Demonstrated Performance of the Lenovo System x3850 X6 as a Highly Scalable SAP HANA Appliance

Analyzes and explains importance of three recently published SAP BW-EML Benchmarks on Lenovo HANA Appliances

Compares Lenovo BW-EML benchmark publication to DELL BW-EML benchmark publication

Explains the linear scalability of Lenovo HANA Appliances

Analyze industry first 10B SAP BW-EML benchmark on Lenovo HANA Appliance

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Abstract

This paper highlights three recently published benchmark results achieved by Lenovo® X6 high-end servers on the SAP Business Warehouse-Enhanced Mixed Load (SAP BW-EML) standard application benchmark.

The paper illustrates the superior, near-linear scaling with larger data volumes, additional nodes and higher processor core count delivered by the Lenovo System x3850 X6 workload-optimized solution for the SAP HANA platform. This paper also compares Lenovo publication to Dell publication to illustrate superior scalability of Lenovo HANA appliances.

This paper is for customers wanting to understand how the x3850 X6 is an ideal platform for SAP HANA implementations that can be easily and effectively scaled over time as business needs arise.

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Benchmark results

In the first half of 2015, Lenovo published three ground-breaking results on the SAP Business Warehouse-Enhanced Mixed Load (SAP BW-EML) standard application benchmark demonstrating impressive scalability as Lenovo System x3850 X6 appliances and data loads are added.

The SAP BW-EML standard application benchmark measures performance in a real-time data warehouse environment running SAP software.

The three benchmark results were:

1. World-record result with 1 billion records using seven x3850 X6 workload-optimized systems for SAP HANA as of March 16, 2015, each configured with four Intel Xeon Processor E7-4880 v2, 2.50 GHz

   Performance results (ad-hoc navigation steps/hour=1,542,060) of the Lenovo System x3850 X6 on the SAP BW-EML standard application benchmark as of March 16, 2015 (certification number 2015007) configured with seven database servers: 4 processors / 60 cores / 120 threads, Intel Xeon Processor E7-4880 v2, 2.50 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 37.5 MB L3 cache per processor, 1024 GB main memory, SAP NetWeaver technology platform 7.40, SAP HANA 1.0 and SUSE Linux Enterprise Server (SLES) 11

2. World-record result with 1 billion records using seven x3850 X6 workload-optimized systems for SAP HANA as of May 5, 2015, each system configured with four Intel Xeon Processor E7-8890 v3

   Performance results (ad-hoc navigation steps/hour=1,992,570) of the Lenovo System x3850 X6 on the SAP BW-EML standard application benchmark as of May 5, 2015 (certification number 2015011) configured with seven database servers: 4 processors / 72 cores / 144 threads, Intel Xeon Processor E7-8890 v3, 2.50 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 45 MB L3 cache per processor, 1024 GB main memory, SAP NetWeaver 7.40, SAP HANA 1.0 and SUSE Linux Enterprise Server 11

3. World-record result with 10 billion records using seven x3850 X6 workload-optimized systems for SAP HANA as of May 5, 2015, each system configured with four Intel Xeon Processor E7-8890 v3

   Performance results (ad-hoc navigation steps/hour=269,960) of the Lenovo System x3850 X6 on the SAP BW-EML standard application benchmark as of May 5, 2015 (certification number: 2015018) configured with seven database servers: 4 processors / 72 cores / 144 threads, Intel Xeon Processor E7-8890 v3, 2.50 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 45 MB L3 cache per processor, 1024 GB main memory, SAP NetWeaver 7.40, SAP HANA 1.0 and SUSE Linux Enterprise Server 11

With the third of those three benchmark results, Lenovo ultimately achieved a world-class, number-one performance result that was run with 10 billion records. Not only that, in the final published result, throughput was reduced by only 7.38 times versus the typical 10 times for implementations without IBM General Parallel File System (GPFS).

GPFS uses storage contained within each server node, enabling scaling of SAP HANA memory by adding additional server nodes to existing infrastructure. The server infrastructure then is able to scale linearly in terms of hardware as well as throughput. Thus, by simply adding more nodes to the existing infrastructure, users can benefit from extremely fast response times for analytical workloads and business queries. Such benefits apply to data workloads of a broad range of sizes, ranging from medium (1 billion records) to very large (10 billion records and beyond). GPFS also has features that provide additional capabilities such as high availability and synchronous disaster-recovery for business critical applications.

Linear scaling with data volume

Figure 1 compares two results achieved on the SAP BW-EML standard application benchmark executed on the same Lenovo appliances with two different initial numbers of records. One result one has 1 billion initial records (see result 2 on page 3) and the other has 10 billion initial records (see result 3 on page 3).
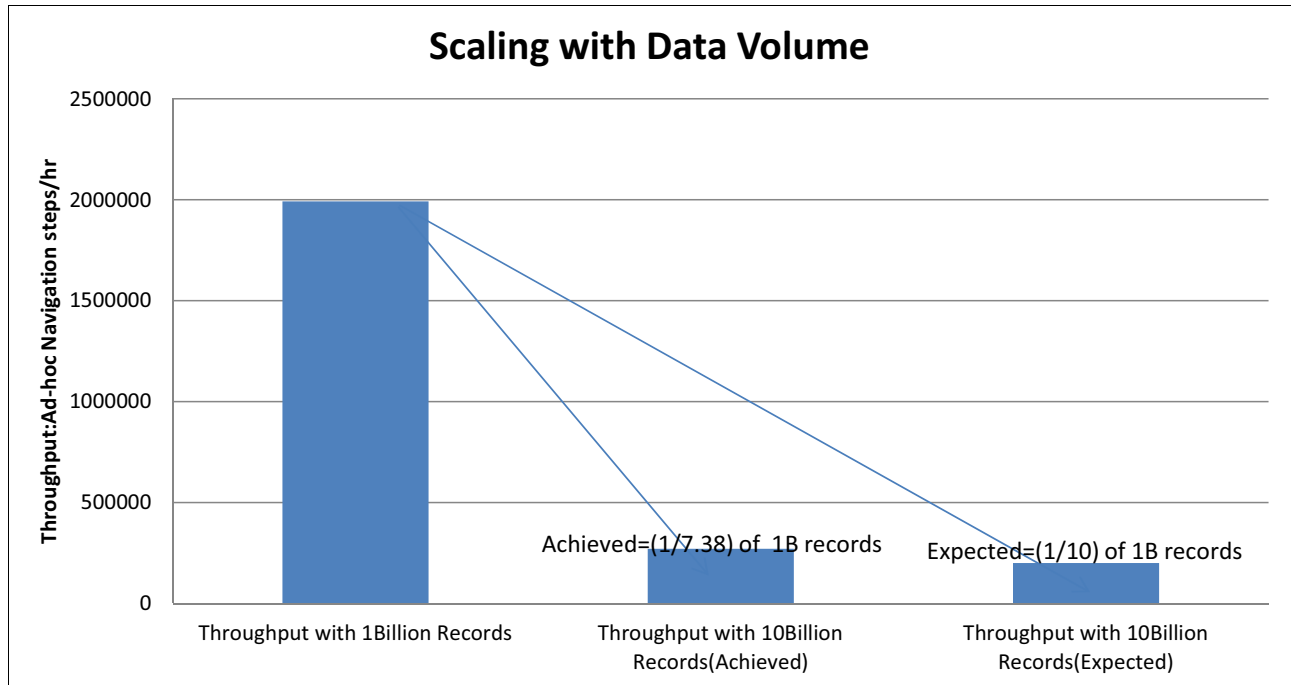
Scaling with Data Volume

Throughput:Ad-hoc Navigation steps/hr

Achieved=(1/7.38) of 1B records

Expected=(1/10) of 1B records

| Throughput with 1Billion Records | Throughput with 10Billion Records(Achieved) | Throughput with 10Billion Records(Expected) |

Figure 1   Scaling with data volume

With linear scaling, one would expect performance to be cut to 1/10th the initial performance as the volume of data increased 10x. However, as the graph illustrates, with a tenfold increase in data volume, throughput does not decrease by 10 times. Instead, the throughput, expressed in the number of ad-hoc navigation steps per hour, is reduced by only 7.38 times.

This result demonstrates the superior performance and scalability delivered by Lenovo X6 servers. This capability is especially appropriate for data center leaders who are looking for quick access to business data with up-to-the-minute information even with ever-growing database sizes. As data volumes grow, additional nodes can be added to existing infrastructure to maintain query response times.

Near-linear scaling with the addition of nodes

Figure 2 on page 5 compares the Lenovo result achieved on the SAP BW-EML standard application benchmark with 1 billion records using seven nodes to the Dell result achieved on the same benchmark with 1 billion records using a single node.

The result by Dell on the SAP BW-EML standard application benchmark of 1 billion records was achieved using a single node Dell PowerEdge R930 appliance for SAP HANA[1]. Results were published on May 5, 2015. The Dell appliance was configured with four Intel Xeon Processor E7-8890 v3, illustrating that Lenovo x3850 X6 workload-optimized systems for SAP HANA are highly scalable.

> **More memory installed in the Dell server:** The System x3850 X6 benchmark results described here were achieved using 1 TB memory per node except the Dell result, which used 1.5 TB memory per node.
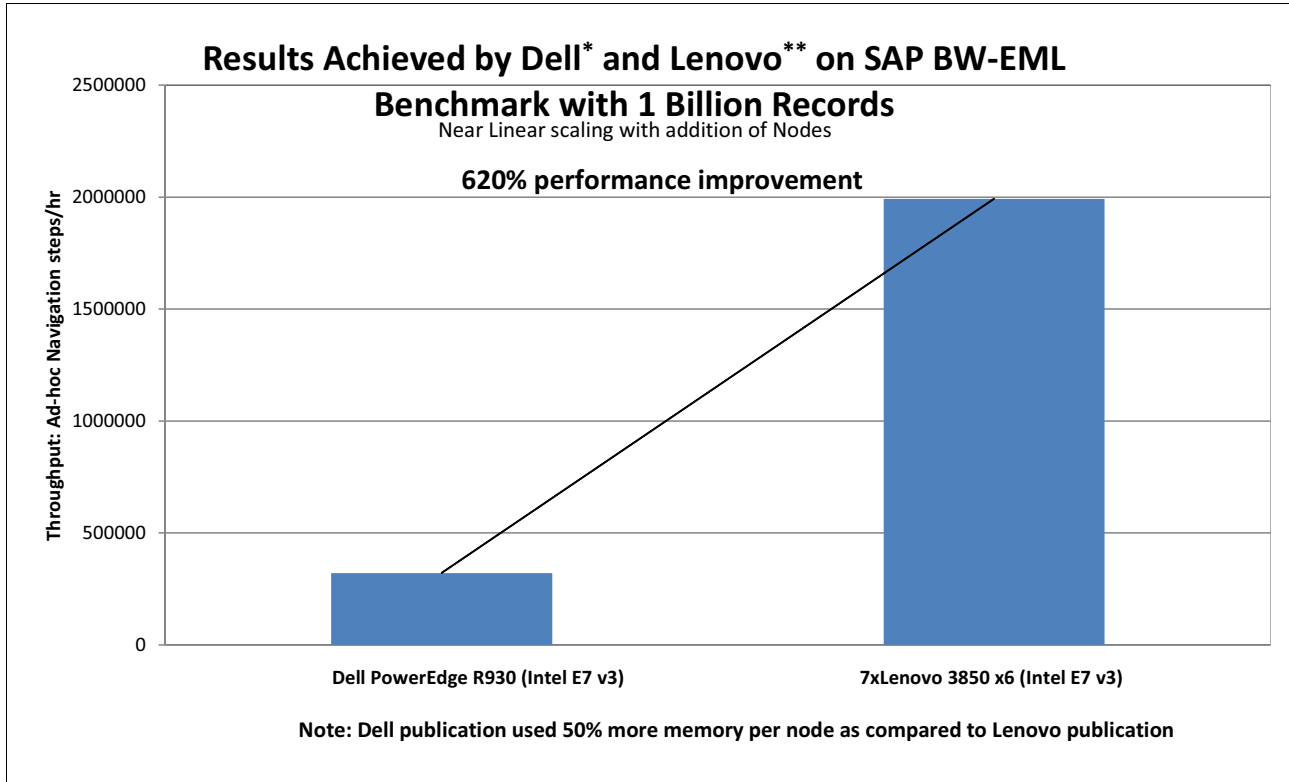

Figure 2   Near-linear scaling with the addition of nodes (see footnote; ** see result 3 on page 3)*

Both results use the same Intel Xeon E7 v3 processors. As the graph illustrates, the Lenovo result demonstrates near-linear scaling as nodes are added with a performance increase of 620% with six additional nodes.

Keep in mind that the Dell appliance used 50% more memory per node as compared to the Lenovo configuration. This demonstrates more than linear scaling as compared to the best from this competitor4. The Lenovo result also demonstrates that at constant data volume, throughput can be increased to any desired value. This occurs by adding more nodes to the configuration, and almost perfect scaling is achieved, even with the addition of six more nodes.

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[1] Performance results (ad-hoc Navigation steps/hour=320,940) of the Dell PowerEdge R930 on the SAP BW-EML standard application benchmark as of May 5, 2015 (certification number: 2015015) configured with one database server: 4 processors / 72 cores / 144 threads, Intel Xeon Processor E7-8890 v3, 2.50 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 45 MB L3 cache per processor, 1536 GB main memory, SAP NetWeaver 7.31, SAP HANA 1.0 and SUSE Linux Enterprise Server 11

Industry-leading performance gains with latest Intel Xeon Processor E7 v3

Figure 3 shows that the System x3850 X6 using Intel Xeon E7 v3 processors returned a 29.2% performance gain (see result 2 on page 3) over the same x3850 x6 server using Intel Xeon E7 v2 processors (see result 1 on page 3). The base processor frequency is 2.5 GHz for both results.
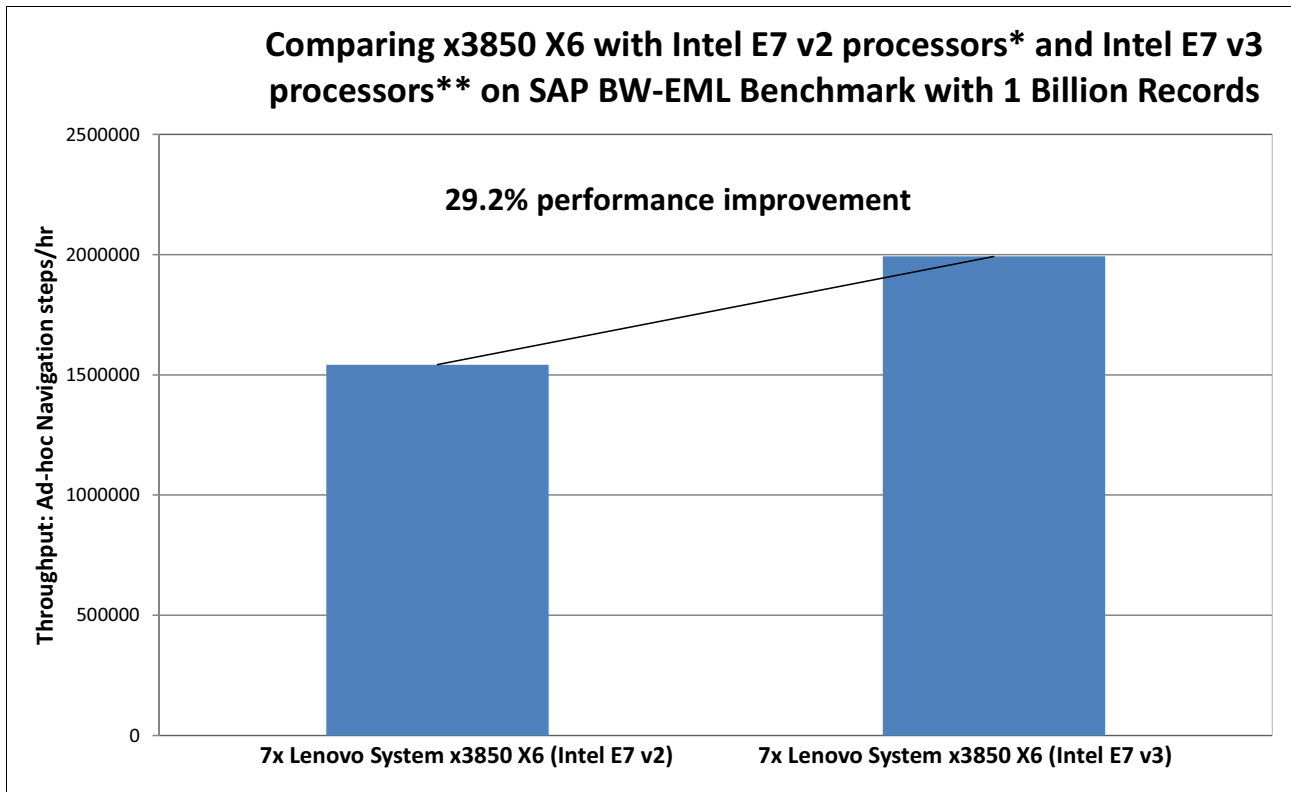

Figure 3   Comparing Intel E7 v2 and Intel E7 v3 performance (see see result 1 on page 3; ** see result 3 on page 3)*

Such performance improvement is made possible by X6 architecture and the Intel Xeon Processor E7 v3 product family which delivers a 20% increase in core count compared to the prior generation E7 v2 processors as well as improvements for in-memory workloads realized due to optimizations in the new Intel Transactional Synchronization Extensions (Intel TSX).

Lenovo System x3850 X6

The Lenovo System x3850 X6, Figure 4 on page 7, is a 4-socket, 4U rack server, designed for maximum performance and uptime for business-critical applications and cloud deployments. The X6 solution provides a powerful platform for mission-critical SAP Business Suite applications, one that is ideal for customers who are looking for reliability, manageability, and scalability with the flexibility to run Windows or Linux. Integrating hardware, software and memory advancements, the X6 enterprise servers are designed to be fast, agile and resilient.

Figure 4   Lenovo System x3850 X6

X6 servers deliver fast application performance – processing speed that is significantly faster than previous-generation Intel Xeon v2 processors as we describe in this paper.

The adaptive modular rack design of x3850 X6 is agile. It enables the design of fit-for-purpose solutions and the ability to realize infrastructure cost savings by hosting multiple generations of technology in a single platform—without compromising performance or capacity. X6 platforms enable customers to:

► Configure the server to fit the unique requirements of specific applications and workloads and add, modify or upgrade X6 platforms easily with selectable modular book components;

► Scale capacity and performance from 4-socket to 8-socket to deliver twice the performance for growing applications without creating IT sprawl;

► Use Lenovo FastSetUp™ software for automated provisioning of a cluster of servers to realize time-to-value in minutes rather than days;

► Capitalize on agile system design that provides the ability to host multiple generations of technology in a single server.

X6 enterprise platforms are resilient. Through differentiated X6 self-healing technology, the x3850 X6 maximizes uptime by proactively identifying potential failures and transparently taking necessary corrective actions. Unique Lenovo features proactively protect applications from corrupt pages in memory; allow the platform to maintain access to networking and storage and server management during a processor failure; enable concurrent updating of the system firmware with no impact on application performance or availability; and enable the creation and management of policies to maintain high availability of virtual machines. These built-in technologies drive the outstanding system availability and uninterrupted application performance needed to host business-critical applications.

X6 platforms help reduce costs and complexity and deliver the breakthrough performance and capacity that enterprise applications demand. X6 servers are the result of more than 15 years of investment in enterprise X Architecture® (EXA) and innovation beyond industry standards.

For more information on the System x3850 X6, see these resources:

► Mission Critical Servers product web page

http://shop.lenovo.com/us/en/systems/servers/mission-critical/

► Lenovo Press product guide on the System x3850 X6:

http://lenovopress.com/tips1250

SAP benchmarks

SAP standard application benchmarks have been designed to represent customer scenarios in different business application areas. The SAP BW-EML standard application benchmark has been developed with near real-time reporting, ad-hoc reporting capabilities, and reduction of TCO in mind. Its focus is a mix of multiuser reporting load and delta data that is input into the database simultaneously to the queries.

For more details, visit:

http://global.sap.com/campaigns/benchmark/appbm_bweml.epx

For the latest SAP benchmark results, visit:

http://www.sap.com/benchmark

Performance Benchmark Reports for recent Lenovo SAP BW-EML benchmarks:

http://public.dhe.ibm.com/eserver/benchmarks/news/newsblurb_x3850X6_sapbweml_20150318.pdf
http://public.dhe.ibm.com/eserver/benchmarks/news/newsblurb_x3850X6_sapbweml_20150505.pdf
http://public.dhe.ibm.com/eserver/benchmarks/news/newsblurb_x3850X6_sapbweml_20150512.pdf

Lenovo Benchmarks Reports:

http://shop.lenovo.com/us/en/systems/server-library/index.html#sortBy=time&sortAscending=false&comboFilters[category]=.Reports&comboFilters[sub_cats]=.Benchmarks

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