



Ask for More from Your Data

The new Intel® Xeon® processor E7 v3 family running the SAP HANA* platform turns real-time transactions and analytics into a real business advantage



As the CTO of a global finance company, Rose wants to upgrade data centers company-wide in order to help the business respond quickly to market movements and get ahead of the competition faster. Like many other industries, the financial sector generates nearly incomprehensible amounts of data every second. Enterprises need quicker and quicker solutions to process this data and query it for real-time analysis. For instance, a bank might need faster insight into customer spending trends in order to identify and reduce risks such as fraudulent credit-card activity. Risk mitigation and other similar insights drive the desire for companies to see their business intelligence as fast as possible.

Last year, Rose deployed the SAP HANA* platform on servers powered by the previous-generation Intel® Xeon® processor E7 v2 family. The results were scalable data warehouse, consistent transactional performance and improved query performance.¹ The CFO was able to make more timely and informed business decisions based on data analytics delivered in minutes instead of days (Figure 1). Excited at the prospect of even faster data-delivery speeds, Rose plans to upgrade her mission-critical servers to the new Intel Xeon processor E7 v3 family.

The Intel Xeon microprocessor E7 v3 family delivers exceptional performance improvements for SAP HANA platform in-memory database processing. With

up to 20 percent more cores and threads, servers with the Intel Xeon processor E7 v3 family running the SAP HANA platform can support lightning-quick transaction processing and data analysis to act upon nearly as fast as users and devices generate that data.¹ Additional capabilities include a large and efficient cache hierarchy, support for up to eighteen cores, multi-threading, Intel® Advanced Vector Extensions 2 (Intel® AVX2), single-instruction, multiple-data (SIMD) processor instructions, and the latest in reliability, availability, and serviceability (RAS) features, such as Intel® Run Sure Technology.²

Users already depend on the fast computing speeds delivered by Intel Xeon processors, but what sets the Intel Xeon processor E7 v3 family apart from previous generation E7 processors is the addition of Intel® Transactional Synchronization Extensions (Intel® TSX). Intel TSX helps improve performance of transactional in-memory database processing on systems with high core counts where the scalability of thread synchronization is important. This technology can help Rose's SAP HANA platform deliver greater value when it runs on multi-socket servers powered by the Intel Xeon processor E7 v3 family. The combination of the new Intel Xeon processor E7 v3 family with Intel TSX and the SAP HANA platform enables faster performance, improves reliability and uptime, and extends scalability to handle any workload (Figure 1).

Faster Performance from the Intel and SAP Partnership

The Intel Xeon processor E7 v3 family combines the latest SAP HANA platform innovations for improved transactional processing with the Intel TSX capability for hardware supported lock elision to deliver exceptional in-memory transactional performance.

With the Intel TSX enabled, SAP HANA internal stress test lab results showed significant performance improvements in transactional processing as depicted in the Figure 1 below.

Intel TSX includes hardware improvements for easier multi-core programming. Intel TSX allows the processor to determine dynamically whether threads need to serialize through lock-protected critical sections and to perform serialization only when required. This is implemented in the internal index structures of the SAP HANA platform to enable more

efficient and scalable database index implementations. In conjunction with upgrades to SAP HANA SPS 09, Intel TSX enabled on the Intel Xeon processor E7 v3 family can deliver transactions over twice as fast as previous generation processors.^{1,3}

In addition to Intel TSX, the Intel Xeon processor E7 v3 family contains Intel® Advanced Vector Extensions 2 (Intel® AVX2). Intel AVX2 includes CPU instructions that enable acceleration of enterprise-class workloads. The scan operation with the SAP HANA platform, which determines how many items in a database can be scanned per second, has been enabled to benefit from Intel AVX2. Improvements from Intel AVX to Intel AVX2 include added support for integer 256-bit operations. Applications that could benefit from Intel AVX2 include general-purpose applications like imaging, audio/video processing, scientific simulations, financial analytics, and 3-D modeling and analysis.

Take Advantage of New Capabilities with Advances in Intel® SSDs

Intel® Solid-State Drives (SSDs) further enhance in-memory databases such as SAP HANA*. The latest Intel SSDs can help IT take advantage of the dynamic data tiering capability that is new in SAP HANA SPS 09. This capability allows for the transfer of cold data from memory to disk, helping to ensure sufficient resources for optimal performance on hot data are still located in memory.

When running SAP HANA platform with the new Intel Xeon processor E7 v3 family, and with Intel TSX enabled, users saw incremental performance gains such as:

Incremental performance gains in transactional processing when running SAP HANA on the Intel Xeon processor E7 v3 family with Intel® TSX enabled

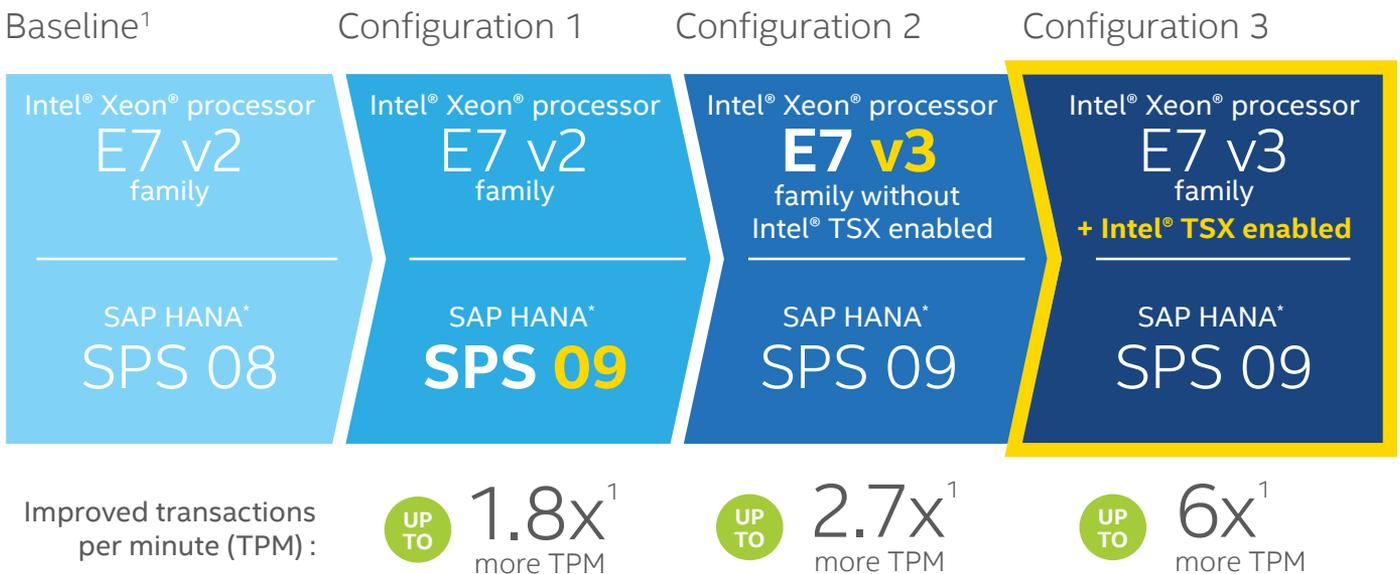


Figure 1. Upgrading to the Intel® Xeon® processor E7 v3 family and SAP HANA* SPS 09 (S-OLTP stress test lab results) provides incremental performance gains.¹

- Upgrading to SAP Business Suite 4 SAP HANA* (S/4HANA*) SPS9 from SPS8; scaling is improved by applying fixes for inefficient locking with additional compute threads enabling 1.8x more transactions.^{1,3}
- When upgrading to the Intel Xeon processor E7 v3 family from the Intel Xeon processor E7 v2 family, the additional threads and cache plus the improved microarchitecture delivered up to 50 percent more performance for a cumulative gain of 2.7x.^{1,3}
- Adding Intel TSX programming currently available only on the Intel Xeon processor E7 v3 family delivered up to 2.2x additional transactions per minute (TPM).^{1,3}
- The total performance improvement seen was up to 6x more TPM, increasing business capacity within the same footprint.^{1,3}

The Intel Xeon processor E7 v3 family includes the following performance and efficiency enhancements for advanced in-memory database processing:

- Support for integer 256-bit operations with Intel AVX2 for faster scan operations.
- Up to 18 cores (36 threads) and up to 45 MB of last-level cache—This is an increase over previous-generation processors, which contained up to 15 cores and 30 threads.
- Per-core p-state (PCPS)—This feature dynamically regulates and adjusts power in each processor core for more power-efficient workload processing.
- Cache Quality of Service (QoS) Monitoring—This feature can help identify and monitor virtual machines and/or applications working in cache so that resources can be optimized through intelligent scheduling and load balancing.

These enhancements can help drive additional returns on Rose's SAP HANA

platform investment by enabling greater performance and efficiency across the environment. They provide the horsepower needed to address real-time transaction and analytics requirements of demanding workloads while helping monitor and tune the environment as conditions change.

Improved Reliability and Uptime

In addition to supporting outstanding performance and resource utilization, the Intel Xeon processor E7 v3 family provides more than 40 new and enhanced reliability features that keep mission-critical systems, including the SAP HANA platform, up and running.

Optimize your infrastructure with 40+ RAS features, including Intel Run Sure Technology to help ensure greater uptime. Intel Run Sure Technology, available only on the Intel Xeon processor E7 family, increases uptime with specialized capabilities that can diagnose and recover from system and memory management failures or errors:

- **Enterprise Management Configuration Assistant (eMCA) Recovery Gen 2** expands the server's ability to recover from a broader range of errors, including uncorrectable errors, without interrupting the operating system.
- **Address-based memory mirroring** allows the firmware or operating system to determine a range of memory addresses to be mirrored, which helps reduce cost of memory.

Other RAS enhancements include:

- **Multiple rank sparing** can help reduce the need for frequent server maintenance and downtime. It provides a second rank for dynamic failover of a failing rank to a spare rank behind the same memory controller.
- **DDR4 recovery** reduces the frequency of fatal DDR4 memory errors that would cause system crashes.

Intel® TSX

The increasing number of microprocessor cores every generation poses challenges for high-performance in-memory database systems. While these systems use sophisticated high-level algorithms to partition a query or run multiple queries in parallel, they also utilize low-level synchronization mechanisms to synchronize access to internal database data structures. Developers often spend significant development and verification effort to improve concurrency in the presence of such synchronization. Intel® TSX enables hardware to dynamically determine whether threads actually need to synchronize even in the presence of conservatively used synchronization.⁴

- **Intel® Data Protection Technology with Advanced Encryption Standard New Instructions (AES-NI)** accelerates encryption by reducing the associated performance penalties.

Extend Scalability to Handle Any Workload

Performance and reliability are two crucial pillars upon which every business-critical enterprise system should be built. Scalability is another. Rose needs to be able to expand her systems quickly and efficiently in response to business needs. The Intel Xeon processor E7 v3 family extends scalability through:

- Support for up to 12 TB of memory in an 8-socket configuration for massive in-memory transactional and analytical operations

- Flexible memory options (such as DDR4 and DDR3)
- Native CPU support for 2-, 4-, and 8-socket configurations, and support for more than 8 sockets with third-party node controllers

With these and other scalability features, the Intel Xeon processor E7 v3 family can provide a scalable foundation that can support Rose's short and long-term plans for business growth and change. She can scale out and scale up her SAP HANA platform implementations, expand her software-defined infrastructure (SDI) or software-defined network (SDN), and extend her cloud-deployment visions well into the future.



Query Data Nearly as Fast as Users and Devices Generate Data

The brand-new addition of Intel TSX to the Intel Xeon processor E7 v3 family plus the power of the SAP HANA platform will help Rose and other CTOs and CIOs improve transactional and analytical processing. Rose can bring the business's best ideas to life by transforming big data and real-time analytics into new business opportunities while ensuring the reliability and uptime of the most business-critical services.

For more information on the Intel Xeon processor E7 v3 family, visit <http://www.intel.com/xeon>

Intel and SAP:

Intel and SAP simplify IT by delivering a purpose-built processor and platform combination to reduce complexity and optimize performance. In fact, SAP runs its business mostly on Intel architecture, and Intel runs most of its business on SAP products. SAP HANA offers a choice of over 400 OEM appliances that are certified on previous-generation Intel Xeon processors. The number could grow even more with the Intel Xeon processor E7 v3 family's release.

To see a list of all hardware certified for SAP HANA, visit <http://global.sap.com/community/ebook/2014-09-02-hana-hardware/enEN/appliances.html>

¹ Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors.

Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

Up to 6x performance improvement for transactional workloads with new Intel® Transactional Synchronization Extensions (TSX) claim based on SAP* OLTP internal insert and select tests measuring transactions per minute (tpm) on SuSE* LINUX Enterprise Server 11 SP3.

Configurations:

- Baseline 1.0: 4S Intel Xeon processor E7-4890 v2, 512 GB memory, SuSE* LINUX Enterprise Server 11 SP3, SAP HANA* 1 SP8 scoring 14,327 tpm.
- Up to 1.8x more tpm: 4S Intel Xeon processor E7-4890 v2, 512 GB memory, SuSE* LINUX Enterprise Server 11 SP3, SAP HANA* 1 SP9 scoring 26,139 tpm.
- Up to 2.7x more tpm: 4S Intel Xeon processor E7-8890 v3, 512 GB memory, SuSE* LINUX Enterprise Server 11 SP3, SAP HANA* 1 SP9 – Intel TSX disabled scoring 39,330 tpm.
- Up to 6x more tpm: 4S Intel Xeon processor E7-8890 v3, 512 GB memory, SuSE* LINUX Enterprise Server 11 SP3, SAP HANA* 1 SP9 – Intel TSX enabled scoring 89,619 tpm.

For more complete information visit <http://www.intel.com/performance/datacenter>.

² Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at www.intel.com.

³ Upgrading to SAP Business Suite 4 SAP HANA* (S/4HANA*) SPS9 from S/4HANA SPS8: scaling improved by enhancing locking with additional compute threads enabling 1.8x more transactions. Upgrading to the Intel® Xeon® processor E7 v3 family from the Intel Xeon processor v2 family: the additional threads and cache plus the improved microarchitecture delivered up to 50 percent more performance for a cumulative gain of 2.7x.

Adding Intel® TSX programming currently available only on the Intel Xeon processor E7 v3 family delivered up to 2.2x additional TPM.

The total performance improvement seen was up to 6x more TPM, increasing business capacity within the same footprint.

⁴ Tomas Karnagel (TU Dresden), Roman Dementiev (Intel), Ravi Rajwar (Intel), Konrad Lai (Intel), Thomas Legler (SAP AG), Benjamin Schlegel (TU Dresden), Wolfgang Lehner (TU Dresden). "Improving In-Memory Database Index Performance with Intel TSX."

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