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Dell Expands Two–Socket Menu — Adds More Performance, Availability, Efficiency

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Management Summary

We used to live in a world where *bigger* was always *better*. No longer. We once sought to have the biggest, baddest car on the block; you know the one – convertible, super-charged V8 engine, 400 horsepower, 0-60 in 5 seconds. The price of gas, along with a family of four plus a dog, has tamed that desire back to a hybrid sedan with a mileage rating of 40mpg. We have also learned not to "supersize that" every time we go to a fast food restaurant. You know the invitation – for $1.00 more, you can have a pound of fries and the gallon drink – and another 1000 calories! Bigger is not always better, especially when considering the total cost to you, your health, and your safety. There are many examples, in fact, where the transition to a smaller solution is less expensive and more performant: trading in your "muscle" car for an energy efficient sedan, or changing your "boom box" for an *iPod*.

Nowhere has there been a bigger impact in the downsizing of technology than in the data center. Look at disk drives, for example. Over the past five decades, the disk drive has shrunk from the size of a washing machine with 2-foot platters and 5MB capacity, to 2.5" disks with a capacity of 200GBs that fit into a laptop computer. The world's first gigabyte disk drive, introduced in 1980, was the size of a refrigerator, and had a price tag of $40,000. Today's enterprise data centers, with mission-critical requirements, can buy a 3.5" drive with a capacity of 750GBs for less than $400, requiring only a fraction of the energy demanded by their predecessors. You can even buy a USB Flash Drive with a 1GB capacity for under $40.00. The same price/performance story is true for the data center's application servers, and the microprocessors providing compute power to them. The scale-up architecture that drove the mission-critical data center in the '80s and '90s largely has been replaced with a scale-out architecture driven by more powerful, more energy efficient, one- and two-socket open, or volume, servers, employing virtualization techniques to enable a scale-in environment.

The advent of multi-core, x64 microprocessors has enabled Dell, and others, to implement one- and two-socket servers that provide more performance than their four-socket predecessors. Intel and AMD designed these multi-core CPUs to operate within the same power envelope as single-core processors. This means that the enterprise data center that is running out of power can continue to grow and continue to operate within the same physical plant. If data center growth and total cost of ownership (TCO) issues are troubling you, but you need to provide more compute power to your staff and partners, please read on to see how Dell has reduced those concerns.

IN THIS ISSUE

Data Center Problems

Today's IT staff faces a myriad of issues that were unheard of less than a decade ago. The proliferation of commodity servers and rising energy costs has created a complexity within the data center that adds to the total cost of deploying and maintaining a data center and inhibits the implementation of a scalable enterprise. Expanding existing applications, or rolling out any new application in an IT architecture that does not scale, simply adds to that complexity by highlighting a series of problems.

- **Server Utilization** – The average x86 server that has been running the mission-critical enterprise application, *or* connecting the enterprise to the outside world via the Internet, *or* managing the data center infrastructure, operates at a **CPU utilization rate of under 20%**. The operative word here is "or" because the typical enterprise deploys each new application on a new server, regardless of the availability of sufficient processing resources on existing platforms. Would we allow our employees to work 20% of the time, one day per week, and pay them a full wage? Unfortunately, senior management largely ignored this until the latest energy crisis.
- **Energy** – The **cost of energy** to run your data center is nearing or, in some cases, exceeding the acquisition cost of the power-consuming enterprise IT infrastructure. In some larger facilities, in fact, the CIO has to face the fact that **there is no more energy available from the wall** to run the servers and cool the environment. In the typical smaller enterprise (SMB), management must face sticker shock each month when they open the utility bill.
- **Space Limitations** – Server sprawl has reached the point where there is no more room in the data center. Even if there was sufficient power, there is no floor space left to install another server.
- **Server Management** – Management of data center server sprawl is so complex that the enterprise must employ multiple, expensive systems administrators to keep track of an ever-increasing inventory of server and storage platforms, even though the existing IT environment has unused capacity. The salary of these administrators goes directly into the TCO of the IT resources and off the bottom line. **Simplifying the environment can reduce those costs and improve profitability.**

Many smaller businesses have addressed these issues by *consolidating* their obsolete, mono-core servers onto more performant, less expensive, industry-standard, one- and two-socket multi-core Wintel platforms[1]. By deploying dual- and quad-core engines within a one- or two-socket environment, the data center staff can *virtualize* the environment under the control of a hypervisor[2], such as *VMware* or *Xen*, to partition their IT environment in order to improve resource utilization, simplify operations, and enable user expansion.

Consolidating the Data Center

In order to improve the utilization of enterprise server resources, the data center is migrating to more performant, two-socket, multi-core platforms, and has returned to a trusted mainframe technology that has been around for four decades, *virtualization*. Adapted to an open system environment to improve commodity processor utilization, virtualization is reducing the TCO of IT by enabling the *consolidation* of shared environments on two-socket servers. It permits a single platform to behave as multiple independent servers, reducing both business costs, such as server administration, floor space and energy costs, by controlling consumption. **A single virtualized server can consolidate up to 10 to 15 older platforms while achieving upwards of 80% utilization.**

A virtualization control program runs as a host operating system that creates a simulated computer environment, a virtual machine, for a number of "guest" operating systems, which run the same way as each would on a stand-alone server. Standard hypervisors can manage many virtual machines on a single physical platform, sharing resources. The hypervisor must be robust enough to support any external interface required, including hardware drivers.

Virtualization enables the enterprise staff to simplify data center operations, masking the hardware details from the operating environment, allowing the staff to move an application from one platform to another, to take advantage of server availability and minimize operational disruption during maintenance or upgrades. It improves server utilization, enabling the consolida-

[1] See the March 31, 2007, issue of Clipper Notes entitled *Reducing Cost and Improving Performance – Consolidating the Smaller Data Center*, which is available at http://www.clipper.com/research/TCG2007049.pdf.

[2] A hypervisor is a control program that runs on a given hardware platform, enabling a "guest" operating system, such as Windows or Linux, to run at a level above the hardware.

tion of multiple workloads onto one server, taking advantage of unused CPU cycles, and retiring obsolete systems with expensive maintenance contracts.

Two-socket servers make an ideal platform for the implementation of a virtualized environment to enable cost-effective scalability. Dell has reaffirmed their commitment to provide the broadest menu of these platforms, integrating the latest dual-core and quad-core *Xeon* technologies from Intel and dual-core *Opteron* technologies from AMD into their *PowerEdge* (*PE*) family. Recently, Dell has extended that family with the introduction of a pair of Opteron servers under the PowerEdge brand. The *PE2970*, and an *Energy Smart* version of the PE2970, join the standard and Energy Smart Intel Xeon-based platforms, the *PE1950* and the *PE2950*, to give the data center a choice of platforms to solve their business problems with database, messaging, and network infrastructure solutions.

Dell PowerEdge Servers

Last year, Dell introduced AMD's Opteron technology to the PowerEdge family with two new platforms, the *SC1435*, a two-socket, dual-core, 1U rack-mount server designed for distributive clustering, and the *PE6950*[3], a quad-socket, dual-core server for scale-up applications that can be found in many database and ERP application environments. Now, Dell has extended their Opteron offering with a pair of two-socket servers, to complement their Xeon line of PE platforms, in resolving the most pressing data center problems, in an eco-friendly fashion. The PowerEdge family enables the data center to improve the utilization of each processor through virtualization techniques that enable the enterprise to consolidate their data center resources, saving valuable real estate, while maintaining, or improving, the performance level of each application. Each line brings different performance characteristics to the data center table, enabling the IT staff to configure the right solution for the right problem. Both technologies provide integrated systems that enable an enterprise to reduce architectural complexity with platforms that are easy to order, deploy, manage, and maintain, and offer price/ performance leadership.

Between Xeon- and Opteron-based servers, there is a significant amount of commonality in Dell's ninth generation platforms. This helps to reduce complexity and the learning curve for maintaining and servicing these systems, reducing the TCO for the data center and the enterprise. While innovative in design, Dell servers adhere to industry-standard technology to simplify the integration of low-cost peripherals and commodity software tools to help manage the data center.

The PE2970 is an ideal virtualization platform for the consolidation of multiple, older, underutilized servers that populate the data center, adding to the TCO of IT by occupying excessive space and consuming valuable administrative resources and energy. The PE2970 is another fully certified component of Dell's virtualization solution, taking advantage of AMD's virtualization technology, *AMD-V*, and its *Direct Connect Architecture* to utilize fully the capabilities of the PE2970.

The dual-core PowerEdge 2970 has a variety of performance points, from an entry-level 1.8GHz system[4], consuming 95 watts, all the way to a high-powered 3.0GHz model at 120 watts. The Energy Smart version has an efficient 2.0GHz *Opteron 2212HE*, rated at 68 watts. Each CPU has a 2x1 MB L2 cache and a 1GHz direct-connect HyperTransport. The system can be configured with two CPUs. A similar Xeon-based *PE2950*[5] can support up to two dual-core or quad-core processors, at speeds up to 3.0 GHz (dual-core) or 2.66GHz (quad-core), with a 2X4MB L2 cache for the quad-core version. The PE2950 has two FSB connections up to 1333MHz, instead of the *HyperTransport*, giving the CIO a choice of architectures to solve differing business issues.

The PE2970 can also support up to 32GB of ECC DDR2 memory, with three PCI Express slots for high performance Ethernet, RAID, InfiniBand, and Fibre Channel interconnects, and an integrated NIC processor to offload TCP/IP traffic from the host processor. The PE2970 has an integrated 4-port SAS controller, as well as an optional RAID adapter. This platform can contain up to eight 2.5" SAS disks designed for increased reliability and data transmission, with capacities ranging from 36GB up to 73GB for

[3] See **The Clipper Group Navigator** dated November 16, 2006, entitled *Dell Expands Server Family – Introducing the PowerEdge with Opteron*, available at http://www.clipper.com/research/TCG2006099.pdf.

[4] All models of the PE2970 are upgradeable to quad-core when those chips become available later in 2007.

[5] See **The Clipper Group Navigator** dated January 18, 2007, entitled *Dell Delivers Quad-Core for the Real World*, and available at http://www.clipper.com/research/TCG2007006.pdf.

15K RPM devices, and up to 146GB for 10K RPM disks, for a total capacity of over 1TB. Lower cost 80GB (5400 RPM) SATA devices are also available for second-tier storage requirements. The PE2970 also has a new *Dual Dynamic Power Management* feature ready to optimize quad-core performance and power management.

Energy Smart Models

In an era when saving the environment is *almost* as important as saving money, Dell has taken unusual strides to enable the eco-friendly enterprise to do both. While an energy-efficient CPU is a good first step, it is not enough to make a difference by itself. The microprocessor represents only about 6% of the energy consumption in the data center; other IT equipment, such as storage and communications nodes, power generation, and cooling consume the majority. The Energy Smart PE2970 delivers 25% better performance/watt, over the standard model, using the 2.0 GHz AMD Opteron 2212HE processor along with energy efficient memory, to reduce the generation of excess heat[6]. It supports energy efficient, small form factor SAS disk drives, an Energy Smart redundant power supply, and temperature-sensitive "Low-Flow" fans optimized by Dell to help the enterprise reduce IT TCO, reducing electrical consumption wherever possible to eliminate wasting energy through cooling, power backup and power delivery.

Dell has placed an Energy Smart calculator on its website to assist the data center in approximating the energy cost for any of their Energy Smart servers, the PE1950, PE2950, or the PE2970. Using this tool, we see that an energy-efficient dual-processor, dual-core PE2950 with 4GB of memory will consume $577 worth of energy over three years, based upon cost of $.10/KWH. A standard PE2950, with the *Xeon 5140* CPU and a similar configuration, will consume $744 worth, a difference of $167. If energy costs you $.15/KWH, this delta grows to $250. If the data center installs a full rack of 21 energy-efficient PE2950s, the savings grows to $5265 over three years. It must be noted that this is the energy to run the servers, not to cool the environment from the heat generated. **If you add in the savings from cooling the data center, the difference is even greater, probably double.**

Installing a standard quad-core CPU into the PE2950 provides even greater savings on a performance/watt basis[7]. The cost of energy for the PE2950 with a pair of *Xeon L5310* processors, at $.10/KWH, is $627, an increase of only $50 for twice the performance. This is your classic "no-brainer".

Dell's environmentally-friendly initiatives do not stop in the design lab. Dell has also adopted a very aggressive reclamation policy, instituting a free recycling program for any Dell-branded product regardless of a replacement purchase.

Performance

Commodity technologies provide the data center with a multitude of vendors to choose from offering similar platforms. The difference in performance between them is dependent upon both basic architecture and the innovation employed in engineering the total platform. **There is no way to predict the actual performance of any server in *your environment* short of actually benchmarking the mission-critical applications on the proposed configurations**. By enhancing its Opteron offering, however, Dell provides the SMB community with choice, a variety of complementary solutions with different performance characteristics. The data center can thus select a platform, for example, based upon the computational needs of its applications, some weighted toward integer math, while others more targeted at floating point computations.

Using the latest results published on the SPEC.org website, we see that a 3.0GHz PE2950 has a *Cint_Rate* value of 53.7 for a two-socket, dual-core Xeon implementation while a 3.0GHz PE2970 with two sockets and dual-core Opteron CPUs is rated at 48.5, a 10% edge for the Xeon-based system. If we look at the *Cfp_Rate* listings for floating point math, we see the reverse. The same PE2970 has a floating point value of 48.2 versus a mark of 43.1 for the dual-core Xeon system, about a 10% edge for the PE2970. *Your* results for *your* applications will vary!

If the data center is looking for a platform to run Microsoft *Exchange*, either PowerEdge server will do very nicely, with both ranked in the top five in terms of pure performance and less than two percent difference between them.[8]

[6] Energy Smart Xeon-based PowerEdge servers use a 40-watt dual-core LV5148 CPU along with Intel's *Intelligent Power Capability* and *Advanced Smart Cache*.

[7] In the not-too-distant future, we intend to look at the acquisition and energy costs on a *per core per year* basis. This will allow us to compare – more easily – dual-core versus quad-core alternatives.

[8] See http://www.microsoft.com/technet/prodtechnol/exchange/2003/performance.mspx.

In another published report[9], the Dell PowerEdge Energy Smart 2950 was compared to an IBM x3650 and an HP ProLiant DL380 G5 using the SPECjbb2005 benchmark. As expected, the total performance of each system was quite similar with less than 5% difference between the highest rated IBM x3650 and the Dell 2950. What may have come as a surprise, however, was the discrepancy in performance/watt of each server. Dell's Energy Smart 2950 delivered over 15% more performance/watt than HP's DL380 G5, and almost 10% better performance/watt than IBM's x3650. This provides a clear indication of the energy-innovation implemented by Dell in its ninth generation servers. **Considering the recurring nature of the charges for energy, the TCO impact will be significant.**

Management

The cost of administration and management of an application server often equals the cost of platform acquisition and the power to run and cool the infrastructure. Consolidation may reduce the infrastructure, but it is imperative that the data center can avail itself of a fully integrated set of management capabilities. Most PowerEdge platforms come with Dell's *OpenManage* management suite, a flexible, secure, and comprehensive set of hardware management utilities now optimized for the PE2970. Customers who prefer a more tailored approach have the option to implement a variety of solutions based on open standards from Dell partners such as Altiris, Microsoft, Novell, and LANDesk.

Tools

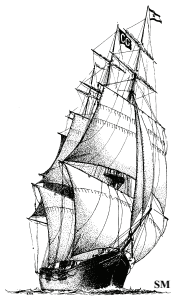
Dell has implemented a pair of tools to assist IT management in deploying new servers or planning a new data center. If the CIO wants to see the impact on energy costs of a new Dell server, Dell has provided an *Energy Smart Calculator*[10] to answer his/her questions. Simply select the server, the processor, and the amount for memory for each platform that you wish to compare, plug in the number of servers, the planned lifecycle in years, the number of CPUs per server, the type of power supply, and the $/KWH, and observe the cost to run each system for its lifecycle. No surprises.

If you need to calculate energy consumption on a data center scale, Dell has developed a *Data Center Capacity Planner*. Input the number of racks, servers, storage arrays, and peripherals into the planner, and Dell will provide the number of watts consumed, the amps required, the noise level, and even the temperature rise expected. Dell provides the enterprise with the ability to be as eco-conscious as possible.

Conclusion

All Dell customers are united with a common set of goals: to reduce IT TCO, implement a consolidation plan, improve server utilization, conserve energy, improve customer satisfaction through improved response time and reliability, and to enable a faster time to market for their applications. With continued innovation in its PowerEdge family of servers, Dell is delivering on all points.

The server is only one aspect, however, of controlling the TCO of the data center. Dell is striving to engineer their two-socket servers for energy efficiency, optimizing the data center with strategic assessment services for consolidation and virtualization, along with comprehensive planning tools. Dell's recycling program is just another tool in their kit to try to prevent additional harm to *our* environment.



If you are looking for a better solution to your IT problems, look at Dell. They may have the choice you need to both save your business and the environment.

[9] Principled Technologies, Inc.: SPECjbb2005 performance per watt on three servers with dual-core processors, dated December 2006.

[10] See http://www.dell.com/content/topics/topic.aspx/global/products/pedge/topics/en/pedge_energy_2970?c=us&cs=555&l=en&s=biz.

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