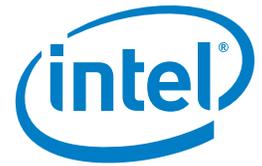


## SOLUTION BRIEF

### Servers Based on the Intel® Xeon® Processor E7 Family

Mission Critical Capabilities/ROI

Financial Services



# Improve Performance and ROI with Intel® Processor-based Servers

As financial institutions look for ways to reduce costs, manage risk, and extract more value from exponentially increasing amounts of data, technology will emerge as both a crucial enabler and competitive advantage. Financial institutions that invest in developing and managing more flexible infrastructure for mission-critical workloads will significantly improve return on investment (ROI), decrease risk, and deliver greater value to their businesses.



“Companies that can get the right balance between superior IT value—manifested as superior business performance—while optimizing infrastructure costs in the context of value generation are truly the masters of their technology economies.”<sup>1</sup>

—Howard Rubin, CEO and Founder,  
[Rubinworldwide.com](http://Rubinworldwide.com)

## Factors Driving IT Change in Banking

Financial institutions are re-evaluating IT operations in order to reduce IT costs while meeting increasing demand for services. Meanwhile, IT objectives in financial institutions are multifaceted and changing. According to a 2012 Ernst & Young report on global banking, “all spending is under heavy scrutiny at the moment but, as the role of technology evolves, banks will need to think about technology expenditure in a different way. Instead of being a cost to manage down, it will be seen more as an investment to support growth and new business development.”<sup>2</sup>

The explosion of structured and unstructured data flooding data centers from an increasing number of sources is strongly influencing this change in perspective. Managers in financial institutions want instant and new insights from this data and look to IT departments to deliver real-time business analytics and information that will help them make critical decisions affecting revenues and operations. Add to this the ever-increasing burden of new regulatory requirements, and the vitality of the financial institution is more dependent than ever on improvements in critical IT infrastructure.

## The Growing Expense of Legacy Technology

Today’s IT departments face the dilemma of how to deliver the necessary technology to support business growth while reducing data center costs. A major part of the problem is the tendency to retain legacy server stacks past their prime. A February 2012 International Data Corporation (IDC) report, “The Cost of Retaining Aging IT Infrastructure,” noted that “while most IT shops replace their x86 systems every three to five years, they have tended to hold onto their UNIX\* servers supporting mission-critical workloads for longer periods of time—generally five to seven years or more.”<sup>3</sup>

Key findings of this IDC study include:

- Upgrading results in an ROI of 150 percent over three years and a payback period of 11.7 months.
- The savings from reduced maintenance and support costs pay for the investment in new technology.
- For every U.S. dollar invested, two-and-a-half dollars are saved over three years per 100 users on the new system.<sup>4</sup>

## Advantages of Migrating to Industry-Standard Servers

To achieve these and even higher levels of ROI benefits, 90 percent of IT organizations are actively migrating or considering migrating from UNIX\* to Intel processor-based servers.<sup>5</sup> Today's Intel processor-based servers offer the critical performance and availability of legacy RISC and UNIX environments at a fraction of the cost.

Intel's top-of-the-line Intel® Xeon® processor provides a major leap in performance (see Figure 1) and reliability at mainstream prices for mission-critical and data-intensive applications in financial services. Servers based on these processors deliver outstanding transaction processing performance across more than 25 enterprise and technical computing benchmarks,<sup>6</sup> and yield a 40-percent improvement in generational compute-intensive performance.<sup>7</sup> Providing solutions for two-, four-, and eight-socket servers, these processors can enhance the pace and accuracy of applications in financial services where speed is essential.

## ROI Benefits of Intel® Architecture

Financial institutions must find ways to keep IT costs in line while expanding services. Supporting existing infrastructure accounts for about two-thirds of total costs for many IT organizations,<sup>8</sup> and rising energy bills continue to push data center costs higher.

Migrating to servers based on Intel® architecture provides benefits such as:

- **Faster ROI through cost reductions** results from such factors as a lower total cost of acquisition, ability to put more compute performance in less space, and lower power and cooling costs due to more energy-efficient performance.
- **Ever-advancing open standards, systems technologies, and technological innovations** enable mission-critical software vendors to deliver new powerful, scalable, and reliable critical solutions.

- **Improved business agility** comes from a more unified data center using industry-standard architecture for both critical and standard workloads
- **A faster path to innovation** is based on Intel's volume economics and alternating-year model for advancing process technology and microarchitecture.

According to IDC "Worldwide Enterprise Server 2012 Top 10 Predictions," x86 servers accounted for 97 percent of units shipped and 60 percent of revenue generated in 2011.<sup>9</sup> The widespread use of x86 servers and obvious cost value are two of the primary forces behind the increasing adoption of industry-standard servers for data-hungry, critical applications in the financial industry.

In many cases, replacing RISC systems with servers based on the Intel® Xeon® processor E7 family-based servers delivered major cost savings in acquisition and operation costs along with greater long-term business value. Benefits commonly far exceed the cost in time and money of migration.

A total cost of ownership (TCO) and power consumption comparison made using the Intel® PC Total Cost of Ownership Estimator estimated the total costs for a three-year ownership period for an IBM Power\* 750 server and servers based on Intel Xeon processor E7-4800 product family. This comparison found a 40-percent lower TCO and a savings of USD 1,092,945 for the Intel processor-based solution (see Table 1). There was also a 9-percent performance gain based on SPECint\*\_rate 2006 benchmark results (see Table 2).<sup>7</sup> The Intel processor-based server cost 80-percent less and consumed 32-percent less energy.

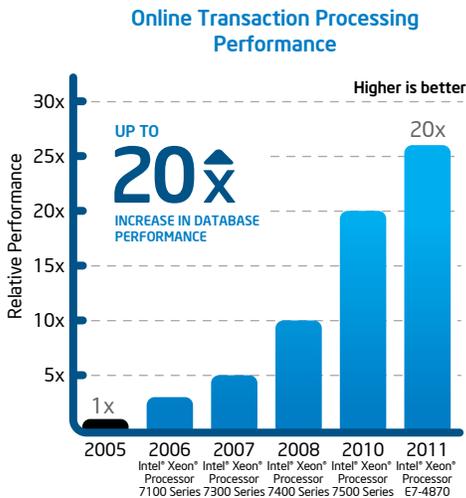


Figure 1. The Intel® Xeon® processor E7 family delivers a leap in generation-to-generation on-line transaction processing performance compared to processors two or more generations ago. (Source: Intel internal online transaction processing database workload performance estimates as of 15 April 2011.)

**Table 1. Three-Year Total Cost of Ownership (TCO) Analysis**

	IBM POWER* 750 (3.66 GHZ, 32 CORES)	INTEL® XEON® PROCESSOR E7-4870-BASED SERVER	SAVINGS WITH SERVER BASED ON INTEL® ARCHITECTURE	
Server Hardware Costs	USD 186,347*	USD 37,000*	USD 149,347	80-percent savings
Server Software Costs**	USD 2,523,200	USD 1,577,000	USD 946,200	37.5-percent savings
Three-Year TCO	USD 2,709,547	USD 1,614,000	USD 1,095,547	40-percent savings

\* IBM Server Consolidation TCO Calculator for Power (UNIX\*).

\*\* Average of Dell PowerEdge® R910 and IBM System x®3850 X5\* price: USD 37,000 with four Intel® Xeon® processors E7-4870, 32x8 GB DIMMs, 1x146 GB 15k SAS, no care packs (priced on May 17, 2012 rounded down).

\* <http://www.oracle.com/us/corporate/pricing/technology-price-list-070617.pdf>

**Table 2. Performance and Power Efficiency Comparison**

	IBM POWER* 750 (3.66 GHZ, 32 CORES)	INTEL® XEON® PROCESSOR E7-4870-BASED SERVER	PERFORMANCE ADVANTAGES	
SPECint*_rate 2006 Benchmark	1,010 <sup>a</sup>	1,100 <sup>b</sup>	90	9-percent better performance
Average Power Consumption per Server	1,525 watts	1,212 watts	313 watts	20.5-percent better performance

<sup>a</sup> <http://www.spec.org/cpu2006/results/res2011q2/cpu2006-20110411-15608.html>

<sup>b</sup> <http://www.spec.org/cpu2006/results/res2012q1/cpu2006-20111223-19278.html>

## New Security Features

As part of the Intel Xeon processor E7 family's feature set, Intel introduced two leading security technologies to the mission-critical server segment for the first time.

- **Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI)** allows systems to quickly encrypt and decrypt data running over a range of applications and transactions.
- **Intel® Trusted Execution Technology (Intel® TXT)** creates a secure server at boot-up by protecting applications from malicious threats.

Together, these security features help ensure that virtualized environments are more reliable when they are launched, migrated, or at rest. This helps maintain data integrity, accelerates encrypted transactions, and maximizes business continuity.

## Performance that Meets Mission-Critical Enterprise Demands

Intel Xeon processor-based servers are not new to mission-critical computing. According to the IDC's, forecast and analysis, the majority of servers shipped worldwide are x86 servers.<sup>10</sup>

As a common solution for RISC migrations today, Intel Xeon processor-based servers are widely used for data center virtualization, consolidation, and cloud computing. Servers based on the Intel Xeon processor E7 family deliver outstanding capacity and capability for critical environments compared to high-end servers (see Figure 2). With up to 25 percent better performance with virtual machine applications than the current generation, these processors hold the industry's highest virtualization performance.<sup>11</sup> In addition, they deliver up to 21-percent higher database performance.<sup>12</sup>

With these processors, Intel continues to provide leading performance per watt. Compared to the previous generation, energy efficiency

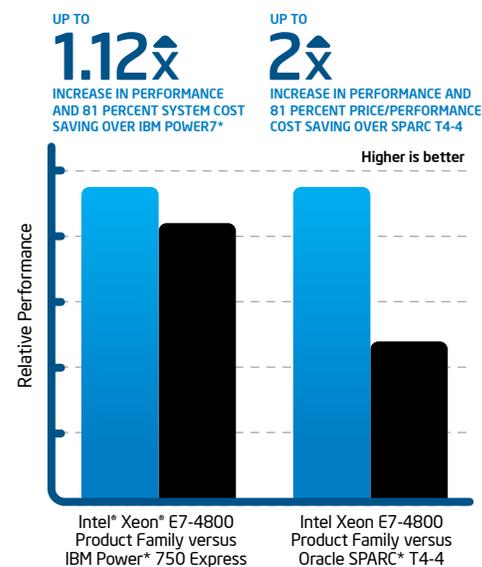


Figure 2. Four-socket servers based on the Intel® Xeon® processor E7 family provide compelling performance at significantly reduced system cost compared to common mission-critical servers.<sup>15</sup>

improvements in the Intel Xeon processor E7 family combine to reduce system idle power consumption (in watts measured at the wall) up to 27 percent and deliver up to a 50-percent performance-per-watt improvement.<sup>13</sup>

The power of Intel's volume production economies also helps reduce costs. Although the percentage of systems worldwide powered by RISC or other architectures is quite small, the corresponding IT acquisition costs of those systems is a substantially large 40 percent of server sales.<sup>14</sup> Addressing this small but costly percentage of systems by moving to Intel Xeon processor E7 family-based systems can help customers significantly reduce costs while achieving the desired performance increases.

### Next Generation Reliability, Availability, and Serviceability (RAS) Features

For large financial institutions, an hour of downtime for critical workloads can mean millions of dollars in lost revenue. Supporting advanced RAS features, including Machine Check Architecture Recovery, the Intel Xeon processor E7 family provides Intel's most extensive and robust set of RAS features in x86 silicon. These features, which include error detection, correction, containment, and recovery for all processors, memory, and I/O data paths enable financial and IT managers to move from RISC server architecture and meet business requirements for availability (see Figure 3).<sup>16</sup>

The Intel Xeon processor E7 family's RAS feature set is a powerful foundation upon which an extensive ecosystem can be built. Hardware and software vendors build higher RAS layers to provide overall server reliability across the entire hardware-software stack, from silicon to application delivery and services. Such reliable critical performance is essential for financial transaction processing, business intelligence and analytics, and database operations.

The Intel Xeon processor E7 family delivers these RAS server features at a highly competitive price point and power consumption level compared to traditional RISC-based solutions. This is a major reason why today's innovative developers of mission-critical software are increasingly shifting to Intel architecture.

### Scalability for Increased Business Agility

The Intel Xeon processor E7 family's performance increases are combined with dramatic improvements in scalability. Supporting server designs offering two, four, or eight sockets without the need for customized OEM chipsets, these processors deliver scalable performance across all configurations. With up to 80 high-performance processor cores, 160 execution threads, and 4 TB of memory,<sup>17</sup> an eight-socket system provides ample resources for heavy workloads and data center consolidation. For breakthrough capabilities that will allow new uses in mission-critical computing, certain OEM

node controllers enable scaling up to 256 sockets with nearly 40 percent more memory bandwidth than the previous generation.

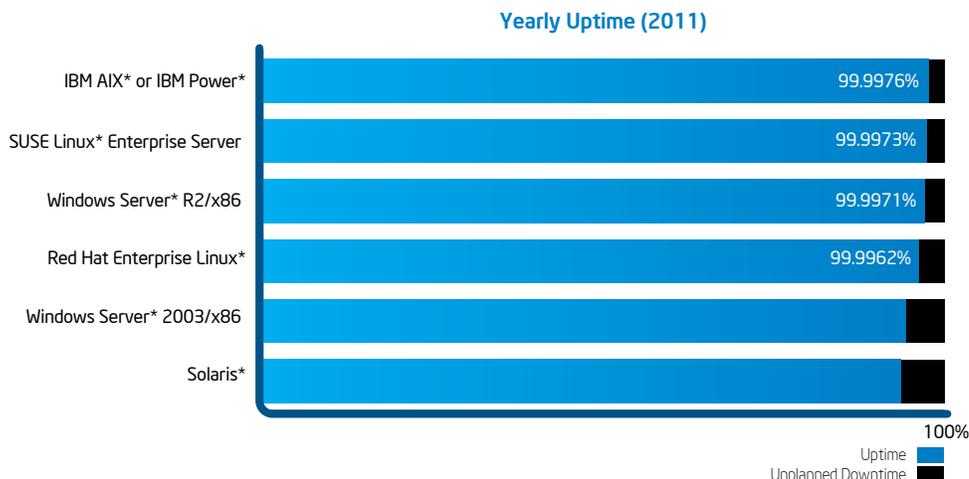
Memory capacity per socket is double that of the previous generation. This large capacity provides the necessary performance for financial services institutions that host large, data-intensive applications, such as enterprise databases, data warehouses, and real-time analytics.

### More Choice in Operating Systems and Software

Software must be as scalable and resilient as hardware used in critical environments. Migrating from an environment with servers based on UNIX or RISC to Intel-based servers provides operating flexibility. Microsoft Windows\* and Linux\* have matured dramatically in recent years. Both now provide the levels of scalability, availability, and resource management needed for critical business applications. In addition, they do it at much lower cost than traditional UNIX OSs and with far greater application support. For solution stacks running on Oracle Solaris\*, Intel Xeon processors provide native support. Together, these options provide tremendous flexibility for hosting critical applications without the excessive costs and vendor lock-in of high-end RISC systems.

Intel also works with the leading critical application vendors to deliver the largest ecosystem of database, workload management, and other solutions for meeting the unique needs of financial institutions.

Figure 3. IT managers in a recent survey reported little difference between the uptime of Intel® Xeon® processor-based servers and RISC and UNIX\* servers. (Source: ITIC Global Server Hardware and OS Reliability Survey, November 2011.)



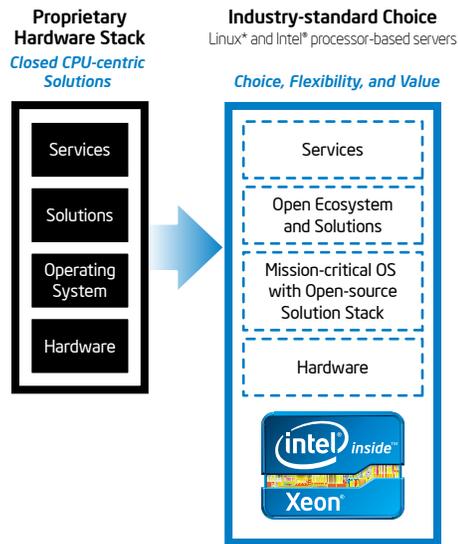


Figure 4. Through an extensive, open ecosystem, industry-standard servers based on Intel® Xeon® processors deliver greater choice, flexibility, and value on every level compared to proprietary RISC architectures.

### Making the Transition from RISC and UNIX to Industry-standard Servers

Moving workloads in RISC and UNIX silos requires careful planning and execution. Industry leaders such as Red Hat, HP, IBM, Dell, and Cisco can help with migration assessment and planning. This makes it easier to move critical workloads to dedicated Intel Xeon processor-based stacks running popular OSs and database solutions. The Intel ecosystem offers the broadest set of server, OS, virtualization, database, and application collaborators, providing more choice and more possibilities to meet critical computing needs today and for the long term (see Figure 4).

Moving to Intel-based solution stacks helps deliver the cost, performance, and ROI advantages of standards-based technology. It also makes it easier to avoid much of the recoding that might be necessary to take advantage of a cloud computing environment.

### Conclusion

Compared with proprietary RISC architectures, servers based on the Intel Xeon processor E7 family offer similar or superior performance, more options, and superior cost models across virtually all key IT infrastructure elements, including hardware, software, maintenance, and facilities.

The Intel Xeon processor family rivals high-end RISC systems for scalability and availability and is supported by a broader pool of suppliers and skilled IT professionals. Financial institutions can use these systems with confidence to support even their most demanding applications.

Integrating the latest solution based on the Intel Xeon processor E7 family into the data center helps financial institutions to stay competitive in the new marketplace, reduce costs, and improve performance and ROI.

### HOW TO REALIZE IMPROVED PERFORMANCE AND ROI

Financial institutions can achieve these goals by taking these steps:

- **Plan the migration.** Intel can act as a trusted advisor as you plan your migration.
- **Determine your savings.** Use our Intel RISC Migration TCO Calculator ([roianalyst.alinean.com/intel\\_migration](http://roianalyst.alinean.com/intel_migration)) for four- or more socket systems to help determine your savings.
- **Take advantage of Intel financial services technology expertise.** See: [www.intel.com/financialservices](http://www.intel.com/financialservices).
- **Contact your field sales representative.**

### Additional Resources

- "Driving Higher Value into the Data Center." <http://premierit.intel.com/docs/DOC-5739>
- "Better Mission Critical Computing with Red Hat and Intel Solutions." [www.intel.com/Assets/en\\_US/PDF/whitepaper/322283.pdf](http://www.intel.com/Assets/en_US/PDF/whitepaper/322283.pdf)

Learn more about the Intel® Xeon® processor family at: [www.intel.com/xeon](http://www.intel.com/xeon)

<sup>1</sup> Telephone conversation between Christian Sommer and Dr. Howard Rubin.

<sup>2</sup> Ernst & Young, "Making the Right Moves," March 2012. [http://emergingmarkets.ey.com/wp-content/uploads/downloads/2012/06/Making-the-right-moves\\_Global-banking-outlook-2012-13.pdf](http://emergingmarkets.ey.com/wp-content/uploads/downloads/2012/06/Making-the-right-moves_Global-banking-outlook-2012-13.pdf).

<sup>3</sup> Perry, Randy, Jean S. Bozman, Joseph C. Pucciarelli, and Jed Scaramella, "The Cost of Retaining Aging IT Infrastructure," IDC white paper. <https://ssl.www8.hp.com/us/en/campaign/rules-of-networking/gen8/registration-gen8.html>.

<sup>4</sup> Ibid.

<sup>5</sup> Gillen, Al, and Jean S. Bozman, "Following Downturn, Platform Migration Accelerates," IDC white paper, February 2011. [www.computerwoche.de/filesserver/idgwpw/files/1974.pdf](http://www.computerwoche.de/filesserver/idgwpw/files/1974.pdf).

<sup>6</sup> For the latest benchmarks, visit the Intel Web site at: [www.intel.com/content/www/us/en/benchmarks/server/xeon-e7-summary.html](http://www.intel.com/content/www/us/en/benchmarks/server/xeon-e7-summary.html).

<sup>7</sup> SPECint\*\_rate 2006 benchmark comparing next-generation Intel® Xeon® processor E7-4870 (30 M cache, 2.40 GHz, 6.40 GT/s Intel® QuickPath Interconnect (Intel® QPI) scoring 1,010 (includes Intel® Compiler XE2011 improvements accounting for about 11 percent of the performance boost) to X7560 (24 M cache, 2.26 GHz, 6.40 GT/s Intel QPI) scoring 723 (Intel Compiler 11.1). Source: Intel SSG TR#1131.

<sup>8</sup> "Server Migration from UNIX/RISC to Red Hat® Enterprise® Linux\* on Intel® Xeon® Processor." Intel Corporation and Red Hat, Inc., September 2009. [www.redhat.com/rhecm/rest-rhecm/jcr/repository/collaboration/jcr:system/jcr:versionStorange/2462de587f000010ca5cccd7115d43/1/jcr:frozenNode/rh.pdfFile.pdf](http://www.redhat.com/rhecm/rest-rhecm/jcr/repository/collaboration/jcr:system/jcr:versionStorange/2462de587f000010ca5cccd7115d43/1/jcr:frozenNode/rh.pdfFile.pdf)

<sup>9</sup> Eastwood, Matthew, Jean S. Bozman, Jed Scaramella, Lloyd Cohen, Michelle Bailey, Kubra Stolarski, and Reuben Miller, "Worldwide Enterprise Server 2012 Top 10 Predictions." IDC, January 2012. [www.idc.com/getdoc.jsp?containerId=232823](http://www.idc.com/getdoc.jsp?containerId=232823).

<sup>10</sup> Bozman, Jean S. and Lloyd Cohen, "Worldwide and US High-Availability Server 2011-2015 Forecast and Analysis," IDC, July 2011. [www.idc.com/getdoc.jsp?containerId=228989](http://www.idc.com/getdoc.jsp?containerId=228989).

<sup>11</sup> Up to 25 percent better virtual machine performance claim based on SPECvirt\*\_sc2010 benchmark comparing next generation Intel® Xeon® processor E7-4870 (30 M cache, 2.40 GHz, 6.40 GT/s Intel® QuickPath Interconnect (Intel® QPI), scoring 2,540 at 162 VMs (Virtual Machine equivalents) to X7560 (24 M cache, 2.26 GHz, 6.40 GT/s Intel QPI) scoring 2,024 at 126 VMs. Source: Intel SSG TR#1118.

<sup>12</sup> Source: Intel internal measurement (March 2010) using the TPC-E\* benchmarks. [www.intel.com/content/www/us/en/benchmarks/server/xeon-e7-8800-server-tpc-benchmark-e.html](http://www.intel.com/content/www/us/en/benchmarks/server/xeon-e7-8800-server-tpc-benchmark-e.html).

<sup>13</sup> Based on SQL Server\* database benchmark performance testing. <http://attachments.wetpaint.serv.us/jD7st0SRn16bZhoLmoZoQ505396>.

<sup>14</sup> Burt, Jeffery, "Intel Xeon 7500 Takes Aim at IBM Power, Oracle SPARC." e-Week.com. April 8, 2010. [www.eweek.com/c/a/IT-Infrastructure/Intel-Xeon-7500-Takes-Aim-at-IBM-Power-Oracle-SPARC-817529](http://www.eweek.com/c/a/IT-Infrastructure/Intel-Xeon-7500-Takes-Aim-at-IBM-Power-Oracle-SPARC-817529).

<sup>15</sup> As of June 7, 2012: four-socket server results on the TPC-H\* 1000-GB non-clustered benchmark is basis for best published SPARC\* T4-4 comparison to Intel® Xeon® processor E7 family. Four-socket server results on the SPECjbb\*2005 benchmark are basis for best published Power\* 750 Express comparison to Intel Xeon processor E7 family. 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. For more information go to [www.intel.com/performance](http://www.intel.com/performance).  
Up to 2x performance at 45-percent system cost based on comparing a four-socket server based on Intel® Xeon® processor E7-4870 to a four-socket server based on an Oracle SPARC\* T4-4 processor using the TPC-H at 1,000 GB QpH benchmark metric and Internet pricing as of October 2011.

Performance:

- Four-socket Intel Xeon processor E7-8837-based server details:
  - Dell PowerEdge® R910 4P server with four (4P/32C/32T) Intel Xeon processors E7-8837 (2.67 GHz / 24 M / 6.4 GT/s Intel® QPI), 1024 GB memory, Vectorwise\* 1.6 database. Referenced as published score of 436,789 QpH at 1000 GB; USD 0.88 USD/QpH at 1000 GB available June 30, 2011. Source: [www.tpc.org/tpch/results/tpch\\_result\\_detail.asp?id=111050402](http://www.tpc.org/tpch/results/tpch_result_detail.asp?id=111050402).
- Four-socket Oracle SPARC T4-4-based server details:
  - SPARC T4-4 with four (4P/32C/256T) SPARC T4 3.0-GHz processors, 512 GB, Oracle Database 11g Release 2 Enterprise\* Edition with Partitioning. Reference as published score 201,487 QpH at 1000 GB at USD 4.60/QpH at 1000 GB available October 30, 2011. Source: [www.tpc.org/tpch/results/tpch\\_result\\_detail.asp?id=111092601](http://www.tpc.org/tpch/results/tpch_result_detail.asp?id=111092601).
- Pricing details:
  - <http://h71016.www7.hp.com/dstore/ldcart/cart.asp?HeaderAction=ViewCart&oi=E9CED&BEID=19701&SBLID=> Intel Xeon processor E7-4870: HP DL580 system price of USD 40,824 with four Intel Xeon processors E7-4870, 256 GB memory, two hard disk drives as of 10/3/11 on HP.com.
  - <https://shop.sun.com/store/product/578414b2-d884-11de-9869-080020a9ed93>; SPARC T4-4 pricing: USD 90,312.00: four SPARC T4 processors 3.00 GHz 8-core, 256 GB memory (32 x 8GB DIMMs), 8 x 300-GB 10,000 RPM SAS hard disk drives, Solaris\* 10 8/11, Oracle VM 2.1, Electronic Prognostics 1.1 pre-installed as of 10/3/2011 on Oracle.com.

Up to 1.12x performance at 28-percent system cost based on comparing a four-socket server based on Intel Xeon processor E7-4870 to a four-socket IBM Power\* 750 Express server based on an POWER7 processors using the SPECjbb\*2005 benchmark metric and Internet pricing as of October 2011.

The IBM Power 750 Express constitutes the majority of IBM's four-socket shipments and is the system Intel typically competes against with the Intel Xeon processor E7 family in a four-socket server configuration.

Performance:

- Four-socket Intel Xeon processor E7-8870-based server details:
  - NEC Express\* 5800/A1080a-S, four Intel Xeon Processor E7-8870 (30 M cache, 2.40 GHz, 6.40 GT/s Intel QPI), 524 GB memory, Oracle Java HotSpot\* 64-bit server virtual machine on Windows\*, version 1.6.0\_26, SPECjbb2005 = 2,783,744 BOPS (billion operations per second); SPECjbb2005 BOPS/JVM = 139,187. Source: [www.spec.org/osg/jbb2005/results/res2011q2/jbb2005-20110614-00993.html](http://www.spec.org/osg/jbb2005/results/res2011q2/jbb2005-20110614-00993.html).
- 4S IBM POWER7-based server details:
  - IBM Power 750 Express (3.55 GHz, 32 core), four POWER7 processors (Intelligent Energy Optimization up to 3.86 GHz), 256 GB memory, IBM Technology for Java\* 1.6 (32-bit JVM) [build pap3260sr7-20091215\_02(SR7)], SPECjbb2005 = 2,478,929 BOPS; SPECjbb2005 BOPS/JVM = 77,467. Source: [www.spec.org/jbb2005/results/res2010q1/jbb2005-20100205-00800.html](http://www.spec.org/jbb2005/results/res2010q1/jbb2005-20100205-00800.html).
- Pricing details:
  - <http://h71016.www7.hp.com/dstore/ldcart/cart.asp?HeaderAction=ViewCart&oi=E9CED&BEID=19701&SBLID=> Intel Xeon Processor E7-4870: HP DL580 system price of USD 34,408 with four Intel Xeon processors E7-4870, 128 GB memory, 2 HDDs as of 10/3/11 on HP.com.
  - IBM Power 750 Express pricing: four 3.55-GHz POWER7 processors, 128 GB memory, two 73.4 GB SFF SAS 15,000-rpm hard disk drives. Pricing: USD 200,000 per call quote on 3/3/2011 for model 8233-E8B13.

<sup>16</sup> To learn more about Intel's RAS features, see the white paper, "Intel® Xeon® Processor E7 Family: Reliability, Availability, and Serviceability." [www.intel.com/content/www/us/en/processors/xeon/xeon-e7-family-ras-server-paper.html](http://www.intel.com/content/www/us/en/processors/xeon/xeon-e7-family-ras-server-paper.html).

<sup>17</sup> Four-socket systems feature up to 2 TB of memory.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, reference [www.intel.com/performance/resources/benchmark\\_limitations.htm](http://www.intel.com/performance/resources/benchmark_limitations.htm) or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

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