



Breakthrough Value for the Virtualized Data Center

Microsoft® Windows Server® 2008 R2
Hyper-V™ and servers based on the
Intel® Xeon® processor 7500 Series

SOLUTION BRIEF

Large-scale consolidation with live migration and simplified management offer a major leap forward in virtualization value.

Virtualization on industry-standard servers has changed the economics of the data center, enabling IT organizations to consolidate multiple applications per server, deploy new applications in minutes, and achieve high availability and disaster recovery at low cost.

To meet these challenges, the Intel® Xeon® processor 7500 series is extending the industry-leading performance and energy-efficiency of the Next-Generation Intel® Micro-architecture (Nehalem) to a new family of scalable, enterprise-class servers. In combination with Microsoft® Windows Server® 2008 R2 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 cut costs and improve service levels, they offer 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. Larger servers are in development by major hardware vendors, and Hyper-V is highly tuned to deliver exceptional performance with low virtualization overhead.
- **Affordable High-Availability** – The Intel Xeon processor 7500 series provides 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, these advances enable organizations to consolidate critical business applications with confidence.
- **Superior Cost Models** – Large-scale consolidation on affordable servers offers unprecedented cost advantages through reductions in server count and lower energy and cooling costs. Microsoft's flexible licensing policies and comprehensive, integrated management capabilities add to this value by further reducing costs and providing a common and familiar interface for managing both virtualized and non-virtualized servers.



Microsoft®

Higher Performance for Virtualized Applications

Customer benchmarks show more than 2x performance increase when running a Hyper-V virtualization environment on Intel Xeon processor 7500 series-based servers¹ and benchmarks running a customer workload with leading ERP software showed Hyper-V running on servers with the Intel Xeon processor 7500 series could support up to 2.67x more virtual machines than the previous-generation processor while providing equal or better performance.² Next-generation Intel® Virtualization Technology^o (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, they are performed more quickly and without consuming valuable processing cycles. Hyper-V has been optimized to take advantage of these and many other silicon-based enhancements to deliver major performance benefits for many workloads.

Greater Scalability for Dense Consolidation

Intel Xeon processor 7500 series-based servers deliver true enterprise-class scalability. Completed workload testing of virtualized Microsoft Dynamics CRM 4.0 on servers equipped with Intel Xeon processors 7500 series showed that with 20 virtual machines (VMs) on two 4-socket servers, the CRM workload was able to sustain 100,000 users.³ Individual processors have up to eight high-performance cores and 24 MB of cache. They also support Intel® Hyper-Threading Technology[†] which doubles the number of execution threads per server; and Intel® Turbo Boost Technology,[§] which delivers higher performance on demand for peak workloads. These processors also provide up to 8x increase in memory bandwidth and 4x the 4-socket memory capacity of the previous-generation Intel® Xeon® processor 7400 series.⁴ They are being integrated into a broad range of server sizes, including 4-socket, 8-socket and larger systems to provide unprecedented scalability on the world's most widely deployed server platform.

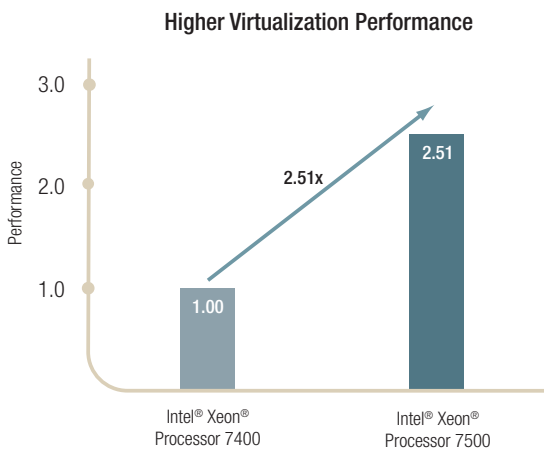


Figure 1. Intel® Xeon® processor 7500 series-based servers improved performance for Kingsoft JX Online* III by 2.51x versus previous-generation Intel® Xeon® processor 7400 series-based servers.

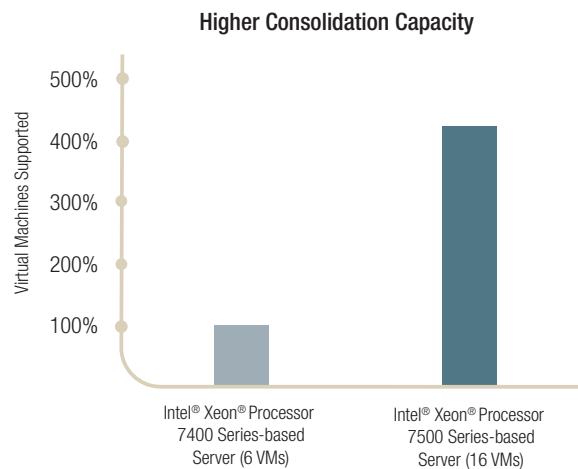


Figure 2. Intel® Xeon® processor 7500 series-based servers running Microsoft Windows Server® 2008 R2 with Hyper-V™ were able to support 2.67x more virtual machines than previous-generation servers and software, while delivering equal or better performance per virtual machine.



Hyper-V has been optimized to support these 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). It also 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 processor 7500 series has been engineered to address this concern by providing up to 72 PCI Express lanes in a 4-socket server.⁵ 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.

“Our benchmarks show that running our online gaming system in a Hyper-V™ virtualization environment on Intel® Xeon® processor 7500 series-based servers more than doubles performance. With their higher performance, consolidation headroom, and energy efficiency, these new Intel® Xeon® processors and Hyper-V will help us reduce our carbon footprint, save on power costs, and let us grow our business a lot further with our existing data centers.”

– Chen FeiZhou, Vice President, Kingsoft



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 Technology⁹ 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. In addition, Microsoft Windows Server 2008 R2 can 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 an entire data centers. With these technologies, energy-efficiency can be optimized across all levels.

Ideal Usage Models

Large-scale Consolidation

An internal Intel study demonstrated the potential benefits of using Intel® Xeon® processor 7500 series-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.⁶ Many businesses have large numbers of Microsoft® SQL Server® and Microsoft SharePoint® implementations, often running on dedicated servers supporting individual departments. With their advanced RAS support and large memory and I/O capacity, Intel Xeon processor 7500 series-based servers are ideal for consolidating these and many other applications to simplify the computing environment and drive down total costs.

Business Continuity

Windows Server® 2008 R2 Hyper-V™ and Intel Xeon processor 7500 series-based servers 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.



Enterprise-Class RAS and Security

Intel Xeon processor 7500 series-based servers 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 support⁷:

- **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 Recovery⁸ (MCA Recovery).
- **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.

Customer benchmarks show more than 2x performance increase when running a Hyper-V virtualization environment on Intel Xeon processor 7500 series-based servers.

Hyper-V running on Intel Xeon processor 7500 series-based servers 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 does become infected, it can be quickly quarantined and a new VM can be brought online almost instantly to restore operation.

Comprehensive and Integrated Management

Microsoft System Center provides 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. It can greatly reduce management costs, while helping IT respond more quickly and effectively to address changing business requirements.

Microsoft System Center Virtual Machine Manager 2008 R2 is a comprehensive management solution for the virtualized datacenter. 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 running 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 add 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.

Find Out More Today

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

To learn more about Intel Xeon processor 7500 series-based servers, 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 Intel and Microsoft, visit www.intelalliance.com/microsoft.

Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See www.intel.com/products/processor_number for details.

[†] Hyper-Threading Technology requires a computer system with a 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 www.intel.com/info/hyperthreading for more information including details on which processors support HT Technology.

[‡] 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 your platform manufacturer on whether your system delivers Intel Turbo Boost Technology. For more information, see <http://www.intel.com/technology/turboboost>.

[§] 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.

[¶] Intel® Intelligent Power Technology requires a computer system with an enabled Intel® processor, chipset, BIOS and for some features, an operating system enabled for it. Functionality or other benefits may vary depending on hardware implementation and may require a BIOS and/or operating system update. Please check with your system vendor for details.

¹ Source: Customer measurements, February 2010. Microsoft Windows Server® 2008 R2 Datacenter with Hyper-V* (6.1.7600.16385) on Intel® Xeon® processor X7500 series, 2.27 GHz; 64 GB, 16x4 GB DDR3-1066 vs. Intel® Xeon® processor X7400 series, 2.67 GHz; 64 GB, 32x2 GB DDR2-667 FB.

² Source: Intel internal measurements, February 2010. SAP ERP workload and Microsoft Windows® Server 2008 R2 Datacenter with Hyper-V* on Intel® Xeon® processor X7500 series, 2.27 GHz; 256 GB, 18x4 GB DDR3-1066 vs. Intel® Xeon® processor X7400 series, 2.67 GHz; 128 GB, 8x4 GB DDR2-667 FB.

³ Source: Internal tests conducted by Intel, Dell and Microsoft March 2010. Microsoft Dynamic CRM 4.0 and Microsoft Windows Server® 2008 R2 Datacenter with Hyper-V* (6.1.7600.16385) on two Dell PowerEdge R910 4-socket servers with Intel® Xeon® processors X7560 2.27 GHz; 256 GB (12x4GB) 1066 MHz. For more information, refer to <http://crmdynamics.blob.core.windows.net/builds/hyperv.pdf>

⁴ 8.2x memory bandwidth claim based on February 2010 Intel internal measurement using Intel internal memory bandwidth workload on comparable 4S Intel® Xeon® processor X7560 and 4S Intel® Xeon® processor X7460-based servers.

⁵ Versus 28 Generation 1 PCI Express lanes in a previous generation, Intel Xeon processor 7400 series based server.

⁶ Less than 1 year ROI claim estimated based on comparison between 4-socket (4S) Single-Core Intel® Xeon® processor 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 20x.

⁷ Most new RAS features are supported by the Intel Xeon processor 7500 series and Microsoft Windows Server 2008 R2 with Hyper-V. Some require system-level support for the server manufacturer. Check with your preferred server vendor for current and planned support.

⁸ MCA Recovery is supported by Microsoft Windows Server 2008 R2, but not in virtual environments with Hyper-V.

Performance increase based on Intel comparison using SPECjbb2005* business operations per second (bops) between 5-year-old single-core Intel® Xeon® processor 3.33GHz based servers and new Intel Xeon processor X7560 based server. Intel consolidation based on replacing 20 5-year-old single-core Intel Xeon processor based servers with one new Intel Xeon Processor X7560-based server while maintaining SPECjbb2009* performance. Costs and return on investment have been estimated based on internal Intel analysis and are provided for information purposes only. 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, visit www.intel.com/performance/serve.

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