Product Brief

Dual-Core Intel® Itanium® 2 Processor 9000 Series

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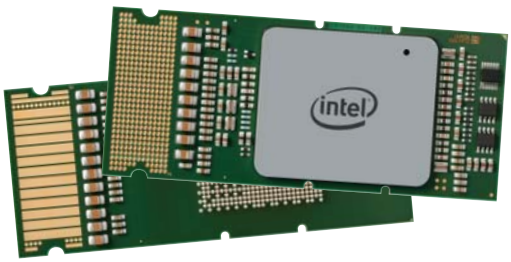
Unbeatable flexibility and scalable performance to power your data center

The Dual-Core Intel® Itanium® 2 processor 9000[Δ] series delivers new levels of flexibility, reliability, performance, and cost-effective scalability for your most data-intensive business and technical applications. With double the performance of yesterday's Intel Itanium 2 processors,[1] the Dual-Core Intel Itanium 2 processor provides more reasons than ever to migrate your business-critical applications off RISC and legacy mainframe systems and onto cost-effective Intel® architecture servers. The Dual-Core Intel Itanium 2 processor provides close to triple the amount of L3 cache (24 megabytes), Intel® Hyper-Threading Technology[†], Intel® Virtualization Technology[Φ] for improved virtualization, Intel® Cache Safe Technology for increased availability, and up to 20 percent lower power consumption.[1]



Make the Move to Dual-Core Itanium® 2-based Servers

The hardware and software support you need to migrate RISC and mainframe applications is here today.

Dual-Core Itanium® 2-based systems are available from leading OEMs worldwide and run popular 64-bit operating systems such as Microsoft Windows Server 2003*; Linux* from Novell, Red Hat, Red Flag, and other distributors; HP NonStop*; OpenVMS*; HP-UX*; Bull GCOS 8*, and NEC ACOS-4*. More than 8,000 applications[2] are available for Itanium 2-based systems from vendors such as Microsoft, BEA, IBM, Ansys, Gaussian, Symantec/Veritas, Oracle, SAP, and SAS. And with industry support growing and future Intel® Itanium® processor family advances already in development, your Dual-Core Itanium 2-based server investment will continue to deliver performance advances and savings for your most demanding applications.

Nonstop Innovation

EPIC Architecture. Explicitly Parallel Instruction Computing (EPIC) architecture is the cornerstone of the Intel Itanium architecture. It provides a variety of advanced implementations of parallelism, predication, and speculation, resulting in superior Instruction-Level Parallelism (ILP) to help address the current and future requirements of high-end enterprise and technical workloads. This architecture is built from the ground up for the most demanding applications, made possible by high levels of compute parallelism, massive caches, and processor execution resources.

Dual-Core Processing. The Dual-Core Intel Itanium 2 processor is Intel's first product in the Itanium processor family with two complete 64-bit cores on one processor.

Intel Hyper-Threading Technology. The Dual-Core Intel Itanium 2 processor is also the first member of the Intel Itanium processor family to include Hyper-Threading Technology, which provides four times the number of application threads provided by earlier single-core implementations.

24 MB On-Die L3 Cache. The Dual-Core Intel Itanium 2 processor features up to 24 megabytes of low-latency on-die L3 cache, nearly three times the amount provided by yesterday's Intel Itanium 2 processor, providing high bandwidth to the two cores. This generous on-die L3 cache combined with dual-core processing and Hyper-Threading Technology provides twice the performance of yesterday's Intel Itanium 2 processor.[1]

Intel Virtualization Technology. The Dual-Core Intel Itanium 2 processor includes hardware-assisted virtualization support that helps increase virtualization efficiency and broaden operating system compatibility. In conjunction with dual-core performance improvements and unparalleled scalability advantages, Intel Virtualization Technology makes Dual-Core Itanium 2-based systems an excellent platform for data-intensive virtualization.

Intel Cache Safe Technology. This new technology enables high-end systems to operate even in the event of errors in the L3 cache that can bring systems down. Intel Cache Safe Technology minimizes cache errors and helps ensure mainframe-caliber availability.

Outstanding Energy Efficiency. The Dual-Core Intel Itanium 2 processor uses up to 20 percent less power than yesterday's Intel Itanium 2 processor, enabling 2.5 times higher performance per watt, lowering energy requirements while providing significant performance improvements.[1]

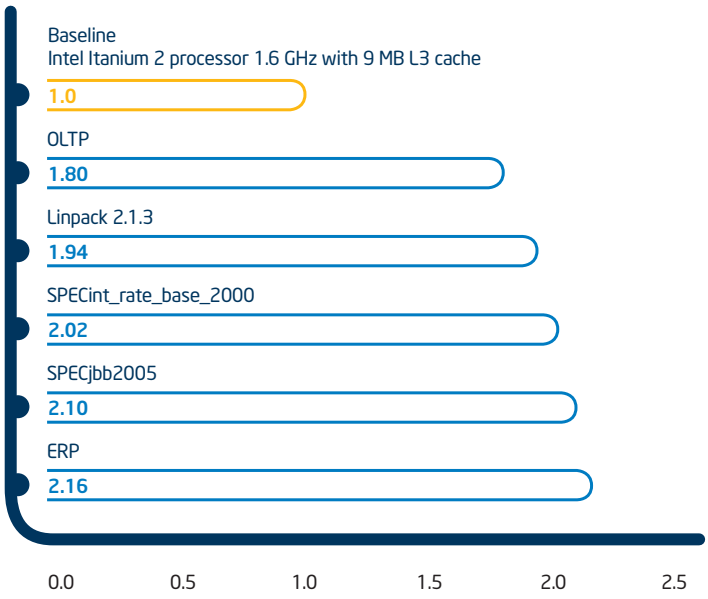
Impressive Price/Performance. Dual-Core Intel Itanium 2 processors continue the Intel Itanium processor family legacy of providing extremely attractive price/performance for data-intensive applications. They provide mainframe-class performance, and reliability without the mainframe price tag.

Security Features. The Intel Itanium 2 processor has a number of unique features to support best-in-class data center security. These include faster data encryption, robust memory compartmentalization (via enhanced paging architecture), and hardware authentication of firmware.

IA-32 Application Support. Itanium 2-based servers have always supported IA-32 application to ease the transition for customers migrating from other processor architectures. The IA-32 Execution Layer enhances this capability, providing improved performance and flexibility. The IA-32 Execution Layer is supported by Microsoft Windows* and Linux* operating systems.

Server and High-Performance Computing Performance

Performance (Intel® Itanium® 2 processor 1.6 GHz with 24 MB L3 cache. Higher is better)



Configuration details: Data Source: Intel Internal Measurement (March 2006)

Baseline: Intel® Itanium® 2 processor 1.6 GHz with 9 MB L3 cache

Benchmark description for OLTP: Measure of database performance in an online transaction processing. OLTP (NT/SQL). Intel® SR870BN4 Server System (Tiger 4): Dual-Core Intel® Itanium® 2 "Montecito" 1.6 GHz. processors, 24 MB L3 cache, 1 MB L2I, 256K L2D, 16 KB, L1I, and 16 KB L1D. C0' stepping, 400 MHz FSB, Memory: 64 GB (16 x 4 GB DDR/PC2100, 266 MHz), SOEMT *Enabled* (BIOS default), Intel Itanium 2 "Madison" 1.6 GHz processors, 9MB L3 cache per CPU. A1 Stepping, 400 MHz FSB, Memory: 64 GB (16 x 4 GB DDR/PC2100, 266 MHz).

Benchmark description for Linpack: Measure of CPU floating point performance. Linpack. Intel® SR870BN4 Server System (Tiger 4). CPU: 8 cores, 4 chips, 1chip/socket, 2 cores/chip "Montecito" C0' stepping processors with 12 MB L3 cache/core at 1.60 GHz/400 MHz, SoEMT disabled (Hyper-Threading Technology disabled), CPU: 4 cores, 4 chips, 1chip/socket, 1core/chip "Madison" processors with 9 MB L3 cache at 1.60 GHz/400 MHz , System/Software (both systems): OS—Linux version 2.6.9-22.EL.

Benchmark description for SPECJBB2005: Measure of Web server performance. SPECjBB2005. Intel® SR870BN4 Server System (Tiger 4): CPU Info: 4 x Intel® Itanium®2 processor "Madison" 1.6 GHz with 9 MB L3 cache, Chipset: E8870, Memory: 16 GB (8 x 2 GB DDR/PC2100, 200 MHz), CPU Info: 4 x Intel Itanium 2 processor "Montecito" 1.6 GHz (C0' stepping) with 24 MB L3 cache, SoEMT enabled, Chipset: E8870, Memory: 32 GB (16 x 2 GB DDR/PC2100, 200 MHz).

Benchmark description for SPECCPU2000 (SPECint_rate_base2000): Measure of CPU performance integer or floating point. SPECCPU2000. Intel® SR870BN4 Server System (Tiger 4). CPU: 8 cores, 4 chips, 1chip/socket, 2 cores/chip Montecito C0' stepping processors with 12 MB L3 cache/core at 1.60 GHz/400 MHz, SoEMT disabled (Hyper-Threading Technology disabled), CPU: 4 cores, 4 chips, 1chip/socket, 1core/chip "Madison" processors with 9 MB L3 cache at 1.60 GHz/200 MHz, OS—RedHat EL4.0 Update-2 (2.6.9-22.1.EL on Montecito and 2.6.9-22.EL on Madison 9 MB), Application: CPU2000 version 1.2, Compilers: Intel® C++ / Fortran Compilers for Linux* version 9.1 Build 20060102.

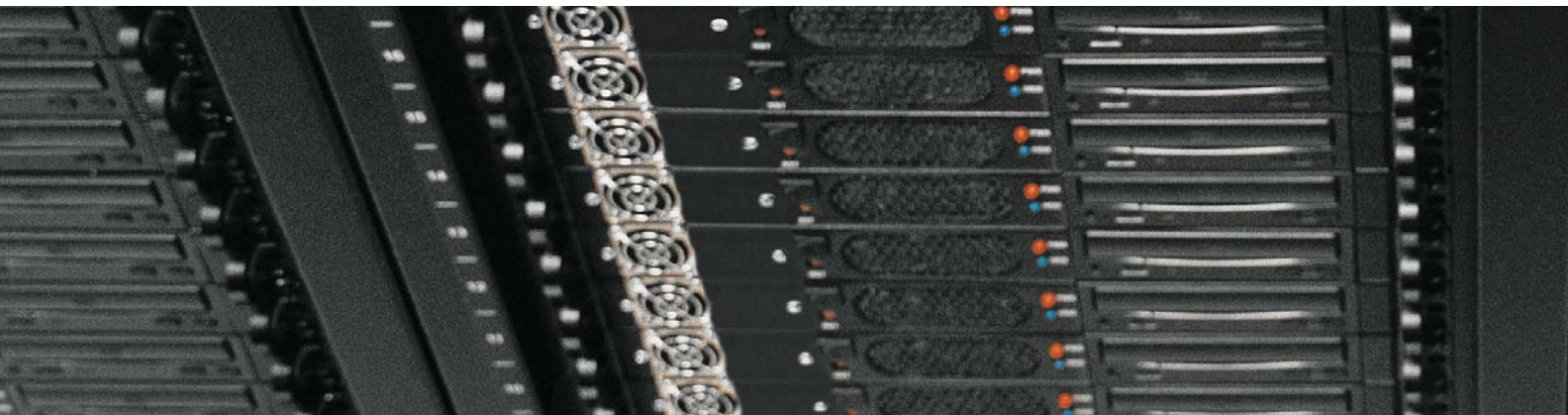
Benchmark Description for ERP:

Intel® SR870BN4 MP Server System (Tiger 4)

Madison A1 Stepping 1.6 GHz/9 MB: 4P, 32 GB (16x2 DDR 266 MHz REG DIMMs)

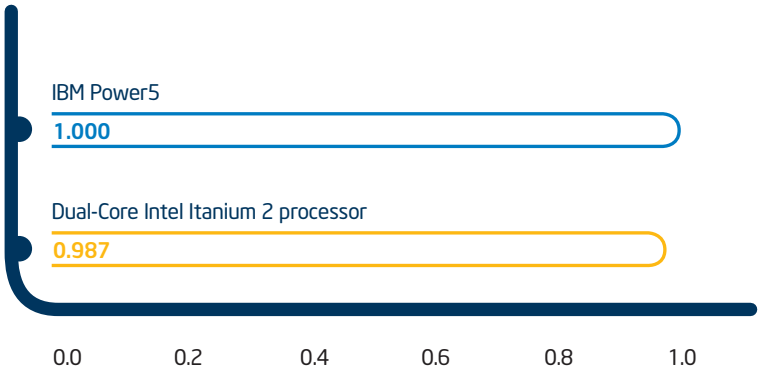
Montecito C0' Stepping 1.6 GHz (12 MB cache per core): 4 sockets, 8 cores, 16 threads

Operating system: SuSE* Linux* Enterprise Server 9 for IA64, Madison: Linux kernel 2.6.5-97-smp, Montecito: Linux kernel 2.6.5-139 (Montecito patch applied for multi-core and multi-thread detection), Oracle9i* Enterprise Edition Release 9.2.0.4.0 64-bit production.



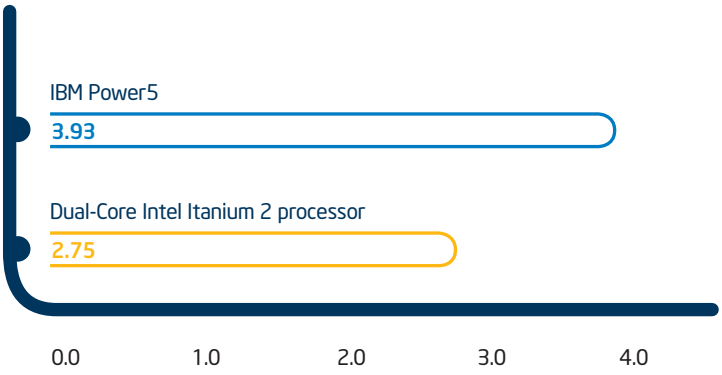
Dual-Core Intel® Itanium® 2 Processor and IBM Power5* 4-Core Performance

Performance (Higher is better)



Dual-Core Intel® Itanium® 2 Processor and IBM Power5* 4-Core Price/Performance

Price/performance (Lower is better)



Configuration details:

Source: www.tpc.org: IBM eServer* p5 570 4P, Power5* 1.9 GHz, 4P (2 processors, 4 cores, 8 threads), 128 GB memory, Oracle Database 10*g* Enterprise Edition*, IBM AIX 5L V5.3*, result of 203,439 tpmC $3.93/tpmC, published on 10/17/05. Intel® Itanium® 2 processor results of 200,829 tpmC and $2.75/tpmC on HP Integrity rx4640* using 2 Intel Itanium 2 processors 1.6 GHz with 24 MB L3 cache (2 processors, 4 cores, 8 threads), 128 GB memory, Oracle Database 10*g* Enterprise Edition, HP-UX 11.iv2* 64-bit base OS, was published on 03/21/06.

Dual-Core Intel® Itanium® 2 Processor Reliability

Features	Functions	Benefits
Intel® Cache Safe Technology: automatic cache recovery	Allows processor and server to continue normal operation in case of cache error; automatically disables cache lines in the event of cache memory error	▪ Greater ability to survive cache errors ▪ Higher levels of computing uptime
Enhanced Machine Check Architecture: extensive error detection and correction capabilities	Address and data path error correction; system-wide ECC protection; automatic error detection, logging, and correction	▪ Detect bit-level errors and manage data corruption, thereby providing outstanding reliability for maximum system uptime
ECC memory with mirroring, redundancy, or Chipkill* capabilities; hot-plug platform components like supplies and disks; built-in hardware redundancy; enhanced platform-level manageability	Servers can detect, log, and correct errors and be configured with many levels of redundancy; server processor boards, memory, I/O, fans, power can be serviced while still up and running with hot-plug capabilities; servers can be managed remotely	▪ Servers are highly reliable, manageable, and easily serviced, providing maximum uptime for business-critical applications

Platform capabilities shown represent example high-end enterprise server capabilities and can vary based on vendor-specific platform features and target applications.

Optimized for Data-Intensive Computing

Dual-Core Itanium 2-based servers offer excellent price/performance and transaction speed for business analytics, databases, ERP, and other data-intensive applications found in enterprise and technical computing environments.

Business Value	Features/Functions	Benefits
Powerful solutions for vast amounts of data and users, data-intensive business analytics, high-volume transactions, and complex calculations	▪ Dual-core processor ▪ Low-latency 24 MB on-die L3 cache (14 cycles) providing 102 GB/s aggregate bandwidth to the cores[1] ▪ 2.5 MB L2 and single-cycle latency L1 ▪ 1.6 GHz frequency ▪ Supports 400 and 533 MHz bus speeds ▪ Explicit parallelism simultaneously executes multiple instructions on each clock cycle ▪ High-precision floating-point architecture: speeds up complex calculations	▪ Improved time to information and real-time business decision making ▪ Faster access to data and improved throughput for enterprise applications ▪ Fast responses to complex calculations ▪ Faster online transaction processing
Mainframe-class reliability and scalability features for business-critical computing	▪ Intel® Cache Safe Technology ▪ Intel® Virtualization Technology[Φ] ▪ Extensive error detection and correction capabilities	▪ Automatic cache error recovery ▪ Greater virtualization efficiency, broader operating system compatibility ▪ High reliability, availability, serviceability and manageability
Intel volume economics extended to the most data-intensive, critical applications	▪ Itanium® 2-based solutions are less expensive than proprietary RISC offerings ▪ Strong Intel® Itanium® processor family roadmap ▪ Support from leading OS and application vendors	▪ Multiple future processors in development ▪ Most extensive OS and application support in industry
Price/performance advantage for business analytics	▪ 1,024 terabytes of physical addressable memory ▪ Support for > 500 processor systems and clusters of > 10,000 processors ▪ High-precision floating-point architecture	▪ Able to handle vast amounts of data, complex calculations, and high-volume transactions
Low power	▪ Dual-core at 104 W ▪ Up to 20 percent lower power usage than previous Intel® Itanium® 2 processor[1]	▪ Cost effective ▪ Improvement over prior-generation platforms[3]

What Is the 9000 Sequence?

At Intel, our processor sequence numbers help differentiate processor features beyond front-side bus speed and brand name. New advancements in our processors, other than bus speed, such as architecture, cache, power dissipation, and embedded Intel® technologies, contribute significantly to performance, power efficiency, and other end-user benefits. Our processor sequence will help developers decide on the best processor for their platform designs, and help end-users understand all the characteristics that contribute to their overall experience.

Intel offers four processor number sequences for server applications.

Processor Sequence	Used For
Intel® Pentium® 4/Pentium® D processor	Small business, entry, or first server
Dual-Core Intel® Xeon® processor 5100[Δ] sequence	Volume DP servers/workstations based on the Intel Xeon processor
Dual-Core Intel® Xeon® processor 7000[Δ] sequence	Greater scalability than DP platforms, with MP enterprise servers based on the Intel Xeon processor MP
Dual-Core Intel® Itanium® 2 processor 9000[Δ] sequence	Maximum flexibility, reliability, performance, and cost-effective scalability for RISC and mainframe replacement

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Processor Number[Δ]	Speed	Cache Size	Front-Side Bus	Total Dissipated Power	Hyper-Threading Technology[†]	Intel® Cache Safe Technology	Intel® Virtualization Technology[‡]	64-bit Support
Dual-Core Intel® Itanium® 2 processor 9050	1.60	24 MB L3	400/533	104 W	yes	yes	yes	yes
Dual-Core Intel® Itanium® 2 processor 9040	1.60	18 MB L3	400/533	104 W	yes	yes	yes	yes
Dual-Core Intel® Itanium® 2 processor 9030	1.60	8 MB L3	400/533	104 W	no	yes	yes	yes
Dual-Core Intel® Itanium® 2 processor 9020	1.42	12 MB L3	400/533	104 W	yes	yes	yes	yes
Dual-Core Intel® Itanium® 2 processor 9015	1.40	12 MB L3	400	104 W	yes	yes	yes	yes
Intel® Itanium® 2 processor 9010	1.60	6 MB L3	400/533	75 W	no	yes	yes	yes

Find out more about Dual-Core Intel® Itanium® 2 processors at **www.intel.com/itanium**.

www.intel.com/itanium

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[1] Performance measured using OLTP (NT/SQL), SPECjbb2005, SPECCPU, Linpack, and SAP-SD. Intel Internal Measurement (March 2006) comparing system configurations of Dual-Core Intel® Itanium® 2 processor 1.6 GHz with 24 MB L3 cache to Intel Itanium 2 processor 1.6 GHz with 9 MB L3 cache. Actual performance may vary. See http://www.intel.com/performance/server/itanium2.

[2] Intel internal data collected as of June 2006.

[3] Intel internal measurements on Intel® Server Platform SR870BH2 and based on integer and floating-point workloads.

[4] Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See http://www.intel.com/products/processor_number for details.

[t] Hyper-Threading Technology requires a computer system with an Intel® processor supporting HT Technology and a HT Technology enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. See http://developer.intel.com/products/ht/Hyperthreading_more.htm for additional information.

[v] Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform software enabled for it. Functionality, performance or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

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.

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