Sun Ultra™ 80 Workstation

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Figure 1. Sun Ultra™ 80 workstation

Multiprocessing Power on the Desktop

The Sun Ultra™ 80 workstation brings multiprocessing power, industry-standard PCI I/O, and dual-UPA graphics capability to the desktop. This next-generation workstation uses the processing power of UltraSPARC™-II processors, Sun™ Expert3D-Lite, Sun Elite3D, and Sun Expert3D graphics technology, UltraSCSI disks, and the innovative high-performance peripheral component interconnect (PCI) I/O bus. With the tower system enclosure, Sun Ultra 80 workstation provides all the modular and expandable features that users have grown to expect from Sun Workstation™ systems. Sun's commitment to high-performance computing means the Ultra 80 workstation delivers increasing levels of performance and preserves 100 percent binary compatibility with application software.

Sun Ultra 80 Workstations

The Sun Ultra 80 workstation is available in three configurations. Models 1450, 2450, and 4450 are configured with one, two, or four 450-MHz UltraSPARC-II processors respectively, each with 4 MB of L2 cache. Models 1450 and 2450 are easily upgraded to their quad-processor counterparts by adding additional processors.

All models include Sun Expert3D-Lite, Sun Expert3D graphics, or the highly integrated Sun Elite3D m6 graphics card, which provide a comprehensive range of graphics functionality and performance without the high cost of the large, expensive frame buffer through I/O bus technology provided by some of the competition.

Ultra 80 workstations continue the Sun tradition of delivering balanced system design and innovation. The powerful Ultra port architecture (UPA), introduced on the original Ultra systems, continues in the Ultra 80 system. The Ultra 80 workstation has dual UPA graphics slots to support up to two Sun Elite3D, Sun Expert3D, or Sun Expert3D-Lite graphics-driven frame buffers.

The Ultra 80 workstation continues Sun's drive to deliver industry-standard PCI I/O bus, enabling access to hundreds of expansion and networking options. The Ultra 80 workstation PCI I/O bus with dual bus channels providing sustained high performance to the system's PCI slots. In addition, Sun has delivered the advanced 66-MHz PCI, which is capable of 200 MB/second throughput, ideal for high-performance networking requirements.

New Features

Sun is announcing Ultra 80 workstation configurations including Sun Expert3D-Lite graphics cards. Sun Expert3D-Lite graphics is the latest Sun graphics offering to feature onboard texture mapping memory plus hardware-accelerated geometry and texture mapping acceleration.

Sun Expert3D-Lite graphics offers many of the same features of Sun Expert3D graphics including 32-bit RGBA double-buffering/32-bit Z-buffering (3-D) support at resolutions of up to 1920 x 1080, stereoscopic video graphics support at up to 1280 x 800@122 Hz or 1152 x 900@120 Hz, and multi-display support. Up to three Sun Expert3D-Lite graphics accelerators are supported in the Ultra 80 workstation.

Product Family Placement

The Ultra 80 workstation is an advanced member of the current desktop product family, which scales from the low-cost, high-performance Ultra 5 and 10 workstations, to the two-way Ultra 60 workstation, and up to the four-way Ultra 80 workstation.

Ultra systems have several things in common, including:

- The SPARC™ processor
- 100 percent binary compatible from the low end to the high end, including Sun's server family
- Scalable from the low-end uniprocessor systems to the 64-way Sun Enterprise™ 10000 (Starfire™) server
- Modular—easy-to-swap components

Workstation	Target Users and Markets
Ultra 5 and Ultra 10	Designed as a low-cost desktop solution, the Ultra 5 and 10 systems appeal to customers looking for a low-priced system offering accelerated graphics, expandability, fast application performance, and investment protection. The Ultra 5 and 10 workstations are well suited for many different customers, from those who require low-cost imaging solutions to those who demand intensive graphics and expansion capabilities. Target markets include software development, financial, government, telecommunications, manufacturing, and education.
Ultra 60 and Ultra 80	The Ultra 60 and Ultra 80 workstations are designed for the technical user who requires high performance and multiprocessing capability. They also addresses the needs of graphics intensive users and continue to support and build upon the upgradability features to which Ultra workstation users have grown accustomed. With the 450-MHz UltraSPARC-II processor with 4 MB of Level 2 cache, these workstation are the performance leader for Sun's workstation family. The target customer is the traditional "power desktop" user who has performance and expansion requirements that exceed the capabilities of the Ultra 5 and Ultra 10 systems. This includes both technical and commercial users who need the large number of applications and the functional capabilities of the Solaris™ Operating Environment, the high-performance of the UltraSPARC-II CPU, dual-headed graphics, and excellent throughput.

Key Messages

Sun Ultra 80 workstation is a member of Sun's UltraSPARC processor-based desktop systems. UltraComputing™ technology has evolved to new levels of performance and technology innovation.

- **Innovative tower system design provides modularity for flexibility, maximum system growth, and expansion potential**
  - The Ultra 80 workstation offers the flexibility of starting with a single CPU and adding more CPUs later as compute needs grow
  - Memory capacity to 4 GB maximum (16 slots using existing 64-MB or 256-MB DIMMs)
  - Supports 18.2- and 36.4-GB drive options (supports 1.0-inch high, 3.5-inch, 10000-rpm UltraSCSI disk drives); up to 72.8 GB of drive space
  - Two UPA graphics slots able to support two Sun Elite3D, Sun Expert3D, or Sun Expert3D-Lite graphics cards
  - Expanded front access capabilities: power switch, 5.25-inch removable media bay for options such as 32X CD-ROM or tape options; 3.5-inch front access bay for optional floppy drive or PCMCIA; and a third bay to accommodate either a 5.25-inch or 3.5-inch front access device
  - High I/O expansion with three full-sized and one short industry-standard PCI bus slots
- **High-performance UltraSPARC-II CPU processor module**
  - 64-bit SPARC™ version 9 at 450 MHz
  - 4 MB of second-level cache memory
  - 100 percent binary compatibility with current Solaris Operating Environment
  - Runs 32-bit applications unmodified from the Solaris 2.5.1, 2.6, 7, and 8 Operating Environment
  - 64-bit applications supported on the Solaris 7 and 8 Operating Environment
- **Exceptional throughput**
  - UPA provides a crossbar-oriented interconnection establishing a 144-bit wide, ECC-protected data path to the CPU
  - Clocked at up to 112 MHz, the UPA crossbar gives a peak throughput of 1.8 GB per second (models with 450-MHz processor)
  - Memory subsystem offers a 576-bit-wide memory path
  - Architecture allows memory to be installed in fours to take advantage of 576-bit-wide memory path
  - UltraSCSI is integrated on the motherboard
  - A second UltraSCSI channel is available, allowing external devices to be connected to separately, further improving I/O throughput
- **One of the industry leaders for networking, connectivity, and I/O performance ratings**
  - 100 Mbps Fast Ethernet through twisted pair is a standard feature on all Ultra 80 workstations, but the system also maintains connectivity with 10 Mbps networking technology through an autosensing speed switch feature
  - Advanced networking options include FDDI and additional Fast Ethernet ports through industry-standard PCI option cards
  - Innovative multiple-channel industry-standard PCI I/O bus provides sustained high throughput on all four PCI slots (three long and one short)

- Industry's first 66-MHz PCI I/O slot capable of delivering 200 MB/second throughput ideal for high-performance networking requirements

- **Support for Sun Expert3D-Lite graphics offers a high-performance, entry-level graphics option**

- **Support for high-power Sun Elite3D m6 graphics provides high-end graphics for a mid-range price**

  - Sun Elite3D m6 graphics is Sun's high-power, high-end 3-D graphics option in the Sun Elite graphics product line.

Sun Ultra 80 System Models

The Sun Ultra 80 workstation comes in three models that differ only in the installed processor module. Model 1450 is the entry Ultra 80 workstation. Model 2450 is the two-processor version of the Ultra 80 workstation. Model 4450 is the four-processor version of the Ultra 80 workstation and should be used in situations that require the highest computing performance.

Sun Ultra 80	Model 1450	Model 2450	Model 4450
Processor speed	1 x 450 MHz	2 x 450 MHz	4 x 450 MHz
UPA speed	112 MHz	112 MHz	112 MHz
Maximum Memory	4 GB	4 GB	4 GB
SPECint_95 *	19.7	19.7	19.7
SPECfp_95 *	27.9	36.1	44.6

* SPECint_95 and SPECfp_95 results using SPARCompiler™ version 5.0.

Availability

Sun Ultra 80 workstation Models 1450, 2450, and 4450 began shipping November 1999. Sun Ultra 80 workstation models with Sun Expert3D graphics and Sun Elite3D series 2 configurations began shipping in April 2000. Ultra 80 models with Sun Expert3D-Lite graphics began shipping in May 2001.

Target Users

The Ultra 80 workstation is a more advanced Ultra 60 workstation. Like the Ultra 60 workstation, the Ultra 80 workstation is designed for the technical users who require high-performance and multiprocessing (MP) capability. Ultra 80 workstation also addresses the needs of users with graphics-intensive applications by supporting up to two Sun Elite3D m6 or Sun Expert3D graphics frame buffers, or three Sun Expert3D-Lite graphics cards.

The target customer is the "power desktop" users who have performance, graphics and expansion requirements that exceed the capabilities of the Ultra 60 system. This includes both technical and commercial users who need the large number of applications and the functional capabilities of the Solaris Operating Environment, the high performance of the UltraSPARC-II CPU, dual-headed high-end graphics, and outstanding throughput.

Target Markets

Industry	Key Features to Highlight
Electronic Design (EDA) • Chip designers, board designers • System houses • Telco	• High-performance CPUs • High-memory capacity • Availability of applications
Financial • Stock and commodity traders **Banks**	• High performance • Compact design • Multimedia capabilities
Mechanical Design (MCAD/MCAE) • Automotive • Aerospace • Defense industry • Mechanical equipment designers	• High-performance CPUs • High-end graphics performance and functionality standard • Availability of applications
Oil and Gas • 2-D, 3-D, and 4-D seismic analysis • Production engineering • Reservoir engineering	• High-performance CPUs • Dual Sun Elite3D graphics monitors • Multithreaded OpenGL® platform • High-end performance and functionality for both graphics and imaging operations
Medical Imaging • Medical research	• High-performance CPUs • Dual Sun Elite3D graphics monitors • Multithreaded OpenGL platform • High-end performance and functionality for both graphics and imaging operations
Research and Development • In-house development • Research institutions	• High-computing performance • Feature-rich Solaris Operating Environment
Visualization and Simulation • Scientific visualization • Technical simulation	• High-performance CPUs • High-end performance and functionality for both graphics and imaging operations • Dual Sun Elite3D graphics monitors

Compatibility

The Ultra™ 80 workstation runs the Solaris™ 8 Operating Environment. It can also run 32-bit applications unmodified from the Solaris 2.5.1 (Hardware 11/97), Solaris 2.6 (Hardware 5/98), and Solaris 7 (Hardware 8/99) Operating Environment, making these systems compatible with previous systems and software.

Market Value Propositions

- As a result of the multiprocessor capabilities of the Ultra 80 workstation, a company can use all the performance capabilities of Solaris Operating Environment software's multithreaded application base.

- As a result of the scalability and flexibility of the UltraSPARC™ processor architecture, a company can better protect its investment in hardware and software.

- As a result of Sun's memory and UPA, a company will notice the significant improvement in application performance and user productivity.

- As a result of the functionality and higher performance of the Sun™ Elite3D and Sun Expert3D graphics product families as well as the ability to use dual Sun Elite3D or Sun Expert3D graphics frame buffers to display multiple graphics-intensive applications simultaneously, a company can be more productive and have shorter turn-around times while using interactive graphics applications.

- As a result of Sun's I/O networking, a company will be able to have faster networking throughput that will help increase application performance and user productivity.

UltraSPARC™-II Processor

The Sun Ultra™ 80 workstation is a shared-memory, multitasking system built around the UltraSPARC™-II microprocessor. The UltraSPARC-II processor is Sun's latest generation of the SPARC™ processor family and the second generation of 64-bit UltraSPARC chips. The Ultra 80 workstation can use the 450-MHz UltraSPARC-II processor.

- Modules have the 64-bit SPARC V9 architecture.
- Systems have up to 4 MB of Ecache per CPU.
- As a member of the UltraSPARC family of CPUs, full binary compatibility is provided.

PCI Technology

System I/O for the Ultra 80 workstation is provided by two industry-standard peripheral component interconnect (PCI) data buses. All PCI buses in the Ultra 80 workstation comply with the 2.1 revision of the PCI specification, released in March 1995.

- Sun is an industry leader with PCI/66, which has twice the throughput of standard PCI.
- Two independent PCI buses deliver outstanding I/O bandwidth—sustained throughput of up to 200 MB/second.

Sun PGX64 Graphics

Sun PGX64 graphics is the next generation low-cost PCI graphics product in the PGX™ family. It is the PGX32™ graphics successor. Sun PGX64 graphics provides Sun with a very low-cost, flexible 24-bit, 2-D graphics board supporting the widest range of Sun systems and supporting up to four boards in systems that can accommodate four PCI boards. Sun PGX64 graphics is a PCI-based graphics board providing support for all Sun PCI-based workstations ,workgroup and enterprise servers including the Sun Blade 100, 1000, Ultra 5, 10, 60, and 80 workstations, Sun Enterprise™ 250, 220R, 420R, and 450 workgroup servers and Sun Enterprise 3500, 4500, 5500, and 6500 mid-range servers as well as future workstations and workgroup servers supporting PCI.

Sun™ Elite3D Graphics Series 2

Sun™ Elite3D graphics represents a high-powered graphics subsystem for the 3-D graphics market. Sun Elite3D graphics retains the basic underlying architecture of Sun Creator graphics while maintaining full API layer compatibility and transparent acceleration of 3-D graphics APIs. Like the Sun Creator graphics, Sun Elite3D graphics incorporates the visual instruction set (VIS™ software). Sun Elite3D graphics comes in two models: Sun Elite3D m3 graphics offers users twice the performance of Sun Creator3D graphics while Sun Elite3D m6 graphics can provide four to five times the performance of Sun Creator3D graphics.

Sun Elite3D graphics provides very fast, high-quality transformation and display of 3-D solid and wireframe objects, and dramatically accelerates high-end functionality, such as double-buffering, triangle and quad rendering, and lighting and shading. At the same time, Sun Elite3D graphics accelerates 2-D objects that meet X11 rules. Fast 8-bit and 24-bit window system and imaging performance are provided.

Sun Elite3D graphics systems provide 96-bit planes, including full 24-bit double-buffer planes required for smooth animation. A 28-bit Z-buffer is included to provides hardware assistance for hidden surface removal and dynamic rendering for 3-D objects. Sun Elite3D graphics accelerates 2-D objects, fast 8-bit and 24-bit windowing and imaging performance, along with acceleration for decompression and display of compress digital video.

Sun Elite3D graphics systems utilize 3D-RAM technology. This technology is responsible for implementing fast, inexpensive 3-D frame buffers. In addition, Sun Elite3D graphics has three or six (depending on the model) on-board floating-point processors that speed up floating-point-intensive operations such as transformations, clip tests, face determinations, and lighting.

Sun Elite3D graphics is fully compatible with Sun Creator3D graphics accelerators, and does not compromise the windowing system, 2-D graphics, imaging, or video performance. Sun Elite3D graphics simply adds significant performance gains for 3-D applications.

Sun Expert3D Graphics

Sun Expert3D graphics is Sun's latest high-end graphics product. It complements Sun Elite3D graphics, adding hardware-accelerated texture mapping required by many 3-D graphics applications in all of Sun's technical markets. The Sun Expert3D frame buffer provides Sun's most complete acceleration of the OpenGL API to date, including 2-D and 3-D texture mapping, image processing, the OpenGL® for Sun™ Solaris 1.2.1 API, and a significant number of extensions beyond this API.

The Sun Expert3D frame buffer has similar geometry performance to Sun Elite3D m6 graphics, but its 64 MB of texture memory and hardware texture mapping provide up to seven times the performance of Sun Elite3D graphics in rendering 25-pixel, trilinear-textured, Z-buffered, and Gouraud-shaded triangles. The 64 MB of frame buffer memory allow high-resolution (1920 x1200), double-buffered displays and 1280 x 1024 stereo displays. Sun Expert3D frame buffer hardware supports full-scene antialiasing, but software support for this feature is not part of the initial release. Wide lines and polygon offset are fully accelerated by the hardware.

Up to two Sun Expert3D frame buffers are supported in the Ultra 60 and 80 workstations, which is a big advantage over competitive systems allowing only one high-powered graphics board per system. In addition, the Sun Expert3D frame buffer provides support for 24-inch (1920 x 1200 resolution) monitors.

Sun Expert3D-Lite Graphics

Sun Expert3D-Lite graphics is a derivative product based on the Sun Expert3D graphics board. Sun Expert3D-Lite graphics offers many of the same features as its predecessor, but at a lower cost. Features include on-board 3-D geometry acceleration, hardware-based texture mapping, and high-resolution, 24-bit, 3-D support for most of Sun's workstations and PCI-based workgroup servers.

Sun Expert3D-Lite graphics accelerates 3-D geometry at up to 4 million triangles/sec. and provides up to three times the texture mapping performance of Sun Elite3D m3 graphics, at a much lower price.

Sun Expert3D-Lite graphics offers 32-bit RGBA double-buffering/32-bit Z-buffering (3-D) support at resolutions of up to 1920 x 1080, stereoscopic video graphics support at up to 1280 x 800@122 Hz or 1152 x 900@120 Hz, and multi-display support. Up to three Sun Expert3D-Lite graphics accelerators are supported in the Ultra 80 workstation.

System Architecture

Technology Overview

Good performance through advanced applications typically demands excellent performance from more than one part of the system. Most often, an application consists of data fetching, computation, and presentation. Unless the system is designed to address all of these, it will always be limited by the weakest link in the chain.

The Sun Ultra™ 80 workstation is designed for balanced system performance, accelerating applications at every step. Faster I/O and networking, together with the Ultra port architecture (UPA) interconnect, allow fast data fetching. The UltraSPARC™ CPU provides supercomputing power, and moves data through the UPA at high speed. Tightly integrated Sun Elite3D or Sun Expert3D graphics provides high-end graphics functionality and performance for the Ultra 80 systems.
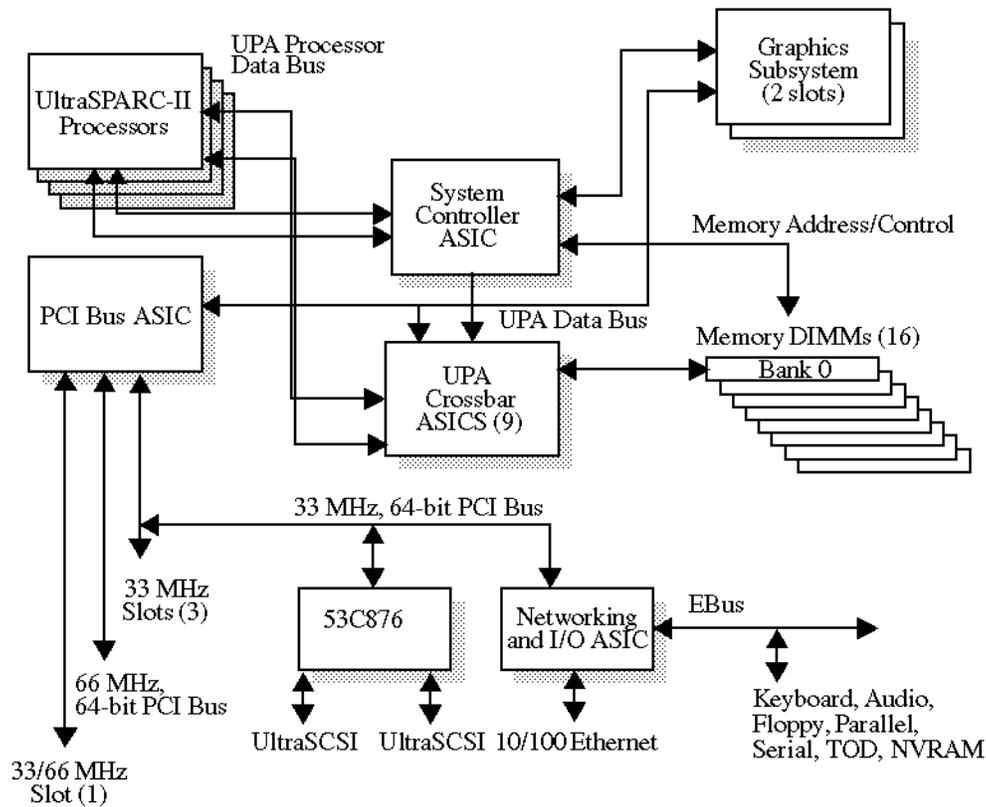
Figure 2. Architecture of the Ultra 80 system

The Sun Ultra 80 workstation has an integrated UPA. This is based on a packet-switched, crossbar architecture. Sun is the first manufacturer to provide such an architecture on the desktop. The Sun Ultra 80 workstation has nine buffered crossbar-switched processors that allow the memory and the graphics to interconnect. This architecture is the basis for high-powered computing and graphics.

Technical Fact Summary

- Sun's fastest performance uniprocessor and multi-processor Sun workstation; uses the 450-MHz UltraSPARC-II processor
- High-performance system bus provides fast access to memory and graphics
- Flexible hard disk expandability
    - Up to two internal 18.2-GB or 36.4-GB UltraSCSI disks
    - Up to 72.8-GB of total disk storage
- High-performance memory subsystem
    - Up to 4 GB for configurations using 16 x 256-MB DIMMs (installed in sets of four)
- Balanced system design
    - High performance UPA at 112 MHz or 1.8 GB/second throughput.
    - Matching performance enhancement in I/O, networking, and memory access
        - Two channels at 40-MB-per-second UltraSCSI
        - Innovative high-performance PCI I/O bus offering dual independent PCI buses, plus 66-MHz PCI support
    - Application performance without compromise
- High-end graphics functionality and performance at mid-level prices with Sun Elite3D and Sun Expert3D graphics
- Designed for interactive media applications
    - Integrated visual instruction set (VIS™ software) in the UltraSPARC CPU
    - 32X CD-ROM, photo-CD compatible
- Expansion to advanced networking
    - Fast Ethernet, 100BASE-T, autosensing, and autoswitching to 10BASE-T for backward compatibility
    - PCI networking options include Gigabit Ethernet, ATM, token ring, and FDDI
- System enclosure
    - Cost-effective tower enclosure offers flexibility in expansion

UltraSPARC Processor

The Ultra 80 workstation is a high-performance, multiprocessing system built around the UltraSPARC-II microprocessor.

The UltraSPARC-II processors used in the Ultra 80 workstation are individually mounted on 4-inch by 6-inch, field-installable module cards along with associated UPA data buffers and up to 4 MB of high-speed SRAM external cache memory. These modules are the same as those used in the Ultra 60 workstation. This modular design facilitates easy system processor addition (to go from uniprocessor to multiprocessor configurations).

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Features	**Benefits**
• Integrated VIS instruction set software	• Ready for increased performance on multimedia and networking operations
• Multilevel trap handling	• Efficient process handling
• CPU is mounted on field-installable module card with associated UPA data buffers and 4 MB of Ecache	• Facilitates easy system processor additions and system service

UPA System Bus

The Ultra 80 workstation processors, memory, and I/O subsystems are interconnected by the high-speed Ultra port architecture (UPA) crossbar datapath. This is an enhanced implementation of the same UPA design used in the Ultra 60 workstations. The CPU datapaths are 144 bits wide, with 128 bits for data and 16 bits for error correcting code (ECC). The UPA data path that support system I/O is 72 bits wide, with 64 bits for data and 8 bits for ECC. The memory interface supports a single 576-bit-wide data path.

With 450-MHz CPU installed, the UPA transfers data at 112 MHz, or one transfer every 9 nanoseconds. CPU segments, which transfer 16 bytes of data in parallel every clock cycle, each have a maximum transfer rate of 1.8 GB per second.

Features	**Benefits**
• Single 576-bit-wide, high-speed memory bus	• High-performance memory access
	• Flexibility in memory expansion options
• 112-MHz UPA	• Able to use advanced UltraSPARC-II processors

Memory

The Ultra 80 workstation supports up to 4 GB of 60-ns, 5-volt, DRAM memory. Dual in-line memory modules (DIMMs) used by the Ultra 80 workstation are the same type as those used in the Ultra 60 workstations. Memory is organized into four banks of four DIMMs. DIMMs must be installed in sets of four identical DIMMs.

Features	**Benefits**
• Uses the same 256-MB memory DIMMs as the Sun Enterprise 450 servers and Ultra 60 workstations	• Helps protect customer's investment
• Supports 64-MB memory DIMMs	• Provides flexibility in memory configurations

System I/O—High-Performance PCI Technology

System I/O for the Ultra 80 workstation is provided by two industry-standard peripheral component interconnect (PCI) data buses. Both PCI buses in Ultra 80 workstations comply with the 2.1 revision of the PCI specification, released in March 1995.

- PCI slot 1 operates at 33 or 66 MHz and supports either a 32-bit or 64-bit, 3.3-volt or universal PCI card.
- PCI slots 2 and 3 operate at 33 MHz and provide for 32- or 64-bit, 5-volt or universal PCI cards.
- PCI slot 4 operate at 33 MHz and provide for 32-bit 5-volt PCI cards.

Slots	Slot Width	Clock Rate	Card Input Voltages Supported
1	32 or 64 bits	33 or 66 MHz	3.3 volt or Universal
2-3	32 or 64 bits	33 MHz only	5 volt or Universal
4	32 bits	33 MHz only	5 volt or Universal

In addition to the I/O capabilities available through PCI option cards, the Ultra 80 workstation provides the following I/O channels directly from the main system board:

- Two internal/external 40-MB UltraSCSI channels with an external 68-pin SCSI connector
- One external 10/100BASE-T autoselect Ethernet port (supports either a Cat-5 UTP, or RJ45 connector)
- Two external EIA-232D or EIA-423 serial ports via two DB25 connectors (support EIA-423 synchronous data rates from 50 baud to 384 Kbps, and asynchronous data rates from 50 baud to 460.8 Kbaud)
- One external 2 MB/second, Centronics-compatible, bidirectional, parallel port with one DB25 connector
- One external standard Sun keyboard/mouse port (mini DIN-8 connector)

Features

- Industry's first 66-MHz PCI with 200-MB/second bandwidth (sustained)
- Two independent PCI buses
- Two independent UltraSCSI buses

Benefits

- High-performance I/O throughput
- Access to many third-party solutions
- High, sustained I/O throughput
- Higher performance throughput through the use of independent busses

Storage

Internal data storage for the Ultra 80 workstation is provided by up to two 3.5-inch UltraSCSI disk drives. UltraSCSI drive size is 18.2 GB or 36.4 GB. These 10000-rpm drives offer a peak data transfer rate of 40 MB/second.

In addition to its internal and external high-speed fixed storage capabilities, the Ultra 80 workstation provides an optional 32X CD-ROM drive and a 1.44-MB, 3.5-inch manual eject floppy drive for software installation and system management.

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Features	Benefits
• 40-MB/second UltraSCSI	• Fast access and retrieval of mass storage data
• 18.2- or 36.4-GB disk options	• Flexibility in internal disk expansion and high internal capacity

The Ultra 80 workstation tower accommodates front-access peripheral expansion through one 1.6-inch drive half-height 5.25-inch bay for a CD-ROM or tape drive, one 3.5-inch bays for a diskette drive or PCMCIA adapter or other options; and the third bay can accommodate either a 5.25-inch or 3.5-inch front accessible device.
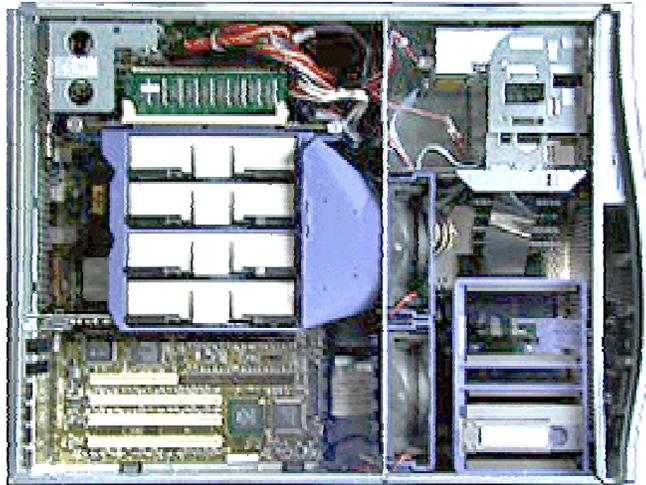
Figure 3. Ultra 80 workstation chassis with access panel removed

Sun PGX64 Graphics

Sun PGX64 graphics is the next generation low-cost PCI graphics product in the PGX™ family. It is the PGX32™ graphics successor. Sun PGX64 graphics provides Sun with a very low-cost, flexible 24-bit, 2-D graphics board supporting the widest range of Sun systems and supporting up to four boards in systems that can accommodate four PCI boards. Sun PGX64 graphics is a PCI-based graphics board providing support for all Sun PCI-based workstations ,workgroup and enterprise servers including the Sun Blade 100, 1000, Ultra™ 5, 10, 60, and 80 workstations, Sun Enterprise™ 250, 220R, 420R, and 450 workgroup servers and Sun Enterprise 3500, 4500, 5500 and 6500 mid-range servers as well as future workstations and workgroup servers supporting PCI.

Sun PGX64 graphics include the following features:

• ATI's RageXL graphics processor

  – 2-D graphics acceleration

  – 8-MB SGRAM

  – 24-bit-only true color video support up to 1920 x 1200

  – 8-bit-only pseudo color video support up to 1600 x 1000

- 33-MHz, 32-bit, 5-volt PCI card, short form factor (< 7-inch length)
- Low power consumption (< 8 watts)
- HD15 video connector on the motherboard supports composite and separate video sync timing
- Compatible with OpenWindows™ environment, CDE windowing, and supports the following APIs: X11, Motif, JDK, XGL, XIL and OpenGL API via a software pipeline.
- Backwards compatibility with Sun's PGX24™ and PGX32 graphics accelerators (including MUX support, support for VESA/Sun resolutions, flexibility, and so on)
- Support for all Sun monitor products released since 1995
- A HD15-to-13W3 vide connector cable is included to connect to monitors with the 13W3 interface.

Sun PGX64 graphics supports the resolutions shown in the table below.

Display Resolution	Vertical Refresh Rate	Sync Standard	Aspect Ratio	Color Depth
1920 x 1200	70 Hz	Sun	16:10	8-bit
1920 x 1080	72 Hz	Sun	16:9	24-bit
1600 x 1280	76 Hz	Sun	5:4	24-bit
1600 x 1200	75 Hz	VESA	4:3	8-bit
1600 x 1000	66, 76 Hz	Sun	16:10	24-bit
1440 x 900	76 Hz	Sun	16:10	24-bit
1280 x 1024	60, 75, 85 Hz	VESA	5:4	24-bit
1280 x 1024	67, 76 Hz	Sun	5:4	24-bit
1280 x 800	76 Hz	Sun	16:10	24-bit
1152 x 900	66, 76 Hz	Sun	5:4	24-bit
1152 x 864	75 Hz	VESA	4:3	24-bit
1024 x 768	60, 70, 75, 85 Hz	VESA	4:3	24-bit
800 x 600	56, 60, 72, 75, 85 Hz	VESA	4:3	24-bit
720 x 400	85 Hz	VESA	9:5	24-bit
640 x 480	60, 72, 75, 85 Hz	VESA	4:3	24-bit

Note: *8-bit color support is via emulation in 24-bit window. Sun PGX64 graphics outputs separate sync for VESA resolutions and composite sync for Sun resolutions.*

Sun PGX64 graphics supports 64-bit/66-MHz, 64-bit/33-MHz, or 32-bit/33-MHz PCI slots in all PCI-based Sun workstations and servers, as indicated in the following table.

System	Standard Configuration?	X-option?	Max. Number of Boards per System	Slot Configuration	Number Supported, if UPA Graphics also Configured
Sun Ultra 5		Yes	3		NA
Sun Ultra 10		Yes	4		1
Sun Ultra 60		Yes	4	1 in 66-MHz slots; 3 in 33-MHz slots	2
Sun Ultra 80		Yes	4	1 in 66-MHz slots; 3 in 33-MHz slots	1 or 2
Sun Blade™100	on-board version	Yes	3		NA
Sun Blade 1000	ATO	Yes	4	1 in 66-MHz slots; 3 in 33-MHz slots	1 or 2
Sun Enterprise 250, 450, 220R, 420R	ATO	Yes	4	1 in 66-MHz slots; 3 in 33-MHz slots	NA
Sun Enterprise 280R		Yes	4	1 in 66-MHz slots; 3 in 33-MHz slots	1 or 2
Sun Enterprise 3500, 4500, 5500, 6500	ATO	Yes	4		N/A

On the Ultra 60, Ultra 80, and Sun Blade 1000 systems, the Sun PGX64 graphics board cannot be installed if there is a double-wide UPA frame buffer (Sun Elite3D m6 graphics) installed in the adjacent UPA slot.

In addition, it is suggested for the Sun Enterprise server systems that at least one CPU be installed for each Sun PGX64 card.

Sun Elite3D Graphics Overview

Sun Elite3D graphics greatly accelerates the rendering of 3-D triangles, vectors, and texture maps over what is possible with Sun Creator or a raw CPU. It does this by adding specialized graphics floating-point units and more powerful pixel-drawing chips. It supports a 1280 x 1024 96-bit-deep frame buffer, configured the same as the double-buffered and Z-buffered Sun Creator3D. The 96-bit pixels support two 24-bit color buffers, an 8-bit pseudo-color overlay buffer and a 28-bit Z buffer, plus some miscellaneous control planes.
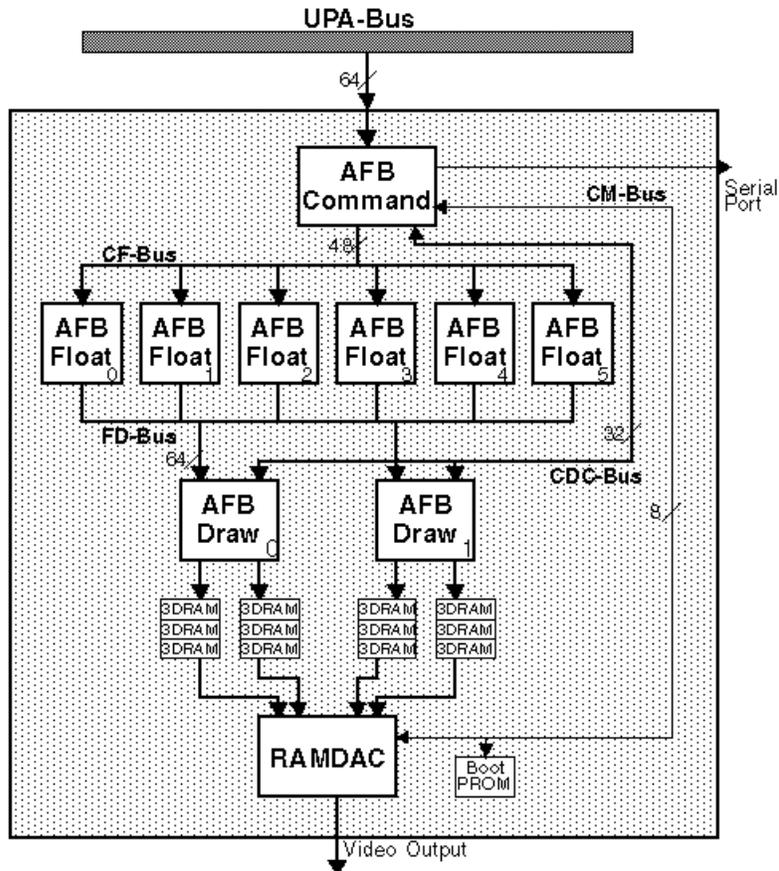
Figure 4. Sun Elite3D m6 graphics chip-level diagram

Sun Elite3D graphics has a highly parallel and efficient graphics pipeline. The Sun Elite3D graphics architecture uses a new generation of 3D-RAM chip. This chip speeds up a read/modify/write pixel access from 160 ns to 10 ns, changing all of the rules about graphics pipeline behavior.

AFB-Command, at the interface level, is a superset of the Sun Creator ASIC chip. The additional functionality supports rendering of model space geometry. The main change is to allow the most important bits to be packaged up into single-header words that can be passed down with the geometric data without stopping the pipeline. Additional functionality includes complete binary compatibility with the register set and functions of Sun Creator3D graphics and support for the OpenGL platform.

Given the technological changes brought on by 3D-RAM, the primary justification for the existence of a 3-D graphics accelerator is to deliver an order of magnitude more floating-point performance than a contemporary general purpose RISC CPU, at a price less than that of a single CPU and cache.

Sun Elite3D Graphics Features and Benefits

Features	Benefits
• Integrated imaging	• Can do fast imaging and 3-D on unified frame buffer
• Very high-performance, accelerated, 24-bit, double-buffered 3-D graphics	• Smooth animation and interactivity of 3-D graphics
• 28-bit Z-buffer	• Improves visual quality and depth accuracy
• 8-bit overlay plane	• Allows overlay of 8-bit windows on top of the 24-bit visuals without damaging the underlying visual. This allows seamless integration and manipulation of windows
• Gouraud shading	• Allows smooth shading of solid geometry
• Acceleration for geometry decompression	• Allows complex compress geometry to be decompressed at hardware rates.
• Alpha blending and screen door transparency	• Simulates transparent materials such as glass
• Line and big dot antialiasing	• Needed in MCAD and visualization for better visual quality
• Per-pixel depth cueing	• More accurate depth cueing or fog
• Per-pixel alpha interpolation	• Variable transparency
• 4-bit stencil support with hardware acceleration of OpenGL stencil functions	• Enables hardware acceleration for OpenGL API
• Accelerated lighting	• More lights can be turned on for enhanced visual display without encountering large performance penalties
• Four 8-bit color maps	• Dynamic color map segment allocation when running 8-bit window systems should eliminate color flashing problems
• Adjustable gamma correction	• Allows users to gamma-correct visuals for enhanced visual quality
• NTSC/PAL video timing support	• Supports frame buffer to video timing
• Stereo 960 x 680 at 112 Hz supported with 21-inch monitor	• With frame buffer, monitor, and window systems support for stereo, users can see better representation of 3-D data
• 1280 x 1024 at 76 Hz resolution standard	• High-resolution display quality
• Two serial-port connectors	• For VR peripherals
• Dual-headed support: one Sun Elite3D m6 frame buffer and an additional Sun Elite3D m3 or Sun Creator/Sun Creator3D frame buffer	• For users who need to be able to do multiple things simultaneously, such as command and control applications, 3-D and video playback for animators, design and analysis for engineers, and so on

Features	**Benefits**
• OpenGL® for Sun™ Solaris 1.2.1, X, and Java 3D™ API support	• A choice of APIs
• Binary compatibility with Sun Creator graphics product family	• Interoperability with existing applications and users

Sun Expert3D Graphics Overview

The Ultra 80 workstation configurations with Sun Expert3D graphics offer a high-performance graphics adapter with on-board texture mapping memory. This PCI graphics adapter provides an outstanding and affordable high-performance graphics solution for demanding 2-D and 3-D graphics applications that specifically require hardware-based texture mapping acceleration.
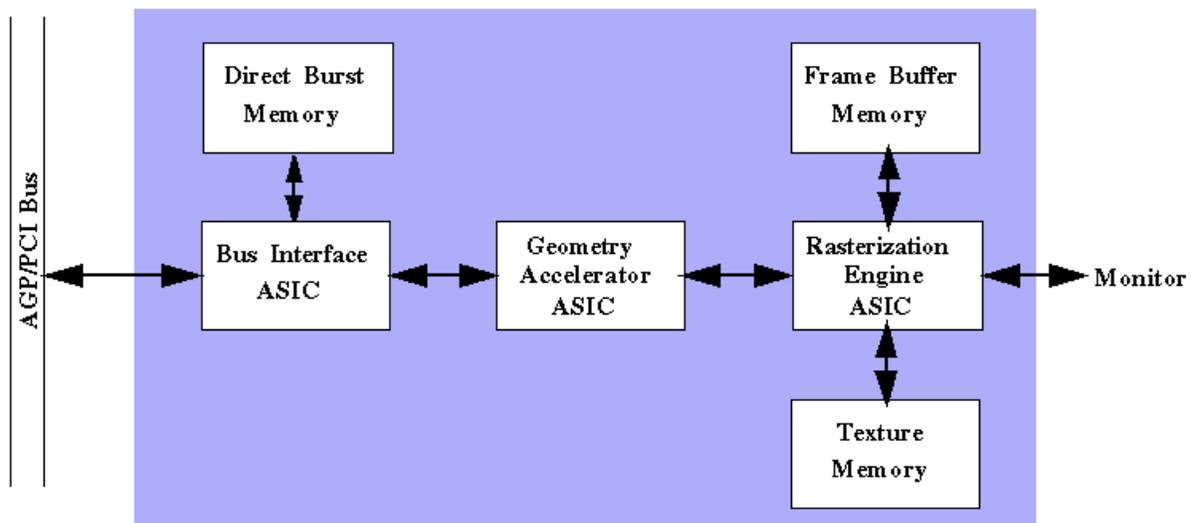
Other features of the Sun Expert3D frame buffer include double-buffering/z-buffering (3-D) support at super high resolutions of 1920 x 1200, stereo-video mode support at 1280 x 1024, and hardware support for 3-D SuperScene antialiasing.

The Sun Expert3D frame buffer is ideal for all Sun Microsystems customers and resellers in the technical marketplace. The Ultra 80 workstation configurations with Sun Expert3D graphics are especially appropriate for customers working with CAD wire-frame models or highly textured seismic data, such as that used in the oil and gas industry.

Sun Expert3D Graphics Features and Benefits

Features	**Benefits**
• On-board 64-MB texture-mapping memory	• Accelerates applications requiring texture maps
• On-board 64-MB frame-buffer memory	• Provides support for 24-bit truecolor 2-D and 3-D up to 1920 x 1200, supporting Sun's 24-inch display

Features	**Benefits**
• Supports double-buffering and Z-buffering at up to 1920 x 1200 resolution	• Allows customers to use large screen monitors including Sun's 24-inch monitor to display their 2-D and 3-D data
• Supports stereo mode graphics at 1280 x 1024 resolution	• Allows customers to display 3-D data in stereo mode at higher resolutions, providing enhanced realism for immersive applications
• Supports SuperScene antialiasing	• Improves rendered image quality
• Graphics framelock support	• Enables multiple graphics framebuffers to be used in a a single or multiple systems to render to very high-screen resolutions

Sun Expert3D-Lite Graphics

Sun Expert3D-Lite graphics is a derivative product based on the Sun Expert3D graphics board. Sun Expert3D-Lite graphics offers many of the same features as its predecessor, but at a lower cost. Features include on-board 3-D geometry acceleration, hardware-based texture mapping, and high-resolution 24-bit, 3-D support for all of Sun's PCI-based workstations and workgroup servers.

Sun Expert3D-Lite graphics accelerates 3-D geometry at up to 4 million triangles/sec. and provides up to three times the texture mapping performance of Sun Elite3D m3 graphics, at a much lower price.

Sun Expert3D-Lite graphics is a single, full-length, 64-bit PCI board. It is a 66-MHz card, and operates at 66 MHz when plugged into a 66 MHz-capable slot and at 33 MHz when plugged into a 33-MHz slot.

Key Features and Benefits

Features	**Benefits**
• High-performance 3-D graphics and texture mapping performance at an affordable entry-level cost—provides great geometry performance of up to 4 million triangles/sec. with up to 60 Mpixels/sec. of texture fill rate	• Aggressive price/performance allows users to capitalize on 3-D application functionality in a cost-effective manner
• High resolution 24-bit 3-D double-buffering with 32-bit Z-buffer, up to 1920 x 1080 HDTV (16:9 aspect ratio) resolution	• Supports 24-bit, 2-D and 3-D graphics on all of Sun's displays including the 24-inch color monitor. With the 24-inch monitor, users can display many applications windows with little or no overlap
• Hardware-accelerated texture mapping with 16 MB of dedicated on-board texture memory	• Provides high-performance for texture mapping operations
	• Large texture storage accelerates complex 2-D and 3-D texturing
	• No trade-offs between resolution support and texture storage capabilities

Features	Benefits
• Stereoscopic graphics support at 960 x 680, 1152 x 900, and 1280 x 800 resolutions	• Allows customers to use stereoscopic viewing for immersive applications, which enhances data comprehension
• Support for up to four Sun Expert3D-Lite boards in a single system (depending on system)	• Enables applications to take advantage of more screen real estate
• 32-bit Z-buffer at all supported resolutions	• Provides high level of three-dimensional accuracy,eliminating anomalies such as the flickering of objects when moving around a 3-D image
• Full acceleration support of OpenGL 1.2.1 and Java 3D™ APIs	• Applications automatically receive performance benefits of these APIs. Single application binary for Sun graphics options

Sun Expert3D-Lite Graphics Specifications

- On-board geometry accelerator ASIC performs transform, clipping, and lighting
- On-board rasterization ASIC performs 2-D/3-D rasterization, 2-D/3-D texturing, pixel transfers, imaging and fragment processing
- High-resolution DAC with 10-bit RGB analog video at dot rates up to 350 MHz.
- Memory
    - 56-MB total on-board memory
    - 8-MB direct burst memory
    - 16-MB dedicated texture memory
    - 32-MB dedicated frame buffer memory
- Standard HD15 video connector with support for Composite and Separate sync provides support for a DDC link for monitor query and control.
- VESA Standard 3-pin mini-DIN stereo connector

Sun Expert3D-Lite and Sun Expert3D Graphics Comparison

Feature	Sun Expert3D-Lite	Sun Expert3D
Maximum 3-D resolution	1920 x 1080	1920 x 1200
Maximum 3-D stereo resolution	1280 x 800	1280 x 1024
Total board memory	48 MB	128 MB
Frame buffer memory	32 MB	64 MB
Texture memory	16 MB	64 MB
Geometry acceleration	4 M tris/sec.	6 M tris/sec.
Max. texture fill rate	88 Mpixels/sec.	110 Mpixels/sec.
Superscene antialiasing support	No	Yes

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microsystems

Feature	Sun Expert3D-Lite	Sun Expert3D
Frame lock sync	No	Yes
Multiview (syncing for stereo)	No	Yes
Display connector	HD15	13W3

Display Resolutions

Sun Expert3D-Lite graphics supports the following resolutions.

Display Resolution	Vertical Refresh Rate	Sync Standard	Aspect Ratio Format
1920 x 1080	72 Hz	Sun	16:9
1600 x 1280	76 Hz	Sun	5:4
1600 x 1200	75 Hz	VESA	4:3
1600 x 1000	66, 76 Hz	Sun	16:10
1440 x 900	76 Hz	Sun	16:10
1280 x 800	112 Hz	Sun-Stereo	16:10
1280 x 800	76 Hz	Sun	16:10
1280 x 1024	60, 75, 85 Hz	VESA	5:4
1280 x 1024	67, 76 Hz	Sun	5:4
1152 x 900	120 Hz	Sun-Stereo	5:4
1152 x 900	66, 76 Hz	Sun	5:4
1024 x 800	84 Hz	Sun	5:4
1024 x 768	75 Hz	VESA	4:3
1024 x 768	60, 70, 77 Hz	Sun	4:3
960 x 680	108, 112 Hz	Sun-Stereo	Sun-Stereo
768 x 575	50i Hz	PAL	PAL
640 x 480	60 Hz	VESA	4:3
640 x 480	60i Hz	NTSC	NTSC

Compatibility

Sun Expert3D-Lite graphics is a full size, single slot width, 64-bit/66-MHz PCI board and can plug into a 64-bit/66-MHz, or 64-bit/33-MHz slot of the Ultra 80 system. When Sun Expert3D-Lite graphics is plugged into a 64-bit/33-MHz or 32-bit/33-MHz slot, the slower bus lowers peak performance by between 20 and 40 percent.

Sun Expert3D-Lite frame buffers can be combined with UPA graphics in the same Ultra 80 system in the configurations shown in the table below.

System	Max. # of Sun Expert3D-Lite Graphics	Max. # of UPA Graphics
Ultra 80 workstation	3	1
	2	2
	1	2

Sun Ultra 80 Workstation Graphics Performance

Benchmarks	Sun Expert3D-Lite	Sun Elite3D m3	Sun Elite3D m6	Sun Expert3D
Xmark93	**19.9**	**39.2**	**40.5**	**22.3**
2-D Vectors/sec.	**6.8 M**	**5.0 M**	**5.0 M**	**7.9 M**
3-D Performance				
• 3-D vectors/sec. • 3-D tris/sec. • 3-D quads/sec. • 3-D tex. fill pix/sec.	8.1 M 4.1 M 2.0 M 88 M	4.9 M 3.0 M 1.5 M —	8.8 M 5.9 M 1.3 M 54 M	10.5 M 6.0 M 3.0 M 118 M
ViewPerf 6.1.1				
• ProCDRS-02 • DX-05 • AWadvs-03	22.9 37.0 42.1	13.8 25.2 —	20.5 28.8 13.5	28.8 39.4 43.1
ViewPerf 6.1.2				
• ProCDRS-03 • DX-06 • AWadvs-04	13.4 9.5 43.9	Not available	10.9 7.9 14.0	16.8 9.9 50.3
Standard Color Monitors Supported	17-, 19-, 21-, and 24-inch monitors and 18-inch flat panel	17-, 19-, and 21-inch monitors and 18-inch flat panel		17-, 19-, 21-, and 24-inch monitors and 18-inch flat panel

Note: *Configuration for timing includes the Solaris™ 8 Operating Environment and OpenGL 1.2.1 performance data collected in December 2000. Performance data is subject to change. Refer to Sun's web site at http://www.sun.com/desktop/ for latest performance numbers.*

Metrics defined:

• 2-D vectors are 10 pixels long, X11 perf numbers

• 3-D vectors are 10 pixels long, depth cued, clip tested, perspective projection, solid line through OGL

• 3-D triangles: 25 pixel triangle mesh, one light source

• 3-D quads: 100 pixel, independent quadrilaterals, with one directional light source

• Both 3-D mesh and quads are Gouraud shaded, randomly oriented, transformed, clip tested, with perspective projection and Z-buffered via OGL

Special Features

- Accelerated imaging and advanced 3-D graphics with Gouraud shading, line antialiasing, per-pixel depth cueing, subpixel addressing, transparency, stereo viewing with monitor.

- Sun Elite3D graphics utilize a connector for stereo viewing synchronization, a 7-pin mini-DIN style of connector. (StereoGraphics Corporations sells a cable adapter for connecting the old and new styles of connectors. It can be ordered from them using the part number ESUN.)

Sun Ultra 80 System Configuration

Feature	Specifications
Dimensions	44.5 cm x 25.5 cm x 60.2 cm (H x W x D) 17.5 inches x 10.0 inches x 23.7 inches
Weight	29.5 kg (65 pounds)
CPU and UPA	
• Architecture	UltraSPARC-II
• Clock rate	450 MHz
• Processor slots	4
• Cache on chip	32 KB
• External cache	4 MB
• UPA speed	112 MHz
Memory	
• Memory type	ECC
• Number of slots	16
• Capacity	256 MB to 4 GB
• DRAM speed	60 ns
• Bus width	576 bits
• DIMM sizes	64 and 256 MB
Internal Storage	Two disks with 18.2- or 36.4-GB capacity each = 72.8 GB total
I/O Interfaces	
• UltraSCSI	40 MB/sec. UltraSCSI (SCSI-3), 2 channels
• Serial ports	Two RS-232C/RS423 DB25
• Parallel port	Centronics compatible (DB25)
• PCI I/O bus	Three full-size and one half-size PCI slots (version 2.1): Three at 33 MHz; one at 33 or 66 MHz

Feature	Specifications
Monitor and Graphics Support	
• Graphics supported in PCI slots	Up to four Sun PGX64 graphics cards
• Graphics supported in UPA slot	Two Sun Expert3D-Lite, Sun Elite3D m3, Sun Elite3D m6, or Sun Expert3D frame buffers
• Monitors	17-, 19-, and 21-inch color monitor; 18-inch flat panel
Networking Ports	TP Ethernet 10/100BASE-T
Backup and Distribution	
• Floppy	Optional 3.5-inch floppy
• CD-ROM	SunCD™ 644 MB
• Internal	Optional 12 to 24-GB DDS-2 4-mm, 14-GB 8-mm
• External	Sun StorEdge™ UniPack, FlexiPack, and MultiPack storage devices; Sun StorEdge A1000, D1000, A3500, A5X00 arrays; Sun StorEdge L1000 and L3500 tape libraries
Solaris Operating Environment Support	Solaris 2.5.1 Hardware: 11/97; Solaris 2.6 Hardware: 5/98 Solaris 7 Hardware: 8/99; Solaris 8

System Management

System Administration

Sun Ultra™ 80 workstations deliver the power and graphics needed by the customers who use heavy compute-intensive applications. Customers who run these compute-intensive applications require a system like the Solaris™ Operating Environment software that can provide a highly reliable, available, fast and safe desktop computing environment. Built into the Solaris Operating Environment are systems management and security features that will help deliver the computing environment demanded by these customers. Sun also offers unbundled systems management products that will supplement the systems management features in the Solaris 8 Operating Environment. Together, the Solaris Operating Environment management features and Sun's unbundled systems management products create one the most stable and available desktop computing environment in the industry.

Solstice AdminTools™ Software

Solstice AdminTools™ software is a set of GUI-based administration tools that have been shipping since the Solaris 2.2 Operating Environment release and can be used to provide local systems administration. Solstice AdminTools software can be used to manage user accounts, groups, hosts, printers, serial ports, and installation/removal of software.

SunVTS™ Software

The SunVTS™ system exerciser is a graphically oriented UNIX® application that permits the continuous exercising of system resources and internal and external peripheral equipment. Used to determine if the system is functioning properly, SunVTS software incorporates a multifunctional stress test of the system through operating-system-level calls, and allows the addition of new tests as they become available.

Solaris Web Start Software

Solaris Web Start software is an easy-to-use Java™ technology-based application that guides users through the installation of both the Solaris Operating Environment and copackaged application software with a single on-screen button. Its graphical user interface facilitates file system configuration. It also features a built-in suite of on-line information and answers questions about the product itself, the software it installs, and the hardware platform it supports.

Solstice Enterprise Agents™ Software

Solstice Enterprise Agents™ software allows the workstation to be managed from simple network management protocol (SNMP)-based system/network management tools. Solstice Enterprise Agents software is based on the extensible agent technology or manager/subagent technology. The Manager agents receive and respond to SNMP or desktop management interface (DMI) requests. After retrieving the appropriate values from the respective subagents, responses are sent. The subagents manage information bases (MIBs or MIFs) designed for specific components and applications.

Solaris Desktop Extensions Software

Solaris Desktop Extensions software features ideal systems management tools for those non-UNIX platform users who want to quickly view processes and system resources. The process manager in

Solaris Desktop Extensions software is a GUI-based tool that enables users to quickly identify, sort, suspend, and eliminate processes based on attributes such as CPU consumption and time elapsed.

Solaris Desktop Extensions software also features a GUI-based performance monitor, enabling users to quickly monitor some of the key system resources such as CPU, load, disk, page, context, job swaps, interrupts, packets, collisions, and errors.

ShowMe How™ Software: State-of-the-Art Installation and Maintenance Instruction

ShowMe How™ software is a documentation system that presents information in a highly understandable multimedia format. Installation and service tutorials as well as reference information provide users with comprehensive, easy-to-use instruction. ShowMe How software streamlines installation and maintenance to help lower service costs and maximize system uptime. Some of the features of this tool are:

- Distributed on CD-ROM

- Movies of installation and replacement procedures played through ShowMe TV™ software packaged with application

- Photo sequences with narrated installation and replacement procedures

- Text-based instructions can be viewed on-line and printed, excerpted from standard Sun documentation

- Photos with active callouts link to more detailed photos and text-based reference information

The Solaris 8 Operating Environment

The Ultra 80 workstation runs the Solaris 8 Operating Environment. It can also run 32-bit applications unmodified from the Solaris 2.5.1 (Hardware 11/97), Solaris 2.6 (Hardware 5/98), and Solaris 7 (Hardware 8/99) Operating Environment, making these systems compatible with previous systems and software.

The Solaris 8 Operating Environment is the latest release of one of the industry's leading enterprise operating environments. The Solaris 8 Operating Environment contains the complete functionality required for all Sun Workstation™ systems. The Solaris 8 Operating Environment is a solid, scalable, 32-bit and 64-bit Operating Environment.

The Solaris 8 Operating Environment includes:

- Reliable, Internet-ready operating environment for 32- and 64-bit SPARC™ processor-based platforms and Intel platforms

- 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

The Solaris Operating Environment delivers a competitive advantage to businesses through networked computing, scalability, and multiarchitecture support. The Solaris Operating Environment provides an advanced solution for all customer IT needs, both technical and business. With its strength in enterprise-class reliability, scalability, and performance, the Solaris Operating Environment is an industrial-grade solution with the quality and robustness required to deliver mission-critical computing.

Sun Ultra 80 systems are supported by Solaris 2.5.1 Hardware: 11/97, Solaris 2.6 Hardware: 3/98, Solaris 7, and Solaris 8 Operating Environment.

Solaris Operating Environment Features and Benefits

Features	Benefits
• 100 percent binary compatibility	• Software investment protection—all of today's Solaris Operating Environment-certified 32-bit applications continue to run on Solaris 8 Operating Environment without modification
• Reliability, availability, and serviceability (RAS)	• Less downtime, more productivity, and faster project completion
• 64-bit computing	• Higher performance, capacity, and precision on 64-bit SPARC processor-based systems and Intel systems with full 32-bit binary compatibility
	• Compliant with UNIX 98 and the Aspen Group LP64 standards
• 64-bit compilers	• Quickly develop and certify 64-bit applications for SPARC and IA-64 processors using Solaris Operating Environment APIs, 64-bit C/C++ and FORTRAN compilers, and ABI certification tools
• Java 2 SDK	• Provides a high-performance, scalable Java virtual machine that offers improved memory management, optimized JIT compiler and faster Java thread synchronization
• IPv6/IPsec/Mobile IP	• Increases addressing range, provides better authentication and privacy, and enables new quality of service capabilities. Mobile IP permits intermittent connection to the Internet with no data loss
• Scale from 1 to 512 processors per node	• Seamlessly increases compute resources as your needs grow—expand to four processors on the desktop, or use up to 64 processors per server, with up to eight servers per cluster
• LDAP directory services	• High-speed, enterprise-class directory service, using the Solaris 8 Operating Environment LDAP client and the iPlanet™ Directory Server, supports your most complex, data intensive network applications.; includes Microsoft Active Directory support
• System management tools	• Reduces the time spent on system administration duties using Web-based wizards and Java technology-powered graphical interfaces

Features	Benefits
• Desktop management and productivity tools	• Increases your productivity with intuitive Printer, Desktop, PDA sync, HotKey, and CDE 1.4 control panel tools and features
	• The StarOffice™ productivity suite easily handles Microsoft Office documents, and creates complex documents, spreadsheets, and presentations; use PC Launcher and the SunPCi™ II card to run Windows, Lotus 1-2-3, and AutoCAD applications on your Sun workstation
• Extended device support	• Connect using your favorite devices, including DVD, Zip and Jaz drives, video cameras, USB, 1394, SCSI, UPA, and PCI buses
• Internationalization	• The Solaris 8 Operating Environment is a comprehensive, global product which supports 37 languages and over 90 locales, the euro currency symbol, and complex text formats for the Arabic, Thai, and Hebrew languages. New language installation tools, expanded Unicode support, and improved data interoperability utilities greatly simplify the development and testing of applications for international markets
• X11R6.4	• Run X applications in a web browser and display a single logical screen across multiple displays
• Real Time application	• Supports guaranteed interrupt response times and priority inheritance for synchronization by multithreaded real-time applications, including simulation, telemetry, data acquisition, signal processing and video-on-demand
• Enhanced security features	• Increased support for security protocols and technologies including IPSec, AMI, Kerberos v5, and smart cards to enhance application and system security

Key Features in the Solaris 8 Operating Environment

The Solaris 8 Operating Environment is Sun's latest release in this product family. The Solaris 8 Operating Environment continues the tradition of reliability, availability, and scalability (RAS) of the earlier operating environment releases, including features such as X11R6.4, IPv6/IPsec/Mobile IP, realtime application support, filesystem logging, and remote console.

Existing applications which adhere to the Solaris application binary interface (ABI) will run unmodified with Solaris 8 Operating Environment software on both SPARC processor-based platforms and Intel platforms. In addition, Sun provides an easy-to-use AppCert testing tool for developers, so they can verify existing Solaris application binaries and report any potential incompatibilities.

• **Productivity features**

Solaris 8 software offers enhanced diagnosing capabilities, availability, scalability, performance, Java technology, and graphics. With the Solaris 8 Operating Environment, you get a full suite of integrated tools for browsing, collaborating, and interoperating with PCs. The Solaris 8 Operating Environment provides a 32-bit and 64-bit UNIX platform that provides customizable workspaces, graphical system monitoring, and business/office productivity tools, including the free StarOffice productivity suite.

Sun microsystems

- **Advanced networking**

  Demonstrating continued leadership in networking technologies, support for IPv6 in the Solaris 8 Operating Environment is seamlessly integrated with NFS, RPC, NIS, NIS+, and DNS. The IPsec features enable secure virtual private networks and network access control, while Mobile IP provides Internet disconnect/reconnect capabilities with no data loss.

- **Bundled software**

  The Solaris 8 Operating Environment ships with support for a number of software components which extend user and system functionality, including Solaris Resource Manager™ software for fine-grained control of system resources, the Java technology-based database server Oracle 8i, `lxrun` for Linux application compatibility (for Solaris on Intel), Apache Webserver, Netscape Communicator, iPlanet Directory Server, `gzip` compression, and the `bash` and `tcsh` shells.

- **Enhancements to the Common Desktop Environment (CDE)**

  The latest generation of the Common Desktop Environment (CDE) comes standard, providing workstation users with an easy-to-use, open, secure platform. Enhanced X11R6.4 support allows the viewing and use of X applications in a browser window, and the use of a single logical screen across multiple displays. 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 MPEG-1, MPEG-2, Quicktime, and AVI formats as well as MIDI audio using the Java Media Framework (JMF) player.

- **Improved system error messages, system debugging capabilities, and a remote console capability**

  Enables customers to apply scarce system expertise remotely across the enterprise.

- **File system logging**

  Logging file system features and parallel SCSI probes make rebooting even faster.

- **Live Upgrade**

  Allows Solaris 8 software to be installed on a separate partition from the currently running version of the operating environment. When installation is complete, a simple reboot enables the Solaris 8 Operating Environment to take control. Since Live Upgrade includes a version migration and fallback feature, you can also fallback to the previous release—through a simple reboot—without losing administration information.

- **Real-time video creation and broadcast support**

  The Java Media Framework (JMF) player provides access to the latest industry-standard audio and video files, including MPEG-1, MPEG-2, Quicktime, VIVO, AVI, AIFF, GSM, WAV, RMF, AU, and MIDI.

Solaris 7 Operating Environment 11/99

A number of features were added to the Solaris 7 Operating Environment in November 1999. They are:

- **Netscape™ application launcher**—Enables users to easily access and launch Netscape files and associated Netscape applications such as Composer automatically. This Netscape application launcher virtually eliminates the need to run the entire Netscape environment, making access to Netscape applications simpler than ever.

- **PDASync (Personal Digital Assistant) support**—A Java technology-based application for professionals on the go. Enables users to easily synchronize their desktop calendar, mail, address book, and memos with their PDA.

- **X11R6.4 support**—An enhanced version of XServer delivers key features that increase user productivity and mobility. These are:

  - **Web-enabled X application**—Access on any browser-based desktop. Provides access to corporate X applications for remote users through the Internet or intranet

  - **Xinerama support**—Provides one logical screen image support that can be displayed across multiple monitors

  - **Color utilization policy (CUP) support**—Minimizes color-map flashing

  - **XPrint extension**—Provides a framework for X applications to render on non-display devices, such as printers and facsimile machines

  - **EnergyStar support**—Built-in power management controls to conserve workstation power

  - **Developer toolkit**—Includes public APIs and documentation for Xinerama, XPrint, XKB, DPMS, and CUP extensions

Graphics Software Interfaces

The Ultra 80 system supports all Solaris 8 Operating Environment graphics and window system APIs, including OpenGL® and Display PostScript™. A large number of Sun and third-party graphics APIs are also supported, including IRIS GL, OpenGL, GKS, HOOPS, and Java 3D™ software. Industry-standard X-extension libraries, such as Xlib and PEXlib, are available.
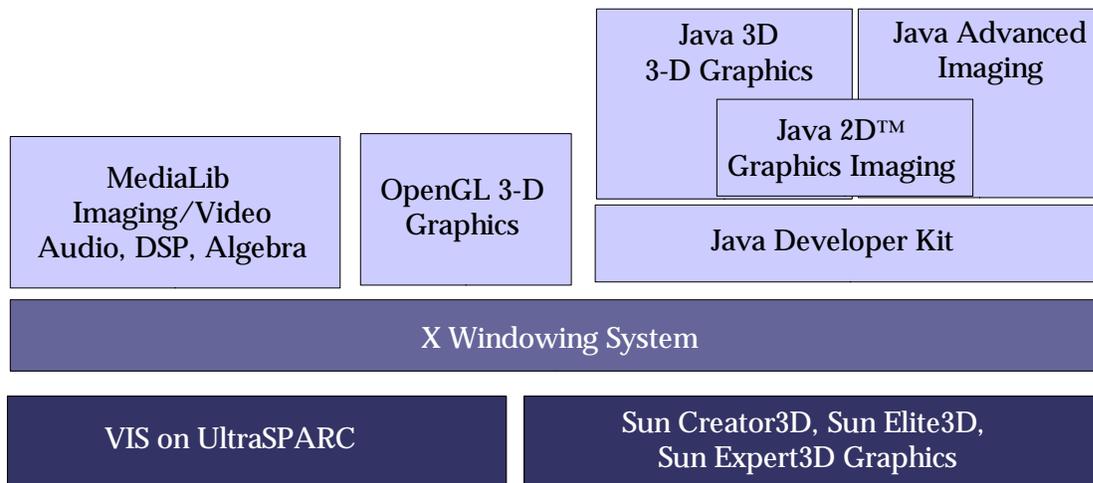

Figure 5. Graphics software interfaces

Solaris Operating Environment System Requirements

Disk Space	End user: 25 MB Developer: 40 MB (runtime binaries and header files)
Memory	64 MB minimum 128 MB or higher recommended for serious applications

Solaris Operating Environment Licensing and Usage

All Sun system and system-board products include a Solaris Operating Environment license. The type of Solaris license(s) shipped with each platform reflects the way in which that system is most commonly used. Additional Solaris licenses are available to allow increased usage of the software.

Ultra 80 workstations come with a Solaris Desktop license. This license is limited and does not provide several of the services provided by the Solaris Server license, such as:

- Allowing more than two users to be directly connected

- Providing database or compute services for more than two continuous users

- Providing swap-disk space for any other system

- Providing home-directory space for any other system

If a system shipped with a Solaris Desktop license will be used as a server (requires services listed above), the system must be upgraded to a Solaris Server license.

OpenGL® for Sun™ Solaris 1.2.1 Software

OpenGL® for Sun™ Solaris 1.2.1 software provides a powerful programming environment for developing and deploying interactive 3-D applications on SPARC workstations. It allows mainstream 3-D graphics and visualization applications to be deployed on Sun's Ultra family of graphics workstations at a compelling price-to-performance ratio.

OpenGL for Sun Solaris 1.2.1 software is an application programming interface (API) that provides 2-D and 3-D graphics features. Features include modeling, transformations, color, lighting, and smooth shading, as well as advanced features such as texture mapping, NURBS, fog, alpha blending, and motion blur. OpenGL for Sun Solaris 1.2.1 software works in both immediate and non-editable display-list modes.

Using the Xinerama X window extension available in the Solaris 8 Operating Environment or Solaris 7 Operating Environment (release 11/99 or later), users can configure their systems to utilize multiple frame buffers as one large, super-high resolution, virtual display. OpenGL for Sun Solaris 1.2.1 software allows existing OpenGL API-based applications to run virtually without change in a multi-screen Xinerama environment.

Widespread multivendor availability of OpenGL software allows source-code portability of 3-D graphics applications across platforms. OpenGL for Sun Solaris 1.2.1 software is a compliant implementation of OpenGL 1.2 specification from the OpenGL Architecture Review Board (ARB) and is source-code compatible with other conformant OpenGL software on the market. Most existing OpenGL applications need only to be recompiled in order to run with OpenGL for Sun Solaris 1.2.1 software.

OpenGL for Sun Solaris 1.2.1 software is targeted at developers creating interactive 3-D graphics applications for technical, creative, and analytical markets. Potential users include those in computer-aided design and manufacturing, global information systems, simulation, industrial design and modeling, entertainment, biochemistry, and petroleum exploration market segments.

OpenGL for Sun Solaris 1.2.1 software is compatible with and accelerated for Sun's Ultra workstation systems with the Sun Creator, Sun Creator3D, Sun Elite3D, and Sun Expert3D graphics products. It is also compatible with all legacy SPARCstation™ systems equipped with SX, ZX, GX, GXplus, TurboGX™, TurboGXplus™, S24™, TCX, or FSV frame buffers.

Features and Benefits

OpenGL for Sun Solaris 1.2.1 software provides the following features:

Features	Benefits
• Multi-screen rendering for super-high resolution 3-D visualization (Xinerama)	• Users no longer need to rewrite their 3-D applications to take advantage of the multiple screens
• 64-bit OpenGL library support	• Allows OpenGL applications to take advantage of the full 64-bit addressing in the Solaris Operating Environment
• Interface imaging and 3-D texturing	• Offers a more portable interface for imaging operation during 3-D texture mapping
– Texture level of detail control	– Offers better texture memory utilization
– BGRA and packed-pixel formats	– Supports more file- and hardware-data types
– Texture specular color	– Allows more realistic lighting effects with texturing
– Texture edge clamping	– Avoids blending border and image texels during texturing
– Constant texture data extension	– Helps reduce texture mapping memory utilization and loading time
• General performance improvements	
– Improved drivers	– Enables better performance for all supported graphics cards; in particular, there has been some substantial performance gains for Sun Elite3D frame buffers—for some applications over 100 percent
– Occlusion culling test extension	– Enables applications to trivially reject occluded objects in a scene, resulting in big improvements in interactive rendering performance for visualization of large models
• Extensions	
– Triangle list primitive	– Allows multiple triangle strips or fans to be specified within a single `glBegin glEnd` pair; improves performance
– Vertex extension	– Allows applications to specify all vertex data (color, normal, coordinates, and so on) in a single function call; saves function call overhead
– Global alpha extension	– Allows applications to specify an alpha component which can be applied globally to all primitives; useful for cases where many vertices share the same alpha value because the application does not have to send an alpha component for each vertex

OpenGL for Sun Solaris 1.2.1 Software Tech Facts

OpenGL for Sun Solaris 1.2.1 software system requirements are shown in the following table.

Platforms	UltraSPARC™ and SPARC processor-based systems using Sun Elite3D, Sun Creator, Sun Creator3D, Sun Expert3D, PGX, ZX, GX, TCX, SX, and S24 frame buffers
Operating environments supported	Solaris 2.5.1 Solaris 2.6 Solaris 7 Solaris 8 Note: Multi-display Xinerama support requires Solaris 7 Operating Environment (11/99 or later) or the Solaris 8 Operating Environment.
Recommended patches • Using PGX graphics on an Ultra™ 5 or 10 workstation	Solaris 2.5.1: patch 103792-19 (or later) Solaris 2.6: patch 105362-19 (or later)
• Using Sun Elite3D graphics	Solaris 2.5.1: patch 105791-16 (or later) Solaris 2.6: patch 105362-19 (or later) Solaris 7: patches 106148-03 and 106144-05 (or later)
Window system supported	CDE or OpenWindows™
Disk space • For end-user runtimes	32 MB for 32 bit; 55-MB for 64 bit
• For ISV developers (total to build examples)	54 MB for 32 bit; 77 MB for 64 bit
Memory	64 MB minimum with 128 MB or more recommended

Ordering Information

The Sun Ultra™ systems use a marketing part number scheme that is designed to provide greater flexibility and expandability. This page explains how to read the part numbering scheme. "N" means "Not available" or "Not applicable."

A11-AAA1-1A-111AAC

- System
- Microprocessor family
- Microprocessor speed
- Ecache size
- Number of microprocessors
- Monitor
- Frame buffer
- Memory
- Disk
- "Non-standard" system
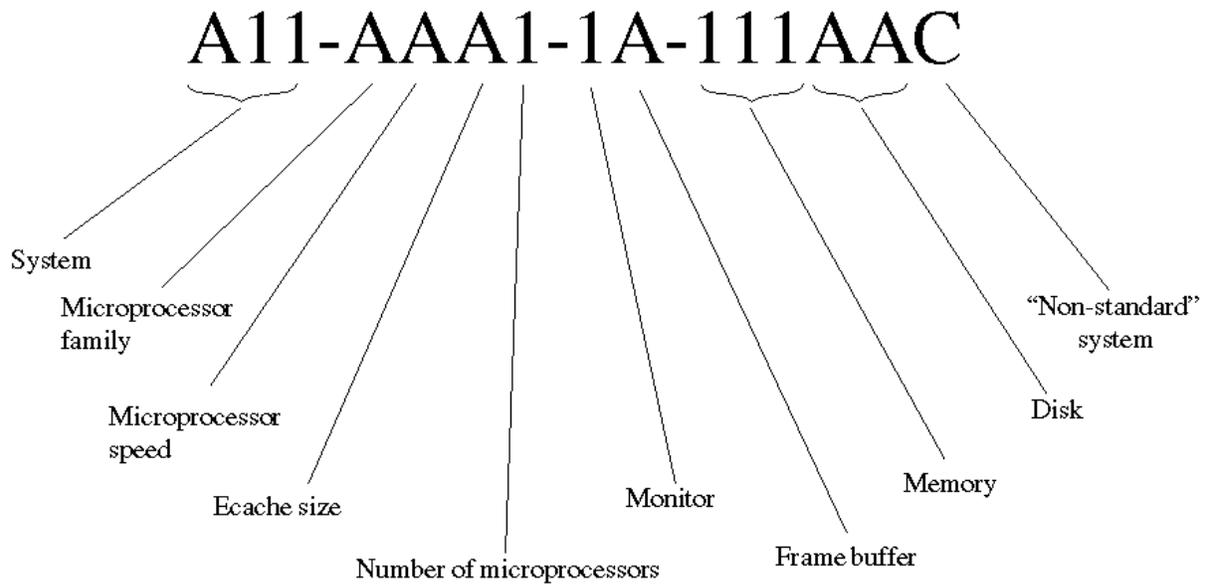
(Note: A = alpha character, 1 = numeric character, C = optional alpha or numeric character)

Model Key (Subset of Part Number Definitions)

System	Monitor	Disk	Non-standard
A27 = Sun Ultra 80	9 = No monitor configured	AQ = 18.2 GB drive	O = OEM
		AV = 36.4 GB drive	R = Master Reseller
Microprocessor Family	**Frame Buffer**	DD = DVD-ROM and	V = Switzerland/Denmark
U = UltraSPARC™	A = Sun™ Expert3D-Lite	36.4-GB drive	
	V = Sun Expert3D	EL = DVD-ROM and	
Microprocessor Speed	Z = Sun Elite3D m6	two 36.4-GB	
L = UltraSPARC-II 450 MHz		drives	
		NN = Diskless	
Ecache Size	**Memory**		
D = 4 MB	1024 = 1 GB		
	2048 = 2 GB		
	4096 = 4 GB		

Sun Ultra 80 Workstation Model 1450

Part Number	Description
A27-ULD1-9A-1024AV	One 450-MHz UltraSPARC-II processor with 4-MB Ecache, 1-GB DRAM, Sun Expert3D-Lite graphics, 36.4-GB, 10000-rpm internal hard drive, no monitor
A27-ULD1-9A-1024AVV	One 450-MHz UltraSPARC-II processor with 4-MB Ecache, 1-GB DRAM, Sun Expert3D-Lite graphics, 36.4-GB, 10000-rpm internal hard drive, no monitor; Switzerland and Denmark only
A27-ULD1-9V-1024AV	One 450-MHz UltraSPARC-II processor with 4-MB Ecache, 1-GB DRAM, Sun Expert3D graphics, 36.4-GB, 10000-rpm internal hard drive, no monitor
A27-ULD1-9V-1024AVV	One 450-MHz UltraSPARC-II processor with 4-MB Ecache, 1-GB DRAM, Sun Expert3D graphics, 36.4-GB, 10000-rpm internal hard drive, no monitor; Switzerland and Denmark only
A27-ULD1-9Z-1024AV	One 450-MHz UltraSPARC-II processor with 4-MB Ecache, 1-GB DRAM, Sun Elite3D m6 series 2 graphics, 36.4-GB, 10000-rpm internal hard drive, no monitor
A27-ULD1-9Z-1024AVV	One 450-MHz UltraSPARC-II processor with 4-MB Ecache, 1-GB DRAM, Sun Elite3D m6 series 2 graphics, 36.4-GB, 10000-rpm internal hard drive, no monitor; Switzerland and Denmark only

Sun Ultra 80 Workstation Model 2450

Part Number	Description
A27-ULD2-9A-1024AV	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D Lite graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor
A27-ULD2-9A-1024AVV	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D Lite graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor; Switzerland and Denmark only
A27-ULD2-9V-1024AV	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor
A27-ULD2-9V-1024AVV	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor; Switzerland and Denmark only

Part Number	Description
A27-ULD2-9Z-1024AV	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Elite3D m6 series 2 graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor
A27-ULD2-9Z-1024AVV	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Elite3D m6 series 2 graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor; Switzerland and Denmark only
A27-ULD2-9V-1024EL	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB L2 cache, Sun Expert3D graphics, 2 x 36.4-GB, 10000-rpm internal UltraSCSI hard drive, 10X DVD-ROM
A27-ULD2-9V-2048EL	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache, 2-GB L2 cache, Sun Expert3D graphics, 2 x 36.4-GB, 10000-rpm internal UltraSCSI hard drive, 10X DVD-ROM

Sun Ultra 80 Workstation Model 4450

Part Number	Description
A27-ULD4-9A-1024AV	Four 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D-Lite graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor
A27-ULD4-9A-1024AVV	Four 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D-Lite graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor; Switzerland and Denmark only
A27-ULD4-9V-1024AV	Four 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor
A27-ULD4-9V-1024AVV	Four 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Expert3D graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor; Switzerland and Denmark only
A27-ULD4-9Z-1024AV	Four 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Elite3D m6 series 2 graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor
A27-ULD4-9Z-1024AVV	Four 450-MHz UltraSPARC-II processors with 4-MB Ecache, 1-GB DRAM, Sun Elite3D m6 series 2 graphics, 36.4-GB, 10000-rpm internal UltraSCSI hard drive, no monitor; Switzerland and Denmark only

Part Number	Description
A27-ULD4-9V-4096EL	Four 450-MHz UltraSPARC-II processors with 4-MB Ecache, 4-GB L2 cache, Sun Expert3D graphics, 2 x 36.4-GB, 10000-rpm internal UltraSCSI hard drive, 10X DVD-ROM

Ordering Guidelines and Notes

- **Disk drives**

  All configurations with Sun Elite3D m6 and Sun Expert3D graphics are standardly configured with the 36.4-GB drives. Earlier configurations with 18.2-GB drives are being transitioned on the following schedule:

Last order date:	February 9, 2001
Last ship date:	May 11, 2001

  These part numbers for these products are the same as for the 36.4-GB disks, but with the suffix AQ rather than AV.

- **Memory**
  - The Ultra 80 workstation supports 4 GB of main memory. This architecture currently accepts 64- and 256-MB memory modules. The 256-MB DIMMs are of the same type as those used in the Sun Enterprise™ 450 systems.

  - The Ultra 80 workstation can accommodate up to 16 DIMM modules in increments of four. DIMM modules within each set *must* be of the same type. DIMM module sets of four may be mixed.

  - The 64-MB DIMMs for the Ultra 80 workstation (X7043A) can be used in the Ultra 60 workstation. However, the existing 64-MB DIMMs used in the Ultra 60 workstation (X7003A) are not supported in Ultra 80 systems.

- **Graphics**
  - All configurations with PGX32™ graphics are being transitioned on the following schedule:

Last order date:	September 7, 2001
Last ship date:	December 7, 2001

  - The Ultra 80 workstation has two UPA graphics slots that support the Sun Elite3D, Sun Expert3D, and Sun Expert3D-Lite graphics accelerators. A customer can mix and match any of these accelerators within the Ultra 80 workstation.

- **Monitors**
  - Monitors are not included with any Ultra 80 systems.

  - A monitor must be purchased with an Ultra 80 workstation.

  - The customer can choose among the 17-, 19-, or 21-inch color monitor, or the 18-inch flat-panel display.

- **SCSI**
  - The internal SCSI host controller operates in Fast-20 (UltraSCSI) mode by default. Installation of non-FAST-20 devices, although allowed, will decrease overall SCSI performance.
  - The total combined SCSI cable length must not exceed three meters for Fast/Wide operation or 1.5 meters for Fast-20 (UltraSCSI) operation.
  - To achieve Fast-20 speeds on all devices on the bus, it is recommended that:
    - A maximum of two Sun StorEdge™ UniPack systems using Fast-20 cables be connected to the external connector.
    - All devices on the SCSI bus should be Fast-20 devices. (Non-Fast-20 devices may cause the internal devices to run at Fast/Wide speeds, but are supported.)
- **Keyboard**
  - Type 6 keyboards are supported on the Ultra 80 workstation.

Options

Below is a comprehensive list of system expansion, networking, graphics, and multimedia options that are supported by Sun Ultra 80 systems. Refer to the Sun Price Book and configuration guides for currently available option listings, configuration notes, and ordering information. When no maximum number is listed, refer to ordering or configuration notes for that option.

Note: *Options listed in italics are supported by the Ultra 80 workstation, but are no longer available for purchase from Sun. These are listed only for reference purposes.*

Part Number	Option Description	Maximum Number Supported	Comments
Processors			
X1195A	UltraSPARC-II 450 MHz, 4-MB Level2 cache	4	
Memory			These are pairs of DIMM units
X7043A	128-MB, 60-ns DIMM memory expansion (2 x 64 MB), 5V	8	
X7005A	512-MB, 60-ns DIMM memory expansion (2 x 256 MB)	8	
Mass Storage: Internal			
X5242A	36.4-GB internal disk drive	2	
X5237A	*18.2-GB, 10000-rpm fast/wide UltraSCSI disk*	*2*	
Mass Storage: Removable Media			
X6004A	3.5-inch, 1.44-MB manual-eject floppy drive (triple density)	1	
X6168A	10X DVD-ROM	1	
X6166A	*SunCD™ 32X CD-ROM drive with cable (for FlexiPack)*	*1*	
X6212A	7-GB to 14-GB, 8-mm tape drive	1	
X6282A	12-GB to 24-GB, 4-mm DDS-3 tape drive	1	
X6106A	*4-GB to 8-GB SLR tape drive*	*1*	
X6208A	*7-GB, 8-mm 8505XLtape drive*	*1*	
X6213A	*7-GB, 8-mm 8705DX tape drive*	*1*	
X6256A	*4-GB to 8-GB 4-mm DDS-2 tape drive*	*1*	
Mass Storage: External			
X814A	*5.0-GB, 8-mm tape backup drive, desktop storage module*	*2*	
X827A	*20-GB, 4-mm tape autoloader, desktop storage module*	*2*	
X567A	*2.1-GB Fast SCSI-2 desktop disk pack*	*4*	
X737A	*2.1-GB Fast SCSI-2 desktop disk pack*	*4*	
X579A	*SunCD 2Plus™, desktop storage pack*	*2*	

Part Number	Option Description	Maximum Number Supported	Comments
X660A	150-MB QIC tape drive, desktop storage pack	2	
X822A	5.0-GB, 4-mm tape drive, desktop storage pack	2	
X834A	10-GB, 8-mm backup tape drive, desktop storage module	2	
X844A	14.0-GB, 8-mm tape drive, desktop storage pack	2	
Mass Storage: Sun StorEdge UniPack (68-pin SCSI)			
SG-XTAP4MM-012A	20-GB, 4-mm DDS-4 tape drive in a UniPack desktop enclosure	2	
SG-XMED4MMDDS410	4-mm 190-meter DDS-4 tapes, package of 10		
SG-XDSK010C-9G	9.1-GB, 7200-rpm UniPack	16	
SG-XDSK010C-18G	18.2-GB, 7200-rpm UniPack	16	
SG-XTAP4MM-011A	12-GB to 24-GB, 4-mm DDS-3 tape drive UniPack desktop enclosure	2	
SG-XTAP8MM-010A	7-GB to 14-GB, 8-mm drive in a UniPack desktop enclosure	2	
SG-XTAP8MM-011A	20-GB to 40-GB, 8-mm drive in a UniPack desktop enclosure	2	
SG-XDSK010A-4G	4.2-GB, 7200-rpm UniPack	16	
SG-XTAPMLR-310A	25-GB to 50-GB MLR tape drive in a UniPack desktop enclosure	2	
SG-XTAPSLR-010A	4-GB to 8-GB SLR tape drive UniPack	2	
SG-XTAP-8MM-020A	20-GB to 40-GB, 8-mm tape UniPack, desktop	2	
X6101A	2.5-GB QIC tape UniPack	1	
X5101A	1.05-GB, 7200-rpm fast/wide SCSI-2 disk UniPack		
X5151A	2.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack		
X5209A	4.2-GB, 7200-rpm fast/wide SCSI-2 disk UniPack		
X5253A	9.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack		
X6208A	14-GB, 8-mm tape UniPack	2	
X6251A	5-GB, 4-mm tape UniPack	2	
X6261A	4-GB to 8-GB, 4-mm DDS-2 drive	2	
X6157A	SunCD 12X CD-ROM UniPack	1	
X6151A	SunCD 4X CD-ROM UniPack	1	

Part Number	Option Description	Maximum Number Supported	Comments
Mass Storage: Sun StorEdge UniPack (54-pin SCSI)			*NOTE*: 68-pin is required on the Ultra 80; these options supported if the correct cable is substituted
X5102A	*1.05-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*4*	
X5152A	*2.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*4*	
X5204A	*2.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*4*	
X5213A	*4.2-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*2*	
X5254A	*9.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*2*	
X6152A	*SunCD 4X CD-ROM UniPack*	*1*	
X6158A	*SunCD 12X CD-ROM UniPack*	*2*	
X6102A	*2.5-GB QIC tape UniPack*	*2*	
X6202A	*14-GB, 8-mm tape UniPack*	*2*	
X6209A	*14-GB, 8-mm tape UniPack*	*2*	
X6252A	*5-GB, 4-mm tape UniPack*	*2*	
X6262A	*4-GB to 8-GB, 4-mm DDS-2 tape drive*	*2*	
X6281A	*12-GB to 24-GB, 4-mm DDS-3 tape drive*	*2*	
X6231A	*20-GB to 40-GB, 8-mm tape drive*	*2*	
Mass Storage: MultiDisk Pack			
X569A	*4.2-GB SCSI MultiDisk Pack (2 x 2.1-GB Fast SCSI-2 disk)*	*2*	
X570A	*8.4-GB SCSI MultiDisk Pack (4 x 2.1-GB Fast SCSI-2 disk)*	*1*	
X739A	*8.4-GB, 7200-rpm MultiDisk Pack (4 x 2.1-GB Fast SCSI-2 disk)*	*1*	
X748A	*8.4-GB SCSI MultiDisk Pack (2 x 4.2-GB Fast SCSI-2 disk)*	*2*	
X749A	*16.8-GB SCSI MultiDisk Pack (4 x 4.2-GB Fast SCSI-2 disk)*	*1*	
X771A	*2.1-GB SCSI MultiDisk Pack (2 x 1.05-GB)*	*2*	
X5211A	*8.4-GB (2 x 4.2 GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*2*	
X5212A	*16.8-GB (4 x 4.2 GB), 5400-rpm fast/wide SCSI-2 MultiPack*	*1*	
X738A	*4.2-GB, 7200-rpm MultiDisk Pack (2 x 2.1 GB)*	*2*	
Mass Storage: Sun StorEdge FlexiPack	*The following FlexiPack options come with a 68 to 68 pin SCSI cable:*		
SG-XTAP-DLT-021A	35-GB to 70-GB, DLT 7000 tape, desktop	2	
SG-XTAP-4MM-021A	12-GB to 24-GB, 4-mm DDS-3 tape FlexiPack	2	
SG-XTAP-4MM-031A	72-GB to 144-GB, 4-mm DDS-3 tape FlexiPack, desktop autoloader	2	

Sun microsystems

Part Number	Option Description	Maximum Number Supported	Comments
SG-XTAP-8MM-020A	14-GB, 8-mm tape FlexiPack	2	
SG-XTAP-8MM-021A	20-GB to 40-GB, 8-mm tape FlexiPack, desktop	2	
X6166A	SunCD 32X internal CD-ROM expansion drive		
X6212A	7-GB 8-mm DDS-3 internal tape expansion drive		
X6236A	20-GB to 40-GB, 8-mm internal tape for FlexiPack		
X6282A	12-GB to 24 GB FlexiPack expansion drive, 4-mm DDS-3 tape		
SG-XTAP-DLT-020A	*20-GB to 40-GB, DLT 4000 tape, desktop*	*2*	
SG-XTAP-SLR-020A	*4-GB SLR tape FlexiPack*	*2*	
SG-XTAP-MLR-320A	*25-GB to 50-GB MLR drive FlexiPack, desktop*	*2*	
SG-XTAP-8MM-011A	*7-GB to 14-GB, 8-mm tape FlexiPack, desktop*	*2*	
X6106A	*4-GB to 8-GB SLR internal tape drive*		
X6122A	*25-GB MLR internal tape FlexiPack or Sun Enterprise server systems*		
X6284A	*112-GB to 24-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6264A	*4-GB to 8-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6159A	*SunCD 12X CD-ROM FlexiPack*	*2*	
X6058A	*DLT 4000*	*2*	***NOTE***: These options require a 58-pin to 68-pin cable
X6061A	*DLT 7000*	*2*	
X6291A	*72-GB to 144-GB, 4-mm DDS-3 autoloader tape FlexiPack*	*2*	
X6285A	*12-GB to 24-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6265A	*4-GB to 8-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6233A	*20-GB to 40-GB, 8-mm tape FlexiPack*	*2*	
X6211A	*14-GB, 8-mm tape FlexiPack*	*2*	
X6150A	*SunCD 12X CD-ROM FlexiPack*	*2*	
Mass Storage: Sun StorEdge MultiPack			
SG-XDSK020A-18G	18.2-GB (2 x 9.1-GB) 10000-rpm MultiPack	8	
SG-XDSK020B-36G	36.4-GB (2 x 18.2-GB) 10000-rpm MultiPack	8	
SG-XDSK040A-36G	36.4-GB (4 x 9.1-GB) 10000-rpm MultiPack	8	
SG-XDSK040B-72G	72.8-GB (4 x 18.2-GB) 10000-rpm MultiPack	8	
SG-XDSK060A-54G	54.6-GB (6 x 9.1-GB) 10000-rpm MultiPack	8	
SG-XDSK060B-109G	109.2-GB (6 x 18.2-GB) 10000-rpm MultiPack	8	

Part Number	Option Description	Maximum Number Supported	Comments
SG-XLIBDLT1-280G	280-GB to 560-GB DLT 7000 tape autoloader (desktop)	1	
SG-XLIBDLT2-280G	280-GB to 560-GB DLT 7000 tape autoloader (rackmount)	1	
SG-XDSK020A-8G	8.4-GB (2 x 4.2-GB) 7200-rpm MultiPack	1	
SG-XDSK040A-16G	16.8-GB (4 x 4.2-GB) 7200-rpm MultiPack	1	
SG-XDSK060A-25G	25.2-GB (6 x 4.2-GB) 7200-rpm MultiPack	1	
X5511A	4.2-GB (2 x 2.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5512A	12.6-GB (6 x 2.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5513A	25.2-GB (12 x 2.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5514A	8.4-GB (2 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5515A	25.2-GB (6 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5516A	50.4-GB (12 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5501A	8.4-GB (2 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5502A	16.8-GB (4 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5503A	25.2-GB (6 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5504A	18.2-GB (2 x 9.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5505A	36.4-GB (4 x 9.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X5506A	54.6-GB (6 x 9.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack	1	
X6528A	18.2-GB MultiPack (2 x 9.1-GB), 7200-rpm UltraSCSI	1	
X6529A	36.4-GB MultiPack (4 x 9.1-GB), 7200-rpm UltraSCSI	1	
Mass Storage: Sun StorEdge Tape Libraries			
SG-XLIBDLT1-1TB-2	Sun StorEdge L1000 tape library, 1-TB native capacity, 1 DLT 7000 tape drive (desktop)	1	
SG-XLIBDLT4-1TB-2	Sun StorEdge L1000 tape library, 1-TB native capacity, 4 DLT 7000 tape drive (desktop)	1	
SG-XLIBDLT1R-1TB-2	Sun StorEdge L1000 tape library, 1-TB native capacity, 1 DLT 7000 tape drive (rackmount)	1	
SG-XLIBDLT4R-1TB-2	Sun StorEdge L1000 tape library, 1-TB native capacity, 4 DLT 7000 tape drive (rackmount)	1	
X6079A	Sun StorEdge L3500 tape library, 3.5-TB native capacity, 2 drive	1	
X6080A	Sun StorEdge L3500 tape library, 3.5-TB native capacity, 7 drive	1	
SG-XLIB8MMB-400G	400-GB to 800-GB 8-mm Sun StorEdge L400 tape library tower, 1 tape drive	1	

Part Number	Option Description	Maximum Number Supported	Comments
SG-XLIB8MM1-400G	*400-GB to 800-GB 8-mm L400 tape library tower, 2 tape drives*	*1*	
SG-XLIB8MMC-400G	*400-GB to 800-GB 8-mm Sun StorEdge L1000 tape library rackmount, 2 tape drives*	*1*	
X6227A	*140-GB L140, tower, one drive*	*1*	
SG-XLIB-8MM1-400G	*400-GB L400, tower, two drives, barcode*	*1*	
SG-XLIB-DLT1-280G	*Sun StorEdge L280 autoloader, desktop*	*1*	
X849A	*SPARCstorage™ Library Model 8/140, 140-GB, 8-mm stackable unit*	*1*	
X867A	*SPARCstorage Library Model 8/140, 140-GB, 8-mm, two drives and barcode reader, tower unit*	*1*	
X869X	*SPARCstorage Library Model 8/140, 140-GB, 8-mm, two drives and barcode reader, stackable unit*	*1*	
Mass Storage: Sun StorEdge A1000 Arrays			
SG-XARY144A-36G	36-GB Sun StorEdge A1000 tabletop array (4 x 9.1-GB, 10000-rpm)	8	
SG-XARY144A-109G	109-GB Sun StorEdge A1000 tabletop array (12 x 9.1-GB, 10000-rpm)	8	
SG-XARY151A-72G	72-GB Sun StorEdge A1000 tabletop array (4 x 18.2-GB, 10000-rpm)	8	
SG-XARY151A-218G	218-GB Sun StorEdge A1000 tabletop array (12 x 18.2-GB, 10000-rpm)	8	
SG-XARY161A-145G	145-GB Sun StorEdge A1000 tabletop array (4 x 36.4-GB, 10000-rpm)	1	
SG-XARY161A-291G	291-GB Sun StorEdge A1000 tabletop array (8 x 36.4-GB, 10000-rpm)	1	
SG-XARY146A-36G	36-GB Sun StorEdge A1000 rackmountable array (4 x 9.1-GB, 10000-rpm)	1	
SG-XARY152A-72G	72-GB Sun StorEdge A1000 rackmountable array (4 x 18.2-GB, 10000-rpm)	1	
SG-XARY162A-145G	145-GB Sun StorEdge A1000 rackmountable array (4 x 36.4-GB, 10000-rpm)	1	
NS-XARY151A-72GAC	72-GB Netra™ st A1000 rackmountable telecom storage array	1	
Mass Storage: Sun StorEdge D1000 Arrays			
SG-XARY145A-36G	36-GB Sun StorEdge D1000 tabletop array (4 x 9.1-GB, 10000-rpm)	8	
SG-XARY145A-109G	109-GB Sun StorEdge D1000 tabletop array (12 x 9.1-GB, 10000-rpm)	8	

Part Number	Option Description	Maximum Number Supported	Comments
SG-XARY153A-72G	72-GB Sun StorEdge D1000 tabletop array (4 x 18.2-GB, 10000-rpm)	8	
SG-XARY153A-218G	218-GB Sun StorEdge D1000 tabletop array (12 x 18.2-GB, 10000-rpm)	8	
SG-XARY163A-145G	145-GB Sun StorEdge D1000 tabletop array (4 x 36.4-GB, 10000-rpm)	1	
SG-XARY163A-291G	291-GB Sun StorEdge D1000 tabletop array (8 x 36.4-GB, 10000-rpm)	1	
SG-XARY147A-36G	36-GB Sun StorEdge D1000 rackmountable array (4 x 9.1-GB, 10000-rpm)	1	
SG-XARY154A-72G	72-GB Sun StorEdge D1000 rackmountable array (4 x 18.2-GB, 10000-rpm)	1	
SG-XARY164A-145G	145-GB Sun StorEdge D1000 rackmountable array (4 x 36.4-GB, 10000-rpm)	1	
NS-XARY153A-72GAC	72-GB Netra st D1000 rackmountable telecom storage array	1	
Mass Storage: Sun StorEdge A3500FC Arrays			Purchase of one or more controller modules required
X6537A	Sun StorEdge A3500 controller module		
X6538A	Fibre-channel controller module, rackmountable for A3500, supports D1000 disk trays		
X6729A	PCI FC-AL single-loop host adapter 1000 MB/sec. optical interface		
SG-XARY164A-145G	145-GB Sun StorEdge D1000 rackmount tray with 4 x 36.4-GB, 10000-rpm disks		
SG-XARY360B-545G	545-GB Sun StorEdge A3500FC array (60 x 9.1-GB, 10000-rpm), 5 trays in Sun StorEdge expansion cabinet, FC-AL controller module	8	
SG-ARY366A-72G	72-GB Sun StorEdge A3500 Light array (8 x 9.1-GB, 10000-rpm), 5 trays in Sun StorEdge expansion cabinet		
SG-ARY370A-91G	91-GB Sun StorEdge A3500 array (10 x 9.1-GB, 10000-rpm), 5 trays in Sun StorEdge expansion cabinet		
SG-ARY372A-182G	182-GB Sun StorEdge A3500 array (20 x 9.1-GB, 10000-rpm), 7 trays in Sun StorEdge expansion cabinet		
SG-ARY374A-273G	273-GB Sun StorEdge A3500 array (30 x 9.1-GB, 10000-rpm), 15 trays in two Sun StorEdge expansion cabinets		

Part Number	Option Description	Maximum Number Supported	Comments
SG-ARY380A-182G	182-GB Sun StorEdge A3500 array (10 x 18.2-GB, 10000-rpm), 5 trays in Sun StorEdge expansion cabinet		
SG-XARY380B-1092G	1092-GB Sun StorEdge A3500FC array (60 x 18.2-GB, 10000-rpm), 5 trays in Sun StorEdge expansion cabinet, FC-AL controller module	8	
SG-XARY381B-1456G	1456-GB Sun StorEdge A3500FC array (40 x 36.4-GB, 10000-rpm), 5 trays in two Sun StorEdge expansion cabinets, FC-AL controller module		
SG-ARY382A-364G	364-GB Sun StorEdge A3500 array (20 x 18.2-GB, 10000-rpm), 7 trays in Sun StorEdge expansion cabinet		
SG-ARY384A-546G	546-GB Sun StorEdge A3500 array (20 x 18.2-GB, 10000-rpm), 15 trays in two Sun StorEdge expansion cabinets		
SG-ARY381A-364G	364-GB Sun StorEdge A3500 array (10 x 36.4-GB, 10000-rpm), 5 trays in Sun StorEdge expansion cabinet		
SG-ARY383A-728G	728-GB Sun StorEdge A3500 array (20 x 36.4-GB, 10000-rpm), 7 trays in Sun StorEdge expansion cabinet		
SG-ARY385A-1092G	1092-GB Sun StorEdge A3500 array (30 x 36.4-GB, 10000-rpm), 15 trays in two Sun StorEdge expansion cabinets		
SG-XARY147A-36G	36-GB Sun StorEdge D1000 rackmount tray with 4 x 9.1-GB, 10000-rpm disks		
SG-XARY154A-72G	72-GB Sun StorEdge D1000 rackmount tray with 4 x 18.2-GB, 10000-rpm disks		
Sun StorEdge A5X00 Arrays			
6729A	S/B PCI FC-AL single-loop host adapter		
SG-XARY550A-182G	182-GB Sun StorEdge 5100 tabletop array (5 x 36.4-GB, 10000-rpm)	2	
SG-XARY550A-509G	509-GB Sun StorEdge 5100 tabletop array (14 x 36.4-GB, 10000-rpm)	2	
SG-XARY553A-1019G	1.0-TB Sun StorEdge 5100 cabinet, two 509.6-GB arrays (14 x 36.4-GB, 10000-rpm)		
SG-XARY553A-3057G	3.0-TB Sun StorEdge 5100 cabinet , six 509.6-GB arrays (14 x 36.4-GB, 10000-rpm)		
SG-ARY553A-509G	509-GB Sun StorEdge 5100 factory configured hubless array (14 x 36-GB, 10000-rpm)	2	
SG-XARY551A-509G	509-GB Sun StorEdge 5100 rackmountable array (14 x 36-GB, 10000-rpm)	2	

Part Number	Option Description	Maximum Number Supported	Comments
SG-XARY552A-509G	509-GB Sun StorEdge 5100 rackmountable array (14 x 36-GB, 10000-rpm)	2	
SG-XARY520A-63G	63.7-GB Sun StorEdge 5200 tabletop array (22 x 9-GB, 10000-rpm)	2	
SG-XARY520A-200G	200-GB Sun StorEdge 5200 tabletop array (7 x 9-GB, 10000-rpm)	2	
SG-XARY521A-200G	200-GB Sun StorEdge 5200 rackmountable array (22 x 9-GB, 10000-rpm) for Sun StorEdge expansion cabinet	2	
SG-XARY522A-200G	200-GB Sun StorEdge 5200 rackmountable array (22 x 9-GB, 10000-rpm) for Enterprise system cabinet	2	
SG-XARY523A-1200G	1.2-TB Sun StorEdge 5200 array (9-GB, 10000-rpm)		
SG-XARY540A-127G	127-GB Sun StorEdge 5200 tabletop array (7 x 18.2-GB, 10000-rpm)	2	
SG-XARY540A-400G	400-GB Sun StorEdge 5200 tabletop array (22 x 18.2-GB, 10000-rpm)	2	
SG-XARY541A-400G	400-GB Sun StorEdge 5200 rackmountable array (22 x 18.2-GB, 10000-rpm) for Sun StorEdge expansion cabinet	2	
SG-XARY542A-400G	400-GB Sun StorEdge 5200 rackmountable array (18.2-GB, 10000-rpm) for Enterprise system cabinet	2	
SG-XARY543A-800G	800-GB Sun StorEdge 5200 array (18.2-GB, 10000-rpm)	1	
SG-XARY543A-2400G	2.4-TB Sun StorEdge 5200 array (18.2-GB, 10000-rpm)	1	
Input Devices			
X180A	SunButtons™ 32-key function I/O device	1	
X190A	SunDials™ 8-dial interactive graphics I/O device for 3-D	1	
PCI Expansion Cards			
X1032A	10/100BASE-T Ethernet with SunPCI UltraSCSI	4	
X1033A	10BASE-T Sun FastEthernet PCI adapter with MII interface	4	
X1034A	Sun Quad FastEthernet™ PCI Card (QFE)	2	
X1133A	Sun Crypto Accelerator I card		
X1150A	Sun GigaSwift Ethernet adapter		
X1152A	*SunFDDI™ single-attach PCI bus interface adapter 2.0*	*3*	
X1153A	*SunFDDI dual-attach PCI bus interface adapter 2.0*	*3*	
X2154A	*SunLink™ token ring interface/PCI adapter 5.0 for Solaris 8 and earlier releases*	*2*	
X1155A	High-speed serial interface PCI adapter 2.0	3	Universal
X2156A	Serial asynchronous interface PCI adapter 3.0 for Solaris 8 and earlier releases	4	

Part Number	Option Description	Maximum Number Supported	Comments
X1141A	Sun GigabitEthernet PCI adapter 2.0	1	
X2069A	Sun GigabitEthernet FC-AL combo adapter, PCI	1	
X1157A	SunATM™-155/MFiber PCI adapter 4.0	2	
X1158A	SunATM-155/UTP PCI adapter 4.0	2	
X1159A	SunATM-622/MFiber PCI adapter 4.0	1	
X2132A	SunPCi™ II 733-MHz coprocessor card, 64-MB memory	1	
X6540A	Dual-channel, single-ended UltraSCSI controller	2	
X6541A	Dual-channel, differential UltraSCSI controller	3	
X6727A	FC network adapter+		
X6729A	S/B PCI FC-AL single-loop host adapter		
X6799A	Sun StorEdge PCI single Fibre Channel network adapter	3	
X7042A	128-MB SODIMM memory expansion for SunPCi II card	1	
X7044A	256-MB SODIMM memory expansion for SunPCi II card	1	
X7045A	512-MB SODIMM memory expansion for SunPCi II card	1	
X1089A	SunVideo Plus™ 3.1 video/audio capture	3	
X499A-EU	PCI multimedia Kit, SunVideo Plus 1.3, a PAL SunCamera™ II, Sun Microphone™ II, and documentation (Continental Europe), supports SunForum™ 3.0		
X499A-UK	PCI multimedia Kit, SunVideo Plus 1.3, a PAL SunCamera II, Sun Microphone II, and documentation (U.K), supports SunForum 3.0		
X499A	PCI Multimedia Kit, SunVideo Plus 1.3, a NTSC SunCamera II, Sun Microphone II, and documentation (U.S.), supports SunForum 3.0		
X2131A	SunPCi II 600-MHz coprocessor card, 64-MB memory	1	
X1131A-64.2	SunPCi 400-MHz K6-2 co-processor card, 64-MB memory	1	
X1131A-64.1	SunPCi 300-MHz K6-2 co-processor card, 64-MB memory	1	
X7041A	64-MB DIMM memory expansion (1 x 64 MB) for SunPCi coprocessor card		
X7035A	128-MB DIMM memory expansion (1 x 128 MB) for SunPCi coprocessor card		
X1035A	SunFDDI single-attach PCI adapter (SAS/5.0)	4	
X1036A	SunFDDI dual-attach PCI adapter (DAS/5.0)	4	
X1066A	SunATM/P-155 Multimode Fiber	2	
X1067A	SunATM/P-155 Cat-5 UTP	2	
X1068A	SunATM/P-622 Multimode Fiber	1	

Part Number	Option Description	Maximum Number Supported	Comments
Graphics			
X3679A	Sun Elite3D m6 series 2 graphics accelerator	1	
X3678A	Sun Expert3D graphics accelerator	2	
X3684A	Sun Expert3D-Lite graphics accelerator	2	
X3668A	*PGX32™ 8- and 24-bit color graphics PCI adapter frame buffer, CD, and cable*	*3*	
X3768A	Sun PGX64 graphics card	4	
X3677A	*Sun Elite3D m3 series 2 graphics accelerator*	*2*	
X3664A	*Sun Elite3D m3 graphics accelerator*		
X3665A	*Sun Elite3D m6 graphics accelerator*		
Monitors			
X7126A	17-inch color monitor		
X7127A	18.1-inch TFT LCD color monitor		
X7135A	19-inch flat screen color Trinitron monitor		
X7136A	21-inch flat screen color Trinitron monitor		
X7124A	Wide-screen 24-inch color monitor		
X3872A	HD15-pin video output (for 17-inch and 19-inch monitors)		
X7103A	*Entry-level 17-inch color monitor*		
X328A	*17-inch color monitor*		
X7119A	*19-inch color monitor*		
X267A	*20-inch color monitor*		
X7121A	*21-inch color monitor*		

Upgrades

Sun™ upgrades offer customers outstanding investment protection for their existing Sun equipment.

Key Messages

- Sun offers customers a variety of flexible upgrade paths to the most popular Sun systems
- Choose from chassis-only to full-system upgrades
- Sun upgrades allow as many components as possible to be carried forward, to protect the customer's hardware investment
- Existing investments in non-Sun hardware can be preserved by upgrading to Sun through competitive full-system upgrades
- SPARCstation™ 20 or Ultra™ workstation upgrades offer excellent value by allowing the migration of memory to Sun Ultra 80 systems

Sun Upgrade Allowance Program (Sun UAP)

Under the Sun UAP program, allowance codes or part numbers have been created and the percentage allowance is built into this part number (see below). These allowance codes replace the previous UG/CU marketing codes used for all desktop upgrades.

Allowance codes can be found in the Sun Pricebook starting with the September 2000 version. Please note that allowance codes apply to configured systems and **cannot be applied to X-options , other than monitors** (see ordering notes below).

Allowance Code Numbering Scheme

Below is an example allowance code, along with a breakdown of the components.

Allowance code = ALW-15-T-D-A27-P2

- **ALW**= Upgrade identifier (All allowance codes start with ALW.)
- **15** = Allowance percentage – Percentage is applied to the list price of a standard marketing part number . "15" means 15% off of list price , "08" means 8% off of list price, and so on.

  (Note: Any other discounts such as volume discounts should also be taken off the list price and not the net of the above.)
- **T** = Desktop upgrades, S for server upgrades, and D for storage upgrades.
- **D** = Indicates the residue group—a way of grouping system in the Sun installed base. The letters A through X are reserved for Sun systems. The letter Z is used for competitive systems.
- **A27** = Identifies the product family that the customer is purchasing.
- **P2** = Promotion code, used for tracking corporate sponsored and other types of promotions.

How to Determine the Right Allowance Code

Scenario: My customer has a SPARCstation 10 workstation and would like to upgrade to an Ultra 80 workstation. What allowance part number should I select?

1. From left hand column select the platform the **customer has.**

2. From the top row select the platform the customer would like to **UPGRADE TO.**

3. Where the UPGRADE FROM column and the UPGRADE TO row intersect (noted with **) is the allowance part number that is applied to the list price of the standard marketing part number.

DESKTOP SYSTEM MIGRATION AND ALLOWANCE MATRIX

UPGRADE TO: FROM:	Ultra 5 (A21)	Ultra 10 (A22)	Ultra 60 (A23)	Ultra 80 (A27)
Early Sun SPARCstation systems	ALW-08-T-A-A21	ALW-08-T-A-A22	ALW-08-T-A-A23	ALW-06-T-A-A27
SS4, 5, 10, or 20**	ALW-12-T-B-A21	**ALW-12-T-B-A22	ALW-10-T-B-A23	ALW-08-T-B-A27
UltraSPARC™ 1,5,10, and 30	ALW-14-T-C-A21	ALW-16-T-C-A22	ALW-16-T-C-A23	ALW-12-T-C-A27
UltraSPARC 2 and 60	ALW-14-T-D-A21	ALW-16-T-D-A22	ALW-18-T-D-A23	ALW-16-T-D-A27
Non-Sun workstations	ALW-10-T-Z-A21	ALW-12-T-Z-A22	ALW-10-T-Z-A23	ALW-10-T-Z-A27

Answer: Allowance part number ALW-08-T-B-A27 should be selected. Your customer gets an 8 percent allowance off the list price of any Ultra 80 workstation configuration for returning the SPARCstation 10 system.

Upgrade Ordering Notes

- Memory migrates from Ultra 1 and Ultra 2 workstations; disks do not migrate
- 300-MHz modules from the Ultra 2 and Ultra 30 will not migrate
- Graphics cards from A12, A14 do not migrate
- Monitors
  - Monitors are not included with any Ultra 80 system upgrades
  - Sun branded 17-inch and 20-inch monitors migrate from previous generation Sun systems
  - For some monitors, a video adapter may be required. Please order correct adapter (i.e., 21-inch color monitor with on-board 8-bit graphics requires X470A). Adapter choices are:
    - X3872A—HD15F to 13W3 video adapter
    - X470A—13W3F to HD15M video adapter (10-inch cable)
  - If a monitor is needed, order an X-option or refer to monitor upgrade section of price book

- Country kits
  - Type 4 keyboards are not supported on the Ultra 80 workstation.
  - Type 5 keyboards can migrate to the Ultra 80 workstation.

Service and Support

The SunSpectrum℠ program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs, ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ Operating Environment software, and telephone support for Sun™ software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value that it represents. Customers should check with their local Sun Enterprise Services representatives for program and feature availability in their areas.

Support Contracts

SunSpectrum program support contracts are available both during and after the warranty program. Customers may choose to uplift the service and support agreement to meet their business needs by purchasing a SunSpectrum contract.

The four levels of SunSpectrum support contracts are outlined below.

SunSpectrum Program Support

Program	Description
Mission-Critical **SunSpectrum Platinum℠ Support**	Designed to support client-server, mission critical solutions by focusing on failure prevention, rapid recovery and year round technical services planning. Support is provided 24 x 7.
Business-Critical **SunSpectrum Gold℠ Support**	Includes a complete package of proactive and responsive services for customers who require maximum uptime for their strategic business-critical systems. Support is provided 24 x 7.
System Coverage **SunSpectrum Silver℠ Support**	Combines the service expertise, responsive on-site support and technical support by telephone and SunSolve™ CD/on-line services. Support is provided 8 a.m. to 8 p.m. Mon. through Fri.
Self-Directed **SunSpectrum Bronze℠ Support**	Provided for customers who rely primarily upon their own in-house service capabilities. Enables customers to deliver high quality service by giving them access to UNIX® expertise, Sun certified replacement parts, software releases and technical tools. Support is provided 8 a.m. to 5 p.m. Mon. through Fri.

SunClient℠ Support Program

The SunClient℠ support program is a suite of offerings that is separate, yet complementary to the SunSpectrum program. This program helps reduce hardware and software support costs for the Ultra℠ 80 workstations. SunClient support program provides:

- A choice for optimizing low-cost workstation support

- Flexibility to select only the services needed

- Administrative simplicity, saving time and money

- Access to world-class UNIX® networking experts

FEATURE	SunClient Maintenance	SunClient Central Maintenance	SunClient Software Tech Support Option*
Systems approach coverage	*	*	
Solaris and unbundled software technical support	—	—	*
9 a.m.–5 p.m., Monday–Friday telephone coverage	*	*	*
9 a.m.–5 p.m., Monday–Friday on-site coverage	*†‡	*‡	—
Response times (phone/onsite)	4 hour callback/next business day response	4 hour callback/second business day response	4 hour callback
Centralized on-site repair of multiple units	—	*	Not Applicable
Patches	Not Applicable	Not Applicable	*
SunSolve license	Not Applicable	Not Applicable	*
SunSolve EarlyNotifier℠ Service	Not Applicable	Not Applicable	*
Software updates	Not Applicable	Not Applicable	Not Applicable

* Can only be sold as an option to SunClient Maintenance or SunClient Central Maintenance.

† Next business day on-site response requires that the request for service be received by 3:00 p.m. If the call is received after 3:00 p.m., service will be provided on the second business day.

‡ Customers located more than 50 miles from an authorized service provider or reseller will be charged an additional fee for service activity.

Features and Benefits of the SunClient Program

Features	Benefits
• Unbundled hardware and software support	• *Flexibility* Select the type and amount of coverage needed for desktop systems, so service dollars are targeted where they are needed most. • *Cost savings* Pay only for the support services needed.
• Next business day (SunClient Maintenance) or second business day (SunClient Central Maintenance) on-site response	• *Cost efficiency* Because Sun can more efficiently manage spare inventory and labor scheduling, the savings can be passed on to the customer.
• Single contract with choice of automatic warranty upgrade	• *Simplicity* One contract covers a predefined number of systems at one low price. New systems acquired can be upgraded to the SunClient service level.
• SunClient Central Maintenance	• *Cost savings* Sun realizes an economy of scale by repairing multiple systems with one visit and leverages existing support infrastructures, so cost efficiency is maximized while duplication of effort is virtually eliminated.
• Service delivery by Sun experts	• *Consistency* Selected desktops can be deployed virtually anywhere with enabling cost-effective, quality service and support.

For more information, visit the SunClient support web site at:
`http://www.sun.com/service/support/sunclient`

Glossary

24-bit color	The ability to render objects from a palette of 16.7 million colors. It is often referred to as true color and results in much more realistic shading of 3-D objects for enhanced image quality.
3D-RAM	Dual-ported video memory with graphics functionality built into the memory chip.
100BASE-T	*See* Fast Ethernet.
Antialiasing	A graphics technique that greatly enhances the quality of images by eliminating many of the inaccuracies ("jaggies") inherent to rendering on a raster display. Typically found only in high-end graphics systems.
DIMM	Dual inline memory module. A memory unit that can come in a variety of sizes, such as 16 MB, 32 MB, 64 MB, and 128 MB.
Fast Ethernet	IEEE standard for 100-Mb Ethernet. This technology supports a data transfer rate of 100 megabits per second over special grades of twisted-pair wiring.
NFS	Sun's distributed computing file system.
ODBC	Open database connectivity.
OpenGL®	The de facto standard software interface for graphics hardware that allows programmers to create interactive 3-D applications. The OpenGL API provides a full-featured, network-transparent application programming interface.
PCI	Peripheral component interconnect. A industry standard for connecting peripherals such as disk drives, tapes drives, and other devices used in the PCs.
PLBwire93	The Picture Level Benchmark for wireframe performance. A benchmark standardized by the National Computer Graphics Associated GPC committee. The value represents the geometric mean performance on several commonly used 3-D wireframe operations.
PLBsurf93	The Picture Level Benchmark for 3-D surface performance. A benchmark standardize by the National Computer Graphics Associated GPC committee. The value represents the geometric mean performance on several commonly used 3-D surface operations.
UPA	Ultra™ port architecture. A high-speed, crossbar-oriented, packet-switched mother board interconnect.
V9	Version 9 of the SPARC™ definition.

VIS™

Visual instruction set. The UltraSPARC™ processor implements a special instruction set that is primarily aimed at image and video processing. Some of the instructions allow the CPU to directly access and operate on image data with a high degree of parallelism. Other instructions provide facilities for formatting and moving data at very high rates of speed both within the CPU, and between the CPU and the other system components.

Materials Abstract

All materials are available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
PowerPack				
– *Sun Ultra™ 80 Workstation, Just the Facts*	Reference Guide (this document)	Training Sales Tool	SunWIN, Reseller Web	110090
– *Sun Ultra Workstations Customer Presentation*	Presentation with Slide Notes	Sales Tool	SunWIN, Reseller Web	111990
Product Literature				
– *Sun Product Intro: New Ultra 60 and Ultra 80 Workstations with Sun™ Expert3D Graphics*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web, E-mail	117890
– *Sun Product Intro: Ultra 60 and Ultra 80 workstations with Sun Elite3D Series 2 Configuration*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web, E-mail	117899
– *Sun Product Intro: Introducing the Ultra 80 Workstation, Models 1450, 2450, and 4450*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web, E-mail	111774
– *Ultra 80 Workstation Architecture White Paper*	Technical White Paper	Sales Tool	SunWIN, Reseller Web	111776
– *Ultra 80 Workstation Performance Brief White Paper*	Performance Brief	Sales Tool	SunWIN, Reseller Web	111777
– *Literature - Ultra 80 Workstation Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web	99625
– *Graphics Solution Guide*	Graphics Overview	Sales Tool	SunWIN	75271
References				
– *Sun Elite3D Graphics, Just the Facts*	Reference Guide	Training Sales Tool	SunWIN, Reseller Web	75245
– *Sun Expert3D Graphics, Just the Facts*	Reference Guide	Training Sales Tool	SunWIN, Reseller Web	114214
– *Sun Expert3D-Lite Graphics, Just the Facts*	Reference Guide	Training Sales Tool	SunWIN, Reseller Web	125033
– *Sun Elite3D Graphics White Paper*	Technical Brief	Sales Tool	SunWIN, Reseller Web	75265

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
– *Sun Creator Graphics series 3: Just the Facts*	Reference Guide	Training Sales Tool	SunWIN, Reseller Web	75246
– *SunVideo Plus™ Subsystem: Just the Facts*	Reference Guide	Training Sales Tool	SunWIN, Reseller Web	75247
Quick Reference Cards				
– *Quick Reference Card: Sun Workstation™ Product Line Overview*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	10826
– *Quick Reference Card: Sun Workstation Graphics Products Overview*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	24507
– *Quick Reference Card Competitive Summary Workstations*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	12259
– *Quick Reference Card: Upgrade Paths*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	24513
Presentations				
– *Sun in EDA Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	59078, 59260
– *Sun in MCAD/MCAE Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	59074, 59263
– *Sun in Software Development Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	59375
– *Sun in Oil and Gas Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	60292, 60297
– *Sun in Entertainment Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	75241, 75242
– *Graphics Overview Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	75254, 75255
Upgrade Return Matrices				
– *Desktop Matrix*	Product Line Matrix	Sales Tool	SunWIN	94726
– *Component Matrix*	Product Line Matrix	Sales Tool	SunWIN	108142
– *Desktop Product Return Matrix*	Return Matrix	Sales Tool	SunWIN	92856
External Web Sites				
– *General Information on Sun's Desktop Line*	`http://www.sun.com/desktop`			
– *Detailed Information on the Ultra 80 Workstation*	`http://www.sun.com/desktop/products/Ultra80`			