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FEATURE SECTION
Implementing Best Practices: The Dell Management Console and IT Infrastructure Library

Smart Migration: Smoothing Your Transition to the New Dell Management Console

COMPUTE MORE, CONSUME LESS POWER WITH SMART DATA CENTER POLICIES
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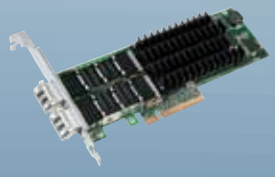

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[1]Intelligent Queuing Technologies for Virtualization White Paper, 2008.

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Dell PowerEdge 4220 (left) and PowerEdge 2420 rack enclosures are designed to efficiently store, power, cool, manage, and secure hardware

POWER AND COOLING PAGE 30

ENHANCING ENERGY EFFICIENCY WITH DELL POWEREDGE 4220 RACK DESIGN

By William Muscato and Andre Fuochi

Taking advantage of the advanced features of the new Dell PowerEdge™ 4220 rack enclosure and following best practices can help IT organizations enhance hardware utilization, increase power and cooling efficiency, and reduce the server footprint in their data centers.

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COMPUTE MORE, CONSUME LESS: SMART POLICIES UNLEASH DATA CENTER PRODUCTIVITY

Dr. Albert Esser, vice president of power and data center infrastructure solutions at Dell, discusses how changing your mind-set can help meet compute demand for years to come. By setting operational policies around virtualization, regular hardware refreshes, and best-practices data center design, IT leaders can help improve productivity and lower power consumption—enabling much more useful work to be performed within facilities that are already in place.

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By John Schouten and Ramesh Radhakrishnan, Ph.D.

The Dell Flexible Computing Solutions suite of products and services is designed to simplify and centralize administrator control over end-user desktops while helping enhance security and reduce total cost of ownership. Understanding the features and usage models of each solution can help administrators optimize their use in enterprise environments.

Deploying Microsoft Office SharePoint Server 2007 on Dell Server Farms

By Gong Wang and Steven A. Grigsby

The Microsoft Office SharePoint® Server 2007 platform offers powerful, flexible support for a wide variety of collaboration functions. By following best practices for deploying and configuring this solution on farms of Dell PowerEdge servers, organizations can create a robust, manageable foundation for end-user productivity.

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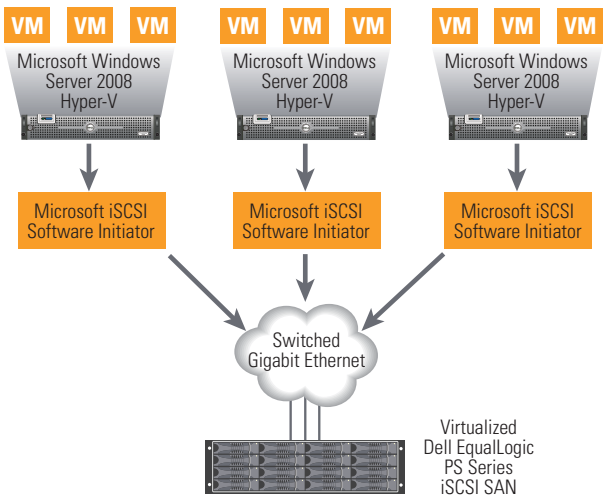
PRODUCT SHOWCASE: F5 BIG-IP AND F5 ARX

ADVANCING INTEGRATION OF MICROSOFT HYPER-V AND DELL EQUALLOGIC VIRTUALIZED SANs

By Stanley L. Stevens and Darren W. Miller

An enterprise-class storage infrastructure is essential for organizations transitioning to a virtualized data center. Dell EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays enable advanced integration with the robust server virtualization offered by the Microsoft Windows Server® 2008 Hyper-V™ virtualization platform—offering the storage foundation for a comprehensive virtualization solution.



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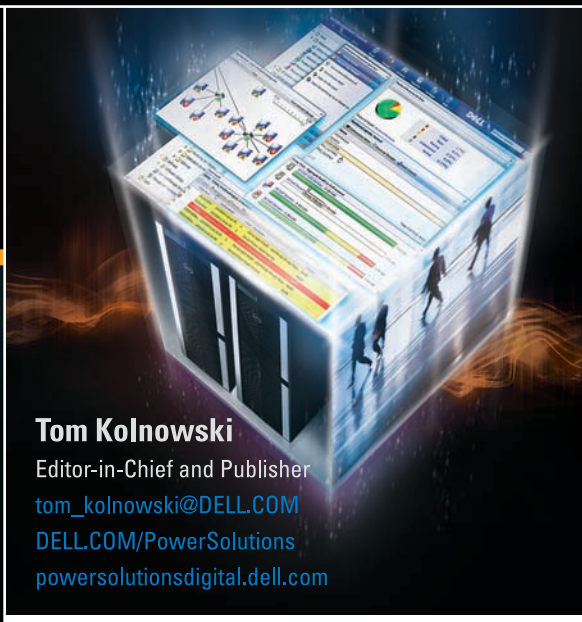
March 2009

YOUR FRAMEWORK, YOUR WAY



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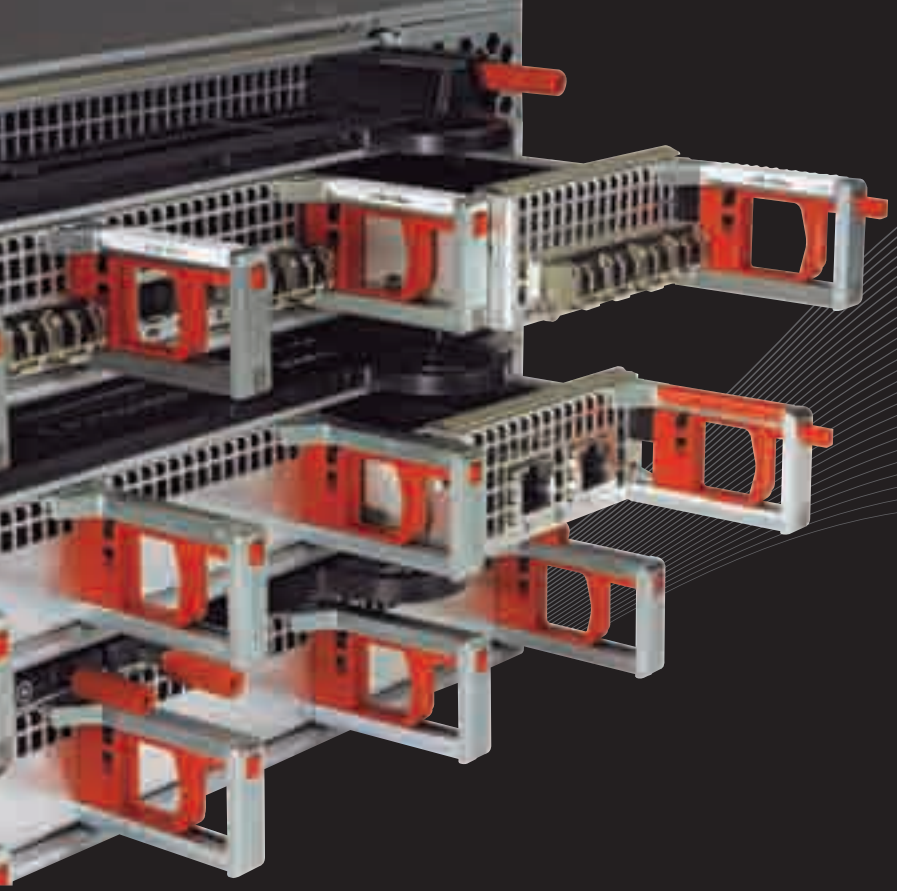
Systems management frameworks have been notoriously complex to implement, often failing to deliver on expectations for an easy-to-manage, enterprise-wide console view of the server infrastructure. The root causes of a failed deployment can encompass a broad range of issues. However, because frameworks are nothing more than a suite of software applications, it is the cost of customizing to meet an organization's unique management requirements through software development that is often the tallest bar on a postmortem Pareto chart.

Enter the new Dell™ Management Console Powered by Altiris™ from Symantec™. This framework redefines much of the systems management paradigm through a holistic, Web browser–based "single pane of glass" approach to enterprise management. The default wizard-based installation provides a rich library of so-called portal pages, which are Web page views of the most common server management, monitoring, and reporting tasks. In a significant departure from the norm, customization does not typically involve any coding, and is accomplished through the addition of *Web parts*—predefined and configurable objects that administrators can easily snap into a portal page with a few mouse clicks.

To demonstrate these rapid customization features, we remotely connected to the Dell TechCenter labs and launched a Dell Management Console session. For the purposes of this demonstration, we created a new portal page by cloning an existing portal page and then adding a Launch Performance Viewer component to the page. With stopwatch in hand, we clicked the Settings menu, selected "Console," and launched Portal Pages. In the left-hand navigation pane, we right-clicked on the Jobs and Tasks Portal item, then selected "Clone" to generate the new portal page. In the right-hand pane, we clicked "Edit" to modify the page, then scrolled the Web Parts window and selected the Launch Performance Viewer item. We then clicked "Add" to display the new component on the page and clicked "Apply" to save the new page. Total elapsed time from concept to a live portal page: 55 seconds.

To read more about how the Dell Management Console can help simplify your management infrastructure, turn to our cover story: "Systems Management Simplified" (page 8) explains why migrating from a piecemeal management approach to this easily customizable and extensible framework promises to usher in a new era of IT staff efficiency. Plus, three drill-down technical articles on the console explore how it embraces IT Infrastructure Library (ITIL) principles, best practices for smoothing migration, and approaches to managing operating systems and applications. For late-breaking information on the Dell Management Console, visit the Dell TechCenter community site at www.delltechcenter.com.



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SYSTEMS MANAGEMENT SIMPLIFIED

Enterprises are getting hit by a double whammy as systems management complexity spirals out of control and outstrips infrastructure spending. By giving administrators single-pane access to comprehensive management functions and scalable process automation across a broad range of Dell and partner systems, the new Dell™ Management Console Powered by Altiris™ from Symantec™ can free vital IT resources to advance innovation and help lower the cost of doing business.

By Pascal Nicolas
Jeanne Feldkamp
Tom Kolnowski

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Over time, IT environments naturally become more complex. Servers, platforms, and applications require increased management resources as they age. Decentralized data centers and departmental silos can result in data duplication and inconsistencies. Hardware and software deployments, migrations, compliance enforcement, patching, and administrator training all sap resources that might otherwise be directed to strategic projects. And operational silos—for example, asset management, service desk, client and mobile management, server and infrastructure management, and security and compliance—typically lead to a lack of integration and communication, not to mention redundant responsibilities.

To compound these issues, decreasing budgets are forcing IT departments to do more with less while the cost of systems management continues to rise. All too often, provider-centric management tools lock organizations into products from a particular vendor rather than simplifying management tasks. Moreover, management can be time-consuming when administrators must use different tools for different tasks. And keeping systems running is often people intensive because the complexity of the task requires a team of administrators.

Despite these everyday realities, garnering support for a cohesive systems management strategy can be a tough sell outside the IT department. Smooth systems operation is critical to business success, but it is not often recognized as a strategic contribution that positively affects the bottom line. Executives need to understand the connection between centralized, simplified systems management and competitive advantage.

REDUCING THE COMPLEXITY OF THE PIECEMEAL APPROACH

Today, administrators often use a variety of systems and network management software to manage computing resources for individual end users, small businesses, departmental workgroups, and global enterprises. However, while systems management tasks have grown in complexity, many vendors have taken a piecemeal approach—which often requires numerous tools to manage different components in an IT environment. For example, administrators might be using separate tools for some or all of the following tasks:

- Hardware management
- OS deployment, monitoring, and patching
- Application management
- Event automation
- Job scheduling
- Output management
- Performance management
- Backup and recovery
- Security and threat management
- Change and configuration management
- Problem management, troubleshooting, and diagnostics
- Network and storage management
- Service desk and workflow management

Many popular solutions were essentially pieced together through multiple acquisitions. The products themselves typically have limited integration capabilities, which can require a significant investment in services to perform the integration work. A large back-end infrastructure encompassing a variety of servers and management databases creates costly overhead, including the burden to manage the management software. And using multiple consoles to manage different aspects of the enterprise can lead to error-prone manual processes, increased troubleshooting time, and people-intensive infrastructure management.

Effective systems management tools help to create competitive advantage by freeing IT organizations to focus on strategic system initiatives. In this way, the Dell approach to systems management is designed to advance business innovation, enhance customer satisfaction, and reduce the cost of doing business.

GUIDED TOUR: THE DELL MANAGEMENT CONSOLE

The Dell Management Console redefines much of the systems management paradigm, through a holistic, Web browser–based "single pane of glass" approach to managing enterprise-wide IT assets. Out of the box, the default portal home page offers a comprehensive console view and a straightforward, wizard-based path to easily migrate existing Dell systems discovery ranges and credentials from the Dell OpenManage IT Assistant tool—a good way to get started on the path to simplified management. But it would be a shame to stop there, bypassing much of the added management depth the console offers, which can be easily harnessed by snapping in "Web parts" from the extensive library provided.

The *Dell Power Solutions* editorial team remotely connected to the Dell TechCenter labs, where the TechCenter team had deployed a Dell Management Console instance in a default configuration to manage their data center. Some key portal views, features, and customization capabilities are shown here:

- **Getting started:** Dell Management Console deployment begins by launching the installer (see Figure A), which offers several options for initiating installation or learning more through tutorials. For many organizations with existing Dell PowerEdge™ servers, using the wizards for migrating Dell OpenManage IT Assistant discovery settings (see Figure B) would be among the first tasks.
- **Monitoring and alerting:** The Monitoring and Alerting portal view (see Figure C) offers single-click drill-down to reveal details on troublesome server nodes.
- **Customizing reports:** A comprehensive library of default reporting templates is available (see Figure D), and all offer extensive customization capabilities. New reports can be readily added.
- **Configuring portal pages:** Portal pages, which are a library of configurable Web page views, can be easily customized by the addition or removal of snap-in Web parts (see Figure E).

Figure A. *Launching the Dell Management Console installer to reveal installation, tutorial, and migration options*

CREATING A FLEXIBLE, COHESIVE SYSTEMS MANAGEMENT STRATEGY

For several years, Dell OpenManage™ tools have helped administrators effectively manage hardware deployment, monitoring, and updates. However, there has been limited support for the non-hardware management tasks that IT departments perform regularly. Using a different tool for each management task added a layer of complexity that made it difficult for IT administrators to work efficiently.

What has been lacking is a comprehensive systems management strategy focusing on simplicity and flexibility. To that end, the new Dell Management Console—based on the modular Symantec Management Platform architecture—offers a holistic view of the data center and unified management of enterprise-wide IT assets through a single console and database.[1] The Dell Management Console is designed to provide a single "pane of glass" for administering tasks throughout the entire IT management life cycle (see the "Guided Tour: The Dell Management Console" sidebar in this article).

The Dell Management Console replaces the existing Dell hardware management console, Dell OpenManage IT Assistant. It is designed to allow organizations to grow functionality without expanding infrastructure as enterprise needs evolve. By enabling IT departments to deploy additional features through the same console, it can also facilitate data sharing through a single configuration management database (CMDB)—which helps reduce overall management costs. Basic management features are offered for Dell servers out of the box at no additional cost, providing the foundation for a comprehensive range of advanced management functions across the enterprise IT infrastructure.

Figure 1 illustrates where the Dell Management Console fits in the overall Dell OpenManage suite of products. The console platform is designed to replace Dell OpenManage IT Assistant only, and to work with all other Dell OpenManage tools.

EXPANDING THE CAPABILITIES OF DELL OPENMANAGE IT ASSISTANT

The Dell Management Console dramatically expands on the capabilities of Dell OpenManage IT Assistant with broad-ranging functionality in key areas. This section provides an overview of features provided at no additional cost with the Dell Management Console:

- **Enhanced hardware reporting:** The console offers a holistic view of the IT environment—providing information, rather than just data, to enhance enterprise decision making. Administrators can choose from a device tree view, graphical reports, or exportable tables, and can drill down into devices to see

[1] The Dell Management Console had not yet been released to ship at press time (February 20, 2009); features and capabilities in the production version are subject to change.

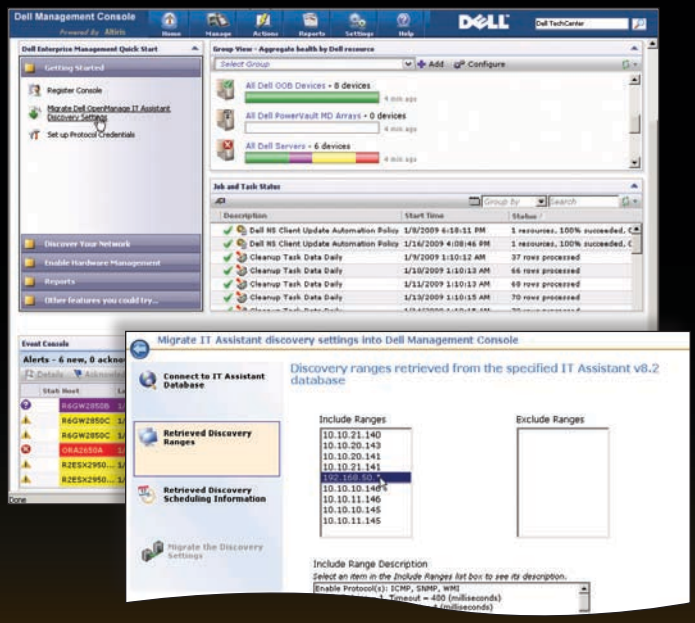

Figure B. *Selecting the Migrate Dell OpenManage IT Assistant Discovery Settings option from the default Dell Management Console home page*

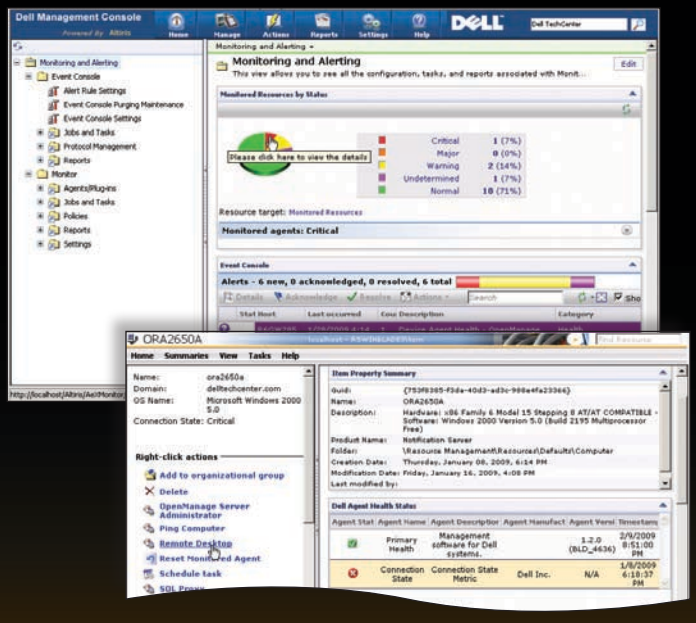

Figure C. *Drilling down into a troublesome server node from the Monitoring and Alerting view's Monitored Resources by Status Web part*

(continued on page 12)

in-depth hardware inventory data. A wide variety of preconfigured graphical and tabular reports are available, and administrators can configure their own reports to help meet particular enterprise requirements.

- **Heterogeneous hardware monitoring:** The console can perform proactive heartbeat monitoring on an administrator-defined schedule as well as asynchronous event reception for Dell systems. Management information bases (MIBs) can be imported for non-Dell devices.
- **Additional device and hypervisor support:** The console includes support for additional devices (such as Fibre Channel switches) and hypervisors (such as VMware® ESXi). The platform can not only monitor the health of hardware running VMware, Microsoft®, or Citrix® hypervisors, but also discover virtual machines and associate them back to a physical host server. In addition to the list of devices supported by Dell OpenManage IT Assistant—Dell

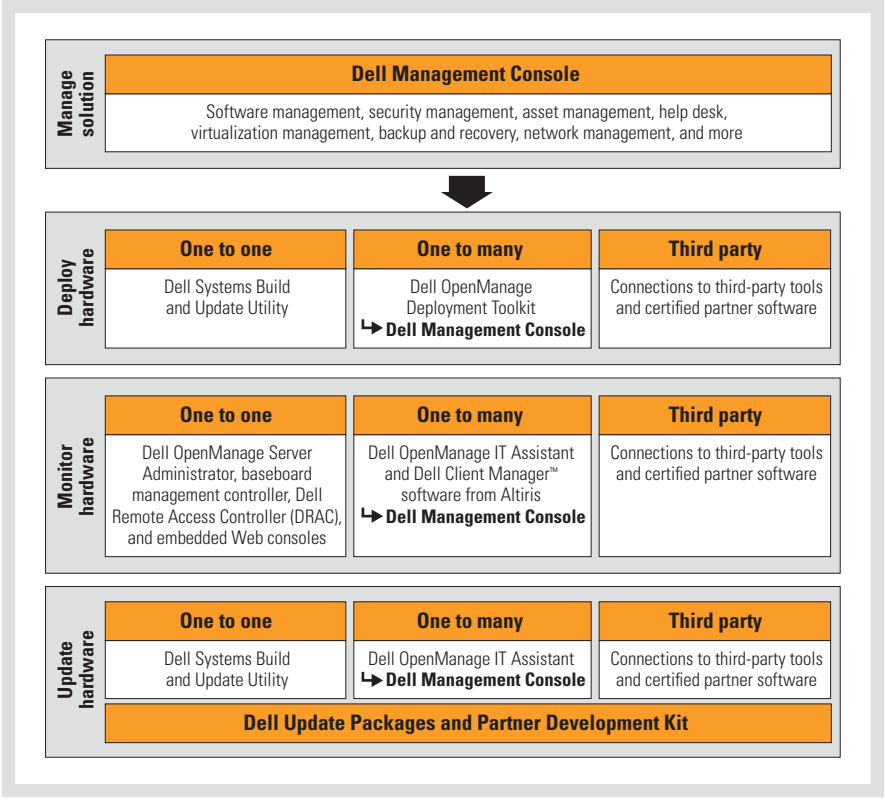

Figure 1. *The Dell Management Console provides a sweeping view of enterprise-wide IT assets to help simplify management*

(continued from page 11)

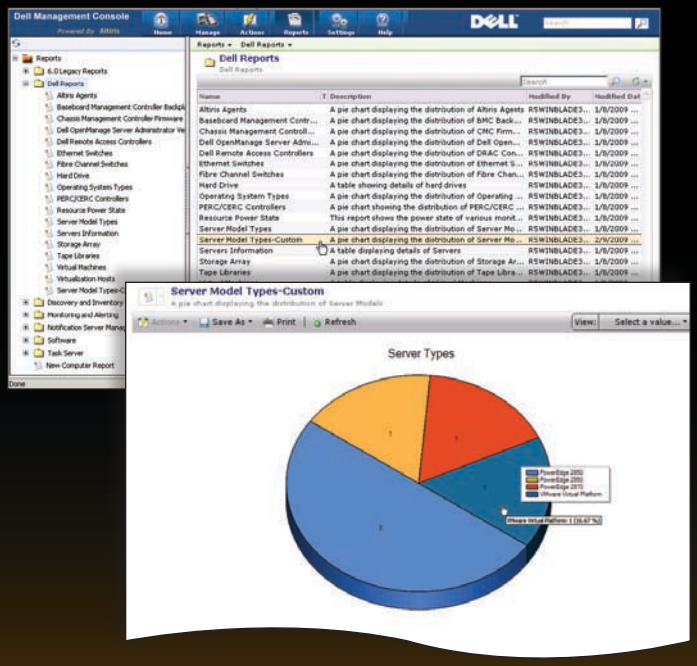

Figure D. *Displaying a customized Server Model Types report from the Reports menu*

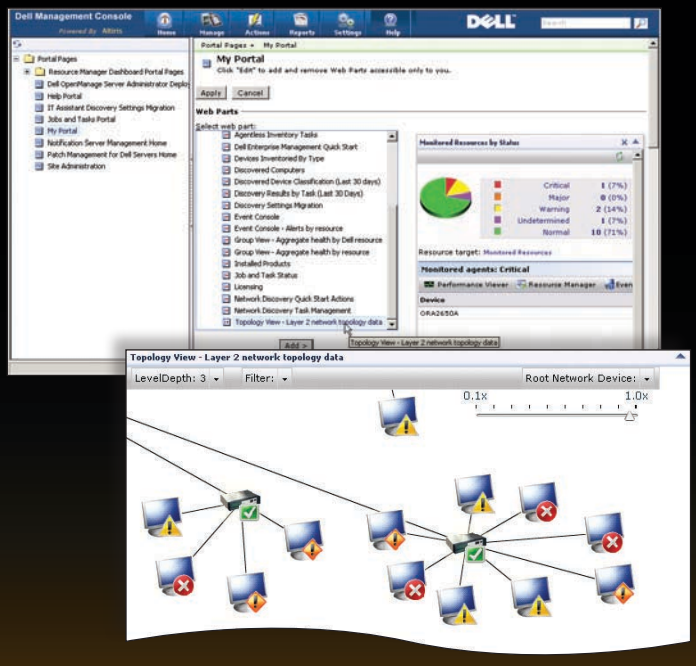

Figure E. *Customizing an existing portal page by snapping in a Topology View Web part (functionality enabled through purchase of the Altiris Server Management Suite™ plug-in)*

desktops, notebooks, printers, servers, storage arrays, Ethernet switches, KVM (keyboard, video, mouse) switches, and tape libraries—the console adds support for Fibre Channel switches and additional hypervisors such as VMware ESXi.

- **Configurable dashboards and portals:** By providing a dashboard view for associated devices, the platform is designed to make it easy for administrators to spot potential problems before they become major issues. Administrators can configure their own portal pages by adding the modular components that are most relevant to their daily activities.
- **Role-based security:** Devices can be segmented or viewed by geographical location, device type, or functional area. Users can import Microsoft Active Directory® roles or create new roles with the console to assign permissions such as ability to view.
- **OS monitoring:** The console monitors utilization of memory, processors, free space, and I/O across the data center. Historical reporting and live graphs are available for monitored devices. The system can generate alerts based on administrator-defined thresholds.
- **Multi-site hardware updates:** The console offers the ability to push agent, BIOS, driver, and firmware updates to Dell servers and to child nodes in different regions or data centers. In addition, the console can be configured to download the latest updates from the Dell Web site on a scheduled basis.
- **Hardware configuration:** The tool enables administrators to push configuration changes to many devices simultaneously, using graphical representations and wizards designed to further streamline the hardware configuration and patching process. For example, administrators can roll out BIOS changes easily by selecting preferences from drop-down menus, without scripting.

CUSTOMIZING A HIGHLY EXTENSIBLE FRAMEWORK

The Dell Management Console offers an à la carte functionality menu designed to simplify, consolidate, and automate IT processes. An intuitive wizard guides administrators through the initial installation. After installation is complete, IT departments can build a dashboard portal that is customized with their own reports, devices, and views.

Because the console is designed to be device agnostic, it can manage hardware devices and operating systems from multiple vendors to deliver a single view and a common data source for the entire IT infrastructure. Its centralized systems management capabilities also allow administrators to track storage resources, monitor performance, and perform updates quickly. The single back-end architecture of the platform helps provide the flexibility to cover every aspect of the IT infrastructure—including hardware from other vendors and virtualized as well as physical systems. This approach allows

organizations to avoid replacing existing management tools when they integrate new applications into the environment.

The console offers an extensible framework to help meet specific organizational needs through a variety of plug-ins that can be purchased individually and installed easily on top of the base platform (see Figure 2). Plug-in upgrades enable IT departments to preserve their existing investments by connecting information systems, enhance visibility of key information within the organization, and minimize total cost of ownership by avoiding costly systems integration projects. For example, console plug-ins can leverage inventory data from the base product to help easily roll out OS patches, monitor applications, take regular system snapshots, track trouble tickets, and automate complex business processes.

Additional plug-ins can take advantage of organizational information by helping to integrate human resources, financial, service delivery, and other enterprise systems—helping to reduce complexity and curb the growth of IT administration costs. The list of available plug-ins is expected to grow as third-party software vendors transition existing consoles and develop features designed to work with the Dell open framework.

In addition, Dell facilitates peer-to-peer communication between IT professionals across company lines through the Dell Management Console section of the Dell TechCenter community (www.delltechcenter.com). There, administrators can view demo videos, wikis, and blog postings; share experiences; post scripts; and contribute functionality they have developed that could be of value to the community as a whole.

SIMPLIFYING SYSTEMS MANAGEMENT THROUGH INTEGRATED ACCESS

Organizations that take a piecemeal approach to systems management can easily become mired in a tangle of administrative tools. The Dell Management Console enables a device-agnostic strategy that allows administrators to simplify IT and control costs through integrated, automated access to the entire IT infrastructure. A single easy-to-understand interface enables administrators to drill down into relevant information quickly and easily, while a modular foundation provides basic out-of-the-box hardware management at no additional cost and supports optional suites for advanced server and client management features such as asset and security management. These connector capabilities help avoid costly integration projects by allowing IT organizations to populate a common CMDB with data from other systems, import and export among key data sources, and integrate to and from enterprise business systems.

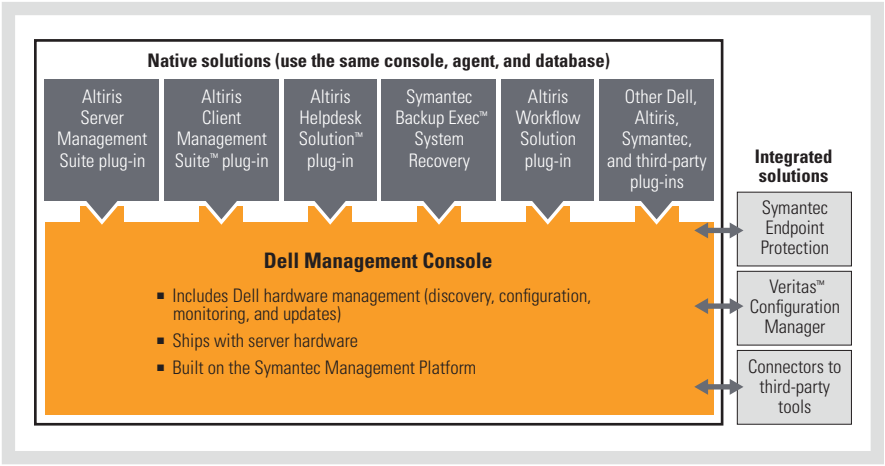

Figure 2. *Dell Management Console plug-ins expand management functionality to a broad range of Dell and partner tools*

Between rising costs and reduced IT budgets, simplified systems management has become an urgent consideration for many enterprises. The new Dell Management Console is designed to provide the framework for a cohesive, comprehensive approach to IT management that can help overcome the pitfalls of skyrocketing cost and complexity. By giving administrators a single centralized tool to help them perform the myriad tasks they contend with on a daily basis, organizations free IT staff to focus on strategic initiatives and innovation—which can ultimately help increase competitive advantage and make a direct impact on the business bottom line.

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Jeanne Feldkamp is a business and technology writer based in San Francisco and a frequent contributor to *Dell Power Solutions* magazine.

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

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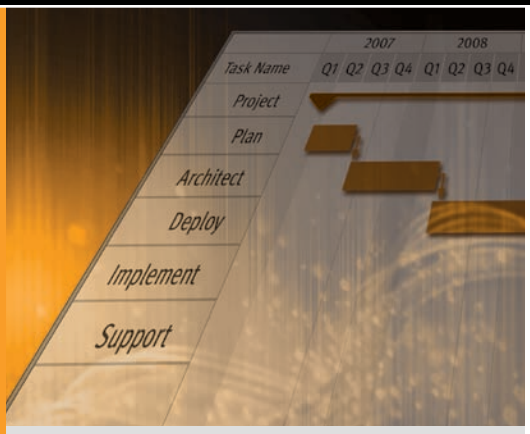

IMPLEMENTING BEST PRACTICES: THE DELL MANAGEMENT CONSOLE AND ITIL

By John Stahmann

The Dell™ Management Console Powered by Altiris™ from Symantec™ provides a comprehensive management platform based on standardized IT Infrastructure Library (ITIL) processes—facilitating the adoption of industry best practices and helping streamline and simplify IT management in enterprise data centers.

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Reduced budgets and growing demands on IT departments have forced organizations to find ways to cut costs, increase IT resource productivity, and optimize existing investments. Among the myriad options available, one key strategy to meet these goals is simplifying and standardizing IT management. Constantly developing and redeveloping processes internally, however, is often costly and unproductive. As a result, IT organizations have turned to the IT Infrastructure Library (ITIL) for guidance on the development and implementation of standardized processes.

The new Dell Management Console[1] is based on ITIL principles, and is designed to facilitate the adoption of industry best practices in data centers based on Dell systems. By taking advantage of the console's modular architecture and comprehensive management features, organizations can use the console to support ITIL processes and help streamline and simplify IT management in their own environments.

UNDERSTANDING ITIL PRINCIPLES

ITIL was conceived in response to increased dependency on IT and the need for process standardization, and has become a worldwide de facto standard for IT management implementation. It consists of a set of comprehensive, detailed, and publicly available IT management guidelines, presented in a series of books that contain recommended best practices, workflows, templates, and terminology developed by the UK Office of Government Commerce. In addition to helping organizations standardize their processes, ITIL also provides definitions of common terminology to promote a forum of communication and help ensure consistent language across the industry.

Many vendors of service- and asset-management tools supply applications that support the implementation of ITIL processes, but lack the architecture and ability to help organizations act on the delivery and execution of ITIL tasks. Three tool domains are associated with providing and supporting IT services:

- **Process management tools:** Support the management and tracking of status, assignments, escalations, historical work conducted, and tasks associated with completing work
- **Analysis tools:** Support the presentation of relevant data, enabling a detailed understanding of metrics and reports to assist with the completion of tasks and enforce enhanced decision-making strategies
- **Execution tools:** Provide an opportunity for individuals responsible for task completion to utilize automation solutions to execute and complete assigned tasks

[1] The Dell Management Console had not yet been released to ship at press time (February 20, 2009); features and capabilities in production version are subject to change.

The Dell Management Console provides organizations with ITIL-aligned processes, presentation of relevant data, and tools for executing IT support activities, helping organizations proactively strategize, allocate resources, and make accurate decisions. The foundation of a successful implementation of ITIL processes starts with knowing what assets are available and how they are functioning. Building asset relationships enables service departments to develop standardized and repeatable services that encompass collections of assets.

Accurate asset information is vital to supporting IT services, and enhances the ability of service departments to detect, diagnose, and resolve infrastructure errors. The Dell Management Console offers robust, automated discovery and collection of detailed asset information, which is then correlated to display resource associations and service-level views of discovered assets. Associating service activities with assets helps IT departments understand the true total cost of ownership of IT assets. The utilization of process management tools, analysis tools, and execution tools, meanwhile, helps align processes with ITIL principles and enables the successful management of IT resources throughout their life cycles.

"The new Dell Management Console is based on ITIL principles, and is designed to facilitate the adoption of industry best practices in data centers based on Dell systems."

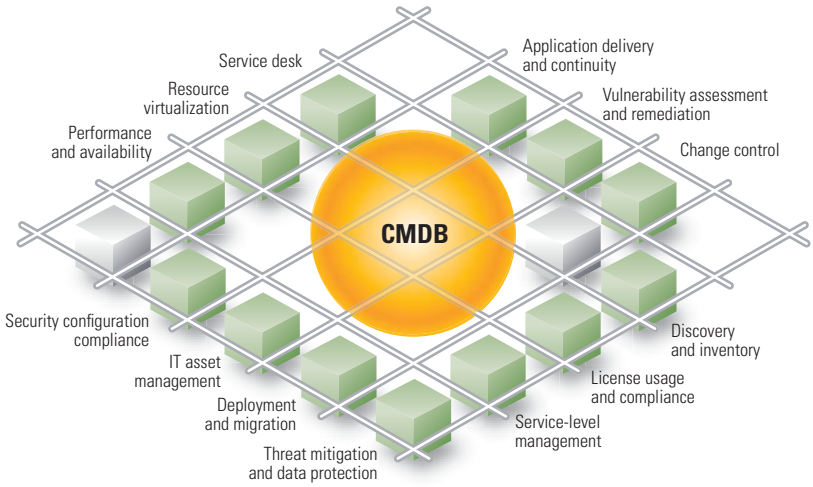

Figure 1. *Dell Management Console integration with a centralized CMDB helps streamline and simplify IT management*

UNDERSTANDING THE CONFIGURATION MANAGEMENT DATABASE

The configuration management database (CMDB) is at the center of the ITIL process model. It is designed specifically to enhance IT efficiency and cost savings throughout the enterprise while helping improve service levels, security, and decision support. ITIL stipulates that a CMDB must perform the following four critical functions:

- Account for all of the IT assets and configurations within an organization and its services
- Provide accurate information on configurations and their documentation to support service management processes
- Provide a sound basis for incident management, problem management, change management, and release management processes
- Verify configuration records against the infrastructure and correct any exceptions

There are many ways to achieve these goals through software and processes, but the most important question is how to do so without incurring more cost and overhead than the results might be worth. The Dell Management Console integrates an extensible CMDB designed to accelerate potential benefits and help reduce both initial and ongoing costs (see Figure 1). It is installed as part of the complimentary Dell hardware management tools at no additional cost, and can be extended automatically as other solutions are added to the system—no complex or costly services are required just to integrate other Dell modules into the CMDB.

Changes, in particular, can be a primary source of problems in IT environments. Once the CMDB is built, organizations should continually monitor for unauthorized changes and ensure that when a change is required, it is guided by a formal change process. CMDBs that are not an active part of the management process are little more than reporting databases—aggregations of data from multiple sources

> **"The Dell Management Console provides a variety of modular solutions for advanced management functions—including asset management, software management, data protection, security, and others—designed to support ITIL processes in a variety of ways and provide a convergence point that can effectively bring together multiple aspects of IT management."**

that may or may not be accurate. Inaccuracy in the CMDB often affects IT staff activities, requiring them to spend extra time troubleshooting problems and often culminating in an increased frequency of desk-side visits or even trips to remote locations, which can adversely affect service levels.

The key to the Dell management approach lies in providing powerful, easy-to-use management tools, organized around a CMDB, to those performing time-consuming, often repetitive work. These tools are designed to save IT staff both time and effort while automatically integrating the data and results of their activities into the CMDB—helping provide IT teams with a reliable source of asset information, the automation and execution tools to act on their findings, and the ability to comply with regulatory requirements to maintain an audit trail of activities.

IMPLEMENTING ITIL WITH THE DELL MANAGEMENT CONSOLE

The Dell Management Console provides a variety of modular solutions for advanced management functions—including asset management, software management, data protection, security, and others—designed to support ITIL processes in a variety of ways and provide a convergence point that can effectively bring together multiple aspects of IT management. The modular architecture of the console provides for automated, policy-based management of discoverable configuration items within the resource model, while comprehensive Web browser–based reports and dashboards provide a unified view of the IT infrastructure across a variety of different functions that can include integrated third-party solutions.

The CMDB installed with the complimentary Dell management tools can be extended automatically as administrators add management modules, helping provide actionable data that IT departments can use to standardize and automate common IT functions. The integration points organized around the CMDB can include discovery and inventory tools, automated system deployment and migration, help desks, software management, change and configuration management, security, data protection, application dependency mapping, human resource data, and more.

Dell has also opened up this management platform to a number of Dell partners who are both building native solutions for the console and integrating their existing products into it. For example, Symantec already provides multiple plug-in solutions that integrate with the console, including Altiris Client Management Suite™, Altiris Server Management Suite™, Symantec Backup Exec™ System Recovery, Symantec Endpoint Protection, Symantec Ghost™, Symantec Network Access Control, Symantec pcAnywhere™, and Veritas™ Configuration Manager software.[2] Other partners plan to provide solutions for network management, printer management, power management, encryption, and more.

SIMPLIFYING IT MANAGEMENT WITH BEST PRACTICES

The Dell Management Console offers a comprehensive management platform that embraces standardized ITIL principles and can scale far beyond Dell hardware management. By using the console to support ITIL processes and industry best practices, organizations can streamline and simplify IT management tasks in their own environments—ultimately helping optimize their resources and control ongoing costs.

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[2] For more information on using Symantec plug-in components with the Dell Management Console, see "Managing Operating Systems and Applications with the Dell Management Console," by Jordan Gardner, in *Dell Power Solutions*, March 2009, DELL.COM/Downloads/Global/Power/ps1q09-20080451-Altiris.pdf.

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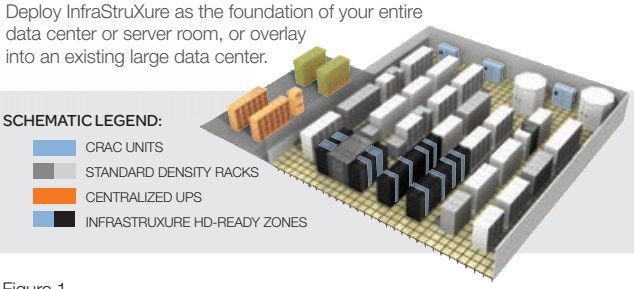

Figure 1

Efficiency and Virtualization

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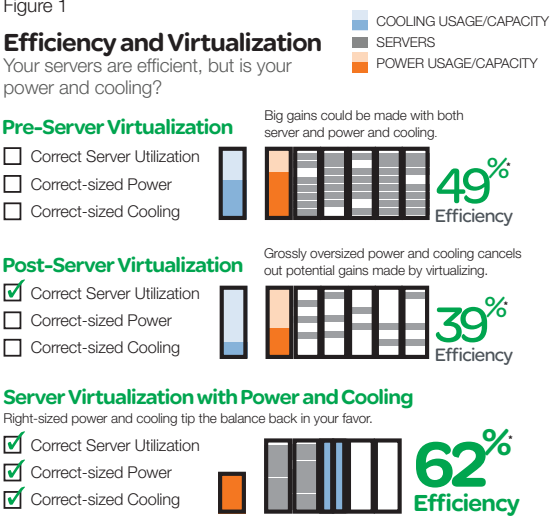

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MIGRATING TO THE NEW DELL MANAGEMENT CONSOLE

By Manoj Poonia
Ed Casmer

The Dell™ Management Console Powered by Altiris™ from Symantec™ centralizes multiple aspects of systems management into a single easy-to-use tool. Administrators can upgrade existing systems to the Symantec Management Platform architecture and migrate data from Dell OpenManage™ IT Assistant to help smooth the transition to this powerful, flexible console.

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The complexity of systems management can be an ongoing source of problems in enterprise data centers, requiring administrators to rely on a host of different tools to manage the disparate servers, storage, software, and other devices and platforms that make up their IT environments. This complexity can burden not only IT staff, but also the organization itself—driving up day-to-day operational costs, increasing the risk of failure, and slowing problem resolution.

The new Dell Management Console[1] is designed to significantly simplify systems management, enabling administrators to manage the myriad aspects of their IT environments—including deployment, help-desk support, security, backup, and servers and storage—from a single centralized console. Based on the flexible, extensible Symantec Management Platform architecture, this tool can integrate easily with an entire catalog of high-value plug-ins without requiring complicated integration services.[2] Implementing a single console that can support a wide variety of management tasks not only helps reduce operational costs, but can also help simplify training for IT staff and enable administrators to focus on enhancing the business value of their IT infrastructures rather than on managing their management tools.

Administrators can implement the Dell Management Console either by performing a clean installation of the software, which includes the Symantec Management Platform, or by first upgrading an existing Altiris Notification Server™ 6 installation to the Symantec Management Platform and then installing the console as a plug-in solution. After upgrading to the Symantec Management Platform, administrators can then migrate discovery ranges and schedule settings from an existing installation of Dell OpenManage IT Assistant to help smooth the transition to the new console.

UPGRADING TO THE SYMANTEC MANAGEMENT PLATFORM

When upgrading from Altiris Notification Server 6 to the Symantec Management Platform, administrators can either replace the existing platform on the current hardware or migrate to new hardware. Each method has its own advantages and disadvantages. Leveraging existing hardware helps keep migration costs low, but does not enable administrators to easily roll back to the previous infrastructure if needed. Migrating to new hardware, on the other hand, does require additional equipment costs, but enables administrators to run each system in parallel, migrate with a phased approach, and gain the performance and processing benefits that new hardware can provide.

[1] The Dell Management Console had not yet been released to ship at press time (February 20, 2009); features and capabilities in production version are subject to change.

[2] For more information on the advantages of this architecture, see "Managing Operating Systems and Applications with the Dell Management Console," by Jordan Gardner, in *Dell Power Solutions*, March 2009, DELL.COM/Downloads/Global/Power/ps1q09-20080451-Altiris.pdf.

In either case, the Symantec Management Platform installation wizard and upgrade framework, known as the Symantec Installation Manager (SIM), can guide administrators through the upgrade process and help ensure that the data is migrated correctly. Even following an upgrade, administrators can retain the legacy database in case they want to access it later.

Performing the upgrade

At a high level, the upgrade process is the same for both an in-place upgrade on existing hardware or a migration to new hardware: administrators export data from Altiris Notification Server 6, install the Symantec Management Platform, and import the data into the new environment. However, the specific steps may differ depending on the option chosen.

Unlike Notification Server 6, which uses the integrated Solution Center to install additional features and functionality, SIM is a portable, stand-alone application that installs both the Symantec Management Platform and additional features and functionality. By default, SIM installs only the core platform, but administrators can easily add plug-in solutions like the Dell Management Console by selecting them from the solution list within the installer. When performing an in-place upgrade, SIM detects the existing Notification Server 6 installation, and then uses the Symantec Upgrade Wizard to enable administrators to choose which data to export before uninstalling Notification Server 6 and its solutions (see Figure 1). It then installs the Symantec Management Platform and the corresponding solutions and runs the Upgrade Wizard in import mode, enabling administrators to choose data to import.

When migrating to new hardware, SIM installs the Symantec Management Platform and the plug-ins on this hardware, and then provides instructions on how to export the existing data from Notification Server 6. The necessary files for export are copied to Notification Server 6 along with the upgrade framework, after which the Upgrade Wizard exports the data to a data store. This data store is simply a file-based store that has no dependency on the Microsoft® SQL Server® platform, and is typically easy to copy, back up, and move. Administrators should keep in mind that the data store is not encrypted and therefore must depend on other security mechanisms for protection. Administrators then copy the data store from the Notification Server 6 system to the Symantec Management Platform system and run the Upgrade Wizard to import the data.

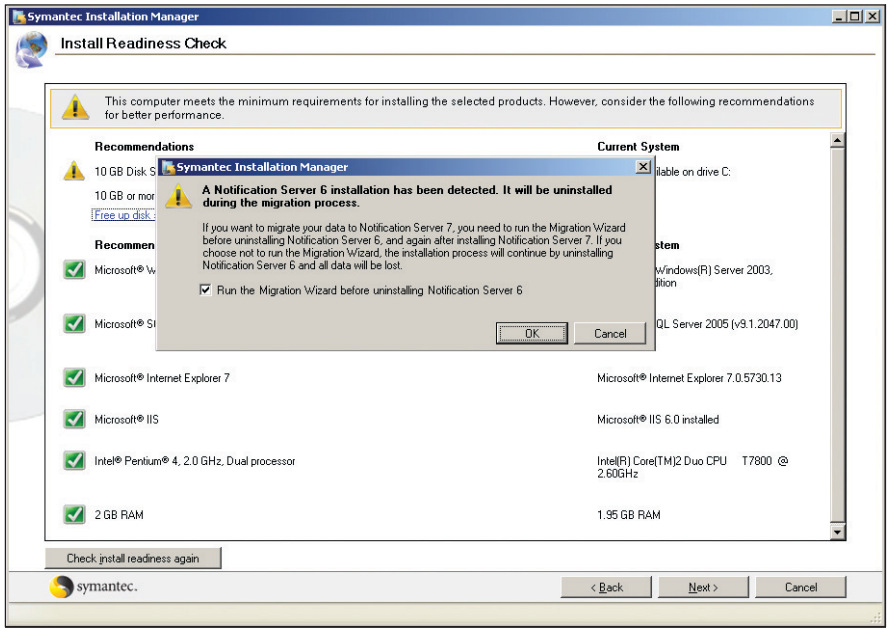

Figure 1. *Symantec Installation Manager preparing to upgrade from an existing Altiris Notification Server 6 platform*

Administrators can use SIM to both support customized installations and modify configuration options later, enabling them to carry out an upgrade in phases. For example, they can extract data for certain plug-ins and install them in a specific order to help minimize testing. If they experience problems, they can reexport the data from the legacy system and reimport it into the new Dell Management Console system. Figure 2 lists several current plug-ins and shows how their functionality translates to the new framework.

After administrators have completed the upgrade, they can complete the transition by running the Dell Management Console installer to add the console to the Symantec Management Platform.

MIGRATING DATA FROM DELL OPENMANAGE IT ASSISTANT

The Dell Management Console is designed to incorporate nearly all of the features of Dell OpenManage IT Assistant 8 while also introducing additional features and enhancements. Administrators can migrate discovery ranges and schedule settings from IT Assistant, run a discovery on the migrated ranges to discover managed devices, and run inventory cycles to retrieve detailed information on those devices.

Administrators should keep in mind that although the Dell Management Console includes much of the same preconfigured information as IT Assistant, the initial release version of the console does not support migrating customized tasks; reports; device groups; favorite application launch points; event actions, filters, categories, and sources; and inventoried device data. After installing the Dell Management Console, however, they can re-create these items manually using equivalent functions.

Performing the migration

Before performing a migration, administrators should ensure that their IT Assistant database is version 8.0 or later, the Dell Management Console system can ping the

Current plug-in for Notification Server 6	Replacement plug-in for the Symantec Management Platform	Notes
Altiris Monitor Solution™ for Dell Servers plug-in	Dell Management Console	The Dell Management Console is designed to incorporate all features of Altiris Monitor Solution for Dell Servers and adds a new event console.
Altiris Patch Management Solution™ for Dell Servers plug-in	Dell Management Console	The Dell Management Console is designed to incorporate all features of Altiris Patch Management Solution for Dell Servers and adds new features to help download, manage, inventory, and apply Dell Update Packages. However, no data from Altiris Patch Management Solution for Dell Servers is migrated to the Dell Management Console during the upgrade.
Altiris Dell Client Manager™ plug-in	Symantec Dell Client Manager	Because Dell and Symantec have released a new version of Dell Client Manager that can coexist with the Dell Management Console, no migration utility is provided. Dell Client Manager functionality is expected to be incorporated into future releases of the Dell Management Console, at which time a migration tool is expected to be provided.
Altiris Deployment Solution™ for Dell Servers plug-in	Altiris Deployment Solution for Dell Servers	The advanced functionality of Altiris Deployment Solution for Dell Servers is not included for free with the Dell Management Console, and therefore continues to be available for purchase as a separate plug-in.

Figure 2. *Example plug-ins for Altiris Notification Server 6 and their replacements for the Symantec Management Platform*

IT Assistant database system, and the discovery ranges they want to migrate are enabled in IT Assistant. Administrators can then use a migration wizard in the Dell Management Console to import these ranges and schedule settings. They can launch this wizard from either the Dell Management Console Portal or Portal Pages and Web Parts sections of the console.

Administrators first provide the necessary information to connect to the IT Assistant database (see Figure 3), after which the wizard guides them through the process of fetching the data. Because the wizard retrieves only ranges that are enabled in IT Assistant, administrators can prevent specific ranges from being migrated by disabling those ranges in IT Assistant and relaunching the wizard. They can also edit the schedule settings for the migrated ranges, or can choose to run a discovery immediately after the migration has completed.

Understanding Dell Management Console objects

The Dell Management Console uses different objects and terminology than IT Assistant to manage discovery ranges and schedule settings (see Figure 4):

- **Network discovery tasks:** Include and exclude ranges from IT Assistant are combined into individual *discovery tasks* in the Dell Management Console. Discovery tasks do not contain the protocol information associated with discovery ranges, however; instead, each discovery task is associated with one connection profile that contains this information.
- **Connection profiles:** Protocols that were part of include ranges in IT Assistant are part of *connection profiles* in the Dell Management Console. These profiles contain only generic information about each protocol, such as time-out and retry settings. Protocol credentials—such as Simple Network Management Protocol (SNMP) community strings, domain names, Intelligent Platform Management Interface (IPMI) KGKeys, usernames, and passwords—are stored by Credential Manager items associated with each connection profile. Each connection profile can be shared across multiple scan groups and can be associated with multiple Credential Manager items.
- **Credential Manager:** Protocol credentials for include ranges in IT Assistant are stored as *Credential Manager* items in the Dell Management Console.
- **Network discovery task schedule:** The discovery schedule in IT Assistant is the *network discovery task schedule* in the Dell Management Console. The Dell Management Console also provides *shared schedules*, which allow administrators to schedule tasks in various advanced ways (such as weekly or monthly) and share these schedules across multiple tasks.

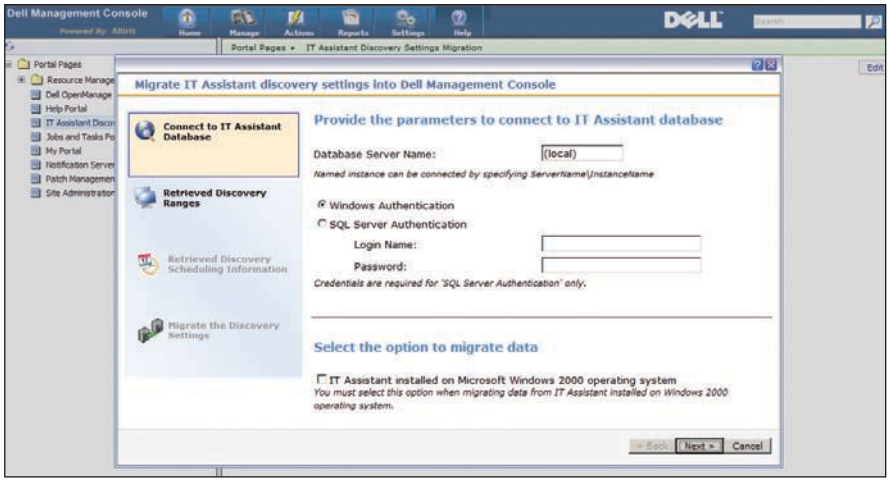

Figure 3. *Migration wizard for importing data from Dell OpenManage IT Assistant*

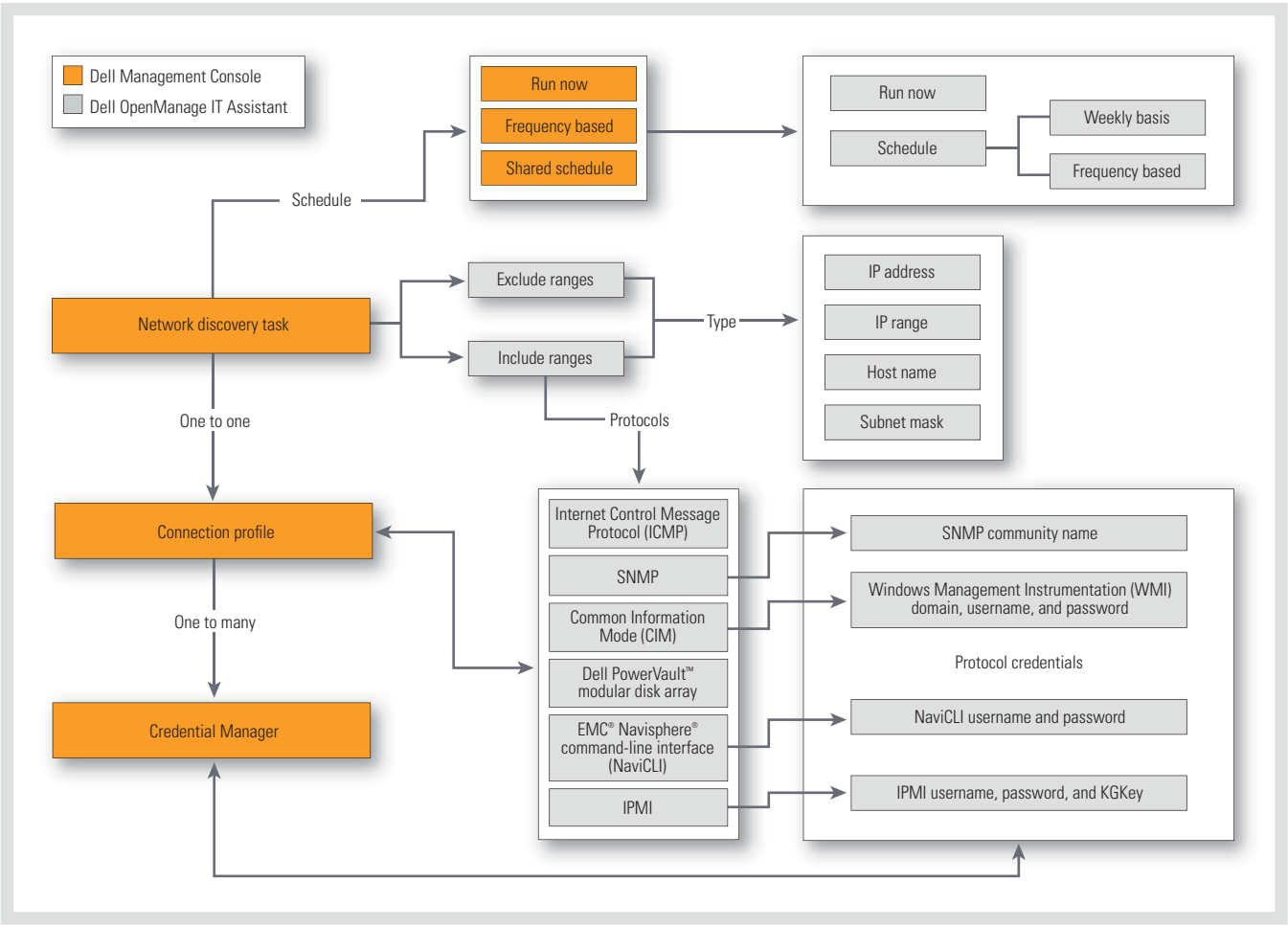

Figure 4. *Relationships between Dell Management Console objects and Dell OpenManage IT Assistant objects*

After the migration has completed, the discovery tasks, connection profiles, and Credential Manager items are created using the imported data, including the associations between each of these objects. The number of discovery tasks for each node is the same as the number of migrated include ranges, with each discovery task containing both the include range and all exclude ranges. The number of connection profiles may be less than the number of include ranges, however, because these profiles can be shared across discovery tasks; if IT Assistant had the same protocol settings across all include ranges, for example, only one connection profile would be created. A Credential Manager item is created for each protocol in IT Assistant that has associated credentials. Credential Manager items can be shared across multiple connection profiles. After the migration, administrators can change or edit the associations between discovery tasks, connection profiles, and Credential Manager items as needed.

MAKING A SMOOTH TRANSITION

The Dell Management Console provides a flexible, simplified tool for systems management that integrates easily with other plug-in solutions through the Symantec Management Platform. By upgrading from an existing Altiris Notification Server 6 infrastructure and migrating data from Dell OpenManage IT Assistant, administrators can help ensure a smooth transition and begin taking advantage of this powerful console in their own environments.

Manoj Poonia is an engineering senior analyst with the Dell OpenManage Group at the Dell Bangalore Development Center.

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MANAGING OPERATING SYSTEMS AND APPLICATIONS WITH THE DELL MANAGEMENT CONSOLE

By Jordan Gardner

The Dell™ Management Console Powered by Altiris™ from Symantec™, based on the modular Symantec Management Platform architecture, is designed to provide comprehensive, simplified systems management in enterprise IT environments. By taking advantage of the extensibility and scalability of the Symantec framework, administrators can use this console to support robust one-to-many OS and application management policies.

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In enterprise IT environments, efficient management processes can be critical to success. Effective management tools must provide broad support for different devices and technologies while still delivering powerful capabilities.

To help meet these needs, Dell has partnered with Symantec to develop its new management solution: the Dell Management Console.[1] Based on the modular Symantec Management Platform architecture, this tool enables administrators not only to increase their control over Dell hardware, but also to take inventory, distribute software packages and OS patches, push images or scripted installations, perform IT Infrastructure Library (ITIL)–compliant asset management, schedule and perform backup and recovery operations, and more.[2] Over 20 plug-in solutions are available to help manage a variety of devices and technologies, with more expected to be released from Symantec, Dell, and their partners in the future. Taking advantage of this flexible, extensible framework enables administrators to implement robust one-to-many OS and application management through a single simplified management solution.

SYMANTEC MANAGEMENT PLATFORM ARCHITECTURE

The Symantec Management Platform architecture is a key component of the Dell Management Console, providing a modular framework for comprehensive systems management (see Figure 1). This framework provides administrators with a single console to manage multiple aspects of their environments, from network switches to the applications installed on handheld devices. Rather than requiring multiple point solutions functioning independently to perform their specific tasks, this architecture enables supported plug-ins to integrate and use data from one another. For example, if a disk drive were failing, alert information would be sent to the Dell Management Console through the monitoring solution, which could then automatically trigger a backup using the backup solution, after which detailed warranty information about the server could be sent to the administrator

[1] The Dell Management Console had not yet been released to ship at press time (February 20, 2009); features and capabilities in production version are subject to change.

[2] For more information on ITIL, see "Implementing Best Practices: The Dell Management Console and ITIL," by John Stahmann, in *Dell Power Solutions*, March 2009, DELL.COM/Downloads/Global/Power/ps1q09-20080450-Stahmann.pdf. For more information on migrating to this new management platform, see "Migrating to the New Dell Management Console," by Manoj Poonia and Ed Casmer, in *Dell Power Solutions*, March 2009, DELL.COM/Downloads/Global/Power/ps1q09-20080448-Gonzalez.pdf.

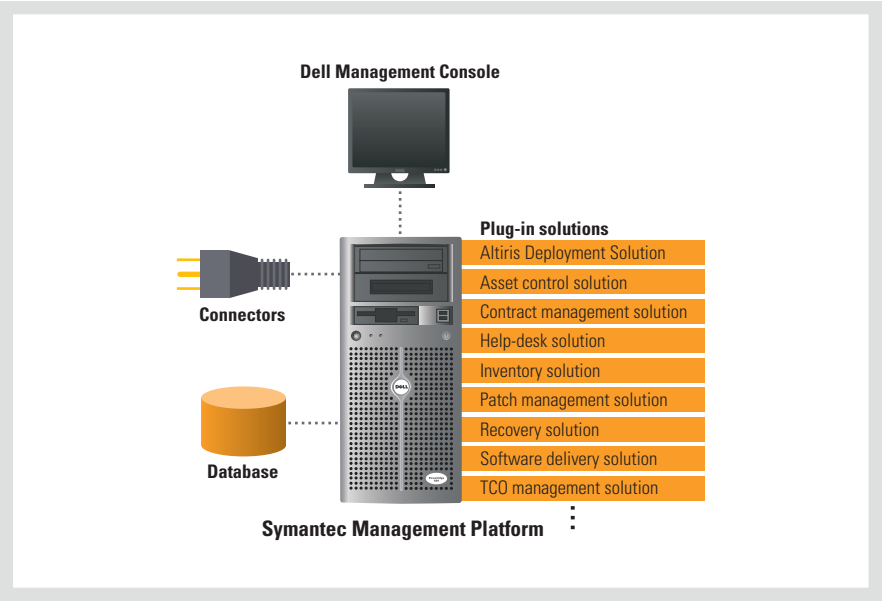

Figure 1. *Symantec Management Platform architecture*

using the data from the asset management solution. The Symantec Management Platform architecture allows this process to happen seamlessly by leveraging the same database and user interface across all of the plug-in solutions. Administrators could also install the Dell Management Console, inventory solutions, and handheld management solutions on the same back-end server framework to provide a single management console for server, desktop, and mobile device management. The role and scope security engine can also work across multiple installed solutions.

The Symantec Management Platform is available as a complimentary download and can be installed independently of other supported components. Once installed, it serves as the engine that manages communication with remote agents and the Microsoft® SQL Server® or SQL Server Express database. Administrators can install the database on the same server as the platform or on a remote server. The Symantec Management Platform provides features common to each of the modular solutions, including the Web browser–based console for uniform navigation between solutions, common agent, reporting engine, event and alert engine, task and automation engine, and notification functionality. (For more information, see the "Symantec Management Platform communication architecture" sidebar in this article.)

OS MANAGEMENT

The modular Symantec Management Platform architecture enables administrators to use the Dell Management Console to manage not only Dell hardware, but also many aspects of operating systems—including deployment, migration, and hardware refreshes; security; and monitoring and availability. Using other plug-in solutions can also further enhance OS management capabilities.

Deployment, migration, and hardware refreshes

Server deployment can be challenging and time-consuming even for experienced administrators. Dell and Symantec have worked together to integrate the hardware component configuration capabilities of the Dell OpenManage™ Deployment Toolkit with the powerful automation capabilities of the Altiris Deployment Solution™ plug-in, creating Altiris Deployment Solution for Dell Servers (see Figure 2). This solution can plug into existing Dell Management Console implementations and help significantly reduce server deployment times—potentially from hours to minutes.

Altiris Deployment Solution is designed not only for servers, but also for desktops, handheld devices, and thin clients. It can use hardware inventory information captured by the Dell Management Console to assist in a migration assessment or hardware refresh assessment, helping identify systems that are capable of migration or that should be retired. Other key processes involved

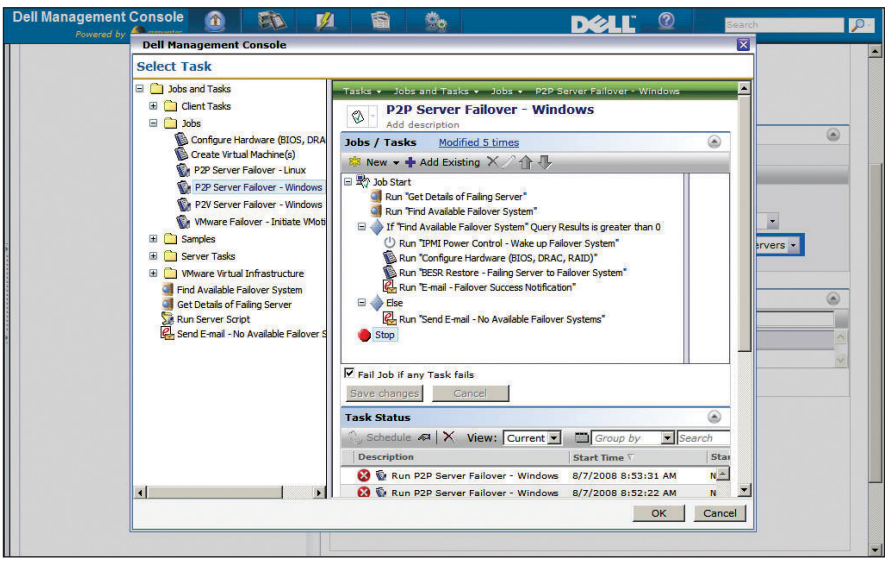

Figure 2. *Automated server failover job using Altiris Deployment Solution for Dell Servers and Symantec Backup Exec System Recovery in the Dell Management Console*

in a migration can then be automated, including configuration capture, imaging, application deployment, and configuration restore operations.

The monitoring capabilities of the Dell Management Console enable data to be continually gathered and summarized to help administrators keep servers up and running 24 hours a day. Reports, dashboards, and the event console view provide an enterprise-wide status of monitored systems. In addition to dashboard views, alerts received that match a set of predefined criteria can trigger a series of automated actions. Administrators can be automatically notified through e-mail, or trigger a set of remediation tasks when a given alert is received that matches the automated action criteria.

The Altiris Monitor Solution™ plug-in contains a set of predefined rules and metrics for monitoring OS performance and availability. It includes predefined monitor packs for Microsoft Windows®, Linux®, and VMware® ESX servers that administrators can easily import into the Dell Management Console to help ensure optimal system uptime and performance.

Security

The Dell Management Console incorporates comprehensive endpoint security through its integration with Symantec Endpoint Protection, which combines multiple endpoint security technologies, including antivirus, anti-spyware, personal firewall, intrusion prevention, device control, and network access control. Through the Dell Management Console, administrators can manage installations and client settings of the Endpoint Protection agent, perform quick scans, and report and fix outdated virus definitions.

In addition to Endpoint Protection, Symantec plans to continue to integrate powerful security, compliance, and backup solutions into the Symantec Management Platform, including Symantec Backup Exec™ and Data Loss Prevention software.

SYMANTEC MANAGEMENT PLATFORM COMMUNICATION ARCHITECTURE

Communication between the management agent and the management server (where the Symantec Management Platform is installed) fundamentally consists of XML files that are compressed and transferred through HTTP (on port 80) or HTTP over Secure Sockets Layer (HTTPS) (on port 443). Each management agent requests a policy update from the management server on an interval defined by the administrator; the default setting is once every hour.

During this update, the agent sends a request to the Symantec Management Platform to request new policies that apply to the system running the agent. If administrators have made any policy additions or modifications, the agent downloads a new policy configuration XML file specifying the work to be performed by the agent and its solution plug-in. For example, the agent might download and parse this XML configuration file to determine that it should now run a software inventory scan every 12 hours and a hardware inventory scan once a week, deny access to unauthorized software programs (such as games or instant messaging clients) during the working hours of 8 A.M. to 5 P.M., and download and execute the most recent Microsoft patches or Dell BIOS updates from the management server immediately. The process of downloading the configuration policy typically generates a little less than 2 KB of round-trip traffic per agent.

POLICIES, TASKS, AND FILTERS

The Symantec Management Platform uses filters to associate policies and tasks with systems. Filters are simply groupings of systems defined by a rule or query. A given system may belong to no filters, one filter, or multiple filters. There are two different types of filters:

- **Static filters:** A system's membership in a static filter changes only when an administrator explicitly adds it to or removes it from the filter.
- **Dynamic filters:** A system's membership in a dynamic filter changes based on the system properties; as those properties change, the system automatically moves into or out of the filter. It can be helpful to think of dynamic filters as being based on a SQL `WHERE` clause. For example, administrators might create a dynamic filter that consists of all systems running the Microsoft Windows Server® 2008 OS with 8 GB of RAM and joined to a specific domain. If either of those two properties changes for a particular system, the system is automatically removed from the filter, thereby disassociating it from policies assigned to that filter.

Dynamic filters provide a powerful mechanism for automating systems management. For example, administrators could create an ongoing policy to deliver a specific Dell BIOS update to systems that may require it. If a new system with the management agent is added to the network several months later, it would automatically join the predefined filters for which it qualifies. Policies assigned to those filters then become effective for the new system, which not only automatically receives the BIOS update it needs, but also executes other tasks assigned to the policies that govern the system.

Monitoring and availability

The Dell Management Console includes robust agent and agentless monitoring of resources, helping ensure server availability and helping reduce costs associated with server downtime through comprehensive, Web browser–based performance and event monitoring (see Figure 3). Administrators can use real-time monitoring to assess current operational states, view historical data to identify trends and isolate recurring issues, and manage problem tasks with integrated alert management.

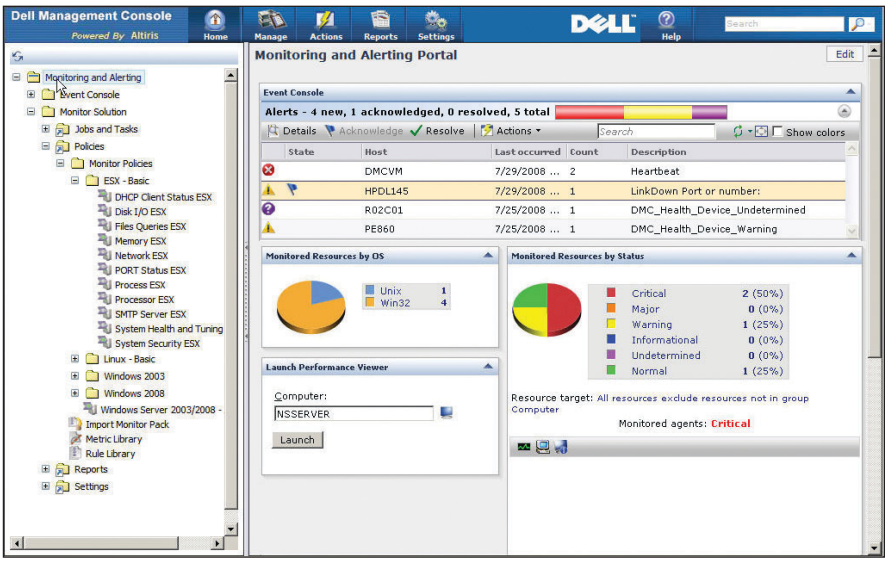

Figure 3. *Robust, comprehensive performance and event monitoring in the Dell Management Console*

APPLICATION MANAGEMENT

The Dell Management Console supports robust application management through plug-in components, enabling administrators to inventory, meter, and report software usage and to package, deliver, and monitor end-user applications.

Inventory, metering, and reporting

The Altiris Client Management Suite™ and Server Management Suite™ plug-ins can capture detailed information about servers, desktops, and laptops and determine how many copies of an application are installed on these systems. The suite's software metering technology can determine which software applications are actually being used and how often, helping administrators eliminate or reallocate unused licenses, prepare for audits, and plan for future software purchases. Matching usage information to purchased license counts stored in the configuration management database (CMDB) can also help administrators accurately gauge future software needs and purchase accordingly, helping reduce the costs and risks associated with over- and underbuying.

Packaging, delivery, and monitoring

The Altiris Client Management Suite and Server Management Suite plug-ins enable powerful application packaging, delivery, and monitoring capabilities, including secure, bandwidth-sensitive distribution of applications and updates throughout an organization. These solutions can support software distribution over local area networks (LANs) or wide area networks (WANs) to servers, desktops, and laptops from the central console, and offer features such as multicasting, Intel® Active Management Technology, and Wake-on-LAN.

Administrators can target specific groups of systems, users, or departments by creating authorized filters to receive the software. Administrators can also apply software uninstall policies to help avoid the malicious installation of unauthorized software, permit or deny the execution of a given application, and send custom denial messages or restrict application usage to certain hours of the day.

Administrators can also import application monitor packs to proactively monitor the performance of critical applications such as Microsoft Exchange and SQL Server. These packs include predefined rules and system performance metrics designed to accurately report current application status, helping administrators to maximize the performance and availability of critical applications.

COMPREHENSIVE, SIMPLIFIED SYSTEMS MANAGEMENT

The Dell Management Console is designed to provide a comprehensive, simplified tool for one-to-many systems management in enterprise IT environments. By taking advantage of the modular Symantec Management Platform architecture, administrators can use this console not only to manage Dell-specific functions and hardware, but also to implement robust automation, control, and extensibility through a single management interface.

Jordan Gardner is a technical strategist on the Dell Alliance team at Symantec. He has a bachelor's degree in Computer Science from Brigham Young University.

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DELL UPDATE DEPLOYMENT USING MICROSOFT SYSTEM CENTER CONFIGURATION MANAGER

By Greg Ramsey
Donnie Taylor

The combination of Dell™ Hardware Update Catalogs and Microsoft® System Center Configuration Manager 2007 provides a powerful, integrated way to deploy hardware, firmware, and software updates for Dell business clients and servers, helping to increase efficiency and simplify systems management in environments based on Dell systems.

Related Categories:
Microsoft
Microsoft System Center
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IT organizations often struggle to efficiently manage a large number of systems while still maintaining a secure environment—and deploying hardware, firmware, and software updates in these environments can be fraught with challenges. For example, administrators in a large environment might rely on a software distribution mechanism to push BIOS packages out to client systems, but even this type of automated system can run into problems if administrators inadvertently target the wrong systems, set up the wrapper incorrectly, or miss key prerequisites. Meanwhile, the end users themselves may be annoyed by a business interruption as the updates are installed.

Manual alternatives are often even more problematic than automated solutions. The time-consuming, reactive, and error-prone nature of these approaches can lead administrators to install only a critical subset of required updates—omitting preventive updates that may be important to avoiding future problems.

The Dell IT group faces many of the same challenges as the IT departments of other large enterprises, including the need to increase efficiency, productivity, and security; reduce costs; and support business demands that often require realignment of IT resources. IT staff members are charged with managing approximately 115,000 Dell OptiPlex™, Dell Latitude™, and Dell Precision™ client systems and 25,000 Dell PowerEdge™ servers while delivering excellent service to end users.

Efficiently managing system updates in this demanding environment requires using a management solution that can scale and automate update deployment in a reliable way. To help meet this need, Dell and Microsoft have collaborated to simplify and accelerate hardware configuration and deployment through an integrated solution that combines Microsoft System Center Configuration Manager 2007 and Dell Hardware Update Catalogs.

IMPLEMENTING DELL HARDWARE UPDATE CATALOGS

Administrators can use Dell Hardware Update Catalogs to import Dell BIOS, firmware, driver, and application updates for Dell business clients and servers into Microsoft System Center Configuration Manager, where they can be seamlessly integrated with the security updates feature in System Center Configuration Manager. Administrators can then easily scan and push these updates out to the appropriate systems.

Dell provides two catalogs that integrate with System Center Configuration Manager: the Dell Business Client Update Catalog and the Dell Server Update Catalog. The Business Client Update Catalog covers several Dell client models, including the Dell OptiPlex 960 desktop, Dell Latitude E-Family laptops, and Dell Precision workstations. The Server Update Catalog includes eighth-generation and later Dell PowerEdge server models.[1]

[1] For more information on these catalogs, visit www.delltechcenter.com/page/Dell+Updates+Catalogs and DELL.COM/SystemCenter.

Before using these Dell catalogs, administrators should be sure they have correctly installed and configured the Microsoft System Center Updates Publisher (SCUP) tool on their System Center Configuration Manager server in order to publish third-party updates to Microsoft Windows Server® Update Services (WSUS). After they have done so, they can import the catalogs by launching SCUP, selecting the Custom Update Partner Catalogs node in the left pane of the SCUP console, selecting Action > Settings, and clicking the Add button. They can then add the Business Client Update Catalog by entering the path ftp://ftp.dell.com/Catalog/DellSDPCatalogPC.cab, or add the Server Update Catalog by entering the path ftp://ftp.dell.com/Catalog/DellSDPCatalog.cab (see Figure 1). They should also select the "Always flag these updates for publishing" check box.

To import the catalogs, administrators can right-click on the System Center Updates Publisher node in the left pane and select "Import updates," click the Next button to confirm the catalogs to import, and click the Next button again to begin the import process. If the SCUP server does not have Internet access, administrators can also manually download the catalogs from a different system and copy them to the SCUP server, and then configure the import settings to import from a Universal Naming Convention (UNC) path.

After the import has completed, a Dell node appears in the left pane of the SCUP console (see Figure 2). A green flag indicates updates that are ready to publish to System Center Configuration Manager.

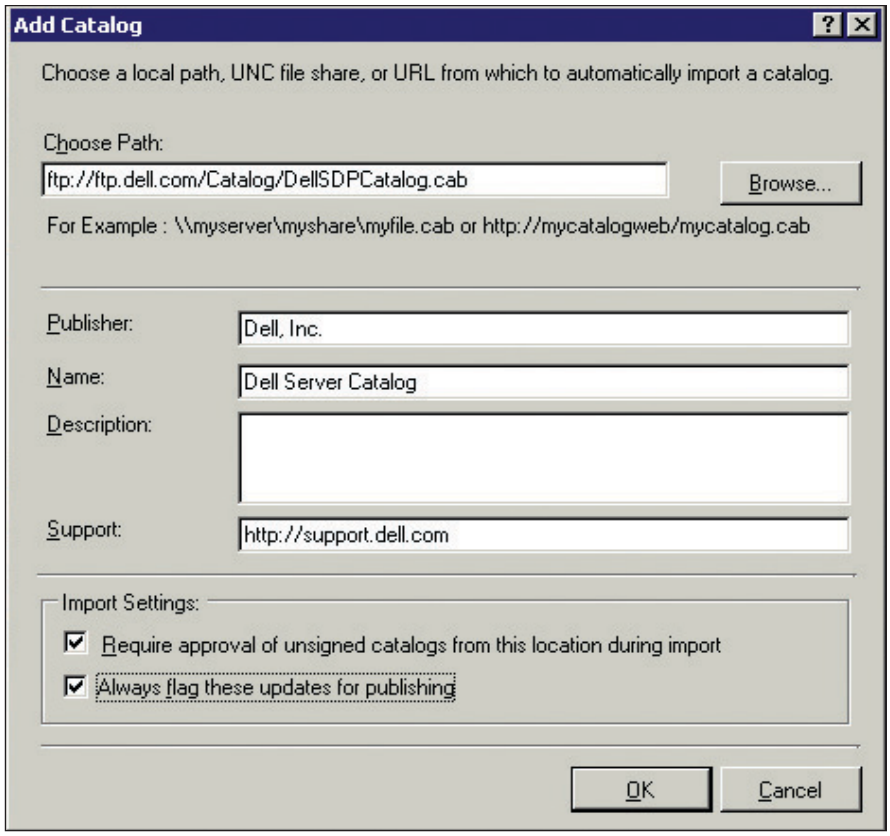


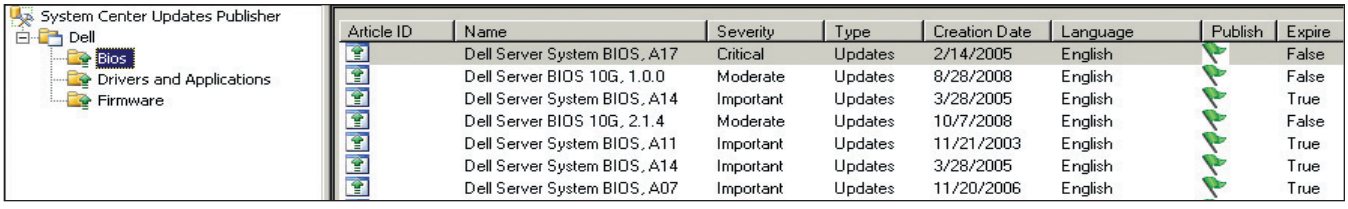
Figure 1. *Add Catalog window in the Microsoft System Center Updates Publisher tool*

PUBLISHING AND DEPLOYING DELL UPDATES

After importing the Dell catalogs, administrators can publish the updates to Microsoft System Center Configuration Manager by right-clicking on the root node in the SCUP console and selecting "Publish Updates." SCUP then publishes updates that are marked to be published to the System Center Configuration Manager central-site WSUS server.

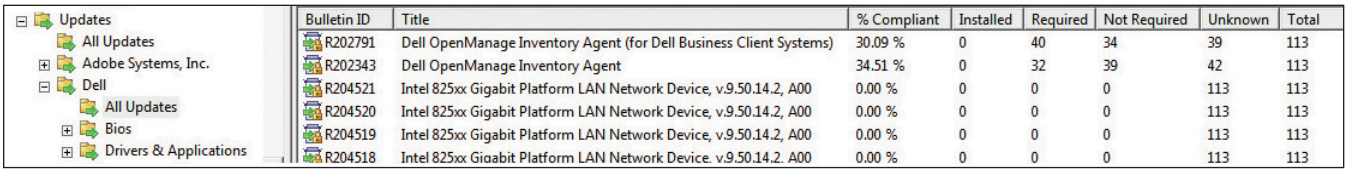
The next step is to run the software updates synchronization cycle in System Center Configuration Manager. When this cycle completes, administrators can navigate to the Updates section of the Update Repository and view the Dell node to review the published updates. The synchronization cycle also causes all systems to scan against the WSUS catalog; as the scanning process completes, two Dell OpenManage™ Inventory Agent updates (one for clients and one for servers) appear as either required or installed for these systems (see Figure 3). This agent must be installed first to manage the detection process for other Dell updates, after which the next scan cycle detects and reports the status of the other Dell updates.

To deploy Dell system updates, administrators can follow the same process they would use to deploy other software



Article ID	Name	Severity	Type	Creation Date	Language	Publish	Expire
	Dell Server System BIOS, A17	Critical	Updates	2/14/2005	English		False
	Dell Server BIOS 10G, 1.0.0	Moderate	Updates	8/28/2008	English		False
	Dell Server System BIOS, A14	Important	Updates	3/28/2005	English		True
	Dell Server BIOS 10G, 2.1.4	Moderate	Updates	10/7/2008	English		False
	Dell Server System BIOS, A11	Important	Updates	11/21/2003	English		True
	Dell Server System BIOS, A14	Important	Updates	3/28/2005	English		True
	Dell Server System BIOS, A07	Important	Updates	11/20/2006	English		True

Figure 2. *Dell updates in the Microsoft System Center Updates Publisher console*



Bulletin ID	Title	% Compliant	Installed	Required	Not Required	Unknown	Total
R202791	Dell OpenManage Inventory Agent (for Dell Business Client Systems)	30.09 %	0	40	34	39	113
R202343	Dell OpenManage Inventory Agent	34.51 %	0	32	39	42	113
R204521	Intel 825xx Gigabit Platform LAN Network Device, v.9.50.14.2, A00	0.00 %	0	0	0	113	113
R204520	Intel 825xx Gigabit Platform LAN Network Device, v.9.50.14.2, A00	0.00 %	0	0	0	113	113
R204519	Intel 825xx Gigabit Platform LAN Network Device, v.9.50.14.2, A00	0.00 %	0	0	0	113	113
R204518	Intel 825xx Gigabit Platform LAN Network Device, v.9.50.14.2, A00	0.00 %	0	0	0	113	113

Figure 3. *Dell OpenManage Inventory Agent updates in Microsoft System Center Configuration Manager*

updates in System Center Configuration Manager—selecting the desired updates, right-clicking and selecting "Deploy Software Updates," and using the resulting wizard to specify the target systems and then send them to the distribution points. They can also optionally specify a mandatory deadline for the updates to automatically install. Figure 4 shows an example list of updates with no specified deadline, with both Microsoft and Dell updates designated for deployment during the same patch cycle. For this example deployment, end users could select and initiate the update process when desired; specifying a deadline would automate the process and help eliminate the need for end-user intervention.

SIMPLIFYING SYSTEMS MANAGEMENT

Managing Dell updates with Microsoft System Center Configuration Manager 2007 offers multiple advantages in enterprise environments. A single administrator can select updates across a variety of hardware devices and configure System Center Configuration Manager to download, package, and present those updates to client systems, after which the clients install only applicable updates. The updates integrate seamlessly into familiar patching cycles, helping minimize reboots and interruptions for end users.

Because the Dell IT group no longer needs to package updates, BIOS and firmware updates are pushed out on a much more regular basis, helping reduce the number of help-desk calls. One staff member can now perform the entire update process in less time than the entire team used to take.

In addition to the update catalogs, several other management tools are available to integrate Dell systems management functionality with System Center Configuration Manager. The Dell Server Deployment Pack helps simplify comprehensive OS deployments to Dell PowerEdge servers, including integrating BIOS and RAID configurations into the System Center Configuration Manager console. The Dell Management Pack for Microsoft System Center Operations Manager helps simplify monitoring by providing detailed rules for hardware events. Dell IT not only uses these tools internally to manage its own global infrastructure, but also tests these tools during development to help ensure optimum performance—helping both Dell and organizations using Dell business clients and servers to increase efficiency and simplify IT management in their environments.

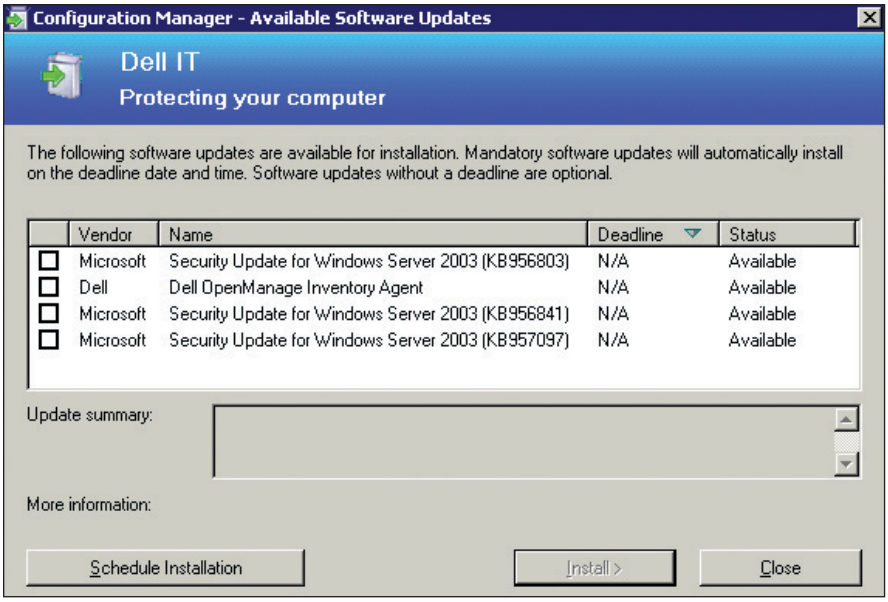


Figure 4. *Available updates in Microsoft System Center Configuration Manager*

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Donnie Taylor has worked in IT for 15 years, including 10 years working with Microsoft Systems Management Server and System Center Configuration Manager and 4 years doing systems management for the Dell IT group. He attended Southwest Missouri State University.

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ENHANCING ENERGY EFFICIENCY WITH DELL POWEREDGE 4220 RACK DESIGN

By William Muscato
Andre Fuochi

Taking advantage of the advanced features of the new Dell™ PowerEdge™ 4220 rack enclosure and following best practices can help IT organizations enhance hardware utilization, increase power and cooling efficiency, and reduce the server footprint in their data centers.

Organizations are constantly faced with the challenge of accommodating increasing amounts of data, increasing numbers of devices and users, and increasingly powerful servers to support critical applications—all while controlling data center costs for power, cooling, and other operations. How IT staff utilize and structure rack enclosures, power distribution units (PDUs), and other accessories can play a key role in helping meet these challenges.

The new Dell PowerEdge 4220 rack enclosure provides advanced features designed for optimal energy efficiency and manageability. Taking advantage of these features and following best practices when deploying this type of rack enclosure can help administrators enhance hardware utilization, create highly efficient power and cooling, and reduce the server footprint in their data centers.

Related Categories:

Data center density
Data center technology
Energy efficiency
Green IT
Power and cooling

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ADVANCED RACK ENCLOSURE DESIGN

Selecting a tested rack enclosure design can be critically important. Racks are no longer simple cabinets that house servers; they have evolved to incorporate technologies designed to efficiently store, power, cool, manage, and secure hardware. Because these features enable each rack to function almost as its own small data center, rack enclosures can no longer be considered mere accessories.

Popular 42U rack enclosures such as the Dell PowerEdge 4210 have directly and indirectly driven product design decisions from the chipset to the chassis, with each component optimized for use within the rack. Dell PowerEdge 1U, 2U, and 4U rack-mounted servers as well as energy-efficient uninterruptible power supplies, for example, are designed with rack features in mind.

Standard 42U racks have certain advantages compared with nonstandard racks—for example, they can typically pass through normal doorways and allow easy access to cables at the top of the rack. Racks taller than 42U can have an increased risk of tipping or bending if they exceed their weight capacity, and an increased risk of overheating equipment at the top of the rack. In addition, deviations from standard rack base dimensions (such as the 600 mm × 1,000 mm base of the PowerEdge 4210) typically work against the objectives of high-density server environments designed to maximize computing and storage capacity per square foot. Dell 42U racks are designed to accommodate the high power distributions and passive cooling requirements of these environments.

The Dell PowerEdge 4220 42U rack can support a weight capacity of 2,500 pounds, compared with the 2,000 pounds supported by the previous-generation PowerEdge 4210 rack. Other key features of Dell 42U racks include fully welded frames, dual-side panels in the PowerEdge 4220 model, removable and reversible doors that can open from the left or right, and fan kit accessories that can quickly remove heat from the top of the rack. A PowerEdge 2420 24U rack

option is also available. (For more information, see the "Optimizing rack design" sidebar in this article.)

MANAGEMENT OF POWER DISTRIBUTION UNITS

To help manage data center space effectively, organizations typically enable power distribution by running power cables along the ceiling or below the floor. Rack enclosures should therefore be designed with sufficient cable entry paths at both the top and bottom. Dell rack enclosures have open floor space at the bottom and cable exit openings at the top and within the rear doors of the rack, and include a high-density rear-door kit with removal panels to create additional cable exit paths.

In addition to addressing room-level power cabling, rack enclosures must enable IT staff to optimally place PDUs for easy access to power outlets within the rack. To avoid the use of space designated for IT equipment, advanced racks should hold PDUs in the 0U space, which is either along the sides of the rack or at the rear along the rear doors. Dell racks can hold compact PDUs in the 0U space along the sides of the rack, a feature enhanced by tool-less mount PDUs available for both single- and three-phase power distribution.

The Dell PowerEdge 4220 rack includes additional space at the rear to hold large vertically mounted PDUs—often referred to as full-length PDUs—that are 1.7 m long and provide outlets close to servers and other IT equipment. Vertically mounted PDUs at the rear of the rack can also allow administrators to deploy shorter server power cables than they could otherwise.

The PowerEdge 4220 rack is also designed to place the full-length PDU outlets as far away from the back panel as possible, providing ample cable distribution space for a rack of its size. In addition, it can hold a total of four full-length PDUs, two on each side, providing the option to add PDUs to the rack enclosure on both sides or only along one side.

Organizations using Dell PowerEdge M1000e modular blade enclosures often need to accommodate three-phase PDUs. Traditionally, Dell racks have enabled three-phase PDUs to reside in the 0U space along the sides of the rack. Three-phase Dell PDUs are available in three outlet models, helping provide a form factor that offers administrators multiple options for PDU placement. The PowerEdge 4220 rack is designed to allow more three-phase PDUs—including the full-length three-phase PDU—to fit in the rack than was possible with previous-generation Dell racks.

OPTIMIZING RACK DESIGN

The new Dell PowerEdge 4220 and PowerEdge 2420 rack enclosures include a variety of advanced features designed for optimized data center operations, including the following:

- Static load rating of 2,500 pounds for the PowerEdge 4220 and 1,500 pounds for the PowerEdge 2420
- Large open base for cable entry and exit
- Dual rear doors and split side panels, with locks
- Reversible front door that opens from the left or right, with lock
- Removable front and rear doors
- Adjustable mounting rails that slide forward or backward within the rack
- Eighty percent perforation of front and rear doors to aid thermal management in ultra-dense environments
- Rack-top cable exits with adjustable sliding door
- Reinforced frame to help provide stability
- Innovative side-rack power distribution unit (PDU) options for Dell PDUs
- Rotating rear casters to help easily position rack
- Standard base dimensions for two-tile placement in data center
- U-space numerical markings on both front server mounting posts
- Easily accessible leveling feet
- Standard height to enable movement through standard doorways
- Availability as a 42U frame only, 42U frame with front and rear doors, or 42U frame with front and rear doors and side panels, and as a 24U frame only or 24U frame with front and rear doors and side panels
- A variety of available accessories, including Dell blanking panels (1U, 2U, 3U, and 6U), rack shelf, fan tray (120 V, 208 V, or 230 V), rack door kit (front and rear doors), side panel kit, ganging kits, stabilizer kit, PDUs, rack-mounted uninterruptible power supply, rack-mounted 17-inch 1U console, KVM (keyboard, video, mouse) switch consoles, and 1U keyboard tray

Dell PowerEdge 4220 (left) and PowerEdge 2420 rack enclosures are designed to efficiently store, power, cool, manage, and secure hardware

MAXIMIZING EFFICIENCY WITH DELL ONLINE TOOLS

Dell provides several online tools to help organizations plan optimized data center designs. The Dell Data Center Capacity Planner, available at DELL.COM/Calc, is designed to assess multiple aspects of power, cooling, and performance to help administrators understand how these variables affect energy efficiency in their environments.

The Dell M1000e Rack and Cable Advisor, available at DELL.COM/RackAdvisor, provides a reference tool administrators can use when setting up Dell PowerEdge M1000e modular blade enclosures in a Dell 42U rack. This tool guides administrators through a series of questions on the specific facility and blade enclosure to help them understand their specific configuration. Next, it provides graphics and information on strain relief bars (supplied with the Dell Blades Rail Kit), power distribution units, and blade enclosure stacking, along with recommendations on an alternative rear door for legacy Dell racks, if applicable. Administrators can also save their configuration and load it at another time.

For more information on energy efficiency and best practices for power and cooling optimization, see "The Energy Smart Data Center," by John Pflueger, Ph.D., and Albert Esser, Ph.D., in *Dell Power Solutions*, February 2008, DELL.COM/Downloads/Global/Power/ps1q08-20080179-CoverStory.pdf.

Because third-party PDUs can also easily fit in the 0U space at the rear of the PowerEdge 4220 rack, organizations using PowerEdge blade servers should determine the three-phase PDU space requirements and the potential for interference with the space required to add or remove power modules from the blade enclosure. Managed, or *switched*, three-phase PDUs often incorporate bulky relays that can cause the PDU metal enclosure to protrude into the space directly behind the blade enclosure. In racks with one or two blade enclosures, administrators can plan the locations of the enclosures and managed PDU relays to help ensure that blocking does not occur. For racks with three or four blade enclosures, administrators using managed PDUs should typically use ones with a small form factor that sit in the 0U space to the side of the blade enclosure.

EFFICIENT POWER AND COOLING

Cooling rising heat loads in a data center can present a significant challenge. Thermal management can be daunting, and cold air distribution (as opposed to heat removal) is not the only answer to thermal management problems, especially when taking the following factors into account:

- Obstructions under the raised floor that can create nonuniform airflow through floor tiles and into racks
- Recirculation of hot air from the rear of the rack to the front of the server air intakes
- Lack of a hot aisle/cold aisle strategy, in which racks face the same direction to enable units to absorb heat exhaust from each other
- Stratification of air temperature across the front face of the racks, which can lead to failures in top-mounted network and server equipment

In general, administrators should try to maximize the amount of cool air going directly to each server. The Dell PowerEdge 4220 rack enclosure includes 80 percent front- and rear-door perforation, essentially lowering the cold air restraint to the server to enhance efficiency. The hot air from the rear of the server can escape quickly with an equivalent 80 percent rear-door perforation. Within the rack, strategically placed air dams along the front of the servers help eliminate in-rack air recirculation, a common impediment to thermal efficiency.

At the front mounting posts of the PowerEdge 4220 rack, the air dams help prevent hot air at the back of the servers from leaking back to the front of the servers, which can increase the server inlet air temperatures. By blocking the hot air from the back of the rack, the servers receive air directly from the front, helping ensure a cold air inlet to all servers. Innovative in-rack air dams offer administrators the flexibility to configure the location of the mounting post inside the rack without losing the advantage of the air dams. Organizations using this rack can benefit from this dual advantage of efficient air dams and movable mounting posts within a single rack enclosure.

Eighty percent perforation of front and rear doors provides efficient airflow to aid thermal management in ultra-dense environments

The amount of internal space within a rack is another critical factor affecting cooling and thermals. With a depth of 1,070 mm, the PowerEdge 4220 rack provides additional internal space to enhance overall rack thermals.

One of the simplest and most cost-effective ways to enhance airflow efficiency is to use blanking panels to fill unused rack positions. Without blanking panels installed in unused spaces, hot air from the back rack can flow directly to the front of the servers, which can lead to increased hot spots within the rack. If vertical space in a rack remains open, the gaps between rack-mounted equipment can cause a change in airflow through the rack and across the components. Dell rack accessories include blanking panels available in many sizes, from 1U to 6U. The increased cooling efficiency from this relatively small investment can help pay substantial dividends.

Flexible PDU placement options and ample cable distribution space help efficiently manage data center space

EFFECTIVE CABLE MANAGEMENT

Cable management is often an afterthought in server deployment, but can have a dramatic impact on data center thermals and serviceability. The Dell PowerEdge 4220 rack enclosure helps simplify the routing of power from servers to the PDU outlets by holding vertically mounted PDUs at the rear of the rack. The rack also includes adjustable cable rings mounted inside the rear of the rack, enabling administrators to route networking cables to one side of the rack and channel them upward and out the top of the rack. For high-density server environments in which cable rings may be insufficient, the PowerEdge 4220 rack features a removable tail bar to help eliminate obstructions to routing cables out the top of the rack while still maintaining sufficient space to close and lock the rack doors.

It can be critical to leave sufficient space at the back of the rack to route cables efficiently and help reduce or eliminate the blocking of warm air exiting the back of the rack. The 1,070 mm depth of the PowerEdge 4220 rack is designed to provide optimal internal rack space while staying within the common two-tile data center footprint.

For more information on how Dell can help organizations plan optimized data center designs, see the "Maximizing efficiency with Dell online tools" sidebar in this article.

ENHANCED ENERGY EFFICIENCY THROUGH DELL RACK DESIGN

Rack design can play a key role in building an efficient, manageable data center. The advanced features of the new Dell PowerEdge 4220 rack enclosure can help organizations enhance hardware utilization, increase power and cooling efficiency, and reduce the server footprint in their data centers.

William Muscato is a product manager at Dell responsible for Dell rack and power infrastructure products. He previously held leadership positions at Gemalto, Motorola, Amadeus Global Travel, and Lenel Systems International. William has a degree in Electrical Engineering from the Rochester Institute of Technology and an M.B.A. from the Ohio State University.

Andre Fuochi is a member of the Dell Global Relationship Marketing team, leading the development of messaging and content for Dell PowerEdge servers. Before joining Dell, he held senior marketing and communications positions at Wyse Technology, Maverick Public Relations, and Platform Computing.

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Dell energy efficiency initiatives:
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COMPUTE MORE, CONSUME LESS: SMART POLICIES UNLEASH DATA CENTER PRODUCTIVITY

Dr. Albert Esser, vice president of power and data center infrastructure solutions at Dell, discusses how changing your mind-set can help meet compute demand for years to come. By setting operational policies around virtualization, regular hardware refreshes, and best-practices data center design, IT leaders can help improve productivity and lower power consumption—enabling much more useful work to be performed within facilities that are already in place.

Standard measures of data center efficiency focus exclusively on how a computing infrastructure uses the power flowing into it. Given that many data centers are reaching the limits of their power and cooling capabilities, these are important metrics. However, a second and equally important consideration can also affect the balance sheets: server utilization. To unlock the true potential of the data center, enterprises must shift their focus from power consumption patterns to the overall productivity of their IT environments.

Operational policies designed to increase server utilization and advance overall performance and efficiency can lead to dramatic improvements in data center productivity without increasing power consumption. Adopting these policies enables administrators to support compute demands for growing business requirements within their existing data centers—instead of having to build a new capital-intensive facility to process the required workload.

Dr. Albert Esser, vice president of power and data center infrastructure solutions at Dell, spoke with *Dell Power Solutions* recently about a new metric to measure overall data center effectiveness, why utilization is so important to data center productivity, and how organizations can dramatically improve their data center productivity while still staying within the boundaries of limited power supplies.

WHAT IS AN ACCURATE GAUGE OF DATA CENTER EFFECTIVENESS?

One way is to look at how efficiently power is consumed. The industry-standard metrics commonly used to measure data center effectiveness are Power Usage Effectiveness (PUE) and Data Center Infrastructure Efficiency (DCiE). Both are useful metrics, but they can be misleading because they do not tell the whole story. Although PUE and DCiE effectively measure the efficiency of power utilization within a data center, they are not designed to capture the amount of actual productive work being completed. For example, a data center may be very power efficient—that is, have an excellent PUE rating—yet still not be operating anywhere near its full compute potential.

At Dell, we believe a useful measure of data center effectiveness must include actual work completed per watt, not just power efficiency. We have proposed a new metric, *data center performance per watt*, which directly measures actual work completed relative to power consumption (see Figure 1). This type of measurement captures not only power efficiency, but also the effectiveness of computing resources in doing actual work.

A useful analogy is car mileage—no one is too concerned about how many gallons a gas tank holds; what people really care about is how many miles a car gets per gallon of gas. Same with a data center: for administrators who have hit the wall in terms of

power availability, the pivotal question is, how far can their data center go on the same amount of power? Another useful metric for measuring data center productivity is *data center IT utilization*, which measures actual work completed relative to data center compute potential (see Figure 1). This measurement captures how effectively a data center is taking advantage of the compute power that is already in place.

In practice, actual processor and network utilization are very good indicators for IT gear in production; exact measures for what constitutes useful work are still being developed, but it is important to start thinking about data center productivity in this way to help determine suitable operational policies. The proposed productivity measures scale from server to facility, and can be used to guide purchase decisions. Today, industry-standard load simulators are good estimators of actual performance in production. At Dell, we believe a holistic metric will help drive efficiency and productivity and enable data centers to compute more while consuming less—leading to a reduction in servers, space requirements, and power consumption.

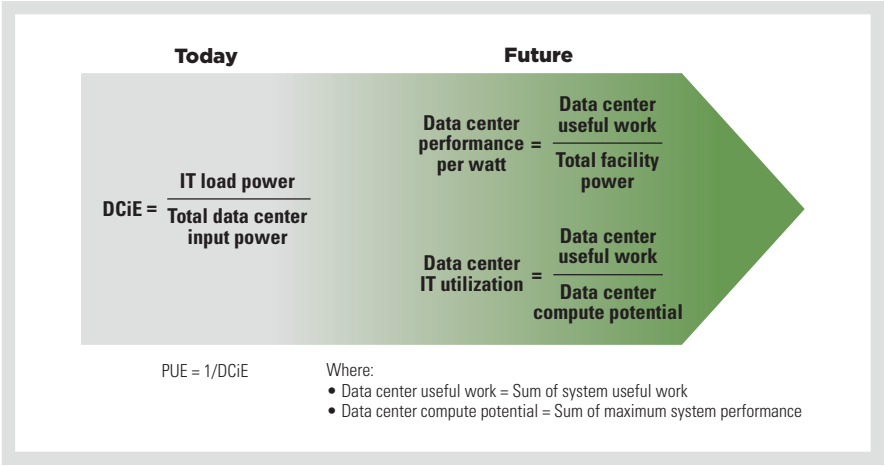


Figure 1. *Evolving data center metrics to focus on overall productivity*

HOW CAN ADMINISTRATORS ENHANCE DATA CENTER PERFORMANCE PER WATT?

There are really two fundamental ways: improving infrastructure efficiency and increasing IT productivity. Infrastructure efficiency is important, but many data centers have already achieved most of the available gains in this area. That said, there are still important infrastructure efficiency considerations and strategies that can have a significant effect on overall data center performance per watt, such as using energy-efficient equipment, optimizing data center temperature, and utilizing best-practices data center design.

The most promising advances, however, lie in improving IT productivity; that is, increasing the actual amount of computing work completed in the data center relative to the amount of power used.

CAN YOU TELL US MORE ABOUT THE IMPACT OF DATA CENTER TEMPERATURE AND BEST DESIGN PRACTICES?

Data center temperature and design can have a tremendous impact on energy efficiency and consumption. For example, data center managers have historically assumed that colder is better. Actually, the opposite is true: a data center with a higher set point for air and water temperatures can actually improve energy efficiency. In particular, our research has shown that in a typical data center, a temperature of roughly 77 degrees Fahrenheit is optimal for Dell hardware. Temperatures lower than 77 degrees typically increase the burden on the air-conditioning system, and temperatures higher than 77 degrees typically trigger an increase in server fan activity (the latter being OEM specific). At Dell, we have focused on industry-leading, low-flow/high-efficiency fan technology. Seventy-seven degrees is, in most cases, the inflection point at which the combined air-conditioning and server fan activity consume the least power.

Data center design can also have a significant impact on overall power efficiency. Fortunately, simple modifications such as moving cooling capabilities closer to equipment, using data center aisles to augment the plenum raised floors, and spacing servers optimally throughout racks to eliminate hot spots can have a major impact on cooling efficiency and power consumption.

HOW DOES HARDWARE UTILIZATION RELATE TO IT PRODUCTIVITY?

Utilization is really the key to accessing the full potential of a data center. Although the compute power of every generation of servers continues to increase dramatically—think of Moore's Law—the actual *utilization* of each subsequent generation of servers has decreased, according to a recent production server utilization study.[1] What this means is that data centers are not only *not* taking advantage of huge gains in compute power, they are actually taking less advantage of each new generation than the generation before it. This is a huge opportunity lost.

The same study found that approximately one-quarter of the servers handle the lion's share of actual work. This scenario leaves an extraordinary amount of server capacity virtually unused, and therefore wasted. These underutilized servers deliver very little work for the amount of power they draw.

Such inefficiencies are routinely incurred by legacy software applications and operating systems that simply were not designed to take advantage of dramatic increases in hardware performance. Also,

[1] Production Server Utilization Study, Dell Labs, November 2008.

the traditional one-application-per-server computing model typically leaves many servers massively underutilized. So we need to think of other ways to take full advantage of the incredible computational power available in today's generation of servers.

HOW CAN VIRTUALIZATION HELP IMPROVE DATA CENTER PRODUCTIVITY?

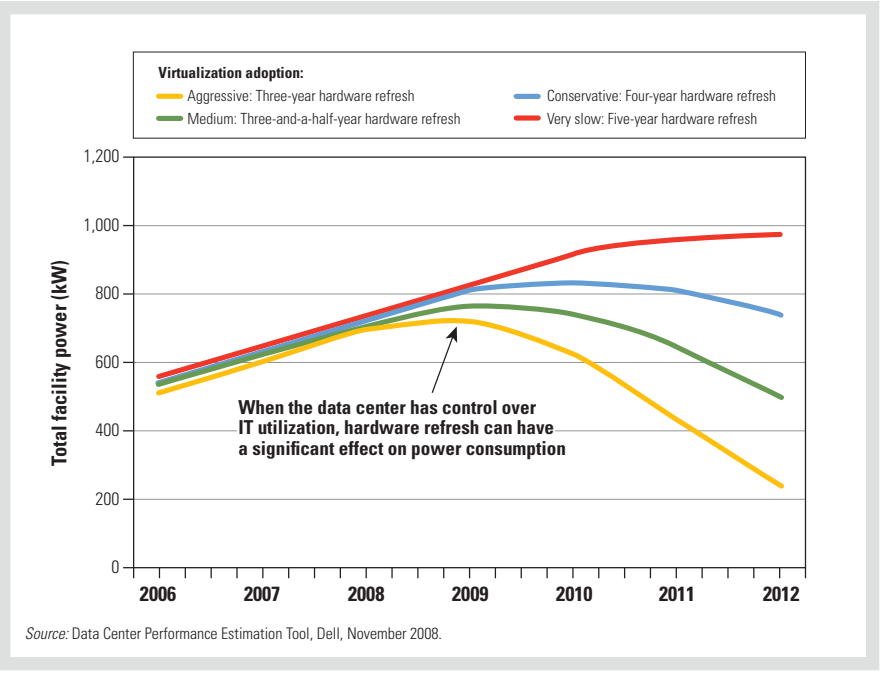
Virtualization is one of the most effective policies an organization can adopt to improve utilization and enhance overall data center productivity. In addition, virtualization can deliver dramatic increases in productivity while reducing overall power consumption and space requirements in data centers.

For example, although a fully utilized server characteristically draws more power than an underutilized one, virtualization enables organizations to reduce the overall number of physical servers required. Virtualization can offer a huge net reduction in power consumption, which enables IT organizations to increase the overall amount of work completed without increasing power consumption—leading to increased data center performance per watt.

There are other ways to improve data center productivity as well. In particular, adopting a policy of regular hardware refreshes can be critical to meeting requirements for year-over-year increases in compute demand without adding to the power requirements or footprint of the data center. A refresh cycle of three years is recommended; however, even organizations that employ four- or five-year refresh cycles can benefit from performance improvements in updated hardware. However, it is critical that old equipment is decommissioned and removed to help reduce operating and capital expenses.

HOW CAN VIRTUALIZATION AND REGULAR HARDWARE REFRESHES HELP LOWER POWER CONSUMPTION?

Policies such as virtualization and regular hardware refreshes not only help improve productivity, they can also help reduce power consumption dramatically. As Figure 2 shows, organizations that pursue aggressive virtualization strategies combined with three-year hardware refresh cycles can meet year-over-year increases in compute demand and reduce power consumption at the same time. Even organizations that adopt relatively conservative virtualization strategies and set less frequent hardware refresh cycles can significantly slow down the increase in power consumption. By adopting a few relatively simple practices, organizations can meet future compute demand within their existing data centers.



Source: Data Center Performance Estimation Tool, Dell, November 2008.

Figure 2. *Applying operational policies to help reduce power consumption in data centers*

WHAT SPECIFIC STEPS CAN ADMINISTRATORS TAKE TO IMPROVE DATA CENTER PRODUCTIVITY?

First, decommission unused equipment. All too often, equipment that has not been used in years is still drawing power and taking up space. In many cases, servers are still in place because no one knows what they do and they are afraid to turn them off.

The second step is to increase server utilization through virtualization and consolidation and to improve energy efficiency by optimizing data center temperature and best-practices data center design. To help with these steps, Dell offers a range of consulting services including virtualization services that help identify opportunities such as data center design improvements.

Once the data center has been purged of unused equipment, virtualized to maximize utilization, and optimized for energy efficiency, the next step is to refresh hardware regularly—ideally every three years. Also, as compute demand increases, organizations can take advantage of the open space created by virtualization and consolidation to add server power to the data center.

Fortunately, these gains are within immediate reach. By following a few simple steps, organizations can help increase data center productivity and help reduce—or at least dramatically decelerate the increase in—power consumption to meet compute demand for years to come.

Albert Esser, Ph.D., serves as vice president of power and data center infrastructure solutions at Dell, where he is responsible for enhancing Dell's enterprise-class IT solutions. Albert has an M.S. and a Ph.D. in Electrical Engineering from the University of Aachen.

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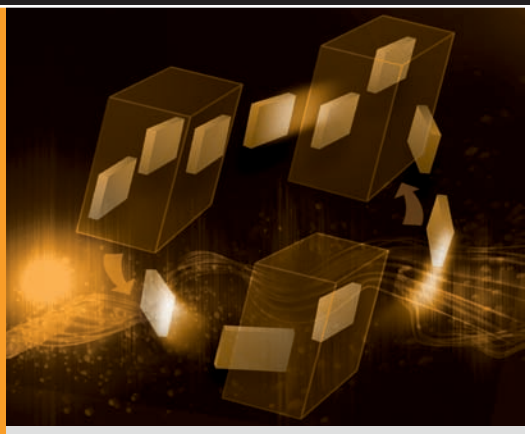

ENHANCING ENERGY EFFICIENCY WITH PAN MANAGER SOFTWARE BY EGENERA FOR DELL

By Michael Baker

The Dell/PAN System combines the advanced infrastructure orchestration capabilities of PAN Manager® Software by Egenera for Dell with energy-efficient Dell™ PowerEdge™ servers to help create a truly reliable dynamic data center—one that can help organizations control ongoing power and cooling costs while maintaining high levels of availability.

Related Categories:

Dell PowerEdge servers

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As energy costs rise and green initiatives become increasingly widespread, reducing power consumption in data centers has become a key focus for many organizations. Rapid increases in processor and server density, meanwhile, only magnify the need to control costs.

Many of these same organizations are optimizing their power consumption by transitioning to renewable energy sources, installing cabinet-level cooling technologies, or arranging system configurations in hot and cold aisles. However, because the cost of cooling often matches or exceeds the cost of system power, organizations that focus instead on reducing system-level power can simultaneously reduce cooling requirements and compound their energy savings.

The Dell/PAN System combines PAN Manager Software by Egenera for Dell with efficient Dell PowerEdge rack and blade servers. By leveraging the advanced infrastructure orchestration capabilities of PAN Manager, the Dell/PAN System is designed to create a shared computing environment, thus helping optimize system power consumption and cooling requirements, reduce ongoing operational costs, and maintain high levels of availability.[1]

UNDERSTANDING APPROACHES TO REDUCING SYSTEM POWER USE

Organizations have traditionally depended on two approaches to help reduce system power consumption. The first is to deploy new hardware and infrastructure components that take advantage of the latest energy efficiency enhancements, which might include power management features, enhanced power supplies, and variable-speed fans. The second is server consolidation, typically implemented using virtualization technology: by enabling individual physical servers to run multiple virtual machines, administrators can reduce the number of servers required to support business operations, thereby helping reduce overall power consumption and related cooling requirements. Multi-core processors complement these approaches, enabling even compute-intensive applications to run in a virtualized environment while providing the advantages of parallel processing to help increase performance per watt.

Although these two options are key tactics in controlling energy use, they generally represent only an incremental savings. Substantially reducing energy use typically requires adopting a more strategic approach

[1] For more information on the Dell/PAN System and PAN Manager, see "Dell and Egenera Drive a New Path to Virtual Data Center Automation," by Greg Lyon, in *Dell Power Solutions*, November 2008, DELL.COM/Downloads/Global/Power/ps4q08-20090120-Egenera.pdf.

to managing the IT infrastructure than these approaches can provide.

Most assessments of IT power and cooling focus strictly on hardware, based on an implicit assumption that all servers host active, production-level application services. This assumption can be misleading, however, because a single application service may actually require up to four additional servers configured for roles such as high availability, disaster recovery, testing, and development. Each of these servers consumes power and generates heat even while idly waiting for an equipment failure, site outage, usage spike, or new software development project. A single application service could therefore potentially quadruple the energy costs of a production system, depending on the size and power requirements of each server.

For IT managers, achieving additional reductions in power consumption means eliminating unneeded equipment while still maintaining high levels of availability. This third approach to lowering energy use is to create a *reliable dynamic data center*—combining a standard virtualized architecture with a comprehensive management framework to form pools of processing, storage, and network resources that can be rapidly configured and allocated. The reliable dynamic data center creates a shared computing environment that enables IT administrators to flexibly repurpose servers based on workloads or user demand, or in response to disruptions in service. The result is a data center that helps eliminate the need for statically configured servers and helps use existing resources as efficiently and cost-effectively as possible.

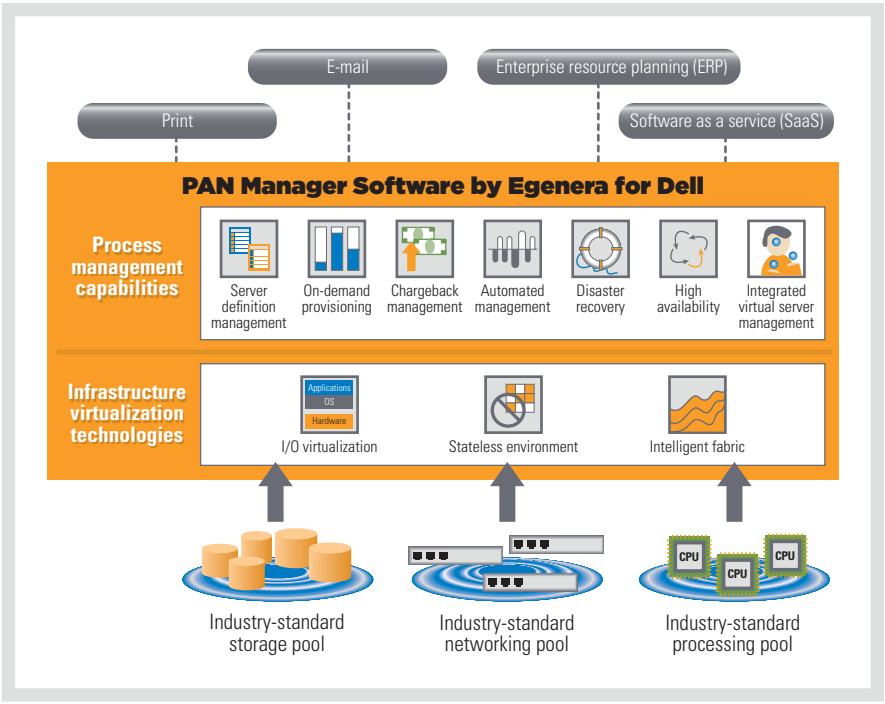

Figure 1. *PAN Manager creates pools of processing resources similar to the way a SAN creates pools of storage resources*

CREATING FLEXIBLE RESOURCE POOLS

The Dell/PAN System includes PAN Manager software, which is based on the Egenera® Processing Area Network (PAN) architecture. A PAN creates pools of processing resources similar to the way a storage area network (SAN) creates pools of storage resources (see Figure 1). At the foundation of PAN Manager is a high-performance fabric that connects servers and controllers within a single chassis to form the PAN. The Dell/PAN System provides external network and storage interfaces that are managed by redundant, load-balanced PAN controllers. Servers gain shared access to these interfaces across the PAN fabric using PAN Manager switching protocols.

Together, these protocols and the fabric constitute an I/O virtualization layer that helps provide servers with secure access to the network and storage interfaces. This layer helps significantly reduce the number of required peripheral interface devices while also helping reduce the associated server power consumption across production, development, testing, and high-availability systems.

PAN Manager lets administrators specify logical server definitions. These server definitions include the information necessary to automatically assign an application to an available physical or virtual server within the PAN, without the need to configure the hardware or install a software stack. These capabilities enable administrators to rapidly provision servers and balance application loads to help optimize use of existing resources.

> **"The reliable dynamic data center creates a shared computing environment that enables IT administrators to flexibly repurpose servers based on workloads or user demand, or in response to disruptions in service."**

Strategy	Characteristics
Efficiency enhancements	• Power management features • Heat dissipation improvements • Component enhancements
Server consolidation	• Server virtualization • Multi-core processors
Reliable dynamic data center	• I/O virtualization • Heterogeneous management capabilities • *n* + 1 high availability • *n* + 1 disaster recovery

Figure 2. *The Dell/PAN System implements a comprehensive approach to infrastructure management that helps maximize energy efficiency*

SUPPORTING COMPREHENSIVE POWER REDUCTION

The Dell/PAN System can help organizations implement each of the three key strategies for reducing power consumption: efficiency enhancements, server consolidation, and the reliable dynamic data center (see Figure 2).

Efficiency enhancements

The Dell/PAN System is based on Dell PowerEdge 1950 III rack servers and PowerEdge M600 blade servers with low-voltage dual- and quad-core Intel® Xeon® processors. In addition, the advanced policy-based power management features in PAN Manager are designed to draw power only for active servers—enabling administrators, for example, to create a policy that shuts down a server when it is not in use or is underutilized, and then powers it up only when needed. By avoiding running unused or underused servers, these features also help reduce associated cooling requirements.

Server consolidation

PAN Manager supports leading industry-standard server virtualization platforms, enabling processing pools to combine physical and virtual servers under the same management domain. IT administrators can transparently allocate virtual servers, helping eliminate the need to learn a new set of management tools. PAN Manager can automatically perform physical-to-virtual and virtual-to-physical conversions, enabling administrators to rapidly move applications between the two environments.

Reliable dynamic data center

PAN Manager supports the reliable dynamic data center through its I/O virtualization and logical server definition features, which help reduce the number of servers and peripheral devices required to support business processes while helping maintain high-availability and disaster recovery mandates. The resulting reduction in equipment, in turn, can help significantly reduce system power consumption and cooling requirements. In addition, advanced policy-based power management features enable the automatic shutdown of unused computing resources to help avoid further unnecessary power and cooling charges.

PAN Manager processing pools also enable the rapid repurposing of servers. For example, once a software development cycle is completed, administrators can reallocate test and development servers to a new project or a production application. The original project configurations are saved within the logical server definitions, and can be restored to an available system when needed.

Using these same principles, the PAN Manager *n* + 1 high-availability capability helps eliminate the need to maintain static one-to-one backup configurations. Instead, administrators can allocate a single server to act as backup for multiple production servers in case of a server failure or to support scalability. Similarly, administrators can allocate a single Dell/PAN System to serve as a disaster recovery site for multiple production data centers. In both these scenarios, these backup systems do not need to sit idle: they can be used for noncritical purposes until needed to recover from a server or site outage. The systems can rapidly transition from noncritical to production support, helping minimize the impact on end users.

OPTIMIZING THE DATA CENTER

The Dell/PAN System can enable organizations to eliminate unnecessary equipment, optimize use of available resources, and automatically power down unused or underused servers—helping meet the power and cooling challenges presented by rising energy costs and increasing equipment density. By helping create a reliable dynamic data center, the Dell/PAN System provides a flexible infrastructure that enables administrators to rightsize resources based on workload demands while still helping maintain high levels of availability.

Michael Baker is the director of Dell original equipment manufacturer (OEM) sales at Egenera. He was previously the Dell channel manager at LANDesk Software, and has also held a variety of sales and sales management positions at Dell. Michael has a B.A. in Management from Concordia University Texas.

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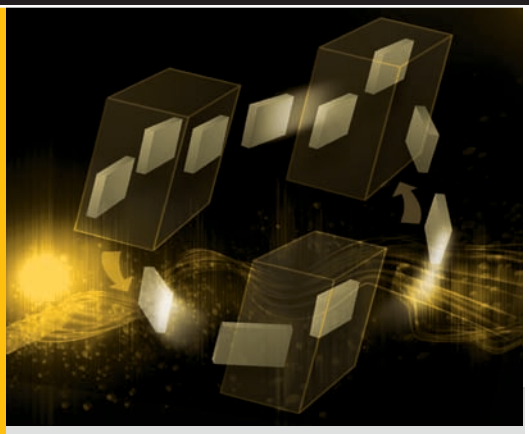

COMPARING MICROSOFT HYPER-V PERFORMANCE ON DELL POWEREDGE AND HP PROLIANT SERVERS

By the Dell TechCenter Team

To evaluate new six-core Intel® Xeon® processors in Microsoft® Hyper-V™ virtualized environments, Dell engineers tested a Dell™ PowerEdge™ server with six-core processors against Dell PowerEdge and HP ProLiant servers with quad-core processors. The results demonstrate the potential increases in performance and performance per watt possible with these powerful multi-core processors.

Related Categories:

Dell Enterprise Technology Center

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The combination of powerful multi-core processors and virtualization technology has enabled organizations to significantly increase the efficiency of their data centers—helping them consolidate physical servers onto multiple virtual machines (VMs) to support increased utilization of hardware resources while still maintaining high levels of performance. Over the past several years, increasing the number of cores in a processor has almost completely replaced increasing clock speed as the primary way to boost processor performance. New six-core Intel Xeon 7400 series processors are an example of this trend, providing higher performance than previous quad-core processors with approximately the same clock speed.

To evaluate these new six-core processors in virtualized environments, in September 2008 the Dell Enterprise Technology Center (Dell TechCenter) team ran a series of tests comparing performance and power consumption on three server configurations running the Microsoft Windows Server® 2008 Hyper-V virtualization platform at 80 percent processor utilization: a Dell PowerEdge R900 server with six-core Intel Xeon processors, the same server with quad-core Intel Xeon processors, and an HP ProLiant DL585 G2 server with quad-core AMD Opteron™ processors. As the results demonstrate, simply upgrading the PowerEdge R900 to six-core Intel Xeon processors helped both increase performance and reduce power consumption, while the PowerEdge R900 with six-core processors provided increased performance and performance per watt over the HP ProLiant DL585 G2.

TEST ENVIRONMENT

The test environment was based on a Dell PowerEdge R900 server and an HP ProLiant DL585 G2 server connected to four Dell EqualLogic™ PS5000XV Internet SCSI (iSCSI) storage area network (SAN) arrays. Each server ran the Microsoft Windows Server 2008 Hyper-V virtualization platform.

Hardware configuration

Figure 1 shows the server configuration used in the test environment. The Dell PowerEdge R900 is a four-socket server that supports Intel Xeon 7300 and Intel Xeon 7400 series processors. In the first round of tests, the Dell TechCenter team configured this server with four quad-core Intel Xeon X7350 processors at 2.93 GHz, for a total of 16 cores; in the second round, the team upgraded the server to four six-core Intel Xeon E7450 processors at 2.4 GHz, for a total of 24 cores. The six-core processors use both level 2 (L2) and L3 cache, providing a high-performance server processor well suited for running many VMs (see Figure 2). The upgrade required only a BIOS update and installation of the new processors; otherwise, the

	HP ProLiant DL585 G2	Dell PowerEdge R900	
OS	Microsoft Windows Server 2008 Enterprise x64 Edition with Hyper-V 1.0	Microsoft Windows Server 2008 Enterprise x64 Edition with Hyper-V 1.0	
Processors	Four quad-core AMD Opteron 8358 SE processors at 2.4 GHz with 512 KB L2 cache and 2 MB L3 cache	Four quad-core Intel Xeon X7350 processors at 2.93 GHz with one 4 MB L2 cache per core pair	Four six-core Intel Xeon E7450 processors at 2.4 GHz with one 3 MB L2 cache per core pair and one 12 MB shared L3 cache
HyperTransport or frontside bus speed	1 GHz	1,066 MHz	
Memory	Thirty-two 4 GB, 667 MHz, PC2-5300 double data rate 2 (DDR2) dual in-line memory modules (DIMMs)	Thirty-two 4 GB, 667 MHz fully buffered DIMMs	
Internal disks	Two 73 GB, 15,000 rpm SAS drives	Two 146 GB, 15,000 rpm SAS drives	
NICs	Four internal 10/100/1,000 Mbps NICs and one dual-port Intel Gigabit Ethernet NIC	Four internal 10/100/1,000 Mbps NICs and one dual-port Intel Gigabit Ethernet NIC	
Disk controller	HP Smart Array P400	Dell PERC 6/i	

Figure 1. *Server configuration in the test environment*

system configuration remained the same for all tests: 128 GB of RAM, one additional Intel Gigabit Ethernet network interface card (NIC), and the on-board Dell PowerEdge Expandable RAID Controller (PERC) 6/i for local storage.

The HP ProLiant DL585 G2 is a four-socket server that supports AMD Opteron 8000 series processors. The test team configured this server with four quad-core AMD Opteron 8358 SE processors at 2.4 GHz and 128 GB of RAM. Each processor is coupled with RAM and interconnected through a 1 GHz HyperTransport™ bus. The direct connection of this design keeps the memory close to the processors and can provide faster access than other processor designs.

Figure 3 summarizes the storage configuration used in the test environment. The test team connected each server to a dedicated Ethernet-based iSCSI SAN with a dual-port Intel Gigabit Ethernet PCI Express (PCIe) NIC. Storage consisted of four Dell EqualLogic PS5000XV arrays, each with sixteen 146 GB, 15,000 rpm Serial Attached SCSI (SAS) drives, for a total of 64 disks. The iSCSI SAN used Dell PowerConnect™ 5448 Gigabit Ethernet switches and was configured to route iSCSI traffic through the iSCSI subnet and NICs only, using the remote configuration

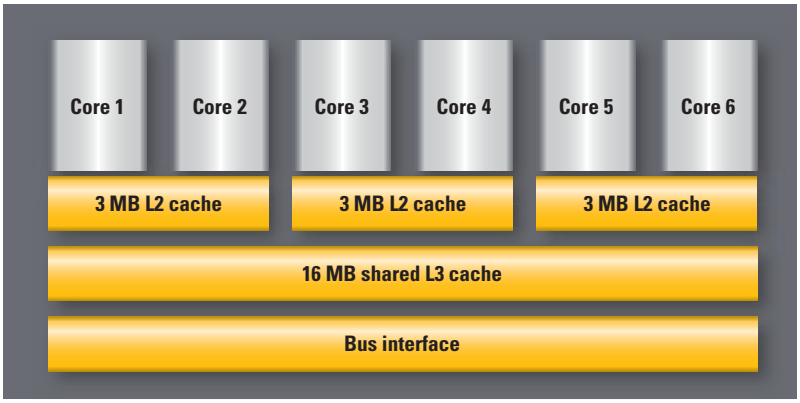

Figure 2. *Intel Xeon 7400 series processor architecture*

feature of the EqualLogic Host Integration Tools. The iSCSI software initiator included with Microsoft Windows Server 2008 was used to connect through two NIC ports to the EqualLogic storage.

The test team configured a RAID-10 storage pool with all four EqualLogic PS5000XV arrays and then created eight 200 GB logical units (LUNs) in this pool. EqualLogic storage arrays are designed

	Dell EqualLogic PS5000XV
iSCSI connections	Three 1 Gbps connections per array
Disks	Sixteen 146 GB, 15,000 rpm SAS drives per array
Storage pool	RAID-10 with all four arrays as members
LUNs	Eight 200 GB LUNs, with four assigned to each server

Figure 3. *Storage configuration in the test environment*

to automatically spread their volumes across the member arrays to help optimize performance; for these tests, the eight volumes were the only active volumes, so they were spread evenly across the member arrays. The test team assigned four volumes to each server, then created VMs and evenly divided them across the volumes.

Software configuration

Each server ran the Microsoft Windows Server 2008 Hyper-V virtualization platform—an optional server role in 64-bit Windows Server 2008 operating systems designed to run on any system with processors that support virtualization.[1] The test team first installed Windows Server 2008 Enterprise x64 Edition on each test server, then added the Hyper-V role to enable the hypervisor. Because a beta version of Hyper-V shipped with the OS, the test team next upgraded to the latest version by applying the Hyper-V update for Windows Server 2008 from the Microsoft Web site.

To compare the performance of each server configuration, the test team created a set of Windows Server 2008 VMs. They first created and installed an initial VM configured with one virtual processor, one virtual NIC, 2 GB of memory, and 18 GB of disk space running the 64-bit versions of the Microsoft Windows Server 2008 OS and the Microsoft SQL Server® 2005 database platform with Service Pack 2, then added the Hyper-V integration services to this initial VM. These services include drivers that are optimized for Hyper-V VMs.

To complete the setup, the test team loaded the open source Dell DVD Store test application, which simulates an online e-commerce application as users log in to a store; search for DVDs by actor, title, or category; and purchase DVDs. The software includes database creation and indexing scripts, stored procedures, data loading scripts, and client simulation driver programs.[2] For these tests, the team loaded the medium-size version of the DVD Store database—approximately 1 GB of data—using the scripts included with the DVD Store kit.

The test team replicated the initial VM by using sysprep to first prepare the virtual hard disk for replication and then perform a simple file copy. The virtual disks were evenly distributed across the LUNs assigned to each server on the Dell EqualLogic arrays. To complete the VM replication, the test team created and configured new VMs to use the new virtual disks.

TEST RESULTS: PERFORMANCE AND POWER CONSUMPTION

The performance of a virtualized server can be measured in two components: sizing or capacity, which indicates the number of VMs that a server can support, and the aggregate performance that those VMs can achieve. In addition to performance, however, organizations should also consider power consumption when evaluating a server. Power consumption depends on multiple factors, including amount of RAM, number of PCI adapters, number of internal disks, and load level.

The Dell TechCenter team used the ds2sqlserverdriver.exe program included with the DVD Store software to run the workload against multiple VMs simultaneously. This driver program connects directly

"Simply upgrading the PowerEdge R900 to six-core Intel Xeon processors helped both increase performance and reduce power consumption, while the PowerEdge R900 with six-core processors provided increased performance and performance per watt over the HP ProLiant DL585 G2."

[1] Microsoft has not certified support for the Windows Server 2008 Hyper-V role on systems with more than 16 cores. For more information on Hyper-V, see "Getting Started with Microsoft Windows Server 2008 Hyper-V on Dell Servers," by Ranjith Purush, Sitha Bhagvat, Ryan Weldon, Brent Douglas, and David Schmidt, in *Dell Power Solutions*, November 2008, DELL.COM/Downloads/Global/Power/ps4q08-20090140-HyperV.pdf.

[2] For more information, visit www.delltechcenter.com/page/DVD+Store.

	Number of VMs	Performance	Performance advantage compared with HP server	Average power consumption	Performance per watt	Performance-per-watt advantage compared with HP server
HP ProLiant DL585 G2	26	58,355 OPM	—	720 W	81.0 OPM/W	—
Dell PowerEdge R900 with quad-core processors	30	62,983 OPM	8%	971 W	64.9 OPM/W	–20%
Dell PowerEdge R900 with six-core processors	40	74,084 OPM	27%	864 W	85.7 OPM/W	6%

Figure 4. *Workload performance results for each server in the test environment at 80 percent processor utilization*

to the SQL Server database and simulates the load that an application server would create against the database when users log in, browse, and purchase items from an online store. For these tests, each VM was driven by an instance of the driver program with 10 threads and a delay time of 0.2 seconds.

To simulate the way enterprises typically run applications on VMs in a production environment, the test team increased the number of VMs through successive rounds of testing until processor utilization for the entire physical server was approximately 80 percent—a reasonably high level of usage that still allowed for workload spikes. The team calculated the utilization by averaging the values from the Hypervisor Logical Processor % Total Run Time performance counter during each test. A power meter attached to the servers measured power consumption during the tests.

Figure 4 summarizes the results, including the number of VMs supported by each server configuration, total performance of all VMs in orders per minute (OPM), average power consumption, and performance per watt. These results demonstrate that the Dell PowerEdge R900 with six-core Intel Xeon processors offered up to a 27 percent performance advantage over the HP ProLiant DL585 G2 with quad-core AMD Opteron processors and up to a 6 percent advantage in performance per watt. In addition, simply upgrading the processors in the PowerEdge R900 increased its performance by approximately 18 percent while decreasing power consumption by approximately 11 percent—providing up to a 32 percent increase in performance per watt. In contrast, although the PowerEdge R900 with quad-core processors outperformed the HP ProLiant DL585 G2, that increase came with up to a 20 percent disadvantage in performance per watt.

"The Dell PowerEdge R900 with six-core Intel Xeon processors offered up to a 27 percent performance advantage over the HP ProLiant DL585 G2 with quad-core AMD Opteron processors and up to a 6 percent advantage in performance per watt."

EFFICIENT, HIGH-PERFORMANCE VIRTUALIZATION

The combination of high performance and efficiency provided by the Dell PowerEdge R900 server makes it well suited for Microsoft Hyper-V virtualization. However, as the Dell TechCenter tests demonstrate, the type of multi-core processors can also play a key role in overall evaluation: the Dell PowerEdge R900 with six-core Intel Xeon processors provided a significant boost in performance while reducing power consumption compared with the same server with quad-core Intel Xeon processors, and provided higher performance and higher performance per watt compared with an HP ProLiant DL585 G2 server with quad-core AMD Opteron processors. For organizations considering upgrading to six-core processors, these results can provide an idea of the potential advantages they can offer in Hyper-V virtualized environments.

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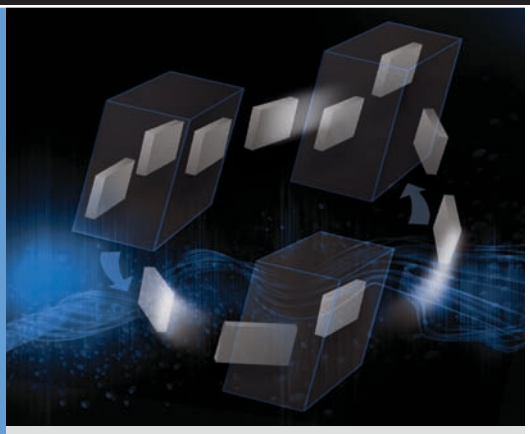

DESIGNING A SCALABLE ARCHITECTURE FOR VMWARE VIRTUAL DESKTOP INFRASTRUCTURE

By David Korsunsky
Timothy Sherbak
Cris Banson

To help address the challenges of enterprise desktop management, VMware and Dell have created a scalable VMware® View reference design based on VMware Infrastructure 3, Dell™ PowerEdge™ servers, and Dell EqualLogic™ PS Series storage arrays—extending the benefits of virtualization to end-user systems while enhancing administrator control and helping reduce ongoing operational costs.

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Managing traditional enterprise desktops has become increasingly difficult and costly, presenting challenges such as supporting rising numbers of remote and mobile users, controlling support and maintenance costs, performing time-consuming software management, and meeting stringent requirements for availability, stability, performance, and security. To help overcome these challenges, organizations are constantly looking for solutions that can provide a simplified, cost-effective approach to desktop management.

Given the success of server virtualization in supporting consolidation, helping simplify management, and helping reduce operating costs, organizations are beginning to look for ways to achieve similar benefits in desktop environments. VMware View—which includes VMware Virtual Desktop Infrastructure (VDI)—offers an end-to-end solution that enables organizations to provide end users with access to virtual desktops hosted in a central data center. This solution enables administrators to take advantage of the VMware Infrastructure 3 virtualization platform along with an enterprise-class desktop manager and connection broker to enhance manageability and control while still delivering a familiar desktop experience to end users. Virtual machine (VM) hardware independence, encapsulation, and isolation, combined with features such as VMware vMotion™ technology, VMware High Availability (VMware HA), VMware Distributed Resource Scheduler (VMware DRS), and VMware Consolidated Backup (VCB), help make virtual desktops substantially more agile than traditional physical desktop configurations.[1]

To help organizations implement this technology in their own environments, VMware and Dell have created a scalable reference design using a building-block approach based on VMware Infrastructure 3, Dell PowerEdge 2950 servers, and Dell EqualLogic PS5000XV Internet SCSI (iSCSI) storage area network (SAN) arrays. The building-block configuration has been designed, sized, and tested based on VMware and Dell best practices to support up to 64 virtual desktops, each handling a workload representative of a user running a common set of business applications. Organizations can use this architecture to help design and fine-tune a deployment that can meet the specific needs of their environments. By doing so, they can create a flexible, scalable environment that extends powerful VMware Infrastructure 3 capabilities such as business continuity and disaster recovery to the

[1] For more information on the advantages of VMware VDI, see "Extending Benefits of Virtual Remote Desktops Using VMware and Dell EqualLogic SANs," by Timothy Sherbak and Cris Banson, in *Dell Power Solutions*, November 2008, DELL.COM/Downloads/Global/Power/ps4q08-20090108-Sherbak.pdf.

desktop, streamlines desktop management, and increases administrator control while helping reduce ongoing operational costs.

VMWARE VIEW REFERENCE SOLUTION

Each building block of the reference architecture is designed to support up to 64 virtual desktops per VMware ESX host (8 per core) running a workload profile commonly referred to as a *knowledge worker* or *information worker*. This profile, based on VMware research on the most common type of desktop worker, is well suited to desktop virtualization. Specifically, the reference architecture was designed and tested with seven typical enterprise applications: Microsoft® Word, Microsoft Excel®, Microsoft PowerPoint®, Microsoft Internet Explorer®, Adobe® Acrobat, WinZip, and McAfee VirusScan software.

Figure 1 shows the building-block design for the target worker profile. The overall reference solution comprises four primary layers, each building on the layer below to provide a comprehensive platform for VMware View deployment in midsize enterprises.

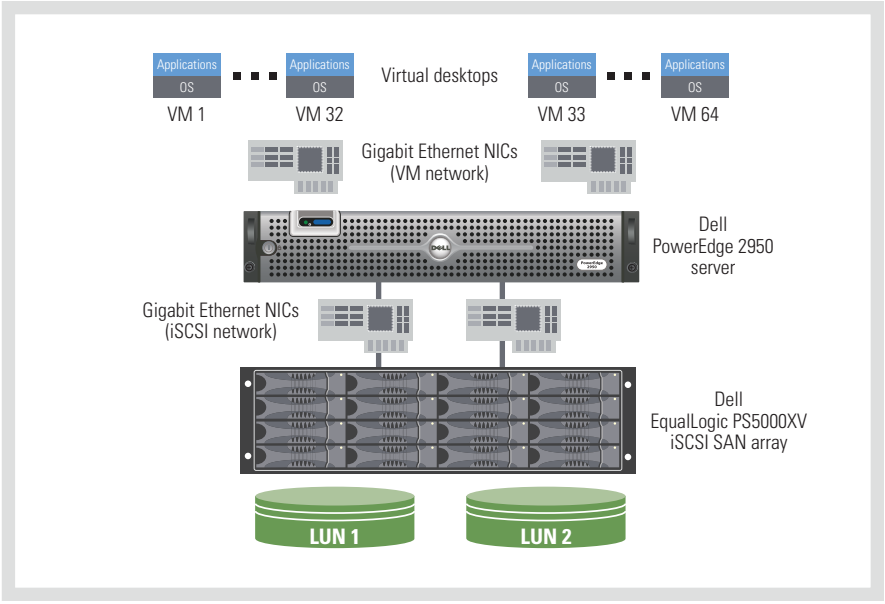

Figure 1. *Scalable building-block configuration supporting up to 64 virtual desktops*

Layer 1: VMware Infrastructure 3

VMware Infrastructure 3 provides the foundation of the reference architecture, abstracting processor, memory, storage, and networking resources into virtualized components that can support multiple VMs while also providing enhanced manageability, increased availability, simplified disaster recovery, and rapid provisioning and allocation of desktop and storage resources. In the reference architecture, this layer incorporates VMware ESX 3.5 Update 2 running on the Dell PowerEdge 2950 server as well as VMware vCenter Server (formerly VMware VirtualCenter) 2.5 software running on a Dell PowerEdge 1850 management server.

This layer can also include the VMware vMotion, VMware HA, VMware DRS, and VCB features. vMotion enables the live migration of VMs from one physical server to another without affecting running applications. VMware HA clusters are designed to provide continuous service availability during both planned and unplanned system downtime, while VMware DRS helps dynamically load balance VMs across the entire pool of available resources. VCB provides centralized, cost-effective backup to help efficiently protect VMs.

Layer 2: Dell EqualLogic PS5000XV iSCSI SAN array

iSCSI arrays are well suited for use with VMware View, offering cost-effective, high-performance storage for the virtualized environment. The Dell EqualLogic PS5000XV array is designed to provide a high-performance iSCSI SAN based on fully redundant, hot-swappable, enterprise-class hardware. Built-in EqualLogic PS Series software functionality includes automatic load balancing, snapshots and replication, multipath I/O, consistency sets, and more at no additional cost.

The EqualLogic PS5000XV array used in the reference architecture is configured with EqualLogic PS Series firmware version 3.2.4 and sixteen 146 GB, 15,000 rpm Serial Attached SCSI (SAS) drives in a RAID-50 configuration with two hot-spare drives. Two 410 GB data volumes are provisioned on the array, each formatted as a VMware Virtual Machine File System (VMFS) volume and supporting 32 virtual desktops. To take advantage of advanced EqualLogic volume virtualization, the data volumes are distributed across all active drives and RAID sets in the array.

VMware ESX provides the software iSCSI initiator. The storage sizing was based on the use of full clones, with each virtual desktop having its own persistent virtual disk. Although this configuration provides a good starting point, organizations should take into account the needs of their specific environments before choosing a storage array, including the following criteria:

- **Performance:** Estimate performance requirements by collecting disk performance statistics on an end-user system during normal operation.
- **Capacity:** Estimate capacity requirements by determining the size of the hard drive to be allocated to each virtual desktop.
- **Drive type:** Choose an appropriate drive type based on performance, capacity, and interface requirements.
- **RAID level:** Choose an appropriate RAID level based on workload characteristics and how the application performs I/O.

- **iSCSI initiator:** Choose an appropriate hardware or software iSCSI initiator.

The basic reference configuration is designed for simple sizing and deployment, but can result in increased costs as it scales up with additional building blocks. To help reduce storage costs as the solution scales up, organizations can take advantage of two additional options: EqualLogic PS Series snapshots and VMware View Composer.[2]

EqualLogic storage arrays include the ability to take one or more snapshots of a VMFS volume and provide these snapshots to VMware ESX as new writable data stores. This approach helps reduce storage requirements because virtual desktops share the desktop images hosted on the originating data volume, thus consuming additional storage only when new data is written by an individual virtual desktop.

VMware View Composer, a new component of VMware View, uses VMware linked clone technology to rapidly create desktop images that share virtual disks with a master image. User data and settings are separated from the desktop image, so they can be administered independently. Administrators can patch or update desktops that are linked to a master image simply by updating the master image, without affecting user settings, data, or applications. This feature helps reduce storage needs and costs while simplifying desktop management.

Administrators should deploy these options carefully, because they can potentially affect performance by increasing the load on a limited set of shared storage resources. A classic storage-sizing tradeoff exists between optimizing cost and capacity and optimizing performance. The performance requirements as defined by the target workload for the reference solution indicate that the aggregate I/O workload for this type of environment is nontrivial and characterized by bursts of activity, requiring storage sizing to take into account both cost and I/Os per second (IOPS).

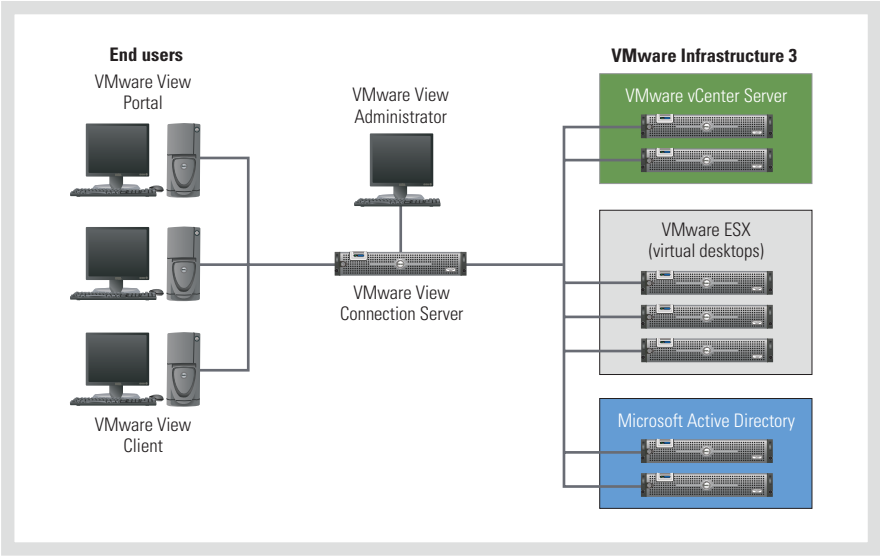

Figure 2. *Example VMware View Manager environment*

Layer 3: Dell PowerEdge 2950 server

Dell PowerEdge servers are designed to provide a simplified, cost-effective, high-performance platform for enterprise data centers, and can easily integrate with VMware Infrastructure 3. The Dell PowerEdge 2950 server used in the reference architecture is configured with two quad-core Intel® Xeon® processors at 2.67 GHz, 32 GB of RAM, and VMware ESX 3.5 Update 2, along with two Gigabit Ethernet network interface cards (NICs) for the VM network and two Gigabit Ethernet NICs for the iSCSI SAN. This configuration helps provide a good balance between overall server hardware cost and sufficient performance to support the 64 virtual desktops. As with the storage layer, organizations should take into account the needs of their specific environments before choosing a server, including the following criteria:

- **Cost per VM:** Choose a server that provides an appropriate balance between overall cost and the number of VMs it can run in a production environment.
- **Number of ESX servers:** Balance cost per VM with the number of ESX servers. Very large deployments may favor servers with increased processor and memory resources to support more VMs per ESX server, thereby requiring fewer ESX servers to manage.
- **ESX license costs:** Choose a server that provides an appropriate balance between license costs and performance; two-socket servers with quad-core processors are typically appropriate for VMware View environments.
- **PCI slots:** Ensure the server has a sufficient number of PCI slots for network and storage connectivity to provide both high availability and resiliency.
- **vMotion compatibility:** Ensure that all ESX hosts in the VMware View environment have compatible processors for vMotion, especially if the hosts will be part of an existing ESX cluster.

Layer 4: VMware View Manager and clients

The final layer in the reference solution is VMware View Manager and the client systems. VMware View Manager is an enterprise-class desktop management platform designed to securely connect end

[2] VMware View Composer requires VMware ESX 3.5 Update 3 and VMware vCenter Server 2.5 Update 3.

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users to virtual desktops in the data center, and includes a simplified Web browser–based interface to manage VMware View environments. It uses existing Microsoft Active Directory® infrastructures for authentication and user management, and integrates with VMware vCenter Server to manage virtual desktops on VMware ESX.

VMware View Manager includes the following primary components (see Figure 2):

- **View Client:** Locally installed application that communicates with View Connection Server to allow users to connect to their desktops using Remote Desktop Protocol (RDP)
- **View Portal:** Web browser–based version of View Client supported by multiple operating systems and browsers
- **View Administrator:** Web browser–based application that serves as the primary mechanism for configuring View Connection Server and managing users and desktops
- **View Connection Server:** Software that acts as a connection broker and provides management and user authentication for virtual desktops
- **View Agent:** Software that installs on virtual desktops and enables features such as RDP connection monitoring, remote USB support, and single sign-on

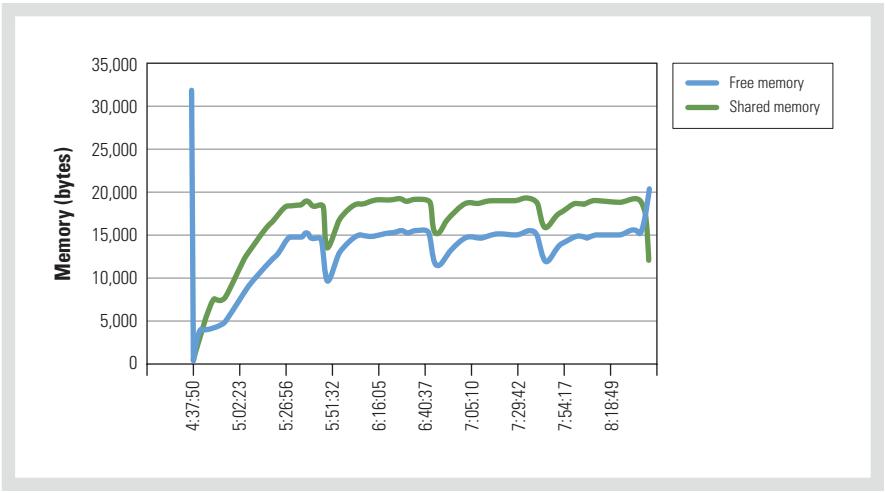

Figure 4. *VMware ESX memory utilization on a Dell PowerEdge 2950 server supporting 64 virtual desktops*

Each virtual desktop in the reference architecture is configured with one virtual processor, 512 MB of RAM, and 10 GB of disk space, and runs the Microsoft Windows® XP Professional OS with Service Pack 2, Microsoft Office 2003 suite, and VMware View Agent software.

TEST ENVIRONMENT AND PERFORMANCE

In November 2008, VMware carried out performance testing on the reference solution using the VMware View Performance test software along with VMware vCenter Server, esxtop, and the Dell EqualLogic performance monitoring tool. Figure 3 shows the test environment.

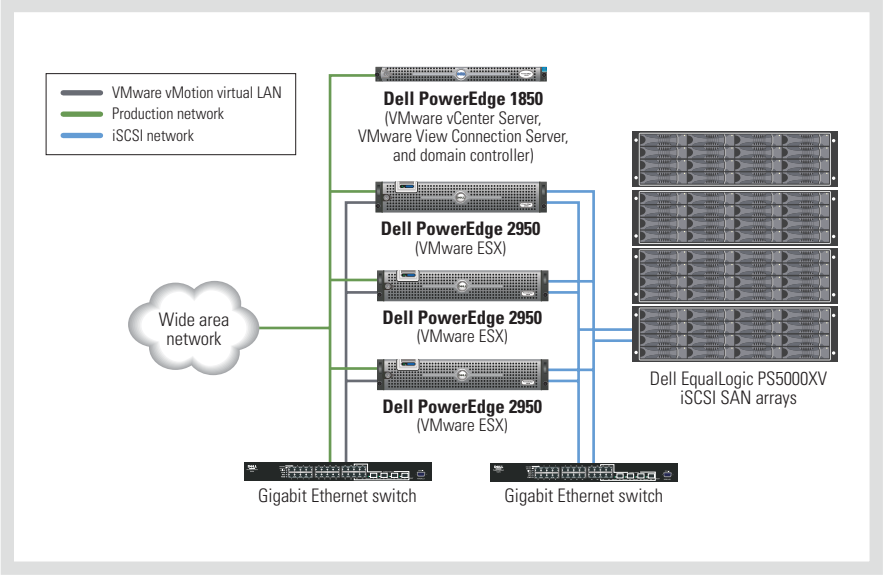

Figure 3. *Test environment based on the VMware View reference architecture*

Figure 4 shows the VMware ESX memory utilization as measured by the esxtop tool when running 64 virtual desktops on a single Dell PowerEdge 2950 server. Actual memory usage and page sharing increased and decreased slightly during the four-hour test run as the virtual desktops opened and closed common applications, with utilization averaging approximately 19 GB. As the test progressed, additional common pages were found in memory for all the virtual desktops, enabling the server to reclaim approximately 13 GB of memory over the course of the test and helping demonstrate the efficient memory usage of the test environment.

Figures 5 and 6 show the storage IOPS and throughput measured by the EqualLogic performance monitoring tool on the EqualLogic PS5000XV array when running 64 virtual desktops. Performance averaged approximately 185 IOPS over the course of the test run, with a peak of approximately 650 IOPS; throughput averaged approximately 3,530 KB/sec, with a peak at 13,733 KB/sec. One of the advantages of the EqualLogic array is that the VMFS data store volumes are virtualized—that is, striped across all drives in the array—thus distributing the aggregate workload across the available storage resources. This approach enables

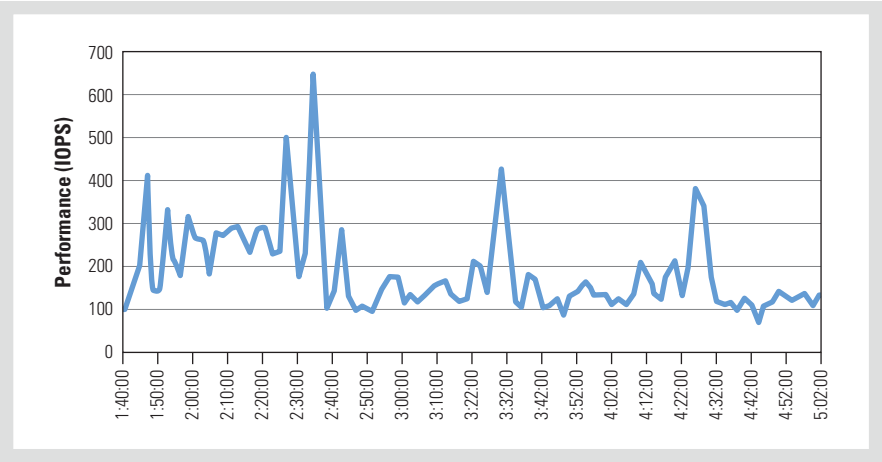

Figure 5. *Storage performance on a Dell EqualLogic PS5000XV array supporting 64 virtual desktops*

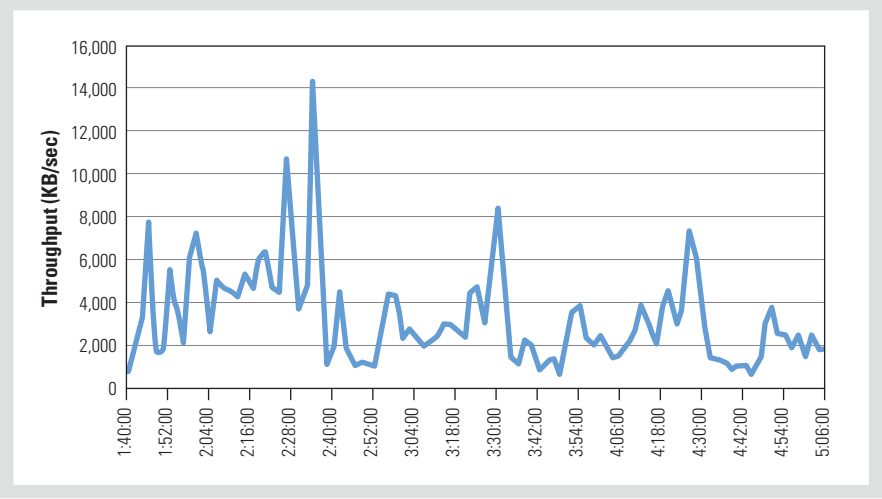

Figure 6. *Storage throughput on a Dell EqualLogic PS5000XV array supporting 64 virtual desktops*

organizations to add performance capacity simply by expanding the SAN with an additional storage array, which can be seamlessly added to the EqualLogic group. The EqualLogic storage can then automatically redistribute the data volume and disk I/O across the additional controller, network ports, memory cache, and disk spindles.

DEPLOYMENT AND SCALING

Designing and testing a server and storage building block for a typical worker profile enables organizations to use the VMware View reference configuration as a basis for their own deployments. Ideally, administrators should deploy the first building block as a proof-of-concept test with a group of pilot end users. This approach provides an opportunity to establish baseline performance measurements on the system to help ensure that the sizing estimates are in line with actual production use.

As organizations scale the environment and deploy additional building blocks, they should keep the following design considerations in mind:

- **VMware configuration maximums:** Always check the latest VMware configuration maximums before scaling up a deployment, particularly in large environments.
- **VMware ESX cluster design:** Determine whether the ESX hosts running the virtual desktop environment will form their own ESX cluster or be part of an existing ESX cluster containing other server workloads.
- **VMware vCenter Server instances:** Consider whether the virtual desktops will be managed by their own dedicated vCenter Server instance or by an existing vCenter Server instance that may already be managing other non–VMware View deployments.

COMPREHENSIVE SOLUTION FOR DESKTOP VIRTUALIZATION

Organizations today must support a wide variety of users on a range of equipment—including local, mobile, and remote users accessing sensitive information assets across desktops, laptops, and unmanaged PCs—making it difficult to support end users in a consistent and secure manner. By combining the advantages of VMware Infrastructure 3 and cost-effective, high-performance Dell servers and storage, the reference solution described in this article provides a robust basis for virtual desktop environments, one that can help both control ongoing costs and easily scale as business needs grow.

David Korsunsky is a storage solutions engineer on the VMware Storage Alliances team.

Timothy Sherbak is senior manager of virtualization solutions marketing for the Dell EqualLogic product family.

Cris Banson is a senior technical storage specialist at VMware.

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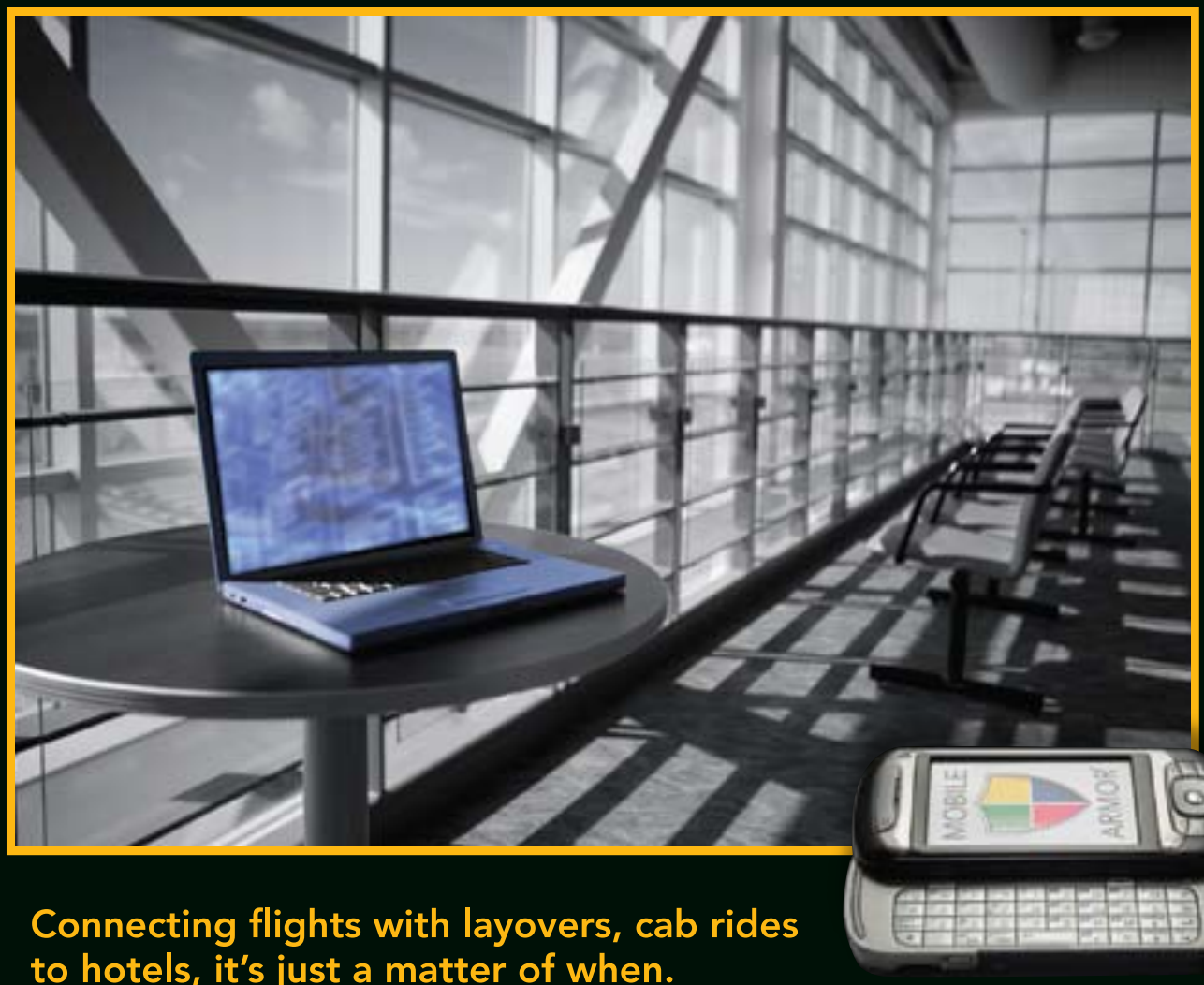

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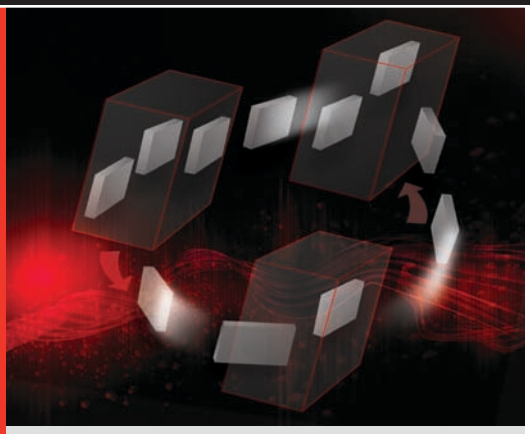

INTEGRATING VIRTUALIZED SERVERS WITH VMWARE vSTORAGE–ENABLED DELL EQUALLOGIC iSCSI SANs

By Eric Schott
Scott Davis

A comprehensive virtualization strategy encompassing virtual servers and consolidated storage enables unprecedented gains in overall data center efficiency and flexibility. VMware® Infrastructure utilizes advanced integration available in Dell™ EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays to further enhance the virtualized IT infrastructure and help simplify the management of complex data center environments.

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Virtualization has had a shape-shifting effect on IT infrastructures, enabling administrators to encapsulate live, running workloads in virtual machines (VMs) and move them transparently across pooled resources without service interruption. VM encapsulation and isolation enable organizations to safely consolidate many workloads on a single physical server—helping to decrease the infrastructure cost. The operational benefits of such virtualization capabilities include the ability to dynamically spread workloads across available hardware, avoid forms of both planned and unplanned downtime, and nondisruptively expand resources on demand.

Until recently, integration of storage area networks (SANs) and virtualization platforms was restricted to basic storage protocols, limiting the coordination and intelligent use of some advanced SAN features in the virtualized environment. Consolidating servers in virtualized data centers introduced a new layer of abstraction that prevented administrators from fully incorporating many preexisting processes from their physical environments into their virtualized environments. Lack of integration between the hypervisor and the underlying storage infrastructure has typically prevented virtualized servers from taking full advantage of the data protection, backup, and performance features of enterprise-class storage.

ENGINEERING THE VIRTUAL DATA CENTER OS

Virtualizing and consolidating physical server and storage resources into a cooperative pool of well-integrated resources that can be dynamically applied to virtual workloads are key capabilities of VMware Infrastructure, the company's premier platform and an example of a Virtual Data Center Operating System (VDC-OS). A VDC-OS can help address the need for flexibility, speed, resiliency, and efficiency by transforming a data center into an elastic, self-managing, self-healing, shared infrastructure.

Dell and VMware are further advancing these capabilities through a cooperative engineering initiative designed to integrate Dell EqualLogic PS Series Internet SCSI (iSCSI) SAN arrays and storage management technologies with VMware Infrastructure. Through this collaboration, new services based on VMware vStorage application programming interfaces (APIs) are being developed by VMware to tightly integrate advanced EqualLogic PS Series capabilities (including provisioning, snapshots, replication, and thin provisioning) seamlessly into the VMware Infrastructure environment.

ADVANCING EFFICIENCY ACROSS THE VIRTUALIZED DATA CENTER

VMware Infrastructure helps create a dramatically simplified, efficient computing model that enables

applications to safely and securely utilize shared data center resources in a dynamic and flexible manner (see Figure 1). By enabling automated management and resource allocation for VMs, it helps free administrators to focus on managing application workloads instead of contending with IT infrastructure details—helping administrators to eliminate both planned and unplanned downtime, rapidly provision new capacity, and optimize resource utilization.

The VMware VDC-OS platform contains a set of Infrastructure vServices, a hardware abstraction layer that enables efficient and flexible use of underlying physical compute, network, and storage resources. Infrastructure vServices use industry-standard server, storage, and network components to help create a unified and efficient shared platform. These services not only abstract the underlying hardware, but also aggregate this hardware into pools, which can then be logically divided into virtual components and made available to applications in a dynamic fashion based on enterprise requirements and priorities.

VMware vStorage services include a range of technologies designed for efficient usage of shared storage as well as maximum performance. VMware's Virtual Machine File System (VMFS) is designed to allow VMs to effectively share physical storage with minimal impact on performance or manageability. In this model, physical storage resources are virtualized and presented to VMs as ordinary dedicated disk devices. These disk devices are actually files stored on the VMFS volume, helping isolate administrators from storage provisioning tasks and management complexity. Optimization techniques such as thin provisioning and linked clone technology enable high consolidation of storage usage. Other vStorage capabilities provide for enhanced integration with current storage management tools, such as those for backup and array replication. vStorage offers APIs that enable VMware and storage partners such as Dell to integrate and optimize their storage technologies with VMware technologies and capabilities.

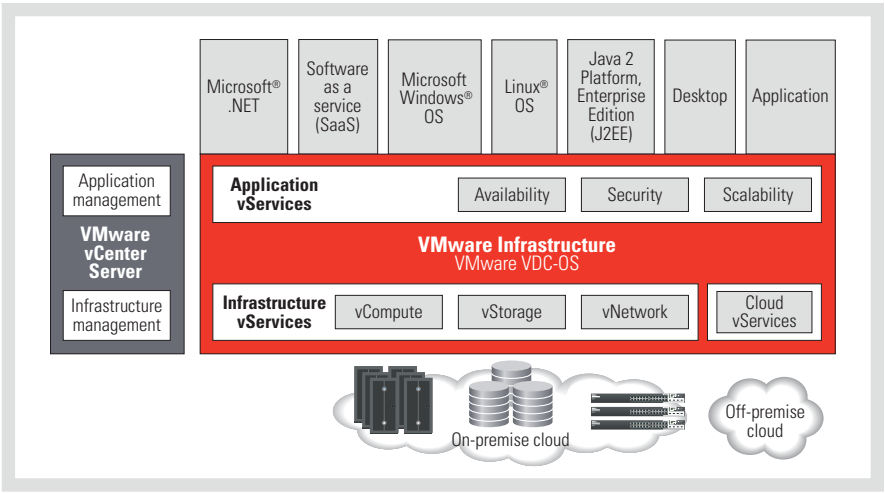

Figure 1. *Forming the basis for a comprehensive virtualized environment with VMware Infrastructure*

REMOVING BARRIERS WITH iSCSI SANs

Virtualizing and consolidating storage is a necessary first step toward realizing the full benefits of a virtualized data center. A virtualized SAN is pivotal for supporting 24/7 operations, enabling advanced enterprise-class functionality, and extending similar benefits of server consolidation and virtualization to storage.

All too often, storage consolidation has been a complex and expensive project requiring proprietary infrastructures and specialty skills not typically available within an IT organization. Today, iSCSI SANs are helping administrators overcome these barriers to implementing a fully virtualized data center environment. However, many iSCSI SANs require expensive add-on functionality such as comprehensive data protection and disaster recovery to make them suitable for consolidated virtualized server deployments where data is highly concentrated.

Simplified management is also critical as the virtualized infrastructure expands to encompass a comprehensive range of data center hardware and networking capabilities. Dell EqualLogic PS Series iSCSI SAN arrays help overcome these challenges with a variety of built-in features that have been widely adopted in data center consolidation scenarios. Now, Dell is using VMware vStorage APIs to integrate these enterprise-class SAN features with the VMware Infrastructure platform.

UNDERSTANDING THE ROLE OF DELL EQUALLOGIC PS SERIES ARRAYS

A high degree of built-in intelligence and automation help make Dell EqualLogic PS Series iSCSI SANs well suited for the demands of virtualized data centers. The innovative design of the arrays enables simple, full-featured deployment with no additional license fees or software required. Arrays can be added to the SAN without service interruption, and the SAN is designed to automatically rebalance the workload to accommodate additional arrays. In many ways, EqualLogic PS Series arrays are designed to provide for storage what VMware can provide for servers: consolidation, flexibility, and high availability.

As workload demands shift or migrate between VMs and their physical host servers, the virtualized SAN can automatically apply storage resources where and when they are needed without manual intervention or tuning. Peer deployment typically enables IT staff to install, configure, and deploy EqualLogic arrays in a matter of minutes.

EqualLogic arrays are also designed to provide the reliability and uptime

required in virtualized data centers. Designed to provide greater than 99.999 percent data availability, the arrays are built with redundant, hot-swappable components. Storage volumes can automatically fail over to another disk if necessary. These features complement the high availability provided by server virtualization and consolidation.

For data protection, the EqualLogic firmware provides many standard features including snapshot, clone, and replication capabilities. Also included standard with the arrays are VMware-specific technologies, Dell EqualLogic Auto-Snapshot Manager/VMware Edition, and the VMware vCenter Site Recovery Manager (SRM) Adapter, which enable advanced automation of the data recovery process. Resource-intensive disaster recovery operations are offloaded from the hypervisor layer to the arrays to help optimize the virtualized data center.

Currently under joint development by Dell and VMware are several advanced technologies that are planned to deliver seamless integration of Dell and VMware tools with the virtualized environment: linked clone technology for minimized storage requirements, SAN data copy offload for high performance and low overhead, advanced multipathing to optimize multiple SAN connections, and thin provisioning management to help protect VMs from running out of space.

UTILIZING vSTORAGE WITH SNAPSHOTS AND DISASTER RECOVERY

In 2008, the tight engineering relationship between Dell and VMware resulted in Dell EqualLogic Auto-Snapshot Manager/VMware Edition and VMware vCenter SRM for virtualized data center protection. Both offerings take advantage of the VMware vStorage APIs and help offload performance-intensive operations from VMware Infrastructure onto the SAN. Auto-Snapshot Manager/VMware Edition, which is bundled with EqualLogic PS Series iSCSI SANs, provides automated, consolidated VM backup and recovery in VMware environments. An easy-to-navigate graphical user interface offers SAN and VMware-centric views (see Figure 2). Auto-Snapshot Manager/VMware Edition works with VMware vCenter Server to take a snapshot of the VM and then takes an EqualLogic SAN snapshot, enabling rollback of VMs for fast recovery. Snapshots can be prescheduled for various time intervals, ranging from minutes to days.

This environment also offers an automated and cost-effective approach to disaster recovery using EqualLogic arrays and vCenter SRM. The arrays include auto-replication software designed to eliminate a recurring licensing expense. The arrays also include Dell EqualLogic PS Series SRM Storage Adapter software at no additional cost, which integrates the SAN auto-replication feature directly into vCenter SRM.[1]

The integrated Dell and VMware environment uses the auto-replication feature in the EqualLogic arrays to make copies of data and send them to a remote location at a safe distance from the primary data center. If the primary site goes down, the volumes are already at the recovery site, and vCenter SRM can automatically coordinate the process of bringing the environment online by running the recovery plan and starting VMs in the intended order with updated networking configurations. Administrators can monitor and pause recovery using VMware vCenter Server.

ENABLING OPPORTUNITIES FOR ENHANCED INTEGRATION

Dell and VMware continue their integration efforts to provide advanced multipathing, coordinated thin provisioning, fast and efficient data movement (including SAN-accelerated VMware Storage vMotion™ technology), and VM data de-duplication.

In future releases, connection-aware multipathing technology provided by Dell EqualLogic PS Series iSCSI SANs is planned to help optimize multiple SAN connections. Redundant connections help safeguard against network problems. Integration with VMware vStorage is expected to enable end-to-end load balancing based on optimal mapping designed to maximize the server and SAN array availability and performance.

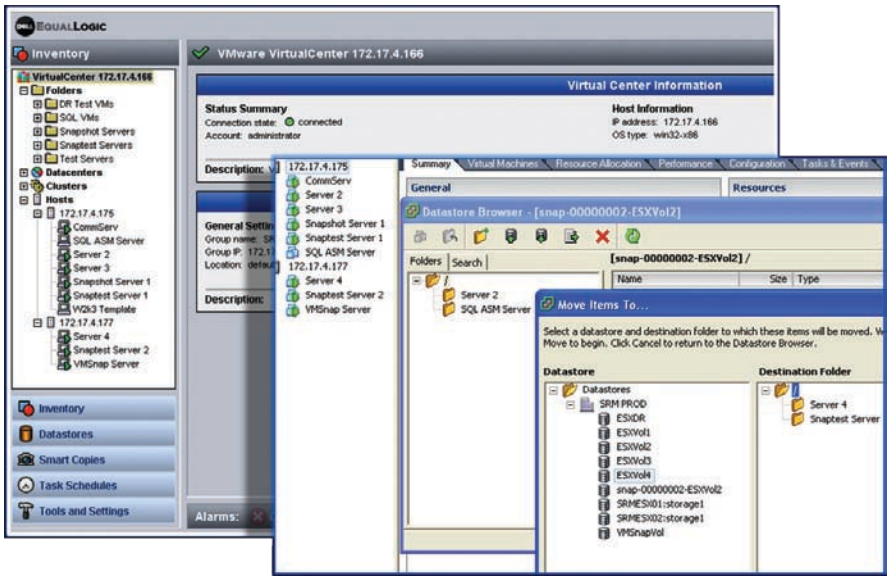

Figure 2. *Navigating VM backup and recovery in Dell EqualLogic Auto-Snapshot Manager/VMware Edition*

[1] For more information on protecting data with VMware software and Dell EqualLogic PS Series iSCSI SANs, see "Automated Disaster Recovery with VMware SRM and Dell EqualLogic iSCSI SANs," by Andrew Gilman and Jon Bock, in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080395-Gilman.pdf; and "How Dell EqualLogic Auto-Snapshot Manager/VMware Edition Helps Protect Virtual Environments," by Andrew Gilman and William Urban, in *Dell Power Solutions*, November 2008, DELL.COM/Downloads/Global/Power/ps4q08-20090107-Gilman.pdf.

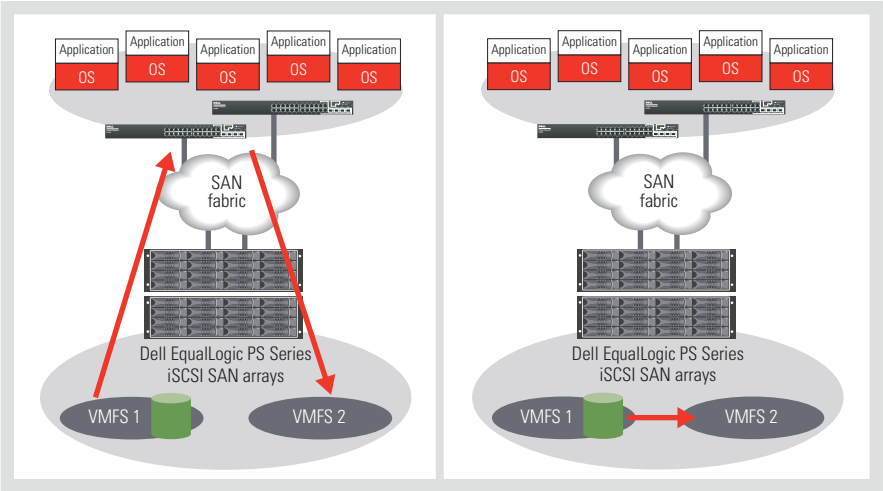

Figure 3. *Copying SAN data without VMware vStorage integration (left) and with VMware vStorage integration (right)*

The integrated technology is planned to automatically adapt to configuration changes on the server, network, or SAN arrays.

EqualLogic arrays include thin provisioning technology that helps relieve storage underutilization problems, allowing organizations to reduce storage purchases up-front and add capacity later as needed. This approach requires an accounting system that lets administrators monitor how much space is being used relative to the physical assets on hand. In future releases, Dell and VMware integration through vStorage is anticipated to automate this process by tying the accounting system to event-based actions and alerts. VMware Infrastructure managed through VMware vCenter Server is designed to automatically pause the VM if capacity is exceeded, notify administrators, and allow Storage vMotion to migrate files to another device before resuming operation.

Linked clone technology is also expected to help reduce VM storage requirements by enabling VMs to share common OS images on the SAN while retaining user-specific profile and application data. Each VM has its own base disk that stores writes, and patches applied to the base disk can be seen by all linked clones. The combination of virtualized storage and linked clones enhances the efficiency of storage utilization, helping to reduce total cost of ownership by minimizing the need to provision added storage capacity.

Performance is also optimized in the integrated Dell and VMware environment by offloading many processing-intensive tasks from the server to the EqualLogic arrays. An example is the SAN data copy offload for Storage vMotion operations (see Figure 3). Without vStorage integration, data must be read from the SAN into the server and then written back to the SAN, leading to significant processor and network overhead. With vStorage integration, data can bypass the server and instead move within the SAN, which helps significantly reduce server processor and network overhead.

BENEFITING FROM A COMPREHENSIVE VIRTUALIZATION STRATEGY

Traditionally, VMs and SANs have lacked advanced integration, making ongoing management, data protection, and disaster recovery complex for organizations that have implemented server consolidation through virtualization. Dell and VMware are helping to simplify these operations for virtualized data centers by delivering advanced automation, intelligence, and integration designed to meet the emerging requirements for a fully virtualized data center environment. By combining VMware Infrastructure and Dell EqualLogic PS Series iSCSI SANs, organizations can pave the way for a virtualized infrastructure that encompasses servers, storage, and networks.[2]

A fully virtualized infrastructure enables consolidation of assets, centralized management, advanced data protection, and integrated disaster recovery. By managing both virtualized servers and virtualized storage centrally as key strategic assets, enterprises can utilize storage resources efficiently, grow storage capacity seamlessly, and minimize downtime caused by storage-related problems. Ultimately, these benefits reach far beyond reductions in capital outlays and operating costs—affording fast, flexible IT response to keep pace with evolving business requirements.

Eric Schott is the director of product management for the Dell EqualLogic product family, where he is responsible for strategy and planning for iSCSI storage networking products.

Scott Davis is the chief data center architect in VMware's Office of the CTO, where he is involved in driving product and technology strategic direction across enterprise data center technologies, storage, and cloud computing.

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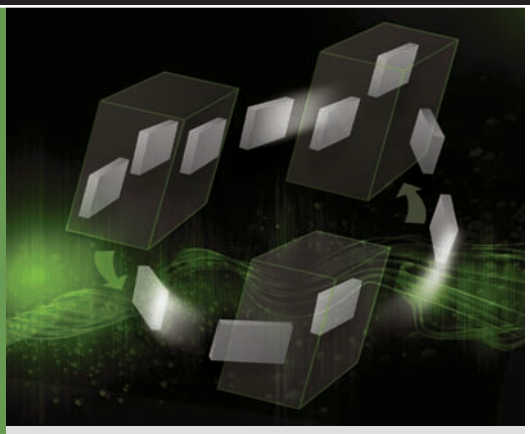
Dell EqualLogic and VMware vStorage:
www.equallogic.com/vstorage

Dell EqualLogic PS Series:
DELL.COM/EqualLogic
DELL.COM/PSSeries

[2] Dell and VMware demonstrated several future vStorage technologies at VMworld 2008. For more information, visit www.equallogic.com/vstorage.



AKORRI BALANCEPOINT: END-TO-END VISIBILITY ACROSS VIRTUALIZED SERVERS AND DELL EQUALLOGIC iSCSI SANs

By Andrew Gilman
Tom Joyce

Although virtualized environments can help significantly boost IT flexibility, responsiveness, and efficiency, virtualized server and storage resources can be difficult to monitor and manage across an enterprise data center. The Akorri™ BalancePoint™ suite of management tools combines cross-domain performance monitoring with advanced visualization and analytic capabilities to help administrators simplify capacity planning and performance optimization.

Related Categories:

Akorri

Data consolidation and management

Dell EqualLogic storage

Internet SCSI (iSCSI)

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Storage area network (SAN)

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To help achieve the full benefits of recent technology innovations, many organizations are expanding their virtualization strategies to include storage virtualization together with server virtualization. Although this approach enables huge advances in IT flexibility, responsiveness, and efficiency, it also requires administrators to contend with an added layer of complexity that can make deploying, monitoring, and managing virtualized data center resources challenging and costly.

In particular, virtualization changes the traditional relationships between applications and the physical server, network, and storage resources that support them. In non-virtualized environments, static relationships between applications and physical resources are easy to identify. Traditional management tools are typically designed to monitor and control these fixed relationships.

In virtualized environments, however, dynamic relationships between applications and the pooled physical resources that support them are difficult to identify, in many ways rendering traditional management tools useless. Because the resources supporting individual applications in a virtualized infrastructure are constantly changing, it can be challenging to pinpoint failures, identify performance bottlenecks, and optimize resource utilization while maintaining the requisite application performance levels.

As a result, despite the considerable bottom-line benefits that virtualization offers, managing a virtualized infrastructure can be inefficient and costly. In fact, because common tasks such as diagnosing problems and identifying performance bottlenecks can be more challenging and time-consuming in a dynamic virtualized environment than in a static physical environment, many organizations compensate by over-provisioning to help ensure the requisite application performance.

Akorri BalancePoint virtual infrastructure management software is designed to help IT organizations easily and effectively monitor, manage, optimize, and grow virtualized IT infrastructures from end to end. BalancePoint is agentless, and supports management of both virtualized servers and virtualized storage (see the "Delivering comprehensive management capabilities" sidebar in this article). BalancePoint combines enterprise-wide systems monitoring with Cross-Domain Analysis™ and advanced visualization tools to help administrators efficiently and effectively diagnose problems, optimize resource utilization, and plan capacity as business needs evolve.

BalancePoint supports a wide range of applications, servers, and storage devices (see the "Extending

virtualization benefits to storage with Dell EqualLogic PS Series iSCSI SANs" sidebar in this article).[1] BalancePoint is available as either a virtual appliance running under the VMware® ESX hypervisor or as a separate hardware appliance.

END-TO-END MONITORING AND VISUALIZATION

Traditionally, enterprise IT systems have been monitored in silos, with organizations deploying different sets of management tools and specially trained experts for different types of resources—including applications, servers, storage, and networks. A key drawback, however, is that the silo-based approach fails to capture the interdependencies between resources in separate IT domains. As a result, fixing a problem in one IT domain may inadvertently generate a problem in another domain, making application service levels difficult if not impossible to guarantee.

In virtualized environments, these interdependencies are particularly complex. Because applications share pooled resources such as servers and storage, diagnosing and resolving problems and performance issues without risking impact to the rest of the infrastructure can be difficult. As a result, maintaining application service levels, optimizing resource utilization, and planning for future capacity needs can be especially challenging in virtualized environments.

Akorri BalancePoint helps simplify the management of virtualized infrastructures by utilizing an agentless discovery tool to collect data *across* IT domains and provide end-to-end monitoring of application performance and resource utilization. In particular, BalancePoint collects performance and utilization data across the virtualized enterprise—from applications to servers to individual hardware components—and identifies interdependencies between resources. Data is collected in real time, and changes or additions to the underlying infrastructure are automatically identified.

DELIVERING COMPREHENSIVE MANAGEMENT CAPABILITIES

The Akorri BalancePoint virtual infrastructure management suite integrated with Dell™ EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays and other virtualization components is designed to provide comprehensive management capabilities, including the following:

- Dynamic infrastructure topology maps enable IT managers to quickly identify performance bottlenecks across virtual and physical applications, servers, and storage.
- Application contention analysis helps quickly resolve resource contention issues that can be the root cause of degraded application performance and indicate that additional server or storage capacity may be required.
- Cross-domain management reports include "scorecards" for overall assessments and health checks, best-practice reports that utilize a rules engine to check configurations against a set of industry-standard and vendor-specific guidelines, and chargeback reporting for virtualized and physical servers, which automatically calculates utilization for each virtual machine (VM) and virtualized server across IT domains.
- Storage capacity forecast analysis offers an assessment of when Dell EqualLogic storage capacity allocated to each VM, server, or application is expected to reach specific thresholds or be fully consumed by data. This information can be instrumental in helping to plan for storage growth and related capital expenditures.
- Rapid deployment of BalancePoint as a virtual appliance in VMware environments, and its agentless data collection design, allows BalancePoint to easily integrate with EqualLogic PS Series iSCSI SANs and be up and running quickly in most virtualized environments.
- Total cost of ownership can be lowered by removing inefficient troubleshooting processes, increasing consolidation ratios, and improving storage utilization rates.

As a result, the integrated BalancePoint and EqualLogic offering helps simplify complex tasks and enable fast, flexible storage provisioning—leading to a dramatic reduction in the costs of storage acquisition and ongoing operations.

BalancePoint displays cross-domain infrastructure data in several simple, easy-to-use visual interfaces that require no special training to understand—enabling administrators to easily view infrastructure topology and dependencies, monitor infrastructure health and status, and troubleshoot problems and performance issues. For example, the BalancePoint Topology view displays applications and dependent physical resources in an intuitive tree format that includes physical and logical layers (see Figure 1). Simple drill-down navigation supports both high-level and low-level views of infrastructure topology, and each node is color coded to indicate current performance status.

The BalancePoint Performance Dashboard offers a concise view of comprehensive infrastructure health and status. In particular, the Performance Dashboard displays the current status of critical applications and recent alerts, and provides an overall summary of resource utilization (see Figure 2). Administrators can drill down into an application, alert, or resource to get more detailed information.

BalancePoint is also designed to help diagnose the source of alerts or performance issues, which helps dramatically

[1] For a comprehensive list of BalancePoint-supported platforms, visit www.akorri.com/products-supported-platforms.htm.

simplify the task of troubleshooting. For example, when administrators drill down into an application alert to investigate the cause of a performance problem, BalancePoint displays possible causes for that problem—such as resource utilization thresholds being exceeded or disk contention in a shared storage area network (SAN) array—enabling them to target an appropriate problem resolution strategy.

Furthermore, BalancePoint can proactively alert administrators of current or impending problems such as performance bottlenecks, and can suggest possible corrective action to remedy the situation. In addition, BalancePoint comes with an integrated engine for comprehensive reports that can be automatically delivered in an e-mail on a daily, weekly, or monthly schedule.

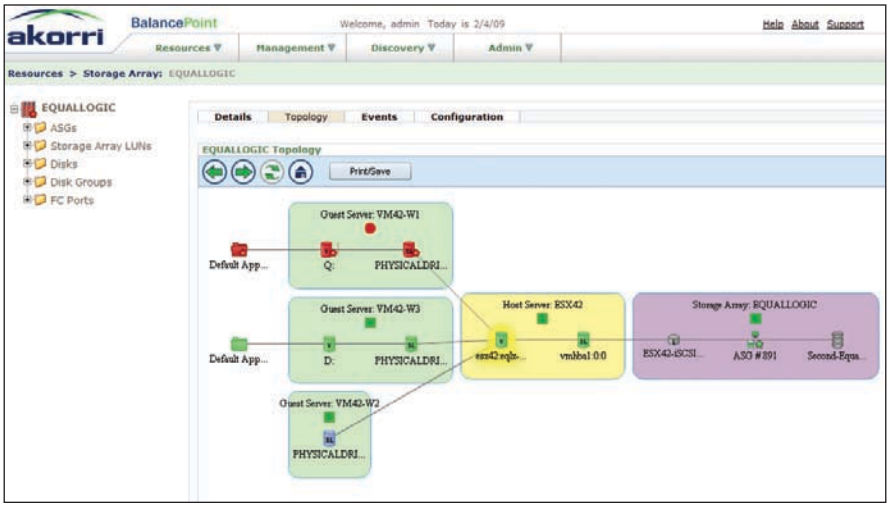

Figure 1. *Easy-to-navigate, cross-domain topology mapping in Akorri BalancePoint helps identify resource dependencies and performance status*

ADVANCED OPTIMIZATION AND CAPACITY PLANNING

Besides offering real-time views of infrastructure topology, health, and status, Akorri BalancePoint tracks application and resource activity over time to help organizations optimize resource utilization and plan for future capacity needs. In particular, BalancePoint applies Cross-Domain Analysis technology to help organizations assess the efficiency of their virtualized infrastructures, analyze resource usage and requirements, and forecast future needs.

For example, the Akorri BalancePoint Performance Index™ feature provides a single-number measure of the performance and efficiency of each application. The Performance Index uses mathematical modeling to compare application performance with optimal and actual resource utilization to help determine whether an application is meeting performance requirements and, if so, how efficiently it is using its resources (see Figure 3). To generate the Performance Index, BalancePoint utilizes a composite queuing matrix model to determine the maximum resource workload for a particular level of performance and to compare actual workload to the calculated maximum.

A Performance Index score of 100 indicates that an application is delivering the desired level of performance while still achieving maximum potential physical resource usage. A score significantly less than 100 indicates that resources are underutilized and may be over-provisioned for the needs of the application, while a score greater than 100 indicates that performance is compromised and that additional physical resources may be needed to meet required service levels.

BalancePoint also offers comprehensive configuration and storage analyses to help organizations assess the efficiency, appropriate size, and growth of their physical resources. For example, a BalancePoint storage scorecard is designed to show whether storage is properly configured and enable administrators to drill down into a given storage array to compare usage with application demands. The Application Storage Trend report shows capacity and current utilization as well as the utilization growth to help accurately determine when thresholds and capacity limits are reached.

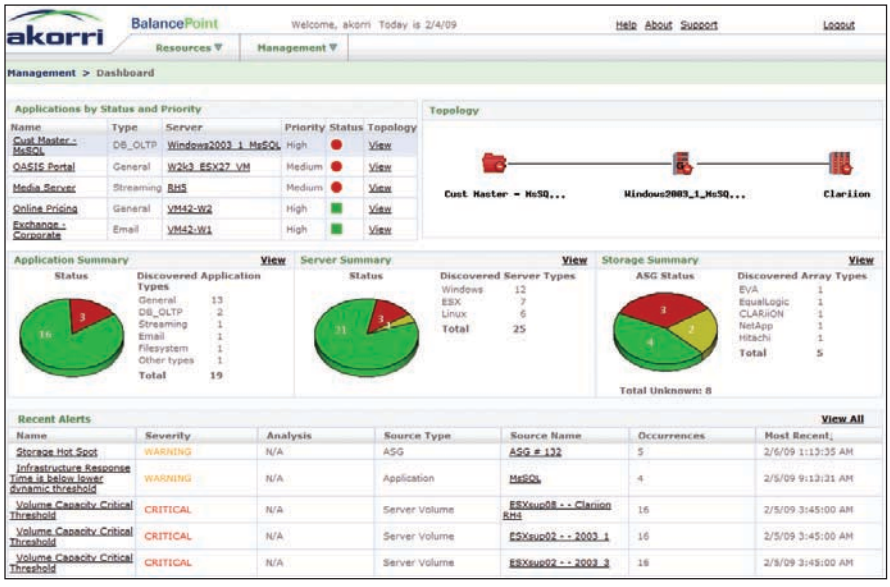

Figure 2. *The Akorri BalancePoint Performance Dashboard displays overall infrastructure health and status at a glance*

EXTENDING VIRTUALIZATION BENEFITS TO STORAGE WITH DELL EQUALLOGIC PS SERIES iSCSI SANs

Administrators are embracing virtualization as a way to help increase flexibility, enhance responsiveness, and improve data center efficiency. Although virtualization has been commonly deployed on servers—enabled by server virtualization software such as the VMware ESX hypervisor—many IT organizations are now expanding their virtualization strategies to include storage virtualization as well.

Dell EqualLogic PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays enable organizations to deploy virtualized storage in a highly scalable, available, and manageable way. In particular, EqualLogic PS Series iSCSI SAN arrays are designed for greater than 99.999 percent data availability and support automated load balancing and capacity expansion for maximum uptime and optimal performance. EqualLogic PS Series iSCSI SANs are also easy to deploy and provision, and come with a comprehensive suite of data protection and management tools at no additional cost.

EqualLogic PS Series iSCSI SANs are supported by Akorri BalancePoint software, which is designed to monitor and manage virtualized data center resources, including virtualized storage. BalancePoint enables organizations to simplify IT management by automatically identifying storage bottlenecks and resource contention. It also helps organizations optimize resource utilization and plan for changing storage needs by allowing administrators to easily visualize the dependencies between applications and the underlying storage resources that support those applications, and to analyze storage usage relative to application demand.

Overall, a virtualized storage infrastructure based on EqualLogic PS Series iSCSI SANs and managed using BalancePoint can help organizations improve storage utilization and efficiency, reduce capital equipment expenditures, and increase the performance of their storage infrastructures.

In combination with real-time infrastructure data, cross-domain analytics such as the Performance Index can help organizations meet application service-level agreements while also optimizing resource utilization. Furthermore, comprehensive analyses and reporting can help organizations efficiently meet current application resource needs and effectively plan for evolving usage requirements. And because BalancePoint collects data and calculates key analytical metrics automatically, organizations do not have to spend precious time manually collecting data and performing complex data analyses.

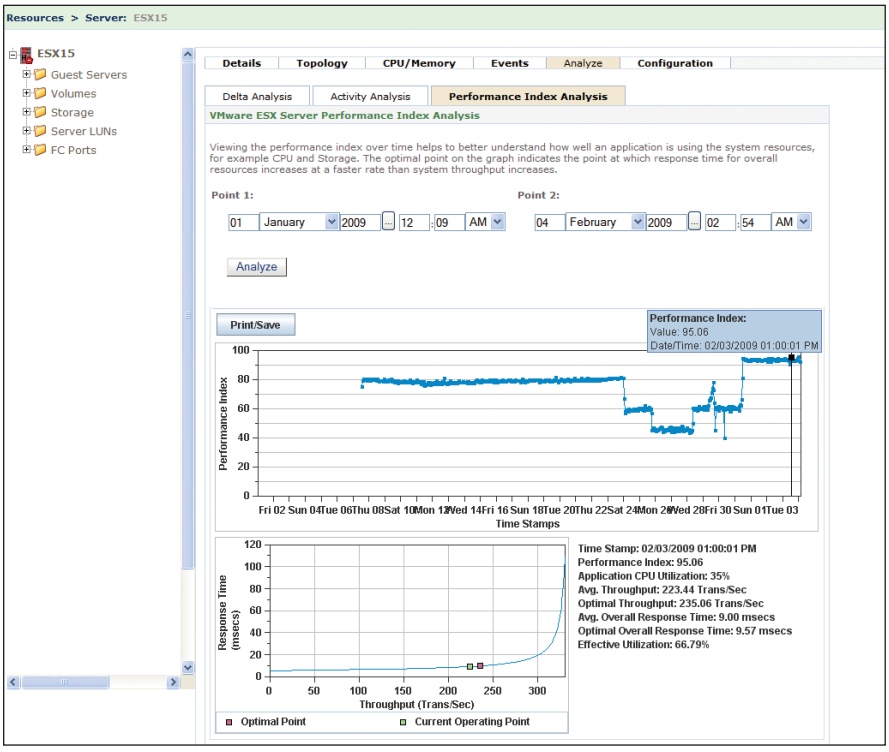

Figure 3. *The Akorri BalancePoint Performance Index helps optimize performance by modeling relationships between resource utilization and application response*

ENHANCED EFFICIENCY AND PERFORMANCE

By combining cross-domain performance monitoring with advanced visualization and analytic capabilities, Akorri BalancePoint helps dramatically simplify the tasks associated with managing virtualized data center resources. In this way, organizations can efficiently and effectively monitor, manage, optimize, and grow virtualized data center environments—ultimately helping to improve resource utilization, enhance application performance, and reduce total cost of ownership.

Andrew Gilman is a solutions marketing manager at Dell.

Tom Joyce is president and CEO at Akorri.

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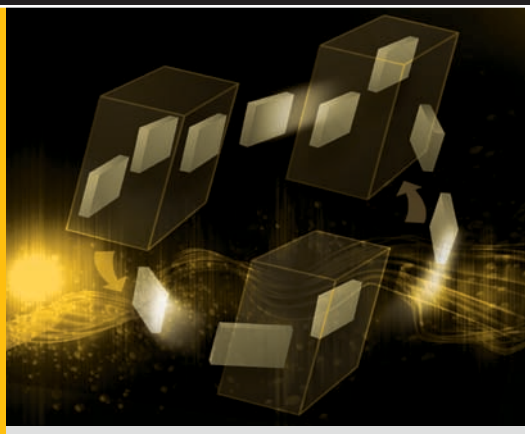

FAST-TRACK VIRTUALIZATION PLANS WITH PLATESPIN

By Peter Spencer

Implementing virtualization technology requires a comprehensive planning, deployment, and management strategy. PlateSpin® workload management solutions from Novell can help organizations adopt, manage, and extend virtualization across their environments, supporting current- and previous-generation Dell™ PowerEdge™ servers and a variety of virtualization platforms and operating systems.

Related Categories:

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Virtualization

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Although virtualization technology can offer a host of key benefits in enterprise data centers, including reduced operating costs, increased flexibility, and increased infrastructure resiliency, it can also bring with it new challenges for IT administrators. These challenges can include ensuring that the specific implementation is optimized for the data center environment, balancing workloads appropriately across available hardware resources, and protecting virtualized systems as part of an overall disaster recovery strategy.

Multi-platform PlateSpin solutions from Novell—including the PlateSpin Recon planning and analysis solution, PlateSpin Migrate workload portability software, PlateSpin Protect recovery software, and PlateSpin Forge™ disaster recovery appliances—are designed to accelerate the adoption of virtualization technology in enterprise data centers. These solutions not only help automate the planning, testing, and workload migration phases of a virtualization initiative, but also help simplify management of both physical and virtualized environments once the implementation is in place. PlateSpin workload management technology supports many current- and previous-generation Dell PowerEdge servers, multiple virtualization platforms (including Microsoft® Hyper-V™, Microsoft Virtual Server, VMware®, and Citrix® XenServer™ software), and both Microsoft Windows® and Linux® operating systems. This approach enables enterprises to span infrastructure boundaries to help unify their physical and virtualized IT environments—regardless of the different hardware platforms and hypervisor technologies running in the data center.

PlateSpin solutions are specifically designed to address three key data center challenges:

- **Workload profiling:** By collecting hardware, software, and services inventory for server workloads as well as gathering and analyzing workload utilization statistics, PlateSpin solutions can provide a clear, concise view of the applications in a data center and how their resources are being used. The resulting workload profile can aid decision making and help organizations manage physical and virtual workloads throughout their life cycles.
- **Workload portability:** PlateSpin solutions enable the decoupling of server workloads from their underlying hardware and the streaming of these workloads over a network between physical servers, virtualized hosts, and image archives. PlateSpin Workload Portability™ technology helps optimize the data center by balancing workload demands between available physical and virtualized server resources.
- **Workload protection:** PlateSpin solutions enable the copying and replication of whole server workloads—both system and data volumes—to a single bootable recovery environment using virtualization. If a

production server outage occurs, workloads can be rapidly powered up in the virtualized recovery environment and continue to run normally until administrators have restored the production environment. If needed, the workloads can then be migrated from the virtualized environment back to the physical hardware.

By enabling organizations to adopt a unified approach to these common challenges, from planning and assessment through to workload migration and ongoing management, PlateSpin technology can help accelerate and optimize virtualization initiatives. Organizations purchasing hypervisor-equipped Dell PowerEdge servers can choose three preinstalled PlateSpin Migrate licenses for virtual-to-physical (V2P) workload migration. This solution is well suited for de-virtualizing Windows or Linux workloads, accelerating migration from a virtual infrastructure to bare-metal Dell servers, and enabling the rapid recovery of workloads from a virtual recovery environment during a primary server outage. Dell also sells and supports the full portfolio of PlateSpin workload management products to help organizations profile, migrate, and protect physical and virtual workloads across their data centers, including licenses for PlateSpin Migrate for physical-to-virtual (P2V) and virtual-to-virtual (V2V) workload migration.

WORKLOAD PROFILING: SUPPORTING EFFECTIVE PLANNING

Successful virtualization initiatives require effective up-front planning and a thorough understanding of the server workloads being virtualized. A poorly planned or executed virtualization effort can result in complex configurations and increased IT overhead, reducing the advantages of a virtualized infrastructure. In the past, IT managers have often relied on guesses to identify underutilized or underprotected servers and allocate sufficient resources to help meet current and future needs.

Dell Global Infrastructure Consulting Services (GICS) can help organizations plan and design an optimal virtualized environment with a multi-vendor Dell Virtualization Readiness Assessment that includes use of PlateSpin Recon. Dell GICS uses the PlateSpin Recon solution to provide organizations with detailed workload profiling, analysis, and planning based on their current data center configuration and performance metrics. PlateSpin Recon helps remotely discover software and services inventory across the server environment as well as monitor and analyze key workload utilization metrics to help develop optimal plans.

PlateSpin Recon includes a variety of target hypervisor and hardware templates for effective modeling along with a hardware specifications database containing data for many current- and previous-generation Dell server platforms. The visual charts and reports created by PlateSpin Recon help illustrate the tangible benefits of using the latest Dell hardware to help reduce space, power, and cooling costs through virtualization as well as time and resources through the development of executable plans.

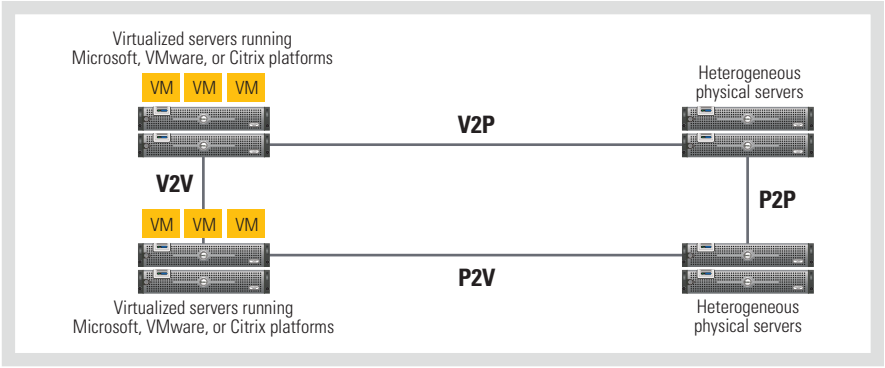

Figure 1. *PlateSpin Migrate enables server workload migration across heterogeneous platforms*

WORKLOAD PORTABILITY: HELPING REDUCE RISK

Following the assessment and planning phase, PlateSpin Workload Portability technology can help accelerate workload migration to the new virtualized environment. With broad support for Microsoft Windows and Linux operating systems as well as leading server hardware and virtualization technologies, PlateSpin Migrate is designed to handle the real-world complexities of mixed IT environments (see Figure 1).

To help reduce the risks associated with enterprise workload migration and help avoid downtime during P2V workload migrations, PlateSpin Migrate enables live testing and workload migration without disrupting production systems. Administrators can simply perform an initial workload transfer to the target host, test the workload in the new location while continuing to run the source system, and then perform a final sync before cutting over the workload. The PlateSpin Migrate Server Sync™ feature helps eliminate the need for a full system replication after testing is complete, helping dramatically accelerate workload migrations over a local area network (LAN) or wide area network (WAN).

For anywhere-to-physical (X2P) migrations, which may include hardware and lease upgrades or de-virtualization projects, PlateSpin Migrate maintains a hardware driver database that supports current- and previous-generation Dell server platforms, enabling organizations to quickly migrate workloads across Dell hardware with minimal manual effort.

WORKLOAD PROTECTION: VIRTUALIZING DISASTER RECOVERY

Critical enterprise workloads running on both physical and virtualized servers must be thoroughly protected in the event of system downtime or a site disaster. Virtualized recovery solutions enable enterprises to cost-effectively protect whole server workloads by replicating

multiple workloads to a single warm-standby virtualized recovery environment without requiring potentially expensive one-to-one hardware and software redundancy. By using a consolidated recovery solution with embedded virtualization technology, enterprises can cost-effectively protect an increased number of server workloads in the data center.

The innovative PlateSpin Forge virtualized disaster recovery appliance, based on the Dell PowerEdge 2950 III server platform, is designed to provide comprehensive, simplified protection for both physical and virtual workloads—including an embedded VMware ESX hypervisor, PlateSpin workload replication technology, and a centralized management console. Available in either a 10- or 25-workload protection model, PlateSpin Forge appliances enable enterprises to cost-effectively match their recovery investments to the size of their data centers (see Figure 2). The latest version provides storage area network (SAN) integration, support for 64-bit Microsoft Windows workloads, and multiple recovery points for enhanced flexibility and workload integrity. This easy-to-deploy appliance is well suited for small and medium-size enterprises or for remote office and branch locations within large enterprises.

AFTER A MIGRATION: MANAGING A VIRTUALIZED DATA CENTER

Migrating server workloads to a virtualized infrastructure can create new management challenges. Implementing virtualization helps reduce the number of physical servers, optimize resource utilization, and reduce power and cooling costs. Over time, however, this peak optimization can begin to deteriorate as workloads and resource demands change, reducing the return on investment from virtualization. Unified PlateSpin solutions help organizations manage and optimize their virtualized environments, rebalance workloads across physical and virtualized servers, and automate common management tasks in the virtualized data center.

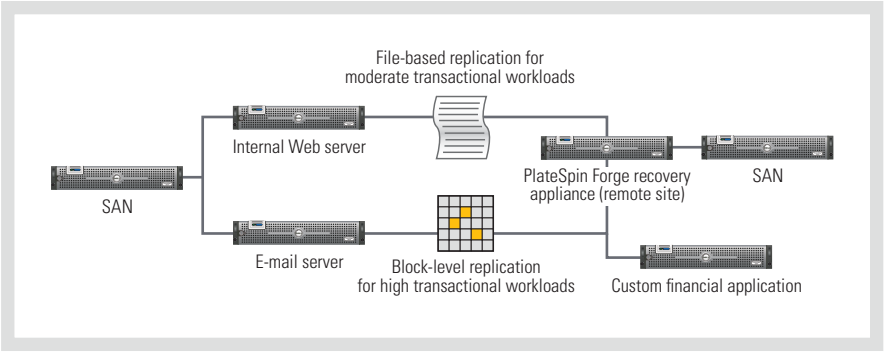

Figure 2. *A single PlateSpin Forge appliance can help protect and recover multiple physical and virtual workloads*

The speed and ease with which anyone can create and provision a new virtual machine (VM) to address nearly any requirement can have both advantages and disadvantages. Without effective management, VMs can rapidly proliferate, leading to poor resource utilization and an unwieldy infrastructure. To help avoid this type of sprawl, organizations need solutions that help them monitor and manage the growth of VMs without needing to implement restrictive IT policies. By providing enhanced visibility into how the virtualized infrastructure is growing and changing, PlateSpin Recon workload profiling technology can help administrators gain a deep understanding of how many VMs are deployed, who owns them, and how they use available resources.

In addition, because server workloads and utilization evolve over time, administrators must perform ongoing monitoring and periodic rebalancing to help keep the data center running in an optimal state. A sudden increase in the number of customers, for example, may increase the strain on invoice or fulfillment processing systems. Bringing a new service online may change the resource loads across the environment and reduce response times. Administrators must monitor these workloads over time, resize the resources allocated to a given workload, and regularly readjust the balance by moving workloads between physical and virtualized servers. PlateSpin Workload Portability technology helps give enterprises the freedom to decouple software from the hardware layer and stream workloads to virtually any platform in virtually any direction—helping ensure that workloads reside on the physical or virtualized servers where they can run most effectively.

FLEXIBLE SOLUTIONS FOR VIRTUALIZED ENVIRONMENTS

PlateSpin solutions from Novell can help organizations adopt, manage, and extend use of virtualization on Dell hardware, and their multi-platform approach to workload profiling, portability, and protection enables organizations to choose the hardware, virtualization platforms, and operating systems that can meet the needs of their IT environments. And, critically, the ability to support heterogeneous physical and virtualized infrastructures in a single environment can help both reduce the risk of adopting virtualization and increase return on investment from new and existing virtualized environments.

Peter Spencer is the global alliances director for PlateSpin, a Novell company.

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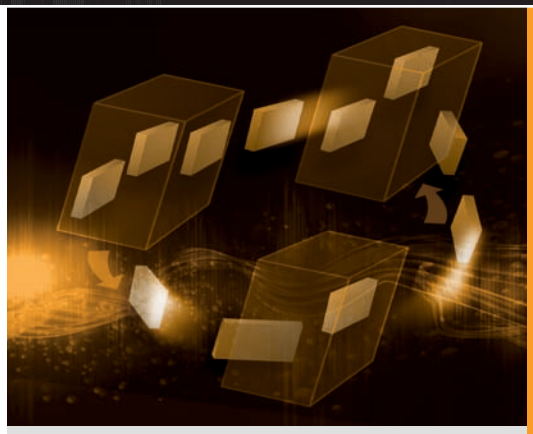
DEPLOYING SIMPLE, COST-EFFECTIVE DISASTER RECOVERY WITH DELL AND VMWARE



By Paul Rad
Debi Higdon
Tim Webb

Because of their complexity and lack of standardization, traditional disaster recovery infrastructures often fail to meet enterprise requirements for recovery speed and integrity at a reasonable cost. By deploying VMware® vCenter Site Recovery Manager on Dell™ server and storage clusters, organizations can implement a simplified, cost-effective disaster recovery solution.

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Downtime, whether planned or unplanned, often translates into lost opportunities and increased costs—and for many enterprises today, any amount of downtime is unacceptable. Having an effective recovery strategy and a set of coherent disaster recovery plans is essential to helping avoid downtime during a crisis.

The need for enhanced quality, efficiency, and predictability for disaster recovery and business continuity has increased significantly, highlighting the necessity of a well-defined set of recovery plans and regular testing. However, as the required scope of critical processes, production applications, and enterprise demands increases, sustaining the timeliness and effectiveness of a recovery plan can become increasingly difficult. For most organizations, disaster recovery is extremely labor intensive, often requiring the manual coordination of hundreds of recovery tasks. So although the importance of having an effective disaster recovery plan is clear, organizations often find it difficult to achieve the level of protection they need.

Dell and VMware have partnered to offer a cost-effective, high-availability architecture based on Dell server and storage clusters and VMware vCenter Site Recovery Manager (SRM)—one designed to minimize scheduled and unscheduled downtime caused by a variety of events, including system failures, site disasters, user errors, data corruption, and maintenance tasks. Dell offers entry-level, mid-range, and high-end server and storage clusters built from standards-based components and designed to increase availability by removing single points of failure within the cluster. At each cluster level, Dell also provides the ability to recover from additional failures, helping protect against multiple component failures. VMware vCenter SRM is a workflow tool designed to accelerate and support successful recoveries by automating the recovery process, helping eliminate complex manual recovery steps, and enabling nondisruptive testing. By taking advantage of the inherent disaster recovery capabilities of the VMware Infrastructure virtualization platform and array-based replication using Dell hardware, this architecture can help significantly simplify the planning and execution of disaster recovery strategies.

TRADITIONAL DISASTER RECOVERY AND VIRTUALIZATION

Traditional disaster recovery plans have generally involved maintaining identical, one-to-one hardware and OS configurations at a secondary site that can enable operations to quickly resume when the primary site is unavailable. This approach, however, requires investments in servers and other hardware that then sit idle at the recovery site for much of the time. Using

hardware that is similar but not identical, meanwhile, creates challenges related to shifting workloads to a different hardware configuration—because of restrictions in putting applications together under one OS, expensive data synchronization, and infrastructure dependencies—that can lead to complex and overly expensive recovery site investments. Given the highly distributed nature of traditional IT, often because of server sprawl and lack of a shared storage environment, it can be difficult or impossible to discover and remediate missing components using a manual approach.

In addition to complex recovery plans, other key factors in traditional disaster recovery include designating the staff members responsible for executing each step of the recovery, identifying exactly when their tasks should be executed, and establishing how the success of these tasks should be determined. Complex recovery processes and dependencies, unclear or incomplete plans, and long recovery times can lead to unacceptable results—and these problems only worsen as organizations add business processes, applications, heterogeneous hardware, and growing amounts of data.

Real-world environments typically require clear, concise recovery execution or automation, enabling staff members to execute the same tasks and achieve similar results. In particular, an effective disaster recovery plan must address three key goals:

- **Minimize downtime:** The consequences of extended downtime can be severe, not only in terms of lost business and lost productivity, but even in terms of survival for small organizations.
- **Minimize risk:** Not having a disaster recovery plan often constitutes an unacceptable level of risk—but simply having a disaster recovery plan in place does not eliminate risk if its reliability is uncertain.
- **Control costs:** Traditional disaster recovery plans are often limited in scope because of the costs associated with building and maintaining a recovery site, training staff members in disaster recovery processes, testing those processes, and so on.

Virtualization can help address many of the challenges and barriers of traditional disaster recovery and help organizations meet the key goals of a viable disaster recovery plan. For example, many of the challenges that IT managers face are the consequence of the physical boundaries of equipment and application workloads. The encapsulation of virtual machines (VMs) means that rather than needing to maintain a corresponding server at a recovery site for each server at a primary site, organizations can replicate physical servers or VMs from the primary site to virtualized servers at the recovery site, helping to reduce the cost of protection or to increase the number of servers that can be protected by the existing recovery infrastructure.

INSTALLING VMWARE vCENTER SITE RECOVERY MANAGER

Before installing VMware vCenter Site Recovery Manager (SRM), administrators should be sure that the necessary prerequisites are in place, including the following:

- Array-based replication configured between the primary site and the secondary site
- VMware ESX 3.0.2, ESX 3.5, or ESXi 3.5 running on the servers hosting the VMs and VMware vCenter Server 2.5 running on a management server, including all required updates and service packs
- Network configuration that allows TCP connectivity between the vCenter Server systems and SRM systems at the primary and secondary sites
- Microsoft® SQL Server® or Oracle® database that uses Open Database Connectivity (ODBC), and SRM license files on the vCenter Server license server

Administrators should be sure to review the SRM administrator guide, which includes a detailed list of prerequisites, before proceeding with installation. They should also keep in mind that because SRM is installed at both the primary site and the secondary site, these prerequisites must be met at both sites.

When they are ready to proceed, administrators can install SRM using the following four basic steps at both the primary site and secondary site:

1. Create an SRM database. The installation wizard does not create this database, so this database must be created before running that wizard. Administrators should set up the SRM database as the SRM user's database and ensure that the SRM database user has administrative privileges for the database. Installation requires providing a data source name, database username, password, connection count, and maximum number of connections.
2. Run the SRM installation wizard to install the SRM server. As part of the installation, administrators connect to the SRM database created in step 1.
3. Use the VMware Infrastructure Client to connect to the vCenter Server system and install and enable the SRM plug-in.
4. Download and install the appropriate storage replication adapters (SRAs) for each array on the same physical server as the SRM service. SRA installation typically requires minimal or no configuration; detailed vendor-specific instructions are typically included in a readme file.

> **"As requirements for avoiding downtime become increasingly stringent, administrators need tools and platforms that can help them plan, design, and implement disaster recovery strategies that can meet those needs."**

This encapsulation helps simplify disaster recovery in a number of ways. For example, because the files necessary to protect a VM are typically stored within a single folder on shared storage, organizations can use array-based replication to replicate entire VMs simply by replicating the logical units (LUNs) on which they reside. In addition, administrators generally no longer need to worry about duplicating hardware at the recovery site or applying OS patches in parallel at both the primary and secondary sites. They also no longer need to rebuild the OS at the time of recovery, because it is already available in a hardware-independent form on the replication target. These advantages can enable organizations to reduce the recovery point objectives and recovery time objectives for the entire data center, not just for first-tier services—enhancing the level of protection while also helping simplify recovery plans and their execution.

VMWARE vCENTER SITE RECOVERY MANAGER

VMware vCenter SRM includes several key features designed to make disaster recovery rapid, reliable, manageable, and cost-effective:

- **Centralized management:** SRM provides a centralized place to create, test, update, and execute recovery plans throughout the enterprise.
- **Automation:** SRM is designed to automate the recovery process, helping eliminate many of the manual processes and associated errors that can lead to slow recovery or recovery failures.
- **Simplified setup and integration:** SRM helps simplify integration with storage replication technologies and facilitates the creation of a single comprehensive plan from existing or incomplete plans.

Planning and preparation are critical to a successful SRM deployment: before installing SRM, organizations should identify which VMs to protect, prepare data store groups, and prepare the VMware vCenter Server (formerly VMware VirtualCenter) inventory at the recovery site, following the best practices described in the "Disaster recovery planning" section in this article. (For more information on deploying SRM, see the "Installing VMware vCenter Site Recovery Manager" sidebar in this article.) They should also be familiar with the basic components of SRM deployments (see Figure 1):

- **LUNs:** LUNs are the smallest unit of storage that can be replicated. In a VMware virtualized infrastructure, a LUN is a single SCSI storage device on a storage area network (SAN), and can be mapped to one or more VMware ESX servers. When grouping VMs on a LUN, administrators should take into account that LUNs are indivisible units—the contents of part of a LUN cannot be failed over without failing over the entire LUN.
- **Data stores:** Data stores are based on VMware Virtual Machine File System (VMFS) and can contain one or more LUNs. Like LUNs, data stores are indivisible units for storage failover. A data store spanning multiple LUNs causes those LUNs to be grouped together in a data store group; similarly, when a VM has multiple virtual disks that reside in different data stores, those data stores are forced together into a data store group to help ensure that the entire VM fails over simultaneously.

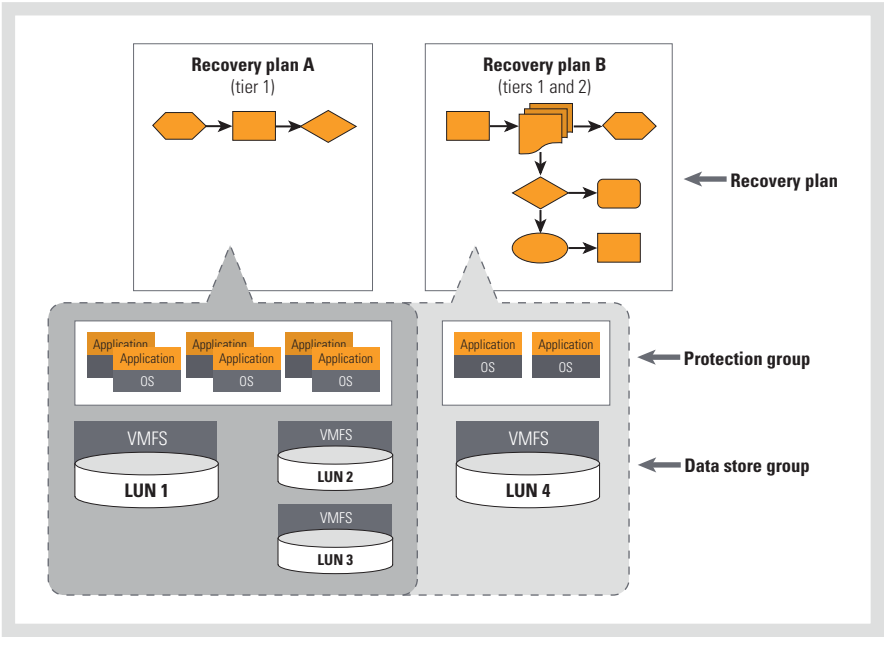

Figure 1. *Basic components of a VMware vCenter Site Recovery Manager deployment*

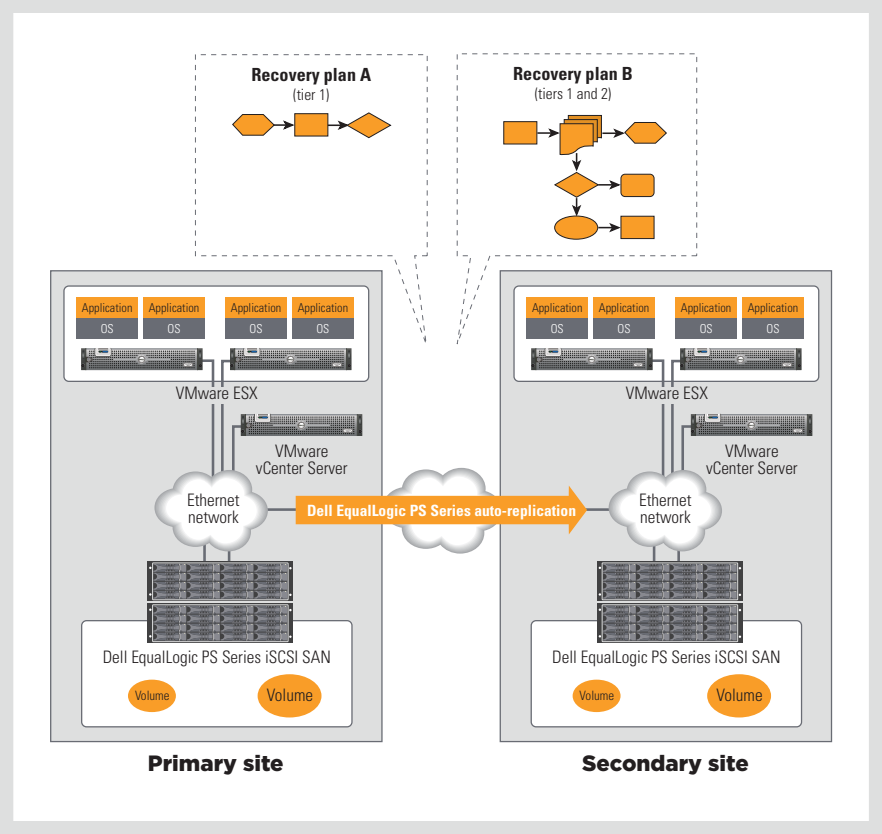

Figure 2. *Example disaster recovery architecture using VMware vCenter Site Recovery Manager and Dell EqualLogic iSCSI SAN arrays*

- **Data store groups:** Data store groups are auto-generated collections of one or more data stores. Like LUNs and data stores themselves, data store groups are indivisible units for storage failover.
- **Protection groups:** Protection groups are collections of all VMs in a data store group. When configuring a protected site, administrators create protection groups with a one-to-one mapping to data store groups. Protection groups are the actual unit of VM protection and recovery.
- **Recovery plans:** Recovery plans contain one or more protection groups. They comprise a list of VMs from the protection groups, a startup order for those VMs, and any custom steps added before or after VM startup—providing a comprehensive list of the automated steps to be executed during disaster recovery tests and actual disaster recovery failovers.

Figure 2 illustrates a disaster recovery architecture based on SRM and the auto-replication features included with Dell EqualLogic™ PS Series Internet SCSI (iSCSI) SAN arrays. Administrators can configure SRM and group VMs into failover units at the primary site, and create and manage disaster recovery plans at the secondary site. The protected VMs reside at the primary site and are replicated to the secondary site.

Understanding how SRM integrates with array-based replication components is key to a successful deployment. As shown in Figure 2, primary VMs hosted on ESX servers are stored in an EqualLogic PS Series SAN array. The array replicates shadow VMs to the array at the secondary site. Administrators should keep in mind that the storage subsystem manages and executes replication. Replication is not performed inside the VMs or by the VMware kernel or service console. SRM interfaces with the EqualLogic PS Series replication software through storage replication adapters (SRAs).[1]

Each site includes its own vCenter Server system; if one site fails, the other site must have its own vCenter Server system to start the failover process and manage the ESX servers. Each VMware Infrastructure client/server pair manages the disaster recovery tasks relevant to its own site. The SRM server is a server process with its own database, and both SRM and its database are separate from vCenter Server and its database.

Once administrators have deployed the VMware software at the primary and secondary sites and established array-based replication between the sites, they can then use SRM to create disaster recovery plans that designate failover instructions. If a disaster occurs, administrators are notified and must decide whether to initiate a failover. If they initiate a failover, SRM implements the disaster recovery plan, generally following four basic steps:

1. At the primary site, SRM shuts down the VMs, starting with those designated as the lowest priority. If SRM cannot connect to the site, it notifies the administrator that it cannot power down the VMs and proceeds to the next step.
2. At the secondary site, SRM prepares the data store groups for failover.
3. At the secondary site, SRM suspends VMs designated as noncritical to provide additional resources.
4. At the secondary site, SRM restarts the VMs from the primary site, starting with those designated as the highest priority.

[1] SRAs are created by array vendors to help ensure tight integration with SRM, and enable SRM to support many different arrays without hard-coding specific array knowledge into the SRM binary. As a result, SRAs can be released separately from the rest of the SRM product and downloaded by administrators from the VMware Web site. SRAs are developed, tested, and supported by the storage vendors, which helps ensure a high level of reliability and support.

DISASTER RECOVERY PLANNING

Disaster recovery planning can be overwhelming, and it can be difficult to know where to start. Organizations should begin by answering one important question: what will the costs in lost revenue be if a real disaster occurs? Determining lost revenue can help identify the impact of a catastrophic event and the level of disaster recovery needed.

Conducting a business impact assessment in the early phases of disaster recovery planning assists with mapping business processes to applications and helps define expectations. In addition, organizations should classify applications according to their importance and financial impact, and determine their recovery point objectives and recovery time objectives. These steps help clearly define which applications must be up and running first and how quickly this must occur, and also help determine the appropriate disaster recovery solution for each application—a recovery time objective of four hours requires a very different disaster recovery solution than a recovery time objective of two weeks.

Other key best practices for disaster recovery planning include the following:

- **Closely analyze single points of failure:** A single point of failure in a critical component can disrupt well-engineered redundancies and resilience in the rest of a system.
- **Plan for worst-case scenarios:** Downtime can have many causes, including operator error, component failure, software failure, and planned downtime as well as building- or city-level disasters. Organizations should be sure that their disaster recovery plans account for even worst-case scenarios.
- **Clearly document recovery processes:** Documentation is critical to the success of a disaster recovery program. Organizations should write and maintain clear, concise, detailed steps for failover so that secondary staff members can manage a failover should primary staff members be unavailable.
- **Centralize information:** In a crisis situation, a timely response can be critical. Centralizing disaster recovery information in one place, such as a Microsoft Office SharePoint® system or portal, helps avoid the need to hunt for documentation, which can compound a crisis.
- **Create test plans and scripts:** Test plans and scripts should be created and followed step-by-step to help ensure accurate testing. These plans and scripts should include integration testing—silo testing alone does not accurately reflect multiple applications going down simultaneously.
- **Retest regularly:** Organizations should take advantages of opportunities for disaster recovery testing such as new releases, code changes, or upgrades. At a minimum, each application should be retested every year.
- **Perform comprehensive practice:** Organizations should practice their master recovery plans, not just application failover. For example, staff members need to know where to report if a disaster occurs, critical conference bridges should be set up in advance, a command center should be identified, and secondary staff resources should be assigned in case the event stretches over multiple days. In environments with many applications, IT staff should be aware of which applications should be recovered first and in what order. The plan should not assume that there will be enough resources to bring everything back up at the same time.
- **Track audit scores:** Organizations should maintain scorecards on the disaster recovery compliance of each application, as well as who is testing and when. Maintaining scorecards generally helps increase audit scores.

For a summary of key considerations recommended by Dell when planning a disaster recovery implementation, see the "10 best practices for disaster recovery planning" sidebar in this article.

10 BEST PRACTICES FOR DISASTER RECOVERY PLANNING

Adhering to best practices can be critical to the success of a disaster recovery implementation. The following are 10 of the most important considerations identified by Dell when planning such a deployment:

1. Articulate the need in financial terms.
2. Use hard data to create a risk profile.
3. Identify the critical resources.
4. Think beyond the data center.
5. Eliminate or mitigate single points of failure.
6. Assume that everything is going to fail.
7. Consider a virtualization data center strategy.
8. Recognize potential vendor weaknesses.
9. Keep disaster recovery capabilities up-to-date.
10. Perform tests on a regular basis.

EXPERT GUIDANCE FROM DELL SERVICES

Dell Global Infrastructure Consulting Services can help organizations identify,

design, and implement comprehensive virtualization solutions for their environments at a number of levels:

- **Workshops:** Workshops can help organizations understand the potential of virtualization technology, including how it can help meet current and future requirements. Disaster recovery planning workshops can assist with determining the best strategy based on the level of disaster recovery capability needed.
- **Assessments:** Assessments are designed to help organizations make informed decisions to help maximize the advantages of virtualization in specific environments. The assessment enables Dell to identify the scope of relevant solutions and make deployment recommendations. Using automated processes, Dell gathers up-to-the-minute information about the server environment, including key data on system inventory and up to one business cycle of performance data. Dell can then analyze the data, assess the situation, and outline options available in the existing infrastructure (see Figure 3).
- **Design:** Design services can provide a comprehensive, detailed server consolidation architecture and implementation plan based on field experience, and can help organizations understand how the solution can be implemented successfully with minimal end-user disruption.
- **Implementation:** Dell can implement the virtualization solution—both hardware and software—to help organizations quickly realize the advantages of virtualization in their environment.

Dell Global Infrastructure Consulting Services can also help organizations plan, design, and implement a disaster recovery infrastructure based on Dell server and storage clusters and VMware vCenter SRM.

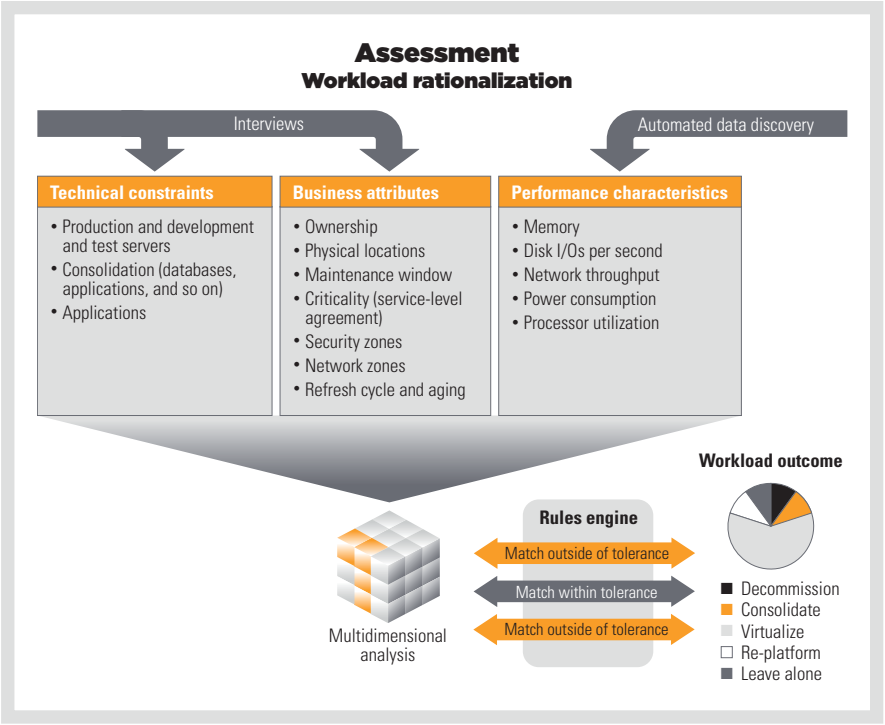

Figure 3. *Example virtualization assessment process used by Dell Global Infrastructure Consulting Services*

SIMPLIFIED, COST-EFFECTIVE DISASTER RECOVERY

As requirements for avoiding downtime become increasingly stringent, administrators need tools and platforms that can help them plan, design, and implement disaster recovery strategies that can meet those needs. Implementing a high-availability architecture based on Dell server and storage clusters and VMware vCenter SRM—and taking advantage of the expert guidance available from Dell Global Infrastructure Consulting Services—can provide a comprehensive solution for simplified, cost-effective disaster recovery.

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Debi Higdon is the practice lead for Dell Disaster Recovery Services. She previously spent seven years as the Dell disaster recovery test manager, facilitating the majority of Dell's disaster recovery tests globally.

Tim Webb is the director of Dell Global Virtualization and Data Center Optimization Consulting Practices. He has a degree in Engineering from Princeton University.

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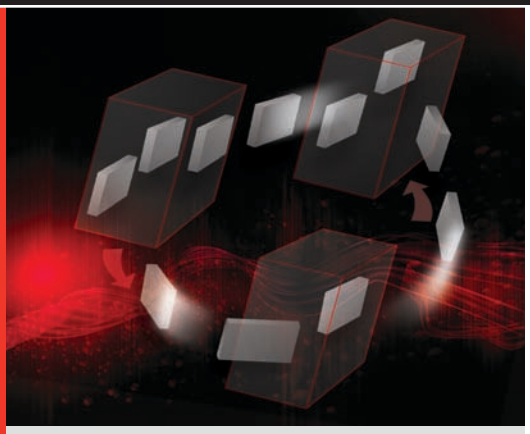

SIMPLIFIED MANAGEMENT OF DELL EQUALLOGIC PS SERIES iSCSI SANs IN CITRIX XENSERVER

By Achmad Chadran
Partha Ramachandran

The Citrix® XenServer™ Adapter module for Dell™ EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays integrates server and storage functionality in a single management interface and delegates tasks according to the core strengths of each platform. This approach helps bring storage into a holistic enterprise virtualization strategy—facilitating robust storage management and protection at the same time.

Related Categories:

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Server virtualization technology enables organizations to achieve high levels of efficiency and cost-effectiveness in their data center operations. Advantages of a virtualized and consolidated server infrastructure range from dynamic allocation of resources and enhanced availability to minimized costs for hardware, power, cooling, and management.

However, to help achieve the full benefits of server virtualization, administrators must virtualize the storage side of the infrastructure as well. A high-availability storage area network (SAN), for example, can help improve the overall availability of a server-based IT infrastructure. Storage must have the same scalability that virtualization brings to servers, so that both storage and servers can grow at the same pace. Virtualized storage also extends the cost benefits of virtualization by enabling increased disk utilization and reduced need for equipment purchases.

Dell and Citrix have partnered to bring together storage and server technologies that help organizations further increase efficiency and cost savings when deploying virtualization. Citrix XenServer 5 now includes an adapter for Dell EqualLogic PS Series Internet SCSI (iSCSI) SAN arrays designed to simplify virtual machine (VM) storage management and enable Citrix XenServer hosts to take advantage of advanced EqualLogic features.

MAXIMIZING DATA CENTER VIRTUALIZATION BENEFITS

Although server virtualization has brought many benefits, it has also created new challenges in the data center. Consolidation of server resources onto a reduced number of physical systems has magnified the potential impact of server downtime, increasing the importance of asset protection.

Consolidation through virtualization has also added complexity to enterprise-wide management. Reducing the number of physical servers in the data center has allowed IT organizations to lower administrative overhead and total cost of ownership. At the same time, many organizations are finding that a proliferation of VMs can add back much of the management workload—at a time when IT staffing levels have been reduced or remain static.

To overcome these challenges, virtualized data center infrastructures require high levels of asset protection and management automation—and both are fundamental to the Dell EqualLogic PS Series iSCSI SAN design philosophy. To that end, Dell and Citrix have worked together to help ensure that asset protection and management automation are well integrated with the management functionality of the Citrix XenServer virtualization platform.

VIRTUALIZING DELL EQUALLOGIC SANs WITH THE CITRIX XENSERVER ADAPTER

The key to this integration is the Citrix XenServer Adapter module for Dell EqualLogic PS Series iSCSI SAN arrays included in Citrix XenServer Dell Edition. XenServer Dell Edition is designed to run from internal flash storage in supported Dell PowerEdge™ servers. XenServer Dell Edition also comes preinstalled with Dell OpenManage™ Server Administrator, enabling out-of-the-box systems management without any additional need to install an agent on the host.

In a typical setup, the PowerEdge servers running XenServer are configured in a resource pool. XenServer hosts are connected through an Ethernet fabric and share storage on one or more Dell EqualLogic PS5000 arrays (see Figure 1). The iSCSI traffic is physically isolated from other network traffic using separate physical Ethernet switches. Two network interface cards on each host are bonded to help provide high availability and load balancing for IP storage traffic.

With the Citrix XenServer Adapter, administrators can provision VMs and associated virtual storage in a single operation. Storage operations are effectively handed off from the hypervisor to the EqualLogic arrays. This handoff helps reduce the burden on the server processor while leveraging the enhanced automation, ease of use, and data protection built into the EqualLogic arrays.

MANAGING STORAGE AND SERVERS FROM A SINGLE CONSOLE

The Citrix XenServer Adapter integrates Dell EqualLogic PS Series iSCSI SAN control interfaces directly into the Citrix XenCenter™ Management Client. The integration uses the respective core strengths of the XenServer and EqualLogic platforms to help simplify management and increase efficiency over traditional deployments.

The EqualLogic SAN consolidates physical storage and provides a single-pane management view of the virtualized storage pool. The EqualLogic SAN is designed to intelligently balance workloads across available arrays without the need for manual intervention, automatically adapting to changes. When new arrays are added, they acquire the correct configuration from previously deployed arrays, and the workload is rebalanced automatically.

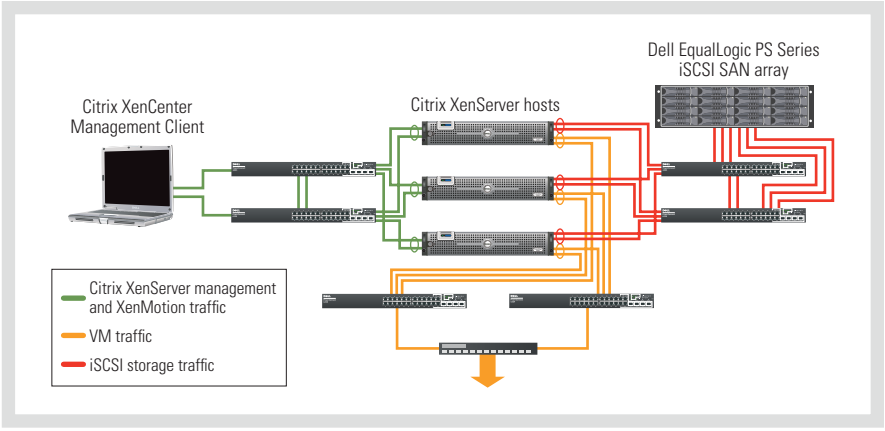

Figure 1. *Citrix XenServer pool configuration using a Dell EqualLogic PS Series iSCSI SAN*

Storage volumes for VMs can be managed directly from XenServer through the XenCenter management console. Administrators can quickly create new volumes and assign them to XenServer hosts, all on the same management screen (see Figure 2). As VMs are provisioned, storage is automatically allocated on the EqualLogic arrays. Volumes on the arrays are immediately available to the hosts as storage repositories with access controls in place.

As the virtual infrastructure grows, the XenCenter management console allows administrators to tag and search the infrastructure to keep track of proliferating VMs. XenCenter also includes performance monitoring, trending, and alerting so that administrators can track performance statistics at a glance and avoid potential problems. In addition, administrators can use Citrix XenMotion™ software from the XenCenter management console to easily move volumes around.

High availability is built in. Each Dell EqualLogic PS Series array offers fully redundant, hot-swappable components including controllers, fan trays, and power supplies; support for RAID-5, RAID-10, and RAID-50; hot drive sparing;

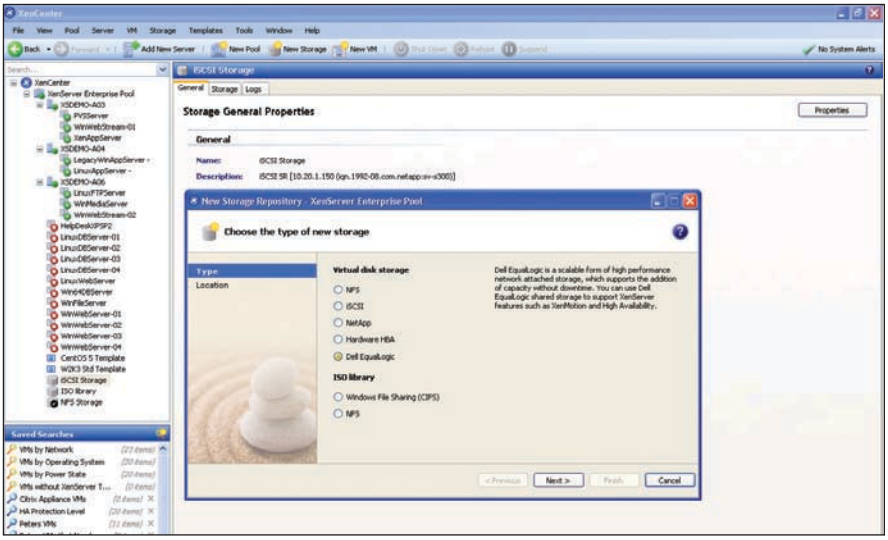

Figure 2. *Dell EqualLogic PS Series iSCSI SAN provisioning using Citrix XenCenter*

automatic failover and rebuild; and a robust design that avoids single points of failure and is designed to provide greater than 99.999 percent data availability. Similarly, administrators can configure automatic failover of VMs from one physical server to another. XenServer adds an extra level of automated high availability with resource-based placement of VMs in the event of a server failure. This automation feature includes dynamic failover planning based on available resources to help ensure that VMs restart on the appropriate physical server.

STREAMLINING ADVANCED MANAGEMENT OPERATIONS

The greatly simplified management provided by Citrix XenServer and Dell EqualLogic PS Series iSCSI SAN integration extends to advanced techniques such as thin provisioning, fast cloning, automated snapshots, multipath I/O, and auto-replication for disaster recovery.[1] These tasks roll up into automated sequences managed from the XenCenter console and are delegated to the EqualLogic arrays to help maintain high operating efficiency.

Several of these advanced technologies are essential for delivering the increased data protection required in virtualized, consolidated data centers. Snapshots help protect data by providing space-efficient images of storage volumes associated with VMs and shared repositories. These point-in-time data captures enable rollback of VMs for fast recovery. The auto-snapshot capability included with EqualLogic arrays enables administrators to schedule automatic snapshots at specified intervals—for example, once a day or once every half hour.

Auto-replication technology in the EqualLogic array firmware enables administrators to easily add disaster recovery protection. By replicating data to designated servers located at a remote site, the IT organization can protect data against a full or partial failure at the primary production site. XenServer includes enhanced support for SAN-based remote replication and auto-backup of VM configurations to the remote site.

A fast cloning capability enables administrators to create exact copies of VMs and associated volumes as a background process without disrupting network operations. As complete copies of data volumes, clones can be used to replicate volumes for backup and testing purposes. In a virtualized environment, new VMs can be provisioned almost instantly by cloning an existing VM. This approach helps IT organizations save management time and expense, while business units within an organization can deploy new applications rapidly.

IT organizations can use thin provisioning in the EqualLogic arrays to add storage as needed and help avoid over-purchasing up front. With a thin-provisioned volume, administrators can dedicate only the capacity needed in the short run. When an administrator-determined limit is reached, alerts provide an opportunity to add capacity from the storage pool, and possibly to invest in additional storage. Thin provisioning helps minimize unused capacity and enables the IT organization to maximize storage efficiency without time-consuming manual processes.

Another advanced technology, multipath I/O, allows multiple network paths for servers and EqualLogic arrays. These redundant connections help safeguard against network problems. The intelligence built into EqualLogic arrays is designed to optimize the connections by automatically choosing the best path for highest overall performance.

INTEGRATING VIRTUALIZED SERVERS AND STORAGE

The integration of Citrix XenServer and Dell EqualLogic PS Series iSCSI SAN arrays offers organizations a way to consolidate servers, centralize storage, protect data, maintain high availability, and enhance management of workload and life cycle costs. As a result, integration helps simplify underlying management processes, effectively turning processes into logical business operations and helping minimize the risk of platform conflicts.

With the Citrix XenServer Adapter for Dell EqualLogic PS Series iSCSI SAN arrays, organizations can combine streamlined VM and storage management from Citrix XenCenter with the cost-effective iSCSI infrastructure and built-in intelligence of an EqualLogic SAN. This integrated server and storage approach is designed to boost efficiency, protect data, and reduce management overhead—helping to lower total cost of ownership while advancing fast, flexible response to evolving enterprise needs.

Achmad Chadran is a member of the Dell EqualLogic product group, where he works with technology partners to articulate and promote collaborative solutions.

Partha Ramachandran is a senior engineering manager at Citrix with responsibilities for outbound engineering, product delivery, and support for Dell.

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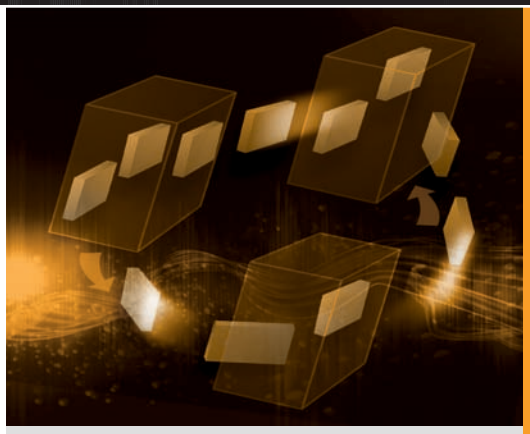
[1] For more information on leveraging advanced Dell EqualLogic array capabilities, see "Integrating Virtualized Servers with VMware vStorage–Enabled Dell EqualLogic iSCSI SANs," by Eric Schott and Scott Davis, in *Dell Power Solutions*, March 2009, DELL.COM/Downloads/Global/Power/ps1q09-20090178-Gilman.pdf.

ADVANCING INTEGRATION OF MICROSOFT HYPER-V AND DELL EQUALLOGIC VIRTUALIZED SANs



By Stanley L. Stevens
Darren W. Miller

An enterprise-class storage infrastructure is essential for organizations transitioning to a virtualized data center. Dell™ EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays enable advanced integration with the robust server virtualization offered by the Microsoft® Windows Server® 2008 Hyper-V™ virtualization platform—offering the storage foundation for a comprehensive virtualization solution.

Related Categories:

Dell EqualLogic storage
Microsoft
Microsoft Hyper-V
Microsoft Windows Server 2008
Storage
Storage area network (SAN)
Virtualization

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Virtualization has become an essential data center technology, allowing IT administrators to consolidate server infrastructure and reduce costs while enhancing service levels. Today, many organizations are advancing toward the next step, which is to couple storage consolidation with server virtualization in a highly available, scalable, and manageable environment. Building the foundation for these next-generation data center infrastructures requires well-integrated server and storage virtualization platforms.

With Microsoft Windows Server 2008 Hyper-V, server virtualization has the potential to become increasingly widespread, reaching a wide range of organizations. Hyper-V is a simplified virtualization platform integrated directly into Dell-supported Microsoft Windows Server 2008 x64 Edition operating systems. Dell supports Hyper-V on systems designed to support virtualization workloads, including Dell PowerEdge™ server models M600, M605, M805, M905, R805, R900, and R905, as well as a broad range of previous-generation servers.

The widespread use of the Microsoft Windows® OS allows many organizations to consider implementing a next-generation virtualized data center, heightening the need for a cost-effective platform to simplify storage area network (SAN) virtualization. Dell EqualLogic PS Series Internet SCSI (iSCSI) SAN arrays can provide that platform, and integration enables EqualLogic arrays to work together with Hyper-V to best advantage.

CREATING A VIRTUALIZED SERVER AND STORAGE INFRASTRUCTURE

Bringing server virtualization and virtualized storage infrastructures together can be beneficial in many ways. It can help reduce costs and increase flexibility. IT organizations can consolidate resources onto a reduced number of physical systems, increase hardware utilization, dynamically allocate resources, and quickly deploy additional capacity.

To help ensure success in the next-generation data center, however, both the server virtualization hypervisor and the storage platform must support mission-critical, enterprise-class capabilities. Important business assets residing on virtual machines (VMs) must be protected against hardware failures and natural disasters. High availability is required on both the server and storage sides of the infrastructure to help avoid application failures and diminished productivity. Reliability is essential to help keep total cost of ownership low.

Other enterprise-class requirements include scalability and performance to help ensure that storage can continue to meet demand as the server infrastructure grows. Organizations need automated management

and reporting capabilities to help reduce the burden on IT staff. And finally, a next-generation server and storage virtualization solution for Microsoft Windows Server environments must work together with key enterprise applications such as Microsoft Exchange and the Microsoft SQL Server® database platform.

INTEGRATING DELL EQUALLOGIC SANs WITH MICROSOFT HYPER-V

Dell EqualLogic PS Series iSCSI SAN arrays provide the elements required for an enterprise-class virtualized server and storage environment based on Microsoft Windows Server 2008 Hyper-V (see Figure 1). EqualLogic PS Series SANs are designed for high availability. The arrays function as peers, working together to share resources, evenly distribute workloads, and enable comprehensive data protection for the VMs in a Hyper-V environment. Power supplies, controllers, enclosures, and disk drives are fully redundant and hot swappable. If a failure does occur, disk failover helps keep operations up and running.

EqualLogic PS Series arrays are designed to deliver enterprise-class reliability in Windows Server 2008 environments. For example, the EqualLogic PS Series product family has been certified for Windows Server 2008 x64 Editions by Microsoft, indicating that it meets Microsoft standards for compatibility and best practices. In addition, the EqualLogic PS Series has received the Microsoft Simple SAN designation, indicating that it has met specific ease-of-use, ease-of-installation, and ease-of-management criteria.

Windows Server 2008 Hyper-V enables organizations to dynamically scale VMs on physical servers, and EqualLogic PS Series arrays help extend that same dynamic scalability to storage. Administrators can expand SAN resources online and even move running workloads, all without disrupting services. Newly added arrays adopt the configuration from currently deployed arrays, and the new arrays are included automatically in the available storage pool.

Enterprise-level management capabilities are provided in the EqualLogic PS Series arrays with no added licensing fees, including role-based management, historical performance trending, and reporting. Storage pooling and tiering are automated, helping save administrative time and costs. Cloning and replication capabilities are also included in the firmware of EqualLogic PS Series arrays, offering advanced data protection for Hyper-V environments.

Hyper-V integrates with familiar, Windows-based server management tools. For organizations that require a comprehensive server management solution, the Microsoft System Center family includes advanced VM management and monitoring. Using Microsoft System Center Virtual Machine Manager with other Microsoft System Center applications and the Dell OpenManage™ suite, administrators can manage the overall environment—virtual and physical—using the same tool.

In addition, Dell and Microsoft have worked together on advanced integration features. One feature is an innovative multipath I/O device-specific module with connection awareness to EqualLogic PS Series SAN volumes, which is designed to automatically optimize server-to-storage connections. Another feature is the Dell EqualLogic Auto-Snapshot Manager/Microsoft Edition tool, which helps provide data protection and rapid recovery for Microsoft Exchange and SQL Server environments. This advanced integration helps organizations increase efficiency and maximize resources (see the "Top 4 reasons to integrate server and storage virtualization platforms" sidebar in this article).

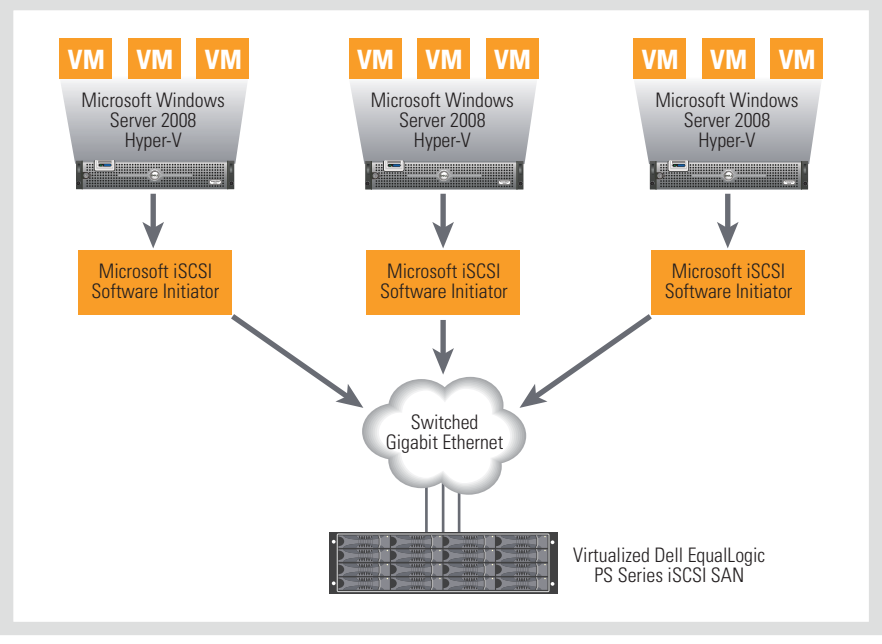

Figure 1. *Virtualized Dell EqualLogic PS Series iSCSI SAN in a Microsoft Hyper-V environment*

EXPLORING MULTIPATH I/O AND AUTO-SNAPSHOT MANAGER

The Dell EqualLogic Multipath I/O device-specific module is designed to improve path performance, failover, and network load-balancing capabilities of multipath I/O in Microsoft Windows Server environments. EqualLogic PS Series iSCSI SAN arrays are designed to apply storage resources where and when they are needed, automatically load balancing to help optimize performance.

In Microsoft Hyper-V environments, performance can be further optimized by advanced I/O multipathing integrated into standard Microsoft iSCSI drivers developed by Dell engineers to optimally configure the EqualLogic PS Series SAN architecture for peer storage. The module enables path

TOP 4 REASONS TO INTEGRATE SERVER AND STORAGE VIRTUALIZATION PLATFORMS

When migrating to a virtualized data center, an enterprise-class IT infrastructure is essential. By leveraging the advanced integration features of Dell EqualLogic PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays with Microsoft Windows Server 2008 Hyper-V, enterprises can achieve the following benefits:

1. **Cost savings through consolidation:** Consolidating storage capacity, increasing hardware utilization, and optimizing the server and storage infrastructure help reduce IT costs.
2. **Ease of deployment and management:** EqualLogic PS Series arrays are designed to be operational in a matter of minutes, providing storage for VMs managed by Windows Server 2008 Hyper-V.
3. **High-availability infrastructure:** EqualLogic PS Series arrays deliver fully redundant and hot-swappable components, including dual controllers, fan trays, and power supplies and disk drives with hot-spare capability.
4. **Reliability and resiliency:** EqualLogic PS Series arrays include a comprehensive set of enterprise software features at no additional cost that provides network load balancing and path failover.

activity levels to be monitored and I/O loads shifted automatically from heavily trafficked to less congested paths for high performance in Hyper-V environments.

The integrated EqualLogic and Hyper-V solution also helps deliver robust data protection capabilities. Many organizations are looking to deploy mission-critical transactional database applications such as Microsoft Exchange and SQL Server in VMs. EqualLogic PS Series arrays enable excellent performance with these applications, including fast SAN storage solutions for Exchange environments[1] and tested performance for intense SQL Server workloads.[2]

However, protecting transactional database applications in a virtualized environment can present challenges. Because these applications are characterized by high I/O and constantly changing information, making consistent volume copies for backup and disaster recovery purposes can be difficult. EqualLogic PS Series arrays automate these activities using Auto-Snapshot Manager/Microsoft Edition, which is included as part of the EqualLogic PS Series Host Integration Tools.

Administrators can use direct connect pass-through volumes in the VMs to help create consistent hardware-based snapshots of application data and quickly recover to prior points in time. Auto-Snapshot Manager/Microsoft Edition also integrates with standard backup software using the Microsoft Volume Shadow Copy Service (VSS) framework, enabling integration into standard backup processes. Currently, Auto-Snapshot Manager/Microsoft Edition can be loaded into a Hyper-V guest OS. Additional integration is planned to help improve the seamlessness of the process.

LAYING THE FOUNDATION FOR NEXT-GENERATION VIRTUALIZED DATA CENTERS

Microsoft Windows Server 2008 Hyper-V is designed to provide simplified, cost-effective server virtualization that can be easily plugged into an existing infrastructure. Dell EqualLogic PS Series iSCSI SAN arrays complement Hyper-V, helping provide the storage capabilities needed to complete the next-generation virtualized data center.

EqualLogic PS Series arrays are designed to support key features and capabilities required for both server and storage components of the next-generation data center—including high availability, enterprise-caliber reliability and management, ease of deployment, and advanced integration with Hyper-V. This approach helps simplify IT by providing a virtualization strategy geared to mobilize and manage the resources of the entire infrastructure, both virtual and physical, to help meet fast-moving enterprise demands.

Stanley L. Stevens is a virtualization solutions marketing manager at Dell and a 16-year veteran of the IT industry. He has previously worked with global companies including Cabletron Systems, Marconi Communications, and 3Com, and has a broad technical background in networking infrastructure.

Darren W. Miller is a product consultant at Dell and has worked in the storage industry for over 12 years. At Dell, he focuses on implementing storage solutions and developing storage best practices with Dell EqualLogic PS Series iSCSI products.

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Dell and Microsoft Hyper-V:
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[1] Based on most I/Os per second (IOPS) per disk for a transaction workload and higher absolute performance scaling than non-mainframe systems from tests introduced in the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage Program v2.0 test framework. For detailed results, see "EqualLogic PS Series 60,000-User Storage Solution for Microsoft Exchange Server 2007," by EqualLogic, September 2007, www.equallogic.com/uploadedfiles/resources/product_documentation/ps3900xv-60000-users.pdf; and "Microsoft Exchange Solution Reviewed Program (ESRP) – Storage v2.1," by Microsoft Corporation, technet.microsoft.com/en-us/exchange/bb412164.aspx.

[2] "Deployments and Tests in an iSCSI SAN," by Microsoft Corporation, June 2007, technet.microsoft.com/en-us/library/bb649502.aspx.

HOW DELL EQUALLOGIC AUTO-SNAPSHOT MANAGER AND VERITAS NETBACKUP ENABLE OFF-HOST BACKUPS

By Sarah Doherty
Troy Lehman

Shrinking backup windows compounded by increasing application performance and uptime requirements are challenging traditional host-based backup and recovery methods. By enabling fast, reliable off-host backups of application data, the Veritas™ NetBackup™ data management tool and Dell™ EqualLogic™ Auto-Snapshot Manager software help organizations increase availability, enhance application performance, and accelerate recovery.

Related Categories:

Backup
Business continuity
Dell EqualLogic storage
Internet SCSI (iSCSI)
Storage
Storage area network (SAN)
Symantec

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Protecting valuable data is a critical business concern. However, increasingly stringent demands are stretching the limits of traditional host-based backup and recovery methods, which often cannot meet enterprise requirements for reduced backup windows, high performance, and rapid recovery.

Off-host backups, in which backup processing is offloaded to a separate system, can help reduce or eliminate the performance and availability impact of backups on production environments. The Veritas NetBackup 6.5 data management tool from Symantec supports fast, reliable off-host backups of enterprise application data stored on Dell EqualLogic PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays. In particular, NetBackup 6.5 works with Dell EqualLogic Auto-Snapshot Manager and Microsoft® Volume Shadow Copy Service (VSS) application programming interfaces (APIs) to support off-host backups for Microsoft applications. Together, these tools can help organizations increase availability, enhance application performance, and accelerate recovery.

ENABLING OFF-HOST BACKUP AND RECOVERY WITH MICROSOFT VSS

Traditional host-based backup and recovery can dramatically degrade application performance and availability. By transferring backup and recovery operations to a separate system, off-host backup and recovery can help reduce performance degradation and avoid the need for a dedicated backup window.

The off-host approach runs backup operations against a copy, or snapshot, of production data. To do so, backup applications need access to application-consistent, point-in-time snapshots or clones of application data. To facilitate off-host backups, it is important to enable the creation of application-consistent snapshots. Microsoft VSS enables the creation of application-consistent, point-in-time snapshots of NT File System (NTFS), Microsoft Exchange, and Microsoft SQL Server® application data. Backup applications and storage arrays that integrate with VSS can use VSS-enabled snapshots for off-host backup operations.

VSS has three components:

- **Requestor:** An application, such as Veritas NetBackup, that requests snapshot creation
- **Writer:** A Microsoft application, such as Microsoft Exchange, that is snapshot enabled
- **Provider:** A storage application, such as Dell EqualLogic Auto-Snapshot Manager, that physically creates and maintains snapshots

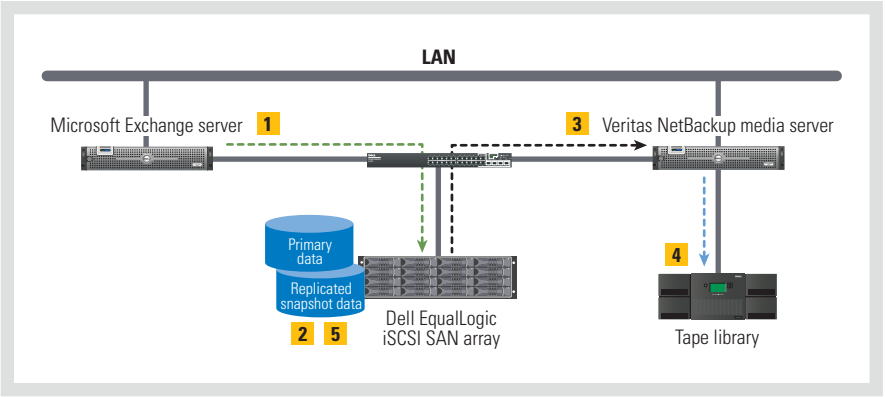

Figure 1. *Example off-host backup process for Microsoft Exchange application data*

By using VSS to create application-consistent, point-in-time snapshots, backup applications can perform data protection and recovery operations without affecting application availability, performance, or integrity.

COORDINATING BACKUP AND RECOVERY OPERATIONS

Veritas NetBackup 6.5 and Dell EqualLogic Auto-Snapshot Manager both take advantage of Microsoft VSS to support off-host backup and recovery of data stored on EqualLogic arrays. NetBackup acts as a requestor, requesting snapshots and then using the resulting copies to perform off-host backup operations; Auto-Snapshot Manager acts as a provider and performs the actual snapshot.

To create off-host backups, IT administrators can use NetBackup to schedule a point-in-time data clone or replica as part of ongoing backup operations. Auto-Snapshot Manager then creates the actual replica on the EqualLogic array. NetBackup can then use the data snapshot to perform the necessary backup operation, such as copying to tape or disk.

For example, an organization running Microsoft Exchange with production data located on an EqualLogic array can use NetBackup 6.5 and Auto-Snapshot Manager to create snapshots, copy them to disk or tape, and then recover or restore them nearly instantaneously (see Figure 1):

1. Microsoft Exchange stores production data in an EqualLogic disk pool.
2. Auto-Snapshot Manager creates an application-consistent replica of the production volume.
3. A NetBackup media server mounts the replicated volume to enable backup operations to be processed on a non-production volume.
4. The NetBackup media server writes the backup image to a tape library and updates the master catalog, mapping the backup file to the original location on the Exchange server.
5. After the backup is complete, the snapshots are automatically deleted.

ENHANCING SCALABILITY AND EASE OF USE

In addition to supporting the creation and recovery of off-host backups, Veritas NetBackup 6.5 can help organizations simplify and streamline overall backup and recovery operations as well. For example, NetBackup leverages built-in data life cycle policies that enable organizations to prioritize data based on its value and to automate the migration of backup data from disk to tape based on its classification. Also, NetBackup offers comprehensive security and management capabilities such as user access and control policies and automated, centralized policy management to help organizations minimize security risks and streamline operations.

By supporting backup and recovery operations on Dell EqualLogic arrays, NetBackup can also help increase backup performance, scalability, and reliability. In particular, EqualLogic arrays support automated load balancing and storage virtualization, enabling organizations to scale storage capacity as needed and distribute storage processing for optimal performance. Also, NetBackup and EqualLogic arrays are designed to support rapid disk-based recovery for enhanced data availability.

ADVANCING BUSINESS CONTINUITY AND RECOVERABILITY

Switching to an off-host backup strategy can enhance business continuity and help increase application performance and recoverability. By working together to deliver fast, reliable off-host backups, Veritas NetBackup 6.5 from Symantec and Dell EqualLogic Auto-Snapshot Manager can help organizations reliably and scalably protect valuable data, maximize uptime, and streamline the management of data protection and recovery.

Sarah Doherty is a senior product marketing manager focused on Dell EqualLogic solutions.

Troy Lehman is a technical product manager at Symantec currently focused on Veritas NetBackup strategy and enablement within Dell.

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SEAMLESS, COST-EFFECTIVE TAPE BACKUP FOR iSCSI SANs

By Michael Linane
Jo Ann Varble
Neil Ozarkar
Curt Krempin
Charles Butler

The introduction of Internet SCSI (iSCSI)–to–Serial Attached SCSI (SAS) bridge cards for Dell™ PowerVault™ TL Series tape libraries enables organizations to directly attach these libraries to an iSCSI storage area network (SAN) with minimal or no degradation in transfer rates, helping provide seamless, cost-effective tape backup.

Related Categories:

Dell PowerVault storage
Internet SCSI (iSCSI)
Symantec
Tape backup
Tape library

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Most leading tape drive technologies, including the popular Linear Tape-Open (LTO) format, support three primary system interfaces: SCSI, Serial Attached SCSI (SAS), and Fibre Channel. Until now, organizations with an Internet SCSI (iSCSI) storage area network (SAN) typically had two options for tape backup that would not significantly reduce transfer rates. In most cases, organizations could either use an intermediary backup or media server to act as a buffer between the tape backup target and the iSCSI SAN, or use an external iSCSI bridge to translate between protocols.

With the introduction of iSCSI-to-SAS bridge cards for Dell PowerVault TL2000 and PowerVault TL4000 tape libraries, however, organizations can now directly attach SAS-based tape backup targets to iSCSI-based Gigabit Ethernet networks, including Dell PowerVault MD3000i, Dell EqualLogic™, or Dell/EMC SANs, with minimal or no degradation in transfer rates. The internal card acts as an iSCSI target and provides SAS connectivity for full-height LTO-4 and half-height LTO-4 and LTO-3 SAS drives, helping provide a seamless, cost-effective target for tape backup.

Figure 1 shows a typical network configuration using a PowerVault TL2000 or PowerVault TL4000 tape library with an iSCSI SAN. The process of configuring this type of environment is designed for simplicity. This article outlines the steps necessary to choose a backup strategy and to configure the servers, network settings, and storage targets in this type of environment.

CHOOSING A BACKUP STRATEGY

The first step in determining an appropriate backup strategy is to define the backup windows for each system and identify the amount of data to be protected. Symantec™ Backup Exec™ software, for example, supports two backup strategies: traditional backups to disk or tape or continuous backup to disk. This article focuses on traditional backups to Dell PowerVault TL2000 or PowerVault TL4000 tape libraries. (For more information on Symantec Backup Exec, see the "Symantec Backup Exec 12 in iSCSI environments" sidebar in this article.)

The PowerVault TL2000 can accommodate up to two half-height tape drives, while the PowerVault TL4000 can accommodate up to four half-height tape drives. Administrators can create backup jobs to use each drive in a tape library. A typical traditional backup would include a full backup every Sunday night and incremental backups throughout the week to help ensure adequate data protection. Incremental backups store only changes made from the last full or incremental backup job, which helps minimize the backup of duplicate or unchanged data during the week.

Because data recovery requires restoring the last full backup and all following incremental backups, best

practices recommend performing full backups once a week. Differential backups, which store the changes made during the week since the last full backup job, provide an alternative to incremental backups. This approach can help further reduce recovery time, but can also result in additional duplication of unchanged data and increased backup windows during the week.[1]

CONFIGURING THE SERVERS

In the network configuration shown in Figure 1, the backup server requires an iSCSI initiator such as the Microsoft iSCSI Software Initiator, available as a complimentary download from the Microsoft Web site.[2] Once installed, the Microsoft initiator is designed for straightforward setup and use. One key consideration is the use of Challenge Handshake Authentication Protocol (CHAP) as a security measure. If the iSCSI SAN is visible to the external Internet, administrators should enable this security feature in addition to following other security best practices.[3]

The Microsoft iSCSI Software Initiator does have disadvantages, however. Creating iSCSI packets requires server cycles, which in combination with other processor-intensive operations (such as backup jobs) can reduce overall server performance and throughput. As an alternative, administrators could consider implementing an iSCSI host bus adapter or other offloading hardware solution. This approach removes the SCSI-to-iSCSI conversion workload from the server's processor, which can help increase performance.

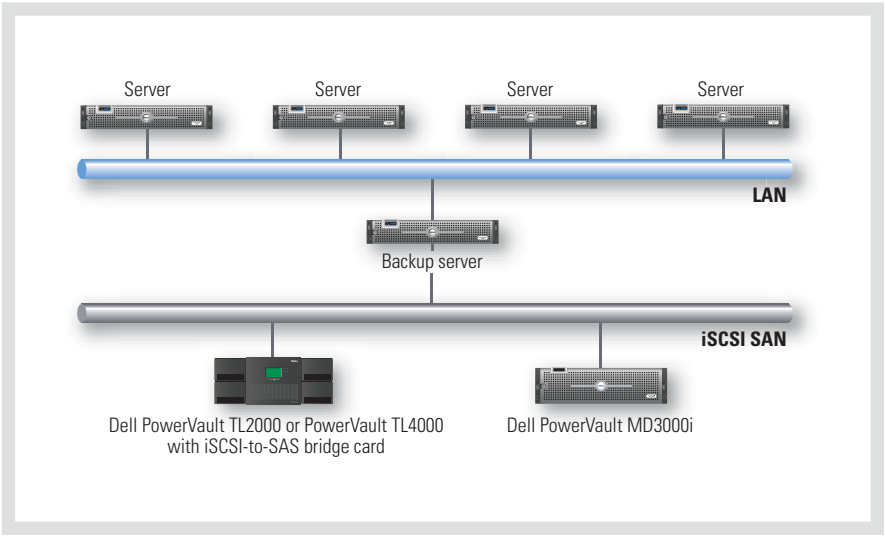

Figure 1. *Typical network configuration using a Dell PowerVault TL2000 or PowerVault TL4000 tape library with an iSCSI SAN*

CONFIGURING THE NETWORK SETTINGS

In addition to configuring the iSCSI initiator, administrators should pay special attention to network settings. Best practices highly recommend using a dedicated network interface card port and static IP address. Using jumbo frames can help reduce overhead and significantly increase the performance of backup jobs. This approach can also have drawbacks, however: in an overutilized, high-traffic network that is susceptible to dropping packets, performance could actually decrease because of the need to resend large packets. For jumbo frames to function properly, the entire path between the backup server and the storage target must have jumbo frames enabled.[4]

"The setup process for an iSCSI-capable Dell PowerVault TL2000 or PowerVault TL4000 tape library is designed for simplicity."

CONFIGURING THE STORAGE TARGETS

The setup process for an iSCSI-capable Dell PowerVault TL2000 or PowerVault TL4000 tape library is designed for simplicity. In the iSCSI Bridge Management Console, administrators would first select the Connections option (see Figure 2), then enter the IP address and frame size for the appropriate ports (see Figure 3). For basic configurations, these are typically the only steps required.

When connecting a PowerVault MD3000i to a SAN array, administrators must also configure the iSCSI settings on the PowerVault MD3000i. To do so, they can first go to the iSCSI tab in the Dell Modular Disk Storage Manager interface

[1] For a step-by-step process for creating a comprehensive backup job, see "iSCSI for TL-Series Tape Libraries," by Michael Linane, Jo Ann Varble, Neil Ozarker, Curt Krempin, and Charles Butler, November 2008, DELL.COM/Downloads/Global/Solutions/TL_iSCSI_SAN_WhitePaper.pdf.

[2] To download the initiator, visit www.microsoft.com/downloads/details.aspx?familyid=12cb3c1a-15d6-4585-b385-befd1319f825.

[3] For more information on security in this type of configuration, see "iSCSI for TL-Series Tape Libraries," by Michael Linane, Jo Ann Varble, Neil Ozarker, Curt Krempin, and Charles Butler, November 2008, DELL.COM/Downloads/Global/Solutions/TL_iSCSI_SAN_WhitePaper.pdf.

[4] For more information on using jumbo frames, see "iSCSI for TL-Series Tape Libraries," by Michael Linane, Jo Ann Varble, Neil Ozarker, Curt Krempin, and Charles Butler, November 2008, DELL.COM/Downloads/Global/Solutions/TL_iSCSI_SAN_WhitePaper.pdf.

SYMANTEC BACKUP EXEC 12 IN iSCSI ENVIRONMENTS

Symantec Backup Exec 12 for Windows Servers is designed to provide scalable, comprehensive data protection in storage area network (SAN)–based environments, and can easily be configured for Internet SCSI (iSCSI). Organizations can deploy additional backup servers by purchasing a Symantec Backup Exec Multi-Server Suite through Dell, and can protect two additional remote Microsoft® Windows® OS–based servers and 20 Windows-based desktops and laptops by purchasing a Symantec Backup Exec Windows Remote Server Add-on Pack through Dell. Organizations can also protect Novell® NetWare®, Linux®, and UNIX® OS–based servers with the Symantec Backup Exec NetWare, Linux, and UNIX Remote Server Add-on Pack, available through Dell. The Symantec Backup Exec SAN-Based Server Suite, also available through Dell, enables the software to scale to SAN environments.

In addition, Symantec Backup Exec 12 offers a remote agent system service that runs on remote Windows-based servers and workstations. This agent is designed to accelerate backup processing by locally performing tasks that require extensive network interaction in typical backup technologies. It processes backup data into a continuous stream that the media server then processes as a single task—a method that typically provides higher data transfer rates than traditional technologies, which generally require multiple requests and acknowledgments between the media server and the remote server.

For more information on installing and setting up Symantec Backup Exec 12, see "iSCSI for TL-Series Tape Libraries," by Michael Linane, Jo Ann Varble, Neil Ozarker, Curt Krempin, and Charles Butler, November 2008, DELL.COM/Downloads/Global/Solutions/TL_iSCSI_SAN_WhitePaper.pdf. For more information on Symantec Backup Exec 12, see "Comprehensive Data Protection with Symantec Backup Exec 12," by Charles Butler, in *Dell Power Solutions*, May 2008, DELL.COM/Downloads/Global/Power/ps2q08-20080217-Symantec.pdf.

(see Figure 4). To configure the host ports, they can then select "Configure iSCSI Host Ports" (see Figure 5). Each controller has two host ports, which by default are assigned IP addresses 192.168.130.101–102 and 192.168.131.101–102. The Advanced button enables administrators to change settings for virtual LAN support, Ethernet priority, TCP listening port, and Ethernet jumbo frames. Administrators should enable jumbo frames and select "9000" as the bytes/frame size.

Administrators should note that if they have enabled jumbo frames on the storage, they must also do so for all devices across the network (including the host, target, and any switches or routers in between). If administrators plan to use the Internet Control Message Protocol (ICMP) `ping` command to test network connectivity, they must also select the "Enable ICMP PING responses" check box.

After configuring these settings, administrators can use the iSCSI initiator on the host system to discover the PowerVault MD3000i target. After doing so, they can go to the Configure tab in Dell Modular Disk Storage Manager and select "Configure Host Access - Manual," enter the host name into the configuration, select the OS, and click the Next button. On the next screen, they can select iSCSI initiators. If a known initiator is displayed, they can highlight it, click "Add," and then click the Next button. Otherwise, they can select "New," enter

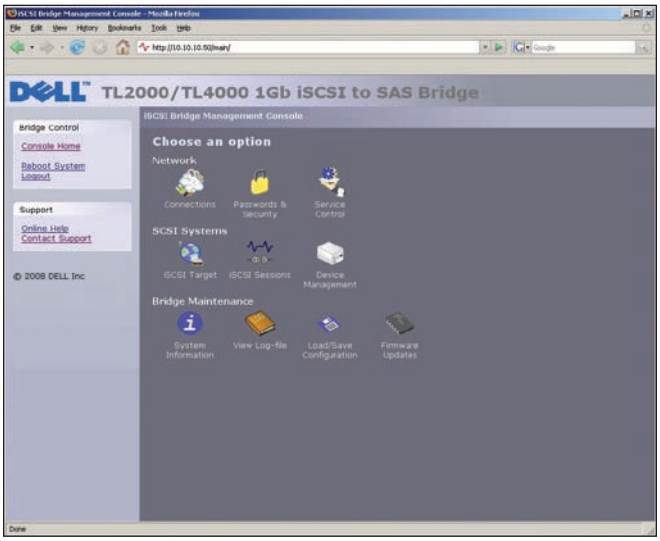

Figure 2. *iSCSI Bridge Management Console for Dell PowerVault TL2000 and PowerVault TL4000 tape libraries*

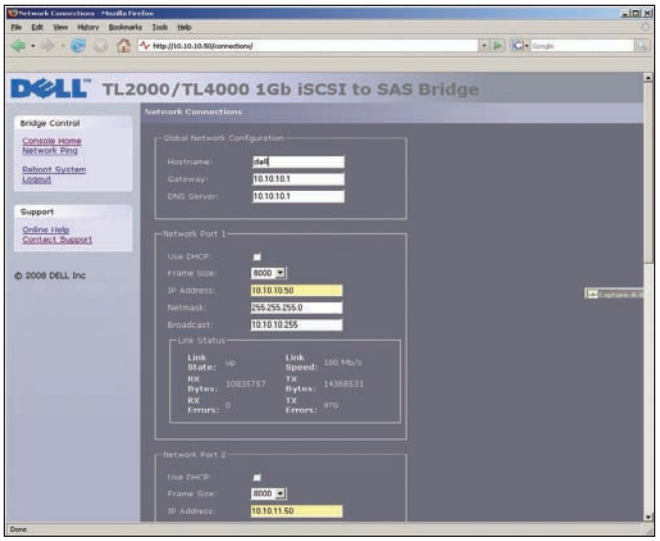

Figure 3. *Network Connections settings for Dell PowerVault TL2000 and PowerVault TL4000 tape libraries*

the iSCSI initiator name, and click the Next button. After selecting whether the host is on a Microsoft cluster, they can click the Finish button.

If administrators want to use CHAP in the iSCSI network, they can now enable it in the Dell Modular Disk Storage Manager iSCSI tab through the Change Target Authentication and Enter Manual Authentication Permissions settings.

DEPLOYING SEAMLESS, COST-EFFECTIVE TAPE BACKUPS

The iSCSI-to-SAS bridge cards available for Dell PowerVault TL2000 and PowerVault TL4000 tape libraries are designed to let organizations easily integrate tape backup targets with their iSCSI SAN with minimal or no degradation in transfer speeds. This flexible option enables organizations to implement tape backups seamlessly and cost-effectively in iSCSI environments.

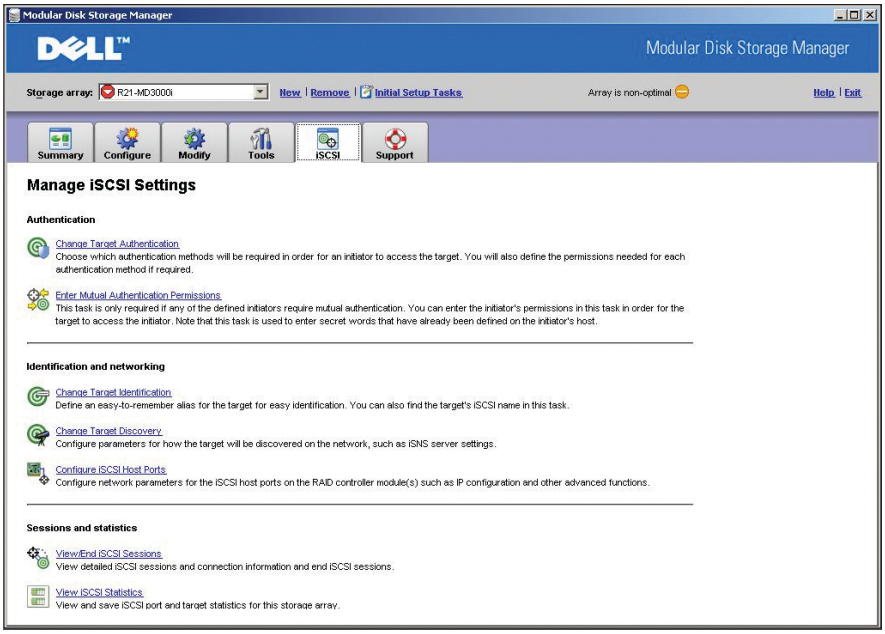

Figure 4. *iSCSI tab for a Dell PowerVault MD3000i SAN array in Dell Modular Disk Storage Manager*

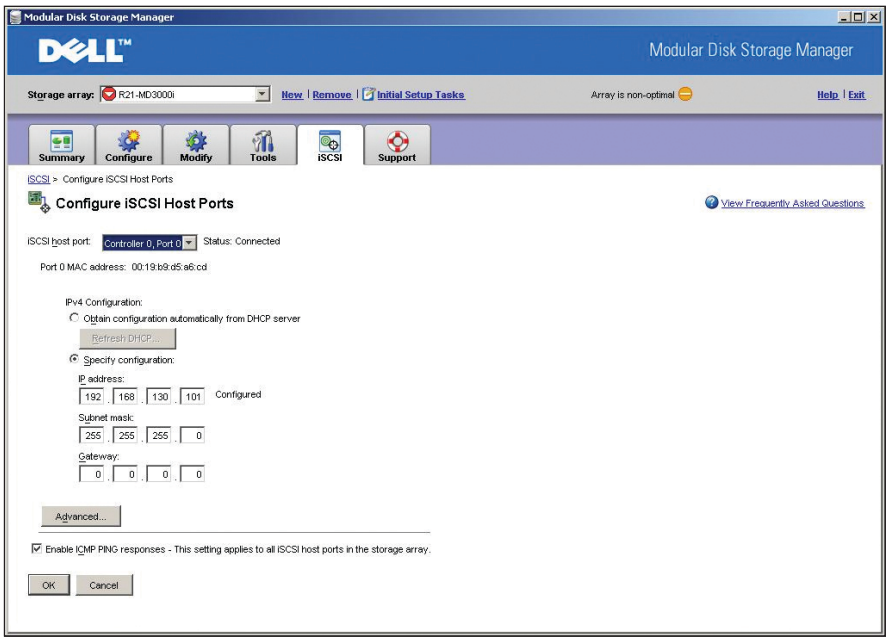

Figure 5. *Configure iSCSI Host Ports screen in Dell Modular Disk Storage Manager*

Michael Linane is a lead engineer on the Tape Development team at Dell. He has degrees in Electrical Engineering, Computer Science, and the Mathematical Sciences from Rice University, and joined Dell in 2004.

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Dell PowerVault storage:
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THE DELL POWERVAULT NF100: SIMPLIFIED FILE SHARING AND BACKUP FOR SMBs

By Brian Garrett
Claude Bouffard

The Dell™ PowerVault™ NF100 storage server is designed to provide simplified, cost-effective file sharing and data protection for small and medium businesses (SMBs). In validation tests performed by the Enterprise Strategy Group, the test team deployed the system out of the box in less than 15 minutes and configured it to provide centralized backup and recovery.

Related Categories:

Backup

Data consolidation and management

Dell PowerVault storage

Network attached storage (NAS)

Storage

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As small and medium businesses (SMBs) generate increasing amounts of critical data, the need to flexibly access and protect those resources becomes increasingly important. SMBs have traditionally shared unstructured file data by creating network shares for files stored within desktops and servers. This direct attach storage (DAS) approach is often quick and easy at first—but can also become complex, expensive, and difficult to manage as capacity and backup requirements grow, straining limited budgets and IT staffs. For these organizations, network attached storage (NAS) can provide a simple and cost-effective alternative that supports both file sharing and data protection.

In July 2008, the Enterprise Strategy Group (ESG) Lab evaluated a Dell PowerVault NF100 NAS server as a company-wide repository for file sharing and as a backup and recovery platform for both local and remote users. ESG—a typical small business supporting 6 remote users and 30 local users, with several employees either mobile or working from home at any given time—had been relying on DAS systems and two legacy NAS appliances to share files, and was seeking a way to simplify its storage infrastructure. ESG found that the PowerVault NF100 provided a convenient, easy-to-install NAS server for centrally managed file sharing and backup.

DELL POWERVAULT NF FAMILY STORAGE

The Dell PowerVault NF family of storage servers is designed to provide simplified, cost-effective NAS optimized for SMB file sharing and backup. Dell preconfigures the RAID and preinstalls the Microsoft® Windows® Storage Server 2003 Release 2 (R2) OS at the factory, providing a comprehensive, easy-to-deploy system for file sharing right out of the box. No additional software or client licenses are required unless administrators choose to install supported third-party backup, antivirus, or other software. Third-party backup software enables PowerVault NF storage to function as a centrally managed backup-to-disk platform that helps protect local and remote user data.

The PowerVault NF family is available in tower and rack-mountable form factors to help meet a wide variety of storage needs. The entry-level PowerVault NF100 evaluated by ESG is a tower system that supports up to 4 TB of Serial ATA (SATA) capacity, and is designed specifically for SMBs that need a simplified file-sharing and backup platform.

ESG LAB VALIDATION RESULTS

Ordering and configuring the Dell PowerVault NF100 through the Dell Web site was quick and easy for the ESG Lab. The system arrived with four 500 GB SATA disk drives set up in a RAID-5 configuration, with Microsoft Windows Storage Server 2003 R2

preinstalled on one 12 GB partition and the remaining capacity available for file sharing and backup data.

The ESG Lab team began the validation by unpacking the system and connecting a keyboard, monitor, and mouse. The team then connected the system to the network, powered it up, configured its network settings, and used Dell OpenManage™ Server Administrator software to review the configuration. They then created a shared drive using the File Server Management wizard in Windows Storage Server 2003, after which end users were able to map the file share on their desktops or laptops, where it appeared as a typical drive letter. The system was serving files to end users less than 15 minutes after the ESG Lab team had opened the box. Creating, sharing, and managing files was straightforward and intuitive, and end users had no problems learning how to use the shared drive.

The ESG Lab team next evaluated the PowerVault NF100 as a backup and recovery platform for local and remote users. They installed Symantec™ Backup Exec™ 12.0 software on one of the PowerVault NF100 drives and installed the Backup Exec remote agent on a pair of laptops, one for a local user at company headquarters and one for a mobile user connected through a cable modem. Approximately 222 MB of typical office data files was backed up from each laptop and restored to an alternative location, with a file comparison program then verifying the integrity of the restored data. The team also used Backup Exec to back up approximately 4.5 GB of shared data on the PowerVault NF100 itself. Backup Exec reported that during this internal operation, the PowerVault NF100 backed up the shared data at an impressive rate of 5,262 MB/min (approximately 88 MB/sec).

Figure 1 shows the ESG environment before and after the file-sharing and backup systems were consolidated onto the PowerVault NF100. Administrators should be sure to carry out disk capacity and performance planning for their environments before choosing and configuring a NAS system, and should perform network planning before deploying a network-intensive backup-to-disk system.

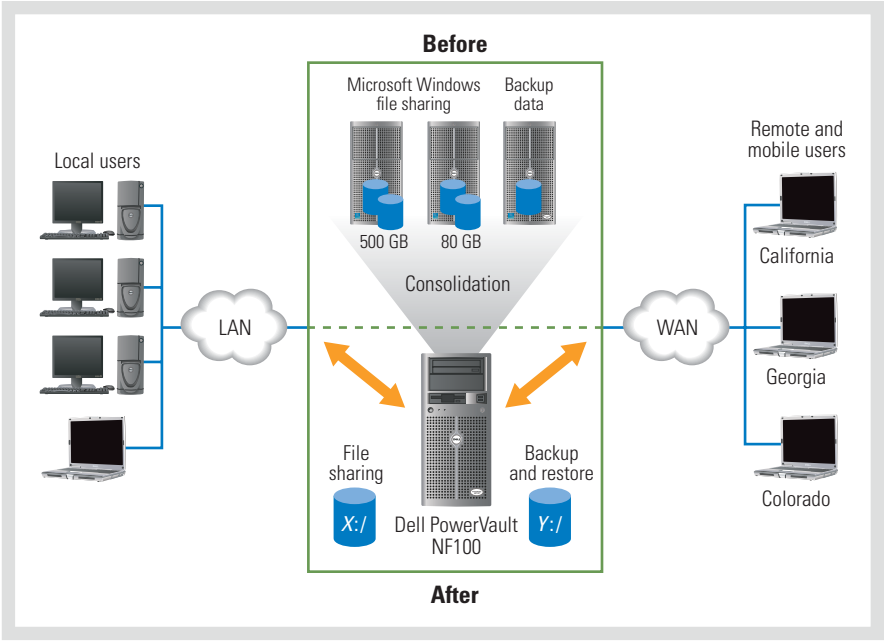

Figure 1. *The Dell PowerVault NF100 storage server helped ESG consolidate and simplify its file-sharing and backup infrastructure*

SIMPLIFIED FILE SHARING AND BACKUP

The ESG Lab team was impressed with how easy it was to order, configure, and manage the Dell PowerVault NF100. Rapid, simple deployment is often a key requirement for SMBs, and the PowerVault NF100 was ready to go right out of the box, with the ESG Lab team able to deploy it and begin serving files to end users in less than 15 minutes. For SMBs contending with rising amounts of data, the PowerVault NF100 provides a simplified, cost-effective alternative to DAS for file sharing and centralized data protection.

Brian Garrett is the technical director for the ESG Lab, providing independent, hands-on validation and analysis of emerging technologies and products in the storage, data management, and information security industries. Before joining ESG, Brian was a founder and CTO of I/O Integrity. He has a degree in Mathematics from Rutgers University and has been awarded nine patents.

Claude Bouffard performs independent, hands-on validation and analysis of emerging storage hardware and software products for the ESG Lab and provides coverage of storage systems as an analyst. Before joining ESG, Claude conducted hands-on testing, qualification, validation, and performance analysis of backup data management applications, tape and disk storage systems, and disk-based backup technologies for both EMC and Quantum as a principal software engineer.

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Full ESG Lab validation report:
DELL.COM/Downloads/Global/Products/Pvaul/En/pvaul_nf100_esglab_validation.pdf

Dell PowerVault storage:
DELL.COM/PowerVault

UNIFYING COMMUNICATIONS

M Dados, a hosted services provider based in Portugal, implements a virtualized environment based on high-performance Dell™ PowerEdge™ blade servers—reducing the number of required physical servers by 40 percent while helping simplify management, business continuity, and scalability.

CHALLENGE

To deliver services based on Microsoft® unified communications, M Dados needed a high-performance hardware infrastructure that included the latest quad-core Intel® Xeon® processors.

SOLUTION

The company implemented a new environment based on Dell PowerEdge blade servers running VMware® virtualization software to support these services.

BENEFITS

- Virtualization helped reduce the number of required physical servers by 40 percent while also helping to reduce server provisioning time from days to hours and to reduce the risk associated with hardware failures.
- Energy-efficient Dell PowerEdge blade servers meet high performance demands while helping simplify management and scalability.
- Dell/EMC storage can scale cost-effectively to help meet growing data requirements.
- Comprehensive Dell support helped ensure a seamless transition.

Related Categories:
Blade servers, case study, Dell PowerEdge blade servers, M Dados, Microsoft, unified communications, virtualization, VMware

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The evolution of unified communications—where e-mails are accessed over the telephone and calls are made using a PC—can offer huge business opportunities for hosted service suppliers. Yet the demands for providing such unified communications are high. The software is processor intensive and relies on high-performance servers, which can be expensive to power and complex to manage.

These challenges were a concern for M Dados, a hosted services provider based in Portugal offering leading-edge communications technologies. The company, a subsidiary of the José de Mello Group, planned to roll out a suite of services based on Microsoft unified communications using solutions such as Microsoft Exchange Server 2007, Microsoft Office Communications Server 2007, and Microsoft Office Communicator 2007. The suite enables businesses to unite desktop telephony, e-mail, instant messaging, fax, Internet, legacy phone networks, and voice mail. Implementing and optimizing new services like unified communications, however, requires high performance with a small footprint, low energy consumption, and simplified management.

CONSOLIDATING ON HIGH-PERFORMANCE BLADE SERVERS

Dell has worked with M Dados for seven years, helping meet all of the company's IT requirements over that time. Manuel Castelo Branco, IT administrator at M Dados, and the team keep track of Dell's newest server and management software and update the data center with new technology on a regular basis. Three years ago, for example, Jorge Gonçalves, technical director at M Dados, rolled out VMware ESX Server virtualization software on Dell PowerEdge 1855 blade servers. He liked the performance and manageability of the blades so much that he upgraded to the PowerEdge 1955 blade server model when it became available and added a Dell/EMC CX500 storage area network (SAN) that is easy to scale and delivers business continuity.

Castelo Branco says, "At the time, adoption of VMware was the best thing that could have happened to us." Suddenly, the company was running three or four

virtual machines on a single physical server, helping consolidate its server footprint. The IT team was also provisioning new servers in a few hours instead of a few days, helping significantly improve the company's ability to react to customer demands.

Castelo Branco turned to Dell for the right server hardware to deploy a Microsoft unified communications environment. "Because Dell understands our business needs, it delivers the right solutions quickly," says Castelo Branco. "Due to its alliance with Microsoft, it was able to offer a suitable IT solution to successfully deliver a unified communication infrastructure."

According to Microsoft, servers supporting a unified communications infrastructure required a minimum configuration of dual-core processors at 2.6 GHz and 4 GB of RAM. Says Castelo Branco, "Dell PowerEdge M600 blades had the power to deliver a Microsoft unified communications environment, offering dual- or quad-core Intel Xeon processing and more than enough RAM."

Dell Global Infrastructure Consulting Services proposed a design that included the latest Dell PowerEdge M600 blade servers featuring quad-core Intel Xeon processors paired with a Dell PowerEdge M1000e modular blade enclosure. The enclosure is one of the most energy-efficient, flexible, and manageable blade units available. In addition, it is designed to support the next generation of Dell blades.

It does not take Castelo Branco long to calculate the savings from virtualization. "By choosing VMware ESX Server 3.5 Update 2 software running on Dell PowerEdge M600 blade servers, we can deliver our Microsoft unified communications environment with 40 percent fewer servers," he says. Six Dell blades are doing the work of 10 high-end physical servers, which each would have required dual-core Intel Xeon processors and at least 4 GB of RAM.

> **"We've done our homework. We could be seeing energy reductions that are 19 percent higher than with other blade solutions."**
>
> —Manuel Castelo Branco
> IT administrator at M Dados
> January 2009

Castelo Branco expects significant savings in energy consumption from the Dell blade servers, even when compared with other blade offerings. "We've done our homework," he says. "We could be seeing energy reductions that are 19 percent higher than with other blade solutions." He adds, "The performance has been excellent and there hasn't been any downtime."

ENHANCING BUSINESS CONTINUITY AND SCALABILITY

Because the new unified communications environment runs virtualization technology, the risk associated with a hardware failure is significantly reduced—if one server fails, the virtual machines can be switched to another physical server in real time. Day to day, this environment enables the IT team to respond quickly to sudden increases in data loads on individual servers, and to perform hardware upgrades and maintenance with very little impact on its business-critical operations.

The blades are engineered to scale easily with demand. A key factor here is the Dell PowerEdge M1000e enclosure, which has additional I/O slots and switch options to help meet increasing demands for I/O consumption. Likewise, the Dell/EMC CX500 SAN, which has 4 GB of memory cache and holds up to 17.5 TB of data with Fibre Channel drives, can scale to help meet the company's growing data requirements.

"Success in our market depends on reacting instantly to customer needs," says Castelo Branco. "If they want a new service or to add a few hundred e-mail boxes, we have to do it fast. The Dell infrastructure supporting M Dados ensures we are agile enough to take advantage of business opportunities when they arise."

SUPPORTING A SEAMLESS TRANSITION

Just like previous Dell deployment projects, Dell is supporting M Dados, helping create the new unified communications infrastructure. For example, Dell is configuring the systems and handling the certification side of the project to help ensure the work remains on schedule. And because M Dados has Dell ProSupport for IT, the environment will remain highly available both now and in the years ahead. "Dell was the only company that offered us a full support package," says Gonçalves. "The excellent level of service and the fact it can deliver solutions quickly without using intermediaries were key reasons for choosing Dell."

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Dell PowerEdge blade servers:
DELL.COM/Blades

COST-EFFECTIVE AND EFFICIENT VIRTUALIZATION

Virtualized Dell™ PowerEdge™ blade servers help Betagro Public Company Limited, headquartered in Thailand, lower energy consumption by 40 percent, reduce data center space by 30 percent, and cost-effectively scale its infrastructure in support of business expansion.

CHALLENGE

As its business expanded, Betagro Public Company Limited required a robust IT infrastructure that could scale with the company's growth and support a rapidly evolving application environment.

SOLUTION

Betagro deployed Dell PowerEdge M600 blade servers running VMware® virtualization software to deliver a standardized and centralized platform that is easy to manage and offers high availability.

BENEFITS

- Compared with the previous solution, Dell PowerEdge blade servers helped reduce energy use by 40 percent and data center size by 30 percent.
- Dell PowerEdge blade servers help deliver high availability with resilient failover features.
- Competitive pricing and strong service support help ensure cost-effective infrastructure growth.

Related Categories:
Betagro Public Company Limited, blade servers, case study, Dell PowerEdge blade servers, green IT, power and cooling, virtualization, VMware

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

Founded in 1967, Betagro Public Company Limited, part of Thailand conglomerate Betagro Group, is a leader in the country's integrated agricultural sector. Starting out as a feed mill in Prapradaeng, Samut Prakarn Province, the Betagro Group now has more than 30 subsidiaries and specializes in the production and distribution of high-quality animal feed, livestock, and animal health products. The company boasts a huge agricultural base ranging from swine to chicken farms and contract pig farms.

Continual investments in technology have supported its expansion to include a wide spectrum of services. Infrastructure investments, particularly in technology for its food laboratories, have made the company synonymous with high-quality products. Betagro's attitude toward IT is no different. "IT is the strategic building block that enables our business to gain a competitive advantage and supports our organization in enhancing efficiency," explains Nikorn Eamvorasombat, director of the Information Technology Center at Betagro Public Company Limited.

DESIGNING A ROBUST IT INFRASTRUCTURE

Growth brought challenges in managing and communicating with a workforce of more than 3,500 employees. "As we expand the business physically and increase staff resources, planning and designing an IT infrastructure within reasonable budgets becomes critical," notes Eamvorasombat. To help address this concern, Betagro needed a solution that could offer superb performance at a competitive price and provide sufficient room for expansion as the company pursued its aggressive growth strategy. "We carefully considered all feedback from our business units," says Eamvorasombat, "and once we had clearly identified the job requirements, the IT department designed an infrastructure plan. We used this as the basis for the project."

Betagro established stringent criteria for selecting the appropriate vendor and solution, including reliable system performance, pre- and post-sales services, and competitive pricing. "Although we had a five-year relationship with Dell as a preferred IT partner, we did evaluate several alternatives before we made our final selection," says Eamvorasombat. After a comparative analysis,

Dell was selected as the best overall solution provider. "It helped that the Dell team kept our IT department updated regularly on products and services," says Eamvorasombat.

> **"By deploying Dell blade servers, we realized 40 percent energy savings over our previous solution and reduced our data center size by 30 percent—all without any reduction in performance."**
>
> —Nikorn Eamvorasombat
> Director of the Information Technology Center at Betagro
> September 2008

REDUCING ENERGY USE

Betagro and Dell jointly reviewed the design of the company's infrastructure plan. Dell had initially offered a proof-of-concept solution and proposed a blade server configuration with VMware ESX virtualization software to consolidate Betagro's servers—helping to save space in the company's data center and simplify management of multiple servers. "There were some differences between Dell's proposal and our original infrastructure plan," notes Eamvorasombat. "For example, we needed to run numerous applications for company subsidiaries, such as an ERP system that would have required more servers and expanded the data center. With the previous solution, we would have needed to propose high budgets to our board and make plans to rebuild the room, purchase the servers, and prioritize activities to ensure completion within four to six months. In the end we decided to start with fewer VMware licenses and expand the system once the practical usage was proven in the day-to-day operations."

The project was divided into four- to six-week phases. Betagro was pleased with the smoothness of the first phase, and after this successful trial run, the company moved on to the second phase while the IT department looked into expanding its VMware licenses to move more applications onto the platform. "By deploying Dell blade servers, we realized 40 percent energy savings over our previous solution and reduced our data center size by 30 percent—all without any reduction in performance," says Eamvorasombat. "The Dell platform is robust and scalable, so we pay less and achieve high performance. We are very satisfied with the level of services Dell provides and the attentiveness the team brings to projects."

Overall, the Dell and VMware solution offered Betagro the best balance between price and performance. "The key differentiators for us in selecting this solution were the excellent service record and competitive pricing from Dell," remarks Eamvorasombat. He adds that the return on investment clearly favored using Dell PowerEdge blade servers with VMware ESX. "From a cost perspective, we would have had to spend more on multiple stand-alone servers to support our growing application environment," says Eamvorasombat. "Dell blade servers are a better fit for us by providing a way to consolidate all our applications onto a standardized platform."

SUPPORTING RAPID PROJECT LAUNCHES

"Users are impressed that the Dell blade servers can run applications with maximum uptime," says Eamvorasombat. "Because of our growth, we always have new projects under development. Dell blade servers combined with VMware virtualization let us create virtual servers to support faster project launches. We can now consolidate all our servers, which were previously across multiple platforms, into one."

> **"Dell blade servers are a better fit for us by providing a way to consolidate all our applications onto a standardized platform."**
>
> —Nikorn Eamvorasombat
> Director of the Information Technology Center at Betagro
> September 2008

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Dell PowerEdge blade servers:
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ACCOUNTING FOR THE FUTURE

By consolidating its aging infrastructure onto Dell™ PowerEdge™ blade servers and Dell/EMC storage, the American Institute of Certified Public Accountants improved online services, reduced its server footprint by 98 percent, and saved over US$3 million.

CHALLENGE

In conjunction with a data center move, the American Institute of Certified Public Accountants (AICPA) sought to consolidate 250 Web and application servers onto a scalable server and storage infrastructure and improve online service availability.

SOLUTION

By combining Dell PowerEdge servers, Dell/EMC storage, and VMware® virtualization software, the AICPA reduced its hardware footprint and energy needs while increasing application availability.

BENEFITS

- Consolidating to a virtualized infrastructure helped reduce hardware footprint by 98 percent and save over US$3 million.
- VMware vMotion™ technology helps provide 99.999 percent uptime for online member services.
- Simplified management helps reduce systems administration time by approximately 60 percent.

Related Categories:
American Institute of CPAs, blade servers, case study, Dell PowerEdge blade servers, Dell/EMC storage, virtualization, VMware

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

While IT organizations often struggle to do more with less, finance departments are traditionally wary of new technology investments. This is not the case, however, at the American Institute of Certified Public Accountants (AICPA), a nonprofit organization of more than 330,000 members. "We have IT-savvy accountants who understand the benefits of keeping up with technology," says Stan Noel, systems engineer at the AICPA. "So it's not hard to sell them on a great idea."

CONSOLIDATING IT INFRASTRUCTURE

One of those great ideas was migrating an aging infrastructure of 250 stand-alone HP servers to just five Dell PowerEdge 6850 servers with Intel® Xeon® processors running VMware virtualization software purchased through Dell. "When we moved our headquarters from Jersey City to Durham, North Carolina, it didn't make sense to move the old hardware and have the same problems here," says Noel. "I've been a Dell advocate for years, so I was very happy that the organization decided to standardize on Dell."

The AICPA also deployed a Dell/EMC CX300 storage area network (SAN) as well as Dell OptiPlex™ 745 desktops and Dell Latitude™ D610, Latitude D620, and Latitude D630 laptops. "We are now completely a Dell organization," says Noel. "Having one point of contact for our PCs, servers, storage, and VMware is very helpful."

Noel led the migration from physical servers to virtualized servers, using PlateSpin® software from Novell to accelerate the process. "PlateSpin allows for a live transfer, where both the source and the target servers are up and running during the migration," says Noel. "We were able to migrate 20 servers every two weeks without any downtime." As a result of the project, the AICPA transformed an 800-square-foot data center into just 16 square feet—reducing the server footprint by 98 percent and cabling by about 99 percent.

The consolidation has helped the AICPA save money in other ways as well. "Consolidating our infrastructure onto Dell servers running VMware saved us over US$2 million in extended warranties on our old servers," says Noel. "In

addition, virtualization has saved us US$1.6 million on new physical hardware, and we're saving around US$200,000 a year in energy costs."

The infrastructure has also reduced systems administration time by approximately 60 percent, according to Noel. "I know it has saved me about 75 percent of my time," he says. "And it has saved our other two engineers around 25 to 30 percent of their time, because we centralized a lot of the services that used to be hosted in each of our remote offices and virtualized most of the applications."

> **"Consolidating our infrastructure onto Dell servers running VMware saved us over US$2 million in extended warranties on our old servers."**
>
> —Stan Noel
> Systems engineer at the AICPA
> October 2008

ACCELERATING SERVER DEPLOYMENT

To support new initiatives, the AICPA added a Dell PowerEdge M1000e modular blade enclosure with PowerEdge M600 and PowerEdge M605 blade servers. Noel appreciated the consistency between the blades' management interface and the Dell OpenManage™ systems management tools he was already familiar with. "I was so impressed with how easy the 10th-generation Dell blades were to set up," says Noel. "The interface is very intuitive, and it was easy to get the blades talking to the SAN. The documentation was easy to read and follow. I literally had the book open for 15 minutes and we were off and running. Dell Deployment Services came out later and checked that everything was properly configured, but we were able to do pretty much the entire installation ourselves."

The first task for the new Dell blades was hosting the back-end Microsoft® SQL Server® database for the organization's Microsoft SharePoint® implementation. "We were doing the SharePoint upgrade migration, and we had a Friday night set at midnight to start the SQL database move from one of our old HP servers to the M600 blade," says Noel. "We had the blade up and running and ready for the SQL migration two hours before it was due." The fact that Dell was able to ship the blades quickly was also a big help. "Our Dell rep was able to get the enclosure and blades here fast," says Noel. "We were able to stay on track with our SharePoint project completion deadline thanks to Dell."

SUPPORTING HIGH AVAILABILITY

The AICPA can now provide 99.999 percent uptime for its Web sites and accounting certification services—another benefit of the virtualized infrastructure. Using VMware vMotion technology for load balancing and failover enables the AICPA to offer its members the best possible service. "We didn't keep metrics on uptime before the server consolidation, but availability for online services was sometimes a problem," says Noel. "With the Dell infrastructure, we're truly running at five-nines availability for our online member services. If we need to take a physical server offline for any reason, we can just vMotion the virtual servers over to another physical server with no downtime."

With the new infrastructure in place, the AICPA also decided to implement a disaster recovery plan. The organization purchased a Dell/EMC CX3-10c SAN for its New York office to support this plan and help ensure smooth recovery of data if disaster strikes its Durham data center.

ENABLING NEW PROJECTS

Thanks to its powerful, scalable, and compact Dell infrastructure, the AICPA can now take on new IT projects that it couldn't have considered before. "A lot of projects that had been waiting for hardware acquisitions are suddenly possible," says Noel. "Instead of buying a dedicated server for new applications, I can just add new virtual servers. So there were about a dozen projects that came to the table just after we virtualized everything, including revising current applications that were limited by the old hardware and establishing true development, staging, and test production areas."

Noel concludes, "Dell has a very good reputation and very reliable hardware, and everybody has been extremely happy with what we have done so far. By working with Dell, we are in prime position to continue to enhance the services we deliver to our members."

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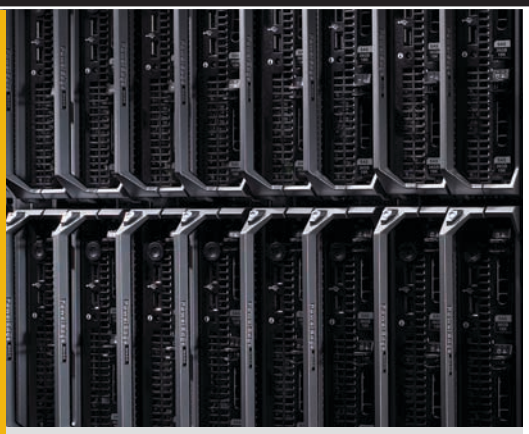

BLADES GIVE TRADING APPLICATION AN EDGE

Tora Trading Services, headquartered in Japan, uses Dell™ PowerEdge™ blade servers to optimize its IT infrastructure—reducing energy use by 30 percent, space requirements by 35 percent, and setup time by up to 90 percent.

CHALLENGE

Power constraints and a reliance on 1U and 2U rack servers left Tora Trading Services with a complex, inefficient infrastructure that could not scale to provide necessary resources.

SOLUTION

Working with Dell, Tora migrated its trading application to three Dell PowerEdge M1000e modular blade enclosures housing 33 PowerEdge M600 blade servers.

BENEFITS

- Power management and cooling features in Dell blade servers help reduce energy use by 30 percent.
- Dell blade servers help reduce physical installation time by up to 90 percent while greatly simplifying systems management.
- Compact, modular blade design helps save time and infrastructure costs, including reducing hardware footprint by 35 percent.

Related Categories:
Blade servers, case study, Dell PowerEdge blade servers, green IT, power and cooling, Tora Trading Services

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

Tora Trading Services is the recognized leader in electronic trading systems and liquidity access for Asia. Its TORA Compass trading platform is used by clients across Asia, the United States, and Europe, and accounts for more than 25 percent of the electronic trading flow on the Tokyo Stock Exchange.

Such demanding work and high availability require an efficient, scalable, and robust IT infrastructure. However, the company's existing data centers could not meet these requirements because they depended on 1U and 2U servers that consumed significant power and management resources. "Because our business is growing rapidly, the challenge is to create an efficient data center by reducing power consumption and simplifying server management," says Keith S. Smith, Jr., systems engineer at Tora.

FLEXIBLE, COST-EFFECTIVE BLADE SERVERS

Tora concluded that it needed a system that would draw less power than its existing servers and could integrate advanced I/O connectivity, including multiple network interface card ports and Fibre Channel connectivity. The company also wanted a built-in, streamlined, simple management system that met its stringent redundancy requirements.

After evaluating offerings from several vendors, Tora was impressed by Dell's solution feature set and superior cost advantage. "We've been a Dell customer for a while, and chose its blade servers in part because we wanted to continue to receive the high level of technology, support, and price competitiveness the company provides," says Smith.

Tora selected Dell PowerEdge M1000e modular blade enclosures and asked Dell Infrastructure Consulting Services to help determine the best blade server configuration. As a result, the company deployed 33 PowerEdge M600 blade servers and three PowerEdge M1000e enclosures in its Hong Kong data center, and will purchase three more enclosures in the near future. The company also plans to replace existing 1U and 2U servers in the Tokyo data center with blade servers. Tora received the servers and completed the installation and Linux® OS setup in only two weeks.

"Dell was invaluable in the assessment and design phase. This is because we were taking a chance on a system that had not yet been released. Dell demonstrated

its excellent customer service in getting us crucial unreleased information in time to make our decisions," Smith notes. "Additionally, Dell worked closely with Tora to achieve its desired configuration at an attractive cost."

> **"Dell was invaluable in the assessment and design phase. Dell demonstrated its excellent customer service in getting us crucial unreleased information in time to make our decisions."**
>
> —Keith S. Smith Jr.
> Systems engineer at Tora Trading Services
> October 2008

EFFICIENT ENERGY USE

Power constraints limited the number of servers the company could fit in a rack with proper power redundancy. However, the blade servers' enhanced design features immediately reduced energy use. "We had significant power savings when we installed the three enclosures," Smith remarks. "For example, we tested 16 of our original 1U 1950 rack servers at 4,266 VA as opposed to 3,016 VA with one of the enclosures housing 16 blades. That's a 30 percent power decrease."

Smith also cites design features such as the high-flow/low-power fans, ultra-efficient power supply, and optimized airflow as useful in efficient power consumption management. "Intelligent design features on the Dell blades, like the dynamic power management tool, ensure we can operate the blades within a specified power envelope," Smith says.

SIMPLIFIED MANAGEMENT AND DEPLOYMENT

The Dell blade servers have greatly simplified systems management. Tora can now easily manage the entire system with the built-in Chassis Management Controller, and a single console lets staff manage multiple enclosures and blades through redundant, secure access paths. In addition, real-time reporting for enclosure and blade power consumption through the Integrated Dell Remote Access Controller (iDRAC) greatly enhances the visibility and accuracy of resource utilization. "The entire blade solution is very user-friendly; it's wonderful to have everything in one place," Smith says.

Tora can also deploy new server resources quickly and efficiently. "Dell's unified Web interface saves us a tremendous amount of administration and setup time on our blade servers," Smith remarks. "For example, with 1U and 2U servers, initial setup and pre-OS configuration can take several hours for 16 1U servers, compared to just 5 to 10 minutes with a chassis full of blades." The unified Web interface can remotely shut down a blade in minutes, compared with over 30 minutes to arrange a remote hands service to press the power button on a standard rack server. Additionally, power readings take only 2 minutes with blade servers, which is useful for checking power circuit utilization before adding new equipment.

The flexibility of the Dell blade design also simplifies hardware access and configuration. "It only takes us 2 minutes to slide a blade into the chassis and have it ready for use. In our experience, a similar task with 1U and 2U servers would take more than 20 minutes, even with an experienced engineer on-site," says Smith. He also notes that configuring the I/O module takes only 5 minutes on blade servers and eliminates the need for network patching to a separate Ethernet switch that is associated with 1U and 2U servers.

REDUCED SPACE AND INFRASTRUCTURE COSTS

One of the biggest benefits of using Dell blade servers is the modular design. The ability to install components such as switches into the enclosure, for example, has saved Tora time and infrastructure costs. "We could not have done this without Dell's FlexIO switch technology," says Smith. "We can scale to provide more stacking functionality without having to throw out existing hardware investments."

Tora has also benefited from the offer of greater-density blade servers compared with 1U servers. "The Dell PowerEdge M600 blade servers provide 35 percent greater density than our 1U servers. They are excellent in saving space costs," notes Smith.

"We rely on Dell blades because they allow us to get the most out of our data center space at the best price," Smith says. "Dell blades are the right solution for our business because the reduced power, space, and management requirements allow us to focus our resources. We are confident that our clients are benefiting from the most reliable and efficient technology available today."

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Dell PowerEdge blade servers:
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SIMPLIFYING IT WITH INTEROPERABLE MICROSOFT–NOVELL VIRTUALIZATION SOLUTIONS ON DELL SERVERS

Virtualization solutions enable data center administrators to maximize efficiency and simplify management by combining workloads onto fewer servers. Dell™ PowerEdge™ rack and blade servers running the Microsoft® Windows Server® 2008 OS with Hyper-V™ technology and the Novell® SUSE® Linux® Enterprise Server 10 OS create flexible, robust solutions designed to fully leverage the benefits offered by virtualization.

Related Categories:

Dell PowerEdge servers
Microsoft
Microsoft Hyper-V
Microsoft Windows Server 2008
Novell
Novell SUSE Linux
Virtualization

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Many enterprises today are running multiple operating systems in their data centers, challenging IT administrators to manage disparate systems while simultaneously working to make the most of IT investments as energy costs continue to rise. Data center hardware is often underutilized, and administrators are overburdened with the task of maintaining various operating systems on tight budgets. Administrators need solutions that allow them to adapt to changing business needs and manage systems effectively.

VIRTUALIZATION AND INNOVATION THROUGH PARTNERSHIP

Enterprises now have choice and flexibility by virtualizing their environments with Dell virtualization solutions that combine Dell servers with Microsoft and Novell software. Dell provides a simple path to virtualization with solutions that enable IT administrators to combine heterogeneous workloads onto a reduced number of physical servers, thereby helping to increase efficiency and reduce costs. By running Windows and Linux operating systems on powerful Dell servers, administrators can create a dynamic virtualized environment designed for optimal resource utilization. The joint effort between Dell and the interoperability partnership of Microsoft and Novell helps ensure that enterprises receive an optimal solution right out of the box.

COMPREHENSIVE SOLUTION

As a result of the Dell partnership with Microsoft and Novell, enterprises can implement comprehensive virtualized solutions on Dell PowerEdge rack and blade servers running Windows Server 2008 with Hyper-V and SUSE Linux Enterprise Server 10. Through combined work on virtualization, the Microsoft and Novell interoperability partnership enables enterprises to run SUSE Linux Enterprise Server 10 as a guest OS on Hyper-V, consolidating workloads onto a reduced number of physical servers for enhanced efficiency and flexibility. IT administrators can implement optimized virtualization solutions on industry-standard Dell hardware designed to provide simple integration and maximum reliability. Enterprises receive exceptional enterprise-level hardware and software support from Dell ProSupport and IP assurance[1] from Microsoft and Novell.

[1] To learn more about the patent agreement between Microsoft and Novell for interoperability collaboration, visit www.microsoft.com/interop/msnovellcollab/patent_agreement.mspx.

ADVANCED VIRTUALIZATION TECHNOLOGY

With Dell virtualization solutions, enterprises can take full advantage of a powerful set of tools and hardware. Dell PowerEdge rack and blade servers utilize multi-core processors designed to create scalable and efficient hardware platforms for virtualization solutions. Microsoft Windows Server 2008 with Hyper-V and Novell SUSE Linux Enterprise Server 10 work together seamlessly through application programming interfaces (APIs) that enable communication and assistance for key I/O paths between operating systems. Together, Windows Server 2008 with Hyper-V and SUSE Linux Enterprise Server 10 offer enterprises a powerful virtualization solution designed to reduce the cost and complexity of managing heterogeneous environments.

OPTIMIZED EFFICIENCY AND STREAMLINED MANAGEMENT

With Dell PowerEdge rack and blade servers running Microsoft Windows Server 2008 with Hyper-V and Novell SUSE Linux Enterprise Server 10, IT administrators can increase flexibility and agility in their environments by enhancing resource utilization on individual servers, helping data centers achieve multiple benefits:

- **Flexible and robust interoperability:** IT administrators can maintain a Linux workload while leveraging Hyper-V as the underlying platform using high-performance servers. SUSE Linux Enterprise Server 10 is optimized and validated by Microsoft to operate with Windows Server 2008 as a guest OS running on Hyper-V.[2] As a result of the interoperable Microsoft-Novell solution, administrators can redeploy physical server resources quickly and easily to help meet changing business needs (see Figure 1).
- **Savings on hardware and energy costs:** Virtualization enables IT administrators to reduce server sprawl and consolidate hardware, helping to lower total cost of ownership. Dell PowerEdge rack and blade servers also utilize Dell Energy Smart technology, which is designed to minimize operating costs and improve performance.
- **Reduced complexity and streamlined management:** Leveraging systems with validated interoperability enables administrators to simplify their data center and systems management activities. Administrators can manage both Windows Server 2008 and SUSE Linux Enterprise Server 10 using a single common set of tools such as Microsoft System Center or Novell ZENworks® Orchestrator.
- **Enhanced responsiveness and performance:** Administrators can enhance business continuity and system uptime by advancing reliability and security through a thin, micro-kernelized hypervisor architecture. In addition, Hyper-V enables a secure solution with live backups, Microsoft Volume Shadow Copy Service (VSS), and role-based security through Microsoft Active Directory® integration.
- **World-class support:** Organizations can receive enterprise-level combined support from Dell, Microsoft, and Novell. Dell ProSupport works with Microsoft and Novell to help ensure that enterprises receive the support they need.

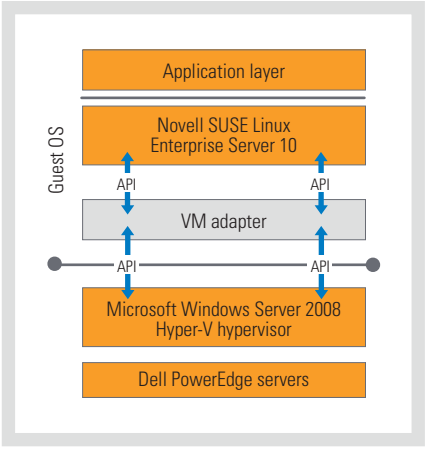

Figure 1. *Virtualization with Dell server hardware and Microsoft and Novell software enables mutual collaboration on software "adapters" that translate APIs and enhance performance between respective virtualization technologies*

TRANSFORMING DATA CENTERS WITH VIRTUALIZED SOLUTIONS

To address the challenges that data centers face today, such as increased costs and managing disparate systems, IT organizations are turning to virtualization as a way to maximize hardware utilization, streamline management, and reduce costs. Dell, in conjunction with Microsoft and Novell, provides innovative virtualization solutions that allow for enhanced flexibility, reduced energy costs, and a robust infrastructure with world-class support.

> **"Enterprises receive exceptional enterprise-level hardware and software support from Dell ProSupport and IP assurance from Microsoft and Novell."**

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[2] Through engineering efforts in their joint lab in Cambridge, Massachusetts, Microsoft and Novell have optimized SUSE Linux Enterprise Server as a guest OS on Windows Server 2008 Hyper-V. For details, visit www.moreinterop.com.

OVERCOMING 7 KEY CHALLENGES TO VIRTUALIZATION: HOW DELL- AND F5-BASED IT INFRASTRUCTURES SMOOTH THE WAY

While server virtualization promises significant bottom-line business benefits, it can also add significant burdens to network and storage infrastructures. F5® BIG-IP® application delivery networking systems and F5 ARX® Series intelligent file virtualization devices work with Dell™ server and storage platforms to help organizations cost-effectively prepare to meet the demands of virtualization.

Moving to a virtualized environment enables tremendous improvements in data center productivity and flexibility. But virtualization can also burden an IT infrastructure, resulting in decreased performance and availability, compounded by increases in cost and complexity. To help organizations achieve the full benefits of virtualization, F5 Networks offers a range of products designed to prepare network and storage infrastructures for the heightened demands that server virtualization brings—helping to increase availability, enhance performance, and reduce total cost of ownership for virtualized data center environments.

Seven key challenges typically arise when IT organizations migrate to a virtualized environment. By laying the foundation with a suitable network and storage infrastructure, administrators can overcome potential pitfalls and reap bottom-line business benefits. In particular, by facilitating application delivery from storage to application server to Web server to end user, F5 BIG-IP Local Traffic Manager™ (LTM) systems, BIG-IP Global Traffic Manager™ (GTM) systems, and ARX Series intelligent file virtualization devices help organizations enhance data center performance, increase application availability, and reduce the total cost of ownership necessary to support a virtualized environment (see Figure 1). These F5 products are designed to work seamlessly with platforms such as Dell PowerEdge™ servers, Dell EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays, Dell PowerVault™ storage arrays, and EMC® Celerra® storage arrays.

Related Categories:

F5 Networks

Virtualization

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

CHALLENGE #1: RESOURCE STARVATION

Running several virtual machines (VMs) on a single physical server can dramatically increase server utilization, but it can also increase the burden on hardware resources. For example, I/O bottlenecks can occur when multiple VMs on a single server share the same network card, especially in I/O-intensive applications. Although many applications optimize their I/O operations for specific hardware platforms, in a virtualized environment those optimizations are lost in the hypervisor translation layer. Unaddressed, this situation can contribute to degraded network performance and increased response-time latency.

F5 BIG-IP LTM systems are designed to reduce resource overload associated with virtualization by offloading processor-intensive I/O processing such as Secure Sockets Layer (SSL) processing, caching, and compression from VMs to a purpose-built appliance. For example, a VM running an I/O-intensive application may have to process hundreds of SSL-encrypted sessions, which can be very demanding on the host server. BIG-IP LTM systems enable SSL operations to be offloaded to a separate device, relieving individual VMs from the burden of performing computationally expensive SSL processing. Furthermore, offloading network processing helps reduce costs and increase VM density on servers by enabling each physical server to support more VMs than it could otherwise. This approach enables significant overall efficiency enhancements in virtualized environments.

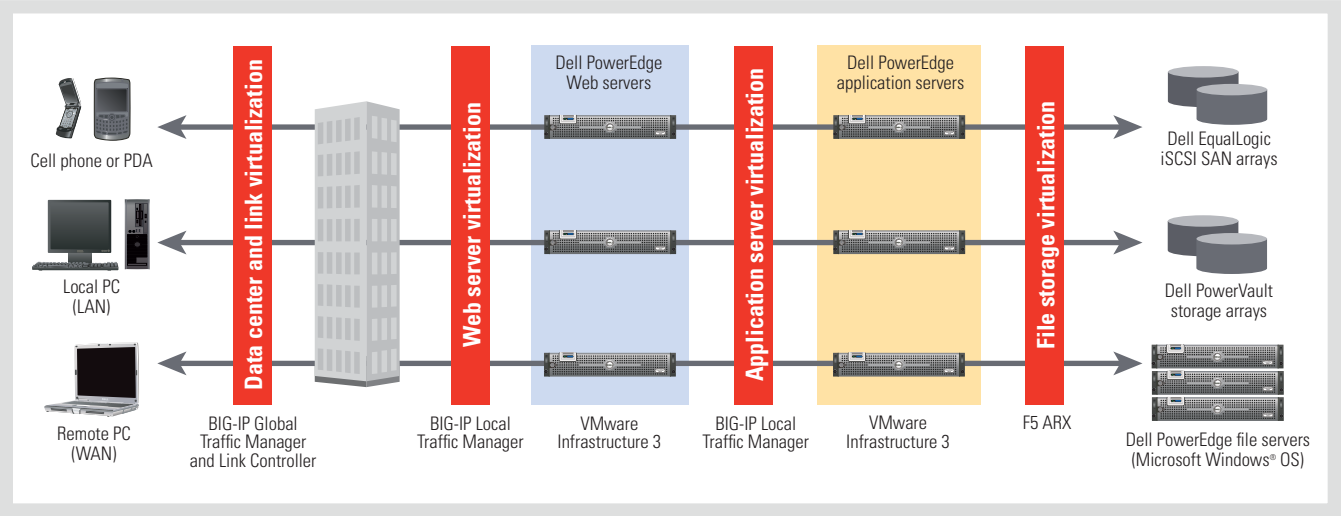

Figure 1. *Preparing IT infrastructure to support the heightened demands of server virtualization*

CHALLENGE #2: LACK OF APPLICATION AWARENESS

Because they virtualize only the OS and not the applications themselves, server virtualization platforms lack the application awareness that is often vital for making effective load-balancing decisions and maintaining state for uninterrupted application availability during VM migrations. Because server virtualization software lacks information about application resources such as network, storage, and database usage, it is not well equipped to make intelligent load-balancing or application traffic decisions, which can lead to suboptimal application performance and availability. Also, because server virtualization platforms are not designed to keep track of application state, key application parameters such as shopping cart information may be lost during a VM migration—often bypassing critical application processes as a result.

F5 BIG-IP LTM systems are designed to maintain awareness of critical application information such as state, performance, and resource usage, and can use this information to help make informed load-balancing decisions and help ensure that application state and availability are maintained during VM migrations. For example, if a shopping cart application must be migrated to a new VM, BIG-IP LTM systems can route the connection to another image while maintaining the current state of the application, helping protect the user state to avoid losing the shopping cart data. Also, BIG-IP LTM systems can continuously monitor a wide range of application health and performance parameters, including resource usage, response time, and availability, and then make routing and load-balancing decisions accordingly.

CHALLENGE #3: UNANTICIPATED COSTS

Virtualization is often implemented to help reduce data center costs by consolidating physical servers, minimizing energy consumption, and enhancing business continuity. However, virtualization can also incur unanticipated hardware and software expenditures to help solve availability, performance, and management problems. For example, when VMs running I/O-intensive applications overwhelm the network cards on physical servers, administrators typically run fewer VMs on each physical server than originally planned—leading to unplanned deployment of additional physical servers. Meanwhile, virtualization increases the demand on storage infrastructures because it requires an enormous amount of capacity to create and store VMware virtual disk (VMDK) images over time. This often requires organizations to purchase unbudgeted storage equipment as well (see the "Challenge #5: Increased storage requirements" section in this article).

Because they are designed to offload most network processing from the server to a specialized device, F5 BIG-IP LTM systems help free servers from the burden of extensive network processing, enabling each server to support additional VMs and thereby helping to reduce the need to purchase unbudgeted hardware.

CHALLENGE #4: UNUSED VIRTUALIZATION FEATURES

Although server virtualization platforms offer many advanced capabilities—such as live VM migration, virtual software switching, and support for virtual LAN segmentation—existing network infrastructures may not be equipped to support such features. For example, a virtualized infrastructure environment managed using VMware® vCenter Server (formerly VMware VirtualCenter) cannot take advantage of VMware Distributed Resource Scheduler (VMware DRS), VMware High Availability (VMware HA), or VMware vMotion™ features unless the network is equipped to manage application connections, maintain application state, and perform load balancing across servers.

F5 BIG-IP LTM systems are integrated with the VMware vCenter Server application programming interface (API), enabling organizations to take advantage of advanced VMware networking capabilities such as VMware DRS and VMware HA. In particular, BIG-IP LTM devices are designed to send networking and application information directly to vCenter Server, allowing

VMware DRS and vMotion technology to make decisions based on both computing and network resource data. Also, this integration enables configuration and policy information to be shared between BIG-IP LTM systems and vCenter Server, allowing configuration changes to be passed automatically between the application network and VM platforms.

CHALLENGE #5: INCREASED STORAGE REQUIREMENTS

In non-virtualized environments, OS files often reside on internal or direct attach storage. In virtualized environments, however, OS files are converted to flat VMDK files—which can range from tens to hundreds of gigabytes each—and are often stored on shared file servers. Over time, the proliferation of VMDK files can overwhelm the capacity of existing storage environments.

F5 ARX devices help ease the burden on storage infrastructures and help reduce storage costs in a virtualized environment, which is especially important given today's tight IT budgets. First, ARX devices are designed to dramatically reduce expensive tier 1 storage utilization by saving only the most active and business-critical data on tier 1 storage. This process is designed to occur seamlessly in the background based on administrator-defined management policies, helping increase control over storage growth and spending.

Second, by supporting policy-based data life cycle management across heterogeneous storage arrays, ARX devices are designed to automatically move old data between storage tiers based on enterprise policies. For example, frequently accessed VMDK files can be placed automatically in tier 1 storage, while less frequently used VMDK files can be automatically moved to less expensive tier 2 storage. In addition, ARX devices provide persistent access to these files to help maintain application uptime and avoid business downtime throughout the process. ARX devices also enable file storage to be seamlessly merged into large shared pools with a single global namespace, helping increase aggregate storage utilization.

ARX devices support a range of heterogeneous platforms, including Dell EqualLogic PS Series iSCSI SAN arrays, Dell PowerVault storage arrays, and EMC Celerra storage arrays. By offering the flexibility to utilize best-of-breed storage that is most appropriate to specific needs, ARX devices help organizations increase storage efficiency and performance, simplify data management, and reduce the cost of supporting the storage needs of virtualized environments.

CHALLENGE #6: CONGESTED STORAGE NETWORK

Besides increasing storage utilization, server virtualization can dramatically increase data storage traffic. For example, passing large amounts of data from multiple VMs through one host storage network connection can lead to serious storage traffic congestion. Also, moving large VMDK images over wide area network (WAN) connections can be slow and interfere with other traffic.

F5 ARX devices help ease the burden on storage networks by helping ensure that new VMDK files are stored on tier 1 storage while old VMDK files are migrated to the appropriate storage tiers based on administrator-defined data management policies. This approach helps reduce bottlenecks and increase utilization. In addition, F5 BIG-IP WAN optimization features help compress and de-duplicate the transmission of data such as VMDK files over a WAN, which helps greatly accelerate link performance despite latency and enables organizations to exploit limited bandwidth to best advantage.

CHALLENGE #7: MANAGEMENT COMPLEXITY

Managing a virtualized environment can be one of the most difficult challenges of all. Typical virtualization management tools are designed to provide insight into only the virtualized elements of the environment, not into the data center as a whole. Similarly, existing data center management tools are generally not aware of virtualization components such as hypervisors, VMs, and VM monitors. As a result, administrators must contend with multiple management tools and incomplete information, which can increase the time, cost, and complexity of managing virtualized environments.

F5 BIG-IP LTM systems are designed to integrate directly with both VMware vCenter Server and Microsoft® System Center Operations Manager to help administrators simply and effectively manage their virtualized data center resources. For example, BIG-IP LTM systems are designed to add or remove application connections and make load-balancing decisions based on metadata received from these virtualization management platforms through the F5 iControl® API.

OVERCOMING THE CHALLENGES OF VIRTUALIZATION

Virtualized environments can offer significant improvements in data center productivity and flexibility. But first, administrators must lay the groundwork for making a successful transition. To help organizations achieve the full benefits of virtualization, F5 Networks offers a range of products that equip network and storage infrastructures to handle the extra demands that virtualization can bring. F5 products work seamlessly with Dell PowerEdge server platforms, Dell EqualLogic PS Series iSCSI SANs, Dell PowerVault storage arrays, and EMC Celerra storage arrays to help increase availability, enhance performance, and reduce total cost of ownership for virtualized data center environments.

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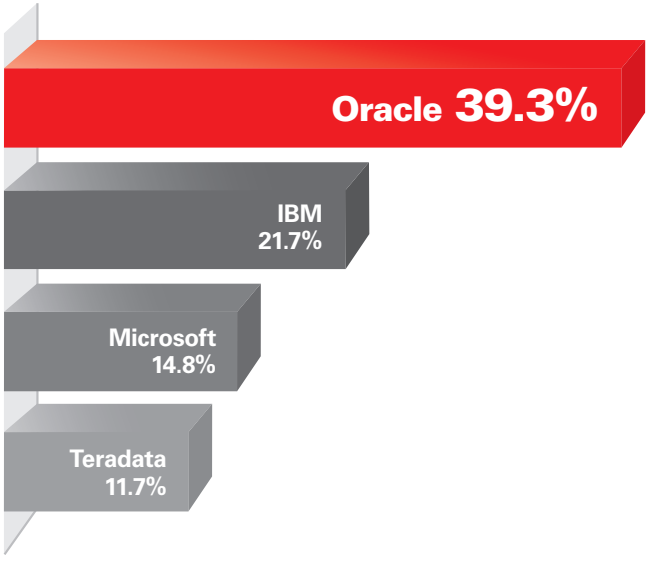

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