

# Virtualization Performance of SAP ERP\* Solutions on the Intel® Xeon® Processor 5500 Series with Microsoft Hyper-V\*

## White Paper

Intel® Xeon®  
Processor 5500

SAP ERP\*

Microsoft Hyper-V\*



### Overview

SAP, one of the leading vendors of enterprise software, offers a broad portfolio of solutions addressing key business functions such as Enterprise Resource Planning (ERP)\*; Customer Relationship Management (CRM)\*; and Warehouse (BW)\*. SAP solutions give local and global companies the power to adapt quickly and cost-effectively to changing business, market and industry requirements.

Running large-scale enterprise solutions in a data center – especially mission-critical solutions such as ERP – requires significant amounts of hardware infrastructure. It requires servers for testing new programs and functionality, servers to verify and implement upgrades and patches, and others to run the production systems. But by running supported SAP solutions in a virtualized environment, all these needs can be met with fewer servers, maximizing benefits from your SAP software while lowering data center costs and increasing business agility.

The Intel® Xeon® processor 5500<sup>A</sup> series with a new generation of Intel® Microarchitecture, codenamed Nehalem, helps achieve near-native performance and near-linear scalability for SAP ERP in a virtualized environment, to help lower IT costs and increase agility without compromising performance. With automated energy-efficiency features, the Intel Xeon processor 5500 series also scales energy usage to workload requirements, delivering optimal performance/watt.

## How Intel Benefits SAP ERP

For more than 10 years, Intel and SAP have worked together to help ensure leading performance for SAP software solutions on Intel® processor-based platforms. By running SAP ERP on servers with Intel Xeon processors, enterprises may tap the power of that collaboration and access outstanding application performance and easy scalability to help achieve their business goals. Servers based on the Intel Xeon processor 5500 series boost performance while saving on power and cooling requirements, delivering as much as 2.25x more performance in a similar power envelope<sup>1</sup> and reducing idle power as much as 50 percent versus the previous generation of two-socket servers<sup>2</sup>

In addition, the Intel Xeon processor 5500 series with Intel Nehalem Microarchitecture, combined with Microsoft Hyper-V,\* expands the benefits of virtualizing SAP ERP, with innovations that boost performance, increase consolidation ratios, and enable serves of different generations to be combined in the same virtualized server pool, improving virtual machine, load balancing, failover, and disaster recovery capabilities.

Next-generation Intel® Virtualization Technology<sup>1</sup> (Intel® VT), combined with Microsoft Hyper-V, enhances the virtualization performance of SAP ERP by up to 1.88x<sup>3</sup> with new hardware-assist capabilities:

- **Processors with Intel® Virtualization Technology (Intel® VT-x)** continue to offer investment protection and infrastructure flexibility with hardware assistance to increase virtualization performance. Intel® VT FlexMigration enables live VM migration across the full range of 32-bit and 64-bit configurations, enabling bigger VM pools.

- **Intel® Virtualization Technology for Directed I/O (Intel® VT-d)** speeds data movement and reduces performance overhead by giving designated VMs their own dedicated I/O devices. Windows Server\* 2008 R2, now available in beta, will support this via Hyper-V configuration.

### Performance Results Before and After Virtualization

We measured virtualization performance using the SAP ERP application running a typical ERP workload. Server virtualization was implemented using Microsoft Hyper-V 1.0 (Build 6.0.6001.18125). Virtual machine (VM) layout and system utilization and resource distribution by the hypervisor all showed excellent scaling behaviour. When running from one to four VMs with four virtual CPUs simultaneously, the benchmarks showed a total performance increase on servers with the new Intel Xeon processor 5500 series of up to 1.60x<sup>4</sup> compared to the previous-generation Intel® Xeon® processor 5400<sup>4</sup> series. Microsoft Hyper-V 1.0 took full advantage of the enhanced processor features Intel® Turbo Boost Technology<sup>5</sup> and Intel® QuickPath Technology.

### Multiplying the Benefits of Virtualization for SAP

Database performance is a critical part of a successful ERP implementation, and it is essential that virtualization does not compromise that performance. By running SAP ERP in a virtualized environment built on Intel Xeon processor 5500 series-based platforms, companies can achieve outstanding ERP performance and scalability while lowering IT costs.

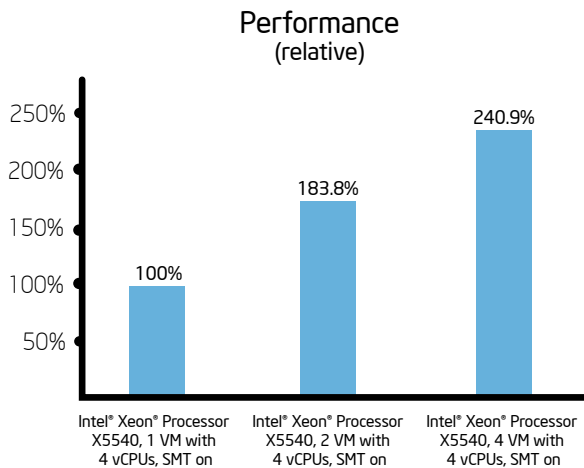


Figure 1. Scaling the number of VMs on Intel® Xeon® Processor X5540.

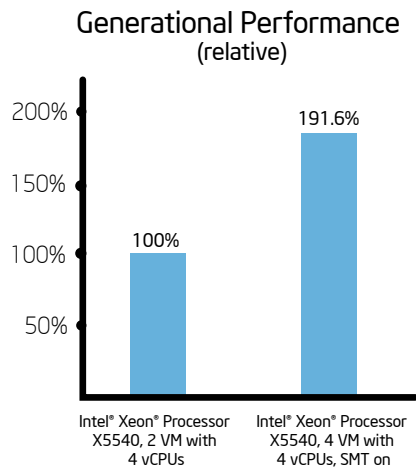


Figure 2. Comparing Intel® Xeon® processor X5440 vs. Intel® Xeon® processor X5540.

Application/Workload Name	SAP ECC* 6.0 on Hyper-V* with Microsoft Windows Server* 2008 and Microsoft SQL Server* 2008 for x86 64 guest OS and applications	
Operating System	Windows Server 2008	
Platform Name	Bensley	Nehalem EP
Processor Name <sup>Δ</sup>	Intel® Xeon® Processor X5440	Intel® Xeon® Processor X5540
Chipset	Intel® 5000P	Intel® 5500
Frequency	2.83 GHz	2.4 GHz
FSB/QPI Frequency	1333 MHz	6.4 GT/s
Memory	32 GB, 8x4 GB DDR2-667 FB	72 GB, 18x4 GB DDR3-1066
BIOS Version	12/02/2007	06/05/2008
DCU IP Prefetcher	Default (Enabled)	Default (Enabled)
DCU HW Prefetcher	Default (Disabled)	Default (Enabled)
HWP Prefetcher	Disabled	Default (Enabled)
ASP Prefetcher	Disabled	Default (Enabled)
SMT	n/a	Default (Enabled)
NUMA	n/a	Default (Enabled)
Turbo Mode	n/a	Default (Disabled)
Intel® Virtualization Technology <sup>†</sup>	Enabled	Enabled
EPT	n/a	Enabled
VTD	n/a	Enabled

Processor Name	Intel® Xeon® Processor X5440	Intel® Xeon® Processor X5540
<b>VM Configuration</b>		
VMM Vendor Name	Microsoft Hyper-V*	Microsoft Hyper-V*
VMM Version	6.0.6001.18125	6.0.6001.18125
Number of VMs	2	4
Number of vCPUs per VM	4	4
Memory per VM	15 GB	16 GB
Internal Disks per VM	1	1
Total IOPS/Second	39.7	58.6
Network Bandwidth	1 GB	1 GB

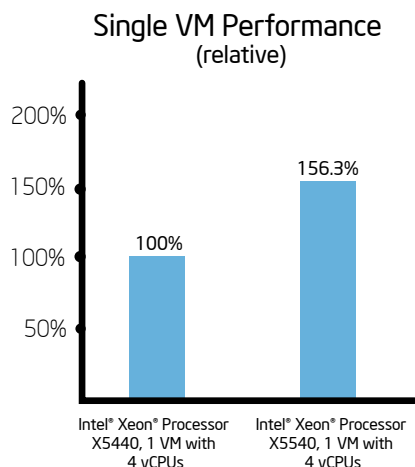


Figure 3. Comparing single VM performance on Intel® Xeon® processor X5440 vs. Intel® Xeon® processor X5540.

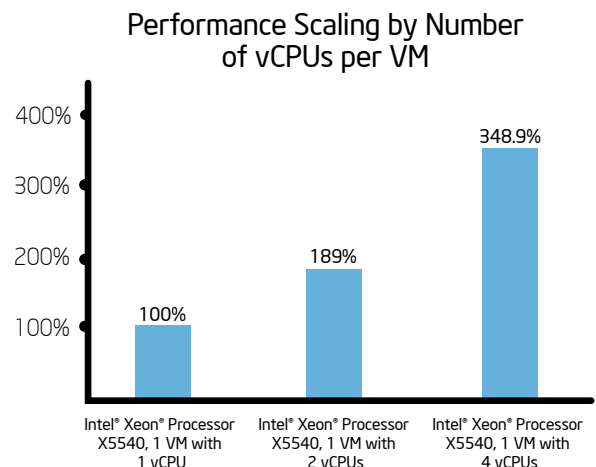


Figure 4. Scaling performance by number of vCPUs.

<sup>4</sup> 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](http://www.intel.com/products/processor_number) for details.

<sup>1</sup> 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.

<sup>8</sup> 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>.

<sup>1</sup> Compared to Intel® Xeon® processor 5400 series. Claim supported by multiple performance results including an OLTP database benchmark on Windows Server 2008. Intel preproduction server platforms with two Quad-Core Intel® Xeon® processors X5460, 3.16 GHz, 2x6 MB L2 cache, 1333 MHz system bus, 64 GB memory (16x4GB FB DDR2-667) vs. Intel preproduction server platform with two Quad-Core Intel® Xeon® processors X5570, 2.93 GHz, 8 MB L3 cache, 6.4QPI, 72 GB memory (18x4GB DDR3-800), Microsoft Windows Server 2008 Enterprise x64 Edition OS. Performance measured in transactions per second. Intel internal measurement. (Feb 2009).

<sup>2</sup> Intel internal measurements of 221 W at idle with Supermicro 2xE5450 (3.0GHz 80W) processors, 8x2 GB 667 MHz FB DIMMs, 1x700 W PSU, 1x320 GB SATA hard drive vs. 111 W at idle with Supermicro software development platform with 2xE5540 (2.53 GHz Nehalem 80 W) processors, 6x2 GB DDR3-1066 RDIMMs, 1x800W PSU, 1x150 GB 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.

<sup>3</sup> Source: Intel Internal measurements, February 2009. Intel® Xeon® processor X5500 series, 2.4 GHz; 72 GB (18x4 GB) DDR3-1066 MHz, vs. Intel® Xeon® processor E5400 series, 2.83 GHz; 32 GB (8x4 GB) DDR2-667 MHz.

<sup>4</sup> Source: Intel Internal measurements, January 2009. Intel® Xeon® processor X5540, 2.4 GHz; 72 GB, 18x4 GB DDR3-1066 vs. Intel® Xeon® processor E5440, 2.83 GHz; 32 GB, 8x4 GB DDR2-667 FB.

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