Dual-Core Intel® Itanium® Processor 9100 Series

Powering mainframe-class solutions on flexible, industry-standard servers
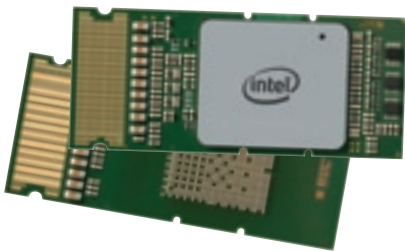
The Dual-Core Intel® Itanium® processor 9100[1] series is delivering new levels of flexibility, reliability, performance and cost-effective scalability for mission-critical and data-intensive applications. Servers based on these powerful processors rival mainframe and high-end RISC systems for scalability and availability, yet are based on an industry-standard architecture that provides unprecedented choice, flexibility and value.

Many of the world's most successful businesses are using Itanium®-based servers to:

- Host mission-critical, data-intensive applications.

- Virtualize and consolidate data center infrastructure.

- Establish a more scalable, adaptable and cost-effective foundation for core business applications.

Built for the Data Center

Deploy your most data-intensive, mission-critical applications with confidence

Mainframe-class systems based on the Dual-Core Intel® Itanium® processor are available from many of today's most respected server vendors. These large, scalable and highly available servers provide robust support for today's most demanding business applications, and for HPC applications that scale best on large, shared-memory systems.

Optimized for:	Recommended Processor[a]	Software Application Examples[b]
Database	Dual-Core Intel® Itanium® processor 9150[1]	Oracle Database* (for HP-UX* and Linux*), Microsoft SQL Server,* IBM DB2,* MySQL Database Server*
Business Intelligence	Dual-Core Intel® Itanium processor 9150	SAS,* Microsoft Analysis Services,* Hyperion SQR,* Informatica PowerConnect*
ERP, CRM	Dual-Core Intel® Itanium processor 9150	SAP R/3 Enterprise,* mySAP CRM*
High-performance Computing (HPC)	Dual-Core Intel® Itanium® processor 9130M[1] (or 9110N[1])	Custom applications, Ansys,* MSC Software,* Fluent*

[a] For the very highest levels of processing and data integrity, selected Dual-Core Intel Itanium processor 9100 series products support Core-Level Lockstep.

[b] Many more applications are available in each category. For a complete listing, see the Itanium Solutions Catalog. whww.itaniumsolutionsalliance.org/programs/solutions_catalog.

Breakthrough Flexibility for Growing Your Business

The hardware and software support you need is here today

Dual-Core Intel Itanium processor-based systems:

- **Are available from dozens of leading server vendors,** in configurations ranging from 2-way servers and blades, to highly scalable systems with up to 512 processors and 128 terabytes of globally shared memory.

- **Support more than 10 operating systems,** including Microsoft Windows Server*; Linux* from Novell, Red Hat, Red Flag and other distributors; HP NonStop*; OpenVMS*; HP-UX*; Bull GCOS 8*; NEC ACOS-4*; IBM z/OS*; Solaris*/SPARC*; and more.

- **Support more than 12,000 applications** from over 2,000 software vendors, including Microsoft, BEA, IBM, Ansys, Gaussian, Symantec/Veritas, Oracle, SAP, SAS and many others.

This broad choice of vendors, hardware and software is freeing businesses from the restrictions of proprietary RISC and mainframe architectures, so they have better control over their costs, risks and solutions. It is also providing a broad community of support, and a better foundation for rapid, ongoing innovation.
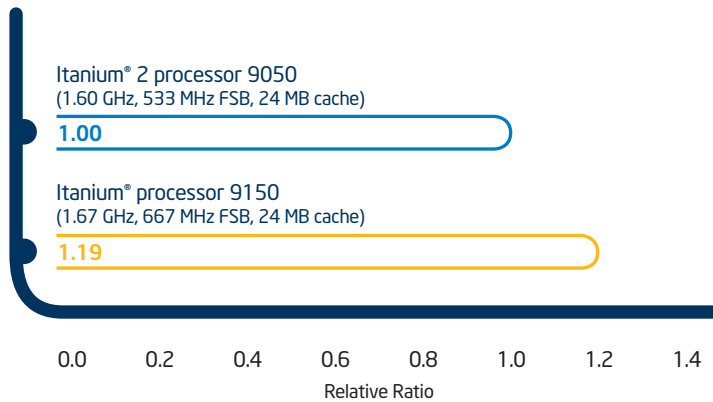
Proven Performance and Value for Demanding Business and Technical Workloads

The latest Dual-Core Intel Itanium processor boosts performance yet again for Itanium-based servers, which deliver excellent performance and value for today's data-intensive business and technical applications, and scales to support massive workloads.
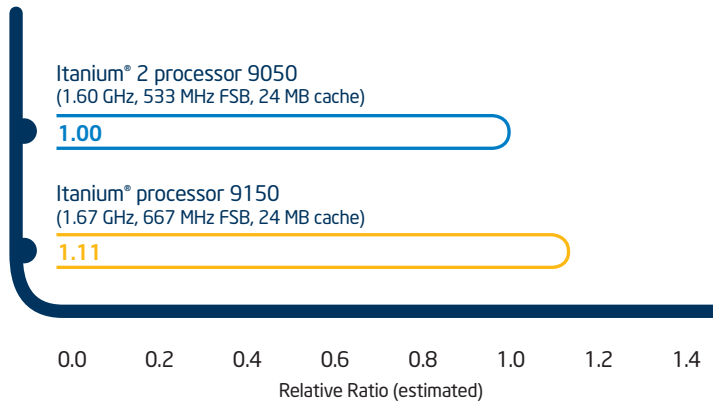
19% Performance Gain for STAR-CD*

Performance (higher is better)

Itanium® 2 processor 9050
(1.60 GHz, 533 MHz FSB, 24 MB cache)
1.00

Itanium® processor 9150
(1.67 GHz, 667 MHz FSB, 24 MB cache)
1.19

0.0   0.2   0.4   0.6   0.8   1.0   1.2   1.4
Relative Ratio

11% Performance Gain for SPECfp*_rate_base2006

Performance (higher is better)

Itanium® 2 processor 9050
(1.60 GHz, 533 MHz FSB, 24 MB cache)
1.00

Itanium® processor 9150
(1.67 GHz, 667 MHz FSB, 24 MB cache)
1.11

0.0   0.2   0.4   0.6   0.8   1.0   1.2   1.4
Relative Ratio (estimated)

Benchmark Configuration Details as of July 2007 – STAR-CD* v3.26 "A Class" workload:
- Dual-Core Itanium® 2 processor 9100 Series based Platforms: Intel® S6E5100 SDP Hitachi Cold Fusion*-3e, Chipset Hitachi ColdFusion3e, FSB at 533/667 MT/s, 4x Intel® Itanium® processor 9150 (Montvale 1.67 GHz, FSB at 667 MHz, 24M L3 cache, A1 Stepping), 16x1 GB DDR2-667 (ELPIDA* EBE10RD4AGFA-6E-E), O/S Red Hat Enterprise Linux* AS release 4 (Nahant Update 4), Linux kernel version 2.6.9-42.ELsmp on IA-64, SoEMT disabled.

- Dual-Core Itanium® 2 processor 9000 Series based Platforms: Intel® S6E5100 SDP Hitachi Cold Fusion*-3e, Chipset Hitachi ColdFusion3e, FSB at 533/667 MT/s, 4x Intel® Itanium® 2 processor 9040 (Montecito 1.6 GHz, FSB at 533 MHz, 18M L3 cache), 16x1 GB DDR2-667 (ELPIDA* EBE10RD4AGFA-6E-E), O/S Red Hat Enterprise Linux* AS release 4 (Nahant Update 4), Linux kernel version 2.6.9-42.ELsmp on IA-64, SoEMT disabled.

SPECfp*_rate_base2006 Configuration Details:
- Dual-Core Itanium® 2 processor 9100 Series based Platforms: Hitachi S6E4512* 4S/4U with 4x Intel® Itanium® processor 9150 (Montvale 1.67 GHz, FSB at 667 MHz, 24M L3 cache, A1 Stepping), Memory 16 GB (16x1 GB DDR2-667 running at 667 MHz), SOEMT Disabled, O/S RedHat Enterprise Linux* 4.0 Update-3 (2.6.9-36.EL Kernel).

- Dual-Core Itanium® 2 processor 9000 Series based Platforms: Hitachi S6E4512* with Dual-Core Intel® Itanium²2 processor 9000 series (Montecito) 1.6 GHz, Caches on per core base: 12 MB Unified L3, 1 MB L2I, 256 KB L2D, 16 KB L1I and 16 KB L1D. C1 stepping. 533 MHz bus, Memory 16 GB (16x1 GB DDR2-667 running at 533 MHz, SOEMT Disabled, O/S RedHat Enterprise Linux* 4.0 Update-3 (2.6.9-36.EL Kernel).

A Better Foundation for Enterprise Applications

The capabilities you need for your applications, your data center and your business

Scalable performance for your most complex, data-intensive workloads

With two high-performance cores per processor, memory address-ability up to 1,024 terabytes, exceptionally large on-die cache (24 MB), and a fast new 667 MHz front-side bus, today's Dual-Core Intel Itanium processors deliver enormous compute power for data-intensive applications.

They also provide excellent per-core performance through multi-threading (two threads per core) and Explicitly Parallel Instruction Computing (EPIC). EPIC was designed specifically to enable mas-sively parallel throughput, with up to six instructions per clock cycle, enormous execution resources (128 general-purpose registers, 128 floating point registers and 8 branch registers) and a variety of advanced capabilities for optimizing parallel throughput.

High availability for your mission-critical applications

Itanium-based servers deliver mainframe-class reliability, availability and serviceability (RAS) without the mainframe price tag. They provide advanced error detection, correction and containment across all major data pathways and the cache subsystem, and they support integrated, standards-based error handling across the hardware, firmware and operating system. Multiple vendors with extensive mainframe experience have built on this foundation to deliver fault-tolerant systems designed for uninterrupted opera-tion. With new Core-Level Lockstep, one core can even be used to mirror the operations of another, to enable even higher levels of pro-cessing and data integrity for the most demanding environments[2].

Flexible virtualization and consolidation to simplify your data center and drive down costs

Dual-Core Intel Itanium processors include built-in, silicon-level support for virtualization via Intel® Virtualization Technology[3] (Intel® VT), and multiple hardware and software vendors are deliver-ing advanced platform-level virtualization solutions. From physical and logical partitioning, to OS virtualization and advanced workload management tools, Itanium-based servers offer a wide range of options. Combined with their scalability, availability and multi-OS support, this makes them ideal for consolidating mission-critical applications and streamlining data center operations.

Advanced security capabilities to protect your business

Intel® Itanium® microarchitecture was designed with security as a core requirement. It includes a number of features that can be used to provide transformative levels of system and application security, including:

- **Hardware authentication of firmware,** to ensure the integrity and security of the system when first booted.

- **Unique memory compartmentalization,** which can be used to prevent the insertion of foreign code into a running system.

- **Fast data encryption,** to enable strong security at all levels, without excessive overhead that can drive down performance.

Lower total costs to free up resources for innovation

Total costs tend to be considerably lower for Itanium®-based solu-tions than for comparable RISC and mainframe solutions, and those cost benefits typically extend across the entire solution, including hardware, software and services. Itanium-based solutions also help to reduce vendor lock-in, so you retain more control and can man-age your costs more effectively. These cost benefits are increased by the outstanding energy efficiency of Dual-Core Intel Itanium processors. They use only 104 W at peak utilization, and new Demand Based Switching works with enabled operating systems to reduce energy consumption even more as workloads vary.

A Roadmap to Increasing Value

Three more Intel Itanium processor generations are on the way

Intel is investing strongly in Itanium-based solutions, and future Intel Itanium processor generations will deliver ongoing advances in performance, reliability, flexibility and value.

- **Quad-Core Intel Itanium processor** (code-name Tukwila). This processor will be equipped with more than two billion transistors and can be expected to deliver more than double the performance of today's Intel Itanium processors (based on system performance benchmark projections). It will also include the Intel® QuickPath Architecture, a new system architecture that will help increase the performance of future generations of multi-core Intel Itanium (and Intel® Xeon®) processors. Tukwila processor shipments will ramp in 2009, and systems for IT evaluation and software certifications (seed units) will be available in the first part of the year.

- **Many-core Intel Itanium processor** (code-name Poulson). This processor will take performance and flexibility to new heights, with an ultra-parallel architecture built on Intel's 32 nanometer process technology. (This new technology will support roughly 4 times the transistor density of Tukwila.)

- **And Beyond.** This future Intel Itanium processor (code-name Kittson) is in definition today and will deliver another major leap in performance and value.

Intel also works continuously with the broader community, including the Itanium Solutions Alliance, whose founding members have committed to a $10 billion investment in Itanium-based solutions through 2010. Those investments will continue to fuel ongoing advances that will help to position your business for faster, more cost-effective growth.

Dual-Core Intel® Itanium® Processor 9100 Series[a]

Processor Number[1]	Speed/L3 Cache Size	Front-Side Bus Speed	Total Dissipated Power	Hyper-Threading Technology[4]	Demand Based Switching	Intel® Cache Safe Technology	Intel® Virtualization Technology
Dual-Core Intel® Itanium® processor 9150M	1.66 GHz/ 24 MB	667 MHz	104 W	yes	yes	yes	yes
Dual-Core Intel® Itanium® processor 9150N	1.60 GHz/ 24 MB	400/533 MHz	104 W	yes	yes	yes	yes
Dual-Core Intel® Itanium® processor 9140M	1.66 GHz/ 18 MB	667 MHz	104 W	yes	yes	yes	yes
Dual-Core Intel® Itanium® processor 9140N	1.60 GHz/ 18 MB	400/533 MHz	104 W	yes	yes	yes	yes
Dual-Core Intel® Itanium® processor 9120N	1.42 GHz/ 12 MB	400/533 MHz	104 W	yes	no	yes	yes
Dual-Core Intel® Itanium® Processor 9130M	1.66 GHz/ 8 MB	667 MHz	104 W	no	no	yes	yes
Intel® Itanium® Processor 9110N (single core)	1.60 GHz/ 12 MB	400/533 MHz	75 W	no	no	yes	yes

[a] Core-Level Lockstep is supported in selected Dual-Core Intel Itanium processor 9100 series products (at 400/533 front-side bus speeds).

Quick Guide to Features and Benefits

Business Advantages	Features/Function	Benefits
Mainframe-class reliability for uninterrupted business operations	**Enhanced Machine Check Architecture:** Defines standards-based interfaces for integrated error handling across hardware, firmware and OS	Provides outstanding availability for maximum uptime, and enables system and software vendors to collaborate effectively on next-generation solutions
	Socket-Level Lockstep: Enables a processor in one socket to mirror the operations of another	Can be used to provide even higher processing and data integrity for the most mission-critical applications
	Core-Level Lockstep: Enables one processor core to mirror the operations of the other	
	Intel® Cache Safe Technology: Automatically disables affected cache lines in the event of a cache error	Allows processor and server to safeguard against errors that could bring down other platforms
	Advanced error detection/correction/containment across all major data pathways (includes ECC memory with mirroring and memory device failure correction capabilities)	Servers can detect, log, correct and otherwise respond to errors to increase uptime
	Advanced system-level features, such as hot-plug power supplies and disks, built-in hardware redundancy, and enhanced manageability	Servers are highly reliable, manageable and easily serviced to provide maximum uptime for business-critical applications
Scalable, flexible systems for virtualizing and consolidating your data center	**Wide range of configurations:** From 2-processor servers and blades, to systems with up to 512 processors	Scales to support the most demanding applications and workloads
	Powerful clustering: Up to 10,000+ processors per cluster	Massive scalability for HPC applications
	Silicon-level virtualization support: Intel® Virtualization Technology	Better workload isolation and less overhead when consolidating applications in virtualized environments
High-end computing power for fast handling of complex transactions, massive amounts of data and large user populations	**Dual-Core processor**	Doubles the execution resources per processor
	Large addressable memory: Up to 1,024 terabytes	Able to hold vast datasets in main memory for faster processing
	Low-latency 24 MB on-die L3 cache: (14 cycles) providing 102 GB/s aggregate bandwidth to the cores[2]	Fast access to data and improved throughput for memory-intensive applications
	2.5 MB L2 (5-7 cycles) and single-cycle latency L1	
	High-bandwidth 667 MHz System Bus	
	1.66 GHz frequency, with up to 6 instructions per clock cycle	Fast responses to complex calculations
	High-precision floating-point architecture	
Intel volume economics for lower costs and better value	**Less costly** than proprietary RISC and mainframe offerings	Better value, more choice and stronger investment protection than competing solutions
	Strong Intel® Itanium® processor family roadmap	
	Broad hardware, software (OS and application) and vendor support	
Energy efficiency for reducing data center costs	**Dual-core at 104 W**	Improved data center density with lower power and cooling costs
	New Demand-Based Switching dynamically reduces energy consumption during typical CPU utilization (in conjunction with enabled OS)	

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