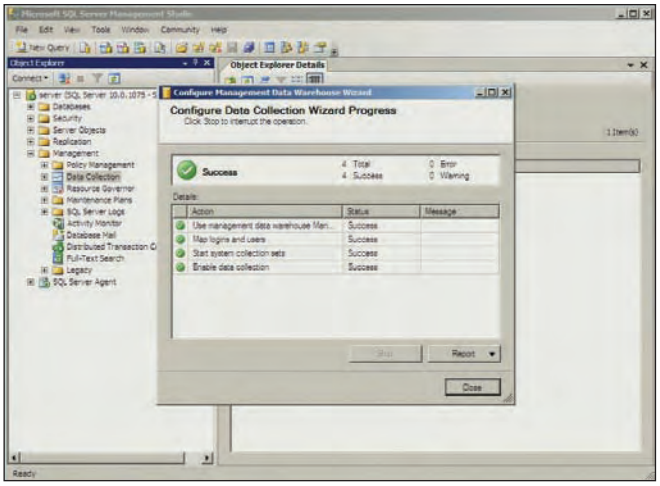

Figure 3. *Completed Configure Management Data Warehouse wizard in the 64-bit version of Microsoft SQL Server 2008*

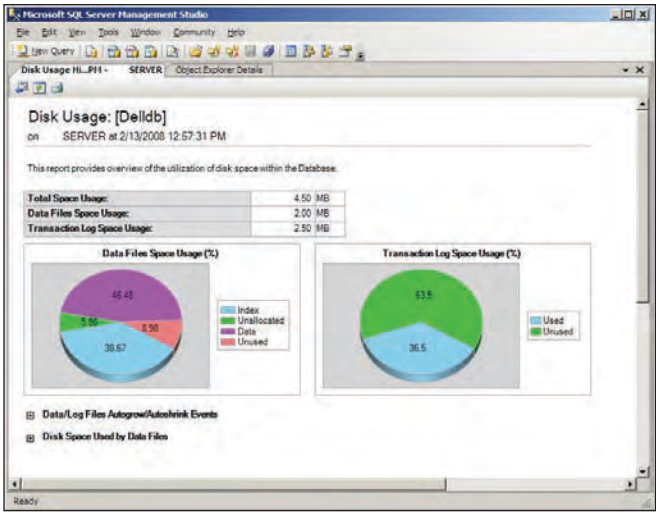

Figure 4. *Example report for the 64-bit version of Microsoft SQL Server 2008*

value of certain SQL Server performance counters (see Figure 2). Best practices for performance monitoring recommend capturing baseline data and setting up a regular monitoring plan.[4]

Performance Data Collector. The 64-bit version of SQL Server 2008 introduces the Performance Data Collector, which builds on the 64-bit SQL Server 2008 Data Collector architecture[5] and provides a framework for collecting diagnostic and performance data to help simplify database tuning. The Performance Data Collector is part of the broad set of capabilities in the Microsoft Performance Studio, which enables administrators to collect performance data from multiple databases and store it in a central repository so they can compare past and current SQL Server performance.

The Performance Data Collector stores its data in a special Management Data Warehouse database and uses three system data collection sets: Disk Usage, Server Activity, and Query Statistics. The Disk Usage set collects data about disk and log usage for databases on a server, the Server Activity set collects resource usage statistics and performance data from the server and SQL Server, and the Query Statistics set collects query statistics, query text, query plans, and specific queries.[6] Administrators can configure data collection in the SQL Server Management Studio using the Configure Management Data Warehouse wizard (see Figure 3), or can configure collection sets individually.

Once the Performance Data Collector is running, administrators can wait for the collection schedule to cycle completely or update the data immediately. They can then view a historical report or create a custom report using the 20 fields available for each collection (see Figure 4).

BEST PRACTICES FOR SQL SERVER 2008

The 64-bit versions of Microsoft SQL Server 2008 and Windows Server 2008 introduce multiple features and enhancements for enterprise IT environments. Advance planning and following the best practices described in this article can help administrators successfully deploy and optimize SQL Server 2008 on Dell PowerEdge servers running Windows Server 2008 Enterprise x64 Edition.

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www.microsoft.com/sql/2008

[4] For more information on DMVs/DMFs, including query options and required parameters, see "Dynamic Management Views and Functions (Transact-SQL)," by Microsoft Corporation, SQL Server 2008 Books Online, May 2008, msdn2.microsoft.com/en-us/library/ms188754(SQL.100).aspx.

[5] For more information on this architecture, see "Data Collector Architecture and Processing," by Microsoft Corporation, SQL Server 2008 Books Online, May 2008, msdn2.microsoft.com/en-us/library/bb677355(SQL.100).aspx.

[6] For more information on data collection sets, see "System Data Collection Sets," by Microsoft Corporation, SQL Server 2008 Books Online, May 2008, technet.microsoft.com/en-us/library/bb964725(SQL.100).aspx.

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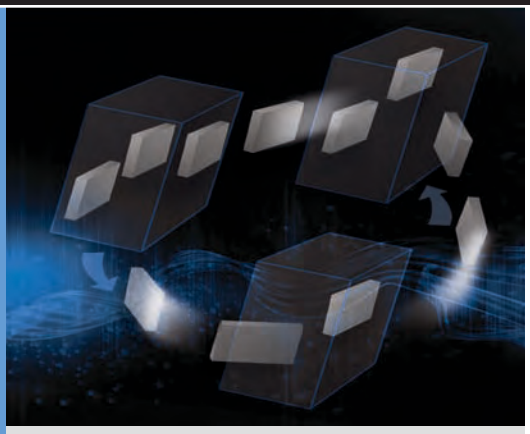

OPTIMIZING NETWORK INFRASTRUCTURES FOR VIRTUALIZATION

By Shefali Chinni
Carl Hansen
Bill Henderson
Nelson Stewart

To help meet the growing bandwidth demands of multi-core architectures and server virtualization, Dell, Intel, and VMware have collaborated to develop virtualization solutions built on Dell™ PowerEdge™ servers, Intel® Xeon® processors and 10 Gigabit Ethernet adapters, and VMware® ESX software. Utilizing Intel Virtual Machine Device Queues (VMDq) and VMware NetQueue technology, these solutions can enhance performance, increase flexibility, and simplify management in virtualized environments.

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Data centers and other enterprise IT environments are facing exponential growth in their business requirements and service-level agreements. In the past, IT departments may have deployed dedicated physical servers to help reliably support critical applications. As an organization's data needs grow, however, this approach can become increasingly costly and complex. Running dedicated physical servers at utilization levels significantly below their capacity, for example, drives up power consumption as well as the costs of maintaining the servers and the infrastructure to support them—including cooling systems to handle heat output and the physical space to house servers, storage, and networking equipment—and requires administrators to manage an increasingly complicated environment as the number of systems grows. Running multiple applications on individual servers, meanwhile, can rapidly become difficult to manage and potentially unreliable, and can leave applications battling each other for network bandwidth.

Virtualization provides a key way to overcome these challenges. By enabling organizations to run multiple virtual machines (VMs) on a single physical server, IT administrators can consolidate their systems onto a reduced number of physical platforms, increasing processor utilization to make efficient use of available resources while still maintaining the management and reliability advantages of isolated applications. This approach not only helps reduce the costs of physical hardware and infrastructure, but also helps simplify management and provide flexible, dynamic load balancing of workloads across multiple physical servers.

Combining consolidation with the need to access large amounts of data, however, has also made high-bandwidth, high-performance networks a critical requirement in enterprise data centers. Dell, Intel, and VMware have worked together to create collaborative virtualization solutions based on 10 Gigabit Ethernet (10GbE) technology and optimized for powerful multi-core processors. By deploying key technologies such as Intel Virtual Machine Device Queues (VMDq) and VMware NetQueue on Dell PowerEdge servers with multi-core Intel Xeon processors and 10GbE adapters, enterprises can implement optimized, high-performance virtualized environments designed for simplified management and flexible resource utilization.

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10 GIGABIT ETHERNET HELPS MEET INCREASING BANDWIDTH DEMANDS

Both data-intensive applications and the ever-increasing amount of data stored on enterprise networks are driving up the need for high levels of I/O performance and network bandwidth. In addition, as powerful multi-core processors enable each server to support an increasing number of VMs, the need for bandwidth to support those VMs and avoid network I/O bottlenecks also increases.

10GbE has become the medium of choice to help meet the ever-increasing need for high performance in virtualized environments. It can provide reliable links in ranges from 30 m to 300 m depending on the specific cabling medium. When deployed as part of the network infrastructure in a virtualized server environment, 10GbE helps provide the bandwidth and performance to support more VMs per server than would be possible with a standard Gigabit Ethernet infrastructure. By doing so, it also enables high consolidation ratios to help organizations maximize the advantages of virtualization on servers with multi-core processors, helping reduce overall power consumption, heat output, and hardware footprint.

VIRTUALIZATION TAKES ADVANTAGE OF MULTI-CORE PROCESSORS

Non-virtualized servers are relatively simple from a networking perspective: the processor communicates with the OS, which communicates with the adapter. The one-to-one relationship between the server and processor helps minimize the complexity of directing network traffic to and from the system.

Virtualized servers, in contrast, introduce additional complexities, because an individual host server now supports multiple independent VMs: servers with multi-core processors, for example, may assign multiple cores to a single VM, a single core to each VM, or multiple VMs to each core. The dynamic nature of virtualized environments—in which VMs may migrate across different host servers to help provide load balancing and high availability—only adds to this complexity.

Adding a VMware ESX hypervisor on top of multi-core Intel Xeon processors enables enterprises to maximize the advantages offered by multiple cores while helping efficiently handle the specific needs of virtualized environments. The VMware ESX layer, for example, enables each VM to run on its own core, with the ESX software managing the network traffic to each VM (see Figure 1).

Managing traffic at the hypervisor level, however, comes at the cost of additional processor overhead, which can reduce overall performance. The collaborative virtualization solutions from Dell, Intel, and VMware are designed in part to address this problem, enabling enterprises to take advantage of the benefits of virtualization on multi-core processors while minimizing the overhead associated with network traffic management.

COLLABORATIVE SOLUTIONS HELP OPTIMIZE VIRTUALIZED ENVIRONMENTS

Through strong, long-standing collaboration, Dell, Intel, and VMware have developed virtualization solutions designed for high levels of performance, efficiency, and flexibility as well as simplified management. Based on Dell PowerEdge server models 6850, 1950, 2950, 2970, 6950, R900, and R905 with multi-core Intel Xeon processors; Intel 10GbE adapters with Intel Virtualization Technology for Connectivity (Intel VT-c); and VMware ESX software, these solutions integrate advanced technologies such as Intel VMDq and VMware NetQueue to help optimize performance and simplify management in virtualized environments.

Intel 10GbE adapters are designed to provide several key advantages as part of virtualized environments based on Dell PowerEdge servers with multi-core Intel Xeon processors and VMware software. Their advanced networking features help efficiently distribute networking workloads across multiple processor cores,

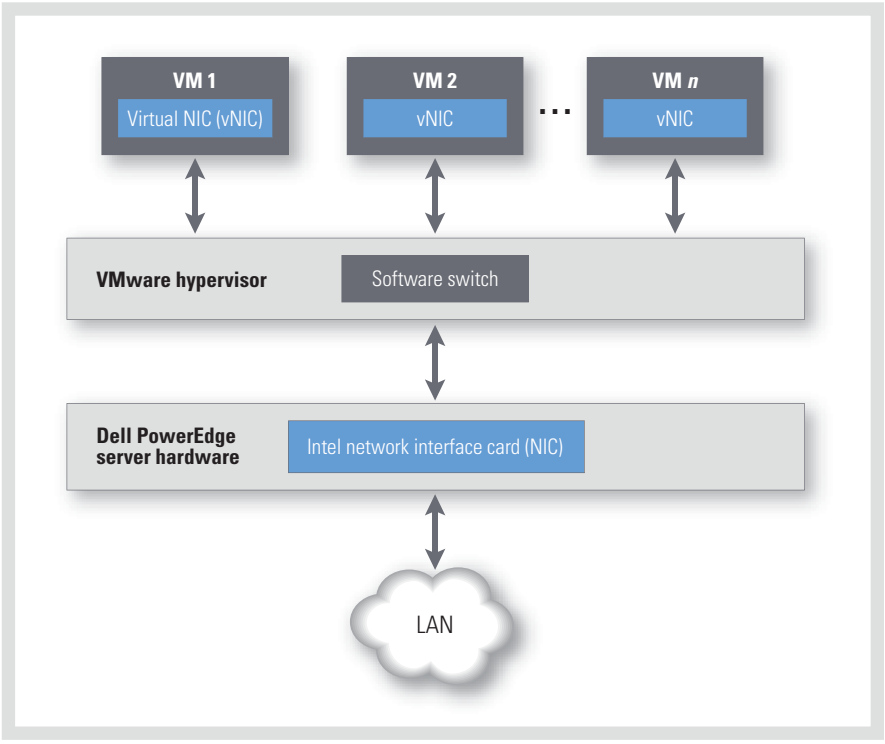

Figure 1. *In typical virtualization environments, the hypervisor manages network traffic to each virtual machine*

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while their support for multiple queues helps alleviate I/O bottlenecks on servers hosting multiple VMs.

Intel VT-c, supported in Intel 10GbE controllers, is a set of virtualization-specific enhancements designed to accelerate network I/O performance and reduce processor utilization. Intel VT-c incorporates two key technologies that help reduce latency, accelerate I/O throughput, and offload network overhead tasks for virtualized servers: Intel I/O Acceleration Technology (Intel I/OAT) and Intel VMDq. Using Intel 10GbE adapters that support these features in combination with the VMware NetQueue technology in VMware ESX 3.5 Update 1 enables organizations to enhance performance across platforms, optimize network traffic management in virtualized servers, and efficiently balance adapter workloads.

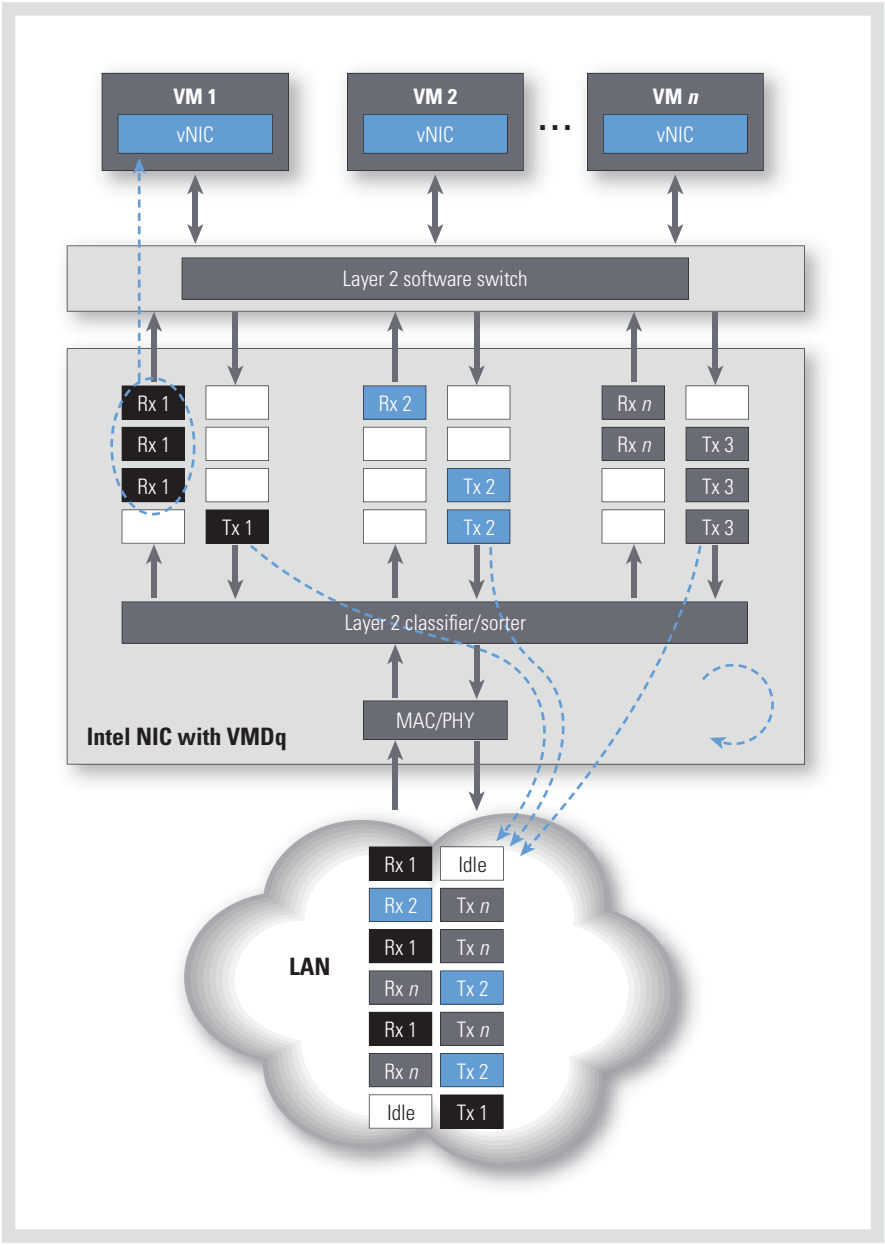

Figure 2. *Intel VMDq technology offloads network I/O data sorting from the hypervisor to the network silicon to enhance I/O performance*

Intel I/O Acceleration Technology enhances performance across platforms

Intel I/OAT is a suite of features that helps enhance data acceleration across a platform—including the network adapters, memory, and chipset—independent of the specific OS on the server. It includes features such as checksum and segmentation offloads, Message Signaled Interrupts Extended (MSI-X), receive-side scaling, receive-side coalescing, Intel QuickData Technology, low-latency interrupts, and more.

Available on Dell PowerEdge servers with dual-core and quad-core Intel Xeon processors, Intel I/OAT is designed to both enhance I/O traffic across an entire platform and increase network scalability seamlessly across ports in Intel 10GbE adapters. These features also help improve I/O performance in VMware virtualized environments, although currently only a subset of features—such as MSI-X and checksum and segmentation offload—are supported for use with VMware software.

Intel Virtual Machine Device Queues optimize network traffic

Intel VMDq technology is a key element in virtualized environments based on Dell PowerEdge servers with multi-core Intel Xeon processors, Intel 10GbE server adapters, and VMware ESX software. It is designed to offload data packet sorting from the hypervisor to the network silicon, helping optimize performance in virtualized environments by releasing processor cycles for application processing rather than network I/O processing to make efficient use of available resources (see Figure 2).

VMDq technology offloads the data sorting functionality to the network silicon and sorts the data packets to the respective queues based on Media Access Control (MAC) addresses and/or virtual LAN tags. Each queue is typically associated with an individual VM. The network controller transmits the queued packets to the wire using a round-robin service, which minimizes head-of-the-line blocking

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and helps ensure sufficient quality of service for each VM.

Using Intel VMDq in conjunction with VMware NetQueue can help dramatically increase network I/O performance in virtualized environments. In tests using the NTttcp benchmark and a standard frame size of 1,500 bytes, the addition of VMDq more than doubled the throughput on a virtualized platform using VMware ESX 3.5 Update 1, from 4.0 Gbps to 8.8 Gbps (see Figure 3).[1]

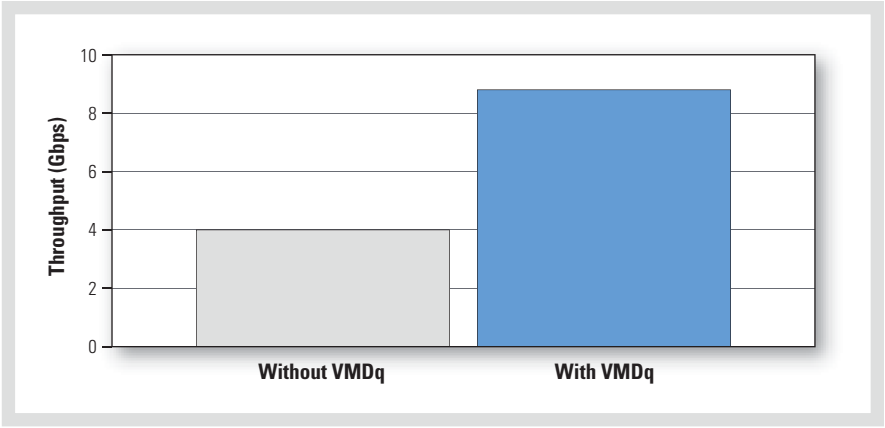

Figure 3. *Intel VMDq technology helps dramatically increase network I/O performance in virtualized environments*

VMware NetQueue efficiently balances adapter workloads

Intel and VMware have collaborated to enable their respective queuing technologies to work together in a virtualized ecosystem, and using Intel VMDq technology with the VMware NetQueue technology in VMware ESX 3.5 Update 1 helps significantly improve I/O performance in 10GbE-based virtualized environment. VMware NetQueue uses MSI-X to help affinitize the data interrupts to a specific processor that is associated with individual VMs. Combining this feature with Intel VMDq provides efficient packet routing and helps maximize the advantages of multi-core architectures.

DELL, INTEL, AND VMWARE PROVIDE OPTIMIZED VIRTUALIZATION

Virtualized infrastructures built on powerful Dell PowerEdge servers with multi-core Intel Xeon processors, high-throughput Intel 10GbE adapters with VMDq technology, and VMware ESX software with VMware NetQueue technology can maximize the advantages of virtualization and multi-core architectures in enterprise IT environments. The collaborative virtualization solutions developed by Dell, Intel, and VMware can help organizations deploy virtualized environments designed for high levels of server and network performance, flexible and dynamic workload management, efficient resource utilization, and simplified management to help meet the demanding requirements of critical enterprise applications.

Shefali Chinni is the marketing manager for I/O virtualization technologies and future Gigabit Ethernet silicon at Intel. Before joining Intel, she held various product marketing management and strategic planning positions at Hewlett-Packard, where she was responsible for managing a diverse portfolio of software, hardware products, and virtualization technologies. Shefali has an M.B.A. in Marketing from Osmania University.

Carl Hansen is the senior product manager for the original equipment manufacturer line of Intel Ethernet adapters with the Intel LAN Access Division. Carl has been with Intel for 12 years and has been responsible for a number of carrier-grade and enterprise products. Before joining Intel, he was a product manager at WordPerfect and Novell. He has a B.A. from the University of Colorado.

Bill Henderson is a staff systems engineer on the Dell Alliance team at VMware working as a technical alliance manager. Before joining VMware, he worked at Dell for 7 years in the Enterprise Product Group in various engineering and engineering management roles. He has an M.S. in Management, Computing, and Systems from Houston Baptist University.

Nelson Stewart is a storage and networking product manager for enterprise NICs and blade server I/O, and has over 29 years of experience in the computer industry. Before joining Dell, he was a product manager for embedded SAN switches at Brocade, served as a key member of Hewlett-Packard's BladeSystem Business team focused on increasing worldwide customer adoption and promoting industry-wide blade products and technologies, and was involved in various other roles over the course of more than 17 years at Compaq/Hewlett-Packard.

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Intel server adapters for virtualization:
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[1] Based on tests performed in July 2008 by Intel using a Dell PowerEdge 2950 server with quad-core Intel Xeon X5460 processors at 3.16 GHz, 8 GB of RAM, and an Intel 10GbE XF SR dual-port server adapter running VMware ESX 3.5 Update 1 with VMware NetQueue technology, supporting eight VMs running the Microsoft® Windows Server® 2003 OS.

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Bundle Up: Intel Offers Comprehensive Professional Editions with New Releases of Compilers and Math Kernel Library

By Shari L. Gould

Regardless of the operating system, creating multi-threaded applications requires more than just the compiler. That's why Intel released Intel C++ and Fortran Compiler Professional Edition 10.0, combining the compiler with key libraries to help simplify multi-threaded application development and provide the tools that support multi-core processors.

Numerous compiler and Math Kernel Library (MKL) improvements are available with this release, including the compiler itself, math processing, and C++ templates for parallelism and multimedia libraries. Intel C++ and Fortran Compiler Professional Editions also offer advanced optimization, multi-threading and processor support, including automatic processor dispatch, vectorization, auto-parallelization, OpenMP, data pre-fetching and loop unrolling.

There are two products to choose from for multi-threaded development. The version for Mac OS X introduced last year combined the compiler with libraries. The 10.0 release extends this model to all supported operating systems.

New Compiler Features

The Intel C++ Compiler Professional Edition 10.0 bundles the compiler with Intel MKL, Intel Integrated Performance Primitives and Intel Threading Building Blocks. Additionally, the Intel Visual Fortran Compiler for Windows comes with the Microsoft Visual Studio development environment.

- *Optimized Performance and Threading*
  Help improve performance for computationally-intensive applications.
- *Enhanced Optimization in C++*
  The compilers can optimize in the presence of C++ exception handling, analyzing and optimizing C++ class hierarchies.
- *Security Checking and Diagnostics*
  Provides GNU Mudflap, Static Verifier for buffer overflow, security and OpenMP API verification.
- *Stand-alone Visual Fortran on Windows*
  Windows users no longer need to purchase Microsoft Visual Studio 2005 separately.
- *64-bit Mac OS X Support*
  Leverage addressing and performance capabilities enabled by the Intel 64 processors in the latest Mac OS X systems.
- *Windows Vista and Visual Studio.Net 2005 Support*
  Get seamless use of property pages, helping to improve the compatibility with your existing VS 2005 projects files.

New Intel MKL Features

The Intel MKL is a set of mathematical functions for engineering, scientific and financial applications. These functions are highly optimized and multi-core ready, meaning they are extensively threaded and thread-safe.

- *Optimization Reports*
  Use advanced optimizations to help the compiler effectively tune your applications.
- *Optimizations for Latest Intel Processors*
  Take advantage of the latest Core2 architecture features designed for improved performance.
- *New Data Compression Functions and Performance*
  Incorporate industry-standard data compression with ready-to-use templates.
- *New bzip2 Functions and gzip-compatible Command Line Utility Code Sample*
  MKL provides data-compression routines targeting enterprise developers.
- *Support for New VC-1 and H.264 High Profile Video codecs*
  MKL can incorporate ready-made templates to render video.
- *LAPACK 3.1 Support*
  MKL is compliant with the latest LAPACK specification.
- *Automatic Grain Size Designed for Better Parallel Algorithms*
  MKL automatically subdivides to optimize.
- *Support for Microsoft Vista and Linux Distributions*
  Deploy applications on the latest operating systems.

Regardless of your platform, you now have the tools to help increase your productivity when developing multi-threaded applications — and you get them at a single, bundled price.

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