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Chapter 1
Introduction

While faster processors, larger memory, and powerful graphics are fundamental requirements for workstations, users are also demanding a low-cost, solution-based approach wrapped around a standards-based technology. The Sun Ultra™ 20 Workstation, which leverages the AMD Opteron™ processor with Direct Connect Architecture based on AMD64 technology, provides multiple operating system choices and leading nVidia graphics, delivers a platform that offers flexibility and performance in a cost-effective package with solutions to benefit customers across the board.

About this Document

This document describes the Sun Ultra 20 Workstation key features, system architecture, graphics options, environmental and regulatory compliance, and key software components. Before reading this document, you may want to also review the following documents relating to the Sun Ultra 20 Workstation:
- Ultra 20 Datasheet
- Ultra 20 Sun Services Datasheet
- Ultra 20 Just the Facts
- Ultra 20 Customer Presentation
- Workstation Beat Sheet: Ultra 20 vs. HP, Dell and IBM Pentium 4-based Workstations

Chapter 2
Sun Ultra 20 Workstation Overview

Ultra Conservative on Price, Ultra Liberal on Performance

The Sun Ultra 20 Workstation is a single-socket, AMD Opteron™ processor-based workstation (a dual-core configuration will be available in the near future) with a powerful suite of Java developer tools. It supports multiple operating systems and comes with the Solaris™ 10 Operating System pre-installed. The Ultra 20 Workstation is suitable for compute-intensive and visualization applications in software development, EDA (electronic design automation), and MCAD (mechanical computer-aided design). The single, AMD Opteron processor based on the x86-64 architecture provides high performance with support for both 32-bit and 64-bit operating systems and applications, offering the highest degree of flexibility for customers who want to run existing 32-bit operating systems and applications and still be able to gracefully migrate to the next-generation 64-bit operating systems and applications when they are ready. In addition, a three-year base warranty and next-business-day support mean that the Sun Ultra 20 Workstation offers competitive total cost of ownership (TCO) for workstations with a great return on investment (ROI).

Figure 2-1: Sun Ultra 20 Workstation

Target Users and Markets

The Sun Ultra 20 Workstation is designed to provide blazing performance, reliability, and scalability for the widest range of users and markets in Sun's history. With the new workstations, Sun has delivered a platform that offers flexibility and performance in cost-effective packages. The entry-level, single-socket workstation is ideal for the following users and markets:

- Software development
- General and higher education
- Government
- Semiconductor manufacturers
- MCAD
- EDA
- Automobile
- Aerospace

Key Features

The Sun Ultra 20 Workstations are solidly built to Sun's renowned quality specifications and come from the factory with a robust set of desktop workstation features, including:

- **PCI-Express Graphics**. The Sun Ultra 20 Workstation is the first-ever workstation from Sun to utilize PCI-Express graphics. PCI-Express is the best input/output implementation update in a decade. Effectively replacing PCI, and AGP, this third-generation I/O interconnect standard doubles the bandwidth of AGP 8x.
- **High-Density, High-Performance, Reliable Internal Storage.** The Sun Ultra 20 Workstation will be the first single-processor workstation from Sun to reach half a terabyte of internal storage. Utilizing Serial ATA (SATA) for density, the Sun Ultra 20 Workstation can accommodate up to two internal 250 GB drives for a total capacity of 500 GB. Utilizing RAID 0* for high performance, the Sun Ultra 20 Workstation delivers very high transfer rate. Utilizing RAID 1* for redundancy, the Sun Ultra 20 Workstation safeguards data for mission-critical applications.
- **High-performance, high-throughput, single-processor workstation.** The Sun Ultra 20 Workstation is one of the the highest-performance single-socket workstations for both 64-bit and 32-bit x64 applications. To provide such high levels of performance, the Sun Ultra 20 Workstation is built with a robust set of workstation features, including:
    - Support for one AMD Opteron™ processor with HyperTransport™ technology and an integrated 128-bit memory controller
    - Support for up to 4 GB of unbuffered ECC memory
    - High bandwidth memory subsystem with error correction
    - Gigabit Ethernet
    - Three PCI-Express expansion slots: 2 x1 and 1 x16
    - Four 33MHz/32-bit slots that enable expansion, such as Ultra320 SCSI, additional Gigabit Ethernet adapters, etc.
    - Expandable, high-performance storage options

- **World-class benchmarks.** The Sun Ultra 20 Workstation intends to demonstrate world-class benchmarks on SPECintRate2000, SPECfpRate2000, SPECviewperf, Stream (memory bandwidth), as well as EDA and MCAD benchmarks.

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*The Sun Ultra 20 Workstation has been tested on Windows XP Professional and Windows XP Professional x64 only.

Feature Comparison

Table 2-1 describes the main features offered by the Sun Ultra 20 Workstation.

Table 2-1: Sun Ultra 20 Workstation Features Comparison.

Features	Sun Ultra 20 Workstation Features	Sun Java Workstation W1100z	Sun Blade 1500
Processor			
Number of Processor(s)	One	One	One
Processor Type	AMD Opteron 100 Series Processor	AMD Opteron 100 Series Processor	Sun UltraSPARC IIIi CPU
Front Side Bus	HyperTransport™ (8 GB/s per link)	HyperTransport (6.4 GB/s per link)	J-Bus (128-bit @ 167MHz)
Memory			
Size	4GB @ PC3200	Up to 8 GB @ PC3200	8GB @ PC2100
# of expansion slots	Seven (4 PCI and 3 PCIe)	Six (5 PCI and 1 AGP)	Four
Type	Un-buffered ECC (1GB, 512MB) or non-ECC (256MB) DIMMs only	Registered ECC	Registered ECC DIMMS only
Graphics Accelerators			
	- ATI Entry 2-D (on-board) - nVidia NVS280 PCI-Express - nVidia FX1400	- nVidia Quadro NVS280 - nVidia FX500 - nVidia FX1100 - nVidia FX3000 - nVidia FX4000	- Sun XVR-100 - Sun XVR-600 - Sun XVR-1200
Networking	On-board 1 x Gigabit Ethernet	Gigabit Ethernet	On-board 1 x Gigabit Ethernet
Optical Drives	- DVD-ROM (Option) - DVD Dual (Option)	DVD-ROM/CD-RW Standard (DVD +/- R/RW Optional)	DVD-ROM (Standard)
Floppy Disk Drive	None	None	None
Smart Card Reader	None	None	One
Hard disk drives			
Drive Type	SATA	Ultra ATA-100	IDE
# Drives Supported	Two	Two	Two
Maximum Size	500 GB (80, 250 GB)	160 GB (80 GB)	160 GB (80 GB)
Connection Type	X-Option card (X9265A) for SCSI support. No SCSI disk drives will be sold with the Sun Ultra 20 Workstation.	IDE	SCSI
RAID 0/1 *	Yes	None	None

Features	Sun Ultra 20 Workstation Features	Sun Java Workstation W1100z	Sun Blade 1500
FireWire/USB Ports	Two / Six	Two /Six	None /Seven
Audio	AC '97	AC '97	AC '97
Parallel/Serial	None	None	One parallel / one serial
PCI-Express slots	One full-length @ x16 Two full-length @ x1	None	None
64-bit PCI slots (66 or 33MHz)	None	One PCI-X @ 133 MHz Four PCI-X @ 100 MHz	One full-length @ 66MHz Three full-length @ 33MHz
32-bit PCI slots (33MHz)	Four full-length	None	One full-length
O/S Validated by Sun	• Solaris 10 for x64 • Red Hat Enterprise Linux WS v3 – 32-bit • Red Hat Enterprise Linux WS v3 – 64-bit • Red Hat Enterprise Linux WS v4 – 32-bit • Red Hat Enterprise Linux WS v3 – 64-bit • SuSE Linux Enterprise Server 9 – 64-bit • 32- and 64-bit Windows XP Professional (Sun Certified) –not supported by Sun	• Solaris 10 • Solaris 9 (4/03 or later) • RH Enterprise3 and SuSe9 • Windows XP 32-bit	• Solaris 8 (2/04 or later) • Solaris 9 (9/04 or later) • Solaris Express 11/04 for Solaris 10

*The Sun Ultra 20 Workstation has been tested on Windows XP Professional and Windows XP Professional x64 only.

External View of the Sun Ultra 20 Workstation

Front View

Figure 2-2 shows the front view of the Sun Ultra 20 Workstation. The CD-RW/DVD-ROM always occupies the first external drive bay. The cooling system uses low-noise fans with fan speed controlled by monitoring multiple component temperatures. Structure-borne vibration and acoustic noise is minimized by rigid chassis design and control of disk drive vibrations.

The Ultra 20 Workstation front panel contains the power button and power LED as well as convenient attachment to external portable hard drives or video cameras via two USB 2.0 connectors and two IEEE 1394a (FireWire) connectors. An input for a microphone and an output for headphones are also included.
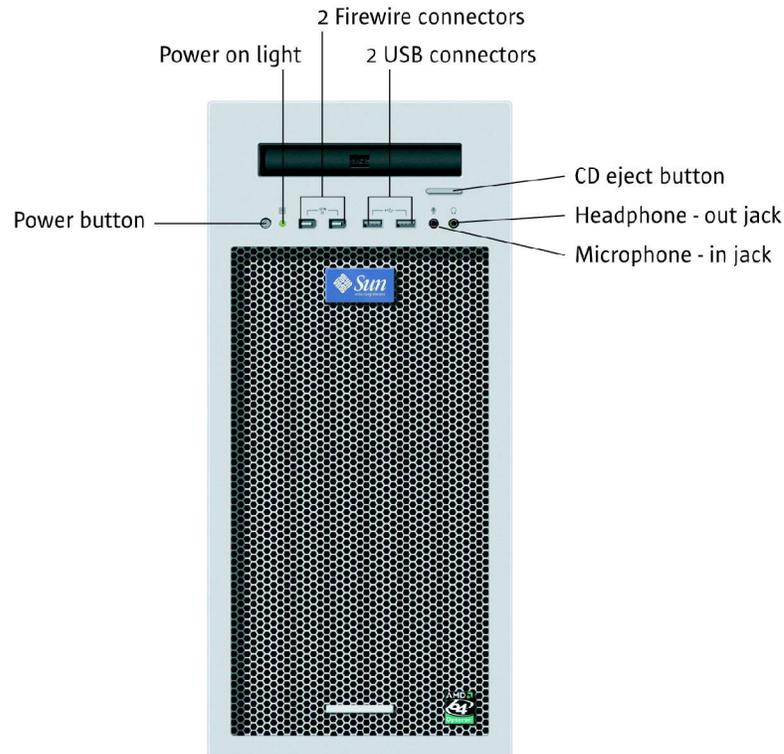
Figure 2-2: Sun Ultra 20 Workstation—Front View

Rear View

Figure 2-3 shows the rear view of the Sun Ultra 20 Workstation.

Starting from the top of the chassis, the Sun Ultra 20 Workstation provides a VGA connector for the on-board Rage XL PCI graphics controller, followed by the remaining audio connectors (audio out, audio in, microphone in). Finally, one RJ-45 Gigabit Ethernet port is stacked above two sets of two USB 2.0 ports.

Power connector

Onboard HD115 video connector

Microphone jack

Line-in jack

Line-out jack

Ethernet connector

4 USB connectors

PCI EXPRESS x16 graphics slot

4 PCI slots

2 PCI EXPRESS x1 slots
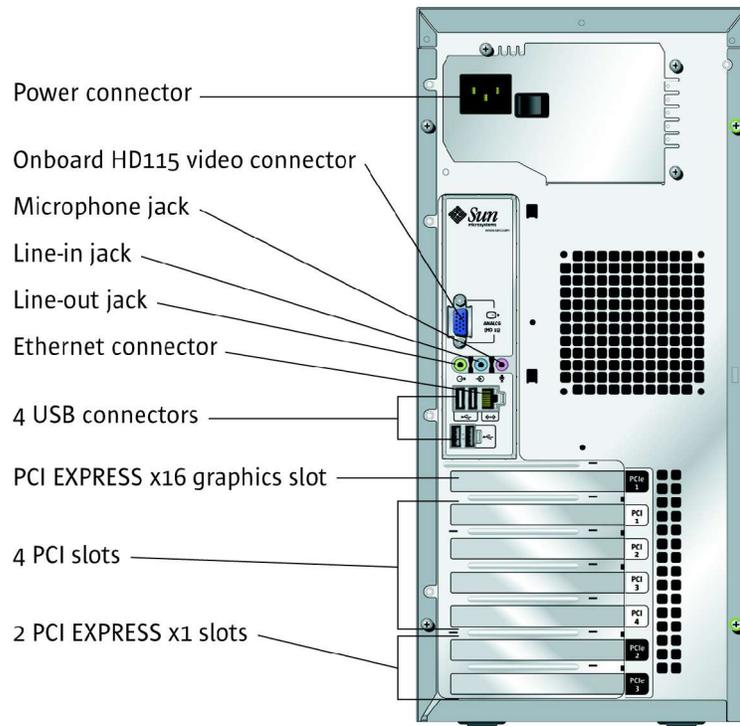
Figure 2-3: Sun Ultra 20 Workstation—Rear View

Chapter 3
Sun Ultra 20 Workstation System Architecture

This chapter describes the Sun Ultra 20 Workstation architecture in detail, including the motherboard and processor, memory subsystem, interconnects and ASICs, storage, and system I/O.

Motherboard

The heart of the new Sun Ultra 20 Workstation is the motherboard. Sun Ultra 20 Workstations are based on one AMD Opteron™ 100 series processor (1.8 GHz and higher). The main board provides the majority of the functionality common to all systems. Figure 3-1 illustrates the motherboard for the Sun Ultra 20 Workstation in a basic block diagram that represents the actual physical board layout of the CPUs, ASICs, sockets, interfaces, and connectors.

Ultra 20 Block Diagram
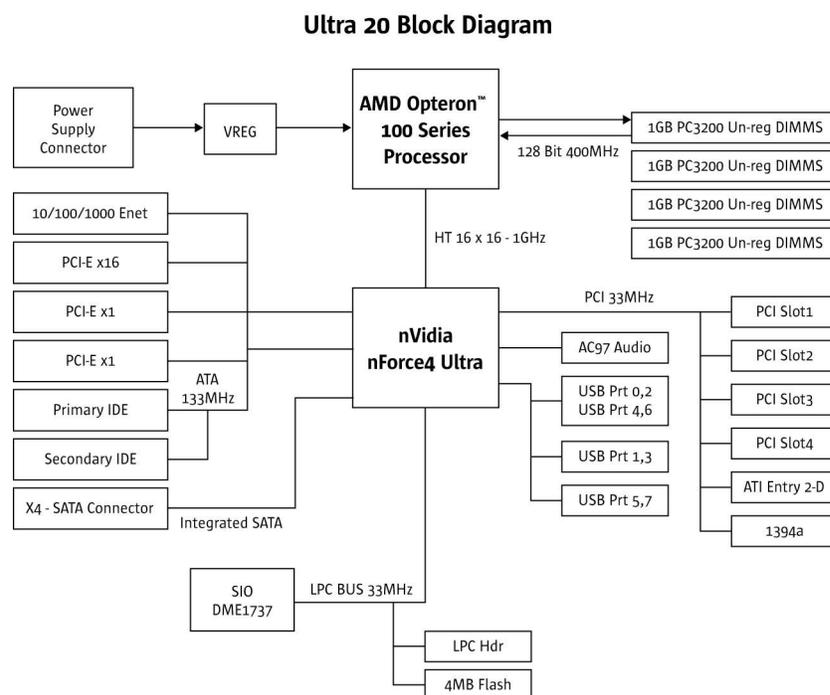
Figure 3-1: Physical Layout Block Diagram of the Sun Ultra 20 Workstation Motherboard

The Sun Ultra 20 Workstation motherboard PCBA is unique to the Sun Ultra 20 Workstation products, and need not conform to any specific form factor. However, for the purposes of this specification, it is ATX.

Motherboard Features

The Sun Ultra 20 Workstation is powered by the AMD Opteron 100 series processor, which enables simultaneous 32-bit and 64-bit computing. The motherboard has the following features:

- Single high-performance single- or Dual-Core AMD Opteron processor
  - One HyperTransport™ technology link per processor
  - 100A VRM per processor
- Four unbuffered PC3200 DIMM slots supporting up to 4 GB of ECC memory
  - One bank (2 slots) with blue sockets (DIMMs should be installed in the blue sockets first)
  - One bank (2 slots) with black sockets

nVidia nForce04 Ultra core logic chipset provides a HyperTransport-to-PCI-Express bridging interface well as the following functionality:

- One PCI-Express X16 graphics slot (75W high-power)
- Two PCI-Express X1 expansion slots
- Four PCI 33 MHz 32 bit slots
- Two 1.5 GB/s SATA lanes for disk drives
- One ATAPI channel for CD/DVD
- One 10/100/1000-Base T Gigabit Ethernet port
- Two P1394a Firewire ports with 6-pin connectors
- Six USB 2.0a ports four connectors in back and two in front
- AC97 Audio
- Audio connector for optical drive
- Back panel connectors:
  - RJ45 Ethernet
  - Four USB 2.0a
  - Microphone, Audio-in, Audio-out connectors
  - 1394a 6-pin (unless both 1394 connectors are on front panel)
  - HD15 video display connector

Ultra 20 Archtectural Overview
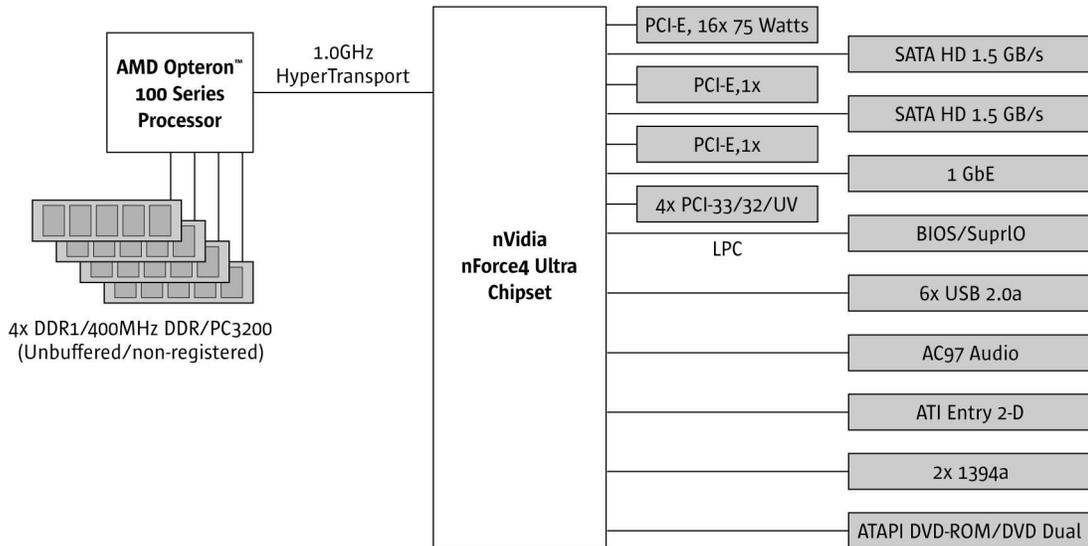
Figure 3-3: Sun Ultra 20 Workstation Motherboard Architecture

CPU Specifications

AMD Opteron™ Processor with Direct Connect Architecture

Based on AMD64 technology with Direct Connect Architecture, the AMD64 Opteron processor addresses and helps reduce the real challenges and bottlenecks of system architectures by directly connecting:
• Memory to the CPU for optimizing memory performance
• I/O to the CPU for more balanced throughput and I/O
• CPUs to CPUs for more linear and symmetrical multiprocessing

AMD64 Technology

AMD64™ technology allows end-users to run existing 32-bit applications and operating systems at peak performance while providing a migration path that is 64-bit capable. It is designed to enable 64-bit computing while remaining compatible with the vast x86 software infrastructure. The AMD64 technology Instruction Set Architecture (ISA) extends the existing x86 ISA and natively executes 32-bit code with no "emulation mode" to degrade performance. For 32-bit software that does not require immediate 64-bit implementations, AMD64 processor-based systems are designed to provide full application performance while continuing to improve with AMD64 platform performance enhancements.

Major enhancements over legacy x86 include:
• Sixteen 64-bit general-purpose integer registers that quadruple the general purpose register space available to applications and device drivers as compared to x86 systems

- Sixteen 128-bit XMM registers for enhanced multimedia performance to double the register space of any current SSE/SSE2 implementation
- A full 64-bit virtual address space with 52 bits of physical memory addressing that can support systems with up to 4 petabytes of physical memory—65,535 times the amount of RAM supported by 32-bit x86 systems
- 64-bit operating systems to provide full, transparent, and simultaneous 32-bit and 64-bit platform application multitasking

AMD64 technology-based processors include HyperTransport™ technology and are designed for flexibility and scalability. HyperTransport technology provides links-based multiprocessing, simplifying the design of multiprocessor workstations and servers. Compatibility with x86 makes the AMD64 technology-based computing platform the first 64-bit platform designed to be compatible with mainstream PC applications while offering world-class performance, making it suitable for solutions ranging from consumer client PCs to high-performance clusters. The combination of flexibility and scalability directly addresses the broad range of capability and performance requirements IT professionals face today. More information about AMD64 technology is available at http://www.amd.com/opteron.
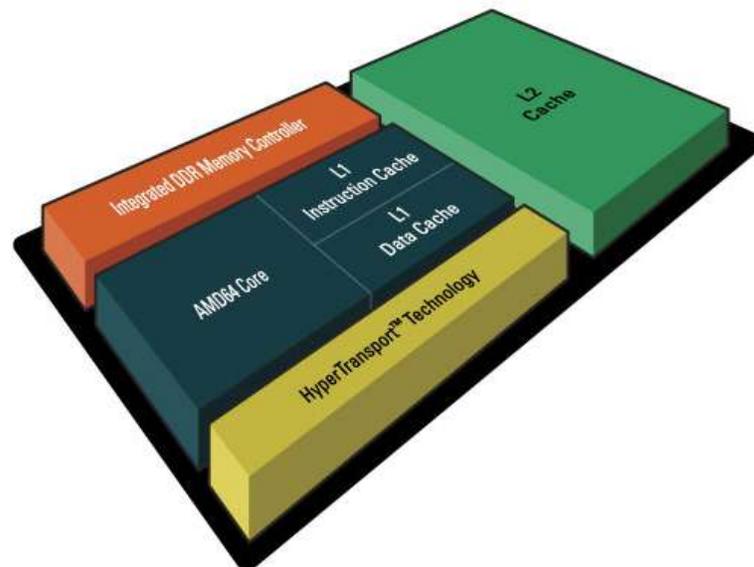
Figure 3-4: AMD Opteron Processor Block Diagram

CPU Packaging

AMD Opteron™ processor packaging specifications include:
- 939-pin organic microPGA package
- 1.27 mm pin pitch
- 31 x 31 row pin array
- 40 mm x 40 mm organic substrate, C4 die attachment
- 16.5 mm x 11.3 mm die size

Processor VRM

The CPU receives core voltage from an individual voltage regulator module (VRM). The VRM regulates the bulk 12 Volt supply to the value required by the CPU core, as specified by the VID code output by the CPU package. The processor VRM is integral to and physically located adjacent to the memory sub-system.

HyperTransport™ Technology

HyperTransport technology is a high-speed, low latency, point-to-point link designed to increase the communication speed between integrated circuits in computers, servers, embedded systems, and networking and telecommunications equipment. It provides significantly more bandwidth than current technologies. HyperTransport technology helps reduce the number of buses in a system, which can reduce system bottlenecks and enable today's faster microprocessors to use system memory more efficiently. HyperTransport technology provides:
• Scalable bandwidth interconnect between processors, I/O subsystems, and other chipsets
• Coherent HyperTransport links providing up to 24.0 GB/s peak bandwidth per processor
• Up to 8.0 GB/s bandwidth per link providing sufficient bandwidth for supporting new interconnects including DDR, InfiniBand, and 10G Ethernet
• Low power consumption (1.2 volts) to help reduce a system's thermal budget
HyperTransport technology is designed to:
• Provide significantly more bandwidth than current technologies
• Use low-latency responses and low pin counts
• Maintain compatibility with legacy PC buses while being extensible to new SNA (Systems Network Architecture) buses.
• Appear transparent to operating systems and offer little impact on peripheral drivers.

Memory Interface

The AMD Opteron processor with Direct Connect Architecture incorporates an integrated memory controller and improves the way typical x64 processors access main memory, resulting in increased bandwidth, reduced memory latencies, and increased processor performance.

The 128-bit wide integrated DDR DRAM memory controller is capable of yielding a memory bandwidth of 6.4 GB/s and supports up to four unbuffered DDR DIMMs. The Sun Ultra 20 Workstation can reach up to a maximum of 4 GB using its 4 DIMM slots. The Sun Ultra 20 Workstation supports 1 GB ECC DIMMs, 512 MB ECC DIMMs, and 256 MB non-ECC DIMMs.

Chip-to-Chip Interconnect

Current existing interface schemes offer throughput performance on the order of 266 MB/sec. to 1 GB/sec. Although these rates may be sufficient for desktop platforms, workstation, server, and other future platforms require a more robust interface. The simultaneous integration of high-speed technologies (such as AGP-8X, Gigabit Ethernet, and the InfiniBand Architecture) onto high-end platforms will quickly dwarf the bandwidth capabilities of existing interfaces.

HyperTransport Technology provides a high-speed, chip-to-chip interconnect that virtually eliminates the I/O performance bottleneck while providing ample performance headroom for future growth.

I/O Expansion Capability to High-Speed Industry Buses

The traditional NorthBridge/SouthBridge architecture is not intended to support more than two "core-logic" elements. Adding additional high-speed functionality (such as Gigabit Ethernet, the InfiniBand Architecture, or any combination thereof) would have to occur in one of three ways:

• The functionality would have to be attached to an existing bus interface such as the PCI bus. However, an existing bus may not have sufficient bandwidth to support high-speed technologies, especially in instances in which multiple buses or combinations of buses must be supported simultaneously.

• The functionality would have to be directly attached to the higher-speed, proprietary, chip-to-chip interconnect bus via a bridging device. However, the proprietary nature of this solution may limit the number of components available from vendors, thus impacting cost and availability.

• The functionality would have to be integrated into one of the core logic components. This solution is the least flexible, as a wide range of components would have to be created for each desired combination of feature-set buses.

HyperTransport technology, an industry standard, provides system designers a high-speed, daisy-chained interconnect between system components. Specific components can be connected in a building-block fashion to achieve a platform with specific feature-set and performance objectives. Figure 3-5 shows a sample HyperTransport technology architecture block diagram.

HyperTransport I/O links
- Up to 8 GB/sec. total bandwidth per link (bi-directional) at 16 x 16 bits, 1 GHz operation
- Extensive data protection/management
- Integrated power management
- Building block structure
- Up to 5 devices supported in chain
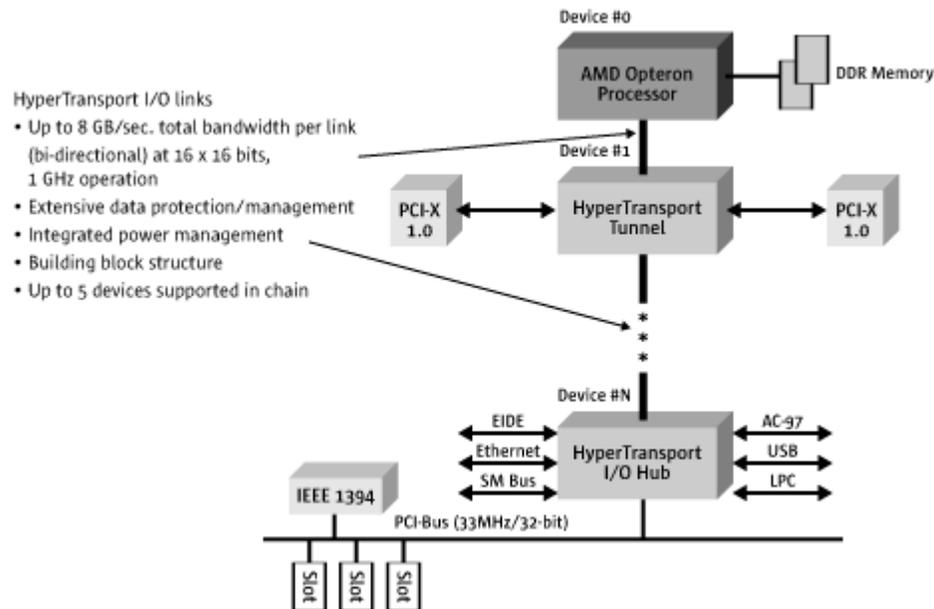
Figure 3-5: Sample HyperTransport Technology Architecture Block Diagram

nVidia nForce4 Ultra Chipset

The nVidia nForce4 Ultra chipset provides a HyperTransport-to-PCI-Express bridging interface as well as the following functionality:

- HyperTransportTM technology interface to AMD OpteronTM processor
- PCI Express x16 interface
- PCI Express x1 interface
- 10/100/1000BASE-T Ethernet
- Serial ATA 1.5GBps controller
- EIDE Controller, supporting up to ATA-133
- AC'97 Audio
- USB 2.0
- I/O buses: PCI, LPC, SMbus, and APIC

The nVidia nForce4 Ultra chipset enhances the AMD Athlon 64 system with powerful features like "instant on" secure networking, an advanced storage solution that protects valuable digital media assets, and PCI Express, the industry's latest bus architecture for graphics and expansion cards.

The nVidia nForce4 Ultra provides a 16-lane PCI Express link for graphics cards and other devices. It includes one x16 PCI Express graphics slot and three x1 PCI Express expansion slots. This new bus delivers over 4 GB/sec. in both upstream

and downstream data transfers.

The nVidia nForce4 Ultra chipset protect and saves important digital assets from hard drive failure or corruption. A simple-to-use interface makes disk management easy. The Ultra 20 Workstation provides support for two SATA 1.5 GB/sec. drives.

nVidia nForce4 Ultra also includes a secure Gigabit Ethernet network interface that features the ActiveArmor Firewall—a "native" hardware-optimized solution built directly into the network connection.

BIOS

The Sun Ultra 20 Workstation BIOS contains software that initially boots, initializes, and configures the workstations. The BIOS will initialize components, detect CPUs, check and test physical memory, configure onboard devices, configure PCI devices, and support and optimize any other functionality on the motherboard before passing control to the boot device. The BIOS contains Phoenix Award BIOS v6.000PG and includes the following features:
- ACPI 1.0b/2.0 support
- Wake on LAN
- PXE (Preboot Execution Environment) support
- Simple Boot Flag support (Quick-Boot)
- System Summary Screen
- ROM-based setup
- Mixed memory speed support
- Boot block function support

The Sun Ultra 20 Workstation comes from Sun with the BIOS already updated with a current released version of the software. Current versions, and future updates to the BIOS, which is included on the Sun Ultra 20 Workstation Supplemental CD, will be made available for download via http://www.sun.com/ultra20/downloads.html.

Memory

An integrated DDR DRAM memory controller changes the way the processor accesses main memory, resulting in increased bandwidth, reduced memory latencies, and increased processor performance. This allows the available memory bandwidth to scale with the number of processors.

The Sun Ultra 20 Workstation is built with a 128-bit wide integrated DDR DRAM memory controller that is capable of supporting up to four (4) registered DDR DIMMs per processor and a total of 4 GB of memory. It has an available memory bandwidth up of up to 6.4 GB/sec. (with PC3200) per processor. Due to physical design constraints, the maximum density currently available for unbuffered PC3200 DIMMs is 1 GB, thus the 4 GB maximum memory limit.

Both ECC and Non-ECC DIMMS are acceptable, but should not be mixed. The memory controller works in 64-bit or 128-bit mode ECC operation. For best performance, Sun recommends running in 128-bit mode ECC operation, requiring that

DIMMs be populated in pairs such that they each occupy one-half of 128-bit memory controller interface.
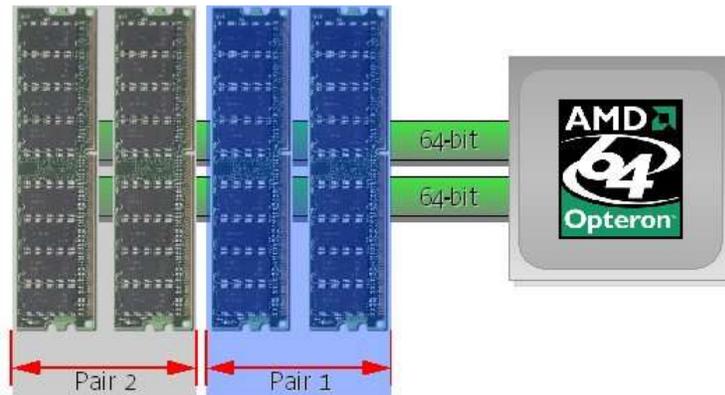
Figure 3-6: The Sun Ultra 20 Workstation has two memory banks, each with two slots. One bank has black DIMM sockets and one has blue DIMM sockets. Memory should be installed in the blue sockets first.

Supported Configurations

The Sun Ultra 20 Workstation supports the following non-ECC memory configurations:
- 2 x 256 MB unbuffered DDR400
- 4 x 256 MB unbuffered DDR400

The Sun Ultra 20 Workstation supports the following ECC memory configurations:
- 2 x 1 GB unbuffered DDR400
- 4 x 1 GB unbuffered DDR400
- 2 x 512 MB unbuffered DDR400
- 4 x 512 MB unbuffered DDR400
- 2 x 512 MB unbuffered DDR400 plus 2 x 1 GB unbuffered DDR400

System Interconnect Technology

PCI-Express

PCI-Express architecture is a new serial interconnect technology that retains the PCI usage model and software interfaces while supporting chip-to-chip, board-to-board and adapter solutions at an equivalent or lower cost structure than existing PCI designs. PCI-Express currently runs at 2.5 GB/sec., or 250 MB/sec. per lane in each direction. Future frequency increases will scale up total bandwidth capabilities beyond that expected from PCI-X 2.0, providing I/O attach points for high-performance graphics, 1394b, USB 2.0, InfiniBand Architecture, Gigabit Ethernet, and other technologies. PCI-Express has been adopted first as the next generation of graphics technology, replacing AGP 8X.

Storage

Serial ATA is the primary method of storage for Sun Ultra 20 Workstation. Sun Ultra 20 Workstation is available in standard configuration with SATA drives only and the option to add one more SATA drive for a maximum of two drives. Sun Ultra 20 Workstation will initially be available with SATA RAID 0 and RAID 1 under Windows XP Pro and Windows XP Pro x64 only.

NOTE: Sun Ultra 20 Workstation will not be sold with SCSI hard disk drives, in standard configurations, ATO, or X-Option. However, Sun will validate an Ultra320 SCSI adapter (X9265A) and will make it available for purchase via X-Option only (ATO not available). Customers may attach their preferred SCSI disk drives to X9265A. The Ultra 20 Workstation supports only external SCSI drives.

External Connectivity Ports

The Sun Ultra 20 Workstation contains several expansion and peripheral connectivity ports, as shown in Table 3-1. All ports are located either in the front or the back, providing easy access to peripherals, connectors, and visual indicators.

Table 3-1: Ultra 20 Workstation External Connectivity Ports

Port Type	Front	Back
USB 2.0	2	4
FireWire (IEEE 1394a)	2	
Gigabit Ethernet		1
Audio		2
PCI		4
PCI-Express		3

Expansion

Expansion Bays

Sun Ultra 20 Workstation each have three expansion bays: one external and two internal. The external bay is always occupied by either the DVD Dual drive or the DVD-ROM drive. Table 3-2 describes the different expansion bays.

Table 3-2: Sun Ultra 20 Workstation Expansion Bays

Bay	Type	Size	Description
Bay 1	External	3.5-inch	Occupied by DVD-Dual or DVD-ROM
Bay 2	Internal	3.5-inch	Occupied by 80GB or 250GB SATA hard disk drive
Bay 3	Internal	3.5-inch	Occupied by 80GB or 250GB SATA hard disk drive

Expansion Slots

Sun Ultra 20 Workstation has seven (7) expansion slots, the most of any P4-based workstations in its class:
• One PCI-Express x16 slot (reserved for graphics accelerator)
• Two PCI-Express x1 slots
• Four conventional PCI slots (32-bit, 33MHz)

The PCI-Express x16 slot is reserved for the graphics card. Sun Ultra 20 Workstation will be available without a graphics card installed. If a graphics card is not inserted into the PCI-Express x16 slot of Sun Ultra 20 Workstation, the on-board ATI Entry 2-D graphics controller will serve as the graphics controller. PCI-Express x1 slots and conventional PCI slots can be used for optional cards such as Gigabit Ethernet, Ultra320 SCSI Adapter.

Chapter 4
Sun Ultra 20 Workstation Graphics Accelerators

Customers familiar with Sun workstations will also be familiar with Sun's consistency in cost-effectively delivering outstanding graphics performance. In the infancy of the performance workstation market, graphics accelerators were typically provided by the workstation vendor. The computer graphics industry has fully matured with well-established first, second, and third tiers of commodity graphics hardware vendors who have revolutionized the entire market with commodity pricing and virtual-reality-level performance.

The Sun Ultra 20 Workstation is well-suited for compute-intensive and visualization applications in software development, EDA (electronic design automation), and MCAD (mechanical computer-aided design). A variety of graphic cards are available, which allows customers to maximize the functionality of their system(s) relative to the chosen application.

The following graphics accelerator cards are available from Sun:
• ATI Entry 2-D on-board graphics controller (does not carry ISV certification)
• nVidia Quadro NVS280 PCI-Express card (carries ISV certification)
• nVidia Quadro FX1400 card (carries ISV certification)
• nVidia Quadro FX3450 card (carries ISV certification)

ATI Entry 2-D On-Board Graphics Controller

The on-board ATI Entry 2-D graphics controller provides Sun customers a basic set of graphics functionality suitable for software development, education, and training. This chip addresses up to 8 MB of 64-bit wide memory and can drive any single Sun display. The on-board ATI Entry 2-D graphics controller cannot drive two displays; it can drive a single display without a graphics card installed.

nVidia Quadro NVS280 PCI-Express Graphics Accelerator

Figure 4-1: nVidia Quadro NVS280 Graphics Accelerator

The nVidia Quadro NVS 280 (PCI-Express version) graphics accelerator provides Sun customers a very cost-effective 2D board for software development, education, training, or financial trading. This card ships with 64 MB of DDR memory and can drive up to two Sun 17-inch Color Monitors, two Sun 22-inch CRTs, or two Sun 19-inch TFT LCD Monitors. The Sun Ultra 20 Workstation supports up to two NVS280 graphics accelerators and can drive up to four Sun displays at the maximum resolution of the display.

nVidia Quadro FX1400 PCI-Express Graphics Accelerator

Figure 4-2: nVidia Quadro FX1400 PCI-Express Graphics Accelerator

The nVidia Quadro FX 1400 graphics accelerator provides Sun customers a mid-range 3D performance workstation graphics solution for professional CAD, MCAE applications. This card ships with 128MB of DDR memory and can drive any two Sun displays, including two 24.1-inch LCD monitors.

Key Specifications and Features Comparison

Table 4-1 compares the key specifications and features of each of the available graphics accelerators.

Table 4-1 Graphics Accelerators Key Specifications and Features

Specification/Feature	ATI Entry 2-D	nVidia Quadro NVS280	nVidia Quadro FX1400
Form Factor	Soldered down on motherboard	Half-height	Full-height
Bus Type	Conventional PCI	PCI Express x16	PCI Express x16
Memory	8 MB of SDRAM (64-bit interface	64 MB of DDR SDRAM (64-bit interface)	128 MB of DDR SDRAM (256-bit interface)
Connector	One DB-15 VGA connector	One high-density connector (DMS-59) to support dual DVI-I	2 x DVI-I 1.0 (Single link) 3-pin mini-din stereo connector
Single DVI Support	No	Yes	Yes
Dual DVI Support	No	Yes	Yes
Maximum Resolution			
Sun 17-inch color CRT	1280 x 1024	1280 x 1024	1280 x 1024
Sun 19-inch LCD	1280 x 1024	1280 x 1024	N/A
Sun 19-inch TFT flat panel LCD	N/A	1600 x 1200	1600 x 1200 (32 bpp @ 60 Hz)
Sun 22-inch flat screen AG CRT	1600 x 1200	2048 x 1536	2048 x 1536
Sun 24.1-inch LCD	1600 x 1200	N/A	1920 x 1200
Max Boards per Sun Ultra 20 Workstation	One	One	One
# Display(s) Supported	One	Two	Two
Standard Configuration	Yes	Yes	Yes
ATO	No	Yes	Yes
X-Option	No	Yes	Yes
Available Drivers	Solaris, Windows XP Professional, Red Hat, SuSE		

Chapter 5
Sun Ultra 20 Workstation Environmentals and Regulations

This chapter outlines the environmental and regulation specifications for the Sun Ultra 20 Workstation Workstation.

Environment

The Sun Ultra 20 Workstation Workstation meets or exceeds the environmental specifications listed in Table 5-1.

Table 5-1: Sun Ultra 20 Workstation Environmental Specifications

	Sun Ultra 20 Workstation
AC Power	100-120; 220-240 V AC, 47-63 Hz, typical config 0.39 KVA; Maximum 0.875 KVA
Operating Temperatures	5° C to 35° C (41° F to 95° F); 20% to 93% relative humidity, non-condensing
Non-operating	-40° C to 65° C (-40° F to 149° F) at sea level; 93% relative humidity, non-condensing 38° C maximum wet bulb
Operating Acoustic Noise	4.7 bels
Idling Acoustic Noise	4.3 bels

Regulations

The Sun Ultra 20 Workstation meets or exceeds the following regulatory specifications listed in Table 5-2.

Table 5-2: Sun Ultra 20 Workstation Regulatory Specifications

	Sun Ultra 20 Workstation
Safety	UL/CSA-60950, EN 60950, IEC 60950 CB
Ergonomics	EK1-1TB-2000
RFI/EMC	EN 55022/CISPR22 Class B, FCC CFR47 Part 15 Class B; EN 61000-3-2, EN 61000-3-3; EN 300-386 v1.3.1
Immunity	EN 55024
Regulatory Markings	UL/cUL, TUV-GS, CE FCC, ICES-003, C-Ticek, VCCI, GOST-R, BSMI, MIC, CCC (pending), S-Mark
Power Management	Energy Star (E-Star) support will be provided in future Solaris OS releases

Chapter 6
Software Operating Environment

The 64-bit Sun Ultra 20 Workstation offers the greatest range of operating systems support in Sun history — a greater range than is offered by Sun's competitors. The Sun Ultra 20 Workstation supports multiple 32-bit and 64-bit operating systems, including Linux and Solaris. The Sun Ultra 20 Workstation is also Windows XP Professional WHQL (Windows Hardware Qualification Lab) certified. Table 6-1 lists the different operating systems supported on the Sun Ultra 20 Workstation.

Table 6-1: Supported Operating Systems

Operating System		Orderable from Sun?
Solaris 10 x64	64 -bit	Yes
Red Hat Enterprise Linux 3.0 (update 4 min.)	32-bit	Yes
Red Hat Enterprise Linux 4.0	64-bit	Yes
SuSE Linux Enterprise Server 9 - AMD64	64-bit	Yes
MS Windows XP Professional	32 -bit	No — must be purchased separately from
MS Windows XP Professional - X64 Edition	64-bit	Microsoft or a Microsoft certified partner

Red Hat Enterprise Linux 3.0 (update 4 minimum, update 5 required for latest hardware support), Red Hat Enterprise Linux 4.0, and Solaris 10 HW 03/05 x64 operating systems can be ordered from Sun. Support contracts are also available for these operating systems.

The Sun Ultra 20 Workstation has been certified by the Microsoft Hardware Quality Labs (Windows Server Catalog) and has earned the "Designed for Windows" designation as a certified platform to run the Microsoft Windows XP Professional Operating system. The Sun Ultra 20 Workstation is also listed on the Microsoft Hardware Compatibility List (HCL) which can be seen by visiting the Microsoft Windows Hardware and Driver Central (WHDC) Web site at http://www.microsoft.com/windows/catalog/server.

Solaris Operating System Features

Solaris 10 delivers performance advantages for database, Web, and Java technology-based services, as well as massive scalability with price/performance advantages.
• Real-time troubleshooting of system problems
• New tools for low-level system debugging
• System hardware testing and analysis
• Fine-grained project accounting
• Enhanced patch analysis and delivery tools
• Existing applications benefit from Solaris 10 enhancements without modification
• Provides integrated Sun Java™ Enterprise System suite components and the Sun Java Desktop System
• Includes 187 of the most popular free and open source software packages, many of which are supported by Sun

• Provides integrated developer tools such as GNU utilities and Perl and Python programming languages

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NOTE: All occurrences of Solaris 10 OS for the Sun Ultra 20 Workstation refer specifically to Solaris 10 for x64 OS.

Solaris 10 for x64 OS is the minimum required release for the Sun Ultra 20 Workstation. The Solaris 10 x64 OS on the Sun Ultra 20 Workstation will deliver both 32-bit and 64-bit support.

Key Productivity Features

The Solaris Operating System delivers several critical performance and reliability features, such as:
• Enhanced ease of use and PC-interoperability features
• Integrated, high-performance Java technology and tools
• Robust software developer environment
• Advanced, standards-based networking
• Improved systems installation and management tools
• Enterprise-class directory services
• Enhanced desktop tools, I/O standards, and security

Other key features include:
• 100% binary compatibility
• Reliability, availability, and serviceability
• Java 2 SDK
• IPv6/IPsec/Mobile IP
• LDAP directory services
• System management tools
• Desktop management and productivity tools
• Observability
• Internationalization
• Data Management
• Real-time application support
• Enhanced security features

Manageability Features

The Solaris 10 Operating System dramatically improves the way system administrators and developers can identify the reasons for suboptimal system and application performance. Solaris Dynamic Tracing (DTrace) technology makes it possible to delve deeply into today's complex systems to troubleshoot problems in real time and quickly eliminate bottlenecks. Additional Solaris 10 features provide enhanced system insight, enabling a system administrator to quickly identify and resolve hardware problems, and streamline and automate patch management. Solaris Containers can also consolidate multiple applications onto a single system to increase utilization rates and cut system and licensing costs.

Existing applications that adhere to the Solaris x64 OS application binary interface (ABI) and that are compiled with the same APIs, will run unmodified on x64 platforms. In addition, Sun provides an easy-to-use AppCert testing tool for developers to verify existing Solaris OS application binaries and report any potential incompatibilities.

Interoperability

Understanding that businesses today rely on a mix of technologies from a variety of vendors, Solaris 10 provides tools to enable seamless interoperability with hundreds of heterogeneous hardware and software platforms. Some key interoperability features include:

- Desktop with a modern GUI that is familiar to someone using Windows
- StarOffice with support for native Microsoft Office file formats, making document interchange easier.
- Evolution email and calendar client, which has similar functionality to Outlook, making transition easy
- Mozilla browser, which looks familiar for Internet Explorer users
- Ability to mount networked Windows folders and exchange files via drag and drop
- Ability to print to printers served by Windows
- Java Desktop System Configuration Manager, which works with employee data stored in LDAP-based systems or Active Directory

Availability

New Solaris 10 features, such as Predictive Self Healing, offer capabilities that automatically diagnose and recover from hardware and application faults, maximizing system uptime.

Advanced Networking

Support for IPv6 in the Solaris OS is integrated into NFS, RPC, NIS, NIS+, and DNS. IPsec enables secure virtual private networks and network access control. Mobile IP provides Internet disconnect/reconnect capabilities with no data loss.

Bundled Software

Software bundled with the Solaris OS includes Oracle 8i Enterprise Edition, lxrun for Linux application compatibility (for the Solaris OS x64), Apache Web Server, Netscape Communicator, Sun Java System Directory Server, gzip, bash, and tcsh.

The Solaris operating environment ships with a number of software components that increase overall availability, including Solaris Resource Manager software for fine-grained control of system resources, Solaris Bandwidth Manager software for enhanced network resource availability, and Sun Cluster 3.1 software for even greater application availability through a clustered file system, scalable data services, and built-in load balancing.

Sun Studio

Sun Studio 10 software is Sun's latest and best developer tool suite for C, C++ and Fortran application development. It continues to provide corporate developers and ISVs with a comprehensive, integrated suite of tools for the development, debugging, tuning, and deployment of enterprise applications on Sun platforms. With this release, Sun Studio 10 software extends its world class development environment to the AMD64 architecture and delivers reliable, scalable, and high performance applications for the Solaris 10 Operating System.

Additionally, Sun Studio 10 software provides a common debugger that can visually debug single and multi-threaded C, C++, and Fortran code. It can even handle intermixed Java and native code, an industry first! All of these powerful tools are presented within a NetBeans™-based Integrated Development Environment.

Sun Studio 10 software also provides an integrated development environment (IDE), performance analysis tools and intuitive debugger for Linux Operating systems. These components are compatible with GCC 3.2 software. Note that Sun is neither supplying nor providing support for the gcc compiler.

Customers using prior software versions including Forte Developer 6 Update 2, Sun ONE Studio 7 Enterprise Edition, Sun Studio 8, and Sun Studio 9 releases can easily upgrade to Sun Studio 10 software since it is fully compatible with these previous releases. The software is full of productivity enhancements, feature improvements, and expanded platform support to make Solaris and Linux application development more productive.

Solaris Flash Software

To improve utilization of the systems that make up today's data centers, administrators are turning to tools such as Solaris Flash software. Solaris Flash software provides new provisioning functionality that allows administrators to capture a snapshot image of a complete system—including the Solaris OS, the applications stack, and the system configuration into a new Flash Archive format. Using this system image, administrators can then rapidly replicate a reference system configuration onto many target systems. Solaris Flash images can be deployed via standard media or over the network via HTTP and NFS protocols. Solaris Flash software images can be installed using custom Solaris JumpStart software scripts, the Solaris Web Start software graphical interface, or through interactive installation of the Solaris Operating System.

Solaris LIVE! Upgrade Software

Solaris LIVE!™ Upgrade software allows Solaris OS software to be installed on a separate partition from the currently running version of the operating environment. In particular, Solaris LIVE! Upgrade software enables systems to run uninterrupted while a system administrator installs a Solaris Flash archive or upgrades to a new version of the Solaris Operating System. As a result, downtime for upgrades is reduced to the time needed for a reboot. When installation is complete, a simple reboot enables the Solaris 10 OS to take control. Since Solaris LIVE! Upgrade software includes a version migration and fallback feature, organizations can also fall back to the previous release (again, through a simple reboot) without losing administration information.

Real-Time Video Creation and Broadcast Support

A Java Media Framework (JMF) technology player provides access to the latest industry-standard audio and video files, including MPEG1/2, QuickTime, VIVO, AVI, AIFF, GSM, WAV, RMF, AU, and MIDI.

Solaris 10 OS Bundled Desktop Environments

Common Desktop Environment (CDE) Enhancements

The latest generation of the Common Desktop Environment (CDE) comes standard, providing workstation users with an easy-to-use, open, secure platform. Personal Digital Assistant (PDA) support synchronizes data from most Palm computing devices with the CDE calendar, mail, memo, and address book. CDE now features streaming video using MPEG1, MPEG2, QuickTime, and AVI formats, as well as MIDI audio using Java Media Framework technology.

GNOME 2.0 Desktop Environment

GNOME 2.0, the modern desktop for the Solaris 10 Operating System (OS), provides applications and tools that are designed to enhance business productivity in a networked world. GNOME 2.0 helps organizations achieve their business goals by offering a unified, modern, open, networked, and cost-effective desktop solution. Key features of GNOME 2.0 include:

• Personalization capabilities that allow users to change settings to suit their preferences
• Built-in applications and assistive technology solutions for users with disabilities
• Removes complexity of supporting disparate desktop user environments and provides a richer common unified desktop
• Open file standards provide transparent file and data interchange
• Built-in accessibility support enables all users to interact with the GNOME 2.0 desktop environment running on any UNIX platform
• Flexibility and choice to run GNOME, CDE/Motif, and Java technology-based applications unmodified, preserving existing software investments
• Support for key open standards to facilitate interoperability, compatibility, and collaboration in today's highly-networked, heterogeneous world, including support for XML, DOM, HTTP, HTML, CORBA, MIME, Unicode, MPEG, JPEG, AVI, MIDI, XDnD (drag & drop), X11, NFS, and TCP/IP

GNOME 2.0 for the Solaris OS is open source, free software with no upgrade or licensing fees. More information about GNOME 2.0 is available at http://www.sun.com/gnome.

Solaris OS Licensing and Usage

Under the Free Solaris™ Binary License Program program, Sun is making the binary (runtime) version of its Solaris 10 OS available to anyone who accepts the terms of the Solaris OS Binary Code License (BCL) and the Free Solaris Binary License Program. There are no fees for the right to use the software on computers with a capacity of eight or fewer

processors. There is a small charge for the media kit. Refer to http://www.sun.com/software/solaris for current licensing details.

Features of the Solaris OS license include the following:
- No distinction between desktop and server licenses
- Free binary (runtime) license for all systems with eight or fewer CPUs for users who accept the terms of the Solaris 10 OS Binary Code License and the Free Solaris Binary License Program
- Solaris 10 OS software is provided via the Solaris 10 Media Kit available for purchase at http://www.sun.com/solaris/binaries
- Single Solaris Media Kit for installing multiple systems
- Solaris Media Kit contains additional bundled software
- Solaris Supplemental CD of bundled user and system management tools
- Oracle 8i Enterprise Edition (with development license)
- StarOfficeTM 7.0 productivity suite
- Solaris Software Companion CD of popular freeware

Chapter 7
Additional Software Tools

Sun Java Studio Software

Sun Java Studio software is a comprehensive, integrated offering that improves developer productivity with intuitive, easy-to-use tools and technologies.

Java Studio software consists of tools, software development kits (SDKs), application programming interfaces (APIs) and libraries, and developer services. Using Java Studio software, developers can rapidly develop applications and Web services across multiple platforms and environments.

Sun Java Studio Enterprise Software

Java Studio Enterprise software is a complete, cost-effective, unified platform of tools, support, and services designed to fully integrate with the capabilities of the Sun Java Enterprise System. Java Studio Enterprise software enables the development of applications in an environment carefully designed to improve productivity while simplifying the creation of sophisticated network applications ready to be deployed on the Java Enterprise System.

Java Studio Enterprise delivers an awe-inspiring array of new enterprise-centric, innovative, advanced and completely integrated developer-focused features and services. Enterprise-grade applications are delivered faster with rapid architecture and modeling capabilities. Faster transaction throughput and an optimal user experience can be achieved through the implicit understanding and tuning of application performance driven by the latest application profiling solution.

Groundbreaking and unique, industry leading, code-aware developer collaboration software is unveiled in this release. It will increase enterprise development team productivity by enabling groups to dynamically and globally work together; optimizing code and accelerating high quality application delivery.

Sun Java Studio Creator Software

The Sun Java Studio Creator environment is the next-generation tool for Java application development. This effort brings together the power of 100% Java standards with a simplified visual development model recognized by many developers as the most effective and productive way to work.

The Java Studio Creator environment is designed to address the needs of skilled developers whose primary day-to-day concern is how to rapidly deliver business-critical applications. It enables developers to leverage the power of the Java platform to solve business problems without getting bogged down in plumbing and without giving up the highly productive visual development they are used to.

Sun has always focused on making Java technologies robust. The Java Studio Creator development environment demonstrates a new direction: highly robust, powerful technologies that can be used productively and effectively. With the Java Studio Creator environment, Sun delivers a complete solution for key requirements that customers have stated are increasingly important.

Chapter 8
Conclusion

The Sun Ultra 20 Workstation is designed for high-performance, scalability, and flexibility at a cost-effective price in a common deskside tower enclosure. It features 64-bit performance, large memory support, I/O capability to support low-latency, high-bandwidth interconnects for technical computing, 32-bit x64 compatibility, multiple OS support, and a wide range of peripheral and ISV support. Customers can run their current 32-bit applications and leverage their existing knowledge base while laying a foundation that can take advantage of the future benefits of next-generation 64-bit operating systems and applications.

References

Sun regularly posts product information in the form of data sheets, specifications, and white papers. Look for these and other Sun technology papers at http://www.sun.com. For documentation on the Sun Ultra 20 Workstation as well as all other Sun hardware platforms, visit http://docs.sun.com.

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