An Oracle White Paper
December 2010

Oracle's Sun Netra X4250 and X4270 Server Architecture

ORACLE

Executive Overview

Challenged by the explosive demand for rich multimedia services, telecommunications companies must effectively manage rapid datacenter growth within tight operational budgets. To meet these companies' need for compute performance, scalability, and mission-critical availability even in harsh conditions, Oracle® offers two rackmounted carrier-grade Sun systems based on Intel Xeon processors — the Sun Netra X4250 and X4270 servers. These systems feature high performance and unprecedented density in a rugged, energy-efficient 2U form factor.

Introduction

Emerging telecommunications applications and expanding multimedia services have fueled an escalating demand for scalable computing systems and continuous availability. As a result, datacenters that support telecommunications services have experienced rapid growth as the number of services, the population of users, and the quantity of transactions have multiplied.

Today in these environments, IT managers face a formidable task in administering a complex storage and computing infrastructure — one that typically houses many small servers that have been added over time to meet growing service volume, application, and availability demands. Since administrative, energy, and real estate costs continue to skyrocket, datacenter sprawl strains existing IT budgets, which are already flat or shrinking. To curb operational expenses, many companies are turning to consolidation and virtualization to improve resource utilization and enhance agility. In doing so, organizations seek to cut ongoing operational costs associated with administration, management, and infrastructure power and cooling.

The Sun Netra server family from Oracle — specifically the Sun Netra X4250 and X4270 servers — demonstrates a design focus on mission-critical computing and eco-responsibility. These powerful and expandable 2U carrier-grade systems use high-performance Intel Xeon processor technology and offer breakthrough compute, memory, storage, and I/O density. At

the same time, they feature tremendous energy efficiency and low power envelopes in platforms that meet certification for Telecordia NEBS (Network Equipment Building Standard) Level 3. Because these systems support multiple operating systems, including Oracle Solaris, Linux, and Windows implementations, they are ideal for virtualization and consolidation initiatives.

Sun Netra X4250 and X4270 servers showcase Intel's talent for creating high-performance commodity chipsets — namely, Intel® Xeon® Processor 5400 Series (codenamed Harpertown) and next-generation Intel Xeon Processor 5500 Series (codenamed Nehalem-EP) — along with Oracle's Sun systems engineering expertise.

Chapter 1
Managing Complexity

In today's competitive telecommunications marketplace, new services and rising volumes place ever-increasing demands on the IT infrastructure. Next-generation technologies for wireless, video, and messaging fuel application growth and complexity. Network Equipment Providers (NEPs) and Service Providers (SPs) place increasing demands on the IT infrastructure to support converged voice and data services, as transaction volumes continue to rise. As a result, telecommunications datacenters are expanding exponentially, with new compute servers added continuously to satisfy ongoing growth and resource demands.

Such rapid expansion has produced its own set of challenges. The cost of maintaining large numbers of servers can prove to be formidable, especially at a time when real estate costs are rising, energy costs are soaring, and department budgets are flat or declining. Managing the complexity that results from sprawling server resources puts tremendous strain on IT staff and budgets. To successfully meet business needs, IT management must control both cost and complexity while simultaneously scaling processing throughput and capacity.

Today the responsibility of managing rapid growth in the datacenter commonly fuels IT initiatives like consolidation and virtualization. Typically, these initiatives strive to improve resource utilization, reduce administrative complexity, and drive down IT costs. Consolidating many small servers into fewer powerful systems helps to minimize administrative workloads while increasing capacity and conserving datacenter space. Consolidation can also help to reduce energy costs and vastly improve performance relative to the amount of energy consumed. In addition, when IT organizations consolidate under-utilized resources, virtualization technologies can balance IT resource demands, applying key resources as needed to business-critical applications to enhance agility.

Introducing Sun Netra X4250 and X4270

To help telecommunications companies address the challenge of increasing capacity while managing datacenter growth, Oracle offers two high-performance yet compact carrier-grade Sun systems based on Intel Xeon processors — the Sun Netra X4250 and X4270 servers. These systems feature high performance and unprecedented density in a rugged, energy-efficient 2U form-factor.

With capabilities that complement the rest of the Sun Netra server product line, these servers raise the bar for 32- and 64-bit carrier-class computing. These systems offer:

- *Best-in-class performance.* With large on-die caches, high clock speeds, and low power envelopes, the embedded class processors in the Sun Netra X4250 and X4270 servers are designed for high performance as well as harsh operating conditions. The Sun Netra X4250 server houses one or two quad-core Intel Xeon Processor 5400 Series, offering impressive performance in a 2U chassis. To support even higher levels of performance and throughput, Intel Xeon processors in the Sun Netra X4270 server incorporate the next-generation Intel Core Microarchitecture (codenamed Nehalem). With HyperThreading technology, the CPUs in the Sun Netra X4270 server — the Intel Xeon Processor 5500 Series (formerly Nehalem-EP) — provide twice as many compute threads as

previous generation Intel Xeon processors. They also support enhanced power management features, the Intel QuickPath Interconnect, and Intel Turbo Boost technology to deliver new levels of performance while lowering power consumption.

- *Remarkable density*. Density is the cornerstone of the Sun Netra X4250 and X4270 server designs from Oracle. When populated in a 40-rack unit (RU) enclosure, the 2U Sun Netra X4270 server facilitates a single rack that contains up to 160 cores, 320 threads, 360 DIMM slots, and 120 PCI Express (PCIe) slots. Such density easily facilitates the consolidation of many smaller servers, helping to conserve real estate, lower energy expense, and reduce costly administrative talent. In addition, Sun Netra X4250 and X4270 servers support multiple operating systems, which can help to simplify consolidation efforts and diminish server sprawl.
- *Extensive system expandability*. The ability to expand a server over time reduces the need for additional capital acquisitions and lowers application lifecycle costs. The Sun Netra X4250 and X4270 servers feature two CPU sockets per system and up to four internal SAS disk drives, four on-board Gigabit Ethernet ports, and up to six PCI slots. Because of their capacity and expandability, these servers scale extremely well to support new user populations, more transactions, and new 32-bit or 64-bit applications, enhancing system longevity and increasing ROI.
- *Improved energy efficiency*. Oracle offers a broad portfolio of eco-responsible Sun products and computing solutions to address customer IT needs. In the Sun Netra X4250 and X4270 servers, 40- and 60-watt Intel Xeon processors (respectively) feature innovative technologies to minimize power use and enhance energy efficiency. The embedded class processors used in these systems offer power savings over Intel's commercial processor offerings, which often have power envelopes of 80 watts or more.

  The new Intel Core Microarchitecture helps to optimize processor performance relative to power consumed. Power management capabilities limit power to unused execution units in each core, which helps to lower power and cooling requirements. In the Sun Netra X4270 server, the Intel Xeon Processor 5500 Series incorporates new technology that decreases power consumption at times when processing workloads diminish. When the workload is low, the Intel Core Microarchitecture adjusts power use, reducing processor frequency, limiting power to unused execution units in each core or temporarily disabling Intel Turbo Boost technology, which helps to decrease power and cooling requirements.

  In addition, high-efficiency power supplies reduce overall power consumption. Variable speed fans, effective disk carrier designs, and front-to-back air flow help to cool the systems effectively and maintain appropriate processor and system ambient temperatures.
- *Carrier-class availability*. Sun Netra X4250 and X4270 servers are designed with carrier-grade reliability, availability, and serviceability (RAS) features that help to increase availability, reduce costs, and meet Service Level Agreement (SLA) targets, in spite of harsh operating environments. To maximize uptime, the systems include redundant hot-swappable AC or DC power supplies. Internal SAS disk drives can be configured for RAID 0 or 1 — when mirroring is implemented, drives are also hot-swappable. Four integrated Gigabit Ethernet ports enhance network availability and can be installed in failover configurations. On-board system management tools encourage remote, proactive

monitoring and intervention. Telecordia NEBS (Network Equipment Building Standard) Level 3 certification and ETSI (European Telecommunications Standards Institute) compliance demonstrate that these systems have been rigorously tested and can withstand severe operating conditions.

- *Simplified system management.* To support out-of-band management, Sun Netra X4250 and X4270 servers incorporate a service processor that enables robust lights-out management. This built-in functionality allows administrators to monitor and manage systems remotely, allowing them to take corrective action as necessary and to minimize unplanned downtime. The Sun Netra X4270 server adds "side-band" management capabilities that allow one of the four on-board Ethernet ports to be configured for system management, reducing the number of network switch connections needed.
- *Accelerated time-to-deployment.* Sun Netra X4250 and X4270 servers running the Oracle Solaris 10 operating system provide full binary compatibility with earlier x64 systems running Oracle Solaris, preserving investments and speeding time-to-deployment. Systems are shipped from the factory with Oracle Solaris 10 pre-installed.

Sun Netra X4250 and X4270 servers combine best-in-class performance with expandable compute, memory, and I/O resources. As a result, these systems are designed to scale up, scale out, and scale within, enabling deployment in a wide range of application architectures:

- *Scale-up architectures.* With 8 or 16 threads maximum per system, these servers are well-suited to scale for growing workloads and the delivery of key telecommunications and infrastructure services.
- *Scale-out architectures.* With large memory capacities, internal storage, four Gigabit Ethernet ports, and high-bandwidth PCI expansion for high-speed, state-of-the-art system interconnects (such as 10 Gigabit Ethernet, Fibre Channel, or InfiniBand), these servers can scale to meet demands for compute power and bandwidth.
- *Scale-within.* With the ability to support virtualization technologies such as Oracle Solaris Containers, Sun Netra X4250 and X4270 servers are ideal for consolidating applications within a single extensible platform.

Common Applications

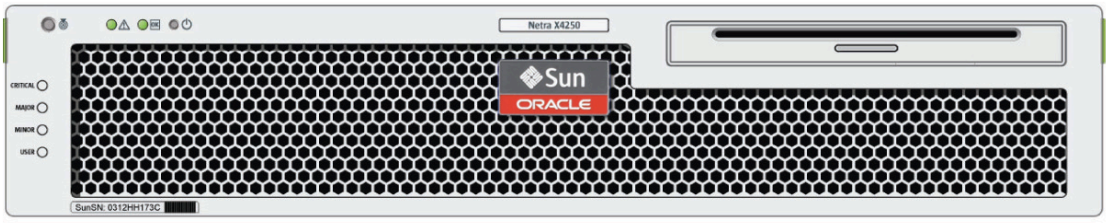
Sun Netra X4250 and X4270 servers deliver scalability, energy efficiency, and reliability for a variety of demanding telecommunications applications, including:

- Media gateway controllers
- Operations and maintenance systems for telecommunications networks
- Signaling gateways
- Intelligent networks
- MMS (multimedia messaging services)/SMS (short messaging services), unified messaging
- Defense/military/intelligence applications including shipboard command and control, mobile weapons control, and remote intelligence access servers

- Embedded Original Equipment Manufacturer (OEM) applications, such as industrial process control, semiconductor test equipment, and network imaging systems
- Application servers
- Web servers
- Content caching, network proxy servers
- Home/visitor location registries (HLR/VLR)
- Base station controllers (BSC)
- Content distribution networks
- DNS services
- Firewalls for virtual private network/IP security (VPN/IPSEC)
- IP traffic management systems
- Security systems
- Streaming media systems

Innovative System Design

Figure 1 shows the Sun Netra X4250 and X4270 system enclosures.



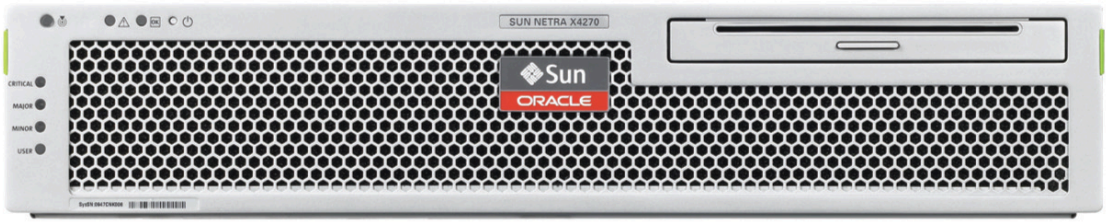


Figure 1. Sun Netra X4250 and X4270 servers offer compute density in a ruggedized 2U form-factor.

Telecommunications providers have unique and pressing needs that require special attention on the part of system designers. Density, performance, and scalability are essential considerations, but systems must also be reliable and operate within strategies that consider power, cooling, reliability, and serviceability. Sun Netra X4250 and X4270 servers share an innovative design philosophy that extends across the families of Sun and Sun Netra rack-mount servers. Design principles related to this philosophy include:

- *Optimal compute density*. Sun servers provide leading density in terms of CPU threads, memory, storage, and I/O. This focus on density often allows a Sun 2-rack unit (2U) rackmount server to replace competitive 4U rackmount servers, resulting in a 50-percent space savings. The leading-edge density of Sun systems simplifies server consolidation, especially since Oracle Solaris 10 provides native virtualization capabilities.
- *Leading I/O and storage capacity*. Sun Netra servers provide leading PCI and storage density, as well as flexible RAID options. Smaller disk drives and innovations in chassis, airway, and disk and card carrier design allow more capacity in smaller spaces, at the same time promoting system airflow.
- *Common, shared management*. Sun Netra X4250 and X4270 servers are designed for ease of management and serviceability, using a built-in service processor and the same firmware-based tools as other Sun server platforms. Sun Netra systems and components are designed for easy identification, and in many cases, key components are redundant and/or hot swappable, facilitating on-line replacement.
- *Continued investment protection*. Binary compatibility means that applications that run on Oracle Solaris OS x64 can run on Sun Netra X4250 or x4270 servers and Oracle Solaris without modification. The binary compatibility promise of Oracle Solaris helps to protect investments in applications and training.
- *Common chassis design*. A shared chassis design leverages key system innovations across multiple architectures. It also enables common components and subassemblies, and greatly simplifies administration for customers deploying multiple processor architectures. The following section highlights specific chassis innovations in Sun Netra X4250 and x4270 systems.

Chassis Design Innovations

Sun Netra X4250 and X4270 servers share common chassis design characteristics with many Sun x64 and SPARC server platforms. This approach not only provides a consistent look and feel across product lines but simplifies administration and serviceability through consistent placement and shared components.

- *Enhanced system and component serviceability*. Finding and identifying servers and components in a modern datacenter can be a challenge. Sun Netra X4250 and X4270 servers are optimized for lights-out datacenter configurations with easy to identify servers and modules. Color-coded operator panels provide easy-to-understand diagnostics, and systems are designed for deployment in hot-isle/cold-isle multi-racked deployments, with both front and rear diagnostic LEDs to pinpoint faulty components.

Consistent connector layouts for power, networking, and management make moving between Sun systems straightforward. Hot-plug components are tool-less and easily available for serviceability. For instance, a hinged front bezel panel provides easy access to disk drives so that drives can be inserted or replaced without exposure to sensitive components.

- *Robust chassis, component, and subassembly design.* Many Sun Netra servers share chassis designs that are carefully engineered to provide reliability and cool operation. Even features such as the honeycomb-shaped chassis ventilation holes help to provide the best compromise for strength, maximum airflow, and maximum electronic attenuation.

  In spite of extreme computational and I/O density, Sun servers are able to maintain adequate cooling using conventional technologies. Efficient modular fan assemblies keep the chassis within an effective operating temperature range. A fan assembly resides directly in front of disk drives, allowing airflow to be directed effectively both above and below the disk drives. Next-generation drive carriers enhance chassis ventilation, enabling greater storage density while increasing system airflow. An additional system fan assembly forces air from the front of the chassis to the back, directing air flow over the motherboard, CPUs, and memory to cool system components efficiently. Fan modules are isolated from the chassis to avoid transferring rotational vibration to other components.

  Minimized DC-to-DC power conversions also contribute to overall system efficiency. By providing 12 volt power to the motherboard, power conversion stages are eliminated. This approach generates less heat, and introduces further system efficiencies.

- *Minimized cabling for maximized airflow.* To minimize cabling and increase reliability, a variety of smaller boards and riser cards are used:

  - Power distribution boards (PDBs) distribute system power from the power supplies to the motherboard and the disk backplane (via a connector board).
  - Connector boards eliminate the need for many discrete cables, providing direct interconnects to distribute control and data signals to the disk backplane, fan boards, and the PDB.
  - PCI riser cards and mezzanine boards plug into the system motherboard, enabling robust PCI expansion capabilities. PCI mezzanine boards house components necessary to support PCIe buses and slot expansion.
  - A disk backplane mounts to a disk enclosure cage, delivering data through cables connected to the PCIe SAS Host Bus Adapter card.

- A telecommunications alarm card allows Dry Contact Alarm (DCA) conditions to be easily monitored and reported.

Chapter 3 gives more details on the chassis, system features, and internal components, highlighting similarities and differences in the Sun Netra X4250 and X4270 servers.

A Choice of Operating Systems

To optimize flexibility and investment protection, Sun Netra X4250 and X4270 servers support a choice of operating systems, including:

- Oracle Solaris, which is pre-installed
- Linux operating systems
- Microsoft Windows
- VMware ESX and ESXi

Chapter 4 describes the OS releases supported as of this writing. Please see www.oracle.com/us/products/servers-storage/servers/x64/index.htm for the latest information on supported operating systems and environments.

Chapter 2

The Intel Advantage

Intel Corporation collaborates closely with Oracle's Sun engineering teams to create comprehensive server families based on Intel Xeon processors and to optimize x64 system performance for Oracle Solaris. With Intel Xeon processor-based Sun Netra X4250 and X4270 servers, Oracle extends the Sun x64 system portfolio and complements SPARC processor-based Sun platforms. Moving forward, Oracle and Intel plan to continue participating in joint engineering efforts aimed at enhancing Oracle Solaris, Java™ technologies, and systems built using Intel Xeon processor designs.

In this new family of servers, expertise in Sun systems engineering combines with an emphasis on performance, quality, reliability, and eco-responsibility. Sun Netra X4250 and X4270 servers leverage an embedded class of low-power, quad-core Intel Xeon processors that feature key Intel technologies for virtualization, I/O acceleration, and energy efficiency. These 64-bit processors are compatible with a legacy of IA-32 software, instantly making available a large volume of existing 32-bit applications as well as emerging 64-bit applications.

Figure 2. Intel Xeon Processor 5500 Series chips are used in the Sun Netra X4270 server.

This chapter introduces the embedded class of Intel Xeon processors and chipsets used in the Sun Netra X4250 and X4270 servers. The Sun Netra X4250 server has two processor sockets that can be populated with embedded-class, quad-core Intel Xeon L5408 processors for a maximum of 8 cores and a low, 40-watt per processor power envelope. Featuring the next-generation Intel Xeon Processor 5500 Series, the Sun Netra X4270 server contains two sockets for the embedded-class Intel Xeon L5518 processors that feature the new Intel Core Microarchitecture (formerly Nehalem).

Table 1 summarizes processor characteristics for Intel Xeon processors used in Sun Netra X4250 and X4270 servers.

TABLE 1. PROCESSOR CHARACTERISTICS FOR INTEL XEON PROCESSORS IN SUN NETRA X4250 AND X4270 SERVERS

SYSTEM	PROCESSOR	SPEED	ON-DIE CACHE	SYSTEM INTERCONNECT	POWER ENVELOPE
Sun Netra X4250 server	Non-throttling, embedded class, quad-core Intel Xeon L5408	2.13GHz	12MB shared Level 2 cache	FSB, 1066MT/s	40W
Sun Netra X4270 server	Non-throttling, embedded class, quad-core Intel Xeon L5518, 2 threads/core	2.13GHz	256kB Level 2 cache per core, 8MB shared Level 3 cache	Quick-Path Interconnect, 5.86 GT/s	60W

Note that both systems use Intel Xeon embedded-class processors that are "non-throttling" — that is, through the range of NEBS temperature conditions, they maintain consistent performance levels even under severe conditions.

For an overview of Intel chipsets implemented in these servers, see Chapter 3. For detailed information on the Intel chipsets, see the Web site www.intel.com/products/processor/xeon5000.

Intel Xeon Processor 5400 Series

The Intel Xeon Processor 5400 Series uses a Multi-Chip Package (MCP) approach to provide four execution cores (Figure 3). This packaging approach increases die yields and lowers manufacturing costs, which helps Intel and Oracle to deliver higher performance at low price points. On each processor, two cores share a 6MB Level 2 cache (for a total of 12MB). With two sockets in the Sun Netra X4250 server, the design enables a maximum of 8 processor cores in a compact 2U form factor.

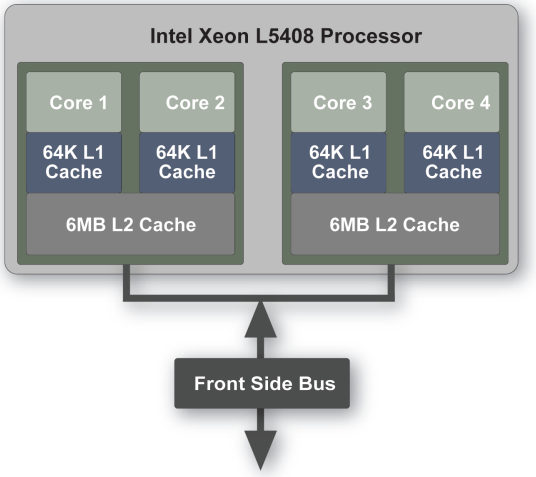


Figure 3. The Intel Series L5408 processor uses two dies and features four cores.

Compared to early generation Intel Xeon Processor 5000 Series, the Intel Xeon 5400 Processor Series features larger Level 2 (L2) caches over previous generation Intel Xeon Processor 5000 Series

processors. Like the next-generation Intel Xeon Processor 5500 Series, this series is manufactured using an advanced 45nm process that increases transistor density.

Microarchitecture of Intel Xeon Processor 5400 Series

The microarchitecture of the Intel Xeon Processor 5400 Series includes several features designed specifically to enhance performance while maintaining energy efficiency:

- Out-of-order execution conserves processor-to-memory bandwidth, improving memory access and increasing overall processing performance
- Speculative prefetches move data to the L2 cache before an L1 cache request occurs
- Large L2 caches increase system memory efficiency and enhance performance
- Power management capabilities modulate power delivery to execution cores, limiting power to unused components

The Intel Xeon L5408 processor provides performance for multiple application types and user environments in a substantially reduced power envelope. These 40-watt, quad-core processors maximize performance-per-watt, providing increased density for deployments where energy efficiency is a key goal.

Intel Xeon 5000 Sequence Chipset

The Sun Netra X4250 server incorporates the Intel Xeon Processor 5000 Sequence chipset, including:

- One or two quad-core Intel Xeon L5408 processors
- The Northbridge Intel 5000P Memory Controller Hub (MCH)
- The Southbridge Intel 6321ESB Input/Output Handler IOH (ESB-2). The ESB-2 is interconnected to the MCH using one ESI link and one 4-lane PCIe link.

For more information on the Intel Xeon Processor 5000 Sequence chipset, see www.intel.com/products/processor/xeon5000/.

Intel Xeon Processor 5500 Series

With each release of a new processor series, Intel tends to alternate between enhancing the manufacturing process (shrinking the processor die) and redesigning the core microarchitecture. Several years ago, Intel transitioned to a 45nm manufacturing process that enabled smaller transistors, allowing the Intel Xeon Processor 5400 Series to consume less power, achieve faster switching times, and provide greater on-die density than the generation before. In the Intel Xeon Processor 5500 Series, Intel introduced a totally new microarchitecture design (formerly codenamed Nehalem) — at the same time reaping the benefits from the company's previous expertise with 45nm silicon manufacturing.

New Intel Core Microarchitecture

The new Intel Xeon Processor 5500 Series is targeted at delivering optimal performance for bandwidth-intensive, threaded applications, with a microarchitecture that features significant innovations:

- *Intel QuickPath technology*. This new technology provides a high-speed, point-to-point interconnect between processors, memory, and I/O. The Intel QuickPath Interconnect (QPI) links processors in a distributed shared memory design that enables high bandwidth and low latency memory access. Because it is a point-to-point interconnect, processors do not contend for a single bus when accessing memory and I/O, and do not compete for bus bandwidth, which enhances scalability. Each QPI port includes two unidirectional links that support from 4.8 up to 6.4 GT/s per link, enabling up to 12.8 GB/s bandwidth in each direction for a total bandwidth of 25.6 GB/s — significantly higher than previous bus designs.
- *Multiple processor cores*. The microarchitecture design scales from 2 to 8 cores per die, with four cores in the Intel Xeon Processor 5500 Series.
- *Integrated DDR3 memory controller*. Implemented as a separate component in earlier architectures, the memory controller is now integrated on the processor die. The processor design creates a Non-Uniform Memory Access (NUMA)-style memory architecture since each processor in multi-socketed systems can access local memory (connected to the local memory controller) as well as remote memory connected to the second processor.

  In addition to independent channel mode operation in which each memory channel supports direct memory access, the integrated memory controller also supports the following two modes:

  - Memory channel mode increases reliability through memory mirroring. In this mode, two memory channels operate as mirrors of each other. The same content is written to both channels simultaneously, creating data redundancy. As a consequence of mirroring, the amount of usable system memory reduces to half of the total physical memory installed. To use memory channel mode, both channels must be populated with identical DIMM types.
  - Lockstep channel mode operates two memory channels in lockstep, increasing the reliability of each memory operation. In this mode, the cache line is split across two channels, both channels must be populated identically, and memory mirroring and sparing are not supported.

  Regardless of the mode in use, the integrated memory controller also increases data protection through support for demand and patrol scrubbing and single device data correction (SDDC).

  - Demand and patrol scrubbing technology proactively searches system memory, repairing correctable errors. In the case of uncorrectable errors, the algorithm permanently marks the memory location as unreadable.
  - x4 and x8 SDDC offers an advanced form of ECC technology that protects computer memory systems from any single memory chip failure. This technology can detect and correct 1-bit to 4-bit internal data and data pin failures within one DDR memory device, and detect up to 8-bit internal data and data pin failures within two DDR memory devices. SDDC performs this function by

scattering the bits of an ECC word across multiple memory chips, so that the failure of any one memory chip affects only one ECC bit. (Note: x8 SDDC is only available in lockstep channel mode.)

- *Advanced cache model*. Each core has an associated Level 1 (L1) instruction/data cache (64KB per core) and a large integrated Level 2 (L2) cache (256KB per core). Also, all cores on a die share access to an inclusive Level 3 (L3) cache. In the processor series, the L3 cache varies in size from four to eight MB, depending on the specific processor model, with an 8MB L3 cache implemented in the embedded-class Intel Xeon L5518 processor (Figure 4).

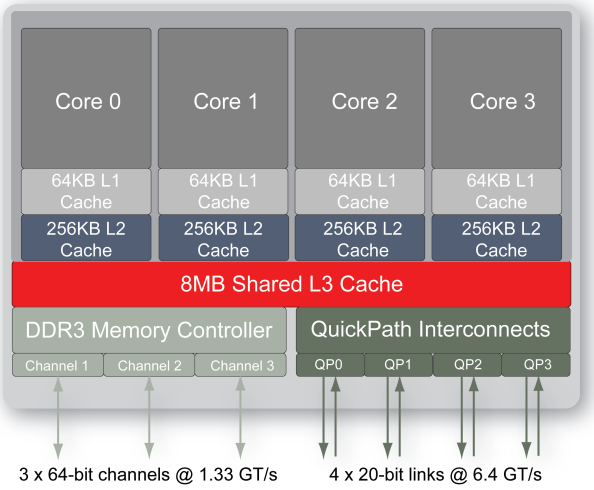


Figure 4. Intel Core Microarchitecture for the Intel Xeon Processor 5500 Series shows a shared 8MB Level 3 Cache.

- *Extended SSE4 (Streaming SIMD Extensions)*. These processor extensions improve performance for XML, string, and text processing.
- *Virtualization enhancements*. Embedded virtualization technologies enable hardware-based assistance for I/O device virtualization, improved virtualization efficiency, and enhanced connectivity within a virtualized server.
- *Intel HyperThreading (HT) technology*. This technology provides multiple virtual threads per core, increasing performance for highly threaded applications. In the Sun Netra X4270 server, the Intel Xeon L5518 processor implements two threads per core, for a maximum of 16 threads per server.
- *Intel Turbo Boost Technology*. For both multi-threaded and single-threaded workloads, this technology increases performance by taking advantage of processor and system power along with thermal headroom. The Turbo Boost feature can increase performance up to two or three speed bins (266 or 400 MHz) above typical performance levels. Turbo Boost and HyperThreading capabilities vary according to specific processor models.
- *Intel Intelligent Power Technology*. When a processor workload decreases, unneeded components — cores, cache and memory — are put into sleep mode to reduce power consumption.

Power Management Technologies

Continuing the trend of reducing the processor energy footprint, Intel has designed a microarchitecture that facilitates high performance while minimizing power use. Enhancements in the new Intel Core Microarchitecture add a greater number of CPU power states and decrease latency when a core switches from one state to another. In fact, the Intel Xeon Processor 5500 Series has up to 15 operating states, offers a two-microsecond state-to-state transition latency, and reduces CPU idle power to 10 watts. Power gates that reside on the die allow idle cores to go to a near-zero power state independently of one another.

To further conserve energy, memory, QPI, and PCIe circuitry can also transition to lower power states. Using DIMM self-refresh, DIMMs are automatically idled when all CPU cores in the system are idle. DIMM Clock Enable (CKE) automatically places idle DIMMs into a lower power state. QPI links and PCIe lanes are also placed in reduced power states during periods of inactivity.

The processor design helps to conserve power use, which can directly translate into energy savings and reduced operational costs. Because of innovative power efficiencies in the new microarchitecture, even the highest speed processors in the Intel Xeon Processor 5500 Series have a power envelope of only 95W — in comparison to the previous generation of high-speed processors that exhibited a power envelope as high as 120W. (The embedded class processor used in the Sun Netra X4270 server is rated at only 60 watts.)

Intel Xeon Processor 5500 Platform

The Sun Netra X4270 server uses the Intel Xeon 5500 Series Platform (codenamed Tylersburg-EP). Up to two processors interface to each other and to the Intel 5520 I/O Handler (IOH) over multiple Intel QuickPath technology interconnects. The IOH (codenamed Tylersburg-36D) interfaces to an Intel 82801JR I/O Controller Hub (ICH10R), enabling expandability and high I/O throughput. Each Intel Xeon Series Platform is designed to match processor performance with memory capacity, I/O expandability, and interconnect bandwidth. For more information on the Intel Xeon Processor 5500 Series and the related platform, see www.intel.com/products/processor/xeon5000/.

Chapter 3
Sun Netra X4250 and X4270 Server Architectures

Sun Netra X4250 and x4270 servers are designed to provide best-in-class performance with high reliability and low power consumption. This chapter details physical and architectural aspects of the systems, highlighting similarities and differences between these two Sun Netra server designs.

Comparing Sun Netra X4250 and X4270 Servers

Table 2 summarizes features of these two server platforms.

TABLE 2. FEATURE COMPARISON FOR SUN NETRA X4250 AND X4270 SERVERS

FEATURE	SUN NETRA X4250 SERVER	SUN NETRA X4270 SERVER
Chassis size (in rack units)	2U	2U
Number of CPU sockets	2	2
Supported processor types	Quad-core Intel Xeon Processor 5400 Series (L5408)	Quad-core Intel Xeon Processor 5500 Series (L5518)
Number of cores/threads per 40 RU rack enclosure	Up to 160 cores/160 threads	Up to 160 cores/320 threads
Processor system bus	Dual Front-Side Bus (FSB)	Intel QuickPath Interconnect
Number of memory slots	16	18
Memory capacity	Up to 64GB (using 4GB DIMMs)	Up to 144GB (using 8GB DIMMs)
Memory type	DDR2 DIMMs	DDR3 DIMMs
Internal storage	Up to 4 2.5-inch SAS HDDs or SSDs without DVD, or up to 2 SAS HDDs or SSDs with DVD (using PCIe SAS HBA)	
Removable media	1 SATA DVD/RW (only in 2-disk SAS configuration)	
Number of PCI slots	2 PCI-X (1 FL/FH, 1 HL/FH) 4 PCIe (1 FL/FH, 3 MD2 LP)	6 PCIe 2.0 (2 FL/FH, 4 MD2 LP)
Number of Gigabit Ethernet ports	4 on-board	
Number of I/O ports	2 USB on rear	
System management	Integrated service processor and ILOM	
Power supplies	2x650w AC or DC (N+1)	760W AC PSUs or 660W DC PSUs (2N)

RAS components	Hot swappable and redundant power supplies, disk drives
Telco features	DCA, WDT, NEBS 3 certified
OS support	Oracle Solaris 10, Linux, Windows, VMware

As Table 2 shows, Sun Netra X4250 and x4270 systems share many features, including:

- Chassis enclosure (2U)
- Intel Xeon-based architecture supporting one or two quad-core processors
- Large memory capacities
- Multiple high-bandwidth system interconnects
- Large-capacity internal storage using SAS or SSD drives and an installed PCIe SAS Host Bus Adapter (HBA), supporting 2 SAS or SSD drives with a DVD/RW drive or 4 SAS or SSD drives without a DVD/RW drive (SSDs to be available after the qualification process is completed)
- PCIe expandability
- Built-in quad Gigabit Ethernet support
- An integrated service processor for lights-out system management
- Ruggedized design to withstand harsh environments, demonstrated by NEBS Level 3 certification and ETSI compliance
- Redundancy using either AC or DC power supplies
- Support for multiple operating systems

Notable differences between Sun Netra X4250 and X4270 servers include:

- Supported processor types (Intel Xeon Processor 5400 Series versus Intel Xeon Processor 5500 Series)
- The type of system interconnect (FSB versus QPI)
- Memory capacity (a maximum of up to 64GB, using 4GB DIMMs, versus 144GB, using 8GB DIMMs) and memory type (DDR2 DIMMs versus DDR3 DIMMs)
- The type of PCIe slots supported (the Sun Netra X4270 server supports PCIe 2.0 while the Sun Netra X4250 server supports PCIe and PCI-X expansion)

The Sun Netra X4250 and X4270 servers offer the density and expandability needed to realize operational and administrative cost-savings —which is a goal of many IT strategic plans.

Sun Netra X4250 System-Level Architectural Overview

Figure 5 contains a system-level block diagram for the Sun Netra X4250 server. Up to two host processors connect to a Northbridge Memory Controller Hub (MCH) that in turn connects to a Southbridge I/O Hub (IOH). Details about key subsystems — system chipsets, memory subsystems, I/O subsystems, etc. — are given later in this chapter.

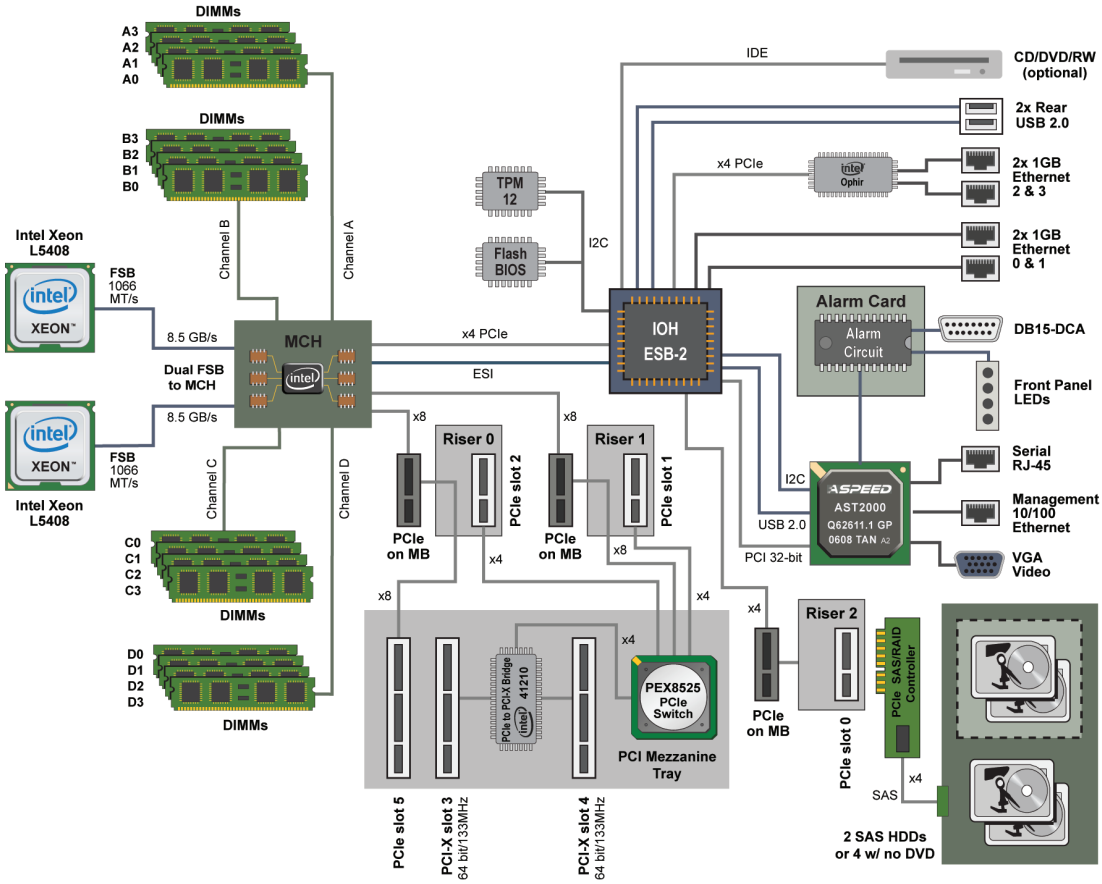


Figure 5. Block Diagram of Sun Netra X4250 Server shows the system-level architecture.

The Sun Netra X4250 server includes these major components:

- Up to two quad-core Intel Xeon L5408 processors
- Up to 64 GB of memory populated in 16 Fully-Buffered Dual Inline Memory Module (FB-DIMM) slots (2GB or 4GB DDR2 DIMMs are supported)
- Four on-board 10/100/1000 Mbps Ethernet ports
- Two PCI-X slots and four PCIe slots (1 FL/FH, 3 MD2 LP), although one of the three low-profile PCIe slots is already occupied by the PCIe SAS Host Bus Adapter

- Two internal 2.5-inch SAS or SSD drives with an internal DVD/RW, or four internal 2.5-inch SAS or SSD drives with no internal DVD/RW (SSDs to be available after the qualification process is completed)
- Two USB 2.0 ports on the rear panel
- An integrated service processor with Integrated Lights-Out Management (ILOM)
- Two hot-swappable, high-efficiency, AC or DC power supply units (PSUs) for
- N+1 redundancy
- Variable speed fan assemblies that operate under environmental monitoring and control

Sun Netra X4250 System Enclosure

The Sun Netra X4250 server enclosure is designed to occupy two rack units in a standard 19-inch rack (Table 3).

TABLE 3. DIMENSIONS AND WEIGHT OF THE SUN NETRA X4250 SERVER

DIMENSION	U.S.	INTERNATIONAL
Height	3.43 inches (2 RU)	87.1 millimeters
Width	17.52 inches (including bezel)	445 millimeters (including bezel)
Depth	20.71 inches (to PSU handles) 19.72 inches (to rear I/O)	526 millimeters (to PSU handles) 501 millimeters (to rear I/O)
Weight	38.5 pounds maximum	17.5 kilograms maximum

Sun Netra X4250 System Front and Rear Perspectives

Figure 6 illustrates the front and rear panels of the Sun Netra X4250 server. External features and connections include:

- Front and rear system status indicator lights, which report "locator" (white), "service required" (amber), and "activity status" (green) for the system and components
- Four additional front-panel indicators ("Critical", "Major", "Minor", and "User"), which signify application-defined DCA (Dry Contact Alarm) conditions
- Two or four hot-pluggable SAS or SSD drives, which insert through the front panel (an internal DVD/RW is available in configurations with only two internal drives)
- A slimline, slot-accessible DVD-RW, which is accessible through the front panel (two-disk drive configurations only)
- Two USB ports on the rear panel

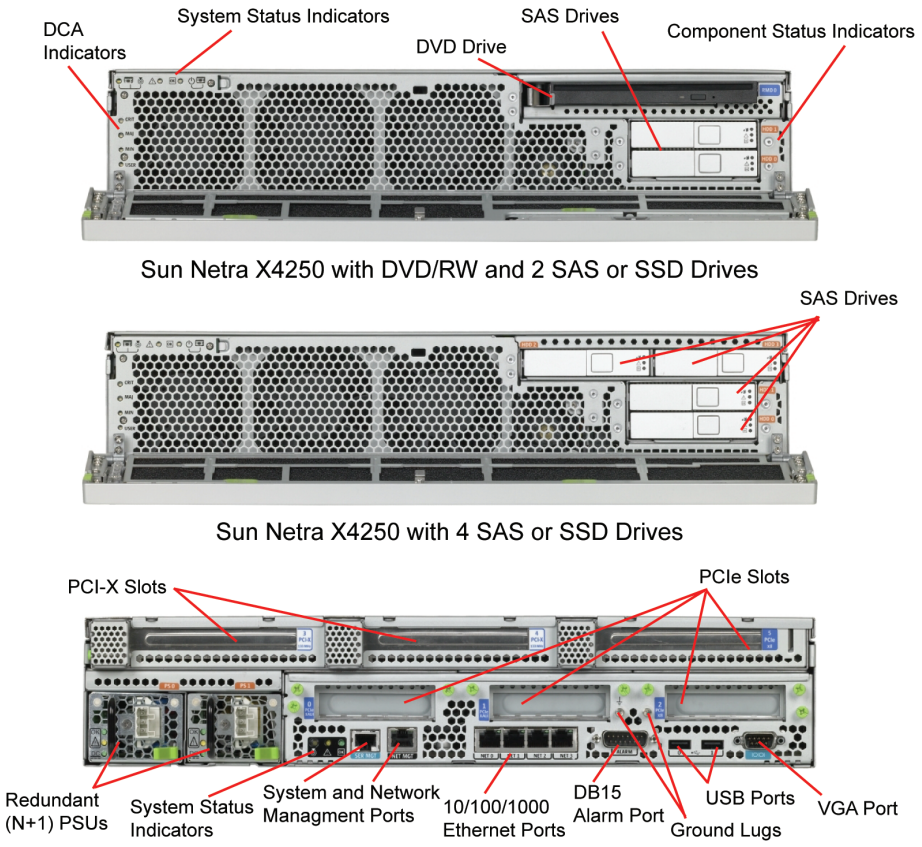


Figure 6. Sun Netra X4250 server, front and rear panels, feature status indicators and needed ports for I/O and connectivity.

- Two AC or DC power supply units (for 2N+1 redundancy) with integrated fans
- Rear power-supply indicator lights, showing the status of each hot-swappable power supply
- Four 10/100/1000Base-T autosensing Ethernet ports, accessible on the rear panel
- Two PCI-X slots (1 FL/FH, 1HL/FH) and four PCIe slots (1 FL/FH, 3 MD2 LP), in which cards can be installed from the rear (one low-profile PCIe slot, slot 0, is already occupied by the PCIe SAS Host Bus Adapter)
- Two management ports (one 10/100 Mbit Ethernet port and one RJ-45 serial management port) on the rear panel for connections to the service processor
- One Dry Contact Alarm (DCA) output port (DB-15) on the rear panel, which connects to the service processor and can report application-specific conditions
- VGA video port on the rear panel with an analog HD-15 VGA connector

Sun Netra X4270 System-Level Architectural Overview

Figure 7 contains a system-level block diagram for Sun Netra X4270 servers. Key subsystems — the chipset, the memory subsystem, the I/O subsystem, etc. — are discussed later in this chapter.

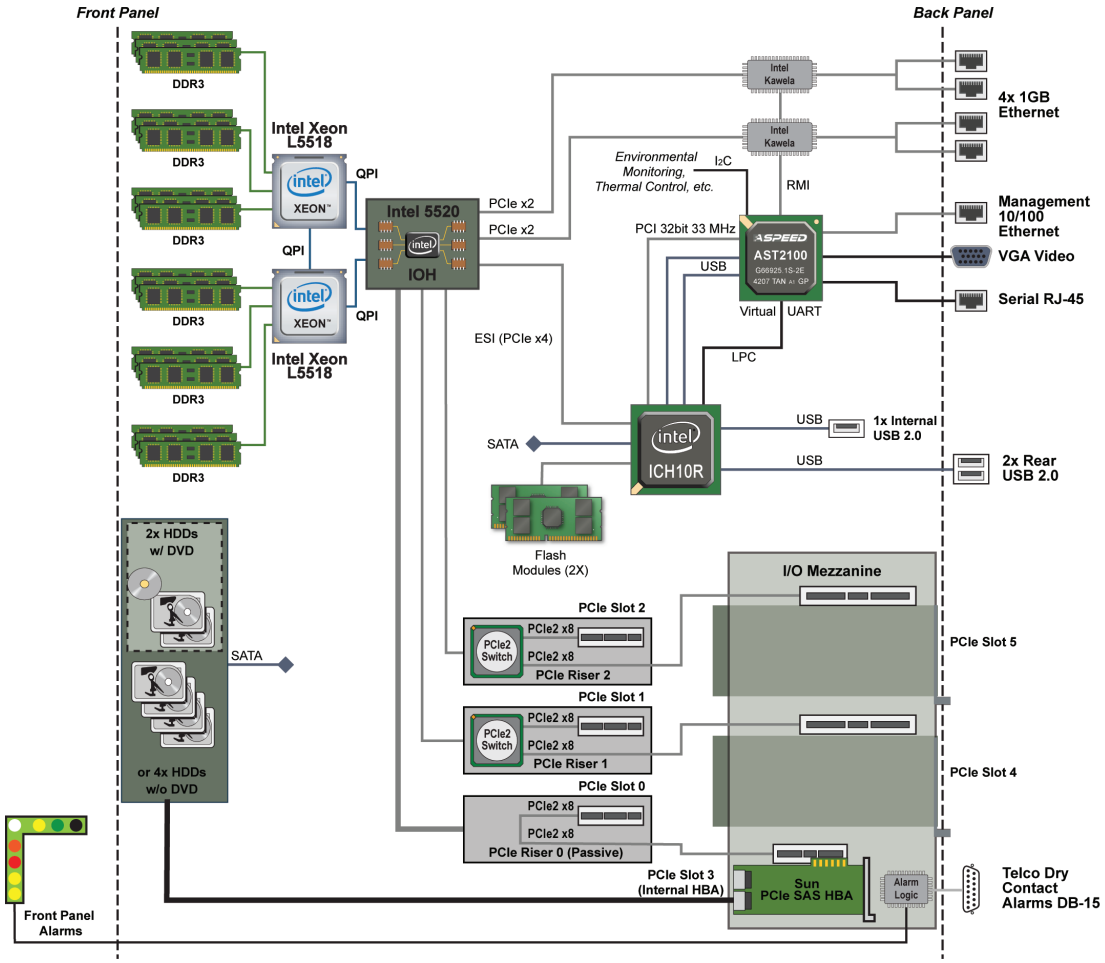


Figure 7. Block Diagram of Sun Netra X4270 Server shows the system-level architecture.

The Sun Netra X4270 server includes the following major components:

- Up to two quad-core Intel Xeon L5518 processors
- Up to 144 GB of DDR3 memory (4GB or 8GB DIMMs supported)
- Four on-board 10/100/1000 Mbps Ethernet ports
- Six PCIe slots (2 FL/FH, 4 MD2 LP), although one of the six low-profile PCIe 2.0 slots is occupied by an internal PCIe SAS Host Bus Adapter (HBA)

- Four internal 2.5-inch SAS or SSD drives (via the PCIe SAS HBA) with no DVD-RW, or two drives with a slimline DVD-RW accessible through the front panel (SSDs to be available once the qualification process is completed)
- Sockets for up to two optional internal 24 GB Sun Flash Modules in a mini-DIMM form factor
- Two customer-accessible USB 2.0 ports on the rear panel
- An integrated service processor with Integrated Lights-out Management (ILOM)
- Two AC or DC hot-swappable, high-efficiency PSUs (with integrated fans) to provide 2N redundancy
- Variable speed fan assemblies that operate under environmental monitoring and control

Sun Netra X4270 System Enclosure

The Sun Netra X4270 server enclosure occupies two rack units in a standard 19-inch rack (Table 4).

TABLE 4. DIMENSIONS AND WEIGHT OF THE SUN NETRA X4270 SERVER

DIMENSION	U.S.	INTERNATIONAL
Height	3.43 inches (2 RU)	87.1 millimeters
Width	17.52 inches (including bezel)	445 millimeters (including bezel)
Depth	20.71 inches (to PSU handles) 19.72 inches (to rear I/O)	526 millimeters (to PSU handles) 501 millimeters (to rear I/O)
Weight	38.5 pounds maximum	17.5 kilograms maximum

Sun Netra X4270 System Front and Rear Perspectives

Figure 8 illustrates the front and rear panels of the Sun Netra X4270 server. External features include:

- Front and rear status indicator lights, which report "locator" (white), "service required" (amber), and "activity status" (green) for the system and components
- Four additional front-panel indicators ("Critical", "Major", "Minor", and "User"), which signify application-defined DCA (Dry Contact Alarm) conditions
- Two or four hot-pluggable SAS or SSD drives, which insert through the front panel (an internal DVD/RW is available in configurations with only two internal drives)
- An optional slimline, slot-accessible DVD-RW, accessed through the front panel

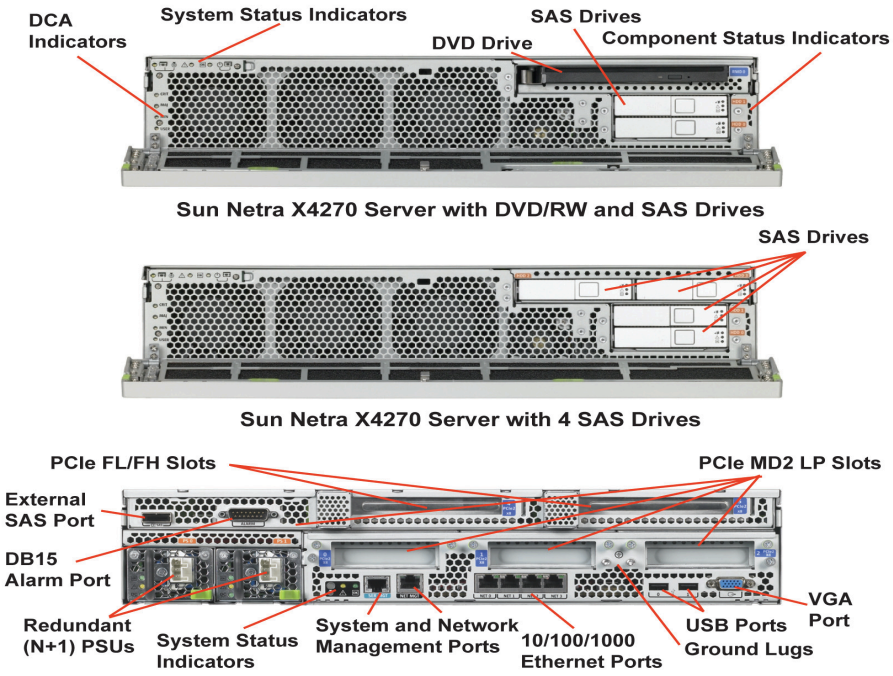


Figure 8. Sun Netra X4270 server, front and rear panels feature status indicators and needed ports for I/O and connectivity.

- Two USB ports on the rear panel
- Two AC or DC power supply units (with integrated fans) to enable 2N redundancy
- Rear power-supply indicator lights, showing the status of each hot-swappable AC or DC power supply
- Four 10/100/1000Base-T autosensing Ethernet ports, accessible on the rear panel
- Six PCIe 2.0 slots (2 x8 FL/FH slots and four MD2 LP slots, in which cards can be installed from the rear panel. (One low-profile PCIe 2.0 slot is already occupied by the internal PCIe SAS Host Bus Adapter.)
- Two management ports (one 10/100 Mbit Ethernet port and one RJ-45 serial management port on the rear panel) for default connections to the service processor
- One Dry Contact Alarm (DCA) output port (DB-15) on the rear panel, which connects to the service processor for reporting application-specific conditions
- VGA video port with an analog HD-15 VGA connector on the rear panel

System Processors and Chipsets

Sun Netra X4250 and X4270 servers are based on different Intel Xeon processors and chipsets. Each chipset is designed to match processor performance with memory capacity, I/O expandability, and interconnect bandwidth. Refer back to the server block diagrams earlier in this chapter and information on processors and chipsets in Chapter 2, "The Intel Advantage".

Intel Xeon Processor 5400 Series Platform

The Sun Netra X4250 server incorporates the Intel Xeon Processor 5400 Series Platform, including:

- One or two quad-core Intel Xeon L5408 processors
- The Northbridge Intel 5000P Memory Controller Hub (MCH)
- The Southbridge Intel 6321ESB Input/Output Handler IOH (ESB-2). The ESB-2 is interconnected to the MCH using one ESI link and one 4-lane PCIe link.

Dual independent Front Side Buses (FSBs) act as a system interconnect between each processor socket and the MCH. Operating at 1066MT/s, the 64-bit wide FSBs are capable of peak bandwidths up to 8.5GB/s. The Southbridge IOH interfaces to I/O devices, enabling expandability along with high I/O throughput.

Intel Xeon Processor 5500 Series Platform

The Intel Xeon Processor 5500 Series platform includes:

- *Intel Xeon Processor 5500 Series*. The Sun Netra X4270 server motherboard includes two processor sockets. (Chapter 2 describes the processor microarchitecture.)
- *Intel 5520 I/O Handler (IOH)*. The IOH (formerly Tylersburg-36D) features two QuickPath interconnects and 36 PCIe 2.0 lanes. Of the 36 PCIe 2.0 lanes, 32 connect to PCIe risers to enable PCIe 2.0 expandability. The remaining four lanes connect to two Intel 82576EB (formerly Kawela) Gigabit Ethernet Controllers to support the four on-board Ethernet ports.
- *Intel 82801JR I/O Controller Hub (ICH10R)*. The ICH10R is interconnected to the IOH using one ESI (Enterprise South Bridge Interface) link. The ESI link is based on a 4-lane PCIe interconnect with proprietary extensions and offers a 2 GB/sec transfer rate. The ICH10R enables additional I/O functionality including support for system USB ports, Flash Modules, and the optional SATA DVD/RW device. The ICH10R connects to the Aspeed AST2100 Service Processor using USB (for virtual devices), PCI (for video), and LPC (serial port).

Memory Subsystems

To address memory-intensive applications, Sun Netra X4250 and X4270 servers feature memory subsystems that feature large densities, high bandwidth, and multiple independent memory channels. However, the memory subsystems in these servers differ significantly.

Memory Subsystem in the Sun Netra X4250 Server

The Sun Netra X4250 server supports up to 16 DDR2 DIMMs per system for a maximum capacity of 64GB using 4GB modules. Four memory channels are organized into two branches, and each channel supports up to four DIMMs. Modules of identical size must be populated in pairs, starting with memory slot 0 on each channel (slot 0 on each channel is marked with blue connector handles).

The same 667MHz, PC2-5300 DDR2 DIMM modules — in either 2GB or 4GB capacities — are supported. Peak read bandwidth to the DIMMs is 5.3GB/s per channel (21GB/s total), and peak write bandwidth is 2.7GB/s per channel (10.7GB/s total). Memory modules feature Error Checking and Correcting (ECC) with Chipkill technology for high reliability.

Memory Subsystem in the Sun Netra X4270 Server

In contrast, the Sun Netra X4270 server features an on-die, integrated memory controller and multiple DDR3 memory channels per processor, providing high bandwidth for memory-intensive applications. DDR3 memory components offer greater density and run at higher speeds, but at significantly lower voltages, than previous generation DDR2 memories. The Sun Netra X4270 server can be populated with DDR3 Registered ECC DIMM modules in either 4 GB or 8 GB capacities.

Each processor features an integrated memory controller, which means that the systems adhere to a Non-Uniform Memory Access (NUMA) memory architecture — the memory controller on one processor can access local memory as well as remote memory. The integrated memory controller supports DDR3 memories in three speeds — 800 MT/s, 1066 MT/s, and 1333 MT/s — although Oracle only qualifies and offers 1066 MT/s and 1333 MT/s RDIMMs. When configuring system memory, it is important to note that DIMMs may run at slower than individually rated speeds depending on the CPU type, the number of DIMMs per channel, and the type of memory (speed, rank, etc.). The speed at which memory is actually running is set by system BIOS at start-up, and all memory channels will run at the fastest common frequency.

Memory Population Guidelines

Each processor in the Sun Netra X4270 server features three memory channels. Each channel supports three RDIMM slots, enabling up to 18 RDIMMs per system in a fully populated system. Memory slots in each channel are color-coded to simplify identification:

- Blue represents slot 0
- White represents slot 1
- Black represents slot 2

As a general rule to optimize memory performance, DIMMs should be populated in sets of three, one per channel per CPU, starting with the slot furthest from the CPU socket (in slot 0, the blue slot). Ideally each channel should be populated with equal capacity DIMMs, and if possible, with the same number of identical DIMMs (which helps to make memory performance more consistent). In a server with a single processor, the DIMM slots next to the empty CPU socket should not be populated. In general, it is better to populate quad rank (QR) DIMMs first, followed by dual rank (DR) DIMMs and/or single rank (SR) DIMMs.[1]

Optimizing Memory for Bandwidth

Configurations with optimal memory bandwidth can be achieved using memory components that run at 1333MT/s. To optimize a configuration for bandwidth, populate one single rank (SR) or dual rank (DR) DDR3 1333 MT/s DIMM per channel (the use of quad rank (QR) DIMMs limits the number of DIMMs per channel to two, and restricts the maximum memory access speed to 1066 MT/s).

Optimizing Memory for Capacity

If three DIMMs per channel are populated to optimize for capacity, memory access speed is reduced to 800 MT/s, regardless of the DIMM type (1066 MT/s or 1333 MT/s). For this reason, using 1066 MT/s DIMMs is recommended to reduce configuration cost. With all 18 slots populated using 8 GB DIMMs, it is possible to achieve a maximum system memory capacity of 144 GB.

I/O Subsystem

Designed with the headroom needed to expand systems and to scale users and applications, Sun Netra X4250 and X4270 servers feature a PCIe expansion bus, integrated storage, four on-board Intel Gigabit Network Interface Controllers (NICs), and external USB ports. The Sun Netra X4270 server also features support for up to two internal 24 GB Sun Flash Modules in a mini-DIMM form factor that can be installed on the motherboard.

On the Sun Netra X4250 server, the I/O subsystem is interconnected to the Northbridge MCH and Southbridge IOH ESB-2 using one ESI link and PCIe links, and connects to the service processor via a 32-bit, 33MHz PCI channel. The ESB-2 provides two built-in Gigabit Ethernet NICs going directly to external NIC ports 0 and 1. Two additional Gigabit Ethernet NIC ports (ports 2 and 3) are connected to a Dual Gigabit Intel Ophir 82571 chip that interfaces to the ESB-2 using a 4-lane PCIe link.

[1] "Rank" refers to the number of memory chips that a DIMM module has connected on any given data line. Oracle offers only single rank (SR) and dual rank (DR) DIMMs at this time.

The ESB-2 also supports all USB functionality on the Sun Netra X4250 server. Two USB ports go from the ESB-2 to the rear panel. The ESB-2 also supports a USB-to-IDE interface that enables the connection of an internal SATA DVD/RW drive. An internal USB port exists inside the chassis, but it is not intended for external device connections (nor is it NEBS-certified). In addition, a USB-to-IDE interface in the Sun Netra X4250 server connects to an internal compact flash slot (and Oracle offers a 16GB compact flash device as an optional boot device).

On the Sun Netra X4270 server, the I/O subsystem is interconnected to the Intel 5520 IOH (formerly Tylersburg-36D) and the Intel 82801JR ICH10R. The service processor connects to the ICH10R via a 32-bit, 33MHz PCI channel. On the Sun Netra X4270 server, the ICH10R provides connectivity for system USB ports, two SATA Flash Module sockets, and the SATA DVD/RW device. Two USB ports also go from the ICH10R to the rear panel.

System Network Interfaces

Multiple on-board Gigabit Ethernet connections promote flexible connectivity, as well as configurations that support network interface failover. Sun Netra X4250 and X4270 servers both feature four 10/100/1000Mb/s Ethernet ports on the rear panel, numbered in sequence from left to right. Each port auto-negotiates its link connection — LEDs above the port indicate the speed of the established link (green signifies that the established link is 1000Mb/s). All four Ethernet interfaces support PXE boot for network interface booting.

For configurations that require dual 10 Gigabit Ethernet connections, a Sun 10-Gigabit Ethernet PCI-e adapter card can be optionally installed in the system.

PCI Expansion

Operating at 2.5GHz, PCI Express (PCIe) is a high speed, point-to-point system bus interconnect that replaces the original PCI bus design. In Sun Netra X4250 and X4270 servers, riser cards connect the PCI bus between the motherboard and one or two PCI mezzanine boards. The Sun Netra X4250 server includes support for legacy PCI-X telecommunications cards as well as support for PCIe expansion. The Sun Netra X4270 server features the next-generation PCIe 2.0 expansion bus, which effectively doubles the interconnect bit rate, increasing the aggregated bi-directional bandwidth of a 16-lane link to approximately 16 GB/s.

PCI Expansion in the Sun Netra X4250 Server

The Sun Netra X4250 server uses a single PCI mezzanine tray and three risers that connect to the motherboard. The PCI mezzanine tray incorporates a PLX Technology PEX8525 PCIe switch (to fan out PCIe buses) and an Intel 41210 bridge chip, which converts 4-lane PCIe buses to PCI-X buses in support of the two PCI-X slots.

On the Sun Netra X4250 server, PCIe or PCI-X cards are installed in a horizontal orientation. When viewing the Sun Netra X4250 server from the rear, PCI slots are numbered starting at the bottom, left to right, from 0 to 2, and continuing on the top, left to right, from 3 to 5. The Sun Netra X4250 server features a total four PCIe card slots (slots 0, 1, 2, and 5). In addition, slots 3 and 4 are PCI-X slots,

designed to support legacy PCI-X cards. (Refer back to Figure 6, which shows the rear panel of the Sun Fire X4250 server.) A SAS Host Bus Adapter (required for SAS disk drive support) is installed in slot 0. Table 5 summarizes numbering, type, and mechanical and electrical characteristics for PCI slots in Sun Netra X4250 servers.

TABLE 5. SUN NETRA X4250 SERVER PCI SLOT NUMBER, TYPE, AND CHARACTERISTICS

SLOT #	TYPE	MECHANICAL	ELECTRICAL
0	PCIe (low-profile, occupied by SAS HBA)	x8	x4
1	PCIe (low-profile)	x8	x4
2	PCIe (low-profile)	x8	x8
3a	PCI-X	133MHz @ 64-bit, half-length, full-height	
4a	PCI-X	133MHz @ 64-bit, full-length, full-height	
5a	PCIe (full-length, full-height)	x16	x8

a. For the Netra X4250 server, there is a 75w maximum load for slots 3-5.

PCI Expansion in the Sun Netra X4270 Server

The Sun Netra X4270 server supports six PCIe 2.0 slots — two FL/FH and four MD2 LP slots, one of which is used for an internal SAS HBA. The slots are numbered left to right across the bottom (Slots 0 to 2) and then left to right across the top of the rear panel (Slots 3 to 5). (Refer back to Figure 8, which shows the rear panel of the Sun Netra X4270 server.) Cards are all oriented horizontally and can be compliant with either Revision 1.0a or 2.0 of the PCIe Card Electromechanical Specification.

The server incorporates a single passive riser (for Slots 0 and 3) and two active risers (for Slots 1 and 4, and Slots 2 and 5). Each 2U riser supports an 8-lane (electrical and mechanical) PCIe 2.0 slot and an 8-lane PCIe 2.0 connection to a slot on the mezzanine board. The passive riser splits 16 PCIe 2.0 lanes from the IOH into two sets of 8 lanes, one set for each riser connection.

The active riser uses an IDT PES24T6G2 PCIe 2.0 switch to expand eight PCIe lanes from the IOH into two x8 slots. The switch features six ports and twenty-four 5 Gbps PCIe 2.0 lanes supporting 5 Gbps, 2.5 Gbps, and mixed 5 Gbps/2.5Gbps modes. As implemented in the Sun Netra X4270 server, the switch provides high-performance I/O connectivity and switching functions between the riser's x8 PCIe 2.0 upstream port and the two x8 downstream ports. The switch helps to support PCIe applications that demand high throughput and low latency, such as high throughput 10 Gigabit I/O cards, SATA controllers, and Fibre Channel HBAs. However, it is not recommended to insert more than one high bandwidth and latency-sensitive PCIe card in slots managed by a single switch at the same time (e.g., simultaneously in Slots 1 and 4, or in Slots 2 and 5).

Table 6 summarizes numbering, type, and mechanical and electrical characteristics for the six PCIe 2.0 slots in the Sun Netra X4270 server.

TABLE 6. SUN NETRA X4270 SERVER PCI SLOT NUMBER, TYPE, AND CHARACTERISTICS

SLOT #	TYPE	MECHANICAL	ELECTRICAL
0	PCIe 2.0 (low-profile)	x8	x8
1	PCIe 2.0 (low-profile)	x8	x8
2	PCIe 2.0 (low-profile)	x8	x8
3	PCIe 2.0 (low-profile, occupied by SAS HBA)	x8	x8
4	PCIe 2.0 (full-length, full-height	x16	x8
5	PCIe 2.0 (full-length, full-height	x16	x8

Integrated Storage

In addition to breakthrough compute, memory, and I/O densities, the Sun Netra X4250 and X4270 servers offer large internal storage capacities, with the ability to support two or four internal 2.5-inch SAS (four drives assuming no internal DVD/RW). An innovative new drive carrier design includes an ejection handle that simplifies drive removal — drives are hot-swappable when disk mirroring is configured. Drive status lights indicate "Ready to remove", "Fault", and "Status". Currently 10,000RPM SAS drives are available with a capacity of 146GB or 300GB in the Sun Netra X4250 server and 300GB in the Sun Netra X4270 server.

In Sun Netra X4250 and X4270 systems, drives plug into a disk backplane and connect to PCIe SAS Host Bus Adapters (HBAs). Slot 0 is used for the SAS HBA on Sun Netra X4250 servers, and slot 3 on Sun Netra X4270 servers. In the Sun Netra X4270 server, the SAS HBA also connects to an external SAS interface. Optional SAS HBAs support RAID levels 0, 1, 1E, 5, 5EE, 6, 10, 50, and 60. RAID capabilities of the SAS HBAs allow customers to effectively balance storage capacity, availability, and cost according to application requirements.

Flash Technology

Flash technology can provide an economical alternative that can dramatically enhance application I/O performance while also operating with significantly better energy efficiency than conventional rotational hard disk drives (HDDs). Solid state drives (SSDs) are in the process of being qualified for the Sun Netra X4250 and X4270 servers because flash technology can often deliver a greater number of IOPS than HDDs, especially under certain workloads. Since SSDs have no moving parts, they can enable fast access times while reducing the need for cooling.

DVD/USB Assembly

A slim form-factor IDE optical drive assembly is available as an option in the Sun Netra X4250 and X4270 servers. In both servers, the assembly provides an internal DVD-RW device in lieu of two additional drives. A locking handle allows the assembly to be safely secured and easily extracted from the system chassis.

Enclosure Features

The Sun Netra X4250 and X4270 servers feature similar innovative chassis designs engineered to conserve system power and lessen the need for cooling. The servers' power and cooling efficiency exceeds that of many competitive systems configured with similar processing, memory, and storage capacities. Effective front-to-back air flow helps to lower component temperatures, reducing the number of fans needed for cooling.

Key chassis design features include:

- A hinged front cover that allows easy access to disk drives, simplifying drive insertion and removal
- Hex-shaped, honeycombed air inlet holes that enhance airflow and provide EMI shielding
- Front-mounted fans (located at the front of the system and directly behind the disk drive cage) that pull air through the chassis, over system components, and exhaust it out the rear panel
- An air baffle over key component areas, along with effective system cable and component placement, that helps to optimize cooling efficiency and channel air flow effectively
- Fewer DC-to-DC conversions, which enhance power efficiency and generate less heat

Power Distribution

Engineered for high availability as well as low energy consumption, the Sun Netra X4250 and X4270 servers are configured with redundant, hot-swappable AC or DC power supply units (PSUs), each with separate power cords. PSU redundancy means that continuous power is supplied if a power supply fails. (Note that PSUs can be easily serviced if necessary without sliding the server completely out of the rack.) In normal operation, redundant PSUs share system power demands equally.

To reduce power requirements and meet Telecordia NEBS Level 3 certification, the Sun Netra X4250 and x4270 servers can be configured with DC (rather than AC) power supplies. Using DC power reduces overall operating costs by lowering energy use, reducing heat, and increasing reliability. Mixing AC and DC power supplies within a single server is not supported. In addition, systems cannot be upgraded from one type of power supply to the other (e.g., from AC to DC or from DC to AC).

AC or DC PSUs in the Sun Netra X4250 server are 650 watts. In the Sun Netra X4270 server, the power supplies are rated at a maximum of 760 watts for AC power and 660 watts for DC power to support a broad range of system configurations. In both cases, the PSUs are highly efficient units, having a typical efficiency rating that exceeds at least 80%. Each PSU features a non-removable internal fan that supplies independent cooling. Three light indicators display power supply status information ("AC", "Fault", and "OK").

The Sun Netra X4250 and X4270 servers use a Power Distribution Board (PDB) to route connections between the power supplies and major system components. The PDB contains a single 10Amp 12V-to-5V DC-to-DC supply that powers the disk subsystem and the optional IDE DVD-RW device.

Fan Assemblies

Sun Netra X4250 and X4270 servers feature an innovative chassis design that helps to reduce the need for cooling. Effective front-to-back air flow helps to lower component temperatures, reducing the number of fans needed to cool the systems.

An on-board service processor, which monitors processor temperatures and system ambient air temperatures, controls variable speed system fans. Based on temperature readings, the fans operate at the lowest speed possible to provide sufficient cooling — conserving power usage, prolonging fan life, and reducing acoustical noise. A green status light on a fan module indicates proper operation while an amber light indicates a fan fault.

The Sun Netra X4250 and X4270 systems share similar chassis enclosures, so system air flow and fan designs are also similar. In both systems, the chassis is divided into distinct air flow chambers with separate sets of fans for cooling. System fans draw air across the motherboard (including the CPUs and memory) and vent it through the rear of the system. An air baffle is used to channel air flow effectively across the motherboard area. Another set of fans pulls air flow across the hard drives and the DVD-RW device (if present). Both chambers are front-to-back cooled (Figure 9).

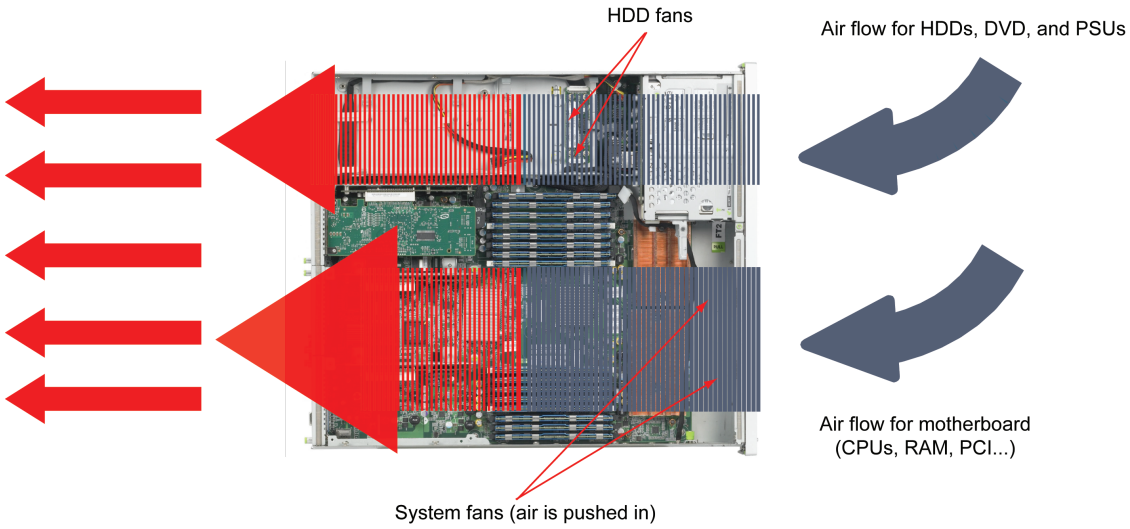


Figure 9. Fans force air flow in Sun Netra X4250 and X4270 servers from front to back.

Two fan modules located behind the SAS disk drive bays, which pull air across the drives and exhaust it through the PSU bays, cool the power supply/storage chamber. A system fan assembly (with three fans located behind the front bezel) cools the motherboard and PCI chamber. An air duct fits over the motherboard to optimize air flow. A single additional fan augments memory cooling.

Rack Mounting

To shorten time-to-deployment, Oracle's Sun Customer Ready program can pre-install Sun Netra X4250 and X4270 servers in rack configurations. Alternatively, these 2U servers can be field-installed into Sun or other third-party racks. Rack mount kits for 4-post mounting in 19-inch racks are included in each base configuration.

The following options are also available to facilitate rack mounting:

- *Rack-Mounting Slide Rail Kit*. This is a 4-point mounted slide rail kit (i.e., mounting points are located at the rack front and rear).
- *Cable Management Arm*. The Cable Management Arm supports and protects cables as the server slides into and out of the rack.

The Slide Rail Kit and optional Cable Management Arm enable the servers to be installed in these Sun racks available from Oracle:

- Sun Rack 900 (-38 and -36N)
- Sun Rack 1000 (-38 and -42)
- Sun Rack II 1042 and 1242
- Third Party ANSI/EIA-310-D-1992 or IEC 60927-compliant racks in 19-inch/482.6mm panel-width series

The Slide Rail Kit includes hardware to mount to rack rails with either 6mm threaded holes, #10-32 threaded holes, #10 clearance holes, or square unthreaded holes per ANSI/EIA 310-D-1992 or IEC 60927 standards. Note that not all third-party racks are compatible with the slide rail kit. Rack density will vary widely based on systems installed, power distribution (in-cabinet or external), power source (single-phase or three-phase), and whether redundant power is required.

Service Processor and System Management

As in other Sun rack-mounted and Sun Netra servers, Sun Netra X4250 and X4270 servers feature a built-in, hardware-based service processor. Integrating the service processor on the motherboard enables remote power control and system monitoring — capabilities that help to simplify system management.

Sun Netra X4250 server embeds an Aspeed AST2000 chip as the on-board service processor, while the Sun Netra X4270 server uses the next-generation Aspeed AST2100. One significant difference in the service processor implementations is the ability for the Sun Netra X4270 server to support side-band management. Side-band management refers to the sharing of a single Ethernet port for host and service processor network connectivity. In the Sun Netra X4270 server, side-band management is enabled through a connection between the Ethernet controllers and the Aspeed AST2100 service processor (Figure 10).

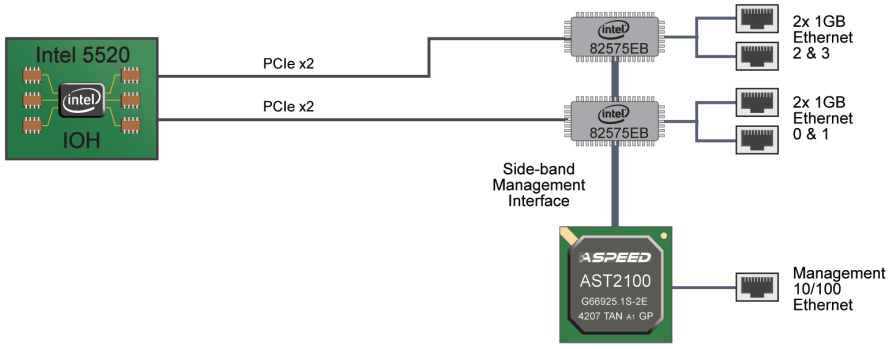


Figure 10. The service processor in the Sun Netra X4270 server supports side-band management.

Otherwise, both Aspeed chip designs are similar in that they combine a graphics controller and a service processor into a single chip, saving space and power. The Aspeed chip uses two USB ports for virtual devices and one 32-bit, 33MHz PCI bus for data to connect to the Southbridge ESB-2 (for the Sun Netra X4250 server, Figure 5) or to the ICH10R (for the Sun Netra X4270 server, Figure 7).

On the Sun Netra X4250 server, the Aspeed AST2000 chip supports three external interfaces on the rear panel:

- One RJ45 RS-232 serial interface
- One 10/100 MB/s Ethernet network interface (also an RJ-45 connector)
- One HD-15 SVGA Video port

For system management operations, the Aspeed AST2100 uses these connections:

- Two USB ports for virtual devices (both ports are routed directly on the motherboard between the AST2100 and the ICH10R)
- Two serial ports (one external, one to the ICH10R)
- Two Ethernet interfaces for IP-based management connections (one external for out-of-band management, one to the Intel NIC controllers for side-band management)
- One SVGA video port for local video output
- One 33 MHz, 32bit PCI connection to the ICH10R for video

The serial interface is intended for console use only (it does not support modem connection). Default serial port configuration parameters are 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control. By default, the BIOS directs system output to the service processor, or it can be redirected to the serial port by changing a BIOS option. The BIOS can also be used to check or modify the service processor's IP address.

Integrated Lights-Out Management Capabilities

The need for high availability in business-critical systems calls for robust and proactive system management. The service processor supports firmware-resident system management capabilities —

known as Integrated Lights-Out Management (ILOM) — that enable remote monitoring and system control using industry-standard protocols. Since ILOM management tools reside in firmware, they can be easily upgraded and enhanced at any future time. Sun Netra X4250 and X4270 servers are configured with support for ILOM 2.0, the second generation of this comprehensive system management firmware. ILOM capabilities are available on a number of other Sun and Sun Netra servers, so they are often already familiar to many system administrators. The service processor and ILOM tools are IPMI 2.0 compliant.

The service processor enables management functionality that includes: system configuration information retrieval; key hardware component monitoring; remote power control; SNMP V1, V2c, and V3 support, and event notification and logging.

Digital thermal sensors on the processor die and the motherboard are used to monitor temperatures, which helps to increase reliability. The service processor continuously monitors and detects errors on these and other system sensors:

- Memory Voltage
- CPU Core Voltage
- System 3.3V
- System 5V
- System 12V
- CPU Fan
- System Fans
- CPU Temperature
- Chassis Temperature

Administrators can track status information from many of these sensors and take action before a minor system issue escalates into a serious problem.

Secure access to the service processor and its ILOM management capabilities is available in several ways:

- Via a Secure Shell (SSH) command line interface. To access management capabilities through a remote Secure Shell (SSH), a Secure Shell communications application must be available on the remote administrative system.
- Using a Command Line Interface (CLI) with industry-standard keyboard commands and scripting protocols. The Desktop Management Task Force's (DMTF) Systems Management Architecture for Server Hardware (SMASH) command line protocol is supported over both the serial interface and the secure shell network interface.
- Via Simple Network Management Protocol (SNMP) v3 interfaces for external datacenter management tools (such as Oracle Enterprise Manager Ops Center, IBM Tivoli, and Hewlett-Packard OpenView).
- Using an easy-to-use, web-based graphical user interface. The web-based interface offers a wide spectrum of management capabilities, from retrieving current system configuration data to monitoring the status of key hardware components.

For enhanced security, the service processor includes multi-level role-based access, and supports native and Active Directory Service lookup of authentication data. All functions can be provided out-of-band through a designated serial or network interface, virtually eliminating any performance impact to workload processing.

Keyboard/Video/Mouse Over IP

To simplify remote access to management functions, the service processor supports Keyboard/Video/Mouse (KVM) over IP to redirect the server's video screen, keyboard, and mouse data to a remote administrative workstation via the network. The service processor captures keyboard and mouse input and output at a remote workstation and emulates USB-connected keyboard and mouse devices. Sun Netra X4250 and X4270 servers can then detect these emulated devices and treat them as directly connected interfaces.

The service processor captures, compresses, encrypts, and sends video output to the remote workstation. The workstation subsequently receives and displays the managed server's video screen. Advanced Encryption Standard (AES) governs encryption and decryption of KVM control commands to protect the managed server from intervention by a remote hacker.

Virtual Storage

The virtual storage feature of the service processor emulates devices to enable remote storage operations — just as if the units were physically attached to the Sun Netra X4250 or X4270 server. The service processor incorporates a USB 2.0 device controller that connects to the server's internal USB host controller. By launching the virtual storage function at a remote workstation, Sun Netra X4250 and X4270 servers detect USB storage device attachment.

This feature applies to a variety of remote storage devices such as DVD, CD-ROM, and floppy drives, as well as USB flash disk drives and ISO image files. For example, when CD-ROM emulation is enabled, the servers detect a USB-attached CD-ROM. A target disk placed in the CD-ROM drive of the remote PC becomes accessible by the managed Sun Netra X4250 and X4270 server. To maintain security, the Advanced Encryption Standard governs remote storage transmissions. Most importantly, administrators can use KVM over IP and virtual storage together to enable remote power-on, BIOS booting, or to remotely install operating systems, device drivers, or application software from an authorized system elsewhere on the network.

In-band System Management

Some organizations prefer in-band system management in order to standardize administrative tasks across multi-vendor, heterogeneous environments. Using in-band system management, administrators perform monitoring and maintenance tasks through the host operating system. The Sun Netra X4250 and X4270 servers provide in-band system management using two methods: IPMI v2.0 with a Keyboard Controller Style interface and IPMI kernel driver, or by using SNMP operating system resident agents. IPMI 2.0 and SNMP V1, V2c, and V3 are industry-supported standards for performing autonomous platform management functions.

RAS Features

Corporate data and business information comprise critical business assets. Enterprise computing technologies strive to furnish a high degree of data protection (reliability), to provide virtually continuous application access (availability), and to incorporate procedures and components that help to resolve problems with minimal business impact (serviceability). Commonly referred to as RAS, these capabilities are a standard part of Sun's mission-critical computing solutions.

The Sun Netra X4250 and X4270 servers are engineered for hardware failure prevention, near continuous operation, fast recovery, system security, and easy serviceability. RAS features for these systems include:

- *High CPU density*. Multiple Intel Xeon processors enable density that increases overall availability.
- *Hot-swappable redundant components*. Mirrored disks and redundant power supply units can be quickly and easily changed out, increasing system uptime.
- *Accessible components for improved serviceability*. Front-accessible, hot-swappable disk drives can be replaced quickly. The optional DVD/RW drive can also be removed without opening the top cover of the chassis. Power supply units can be replaced without completely removing a system from a rack.
- *RAID options*. The pre-installed SAS controller supports RAID 0, 1, and 0+1, allowing customers to balance storage capacity, availability, and cost.
- *Indicator LEDs on the front and back of the chassis*. Easily visible LEDs allow problems to be identified and isolated easily. Diagnostic LEDs are also included on the motherboard.
- *Integrated lights-out management capabilities*. Standard on Sun Netra X4250 and X4270 servers at no additional charge, the integrated service processor provides powerful ILOM tools for local or remote system management, simplifying administrative tasks, reducing on-site personnel needed, and lowering overall operational costs.
- *Trusted Platform Module (TPM)*. Increasingly platform security is an important factor in enhancing system availability and reliability. Sun Netra X4250 and X4270 servers include a Trusted Platform Module (TPM) chip. The TPM chip is used to securely store certificates or encryption keys to help perform platform authentication and/or attestation (a process that indicates that a server is trustworthy and has not been breached).
- *Dry Contact Alarms*. Sun Netra X4250 and X4270 servers are configured with Dry Contact Alarms (DCA) and Watchdog Timers (WDT) to detect and report conditions so that administrative action can be taken to avoid more serious problems. Alarm I/O circuitry provides four "dry contact" relays. Each relay provides one pair of dry (i.e., no electrical signal is provided by the system) closed-open contacts that are controlled via user-defined application interfaces and I/O through the DB-15

DCA connector. (Typically these relay connections are used to connect to an external network management controller to report a component failure.)

- *Telecordia NEBS Level 3 certification*. Telecordia NEBS Level 3 certification demonstrates that the Sun Netra X4250 and X4270 servers meet stringent reliability requirements, even in extremely harsh operating environments.

The robust design of Sun Netra X4250 and X4270 servers makes these platforms ideal for critical telecommunications applications and environments that demand continuous availability.

Chapter 4
Carrier-Grade Software Support

To give organizations unparalleled flexibility and investment protection, Sun Netra X4250 and X4270 servers support multiple operating systems, including Oracle Solaris, Windows, and Linux environments. Support for multiple operating systems allows organizations to deploy a choice of application environments without having to shift hardware platforms when software requirements change. This added flexibility enables enterprises to reduce cost and complexity when supporting and managing solutions from multiple vendors, helping organizations to reduce risk and increase return on investment.

Sun Netra X4250 and X4270 servers are certified to run the following operating system versions:

- Oracle Solaris 10 Operating System
- Red Hat Enterprise Linux 5 (32-bit or 64-bit on the Sun Netra X4250 server; 64-bit on the Sun Netra X4270 server)
- SUSE Linux Enterprise Server 10 (64-bit) — SP2 certified on Sun Netra X4250 server and SP3 on Sun NetraX4270 server
- SUSE Linux Enterprise Server 11 (64-bit)
- Windows Server 2003 (only on the Netra X4250 server) or 2008 Standard and Enterprise Editions (32-bit or 64-bit on the Sun Netra X4250 server; 64-bit on the Sun Netra X4270 server)
- Oracle Enterprise Linux 5.5

In addition, the Sun Netra X4250 and X4270 servers will be certified for Oracle VM Server 2.2 and VMware ESX 4.0 U1 and ESXi 4.0 U1.

Additional patches and drivers required to complete the installation of these operating systems are available from the web site www.sun.com/download/ or on the Tools and Drivers CD-ROM provided with every Sun Netra X4250 and X4270 server. Drivers and installation scripts on the Tools and Drivers CD-ROM help to reduce the complexity of installing supported operating system distributions (since additional device drivers are included on the CD-ROM). Note that Oracle Solaris 10, Red Hat Enterprise Linux 5, SUSE Linux Enterprise Server 9, and Windows Server 2003 or 2008 are available along with support contracts. In addition, Sun Netra X4250 and X4270 servers come with Oracle Solaris 10 pre-installed.

Oracle Solaris 10

In a class by itself, Oracle Solaris 10 offers many innovative technologies that change the equation for organizations needing to reduce costs, minimize complexity, and eliminate risk. Optimized for Sun Netra systems with 64-bit Intel Xeon processors and supported on hundreds of third-party x86 and

x64 systems, Oracle Solaris 10 brings flexibility and power to the enterprise. Running on diverse hardware, ranging from laptops and single-board computers to datacenter and grid installations, Oracle Solaris supports demanding applications that include military command and control systems, telecommunication switching gear, and stock trading applications, among others.

Supplied on all Sun systems at no charge and pre-installed on the Sun Netra X4250 and X4270 servers, Oracle Solaris delivers performance, security, scalability, and reliability advantages for scale-out computing environments. Underlying technologies (such as a high performance networking stack, advanced file system, and modern memory model) combine to optimize application performance. A suite of security features previously only found in the military-grade Oracle Trusted Solaris operating system are included in Oracle Solaris 10 to fortify the commercial enterprise. Oracle Solaris 10 supports near linear scalability from 1 to 72 CPUs and addressability of up to 264 bytes of memory, which is well beyond the physical memory limits of even the largest Sun server. In addition, by providing the ability to automatically recover from hardware faults, Oracle Solaris optimizes data and application availability.

One of the most advanced operating systems on the planet, Oracle Solaris includes features not found in any other operating system, including:

- *Oracle Solaris DTrace* is a powerful tool that provides a true, system-level view of application and kernel activities, even those running in a Java Virtual Machine. System administrators, integrators, and developers can use this dynamic instrumentation tool to reduce the time to diagnose problems from days and weeks to minutes and hours, accelerating problem resolution.
- *Oracle Solaris Containers* technology provides a break-through approach to virtualization and software partitioning, supporting the creation of many private execution environments within a single instance of Oracle Solaris. Using this technology, organizations can improve resource utilization, reduce downtime, and lower solution costs.
- *Oracle Solaris Predictive Self Healing* technology automatically diagnoses, isolates, and recovers from many hardware and application faults. As a result, business-critical applications and essential system services can often continue uninterrupted in the event of software failures, major hardware component breakdowns, and software misconfiguration problems.
- *Resource management* facilities built into Oracle Solaris 10 enable computing resources to be allocated among individual tasks and users in a structured, policy-driven fashion. By using these facilities to proactively allocate, control, and monitor system resources (such as CPU time, processes, virtual memory, connect time, or logins) on a fine-grained basis, organizations can often reach and maintain more predictable service levels.

Linux Environments

Organizations that seek broad x86 platform support and open source community resources commonly rely on Linux operating environments. Oracle offers and supports leading Linux environments on Sun Netra and Sun x64 servers, including Oracle Enterprise Linux, Red Hat Enterprise Linux, and SUSE

Linux Enterprise Server. Support contracts for Linux provide front-line support and transparent access to back-line support from either Red Hat or SUSE.

As a leader in enterprise services for UNIX, Oracle brings decades of expertise to Linux environments. Indeed, Oracle provides key hardware and software offerings for Linux including Java technology, AMD and Intel x64-based Sun servers and workstations, the Sun Java Enterprise System software stack, and developer tools. Furthermore, Oracle is one of the largest contributors to the GNU/Linux operating system. Areas of contribution include OpenOffice.org, Mozilla, and X.org.

Microsoft Windows Environments

Organizations strive to reduce variety of platforms in the datacenter, even when a wide range of workloads are present. To help this effort, Sun Netra X4250 and X4270 servers can run the Microsoft Windows operating environment. Indeed, these servers have passed Microsoft compatibility test suites, demonstrating Oracle's commitment to providing the best platforms to run not only the Oracle Solaris OS and Linux, but Windows as well.

Oracle VM Server for x86

Oracle offers a family of software technologies that integrate virtualization and management capabilities, simplifying the oversight of physical and virtualized assets across heterogeneous environments. Built on proven technology, Oracle offerings address desktop and server virtualization.

Oracle offers choice and flexibility with server virtualization solutions for both x86/x64 and SPARC architectures. Oracle VM Server for x86 is a high efficiency, open source hypervisor based on technology from the Xen community for hosting multiple operating systems. Oracle VM Server for SPARC (previously called Sun Logical Domains) uses a hypervisor that allows administrators to allocate resources to different domains each running a separate operating environment instance. Sun servers running Oracle Solaris can also use built-in Oracle Solaris Containers technology to allocate system resources and isolate applications to different execution zones. In addition, to efficiently provision and control virtualized environments, Oracle Enterprise Manager Ops Center is a highly scalable automation tool that simplifies discovery, provisioning, and update of physical and virtualized assets in cross-platform environments. It allows:

- Better datacenter consolidation and resource management
- Updates of guest operating systems and monitoring of virtual assets on a network
- Automated provisioning and updating of Linux and Oracle Solaris instances to increase availability and utilization, and to minimize downtime
- More effective deployment, management, and monitoring of security and compliance in IT operations, either locally or remotely

For more details about Oracle's virtualization solutions for Sun servers, see www.oracle.com/us/technologies/virtualization/index.htm.

Conclusion

Telecommunications companies face increasing pressure to deliver new services and satisfy escalating resource demands for new applications and users. Sun Netra X4250 and X4270 servers from Oracle offer incredible system density — with robust compute, memory, networking, storage, and I/O expansion in a compact 2U form factor. Leveraging an embedded class of Intel Xeon processor technologies and Oracle's engineering expertise in Sun chassis and systems design, these platforms deliver new levels of performance — and new levels of performance-per-watt — in a ruggedized, rack-mountable chassis. Deploying these servers can create a more agile infrastructure that can scale to meet new business challenges while maintaining a small footprint in terms of space and energy consumption.

Oracle's Sun Netra X4250 and X4270 servers provide expandable, high-capacity resources needed for demanding compute, web infrastructure, database, and server consolidation and virtualization initiatives. These systems are ideal for installations where performance, density, and energy conservation are paramount. Given the speed and efficiency of these servers, companies can easily consolidate workloads and improve utilization — at the same time preserving investments in existing x64 applications.

Oracle offers professional services, training, and integrated support to optimize server implementations and speed time-to-deployment. Experienced Sun server specialists can assist with datacenter capacity planning, and consolidation and virtualization strategies. To experience the density and power of Oracle's Sun Netra X4250 and X4270 servers first-hand, contact your Oracle account representative or visit www.oracle.com/us/products/servers-storage/servers/netra-carrier-grade/index.html.

References

WEB SITES	
Sun Netra Carrier-Grade Servers from Oracle	www.oracle.com/us/products/servers-storage/servers/netra-carrier-grade/
Intel Xeon Processor 5000 Series	www.intel.com/products/processor/xeon5000/

Oracle is committed to developing practices and products that help protect the environment

Oracle's Sun Netra X4250 and X4270 Server Architecture
December 2010

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200
oracle.com

SOFTWARE. HARDWARE. COMPLETE.