Maximizing Value in the Efficient Data Center

A Dell™ Technical White Paper

Dell │ Intel

**Dell™ PowerEdge™ Servers with Intel® Xeon®
7500 Series Processors and Microsoft® Windows
Server® 2008 R2 Hyper-V™**

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Solution Brief

Large-scale consolidation with live migration and simplified management offers a major leap forward in virtualization value on the Dell™ PowerEdge™ platform. Dell has partnered with industry leaders Intel® and Microsoft® to deliver a state-of-the-art virtualization solution to maximize value in the Efficient Data Center. Dell is focused on delivering the right balance of processor, memory, and I/O to help our customers get the most out of virtualization. Our servers are designed with features to enable rapid virtualization deployment, simplified integration, and low maintenance.

Customers can run more workloads on Dell PowerEdge servers with Intel® Xeon® 7500 series processors, embedded hypervisors, and balanced memory architectures. Dell has received accolades for our virtualization performance in the past, and we are excited to offer even better performing servers with this release.

Dell, Intel, and Microsoft are delivering the performance, scalability, and availability needed to virtualize mission-critical applications and to increase consolidation ratios across the data center. Virtualization on industry-standard servers has changed the economics of the data center, enabling IT organizations to consolidate multiple applications per server, to deploy new applications in minutes, and to achieve high availability and disaster recovery while driving down the total cost of ownership (TCO).

Dell PowerEdge servers with Intel® Xeon® 7500 series processors are extending the industry-leading performance and energy-efficiency of this microarchitecture to a new family of scalable, enterprise-class servers. In combination with Hyper-V, these new servers provide unprecedented potential for large-scale consolidation on the world's most widely supported computing platform. For IT organizations looking to reduce costs and to improve service levels, this solution offers compelling advantages.

Dramatically Higher Consolidation Ratios: With up to 32 high-performance cores, 64 execution threads and a full terabyte of memory in a standard 4-socket server, IT organizations can consolidate far more applications per physical system. Hyper-V is highly tuned to deliver exceptional performance with low virtualization overhead.

Affordable High-Availability: The Dell PowerEdge servers with the Intel Xeon 7500 series processors provide more than 20 new reliability, availability and serviceability (RAS) features to enable levels of system resilience and data integrity never before seen in high-volume, industry-standard servers. Combined with the high-availability support in Microsoft® Windows Server® 2008 R2 and Hyper-V™, organizations can consolidate critical business applications with confidence.

Superior Cost Models: Large-scale consolidation on Dell PowerEdge servers offers unprecedented cost advantages through reductions in the number of servers and lower energy and cooling costs. Additionally, Microsoft's flexible licensing policies and comprehensive, integrated management capabilities add to the value by further reducing costs and providing a common and familiar interface for managing both virtualized and non-virtualized servers.

Higher Performance for Virtualized Applications

Dell PowerEdge servers with the Intel Xeon 7500 series processors will help to increase database performance by roughly three times versus its predecessor, with comparable gains across a wide range of workloads.[i] Next-generation Intel Virtualization Technology[ii] (Intel VT) helps to extend this exceptional performance into virtual environments by providing comprehensive hardware assists for core virtualization functions. For example, Intel Extended Page Tables (Intel EPT) perform virtual-to-physical memory translation and Intel VT FlexPriority manages system interrupts. By offloading these

functions to silicon, the functions are performed more quickly and without consuming valuable processing cycles. Hyper-V has been optimized to take advantage of Intel EPT and Intel VT FlexPriority and many other silicon-based enhancements to deliver major performance benefits for many workloads.

Greater Scalability for Dense Consolidation

Dell PowerEdge servers with the Intel Xeon 7500 series processors deliver true enterprise-class scalability. Individual processors have up to eight high-performance cores and 24 MB of cache. The processors also support Intel® Hyper-Threading Technology[iii] which doubles the number of execution threads per server, and Intel® Turbo Boost Technology,[iv] which delivers higher performance on demand for peak workloads. These processors also provide a 9x increase in system bandwidth, a 6x increase in memory bandwidth and twice the memory capacity of the previous generation Intel Xeon 7400 series processors. They are being integrated into a broad range of server sizes, including 4-socket, to provide unprecedented scalability on the world's most widely deployed server platform. Hyper-V has been optimized to support systems with up to 64 logical processors per physical server and up to 64 logical processors and 64 GB of memory per virtual machine (VM). Hyper-V optimizes memory utilization by maintaining a single copy of memory pages that are shared among multiple VMs.

I/O bandwidth has become a common performance bottleneck in virtualized environments and the Intel Xeon 7500 series processor has been engineered to address this concern by providing up to 72 PCI Express lanes in a 4-socket server.[v] Importantly, Hyper-V also supports Virtual Machine Device Queues (VMDq) from Intel, a hardware feature of Intel Ethernet Server Adapters that greatly improves I/O performance in a virtual environment. By sorting packets in the Intel Ethernet Controller and enabling direct memory access (DMA) for guest OSs, much of the overhead and latency of I/O virtualization are eliminated. This not only helps to improve consolidation ratios, but also allows IT organizations to virtualize a wider range of data center workloads, including I/O-intensive applications, such as databases and transactional applications.

Lower Costs through Automated Power Management

High consolidation ratios provide fundamental power savings by supporting heavier workloads on fewer servers. Windows Server 2008 R2 and Intel Intelligent Power Technology increase these savings by automatically tailoring power consumption to match workload demands. Processors and memory operate at the lowest energy states that do not impair performance. Microsoft Windows Server 2008 R2 can also consolidate processing onto fewer cores and "park" inactive cores, to further enhance energy efficiency. It also supports the Intel Intelligent Power Node Manager, which helps IT manage power for a rack, a row of servers, or entire data centers. With these technologies, energy-efficiency can be optimized across all levels.

Enterprise-Class RAS and Security

Dell PowerEdge servers with the Intel Xeon 7500 series processors offer levels of reliability, availability and serviceability (RAS) that rival high-end RISC systems, but at a fraction of the cost. In tandem with Microsoft Windows Server 2008 R2 and Hyper-V, these systems support[vi]:

- **Advanced error detection, correction and containment** across all major components and communication pathways.
- **Automatic system recovery** from many uncorrectable errors via Intel® Machine Check Architecture Recovery[vii] (MCA Recovery). (Supported June 2010)

- **Predictive failure analysis** via the Windows Hardware Error Architecture (WHEA) to identify failing components before they cause problems.
- **Dynamic addition and replacement of components** without downtime.
- **Static Hard Partitioning** to provide advanced workload isolation and to enable maintenance without bringing down the system.
- **Host and guest clustering with live VM migration** to provide failover and load balancing across LANs and WANs.

Hyper-V running on Dell PowerEdge servers with the Intel Xeon 7500 series processors also provides robust and flexible security options. The combined solution provides a high level of workload isolation among VMs and makes it easy to configure security independently for each application. If a VM becomes infected, it can be quickly quarantined and a new VM can be brought online almost instantly to restore operations.

Comprehensive and Integrated Management
Dell offers Dell Server PRO Management Packs that integrate with Microsoft System Center to provide centralized management of physical and virtual assets — including both Hyper-V and VMware ESX-based environments — all from a single console using familiar tools and interfaces. PRO Packs continually monitor the health of the virtual and physical infrastructure and can greatly reduce management costs, while helping IT respond more quickly and effectively to address changing business requirements.

Dell Server PRO Management Pack 2.0 for Microsoft System Center Virtual Machine Manager is a management solution that allows you to proactively manage virtual environments and ensure high availability of your systems. It collects and stores information on the server along with a description on the health status. It also recommends remedial actions when monitored objects transition to an unhealthy state.

Microsoft System Center Virtual Machine Manager 2008 R2 is a comprehensive management solution for the virtualized data center. It simplifies consolidation of physical servers and enables rapid provisioning of new virtual machines. It has been optimized to support many new features of Windows Server 2008 R2 Hyper-V including:

- Live migration for moving virtual machines between hosts without downtime.
- Enhanced SAN migration (in and out of clusters).
- Clustered share volumes for supporting multiple virtual machines per LUN.
- Hot addition of virtual machine storage to scale capacity without downtime.

Microsoft System Center Operations Manager 2007 allows advanced monitoring and service reporting for consolidation, configuration, utilization, and growth projections.

Microsoft System Center Data Protection Manager 2007 provides live backup and virtual machine snapshots to support business continuity.

Ideal Usage Models

Large-Scale Consolidation
An internal Intel study demonstrated the potential benefits of using Intel Xeon series 7500 processor based servers to consolidate workloads from older servers based on single-core processors. Results showed 90 percent lower operating costs, approximately 94 percent lower annual energy costs

(estimated) and full payback in just one year.[viii] Many businesses have large numbers of Microsoft® SQL Server® and Microsoft SharePoint® installations, often running on dedicated servers supporting individual departments. With their advanced RAS support and large memory and I/O capacity, Intel Xeon 7500 series processor-based servers are ideal for consolidating these and many other applications to simplify the computing environment and drive down total costs.

Business Continuity

Dell PowerEdge servers with the Intel Xeon 7500 series processors and Windows Server 2008 R2 Hyper-V provide a flexible and resilient computing platform for reducing planned and unplanned downtime. The inherent resilience of these servers is complemented by the strong workload isolation Hyper-V provides among VMs and by the robust support for clustering and live migration. Virtual machines can be configured to failover automatically within a single physical server or to a different physical server across a LAN or WAN. Workloads can also be moved at will to enable maintenance without downtime.

Find Out More Today

Large-scale consolidation using Dell PowerEdge servers with the Intel Xeon 7500 series processors and Hyper-V can multiply the benefits of virtualization, while significantly reducing associated costs.

To learn more about Dell PowerEdge servers with the Intel Xeon 7500 series processors, visit www.dell.com/poweredge.

To learn more about Intel Xeon 7500 series processors, visit www.intel.com/xeon.

To learn more about Windows Server 2008 R2 Hyper-V, visit www.microsoft.com/hyper-v and www.microsoft.com/virtualization.

To learn more about solutions from Dell and Microsoft, visit www.dell.com.com/microsoft.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit www.intel.com/performance/resources/limits.htm.

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[i] Source: Internal Intel measurements performed in May of 2008. To view the latest published benchmarks as they become available, visit the Intel Web site at: http://www.intel.com/performance/server/index.htm.

[ii] Intel Virtualization Technology requires a computer system with an enabled Intel processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform software enabled for it. Functionality, performance or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

[iii] Hyper-Threading Technology requires a computer system with an Intel processor supporting Hyper-Threading Technology and an HT Technology enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. See http://www.intel.com/info/hyperthreading for more information including details on which processors support HT Technology.

[iv] Intel Turbo Boost Technology requires a platform with a processor with Intel Turbo Boost Technology capability. Intel Turbo Boost Technology performance varies depending on hardware, software and overall system configuration. Check with Dell on whether your system delivers Intel Turbo Boost Technology. For more information, see http://www.intel.com/technology/turboboost .

[v] Versus performance of 28 Generation 1 PCI Express lanes in a previous generation, Intel Xeon 7400 series processor-based server.

[vi] Most new RAS features are supported by the Intel Xeon 7500 series processor and Microsoft Windows Server 2008 R2 with Hyper-V. Some require system-level support. Check with Dell for current and planned support.

[vii] MCA Recovery is supported by Microsoft Windows Server 2008 R2, but not in virtual environments with Hyper-V.

[viii] Less than 1 year ROI claim estimated based on comparison between 4-socket (4S) Single-Core Intel® Xeon® 3.33 GHz and 4S Nehalem-EX 2.26 GHz based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, operating system annual license costs and estimated server costs. This assumes 8kW racks, $0.10 per kWh, cooling costs are 2x the server power consumption costs, operating system license cost of $900/year per server, per server cost estimation of ~$32,000 based on estimated list prices and estimated server utilization rates. All dollar figures are approximate. Performance and power comparisons are based on Intel internal 4S Nehalem-EX 2.26 GHz processor-based platform measurements on key server workloads over a Single-Core Intel® Xeon® 3.33 GHz processor-based platform. Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was up to 20 x.