



An Oracle White Paper

Oracle's Sun Server X4-2 and Sun Server X4-2L System Architecture

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Introduction

Oracle's Sun Server X4-2 and Sun Server X4-2L systems utilize the latest Intel Xeon processor E5-2600 v2 product family CPUs, enabling 50 percent more processing power than the previous generation of servers¹ while remaining within the same physical and environmental footprint.

With the new Sun Server X4-2, Oracle has designed in the perfect balance between compute power, I/O bandwidth, and memory footprint in one rack unit, making it the best platform for high density, clustered computing in an enterprise cloud environment.

With the new Sun Server X4-2L, Oracle has maximized storage and compute density simultaneously. With over 50 TB of internal storage or over 10 TB of flash and 24 CPU cores in a two rack unit, this server is ideal for compute intensive applications requiring large amounts of direct attached storage and flash.

The two servers also share a similar system board design. In order to maintain a balanced architecture, the storage capabilities have also been significantly enhanced with the introduction of Serial Advanced Technology Attachment (SATA-3) solid-state drives (SSDs) and higher capacity Serial Attached SCSI (Small Computer System Interface) (SAS-2) hard disk drives (HDDs). The new load-reduced dual inline memory modules (DIMMs) in the new server line also provide higher memory performance.

The ability to choose a suitable configuration of processing capacity, memory configuration, and appropriate storage capacity, together with the expandability offered by high-bandwidth PCIe 3.0 connectivity, provide extreme flexibility for hosting a wide variety of applications on the Sun Server X4-2 and Sun Server X4-2L systems.

¹ The Intel Xeon processor E5-2600 v2 product family CPUs support up to 12 CPU cores, compared to the previous-generation Intel Xeon processor E5-2600 product family CPUs, which support up to 8 cores.

Sun Server X4-2

The Sun Server X4-2 has two different base configurations with different disk density and CD/DVD components. It supports up to two Intel Xeon processor E5-2600 v2 product family processors and supports up to 512 GB of memory using 32 GB 1,600 MHz load-reduced DIMMs. The Sun Server X4-2 offers dense I/O for a 1U server with four PCIe 3.0 slots (one internal slot for a SAS-2 HBA and three externally accessible slots for general use), four onboard 10GBase-T ports, and six USB 2.0 ports (four externally accessible and two internal to the system).

In addition to the shared components, the Sun Server X4-2 offers the following two base configurations.

The Sun Server X4-2 system with a DVD drive (Figure 1) supports up to four 2.5-inch SAS-2 HDDs or SATA-3 SSDs along with a DVD drive that supports the following format options:

- DVD-R/RW
- DVD+R/RW
- CD-R/RW
- CD+R/RW



Figure 1. Front view of Sun Server X4-2 with four 2.5-inch drives and DVD drive.

The Sun Server X4-2 with eight 2.5-inch drive bays supports up to eight SAS-2 HDDs or SATA-3 SSDs (Figure 2).



Figure 2. Front view of Sun Server X4-2 with eight 2.5-inch drives.

Sun Server X4-2L

The Sun Server Sun Server X4-2L has three different base configurations with different disk density and CD/DVD components. It supports up to two Intel Xeon processor E5-2600 v2 product family processors and supports up to 512 GB of memory using 32 GB 1,600 MHz load-reduced DIMMs. The Sun Server X4-2L provides robust I/O for a 2U server with six PCIe 3.0 slots, four onboard 10GBase-T ports and six USB 2.0 ports (four externally accessible; two internal to the system).

In addition to the shared components, the Sun Server X4-2L offers the following three base configurations.

The Sun Server X4-2L with a DVD drive (Figure 3) provides eight 2.5-inch drive bays that support up to eight SAS-2 HDDs or SATA-3 SSDs along with a DVD drive that supports the following format options:

- DVD-R/RW
- DVD+R/RW
- CD-R/RW
- CD+R/RW

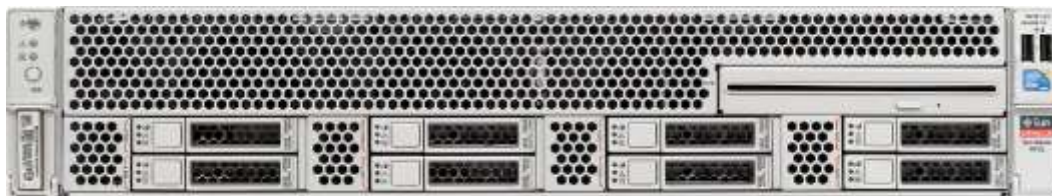


Figure 3. Front view of Sun Server X4-2L with eight 2.5-inch drives and DVD drive.

The Sun Server X4-2L with twenty-four 2.5-inch drive bays supports up to twenty-four SAS-2 HDDs or SATA-3 SSDs (Figure 4). This enclosure also has two rear disk slots for an additional two 2.5-inch SAS-2 HDDs or SATA-3 SSDs.



Figure 4. Front view of Sun Server X4-2L with twenty-four 2.5-inch drives.

The Sun Server X4-2L with twelve 3.5-inch drive bays supports up to twelve SAS-2 HDDs or SATA3 SSDs (Figure 5). This enclosure also has two rear disk slots for an additional two 2.5-inch SAS-2 HDDs or SATA-3 SSDs.

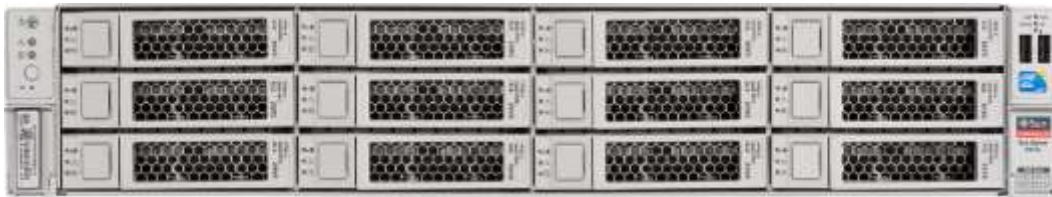


Figure 5. Front view of Sun Server X4-2L with twelve 3.5-inch drives.

Comparing the Sun Server X4-2 and Sun Server X4-2L

The Sun Server X4-2 and Sun Server X4-2L systems leverage earlier chassis design work to further improve system effectiveness by delivering improved operational efficiencies and optimized data center value, while packaging the latest Intel Xeon processors.

The five models are described in Table 1A and Table 1B. Table 1A compares the two different Sun Server X4-2 base chassis configurations and Table 1B compares the three different Sun Server X4-2L base chassis configurations.

TABLE 1A. SUN SERVER X4-2 COMPARISONS

FEATURE	SUN SERVER X4-2, 4X 2.5-IN. DISK + DVD	SUN SERVER X4-2, 8X 2.5-IN. DISK
Chassis	1U	
Number of CPU sockets	Up to 2, 12 cores each	
Supported processor type	Intel Xeon processor E5-2600 v2 product family	
Processor system interconnect	Intel QuickPath Interconnect	
Number of memory slots	16	
Memory capacity	Up to 512 GB (using 32 GB, ECC, 1,600 MHz, load-reduced DIMMs)	
Memory type	DDR3 low-voltage or load-reduced registered DIMMs	
Memory options	8 GB DDR3-1,600 low-voltage DIMMs 16 GB DDR3-1,600 low-voltage DIMMs 32 GB DDR3-1,600 load-reduced DIMMs	
Internal storage: cage options	Up to four 2.5-in. SAS-2 HDDs or SATA-3 SSDs (HBA required)	Up to eight 2.5-in. SAS-2 HDDs or SATA-3 SSDs (HBA required)
DVD Drive	Yes	No
Number of PCIe 3.0 slots	4 total: 1 x16 external, 3 x8 (2 external, 1 internal)	
Number of 10GBase-T ports	4 onboard	
Number of USB ports	2 front, 2 rear, 2 internal	
System management	Onboard Oracle Integrated Lights Out Manager (Oracle ILOM) service processor Side-band management via any onboard 10GBase-T port or through the dedicated 10/100 Base-T Ethernet system management port Oracle System Assistant Oracle Enterprise Manager Ops Center	
RAS components	Hot-swappable and redundant power supplies, fans, disk drives RAID 0, 1, 10, 5, 6, 50, and 60 provided via SAS-2 RAID with 512 MB onboard DDR2 memory	
OS support ² (Base Versions)	Oracle Solaris10 01/13 U11; Oracle Solaris 11 U1; Oracle Linux 5.9, 6.3, and 6.4; Oracle VM 3.2; Red Hat Enterprise Linux 5.9 and 6.4; SUSE Linux Enterprise Server 11 SP2; Microsoft Windows Server 2008 SP2 64bit; Microsoft Windows Server 2008 R2 SP1; Windows Server 2012; and VMware ESXi 5.1 U1 and 5.0 U2	

² Please refer to <http://www.oracle.com> for the most up-to-date information on supported versions of operating systems for each platform.

TABLE 1B. SUN SERVER X4-2L COMPARISONS

FEATURE	SUN SERVER X4-2L, 8X 2.5-IN. DISK PLUS DVD	SUN SERVER X4-2L, 24X 2.5-IN. DISK	SUN SERVER X4-2L, 12X 3.5-IN. DISK
Chassis	2U		
Number of CPU sockets	Up to 2		
Supported processor type	Intel Xeon processor E5-2600 v2 product family		
Processor system interconnect	Intel QuickPath Interconnect		
Number of memory slots	16		
Memory capacity	Up to 512 GB (using 32 GB, ECC, 1,600 MHz, load-reduced DIMMs)		
Memory type	DDR3 low-voltage or load-reduced registered DIMMs		
Memory options	8 GB DDR3-1,600 low-voltage DIMMs 16 GB DDR3-1,600 low-voltage DIMMs 32 GB DDR3-1,600 load-reduced DIMMs		
Internal storage: cage options	Up to eight 2.5-in. SAS-2 HDDs or SATA-3 SSDs (HBA required)	Up to twenty-four 2.5-in. SAS-2 HDDs or SATA-3 SSDs (HBA required) Rear disk cage for two 2.5-in. SAS-2 HDDs or SATA-3 SSDs	Up to twelve 3.5-in. SAS-2 HDDs (HBA required) Rear disk cage for two 2.5-in. SAS-2 HDDs or SATA-3 SSDs
DVD-ROM Drive	Yes	No	No
Number of PCIe 3.0 slots	6 total: 1 x16 and 5 x8 external		
Number of 10GBase-T ports	4 onboard		
Number of USB ports	2 front, 2 rear, 2 internal		
System management	Onboard Oracle iLOM service processor Side-band management via any onboard 10GBase-T port or through the dedicated 10/100 Base-T Ethernet system management port Oracle System Assistant Oracle Enterprise Manager Ops Center		

TABLE 1B. SUN SERVER X4-2L COMPARISONS

FEATURE	SUN SERVER X4-2L, 8X 2.5-IN. DISK PLUS DVD	SUN SERVER X4-2L, 24X 2.5-IN. DISK	SUN SERVER X4-2L, 12X 3.5-IN. DISK
RAS components	Hot-swappable and redundant power supplies, fans, disk drives RAID 0, 1, 10, 5, 6, 50, and 60 provided via SAS-2 RAID HBA with 512 MB onboard DDR2 memory		
OS support ³ (Base Versions)	Oracle Solaris10 01/13 U11; Oracle Solaris 11 U1; Oracle Linux 5.9, 6.3, and 6.4; Oracle VM 3.2; Red Hat Enterprise Linux 5.9 and 6.4; SUSE Linux Enterprise Server 11 SP2; Microsoft Windows Server 2008 SP2 64bit; Microsoft Windows Server 2008 R2 SP1; Windows Server 2012; and VMware ESXi 5.1 U1 and 5.0 U2		

As Tables 1A and 1B show, the systems share numerous features, including the following:

- Two Intel Xeon processor E5-2600 v2 product family processors
- Integrated memory controller supporting up to 1,600 MHz registered DDR3 memory modules (memory is organized in four channels per processor with two DIMMs per channel)
- Multiple point-to-point Intel QuickPath Technology–based interconnects
- Intel Turbo Boost Technology mode and Hyper-Threading Technology capabilities, depending on the CPU model
- Intel C602J chipset
- Large-capacity internal storage, including support for SSDs and HDDs
- Intel Integrated I/O for PCIe 3.0 connectivity directly to the processor die
- PCIe 3.0 expandability
- Built-in quad 10GBase-T support
- An onboard Oracle ILOM service processor for system management
- Enterprise-class reliability, availability, and serviceability (RAS) features, including redundant, hot-swappable power supplies, fans, and drives
- Support for multiple operating systems

³ Please refer to <http://www.oracle.com> for the most up-to-date information on supported versions of operating systems for each platform.

Choice of Operating Systems and Virtualization Environments

To optimize flexibility and investment protection, the Sun Server X4-2 and Sun Server X4-2L support a choice of operating systems³, including the following:

- Oracle Solaris
- Oracle Linux
- Red Hat Enterprise Linux
- SUSE Linux Enterprise Server
- Microsoft Windows Server

The systems also support virtualization using Oracle VM or VMware ESXi.

The Intel Xeon Processor E5-2600 v2 Product Family Advantage

Oracle has worked closely with Intel Corporation to bring to market a broad server family based on the latest Intel Xeon processor technology. In the Sun Server X4-2 and Sun Server X4-2L, systems engineering expertise combines with processor design proficiency to emphasize performance, quality, reliability, and eco-responsibility. Engineers have optimized system performance and availability under Oracle operating systems.

The Sun Server X4-2 and Sun Server X4-2L incorporate Intel Xeon processor E5-2600 v2 product family processors, which incorporate 50 percent more cores (Figure 6), while remaining within the same power profile as the prior generation of servers.

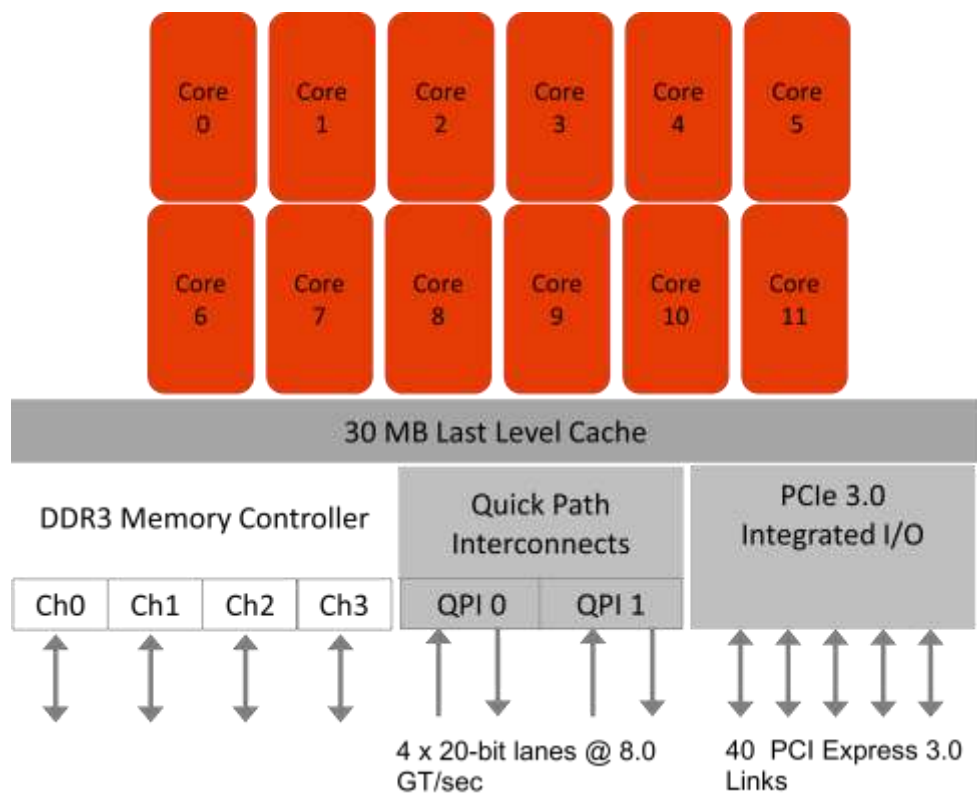


Figure 6. The new Intel Xeon processor E5-2600 v2 product family offers 50 percent more cores

The Sun Server X4-2 and Sun Server X4-2L are available with CPUs that feature four, six, eight, ten or twelve cores, up to 30 MB of shared last-level cache, as well as Intel Turbo Boost Technology and Hyper-Threading (HT) Technology.

For more information on the latest Intel Xeon processor E5-2600 v2 product family CPUs, please visit Intel's website at <http://www.intel.com>

Architecture of the Sun Server X4-2 and Sun Server X4-2L

The Sun Server X4-2 and Sun Server X4-2L are designed to provide best-in-class performance along with unprecedented expandability and low power consumption. This section details physical and architectural aspects of the systems, highlighting similarities and differences among the server designs.

System-Level Architecture: Sun Server X4-2 with Eight 2.5-Inch Disks

The following system-level block diagram aids understanding of the architecture of the Sun Server X4-2 systems with eight 2.5-inch disks (Figure 8).

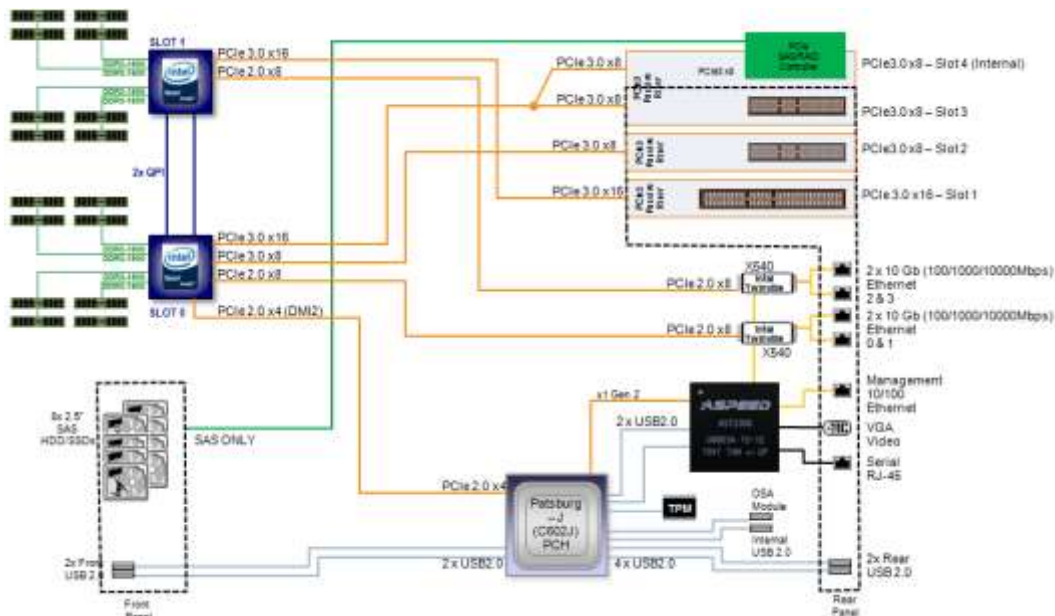


Figure 8. This block diagram depicts the Sun Server X4-2 systems with eight 2.5-inch disks, including the required SAS-2 HBA on internal PCIe slot 4.

Figure 8 depicts the standard configuration with a required SAS-2 HBA card that supports eight internal SAS-2 HDDs or SATA-3 SSDs. System management service processor and USB connectivity are controlled by the Intel C602J I/O controller.

Overview of Sun Server X4-2 with Eight 2.5-Inch Disks

The Sun Server X4-2 systems with eight 2.5-inch disks include eight internal SAS-2 HDDs or SATA-3 SSDs in addition to the shared components of the Sun Server X4-2.

Overview of the Sun Server X4-2 Enclosure

The Sun Server X4-2 system's enclosure is designed to occupy 1U in a standard 19-inch rack. Table 2 provides system dimensions and weight.

TABLE 2. SUN SERVER X4-2 SYSTEM DIMENSIONS AND WEIGHT

DIMENSION	UNITED STATES	INTERNATIONAL
Height	1.7 in. (1U)	42.6 mm
Width	17.2 in.	436.5 mm
Depth	29.0 in.	736.6 mm
Weight	40.0 lb. maximum	18.0 kg

Sun Server X4-2 Rear Perspectives

The three Sun Server X4-2 system configurations share the same rear panel. Figure 9 shows the rear view of the Sun Server X4-2.

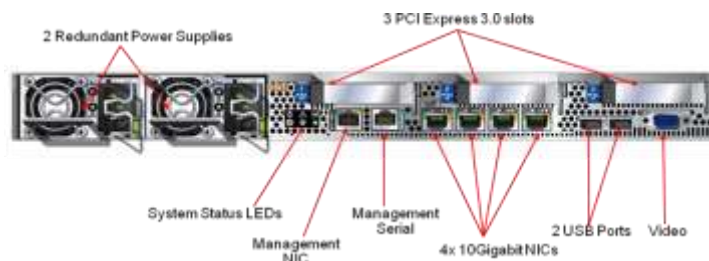


Figure 9. The rear view of the Sun Server X4-2 systems showing the server's external features and connections.

The external rear features and connections include the following:

- Rear status indicator lights, which report Locator (white), Service Required (amber), and Activity Status (green) for the system and components
- Two USB ports
- Two power supply units (for N+1 redundancy) with integrated fans, with each power supply having a single, independent AC plug
- Rear power-supply indicator lights, showing the status of each hot-swappable power supply
- Four onboard 100/1000/10000 Base-T ports
- Three external PCIe 3.0 I/O slots, in which low-profile cards can be installed from the rear panel

- Two management ports (one 10/100 Base-T port, one RJ45 serial port) for default connections to the service processor, with any one of the four onboard Ethernet ports also being configurable as a shared system management port
- VGA video port with an analog HD-15 VGA connector on the rear panel

Sun Server X4-2 Front Perspectives

The Sun Server X4-2 systems have two different storage configurations; this requires two different front disk cages.

Figure 10 shows the front view of the Sun Server X4-2 systems with four 2.5-inch disks and DVD+/-RW.

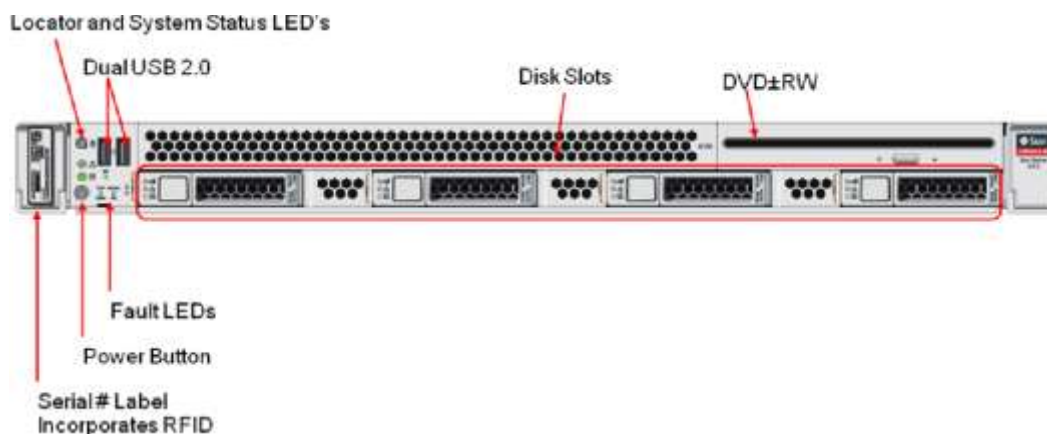


Figure 10. The front view of the Sun Server X4-2 system with four 2.5-inch disks and DVD showing the server's external drive, DVD, and connection features.

The front external features and connections include the following:

- Status indicator lights, which report Locator (white), Service Required (amber), and Activity Status (green) for the system and components
- Four 2.5-inch SAS-2 HDDs or SATA-3 SSDs (required SAS-2 HBA) with all HDD and SSD devices inserted through the front panel
- One slim-line SATA DVD+/-RW
- Two USB ports

Figure 11 shows the front view of the Sun Server X4-2 systems with eight 2.5-inch disks.

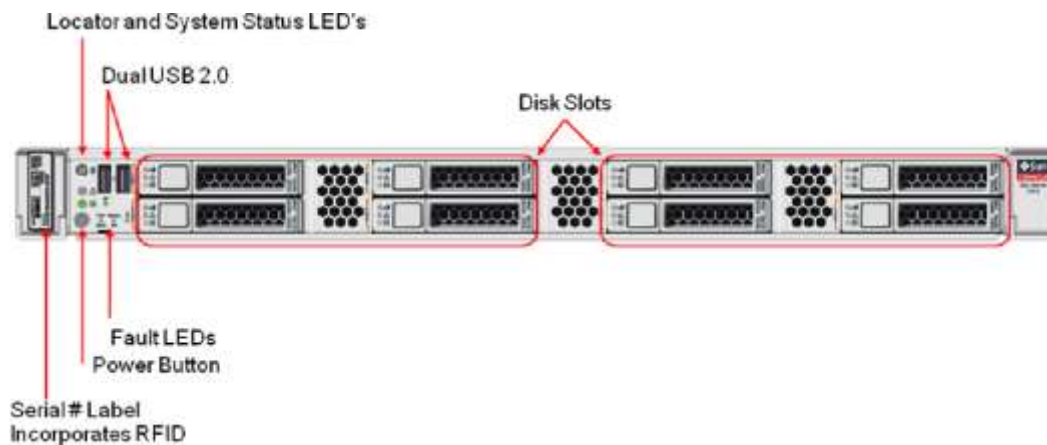


Figure 11. The front view of the Sun Server X4-2 systems with eight 2.5-inch disks shows the server's external drive and connection features.

The front external features and connections include the following:

- Status indicator lights, which report Locator (white), Service required (amber), and Activity Status (green) for the system and components
- Eight 2.5-inch SAS-2 HDDs or SATA-3 SSDs (required SAS-2 HBA) with all HDD and SSD devices inserted through the front panel
- Two USB ports

System-Level Architecture: Sun Server X4-2L with Eight 2.5-Inch Disks and DVD

The following system-level block diagram aids understanding of the architecture of the Sun Server X4-2L system with eight 2.5-inch disks and DVD+/-RW (Figure 12).

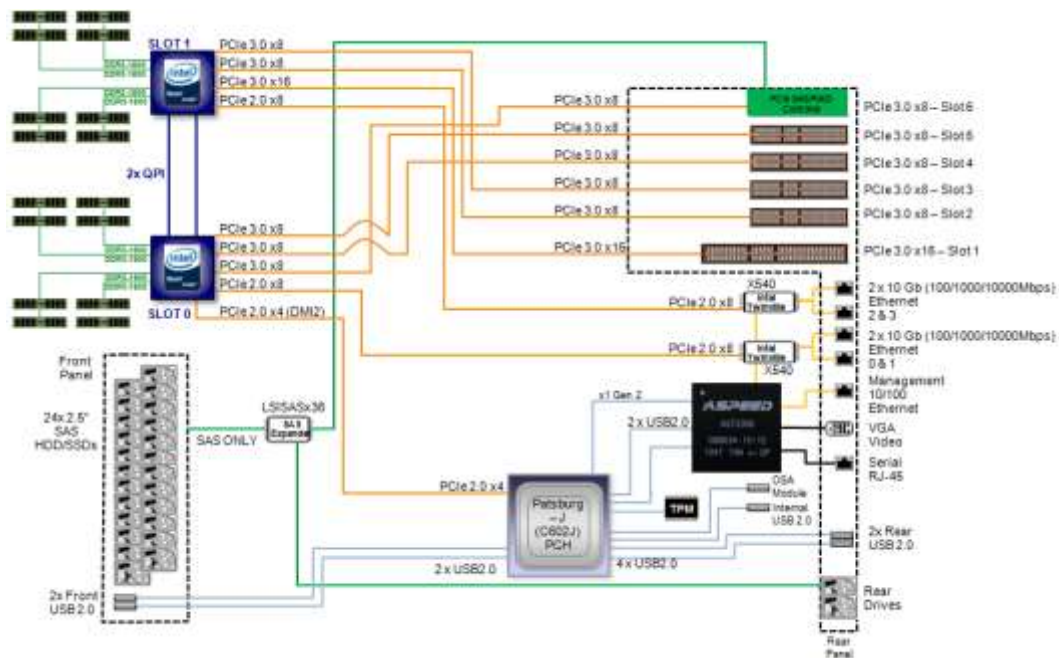


Figure 13. This block diagram depicts the Sun Server X4-2L system with twenty-four 2.5-inch disks, including the required SAS-2 HBA on PCIe slot 6.

Figure 13 depicts the standard configuration with a required SAS-2 HBA card that supports 24 internal SAS-2 HDDs or SATA-3 SSDs and two rear-accessible 2.5-inch SAS-2 HDDs or SATA SSDs. System management service processor and USB connectivity is controlled by the Intel C602I I/O controller.

Overview of Sun Server X4-2L with Twenty-Four 2.5-Inch Disks

The Sun Server X4-2L system with twenty-four 2.5-inch disks includes the following major components in addition to the shared components of the Sun Server X4-2L:

- Twenty-four internal 2.5-inch SAS-2 HDDs or up to twenty-four SATA-3 SSDs
- Two rear-accessible 2.5-inch SAS-2 HDDs or SATA-3 SSDs

System-Level Architecture: Sun Server X4-2L with Twelve 3.5-Inch Disks

The following system-level block diagram aids understanding of the architecture of the Sun Server X4-2L system with twelve 3.5-inch disks (Figure 14).

TABLE 3. SUN SERVER X4-2L SYSTEM DIMENSIONS AND WEIGHT

DIMENSION	UNITED STATES	INTERNATIONAL
Height	3.45 in. (2U)	87.6 mm
Width	17.5 in.	445.0 mm
Depth	29.0 in.	737.0 mm
Weight	63 lb. maximum	28.5 kg

Sun Server X4-2L Rear Perspective

The three Sun Server X4-2L system configurations share the same rear panel. Figure 15 shows the rear view of the Sun Server X4-2L.

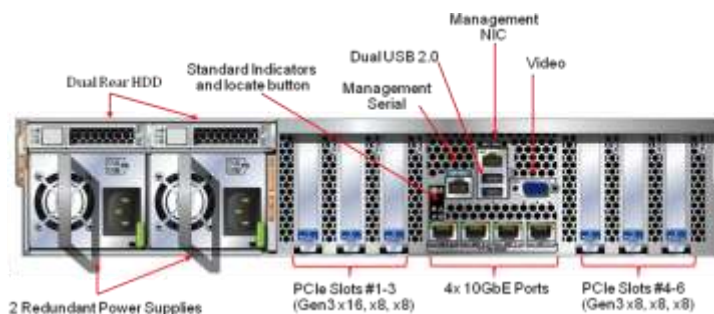


Figure 15. The rear view of the Sun Server X4-2L system shows the server's external features and connections.

The external rear features and connections include the following:

- Rear status indicator lights, which report Locator (white), Service Required (amber), and Activity Status (green) for the system and components
- Two rear-accessible 2.5-inch SAS-2 HDDs or SATA-3 SSDs available only on the 24x 2.5-inch disk and 12x 3.5-inch disk cage configurations
- Two USB ports
- Two power supply units (for N+1 redundancy) with integrated fans, with each power supply having a single, independent AC plug

- Rear power-supply indicator lights, showing the status of each hot-swappable power supply
- Four onboard 100/1000/10000 Base-T ports
- Six PCIe 3.0 slots, in which low-profile cards can be installed from the rear panel
- Two management ports (one 10/100 Base-T port, one RJ45 serial port) for default connections to the service processor, with any one of the four onboard Ethernet ports also being configurable as a shared system management port
- VGA video port with analog HD-15 VGA connector on the rear panel

Sun Server X4-2L Front Perspectives

The Sun Server X4-2L system has three different storage configurations; this requires three different front disk cages.

Figure 16 shows the front view of the Sun Server X4-2L system with eight 2.5-inch disks and DVD+/-RW.

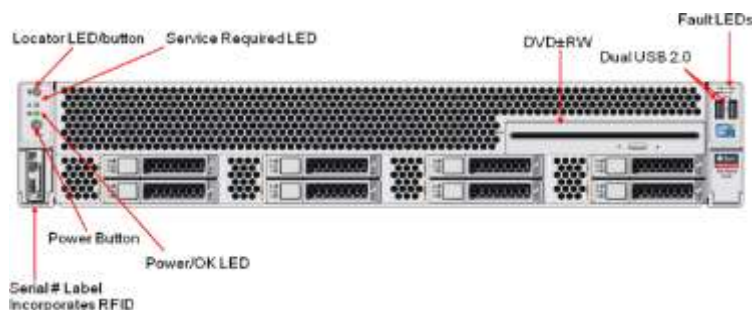


Figure 16. The front view of the Sun Server X4-2L system with eight 2.5-inch disks and DVD showing the server's external drive, DVD, and connection features.

The front external features and connections include the following:

- Status indicator lights, which report Locator (white), Service Required (amber), and Activity Status (green) for the system and components
- Eight 2.5-inch SAS-2 HDDs or SATA-3 SSDs (required SAS-2 HBA) with all HDD and SSD devices inserted through the front panel
- One slim-line SATA DVD+/-RW
- Two USB ports

Figure 17 shows the front view of the Sun Server X4-2L system with twenty-four 2.5-inch disks.

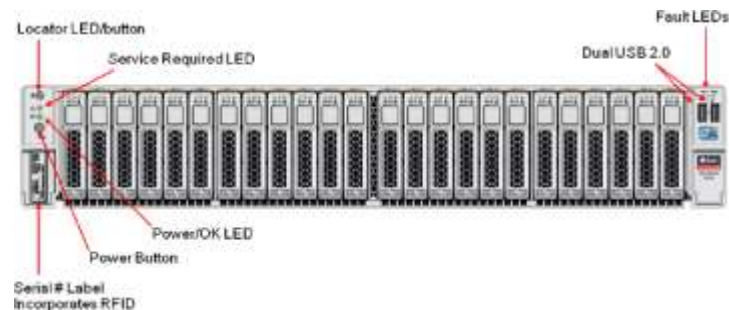


Figure 17. The front view of the Sun Server X4-2L system with twenty-four 2.5-inch disks shows the server's external drive and connection features.

The front external features and connections include the following:

- Status indicator lights, which report Locator (white), Service required (amber), and Activity Status (green) for the system and components
- Twenty-four 2.5-inch SAS-2 HDDs or SATA-3 SSDs (required SAS-2 HBA) with all HDD and SSD devices inserted through the front panel
- Two USB ports

Figure 18 shows the front view of the Sun Server X4-2L system with twelve 3.5-inch disks.

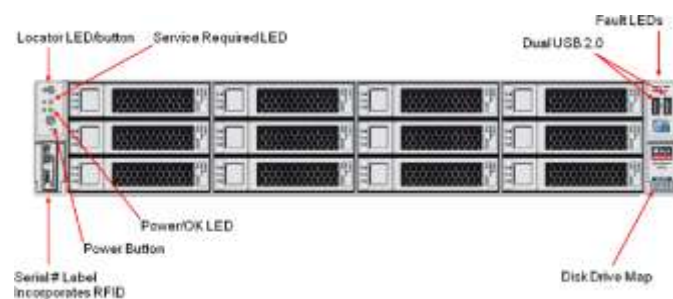


Figure 18. The front view of the Sun Server X4-2L system with four 3.5-inch disks shows the server's external drive and connection features.

The front external features and connections include the following:

- Status indicator lights, which report Locator (white), Service Required (amber), and Activity Status (green) for the system and components

- Twelve 3.5-inch SAS-2 HDDs (required SAS-2 HBA) with all HDD devices inserted through the front panel

Memory Subsystem

The integrated memory controller and multiple DDR3 memory channels per processor help provide high bandwidth for memory-intensive applications. Both Sun Server X4-2 and X4-2L systems can be populated with DDR3 registered ECC low-voltage DIMM modules in 8 GB and 16 GB capacities, or with DDR3 load-reduced ECC DIMM modules in 32 GB capacities.

When configuring system memory, it's important to note that DIMMs might run at speeds slower than their individually rated speeds, depending on the CPU type, the number of DIMMs per channel, and the type of memory (speed, rank, and so on). The speed at which memory is actually running is set by system BIOS at startup, and all memory channels will run at the fastest common frequency.

Memory Population Guidelines

Each processor features four memory channels, each of which supports two DIMM slots, enabling as many as 16 RDIMMs or LRDIMMs 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.

First fill all blue sockets in the following order:

- D0 first on P0, then on P1
- D2 first on P0, then on P1
- D5 first on P0, then on P1
- D7 first on P0, then on P1

Then fill the white sockets in the following order:

- D1 first on P0, then on P1
- D3 first on P0, then on P1
- D4 first on P0, then on P1
- D6 first on P0, then on P1

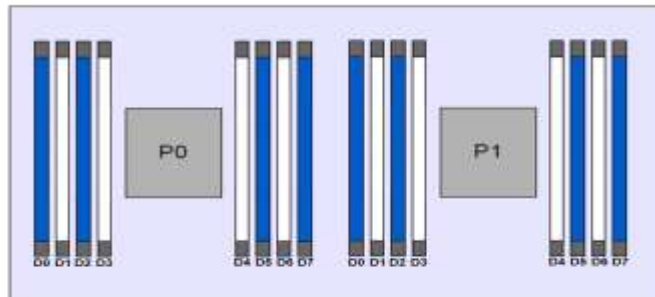


Figure 19 Memory Population Guideline

As a general rule for optimizing memory performance, DIMMs should be populated in sets of two, one per channel per CPU, starting with the slot farthest from the CPU socket (in slot 0, the blue slot). The blue slots should be filled first, followed by the white slots, starting with slot 0 of processor 0 and then slot 0 of processor 1. Ideally, each channel should be populated with equal-capacity DIMMs and (if possible) with the same number of identical DIMMs (which helps make

memory performance more consistent). In general, it is better to first populate quad-rank (QR) DIMMs, which would be furthest from the processor, followed by dual-rank (DR) DIMMs and/or single-rank (SR) DIMMs.⁴ Moreover, RDIMMs and LRDIMMs cannot be mixed in the same system.

Optimizing Memory for Bandwidth

Configurations with optimal memory bandwidth can be achieved with the performance class of Intel Xeon processor E5-2600 v2 product family processors and memory components that run at 1,600 MHz. To optimize a configuration for bandwidth, users can populate one or two DDR3 1,600 MHz low-voltage or load-reduced DIMMs per channel.

I/O Subsystem

With built-in headroom to expand systems and scale applications, the Sun Server X4-2 and Sun Server X4-2L feature expandability through a PCIe 3.0 expansion bus, internal storage options, four onboard Intel 10GBase-T network interface controllers (NICs), and integrated USB capabilities.

As shown in the block diagrams for the systems, the Intel C602J I/O controller provides connectivity for system USB ports, the internal USB port, and the SATA DVD/RW device. Two USB ports go from the C602J to the rear panel, two USB links are routed to the internal USB port, and two additional USB ports are routed from the C602J to the front panel.

The C602J also includes a SATA interface to connect the internal SATA DVD/RW drive on the Sun Server X4-2 and Sun Server X4-2L.

System Network Interfaces

Each Intel Xeon processor E5-2600 v2 product family processor has eight PCIe 3.0 lanes that interface with an Intel X540 10GBase-T (Twinville) controller. Each controller supports two onboard 100/1,000/10,000 Base-T ports. Multiple onboard 10GBase-T connections promote flexibility and enable configurations that support network interface failover.

The four onboard 10GBase-T ports are numbered in sequence from right to left on the rear panel. Each port auto-negotiates its link connection speed, and LEDs above the port indicate the speed of the established link. The Ethernet interfaces also support PXE boot for booting over the network.

⁴ *Rank* refers to the number of memory chips a DIMM module has connected on any given data line.

The Sun Server X4-2 and Sun Server X4-2L feature the ability to configure any one of the four onboard 10GBase-T ports for “side-band” management (the Oracle ILOM Service Processor and System Management section provides more information). When configured as a management port, one of the onboard Ethernet interfaces has two MAC addresses and requires two IP addresses (one for data and one for management). In this configuration, the two IP addresses need to be on the same subnet.

Just like the AST2300 service processor on the motherboard, the two Intel X540 10GBase-T controllers are powered from a “standby” power source from the system power supplies. Even when power to the server is turned off, the side-band management interface remains active to enable remote management.

PCIe 3.0 Expansion Bus

The Sun Server X4-2 and Sun Server X4-2L include PCIe 3.0 expansion slots that can accommodate low-profile cards rated at 25 watt maximum.

On the Sun Server X4-2 systems, three right-angle risers plug directly into the motherboard to enable PCI 3.0 expansion. The first two PCIe slots use single-slot 1U risers, but the riser used in PCIe slot 3 is a dual-slot 1U riser allowing external access to the upper PCIe port (PCIe port 3) and internal-only access to the lower PCIe port (PCIe port 4) on the riser. PCIe port 4 is reserved for the internal SAS-2 storage HBA in system configurations where local disks are used.

On the Sun Server X4-2L systems, no risers are used, and PCIe cards are installed vertically. PCIe slot 6 is reserved for the internal SAS-2 storage HBA in system configurations where local disks are used. Cards can be compliant with Revision 1.0a, 2.0, or 3.0 of the PCIe Card Electromechanical Specification.

On the Sun Server X4-2 systems, the PCIe 3.0 slots are numbered left to right with slots 3 and 4 using the same riser card, but only slot 3 is externally accessible. Slot 1 uses one x16 mechanical riser and has 16 electrical lanes to CPU 1. Slot 2 uses one x16 mechanical riser but with only eight electrical lanes. Slot 3 uses the dual-slot riser for PCIe ports 3 and 4. The dual-slot riser is x16 mechanical/electrical but is split for the two PCIe ports to x8 mechanical/electrical. Slots 2 and 3 have electrical lanes to CPU 0. The risers are keyed to insert correctly into the motherboard.

The six slots on the Sun Server X4-2L system models are numbered left to right across the bottom (slots 1 to 3) and then left to right across the top of the rear panel (slots 4 to 5). See Figure 15, which shows the rear panel of the Sun Server X4-2L system. Unlike the Sun Server X4-2, no risers are used in the Sun Server X4-2L system models. The PCIe cards are inserted directly on the system board.

Integrated Storage

The Sun Server X4-2 and Sun Server X4-2L systems offer large internal storage capacities for SAS-2 HDDs and can also accommodate SATA-3 SSDs. The servers differ, however, in the number and type of internal storage devices supported. Table 4A and Table 4B summarize the differences.

TABLE 4A. STORAGE CHARACTERISTICS OF THE SUN SERVER X4-2 SYSTEM MODELS

	SUN SERVER X4-2, 4X 2.5-IN. DISK PLUS DVD	SUN SERVER X4-2, 8X 2.5-IN. DISK
Number of device slots	4	8
Device form factor	2.5 in. drive	2.5 in. drive
Maximum number of internal SAS HDDs	4 300 GB 10K RPM (2.5 in.) 600 GB 10K RPM (2.5 in.) 1.2 TB 10K RPM (2.5 in.)	8 300 GB 10K RPM (2.5 in.) 600 GB 10K RPM (2.5 in.) 1.2 TB 10K RPM (2.5 in.)
Maximum number of internal SATA-3 SSDs	4 400 GB eMLC SSD (2.5 in.)	8 400 GB eMLC SSD (2.5 in.)

TABLE 4B. STORAGE CHARACTERISTICS OF THE SUN SERVER X4-2L SYSTEM MODELS

	SUN SERVER X4-2L, 8X 2.5-IN. DISK PLUS DVD	SUN SERVER X4-2L, 24X 2.5-IN. DISK	SUN SERVER X4-2L, 12X 3.5-IN. DISK
Number of front device slots	8	24	12
Device form factor	2.5 in. drive	2.5 in. drive front 2.5 in. rear	3.5 in. drive front 2.5 in. rear
Maximum number of internal SAS HDDs	8 300 GB 10K RPM (2.5 in.) 600 GB 10K RPM (2.5 in.) 1.2 TB 10K RPM (2.5 in.)	26 (24 front + 2 rear) 300 GB 10K RPM (2.5 in.) 600 GB 10K RPM (2.5 in.) 1.2 TB 10K RPM (2.5 in.)	14 (12 front + 2 rear) 4 TB 7.2K RPM (3.5-in.) 300 GB 10K RPM (2.5 in.) 600 GB 10K RPM (2.5 in.) 1.2 TB 10K RPM (2.5 in.)

Maximum number of internal SATA-3 SSDs	8	26 (24 front + 2 rear)	2 (rear)
	400 GB eMLC SSD (2.5 in.)	400 GB eMLC SSD (2.5 in.)	400 GB eMLC SSD (2.5 in.)

A PCIe SAS-2 RAID HBA card is required in all configurations to support internal storage options and to implement RAID. Internal mixing of SATA and SAS devices is supported (but not within a RAID volume).

Available Devices

The following devices are available for the Sun Server X4-2 and Sun Server X4-2L:

- SAS HDDs:
 - 2.5-inch SAS-2 disks: 300 GB 10K RPM, 600 GB 10K RPM, and 1.2 TB 10K RPM
 - 3.5-inch SAS-2 disks: 4 TB 7.2K RPM
- SATA SSDs:
 - 2.5-inch eMLC SFF SATA-3 SSDs: 400 GB

Disk Controller and I/O RAID Options

The Sun Server X4-2 and Sun Server X4-2L support the following options for disk controllers:

- **Sun Storage 6 Gb SAS-2 PCIe HBA.** This low-profile SAS HBA card has two four-port SFF-8087 connectors and enables hardware RAID levels 0, 1, or 10. The card is available in two versions: one with internal connectors and one with external connectors.
- **Sun Storage 6 Gb SAS-2 PCIe RAID HBA.** This RAID HBA is an eight-channel, low-profile card with two four-port SFF-8087 connectors, and it supports 6 Gb/sec SAS-2 and hardware RAID levels 0, 1, 5, 6, 10, 50, and 60. The card is available in two versions: one with internal connectors and one with external connectors. This HBA includes 512 MB of DDR2 onboard memory and a battery-backed write cache for 48-hour backup, which helps deliver protected, high-availability storage.

Two cables, each with four lanes (at 6 Gb/sec), are wired from the SAS adapter to the disk backplane to control the internal HDD and SSD drives and provide high bandwidth. For the Sun Server X4-2, the four SAS links from the HBA connect directly to the SAS/SATA devices. This is also true for the Sun Server X4-2L with eight 2.5-inch drives. For the Sun Server X4-2L twelve and twenty-four disk configurations, the four SAS links connect to the SAS expander, which provides connections to individual disks in the drive cage.

Power Supplies

Engineered for high availability as well as low energy consumption, the Sun Server X4-2 and Sun Server X4-2L are configured with two highly efficient (91 percent efficiency standard), redundant, hot-swappable AC PSUs, each with separate power cords. The second power supply in the systems enables N+1 redundancy, supplying continuous power to the systems if a single power supply fails.

The PSUs differ between systems, with the Sun Server X4-2 systems using 600 W PSUs and the Sun Server X4-2L systems requiring 1,000 W PSUs.

TABLE 5. POWER SUPPLY UNIT COMPARISON

SYSTEM	MAXIMUM OUTPUT POWER	MAXIMUM AC INPUT CURRENT	MAXIMUM POWER SUPPLY EFFICIENCY
Sun Server X4-2	600 w	At 100 V AC and 600 W output: 7.2 A	At 600 W (100%) load: 91%
Sun Server X4-2L	1,000 w	At 100 V AC and 1,000 W output: 12.0 A	At 1,000 W (100%) load: 91%

Each PSU features a non-removable internal fan that supplies independent PSU cooling. Three light indicators display power supply status information (AC, Fault, and OK).

Oracle Advanced System Cooling

With an advanced cooling system unique to Oracle, the Sun Server X4-2 and Sun Server X4-2L systems achieve efficiencies which result in power savings and maximum uptime. Oracle Advanced System Cooling utilizes remote temperature sensors for fan speed control, minimizing power consumption while keeping optimal temperatures inside the server. These remote temperature sensors have been designed into key areas of this server to ensure appropriate fan usage in zones which include power supply units, PCIe slots, Ethernet ports, exiting air, entering air, and thermal diodes. Oracle Advanced System Cooling helps reduce energy consumption in a way that other servers cannot.

Rackmounting

The Sun Server X4-2 and Sun Server X4-2L can be mounted in the following racks:

- Third-party ANSI/EIA-310-D-1992 or IEC 60927-compliant racks in a 19 in./482.6 mm panel-width series
- Oracle's Sun Rack II 1042 and Sun Rack 1242

The Sun Server X4-2 and Sun Server X4-2L can be rackmounted in either the Sun Rack II 1042 or the Sun Rack 1242. The Sun Rack 1242 provides added depth to the rack. As a part of their chassis, the Sun Server X4-2 and Sun Server X4-2L feature slide rail release levers. Pulling down on these levers unlocks the rails' sliding mechanism so the chassis can be pulled out of the rack for easier servicing.

The following options are available to simplify rackmounting:

- **Tool-less rack kit.** As the name implies, this rackmounting kit snaps into certain Oracle and third-party racks without requiring the use of any tools.
- **Cable management arm.** The cable management arm supports and protects cables as the server slides in and out of the rack.

The slide rail kit includes hardware for mounting it to rack rails with either 6 mm 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 varies widely, depending on the systems installed, power distribution (in-cabinet or external), the power source (single-phase or three-phase), and whether redundant power is required.

RAS Features

The Sun Server X4-2 and Sun Server X4-2L are engineered for hardware failure prevention, near-continuous operation, fast recovery, and easy serviceability. For these systems, reliability, availability, and serviceability features (commonly referred to as RAS features) include the following:

- **Hot-swappable redundant components.** Mirrored disks, redundant fan modules, and redundant PSUs 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. Fan modules and power supply units can be replaced even if a system has not been completely removed from the rack.
- **A variety of RAID options.** These options enable customers to balance storage capacity, availability, and cost. The LSI-based Sun Storage 6 Gb SAS-2 PCIe HBA with internal connectors supports RAID 0 and 1, and the Sun Storage 6 Gb SAS-2 PCIe RAID HBA supports RAID 0, 1, 10, 5, 50, 6, and 60 and also features a battery-backed disk write cache.
- **Indicator LEDs on the front and back of the chassis.** Easily visible LEDs enable problems to be identified and isolated easily. Diagnostic LEDs are also included on the motherboard to aid in locating a failed component, such as a DIMM or CPU.
- **Oracle ILOM capabilities.** The integrated Oracle ILOM service processor provides powerful tools for local or remote system management, simplifying administrative tasks, reducing the number of onsite personnel needed, and lowering overall operational costs. (The

next section—Oracle ILOM Service Processor and System Management—provides more information on the servers' system management capabilities.)

Oracle ILOM Service Processor and System Management

Like many other Oracle servers, the Sun Server X4-2 and Sun Server X4-2L feature a built-in hardware-based service processor that enables remote server monitoring, system management, and task automation capabilities that are consistent across much of the Oracle server product line.

Oracle ILOM Service Processor

The Sun Server X4-2 and Sun Server X4-2L embed an Aspeed AST2300 chip as the onboard service processor (that is, the baseboard management controller, or BMC). The Aspeed AST2300 combines a graphics controller and a service processor into a single chip, saving space and power. It uses two USB ports for virtual devices and one PCIe x1 link for video to connect to the Intel C602J I/O Controller. (The system block diagrams in the Architecture of the Sun Server X4-2 and Sun Server X4-2L section provide more information.)

The Oracle ILOM service processor provides lights-out management, which can help organizations simplify system management. The service processor runs independently of the host platform, executing a robust, security-hardened operating system.

The capabilities of the Oracle ILOM service processor include the following:

- Full remote keyboard, video, mouse, and storage (RKVMS) access via redirection over IP, eliminating the need for local KVM
- Monitoring and reporting of environmental, power, hardware, BIOS, and operating system events
- Backup and restoration of BIOS configuration
- Remote power control, diagnostics, virtual media attachment and upgrades of the system BIOS and service processor software
- System configuration information retrieval
- User-configurable serial console access through a physical port or redirected over IP
- Java-enabled remote console access across a secure web connection
- Multilevel role-based access with support for RADIUS, LDAP, and Microsoft Active Directory Service lookup of authentication data
- Simple Network Management Protocol (SNMP) v1, v2c, and v3 support

For system management operations, the ASPEED AST2300 uses these connections:

- Two USB ports for virtual devices (both ports are routed directly on the motherboard between the AST2300 and the C602J)
- One SVGA video port for local video output

Management functions provided by the service processor are implemented by Oracle ILOM 3.1 system management software. This software provides an Intelligent Platform Management Interface (IPMI 2.0) baseboard management controller, platform control agents, diagnostics software, and RKVMS functionality. Many other Oracle servers incorporate these features, providing organizations with a single, consistent, and standards-based management interface.

Secure access to the service processor and associated Oracle ILOM software functions takes several forms:

- Intuitive browser-based user interface (BUI) over SSL
- Distributed Management Task Force (DMTF) command-line interface over Secure Shell (SSH)
- Redirection of the platform console, keyboard, mouse, and video to the Oracle ILOM remote console application
- SNMP v3 interfaces, providing easy integration with Oracle Enterprise Manager Ops Center, or third-party applications from companies such as HP and IBM
- IPMI 2.0 command interface for remote management with IPMI-based tools such as IPMITool

Optimizing Management Flexibility

Although system management tools can play an important role in streamlining operations, organizations must consider the best approach for each environment. Executing management software directly on the host (with or without use of a service processor) is known as *in-band management*. Using a dedicated Ethernet or serial port to execute administrative tasks independently of the host is known as *out-of-band management*. Sharing a single 10GBase-T port for host and service processor network connectivity is called *side-band management*, which is enabled in these servers through a connection between the Ethernet controllers and the service processor (Figure 20). Table 6 presents a comparison of these management strategies.

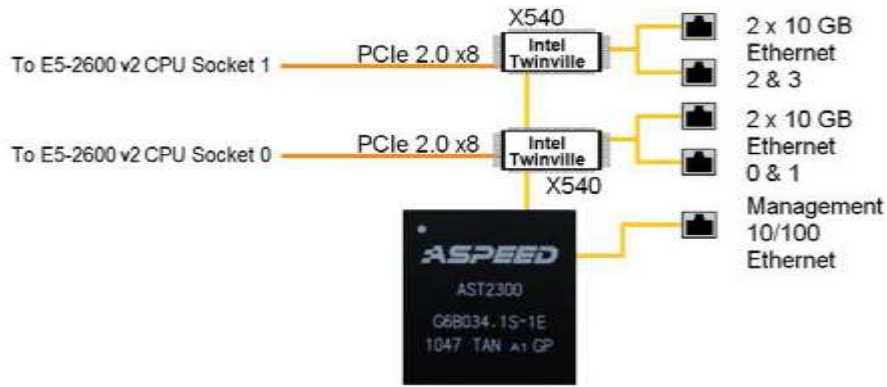


Figure 20. The Oracle ILOM service processor supports side-band management.

TABLE 6. COMPARISON OF IN-BAND, OUT-OF-BAND, AND SIDE-BAND MANAGEMENT

STRATEGY	CHARACTERISTICS	BENEFITS	IDEAL USE CASES
In-band	- It relies on operating system–resident software. - Management tasks utilize platform compute resources.	Use of a single network connection and switch port minimizes cost and complexity.	Heterogeneous environments to provide a common administrative tool across all platforms.
Out-of-band	- It utilizes a dedicated Ethernet or serial port for administrative traffic. - Management tasks execute on an independent service processor.	- It provides continuous access to management capabilities even when the host is disabled. - Management tasks do not consume host resources. - Increased security is a result of physically separating management traffic and server data.	- Environments with compute- or bandwidth-intensive applications. - Projects with complex management requirements or high levels of administrative burden.

Side-band	• The host and service processor share a 10GBase-T port and are each assigned an independent MAC and IP address. • Management tasks execute on an independent service processor.	• It provides continuous access to management capabilities even when the host is disabled. • Management traffic uses part of the server data bandwidth. • It requires only one switch port, lowering implementation costs. • It minimizes processing overhead on the host.	• Cost-sensitive environments.
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The Sun Server X4-2 and Sun Server X4-2L offer extensive flexibility in that they support all three of these strategies—in-band, out-of-band, and side-band management. Organizations can choose a single management method or use in-band management in tandem with out-of-band or side-band management approaches.

The Sun Server X4-2 and Sun Server X4-2L provide out-of-band management across a dedicated 10/100 Mbps Ethernet port or an RS-232 serial port on the Oracle ILOM service processor. Side-band management is supported over one of the four 10GBase-T interfaces shared between the host and the service processor. With a side-band management approach, both the platform and the service processor get a unique MAC address and IP address for the shared physical Ethernet port. When configured, side-band management can provide all the benefits of out-of-band management, at a considerable cost savings, by eliminating the need to consume a switch port for both management and platform connections.

In-Band Server Management

In-band server management enables organizations to take advantage of industry-standard protocols and applications across all data center platforms. The Sun Server X4-2 and Sun Server X4-2L facilitate in-band server management by supporting the IPMI 2.0 and SNMP v1, v2c, and v3 standards. One of the following two options enables these OS-resident platform management functions:

- IPMI with a keyboard-controller-style (KCS) interface and an IPMI kernel driver
- SNMP agents

Out-of-Band and Side-Band Management

Out-of-band and side-band management approaches support the completion of administrative tasks without placing an unnecessary burden on the host. This administrative strategy is desirable for performance-intensive environments. Although in-band management works only as long as

the host operating system is up and running, out-of-band and side-band management are fully functional even when the host is powered off. For side-band management to work even when the host is shut down, the two dual-10GBase-T (Twinville) controllers operate with standby power, much like the service processor.

Although out-of-band and side-band approaches differ with respect to network connectivity, these methods offer comparable capabilities and benefits:

- Based on serial port redirection (serial-over-LAN), serial port connectivity to the Oracle ILOM service processor provides direct console access to the command-line interface (CLI) and to the system console stream. The CLI is designed to follow the DMTF Command Line Protocol.
- Utilizing Ethernet connectivity, administrators can access a web interface or a CLI. An SSH session is required to access the CLI, and the web interface supports both secure (HTTPS) and nonsecure (HTTP) access. Secure access is the default configuration for web-based access.

Remote Keyboard, Video, Mouse, and Storage

The Oracle ILOM service processor provides access to keyboard, video, mouse, and storage remotely over IP. Remote video display is accomplished through the Java Web Start software known as the Oracle ILOM remote console. Setting up a system as a remote console requires downloading the Oracle ILOM remote console software from the Oracle ILOM service processor to the target machine.⁵ From this point on, the Oracle ILOM remote console executes locally. Because the Oracle ILOM remote console does not run locally on the server, it does not put overhead on the host. A single instance of the Oracle ILOM remote console can open multiple sessions, enabling management of several remote servers simultaneously.

The Oracle ILOM remote console software can be used to redirect the BIOS and setup screens as well as all other platform video output. A true remote video view of the management console is provided by handling of the input and output to and from virtual devices and the server. The SVGA display provides resolutions as high as 1,600 × 1,200 pixels with integrated video compression on the ASPEED AST2300 service processor.

The two USB 2.0 ports connected to the Oracle ILOM service processor enable the remote keyboard, mouse, and storage functions. The Oracle ILOM remote console software captures keyboard, mouse and floppy/CD/DVD input on the management console and redirects it over

⁵ The Oracle ILOM remote console requires the installation of Java Runtime Environment 5.0 or higher on the management console. If IPv6 is used, Java Runtime Environment 7.0 or higher is required.

IP to the Oracle ILOM service processor. Keyboard, mouse, and storage inputs are then transmitted over the USB ports to the server. The Sun Server X4-2 and Sun Server X4-2L interpret these inputs as originating from locally connected USB devices, which are referred to as “virtual” devices.

The Oracle ILOM remote console also can be used to boot the remote server from a local device. A virtual device can be a local physical device or an image file. The Oracle ILOM remote console can redirect several types of devices as virtual devices:

- DVD+/-RW
- CD/DVD-ROM image (.iso files)
- Floppy image (.img files)

Intelligent Platform Management Interface (IPMI)

IPMI refers to the industry-standard interface for autonomous monitoring, logging, recovery, and inventory control features implemented in hardware and firmware. The key differentiation of intelligent platform management is that these functions are independent of the main CPU, BIOS, and OS. There are two major components of platform management: the baseboard management controller (BMC) and system management software (SMS). Intelligent platform management facilitates enterprise-class management for high-availability systems.

The Oracle ILOM service processor provides autonomous sensor monitoring and event logging. Typical sensor-related events include out-of-range temperatures or voltage and fan failures. When an event occurs, it is noted in the system event log and made available to the system management controller. The system management controller is powered by power supply standby voltage and functions even when the server is powered down or the operating system has crashed. As a result, the platform status can be obtained and recovery initiated even in situations in which in-band delivery mechanisms are unavailable.

In modern systems, IPMI provides a hardware-level interface specification for monitoring and control functions. It defines a standard, abstract, message-based interface between the BMC and SMS and a common set of commands for operations such as accessing sensor values, setting thresholds, logging events, and controlling a watchdog timer. IPMI messages can be used to communicate with the BMC over serial and LAN interfaces, so taking software designed for in-band (local) management and reusing it for out-of-band (remote) management simply requires changing the low-level communications layer.

SNMP

Simple Network Management Protocol (SNMP) provides remote access for monitoring and controlling network devices and for managing configurations, statistics collection, performance, and security on a network. SNMP is a network management protocol used almost exclusively in TCP/IP networks. The Sun Server X4-2 and Sun Server X4-2L provide SNMP management

information bases (MIBs) for managing and monitoring the servers with any SNMP-capable network management system, such as HP OpenView Network Node Manager (NNM), Tivoli, CA Unicenter, or IBM Director. The MIB data describes the information being managed, reflects current and recent server status, and provides server statistics.

The Oracle ILOM service processor supports SNMP v1, v2c, and v3. SNMP v3 is enabled by default; v1 and v2c are disabled by default. SNMP sets can be enabled and disabled and are disabled by default. SNMP traps can be generated from within the service processor. An IPMI-specific trap called a platform event trap (PET) can also be generated. The following SNMP MIBs are supported:

- The system group and the SNMP group from the RFC 1213 MIB
- SNMP-FRAMEWORK-MIB
- SNMP-USER-BASED-SM-MIB
- SNMP-MPD-MIB
- ENTITY-MIB
- SUN-PLATFORM-MIB

Oracle System Assistant

Oracle System Assistant is a new utility that assists in the installation and configuration of the Sun Server X4-2 and Sun Server X4-2L and is included by default on these servers. The Oracle System Assistant bootable utility can be initiated either from the Oracle ILOM interface or by selecting the Oracle System Assistant utility through the BIOS boot menu. Oracle System Assistant helps with the following system configuration, installation, and ongoing maintenance operations:

- Install latest system firmware updates
- Install software release updates
- Configure Oracle ILOM networking
- Configure storage RAID
- Installation of operating systems with installation assistant for Oracle VM, Oracle Linux, Red Hat Linux, SUSE Linux, and Microsoft Windows

Oracle Enterprise Manager Ops Center

Oracle Enterprise Manager Ops Center, which is included with the Sun Server X4-2 and Sun Server X4-2L under a support contract, is a highly scalable data center management platform. It provides organizations with fluid systems lifecycle management and automation processes. The capabilities of Oracle Enterprise Manager Ops Center can help organizations simplify

management of data center requirements, such as server consolidation, compliance reporting, and rapid provisioning. This management platform helps provision and administer both physical and virtual data center assets in environments that include Sun Server X4-2 and Sun Server X4-2L as well as other Oracle and non-Oracle hardware running Oracle Solaris, Linux, and Microsoft Windows operating systems.

Oracle Enterprise Manager Ops Center provides a single console to facilitate the following key capabilities within globally dispersed heterogeneous IT environments:

- **Oracle cloud management.** Oracle Enterprise Manager Ops Center provides all management functions for Oracle VM Server for x86 with direct communication to the Oracle VM Server for x86 servers.
- **Server discovery and inventory management.** Oracle Enterprise Manager Ops Center automatically scans and identifies servers across the network, even when the servers are powered off, enabling faster deployment and management of IT assets.
- **Firmware and bare-metal server provisioning.** Ops Center Provisioning and Patch Automation, a feature of Oracle Enterprise Manager Ops Center, delivers automatic hands-off installation of bare-metal operating systems, RPM packages, and firmware, bringing new efficiencies to IT departments.
- **Patch management and updating.** Oracle Ops Center Provisioning and Patch Automation provides up-to-date patch management tools for Red Hat Linux, SUSE Linux, and Oracle Solaris, offering organizations greater control over data center plans and minimizing downtime. In addition, unique patch simulation capabilities remove uncertainty from the software update process.
- **Management and monitoring.** Oracle Ops Center Provisioning and Patch Automation securely and remotely manages users and heterogeneous data center assets and proactively resolves problems by monitoring critical parameters, improving the security and stability of systems.
- **Compliance reporting.** Oracle Enterprise Manager Ops Center provides an up-to-date view into the system state, patch status, and software portfolio, helping improve the speed and accuracy of report and compliance validation.

These automation capabilities can be used in conjunction with configuration management investments to achieve knowledge-based change management. Taking advantage of Oracle Enterprise Manager Ops Center can help organizations create a more compliant Oracle Solaris environment that requires less maintenance and recovery downtime and can lead to considerable cost savings. In addition, due to the ease of management that Oracle Enterprise Manager Ops Center brings, it is recommended that systems be managed via Oracle Enterprise Manager Ops Center rather than by directly connecting to each system's Oracle ILOM interface. For further management simplicity, it is recommended that remote monitoring be enabled as well as Oracle

auto service request capabilities for proactive system management and support. For more information, please visit: [Oracle Enterprise Manager](#)

Enterprise-Class Software Support

To provide both flexibility and investment protection, the Sun Server X4-2 and Sun Server X4-2L support multiple 64-bit operating systems, including Oracle Solaris 10, Oracle Solaris 11, Oracle Linux, Oracle VM, Red Hat Linux, SUSE Linux, Microsoft Windows, and VMware environments. Qualification of multiple operating systems enables 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 to reduce risk and increase ROI.

Please check the Oracle product web pages at <http://www.oracle.com> for a current list of supported OS versions.

The Oracle Solaris Operating System

Oracle and Intel have worked together to ensure that Oracle Solaris is optimized to unleash the power and capabilities of current and future Intel Xeon processors. Since 2007, engineering teams from both companies have delivered a range of enhancements for Oracle Solaris on Xeon processors, optimizing the manner in which Oracle Solaris and the new Intel Core microarchitecture work together on Intel Xeon processor E5-2600 v2 product family processors. The results are compelling:

- **Improved performance.** Oracle Solaris takes advantage of Intel Xeon processor E5-2600 v2 product family features—including Intel Hyper-Threading Technology, Intel Turbo Boost Technology, and Intel QuickPath Technology—to deliver significant performance improvements.
- **Automated power efficiency and utilization.** Oracle Solaris is optimized to leverage Intel's power management functions, and it delivers improved energy efficiency and performance per watt through integrated power gates and automated power states.
- **Increased reliability, availability, and serviceability.** The Oracle Solaris Fault Management Architecture feature enables recognition of fault conditions and can take automated actions to preserve data integrity and improve reliability. Fault Management Architecture offlines individual failed processor cores and threads, retires individual pages of memory, and ceases to use problematic I/O devices. In addition to this, Fault Management Architecture is tightly integrated with Oracle ILOM to be able to quickly and accurately recognize, diagnose, and take corrective actions on Sun Server x86 hardware components.

- **Virtualization enhancements.** Oracle Solaris delivers cost-effective virtualization through Intel Virtualization Technology features. Oracle Solaris Zones creates very low overhead on CPUs and memory compared to traditional virtual machines, maximizing the computing resources available to applications. Oracle Solaris also provides network virtualization used to create an entire high-performance, low-cost data center topology within a single OS instance.

Oracle Solaris includes features not found in any other operating system, including the following:

- Oracle Solaris DTrace with dynamic instrumentation for debugging and problem resolution
- Oracle Solaris Zones for creating virtualized execution environments within a single instance of Oracle Solaris
- Oracle Solaris Predictive Self-Healing for automatically diagnosing, isolating, and recovering from many hardware and application faults
- Oracle Solaris resource management features for fine-grained management of resources such as CPU time, processes, virtual memory, connect time, and logins.

For additional information about Oracle Solaris, visit [Oracle Solaris](#).

Oracle VM Environments

Oracle VM Server for x86 is a no-cost, next-generation server virtualization and management solution that makes enterprise applications easier to deploy, manage, and support. Backed worldwide by affordable enterprise-quality support, Oracle VM Server for x86 facilitates the virtualization of enterprise application workloads on Sun Server X4-2 and Sun Server X4-2L. Adopting Oracle VM Server for x86 for Sun Server X4-2 and Sun Server X4-2L deployments can help reduce operations and support costs while simultaneously increasing IT efficiency and agility. Oracle VM Server for x86 also allows live migration between Oracle x86 servers and non-Oracle x86 servers as long as the servers have the same CPU in the same CPU family and CPU type. For further technical details on Oracle VM Server for x86 systems, please visit: [Oracle VM Server for x86](#)

Linux Environments

Oracle has qualified the leading Linux variants on the Sun Server X4-2 and Sun Server X4-2L, including Oracle Linux, Red Hat Enterprise Linux, and Novell SUSE Linux Enterprise Server.

Oracle is one of the largest contributors to the open-source community. Areas of contribution include OpenOffice.org, Mozilla, GNOME, and X.org. In addition, Oracle provides key software offerings for Linux, including the following:

- Lustre File System
- Sun Ray Software
- Oracle Enterprise Manager Ops Center

- Java Desktop System
- Oracle Solaris Studio, Java Studio Creator, and NetBeans
- MySQL Database

Microsoft Windows Environments

The Sun Server X4-2 and Sun Server X4-2L have been tested and fully certified with Microsoft Windows operating environments and have passed stringent Microsoft compatibility test suites.

VMware Environments

The Sun Server X4-2 and Sun Server X4-2L have been heavily tested and certified with VMware ESX, and they offer full support for running VMware's Hypervisor on these systems.

Conclusion

Oracle's x86 systems are the best x86 platform for running Oracle software. They not only provide optimal performance and reliability based on an integrated and fully supported Oracle stack, but also they include everything needed for a cloud-enabled deployment. Every model comes complete with virtualization, choice of OS, cloud provisioning, and Oracle's unique application-to-disk system management environment—all at no extra charge. This enables Oracle's x86 systems to offer up to 50 percent savings in three-year cost of ownership compared to similar competitive offerings.

Oracle's x86 systems have demonstrated proven performance with world-record benchmarks as well as proven enterprise-class reliability in production use running Oracle applications at Oracle. Also, they are the industry's only x86 hardware and software stack to offer the simplicity and reliability of a single vendor to call for support.

More information about Oracle's x86 systems can be found at oracle.com. Or, an Oracle representative can be reached at +1.800.ORACLE1.



Oracle's Sun Server X4-2 and Sun Server X4-2L System Architecture
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