

VMware vSphere™ and Intel® Xeon® Processor 5500 Series: Delivering the IT Infrastructure of Tomorrow – Today



You've heard it all before – servers and applications with game-changing technology, greater ROI, lower TCO, improved efficiency and productivity. Pretty soon, it all starts to sound familiar and it's hard to tell which features truly matter to your business' competitiveness and the bottom line.

But this time it's different. Today, Intel® Xeon® processor 5500^A series and VMware vSphere™ are revolutionizing the economics of the data center. For real. For every company – small, mid-sized, and enterprise.

Here are a few of the highlights. VMware vSphere™ and Intel Xeon processor 5500 series together:

- **Decrease capital expense per application** on the average from \$14,000 USD to \$6,000 USD, and operating (labor cost) from \$8,000 USD to \$3,000 USD¹ (over 3 years).
- **Deliver 9x the performance** compared to installed single-core servers² and up to 50 percent lower server idle power compared to the previous generation.³
- **Save at least 20 percent more cost per application** compared to commodity virtualization offerings as a result of much higher consolidation ratios.⁴

Interested? Read on to learn more.



Maximizing Efficiency: A Reality, Not Just a Slogan

Intel and VMware understand the challenges that businesses have always faced, as well as the new pressures surfacing in today's volatile global marketplace. Both companies are industry leaders in their respective markets, and both offer the most advanced technology and highest level of expertise for creating dynamic IT environments that enable business transformation.

Intel and VMware have worked hard to ensure the combination of their two industry-leading products are designed, manufactured and optimized to handle continually evolving data center requirements. The companies have collaborated closely on the architectural enhancements in the Intel Xeon processor 5500 series to not only boost performance, increase consolidation ratios, and enable servers of different generations to be easily combined in the same virtualized server pool, but to also exploit the capabilities of VMware vSphere™ and build a solid foundation on which to deploy both internal and external clouds.

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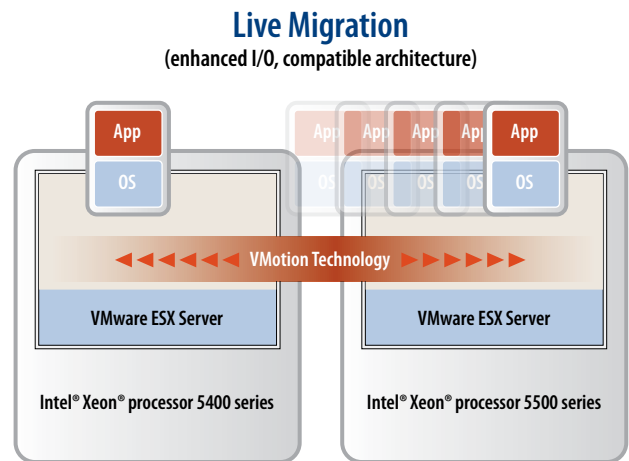
The next generation of Intel® Xeon® processor-based servers built on the new Intel® Microarchitecture, code-named Nehalem, with Intel® Virtualization Technology® (Intel® VT), enhances virtualization performance by up to 2.1x⁵ and reduces roundtrip virtualization latency by up to 40 percent⁶. Add to this Intel® Hyper-Threading Technology,[†] which doubles the number of threads each core can execute during a single clock cycle, and you can further increase the number of virtual machines you can run per socket – maximizing virtual machine density and further reducing your IT energy footprint.

Couple Intel hardware with VMware vSphere™, the leading platform for building cloud infrastructures, and you have the flexibility and agility needed for your data center today and in the future. VMware vSphere™ delivers unparalleled efficiency, control and choice, empowering customers to dramatically reduce capital and operating costs, to increase control through service-level automation, and to give IT departments the flexibility and wide range of options they need to respond to changing business conditions.

Flexibility and Agility for Your Dynamic Data Center

VMware vSphere™ aggregates all data center resources into a shared private cloud, creating massive economies of scale and leading to enormous capital and operational savings. The solution also decreases capital expense per application on the average from \$14,000 USD to \$6,000 USD, and operating (labor cost) from \$8,000 USD to \$3,000 USD¹ (over three years). These results have been proven again and again in more than 130,000 different VMware customer deployments.

VMware vSphere™ supports the broadest range of operating systems OS and applications running on x86, and can seamlessly federate private and public clouds without requiring application



Processor, chipset and I/O enhancements that benefit fluid movement of VMs over network

customization or change, giving you the ability to put an end to “hard-coded” decisions that lock you down. Instead, you get the power to rapidly evolve your IT infrastructure to easily deliver business services on demand, with the freedom to choose the Intel Xeon processor-based server, application architecture, and operating system that’s right for your changing business requirements.

Intel VT with Intel® FlexMigration also gives you more flexibility and choice in managing and allocating VMware virtualized workloads across new and existing Intel-based platforms without having to worry about differences in processor generations – expanding the pool of resources in your virtualized environment.

Combining VMware® Enhanced VMotion™ technology with Intel VT FlexMigration allows you to capture the current live state of a virtual machine and transfer it to a destination system with a different processor generation without any disruptions or downtime and true “production data center” quality reliability, efficiency and manageability. Having the ability to move guests on the fly means that your company can virtually eliminate planned downtime and readjust loads quickly based on changing workload requirements and data center demands. It also enables zero-downtime migration when upgrading to Intel Xeon processor 5500 series-based servers.

Near-Native Application Performance in a Virtual Environment

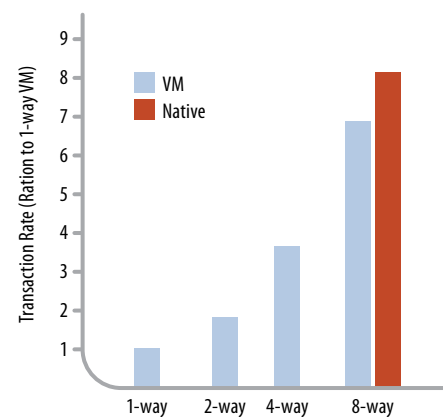
In the past, when you virtualized the CPU, the Memory Management Unit – or MMU – and the I/O devices, there could be an increase in processing overhead and a decrease in the overall performance and scalability of the virtualized environment. But with the introduction of the Intel Xeon processor 5500 series, this performance gap is being bridged with Extended Page Tables (or EPT), hardware support that incorporates MMU virtualization.

Intel and VMware have compared the performance of multiple compute-intensive workloads in a virtual environment with its native counterpart. From this early work, the companies concluded that EPT-enabled systems can easily handle the most demanding of enterprise-class applications. In fact, SAP ERP* running in

a virtual environment on the new Intel Xeon processor 5500 series performed up to 2.03x⁷ better than running in a native environment on the older Intel® Xeon® processor 5400 series.

Another technology that helps improve performance is Intel® VT-d, which helps speed data movement and eliminates much of the performance overhead by giving designated virtual machines their own dedicated I/O devices. When Intel VT-d is combined with VMware® VMDirectPath, network-intensive applications running inside VMware virtual machines improve performance. Intel VT-d and VMDirectPath allow the virtual machine to directly interact with the underlying physical network device and free up the CPU to run additional tasks.

Predictable Performance



Power Efficiency: More Than Just a Lower Utility Bill

As data centers reach the upper limits of their power and cooling capacity, efficiency has become the focus of extending the life of existing data centers and designing new ones. As part of these efforts, companies are beginning to consolidate and refresh existing infrastructure with servers that deliver more performance and scalability, more efficiently.

Intel Xeon processor 5500 series delivers a technological imperative to refresh existing infrastructure or build the core of new data centers. With the Intel Xeon processor 5500 series and VMware vSphere™, you can achieve greater performance while using less energy and space, and dramatically reducing operating costs. With up to 9x the performance compared to installed single-core servers;² up to 50 percent lower server idle power compared to the previous generation;³ and unique virtualization capabilities, Intel Microarchitecture Nehalem lets you deliver more business results from every clock cycle, every hour of IT effort, every watt, and every inch of data center space.

Having the ability to move guests on the fly can virtually eliminate planned downtime and readjust loads quickly based on changing workload requirements and data center demands.

VMware® Distributed Resource Scheduler (DRS) running on Intel Xeon processor 5500 series-based systems can help your data center meet changing priorities, as well. VMware DRS continuously monitors utilization across your data centers resource pools and intelligently allocates available resources among virtual machines according to business needs. When a cluster needs fewer resources, VMware DRS and its component, Distributed Power Management (DPM), consolidate workloads and put hosts in standby mode to reduce power consumption. DPM shuts down and restarts physical servers to reduce power consumption. VMware DRS running on Intel Xeon processor 5500 series-based servers will result in new levels of data center energy efficiency and savings.

Solving Business Challenges Faster and More Efficiently

Companies are always looking for opportunities to do more with less, but in an uncertain economic climate, the right IT investment matters more than ever. VMware and Intel collaborate continually to introduce ground-breaking hardware and software enhancements and to give you the availability, reliability, flexibility and performance you need. The powerful combination of VMware vSphere™ and the Intel Xeon processor 5500 series provides your company with the flexibility, efficiency, control, unprecedented performance, investment protection, and ROI needed to succeed in an on-demand business environment.

VMware vSphere™ on Intel® Xeon® processor 5500 series delivers:

- Greater virtual machine density — for higher consolidation ratios
- Near-native performance in a virtual environment — to efficiently virtualize the most demanding applications
- Power efficiency — to reduce operating expenses
- Flexibility — for new usage models and investment protection

For more information on the Intel Xeon processor 5500 series, visit www.intel.com/xeon.

For more information on VMware vSphere™ visit www.vmware.com/go/vsphere.

For more information on the joint relationship, visit www.vmware.com/go/intel.



⁴Intel 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.

⁵Intel® 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 and software configurations. Consult with your system vendor for more information.

¹Hyper-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.

¹Assuming 40:1 ratio of servers per admin before VMware and 200:1 VMs per admin after VMware. Also assuming \$100K fully loaded cost per sys admin per year.

²Source: Intel estimates as of Nov 2008. Performance comparison using SPECjbb2005 bops (business operations per second). Results have been estimated based on internal Intel analysis and are provided for informational purposes only.

³Intel internal measurements of 221W at idle with Supermicro 2xE5450 (3.0GHz 80W) processors, 8x2GB 667MHz FBDDIMMs, 1x700W PSU, 1x320GB SATA hard drive vs. 111W at idle with Supermicro software development platform with 2xE5540 (2.53GHz Nehalem 80W) processors, 6x2GB DDR3-1066 RDIMMs, 1x800W PSU, 1x150GB 10k SATA hard drive. Both systems were running Windows 2008 with USB suspend select enabled and maximum power savings mode for PCIe link state power management. Measurements as of Feb 2009.

⁴For an extremely relevant and accurate measurement of virtualization's relative cost, visit: www.vmware.com/technology/whyvmware/calculator.

⁵Performance results on VMmark benchmark. Intel® Xeon® processor X5470 data based on published results. Intel® Xeon® processor X5570. Intel internal measurement. (Feb 2009); HP ProLiant ML370 G5 server platform with Intel Xeon processors X5470 3.33GHz, 2x6MB L2 cache, 1333MHz FSB, 48GB memory, VMware ESX V3.5.0 Update 3 Published at 9.15@ 7 tiles vs Intel® Xeon® processor X5570, 2.93 GHz, 8MB L3 cache, 6.4QPI, 72GB memory (18x4GB DDR3-800), VMware ESX Build 140815. Performance measured at 19.51@ 13 tiles.

⁶Source: Intel internal measurements. Intel® Xeon® processor 5500 series (Nehalem) vs. Intel® Xeon® processor 5400 series.

⁷Source: Intel internal measurement, February 2009.

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