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Dual-Core Xeon Arrives — Dell Leads the Charge – Again

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Management Summary

Everyone loves the underdog. It doesn't matter whether it is in business or sports, people will cheer for the team that challenges the leaders – whether it is "Big Blue" or "The Damn Yankees". There has been no bigger surprise than the U.S. Olympic Hockey team from 1980. They were so big an underdog that the game with the Russians was not even broadcasted live. Now, we all remember the game vividly, but how many remember that it was only the semi-final. The match against Finland became an anti-climax, because by then, they were expected to win. When the New England Patriots reached the Super Bowl in 2002, football fans everywhere cheered them on against the unbeatable Rams from St. Louis, but no one gave them a chance. But they won. Surprisingly enough, they were still considered an underdog when they reached the big game in 2004 against Carolina. No one gave them any respect for what they had accomplished – so they did it again. Moreover, in 2005, they did it yet again. Slowly, but surely, as the Tortoise snuck up on the Hare, the underdog finally gained the respect that they deserved as the #1 supplier of x86 servers.

In the enterprise server arena, the team that does not get the respect that it has earned, the tortoise sneaking up on the historically big three server providers, is Dell. While IBM and Sun tried to best each other with innovation within their dedicated platforms (*POWER* and *SPARC*, respectively), Dell quietly went about its business forming a committed alliance with Intel to acquire the best industry-standard technology that Intel could produce, and **to develop an integrated platform to deliver the best solutions with the best value and ease of management to customers across the spectrum**, from the home to the largest enterprise. Starting with the desktop, Dell has gained quite a reputation as a quality volume manufacturer, delivering large quantities of product to the desktop. Earlier this summer, Dell teamed up with Intel to deliver to the enterprise community the first dual-core Intel *Pentium D* server. In fact, the *PowerEdge SC430*, *830* and *850* remain the only Pentium D servers available. Now Dell, riding the crest of a technology wave, has one-upped their competition again - with the introduction of a family of dual-core Intel *Xeon*-based servers.

Now, Dell is preparing to deliver an entire family of dual-core Xeon servers for towers, rack-mounts, and blades. **These servers have been integrated with the latest reliability features that the industry has to offer to enable their use in business-critical environments.** To see if these PowerEdge servers can lower the total cost of ownership for your enterprise, please read on.

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Simplification of the Data Center

The key to lowering the total cost of ownership (TCO) of the enterprise data center is through simplifying the environment. Consolidation enables the data center to reduce their server sprawl, thus reducing not only the administrative costs but also the amount of electricity required to power and to cool the data center. There are two architectures that traditionally are employed to consolidate: scale-up and scale-out.

A scale-up environment can be found in many Fortune 500 data centers with large symmetrical multiprocessing (SMP) systems, such as those based upon IBM's *POWER* microprocessor, Sun's *SPARC*, or HP's *Precision Architecture* (*PA*). Some vendors, such as HP[1] and Groupe Bull[2], have even developed scale-up consolidation platforms based upon Intel's commodity *Itanium 2* microprocessor, using up to 64 SMP CPUs to drive a single operating system image in the *Integrity* (HP) and *NovaScale* (Groupe Bull) families. These systems have been implemented to drive down the costs of proprietary infrastructures, with some enterprises using solutions based upon these architectures to migrate away from proprietary environments such as *HP-UX* and *VMS* (HP) and *GCOS 8* (Bull). While these Itanium 2 servers do reduce costs for enterprises employing them when compared to RISC, the initial investment for a platform that will scale to 64 processors is high, both in terms of hardware and software migration, and includes a heavy SMP overhead.

Other enterprises have chosen to implement their cost reduction projects using a scale-out architecture with dual- and quad-processor rack-mounted-servers or blade systems. These server implementations are frequently based upon an x86, or x64, architecture using Intel's *Pentium* and *Xeon* CPUs or AMD's *Opteron* processor. **While most of the installed servers are based upon single-core implementations, dual-core processors have started to make their presence felt.** There are several examples of scale-out environments from all of the leading server vendors, including Dell's *PowerEdge*[3], HP's *ProLiant*[4], and IBM's *xSeries*[5].

Historically, most of the infrastructure implementations for such activities as web, file, or print services have been accomplished in commodity x86 environments. The costs involved in using a scale-up design would not be justified based upon the CPU requirements for these heavily I/O functions. Unfortunately, dedicated infrastructure servers typically use less than 25% of their processing capability and put a burden on enterprise administrative costs. With the development and implementation of virtualization[6] techniques for commodity servers, consolidated servers can take advantage of over 75% of the CPU capability.

As the performance capabilities of x86-x64 CPUs have improved, these microprocessors have begun to make an even bigger impact for the enterprise in high performance computing (HPC) and business-critical applications. In these environments, however, the architecture of the server-surround environment can be more important than merely the performance capability of the CPU. In fact, as the clock speed (GHz) of the microprocessor is ratcheted up, the cost to drive the server and cool the entire platform, from a purely electrical standpoint, continues to rise. This drives the TCO in the wrong direction as we continue to abuse a costly resource, energy. In addition, the reliability, availability, and serviceability (RAS) for the entire platform determines the environmental compatibility. The IT staff is looking at the MTBF of the entire server, not just the CPU.

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[1] See **The Clipper Group Navigator** dated July 29, 2003, entitled *HP Takes First (Super-sized) Step Toward Product Line Consolidation (Simplification)* at http://www.clipper.com/research/TCG2003034.pdf.

[2] See **The Clipper Group Navigator** dated October 15, 2003, entitled *Bull Transitions GCOS8 to Open Systems - NovaScale 9000 to the Rescue* at http://www.clipper.com/research/TCG2003053.pdf.

[3] See **The Clipper Group Navigator** dated July 14, 2005, entitled *Dell Drives Server Technology Race with Intel Dual-Core for Small Enterprises* at http://www.clipper.com/research/TCG2005043.pdf.

[4] See **The Clipper Group Navigator** dated April 24, 2005, entitled *HP Solidifies 4-Way Lead – Extends Choice in ProLiant Platforms* at http://www.clipper.com/research/TCG2005024.pdf.

[5] See **The Clipper Group Navigator** dated May 27, 2005, entitled *Scale-up and Scale-out Architectures – IBM Provides Choice with xSeries* at http://www.clipper.com/research/TCG2005031.pdf.

[6] See **The Clipper Group Explorer** dated September 8, 2004, entitled *Understanding the Role of IT Virtualization – It's a Matter of Architecture* at http://www.clipper.com/research/TCG2004074.pdf.

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As mentioned above, both Intel and AMD make commodity processors for the scale-out community. Some vendors, in fact, have chosen to support both architectures in their product family. If you are purchasing a *ProLiant* server from HP, for example, you must look twice to determine whether it is Xeon or Opteron, and not to be confused with HP's Itanium 2 *Integrity* line. The same is true for IBM, except here Xeon, Opteron, and Itanium all fly under the same xSeries banner. **Dell, on the other hand, has established a uniform product set emphasizing Xeon[7], the architecture that runs over 70% of today's servers. PowerEdge Xeon servers encompass blade, rack, and tower configurations, allowing customers to move from single-core to dual-core without changing their Xeon architecture.** This policy seems to be a wise one, as we now see the arrival of dual-core for Xeon, Intel's *Paxville DP* processor, before their Itanium 2 offering, *Montecito*, becomes available at an enterprise level. The only non-Xeon dual-core offering generally available today is the entry-level *PowerEdge SC430/830/850* Pentium offering. **As a result of their focused strategy, Dell has seized the Xeon technology leadership mantle, becoming the first vendor to offer a dual-core Xeon server and allowing customers to easily migrate to dual-core with minimal impact to their data center.**

Dell PowerEdge Family

In order to understand the advantages that dual-core Xeon brings to the PowerEdge (PE) family, we first must understand how Dell has implemented the PowerEdge product set with the original single-core Xeon.

PowerEdge is an open-ended family of servers, with both *Pentium 4* and the dual-core *Pentium D*, as well as the Xeon architectures. These two architectures represent almost 90% of the overall x86 market. Using the *EM64T* single-core version, Dell introduced a set of servers covering blade, rack, and tower implementations. (See Exhibit 1, at right.)

With the exception of the 1–way *PowerEdge 8x0* servers and the 4-way *PowerEdge 68x0*, all of the models are dual-processors systems with extensive RAS functionality, including hot-plug, redundant power supplies, RAID controllers, and hot-plug SCSI drives, providing the foundation for a mission-critical scale-out architecture. They support Xeon at speeds of up to 3.8GHz, with scalable amounts of 400 MHz ECC DDR2 memory, up to 64GB in the 68x0 with 4GB DIMMs. The dual processor models include the Intel e7520 chipset and share an 800 MHz front side bus (FSB) architecture with either 1 or 2MB of L2 cache. The four-way models use the Intel 8500 chipset and employ a 667MHz FSB with up to 8MB of L3 cache. All models support both PCI-X and PCI Express adapters for high speed I/O. They share binary compatibility for the BIOS, drivers, firmware, and operating system[8] across all models, including the new dual-core versions detailed below.

Exhibit 1 – PowerEdge Family

Blade

- ***PowerEdge 1855*** – For enterprises that wish to deploy multiple servers in a scale-out environment or to achieve the high density required for distributed clusters and high-performance cluster computing.

Tower/Rack

- ***PowerEdge 1800/1850 1U*** – Entry-level 2-way departmental server that offers a balance of performance and features traditionally attributed to higher-end systems at an affordable price.
- ***PowerEdge 2800 5U/2850 2U*** – 2-way workgroup server with increased performance and reliability.
- ***PowerEdge 6800 6U/6850 4U*** – High-end 4-way server with scalable performance using open standards to support an enterprise workload.

Introduction of Dual-Core Xeon

Dual-core[9] microprocessors have been around for a while now. Both IBM (with POWER) and Sun (with SPARC) have employed this feature to increase the performance

[7] Dell did have a single 4-way Itanium 2 offering, the PowerEdge 7250, not the scale-up implementation seen from other vendors, but that product no longer is marketed.

[8] PowerEdge servers support Microsoft Windows, Red Hat Linux, and SuSE Linux.

[9] That is, two logic units in the same socket.

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of their *UNIX* platforms. The rapid acceptance of the dual-core AMD Opteron processor within the *Windows* and *Linux* communities, however, apparently convinced Intel to accelerate their development and production cycle for the Paxville version of Xeon. The ability to double the core count and number of process threads (through hyper-threading) while holding the power level to the existing level provides the data center staff with an immediate solution for improving server performance while lowering the TCO of the server farm.

Dell has reacted a little quicker than the rest of the server vendor community by introducing this new architecture within their existing line of servers, enabling their customer base to take advantage of existing support and administrative infrastructure, eliminating the necessity to re-tool their operations. Dell has now announced the availability, at slightly above existing single-core price levels, of dual-core Intel Xeon processors at 2.8GHz with two 2MB L2 caches per socket for the following PowerEdge Xeon servers: the *1850*, *2800*, *2850*, and the *1855* blade. Dell expects upwards of a 53% improvement over single-core implementations in compute performance, with the largest gains to be seen in integer-based compute processes and Java-based workloads. There has been no discussion, yet, regarding the upgrading of the PowerEdge 68x0 line, but we can assume that quad-processor servers with eight cores and sixteen threads cannot be far behind.

A new measure of performance, however, has arisen from the power-efficient dual-core chips: performance per watt. Because there is twice the compute capability, the Xeon chip can run slower, i.e., at a reduced MHz rate, and still experience significant performance gains. In fact, the new PowerEdge servers are running at 2.8GHz and, according to Dell, experiencing a 40+% improvement when compared to their single-core predecessors. This will translate to a significant savings in electrical power.

All of this merely represents a *potential* performance upgrade, however; the application set must be able to take advantage of this increased capability. Infrastructure applications such as web, file, and print services will undoubtedly do just fine with existing single-core servers in the near term until dual-core technology completely supplants single-core. Processor-bound applications such as database, ERP, and HPC (high-performance computing) applications - all of which can take advantage of the multi-threaded environment and the 64-bit addressing capability of PowerEdge servers - will achieve significant improvements in overall performance. Data centers that are in the throes of consolidation efforts can experience the biggest gains by adding virtualization middleware to improve the utilization of CPU power and reduce the TCO of the data center.

In addition to the introduction of dual-core, Dell has also announced continued improvements in the single-core family. These include a new high-end 3.8GHz processor for high-performance Xeon environments, a 2.8GHz chip with 2MB of cache for value environments, and a low-voltage 3.0GHz Intel Xeon for dense data center requirements that need to minimize power and cooling per server. Dell will also begin to deliver 4Gb FC adapters for both PCI-X and PCI Express environments, to ease the deployment of SAN technology for PowerEdge.

Conclusion

Dell became the technology leader in the *desktop* arena with leading-edge implementation, a commitment to standards, and aggressive pricing. Now they are leading the scale-out *server* market by pursuing the cutting edge in that arena – dual-core – first with Pentium D, and now focused on Xeon. Based upon their alliance with Intel, Dell can be counted upon to maintain a single system image and binary compatibility across their PowerEdge line whether it is a single-core or dual-core system. This provides the enterprise with a clear path to leading edge servers, using Intel's roadmap, to lower the TCO of the data center. Improving performance, while lowering costs, is a good thing for any enterprise. If your enterprise is committed to Intel technology and you want to take advantage of the higher performance and lower TCO of dual-core, at this time, the only solution is spelled *D-E-L-L*.

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