

Leading Virtualization Performance and Energy Efficiency in a Multi-processor Server

Product Brief

Intel® Xeon® processor
7400 series



Fewer servers. More performance.

With the architecture that's specifically built for virtualization, the Intel® Xeon® processor 7400 series gives you more than 40% better performance and up to 38% better virtualization performance than previous generations¹—within the same power envelope. Intel Xeon processor 7400 series helps provide your data center or business with the performance headroom needed to confidently consolidate applications onto fewer systems using proven virtualization solutions. It also provides the compute power necessary for critical business applications such as ERP and Business Intelligence.



Performance for your data demanding business applications

With enhanced 45nm technology, Intel® Virtualization Technology² and a 6-core processor with 16 MB of L3 cache, Intel Xeon processor 7400 series-based servers help drive your data-demanding enterprise applications faster. This allows you to be more productive and deliver more computing power and performance without increasing footprint or power demands.

Uniquely architected for data-demanding applications, virtualization and server consolidation, the Intel Xeon processor 7400 series lets you deploy increasingly powerful business tools to track your marketplace and identify previously hidden opportunities.

With 50% more cores³, 16 MB of shared L3 cache—2x the cache-memory capacity of the previous generation⁴, and the performance-enhancing and energy-efficient technologies of the Intel Core microarchitecture, Intel Xeon processor 7400 series-based servers provide more computing power and strong, scalable performance. Together, these capabilities help your well-threaded, data demanding applications to perform at their peak. Additional scalable performance includes:

- **Up to 43%** more performance compared to previous generation of expandable servers, within the same power envelope⁵
- **Up to 38%** better performance in a virtualized environment than previous generations⁶
- **37% better** performance on ERP applications⁷ and **up to 17%** better performance on business intelligence applications⁸

Maximize Performance with Intel® Xeon® Processor 7400 Series

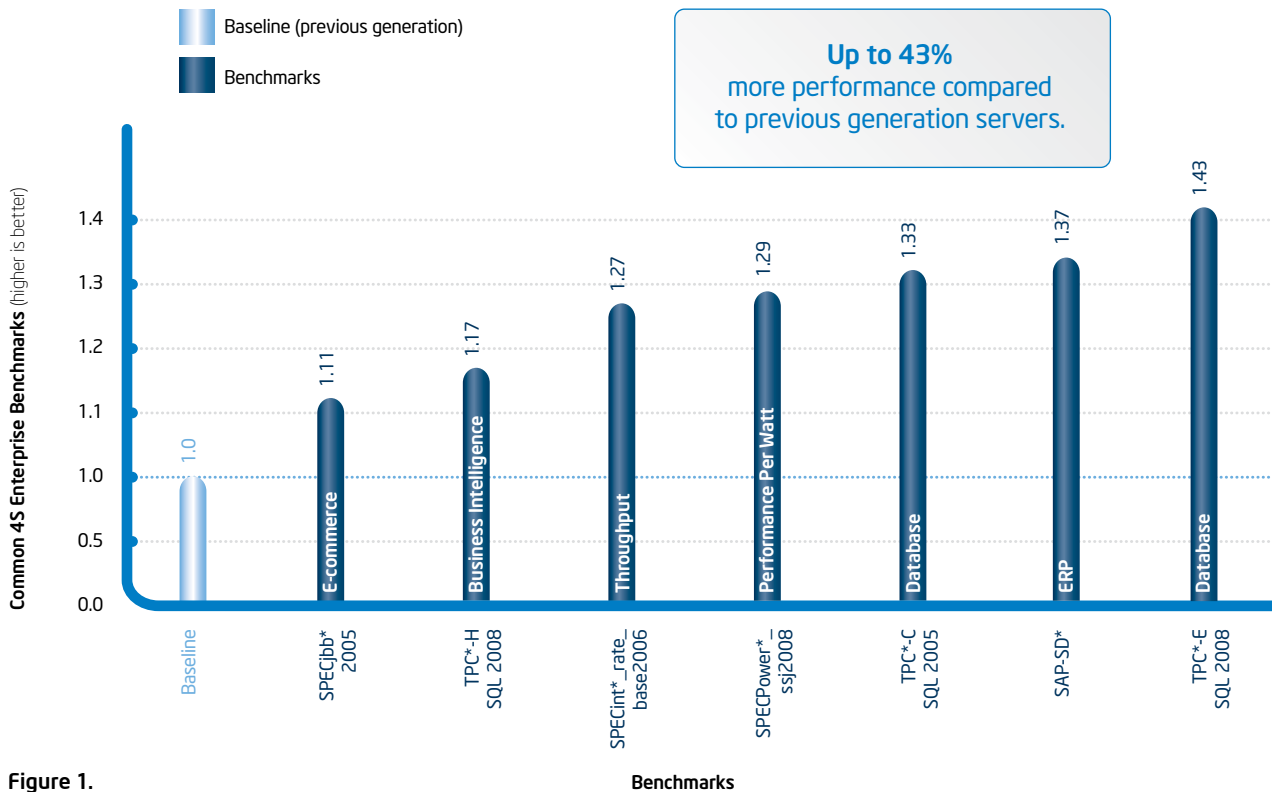


Figure 1.

Built for virtualization, built for efficiency

Intel Xeon processor 7400 series is built specifically for virtualization and helps you keep up by optimizing server productivity and efficiency, and supports more virtual machines per server. On a four socket platform, with up to 24 threads and 16 MB of shared L3 cache per processor, you can consolidate your data center onto fewer systems. This may be done while providing the peak load responsiveness needed for the unpredictability of virtualized applications, while still reducing cooling challenges, and giving you more performance and services per square foot.

With 6-core/65 Watt and 4-core/50 Watt processor options, Intel Xeon processor 7400 series-based servers provide up to 60%⁹ better performance per watt versus those with previous generation processors, and are offered by multiple OEM partners in blade and ultra-dense form factors.

The Intel Xeon processor 7400 series has integrated virtualization hardware support with Intel Virtualization Technology (Intel VT). Intel VT works by hardware assisting your virtualization environment and, in combination with powerful, reliable processor features, boost asset utilization and IT flexibility while reducing costs and data center power consumption. And new enhancements to Intel VT speed up virtual machine transition (entry/exit) times by an average of 25 to 75 percent.

You can now build one compatible group of platforms offering maximum flexibility for live migration across all Intel Core microarchitecture-based servers including 2-socket Intel Xeon processor 5000 sequence-based servers and the scalable 4-socket Intel Xeon processor 7000 sequence.

The ability to conduct live VM migration offers tremendous flexibility for fail-over, load-balancing, disaster-recovery, and real-time server maintenance scenarios. And with Intel® VT FlexMigration, you have the capability to add future Intel® Xeon® processor-based systems to the same resource pool. This gives you the power to choose the right server platform to best optimize performance, cost, power, and reliability. These enhancements are further supplemented by additional processor, chipset, and NIC features, including:

- Virtual Machine Device Queues (VMDq), a network silicon technology that off-loads the network I/O management burden from the hypervisor, freeing processor cycles and improving overall system performance.
- Intel® VT FlexPriority, which optimizes virtualization software efficiency by improving interrupt handling.



Intel Xeon processor 7400 series overview

The Intel Xeon processor 7400 series helps you keep up by optimizing server productivity and efficiency and letting you deploy more virtual machines per server. With powerful multi-core processors, you'll experience better productivity while using fewer servers.

Features	Benefits
<p>6-Core Processing</p>	<ul style="list-style-type: none"> ▪ Platform-compatible with Intel® Xeon® processor 7300 series for ease of migration and IT stability ▪ Increased performance with 45nm technology and increased headroom for multi-threaded applications and data demanding applications ▪ Enables improved virtualization performance, increasing system utilization
<p>Enhanced Intel® Core™ Microarchitecture</p>	<ul style="list-style-type: none"> ▪ Boosts performance on multiple applications/user environments and data-demanding workloads, while enabling denser data center deployments, through improved performance-per-watt ▪ 45nm Hi-k process technology enables larger on-die cache for better performance, and reduced transistor gate leakage for greater energy efficiency
<p>16 MB of L3 Cache</p>	<ul style="list-style-type: none"> ▪ Increases efficiency of cache-to-core data transfers, maximizing main memory to processor bandwidth ▪ Reduces latency by storing larger data sets closer to the processor, reducing the number of trips to main memory
<p>Intel® Virtualization Technology²</p>	<ul style="list-style-type: none"> ▪ A suite of processor hardware enhancements that assists virtualization software to deliver more efficient virtualization solutions and greater capabilities including 64-bit guest OS support ▪ Intel® VT FlexPriority optimizes virtualization software efficiency by improving interrupt handling ▪ Intel® VT FlexMigration enables Intel Xeon processor 7400 series-based systems to be added to the existing virtualization pool with single, two, or 4+ socket Intel Core microarchitecture-based servers
<p>1066 MHz Dedicated High-Speed Interconnects (DHSI)</p>	<ul style="list-style-type: none"> ▪ Enables increased throughput and bandwidth between each of the processors and the chipset
<p>Intel® 64 Architecture</p>	<ul style="list-style-type: none"> ▪ Flexibility for 64-bit and 32-bit applications and operating systems

What is the 7000 sequence?

At Intel, our processor series numbers are designed to help clarify processor features, capabilities, and intended usages. Intel offers four processor number sequences for server applications:

- **Intel® Xeon® processor 3000 sequence**

One-processor servers for small business, entry, or first server based on the Intel Xeon processor.

- **Intel® Xeon® processor 5000 sequence**

Two-processor general-purpose, standard high-volume servers, HPC systems, and workstations based on Intel Xeon processors.

- **Intel® Xeon® processor 7000 sequence**

Greater performance and scalability with 4- to 32-processor enterprise servers. Designed for virtualization and data-demanding enterprise applications based on Intel Xeon processors.

- **Intel® Itanium® processor 9000 sequence**

Maximum scalability and RAS features for mission-critical workloads with 2- to 512-processor servers based on the Intel Itanium processor.

SKU list

The Intel Xeon processor 7400 series is available in a range of features to match different computing demands. All processors integrate Intel Virtualization Technology and Intel 64 architecture, and are available in the FC-mPGA8 packaging. Intel Virtualization Technology, Intel FlexMigration, Intel FlexPriority, and Intel 64 architecture are standard on all SKUs. Higher frequency versions of the Intel Xeon processor 7400 series also support Demand-based Switching (DBS).

Processor Number	Power	Cores Per Processor	Speed	L3 Cache	DBS
X7460	130 W	6	2.66 GHz	16 MB	Yes
E7450	90 W	6	2.40 GHz	12 MB	Yes
E7440	90 W	4	2.40 GHz	16 MB	Yes
E7430	90 W	4	2.13 GHz	12 MB	No
E7420	90 W	4	2.13 GHz	8 MB	No
L7455	65 W	6	2.13 GHz	12 MB	No
L7445	50 W	4	2.13 GHz	12 MB	No

Multi-processor servers based on the Intel Xeon processor 7400 series deliver

Up to 43% better performance
compared to the previous generations.¹⁰



Server Platform Designed for Your Needs

Intel® 7300 chipset

The Intel 7300 Chipset improves data movement across Intel Xeon processor 7400 series-based servers by increasing interconnect bandwidth, optimizing system bandwidth, increasing memory capacity, and improving network traffic processing while reducing I/O latency.¹¹ The Intel 7300 Chipset also has 28 lanes of PCI Express* with support for third-party expanders for additional I/O.

Intel® Ethernet Server Adapter

Designed for Intel® Xeon® processors with features that distribute I/O processing across multiple CPU cores. Intel Ethernet Server Adapters are optimized for virtualization and include technologies such as Virtual Machine Device Queues (VMDq), which off-load some hypervisor functions to the network silicon, freeing processor cycles and improving overall system performance.

Platform features enabled by the Intel 7300 chipset with data optimization include:

Dedicated High-Speed Interconnects (DHSI)	<ul style="list-style-type: none">▪ DHSI is an independent point-to-point interconnect between each of the four processors and the chipset. DHSI has increased the memory bandwidth by up to 2x over previous-generation multi-processor platforms¹²
64 MB Snoop Filter	<ul style="list-style-type: none">▪ Significantly reduces data traffic on the DHSI providing lower latencies and greater available bandwidth. The snoop filter manages data coherency across processors with a directory of the current cached data, eliminating unnecessary snoops and boosting available bandwidth
Fully Buffered DIMM (FBDIMM) Technology	<ul style="list-style-type: none">▪ Provides 4x the memory capacity¹³ (up to 256 GB based on 8 GB Fully Buffered DIMM)▪ Increases memory speed to 1066 MHz
Intel® I/O Acceleration Technology (Intel® I/OAT) with Next-Generation Improvements (using Intel® Server Adapter)	<ul style="list-style-type: none">▪ Improves CPU utilization and lowers latency through features like low latency interrupts, MSI-X (next-generation interrupt handling) and stateless offloads▪ Direct Cache Access (DCA) leverages Intel® QuickData Technology in the Intel 7300 Chipset, a platform solution designed to maximize the throughput of server data traffic and achieve faster, scalable, and more reliable I/O

Reliable uptime

The Intel 7300 Chipset also builds in enhanced reliability to support continuous server availability and help prevent unplanned downtime.

Reliability feature	Benefit
Memory ECC	<ul style="list-style-type: none">▪ Detects and corrects single-bit errors
Enhanced Memory ECC	<ul style="list-style-type: none">▪ Retry double-bit errors
Memory Sparing	<ul style="list-style-type: none">▪ Predicts a failing DIMM and copies the data to a spare memory DIMM, maintaining server availability and uptime
Memory Mirroring	<ul style="list-style-type: none">▪ Data is written to two locations in system memory so that if a DRAM device fails, mirrored memory enables continued operation and data availability
Memory CRC	<ul style="list-style-type: none">▪ Address and command transmissions are automatically re-tried if a transient error occurs
Symmetric Access to All CPUs	<ul style="list-style-type: none">▪ Enables a system to restart and operate if the primary processor fails



Intel offers a complete line of industry-leading single- and multi-port Gigabit and Fast Ethernet controllers. For more information go to: www.intel.com/network.

For I/O virtualization solutions go to, www.intel.com/go/vtc.

Configuration Information for Benchmarks in Figure 1.

Platform common configuration details: Intel server pre-production platform with four processors Intel® Xeon® Processor X7350 (2.93 GHz, with 2x4M L2 Cache) or Intel® Xeon® Processor X7460 (2.66 GHz with 16M L3 Cache) 1066 MHz system bus, Intel® 7300 Chipset.

Benchmark specific details (All data based on Intel internal measurements, April 2008).			
Benchmark	OS	Memory (same for both unless stated)	Other software and hardware details
SPECint*_rate_base2006, SPECint*_rate2006, SPECfp*_rate_base2006, SPECfp*_rate2006	Suse Linux-64	Intel® Xeon® processor X7350 16 GB (16x1 GB) FB DDR2-667 MHz Intel® Xeon® processor X7460 32 GB (16x2 GB) FB DDR2-667 MHz	SPEC binaries built with Intel Compiler 10.1 for 32-bit/64-bit Linux*
TPC Benchmark* C	Microsoft Windows Server 2003*	256 GB memory simulated using 128 GB (32x4 GB) FB DDR2-667 MHz	SQL Server* 2005 SP1 (64-bit)
SAP* SD two-tier	Microsoft Windows Server 2003	64 GB (16x4 GB) FB DDR2-667 MHz	SAP* 2-Tier SD benchmark. ECC 6.0 Version. SQL Server 2005 database
SPECjbb*2005	Microsoft Windows Server 2003	64 GB (16x4 GB) FB DDR2-667 MHz	JVM: BEA JRockit JDK R27.5. 8 JVM instances for Intel Xeon processor X7350; 4 JVM instances for Intel Xeon processor X7460
TPC Benchmark*E	Microsoft Windows Server 2008*	128 GB (32x 4GB) FB DDR2-667 MHz	SQL Server* 2008
TPC Benchmark*H – 100 GB	Microsoft Windows Server 2005*/2008	128 GB (32x4 GB) FB DDR2-667 MHz	SQL Server* 2008/2005
vConsolidate	Various	32 GB (16x 2 GB) FB DDR2-667 MHz	vCon 1.1; Profile 2
SPECpower*_ssj*2008	Microsoft Windows Server 2003	16 GB (8x2 GB) FB DDR2-667 MHz	JVM: BEA JRockit JDK R27.5

Performance data is accurate at time of document publication. For latest performance information, visit www.intel.com/performance.

- Intel internal measurements as of June 2008 running vConsolidate. System configuration: Intel® SDP platform (4 x processors listed, 32 GB memory (16*2 GB DIMMs), 2 power supplies, power management settings disabled in BIOS, 2xQLE2462 FC HBA cards (1 in use, 1 at idle).
- Intel Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM), and applications enabled for virtualization technology. Functionality, performance or other virtualization technology benefits will vary depending on hardware and software configurations. Virtualization technology-enabled BIOS and VMM applications are currently in development.
- Compared to previous generation processors.
- Comparing Intel® Xeon® X7350 with 8 MB of L2 to Intel® Xeon® X7460 with 16 MB Shared L3.
- TPC-E SQL Server 2005/2008; Intel server pre-production platform with four processors Intel® Xeon® Processor X7350 (2.93 GHz, with 2x4M L2 Cache) or Intel® Xeon® Processor X7460 (2.66 GHz with 16M L3 Cache) 1066 MHz system bus, Intel® 7300 Chipset.
- Ibid.
- SAP* 2-Tier SD benchmark. ECC 6.0 Version. SQL Server2005 database; Intel® server pre-production platform with four processors Intel® Xeon® Processor X7350 (2.93 GHz, with 2x4M L2 Cache) or Intel Xeon processor X7460 (2.66 GHz with 16M L3 Cache) 1066 MHz system bus, Intel® 7300 Chipset.
- TPC-H 100 GB, SQL Server2005 database; Intel server pre-production platform with four processors Intel® Xeon® Processor X7350 (2.93 GHz, with 2x4M L2 Cache) or Intel Xeon Processor X7460 (2.66 GHz with 16M L3 Cache) 1066 MHz system bus, Intel 7300 Chipset.
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- Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor series, not across different processor sequences. See http://www.intel.com/products/processor_number for details.
- As compared to previous platforms.
- Over previous generations.

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Relative performance is calculated by assigning a baseline value of 1.0 to one benchmark result, and then dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms, and assigning them a relative performance number that correlates with the performance improvements reported.

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All Performance claims and comparisons in this package are among Dual Processor Server platforms based on x86 architecture.

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