

# Virtualization Performance of SAP\* ERP Solutions on the Intel® Xeon® Processor 7500 Series with Microsoft Windows Server\* 2008 R2 and Hyper-V\*

## White Paper

Intel® Xeon®  
Processor 7500

SAP\* ERP

Microsoft Hyper-V\*



### Overview

SAP AG, one of the leading providers of enterprise business software, offers a broad portfolio of solutions addressing key business functions such as enterprise resource planning (ERP), customer relationship management (CRM), and business 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 production applications. By running supported SAP solutions in a virtualized environment, all these needs can be met with fewer servers, maximizing the benefits of your investment in SAP software solutions while lowering data center costs and increasing business agility.

Intel® Xeon® processor 7500<sup>A</sup> series-based servers offer new value for virtualizing SAP solutions with Microsoft Windows Server\* 2008 R2 Hyper-V.\* They also adapt intelligently to changing workloads to deliver optimized performance per watt. Four-socket and larger servers based on this new processor family are ideal for virtualizing and consolidating heavy ERP workloads to reduce costs and increase agility without compromising performance.

## 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 the SAP ERP application on servers with Intel Xeon processors, enterprises can 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 7500 series take the capability and value of the combined platform to new heights. With up to 32 processor cores, 64 execution threads and a full terabyte of memory, a standard four-socket server provides ample resources for consolidating heavy ERP workloads. Microsoft Windows Server 2008 R2 with Hyper-V provides an excellent fit for these high-capacity systems. With support for up to 64 logical cores (one per execution thread on a four-socket server, four logical cores per VM), IT administrators can allocate available resources with a high degree of flexibility. They can also take advantage of Core Parking to conserve energy during low utilization by automatically shifting workloads onto fewer cores and putting inactive cores into low energy states.

The Intel Xeon processor 7500 series includes more than 20 new reliability, availability and serviceability (RAS) features that deliver enhanced support for mission-critical environments. In tandem with Microsoft Windows Server 2008 R2 and Hyper-V, these new features provide capabilities that have traditionally been available only on high-end RISC or mainframe systems, such as advanced error management, automatic system recovery, predictive failure analysis and the ability to add and replace components without downtime. Hyper-V also supports host and guest clustering with live virtual machine migration to provide failover and load balancing across LANs and WANs.

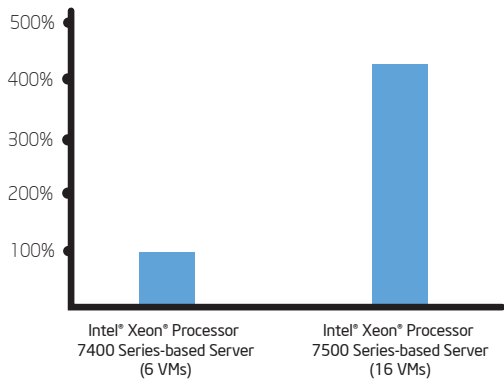
Hyper-V has been tuned and optimized to take full advantage of next-generation Intel® Virtualization Technology<sup>1</sup> (Intel® VT), which provides hardware assistance for core virtualization processes to enable near-native application performance in virtual machines. One of the key improvements for performance is the usage of Extended Page Tables (EPT) of the Intel Xeon processor 7500 series. EPT allows smoother transitions between virtual machines and much lower virtualization overhead. And support for EPT comes with Hyper-V 2.0 and Microsoft Windows Server 2008 R2.

- **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 virtual machine migration across the full range of 32-bit and 64-bit configurations, enabling IT to maintain a common pool of virtualized servers as new servers are added to the data centers.
- **Intel® Extended page tables (Intel® EPT).** When this feature is active, the ordinary IA-32 page tables (referenced by control register CR3) translate from linear addresses to guest-physical addresses. A separate set of page tables (the EPTs) translate from guest-physical addresses to the host-physical addresses that are used to access memory. As a result, guest software can be allowed to modify its own IA-32 page tables and directly handle page faults. This allows a VMM to avoid the VM exits associated with page-table virtualization, which are a major source of virtualization overhead without EPT.

**Table 1. Test Configurations**

Application/Workload Name	SAP ERP 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 SP2	Windows Server 2008 SP2
Processor Name <sup>A</sup>	Intel® Xeon® Processor 7400 Series	Intel® Xeon® Processor 7500 Series
Chipset	Intel® 5000P	Intel® 7500
Frequency	2.67 GHz	2.26 GHz
FSB/QPI Frequency	1066 MHz	6.4 GT/s
Memory	128 GB, 8x4 GB DDR2-667 FB	256 GB, 18x4 GB DDR3-1066
BIOS Version	SFC4UR.86B.01.00.T136	QSSC-S4R.QCI.01.0021.1.21720091721
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	Enabled
Intel® Virtualization Technology <sup>1</sup>	Enabled	Enabled
EPT	N/A	Enabled
VTD	N/A	Enabled

### Total Performance



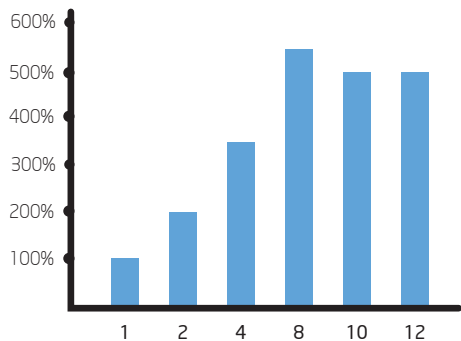
**Figure 1.** Intel® Xeon® processor 7500 series-based servers running Microsoft Windows Server\* 2008 R2 with Hyper-V\* were able to support 2.67x more virtual machines than previous-generation servers and software, while delivering equal or better performance per virtual machine.

### Scalable Performance in a Virtualized Environment

To verify performance, a typical SAP ERP workload was run on Intel Xeon processor 7500 series-based servers and Microsoft Windows Server 2008 R2 with Hyper-V. The same workload was then run on previous-generation servers and software (Intel® Xeon® processor 7400 series-based servers running Microsoft Windows Server 2008 SP2 with Hyper-V). The workload was run in multiple virtual machines on each server, and all virtual machines were configured with four virtual CPUs.

Results show that the new-generation server and virtualization software can support 2.67 times more virtual machines than the older-generation solution, while delivering equal or better performance per virtual machine (Figure 1). The test results also showed excellent performance scaling as additional virtual machines were added to the Intel Xeon processor 7500 series-based server (Figure 2). These results were achieved even before turning on Intel® Hyper-Threading Technology (Intel® HT Technology)<sup>5</sup> By doubling the number of available execution threads from 32 to 64, Intel HT Technology provided an additional 23 percent increase in total system throughput (Figure 3).

### Scaling the Number of Equally Sized Virtual Machines

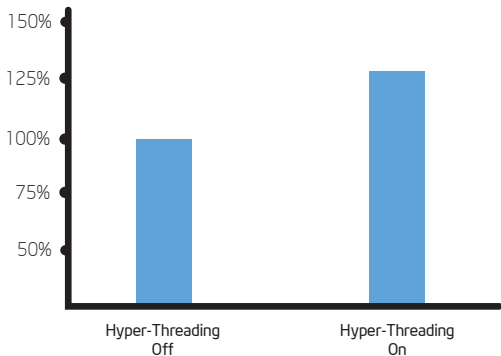


**Figure 2.** Intel® Xeon® processor 7500 series-based servers running Windows Server\* 2008 R2 with Hyper-V\* showed excellent performance scaling as additional virtual machines were added (each VM was configured with four virtual CPUs).

### Multiplying the Benefits of Virtualization for SAP ERP

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 7500 series-based platforms and Microsoft Windows Server 2008 R2 with Hyper-V, companies can achieve outstanding ERP performance and scalability while consolidating their mid-range infrastructure solutions to reduce IT costs.

### Performance Gain with Intel® Hyper-Threading Technology



**Figure 3.** Turning on Intel® Hyper-Threading Technology increased total system performance by an additional 23 percent.

<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> 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>5</sup> Intel® 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.

<sup>1</sup> 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.

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