Dell Extends the Scalable Enterprise with

Eighth-Generation PowerEdge Servers

Eighth-generation Dell™ PowerEdge™ servers are designed as the foundation for a cost-effective network infrastructure that can grow flexibly to meet business needs. This article introduces the latest servers and describes the technical features that enable these platforms to deliver excellent manageability, performance, and scalability across the enterprise.

BY JOHN FRUEHE

With the introduction of eighth-generation Dell PowerEdge servers, Dell continues to deliver key elements of its enterprise strategy—which is, in effect, the scalable enterprise. At its heart, the scalable enterprise is built upon the standardization of core data center elements, and the latest generation of Dell servers is designed to bolster an already strong foundation with enhanced manageability, excellent performance, and low total cost of ownership (TCO).

Eighth-generation PowerEdge servers feature the next wave of industry-standard technologies such as Intel® Xeon™ processors with Intel Extended Memory 64 Technology (EM64T), Peripheral Component Interconnect (PCI) Express I/O, double data rate 2 (DDR2) memory, and a host of chip-set features including an 800 MHz frontside bus. These technologies help to provide optimal performance today and lay the groundwork for the future by allowing administrators to deploy the current generation of enterprise applications in 32-bit mode and then migrate to 64-bit applications as they become available.

Enhanced manageability is enabled by the Dell OpenManage™ 4 suite of systems management software and the industry-standard baseboard management controller (BMC), which is included in each eighth-generation PowerEdge server. The BMC helps drive standards further in the data center by adhering to the Intelligent Platform Management Interface (IPMI) 1.5 specification that is backed by Dell, Intel, HP, IBM, and other key enterprise systems vendors. In addition, the recently released Dell Remote Access Controller 4 (DRAC 4) helps extend the remote manageability of eighth-generation PowerEdge servers by providing a graphic remote console to facilitate systems management and administration—whether the remote servers are located around the corner or across the globe. In fact, in a recent comparison of 2U servers in *PC Magazine*, the Dell PowerEdge 2850 server earned the Editors' Choice award—largely because of its manageability credentials: "With its raw performance and unmatched manageability features, the Dell PowerEdge 2850 made our decision quite simple."[1]

[1] Source: "Servers: More Power 2U" by Konstantinos Karagiannis in *PC Magazine*, October 5, 2004, pages 137–138, http://www.pcmag.com/article2/0,1759,1645643,00.asp.

By driving commonality across eighth-generation PowerEdge servers through a common system design with common drivers and BIOS, Dell aims to help organizations address the constant challenge of change management across their installed base of servers. For example, platform commonality can dramatically reduce the time-consuming tasks of image management and software updates. By reducing the time spent on these administrative tasks, platform commonality can help increase IT productivity, enabling administrators to focus more time on proactive tasks that can help provide a measurable business return to the enterprise.

Meeting enterprise challenges

Today's enterprises face various challenges from a technology standpoint as well as a management standpoint. These challenges often translate directly into business needs that drive IT decisions. For example, in response to anticipated Y2K issues toward the end of the 1990s, organizations implemented technology refreshes to help ensure business continuity as the calendar rolled from 1999 to 2000. This response to the Y2K challenge resulted in the deployment of a large number of servers throughout 1999.

However, from 2000 until recently, many enterprises have curtailed their IT strategy in the midst of uncertain economic times. Through the first part of this decade, challenging business environments have led to a dormant technology refresh cycle. In many cases, organizations procured servers to meet individual needs instead of focusing on large-scale deployments, such as replacing all Intel Pentium® II processor–based servers with Intel Xeon processor–based servers or refreshing all servers that have exhausted their depreciated life cycle or warranty.

The performance enhancements of eighth-generation PowerEdge servers are designed to provide excellent performance today—with increased scalability over the previous generation of PowerEdge servers to accommodate future growth.

Today, many of the aging industry-standard servers are coming off warranty, are fully depreciated, and need to be replaced. At the same time, a host of powerful technologies have emerged, such as EM64T, PCI Express, and DDR2, which are designed to deliver excellent performance and scalability—creating a perfect opportunity to again address the issue of technology refreshes.

In addition, throughout the past four to five years organizations have begun relying more on industry-standard servers to drive their IT infrastructures. As proprietary systems, such as RISC platforms running the UNIX® operating system, have been successfully migrated to industry-standard servers running Microsoft® Windows® or Linux® operating systems, IT organizations have found their needs for remote management increasing. No longer are single monolithic platforms tucked securely in the server room down the hall. Instead, administrators can now provide a higher level of performance and data access by deploying a greater number of distributed systems throughout the enterprise. But in turn, manageability becomes an increasingly complex issue because of the larger number of discrete platforms that must be managed, compared to single monolithic platforms.

The desire to drive even greater performance, scalability, and manageability than the previous generation of PowerEdge products led Dell to develop the eighth generation of PowerEdge servers. These servers are designed to be deployed as industry-standard building blocks that can enable organizations to create a scalable enterprise.

Providing performance for today, room for future growth

The performance enhancements of eighth-generation PowerEdge servers are designed to provide excellent performance today—with increased scalability over the previous generation of PowerEdge servers to accommodate future growth. The new dual-processor, general-purpose servers can be viewed as the workhorses of the enterprise, running file-sharing, print-sharing, network infrastructure, and Internet applications as well as key enterprise applications such as databases and messaging. Because the return on investment (ROI) for infrastructure servers can be more difficult to measure than the ROI for dedicated application servers, dual-processor infrastructure servers deployed today tend to have a longer life cycle before replacement than higher-end, quad-processing application servers. Consequently, room to grow is crucial for infrastructure platforms.

Enhanced memory addressing with Intel Xeon processor

Performance-enhancing technologies in the latest generation of PowerEdge servers start at the Intel Xeon processor with EM64T, which enables enterprises to run both 32-bit and 64-bit applications at the same time on the same physical hardware platform. In this way, the Intel Xeon processor with EM64T allows organizations to deploy 32-bit operating systems while providing a clear, simplified migration path to 64 bits.

Just as the desktop environment moved from 16 bits to 32 bits, the enterprise is expected to move from 32 bits to 64 bits in the next one to two years. Preparing for this transition is critical. For example, 64-bit platforms can support 64-bit memory addressability[2] (theoretically, up to 18 exabytes[3] of unsegmented memory), providing a

[2] Requires 64-bit operating system and application.

[3] One exabyte = 2^{60} (1,152,921,504,606,846,976) bytes, or 1,024 petabytes.

BUILDING BLOCKS FOR A SCALABLE ENTERPRISE: DELL POWEREDGE SERVERS DESIGNED FOR OPTIMAL FLEXIBILITY AND MANAGEABILITY

Dell PowerEdge 1850

Dell has introduced four dual-processor PowerEdge servers that feature the Intel Xeon processor with support for EM64T. These eighth-generation PowerEdge servers share several common features—including a 1 MB L2 cache, an 800 MHz frontside bus, DDR2 memory, PCI Express, and a BMC—that enable them to deliver outstanding performance, availability, and scalability while also helping to reduce management costs. Figure A compares several features of the two eighth-generation rack servers: the PowerEdge 1850 and the PowerEdge 2850.

The PowerEdge 1850 is designed to deliver excellent performance in a 1U, rack-dense chassis. Its high concentration of computing power and redundancy makes the PowerEdge 1850 well suited for high-performance computing (HPC) clusters, for a storage area network (SAN) front end, and for Web and infrastructure applications, especially where data-center real estate is at a premium. The PowerEdge 1850 includes improved functionality for managing the servers from remote locations, leading to improved manageability compared to its predecessor, the PowerEdge 1750.

The PowerEdge 2850 combines the performance and manageability features of the PowerEdge 1850 with the configuration flexibility of a 2U chassis. Internal expandability enables this server to help enterprises obtain a high level of performance with the drive capacity demanded for growing applications. The PowerEdge 2850 is suitable for first- and second-tier network infrastructure applications such as Web, messaging, database, and file/print consolidation.

The PowerEdge 2800, which shares a common system-board design with the PowerEdge 1850 and PowerEdge 2850, is designed to offer high performance, manageability, and large internal storage capacity in a rack-mountable 5U tower. The PowerEdge 2800 is well suited for server consolidation projects, departmental applications, messaging and groupware, and database or larger distributed applications. With hot-pluggable redundancy in many critical components as well as an expandable rack/tower chassis, the PowerEdge 2800 can help provide a flexible foundation for high-availability enterprise requirements.

Also shipping now, the PowerEdge 1800 is an entry-level, rack-mountable tower server that is designed to deliver a balance of availability, manageability, and expandability at an affordable price. Target deployments for the PowerEdge 1800 include file sharing, print sharing, workgroups, and distributed retail/point-of-sale applications.

Feature	PowerEdge 1850	PowerEdge 2850
Storage capacity	Up to 600 GB* (two bays)	Up to 1.8 TB* (six bays)
Internal tape support	No	Yes
PCI slots	Two (either a PCI-X riser with one 64-bit, 133 MHz slot and one 64-bit, 100 MHz slot or a PCI Express riser with one x4 slot and one x8 slot)	Three (either a PCI-X riser with three 64-bit, 133/100 MHz PCI-X slots or a PCI Express riser with two PCI Express slots (x4 and x8) and one 64-bit, 100 MHz PCI-X slot
Split backplane support for duplexing hard drives	No	Yes
Rack density	1U	2U
Cooling fans	Redundant	Hot-plug redundant
RAID on Motherboard support for external SCSI	No	Yes

*Post-RTS (ready to ship) with 300 GB drives

Figure A. Comparison of the PowerEdge 1850 and PowerEdge 2850 servers

Dell PowerEdge 2850

flat memory space for better performance than 32-bit platforms. In comparison, 32-bit processors are limited to 4 GB of physical memory and must use memory managers to access memory that has been extended above the 4 GB limit. This memory limitation of 32-bit processors can be a gating factor for the performance of many databases and other large applications. For example, the memory limitation requires a 32-bit processor to work harder than a 64-bit processor because the 32-bit processor must swap data in and out of the extended memory segments. Such processing overhead can be minimized by the ability of the Intel Xeon processor with EM64T to address a large flat memory space and to support 12 GB or even 16 GB of memory.[4]

Recently released Intel Xeon processors are available with core speeds of 3.4 GHz and 3.6 GHz, and future processors are expected to support even higher frequencies. In addition, the Intel Xeon processor's 1 MB level 2 (L2) cache, which is twice that of the 512 KB cache in previous generations of Intel processors, can help to speed up processing by providing a larger repository for the most used or most critical information.

High throughput, high-density memory supported by Intel E7520 chip set

Eighth-generation PowerEdge servers incorporate the Intel E7520 chip set, which includes an 800 MHz frontside bus. The 800 MHz bus is designed to enable up to a 50 percent increase in throughput relative to the 533 MHz frontside bus of previous-generation PowerEdge servers. This faster path between processor and memory is designed to allow the processor to retrieve data from system memory significantly faster than is possible with the 533 MHz frontside bus of previous-generation Intel Xeon processors. Two other enhancements in the E7520 chip set include support for PCI Express to enable the latest generation of system I/O, and DDR2 memory to enable the latest generation of dense, scalable memory.

PCI Express is the natural extension of the PCI specification; in fact, the PCI Express specification is designed to be compatible with existing PCI drivers. PCI Express allows for several key features, the most compelling of which is throughput higher than that of PCI Extended (PCI-X). Designed to provide up to 4 GB/sec (in an x8 lane)—which is four times the specified 1 GB/sec throughput of PCI-X—PCI Express is the natural choice for many high-throughput peripherals that are now being developed, such as 10 Gigabit[5] Ethernet network and storage peripherals. PCI Express can also help provide greater availability than PCI-X through error detection and error handling on the bus as well as native support for hot plugging, capabilities which are not offered by PCI-X. The point-to-point architecture of PCI Express allows quality of service (QoS) functions to better manage data flow through the system than PCI-X does. In addition, PCI Express specifies a compact slot design with fewer pins than PCI-X, which can, over time, help organizations lower the cost and power consumption of their systems.

The ability to address greater amounts of memory using 64-bit addressing as compared to 32-bit addressing is further enhanced by the support of DDR2 memory by eighth-generation PowerEdge servers.[6] Although DDR2 memory is designed to run at 400 MHz initially—just like DDR memory—DDR2 is designed with the capability to scale to higher speeds. However, the density of DDR2 is the primary appeal. Because DDR2 is designed to support densities that will allow 2 GB and 4 GB dual in-line memory modules (DIMMs) when they become available, organizations can launch eighth-generation PowerEdge servers with 8 GB of memory and potentially scale to as much as 12 GB by the end of the year and 16 GB in the first half of next year, when 2 GB and 4 GB dual-rank DIMMs, respectively, are expected to be available. DDR2 memory is also designed to draw less power than DDR, using 1.8 volts versus 2.5 volts. In addition, DDR2 memory is terminated on the chip itself instead of on the system board, where DDR memory is terminated. This on-die termination is designed to enhance memory and data integrity by shortening the distance to termination and providing a termination without any physical connection point at the socket.

DRAC 4 provides three key features that are not available in previous versions of the DRAC controller: continuous video, virtual media, and integration with the Microsoft Active Directory directory service.

Simplifying systems management through industry standards

Administrators spend a large part of their day dealing with the complexities of managing servers, both on-site and remotely. One main challenge faced by administrators is that, from a hardware management standpoint, each server has its own tools. Although these tools are designed to help simplify administrative tasks, the interface and set of manageable tasks and information can vary from system to system.

To help reduce the amount of time administrators must spend managing servers, Dell OpenManage 4 provides a consistent set

[4] The eighth-generation PowerEdge servers currently support 8 GB of total system memory, with 12 GB support planned for the fourth quarter of 2004 and 16 GB of support planned for the first half of 2005, depending on the availability of high-capacity dual-rank DIMMs.

[5] This term does not connote an actual operating speed of 10 Gbps. For high-speed transmission, connection to a 10 Gigabit Ethernet server and network infrastructure is required.

[6] For more information about DDR2, see "Introducing DDR2 Memory in Eighth-Generation Dell PowerEdge Servers for Improved Performance" by Ramesh Radhakrishnan, Ph.D., and Jim Pankratz in *Dell Power Solutions*, October 2004.

of management components and tools that is designed to work across eighth-generation PowerEdge servers. The design of Dell OpenManage 4 is based on two tenets: commonality and industry standards. OpenManage 4 provides a common management interface for all PowerEdge servers, and supports key standards such as Common Information Model (CIM), Desktop Management Interface (DMI), Simple Network Management Protocol (SNMP), and Wired for Management (WfM).

BMC for standardized server management

Eighth-generation PowerEdge servers include BMC[7] circuitry on the system board that adheres to the IPMI 1.5 specification.[8] IPMI defines an out-of-band access and remote-management protocol that is usable through either the primary network connection or a serial connection and is independent of the operating system state. By adopting the IPMI standard and IPMI-enabled management applications, organizations can be enabled to implement a management interface that is designed to be consistent not only with eighth-generation Dell servers, but also with other servers that adhere to the IPMI standard. This approach can help to significantly shorten the learning curve for managing servers.

Dell endorses the IPMI specification and is committed to helping drive more standardization into the data center through participation in other standards efforts. As an active member of the Distributed Management Task Force (DMTF) and its Server Management Working Group (SMWG), Dell is collaborating with other industry leaders to champion the adoption of an industry-standard command-line management interface that can help enterprises streamline server management.

Remote console through DRAC 4

In addition to the standard BMC, some servers require a higher level of manageability, which can be provided by a remote console. For these servers, Dell has introduced two versions of the DRAC: the DRAC 4/I, which is a slotless daughterboard for the PowerEdge 1850, PowerEdge 2800, and PowerEdge 2850; and the DRAC 4/P, which is a PCI-based card for the PowerEdge 1800. DRAC 4 provides a remote console that is designed to allow administrators to view remote server activity on the local console. DRAC 4 also provides three key features that are not available in previous versions of the DRAC controller: continuous video, virtual media, and integration with the Microsoft Active Directory® directory service.

Continuous video. This capability is designed to provide a constant, graphical console view of the server in real time, regardless of the server state. Continuous video helps enable the administrator to maintain contact with the remote server during reboot, operating system load, and other states—even if the remote server is not functioning properly or has shut down from a power outage.

Virtual media. Also supported by DRAC 4 is virtual media. This time-saving capability can help facilitate software updates and installations by allowing administrators to redirect a remote server's CD or floppy drive to local media or a specified location on the network. No longer must administrators travel to the server room or a remote location to manually reboot a server to a media device for patch installation. When the server reboots, the internal media access on the server can be redirected to the network as if it were the server's own CD or floppy drive.

Integration with Microsoft Active Directory. On servers running Microsoft Windows, DRAC 4 is designed to use Active Directory to authenticate a user and authorize an associated set of management features such as console redirection and power control. This functionality allows the controller to be integrated into the security structure already established for secure access on a network—thereby eliminating the need to keep multiple security access lists for remote server management.

Together with Dell OpenManage 4—which helps integrate the management of server-based RAID into Dell OpenManage Server Administrator—BMC and DRAC 4 are designed to provide a robust set of tools that can help both to reduce the complexity of server management and to lower TCO for businesses.

Reducing software-based management complexity through commonality

Whether it is managing drivers, BIOS updates, and security patches, or dealing with worms and other malicious code, software management can be a huge chore for administrators. Recognizing this, Dell has engineered its eighth generation of PowerEdge servers around a common set of system-board designs to help minimize these time-consuming software management tasks.

Because the PowerEdge 1850, PowerEdge 2800, and PowerEdge 2850 are all based on a common system-board design, administrators who deploy these three server models can deploy a single software image for the servers' BIOSs and drivers—instead of maintaining a separate image for each platform. As a result, this common system-board design can help reduce the amount of time administrators spend managing software images by up to two-thirds, because one image can be deployed across any of the three systems. Moreover, after developing one software image, an enterprise can choose the specific platform on which to deploy that image later. Another benefit of platform commonality is that, as storage needs

[7] For more information about server management using the BMC, see "Remote Management with the Baseboard Management Controller in Eighth-Generation Dell PowerEdge Servers" by Haihong Zhuo; Jianwen Yin, Ph.D.; and Anil V. Rao in *Dell Power Solutions*, October 2004.

[8] For more information about the Intelligent Platform Management Interface, visit http://www.intel.com/design/servers/ipmi/index.htm.

grow, administrators can increase capacity quickly and easily. For example, an administrator can move drives from a 1U PowerEdge 1850 server to a 2U PowerEdge 2850 server—improving scalability without being required to reconfigure the drivers or settings on the PowerEdge 2850 system.

Administrators generally spend several hours developing and prototyping an image, and can then spend several days testing the image before it is ready for a production environment. Given a single image of BIOS and drivers to develop, administrators can greatly accelerate this time-consuming task. In addition, the Dell ImageWatch™ program is designed to notify administrators of upcoming changes that may affect their images, and to provide information that can help them proactively determine whether to deploy an update and help them build a schedule to support these updates within their normal processes.[9]

By integrating next-generation technology, the eighth-generation PowerEdge servers can provide a solid foundation for a scalable enterprise—allowing organizations to move to the next generation of 64-bit applications without being required to replace the infrastructure in which they have invested.

Although the entry-level PowerEdge 1800 server has a different system design and leverages a different system image than the PowerEdge 1850, PowerEdge 2800, and PowerEdge 2850 servers, it does feature many of the same components. These common system components can help to simplify the task of upgrading software by allowing administrators to consolidate their upgrade activities.

As part of the common system-board design, all eighth-generation PowerEdge rack and tower servers share a common hot-pluggable SCSI drive carrier. This common drive carrier is designed to help administrators streamline the management of spare parts inventories; the deployment of drive systems; and the movement of large, multigigabyte data blocks without affecting network performance. The sidebar "Building blocks for a scalable enterprise: Dell PowerEdge servers designed for optimal flexibility and manageability" provides additional information about the PowerEdge 1800, PowerEdge 1850, PowerEdge 2800, and PowerEdge 2850 servers.

Extending the scalable enterprise

The goal of the Dell scalable enterprise strategy is to allow organizations to deploy industry-standard servers as building blocks for a flexible network infrastructure that can grow cost-effectively with an enterprise's needs. The technology enhancements of the eighth-generation Dell PowerEdge servers can help to enable a scalable enterprise by providing excellent performance today in 32-bit mode with the flexibility to scale easily to 64-bit capacity in the future. This flexibility helps support growth and scalability for business-critical enterprise applications and increased workloads. By integrating next-generation technology, the eighth-generation PowerEdge servers can provide a solid foundation for a scalable enterprise—allowing organizations to move to the next generation of 64-bit applications without being required to replace the infrastructure in which they have invested.

The increased manageability of the eighth-generation servers relative to previous generations also holds true to Dell's scalable enterprise strategy of enabling management simplification and standards-based tools. For example, these servers are designed to help reduce the complexity and challenge of managing remote systems, which can provide administrators with more time to deploy additional applications on the servers and to facilitate the migration from expensive proprietary systems to cost-effective, standards-based servers.

The commonality of the server platforms enables these systems to be deployed as true building blocks because the same technology is simply housed in different form factors. This approach allows enterprises to deploy a solid foundation regardless of what applications they need to run or where they need to run them. In addition, platform commonality helps to reduce TCO and simplify management, allowing organizations to be more responsive to business-critical demands and more proactive in the deployment of a scalable enterprise.

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Dell Server Advisor:
http://www.dell.com/serveradvisor

[9] For more information about the Dell ImageWatch program, visit http://www1.us.dell.com/content/topics/global.aspx/vectors/en/2001_imagewatch?c=us&l=en&s=corp.