



Dell PowerEdge with Xeon 5500 — Simplifying an Optimized Data Center

Analyst: David Reine

Management Summary

So simple a child could do it! These are the words you remember at 4:00 a.m. on Christmas morning when you have finally put together that bicycle advertised as “*some assembly required!*” You had a choice: have the store’s service department assemble the bicycle for you for an additional service charge of \$25 or take it home in the original packaging. When you consider the alternatives, you have to make a choice between cost and convenience. In these tough economic times, the cost of the bicycle itself could be stressful enough without adding to it by asking the store to do something that “you can do yourself”. That is, of course, until you get it home and open the packaging to find an array of parts and, if you’re lucky, tools, along with a checklist and instructions in several languages; none of which you can understand. You may discover, too late, that it would have been less expensive, and way less stressful, to have had the experts do it. If you had considered optimizing your own time versus the cost to bring home a fully-assembled bicycle, you may have made a different decision.

Similar decisions are made every day in the data center of enterprises around the globe. The choice between simplification and optimization is not an easy one; in fact, by necessity, the data center staff must select a point on the continuum between the extremes of simplification and optimization. For years, whenever the data center had to install a new application, it would acquire a new server, or multiple servers, to load and deploy the application throughout the enterprise. One application per server makes sense when you are obsessed with simplifying the deployment of *that* solution. However, one application rarely, if ever, can fully utilize the compute, memory, storage, and communications resources of an open systems server configured with the latest Intel Xeon processor. In fact, the typical application only uses about 15 to 20% of the compute capability of an older Xeon platform, let alone the latest multi-core CPU. This results in a huge waste of resources, not only for the server, but for the data center as a whole. An under-utilized server is wasting the energy to drive and cool the server, wasting floor space, and it is wasting administrative resources, as well. A totally simplified environment, filled with servers like these, can add significantly to the total cost of ownership (TCO) of the data center. However, consolidating multiple applications onto a single server to optimize both performance and TCO is a non-trivial task.

Fortunately, for the small, mid-sized, and large enterprise, Dell has recognized this problem and decided to do something about it. With the latest announcement by Intel for the Xeon 5500 (*Nehalem*), Dell had the right engine to create versions of their PowerEdge servers that can right-size the data center with both simplification *and* optimization in mind. Using the Xeon 5500 as the focal point, Dell has surrounded the CPU with the right resources to optimize the data center through consolidation and virtualization, while providing the utilities to simplify server deployment and administration. To learn more about how you can lower the TCO of your enterprise, please read on.

IN THIS ISSUE

➤ Data Center Complexity	2
➤ Intel’s Xeon 5500 Processor	2
➤ PowerEdge Simplifies the Data Center ..	3
➤ Conclusion.....	5

Data Center Complexity

Because of the growing complexity in data centers and the remote offices of all enterprises, and the increase in the TCO of the IT infrastructure, it has become apparent that the IT staff in these data centers must simplify daily operations and the deployment of new applications. In addition, due to the under-utilization of the IT resources throughout the enterprise, they must also do whatever is necessary to optimize the IT infrastructure.¹

In order to both simplify the daily operations of the data center and optimize the infrastructure, the IT staff must take advantage of the increased processing capability of the newest processing architecture to consolidate the server sprawl which has overtaken enterprise resources. Once consolidated, the IT staff can virtualize multiple applications onto a single platform using enhanced virtualization capabilities, such as larger memories, faster communication channels, and unified I/O, along with improved systems management tools. Improving the ease of use of mission- and business-critical applications is essential to lowering the TCO of the data center. The total cost of ownership clearly involves more than just the acquisition costs of new IT resources. Energy consumption, floor space, administration, and maintenance clearly factor into any accounting equation to calculate TCO.

Changing the paradigm of an enterprise data center is a major step, and is one that the CIO does not want to have to repeat in the foreseeable future. Any new acquisition must have open-ended scalability to be able to handle tomorrow's problems as well as today's. The new architecture must enable the data center to improve the deployment of new applications and the ability of the IT staff to manage them. One new architecture that appears to possess these qualities is Intel's *Xeon 5500 Series*.

Intel's Xeon 5500 Processor

With the introduction of the *Xeon 5500 Series EP* processor, Intel has taken the x86 architecture to a higher plateau. Based upon the *Nehalem* architecture, the 5500 will allow Intel to scale processors from two-to-eight cores in a 45nm fabrication. *Nehalem* is a new architecture for Intel and requires a new socket, and thus a

¹ See [The Clipper Group Navigator](http://www.clipper.com/research/TCG2009016.pdf) dated March 30, 2009, entitled *Simplifying and Optimizing I.T. – Dell Helps Control Data Center TCO*, available at <http://www.clipper.com/research/TCG2009016.pdf>.

Exhibit 1 —
Dell's Xeon 5500 EP Servers

Model	Cores	Frequency	Power
X5570	Quad	2.93 GHz	95W
X5560	Quad	2.80 GHz	95W
X5550	Quad	2.66 GHz	95W
E5540	Quad	2.53 GHz	80W
E5530	Quad	2.40 GHz	80W
E5520	Quad	2.26 GHz	80W
E5506	Quad	3.20 GHz	80W
E5504	Quad	3.20 GHz	80W
E5502	Dual	3.20 GHz	80W
L5520	Quad	2.26 GHz	60W
L5506	Quad	2.13 GHz	60W

Source: Dell

new baseboard. The Xeon 5500 comes in 11 versions, two of which are low-voltage, ten with a quad-core design, and one with a dual-core fabrication. (See Exhibit 1, above.) Each 5500 (except for the *E5502*) comes with four processor cores on a single die, 32KB of L1 instruction and 32KB of L1 data cache per core, 56KB of L2 cache per core, and 2MB of L3 cache per core.

The major improvements made for the Xeon 5500 include:

- **An integrated memory controller** within the processor die. This may be the feature with the biggest impact. It eliminates the requirement for a front-side bus and increases performance by lowering memory latency without increasing clock speed. This keeps the thermal envelope at the same level as the previous Xeon CPU.
- Support for up to **three channels of DDR3 memory** – increasing memory bandwidth.
- **Independent power** for each of the four processor cores enables more control of the energy management of the processor.
- **Four cores on a single die** improves core-to-core communication with higher bandwidth.
- **QuickPath Interconnect** – a high-speed, chip-to-chip interconnect technology to enable the 5500 CPU to connect to another component or another chip on the processor board.
- **45nm process** – the smaller architecture enables the CPU to run with lower power and higher clock speed, squeezing more transistors onto the CPU die.
- **Hyper-Threading** – each core supports simultaneous multithreading (SMT), with two

threads per core, for a total of eight threads, improving performance for multithreaded applications.

- **Advanced Power Management** provides support for an additional, smaller processor core, transparent to the operating system. This power management unit manages the power envelope of the 5500 via sensors built into the main cores to monitor heat, power, and current, optimizing energy consumption as required. The Xeon 5500 also minimizes idle power, invoking a sleep state, as needed.
- **Turbo Mode** – an automatic over-clocking feature enabling individual cores to be driven dynamically at a higher clock frequency to improve application responsiveness. Turbo Mode is controlled by the power management unit and executes transparently to the operating system.

With all of the improvements made to Nehalem, the Xeon 5500 consumes 30% less energy with the same performance as its predecessor, based on data provided by Intel. However, again based on Intel's data, the Xeon 5500 provides up to 2.5 times the performance for enterprise computing, 3.5 times the bandwidth for technical computing, and twice the software threads over the previous version of Xeon.

However, there is more to system evaluation than simply a better engine. If that was all you needed, all systems would perform the same and use the same amount of energy. We know that that is not true. The data center staff has to be concerned with TCO, total system energy requirements and overall performance. Some vendors do not consider all of these factors. With PowerEdge, Dell addresses all of these concerns.

PowerEdge Simplifies the Data Center

With no legacy hardware or software to protect, Dell has committed 100% of its efforts to open standards and operational efficiency. Working in concert with a variety of software houses, ISVs, and distributors, Dell has dedicated itself to a philosophy of collaborative co-development to deliver the best IT value that it can for your enterprise. Dell's *PowerEdge* servers support all of the open operating system platforms. (See Exhibit 2, in the next columns.). In addition to the standard OS support, the new PowerEdge servers also are qualified with applications such as *vSMP Foundation* from ScaleMP², which

² See [The Clipper Group Navigator](#) dated January 23, 2009, entitled *Virtualizing Open Systems Servers with SMP* –

Exhibit 2 – Operating System Support

- Microsoft *Windows Server 2008 with Hyper-V*
- Microsoft *Windows Storage Server*
- Novell *Netware*
- Novell *SUSE Linux*
- Red Hat *Linux Enterprise*
- Sun *Solaris*

Source: Dell

enables the data center to aggregate up to 128 Xeon 5500 cores and 4TB of RAM in a single scale-up architecture as an alternative to proprietary scale-up UNIX platforms.

There are five new servers in generation 11 of the Dell PowerEdge family encompassing blade, rack, and tower, all configured with the Intel Xeon 5500 Series microprocessor and engineered to improve virtualized performance, increase power efficiency, improve reliability to drive down the cost of maintenance, eliminate data center complexity, and maximize uptime with embedded management using Dell's *Unified Server Configurator Powered by Dell's Lifecycle Controller*. By using common components across all of these platforms, Dell can lower deployment and management costs, enabling Dell to simplify systems management across the entire PowerEdge family. All of these improvements were made with an eye toward lowering data center TCO.

Embedded Systems Management

Dell has expanded their simplified integrated systems management via their *OpenManage* suite of management tools. With their *OpenManage Lifecycle Controller* Dell provides a significant capability for Dell's customers. Lifecycle Controller is the engine for advanced embedded management and is delivered as part of *iDRAC³ Express* in this new generation of Dell servers. With OpenManage, Dell provides the efficient operations and standards-based commands to interface with existing systems to protect your investment in the data center. It includes a 1GB managed and persistent storage that embeds systems management features in addition to the iDRAC features. It eliminates the media based system management tools and

ScaleMP Lowers TCO, Raises Performance, available at <http://www.clipper.com/research/TCG2009004.pdf>.

³ Integrated Dell Remote Access Card with out of Band alerting, status, inventory, and troubleshooting via Secure Web GUI/CLI (telnet/SSH).

utilities for managing Dell systems.

PowerEdge comes with the Dell *Unified Server Configurator (DUSC)*, a GUI for local access to the Lifecycle Controller features in a pre-OS environment, to deliver “Instant On” integrated manageability through a single access point, embedded and integrated into the system for flexibility. DUSC includes significant capabilities to enable the data center to deploy an operating system with built-in driver installations, firmware updates, and to issue diagnoses. For remote capabilities, Lifecycle Controller will enable the hosting of customized and/or bootable service images via *VFlash* media, an optional add-on to *iDRAC Enterprise*.

The Lifecycle Controller simplifies server management.

- **Provisioning an entire pre-OS configuration** from a unified interface.
- **Deployment** – Simplifies OS installation with drivers resident on the Lifecycle Controller.
- **Patching/Updates** – Minimizes the maintenance downtime with direct access to updates on the Dell support site; simplifies BIOS and firmware updates by maintaining a working version for rollback purpose.
- **Servicing** – Availability of diagnostics 24x7 without hard drive dependency.
- **User customization** – A bootable/managed 256MB persistent storage for logs, service images, crash dumps, etc. This data is accessible out of band via *iDRAC Enterprise UI* even when the system is on standby power.

Ongoing Lifecycle Controller enhancements will continue to enhance the data center’s systems management capabilities.

The *Dell Management Console (DMC)* simplifies operations by reducing infrastructure management to a single pane of glass, with one view and a common data source for infrastructure management. The DMC cuts management costs and contains an extensible, modular foundation to provide basic hardware management with support for advanced functions such as asset and security management. DMC reduces or eliminates manual processes, saving the data center time and money, and reducing the TCO of the IT infrastructure.

Dell Global Services includes Dell *ProConsult* for data center optimization and systems management with the DMC. Dell *ProManage* offers *ImageDirect* for servers to simplify image management and to securely create, deploy, and manage virtual and physical images on new Dell

servers, saving IT staff time. Dell also offers *Asset Recovery* services and Dell *ProSupport* for enhanced support for enterprise IT.

Power and Thermal Efficiency

Dell’s Energy Smart Technology helps the IT staff to optimize performance while reducing system power consumption. PowerEdge energy efficiency enhancements include:

- Efficient power supply units optimized for system requirements.
- Improved system-level design efficiency.
- Policy-driven power/thermal management.
- Highly-efficient, standards-based Energy Smart components to lower operations cost per kilowatt hour.

Advanced virtualization Performance

Dell’s new servers include an embedded hypervisor with options for Microsoft’s *Hyper-V*, VMware’s *ESXi 3.5*, or *XenServer* from Citrix. PowerEdge supports up to 125% more memory capacity than the previous generation of Dell servers, enabling more virtual machines per server than ever before. Along with fully integrated I/O, these optional factory-integrated virtualization capabilities speed deployment and simplify virtual infrastructures.

The first of these 11th generation servers includes the *R610* and *R710* rack-mounted servers, the *M610* and *M710* blades for the *M1000e* chassis, and the *T610* tower. In addition, Dell has announced the intention to complete the set of two-socket servers with the *R410* rack-mounted server and the *T410* and *T710* towers.

M-Series Blades

The Dell *PowerEdge M-Series* blade servers enable the data center to lower the TCO of the infrastructure by reducing operating expenses through the efficient use of energy, data center floor space, and product flexibility. With simplified management, an outstanding storage offering, and world-class service and support, the M-Series can provide the foundation for a growing enterprise.

M610

To provide improved support for virtualization and database performance, the half-height PowerEdge M610 blade has 50% more memory capacity than previous models. This increase enables the IT staff to use less-expensive DIMMS to meet data center compute requirements, reducing acquisition costs.

The M610 supports the full range of Xeon 5500 CPUs (as shown in Exhibit 1 on Page 2),

from 60W for energy efficiency to 95W for superior performance. With 12 DIMM slots, the M610 can support up to 96GB of ECC DDR3 memory and two internal hot-swap drives for up to 600GB of disk. The M610 has two embedded *Broadcom NetXtreme II 5709* Gigabit Ethernet NICs with failover and load balancing. TOE⁴ is supported on Microsoft *Windows Server 2003*, SP1 or higher with *Scalable Networking Pack*. With an optional SD card, the M610 can support an embedded version of ESXi 3.5, Hyper-V, or XenServer.

M710

The full-height PowerEdge M710 Blade provides exceptional I/O capacity with full-fabric redundancy. The full height geography of the M710 enables support for 144GB of ECC DDR3 memory over 18 DIMM slots with the same disk capacity as the M610.

The M710 supports four embedded *Broadcom NetXtreme II 5709* Gigabit Ethernet NICs with failover and load balancing. TOE is supported on Microsoft *Windows Server 2003*, SP1 or higher with *Scalable Networking Pack*. Using an SD card or internal USB, the M710 provides quick virtualization with applications from the leading virtualization vendors.

R610

Dell's PowerEdge R610 Server is a vital component to any data center, designed for a rack-mounted infrastructure. It is a general-purpose two-socket server in a 1U package for enterprise data centers or remote offices that require a highly-available single- or dual processor server in a server-dense environment.

The R610 supports up to two Xeon 5500 Series CPUs and up to 96GB of ECC DDR3 memory over 12 DIMMs. It supports up to 1.8TB of storage with six 2.5 inch hot-plug SAS or SSD drives. The R610 has two embedded *Broadcom NetXtreme II 5709c* Gigabit Ethernet NICs with failover and load balancing, with optional 1GBe and 10GBe add-in NICs.

R710

Dell's PowerEdge R710 Server is a vital building block to any data center using a rack-mounted infrastructure, with even more scalability than the R610. It is a general-purpose two-socket server in a 2U package that enables the data center to scale organically, based upon the changing requirements of the enterprise.

The R710 supports up to two Xeon 5500

Series CPUs and up to 144GB of ECC DDR3 memory over 18 DIMMs. It supports up to 6 TB of SATA or Near Line SAS storage with eight 2.5" or six 3.5" SAS or SATA drives. The R710 has four embedded *Broadcom NetXtreme II 5709c* Gigabit Ethernet NICs with failover and load balancing. TOE is supported on Microsoft *Windows Server 2003*, SP1 or higher with *Scalable Networking Pack*, with optional 1GBe and 10GBe add-in NICs.

T610

Dell's PowerEdge T610 is a key element for any smaller data center seeking the highest level of performance and scalability with outstanding RAS features. Configurable as a tower or a 5U rack-mounted server, the T610 is a key building block for IT professionals seeking the highest level of performance, availability, and scalability in a 2-socket platform.

The T610 supports up to two Xeon 5500 Series CPUs and up to 96GB of ECC DDR3 memory over 12 DIMMs. It supports up to 8TB of SATA, Near Line SAS, SAS, or SSD storage with over 2.5" or 3.5" bays. The T610 has one dual-port embedded *Broadcom NetXtreme II 5709c* Gigabit Ethernet NICs with failover and load balancing, with optional 1GBe and 10GBe add-in NICs.

Conclusion

The goal of any data center has to be to reduce the TCO of the IT infrastructure without impacting performance. If you can improve reliability, availability, and serviceability (RAS) without reducing performance, then you are one step ahead of the field. If you can simplify and optimize your infrastructure to reduce waste of IT resources, you are improving the bottom line for the enterprise. If you can do all of the above in a scalable package which protects the investment made in the data center, you have earned your paycheck.

With Dell's new PowerEdge servers based upon Intel's new Xeon 5500 Series processors and Dell's new server surround architecture, the data center has the ideal platform to put that plan in motion. If your enterprise is ready to face the challenges of a new data center paradigm, take a look at Dell's implementation of Intel's Nehalem architecture.



⁴ TCP/IP Offload Engine.

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- ***The Clipper Group can be reached at 781-235-0085 and found on the web at www.clipper.com.***

About the Author

David Reine is Director, Enterprise Systems for The Clipper Group. Mr. Reine specializes in enterprise servers, storage, and software, strategic business solutions, and trends in open systems architectures. He joined The Clipper Group after three decades in server and storage product marketing and program management for Groupe Bull, Zenith Data Systems, and Honeywell Information Systems. Mr. Reine earned a Bachelor of Arts degree from Tufts University, and an MBA from Northeastern University.

- ***Reach David Reine via e-mail at dave.reine@clipper.com or at 781-235-0085 Ext. 123. (Please dial “123” when you hear the automated attendant.)***

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