Virtualization Performance of SAP® ERP on the Intel® Xeon® Processor E7 Family with VMware

Overview

SAP® ERP applications help companies address the ups and downs of markets, business cycles, and compliance by providing software solutions that include operations, financials, corporate services, and human capital management. With greater enterprise productivity and insight from SAP ERP, companies have the power needed to adapt quickly and cost-effectively to changing business, market, and industry requirements. By running SAP ERP in a virtualized environment, IT can add to these benefits by lowering IT costs and increasing data center and business agility.

Not long ago, Intel® Xeon® processor 7500[A] series delivered breakthrough capability and value for SAP deployments by providing near-native performance in virtual machines, along with levels of reliability and scalability never before seen in industry-standard servers. Intel® Xeon® processor E7 family extends those benefits by providing additional computing resources for demanding enterprise workloads, including more cores, more cache, and twice the memory capacity. These processors also include new reliability and security features to protect systems, applications, and data even more effectively. Four-socket and larger servers based on this new processor family are ideal for virtualizing and consolidating mission-critical ERP workloads to reduce costs and increase agility without compromising performance.

How Intel Benefits SAP ERP

For more than 10 years, Intel and SAP AG have worked together to help ensure leading performance for SAP software solutions on Intel® processor-based servers. By running SAP ERP 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 E7 family deliver top-of-the-line support for demanding SAP workloads. Non-virtualized SAP software deployments can result in significant server sprawl due to the use of multiple paths to production and the tiered software architecture. With up to 40 processor cores, 80 execution threads and two terabytes of memory, a standard four-socket Intel Xeon processor E7 family-based server provides ample resources for consolidating SAP environments. Eight-socket and larger systems are available from leading server vendors, offering even higher capacity for virtualizing and consolidating demanding workloads.

VMware software solutions provide the most flexible and cost-effective virtualization solution for SAP software implementations and are optimized for the Intel Xeon processor E7 family. VMware vSphere* is a business virtual infrastructure, which is a new category of software specifically designed to holistically manage large collections of infrastructure – including CPUs, storage, and networking – as a seamless, flexible and dynamic operating environment. Analogous to the operating system that manages the complexity of an individual machine, the business virtual infrastructure manages the complexity of a data center.

VMware vSphere 4.1 includes the VMware ESX* hypervisor, which provides a flexible and scalable software foundation for virtualizing high-capacity Intel Xeon processor E7 family-based servers. Virtual machines can be configured with up to eight virtual CPUs and 255 GB of memory. They can also 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 workloads can be successfully virtualized.

Intel® Xeon® processor E7 family-based platforms deliver 1.35x the performance of previous-generation Intel Xeon processor 7500 series-based platforms running the SAP® ERP application in a virtualized environment.[6]

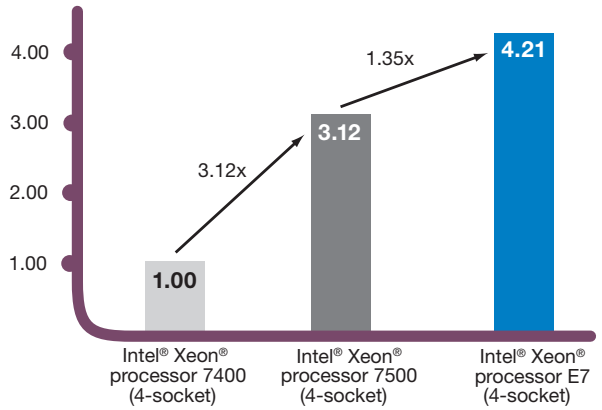

Figure 1. Substantial generation-to-generation performance gains. Intel® Xeon® processor E7 family-based servers running VMware ESX* Server demonstrated 1.35x higher performance for SAP® ERP versus previous-generation Intel® Xeon® processor 7500 series-based servers.

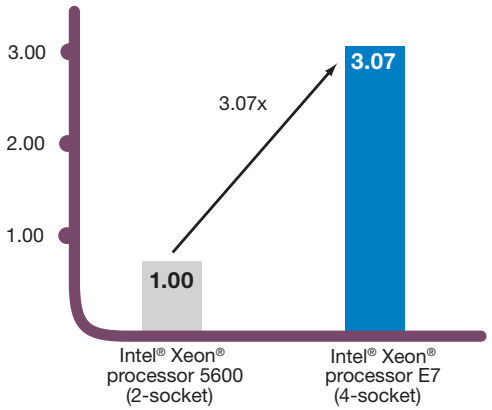

Figure 2. Excellent performance scaling in larger server configurations. Four-socket servers based on Intel® Xeon® processor E7 family running VMware ESX* Server demonstrated 3.07x higher performance for SAP® ERP than two-socket servers based on the Intel® Xeon® processor 5600 series.

VMware ESX Server provides comprehensive support for Intel® Virtualization Technology[1] (Intel® VT), which enables near-native performance and increased flexibility for virtualized workloads.

- Intel® VT-x, with Intel® VT FlexPriority and Extended Page Tables, provides performance optimization across the full range of 32-bit and 64-bit operating environments and has been shown to reduce round trip virtualization latencies by up to 40 percent.[2] Intel VT-x also includes Intel® VT FlexMigration, which, in tandem with VMware Enhanced VMotion*, provides an enterprise-class live migration solution that supports workload migration among current and future Intel Xeon processor-based servers.
- Intel Virtualization Technology for Directed I/O (Intel® VT-d) speeds data movement and eliminates much of the performance overhead of I/O virtualization by giving designated virtual machines direct access to their own dedicated I/O devices.
- Intel® Virtualization Technology for Connectivity (Intel® VT-c) further enhances server I/O solutions by integrating extensive hardware assists into the I/O devices that are used to connect servers to the data center network, storage infrastructure, and other external devices. Intel VT-c can increase network throughput by up to 2x compared with non-hardware-assisted devices.[3]

The Intel® Xeon® processor E7 family helps IT organizations achieve near-native performance for SAP® ERP in a virtualized environment, so IT can lower costs and improve agility without compromising performance.

Intel Xeon processor E7 family is engineered specifically to support the demands of mission-critical environments. It adds to the more than 20 mainframe-inspired reliability, availability and serviceability (RAS) features delivered in the Intel Xeon processor 7500 series, so it provides even better support for data integrity and system resilience.[4] New security features, including new instructions for accelerated encryption, are included to help businesses protect their data, applications, and infrastructure more effectively. VMware complements these capabilities, by offering comprehensive support for high availability, fault tolerance, and disaster recovery through automatic failover of virtual machines across LANs and WANs.

Performance Results

The Intel Xeon processor 7500 series delivered the biggest performance leap ever for an Intel processor, providing an average of 3x better performance than the previous-generation Intel® Xeon® processor 7400 series across a range of industry-standard benchmarks[5] – and 3.12x better performance for SAP ERP in particular.[6]

Recent tests show that servers based on the Intel Xeon processor E7 family deliver additional and significant gains for SAP ERP versus comparably configured Intel Xeon processor 7500 series-based servers. They also show that four-socket servers based on this new processor family provide exceptional scalable performance compared with two-socket servers based on the Intel® Xeon® processor 5600 series.

- Four-socket servers based on the Intel Xeon processor E7 family demonstrated 1.35x higher performance than four-socket servers based on the Intel Xeon processor 7500 series (at 1.76x the performance per watt).

Table 1. Hardware Configuration

Platform	Supermicro (2-socket)	Boxboro (4-socket)	Boxboro (4-socket)
Processor	Intel® Xeon® Processor 5600 series	Intel® Xeon® Processor 7500 series	Intel® Xeon® Processor E7 family
Processor Details	3.33 GHz/6.4 GT/sec Intel® QPI	2.26 GHz/6.4 GT/sec Intel® QPI	2.40 GHz/6.4 GT/sec Intel® QPI
Cores per Processor	6	8	10
LLC per Socket	16 MB	24 MB	30 MB
Intel® Hyper-Threading Technology[7]	Performance measured with these features enabled and disabled		
Intel® Turbo Boost Technology[8]			
NUMA	Enabled on all test runs		
Memory Interleaving	Auto	2-way	2-way
Memory Details	72 GB, 18x4 GB DDR3-800	256 GB, 64x4 GB DDR3-1066	256 GB, 64x4 GB DDR3LV-1066

Table 2. Software Configuration

SAP® Enhancement Package 4 for SAP ERP 6.0 (Unicode)			
Hypervisor	VMware ESX* Server 4.0 U1, build 208167	VMware ESX* Server 4.0 U2, build 239295	VMware ESX* Server 4.1 U1, build 348481
Guest OS	SUSE Linux* Enterprise Server 10 SP2 64-bit		
Number of VMs	6	32	20
vCPUs per VM	4	4	4
Memory per VM	12 GB	8 GB	12 GB
Storage per VM	160 GB LUN	160 GB LUN	200 GB LUN

- Four-socket servers based on the Intel Xeon processor E7 family demonstrated 3.07x higher performance than two-socket servers based on the Intel Xeon processor 5600 series (at 1.16x the performance per watt).

Additional tests were run to test the effectiveness of enabling Intel® Hyper-Threading Technology[7] (Intel® HT Technology) and Intel® Turbo Boost Technology[8] when running SAP ERP on Intel Xeon processor E7 family-based servers.

- Enabling Intel HT Technology delivered 1.31x higher performance (with only 1.12x power increase).
- Enabling Intel Turbo Boost Technology delivered 1.04x higher performance (with 1.07x power increase).

The above results were measured using a typical SAP ERP workload. Virtualization support was provided by VMware ESX Server 4.1 U1 (see Table 2), which has been optimized to take advantage of hardware features in the Intel Xeon processors, including Extended Page Tables (EPT), Intel® Turbo Boost Technology, and Intel® QuickPath Technology.

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 E7 family-based platforms and VMware ESX Server, companies can achieve outstanding ERP performance and scalability, while virtualizing and consolidating their server infrastructure to reduce IT costs.

Learn More

For more information on SAP ERP, visit **www.sap.com/solutions/business-suite/erp/index.epx**.

For more information on VMware ESX Server, visit **www.vmware.com/products/vi/esx**.

For more information on the Intel Xeon processor E7 family, visit **www.intel.com/xeon**.



[1]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 hard-ware 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.

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

[3]Intel internal measurement. (April 2008) Ixia IxChariot* 6.4 benchmark. VMware ESX* v3.5U1. Intel® Xeon® processor E5355, 2.66 GHz, 8 MB L2 cache, 1333 MHz system bus, 8 GB memory (8x1 GB FB DIMM 667 MHz).

[4]Most RAS features in the Intel Xeon processor 7500 series and the Intel Xeon processor E7 family are supported in VMware ESX Server. Some require system-level support from the server manufacturer. Check with your preferred server vendor for current and planned support.

[5]Average of 3x performance claim based on geometric mean of four industry-standard, common enterprise benchmarks (SPECjbb*2005, SPECint*_rate_base2006, SPECfp*_rate_base2006, and TPC Benchmark* E) comparing best published / submitted results on 4-socket (4S) Intel Xeon processor X7560 –based server platform to best published 4S Intel Xeon processor X7460 –based server platform as of March 26, 2010.

[6]Source: Intel internal measurement, February 2010. Intel® Xeon® processor X7500, 2.27GHz; 256 GB (64x4 GB DDR3-1067) versus Intel® Xeon® processor X7400, 2.67 GHz; 128 GB (32x4 GB DDR2 667 FB).

[7]Intel® Hyper-Threading Technology requires a computer system with a processor supporting HT Technology and an HT Technology-enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. For more information including details on which processors support HT Technology, see http://www.intel.com/info/hyperthreading.

[8]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.

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