

New Power for Data Center Virtualization



VMware vSphere™ 4.1 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 dramatically 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 four-socket, eight-socket and larger enterprise-class servers that provide the high-end capacity and reliability needed to virtualize and consolidate even the most demanding enterprise workloads.
- **VMware vSphere 4.1** adds to these advantages by providing the leading virtualization platform for running mission-critical applications, and delivering major increases in live migration speed and flexibility, resource management, and health monitoring. This platform also provides the ideal IT infrastructure for supporting scalable, reliable cloud computing environments.

With these advances, companies of all sizes can transition confidently toward high-density, fully virtualized data centers that deliver better value to the business at lower cost.



With VMware 4.1 and Intel Xeon processor 7500 series-based servers, IT organizations can extend the benefits of virtualization and high-density consolidation across all their workloads to achieve data center efficiencies that have never before been possible using affordable, industry-standard servers. This industry-leading virtualization platform provides:

- **Dramatically higher consolidation ratios** to drive down data center space, power, and cooling requirements, reduce related maintenance costs, and improve the utilization of network and storage ports.
- **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 silicon-based high availability features, plus dial-up control of service levels through policy-based resource guarantees, enhanced health monitoring and diagnostics, and automated virtual machine failover across LANs and WANs.
- **Scalable data center management**, with the ability to run up to 3,000 virtual machines per cluster, while managing up to 1,000 physical hosts (and 10,000 virtual machines) from a single vCenter™ Server console.

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.

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,² with comparable gains across a wide range of workloads. Next-generation Intel® Virtualization Technology⁰ (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. 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.⁵ 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 8x the memory bandwidth and 4x the memory capacity of previous-generation four-socket systems based on the Intel® Xeon® processor 7400 series.

With these advancements, a single four-socket server now provides enormous capacity for consolidation, with up to 32 high-performance cores, 64 execution threads and a full terabyte

of memory. Compared with widely deployed systems based on single-core processors, the newer servers can support up to 20x higher consolidation ratios, with:⁵

- Up to 90 percent lower operating costs.⁶
- Approximately 91 percent lower estimated annual energy costs.⁷
- Estimated full payback in as little as one year.⁸

Businesses can take their consolidation ratios even higher with eight-socket Intel Xeon processor 7500 series-based servers that provide up to 64 cores, 128 threads and 3 TB of memory.⁹ VMware vSphere 4.1 enables full utilization of these resources to support truly massive workload consolidation. It also provides industry-leading support for memory compression and memory over-commit, which help to eliminate memory bottlenecks to further increase virtual machine densities.

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.

Achieve High Availability and Disaster Recovery Cost Effectively

As you virtualize and consolidate heavier and more critical workloads, 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 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 for your most critical applications and to enable maintenance without bringing down the system

VMware vSphere complements these hardware capabilities by providing fully automated control of 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, both in the lab and in thousands of mission-critical customer environments. It provides a solid foundation for a complete array of high-availability and disaster-recovery solutions.

- **VMware High Availability** monitors and restarts virtual machines on servers that have spare capacity. This cost-effective, automated solution 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. It provides zero down-time, zero data-loss protection without the cost or complexity of alternative solutions.
- **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.

The latest version of vSphere improves all of these functions by migrating virtual machines up to 5x faster and enabling up to eight simultaneous vMotion events. It also provides deeper diagnostics and health checking, quality-of-service prioritization for storage and network I/O, and improved reporting for key storage performance statistics. With this support, IT staff can monitor, control and adapt data center infrastructure more quickly and effectively to further improve service levels.¹⁰

Lower Costs through Automated Power Management

Increasing consolidation ratios with four-socket and eight-socket Intel Xeon processor 7500 series-based servers is one of the most effective ways to drive down space, power and cooling costs in your data center. VMware vSphere takes advantage of Intel® Intelligent Power Technology³ to further reduce power consumption at the system level, by consolidating workloads onto as few cores as possible. For example, when workloads are light, vSphere can automatically increase the frequency of one or more cores by as much as 400 MHz, shift more workloads onto the higher performing cores, and put idle cores into low-power sleep states. VMware® Distributed Power Management (DPM) provides similar control at the data center level, by automatically redistributing virtual machines onto a smaller number of servers when workloads are light and shutting down the unneeded systems.

An Evolutionary Path to the Cloud

VMware and Intel are strongly invested in delivering advanced cloud computing functionality today, while also helping customers establish an interoperable foundation for integrating with current and next-generation public clouds. Both companies are working closely with each other, with industry leaders, and with major service and hosting providers to make cloud computing more powerful, efficient, secure and interoperable. Intel Xeon processor-based servers provide a high-performing, scalable, energy-efficient hardware platform for public and private cloud infrastructures. The vSphere platform helps to ensure broad

software compatibility with diverse public cloud solutions, through new storage APIs and the new vCloud application programming interface (API). You can take advantage of this industry-leading virtualization platform to deploy advanced cloud computing functionality today, while keeping your options open as cloud computing models continue to evolve. There is no better way to extend virtualization across all your systems and workloads, so you can deliver better service to your business while increasing operating efficiency and driving down costs throughout your data center.



To learn how your company can take advantage of VMware virtualization running on Intel Xeon processor-based servers to improve energy-efficiency and performance visit www.vmwareintelalliance.com

⁰ 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.

¹ 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.

⁵ 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>.

² 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 For a description of the VMmark benchmark and for complete test configurations and results, visit: <http://www.vmware.com/products/vmmark/overview.html>

² Comparison based on Intel internally estimated/measured/historical results as of 12 February 2010. Intel® Xeon® processor X7460-based platform details Hewlett-Packard ProLiant® DL580 G5 server platform with four Intel® Xeon® processors X7460 (16 MB cache, 2.66 GHz, 1066 MHz FSB), 256 GB memory, ISV Database, Enterprise LINUX. 45 Intel® Xeon® processor X7560-based platform details Intel® 7500 Chipset-based reference server platform with four Intel® Xeon® processor X7560 (8-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 QR 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 w/ 5.5 kernel. Source: Intel internal testing as of January 2010 referenced as measured score of 1,958K transactions.

³ Intel comparison replacing one Intel® Xeon® processor X7460-based server with one new Intel® Xeon® processor X7560-based server. Consolidation Performance on VMmark® benchmark Comparison based on Intel internally measured as of 12 February 2010. 45 Intel® Xeon® processor X7460-based platform details IBM System x® 3850M2 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 ESX® 3.5.0 U3 GA. Referenced as published at 20.2 @ 14 tiles. For more information, see: <http://www.vmware.com/files/pdf/vmmark/VMmark-IBM-2009-03-24-x3850M2.pdf>. 45 Intel® Xeon® processor X7560-based platform details Intel® 7500 Chipset-based reference server platform with four Intel® Xeon® processor X7560 (8-Core, 2.26 GHz, 24 MB L3 cache, 6.4 GT/s QPI), Intel EIST enabled, Turbo Boost enabled, Hyper-Threading enabled, NUMA enabled, Prefetchers enabled, 512 GB (64x 8 GB DDR3-1066) memory, VMware ESX® 4.0 Update 1 patch X, 2x Intel® 10 Gb CX4 Dual-Port Server Adapter, FC SAN 2x QLogic QLA2462, 16x 32 GB SSD disk storage system. Source: Intel internal testing as of February 2010 referenced as estimated score of 75 @ 50 tiles.

⁴ Source: VMware Capacity Planner assessments.

⁵ Intel consolidation based on replacing 20 5-year-old single-core Intel® Xeon® processor 3.33 GHz-based servers with one new Intel Xeon processor X7560-based server while maintaining performance as measured by SPECjbb2005 business operations per second. 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/server <<http://www.intel.com/performance/servers>> .

⁶ Intel comparison replacing 20 5-year-old single-core Intel® Xeon® processor 3.33 GHz-based servers with one new Intel Xeon processor X7560-based server. Costs have been estimated based on internal Intel analysis and are provided for informational purposes only.

⁷ Based on comparison between 45 Intel® Xeon® MP CPU 3.3 GHz (Single core w/ HT, 1 MB L2, 8 MB L3, Potomac) and 45 Intel® Xeon® X7560 (8 core, 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 42U 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 of \$36,000 based on estimated list prices, and estimated server utilization rates. All dollar figures are approximate. SPECint_rate_base2006* performance and power results are measured for X7560 and Xeon 3.3 GHz-based servers. Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 20x. Baseline platform (measured score of 33.8): Intel server with four MP Intel® Xeon® processor 3.33 GHz (single core w/HT, 1 MB L2, 8 MB L3), 16 GB memory (8x2 GB DDR2-400), 2 hard drives, 1 power supply, using Red Hat EL 5.3 x86_64 operating system. New platform (measured score of 705): Intel internal reference server with four Intel® Xeon® processor X7560 (24 M Cache, 2.26 GHz, 6.40 GT/s Intel® QPI, Intel Hyper-Threading Technology, Intel Turbo Boost Technology), 256 GB memory (64x 4 GB QR DDR3-1333), 1 hard drive, 2 power supplies, using SuSE® LINUX 11, cpu2006.1.1.ic11.1.linux64.binaries.nov242009.tar.bz2 binaries.

⁸ Intel comparison replacing 20 5-year-old single-core Intel® Xeon® processor 3.33 GHz servers with one new Intel Xeon processor X7560-based server. Return on investment has been estimated based on internal Intel analysis and is provided for informational purposes only.

⁹ The Intel® Xeon® processor 7500 series supports "glueless" system designs with up to eight sockets and two terabytes of memory. However, using custom designed chipsets, select vendors are delivering eight-socket servers that support up to 3 TB of memory.

¹⁰ Source: VMware vSphere 4.1 Product Datasheet 2010, <http://www.vmware.com/files/pdf/products/vsphere/VMware-vSphere-Enterprise-DataSheet-DS-EN.pdf>.

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.

Copyright © 2010 Intel Corporation. All rights reserved. Intel, the Intel logo, and Xeon are trademarks of Intel Corporation in the U.S. and other countries.

Copyright © 2010 VMware, Inc. All rights reserved. VMware, the VMware logo, vSphere, vMotion, and vCenter are trademarks or registered trademarks of VMware, Inc. in the United States and/or other jurisdictions.

*Other names and brands may be claimed as the property of others.