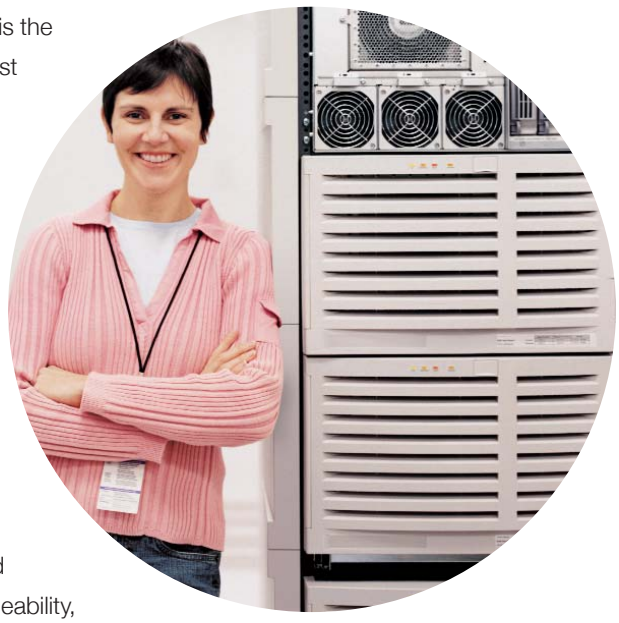
The 64-bit Intel® Xeon™ Processor MP platform

An MP chipset that works with Intel single-core processors today, and Intel dual-core processors tomorrow.



The Intel® E8500 chipset is the highest performance, most scalable platform offering in the 64-bit Intel® Xeon™ processor family. Intel's sixth-generation four-way MP platform is architected for Intel dual-core processors, yet it is also compatible with Intel's current single-core processors, giving it an enhanced lifespan and lowering Total Cost of Ownership (TCO).

In addition, the Intel E8500 chipset offers enhanced performance, increased bandwidth, and greater flexibility, manageability, and I/O integration than Intel's previous-generation MP chipsets. Plus, it is available in a variety of configurations suitable for a wide range of price points and application environments.

Improve return on investment with smart platform design.

The Intel E8500 chipset delivers an extended lifespan, working with both Intel's current-generation single-core processors as well as future Intel dual-core processors. And the chipset's ability to support 64-bit as well as 32-bit applications lets your customers utilize their investment even further.

Intel's first chipset architected for 4-socket dual-core processors offers dual front-side system buses and faster FSB speeds for outstanding performance under certain workloads. It also offers support for the 64-bit Intel Xeon processor MP with up to 8 MB L3 cache. This higher throughput leads to better performance.

Improve productivity and help lower costs with new Reliability-Availability-Serviceability (RAS) innovations.

Intel has a proven track record of providing the latest technologies and innovations, and the Intel E8500 chipset follows suit by offering the most comprehensive platform RAS coverage in the 64-bit Intel Xeon processor family. What's more, these new features are offered at a cost that's competitive with older-generation technologies. New features include an ECC system bus, memory RAID, demand and patrol scrubbing, and an SMBus.

With the rapid price decline of memory, there has been an increase in the amount of memory usage in systems. With more memory in use, the potential for memory failure increases, which increases the importance of memory reliability features in the platform. The Intel E8500 chipset offers increased reliability over previous platforms through new features implemented in the chipset memory controller:

- **Error Correcting Code (ECC) –** The system detects single- and double-bit errors and automatically corrects single-bit errors on internal data paths.
- **New! Memory RAID –** Similar to RAID for disks, Memory RAID uses partitions of the system memory as independent, redundant data stores to allow for reconstruction of the system data even in the event of a memory board failure.
- **New! Demand and patrol scrubbing –** The system proactively searches the system memory, repairing correctable errors or permanently marking the memory location as unreadable.
- **SMBus with PIROM and thermal sensor –** This feature allows for scheduled service in the event of a system manufacturing defect or cooling device failure, going to a lower power state if a critical temperature is reached.
- **Memory mirroring –** Splits the memory subsystem into two and duplicates the data in each half. The redundant memory image is used as a check against errors in the memory.
- **Hot-plug I/O and memory –** Add memory or I/O after installation without service interruption.
- **DIMM sparing –** Swaps "defective" DIMMs with installed but otherwise unused DIMMs.
- **X8 single device data correction (X8 SDDC) –** Fixes the failure of an entire DRAM device on-the-fly without impacting the performance of the platform by removing a single DRAM from the memory map and recovering its data into a new device.

Improve performance with expanded bandwidth.

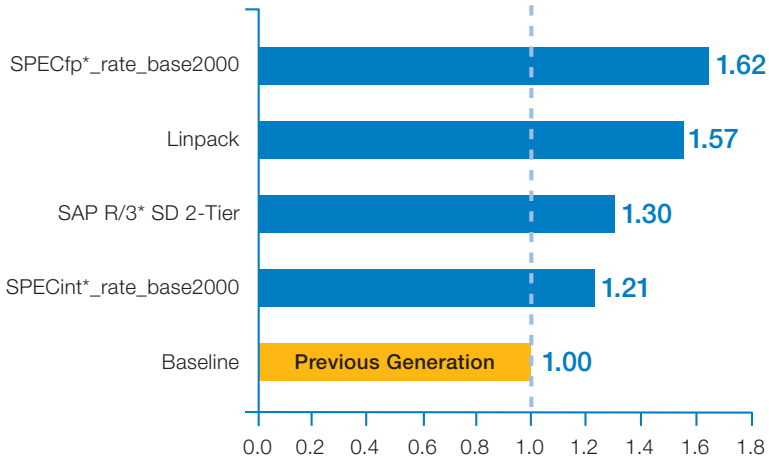
The system bandwidth of the Intel E8500 chipset is 10.6 GB/s — over three times faster than previous Intel Xeon processor MP-based platforms. This lets your customers complete backups faster on fewer servers and in less time, helping to reduce the overhead costs of standard server reliability such as RAID.

Other performance-enhancing features include:

- DDR-266, DDR-333 or DDR2-400 memory-based subsystems offer reduced latency while consuming less power.
- Up to 8 MB cache from 64-bit Intel Xeon processors MP for faster response times.
- Demand-Based Switching (DBS) with Enhanced Intel SpeedStep® technology gives you the advantage of power savings and increased system density for server applications and helps improve workstation acoustics.
- Intel® Extended Memory 64 Technology (Intel® EM64T) extends flat memory addressability beyond 4 GB.
- Streaming SIMD Extensions 3 (SSE3) includes 13 additional SIMD instructions over SSE2. The new instructions are primarily designed to improve thread synchronization and specific application areas such as media and gaming.
- Hyper-Threading enhancements help increase server application performance.
- PCI Express* offers greater performance headroom and bandwidth efficiency.

64-bit Intel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 Cache
Server Platform Performance

Compares 64-bit Intel® Xeon™ processor MP-based server platforms with its previous generation



Relative Performance – Higher is better

Data Source: All results published/submitted as of March 18, 2005 except Linpack. Linpack result based on Intel internal measurement.

Configuration Details: 64-bit Intel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 Cache – Server Platform Performance

SPECfp*_rate_base2000: Baseline Platform configuration: Dell PowerEdge 6600*, 4xIntel® Xeon™ Processor MP 3.0 GHz with 4 MB L3 Cache, 400 MHz FSB HT Off, Memory: 4 GB (4x1024 MB) DDR200; OS – Build: Microsoft Windows 2000 Advanced Server* (SP2) 32bit; Application: SPEC* CPU2000 benchmark binaries produced with Intel® C/C++ and FORTRAN Compilers version 7.1 (20030402Z) Referenced as published. For more information see http://www.spec.org/cpu2000/results/res2004q1/cpu2000-20040206-02817.html

New Platform configuration: HP ProLiant ML570* G3 with 4xIntel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 Cache, HT ON, Memory: 32 GB memory (16x2 GB DDR2-400); OS – Build: Microsoft Windows Server 2003 Enterprise Edition* Build 3790 (RTM) 32bit; Application: SPEC* CPU2000 benchmark binaries produced with Intel® C/C++ and FORTRAN Compilers version 8.1 (Build 20040802Z) Result submitted to www.spec.org for review as of March 16, 2005

Linpack: Baseline Platform configuration: Intel internal measurement – Feb. 2004; Intel® SRSH4 Server (Shasta), BIOS Version: SSH40.86B.0086.B.0308011746, 4x3.0 GHz Intel® Xeon™ processors MP with 4 MB L3 cache (stepping R0); Hyper-Threading disabled, Hardware prefetch enabled, Adjacent Sector prefetch enabled, 100 MHz (400 MT/s) Bus, Chipset: ServerWorks Grand Champion* HE; 8 GB memory (8x1 GB DDR266 installed from DIMM1to DIMM8); Red Hat Linux EL3.0* kernel 2.4.21-4.ELcustom #2 SMP with 4 GB kernel-space and 4 GB user-space virtual memory support enabled; MKL LINPACK Version 2.0.2c binary

New Platform configuration: Intel internal measurement – Feb. 2005; Intel® SR6850HW4 (Harwich SDP) 4xIntel® Xeon™ Processor MP 3.33 GHz 8 MB L3 cache, Intel® E8500 chipset (Twincastle), Dual Independent Busses at 667 MHz, 10.67 GB/sec theoretical bandwidth; Memory: 16x1 GB DDR2-400 BIOS: SHW40.86B.B10.01.00.0031; Hardware Pre-fetch: Default state (enabled), Adjacent Cache Line Pre-fetch: Default state (enabled), HT disabled OS – Red Hat Enterprise Linux* AS release 3 (Taroon Update 3) 2.4.21-20.EL x86_64 GNU/Linux Workload: 5Kx5K through 44Kx44K matrix sizes used; 44Kx44K matrix allocates 15.5 GB Workload Type: Scalar

SAP R/3* SD 2-tier: Baseline Platform configuration: IBM eServer xSeries* x365 server platform with 4xIntel® Xeon™ processor MP 3.0 GHz with 4 MB L3 Cache, 8 GB Memory, Microsoft Windows Server 2003 Enterprise Edition* (32-bit), IBM DB2* UDB 8.1 (32-bit), SAP SD standard R/3 Enterprise* 4.70 (32-bit) application benchmark. Referenced as published at 720 users. Results at http://www50.sap.com/benchmark/pdf/cert1904.pdf

New Platform configuration: HP ProLiant* DL580 G3, 4-way SMP, 64-bit Intel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 cache, 32 GB main Microsoft Windows Server 2003 Enterprise Edition* (64-bit), SQL Server 2000* (32-bit), SAP SD standard R/3 Enterprise* 4.70 (64-bit) application benchmark. Referenced as published at 937 users. Results at http://www50.sap.com/benchmark/

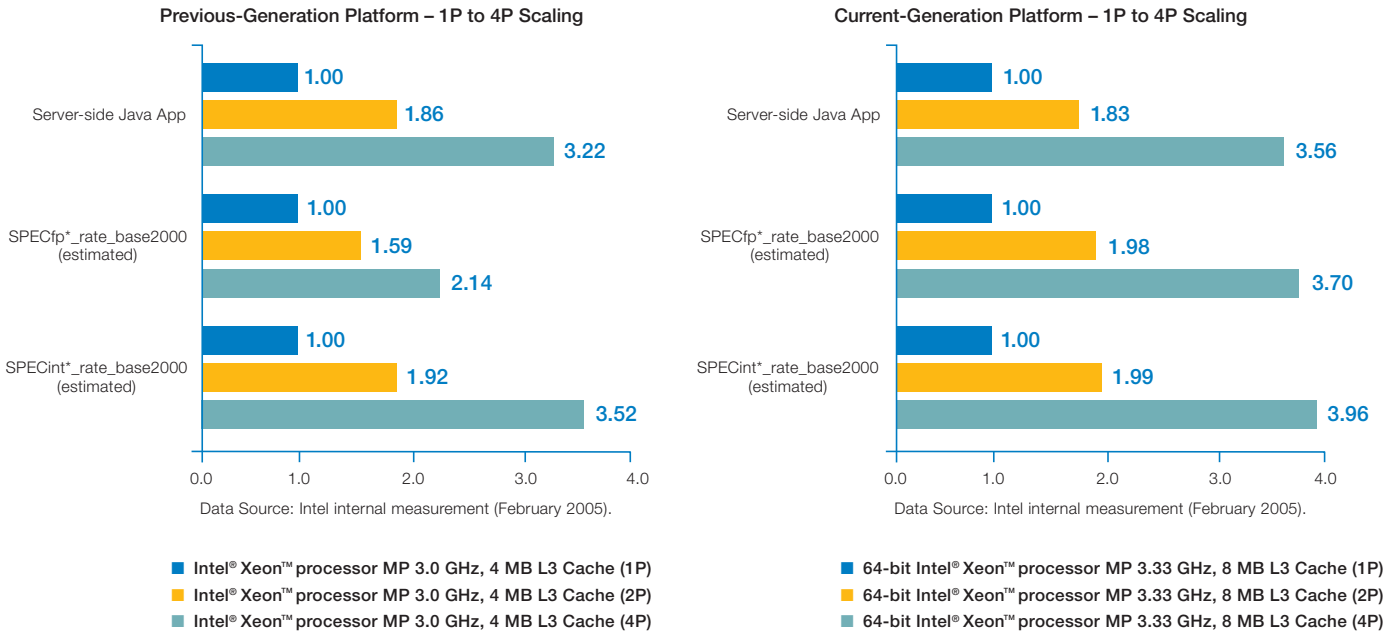
SPECint*_rate_base2000: Baseline Platform configuration: ION Computer Systems, BX41 4xIntel® Xeon™ Processor MP 3.0 GHz with 4 MB L3 Cache and 400 MHz system bus, HT OFF, 2 GB, DDR266 memory, Red Hat Enterprise Linux ES* release 3, Intel® C++ Compiler for Linux 8.0 (Build 20040412Z), MicroQuill SmartHeap* Library 7.1. Result published at http://www.spec.org/cpu2000/results/res2004q2/cpu2000-20040514-03026.html

New Platform configuration: HP ProLiant ML570* G3 with 4xIntel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 Cache, HT ON, Memory: 32 GB memory (16x2 GB DDR2-400); OS – Build: Microsoft Windows Server 2003 Enterprise Edition* Build 3790 (RTM) 32bit; Application: SPEC* CPU2000 benchmark binaries produced with Intel® C/C++ and FORTRAN Compilers version 8.1 (Build 20040802Z). Result submitted to www.spec.org for review as of March 16, 2005

64-bit Intel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 Cache
Scalability – 1P to 4P Scaling Comparison with Previous Generation

Compares 1P to 4P scalability of 64-bit Intel® Xeon™ processor MP 3.33 GHz with 8 MB L3 Cache platform with its previous generation

Relative Performance – Higher is better



Configuration Details: 64-bit Intel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 Cache
Scalability – 1P to 4P Scaling Comparison with Previous Generation

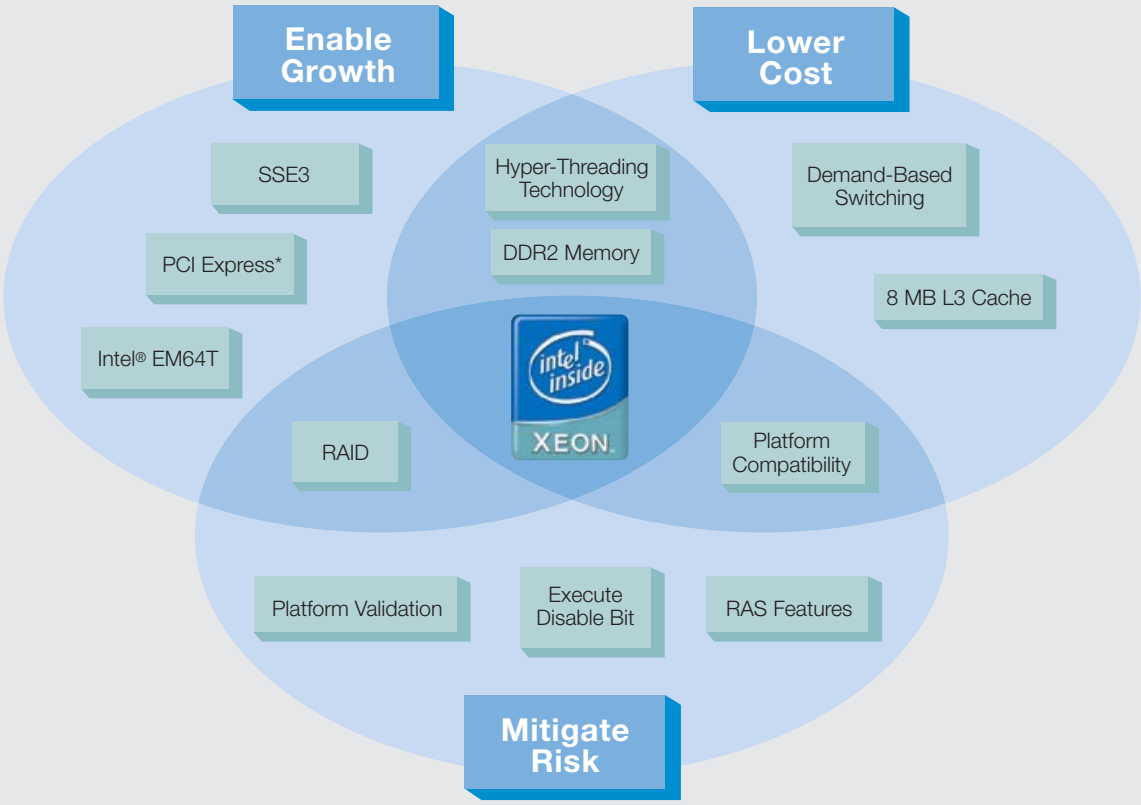
SPECfp*_rate_base2000, SPECint*_rate_base2000: Performance estimates based on Intel internal measurement. For details see www.spec.org/cpu2000: Previous-generation platform configuration: Intel internal measurement – February 2005: Intel® SRSH4 Server System (Shasta) BIOS: SSH4 BIOS Release 14.0, 1, 2, and 4P configuration with Intel® Xeon™ Processor MP 3.0 GHz with 4 MB L3 Cache (Gallatin), (CPUID F26, Revision E), 4x100 MHz FSB HT ON, Memory: 3 GB (12x256 MB DDR 266) fully populated; OS – Build: Microsoft Windows Server 2003 Enterprise Edition* Build 3790 (RTM) 32bit; Application: SPEC* CPU2000 benchmark version 1.2 precompiled "official" binaries produced with Intel® C/C++ and FORTRAN Compilers version 8.1 (Build 20040802Z)

Current-generation platform configuration: Intel internal measurement – February 2005: Intel® Harwich Beta Server System, BIOS: SHW40 BIOS Version 1.00, Beta BIOS 01 Build 24, 1, 2, and 4P configuration with Intel® Xeon™ Processor MP 3.33 GHz with 8 MB L3 Cache, B0 Stepping, 4x166 MHz FSB HT ON, Memory: 16 GB (16x1 GB DDR2-400) fully populated; OS – Build: Microsoft Windows Server 2003 Enterprise Edition* Build 3790 (RTM) 32bit; Application: SPEC* CPU2000 benchmark version 1.2 precompiled "official" binaries produced with Intel® C/C++ and FORTRAN Compilers version 8.1 (Build 20040802Z)

Server-Side Java App – This workload evaluates the performance of Server-side Java Application. Measured in operations per second. Performance estimates based on Intel internal measurement: Previous-generation platform configuration: Intel internal measurement – September 2004; Intel® Server Platform SRSH4 (Shasta) Serverworks Grand Champion* HE chipset; BIOS Version: SSH40.86B.0086.B.03080011746; AS prefetch enabled, HW prefetch disabled; 1, 2, and 4P configuration with Intel® Xeon™ processor MP 3.0 GHz 4 MB L3, HT enabled; Memory: 4 GB memory (4x1 GB DDR 266 installed from DIMM#1 to DIMM#4) Intel® PRO/1000 XT Server Adapter (1 GB) Red Hat Linux* EL3.0 (Kernel 2.4.21-4.ELsmp) BEA WebLogic* JRockit* 1.4.2_04 JVM Load16

Current-generation platform configuration: Intel internal measurement – February 2005; S3E3100 Server System, "Harwich" Platform, 1, 2, and 4P configuration with Intel® Xeon™ Processor MP 3.33 GHz 8 MB L3 Cache, C0 Stepping, BIOS: SHW40.86B.B01.01.0024, Prefetch settings: (default), Hardware prefetch enabled, Adjacent sector prefetch enabled, Memory: 8 GB (8x1 GB DDR2-400 DIMMs), Microsoft Windows Server 2003 Enterprise Edition* RTM, BEA WebLogic* JRockit* 1.5.0 JVM build dra-38972-20041208-2001-win-ia32 (from BEA website)

The Platform of Choice Just Got Better



Products and technologies designed and validated together to deliver greater end-user benefits.

For more information on 64-bit Intel® Xeon™ processor MP-based platforms please go to: www.intel.com/business/bss/products/server/xeon_mp/index.htm

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, visit http://www.intel.com/performance/resources/limits.htm or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

All dates and products specified are for planning purposes only and are subject to change without notice

Relative performance for each benchmark is calculated by taking the actual benchmark result for the first platform tested and assigning it a value of 1.0 as a baseline. Relative performance for the remaining platforms tested was calculated by 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.

64-bit Intel® Xeon™ processors with Intel® EM64T requires a computer system with a processor, chipset, BIOS, OS, device drivers and applications enabled for Intel EM64T. Processor will not operate (including 32-bit operation) without an Intel EM64T-enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel EM64T-enabled OS, BIOS, device drivers and applications may not be available. Check with your vendor for more information.

SPECint2000 and SPECfp2000 benchmark tests reflect the performance of the microprocessor, memory architecture and compiler of a computer system on compute-intensive, 32-bit applications. SPEC benchmark tests results for Intel microprocessors are determined using particular, well-configured systems. These results may or may not reflect the relative performance of Intel microprocessor in systems with different hardware or software designs or configurations (including compilers). Buyers should consult other sources of information, including system benchmarks; to evaluate the performance of systems they are considering purchasing.

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