New Power for Data Center Virtualization

VMware vSphere™ 4 and Intel® Xeon® Processor 7500 Series-based Servers

Intel and VMware are delivering the performance, scalability and availability needed to virtualize mission-critical applications and to increase consolidation ratios across the data center.

The value of data center virtualization continues to grow. Not long ago, VMware vSphere™ 4 running on the Intel® Xeon® processor 5500 series (based on the Intel® Microarchitecture Nehalem) delivered world-record results for two-socket servers on the VMmark benchmark, with a remarkable increase of up to 160 percent versus previous-generation solutions.1 The Intel® Xeon® processor 7500 series extends that high performance to a new family of enterprise-class servers that provide the capacity and reliability needed to virtualize even the most demanding enterprise workloads.
In combination with VMware vSphere, Intel Xeon processor 7500 series-based servers can help you achieve:

- **Dramatically higher consolidation ratios** to drive down data center space, power and cooling requirements, reduce related maintenance costs and use available local area network (LAN) and storage area network (SAN) ports more efficiently.

- **Near-native application performance** in a virtual environment, with the scalability to support the full range of enterprise applications, including large databases and high-volume transactional and productivity applications.

- **Rock-solid support for mission-critical computing needs** with more than 20 new high availability features, plus dial-up control of service levels through automated virtual machine failover across LANs and WANs.

VMware vSphere is the leading platform for building cloud infrastructures that give IT organizations simple and comprehensive control of systems, workloads and service levels. With scalable servers based on the Intel Xeon processor 7500 series, IT organizations can now extend these benefits into the highest reaches of the enterprise data center to drive down total costs and improve business and IT agility. They can also magnify the cost benefits of virtualization by achieving consolidation ratios that have never before been possible on affordable, industry-standard servers.

**Enjoy Near-Native Performance in a Virtualized Environment**

The Intel Xeon processor 7500 series has been shown to increase performance by up to three times versus its predecessor; with comparable gains across a wide range of workloads. Next-generation Intel® Virtualization Technology◊ (Intel® VT) helps to extend this exceptional performance into virtual environments by providing comprehensive hardware assists for core virtualization functions.

In tandem with software optimizations in VMware vSphere, Intel VT:

- **Delivers up to 3.7x better virtual machine performance** than previous generations.³

- **Reduces performance overhead** to as low as 2 percent (typically 2-10 percent).⁴

- **Enables near-native I/O performance** through direct assignment of I/O devices to meet the demanding throughput requirements of large databases and transactional applications.

This enterprise-class virtualization platform provides the scalability you need to host heavy workloads. With VMware vSphere, a single virtual machine can be configured with up to eight virtual CPUs and 255 GB of memory, and it can support up to 30 GB/s of network bandwidth and more than 300,000 I/O operations per second. With these resources, all but the most extreme enterprise workloads can be successfully virtualized. If you are moving applications from older dedicated servers, you can expect to see dramatic improvements in application throughput and response times.

**Magnify Your Cost Savings through Higher Consolidation Ratios**

Intel Xeon processor 7500 series-based servers and VMware vSphere provide the scalable capacity to consolidate large numbers of applications per server. Individual processors have up to eight high-performance cores and 24 MB of cache. They also support Intel® Hyper-Threading Technology† and Intel® Turbo Boost Technology.§ The first doubles the number of execution threads per server and the second delivers higher performance on demand for peak workloads. These processors also provide a eight times increase in memory bandwidth and four times the memory capacity of the previous-generation 4-socket system based on Intel® Xeon® processor 7400 series.

With these advancements, a single four-socket server now provides up to 32 high-performance cores, 64 execution threads and a full terabyte of memory. These systems provide enormous capacity...
for consolidation. An internal Intel study quantified the potential benefits. Compared with widely deployed systems based on single-core processors, the newer servers supported up to a 20x increase in consolidation ratios, which resulted in:

- Up to 90 percent lower operating costs.
- Approximately 91 percent lower estimated annual energy costs.
- Estimated full payback in as little as one year.

With eight-socket and larger servers in development by leading vendors, IT organizations will be able to implement even higher consolidation ratios.

VMware vSphere plays a critical role in delivering these high consolidation ratios. In most cases, system memory management is the dominant factor in determining the number of virtual machines that can run on a physical host. VMware ESX® and EXSi™ fully support memory over-commit, with unique features such as transparent memory page sharing and memory swap prioritization to reclaim idle physical memory. Available memory is used more efficiently, which enables higher virtual machine densities along with the consistent performance required in production data centers.

VMware vSphere and the latest Intel Xeon processor-based servers support more than twice the virtual machine density of previous generations, enabling higher consolidation ratios.

Achieve High Availability and Disaster Recovery Cost Effectively

As you virtualize and consolidate heavier workloads and more critical applications per server, you need systems and solutions you can count on to maintain uninterrupted service. 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. These new RAS features provide or enable:

- Advanced error detection, correction and containment across all major components and communication pathways
- Dynamic addition and replacement of components in running systems to prevent downtime and to scale resources to support growth and unexpected workload spikes
- Static Hard Partitioning to provide advanced workload isolation and to enable maintenance without bringing down the system

VMware vSphere complements these hardware capabilities by providing fully automated control over workloads and service levels. VMware Enhanced VMotion™ and Intel® Virtualization Technology FlexMigration provide a proven, enterprise-ready live migration solution for moving workloads without downtime among current and future Intel Xeon processor-based servers. This capability has been extensively tested with diverse systems and demanding workloads, both in laboratory settings and across thousands of production deployments in mission-critical customer environments. It lets you grow a unified pool of virtualized resources as you continue to add new Intel Xeon processor-based servers. It also provides the foundation for a complete array of high availability and disaster-recovery solutions.

- VMware High Availability automatically monitors and restarts virtual machines on servers that have spare capacity. It minimizes downtime and IT service disruption, while eliminating the need for dedicated stand-by hardware.
- VMware Fault Tolerance takes high availability to the next level, by providing fully mirrored operation with continuous availability to eliminate even the smallest IT service disruption or data loss.
- VMware vCenter™ Site Recovery Manager allows you to automate failover for an entire data center. It is not only far simpler and more cost effective than traditional disaster-recovery solutions, but also more reliable, since it eliminates error-prone manual processes and is easily tested without disrupting the production environment.
Lower Costs through Higher Virtual Machine Density and Automated Power Management

VMware vSphere and the latest Intel Xeon processor-based servers support more than twice the virtual machine density of previous generations, enabling higher consolidation ratios to drive down space, power and cooling requirements in your data center. They also increase your savings by intelligently tailoring energy consumption to match workloads. Intel® Intelligent Power Technology\(^{\text{a}}\) can reduce power consumption up to 18 percent per server by independently optimizing the power consumption of each core. VMware® Distributed Power Management (DPM) extends power management across the entire data center, by automatically redistributing virtual machines onto a smaller number of servers when workloads are light and shutting down the unneeded systems.

Higher Value through Comprehensive Data Center Virtualization

Virtualization on industry-standard servers has transformed IT service delivery, enabling companies to dramatically consolidate infrastructure and reduce costs, while implementing high availability and disaster-recovery more cost effectively and across a wider range of applications. VMware vSphere and Intel Xeon processor 7500 series-based servers take these benefits to new heights by furnishing an enterprise-class virtualization platform that rivals the scalability and availability of high-end RISC systems, but at a fraction of the cost and with better performance and energy efficiency.

There is no better platform for optimizing your consolidation ratios, extending virtualization across your entire data center, and maximizing value at all points through leading-edge cloud computing functionality.

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\(^{\text{a}}\)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.

\(^{\text{b}}\)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.

\(^{\text{c}}\)Intel® Turbo Boost Technology requires a computer system 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/turbo Boost.

\(^{\text{d}}\)Intel® Intelligent Power Technology requires a computer system with an enabled Intel processor, chipset, BIOS and for some features, an operating system. For Intel® Xeon processor 7500 product information, visit www.intel.com/products/7500.

\(^{\text{e}}\)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. Please check with your system vendor for details.

\(^{\text{f}}\)For a description of the VMmark benchmark and for complete test configurations and results, visit: http://www.vmware.com/products/vmmark/overview.html

\(^{\text{g}}\)Comparison based on Intel internally estimated/measured/historical results as of 12 February 2010. Intel® Xeon® processor X7460 based platform details: Hewlett-Packard® ProLiant DL380 G5 server platform with four Intel® Xeon® processors X7460 (16 MB cache, 2.66 GHz, 1066 MHz FSB), 256 GB memory, I/O Subsystem, Enterprise Linux*. 4S Intel® Xeon® processor X7560 based platform details: IBM System x® 3850 M2 server platform with four Intel® Xeon® Processor X7560 (9 Core, 2.26 GHz, 24 MB L3 cache, 6.4 GT/s QPI), EIST Enabled, Turbo Boost Enabled, Hyper-Threading Enabled, NUMA Enabled, Prefetchers Disabled, Early Data-Return enabled, 256 GB (32x 8 GB DDR3-1066) memory scaled to estimate 512 GB installed, ISV Database, 7x LSI 9200-8e SAS HBAs using 504x X-25 SSD (JBOD) + 144 x 36 GB FC 15K RPM disk storage system, Red Hat® Enterprise Linux 5.4 64-bit.

\(^{\text{h}}\)Intel® Xeon® processor X7460 based platform details: IBM System x® 3850 M2 server system with four Intel Xeon processors X7460 (16 M cache, 2.66 GHz, 6.4 GT/s Intel QPI, 6C), 128 GB (32x 4 GB PC2-5300 667 MHz Registered ECC DDR2 DIMMs), VMware ESXi 5.0 U3 GA. Referenced as published at 20.2 @ 14 tiles. For more information, see: http://www.vmware.com/files/pdf/vmware/VMware-IBM-2009-03-24-x3850M2.pdf. 4S Intel® Xeon® processor X7560 based platform details: Intel® 7000 Chipher based reference server platform with four Intel® Xeon® Processor X7560 (9 Core, 2.26 GHz, 24 MB L3 cache, 6.4 GT/s QPI), Intel® ESL enabled, Turbo Boost enabled, Hyper-Threading enabled, NUMA enabled, Prefetchers enabled, 512GB (64x 8 GB DDR3-1066) memory, VMware® ESX 4.0 Update 1 patch X, 2x Intel® 10 GB-CX4 Dual-Port Server Adapters, FC SAN 2x QLogic QLA2462, 16x 32GB SSD disk storage system. Source: Intel internal testing as of February 2010 referenced as estimated score of 75 @ 50 tiles.

\(^{\text{i}}\)Other names and brands may be claimed as the property of others.

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To learn how your company can take advantage of VMware virtualization running on Intel Xeon processor-based servers to improve energy-efficiency, please visit www.vmware.com/go/intel