



The Solaris™ OS and the Intel® Xeon® Processor 5500 Series

Maximizing performance while minimizing energy costs



The decision to invest in an IT development and deployment platform is complex, and requires assessing current needs as well as accurately predicting future technology and business trends. IT professionals want to ensure that their development and deployment platforms take full advantage of all that can be offered, including end-to-end performance, runtime flexibility, rock-solid reliability, and minimized energy use. Innovative server designs can deliver on these requirements, but maximizing value and utility demands unprecedented collaboration between processor architecture and operating environment designers.

Highlights

Sun and Intel's strategic alliance includes joint engineering focused on optimizing and enabling the Solaris Operating System for the Intel Xeon processor-based systems to provide:

- Intelligent, scalable performance
- Automated power management
- Enterprise-proven reliability
- Advanced virtualization and consolidation capabilities

Sun and Intel, as part of a strategic alliance, have been working together—from design and architecture through implementation—to ensure that the Solaris™ OS is optimized to unleash the power and capabilities of current and future Intel Xeon processors at the time of launch. Since 2007, engineering teams from the two companies have delivered a range of enhancements for Solaris on Xeon processors. They collaborated on optimizing how the Solaris platform and the Intel® Microarchitecture (formerly code-named Nehalem) work together on the Intel® Xeon® processor 5500 series, with compelling results:

- **Improved performance.** The Solaris OS takes advantage of the Intel Xeon processor 5500 series, including Intel® Hyper-Threading Technology, Intel® Turbo Boost Technology and the new Intel® QuickPath Technology resulting in significant performance improvements.
- **Automated power efficiency and utilization.** The Solaris OS has been optimized to take advantage of Intel's power management functions, improving energy efficiency and performance-per-watt through Integrated Power Gates and Automated Power States.
- **Increased reliability, availability, and serviceability (RAS).** The Solaris Fault Management Architecture (FMA) infrastructure

is enhanced to take advantage of the Intel Xeon processor 5500 series RAS features to provide an even stronger enterprise compute solution.

- **Virtualization enhancements.** The Solaris OS delivers cost-effective virtualization by taking advantage of Intel® Virtualization Technology features.

The Solaris platform

The Solaris ecosystem consists of the Solaris and open source OpenSolaris OS releases, as well as the Sun Studio development tools. The free and open Solaris OS is a proven, industry leading operating system with features designed to save time and money in business-critical operations. The Solaris OS provides stability, virtualization, massive scalability, high performance, and guaranteed forward binary compatibility. Intel has embraced Solaris as a mainstream OS and the enterprise class, mission critical UNIX® OS for Intel Xeon processor-based servers.

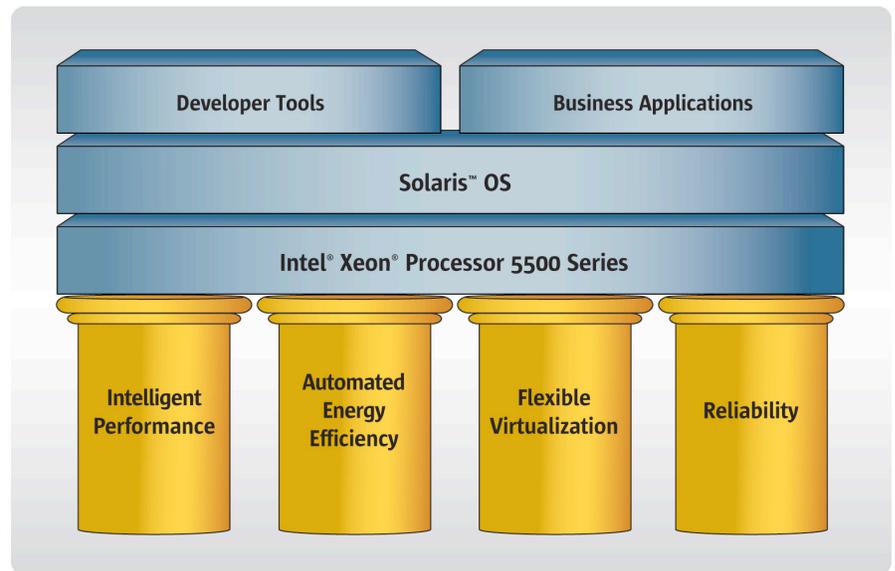
The OpenSolaris community is where the next generation of Solaris is being built, and where the latest innovations from Sun and Intel—the largest contributors—can be found. The OpenSolaris OS release offers cutting-edge features contributed by a global

development community, with built-in features that help businesses and organizations build, debug, and deploy new applications faster, presented in an environment familiar to open-source developers. OpenSolaris is built on the strong foundations of the Solaris enterprise-class operating system, and continues to deliver on a six-month release cycle with powerful new features. Future releases of the Solaris OS will be based on OpenSolaris OS releases. Solaris OS releases feature an extended support life cycle as needed in today's demanding data centers.

The Solaris ecosystem, in conjunction with the Intel Xeon processor 5500 series and other Intel Xeon processors, is a superior choice for both leading edge applications such as Web 2.0 and high performance computing, and all forms of enterprise computing. Organizations can leverage Solaris as the mission-critical enterprise class operating system for Intel Xeon processor 5500 series systems from Sun as well as other manufacturers—the Solaris OS is supported on over 1,100 hardware platforms, and OpenSolaris on over 4,000 hardware platforms.

Today, more than 7,832 applications for the Intel Xeon processor architecture are available to run on the Solaris 10 OS, providing unmatched performance, security, and scalability as well as a number of features not available in any other OS, including:

- Dynamic Tracing (DTrace), a comprehensive, dynamic tracing framework that enables developers and administrators to performance-tune applications and troubleshoot production systems in real time
- Predictive Self Healing, which automatically diagnoses, isolates, and recovers from hardware and application faults
- Solaris ZFS, a ground-breaking file system that automates common administrative tasks, protects data from corruption, includes features specifically designed to improve application performance using Solid



The Solaris OS unlocks the enterprise capabilities of the Intel Xeon Processor 5500 Series.

State Disks, and provides virtually unlimited scalability

- Solaris Containers, which increase utilization rates and cut system and licensing costs by safely consolidating multiple applications onto a single system

The Solaris OS unlocks many of the enterprise capabilities of the Intel Xeon processor 5500 series, and is widely recognized as the OS of choice for high-end systems, which may have dozens of processors as well as dozens of gigabytes of memory. The highly optimized symmetric multiprocessing capabilities of the Solaris OS deliver significant advantages on Intel Xeon processor-based systems from Sun as well as from IBM, Dell, HP, Fujitsu Siemens, and other manufacturers.

The Intel Xeon Processor

The breakthrough performance, energy efficiency, and reliability of Intel Xeon processor-based server systems make them the ideal choice for demanding enterprise infrastructure applications. Uniquely well-suited for virtualization and consolidation projects as well as high-density deployments in power-constrained data centers, Xeon processor-based

systems enable businesses to develop and deploy high-performing Solaris applications on the world's most popular server platform. The Solaris OS dynamically manages cores, threads, cache, interfaces, and power to deliver outstanding energy efficiency, performance, and scalability on demand.

The foundation for the Intel Xeon processor 5500 series is the new Intel Microarchitecture (formerly codenamed Nehalem), which is designed to deliver intelligent performance, automated energy efficiency and flexible virtualization capabilities. The Intel Xeon processor 5500 series is a multi-core processor for two-socket servers that can boost performance by up to 2.25x¹ for enterprise computing compared to the previous generation quad-core Xeon processor 5400 series based servers.

Servers based on the Intel Xeon processor 5500 series enable businesses to be more productive and reduce data center space, power, and administration/operation costs through data center consolidation. Solaris on Intel Xeon processors offers IT managers true investment protection—that is, the

opportunity to take advantage of the cost, performance, and power advantages that Solaris has to offer without having to abandon their existing hardware and operating system assets.

Improved performance

There are significant areas where Solaris provides an environment for maximum application performance by taking advantage of the Intel Xeon processor 5500 series features.

- Intel® Turbo Boost Technology converts any available power headroom into higher frequencies. In those situations where the application requires maximum processing power, the Intel Xeon processor 5500 series increases the frequency in the active core when conditions such as load, power consumption and temperature permit it. By utilizing thermal and power headroom as a performance boost, the Solaris OS and the Intel Xeon processor 5500 series can deliver more work for less overall heat and power consumption.
- With the Intel Xeon processor 5500 series, Intel® Hyper-Threading Technology provides two threads per core, which enables increased performance for multi-threaded workloads. Solaris has an outstanding threading model for the commercial operating system market, outperforming the competition on customer applications as well as industry-standard benchmarks. With specific optimizations for the Intel Xeon processor 5500 series, the Solaris OS enables new levels of performance as applications incorporate multi-threaded design, increasing throughput, responsiveness, efficiency, scalability, and overall performance.
- The Solaris OS leverages the capabilities of the new Intel® QuickPath Interconnect (QPI) architecture with capabilities such as an optimized scheduler and memory placement optimization (MPO) capability that has proven performance benefits with non-uniform memory access (NUMA) archi-



For Solaris administrators, internal/third-party enterprise developers

What you get:

- Access to thousands of 3rd party software applications
- A 10 year+ support life cycle to create rock-solid, long-term deployments
- The latest updates to supplement existing Solaris deployments
- Unmatched enterprise support offerings



For students, Web 2.0 developers, open source OS developers

What you get:

- The latest Web 2.0 free/open source applications
- Frequent releases; the latest Solaris features under development
- LiveCD, the easy way to evaluate Solaris technologies risk free
- Comprehensive repository of packages

The Solaris ecosystem consists of the Solaris OS release plus the open source OpenSolaris OS release.

itecture systems. The Intel QPI architecture delivers best-in-class performance, and unleashes the performance of next generation microarchitecture-based processors and future generations of Intel® multi-core processors.

Efficient power management

Reducing power utilization is a high priority for data centers today. The Sun and Intel engineering teams are working to ensure that the Solaris OS running on Xeon processor-based systems delivers the very best energy efficiency possible.

The Solaris OS and the Intel Xeon processor 5500 series work together to provide greater power efficiency without adversely affecting performance. For the Intel Xeon processor 5500 series, enhanced power management in the Solaris OS can adjust processor power requirements in response to utilization — without any configuration or tuning — enabling the system to go into the deepest power saving state possible when a core is idle. Intel® Intelligent Power Technology

automatically enables an idle core to go to near zero power. Power consumption is adjusted independently on each core, based on real-time load.

As a means of monitoring the power utilization, Sun and Intel have developed an application called PowerTOP, which points to areas that consume high power within an application. PowerTOP is an important tool to help identify what within applications may be waking the system unnecessarily, preventing the system from going into a power-saving sleep mode. As a result a server based on the Xeon processor can go into the deepest power-saving state possible when Solaris and the applications allow.

Increased reliability

For mission-critical enterprise computing, the Solaris OS is designed to ensure that business-critical applications and essential system services can continue uninterrupted in the event of system failures.

To further increase Solaris' computing capabilities, Intel and Sun added enhancements to the Solaris Fault Management Architecture (FMA) software to provide increased reliability, availability and serviceability. These improvements increase the ability of Solaris Predictive Self Healing technology to automatically diagnose software and hardware faults and maximize availability. Predictive Self Healing makes it possible for systems and services to stay up in the event of software and hardware faults, and provides a simplified administration model and automated error diagnoses.

Solaris Fault Manager receives data related to hardware and software errors and automatically diagnoses the underlying problem. Once diagnosed, Solaris Fault Manager automatically responds by taking the appropriate action, such as off-lining faulty components or restarting applications. Sun and Intel have worked together to extend these capabilities to systems based on the new Intel Xeon processor 5500 series, including chipsets and memory subsystems.

Virtualization enhancements

Both the Solaris OS and the Intel Xeon processor are industry pioneers in the area of virtualization technology, enabling unprecedented efficiencies throughout the IT infrastructure.

As strong proponents of open source software, Sun and Intel collaborate with the Xen community to enable the Xen hypervisor to take advantage of the latest Intel Virtualiza-

tion Technology capabilities. The Sun xVM™ portfolio will offer comprehensive support for new Intel Xeon processor 5500 series virtualization capabilities.

The Intel Xeon processor 5500 series includes next generation Intel® Virtualization Technology that delivers even more efficient virtual machine operation with optimizations that enable a higher level of performance and reliability. These new features will enable improved software performance, security, and reliability in virtualized environments. The Intel Xeon processor 5500 series delivers faster virtualization performance by reducing transition latency into and out of virtual machine mode, as well as reducing the overall number of such required transitions. In addition, the Intel Xeon processor 5500 series offers improved I/O virtualization as part of the core logic chipset, and improved I/O performance through direct assignment of a device to a virtual machine. Fast, reliable, comprehensive, hardware-assisted virtualization capabilities contribute to better power efficiency, improved reliability, and increased asset utilization.

The Sun/Intel Alliance

Together, Sun and Intel are ensuring that the Solaris OS on Intel Xeon processor-based systems provide businesses with powerful innovations for increased performance, higher energy efficiency, better virtualization and reliability—all to provide maximum datacenter efficiency to enable improved business efficiency and reduced costs

Learn More

To learn more about Sun and Intel's strategic alliance, visit sun.com/x64/intel. For information on how Solaris can benefit your company, go to sun.com/solaris. Additional information about Intel's Xeon processor technology is available at intel.com/products/server/processors.

To learn more about Solaris on Intel benchmarks, see www.sun.com/x64/benchmarks

About Sun

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About Intel

Intel, the world leader in silicon innovation, develops technologies, products and initiatives to continually advance how people work and live. Additional information about Intel is available at intel.com.

1 Source: Intel estimates as of November 2008. Performance comparison using SPECjbb2005 bops (business operations per second). Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. Also see: sun.com/x64/benchmarks

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Sun Microsystems, Inc. 4150 Network Circle, Santa Clara, CA 95054 USA Phone 1-650-960-1300 or 1-800-555-9SUN Web sun.com

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