Dual-Core Intel® Itanium® Processor 9100 Series

Powering mainframe-class solutions on flexible, industry-standard servers

The Dual-Core Intel® Itanium® processor 9100 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.

<table>
<thead>
<tr>
<th>Optimized for:</th>
<th>Recommended Processor a</th>
<th>Software Application Examples b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>Dual-Core Intel® Itanium® processor 9150 1</td>
<td>Oracle Database* (for HP-UX* and Linux*), Microsoft SQL Server*, IBM DB2*, MySQL Database Server*</td>
</tr>
<tr>
<td>Business Intelligence</td>
<td>Dual-Core Intel® Itanium processor 9150</td>
<td>SAS*, Microsoft Analysis Services*, Hyperion SQR*, Informatica PowerConnect*</td>
</tr>
<tr>
<td>ERP, CRM</td>
<td>Dual-Core Intel® Itanium processor 9150</td>
<td>SAP R/3 Enterprise*, mySAP CRM*</td>
</tr>
<tr>
<td>High-performance Computing (HPC)</td>
<td>Dual-Core Intel® Itanium* processor 9130M1 (or 9110N1)</td>
<td>Custom applications, Ansys*, MSC Software*, Fluent*</td>
</tr>
</tbody>
</table>

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

2 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)

11% Performance Gain for SPECfp*_rate_base2006
Performance (higher is better)

Benchmark Configuration Details as of July 2007 – STAR-CD* v3.26 "A Class" workload:
- Dual-Core Itanium® 2 processor 9100 Series based Platforms: Intel® XE5100 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® XE5100 SDP Hitachi Cold Fusion®-3e, Chipset Hitachi ColdFusion3e, FSB at 533/667 MT/s, 4x Intel® Itanium® 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 9000 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 Red Hat 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® Itanium®2 processor 9000 series (Montecito 1.6 GHz, Caches per core base: 12 MB Unified L3, 1 MB L2, 256 KB L1d, 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 Red Hat Enterprise Linux* 4.0 Update-3 (2.6.9-36.EL Kernel).
Scalable performance for your most complex, data-intensive workloads

With two high-performance cores per processor, memory addressability 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 massively 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 operation. With new Core-Level Lockstep, one core can even be used to mirror the operations of another, to enable even higher levels of processing and data integrity for the most demanding environments.

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 (Intel® VT), and multiple hardware and software vendors are delivering 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 solutions 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 manage 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 Better Foundation for Enterprise Applications

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

### A Roadmap to Increasing Value

Three more Intel Itanium processor generations are on the way

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**Dual-Core Intel® Itanium® Processor 9100 Series**

<table>
<thead>
<tr>
<th>Processor Number1</th>
<th>Speed/L3 Cache Size</th>
<th>Front-Side Bus Speed</th>
<th>Total Dissipated Power</th>
<th>Hyper-Threading Technology4</th>
<th>Demand Based Switching</th>
<th>Intel® Cache Safe Technology</th>
<th>Intel® Virtualization Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual-Core Intel® Itanium® processor 9150M</td>
<td>1.66 GHz/24 MB</td>
<td>667 MHz</td>
<td>104 W</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Dual-Core Intel® Itanium® processor 9150N</td>
<td>1.60 GHz/24 MB</td>
<td>400/533 MHz</td>
<td>104 W</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Dual-Core Intel® Itanium® processor 9140M</td>
<td>1.66 GHz/18 MB</td>
<td>667 MHz</td>
<td>104 W</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Dual-Core Intel® Itanium® processor 9140N</td>
<td>1.60 GHz/18 MB</td>
<td>400/533 MHz</td>
<td>104 W</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Dual-Core Intel® Itanium® processor 9120N</td>
<td>1.42 GHz/12 MB</td>
<td>400/533 MHz</td>
<td>104 W</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Dual-Core Intel® Itanium® Processor 9130M</td>
<td>1.66 GHz/8 MB</td>
<td>667 MHz</td>
<td>104 W</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Intel® Itanium® Processor 9110N (single core)</td>
<td>1.60 GHz/12 MB</td>
<td>400/533 MHz</td>
<td>75 W</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

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*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

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<tr>
<th>Business Advantages</th>
<th>Features/Function</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainframe-class reliability for uninterrupted business operations</td>
<td><strong>Enhanced Machine Check Architecture:</strong> Defines standards-based interfaces for integrated error handling across hardware, firmware and OS</td>
<td>Provides outstanding availability for maximum uptime, and enables system and software vendors to collaborate effectively on next-generation solutions</td>
</tr>
<tr>
<td></td>
<td><strong>Socket-Level Lockstep:</strong> Enables a processor in one socket to mirror the operations of another</td>
<td>Can be used to provide even higher processing and data integrity for the most mission-critical applications</td>
</tr>
<tr>
<td></td>
<td><strong>Core-Level Lockstep:</strong> Enables one processor core to mirror the operations of the other</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Intel® Cache Safe Technology:</strong> Automatically disables affected cache lines in the event of a cache error</td>
<td>Allows processor and server to safeguard against errors that could bring down other platforms</td>
</tr>
<tr>
<td></td>
<td><strong>Advanced error detection/correction/containment:</strong> across all major data pathways (includes ECC memory with mirroring and memory device failure correction capabilities)</td>
<td>Servers can detect, log, correct and otherwise respond to errors to increase uptime</td>
</tr>
<tr>
<td></td>
<td><strong>Advanced system-level features,</strong> such as hot-plug power supplies and disks, built-in hardware redundancy, and enhanced manageability</td>
<td>Servers are highly reliable, manageable and easily serviced to provide maximum uptime for business-critical applications</td>
</tr>
<tr>
<td>Scalable, flexible systems for virtualizing and consolidating your data center</td>
<td><strong>Wide range of configurations:</strong> From 2-processor servers and blades, to systems with up to 512 processors</td>
<td>Scales to support the most demanding applications and workloads</td>
</tr>
<tr>
<td></td>
<td><strong>Powerful clustering:</strong> Up to 10,000+ processors per cluster</td>
<td>Massive scalability for HPC applications</td>
</tr>
<tr>
<td></td>
<td><strong>Silicon-level virtualization support:</strong> Intel® Virtualization Technology</td>
<td>Better workload isolation and less overhead when consolidating applications in virtualized environments</td>
</tr>
<tr>
<td>High-end computing power for fast handling of complex transactions, massive amounts of data and large user populations</td>
<td><strong>Dual-Core processor</strong></td>
<td>Doubles the execution resources per processor</td>
</tr>
<tr>
<td></td>
<td><strong>Large addressable memory:</strong> Up to 1,024 terabytes</td>
<td>Able to hold vast datasets in main memory for faster processing</td>
</tr>
<tr>
<td></td>
<td><strong>Low-latency 24 MB on-die L3 cache:</strong> (14 cycles) providing 102 GB/s aggregate bandwidth to the cores(^2)</td>
<td>Fast access to data and improved throughput for memory-intensive applications</td>
</tr>
<tr>
<td></td>
<td><strong>2.5 MB L2 (5-7 cycles) and single-cycle latency L1</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>High-bandwidth 667 MHz System Bus</strong></td>
<td>Fast responses to complex calculations</td>
</tr>
<tr>
<td></td>
<td><strong>1.66 GHz frequency, with up to 6 instructions per clock cycle</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>High-precision floating-point architecture</strong></td>
<td></td>
</tr>
<tr>
<td>Intel volume economics for lower costs and better value</td>
<td><strong>Less costly than proprietary RISC and mainframe offerings</strong></td>
<td>Better value, more choice and stronger investment protection than competing solutions</td>
</tr>
<tr>
<td></td>
<td><strong>Strong Intel® Itanium® processor family roadmap</strong></td>
<td></td>
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<tr>
<td></td>
<td><strong>Broad hardware, software (OS and application) and vendor support</strong></td>
<td></td>
</tr>
<tr>
<td>Energy efficiency for reducing data center costs</td>
<td><strong>Dual-core at 104 W</strong></td>
<td>Improved data center density with lower power and cooling costs</td>
</tr>
<tr>
<td></td>
<td><strong>New Demand-Based Switching</strong> dynamically reduces energy consumption during typical CPU utilization (in conjunction with enabled OS)</td>
<td></td>
</tr>
</tbody>
</table>
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1 Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families.
2 Check with your vendor for information regarding support for Lockstep technologies.
3 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.
4 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.

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