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Oracle's Netra Server X3-2
Server Architecture

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Introduction

The rapidly expanding popularity of smart phones and the growth of 4G LTE networks have created an environment in which agility is increasingly critical to telecommunications providers. Service providers must deliver compelling services in cost-effective ways, utilizing the latest virtualization, consolidation, and cloud computing technologies to improve efficiency. New services must also be designed to ramp up quickly and deliver continuous availability from the very beginning. To meet these business requirements, telecommunications providers need a high performance and flexible network infrastructure that can scale with demand while offering a secure, and environmentally robust foundation for service delivery.

Oracle is the only vendor to offer a carrier-grade x86 system that provides a complete hardware and software stack from applications to disk. Oracle's new carrier-grade Netra Server X3-2 systems include everything needed to build and manage a flexible and high performance telecommunications infrastructure. The systems provide simple, comprehensive manageability, making them ideal for cloud deployments and the introduction of new services. All Netra x86 servers under an Oracle support agreement come with no limit virtualization, a choice of Oracle enterprise operating systems, infrastructure provisioning, and Oracle's unique application-to-disk system management environment—all at no extra charge.

Oracle's Netra servers are the most deployed carrier-grade systems of any vendor. The systems are designed from the ground up to deliver continuous reliable service, proven long system lifecycles, and the stability to withstand harsh environmental conditions—even severe earthquakes. By combining no-cost software licenses, proven reliability, and Oracle's unique application-to-disk system management environment, Netra Server X3-2 servers offer unmatched cost savings and provide the safest choice for long, multi-year telecommunications deployments.

Netra Server X3-2 Systems

To help telecommunications providers address the challenges of increasing capacity and controlling data center costs, Oracle offers the high-performance yet compact carrier-grade Netra Server X3-2 system based on Intel Xeon processors. The system comes in two configurations and delivers high performance along with unprecedented density in a rugged, energy-efficient 2U form-factor.

Netra Server X3-2 servers offer expandable compute, memory, and I/O resources. They are designed to scale up, scale out, and scale within, enabling deployment in a wide range of application architectures:

- *Scale-up architectures.* With 16 cores or 32 threads 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 onboard 10 GbE ports, and high-bandwidth PCI expansion for high-speed, state-of-the-art system interconnects (such as Fibre Channel), these servers can scale to meet demands for compute power and bandwidth.

- *Scale-within.* With the ability to support virtualization technologies such as Oracle VM and Oracle Solaris Zones, Netra Server X3-2 servers are ideal for consolidating applications within a single extensible platform.

The systems offer carrier-grade reliability and availability as well as remarkable density, making them an ideal fit for consolidating telecommunications infrastructures. They are compliant with Telecordia NEBS (Network Equipment Building Standard) Level 3 certification and ETSI (European Telecommunications Standards Institute), demonstrating that the systems have been rigorously tested and can withstand severe operating conditions. Netra Server X3-2 systems also include a number of reliability, availability, and serviceability (RAS) features such as redundant hot-swappable components, easily accessible components, and chassis indicator lights for simplified serviceability.

High density also facilitates the consolidation of many smaller servers, helping to conserve real estate, lower energy expense, and reduce costly administrative talent. When populated in a 40-rack unit (RU) enclosure, the 2U Netra Server X3-2 server enables a single rack to contain up to 320 cores, 640 threads, 320 DIMM slots, and 120 PCI Express (PCIe) slots. In addition, Netra Server X3-2 servers support multiple operating systems, which can help to simplify consolidation efforts and diminish server sprawl.

Key Features

The Netra Server X3-2 server (Figure 1) utilizes the Intel Xeon processor E5-2600 Series-based Platform for Intelligent Systems, which represents Intel's embedded line of CPUs. Each Netra Server X3-2 server contains two Intel Xeon processor E5-2600 product family CPUs and supports up to 256 GB of memory using 16 GB 1600 MT/s low-voltage registered DIMMs (RDIMMs).

Figure 1. Netra Server X3-2 servers offer compute density in a ruggedized 2U form-factor.

The system is available in two configurations with different storage options:

- Six-disk version that includes an optical DVD+/-RW drive and 6 x 2.5" SAS-2 drives

- Eight-disk version that does not offer a DVD+/-RW drive, but includes 8 x 2.5" SAS-2 drives

Table 1 provides an overview of the features in the two available configurations.

TABLE 1. NETRA SERVER X3-2 FEATURES

FEATURE	NETRA SERVER X3-2, 6X 2.5" DISK	NETRA SERVER X3-2, 8X 2.5 DISK
Internal storage cage options	Six 2.5-inch SAS-2 HDDs (HBA required)	Eight 2.5-inch SAS-2 HDDs (HBA required)
Removable media	- SATA DVD/RW - Internal USB ports for internal boot devices	- No DVD/RW option - Internal USB ports for internal boot devices
COMMON FEATURES FOR BOTH MODELS		
Chassis	2U	
Number of CPU sockets	2	
Supported processor type	Intel Xeon processor E5-2600	
Processor system interconnect	Intel QuickPath Interconnect (8.0 GT/s)	
Number of memory slots	16	
Memory capacity	Up to 256 GB using 16 GB RDIMMS (8 GB or 16 GB RDIMM capacities are supported)	
Memory type	ECC, DDR3, 1600 MT/s, low voltage RDIMM	
Memory Options	8GB DDR3-1600 LVDIMM 16GB DDR3-1600 LVDIMM	
Number of PCIe 3.0 slots	Six x8 PCIe Gen 3	
Number of 10 GbE ports	4 onboard	
Number of USB ports	2 front, 2 rear, 2 internal	
System management	- Onboard ILOM service processor - Side-band management via onboard GbE port or through 10/100 Ethernet system management port - Oracle Systems Assistant (OSA) - Oracle Enterprise Manager Ops Center	

TABLE 1. NETRA SERVER X3-2 FEATURES

Power supplies	760W AC PSUs or 660W DC PSUs (2N)
Telco features	Dry contact alarms (DCA), NEBS 3 certified
RAS components	• Hot-swappable and redundant power supplies, fans, disk drives
	• RAID 0, 1, 10, 1E, 5, 6, 50, 5EE, 60 provided via SAS-2 RAID HBA
OS and virtualization support[1]	• Oracle Solaris 10 (Update 10)
	• Oracle Solaris 11
	• Oracle Linux 5.7 and 6.1
	• Red Hat Linux 5.7 and 6.1
	• SUSE Linux Enterprise Server 11 SP1 and SP2
	• Microsoft Windows Server 2008 SP2 and Microsoft Windows Server 2008 R2 SP1
	• Oracle VM 3.0.2
	• VMware ESXi 5

Common Applications

Netra Server X3-2 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

- Cloud deployments

- Signaling gateways

- Intelligent networks

- MMS (multimedia messaging services)/SMS (short messaging services) and 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

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[1] Please refer to www.oracle.com for the most up to date information on supported versions of Operating Systems for each platform.

- 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

Netra System Design Criteria

Netra Server X3-2 servers share an innovative design philosophy that extends across the families of Sun x86 systems and Netra rack mount servers. Design principles related to this philosophy include:

- *Optimal compute density*. Sun x86 servers provide leading density in terms of CPU threads, memory, storage, and I/O. This focus on density often allows Oracle to offer a 2U rack mount server that can often replace competitive 4U rack mount servers, resulting in a 50% space savings. The leading-edge density of Netra systems simplifies server consolidation, especially since Oracle Solaris provides native virtualization capabilities.

- *Leading I/O and storage capacity*. 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*. Netra Server X3-2 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. 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 and x86 systems can run on Netra Server X3-2 servers 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. More information about the innovative chassis design is provided in the following section.

Chassis Design Innovations

Netra Server X3-2 servers share common chassis design characteristics with many Sun x86 and SPARC server platforms. This approach not only provides a consistent look and feel across product lines, but also simplifies administration and serviceability through consistent placement and shared components.

Key chassis design features include:

- *Enhanced system and component serviceability.* Finding and identifying servers and components in a modern data center can be a challenge. Netra Server X3-2 servers are optimized for lights-out data center 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 accessible for serviceability. For instance, a removable air filter 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 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 mid-system to enhance cooling the drives. Next-generation drive carriers enhance chassis ventilation, enabling greater storage density while increasing system airflow. 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.

  - PCI riser cards plug into the system motherboard, enabling robust PCI expansion capabilities.

  - 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.

The Intel Xeon Processor E5-2600 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. The Intel Xeon processor E5-2600 CPUs used in Netra Server X3-2 servers incorporate a faster Intel QuickPath interconnect and the Intel Xeon micro architecture. They are the first Intel Xeon processors to have PCI Express 3.0 integrated on the processor die. Compatible with a legacy IA-32 software, these 64-bit processors support a large volume of existing 32-bit applications as well as emerging 64-bit applications. Netra Server X3-2 servers are populated with two processors, providing 16 cores and up to 20 MB of shared L3 cache. This gives the systems the power to deliver short response times and high throughput for performance-hungry applications.

Intel Core Micro Architecture

With this latest introduction, Intel continued with a 32 nm manufacturing process, but increased the core computing power from six processor cores to eight processor cores as well as increasing cache in the processor die. The new Intel Core micro architecture (Figure 2) is extremely modular, enabling a range of implementations to meet a variety of application needs and price points.
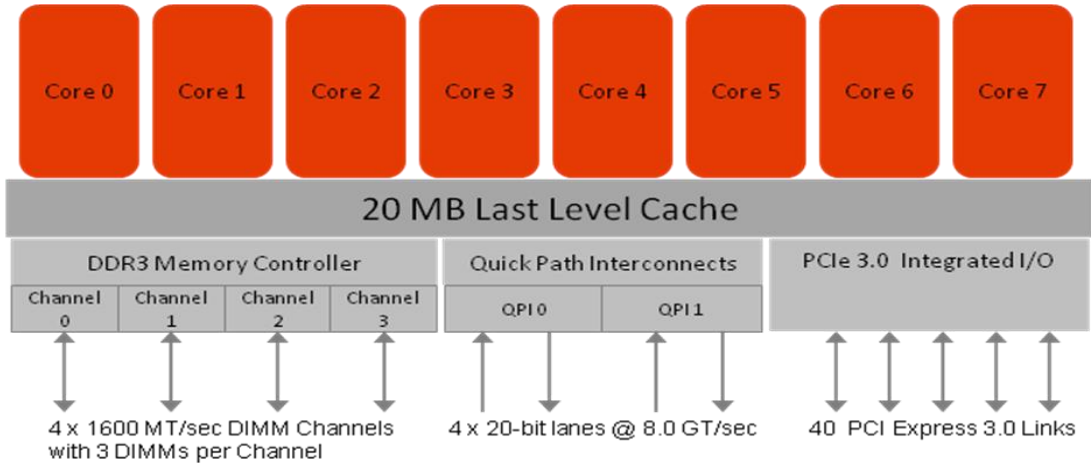

Figure 2. The micro architecture employed by the Intel Xeon processor E5-2600 product family offers significant innovations over previous designs.

Intel Xeon Processor C600 Series Chipset for I/O Expandability

The Netra Server X3-2 servers utilize the Intel C600 Series chipset and interface to each other over Intel QuickPath Technology interconnects. In previous generation processors, PCI expandability was handled with a separate IOH chipset. In the new platform, PCI expandability is integrated directly on the processor die. The CPU interfaces with an Intel C602J I/O Controller Hub, enabling expandability and high I/O throughput. The Intel C602J I/O Controller Hub enables additional I/O functionality, including internal and external USB ports and the SATA DVD/RW device.

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 latest Intel Xeon processor E5-2600 product family CPUs, please visit Intel's web site at www.intel.com.

Netra Server X3-2 Server Architecture

The Netra Server X3-2 servers are designed to provide best-in-class performance along with unprecedented expandability and low power consumption. Netra Server X3-2 servers include the following major components:

- Two Intel Xeon processor E5-2600 product family processors

- Up to 256 GB of memory (using 16 GB registered dual inline memory modules (RDIMMs) populated in 16 registered DIMM slots—8 GB or 16 GB low-voltage RDIMMs are supported.

- Four onboard 100/1,000/10,000 Mb/sec Ethernet ports

- Six internal low-profile PCIe 3.0 slots (x8-lane slots)

- Either 6 x 2.5" SAS HDDs along with a DVD+/-RW drive, or 8 x 2.5" SAS HDDs without a DVD+/-RW drive

- Six USB 2.0 ports (two front, two rear, and two internal)

- An onboard ILOM service processor

- Two hot-swappable, high-efficiency power supply units (PSUs) for 2N redundancy

- Five variable-speed fan modules (for N+1 redundancy), each containing two counter-rotating, low vibration fans operating under environmental monitoring

Netra Server X3-2 System Enclosure Specifications

The physical dimensions and weight for both configurations of the Netra Server X3-2 system are the same. Table 2 identifies the enclosure specifications.

TABLE 2. NETRA SERVER X3-2 SERVER DIMENSIONS AND WEIGHT

DIMENSION	UNITED STATES	INTERNATIONAL
Height	3.43 in. (2 RU)	87 mm
Width	17.52 in.	445.0 mm
Depth (front to rear I/O)	19.74 in.	501.4 mm
Depth (front to PSU handles)	20.8 in	527.8 mm
Weight	40.8 lb maximum	18.5 kg maximum

Power Distribution

Engineered for high availability as well as low energy consumption, Netra Server X3-2 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 from the rear of the system. In normal operation, redundant PSUs share system power demands equally.

To reduce power requirements and meet Telecordia NEBS Level 3 certification, Netra Server X3-2 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 Netra Server X3-2 server are rated at a maximum of 760 watts for AC power and 660 watts for DC power. 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").

Netra Server X3-2 servers use a Power Distribution Board (PDB) to route connections between the power supplies and major system components.

Fan Assemblies

Netra Server X3-2 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 Netra Server X3-2 system 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, memory, and PCI chamber) and vent it through the rear of the system (Figure 3). The system fan assembly consists of five fans located behind the front air filter and hard disk drives. An air baffle is used to channel air flow effectively across the motherboard area and an air duct fits over the memory to optimize air flow. Power Supplies also have internal cooling fans.
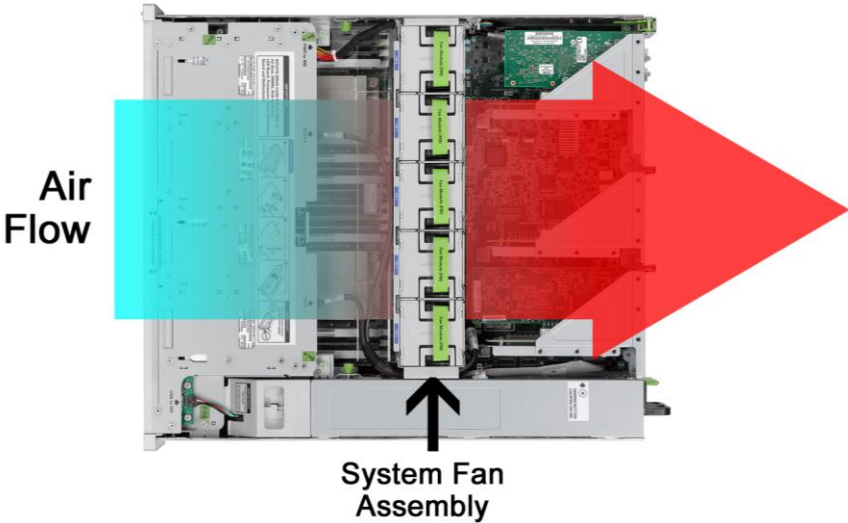

Figure 3. Fans force air flow in Netra Server X3-2 servers from front to back.

Rack Mounting

The Netra Server X3-2 server ships with a hard rack mount 19-inch 4-post kit. Optional kits are available for 19-inch two-post, 23-inch two-post, and 600 x 600 millimeter hard rack mount, as well as 19-inch 4-post slide rack mount and 19-inch 2-post with CMA slide rack mount.

Netra Server X3-2 – 6x 2.5" Disk with DVD System Architecture

Figure 4 shows an architecture block diagram for the Netra Server X3-2 server configuration with 6x 2.5" disks and a DVD+/-RW drive. The Intel Xeon processor E5-2600 product family processor in

slot 0 connects to an Intel C602J IOH over PCIe interconnects. The C602J connects to the Aspeed AST2300 service processor via USB (for virtual devices), PCI (for video), and LPC (serial port).

The required SAS HBA that supports six internal SAS-2 HDDs is shown in PCIe slot 1. USB connectivity and SATA devices, such as the CD/DVD drive are controlled by the Intel 602J I/O controller.
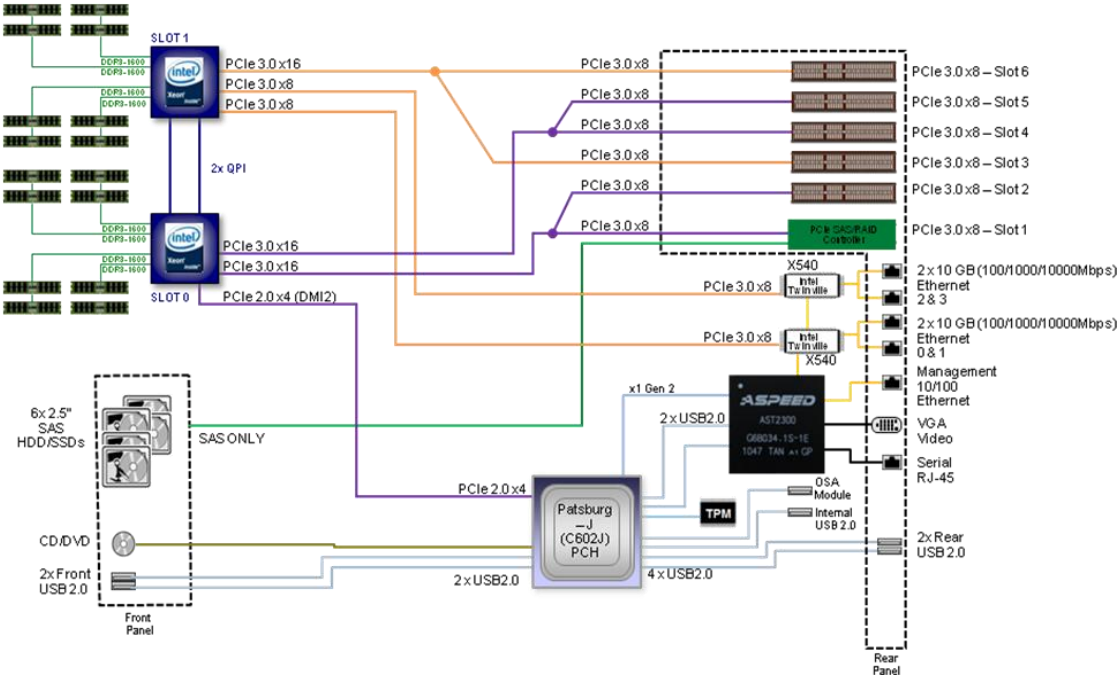

Figure 4. This block diagram depicts the Netra Server X3-2 server configuration with 6x 2.5" disks and a DVD+/-RW drive.

Netra Server X3-2 – 8x 2.5" Disk System Architecture

Figure 5 shows an architecture block diagram for the architecture of the Netra Server X3-2 server configuration with 8x 2.5" disks. The Intel Xeon processor E5-2600 product family processor in slot 0 connects to an Intel C602J IOH over PCIe interconnects. The C602J connects to the Aspeed AST2300 service processor via USB (for virtual devices), PCI (for video), and LPC (serial port).

The required SAS HBA that supports eight internal SAS-2 HDDs is shown in PCIe slot 1. USB connectivity is controlled by the Intel 602J I/O controller.
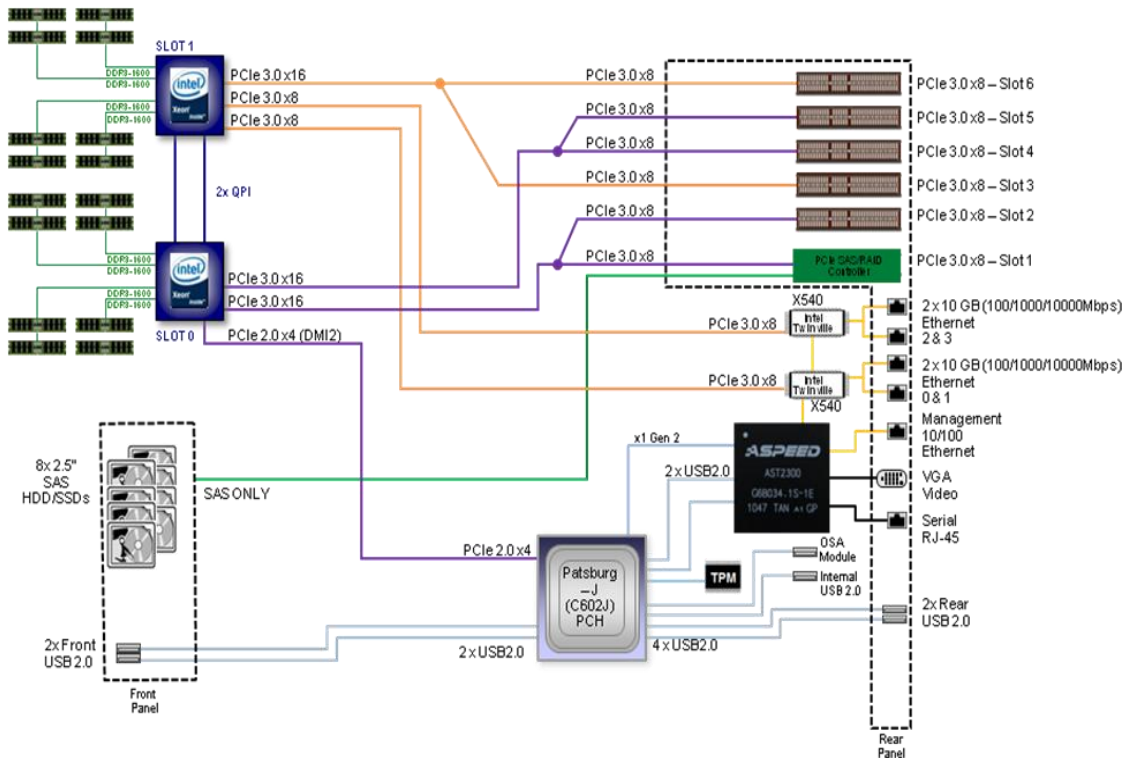
Figure 5. This block diagram depicts the Netra Server X3-2 server configuration with 8 x 2.5" disks.

Front and Rear Perspectives of Netra Server X3-2 – 6x 2.5" Disk with DVD

Figure 6 shows the front and rear views of the Netra Server X3-2 server configuration with 6x 2.5" disks and a DVD+/-RW drive.
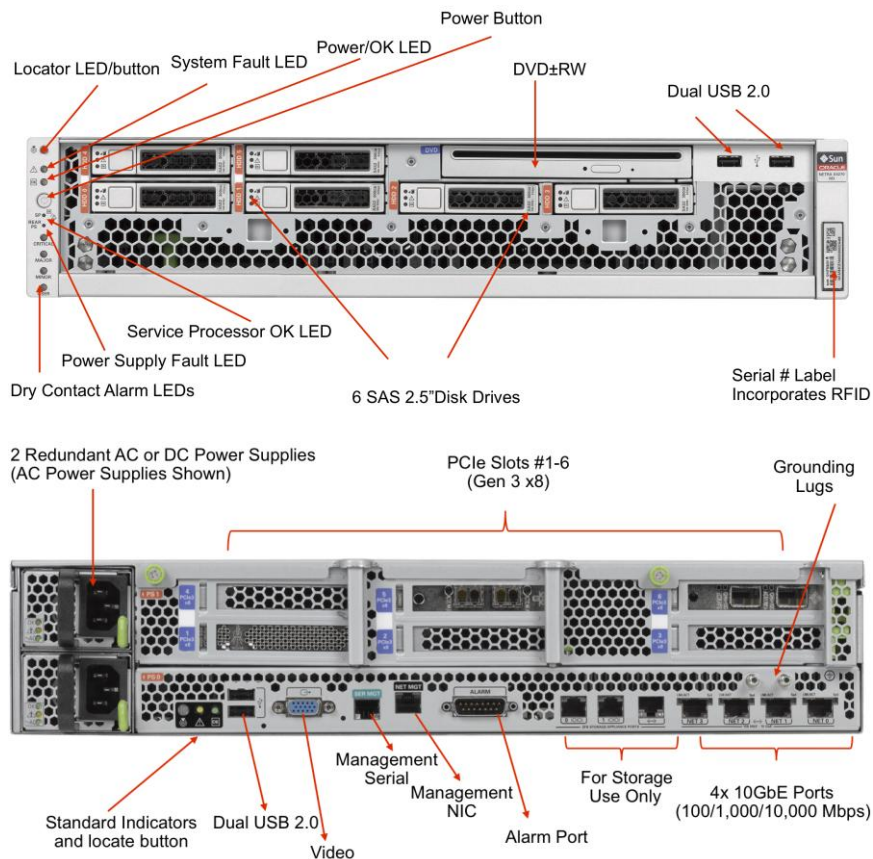
Figure 6. Front and rear views of the Netra Server X3-2 with 6x 2.5" disks and a DVD+/-RW drive.

The external features and connections of this six-disk configuration include:

- Front and rear status indicator lights, which report "locator" (white), "service required" (amber), and "activity status" (green) for the system and components

- Six 2.5-inch SAS-2 HDDs (using the required SAS-2 HBA) with all HDD devices inserted through the front panel

- Internal DVD/RW drive

- Six USB ports: two on the front panel, two on the rear panel, and two internal (for attaching internal boot devices)

- Two AC or DC hot-swappable, high-efficiency power supply units (with integrated fans) to provide 2N redundancy

- Rear power-supply indicator lights, showing the status of each hot-swappable power supply

- Four 100/1000/10000BASE-T, RJ45 copper, autosensing Ethernet ports, accessible on the rear panel

- Six PCIe 3.0 slots, in which low-profile cards can be installed from the rear panel

- Two management ports on the rear panel (one 10/100BASE-T Ethernet 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

Front and Rear Perspectives of Netra Server X3-2 – 8x 2.5" Disk

Figure 7 shows the front and rear views of the Netra Server X3-2 server configuration with 8x 2.5" disks.
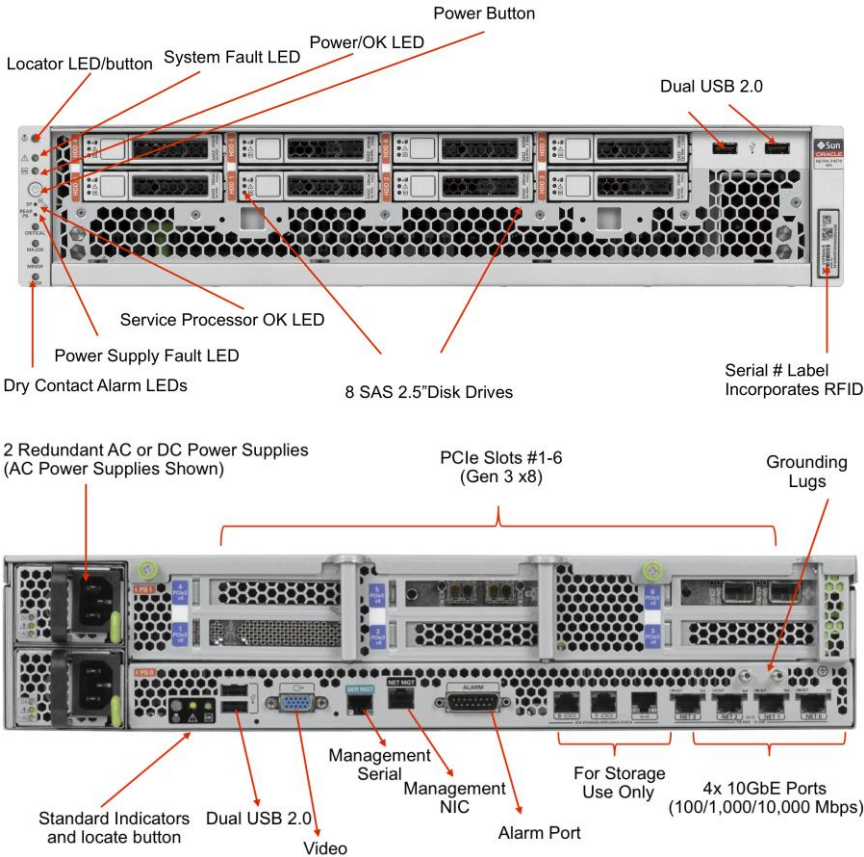
Figure 7. Front and rear views of the Netra Server X3-2 with 8x 2.5" disks.

The external features and connections of this eight-disk configuration include:

- Front and rear 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 (using the required SAS-2 HBA) with all HDD devices inserted through the front panel

- Six USB ports: two on the front panel, two on the rear panel, and two internal (for attaching internal boot devices)

- Two AC or DC hot-swappable, high-efficiency power supply units (with integrated fans) to provide 2N redundancy

- Rear power-supply indicator lights, showing the status of each hot-swappable power supply

- Four 100/1000/10000BASE-T, RJ45 copper, autosensing Ethernet ports, accessible on the rear panel

- Six PCIe 3.0 slots, in which low-profile cards can be installed from the rear panel

- Two management ports on the rear panel (one 10/100BASE-T Ethernet 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

Memory Subsystem

The integrated memory controller and multiple DDR3 memory channels per processor help provide high bandwidth for memory-intensive applications. The Netra Server X3-2 server can be populated with DDR3 Registered ECC Low-Voltage DIMM modules in 8 GB or 16 GB modules.

Each processor features an integrated memory controller, which means that the systems adhere to a NUMA memory architecture in which the memory controller on one processor can access local as well as remote memory. The integrated memory controller supports DDR3 memories in four speeds—800 MT/sec, 1,066 MT/sec, 1,333 MT/sec, and 1,600 MT/s—although Oracle qualifies and offers only 1,600 MT/sec RDIMMs. When configuring system memory, it's important to note that DIMMs may run at speeds slower than individually rated speeds, depending on 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.

Memory Population Guidelines

Each processor features four memory channels, each of which supports two RDIMM slots, enabling as many as 16 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.

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). Fill the blue slots first followed by the white slots starting with slot 0 of processor 0 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. This should be followed by dual-rank (DR) DIMMs and/or single-rank (SR) DIMMs.[2]

Optimizing Memory for Bandwidth

Configurations with optimal memory bandwidth can be achieved with memory components that run at 1,600 MT/sec. To optimize a configuration for bandwidth, populate one or two SR or DR DDR3 1,600 MT/sec DIMM per channel .The use of QR DIMMs limits the maximum memory speed to 1333 MT/sec when populating a single DIMM per channel, or 1067 MT/sec when two DIMMs per channel are populated.

I/O Subsystem

With built-in headroom to expand systems and scale applications, the Netra Server X3-2 servers feature expandability through a PCIe 3.0 expansion bus, internal storage options, four onboard Intel 10GbE network interface controllers (NICs), and integrated USB capabilities.

As shown in the block diagrams for the systems, the Intel C602J I/O Controller Hub provides connectivity for system USB ports, the internal USB port, and the SATA DVD/RW device. To enable USB 2.0 functionality on the Netra Server X3-2 servers, two USB ports go from the Intel C602J to the rear panel and two USB links are routed to the internal USB port. Two additional USB ports are routed from the Intel C602J to the front panel.

The Intel C602J also includes a SATA interface to connect the internal SATA DVD/RW drive on the six-disk version of the Netra Server X3-2 servers.

System Network Interfaces

One of the two Intel Xeon processor E5-2600 product family CPUs interfaces with two Intel X540 10GbE (Twinville) controllers. Each controller supports two onboard 10/100/1,000/10,000 Mb/sec Ethernet ports. Multiple onboard 10GbE connections promote flexibility and enable configurations that support network interface failover.

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

The Netra Server X3-2 servers feature the ability to configure any one of the four onboard 10GbE ports for "side band" management (see the "ILOM Service Processor and System Management"

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[2] "Rank" refers to the number of memory chips a DIMM module has connected on any given data line.

section). 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 10GbE controllers are powered from a "standby" power source from system power supplies. Even when power to the server is lost or turned off, the side-band management interface remains active to enable remote management.

PCIe 3.0 Expansion Bus

The Netra Server X3-2 servers include a PCIe 3.0 expansion bus that can accommodate low-profile cards rated at 25 W maximum. PCIe 3.0 doubles the interconnect bit rate over the previous PCIe Gen 2 by increasing the signaling rate to 8 Gbps from 5 Gbps and by using 128/130 bit encoding instead of 8/10 bit encoding.

The six slots on the Netra Server X3-2 servers are numbered left to right across the bottom (Slots 1 to 6). Refer to the rear panel views presented earlier in Figures 6 and 7 for a visual representation. PCIe slot 1 is reserved for the internal SAS storage HBA. The PCIe cards are inserted into the riser cards on the system board and cards can be compliant with Revision 1.0a, 2.0, or 3.0 of the PCIe Card Electromechanical Specification.

Integrated Storage

Netra Server X3-2 servers offer large internal storage capacity for SAS hard disk drives (HDDs). The two available configurations offer differing internal storage characteristics. Table 3 highlights the storage component options for each configuration.

TABLE 3. INTERNAL STORAGE CHARACTERISTICS FOR NETRA SERVER X3-2 SERVER CONFIGURATIONS

	NETRA SERVER X3-2, 6X 2.5" DISK	NETRA SERVER X3-2, 8X 2.5 DISK
Number of front device slots	6	8
Device form factor	2.5 in. drive	2.5 in. drive
Maximum number of internal SAS HDDs	6 • 300 GB, 10K RPM • 600 GB, 10K RPM	8 • 300 GB, 10K RPM • 600 GB, 10K RPM
Removable media	• SATA DVD/RW • Internal USB ports for internal boot devices	• Internal USB ports for internal boot devices

A PCIe SAS-2 RAID HBA card is required in all configurations to support internal storage options and to implement RAID.

Available Devices

The following devices are available for the Netra Server X3-2 servers (at the time of this writing):

- 2.5-inch SAS-2 disks with 300 GB capacity and 10,000 RPM speed

- 2.5-inch SAS-2 disks with 600 GB capacity and 10,000 RPM speed

Drive Cage Design

The impressive storage density of the Netra Server X3-2 servers is attributable partly to innovative drive carrier designs that facilitate effective airflow through each drive. Drives insert into a disk cage and disk backplane that increases reliability and serviceability. The carrier includes an ejection handle that simplifies drive removal (drives are hot-pluggable when disk mirroring is configured). Drive status lights indicate Ready to Remove, Fault, and Status.

To minimize the effects of drive or fan vibration, dampening material was added to the server's fan modules.

Disk Controller and I/O RAID Options

The Netra Server X3-2 servers support the following options for disk controllers:

- **Sun StorageTek SAS-2 HBA.** A low-profile card, the external version of this controller offers no RAID support and has two external four-port SFF-8088 connectors. The internal version of this HBA has two internal four-port SFF-8087 connectors and enables hardware RAID levels 0, 1, or 10.

- **Sun StorageTek SAS-2 RAID HBA (supports 6 GB/sec SAS-2 and hardware RAID levels 0, 1, 1E, 5, 5EE, 6, 10, 50, and 60).** Based on Adaptec and Intel technology, this HBA is an eight-channel, low-profile card with two four-port SFF-8087 connectors. The card is available in two versions: one with internal connectors and one with external connectors. This HBA includes 256 MB of DDR2 memory onboard and a battery-backed write cache for 72-hour backup, which helps protect data for high-availability storage.

Two cables with four lanes each (each lane supports 6 Gb/sec) are wired from the SAS adapter to the disk backplane to control the internal HDD drives and provide high bandwidth. For Netra Server X3-2 servers, the four SAS links from the HBA connect directly to the SAS devices.

DVD Assembly

A slim form factor SATA DVD/RW assembly is available in the Netra Server X3-2 six-disk configuration. The assembly provides an internal DVD+/-RW device connected to one of the SATA host controllers on the C602J I/O Controller Hub via a standard SATA cable.

RAS Features

The Netra Server X3-2 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 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.

- *A variety of RAID options*. These options enable customers to balance storage capacity, availability, and cost. The LSI-based Sun Storage 6 Gb SAS PCIe HBA with internal connectors supports RAID 0, 1, 1E, and 10E. The Sun Storage 6 Gb SAS PCIe RAID HBA supports RAID 0, 1, 10, 1E, 5, 50, 5EE, 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 allow problems to be identified and isolated easily. Diagnostic LEDs are also included on the motherboard.

- *Integrated lights-out management capabilities*. Standard on Netra Server X3-2 servers at no additional cost, 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. Netra Server X3-2 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*. Netra Server X3-2 servers are configured with Dry Contact Alarms (DCA) 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 Netra Server X3-2 servers meet stringent reliability requirements, even in extremely harsh operating environments.

The robust design of Netra Server X3-2 servers makes these platforms ideal for critical telecommunications applications and environments that demand continuous availability.

ILOM Service Processor and System Management

Like many other Oracle servers, the Netra Server X3-2 servers 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.

ILOM Service Processor

The Netra Server X3-2 servers 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 PCI Express x1 link for video to connect to the C602J I/O Controller. (See the system block diagrams in the earlier "Netra Server X3-2 Server Architecture" section.)

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 local and remote keyboard, video, mouse, and storage (RKVMS) access via redirection over IP, eliminating the need for 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 the following connections:

- Two USB ports for virtual devices (both ports are routed directly on the motherboard between the AST2300 and the C602J)

- Two serial ports (one external, one to the C602J)

- 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 PCI Express x1 connection to the C602J for video

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 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 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 10GbE 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 (see Figure 8). Table 4 presents a comparison of these management strategies.
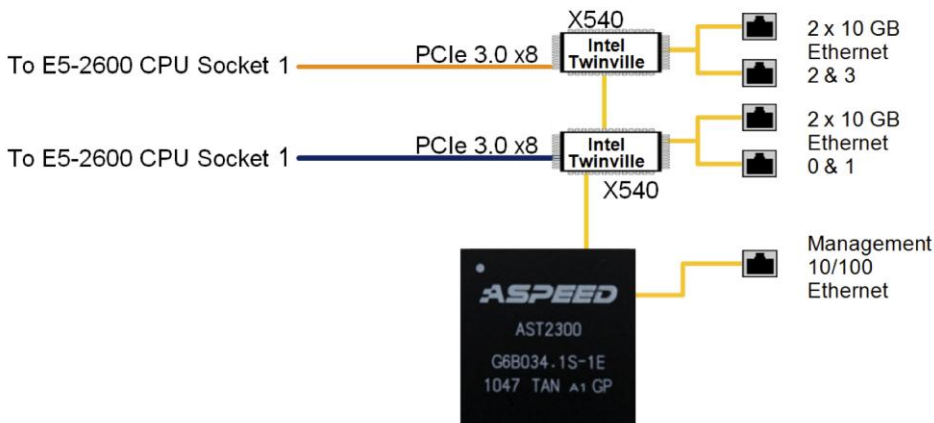
Figure 8. The Oracle ILOM service processor supports side-band management.

TABLE 4. COMPARISON OF IN-BAND, OUT-OF-BAND, AND SIDE-BAND MANAGEMENT

STRATEGY	CHARACTERISTICS	BENEFITS	IDEAL USE CASES
In-band	• 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	• Provide a common administrative tool across all platforms in a heterogeneous environment
Out-of-band	• Utilizes a dedicated Ethernet or serial port for administrative traffic • Management tasks execute on an independent service processor	• Provides continuous access to management capabilities even when the host is disabled • Management tasks do not consume host resources • Increased security as 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 10GbE port and are each assigned an independent MAC and IP address • Management tasks execute on an independent service processor	• Provides continuous access to management capabilities even when the host is disabled • Management traffic uses part of the server data bandwidth • Requires only one switch port, lowering implementation costs • Minimizes processing overhead on the host	• Cost-sensitive environments

The Netra Server X3-2 servers 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.

In-Band Server Management

In-band server management enables organizations to take advantage of industry-standard protocols and applications across all data center platforms. Netra Server X3-2 servers facilitate in-band server management by supporting 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. The Netra Server X3-2 servers provide out-of-band management across a dedicated 10/100 Mb Ethernet port or an RS-232 serial port on the ILOM service processor. Side-band management is supported over one of the four 10GbE 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.

An out-of-band management 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-10GbE (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 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 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 ILOM Remote Console. Setting up a system as a remote console means downloading ILOM Remote Console software from the ILOM service processor to the target machine.[3] From this point on, the ILOM Remote Console executes locally. Because ILOM Remote Console does not run locally on the server, it does not put overhead on the host. A single instance of ILOM Remote Console can open multiple sessions, enabling management of several remote servers simultaneously.

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 $1,600 \times 1,200$ pixels with integrated video compression on the Aspeed AST2300 service processor.

The two USB 2.0 ports connected to the ILOM service processor enable the remote keyboard, mouse, and storage functions. The ILOM Remote Console software captures keyboard, mouse and floppy/CD/DVD input on the management console and redirects it over IP to the ILOM service processor. Keyboard, mouse, and storage inputs are then transmitted over the USB ports to the server. The Netra Server X3-2 servers interpret these inputs as originating from locally connected USB devices, which are referred to as "virtual" devices.

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

- DVD+/-RW

- Floppy

- USB flash disk drives

- 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

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[3] ILOM Remote Console requires the installation of Java Runtime Environment 5.0 on the management console.

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 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 will function 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 means 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. Netra Server X3-2 servers 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 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 RFC1213 MIB

- SNMP-FRAMEWORK-MIB

- SNMP-USER-BASED-SM-MIB

- SNMP-MPD-MIB

- ENTITY-MIB

- SUN-PLATFORM-MIB

Oracle Support Assistant

Oracle Support Assistant is a new utility that assists in the installation and configuration for the Netra Server X3-2 server and is included by default on these servers. The Oracle Support Assistant bootable utility can be initiated either from the ILOM interface or by selecting the Oracle Support Assistant utility through the BIOS boot menu. Oracle Support Assistant helps with the following system configuration, installation, and ongoing maintenance operations:

- Latest System Firmware Updates

- Software Release Updates

- ILOM Networking Configuration

- Storage RAID Configuration

- Installation Assistant for Oracle VM, Oracle Linux, Red Hat Enterprise Linux, SUSE Linux Enterprise, and Microsoft Windows

Oracle Enterprise Manager Ops Center

Oracle Enterprise Manager Ops Center, which is included with Netra Server X3-2 servers under a support agreement, is a highly scalable data center management platform. It provides organizations with fluid systems lifecycle management and automation process. 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 Netra Server X3-2 servers as well as other Oracle and third party hardware running Oracle Solaris, Oracle Linux, Red Hat Enterprise Linux, SUSE Linux Enterprise, 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 for x86 with direct communication to Oracle VM Manager.

- *Server discovery and inventory management.* Oracle Enterprise Manager Ops Center automatically scans and identifies servers across the network, even when powered off, enabling faster deployment and management of IT assets.

- *Firmware and bare-metal server provisioning.* Oracle Enterprise Manager Ops Center Provisioning and Patch Automation delivers automatic "hands off" installation of bare-metal operating systems, RPMs, and firmware, bringing new efficiencies to IT departments.

- *Patch management and updating.* Oracle Enterprise Manager Ops Center Provisioning and Patch Automation provides up-to-date patch management tools for Red Hat Enterprise Linux, SUSE Linux Enterprise, and Oracle Solaris, offering organizations greater control over data center plans and minimizing downtime. In addition, unique patch simulation capabilities help remove uncertainty from the software update process.

- *Management and monitoring.* Oracle Enterprise Manager 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, it is recommended to manage systems via Oracle Enterprise Manager Ops Center rather than directly connecting to each system's ILOM interface due to the ease of management Oracle Enterprise Manager Ops Center brings. For further management simplicity, it is recommended to enable remote monitoring as well as Auto Service Request (ASR) capabilities for pro-active system management and support. For more information, please visit: www.oracle.com/us/products/enterprise-manager/index.html.

Carrier-Grade Software Support

To provide both flexibility and investment protection, the Netra Server X3-2 servers support multiple 64-bit operating systems, including Oracle Solaris 10 and Oracle Solaris 11, Oracle Linux, Red Hat Enterprise Linux, SUSE Linux Enterprise, and Microsoft Windows. The servers also support virtualization using Oracle VM and VMware environments. Qualification of multiple operating systems and virtualization platforms 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 organizations reduce risk and increase ROI.

Please check the Oracle product Web pages at 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 Intel Xeon processors, optimizing the manner in which Oracle Solaris and the new Intel Core micro architecture work together on Intel Xeon processor E5-2600 product family processors.

The results of this collaborative effort have been compelling:

- **Improved performance.** Oracle Solaris takes advantage of Intel Xeon processor E5-2600 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.** Optimized to leverage Intel's power management functions, Oracle Solaris 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 (FMA) infrastructure enables recognition of fault conditions and can takes automated actions to preserve data integrity and improve reliability. FMA offlines individually failed processor cores and threads, retires individual pages of memory, and cease using problematic I/O devices. In addition to this, Oracle Solaris FMA is tightly integrated with the Oracle ILOM to be able to quickly and accurately recognize, diagnose, and take corrective actions on Netra Server X3-2 system hardware components.

- **Virtualization enhancements**. Oracle Solaris delivers cost-effective virtualization through Intel Virtualization Technology features. Oracle Solaris Zones create very low overhead on CPU 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.

Important New Features in Oracle Solaris 11

Oracle Solaris 11 provides access to advanced Oracle Solaris features that have been in development for more than five years. Two new Oracle Solaris 11 features are noteworthy for telecommunications providers:

- **Network-based package management.** The Oracle Solaris 11 Image Packaging System (IPS) is a new network-based package management system designed to greatly decrease planned system downtime and provide for completely safe system updates and upgrades. IPS offers a framework for complete software lifecycle management such as installation, upgrade, and removal of software packages. Administrators can install software from network-based package repositories with full automatic dependency checking for any additional libraries that might be required during a software package install.

- **Network virtualization**. A new network stack architecture, also known as the Crossbow project, has been introduced in Oracle Solaris 11. The architecture offers improvements in performance, observability, security, and ease of use. Amongst other features, it enables administrators to create Virtual NICs (VNICs) and virtual switches, resulting in a virtual network infrastructure that is completely independent from the underlying hardware. This gives IT organizations the ability to deploy a "data center in a box" solution that brings increased levels of flexibility and TCO savings, much like a larger data center consolidation project. Network virtualization also gives telecommunications carriers a method to control network bandwidth and network traffic flow for different services deployed on the system. Thus services that are very sensitive to network latency

can get their share of network bandwidth before others, and the physical network can be spared from being flooded with unwanted traffic levels.

Additional Unique Features in Oracle Solaris

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

- 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 www.oracle.com/solaris/.

Oracle VM

Oracle VM is a no-cost, next-generation server virtualization and management solution that makes enterprise x86 applications easier to deploy, manage, and support. Backed worldwide by affordable enterprise-quality support, Oracle VM facilitates the virtualization of enterprise application workloads on Netra Server X3-2 servers. Adopting Oracle VM for Netra Server X3-2 server deployments can help reduce operations and support costs while simultaneously increasing IT efficiency and agility. Oracle VM also allows live migration between Oracle Netra servers and third party 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 for x86 systems, please visit: www.oracle.com/us/technologies/virtualization/024974.htm.

Linux Environments

Oracle has qualified the leading Linux variants on the Netra Server X3-2 server, including Oracle Linux, Red Hat Enterprise Linux, and Novell SUSE Linux Enterprise Server.

Oracle is also 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 parallel file system
- Sun Ray Software
- Oracle Enterprise Manager Ops Center
- Oracle Open Office
- Java Desktop System
- Oracle Solaris Studio, Java Studio Creator, and NetBeans
- MySQL database

Microsoft Windows Environments

The Netra Server X3-2 servers have been tested and fully certified with Microsoft Windows operating environment and have, in fact, passed stringent Microsoft compatibility test suites.

VMware Environments

The Netra Server X3-2 server has been heavily tested and certified with VMware ESX, and offer full support for running VMware's hypervisor on these systems.

Conclusion

Telecommunications companies face increasing pressure to deliver new services and satisfy escalating resource demands for new applications and users. Netra Server X3-2 servers from Oracle offer incredible system density—with robust compute, memory, networking, storage, and I/O expansion—to help telecommunications providers consolidate their IT infrastructures or expand existing services.

Leveraging an embedded class of Intel Xeon processor technologies and Oracle's engineering expertise in chassis and systems design, these platforms deliver new levels of performance and value in a ruggedized, rack mountable chassis designed to support continuous service for multi-year deployments. Given the speed and efficiency of these servers, telecommunications companies can easily consolidate workloads and improve utilization—at the same time preserving investments in existing x86 and x64 applications.

Netra Server X3-2 systems offer the industry's best value for a ruggedized x86 platform. Oracle is the only vendor to offer an integrated hardware and software stack for the telecommunications market—the same stack that has been proven in production use at Oracle. Oracle's Netra Server X3-2 systems not only provide optimal performance and reliability, but also include everything needed for a cloud-enabled deployment. Supported systems come complete with virtualization, choice of OS, cloud provisioning, and Oracle's unique application-to-disk system management environment—all at no extra charge. The systems also offer the simplicity and reliability of a single vendor to call for support.

In addition, Oracle offers professional services, training, and integrated support to optimize server implementations and speed time-to-deployment. Experienced Sun server specialists can assist with data center capacity planning as well as consolidation and virtualization strategies.

For more information about Netra Server X3-2 systems, visit www.oracle.com/us/products/servers-storage/servers/netra-carrier-grade/ or call +1.800.ORACLE1 to speak to an Oracle representative.

References

Table 5 provides references for additional information.

TABLE 5. WEB SITES FOR ADDITIONAL INFORMATION

DESCRIPTION	WEB SITE URL
Netra Carrier-Grade Servers from Oracle	www.oracle.com/us/products/servers-storage/servers/netra-carrier-grade/
Intel Xeon Processor E5 Family	www.intel.com/content/www/us/en/processors/xeon/xeon-processor-5000-sequence.html
Oracle virtualization solutions	www.oracle.com/us/technologies/virtualization/
Oracle Solaris	www.oracle.com/solaris/
Oracle Enterprise Manager	www.oracle.com/us/products/enterprise-manager/index.html

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April 2012, Version 1.0

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