



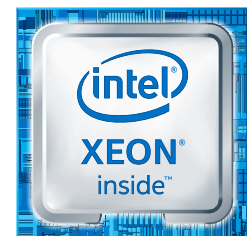
Use Case

# SAP and Intel Co-innovation Enables Global Cloud Migration to the SAP HANA® Platform

SAP increased workload density and reduced operational costs by upgrading global customers to the SAP HANA platform powered by the Intel® Xeon® processor E7 v4 family

## SAP “Future Proofs” Cloud Infrastructure in a Massive Global Migration

As SAP’s true software-as-a-service (SaaS) public cloud and multitenancy cloud offering, the SAP® Business ByDesign® solution initially launched as a dedicated enterprise resource planning (ERP) application, but it has since then grown to be much more for Europe’s biggest enterprise software company. With new extensibility concepts, based on both in-place extensibility and side-by-side extensibility via SAP Cloud Platform, the SAP Business ByDesign solution has become a key business process platform that customers use to build and run their own add-on services, which now total more than 2,600 add-ons and integration scenarios.



Given the substantial customer growth and the ever-increasing need for more compute power, SAP made a strategic decision in 2016 to upgrade all of its customers from aging SAP® MaxDB® databases and TREX® storage environments to SAP HANA® databases, its latest technology platform. By doing so, SAP has enabled its customers to take full advantage of the SAP HANA platform’s capabilities. Perhaps most important for SAP itself, this global migration has eliminated the cost and complexity of maintaining the dual persistency/in-memory infrastructures.

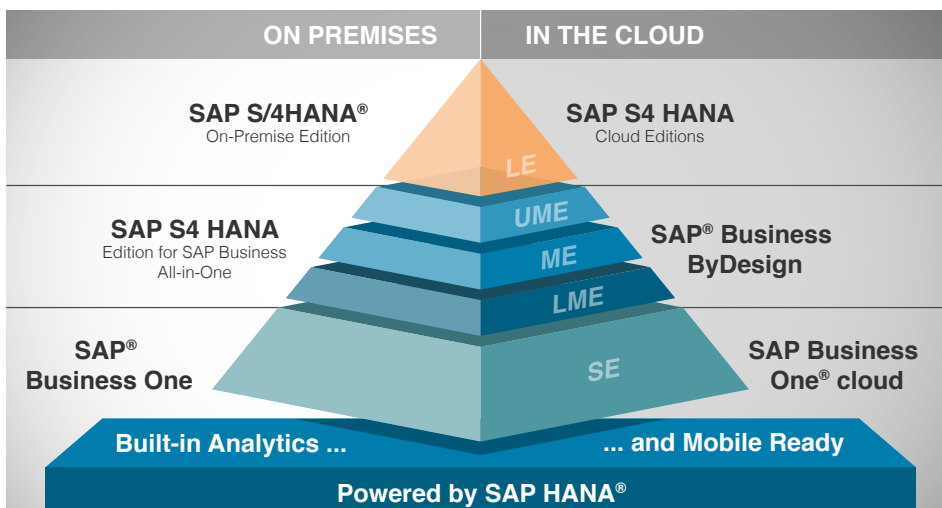


Figure 1. SAP targets the SAP® Business ByDesign® solution at midsize companies.

## Migrating to the SAP HANA Platform and Servers Built on the Intel Xeon Processor E7 v4 Family

For SAP's worldwide operations team, the migration proved to be a massive undertaking that had to be implemented on top of all the critical day-to-day maintenance required to keep the SAP Business ByDesign solution up and running. In 2016 alone, the worldwide customer base of mostly midsize companies relied on the SAP Business ByDesign solution to process a staggering 258 million accounting documents, 24 million customer invoices, and 15 million sales orders.

The SAP worldwide operations team began research into hardware requirements in July 2016, with an inventory of customers' existing database requirements along with a projection for 2017. By August, with a finalized hardware bill of materials (BoM), the team started migrating SAP's own SAP HANA sales-demo systems used to showcase the SAP Business ByDesign solution to new customers. Starting the migration in-house with the company's own technology on the line signaled SAP's total commitment to the upgrade and generated valuable early feedback critical to the success of the rest of the project.

Subsequent migration of test and live production databases commenced in October 2016, requiring coordination with almost 3,600 customers worldwide. Downtime was reduced to approximately 30 hours beginning on a Friday before the system came back online Sunday morning. By early December, SAP's worldwide operations team had completed migrating the entire SAP Business ByDesign productive landscape across its growing constellation of data centers: 45 systems in EMEA, 35 in North America, and 20 in Asia. The project was completed just in time for the opening of SAP's newest data center in Shanghai in February 2017.

### The SAP HANA Platform Fully Optimized with the Intel Xeon Processor E7 v4 Family

The upgrade to the SAP HANA platform presented the perfect opportunity for SAP to update its hardware to run on the Intel® Xeon® processor E7 v4 family, chosen for its robust performance and advanced reliability. For the SAP Business ByDesign solution, new server hardware ranged from 512 GB to 6 TB of memory on 160 cores.

The dramatic improvements of the Intel Xeon processor E7 v4 family, compared to previous-generation Intel Xeon processors, have enabled the SAP HANA platform to reach new levels of performance, resulting in greater real-time responsiveness, quicker results, and increased productivity.<sup>1</sup> With up to 24 cores and 48 threads per processor, the SAP Business ByDesign solution can now handle more concurrent transactions for its customers. The 33-percent increase in supported memory in the Intel Xeon processor E7 v4 family compared to previous-generation Intel Xeon processors means that the SAP Business ByDesign solution can handle larger in-memory workloads and complete conventional online-transaction-processing (OLTP) workloads faster.<sup>2</sup> And with up to 60 MB of L3 cache memory right on the processor die, the Intel Xeon processor E7 v4 family can position more data closer to the computation on the processor, which enables the SAP Business ByDesign solution to handle more transactions faster.

Optimization technologies also play a significant role in increasing the performance that the Intel Xeon processor E7 v4 family provides the SAP Business ByDesign solution. For example, Intel® Trusted Synchronization Extensions (Intel® TSX) enables up to 6.3 times more transactions per minute for both critical ERP OLTP workloads and the online-analytical-processing (OLAP) workloads that provide faster business insights to SAP Business ByDesign customers.<sup>3</sup>

The Intel Xeon processor E7 v4 family's capabilities around hardware-enhanced security for real-time analytics align with SAP's push for the SAP Business ByDesign solution to enable customers to process massive amounts of core business data along with new sources of unstructured data into actionable and timely insights. Put another way,

## The SAP® Business ByDesign® Migration Timeline



**8 weeks**  
for hardware deployment



**8 weeks**  
for migration SAP HANA®



**4 months**  
to full migration

the analytical capabilities enabled by the Intel Xeon processor E7 v4 family deliver competitive advantages to anyone who relies on the speed of information to get his or her job done—such as users who need the ability to ask computationally demanding questions and get an answer in 0.7 seconds.<sup>4</sup> These advancements are transforming industries by making analytics of real-time sales and customer data economically viable for the first time outside of supercomputing.

## Outcome: Better Performance and Lower Costs for SAP

Migrating the SAP Business ByDesign solution to the SAP HANA platform and servers built with the Intel Xeon processor E7 v4 family has provided SAP and its customers with operational and performance benefits.

### Server Consolidation

SAP now benefits from 40 percent more server capacity thanks to the SAP HANA platform's new database-compression capabilities, which enable SAP to run 22 to 25 separate customer tenants on a single server, replacing servers that hosted 15 to 17 tenants. The upgraded multi-tenant architecture still has room for an additional 5 to 10 tenants per server and enough headroom to meet the tenant growth predicted for 2017, in addition to the computing demands of existing customers. The lower management expenses from fewer servers, combined with reduced complexity, translate into reduced costs for SAP. Likewise, the more efficient power consumption of the Intel Xeon processor E7 v4 family contributes to up to 25 percent better total cost of ownership (TCO).

### Improved SAP® Business ByDesign® Solution Performance

SAP anticipates additional performance benefits for its SaaS customers as the SAP Business ByDesign solution incorporates more SAP HANA platform features this calendar year, such as the ability for an eight-socket system to scale from 6 TB to 8 TB of RAM.

### Looking to the Future

SAP plans to continue working closely with Intel, including optimizing the SAP HANA 2 platform for Intel® processors. Likewise, looking further out, SAP is integrating advances in machine learning and related innovations, collaborating with Intel to speed artificial-intelligence (AI) solutions to SAP Business ByDesign customers. Intel's commitment to democratize AI innovation, along with its support for open data-exchange initiatives, is helping make AI accessible and affordable for all customers. The collaboration of SAP and Intel on AI will be similar to the successful joint work around the innovative SAP HTML5 front end that transformed app portability.

By using the Intel Xeon processor E7 v4 family to build out the SAP Business ByDesign solution, SAP won't need to upgrade its hardware again when migrating it to the SAP HANA 2 platform.

## Bringing the Benefits of the SAP HANA Platform and the Latest-Generation Intel® Hardware to All SAP Business ByDesign Customers

SAP's decision to port all its SAP Business ByDesign customers to the SAP HANA platform on servers based on the Intel Xeon processor E7 v4 family was implemented with almost no impact on customers' abilities to operate their businesses without interruption, other than the brief scheduled downtime during non-business weekend hours.

With this migration, the SAP HANA platform has helped to eliminate costly dual infrastructure, realizing cost efficiencies across SAP's global network of data centers while strengthening SAP Business ByDesign as more than just a powerful ERP and web-services platform.

## SAP HANA® 2

With the move to servers based on the latest-generation Intel® Xeon® processor family, SAP will not need to further upgrade its hardware to support migration to the SAP HANA 2 platform.

The SAP HANA 2 platform will provide further benefits to SAP® Business ByDesign® customers, including:

- Simplified databases and data management
- Easier smart and insight-driven app development
- Optimization for innovation—organizations can realize up to 575-percent return on investment (ROI) by innovating on the SAP HANA platform<sup>6</sup>

## SAP HANA® 2

## Learn More

To learn more, visit:

- [intel.com/sap](http://intel.com/sap)
- [sap.com/businessbydesign](http://sap.com/businessbydesign)

<sup>1</sup> Intel. "Business Intelligence with Intel® Xeon® Processor E7-8800/4800 v4 Product Families." June 2016. [intel.com/content/www/us/en/benchmarks/server/xeon-e7-v4/xeon-e7-v4-business-intelligence.html](http://intel.com/content/www/us/en/benchmarks/server/xeon-e7-v4/xeon-e7-v4-business-intelligence.html).

Configurations: submitted/published results as of 6 June 2016:

- 4-socket Intel® Xeon® processor E7-8890 v4 family: Dell PowerEdge R930\* with four Intel Xeon processors E7-8890 v4, 2.20 GHz (96 cores, 192 threads), 1.5 TB memory, running SUSE\* Linux\* Enterprise Server 11, SAP NetWeaver® 7.50, SAP® BW Advanced Mixed Load (BW-AML), SAP HANA® 1.0. Source: SAP certification number 2016025, <http://global.sap.com/solutions/benchmark>. Score: 29,557 advanced query navigation steps/hour; 2 billion records.
- 4-socket Intel Xeon processor E7-8890 v3 family: Dell PowerEdge R930 with four Intel Xeon processors E7-8890 v3, 2.50 GHz (72 cores, 144 threads), 1.5 TB memory, running SUSE Linux Enterprise Server 11, SAP NetWeaver 7.50, SAP BW-AML, SAP HANA 1.0. Source: SAP certification number 2016019, <http://global.sap.com/solutions/benchmark>. Score: 23,690 advanced query navigation steps/hour; 2 billion records.

For more information, go to [intel.com/performance/datacenter](http://intel.com/performance/datacenter).

<sup>2</sup> 33-percent gain based on memory support of up to 8 TB on systems powered by the Intel® Xeon® processor E7 v4 family compared to 6 TB on systems powered by the Intel Xeon processor E7 v3 family. For more information: SAP. "Find Certified Appliances." June 2016. <https://global.sap.com/community/ebook/2014-09-02-hana-hardware/enEN/appliances.html>.

<sup>3</sup> Up to 6.3x performance improvement for transactional workloads with new Intel® Transactional Synchronization Extensions (Intel® TSX) claim based on SAP OLTP internal insert and select tests measuring transactions per minute (TPM) on SUSE\* Linux\* Enterprise Server 11 SP3.

Upgrading to SAP HANA® SPS 09 from SAP HANA SPS 08: 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 on the Intel Xeon processor E7 v3 family delivered up to 6x additional TPM. Upgrading to SAP HANA SPS 12 on the Intel Xeon processor E7 v4 yielded a total performance improvement of up to 6.3x more TPM, increasing business capacity within the same footprint.

Configurations:

1. Up to 1.8x more TPM: 4S Intel Xeon processor E7-4890 v2, 512 GB memory, SUSE Linux Enterprise Server 11 SP3, SAP HANA SPS 09, scoring 26,139 TPM; Intel TSX not supported
2. Up to 2.7x more TPM: 4S Intel Xeon processor E7-8890 v3, 512 GB memory, SUSE Linux Enterprise Server 11 SP3, SAP HANA SPS 9, scoring 39,330 TPM; Intel TSX disabled
3. Up to 6x more TPM: 4S Intel Xeon processor E7-8890 v3, 512 GB memory, SUSE Linux Enterprise Server 11 SP3, SAP HANA SPS 09, scoring 89,619 TPM; Intel TSX enabled
4. Up to 6.3x more TPM: 4S Intel Xeon processor E7-8890 v4, 512 GB memory, SUSE Linux Enterprise Server 11 SP3, SAP HANA SPS 12, scoring 89,558 TPM; Intel TSX enabled

Intel. "Intel® Xeon® Processor E7 v4 and SAP HANA®: A Marriage Made in Heaven." August 2016. [youtube.com/watch?v=RX34C5ZIFWQ](http://youtube.com/watch?v=RX34C5ZIFWQ).

"Up to 25 percent lower TCO (3 years) and up to 55-percent system-power savings on the Intel® Xeon® processor E7 v4 family versus IBM POWER8\*" claim based on pricing of comparable four-processor rack server using the Intel Xeon processor E7-8890 v4 product family (24 cores) against a four-processor IBM Power System E870\* using IBM POWER8 (4.19 GHz, 10 cores) as of February 2016.

Estimated power:

- IBM Power System E870/IBM POWER8: Using <http://www-912.ibm.com/see/EnergyEstimator> for four IBM POWER8 processors (4.19 GHz), four chips, 10 cores/chip, and 1 TB memory at 2,664 watts max power.
- Intel estimate for 8x Intel Xeon processor E7-8890 v4 product family, 1 TB memory, and 2x 146G 15K SAS drives at 1,090 watts max power.

Estimated pricing:

- Four-chip Intel Xeon processor E7-8890 v4 platform: Intel estimated price of \$60,000 with 4x Intel Xeon processors E7-8890 v3, 1 TB memory, and 2 HDDs.
- Four-chip IBM Power System E870: \$575,984; IBM Power System E870, four IBM POWER8 processors (4.19 GHz), four chips, 10 cores/chip, and 1 TB memory. Source: IBM. "IBM System P\* Power-Based Products List Price File." July 2015. <https://www-304.ibm.com/easyaccess3/fileserv?contentid=259221>.

"Up to 25 percent better three-year TCO" claim based on Intel internal TCO tool comparing the two above-referenced options running an internal business-warehouse database. Calculations include analysis based on performance, power, cooling, electricity rates, operating system, and annual support/license costs on Red Hat\* Enterprise Linux\* for IBM Power Systems, SAP HANA® software license cost at [sap.com/documents/2015/04/0078e3e4-1f7c-0010-82c7-eda71af511fa.html](http://sap.com/documents/2015/04/0078e3e4-1f7c-0010-82c7-eda71af511fa.html), and Red Hat Enterprise Linux for Virtual Datacenters at [redhat.com/apps/store/server/](http://redhat.com/apps/store/server/), plus estimated server costs. Assumptions include 42U racks, \$0.10 per kWh, cooling costs 2x average server power-consumption costs, Alinean\* assumptions of \$2,399 per server maintenance and \$30 per server networking costs, average real-estate cost per year from VMware\* planning tool at \$310 per sq. foot x 10 sq. feet per rack divided by the number of servers per rack, 60-percent CPU utilization, and PUE of 2.0.

<sup>6</sup> IDC. "Innovating with Real-Time Data and Insights with SAP HANA for Better Business Outcomes and More Efficient Operations." November 2016. [sap.com/innovate-with-hana](http://sap.com/innovate-with-hana).

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